CONTROL TECHNIQUES

Table of Contents

Introduction - Consider It Solved, What's New 2

AC Drives 6

GENERAL PURPOSE
- Commander SL - simple micro drive 10
- Commander SX - NEMA 4X drive 14
- Commander SK - full featured drive 24

HIGH PERFORMANCE
- Commander GP20 - high performance drive open loop 40
- Unidrive SP - universal drive (open, closed loop & servo) 52

Motion Control 88

SERVO SYSTEMS
- Digitax ST - servo system with flexible integration features 98
- Epsilon EP - compact, intelligent servo system 122
- Unidrive SP - universal servo system 149
- EN - digital servo system 176
- MDS - modular drives with common bus architecture 191
- FM Controls - added control for EN & MDS drives 214

MULTI-AXIS CONTROL
- MC Controllers - multi-axis controller 220

SERVO MOTORS
- Servo Motor Specifications 228

Soft Starters 254

GENERAL PURPOSE
- CSX - compact digital soft starter 256
- CSXi - digital soft starter with motor protection 256

HIGH PERFORMANCE
- IMS2 - digital solid state soft starter 259
- EMX3 - digital soft starter with new adaptive acceleration 262
- DY5 - dynamic braking resistor 268

PACKAGED STARTERS
- Packaged Soft Starters - 0.5 hp to 800 hp 270

DC Drives 280

GENERAL PURPOSE
- Fincor Series - single phase regen & non-regen drives 284
- Fincor DC Motors - shunt wound & permanent magnet 299

HIGH PERFORMANCE
- Mentor II - three phase digital modules 303
- Quantum III - three phase digital drive package 310

Packaged Drives & Engineered Systems 318

- AC PAKS - RapidPaks to 75 hp & Custompaks to 2000 hp 321
- DC PAKS - RapidPaks to 500 hp & Custompaks to 1500 hp 327
- Large Enclosed AC Drives - 100 hp to 500 hp 333
- Unidrive SPMs - high power modules 60 to 2900 hp 335
- Engineered Systems - total system solutions 339

Software & Connectivity 342

- Drive Commissioning 344
- Drive and Controller Programming 347
- Drive Selection and Analysis Tools 372
- Connectivity Software Tools 374
- Fieldbus Connectivity 375
- CTNet Drive Integration Products 381
- Automation Hierarchy 385

Options & Accessories 388

- Support Services 390
- Operator Interfaces 392
- Interconnect Components 395
- Encoder and Logic Supplies 413
- Power & Drive Accessories 415

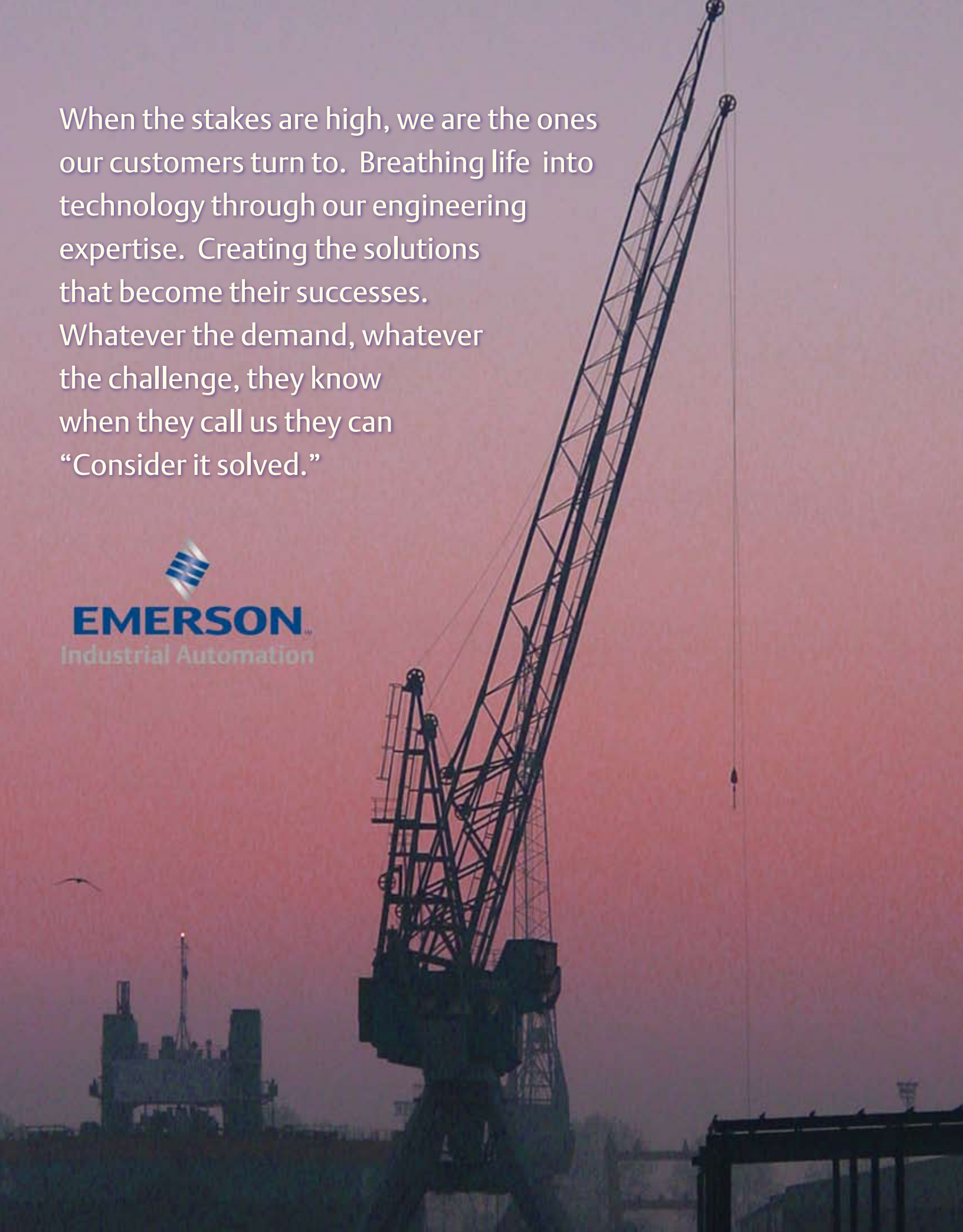
Symbols and Formulae 431
Index 444
Application Questionnaire 447

EMERSON
Industrial Automation

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When the stakes are high, we are the ones our customers turn to. Breathing life into technology through our engineering expertise. Creating the solutions that become their successes. Whatever the demand, whatever the challenge, they know when they call us they can "Consider it solved."
EMERSON
Industrial Automation

Consider it solved

"Consider it solved" is the promise Emerson makes to every customer. To fulfill this promise, Control Techniques focuses on delivering to each of its customers an Emerson solution—one bringing together engineering expertise and innovation. Using its ground-breaking technologies and application "know how" Control Techniques has become one of the world's leading suppliers of motor controls. Control Techniques is part of the Emerson Industrial Automation group. Eight groups, over 60 companies, make up Emerson (NYSE: EMR), a $22 billion corporation.

A history of firsts

Control Techniques has shaped the history of drives and controls. It was among the first to offer an AC flux vector drive, and introduced the first digital DC drive, the first fully-integrated servo drive, and the first universal AC and Servo drive — the Unidrive.

The evolution of the second generation Unidrive SP, "the benchmark for all AC and Servo drive technology," and the new Commander SK, which can provide PLC functionality by adding the "LogicStick," establishes Control Techniques as the leader in the field of drive-based intelligence.



Customer driven

Meeting customer needs has driven the growth of Control Techniques since its inception more than three decades ago. This is evident in our continual development of drive technology—much from customer input, and in our creating a worldwide support network for our customers. In addition to having built over 50 Drive and Application Centers around the globe, Control Techniques has established a distributor and integrator network that now exceeds 800 locations in North America alone. Service programs extend from providing pre-sales engineering expertise to fully supporting a variety of legacy systems.

Powered by service

Having over 50 Control Techniques Drive Centers around the globe means customers can easily obtain service and support wherever their drive systems are located. There are 13 Drive Application and Engineering Centers in the Americas, plus a dedicated Service Center in Grand Island, New York. From these locations, Control Techniques works with its distributors and system integrators to provide complete and fully-supported solutions, from general purpose and high-performance stand-alone drives, to soft starters and multi-section systems. By calling **1-800-893-2321**, customers are put in contact with the Service Center or the nearest Drive Application or Systems Center.

CONTROL TECHNIQUES

Driving Technology

New Products in every section!

Emerson Control Techniques strives to provide its customers with the most cost-effective and productive motor control solutions available. By listening to our customers, we are able to deliver solutions designed for real world applications. Here is an overview of the latest innovations from Control Techniques. These and other recently introduced products found in the catalog are denoted with the red "NEW" button.

NEW AC Drives



Control Techniques is growing, and our catalog features many new products.

The Commander SK AC drive solution has new sizes and voltages available. The Commander SK now includes models from 0.33 hp to 200 hp, adding a size D, and an extended 110V range. Pictured is the new ultra compact Commander SK size D - 5 hp @ 230V, 10 hp @ 460V.



The latest addition to the Unidrive SP series of high performance drives is the compact size Zero with a horsepower range of 0.5 hp to 2 hp. Also new to the Unidrive SP line is a size 5, 230V model, which can provide up to 60 hp.

NEW Solution Modules



Four new solution modules have been added to our offering of Solution Modules. SM-EtherCAT allows for this latest Ethernet communications protocol to be used, High Speed Capture & Registration is now possible with SM-Register, and a SM-Encoder Output Plus, a new feedback module for incremental encoder I/O from external motion controllers. Also available is a new high density digital I/O module, the SM-I/O 32 which further enhances our drive based PLC capabilities.



NEW Servo Systems

The Motion Control section introduces the Digitax ST series servo drives. Meeting the demands of modern, lean manufacturing requires smaller more flexible machinery. The Digitax ST is specifically designed to help machine designers and system integrators meet these challenges.

The Digitax ST is a very compact servo drive that can be mounted flush against another Digitax ST, resulting in a smaller multiple axis footprint. Onboard features such as synchronized motion control and Safe Torque Off reduce the need for external components and further reduce panel size and overall system cost.



The new 16A Epsilon EP is the most powerful servo drive (200 lb-in cont.) available for its size.

NEW Soft Starters



Introducing the EMX3 series, a full-featured line of advanced digital Soft Starters. Built for reliability and ruggedness, these soft starters ensure a long life for motors and machinery. Our line of soft starters runs from the very compact models used in light industrial applications to custom-built starters and enclosures used in harsh and unusual environments.



NEW DC Drives

Fincor DC drives are known for their reliability. Recently updated, these rugged drives are available up to 5 hp and feature full isolation and convenient operator controls. In addition to panel mounted drives Fincor has complete industrial drive solutions for newspaper and commercial printing, and for large-moveable structures.

NEW High Horsepower Packaged Drives & Engineered Systems

The Unidrive SP Free Standing AC drives extend the power range of "the Benchmark" solution platform to 1000 hp, while providing users with the same integration options as the standard, panel-mount Unidrive SP. Packaged in an IP21 or IP23 enclosure, these Free Standing drives deliver maximum horsepower density for physical size, and include rectifier, inverter and inductor.

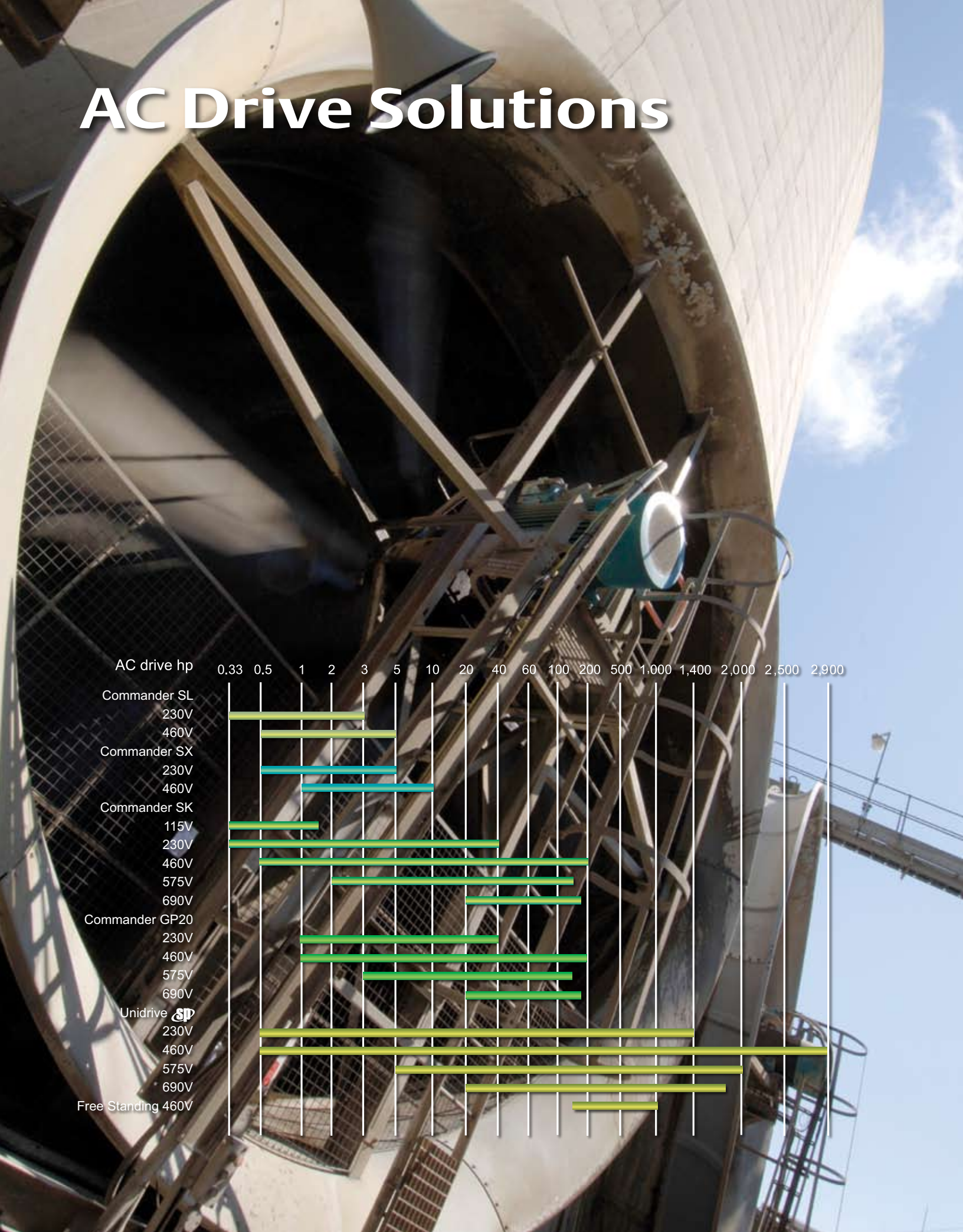
In addition, an "Incomer" enclosure is available with line power bus bars included to integrate fuse switch/MCCB etc.

Our LE Series of high-horsepower drives come enclosed in a NEMA12 Positive Pressure Blown and Filtered AC drive system with all the state-of-the-art integration features of the Unidrive SP. The robust Unidrive SPM technology from Control Techniques gives users the power, performance, and the ultimate in flexibility for all AC applications from 60 hp to 2900 hp.



This cost competitive, pre-engineered "AC In – AC Out" solution is a perfect match for both high performance, and standard drive applications, such as fans, pumps, and conveyors.

AC Drive Solutions



Innovative and Intelligent AC Drives

Innovative and intelligent AC drive technology from Control Techniques enables customers to deploy highly productive, easy-to-use control solutions.

Beyond achieving superior motor performance, the design philosophy of Control Techniques is guided by the voice of our customers to produce truly "user friendly" control solutions. As a result, the drives are quick to install, simple to set up, and easy to maintain. Software tools are intuitive, consistent and flexible. Many advanced features are built in as standard.

General Purpose Drives

Commander Series—Growing with your needs

The **Commander SL** series was developed in response to increasing customer requests for a cost effective, easy to use, compact AC drive. This drive provides outstanding V/Hz and open loop vector performance up to 5 hp, has a clear, intuitive LED keypad, and has optional parameter copy software.

Commander SX provides users with a compact, rugged NEMA 4X drive up to 10 hp for use where a corrosion-proof, wash-down drive is needed.

The Commander SK has grown since its introduction in 2005 with the addition of six new frame sizes, covering all voltage ranges, and delivering up to 200 hp. This versatile drive has several cost and space saving features, such as a built-in EMC filter and "snap in" expandable I/O or communication options. Its capabilities can be extended with Solution Modules, and it can provide PLC functionality using the ***LogicStick*** and IEC-61131-3 compliant ladder logic and function block programming software, ***SyPT Lite***. The Commander SK uses the ***SmartStick*** for parameter storage and copying.

The **Commander GP20** answers the call for a powerful and easily integrated drive for use in a variety of industrial applications. In addition to V/Hz and open loop vector operating modes, the ***Rotor Flux Control*** mode offers best torque performance at low speeds, highest stability control of high inertia loads and best control of low inductance motors. This drive is sized up to 200 hp. The Commander GP20 utilizes the macro-based ***SmartCard*** for a fast setup of ten common applications, parameter storage and copying. The Commander GP20 can accommodate two Solution Modules for enhanced I/O capability and fieldbus communications.

High Performance Drives

Modules take Unidrive SP to 2,900 hp

The **Unidrive SP** line of high performance drives with scalable PLC intelligence continues to grow. All new **Unidrive SPM** models, developed for use by integrators of high-performance systems, have a unique modular design for system design flexibility and cost-effective AC line regeneration.

The **Unidrive SPM** power range starts at 60 hp and extends to 1500 hp at 230V, 2900 hp at 460V, 2000 hp at 575V and 690V. Ratings for the Unidrive SPM can be found in the Engineered Systems section of the catalog.

The newest addition to the Unidrive SP line is a compact and economical size zero drive in a Panel-mount configuration. New application and control cabinets have also been added to the Unidrive SP Free-standing line.

Conforming to standards for quality, safety and interoperability

Control Techniques drives are built to meet rigorous international safety standards, and communicate flawlessly using the most popular fieldbuses. As such, the drives carry the following approval ratings.

c UL us LISTED · ISO 9001:2000 APPROVAL · ISO 14001 APPROVAL · CE · N1652

Control Techniques uses Modbus RTU as its standard protocol. Solution Modules support these protocols, and others:

EtherNet/IP · DeviceNet · PROFIBUS · INTERBUS · CANopen · EtherCAT · MODBUS TCP/IP · SERCOS interface

AC Drives *Product Matrix*

Drive Family	Commander SL *p.10* 	Commander SX *p.14* 	Commander SK *p.24* 
Control Technology	Open Loop Vector, V/Hz	Open Loop Vector, V/Hz, Closed Loop Vector	Open Loop Vector, V/Hz
Power	0.33 hp to 5 hp	0.5 hp to 10 hp	0.33 hp to 200 hp
AC Voltage 50/60Hz ± 10% **hp (ND=Normal Duty, HD=Heavy Duty)**	ND/HD 200-240V 1Ø 3 hp 200-240V 3Ø 3 hp 380-480V 3Ø 5 hp	ND/HD 200-240V 3Ø 3 hp 380-480V 3Ø 5 hp	ND HD 100-120V 1Ø 1.5 hp 1.5 hp 200-240V 1Ø 3 hp 3 hp 200-240V 3Ø 40 hp 30 hp 380-480V 3Ø 200 hp 150 hp 575V 3Ø 150 hp 125 hp 690V 3Ø 175 hp 150 hp
Motor Feedback	N/A	Optional PX module for Incremental encoder	N/A
Input/Output	IN OUT Analog/Digital 1 1 Digital 3 Relay 1	IN I/O OUT Analog/Digital 2 1 Digital 3 1 Relay 1	IN OUT Analog 1 1 Analog/Digital 1 Digital 3 1 Relay 1 Digital/Frequency 1 1
Input/Output Options	N/A	PX modules for Secure Enable and Brake Control	Solution Modules (SM) for: Extended I/O, Real-Time Clock I/O, Double-Insulated I/O, 120V I/O, 24V I/O, 32 I/O, Bi-Polar Analog Input Card
Communication	N/A	MODBUS RTU, RS485 Standard	MODBUS RTU, RS485 Standard Optional Solution Modules for: PROFIBUS DP, DeviceNet, CANopen, INTERBUS-S, Ethernet, EtherCAT
Configuration Software	Parameter Tool	SXSoft	CTSoft
Parameter Storage	PC-Based	XPressKey	SmartStick
PLC	N/A	N/A	LogicStick
Application Software	N/A	N/A	SyPT Lite IEC61131-3 ladder and function block programming
Pre-Programmed Software Solutions	N/A	N/A	N/A
Power Accessories	Optional External Filter	On Board and Optional Filter, Braking Resistors	On Board and Optional Filter, Braking Resistors
Approvals	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000

Drive Family	**Commander GP20** *p.40* 	**Unidrive SP** *p.52* 
Control Technology	V/Hz, Open Loop Vector, Rotor Flux Control	V/Hz, Open Loop Vector, Rotor Flux Control, Closed Loop Vector, Servo, Regenerative
Power	1 hp to 200 hp	0.5 hp to 2900 hp
AC Voltage 50/60Hz ± 10% **hp (ND=Normal Duty, HD=Heavy Duty)**	200-240V 3Ø 380-480V 3Ø 575V 3Ø 690V 3Ø ND 40 hp 200 hp 150 hp 175 hp HD 30 hp 150 hp 125 hp 150 hp	200-240V 3Ø 380-480V 3Ø 575V 3Ø 690V 3Ø ND 1400 hp 2800 hp 2000 hp 2250 hp HD 1200 hp 2400 hp 1750 hp 2000 hp
Motor Feedback	N/A	Universal Encoder Port supports: 14 feedback devices as standard Optional Solution Modules for: Resolver, Second incremental encoder, Universal encoder support with simulated encoder output
Input/Output	IN / I/O / OUT Analog: 3 / 2 Digital: 4 / 3 Relay: 1	IN / I/O / OUT Analog: 3 / 2 Digital: 4 / 3 Relay: 1
Input/Output Options	Solution Modules (SM) for: Extended I/O, Real-Time Clock I/O, Double-Insulated I/O, 120V I/O, 24V I/O, 32 I/O	Solution Modules (SM) for: Extended I/O, Real-Time Clock I/O, Double-Insulated I/O, 120V I/O, 24V I/O, 32 I/O, Remote I/O Option
Communication	MODBUS RTU, RS485 Standard, or ANSI Optional Solution Modules for: PROFIBUS DP, DeviceNet, CANopen, INTERBUS-S, Ethernet, EtherCAT	MODBUS RTU, RS485 Standard, or ANSI Optional Solution Modules for: PROFIBUS DP, DeviceNet, CANopen, INTERBUS-S, Ethernet, EtherCAT, CAN, SERCOS, CTNet, CTSync
Configuration Software	CTSoft	CTSoft
Parameter Storage	GP20 SmartCard	SmartCard
Application Co-processor	Standard	Standard plus - Solution Modules for: Scalable PLC functionality + Motion Control
Application Software	SyPT Lite IEC61131-3 ladder and function block programming	SyPT Lite and SyPT Pro IEC61131-3 ladder and function block programming
Pre-Programmed Software Solutions	GP20 SmartCard Macros	Consult Factory
Power Accessories	On Board and Optional Filter, Braking Resistors	On Board and Optional Filter, Braking Resistors
Approvals	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000

Commander SL

Simplicity with Economy

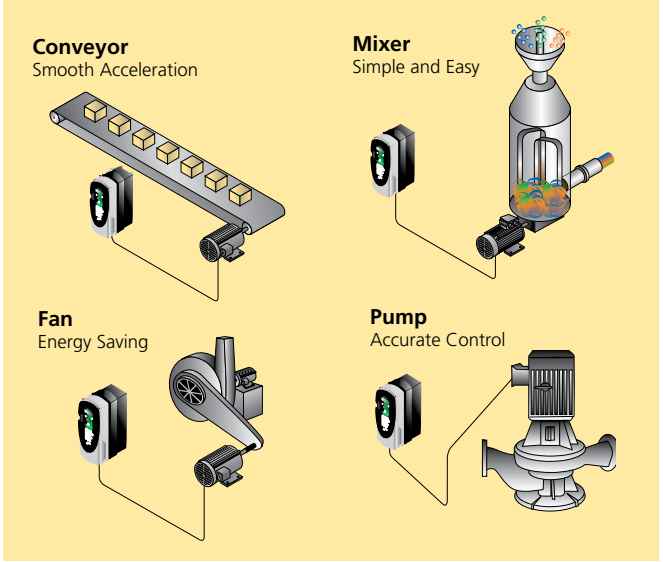
The economical Commander SL is ideal for simple applications where cost is critical and only basic operation is required. The Commander SL operates in V/Hz and open loop vector modes. It has an easy to use LED display keypad for quick setup. The Commander SL also comes with the reliability and performance users have come to expect from more powerful and flexible drives from Control Techniques.





- **0.3 to 3 hp (.25 to 2.2 kW), 1Ø 200-240 VAC**
- **0.5 to 5 hp (0.37 to 3.72 kW), 1Ø, 3Ø 380-480 VAC**
- **Easy to set-up – all the parameters you need (90% of typical applications) are printed on the front**
- **Easy installation – choose between simple panel mounting and DIN-rail mounting (up to 2 hp)**
- **Simple connections – easy access terminals with clear marking**
- **Simple start-up – easy push button set-up - no need for complex programming**
- **Performance – V/Hz or high performance open loop vector**
- **Output frequency 0 to 1,500 Hz**
- **Acceleration and deceleration ramps**
- **Switching frequency 3 (default), 6, 12, and 18 kHz**
- **Positive logic control**
- **Catch a spinning motor**
- **Power loss ride through**
- **Easy commissioning pack allows OEMs fast commissioning of multiple drives**

TYPICAL APPLICATIONS



c UL us LISTED
ISO 9002 APPROVAL
CE
N1652
2 YEAR Digital Drive Warranty

FEATURE

Performance Advantage

Powers up in Simple V/Hz Mode

Easy to use. Ready to run out of the box.

5 Operator Buttons; Mode, Up, Down, Stop/Reset and Start. Bright LED Display

Easy to program and use.

Top Ten Level 1 Parameters Listed on the Drive's Front Cover

On-the-spot easy reference for drive set-up and maintenance. Parameters can be locked for read only access.

Access to Additional Parameter Level

Customizes the drive to meet each user's needs: simple (level 1) or flexible (level 2). 30 set-up parameters and 17 diagnostic parameters.

Configurable Analog and Digital I/O

Customizes drive to the specific application. 3 digital input terminals (not stop, run, jog). 1 configurable (speed, load, current or power) analog output terminal and 1 analog input (analog input 0-10V or 4-20 mA).

Comprehensive Diagnostics

3 display alarm codes, 11 trip codes and 4 trip history.

Capable Control Features

4 preset speeds, 5 stopping modes including DC injection braking. Catch a spinning motor algorithm.

Quadratic Motor Flux V/Hz

Optimizes fan and pump operation.

Dynamic Motor Flux V/Hz

Optimizes energy savings.

Open Loop Vector Control with True Space Vector Modulation

Precise control algorithm provides full torque down to 1 Hz for exceptional performance.

Static Auto-tune (open loop vector)

Allows motor / drive optimization without motor shaft rotation.

COMMANDER SL RATINGS

200 / 240 VAC ±10%, 48-62 Hz

Motor HP ① kW	Input Phase	Contin. Output Current (A)	Overload Current ② (A)	Size	Order Code
0.33 / 0.25	1	1.7	2.6	A	SLA1200025
0.50 / 0.37	1	2.2	3.3	A	SLA1200037
0.75 / 0.55	1	3.0	4.5	A	SLA1200055
1.0 / 0.75	1	4.0	6.0	A	SLA1200075
1.5 / 1.1	1 or 3	5.2	7.8	B	SLBD200110
2.0 / 1.5	1 or 3	7.0	10.5	B	SLBD200150
3.0 / 2.2	1 or 3	9.6	14.4	C	SLCD200220

380 / 480 VAC ±10%, 48-62 Hz

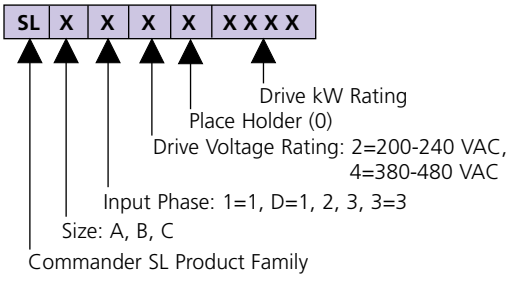
Motor HP ③ kW	Input Phase	Contin. Output Current (A)	Overload Current ② (A)	Size	Order Code
0.5 / 0.37	3	1.3	2.0	B	SLB3400037
0.75 / 0.55	3	1.7	2.6	B	SLB3400055
1.0 / 0.75	3	2.1	3.2	B	SLB3400075
1.5 / 1.1	3	2.8	4.2	B	SLB3400110
2.0 / 1.5	3	3.8	5.7	B	SLB3400150
3.0 / 2.2	3	5.1	7.7	C	SLC3400220
5.0 / 4.0	3	9.0	13.5	C	SLC3400400

① Motor horsepower based on typical 200 / 240 VAC four-pole motor ratings. Select model based on actual motor current rating.

② Overload: 150% for one minute

③ Motor horsepower based on typical 380 / 480 VAC four-pole motor ratings. Select model based on actual motor current rating.

Order String



COMMANDER SL SPECIFICATIONS

Environment

Ambient Operating Temperature	-10°C to 40°C (14°F to 104°F) @ 3 kHz carrier freq. Operation to 55°C (131°F) with de-rating
Cooling method	Convection and forced convection, model dependent
Humidity	95% maximum non-condensing at 40°C (104°F)
Storage Temperature	-40°C to 60°C (-40°F to 140°F) — 12 months Max.
Altitude	Derate the continuous output current by 1% for every 100 m (328 ft) above 1000 m (3280 ft) to a maximum of 4000 m (13,000 ft).
Vibration	Tested in accordance with IEC 68-2-64 and IEC 68-2-36
Mechanical Shock	Tested in accordance with IEC 68-2-29
Enclosure	IP20, NEMA 1 kits available
Electromagnetic Immunity	In compliance with EN61800-3 and EN50082-2

AC Supply Requirements

Voltage	200V models: 200 to 240 VAC ±10% 400V models: 380 to 480 VAC ±10%
Phase	1Ø and 3Ø (Model dependent)
Maximum Supply	2% negative phase sequence
Imbalance	3% voltage imbalance between phases
Frequency	48 to 62 Hz
Input Displacement Power Factor	0.97

Control

Carrier Frequency	3, 6 12 & 18 kHz (Default value model dependent)
Output Frequency	Up to 1500 Hz
Frequency Accuracy	±0.01% of full scale
Frequency Resolution	0.1 Hz
Analog Input Resolution	10 Bit + sign
PC Connections	Modbus RTU via RJ45 connection (option)
Braking	DC injection braking standard. Dynamic braking not available

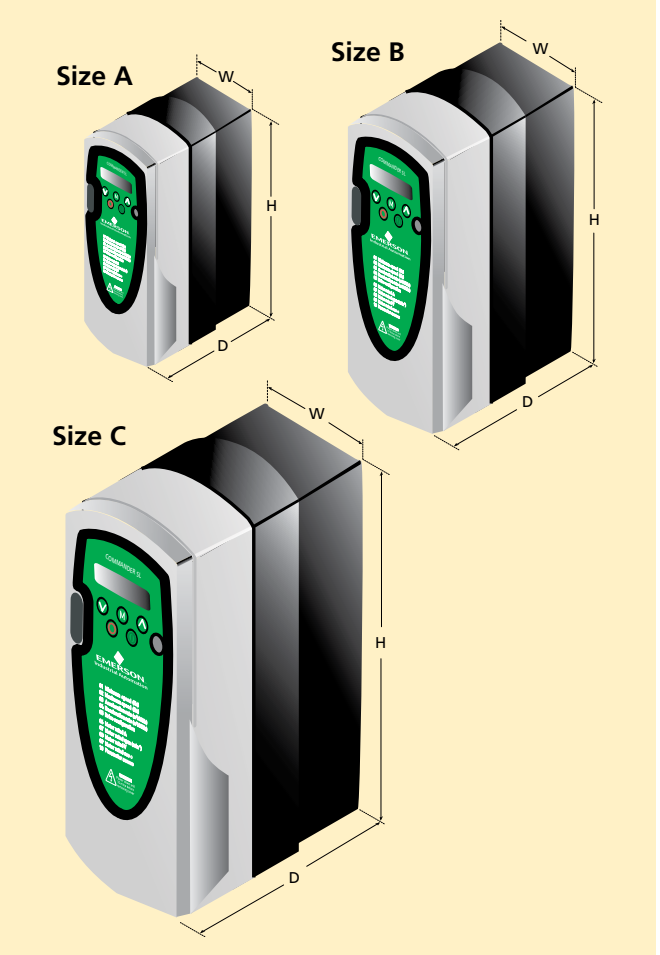
Protection

DC Bus Undervoltage Trip	200V model: 175 VDC (approximately 123 VAC line voltage) 400V model: 330 VDC (approximately 233 VAC line voltage)
DC Bus Overvoltage Trip	200V model: 415 VDC (approximately 253 VAC line voltage) 400V model: 830 VDC (approximately 587 VAC line voltage)
MOV Voltage Transient Protection	160 Joules, 1400 VDC clamping (Line to line and line to ground)
Drive Overload Trip	Current overload value is exceeded. Programmable to allow up to 150% of drive current for one minute.
Instantaneous Overcurrent Trip	215% of drive rated current
Phase Loss Trip	DC bus ripple threshold exceeded
Overtemperature Trip	Drive heatsink temperature exceeds 95°C (203°F)
Short Circuit Trip	Protects against output phase to phase fault
Ground Fault Trip	Protects against output phase to ground fault
Motor Thermal Trip	Electronically protects the motor from overheating due to loading conditions

Approvals & Listings

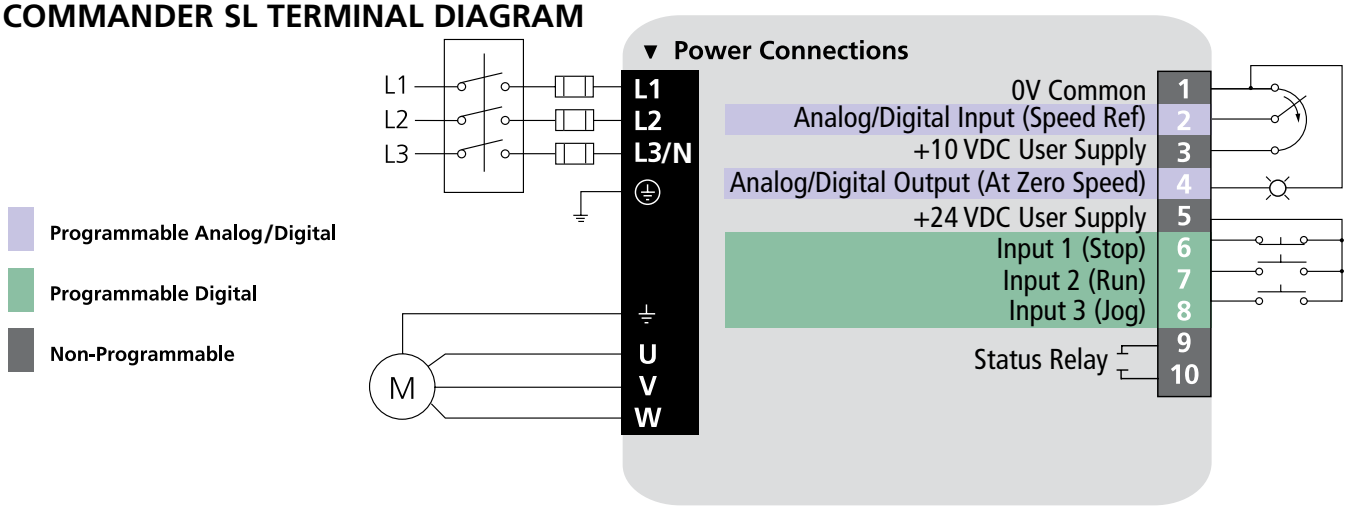
UL, cUL	UL File #E171230
CE	Designed for marking
C✓	N1652
ISO 9002	Certified Manufacturing Facility

COMMANDER SL DIMENSIONS



Drive Size	W		H		D	
	in	mm	in	mm	in	mm
A	2.95	75	5.5	140	5.71	145
B	3.35	85	7.48	190	6.14	156
C	3.93	100	9.45	240	6.81	173

COMMANDER SL TERMINAL DIAGRAM



TERMINAL DESCRIPTION

Pin#	Function ①	Type/Description	Notes
1	0V common	Common for external analog signals	
2	Analog input or digital input (speed reference)	Single ended analog input 10 bit or digital input	0 to +10 VDC or 4-20 mA or 24 VDC digital
3	+10 VDC User Supply	Reference supply	5 mA
4	Analog output or digital output (at zero speed)	Single ended analog output or digital output	0 to +10 VDC or 0 to +24 VDC
5	+24 VDC user supply	User supply	100 mA

Pin#	Function ①	Type/Description	Notes
6	Digital input (stop)	Digital input	0 to +24 VDC
7	Digital input (run)	Digital input	0 to +24 VDC
8	Digital input (jog)	Digital input	0 to +24 VDC
9	Status relay (drive healthy)	Normally open contact	240 VAC, 30 VDC
10			

① Values in parenthesis designate functions when #5=AV and #11=4. Drive default is keypad mode #5=PAd. Refer to getting started guide for details.

Commander SL

Options

Commander SL options include EMC filters that mount directly to the back of the drive or bookshelf style (on the side), conduit boxes and an Easy Commissioning Pack (order code 9500-0078).

OPTIONS AT-A-GLANCE

Option	Description	Order Code
Drive Configuration & Programming	Easy Commissioning Pack	9500-0078
	RS232/485 Cable	CT-COMMS-CABLE
	USB Cable	CT-USB-CABLE
Power Accessories	EMC Filters	See Power Accessories
Environmental Protection & Cable Management	Covers, Conduit Boxes and Nema 1 Kits	See AC Drive Options section



The Easy Commissioning pack consists of:

- 1 x EIA485 (RJ45) Comms Adaptor
- 1 x CD Rom containing Parameter tool software.

The software works with a PC Desktop or Laptop, allowing the user to commission and store parameter settings. CT-Comms-cable or CT-USB-cable are required for PC connection.

For complete product option descriptions please refer to the Options and Accessories section.

Commander SX

NEMA 4X Washdown Duty Drive

Dirt, dust, water, pollution – all environments that can mean additional cost whenever a variable speed drive is needed. From washdown food and drink applications to dust and other airborne particles found in a textile plant, Control Techniques has designed the perfect AC drive for such rugged applications – Commander SX.

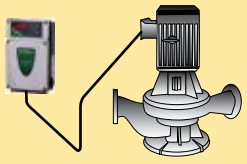
The Commander SX from 0.5 hp to 10 hp (0.37 to 7.5 kW) is a NEMA 4X (IP66) protected drive that enables users to mount the drive close to the motor providing significant cabling, enclosure and installation savings. The practicality of mounting the drive near the motor, while being protected from the harsh environment, brings users the additional benefit over integrated motors/drives by separating the two technologies in the event of maintenance and breakdown.



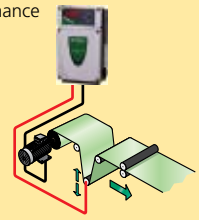
- **0.5 to 5.0 hp (0.37 to 3.7 kW), 3Ø 230 VAC**
- **0.1 to 10 hp (0.25 to 7.5 kW), 3Ø 460 VAC**
- **Nema 4X/IP66 enclosed drive – no need for separate enclosure**
- **Designed for direct to wall or next to motor mounting – reducing cabling, enclosure, and installation costs**
- **Easy set up and commissioning – the first ten parameters cover 80% of applications**
- **More than 8 preset drive configurations**
- **Surface textured and rounded corners designed to maximize washdown effectiveness**
- **Internally fitted EMC filter (to generic and drive standards) for sizes 1 & 2**
- **External IP66 filter option for size 3**
- **Robust industrial housing with simple speed control interface**

TYPICAL APPLICATIONS

Pump
Accurate Control



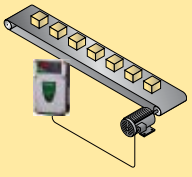
Material Payoff
Performance



Mixer
Simple and Easy



Conveyor
Smooth Acceleration



c UL us LISTED

CE

N1652

2 YEAR Digital Drive Warranty

FEATURE
Performance Advantage

Open Loop Vector Control with True Space Vector Modulation
Precise control algorithm provides full torque down to 1 Hz for exceptional performance

Closed Loop Vector Control
With optional PX-Encoder module

Access to Multiple Parameter Levels
Customizes the drive to meet each user's needs: simple (level 1), flexible (level 2) and advanced (level 3)

XpressKey Cloning Module
Provides fast and cost-effective drive-to-drive parameter transfer and storage without a PC

Static Auto-Tune
Allows fast motor/drive optimization without motor shaft rotation

Configurable Analog and Digital I/O
Customizes drive to the specific application

S-ramp Acceleration & Deceleration
Provides smooth speed transitions, minimizing machine "jerk"

Built-in Independent PID Control
Eliminates the need for an external PID controller while providing "outer loop" control of a process variable not necessarily related to the motor

Built-in Motorized Potentiometer
Emulates the functionality of the traditional motorized potentiometer with increase/decrease pushbuttons.

8 Preset Speeds with Independent Acceleration & Deceleration Ramps
Allows predetermined speed sequencing via logic inputs

Selectable Stopping Modes including Ramp, Coast, DC Injection, and Dynamic Braking
Added flexibility meets many application requirements

Full EMC Compliance with Optional Filter
Meets global standards for worldwide use

COMMANDER SX RATINGS

200 to 240 VAC 3 phase ± 10%

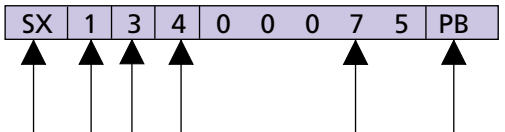
HP / kW	Input Phase	100% Output Current (A)	150% Overload Current for 60s	Size	Order Code
0.5 / 0.37	3	2.5	3.8	1	SX13200037
0.75 / 0.55	3	3.2	4.8	1	SX13200055
1.0 / 0.75	3	4.5	6.8	1	SX13200075
1.5 / 1.1	3	6	9	2	SX23200110
2.0 / 1.5	3	8	12	2	SX23200150
3.0 / 2.2	3	10	15	2	SX23200220
3.0 / 3.0	3	13.5	20	3	SX33200300
5.0 / 4.0	3	16.5	25	3	SX33200400

380 to 480 VAC 3 phase ± 10%

HP / kW	Input Phase	100% Output Current (A)	150% Overload Current for 60s	Size	Order Code
1.0 /.75	3	2.5	3.8	1	SX13400075
1.5 / 1.1	3	3.2	4.8	1	SX13400110
2.0 / 1.5	3	4.5	6.8	1	SX13400150
3.0 / 2.2	3	6	9	2	SX23400220
3.0 / 3.0	3	8	12	2	SX23400300
5.0 / 4.0	3	10	15	2	SX23400400
7.5 / 5.5	3	13.5	20	3	SX33400550
10 / 7.5	3	16.5	25	3	SX33400750

Motor horsepower based on typical 230 / 460 VAC four-pole motor ratings. Select model based on actual motor current rating.

Order String





Commander SX Overview

Washdown drive...

OPERATOR INTERFACE

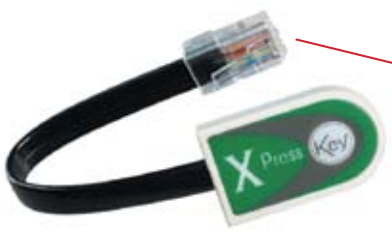


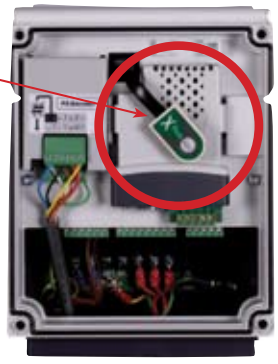
SXSoft
Parameter setting
Software

PX-LCD Remote Keypad



XpressKey





Advanced parameter setting is only possible using the PX-LCD keypad or SXSoft

PX-Encoder



CONTROL MODE



INPUT/OUTPUT

Options

PX-Secure
PX-Brake
PX-Brake-Secure

Standard

3 Analog
5 Digital I/O
(Frequency In & Out)
1 Relay Out

Closed Loop



V/Hz / Open Loop Vector



DYNAMIC BRAKING





PX Brake Resistor

COMMUNICATIONS

Standard



Modbus RTU

FILTERS

Standard



Embedded
(sizes 1 & 2)

Options



RFI Filter

COMMANDER SX SPECIFICATIONS

Environment

IP66 NEMA 4X rating for mounting in close proximity to the motor and application.

Ambient temperature 40ºC (104ºF) without derating. Up to 50ºC operation with a maximum derating of only one motor size.

Removable gland plate for easy termination and removal of control and motor cables.

Complies with EN954-1 Cat 3 with PX-Secure option. EMC cable gland option for shielded cable management.

Electromagnetic Immunity complies with EN61800-3 (Drive standard) and EN61000-6-2 (generic standard).

Electromagnetic Emissions Complies with EN61000-6-3 and EN61000-6-4 (Generic standard) with integral EMC filter. and with EN61800-3 (Drive standard - 1st and 2nd environment) with integral EMC filter.

Earth leakage current less than 3 mA with integral EMC filter in circuit.

European Hygienic Engineering and Design Group EHEDG and FDA hygienic recommendations have been adopted for the food industry:

No paint.
Anodized aluminium heat sink.
Polycarbonate covers.
All slopes > 3 degrees incline.
Roughness < 0.8 microns.
No zones where liquids can accumulate.

AC Supply Requirements

Voltage	208-240V ±10%, 380-480V ±10%
Phase	3
Imbalance	3%
Frequency	50 or 60 Hz ±2%

Control

Open loop vector control.

V/Hz control.

Closed loop vector with PX-Encoder option.

Speed reference input 0-10V, 0-20 mA, 4-20 mA.

Digital inputs: Enable, Run forward, Run reverse, Jog, local/remote select.

Switching frequency 3 kHz to 11 kHz with 4.5 kHz as default.

Acceleration and Deceleration ramps (linear and S-type).

Serial communication as standard
Modbus RTU RS485 via RJ45 connector.

DC injection braking as standard.
Integral dynamic braking transistor and resistor. PID Controller.

Protection

Undervoltage, Supply and DC Link overvoltage, Phase loss, Drive overload, Instantaneous overcurrent, Over temp, Short circuit, Ground fault, Motor thermal, Watchdog.

Approvals & Listings

UL, cUL	UL File Listed 8D14
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Low Voltage Directive
UL	UL type 1 with kit
ISO 9001:2000	Certified Manufacturing Facility
ISO 14001	Certified Manufacturing Facility



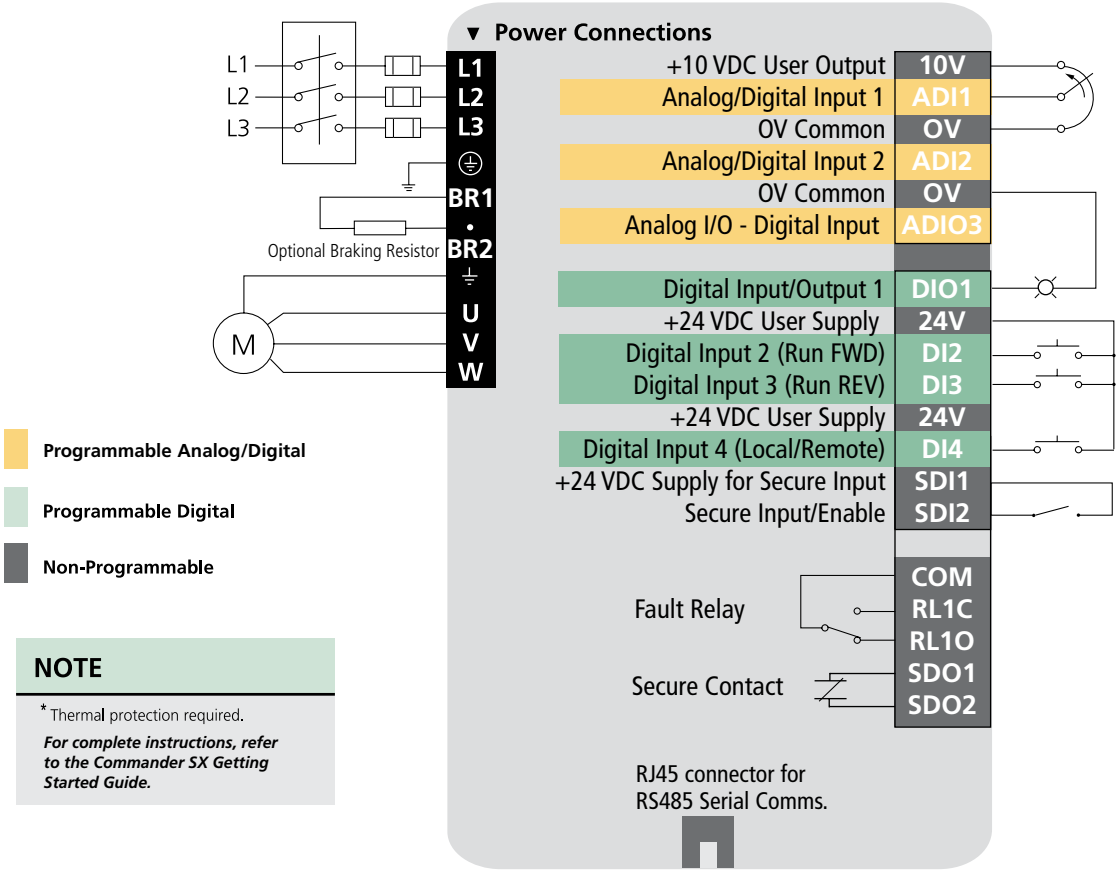


COMMANDER SX DIMENSIONS

Frame Size	H in	H (mm)	W in	W (mm)	D in	D (mm)
1	12.99	(330)	7.08	(180)	7.44	(189)
2	12.99	(330)	7.08	(180)	8.78	(223)
3	12.99	(330)	11.06	(281)	9.17	(233)



COMMANDER SX TERMINAL DIAGRAM



Programmable Analog/Digital

Programmable Digital

Non-Programmable

NOTE

* Thermal protection required.

For complete instructions, refer to the Commander SX Getting Started Guide.

TERMINAL DESCRIPTION

Pin#	Function ①	Type/Description	Notes
10V	Reference Supply	+10 VDC	20 mA max
ADI1	Local Speed reference 0-10V	Analog Input 1 or Digital Input	0 to +10 VDC or 4-20 mA (Analog In)
			0 to +24 VDC (Digital In)
0V	Common for external analog signals	OV Common	
ADI2	Remote Speed reference 4-20 mA	Analog Input 2 or Digital Input	0 to +10 VDC or 4-20 mA (Analog In)
			0 to +24 VDC (Digital In)
0V	Common for external analog signals	OV Common	
ADIO3	Speed Output 0-10V	Analog Input 3 or Analog Output or Digital Input	0 to +10 VDC or 4-20 mA (Analog In or Out)
			0 to +24 VDC (Digital In)
DIO1	Zero speed output	Digital Input/Output 1	0 to +24 VDC
+24V	User supply	+24 VDC output	100 mA maximum load (total of all 24 VDC outputs)
DI2	Run forward	Digital Input 2	0 to +24 VDC
DI3	Run reverse	Digital Input 3	0 to +24 VDC
+24V	User supply	+24 VDC output	100 mA maximum load (total of all 24 VDC outputs)
DI4	Local/Remote select	Digital Input 4	0 to +24 VDC
SDI1		+24 VDC Secure input supply	
SDI2		Secure input/enable	
COM	Fault relay	Relay common	250 VAC, 2A inductive load
RL1C		Closed contact	
RL1O		Open contact	
SDO1	Secure contact open when disabled	Secure contact	250 VAC, 1A inductive load
SDO2			

Programmable Digital Programmable Analog/Digital

① 4-20, 20-4, 20-0 mA are also available. See Commander SX Getting Started Guide.

APPLYING SECURE INPUT TO OBTAIN A SECURE STOP – PX-SECURE

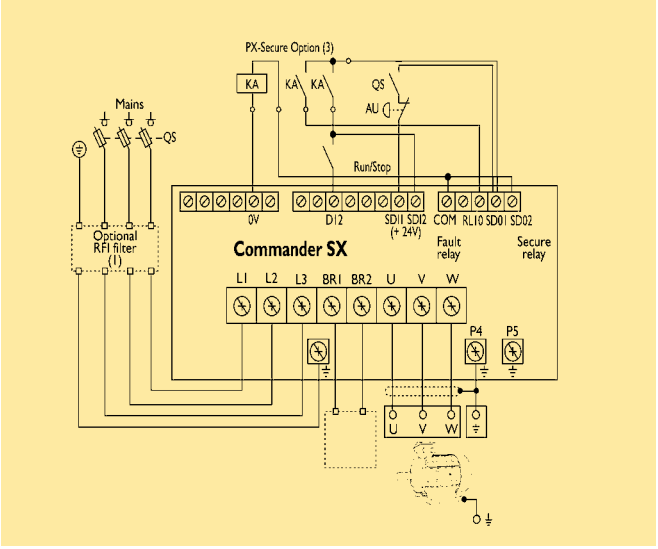
The Secure Input function provides a means of preventing the drive from generating torque in the motor, with a very high level of integrity. It is suitable for incorporation into a safety system for a machine. It is also suitable for use as a conventional drive enable input.

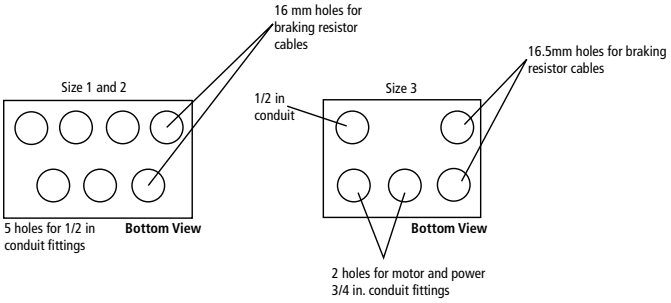
The Secure Input function is fail-safe, so when the input is disconnected the drive will not operate the motor under any circumstances. Secure Input is also independent of the drive firmware. This meets the requirements of EN954-1 category 3 for the prevention of operation of the motor when the PX-Secure option module is used.

Secure Input offers an extra level of safety in addition to electro-mechanical contactors.

CONNECTIONS IN ACCORDANCE WITH SAFETY STANDARD

EN954-1 - Category 2 or 3







XPRESSKEY

See the following page for more information about the XpressKey configuration option.

Slot for I/O Modules

See OPTIONS AT-A-GLANCE chart for more information.

PX-ENCODER

See the SK power accessories section on the following pages for more information.

Commander SX
Options

OPTIONS AT-A-GLANCE

Option	Description	Order Code
Drive Configuration and Programming	LCD hand held programmer	PX-LCD
	Commissioning software	SXSOFT
	PC-to drive Comms cable	CT-COMMS-CABLE
	PC-to drive USB cable	CT-USB-CABLE
	Cloning & parameter copying	XPRESSKEY
Power Accessories	Brake resistor	Drive dependant
	EMC filter IP66	FS6376-17-07
	Cable Gland Kit	PX-CABLING-KIT
Input/ Output	Secure enable	PX-SECURE
	Brake Contactor*	PX-BRAKE
	Brake & Secure	PX-BRAKE-SECURE
Motor Feedback	Encoder feedback	PX-ENCODER
Communications	Modbus RTU	Standard
Braking	300 W size 1 and 2	PX-BRK-300-200
	600 W size 1 and 2	PX-BRK-600-200
	300 W size 3	PX-BRK-300-50
	600 W size 3	PX-BRK-600-50

*Note: This option is protected by a fuse marked "F1" on PCB.

XPRESSKEY

The XPressKey option is used to save a copy of all the Commander SX parameters so that they can be duplicated very simply into another drive. The XPressKey allows you to quickly and easily:

- Save parameters
- Clone parameters
- Transfer parameters



COMMUNICATION CABLE

Use our RS232 or USB to RS485 cable to connect a PC to the RJ45 serial port on the front of the drive. The same cable is used with other Control Techniques products that use a RS485 RJ45 connector such as the Unidrive SP and Commander SK.



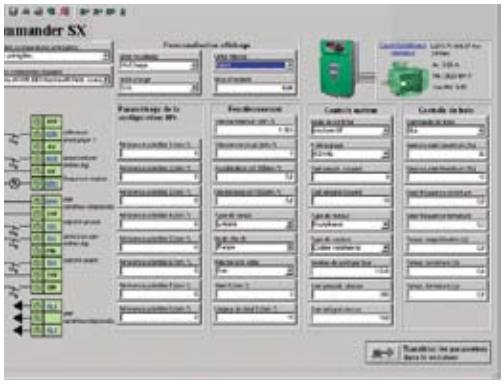
Description	Order Code
Communications Cable - RS232/485	CT-COMMS-CABLE
Communications Cable - USB	CT-USB-CABLE

Drive Configuration & Programming

SXSOFT

SXSoft software is a complimentary Windows-based drive configuration tool designed to enable complete control and display of all parameters within the Commander SX. Functions within SXSoft allow data to be uploaded, viewed and saved, or retrieved from disk, modified and printed. It can be used offline in the office or online in the factory. SXSoft communicates with the Commander SX via the computer's serial port to the drive's RS485 port using a communications cable (CT Comms Cable).

- Interactive parameter setting wizard
- File saving
- Online help
- Comparison of 2 files or one file with the factory setting
- Printing of a complete file or differences compared to the Factory setting
- Diagnostics
- Supervision
- Representation of parameters in table or graph form





FREE Software *SXSoft CAN DOWNLOAD FROM www.emersonct.com*

Operator Interface

LOCAL CONTROLS VIA PUSHBUTTON (PB)



Commander SX is supplied standard with a LED display comprising of a 4 x 7 segment digits to indicate drive status and operating data. Programming is done via intuitive operator panel with control buttons. All parameters follow a simple menu structure and programming is done in a simple and easy way.

PX-LCD

This handheld NEMA 12 option makes it much easier to set the Commander SX parameters and access them. Its LCD display, consisting of one line of 12 characters and 2 lines of 16 characters, offers text which can be displayed in 5 languages (English, French, German, Italian and Spanish). The PX-LCD console has 4 main functions:

- A read mode for Commander SX supervision and diagnostics
- From the time it is plugged in, the PX-LCD display is in read mode. By pressing the keys, the user can scroll through all the parameters required for supervision and diagnostics, such as:
  - motor current
  - motor frequency
  - motor voltage
  - analog I/O levels
  - logic I/O states
  - logic function states
  - timer



- An interactive parameter-setting wizard which makes it very simple to configure the Commander SX. The parameters are set in successive steps. The parameters offered at each step by the PX-LCD handheld console depend on parameters set in the previous steps. The user will therefore only be offered those parameters required by the application
- Access to all the Commander SX advanced parameters in order to optimize settings or configure special applications. All the parameters, organized by menus, can be accessed via the PX-LCD console including last faults.

Motor Feedback

PX-ENCODER



The PX-Encoder module provides an encoder feedback option for closed loop vector control. The module supports differential quadrature type encoders with terminals for A,A\,B,B\ up to 140 kHz operation. The module also provides encoder power, up to 300 mA at 5V or 200 mA at 15V.

Power Accessories

EMC FILTER



Commander SX sizes 1 and 2 drives conform to the drive standard EN 61800-3 since they have an RFI filter integrated internally, as standard.

For conformity of size 3 Commander SX drives and in certain conditions for sizes 1 and 2, an external RFI filter must be added (part number FS6376-17-07).

The customer connects the filter to the main supply, without any special tools, using an IP 66 dust and damp proof insulation displacement connector. For Commander SX sizes 1 and 2, the filter should be mounted on the left as close as possible to the drive. For size 3, the filter should be mounted on the heatsink.

PX-BRAKE RESISTOR



The braking resistors are supplied on a metal plate ready to be fixed using 4 screws at the back of the drive. To ensure that the heat losses from the resistors are dissipated correctly, the drive must be fixed with spacers (supplied with the resistors).

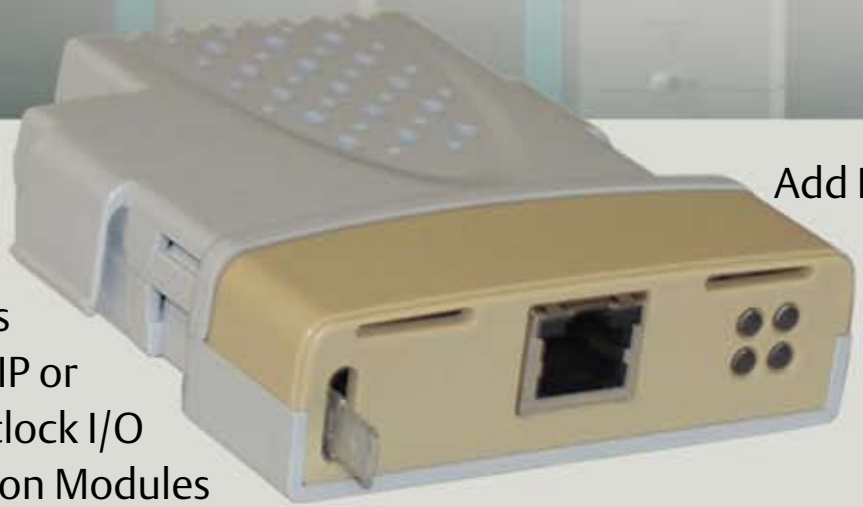
PX-BRAKE

The optional PX-Brake solid-state contactor allows the direct control of an electro-mechanical brake from a single phase AC supply. This option is connected to a dedicated digital output, controlled by the brake command.

Commander SK

Simplicity with Functiona





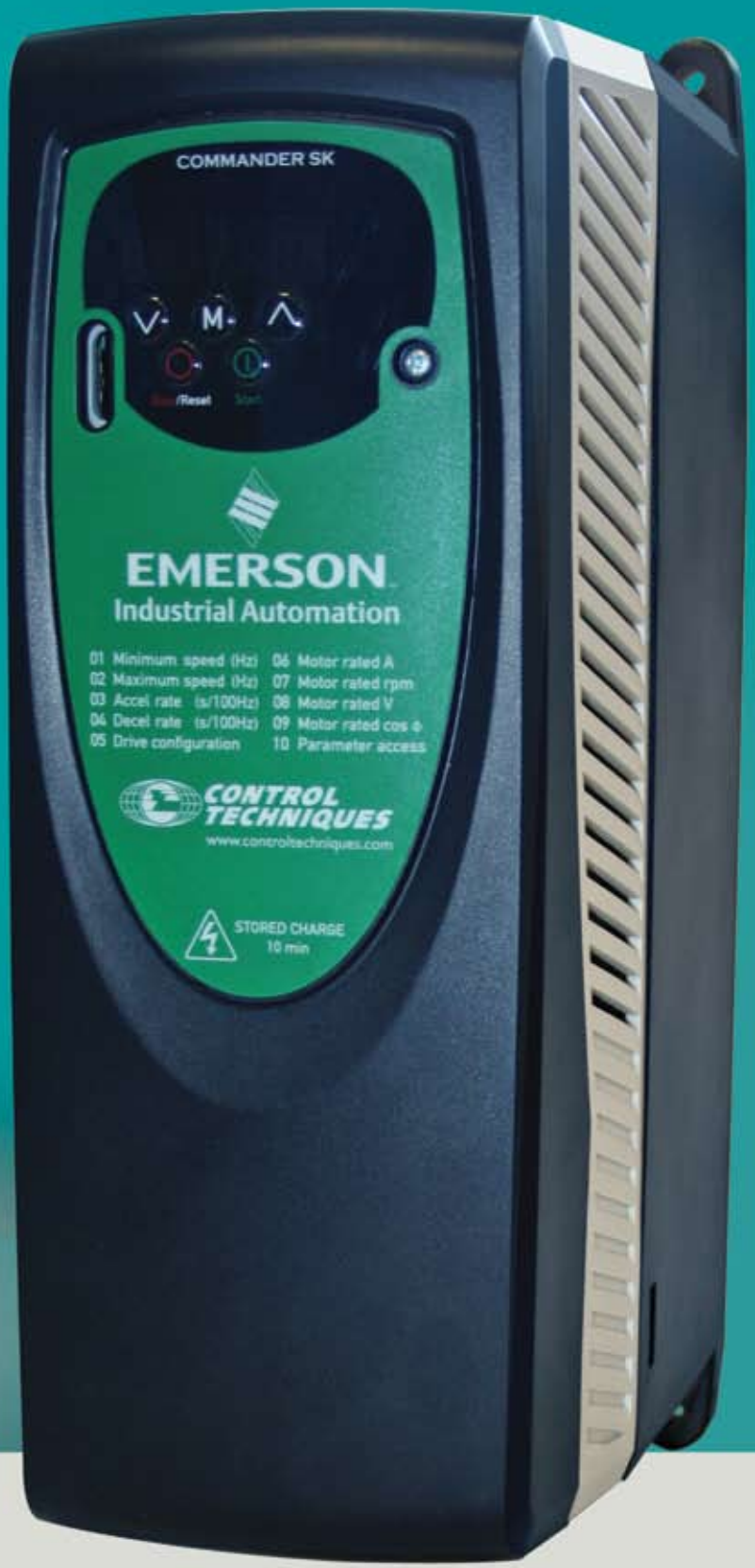
Snap in Fieldbus
or I/O options
such as EtherNet/IP or
"Real-Time" clock I/O
with Solution Modules

Add PLC functionality
with the
LogicStick

lity







- Easy keypad control
- Top 10 parameters on cover
- SmartStick parameter cloning
- Built-in EMC filter and DB transistor
- Industry-leading two-year warranty and all major approvals

The new 3Ø size D Commander SK
5 hp @ 230V, 10 hp @ 460V

Actual size : H=11.81”, W=4.53”, D=7.80”

Commander SK Overview

Simplicity with Functionality



OPERATOR INTERFACE

CTOPCserver

HMI Operator Interface



FREE Software



CTSoft
CTScope

SK-Keypad Remote



SM-Keypad Plus



SmartStick



EXTERNAL PLC CONTROL

CONTROL MODE



PLC



PC

INPUT/OUTPUT

Options

SM-I/O 32



SM-Bipolar



SM-I/O Timer



SM-I/O Lite



SM-PELV



SM-I/O 120V



SM-I/O 24V



Standard

3 Analog
5 Digital I/O
(Frequency In & Out)
1 Relay Out

FILTERS

Standard



Options



V/Hz / Open Loop Vector



DYNAMIC BRAKING



Zero Space Internal
Brake Resistor
E-Stop Duty
(size 2 only)







Dynamic Brake Resistors

APPLICATIONS WITH PLC FUNCTIONALITY



LogicStick

Programming Platform

SyPT Lite

Standard

PLC Functionality
Features
Function Block Programming
Ladder Logic Sequencing

COMMUNICATIONS

Standard

Options



Modbus RTU













Modbus TCP/IP

Commander SK

Simplicity with Functionality



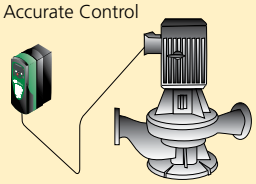
Commander SK has been designed to be a simple, compact, cost effective AC motor speed controller that delivers performance with simplicity and ease of use. With all the parameters you need for 90% of applications printed on the front of the drive, Commander SK ensures installation and commissioning are straight forward.

However, for more demanding applications, Commander SK can deliver benchmark functionality at no added cost to the base drive itself. Plug-in options, dynamic performance, PLC functionality and other advanced features ensure that in more complex applications the Commander SK can deliver more than the average general purpose drive - giving you lower cost solutions and better productivity in your motor control applications.

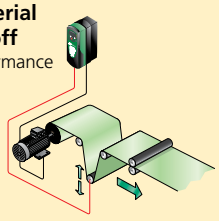
- **0.3 to 1.5 hp (0.25 to 1.1 kW), 1Ø 100-120 VAC**
- **0.3 to 3 hp (0.25 to 2.2 kW), 1Ø 200-240 VAC**
- **1.5 to 40 hp (1.1 to 22 kW), 3Ø 200-240 VAC**
- **0.5 to 200 hp (0.37 to 110 kW), 3Ø 380-480 VAC**
- **3 to 150 hp (2.2 to 90 kW), 3Ø 575 VAC**
- **25 to 175 hp (15 to 110 kW), 3Ø 690 VAC**
- **Easy to set-up – all the parameters you need (90% of typical applications) are printed on the front**
- **Easy installation – choose between simple panel mounting and DIN-rail mounting (up to 2 hp)**
- **Simple connections – easy access terminals with clear marking**
- **Simple start-up – easy push button set-up - no need for complex programming**
- **Communications – Modbus RTU standard, Fieldbus Options; Profibus-DP, EtherCAT, INTERBUS, DeviceNet, CANopen, Ethernet**
- **PLC Functionality– LogicStick and IEC61131-3 ladder and function block programming**
- **Wide range of I/O – extra I/O options available including Real-Time Clock**
- **Performance – high performance open loop vector and torque control**

TYPICAL APPLICATIONS

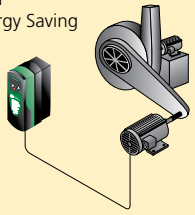
Pump
Accurate Control



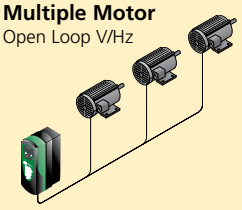
Material Payoff
Performance



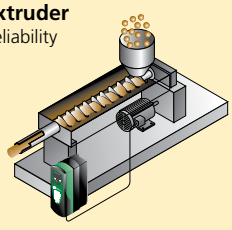
Fan
Energy Saving



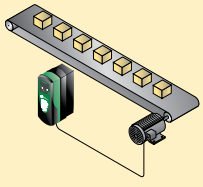
Multiple Motor
Open Loop V/Hz



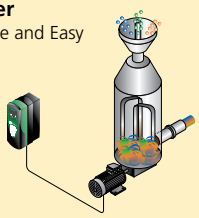
Extruder
Reliability



Conveyor
Smooth Acceleration



Mixer
Simple and Easy



FEATURE
Performance Advantage

Open loop vector control with true space vector modulation
Precise control algorithm provides full torque down to 1 Hz for exceptional performance

Access to multiple parameter levels
Customizes the drive to meet each user's needs: simple (level 1), flexible (level 2) and advanced (level 3)

Top ten level 1 parameters listed on the drive's front cover
On-the-spot easy reference for drive set-up and maintenance

Static auto-tune
Allows fast motor / drive optimization without motor shaft rotation

Two sets of motor map parameters saved in the drive's memory
Allows sequenced switching between two motors with different operating characteristics

Configurable analog and digital I/O
Customizes drive to the specific application

S-ramp accel / decel profiling
Provides smooth speed transitions, minimizing machine "jerk"

Built-in independent PID control
Eliminates the need for an external PID controller while providing "outer loop" control of a process variable

Real-Time Clock option
For scheduling and timing operations

Wide range of industry standard fieldbuses
Modbus RTU (Standard), Profibus-DP, INTERBUS, DeviceNet, CANopen, Ethernet, EtherCAT

c UL us LISTED
CE
N1652
ISO 14001 APPROVAL
ISO 9001:2000 APPROVAL
2 YEAR Digital Drive Warranty
5 YEAR Extended Warranty

Additional Plug-in Functionality

SmartStick

The SmartStick cloning module provides fast and cost-effective drive-to-drive parameter transfer and storage without a PC.


SmartStick

LogicStick PLC Funtionality

Replace nano and micro PLCs by using LogicStick and IEC61131-3 ladder and function block programming.


LogicStick

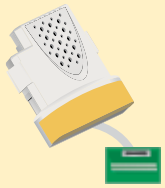
Fieldbus Communications

The available fieldbus options are Profibus DP, INTERBUS, DeviceNet, CANopen, EtherCAT and Ethernet.


SM-Profibus

Expandable I/O

In additional to the standard built-in I/O a wide range of I/O options including the new SM-I/O 32 are available to greatly increase the capabilities of the Commander SK.


SM-I/O 32

READY TO RUN RIGHT OUT OF THE BOX!

Commander SK comes from the factory preset to operate in V/Hz, and takes only minutes to have up and running:

1. Mount the drive
2. Wire up the motor
3. Wire up the power
4. Hardware enable the drive by placing a jumper between B2 and B4
5. Provide input power
6. Verify rated motor Amps and Volts settings
7. Press the Start button to run
8. Press Up or Down arrows to set the speed



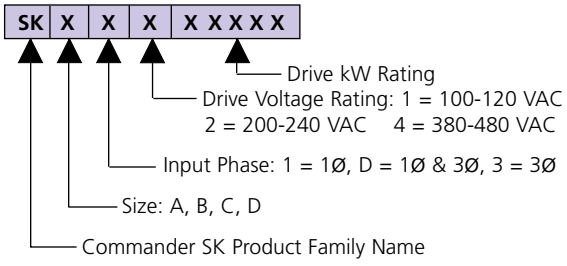
SECONDS TO RECONFIGURE...

To change the drive to another configuration is a simple and fast process. For example, if you want to set the drive to the HVAC (Hand-off-auto) preset, simply:

1. Press the Mode button (M)
2. Press the Up Arrow (^) until you reach parameter 05, Drive Configuration
3. Select by pressing the Mode button (M)
4. Press the Up Arrow through the available preset configurations until you see HVAC
5. Press the Mode button (M) to select HVAC
6. Press the Stop/Reset button and the default HVAC configuration is set

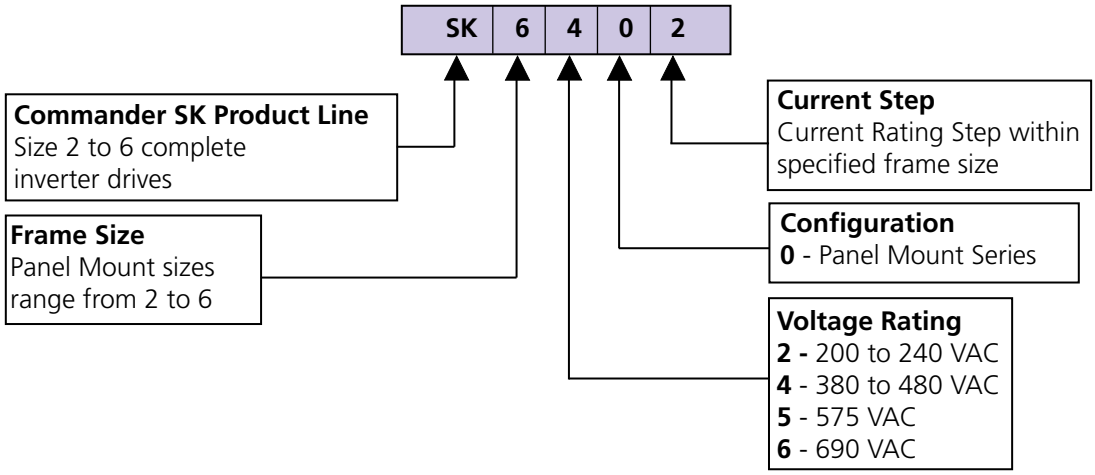
Display Keypad included as standard, Remote Keypad optional

Order String (Sizes A-D)



Note: Drive must be disabled (B2 & B4 open) to change the drive's configuration.

Order String (Sizes 2-6)



COMMANDER SK RATINGS

100 / 120 VAC ±10% 1Ø (230V 3Ø output) Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SKA1100025	.33	1.7	0.25	.33	1.7	0.25
SKA1100037	.5	2.2	0.37	.5	2.2	0.37
SKB1100075	1	4	0.75	1	4	0.75
SKB1100110	1.5	5.2	1.1	1.5	5.2	1.1

200 / 240 VAC ±10% 1Ø (230V 3Ø output) Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SKA1200025	0.33	1.7	0.25	0.33	1.7	0.25
SKA1200037	0.5	2.2	0.37	0.5	2.2	0.37
SKA1200055	0.75	3	0.55	0.75	3	0.55
SKA1200075	1	4	0.75	1	4	0.75
SKBD200110	1.5	5.2	1.1	1.5	5.2	1.1
SKBD200150	2	7	1.5	2	7	1.5
SKCD200220	3	9.6	2.2	3	9.6	2.2
SKDD200300	3	12.6	3	3	12.6	3

200 / 240 VAC ±10% 3Ø Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SKBD200110	1.5	5.2	1.1	1.5	5.2	1.1
SKBD200150	2	7	1.5	2	7	1.5
SKCD200220	3	9.6	2.2	3	9.6	2.2
SKDD200300	3	12.6	3	3	12.6	3
SKD3200400	5	17	4	5	17	3
SK2201	5	15.5	4	3	12.6	3
SK2202	7.5	22	5.5	5	17	4
SK2203	10	28	7.5	7.5	25	5.5
SK3201	15	42	11	10	31	7.5
SK3202	20	54	15	15	42	11
SK4201	25	68	18.5	20	56	15
SK4202	30	80	22	25	68	18.5
SK4203	40	104	30	30	80	22

575 VAC ±10% 3Ø Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SK3501	3	5.4	3	2	4.1	2.2
SK3502	5	6.1	4	3	5.4	3
SK3503	7.5	8.4	5.5	5	6.1	4
SK3504	10	11	7.5	7.5	9.5	5.5
SK3505	15	16	11	10	12	7.5
SK3506	20	22	15	15	18	11
SK3507	25	27	18.5	20	22	15
SK4603	30	36	22	25	27	18.5
SK4604	40	43	30	30	36	22
SK4605	50	52	37	40	43	30
SK4606	60	62	45	50	52	37
SK5601	75	84	55	60	63	45
SK5602	100	99	75	75	85	55
SK6601[1]	125	125	90	100	100	75
SK6602[1]	150	144	110	125	125	90

NEW Higher horse power Commander SK models now to 200 hp and new extended 110V range

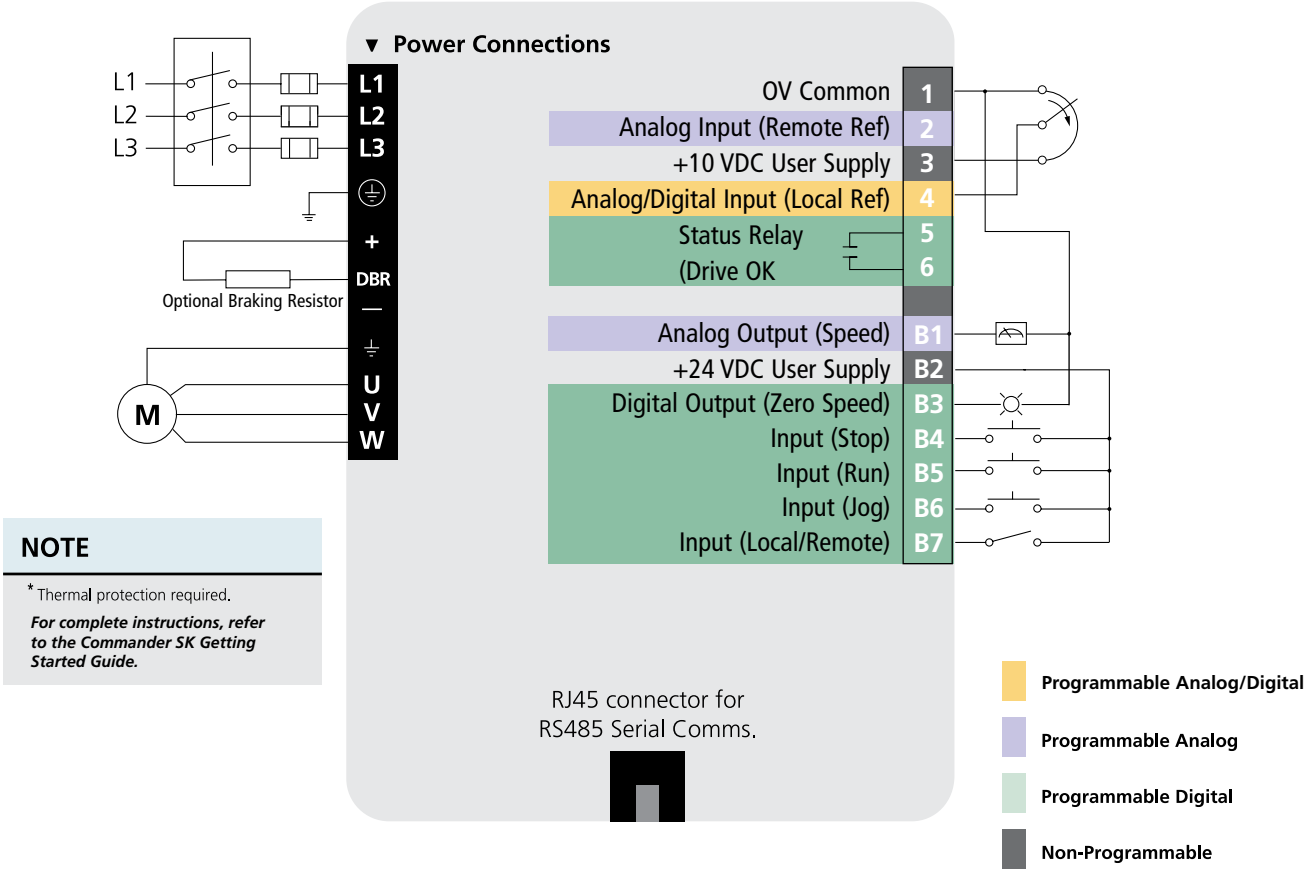
380 / 480 VAC ±10% 3Ø Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SKB3400037	0.5	1.3	0.37	0.5	1.3	0.37
SKB3400055	0.75	1.7	0.55	0.75	1.7	0.55
SKB3400075	1	2.1	0.75	1	2.1	0.75
SKB3400110	1.5	2.8	1.1	1.5	2.8	1.1
SKB3400150	2	3.8	1.5	2	3.8	1.5
SKC3400220	3	5.1	2.2	3	5.1	2.2
SKC3400400	5	9	4	5	9	4
SKD3400550	7.5	13	5.5	7.5	13	5.5
SKD3400750	10	16.5	7.5	10	16.5	7.5
SK2401	10	15.3	7.5	7.5	13	5.5
SK2402	15	21	11	10	16.5	7.5
SK2403	20	29	15	20	25	11
SK2404	20	29	15	20	29	15
SK3401	25	35	18.5	25	32	15
SK3402	30	43	22	30	40	18.5
SK3403	40	56	30	30	46	22
SK4401	50	68	37	50	60	30
SK4402	60	83	45	60	74	37
SK4403	75	104	55	75	96	45
SK5401	100	138	75	100	124	55
SK5402	125	168	90	125	156	75
SK6401[1]	150	205	110	150	180	90
SK6402[1]	200	236	132	150	210	110

690 VAC ±10% 3Ø Order Code	Normal Duty			Heavy Duty		
	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)	Motor Power (HP)	Max Continuous Current (A)	Typical Output (kW)
SK4601	25	22	18.5	20	19	15
SK4602	30	27	22	25	22	18.5
SK4603	40	36	30	30	27	22
SK4604	50	43	37	40	36	30
SK4605	60	52	45	50	43	37
SK4606	75	62	55	60	52	45
SK5601	100	84	75	75	63	55
SK5602	125	99	90	100	85	75
SK6601[1]	150	125	110	125	100	90
SK6602[1]	175	144	132	150	125	110

Normal Duty	For applications that use self-ventilated induction motors and require a low overload capability (e.g. fans, pumps)
Heavy Duty	150% overload current for 60 seconds. For constant torque applications that require a high overload capability (e.g. cranes, hoists).

1) Size 6 drives require a +24VDC - 3.5A power supply for the heat sink fans not provided with unit. See the Options & Accessories section for available power supplies.

COMMANDER SK TERMINAL DIAGRAM



NOTE

* Thermal protection required.

For complete instructions, refer to the Commander SK Getting Started Guide.

TERMINAL DESCRIPTION

Pin	Function ①	Type/Description	Notes
T1	0V Common	Common for External Analog Signals	
T2 ①	Analog Input 1 (A1) either voltage or current	Remote Speed Reference Input 4-20 mA	
T3	+10 VDC	Reference Supply	5 mA max Short Circuit Protected
T4	Analog Input 2 (A2) or Digital Input	Local Speed Reference Input 0-10V	0 to +10 VDC (AI) 0 to +24 VDC (DI)
T5 T6	Status Relay (Normally open)	Drive Healthy	240 VAC 30 VDC 2A/6A resistance
B1	Analog Output 1 single ended Unipolar	Motor Speed	0 to +10 VDC @ 5 mA max
B2	+24 VDC Output	User Supply	100 mA max
B3	Digital Input/Output Pulse Output	Zero Speed	0 to +24 VDC, Pulse Output to 10 kHz

Pin	Function ①	Type/Description	Notes
B4	Stop	Digital Input	0 to +24 VDC
B5	Run	Digital Input	0 to +24 VDC,
B6	Jog	Digital Input	0 to +24 VDC,
B7	Local/Remote Speed Reference Select A1/A2	Digital Input / Pulse Input	0 to +24 VDC, Pulse Input to 50 kHz

① 4-20, 20-4, 20-0 mA are also available. See Commander SK Getting Started Guide.

Values in parenthesis designate functions when #5 = AI.AV
Drive default is keypad mode #5 = PAd

COMMANDER SK SPECIFICATIONS

Environment

IP20

UL TYPE 1or NEMA 1 rating with optional cover + conduit entry kit

Ambient temperature -10°C to +40°C @ 3 kHz switching
Operation to +50°C/+55°C with de-rating

Humidity 95% maximum (non-condensing)

Electromagnetic Immunity complies with EN61800-3 and EN61000-6-3 and 4

Electromagnetic Emissions complies with EN61800-3 (second environment) as standard. Complies with EN61000-6-3 (residential) and EN61000-6-4 (industrial) generic standards with optional footprint EMC filter

Control

Open loop vector control, V/Hz

Speed or torque control

Reference input: 0-10V, 0-20 mA, 4-20 mA, 8 Presets, Pulse, PWM (-10 to +10V SM-Bipolar option)

Digital I/O - All configurable
- 4 inputs, not stop, run, jog, local/remote (default)
- 1 I/O zero speed (default)
- 1 relay drive health (default)

Switching frequency: 3 kHz (default)
- 230V: 6,12,18 kHz
- 460V: 6,12 kHz

Output frequency 0 to 1500 Hz

Accel and Decel ramps (linear and S type)

Positive logic control

Serial communication
- Modbus RTU RS485 via RJ45 connector
- Baud rate 4800, 9600, 19200 or 38400 bits per second

DC injection braking as standard

Dynamic braking transistor as standard (except SKA1100025 & SKA1100037)

Dynamic motor V/Hz for energy saving

Quadratic motor V/Hz for fan and pump optimization

Protection

Undervoltage, Supply and DC link overvoltage, Phase loss, Drive overload, Instantaneous overcurrent, Short circuit, Ground fault, Drive thermal, Watchdog, Motor thermal

General Characteristics

Maximum overload 150% of rated current for 60 seconds

Intelligent Thermal Management (ITM) optimizes switching frequency

Catch a spinning motor

Power loss ride through

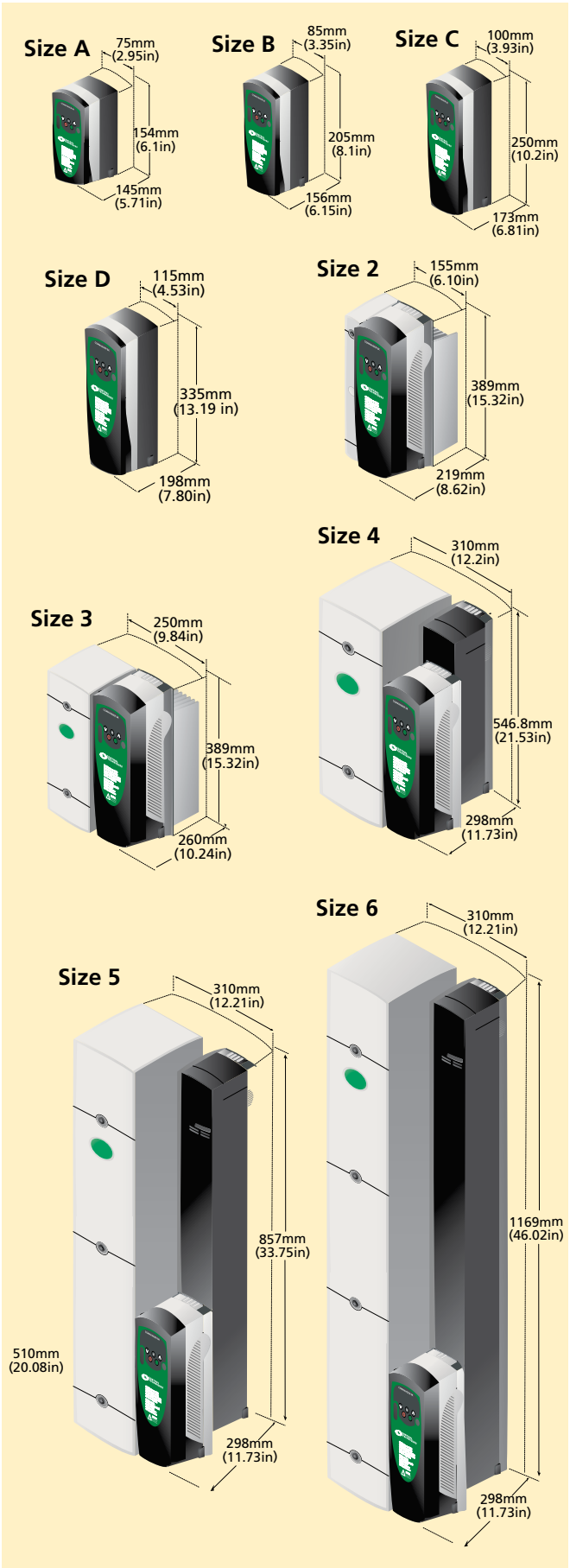
Automatic no-spin auto-tune for fast performance optimization

Keypad access to all parameters for more demanding applications

Approvals & Listings

UL, cUL	UL File #E171230
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Low Voltage Directive
UL	UL type 1 with kit
ISO 9001:2000	Certified Manufacturing Facility
ISO 14001	Certified Manufacturing Facility

COMMANDER SK DIMENSIONS



Commander SK

Options

Commander SK has been designed to offer simplicity with an impressive selection of options and standard features. It also offers functionality that enables users to get more productivity from their machines.

Users that scratch the surface of this simple drive will discover a list of dynamic and functional options that owe much to the ground breaking Solution Platform products, such as Unidrive SP, in the Control Techniques product portfolio.

Plug in the power of a PLC!



OPTIONS AT-A-GLANCE

Option	Description	Order Code
Drive Configuration & Programming	Configuration Tool	CTSOFT
	Keypad to Drive Cable	SP-LCD-485-XXX
	RS232/485 Cable	CT-COMMS-CABLE
	USB Cable	CT-USB-CABLE
	Cloning and parameter storage	SMARTSTICK
Operator Interfaces	Remote LED display	SK-KEYPAD REMOTE
	Remote LCD display	SM-KEYPAD PLUS
	HMI Operator Interfaces	See AC Options & Accessories
Power Accessories	Internal EMC Filter	Standard
	External EMC Filter	See the Options & Accessories section
	Braking Resistor	
Environmental Protection and Cable Management Options	Top & Side covers and conduit entry	SK-NEMA1-KIT-A, B, C OR D
	Conduit Boxes sizes 2-6	See AC Options & Accessories
Input/Output Size B and up accept up to one SM total	Extended I/O	SM-I/O LITE
	Extended I/O	SM-I/O-32
	Extended I/O plus Real Time Clock	SM-I/O-TIMER
	Double Insulated Extended I/O	SM-I/O-PELV
	120V Extended I/O	SM-I/O-120V
	24V Protected I/O	SM-I/O-24V
	Bipolar Reference	SM-BIPOLAR
Communications Size B and up accept up to one SM total	Modbus RTU	Standard
	PROFIBUS DP	SM-PROFIBUS-DP
	DeviceNet	SM-DEVICENET
	CANopen	SM-CANOPEN
	Interbus-S	SM-INTERBUS
	Ethernet	SM-ETHERNET
	Ethernet (EtherCAT)	SM-ETHERCAT
Application Programming Software (IEC61131-3)	Ladder and function block programming	SYPTLITE
	Memory for SyPTLite program	LOGICSTICK





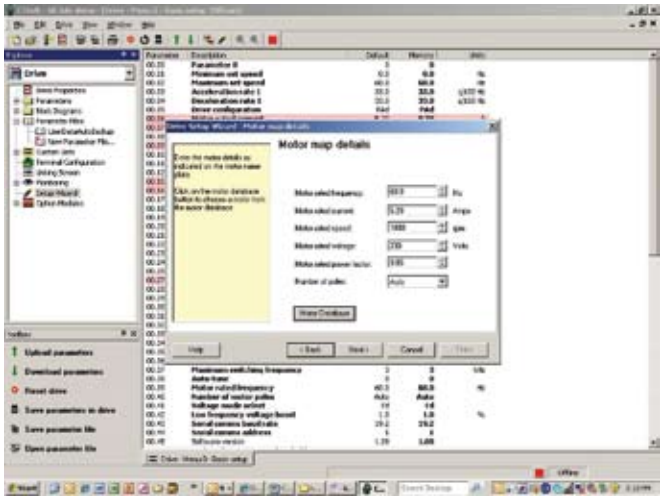
Drive Configuration and Parameter Programming

DRIVE CONFIGURATION TOOL

CTSoft software is a free Windows-based drive configuration tool designed to enable the complete control and display of all parameters within a Commander SK. Functions within CTSoft allow data to be uploaded, viewed, saved, or retrieved from disk, modified and printed. It can be used offline in the office or online in the factory. CTSoft communicates with the Commander SK via the computer's serial port to the drive's RS485 port using a communications cable (CT-Comms-Cable or CT-USB-Cable).

Some of CTSoft's capabilities include:

- Remote Upload/Download
- Parameter Saving
- Monitor Screens
- Multiple Window Display
- Block Diagram Animation
- Project Storage



FREE Software

CTSoft IS SUPPLIED WITH THE DRIVE OR YOU CAN DOWNLOAD FROM www.emersonct.com

SMARTSTICK

This option enables the simple set up of parameters in a variety of ways. The SmartStick can:

- 'Clone' a complete set of parameters from the first drive to multiple drives (ideal for serial production)
- Download parameter settings to the drive to easily set up your application
- Automatically save the user parameter set up for storage and maintenance purposes
- Load complete motor map parameters



The SmartStick may be "hot swapped".



Operator Interfaces

KEYPAD OPTIONS

The Commander SK can be configured or operated using the standard fixed keypad, or with either the SK-Keypad Remote or SM-Keypad Plus. The SK-Keypad Remote is a NEMA12 (IP65) full-function, 7-digit LED data display with an additional multi-function push button. The SM-Keypad-Plus is a back-lit LCD display option that can be remote mounted, has 5 languages, plus custom text database, online help, and HMI features.



SK-Keypad Remote



SM-Keypad Plus

Multi-lingual

English
French
Spanish
German
Italian

Keypad to Drive Cable SP-LCD-485-XXX
XXX=005, 010, 015, 025, 050 feet

HUMAN MACHINE INTERFACE (HMI)

These operator interface units complement the product line by offering an impressive way of accessing parameters and adding more programming power to your application.



For more information, refer to the Accessories Section.

Power Accessories

DYNAMIC BRAKING RESISTORS



Dynamic braking resistors provide a means of rapidly decelerating or stopping the motor and load. The mechanical energy stored in the spinning mass is converted into electrical energy by the drive and then quickly dissipated into the resistor. Internal, panel mount and enclosed version are available.

See the Options & Accessories section for complete braking resistor ratings, model numbers and order codes.

EMC FILTERS



An internal EMC filter is provided as standard with the Commander SK which is adequate for most industrial applications. The drive and filter conforms to EN61800-3 (second environment). For installations where it is deemed necessary, Control Techniques provide a range of addition external EMC filters. The internal filter can be easily removed if the drive is to be used on IT supplies or with low earth leakage external EMC Footprint filters.

External EMC filters are used to minimize high frequency power supply line disturbances caused by PWM AC drives that may interfere with proper operation of sensitive electronic equipment. The Commander SK EMC filters are designed such that they can be mounted in either of two orientations.

- Bookend: filter mounts next to the drive with the smallest dimension being the width of the filter
- Footprint: filter mounts between the drive heatsink and the panel or enclosure

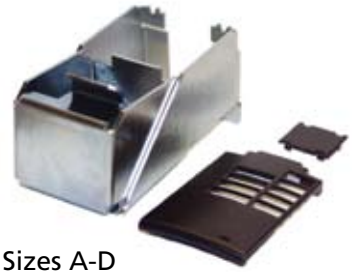
Note: Refer to the *Options & Accessories* section in the back of the catalog for complete details on all EMC filters including low leakage filters.

TOP COVER OPTIONS

A plastic top cover can be fitted to the Commander SK. This cover simply clips onto the top of the drive for protection from falling particles. The top cover provides protection to IP4X per IEC specification.

NEMA 1 KIT

The NEMA 1 Kit includes a Top Cover, Side Covers, and a Conduit Entry Box providing a UL Type 1 Plenum rating. With this option Commander SK drives can be mounted into air handling ducts.



Sizes A-D
SK-NEMA1-KIT-A, B, C or D

CONDUIT BOXES

Conduit plates for Commander SK, Commander GP20 and Unidrive SP wall-mount drives.

For overall dimensions and order codes see the AC Options & Accessories section page 83.

Description	Order Code
Plastic Top & Side Covers	SK-COVER-A, SK-COVER-B, SK-COVER-C, SK-COVER-D
UL Type 1 Rating Kit	SK-NEMA1-KIT-A, SK-NEMA1-KIT-B, SK-NEMA1-KIT-C, SK-NEMA1-KIT-D
Conduit Boxes sizes 2-6	C-BOX-S2, C-BOX-S3, C-BOX-S4, C-BOX-S5, C-BOX-S6

\I/O OPTIONS

SM-BIPOLAR (Commander SK only)



This module provides an optional bipolar speed reference input card for the Commander SK. It allows the direction of rotation of a motor to be controlled via an analog signal rather than the run forward and run reverse terminals or a forward/ reverse terminal.

- ±10V bipolar input
- Relay output

ADDITIONAL I/O OPTIONS*

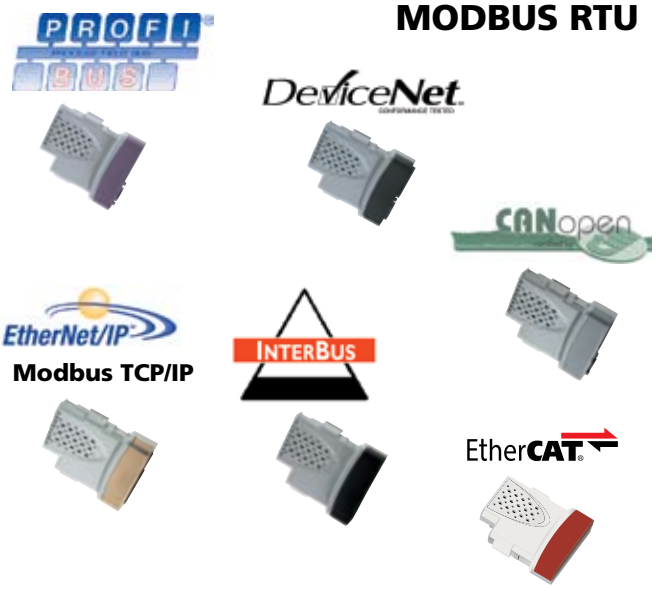


* These SM I/O option modules also work with other Control Techniques drives.

For more details and order codes see the AC Drive Options section at the end of the AC Drives section.

For complete product descriptions please refer to the Options and Accessories section.

COMMUNICATION OPTIONS*



MODBUS RTU

* These SM Communications option modules also work with other Control Techniques drives.

For more details and order codes see the AC Drive Options section at the end of the AC Drives section.

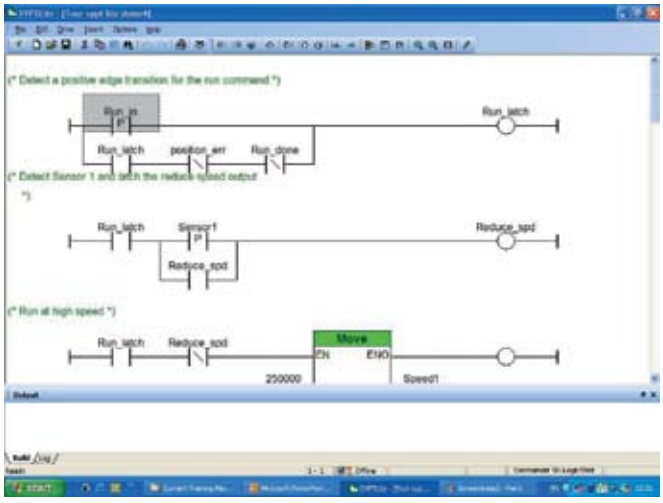
For complete product descriptions please refer to the Options and Accessories section.

PLC Funtionality On-Board

LADDER PROGRAMMING SOFTWARE SyPTLite IEC 61131-3

SyPTLite is a ladder diagram editor that allows you to develop programs that can be executed onboard Commander SK with a LogicStick.

SyPTLite is designed to meet the needs of the majority of automation users wishing to extend the functionality of the drive control and sequencing. The software has been developed with a definite focus on intuitive ease of use allowing you to quickly access all of the drive's parameters and to monitor and debug your ladder program online.



SyPTLite contains a comprehensive library of functions that is based on those available in the SyPTPro programming tool. These include:

- Arithmetic Blocks
- Timers
- Multiplexers
- Bit Manipulation
- Comparison Blocks
- Counters
- Latches

FREE Software *SyPTLite IS SUPPLIED WITH THE DRIVE OR YOU CAN DOWNLOAD FROM www.syptlite.com*

Programming Software

SyPTLite with LogicStick

Commander SK is Control Techniques' simple and easy-to-use general-purpose drive. However, Commander SK contains features and functions that you may not expect to find on a low-cost drive, such as the flexibility to program PLC applications onboard the drive. By inserting a LogicStick into the front of the drive, you quickly add memory for program storage that allows you to write a PLC ladder program using SyPTLite. The drive is prioritized to execute all motor control related functions first and will use any remaining processing time to execute the SyPTLite ladder program as a background activity. Inset shows strap used to secure the LogicStick.



Description	Order Code
The LogicStick plugs into the front of the drive and enables you to program PLC functions within the drive. Typically 30-50 rungs of logic.	LOGICSTICK



See the RapidPak pages in the Packaged Drives and Engineered Systems section for details.

Commander SK

Specialty Pump Drive Solution

NEW

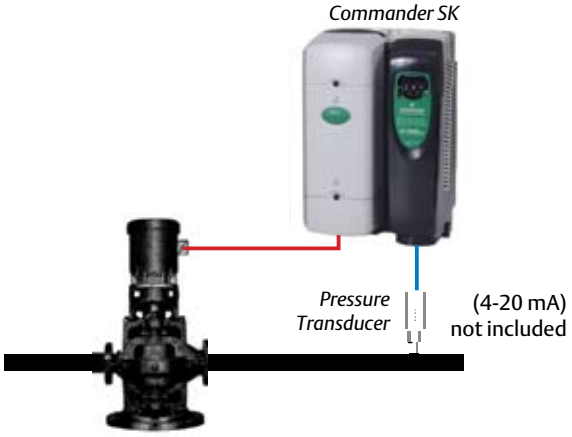


Save energy and control constant pressure with the Commander SK drive that is dedicated to pumping applications. The Commander SK Pump Drive is rich with features that are a perfect match for simplex (single pump) system needs.

The SK Pump Drive is shipped pre-programmed and ready for quick and easy installation. Simply enter the motor parameters, desired control mode, and diagnostic settings and you're up and running! This can be done without a computer through the built-in keypad, or using your PC and our free CTSoft commissioning software.

Save Energy, Time, and Cost With These Features:

- **Constant Pressure PID**
- **Auto / Hand Modes**
- **No Flow Detection**
- **Dry Well Detection**
- **Transducer Loss Detection**
- **Sleep / Wake**
- **Pipe Fill Start Mode**
- **Keypad and Terminal Control**
- **Automatic Fault Reset**
- **Multiple Pressure Set-points**
- **Use Pressure Transducer and/or Switch Feedback**



Simple Ordering

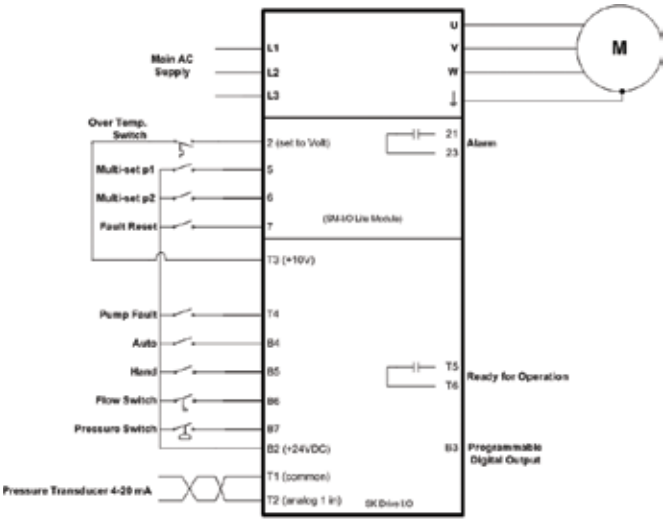
Adding the suffix **-P** to any SK drive specifies it as a pump drive. Using a **-PL** suffix with any SK drive frame size B or larger, adds an SM-I/O Lite module that allows:

1. Multiple pressure set-point selection via digital inputs
2. An external reset digital input
3. Over temperature digital input
4. One additional programmable relay output

In either case, the drive will be shipped with a pumping specific parameter set, a pre-programmed LogicStick, and a manual.

For anyone wishing to convert an existing SK drive to a Pump version, the pre-programmed LogicStick is available as a separate item. Order Code is **LOGICSTICK-PUMP**.

Typical Wiring Diagram:



NOTE:
- Pressure Switch Input B7 Only active in Pump Mode 1 18.12 = 1
- Flow Switch Input B6 Only active in Pump Mode 1 18.12 = 1 Or 2
- All outputs are programmable to indicate any alarm, trip or status

Commander GP20

High Performance Open Loop





- V/Hz, Open Loop Vector, or Rotor Flux Control for outstanding motor shaft performance
- Two zero-space option slots for Solution Modules
- Easy to read LCD "multi-language" keypad
- Industry-leading two-year warranty with five year option



- SmartCard parameter copy device with pre-set macros for fast setup of the most common applications

2 YEAR Digital Drive Warranty

5 YEAR Extended Warranty

Commander GP20 Overview

High Performance Open Loop

OPERATOR INTERFACE

CTOPCserver

HMI Operator Interface



FREE SCtware



CTSoft
CTScope

CGP Keypad Plus



CGP SmartCard



Remove the CGP-Keypad Plus to reveal the SmartCard Slot



EXTERNAL PLC CONTROL

CONTROL MODE



PLC



PC

INPUT/OUTPUT

Options

SM-I/O 32



SM-I/O Plus



SM-I/O Timer



SM-I/O Lite



SM-PELV



SM-I/O 120V



SM-I/O 24V



Standard

5 Analog I/O
6 Digital I/O
1 Disable
1 Relay Out

FILTERS

Standard



Options



VHz / Open Loop Vector / Rotor Flux Control (RFC)



DYNAMIC BRAKING



Zero Space Internal
Brake Resistor
E-Stop Duty
sizes 1&2







Dynamic Brake Resistors

APPLICATIONS WITH PLC FUNCTIONALITY

Programming Platform

SyPTLite

Standard

PLC Functionality
Features
Function Block Programming
Ladder Logic Sequencing

COMMUNICATIONS

Standard



Modbus RTU

Options









Modbus TCP/IP





DC BACK UP POWER SUPPLY



24V Control



48-96V Power

Commander GP20

Incorporating "Smart" Technologies

V/Hz, Open Loop Vector or Rotor Flux Control (RFC)

With the Commander GP20 many basic applications can be up and running in minutes in the standard V/Hz mode, but for applications with demanding speed torque requirements or high inertial loads, Open Loop Vector and the newly developed Rotor Flux Control modes are available to boost shaft performance. Rotor Flux Control provides near closed loop performance without requiring encoder feedback. RFC is easy to configure using CTSoft or keypad controls.

Plain Text, Multi-lingual Keypad

The Commander GP20 has a full-function data display can be either mounted on the drive or remotely mounted. The CGP-Keypad-Plus supports five languages, plus a custom text database, which allows users to customize parameter names to their own terminology. It also possesses one-touch online help, and clearly marked HMI controls. This keypad is "hot-pluggable," enabling it to be moved from one drive to another without powering down.



Multi-lingual Keypad

English
French
Spanish
German
Italian

Keypad to Drive Cable SP-LCD-485-XXX
XXX=005, 010, 015, 025, 050 feet

GP20 SmartCard



The SmartCard is a revolution in simplicity, allowing users to store parameters and/or download stored parameters to a drive, or dozens of drives. This is a standard feature that enables simple configuration of parameters in a variety of ways is supplied free with each Commander GP20.



The SmartCard can:

- Download pre-programmed macros for intuitive configuration of typical general purpose applications
- Save multiple complete sets of parameters
- Copy a complete set of parameters for serial production
- Set up an application as parameter differences from default
- Automatically save all user parameter changes for maintenance purposes
- Load complete motor map parameters

FEATURE
Performance Advantage

Dual Duty Ratings–Normal and Heavy
Provides cost effective sizing choices for all applications.

48 VDC Main Power Supply Input
Ideally suited for elevator rescue and machine tool set up.

24 VDC Auxiliary Power Supply Input
Provides an additional means of maintaining control, fieldbus during power loss.

Comprehensive Auto-tune
Dynamic and static auto-tune. Optimize drive. Match motor. Great performance.

High Resolution Analog Input
16-bit, 250 µsec interface for high performance applications. Two additional 10-bit analog inputs for low level controls.

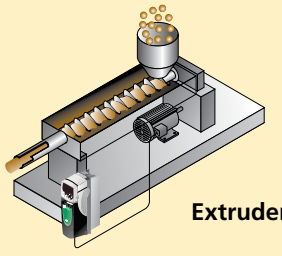
Extensive Fieldbus Connectivity
ModbusRTU (Standard), Profibus-DP (12Mbit), Ethernet, EtherCAT, DeviceNet, CANOpen and Interbus-S optional via zero-space SM modules.

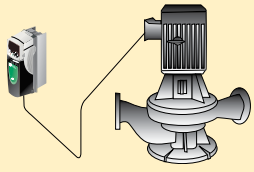
Two Universal Option Slots
Fieldbus and or I/O expansion SM modules fit in either of the two option slots beneath the drive cover.

SmartCard for Simple Setup and Cloning
Easy-to-use card stores drive configuration for simple startup and parameter cloning. Supplied free with Commander GP20.

Drive Mounted Brake Resistor
Commander GP20 sizes 1 and 2 feature a drive mounted E-Stop duty brake resistor option to reduce panel space requirements.

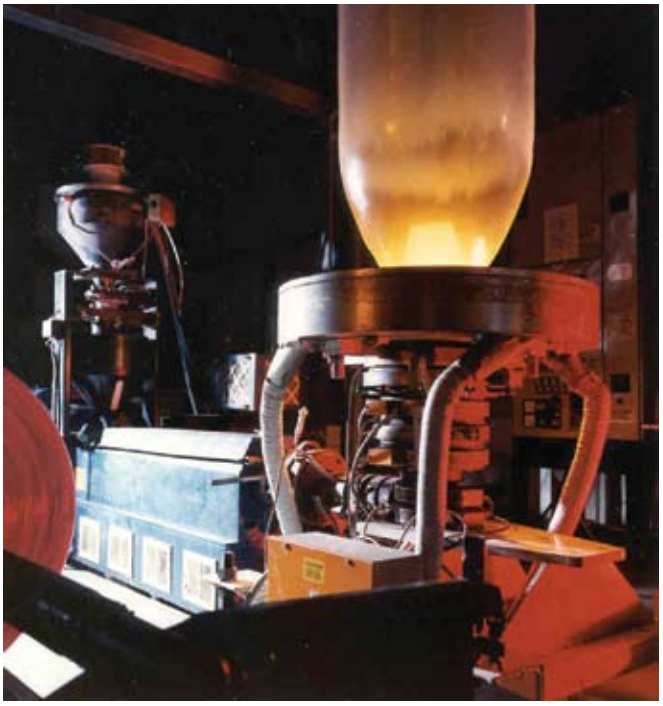
TYPICAL APPLICATIONS


Extruder


Pump

Standard Features of the Commander GP20

- *3 Operating modes: V/Hz, Open Loop Vector and Rotor Flux Control*
- *Programmable boolean logic (AND, NAND, OR, NOR) gates with delay outputs*
- *Programmable threshold comparators*
- *Built-in PID controller*
- *S-ramp accel/decel profiling*
- *Built-in MOP (motorized potentiometer)*
- *8 Preset speeds and independent accel/decel rates*
- *3 Skip frequencies with adjustable bandwidths*
- *Run time chronometers*
- *Configurable analog and digital I/O*
- *Selectable Stopping modes including Coast, Ramp, and DC injection*
- *Dynamic Braking capability*
- *Removable control terminals common to all sizes*
- *Output frequencies up to 3000 Hz*
- *Intelligent Thermal Management (ITM) technology with switching frequencies up to 16 kHz*



COMMANDER GP20 RATINGS

Commander GP20		Motor HP	Continuos Output Current	Peak Output Current	Motor HP	Continuos Output Current	Peak Output Current	Peak Output Current
208/240 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 230V	I_N (A)	(A)	HP @ 230V	I_H (A)	Open loop (A)	RFC (A)
CGP1201	1	1.5	5.2	5.7	1	4.3	6.4	7.5
CGP1202		2	6.8	7.5	1.5	5.8	8.7	10.1
CGP1203		3	9.6	10.5	2	7.5	11.2	13.1
CGP1204		3	11	12.1	3	10.6	15.9	18.5
CGP2201	2	5	15.5	17.0	3	12.6	18.9	22
CGP2202		7.5	22	24.2	5	17	25.5	29.7
CGP2203		10	28	30.8	7.5	25	37.5	43.7
CGP3201	3	15	42	46	10	31	46.5	54.2
CGP3202		20	54	59	15	42	63	73.5
CGP4201	4	25	68	74	20	56	84	98
CGP4202		30	80	88	25	68	102	119
CGP4203		40	104	114.4	30	80	120	140

380/480 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 460V	I_N (A)	(A)	HP @ 460V	I_N (A)	Open loop (A)	RFC (A)
CGP1401	1	1.5	2.8	3.0	1	2.1	3.1	3.6
CGP1402		2	3.8	4.1	2	3	4.5	5.2
CGP1403		3	5	5.5	3	4.2	6.3	7.3
CGP1404		5	6.9	7.5	3	5.8	8.7	10.1
CGP1405		5	8.8	9.6	5	7.6	11.4	13.3
CGP1406		7.5	11	12.1	5	9.5	14.2	16.6
CGP2401	2	10	15.3	16.8	10	13	19.5	22.7
CGP2402		15	21	23	10	16.5	24.7	28.8
CGP2403		20	29	31	15	25	34.5	40.2
CGP2404		20	29	31	20	29	43.5	50.7
CGP3401	3	25	35	38	25	32	48	56
CGP3402		30	43	47	30	40	60	70
CGP3403		40	56	61	30	46	69	80.5
CGP4401	4	50	68	74	50	60	90	105
CGP4402		60	83	91	60	74	111	129.5
CGP4403		75	104	114	75	96	144	168
CGP5401	5	100	138	151	100	124	186	217
CGP5402		150	168	184	125	156	234	273
CGP6401[1]	6	150	202	225	150	180	231	269
CGP6402[1]		200	236	259	150	210	270	315

Note: Motor horsepower ratings are based on typical motor current ratings. Actual motor currents should be checked before selecting a particular drive. For some high efficiency motors, the required full load motor current may allow the selection of a smaller drive than is indicated in the chart. The same consideration would also apply for motors with less common power or voltage ratings.

Normal Duty	Suitable for most applications, current overload is set at 110% for 60 seconds. Where motor rated current is less than the drive rated continuous current, higher overloads are achieved.	**Heavy Duty**	Suitable for demanding applications, current overload is set at up to 175% for 40 seconds (150% on size 6). Where motor rated current is less than the drive rated continuous current, higher overloads (200% or greater) are achieved.

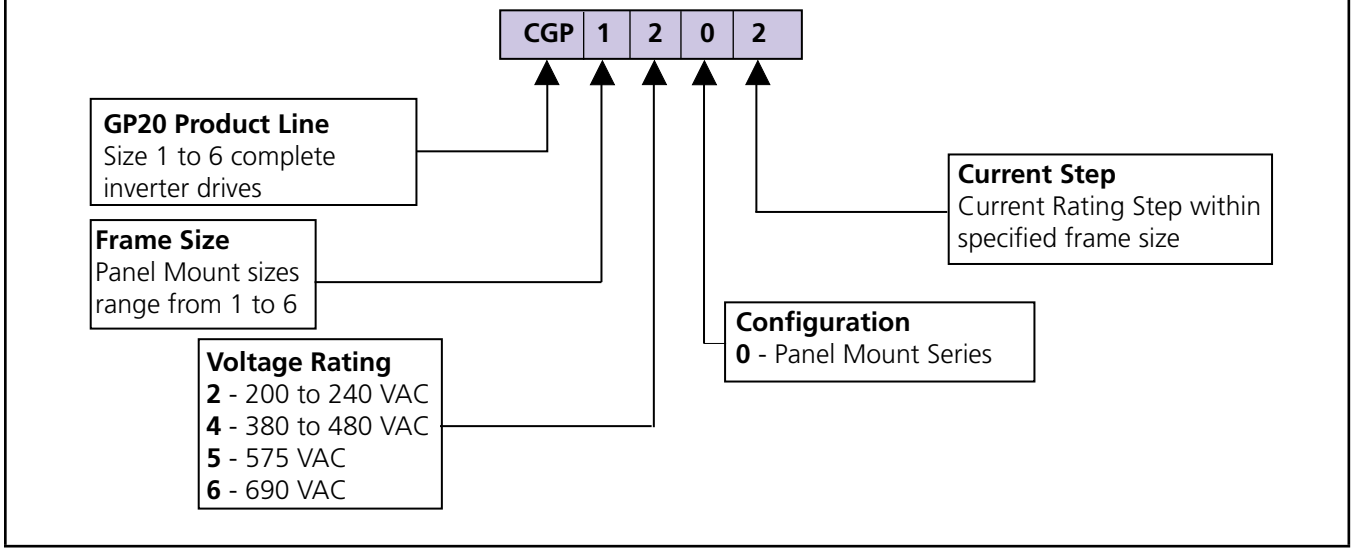
1) Size 6 drives require a +24VDC - 3.5A power supply for the heat sink fans not provided with unit. See the Options & Accessories section for available power supplies.

COMMANDER GP20 RATINGS *(continued)*

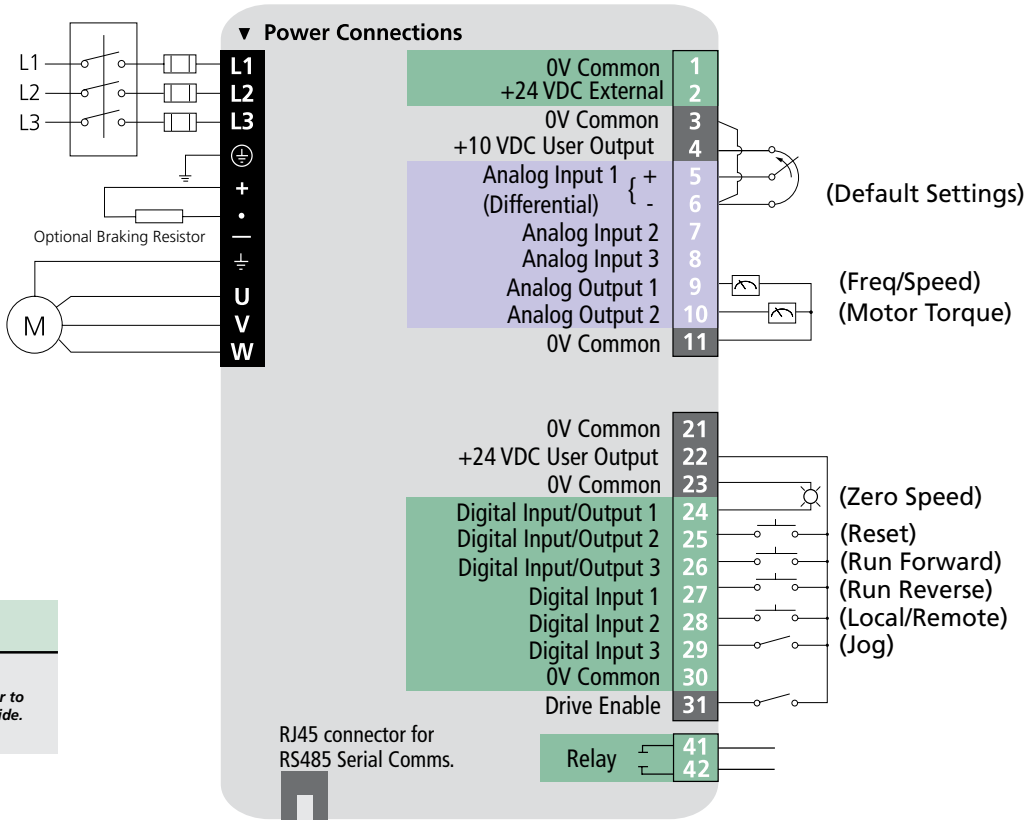
Commander GP20		Motor HP	Continuos Output Current	Peak Output Current	Motor HP	Continuos Output Current	Peak Output Current	Peak Output Current
575 VAC		**Normal Duty**			**Heavy Duty**			
Order Code	Frame	HP @ 575V	I_N (A)	(A)	HP @ 575V	I_H (A)	Open loop (A)	RFC (A)
CGP3501	3	5	5.4	5.9	3	4.1	6.1	7.1
CGP3502		5	6.1	6.7	5	5.4	8.1	9.4
CGP3503		7.5	8.4	9.2	5	6.1	9.1	10.6
CGP3504		10	11	12.1	7.5	9.5	14.2	16.6
CGP3505		15	16	17.6	10	12	18	21
CGP3506		20	22	24.2	15	18	27	31.5
CGP3507		25	27	29.7	20	22	33	36.5
CGP4603	4	30	36	39.6	25	27	40.5	47.2
CGP4604		40	43	47.3	30	36	54	63
CGP4605		50	52	57.2	40	43	64.5	75.2
CGP4606		60	62	68	50	52	78	91
CGP5601	5	75	84	92	60	63	93	108.5
CGP5602		100	99	108	75	85	126	147
CGP6601[1]	6	125	125	137	100	100	128	149
CGP6602[1]		150	144	158	125	125	160	187

690 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 690V	I_N (A)	(A)	HP @ 690V	I_N (A)	Open loop (A)	RFC (A)
CGP4601	4	25	22	24.2	20	19	27	31.5
CGP4602		30	27	29.7	25	22	33	38.5
CGP4603		40	36	39.6	30	27	40.5	47.2
CGP4604		50	43	47.3	40	36	54	63
CGP4605		60	52	57.2	50	43	64.5	75.2
CGP4606		75	62	68.2	60	52	78	91
CGP5601	5	100	84	92	75	63	93	108.5
CGP5602		125	99	108	100	85	126	147
CGP6601[1]	6	150	125	137	125	100	128	149
CGP6602[1]		175	144	158	150	125	160	187

Order String



COMMANDER GP20 TERMINAL DIAGRAM



Programmable Analog

Programmable Digital

Non-Programmable

NOTE

*Thermal protection required.

For complete instructions, refer to the Commander GP20 User Guide.

TERMINAL DESCRIPTION

Pin#	Function ①	Type/Description	Notes
1	0V Common		
2	+24 VDC External Input	Back up Power Supply for Control	60W, 24 VDC
3	0V Common	Common for External Analog Devices	
4	+10 VDC User Supply	Reference Supply	10 mA max
5	Analog Input 1 (Local Frequency/Speed Reference)	Differential Analog Input, Non-inverting Input, 16 bit	±10 VDC 100 k Ohms
6	Analog Input 1 (Local Frequency/Speed Reference)	Differential Analog Input, Inverting Input 16 bit	±10 VDC 100 k Ohms
7	Analog Input 2 (Remote Frequency/Speed Reference)	Single-ended Analog Input 10 bit	±10 VDC, 100 k Ohms or 4-20 mA, 200 Ohms ②
8	Analog Input 3	Single-ended Analog Input 10 bit	±10 VDC, 100 k Ohms or 4-20 mA, 200 Ohms ②
9	Analog Output 1 (Frequency/Speed Monitor)	Single-ended Analog Output, Bi-polar, 10 bit	±10 VDC or 0-20 / 4-20 mA ②
10	Analog Output 2 (Motor Torque Monitor)	Single-ended Analog Output, Bi-polar, 10 bit	±10 VDC or 0-20 / 4-20 mA ②
11	0V Common	Common External Analog Signals	

Pin#	Function ①	Type/Description	Notes
21	0V Common		
22	+24 VDC User Output	User Supply	200 mA max
23	0V Common	Common for External Digital Inputs	
24	Digital I/O 1 (Zero Speed Output)	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC, 100 mA max output
25	Digital I/O 2 (Reset Input) 100 mA max output	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC
26	Digital I/O 3 (Run Forward Input)	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC, 100 mA max output
27	Digital Input (Run Reverse)	Digital Input	0 to 24 VDC, 7.5 k Ohms
28	Digital Input (Local/Remote)	Digital Input	0 to 24 VDC, 7.5 k Ohms
29	Digital Input (Jog)	Digital Input	0 to 24 VDC, 7.5 k Ohms
30	0V Common	Common for External Digital Inputs	
31	Digital Input	Digital Input	0 to 24 VDC, 1 µsec sample
41	Status Relay (Drive Healthy)	Normally Open	240 VAC, 2A resistive
42	Status Relay (Drive Healthy)	Normally Open	240 VAC, 2A resistive

① Values in (parenthesis) designate default functions.
② 0-20, 4-20 mA modes are also available. See Commander GP20 Manual.

COMMANDER GP20 SPECIFICATIONS

Environment

Ambient Operating Temperature	0° to 40°C (32° to 104°F) 0° to 50°C (32° to 122°F) with derating
Cooling method	Forced convection
Humidity	95% maximum non-condensing at 40°C (104°F)
Storage Temperature	-40° to 50°C (-40° to 122°F)
Altitude	0 to 3000 m (9,900 ft). Derate 1% per 100 m (328 ft) between 1000 m (3280 ft) and 3000 m (9,900 ft).
Vibration	Tested in accordance with IEC 68-2-34
Mechanical Shock	In accordance with IEC 68-2-27
Enclosure	NEMA 1 (IP 20), NEMA 12 (IP 54) through panel mounting
Electromagnetic Immunity	In compliance with IEC801 and EN50082-2, and complies with EN61800-3 with built-in filter
Electromagnetic Emissions	In compliance with EN50081-2 when the recommended RFI filter is used and EMC installation guidelines are followed

AC Supply Requirements

Voltage	200 to 240 VAC ±10% 380 to 480 VAC ±10% 500 to 575 VAC ±10% 500 to 690 VAC ±10%
Phase	3Ø
Phase Imbalance Tolerance	2% negative phase sequence (equivalent to 3% voltage imbalance between phases)
Frequency	48 to 65 Hz
Input Displacement Power Factor	0.93

Control

Carrier Frequency	3, 4, 6, 8, 12, 16 kHz
Output Frequency	0 to 3000 Hz (Open loop)
Output Speed	0 to 40,000 RPM
Frequency Accuracy	±0.01% of full scale
Frequency Resolution	0.001Hz
Analog Input Resolution	10 Bit + sign (Qty 2); 16 Bit + sign (Qty 1)
Serial Communications	2-wire RS485. Protocol is ANSI x 3.28-2.5-A4, or Modbus RTU Baud rate 300 to 115,200.
Braking	DC injection braking (stopping and holding) standard. Dynamic braking transistor standard.
Control Power Ride Through	Up to 1 second depending on inertia and decel time

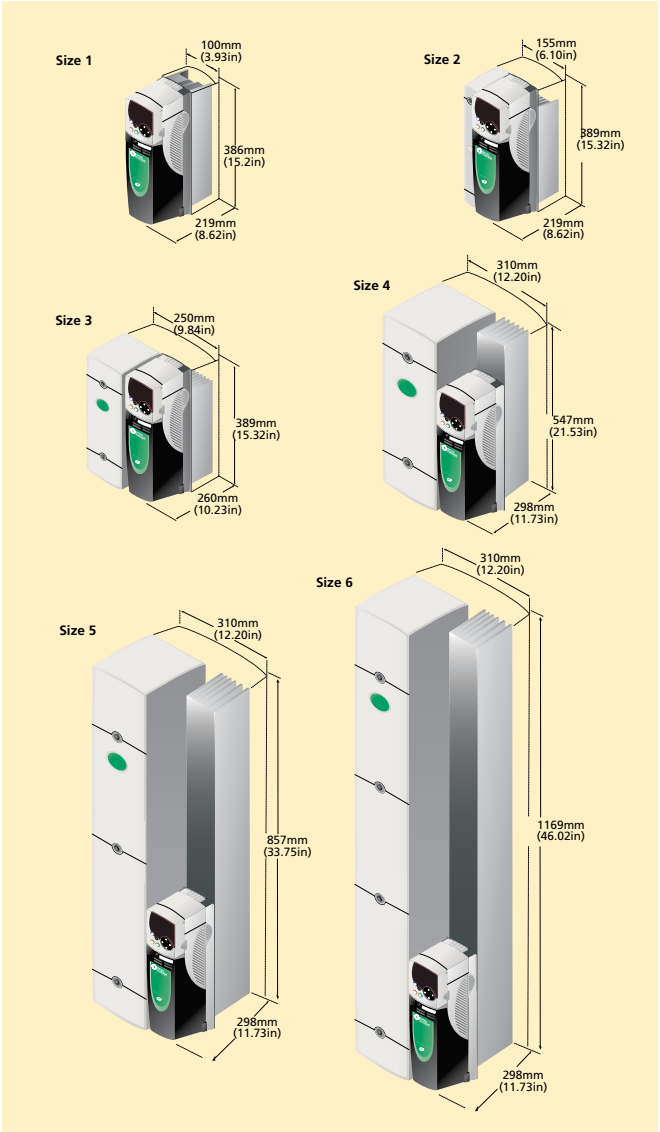
Protection

DC Bus Undervoltage Trip	175 / 350 / 435 VDC (approximately 124 / 247 / 307 VAC line voltage)
DC Bus Overvoltage Trip	415 / 830 / 990VDC (approximately 293 / 587 / 700 VAC line voltage)
MOV Voltage Transient Protection	160 Joules, 1400 VDC clamping (Line to line and line to ground)
Drive Overload Trip	Current overload value is exceeded. Programmable for Normal Duty or Heavy Duty, Open loop or Closed loop operation (RFC mode)
Instantaneous Overcurrent Trip	225% of drive rated current
Phase Loss Trip	DC bus ripple threshold exceeded
Overtemperature Trips	Drive heatsink, control board, and option module(s) monitoring
Short Circuit Trip	Protects against output phase to phase fault
Ground Fault Trip	Protects against output phase to ground fault
Motor Thermal Trip	Electronically protects the motor from overheating due to loading conditions

Approvals & Listings

UL, cUL	UL File #E171230
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Designed for marking
NEMA	NEMA 1 enclosure type - All but Size 5
ISO 9002	Certified Manufacturing Facility

DIMENSIONS



Options



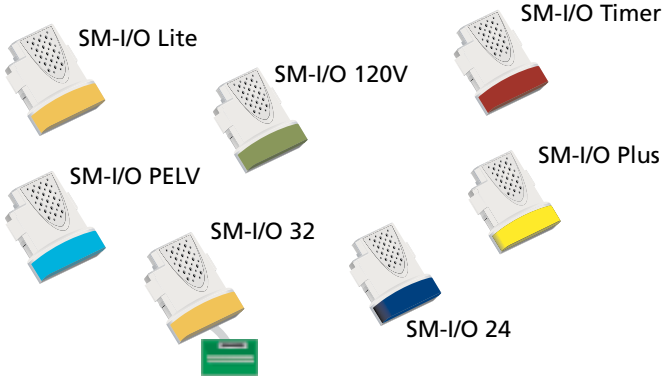
For complete descriptions of the options listed here, please refer to the Options and Accessories section at the end of the AC Drive section.

OPTIONS AT-A-GLANCE

Option	Description	Order Code
Base Drive Configuration and Programming	Cloning and Parameter Storage Card	CGP-SMARTCARD (Standard)
	Configuration Software	CTSOFT (Standard)
	RS232/485 Comms Cable	CT-COMMS-CABLE
	USB Comms Cable	CT-USB-CABLE
	Keypad to Drive Cable	SP-LCD-485-XXX
Operator Interface	LCD display	CGP-KEYPAD-PLUS
	HMI Operator Interfaces	See Options and Accessories
Power Accessories	Internal EMC Filter	Standard
	External EMC Filter	See the Options & Accessories section
	Braking Resistor	
Environmental Protection and Cable Management Options	Conduit boxes	See AC Options & Accessories
Input/Output	Extended I/O	SM-I/O-PLUS
	Extended I/O	SM-I/O-LITE
	Extended I/O	SM-I/O-32
	Extra I/O with RealTime Clock/Calendar	SM-I/O-TIMER
	120/240 Volt AC I/O	SM-I/O-120V
	Double Insulated Extended I/O	SM-I/O-PELV
	+24 VDC Protected I/O	SM-I/O-24V
Communications	Modbus RTU	Standard
	PROFIBUS DP	SM-PROFIBUS-DP
	DeviceNet	SM-DEVICENET
	CANopen	SM-CANOPEN
	Interbus-S	SM-INTERBUS
	Ethernet	SM-ETHERNET
	Ethernet (EtherCAT)	SM-ETHERCAT
Application Programming Software (IEC61131-3)	Ladder and function block programming	SYPTLITE

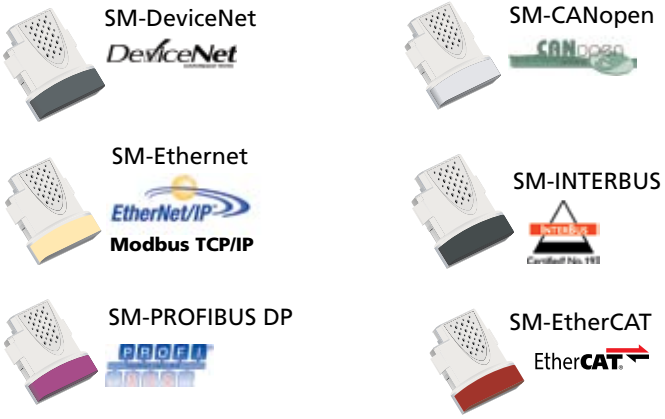
INPUT/OUTPUT MODULES*

To customize your GP20 with more or specialized I/O, or to install a fieldbus option there are slots beneath the cover for two Solution Modules.



COMMUNICATION MODULES*

Standard Modbus RTU/RS485 - RJ45 connector.



CONDUIT BOXES*

Conduit gland plates for Commander SK, Commander GP20 and Unidrive SP (sizes 1-6) wall-mount drives.
For overall dimensions see the AC Options & Accessories section page 83.

* For complete descriptions of the options listed here please refer to the Options and Accessories section at the end of the AC Drive section.

Power Accessories

INTERNAL DYNAMIC BRAKING RESISTORS

During deceleration, the mechanical energy stored in the spinning mass of the motor and load is converted to electrical energy, which recharges the drive's DC bus. Dynamic braking resistors provide a means of rapidly dissipating that energy so that the drive does not fault from overcharging the DC bus. The ohmic value and power rating of the braking resistor is a function of the drive type and size.



Size 1 Commander GP20 heatsink shown

A zero-space braking resistor is available for heatsink mounting on drive frame sizes 1 and 2. These resistors are designed for low-inertia loads commonly used in servo type applications. For higher-inertia loads, the heatsink mounted resistor may not have enough braking capacity, and a larger external resistor may be required. No thermal protection device is required with these heatsink mounted resistor packages.

Frame Size	DC Resistance	Power Rating	Order Code
1	75 Ω	50W	SM-HEATSINK-DBR1
2	37.5 Ω	100W	SM-HEATSINK-DBR2

(Drives Larger than Size 2 do not have this option)

DYNAMIC BRAKING RESISTORS

E-STOP DUTY

E-Stop duty panel mounted and NEMA-1 DB resistors are designed for non-cyclic use where energy dissipation from an active drive is required.



CYCLIC DUTY

These heavy-duty kits have been designed to provide dynamic braking for cyclic and continuous braking applications.



See the Options and Accessories section for details.

HUMAN MACHINE INTERFACE (HMI)

These operator interface units complement the product line by offering an easy way of accessing parameters and adding more programming power to your application. The following features make these screens a simple and impressive solution for you... and your customers:

- Graphical full color or monochrome touchscreens
- Menus, submenus, alarms, fault conditions
- Realtime trends and graphs
- Scheduling and background programs
- Modbus RTU and Modbus TCP/IP
- Import pictures and graphics
- Advanced Recipe capabilities



For more information, refer to the Accessories Section.



See the RapidPak pages in the Packaged Drives and Engineered Systems section for details.

Unidrive SP



- Universal Operation

V/Hz, Open Loop Vector, Closed Loop Vector, Rotor Flux Control, Servo, and Regenerative mode with Power Factor Control



- SmartCard



- Scalable PLC functionality
- Supports all major fieldbus protocols, and provides multiple fieldbus capability
- Supports all major feedback devices, including absolute encoders

Unidrive SP Overview

Integration Flexibility with Unidrive SP: The Solutions Platform

THE BENCHMARK

OPERATOR INTERFACE

CTOPCserver

HMI Operator Interface



FREE SCftware



CTSoft
CTScope

SM Keypad Plus



SP Keypad



(size Zero only)

SM Keypad



SmartCard



Remove the SM-Keypad & reveal the SmartCard Slot

EXTERNAL PLC/MOTION CONTROL



Motion Controller



PLC



PC

CONTROL MODE

INPUT/ OUTPUT

Options

Remote I/O



SM-I/O 32



SM-I/O Plus



SM-I/O Timer



SM-I/O Lite



SM-PELV



SM-I/O 120V



SM-I/O 24V



Standard

5 Analog
6 Digital I/O
1 Safe Torque Off
1 Relay Out

FILTERS

Standard

Options

V/Hz Open Loop



Closed Loop



Servo



Linear Motors



Regenerative Active Front End







DYNAMIC BRAKING



Zero Space Internal
Brake Resistor
E-Stop Duty
(size 0-2)







Dynamic Brake Resistors

APPLICATIONS WITH PLC OR MOTION FUNCTIONALITY

SM-Applications Lite V2



OR SM-Applications Plus



&/OR SM-Register



High Speed
Capture &
Registration

OR SM-EZMotion



Programming Platform
PowerTools Pro
"Motion Made Easy"™
Indexing
Gearing
Profiles

Programming Platform

SyPT*Lite* OR SyPT*Pro* (IEC61131-3)

PLC Functionality
Features
Function Block Programming
Ladder Logic Sequencing

AND

Motion Functionality
Features
Embedded Position Loop
PLC Open Motion Blocks
SyPT / DPL / Function Block

FEEDBACK

Standard

Sin/Cos
Quadrature
Frequency/Direction
Clockwise/Counter Clockwise

EnDat HIPERFACE® SSI

Options

SM-Universal Encoder Plus



Accepts or replicates
all standard feedback types

SM-Encoder Plus



Quadrature

SM-Resolver



SM-Encoder
Output Plus



COMMUNICATIONS

Standard



Modbus RTU

Options



PROFIBUS





CAN



DeviceNet



EtherNet/IP

Modbus TCP/IP





CTNET CTSYNC

Modbus RTU Master/Follower



SERCOS



EtherCAT

DC BACK UP POWER SUPPLY



24V Control



48-96V Power

Unidrive SP - *Incorporating "Benchmark" Technologies*

Safe Torque Off

The Unidrive SP Safe Torque Off function meets the requirements of EN954-I : category 3 for machine safety, and can serve as a part of a category 4 application. Control Techniques' Safe Torque Off safety solution has been independently verified by the European Safety organizations, BGIA and TÜV. This exclusive feature of the Unidrive SP saves money and space. Under many conditions, this standard feature eliminates the need for safety contactors by utilizing secure circuitry to prevent the motor from being powered by the drive.



Multiple Fieldbus Capability

The Unidrive SP provides unrivaled fieldbus flexibility. In addition to the standard Modbus RTU port, up to three fieldbus option modules can be installed in the Unidrive SP's option slots. This provides the capability to control and monitor a Unidrive SP on multiple fieldbus networks. For example, a single Unidrive SP can be configured to communicate on both DeviceNet and Profibus networks simultaneously.

In the example shown, CTNet is used to provide real-time coordination between two Unidrive SP modules. The DeviceNet and Profibus connections allow data to be passed to/from the controllers in a machine line.

Scalable PLC Functionality

In addition to the extensive drive configuration capabilities of the Unidrive SP, scalable programming is available to solve virtually any application requirement. Simple logic function programming is achieved using SyPTLite software and the drive's built in PLC. More complex systems can be solved by adding SM-Applications Lite V2 (with SyPTLite or SyPTPro), or SM-Applications Plus (SyPTPro only) option modules.

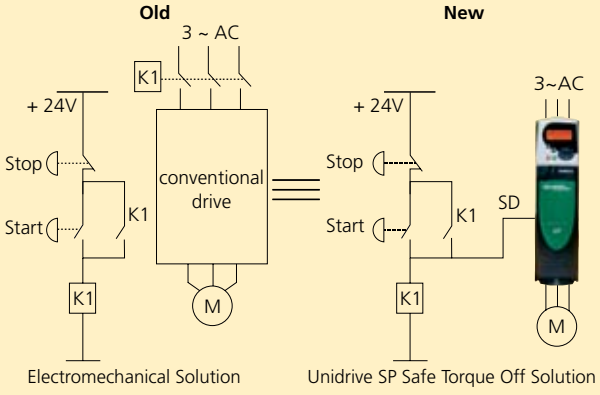


SM-Applications Plus

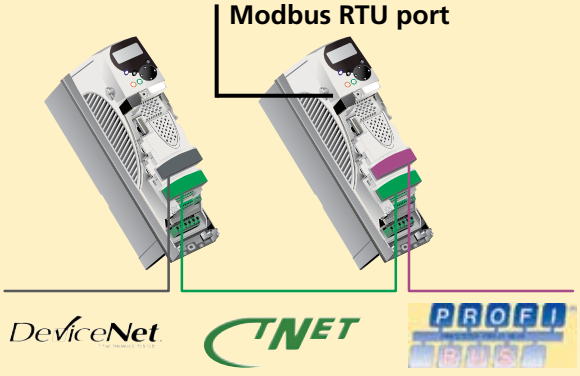


SM-Applications Lite V2

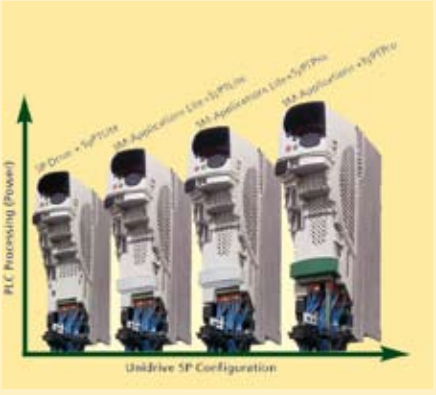
Safe Torque Off



Multiple Fieldbus



Scalable PLC Functionality



N1652

FEATURE
Performance Advantage

THE BENCHMARK

Dual Duty Ratings–Normal and Heavy
Provides cost effective sizing choices for all applications.

48 VDC Main Power Supply Input
Ideally suited for elevator rescue and machine tool set up.

24 VDC Auxiliary Power Supply Input
Provides an additional means of maintaining control, fieldbus and position loop on mains loss

Comprehensive Auto-tune
Inertia monitoring and static auto-tune reduce startup time.

Universal Feedback Interface
Supports 14 different feedback configurations, including several absolute encoders. No need for additional components.

High Resolution Analog Input
16-bit, 250 µsec interface for high performance applications. Two additional 10-bit analog inputs for low level controls.

Extensive Fieldbus Connectivity
ModbusRTU (Standard), Profibus-DP (12Mbit), Ethernet, DeviceNet, CAN, CANOpen, EtherCAT, Interbus-S and CTNet optional via Zero-space SM modules. Up to four fieldbuses can connect to a single drive, eliminating the need for expensive gateways.

Universal Option Slots
Unidrive SP size Zero has 2 slots, sizes one and up have 3 option module slots. SM-Fieldbus, I/O & Application modules fit in any of the open option slots.

Safe Torque Off Function
Conforms to IEC954-1 Category 3 for machine safety with system cost reduction.

SmartCard for Simple Setup and Cloning
Easy-to-use card stores drive configuration for simple startup and parameter cloning. Supplied free with Unidrive SP.

Keypad Options
Choose no keypad, LED keypad or LCD keypad based on the system design and operating environment.

Drive Mounted Brake Resistor
Unidrive SP sizes 0, 1 and 2 feature a drive mounted brake resistor option to reduce panel space requirements.

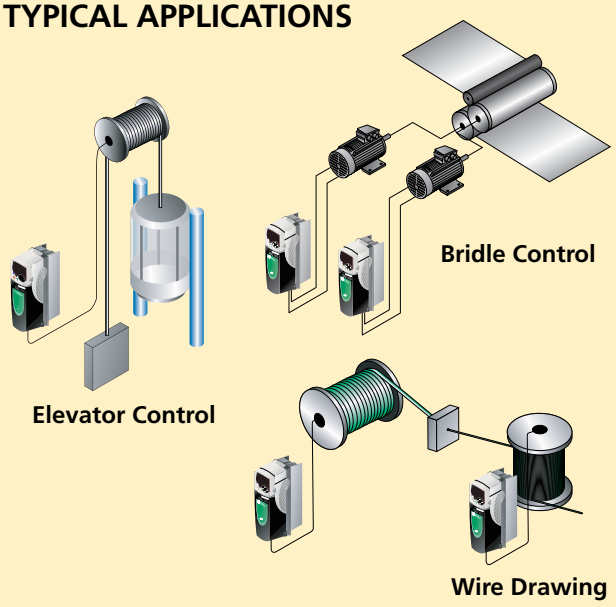
Standard Features of the Unidrive SP

- *7 Operating modes: V/Hz, open loop vector, rotor flux control, closed loop vector, servo, regen, and torque*
- *Encoder feedback as standard (select from 14 types)*
- *Built-in shaft orientation mode*
- *Digital lock with adjustable ratio (frequency slaving)*
- *Programmable boolean logic (AND, NAND, OR, NOR) gates with delay outputs*
- *Programmable threshold comparators*
- *Built-in PID controller*
- *S-ramp accel/decel profiling*
- *Built-in MOP (motorized potentiometer)*
- *8 Preset speeds and independent accel/decel rates*
- *3 Skip frequencies with adjustable bandwidths*
- *Run time chronometers*
- *Configurable analog and digital I/O*
- *Selectable Stopping modes including Coast, Ramp, and DC injection*
- *Dynamic Braking capability, transistor built in*
- *Removable control terminals common to all sizes*

Feature Enhancements to Unidrive SP

- *Output frequencies up to 3000 Hz for very high motor speed operations*
- *Intelligent Thermal Management (ITM) technology with switching frequencies up to 16 kHz*

TYPICAL APPLICATIONS



Unidrive SP Size Zero - ½ hp to 2 hp 230 VAC 1Ø or 3Ø, or 460 VAC 3Ø

The new Unidrive SP size Zero has the same advanced feature set, universal motor control and easy user interface as the rest of the Unidrive SP range. Unidrive SP is quick and easy to set-up. The drive may be configured using the removable keypad or using CTSoft, the free commissioning software which guides the user through the configuration process.

Unidrive SP Size Zero may be mounted side-by-side with other drives or components saving you valuable panel space. The Unidrive SP Zero also uses our SmartCard technology which allows you to safely store and copy parameters quickly from one drive to another.

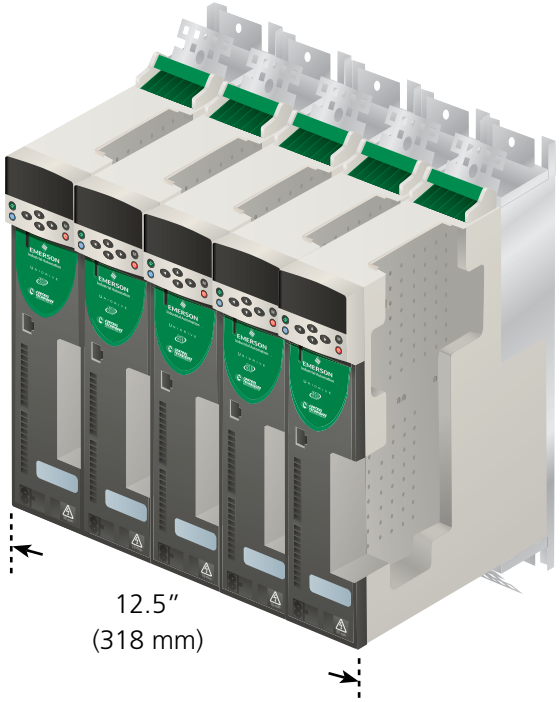
The drives auto-tune features enable you to get the best drive performance by measuring the application dynamics and automatically optimizing the control loop gains.

Safe Torque Off input disables the output stage of the drive with a high degree of security. This reduces the cost of complying with machine safety standards such as EN954 Cat 3 and enables the drive to integrate easily with the machine safety circuit.

- Universal motor control of Induction, Servo and Linear Motors
- 2 Solution Module Slots (3 in Unidrive SP size 1 & up)
- Side-by-side mounting
- Removable LED Keypad
- SmartCard
- Internal EMC Filter
- Safe Torque Off Input
- 24V Backup Supply
- Universal Encoder Input
- High Resolution Analog and Digital I/O
- PC Port for Programming
- 48 VDC Drive Supply
- Quick and Easy Mounting Arrangement
- Optional Internal Braking Resistor
- Reduced commissioning time



Comparison photograph above and illustration below show the size difference between a Unidrive SP size 1 and the new size Zero.



With the Digitax ST's ultra compact mounting (only 2 mm between drives) you can fit 5 drives in a 12.5" width.

RATINGS: *SELECT MODEL BASED ON ACTUAL MOTOR FULL LOAD CURRENT*

The Unidrive SP is available in panel mount, free standing and modular platforms.

Panel Mount Drives - Drives from 0.5 to 200 hp used for any AC Drive application. Shipped as drive only, and to be mounted into customer machine enclosure with other power/control components.

Free Standing Drives - Pre-Engineered drive packages from 150 to 1000 hp in IP21 enclosure (standard), perfect for many standard applications (i.e. fans, pumps, conveyors, etc.).

SPM Drives - Modular drives for OEMs and system integrators. Range from 60 to 2900 hp. See the Engineered Systems section for complete details.



Panel Mount Drives are available in seven frame sizes

PANEL MOUNT RATINGS

Unidrive SP		Motor HP	Continuos Output Current	Peak Output Current	Motor HP	Continuos Output Current	Peak Output Current	
208/240 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 230V	I_N (A)	(A)	HP @ 230V	I_H (A)	Open loop (A)	Closed loop (A)
SP0201-XXX	0	0.5	2.2	3.3	0.5	2.2	3.3	3.9*
SP0202-XXX		0.75	3.1	4.7	0.75	3.1	4.7	5.4*
SP0203-XXX		1	4	6	1	4	6	7*
SP0204-XXX		1.5	5.7	8.6	1.5	5.7	8.6	10.2*
SP0205-XXX		2	7.5	11.3	2	7.5	11.3	13.1*
SP1201-XXX	1	1.5	5.2	5.7	1	4.3	6.4	7.5
SP1202-XXX		2	6.8	7.5	1.5	5.8	8.7	10.1
SP1203-XXX		3	9.6	10.6	2	7.5	11.3	13.1
SP1204-XXX		3	11	12.1	4	10.6	15.9	18.5
SP2201-XXX	2	5	15.5	17.0	4	12.6	18.9	22.0
SP2202-XXX		7.5	22	24.2	5	17	25.5	29.7
SP2203-XXX		10	28	30.8	7.5	25	37.5	43.7
SP3201-XXX	3	15	42	46.2	10	31	46.5	54.2
SP3202-XXX		20	54	59.4	15	42	63	73.5
SP4201-XXX	4	25	68	74.8	20	56	84	98
SP4202-XXX		30	80	88	25	68	102	119
SP4203-XXX		40	104	114.4	30	80	120	140
SP5201-XXX	5	50	130	143	40	105	157.5	183.8
SP5202-XXX		60	154	169.4	50	130	195	227.5

Note: Motor horsepower ratings are based on typical motor current ratings. Actual motor currents should be checked before selecting a particular drive. For some high efficiency motors, the required full load motor current may allow the selection of a smaller drive than is indicated in the chart. The same consideration would also apply for motors with less common power or voltage ratings.

* Unidrive SP Zero 230 VAC models can operate on single or three phase input power. 175% peak currents are valid only when 3 phase input power is supplied. When supplying single phase input power the maximum peak current is 150%.

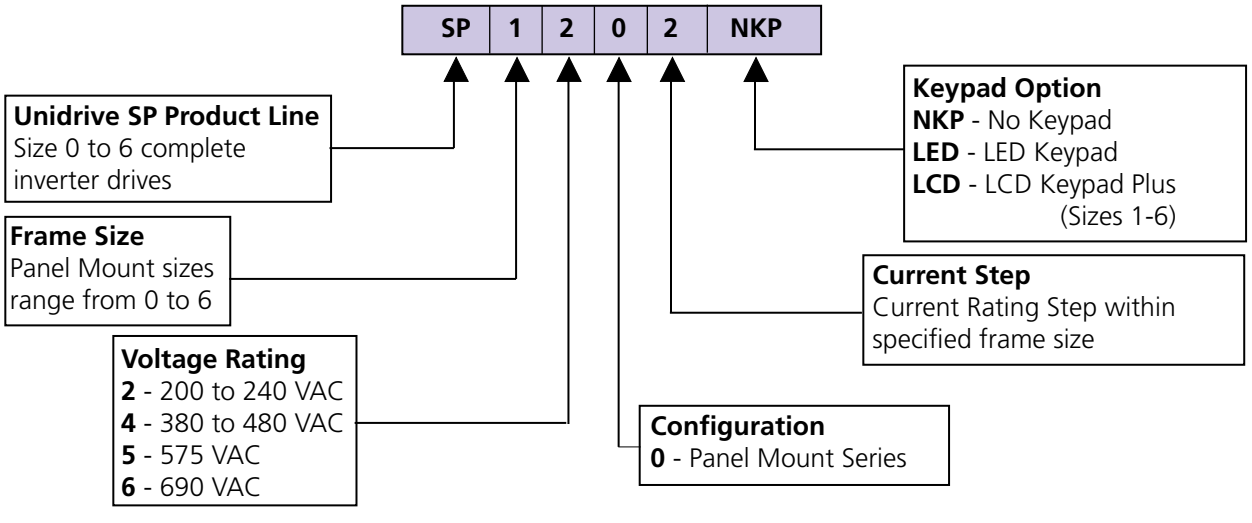
Normal Duty	Suitable for most applications, current overload is set at 110% for 60 seconds. Where motor rated current is less than the drive rated continuous current, higher overloads are achieved.	**Heavy Duty**	Suitable for demanding applications, current overload is set at up to 175% for 40 seconds. Where motor rated current is less than the drive rated continuous current, higher overloads (200% or greater) are achieved.

PANEL MOUNT RATINGS *(continued)*

Unidrive SP		Motor HP	Continuous Output Current	Peak Output Current	Motor HP	Continuous Output Current	Peak Output Current	
380/480 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 460V	I_N (A)	(A)	HP @ 460V	I_N (A)	Open loop (A)	Closed loop (A)
SP0401-XXX	0	0.5	1.3	2.0	0.5	1.3	2.0	2.3
SP0402-XXX		0.75	1.7	2.6	0.75	1.7	2.6	3.0
SP0403-XXX		1	2.1	3.1	1	2.1	3.1	3.6
SP0404-XXX		1.5	3	4.5	1.5	3	4.5	5.2
SP0405-XXX		2	4.2	6.3	2	4.2	6.3	7.3
SP1401-XXX	1	1.5	2.8	3.0	1	2.1	3.1	3.6
SP1402-XXX		2	3.8	4.1	2	3	4.5	5.2
SP1403-XXX		3	5	5.5	3	4.2	6.3	7.3
SP1404-XXX		5	6.9	7.5	4	5.8	8.7	10.1
SP1405-XXX		5	8.8	9.6	5	7.6	11.4	13.3
SP1406-XXX		7.5	11	12.1	5	9.5	14.2	16.6
SP2401-XXX	2	10	15.3	16.8	10	13	19.5	22.7
SP2402-XXX		15	21	23.1	10	16.5	24.7	28.8
SP2403-XXX		20	29	31.9	15	25	34.5	40.2
SP2404-XXX		20	29	31.9	20	29	43.5	50.7
SP3401-XXX	3	25	35	38.5	25	32	48	56
SP3402-XXX		30	43	47.3	30	40	60	70
SP3403-XXX		40	56	61.6	30	46	69	80.5
SP4401-XXX	4	50	68	74.8	50	60	90	105
SP4402-XXX		60	83	91.3	60	74	111	129.5
SP4403-XXX		75	104	114.4	75	96	144	168
SP5401-XXX	5	100	138	151.8	100	124	186	217
SP5402-XXX		150	168	184.8	125	156	234	273
SP6401-XXX [1]	6	150	202	222.2	150	180	231	269
SP6402-XXX [1]		200	236	259.6	150	210	270	315

1) Size 6 drives require a +24 VDC - 3.5A power supply for the heat sink fans not provided with unit. See the Options & Accessories section for available power supplies.

Order String



PANEL MOUNT RATINGS *(continued)*

Unidrive SP		Motor HP	Continuous Output Current	Peak Output Current	Motor HP	Continuous Output Current	Peak Output Current	
575 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 575V	I_N (A)	(A)	HP @ 575V	I_H (A)	Open loop (A)	Closed loop (A)
SP3501-XXX	3	5	5.4	5.9	3	4.1	6.1	7.1
SP3502-XXX		5	6.1	6.7	5	5.4	8.1	9.4
SP3503-XXX		7.5	8.4	9.2	5	6.1	9.1	10.6
SP3504-XXX		10	11	12.1	7.5	9.5	14.2	16.6
SP3505-XXX		15	16	17.6	10	12	18	21
SP3506-XXX		20	22	24.2	15	18	27	31.5
SP3507-XXX		25	27	29.7	20	22	33	38.5
SP4603-XXX	4	30	36	39.6	25	27	40.5	47.3
SP4604-XXX		40	43	47.3	30	36	54	63
SP4605-XXX		50	52	57.2	40	43	64.5	75.3
SP4606-XXX		60	62	68.2	50	52	78	91
SP5601-XXX	5	75	84	92.4	60	62	93	108.5
SP5602-XXX		100	99	108.9	75	84	126	147
SP6601-XXX [1]	6	125	125	137.5	100	100	130	150
SP6602-XXX [1]		150	144	158.4	125	125	162.5	187.5

Unidrive SP		Motor HP	Continuous Output Current	Peak Output Current	Motor HP	Continuous Output Current	Peak Output Current	
690 VAC		Normal Duty			Heavy Duty			
Order Code	Frame	HP @ 690V	I_N (A)	(A)	HP @ 690V	I_H (A)	Open loop (A)	Closed loop (A)
SP4601-XXX	4	25	22	24.2	20	19	28.5	33.3
SP4602-XXX		30	27	29.7	25	22	33	38.5
SP4603-XXX		40	36	39.6	30	27	40.5	47.3
SP4604-XXX		50	43	47.3	40	36	54	63
SP4605-XXX		60	52	57.2	50	43	55.7	75.2
SP4606-XXX		75	62	68.2	60	52	67.6	91
SP5601-XXX	5	100	84	92.4	75	62	93	108.5
SP5602-XXX		125	99	108.9	100	84	126	147
SP6601-XXX [1]	6	150	125	137.5	125	100	128	149
SP6602-XXX [1]		175	144	158.4	150	125	160	187

1) Size 6 drives require a +24 VDC - 3.5A power supply for the heat sink fans not provided with unit. See the Options & Accessories section for available power supplies.

Note: Motor horsepower ratings are based on typical motor current ratings. Actual motor currents should be checked before selecting a particular drive. For some high efficiency motors, the required full load motor current may allow the selection of a smaller drive than is indicated in the chart. The same consideration would also apply for motors with less common power or voltage ratings.

Normal Duty	Suitable for most applications, current overload is set at 110% for 60 seconds. Where motor rated current is less than the drive rated continuous current, higher overloads are achieved.	**Heavy Duty**	Suitable for demanding applications, current overload is set at up to 175% for 40 seconds (150% on Size 6). Where motor rated current is less than the drive rated continuous current, higher overloads (200% or greater) are achieved.

Unidrive SP Free Standing Fully Engineered Cabinet Drives 150 hp to 1000 hp

NEW



Incomer or System Shell | Unidrive SP Size 6-8 | Unidrive SP Size 9

Unidrive SP Free Standing is a range of compact AC drives for high power motors. They inherit their reliability, performance and flexibility from the Unidrive SP modular range.

Unidrive SP Free Standing drives are fully engineered and tested drive cabinets. The whole enclosure is certified to comply with international standards such as CE and UL. Proven design and international approvals release your engineering resources to focus on your application.

A simple model number specifies the drive power, voltage and dynamic braking requirement. Standard cabinet color and dimensions mean that Free Standing drives can be connected together with other manufacturer's cabinets.

Compact size and innovative design enables the drive modules to be easily accessed and removed for servicing or replacement. Standard modules ensure ready availability of components.

We understand your needs. Control Techniques has 54 drive centers located in 31 countries to ensure that service, support and expertise are just around the corner, all around the world.

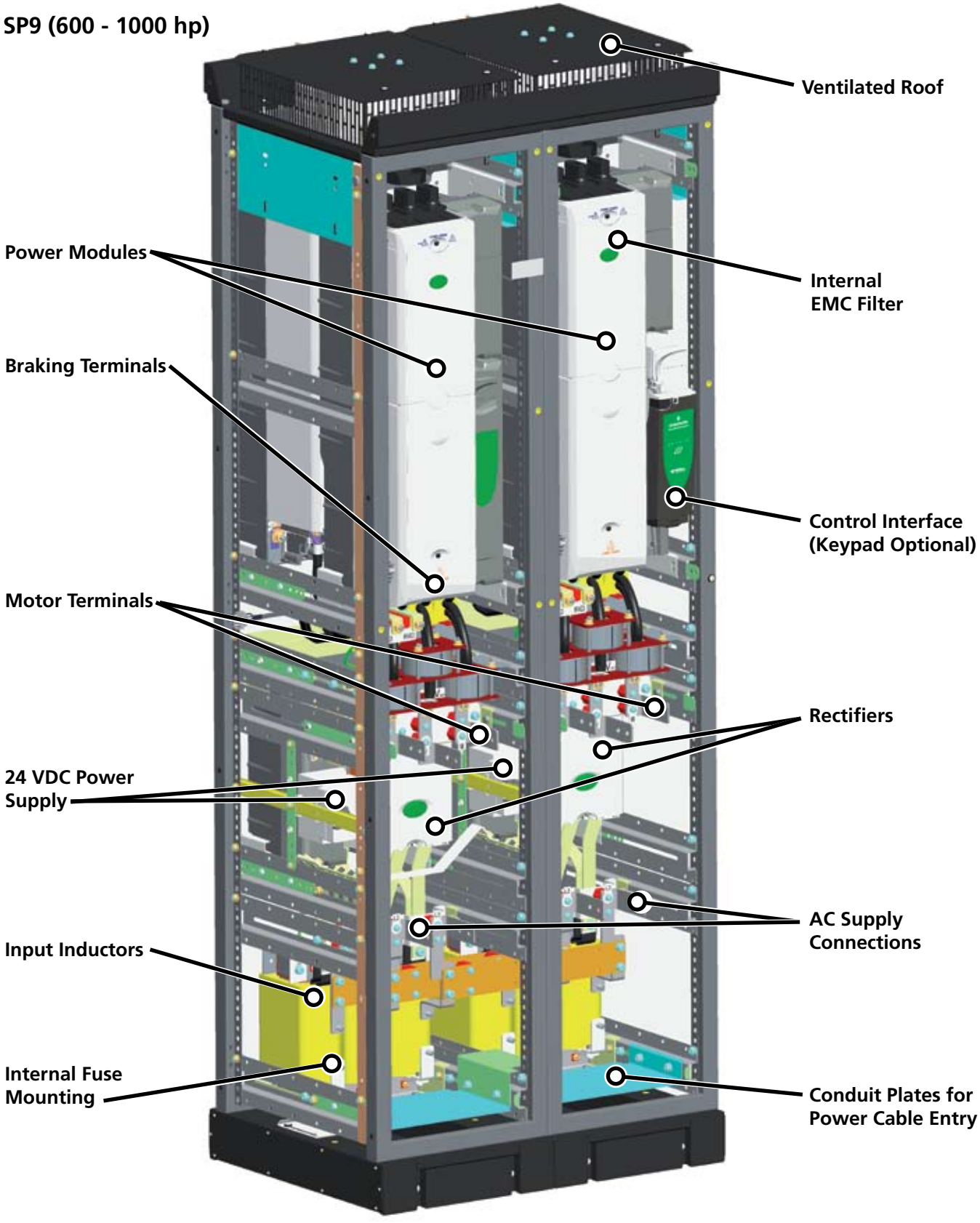


ISO 14001 APPROVAL | ISO 9001:2000 APPROVAL | c UL us LISTED | N1652 | 2 YEAR Digital Drive Warranty | 5 YEAR Extended Warranty

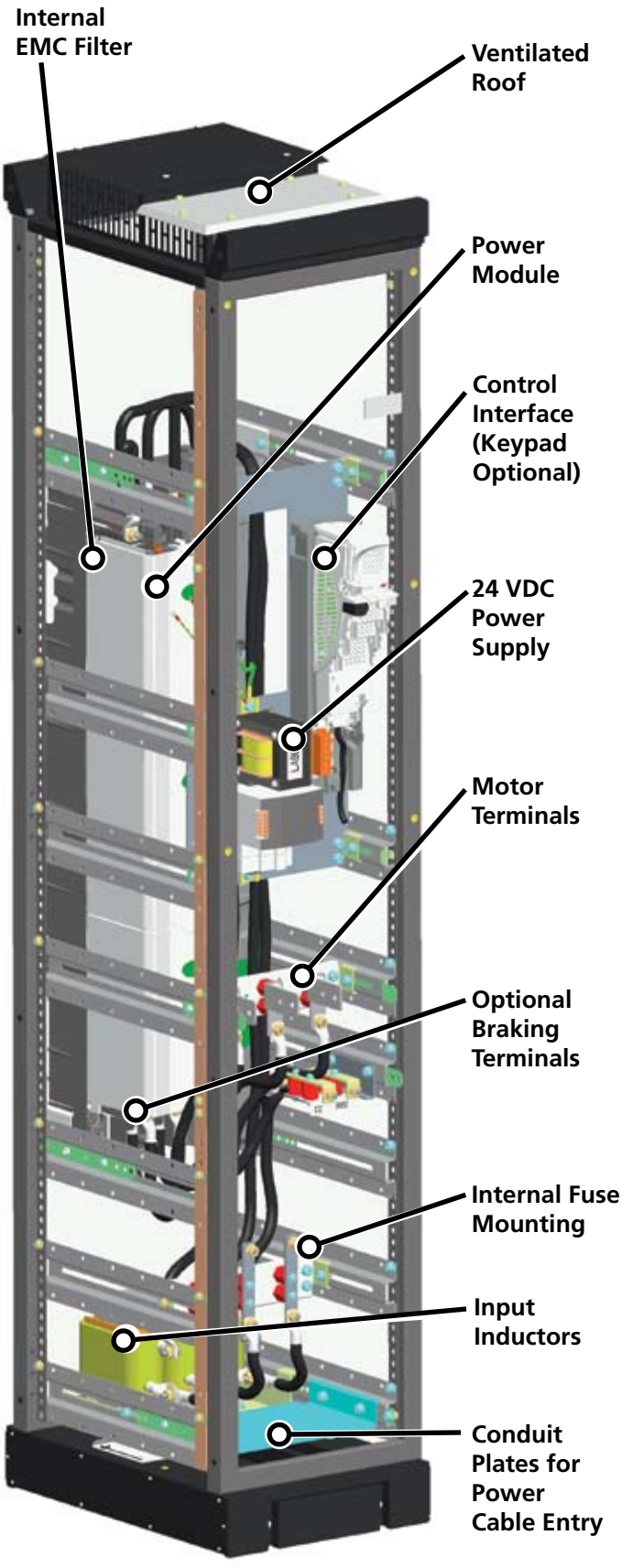
FREE STANDING CABINET DRIVES

A complete engineered drive, Unidrive SP Free Standing eliminates the need for drive panel building saving you time, money and allowing you to focus on your application.

SP9 (600 - 1000 hp)



SP6, SP7 & SP8 (150 - 500 hp)



MUCH MORE COMPACT

500 hp = 15.8 inches wide
1000 hp = 31.5 inches wide

Unidrive SP Free Standing drives are up to 50% smaller and are much lighter than other "compact" drive cabinets. As an example, a 500 hp drive including an Incomer enclosure is only 31.5" wide. This makes Unidrive SP Free Standing the obvious choice where space is a problem such as for new or retrofit energy saving applications.

PROVEN RELIABILITY

Unidrive SP Free Standing utilizes mass produced modules with proven design and reliability. The modules and cabinets are assembled using a sequential build process that eliminates build variation and provides consistently high quality. Excellent thermal and electrical design and computer modelling has ensured the inverters have a long and productive life with trouble free operation.

A TRADITION OF PERFORMANCE SOLUTIONS

Control Techniques has a tradition of high performance solutions. Unidrive SP Free Standing continues that tradition, able to control virtually any type of AC motor including synchronous machines.



FREE STANDING - INCOMER

Empty 15.8 inch wide Incomer cabinets are available to allow you to install your own power input scheme.

For users designing incomers for SP8 and SP9 drives the cabinets are available with interconnection busbars. For users designing incomers for SP6 and SP7 drives a cabinet is available without interconnection busbars as cables are used to make the connection.

For users who wish to use their own cabinet to create an incomer for SP8 and SP9 drives, interconnection busbars may be ordered as an accessory.

Order Code	Description
SP-Incomer-Shell-40	Empty Cabinet with 6 Pulse Interconnection Busbar
SP-Incomer-Shell-40-P12	Empty Cabinet with 12 Pulse Interconnection Busbar
SP-System-Shell-40	Empty Cabinet

POWER QUALITY

Supply harmonics may be minimized by using 12 pulse input versions of SP8 and SP9 Free Standing Drives. The 12 pulse input option is simply specified as part of the drive order code.

For 12 pulse drives the power connections are made within a separate incomer cabinet (SP-Incomer Shell 40-P12-EXX) or your own cabinet using the six phase interconnection busbar (SP P12 kit).

Engineered solutions that further reduce supply harmonics using passive in-line filters, active input modules or 18 pulse configurations are available. These enable your applications to comply with the harmonics standards IEEE 519-1992, IEC 61000-2-2, IEC 61000-2-12 and G5/4-1.

DYNAMIC BRAKING

Unidrive SP Free Standing is also available with integrated dynamic braking control allowing precision deceleration profiles to be achieved. This option is specified as part of the drive order code.

FREE STANDING DRIVE SPECIFICATIONS

Environmental Safety and Electrical Conformance

- Humidity 95% maximum (non condensing) at 40°C
- Altitude: 0 to 3000 m, derate 1% per 100 m between 1000 m and 3000 m
- Vibration: Drive Modules tested in accordance with IEC 60068-2-34
- Mechanical Shock Tested: Drive Modules in accordance with IEC 60068-2-27
- Storage temperature -40°C to 50°C
- Electromagnetic Immunity complies with EN 61800-3 and EN 61000-6-2
- With on board EMC filter, complies with EN 61800-3 (2nd environment)
- EN61000-6-4 with optional EMC filter
- IEC 60146-1-1 General requirements
- IEC 61800-5-1 Safety of Power Drive Systems
- IEC 61131-2 I/O
- EN 60529 Ingress protection
- Safe Torque Off meets EN 954-1-cat3
- UL508C (to 600V)
- CSA C22.2 no 14-05
- IP21 cabinet design, optional IP23



Pictured: SP9 with user designed incomer (interconnection made with SP P06 busbar kit)

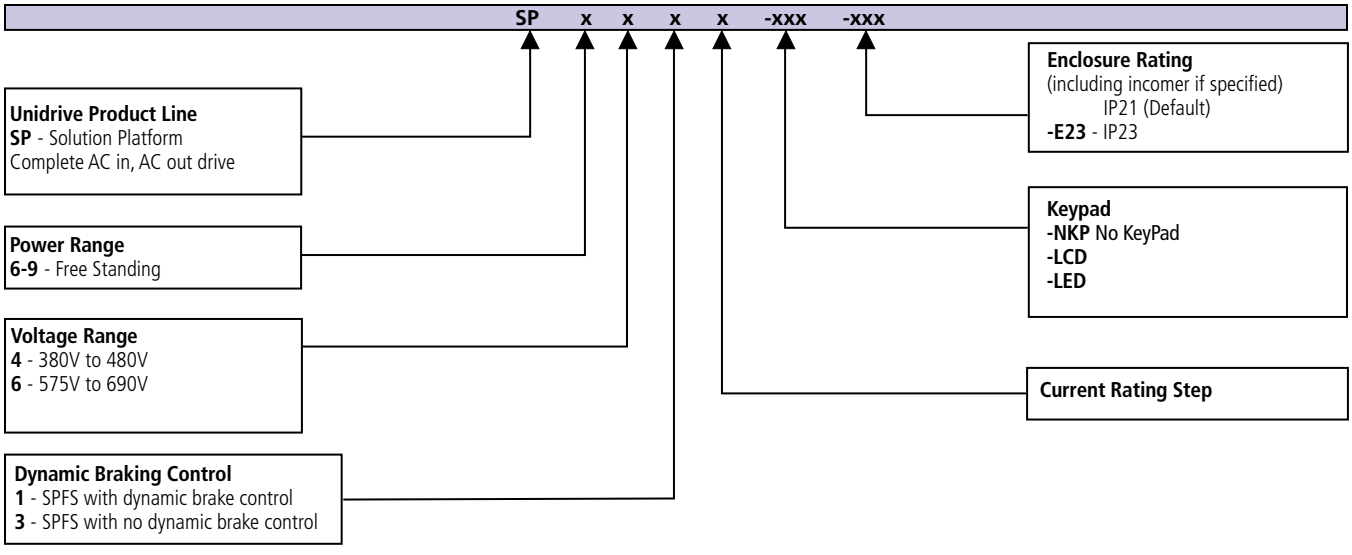
FREE STANDING RATINGS

	Drive Order Code	Output Module Selection: Normal Duty Max Cont. Current (A)	Normal Duty Typical Motor Output	Heavy Duty Max Cont. Current (A)	Heavy Duty Typical Motor Output	Compact Dimensions (inches): Drive only	With incomer cabinet
			460V (HP)		460V (HP)	H x W x D	H x W x D
380-480 VAC +/-10-%	SP64x1	205	150	180	150	85.8 x 15.8 x 23.6	85.8 x 15.8 x 23.6
	SP64x2	236	200	210	150		
	SP74x1	290	250	238	200		
	SP74x2 [9]	350	300	290	250		85.8 x 31.5 x 23.6
	SP84x1	389	300	335	280		
	SP84x2	450	400	389	300		
	SP84x3	545	450	450	400		
	SP84x4	620	500	545	450		
	SP94x1	690	600	620	500	85.8 x 31.5 x 23.6	85.8 x 47.3 x 23.6
	SP94x3	900	800	790	700		
	SP94x4	1010	900	900	800		
	SP94x5	1164	1000	1010	900		
			575V (HP)		575V (HP)		
	SP66x1	125	125	100	100	85.8 x 15.8 x 23.6	85.8 x 31.5 x 23.6
	SP66x2	144	150	125	125		
	SP76x1	168	150	144	150		
	SP76x2	192	200	168	150		
575-690 VAC +/-10-%	SP86x1	231	250	186	200		
	SP86x2	266	300	231	250		
	SP86x3	311	350	266	300		
	SP86x4	355	400	311	350		
	SP96x1	400	500	347	400	85.8 x 31.5 x 23.6	85.8 x 47.3 x 23.6
	SP96x3	533	600	466	500		
	SP96x4	616	700	533	600		
	SP96x5	711	800	622	700		

Note: Select model based on actual motor full load current

Normal Duty	Suitable for most applications, current overload of 110% for 165 seconds is available. Where motor rated current is less than the drive rated continuous current, higher overloads are achieved.
Heavy Duty	Suitable for demanding applications, current overload of 150% for 60 seconds is available in closed loop and 129% for 97 seconds in open loop.

Order String



SEPARATE FREE STANDING ACCESSORIES

Order Code	Description
SM-Keypad	LED display for configuration and monitoring
SM-Keypad-Plus	Enhanced multi-language LCD display
SP-Income-Shell-40	Empty Cabinet (15.8" wide) with 6 Pulse Interconnection Busbar
SP-Incomer-Shell-40-E23	Empty Cabinet (15.8" wide, IP23 Rated) with 6 Pulse Interconnection Busbar
SP-Incomer-Shell-40-P12	Empty Cabinet (15.8" wide) with 12 Pulse Interconnection Busbar.
SP-Incomer-Shell-40-P12-E23	Empty Cabinet (15.8" wide, IP23 Rated) with 12 Pulse Interconnection Busbar
SP-System-Shell-40	Empty Cabinet (15.8" wide)
SP-System-Shell-40-E23	Empty Cabinet (15.8" wide) - IP23 Rated
SP-P06 Kit [1]	6 Pulse Interconnection Busbar for SP8 and SP9
SP-P12 Kit [2]	12 Pulse Interconnection Busbar for SP8 and SP9
6711-0001-00	Mounting Rail (1 Off) - Enables user to mount their own incomer equipment
6541-0047-00	LHS Mounting Bracket - To attach equipment to the mounting rail on left side - Order one for each mounting rail ordered
6541-0048-00	RHS Mounting Bracket - To attach equipment to the mounting rail on right side - Order one for each mounting rail ordered

SPARE FUSE ORDER CODES

Internal AC Fuse Selection (Semi Conductor IEC class aR)		
Drive	Amps	Order Code
SP6 & SP7	400	4300-0400
SP8 & SP9	800	4300-0800

CIRCUIT BREAKER KITS

Kit includes SP System Shell 40 with circuit breaker and operator handle (through front) installed.	
Drive	Order Code
SP64x1	**CB-KIT-SP6411**
SP64x2	**CB-KIT-SP6412**
SP74x1	**CB-KIT-SP7411**
SP74x2	**CB-KIT-SP7412**
SP84x1	**CB-KIT-SP8411**
SP84x2	**CB-KIT-SP8412**
SP84x3	**CB-KIT-SP8413**
SP84x4	**CB-KIT-SP8414**
SP94x1	**CB-KIT-SP9411**
SP94x3	**CB-KIT-SP9413**
SP94x4	**CB-KIT-SP9414**
SP94x5	**CB-KIT-SP9415**

Foot notes:

[1] Power connection between SP6 & SP7 drives and the incomer cabinet should be made using 95 mm2 cabling (6 Pulse interconnection busbar for SP8 & SP9 drives only).

[2] For 12-Pulse installations the supply must be from a double wound star-delta transformer.



Incomer with disconnect shown with side panel removed for illustration purposes.

UNIDRIVE SP REGEN MODE

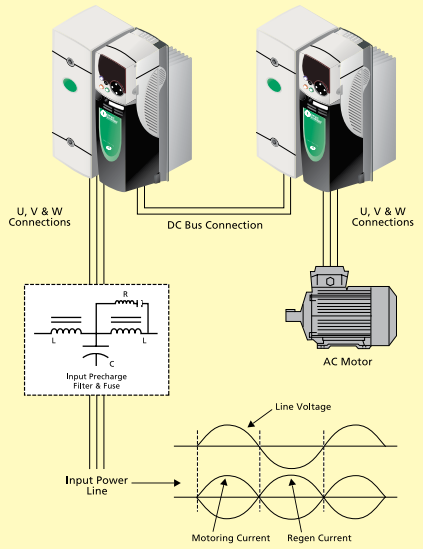
Unidrive SP can be configured to provide full four-quadrant control of the power or drive system. In regen mode, the Unidrive SP is capable of either supplying power to the DC bus of the Unidrive controlling the motor or removing power from the DC bus of the Unidrive SP controlling the motor and returning it back to the supply.

- Unity or controllable Input Power Factor
- Sinusoidal Input Current (Low Harmonic Content)

Control Techniques Engineered Systems are experts at building four-quadrant regenerative systems for use in many applications, where clean, sinusoidal power can be put back to AC supply. See Engineered Systems section.

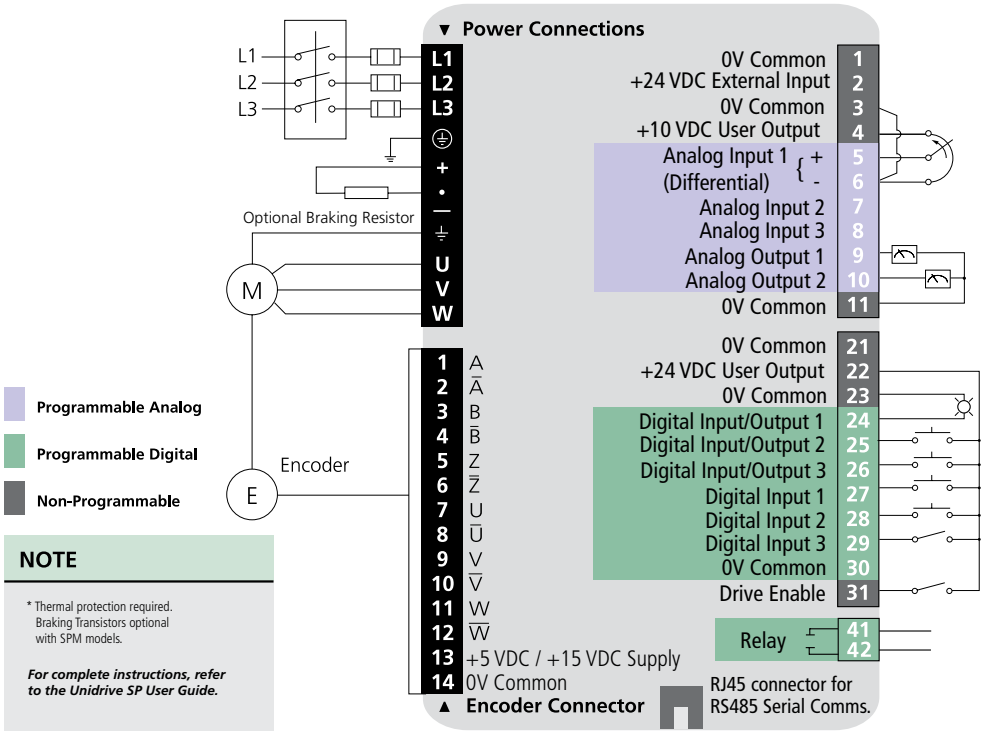
Whether it is cranes and hoists or sophisticated test rigs requiring pure sinusoidal regenerative output, Control Techniques has your regen solution.

Unidrive SP Regen Solutions





UNIDRIVE SP TERMINAL DIAGRAM



TERMINAL DESCRIPTION

Pin#	Function ①	Type/Description	Notes
1	0V Common		
2	+24 VDC External Input	Back up Power Supply for Control	60W, 24 VDC
3	0V Common	Common for External Analog Devices	
4	+10 VDC User Supply	Reference Supply	10 mA max
5	Analog Input 1 (Local Frequency/Speed Reference)	Differential Analog Input, Non-inverting Input, 16 bit	±10 VDC 100 k Ohms
6	Analog Input 1 (Local Frequency/Speed Reference)	Differential Analog Input, Inverting Input 16 bit	±10 VDC 100 k Ohms
7	Analog Input 2 (Remote Frequency/Speed Reference)	Single-ended Analog Input 10 bit	±10 VDC, 100 k Ohms or 4-20 mA, 200 Ohms ②
8	Analog Input 3	Single-ended Analog Input 10 bit	±10 VDC, 100 k Ohms or 4-20 mA, 200 Ohms ②
9	Analog Output 1 (Frequency/Speed Monitor)	Single-ended Analog Output, Bi-polar, 10 bit	±10 VDC or 0-20 / 4-20 mA ②
10	Analog Output 2 (Motor Torque Monitor)	Single-ended Analog Output, Bi-polar, 10 bit	±10 VDC or 0-20 / 4-20 mA ②
11	0V Common	Common External Analog Signals	

Pin#	Function ①	Type/Description	Notes
21	0V Common		
22	+24 VDC User Output	User Supply	200 mA max
23	0V Common	Common for External Digital Inputs	
24	Digital I/O 1 (Zero Speed Output)	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC, 100 mA max output
25	Digital I/O 2 (Reset Input) 100 mA max output	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC
26	Digital I/O 3 (Run Forward Input)	Digital Input/Output	0 to 24 VDC input, or 1 to 24 VDC, 100 mA max output
27	Digital Input (Run Reverse)	Digital Input	0 to 24 VDC, 7.5 k Ohms
28	Digital Input (Local/Remote)	Digital Input	0 to 24 VDC, 7.5 k Ohms
29	Digital Input (Jog)	Digital Input	0 to 24 VDC, 7.5 k Ohms
30	0V Common	Common for External Digital Inputs	
31	Safe Torque Off Input (drive enabled)	Digital Input	0 to 24 VDC, 1 µsec sample
41	Status Relay (Drive Healthy)	Normally Open	240 VAC, 2A resistive
42	Status Relay (Drive Healthy)	Normally Open	240 VAC, 2A resistive

① Values in (parenthesis) designate default functions.
② 0-20, 4-20 mA modes are also available. See Unidrive SP User Guide.

UNIDRIVE SP SPECIFICATIONS

Environment

Ambient Operating Temperature	0° to 40°C (32° to 104°F) 0° to 50°C (32° to 122°F) with derating
Cooling method	Forced convection
Humidity	95% maximum non-condensing at 40°C (104°F)
Storage Temperature	-40° to 50°C (-40° to 122°F)
Altitude	0 to 3000 m (9,900 ft). Derate 1% per 100 m (328 ft) between 1000 m (3280 ft) and 3000 m (9,900 ft).
Vibration	Tested in accordance with IEC 68-2-34
Mechanical Shock	In accordance with IEC 68-2-27
Enclosure	NEMA 1 (IP 20), NEMA 12 (IP 54) through panel mounting
Electromagnetic Immunity	In compliance with IEC801 and EN50082-2, and complies with EN61800-3 with built-in filter
Electromagnetic Emissions	In compliance with EN50081-2 when the recommended RFI filter is used and EMC installation guidelines are followed

AC Supply Requirements

Voltage	200 to 240 VAC ±10% 380 to 480 VAC ±10% 500 to 575 VAC ±10% 500 to 690 VAC ±10%
Phase	3Ø (SP size Zero) 200-240V 1Ø or 3Ø)
Phase Imbalance Tolerance	2% negative phase sequence (equivalent to 3% voltage imbalance between phases)
Frequency	48 to 65 Hz
Input Displacement Power Factor	0.93

Control

Carrier Frequency	3, 4, 6, 8, 12,16 kHz - panel mounted drives 3, 4, 6 kHz - Free Standing and SPM drives
Output Frequency	0 to 3000 Hz (Open loop)
Output Speed	0 to 40,000 RPM (Closed loop)
Frequency Accuracy	±0.01% of full scale
Frequency Resolution	0.001 Hz
Analog Input Resolution	10 Bit + sign (Qty 2); 16 Bit + sign (Qty 1)
Serial Communications	2-wire RS485 4-wire RS232 or RS485 with SM-APPS module Protocol is ANSI x 3.28-2.5-A4, or Modbus RTU Baud rate 300 to 115,200.
Braking	DC injection braking (stopping and holding) standard. Dynamic braking transistor standard.
Control Power Ride Through	Up to 1 second depending on inertia and decel time

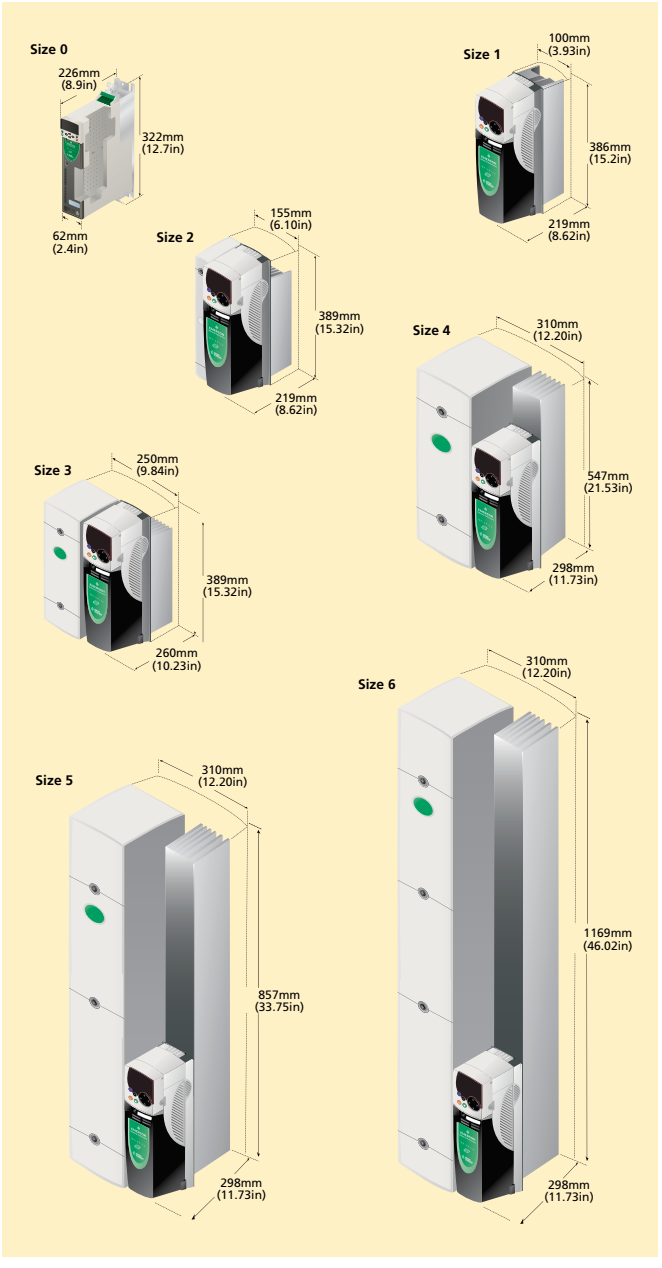
Protection

DC Bus Undervoltage Trip	175 / 350 / 435 VDC (approximately 124 / 247 / 307 VAC line voltage)
DC Bus Overvoltage Trip	415 / 830 / 990 VDC (approximately 293 / 587 / 700 VAC line voltage)
MOV Voltage Transient Protection	160 Joules, 1400 VDC clamping (Line to line and line to ground)
Drive Overload Trip	Current overload value is exceeded. Programmable for Normal Duty or Heavy Duty, Open loop or Closed loop operation
Instantaneous Overcurrent Trip	225% of drive rated current
Phase Loss Trip	DC bus ripple threshold exceeded
Overtemperature Trips	Drive heatsink, control board, and option module(s) monitoring
Short Circuit Trip	Protects against output phase to phase fault
Ground Fault Trip	Protects against output phase to ground fault
Motor Thermal Trip	Electronically protects the motor from overheating due to loading conditions

Approvals & Listings

UL, cUL	UL File #E171230
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Designed for marking
NEMA	NEMA 1 enclosure type
VDE	Meets VDE Electromagnetic Emissions Standards
ISO 9002	Certified Manufacturing Facility

DIMENSIONS



Unidrive SP
Options

The Unidrive SP provides application and system designers with an incredibly flexible drive platform, which is easily modified by an extensive range of sophisticated SM option modules for economical, space saving solutions. SM option modules install easily into any of the three option slots on the SP, with no tools required. The I/O, feedback, motion control, communication and application modules enable the Unidrive SP to provide an optimized solution to meet your specific requirements.





A complete range of other accessories are available to simplify system integration and meet system design criteria. *See the Options and Accessories section for details.*

OPTIONS AT-A-GLANCE

Option	Description	Order Code
Base Drive Configuration and Programming	Cloning and Parameter Storage Card	SMARTCARD[1]
	Configuration Software	CTSOFT[1]
	RS232/485 Comms Cable	CT-COMMS-CABLE
	USB Comms Cable	CT-USB-CABLE
	Keypad to Drive Cable	SP-LCD-485-XXX
Operator Interface	No Keypad Option	Standard
	LED Keypad[6] (size 1-6)	SM-KEYPAD[2]
	LED Keypad[6] (size zero only)	KEYPAD-SP0
	Backlit LCD Keypad Plus	SM-KEYPAD PLUS[2]
	Programmable HMI Panels	See Options & Accessories
Power Accessories	Zero-Space Brake Resistor	Based on Drive
	E-Stop Duty Braking Resistor	See Options & Accessories
	Cyclic Duty Braking Resistor	See Options & Accessories
	Zero Space EMC Filter	Standard
	External EMC Filters	See Options & Accessories
Feedback Solutions Modules	Universal Encoder Feedback SM-UNIVERSAL ENCODER PLUS	SM-UNI-ENCODER
	Incremental Encoder Input SM-ENCODER PLUS	SM-ENCODER-PLUS
	Incremental Encoder Input & Output SM-ENCODER OUTPUT PLUS	SM-ENCODER-OUT
	Resolver Feedback	SM-RESOLVER
	Screw Terminal Connector	SM-ETC
I/O Solutions Modules	Extended Analog and Digital I/O	SM-I/O-PLUS
	Extra Analog and Digital I/O	SM-I/O-LITE
	Extended I/O	SM-I/O-32
	Extra I/O with RealTime Clock/ Calendar	SM-I/O-TIMER
	120/240 Volt AC I/O	SM-I/O-120V
	Double Insulated Extended I/O	SM-I/O-PELV
	Remote Network I/O	See Options & Accessories
	+24 VDC Protected I/O	SM-I/O-24V

Option	Description	Order Code
Communications Solutions Modules	Modbus RTU Follower	Standard
	Modbus RTU Master SM APPLICATIONS PLUS[3]	SM-APPS-PLUS[3]
	DeviceNet	SM-DEVICENET
	PROFIBUS DP	SM-PROFIBUS-DP
	Ethernet (Modbus TCP/IP, Ethernet IP)	SM-ETHERNET
	INTERBUS-S	SM-INTERBUS
	CANopen	SM-CANOPEN
	CAN Interface	SM-CAN
	Ethernet (EtherCAT)	SM-ETHERCAT
	SERCOS	SM-SERCOS
	CTNet, CTSync SM APPLICATIONS PLUS	SM-APPS-PLUS
Application Solutions Modules	Systems Programming (Distributed Control) SM APPLICATIONS PLUS	SM-APPS-PLUS
	Systems Programming (Centralized Control) SM APPLICATIONS LITE V2	SM-APPS-LITE-V2
	System Programming and Registration	SM-REGISTER
	Dedicated Motion Control	SM-EZMOTION[4]
Applications Module Programming Software	Ladder and Function Blocks	SYPTLITE[5]
	IEC 61131-3 (Ladder, FB, and Text Based)	SYPTPRO
	Motion Made Easy Programming	POWERTOOLSPRO
Miscellaneous	Conduit Entry Plates	See Options & Accessories
	IP54 or IP55 Cooling Fans	Based on Drive

[1] Can be ordered separately, but comes standard with Unidrive SP
[2] These options can be ordered separately, but are normally part of the Unidrive SP Order Code
[3] Provides an additional Modbus RTU port (in addition to one on drive)
[4] Only one of these modules can be used in a Unidrive SP at a time
[5] Available via free web site download only
[6] For Keypad details see the Options & Accessories section page 394

Operator Interface

KEYPAD INTERFACE

The Unidrive SP can operate without a keypad, or with either the SM-Keypad and SP-Keypad or SM-Keypad Plus.

The SM/SP-Keypad are full-function, 7-digit LED data displays. The SM-Keypad Plus is a back-lit LCD display option that can be mounted on the drive or remote mounted. SM-Keypad Plus supports 5 languages, plus custom text database, online help, and HMI features. Keypads are "hot-pluggable," enabling them to be moved from one drive to another without powering down.



SP-Keypad (LED) for Unidrive SP size Zero



SM-Keypad, No Keypad size 1-6



SM-Keypad Plus

Multi-lingual Keypad

English **French**
Spanish **German**
Italian

Keypad to Drive Cable SP-LCD-485-XXX
XXX=005, 010, 015, 025, 050 feet

HUMAN MACHINE INTERFACE (HMI)

These operator interface units complement the product line by offering an impressive way of accessing parameters and adding more programming power to your application.



For more information, refer to the Accessories Section.

Power Accessories

INTERNAL DYNAMIC BRAKING RESISTORS

During deceleration, the mechanical energy stored in the spinning mass of the motor and load is converted to electrical energy, which recharges the drive's DC bus. Dynamic braking resistors provide a means of rapidly dissipating that energy so that the DC bus does not become overcharged. The ohmic value and power rating of the braking resistor is a function of the drive type and size.



Size 1 Unidrive SP heatsink shown

A Zero-space braking resistor is available for heatsink mounting on Unidrive SP frame sizes 0-2. These resistors are designed for low-inertia loads commonly used in servo type applications. For higher-inertia loads, the heatsink mounted resistor may not have enough braking capacity, and a larger external resistor may be required. No thermal protection device is required with these heatsink mounted resistor packages.

Frame Size	DC Resistance	Power Rating	Order Code
0	75 Ω	50W	SM-HEATSINK-DBR0
1	75 Ω	50W	SM-HEATSINK-DBR1
2	37.5 Ω	100W	SM-HEATSINK-DBR2

(Drives Larger than Size 2 do not have this option)

DYNAMIC BRAKING RESISTORS

E-STOP DUTY

E-Stop duty DB resistors are designed for non-cyclic use where energy dissipation from an active drive is required.



CYCLIC DUTY

These heavy-duty kits have been designed to provide dynamic braking for cyclic and continuous braking applications.



See the Options and Accessories section for details

EXTERNAL EMC FILTERS

EMC filters are used to minimize high frequency power supply line disturbances caused by PWM AC drives that may interfere with proper operation of sensitive electronic equipment. These specific filters have been assessed for conformance with the EMC directive by testing with the appropriate Control Techniques drives. The filters used with Unidrive SP have been designed to mount in either Footprint or Bookend dimensions, allowing the user to optimize panel space.



See the Options and Accessories section for details.

IP54 AND IP55 FAN OPTIONS

For those applications using through-panel mounting, and located in demanding environments, Unidrive SP can be fitted with optional fans providing either IP54 or IP55 Ingress Protection Ratings. The chart below lists the available fan options.



Unidrive SP Frame Size	IP54 Fan Option Order Code	IP55 Fan Option Order Code
1	3251-4824	3251-3824
2	3251-4824	3251-3824
3	N/A	3251-1224
4	3251-7824	N/A
5	Standard	N/A
6	Standard	N/A

Drives fitted with fan options require field wiring.

COMMUNICATION CABLES

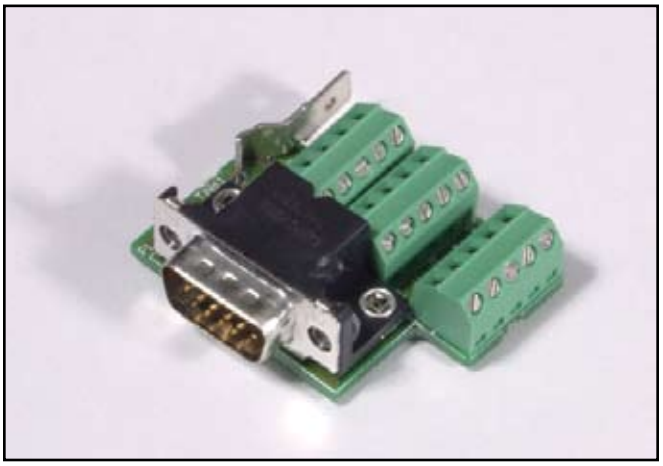
Communication cables are available to allow drive configuration and online monitoring from a PC. The CT Comms Cable connects the 9 pin RS232 serial port of a PC to the RJ45 port of the drive. You may also connect the RJ45 port on the drive directly to the USB port of your PC using the CT USB Cable.



Description	Order Code
PC-to-drive Comms Cable	CT-COMMS-CABLE
PC-to-drive Comms Cable	CT-USB-CABLE

ENCODER TERMINAL CONNECTOR

The 15 way D-Type Converter is used to simplify motor feedback wiring by "Breaking out" the 15-pin D-connector signals to screw terminals.



Description	Order Code
Encoder Screw Terminal connector	SM-ETC

CONDUIT BOXES*

Conduit entry boxes for Commander SK, Commander GP20 and Unidrive SP panel-mount drives. Currently, conduit mounting plates are available for Commander SK, Commander GP20 and Unidrive SP sizes A through 6.

*For overall dimensions and order codes see the AC Options & Accessories section - page 83.

Unidrive SP Solution Modules

Feedback Modules

SM-UNIVERSAL ENCODER PLUS

The SM-Universal Encoder Plus module provides the Unidrive SP with an additional feedback port that supports all of the same feedback types as the base drive, plus has a simulated encoder output that can be programmed to operate in the following modes:



- Quadrature Incremental
- Pulse and Direction
- SSI Gray or Binary Code

The module also incorporates freeze inputs for applications requiring position capture.
Order Code: SM-UNI-ENCODER

SM-ENCODER OUTPUT PLUS

NEW



Incremental encoder input and output option module to enable connection with external motion controllers.
Order Code: SM-ENCODER-OUT

SM-ENCODER PLUS



The SM-Encoder Plus module provides an additional quadrature incremental encoder input.
Order Code: SM-ENCODER-PLUS

Note: More than one SM-Encoder module may be installed in a single drive.

SM-RESOLVER

This module enables the Unidrive SP to control the speed and position of motors fitted with resolvers. Because of their ruggedness, resolvers are often used in hot, demanding environments.



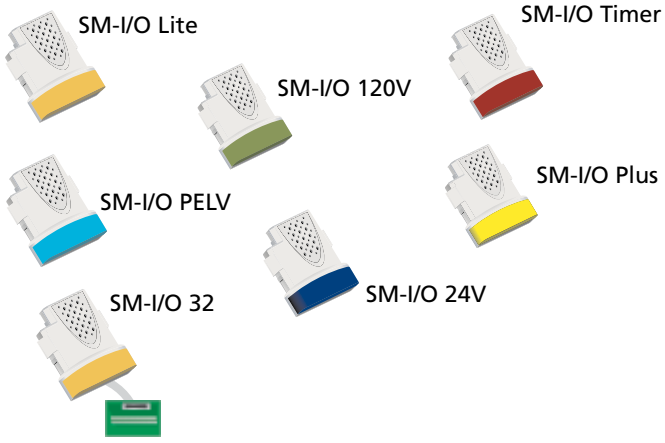
Input Impedance: >85 Ohms
Transformation Ratio: 3:1 or 2:1
Excitation Frequency: 6 kHz

Maximum Motor Speed	Feedback Resolution	Quadrature Format
0-3,300 rpm	14 bit	4096
3,301-13,200 rpm	12 bit	1024
13,201-40,000 rpm	10 bit	256

This module also incorporates a simulated encoder output that can be sourced either from the resolver or the main drive encoder port.

Additional Input / Output Modules*

To customize your Unidrive SP with more or specialized I/O, or to install a fieldbus option there are slots beneath the cover for three Solution Modules.



Communication Modules*

SM NETWORK COMMUNICATION MODULES



** Modbus RTU is standard on Unidrive SP.
An additional Modbus RTU port can be provided with an SM-Applications/Plus module.

See the OPTIONS-AT-A-GLANCE chart for order codes. For more information on individual modules see the Options and Accessories section.

* For more details and order codes see the AC Drive Options section at the end of the AC Drives section.

For complete product descriptions please refer to the Options and Accessories section.

Application / Programming Modules

SM-APPLICATIONS PLUS



SM-Applications Plus meets your most demanding high speed motion application needs.

The SM-Applications Plus module transforms your Unidrive SP drive into a powerful automation controller that adds PLC functionality and can connect to devices via our drive-to-drive network CTNet. This gives you all of the benefits of a fully distributed control system including better performance, reduced cost and smaller electrical panel sizes.

Performance – The SM-Applications Plus module contains it's own high performance microprocessor, leaving the drive's own processor to give you the best possible motor performance. It contains 384K of user program memory, meaning that you are never likely to be limited by the program size or processing power of the module.

Easy Powerful Configuration – The PLC functionality is programmed using SyPTPro (System Programming Tool) allowing you to tackle automation problems from simple start and stop sequencing to more complex machine and motion control applications. The device is programmed within an IEC61131-3 environment with your choice of 3 languages; Ladder Logic, Function Blocks, and text based programming. SyPTPro provides a suite of diagnostic and debugging features for maintenance and to help you to get your solution into service faster.

Real Time Control – SM-Applications Plus module gives you real-time access to all of the drives parameters plus access to data from I/O or other drives. The module uses a high-speed multi-tasking operating system with task update times as low as 250 µs. Tasks are fully synchronized to the drives own control loop to give you the best possible performance for drive control and motion.

Inputs/Outputs – The module has two digital inputs and two digital outputs for high-speed I/O operations such as position capture or actuator firing. The module also features an optically isolated RS485 port supporting standard protocols such as Modbus for connection to external devices like Operator Interface panels, or CTSync which is a protocol used for synchronous communication between drives.

Order Code: SM-APPS-PLUS

SM-REGISTER

NEW



SM-Register provides additional capability for position capture and registration and is designed to be used with the SM-Applications Plus module. It is your best solution for critical high speed motion applications.

- 2 Independent Capture Channels
- Automated Pattern Recognition
- Registration Windowing
- Positive & Negative Edge Capture
- Edge Filtering
- Pulse Capture

SM-APPLICATIONS LITE V2



SM-Applications Lite V2 module is your solution for single drive, time critical applications when multiple networked drives are not required. The SM-Applications Lite V2 module is designed to solve your automation requirements where intelligence is needed on a standalone drive or a drive connected to a centralized controller via I/O or Fieldbus.

The module provides many of the same functions of SM-Applications Plus but may be programmed using either SyPTLite or SyPTPro. SM-Applications Lite V2 with SyPTLite gives you an intermediate level automation solution that is suitable for a wide variety of applications, while SyPTPro and SM-Applications Lite V2 allow you to exploit the full power and performance of the option module in 'stand-alone' applications.

Order Code: SM-APPS-LITE-V2

Note: *CTNET and CTSync are not supported.*

SM-EZMOTION



The SM-EZMotion is ideal for all of your motion control applications whether simple or highly complex. Windows™-based PowerTools Pro configuration software helps to simplify applications while maintaining flexibility and functionality.

The module is equipped with four high speed digital inputs and two digital outputs for external control. Simplify all of your motion applications by using the built-in High-Speed Capture, Queuing, Profile Summation, and Program Multi-tasking capabilities. Ease of use defines this multipurpose motion controller. Take advantage of all its features to quickly solve these applications:

- Indexing
- Random Infeed Control
- Rotary Knife
- Phase Synchronization
- Flying Shear
- High Speed Labeling

See the Software section of this catalog for more details on PowerTools Pro Software, which features "Motion Made Easy"™ programming with Drag and Drop, Point and Click, and Fill in the Blank.

Drive Configuration & Programming

SMARTCARD



This standard feature ships with every Unidrive SP enables simple configuration of parameters in a variety of ways.

The SmartCard can:

- 'Clone' a complete set of parameters for serial production
- Save multiple complete sets of parameters
- Set up an application as parameter differences from default
- Automatically save all user parameter changes for maintenance purposes
- Load complete motor map parameters
- Read/write SmartCard information from within SM-Applications and SM-Applications Lite programs.

The drive only communicates with the SmartCard when commanded to read or write, meaning the card may be "hot swapped".

Description	Order Code
Plug-In drive configuration card. Save/Copy complete drive parameter mapping.	SMARTCARD

REMOTE NETWORK I/O



The high-quality Beckhoff I/O system is available for systems using the CTNet communications network. A CTNet port is standard on SM-Applications Plus modules. Beckhoff systems for CTNet include an I/O bus coupler and a large variety of snap-on terminal blocks allowing up to 256 digital inputs or outputs and up to 100 analog inputs and outputs per bus coupler. Up to 64 Beckhoff I/O systems can be attached to a CTNet network. I/O points can be easily read or written. Contact Control Techniques for details on the wide range of available Beckhoff Remote I/O options.

See page 381 for complete CTNet integration details.







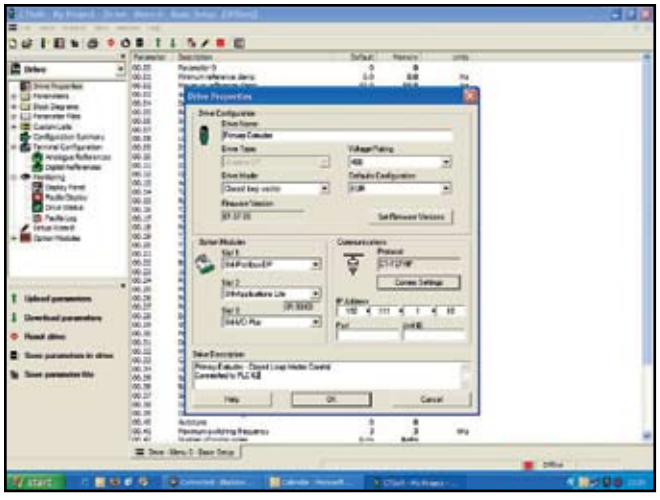
Unidrive SP
Software Overview

DRIVE CONFIGURATION TOOLS (CTSOFT)

CTSoft is a free Windows™-based drive configuration tool designed to enable the complete control and display of all parameters within a Unidrive SP. Functions within CTSoft allow data to be uploaded, viewed and saved, or retrieved from disk, modified and printed. It can be used offline in the office or online in the factory. CTSoft communicates with the Unidrive SP via the computer's serial port to the drive's RS485 port using a communications cable (CT Comms cable) or via SM-Ethernet module. For more information, refer to the Software Section.

Some of CTSoft's capabilities include:

- Remote Upload/Download
- Parameter Saving
- Drive Set Up Wizard
- Monitor Screens
- Multiple Window Display
- Block Diagram Animation
- Drive and SM-Application Reset



FREE Software *CTSoft IS SUPPLIED WITH THE DRIVE OR YOU CAN DOWNLOAD FROM www.emersonct.com --go to downloads*

Application Programming Software

SYPTLITE AND SYPTPRO

Control Techniques has developed a programming tool named SyPT (or System Programming Tool) for OEM's and End Users that allows engineers and machine designers to maximize the functionality of the Unidrive SP and other Control Techniques drives. Whether programming a simple single-drive application that requires Run and Stop controls, or fully networked multi-drive control systems for machine and process control applications, SyPT helps the user to solve the application.

To cover the wide range of application complexity, SyPT is available in two versions called SyPTLite and SyPTPro. SyPTLite is used to create simple or complex Ladder Logic programs that can be used to control the drive, and even to replace small PLC's that control machine I/O. SyPTPro is for the advanced machine programmer, and gives the user IEC-61131-3 style programming with Ladder Logic, Function Block, and DPL (text-based) editors. SyPTPro is used for complete machine control and/or motion control by configuring all drives and control modules, as well as replacing costly PLC's.

Scalable PLC capability is accomplished using Solution Modules, which provide added memory, I/O, and connectivity options, i.e., the SM-Applications Lite and SM-Applications module. (See Software section.)

FREE Software *YOU CAN DOWNLOAD SyPTLite FROM www.syptlite.com*

POWERTOOLS PRO

PowerTools Pro is a Windows™-based software program used to develop "Motion Made Easy"™ motion control applications, and is employed when an SM-EZMotion module is used with the Unidrive SP. PowerTools Pro is used to develop sophisticated motion programs in minutes instead of hours, and is ideal for solving a full range of axis and axis-and-a-half applications. (See the Motion Control section for details.)

FREE Software *YOU CAN DOWNLOAD PowerTools Pro FROM www.emersonct.com*

AC Drive Options



AC Drives

AC DRIVE OPTIONS AT-A-GLANCE

Options & Accessories	Description	Commander Series SL	Commander Series SX	Commander Series SK	Commander Series GP20	Unidrive SP	Order Code
Base Drive Configuration and Programming	Cloning and Parameter Storage		✓	✓	✓	✓	SX=XPRESS-KEY, SK=SMARTSTICK GP20=GP20-SMARTCARD, SP=SMARTCARD
	Configuration Software		✓	✓	✓	✓	SX=SXSOFT SK, GP20, SP=CTSOFT
	PC Configuration Tool / Cloning	✓					9500-0078
	Communications Cable - RS232/485	✓	✓	✓	✓	✓	CT-COMMS-CABLE
	Communications Cable - USB	✓	✓	✓	✓	✓	CT-USB-CABLE
Operator Interface	No Keypad Option					✓	-NKP
	LED Keypad			✓		✓	SK=SK-KEYPAD-REMOTE SP=SM-KEYPAD SP SIZE ZERO=KEYPAD-SP0
	LCD Keypad			✓	✓	✓	SK, SP=SM-KEYPAD-PLUS GP20=CGP-KEYPAD-PLUS
	Programmable HMI Panels		✓	✓	✓	✓	See Options & Accessories
Power Accessories	Zero-Space Brake Resistor		✓	✓	✓	✓	Based on Drive
	E-Stop Duty Braking Resistor		✓	✓	✓	✓	See Options & Accessories
	Cyclic Duty Braking Resistor		✓	✓	✓	✓	See Options & Accessories
Environmental Protection and Cable Management Options	Internal EMC Filter		✓	✓	✓	✓	Standard
	External EMC Filters	✓	✓	✓	✓	✓	See Options & Accessories
	Top Cover and Conduit Entry - NEMA Kit	✓		✓	✓	✓	See Options & Accessories
	Conduit boxes	✓	✓	✓	✓	✓	See AC Drive Options & Accessories
Feedback Solutions Modules	Universal Encoder Feedback SM-UNIVERSAL ENCODER PLUS					✓	SM-UNI-ENCODER
	Incremental Encoder Input SM-ENCODER PLUS					✓	SM-ENCODER-PLUS
	Incremental Encoder Input & Output SM-ENCODER OUTPUT PLUS					✓	SM-ENCODER-OUT
	Resolver Feedback					✓	SM-RESOLVER
	Screw Terminal Connector					✓	SM-ETC
I/O Solution Modules	Extended Analog and Digital I/O				✓	✓	SM-I/O-PLUS
	Extra I/O with Encoder Reference			✓	✓	✓	SM-I/O-LITE
	32 Point Digital I/O			✓	✓	✓	SM-I/O-32
	Extra I/O with Real-Time Clock/Calendar			✓	✓	✓	SM-I/O-TIMER
	120/240 Volt AC I/O			✓	✓	✓	SM-I/O-120V
	Double Insulated Extended I/O			✓	✓	✓	SM-I/O-PELV
	Remote Network I/O					✓	See Options & Accessories
	24 Volt Protected I/O			✓	✓	✓	SM-I/O-24V
	Bipolar Analog Input for Direction Control			✓			SM-BIPOLAR

* For complete product descriptions please refer to the Options and Accessories section.

AC DRIVE OPTIONS AT A GLANCE continued

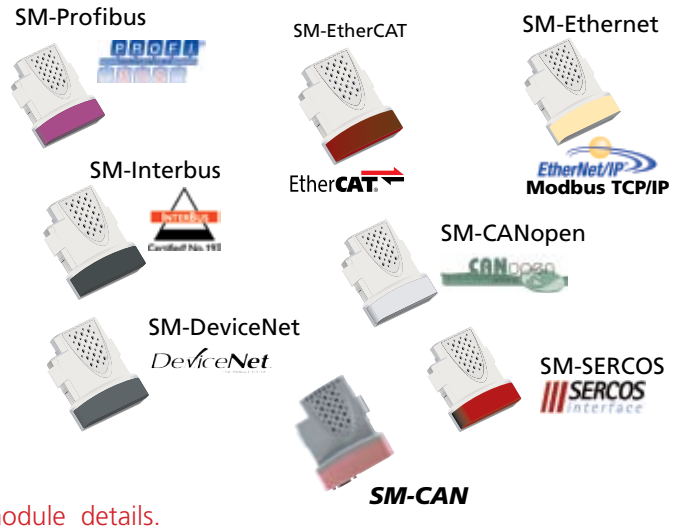
		AC Drives					
		Commander Series				Unidrive SP	
Options & Accessories	Description	SL	SX	SK	GP20		Order Code
Communications Solutions Modules	Modbus RTU Follower		✓	✓	✓	✓	Standard
	Modbus RTU Master SM APPLICATIONS PLUS					✓	SM-APPS-PLUS
	DeviceNet			✓	✓	✓	SM-DEVICENET
	PROFIBUS DP			✓	✓	✓	SM-PROFIBUS-DP
	Ethernet (Modbus TCP/IP, Ethernet IP)			✓	✓	✓	SM-ETHERNET
	Interbus-S			✓	✓	✓	SM-INTERBUS
	CANopen			✓	✓	✓	SM-CANOPEN
	CAN Interface					✓	SM-CAN
	Ethernet (EtherCAT)			✓	✓	✓	SM-ETHERCAT
	SERCOS					✓	SM-SERCOS
	CTNet (SM APPLICATIONS PLUS)					✓	SM-APPS-PLUS
	CTSync (SM APPLICATIONS PLUS)					✓	SM-APPS-PLUS
Application Solutions Modules	Systems Programming (Centralized Control) SM APPLICATIONS LITE V2					✓	SM-APPS-LITE-V2
	Systems Programming (Distributed Control) SM APPLICATIONS PLUS					✓	SM-APPS-PLUS
	High Speed Capture & Registration					✓	SM-REGISTER
	Dedicated Motion Control					✓	SM-EZMOTION[4]
Applications Module Programming Software[6]	Ladder and Function Blocks			✓	✓	✓	SYPTLITE[5]
	IEC 61131-3 (Ladder, FB, and Text Based)					✓	SYPTPRO
	"Motion Made Easy"™ Programming					✓	POWERTOOLSPRO
Miscellaneous	IP54 or IP55 Heatsink Fans			✓	✓	✓	Based on Drive

[4] Only one of these modules can be used in a Unidrive SP at a time
[5] Available via free web site download only
[6] See the Software section for complete details

Communication Modules

SM NETWORK COMMUNICATION MODULES

SM communication option modules can be inserted in a drive's option slot allowing control and monitoring of that drive on fieldbus networks. The standard Modbus-RTU port can also be used for drive configuration using CTSoft. The most popular industrial network protocols are available in the SM range of options.



See the Connectivity section for complete communication module details.

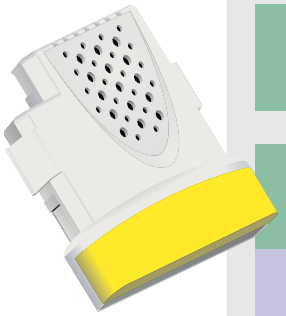
AC Drive Options & Accessories

Input/Output Modules

SM-I/O PLUS

This module provides expanded digital and analog I/O.

- 2 Analog Inputs (10-bit plus sign,±10V)
- 1 Analog Output (10-bit plus sign,±10V)
- 3 Digital Input/Outputs
- 3 Digital Inputs
- 2 Relays (2A @ 240 VAC, 4A @ 30 VDC)



PL1	
OV Common	1
Digital I/O 1	2
Digital I/O 2	3
Digital I/O 3	4
OV Common	5
Digital Input 4	6
Digital Input 5	7
Digital Input 6	8
Analog Input 4	9
Analog Input 5	10
OV Common	11
Analog Output 3	12

PL2	
Relay 1	21
Relay Common	22
Relay 2	23

SM-I/O 24V

The SM-I/O 24V is designed as an over voltage protected I/O Solution Module. The Solutions Module is able to withstand a +48V input voltage being applied to the +24V rated Digital I/O terminals.

- 2 x Analog Current Outputs
- 4 x Digital Input/Outputs
- 3 x Digital Inputs
- 2 x Relays** (30 VDC contact rating)



OV Common	1
OV Common	2
Digital I/O 1	3
Digital I/O 2	4
Digital I/O 3	5
Digital I/O 4*	6
Digital Input 5	7
Digital Input 6	8
Digital Input 7	9
Analog Output 1	10
OV Common	11
Analog Output 2	12
OV Common	13
Relay 1	14
	15
Relay 2**	16
	17

* Digital Input only with Commander SK
** Not available on Commander SK



LEGEND

- Programmable Analog
- Programmable Digital
- Non-Programmable

SM-I/O 120V

This module provides digital I/O rated for 120 or 240 VAC. These I/O conform to IEC 61131-2 120 VAC standard.

- 6 Digital Inputs (120 VAC or 3 Digital Inputs @ 240 VAC)
- 2 Relays (2A @ 120 VAC, 4A @ 30 VDC)



Digital Input 1	1
Digital Input 2	2
Neutral for Digital Inputs 1 & 2	3
Digital Input 3	4
Digital Input 4	5
Neutral for Digital Inputs 3 & 4	6
Digital Input 5	7
Digital Input 6	8
Neutral for Digital Inputs 5 & 6	9
Relay 1	10
Relay Common	11
Relay 2	12

Installing Solution Modules is a SNAP!

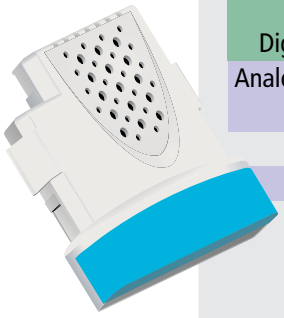


SM-I/O PELV

This module provides PELV (Protective Extra Low Voltage) double insulated digital and analog I/O to meet IEC 61131-2, Clause 3.3.1 Type as well as NAMUR NE37 specifications for chemical industry applications.

- 1 Analog Input (bipolar 0-10V, 4-20 mA or 0-20 mA)
- 2 Analog Outputs (4-20 mA or 0-20 mA)
- 1 Digital Input with freeze function
- 4 Digital Input/Outputs
- 2 Relays (2A @ 240 VAC, 4A @ 30 VDC)

Note: SM-I/O PELV module requires an external 24Vdc power supply rated at 150mA when all outputs are loaded. See the Options & Accessories section under 'Logic and I/O Power Supplies' for 24V dc power supply listings.



0V Common	1
+24 Input	2
Digital I/O 1	3
Digital I/O 2	4
Digital I/O 3	5
Digital I/O 4*	6
Digital Input 5/Freeze Input**	7
Analog Input 1 Inverting Input***	8
Analog Output 1	9
0V Common	10
Analog Output 2	11
0V Common	12
	13
Relay 1	14
	15
Relay 2	16
	17

* Digital Input only with Commander SK
** Freeze Input not available with Commander SK
*** Current mode only

LEGEND

- Programmable Analog
- Programmable Digital
- Non-Programmable

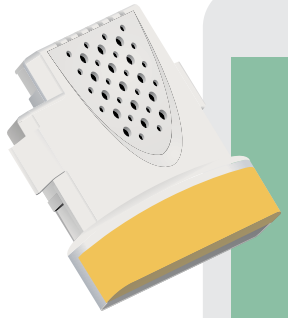
SM-I/O 32

NEW

This module provides expanded digital I/O.

- 32 Digital Inputs/Outputs
- Includes Breakout Board and Cable
- Access to all I/O requires the use of SyPTLite or SyPTPro software





PL1	
Digital Input/Output 1	1
Digital Input/Output 2	2
Digital Input/Output 3	3
Digital Input/Output 4	4
Digital Input/Output 5	5
Digital Input/Output 6	6
Digital Input/Output 7	7
Digital Input/Output 8	8
Digital Input/Output 9	9
Digital Input/Output 10	10
Digital Input/Output 11	11
Digital Input/Output 12	12
Digital Input/Output 13	13
Digital Input/Output 14	14
Digital Input/Output 15	15
Digital Input/Output 16	16
Digital Input/Output 17	17
Digital Input/Output 18	18
Digital Input/Output 19	19
Digital Input/Output 20	20
Digital Input/Output 21	21
Digital Input/Output 22	22
Digital Input/Output 23	23
Digital Input/Output 24	24
Digital Input/Output 25	25
Digital Input/Output 26	26
Digital Input/Output 27	27
Digital Input/Output 28	28
Digital Input/Output 29	29
Digital Input/Output 30	30
Digital Input/Output 31	31
Digital Input/Output 32	32
+24V Out	33
0V	34
0V	35
0V	36
0V	37

[= output group

SM-I/O 32 digital outputs
Each group of 4 outputs can supply a total of 16mA, so each output is able to supply at least 4mA. A digital output can supply up to a maximum of 16mA as long as the total output current for the group does not exceed 16mA, (for example, one digital I/O set as an output and the other three digital I/O in the group set to inputs).

Recommended relay
TYCO Electronics Schrack ST3P2LC4

SM-I/O LITE

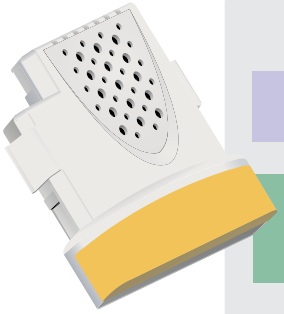
This module provides expanded digital and analog I/O plus encoder reference.

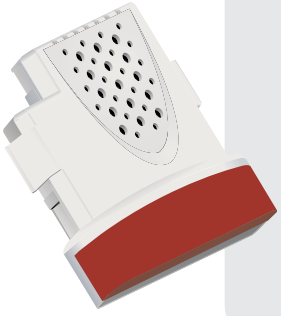
- 1 Analog Input (11-bit plus sign, ±10V, 4-20 mA, or 0-20 mA)
- 1 Analog Output (13-bit, 0-10V, 4-20 mA, or 0-20 mA)
- 3 Digital Inputs
- 1 Relay (2A @ 240 VAC, 4A @ 30 VDC)
- Quadrature encoder reference input

SM-I/O TIMER

As per SM-I/O LITE above, but with the addition of a Real Time Clock and Calendar for scheduling drive events.

- Access to Year, Month, Day, Hour, Minute, Second, and Daylight Savings Mode





PL1	
0V Common	1
Analog Input	2
Analog Output	3
+24V	4
Digital Input 1	5
Digital Input 2	6
Digital Input 3 / Encoder B*	7
Encoder B\	8
Encoder A	9
Encoder A\	10
0V	11
Encoder +5V	12

PL2	
Relay	21
	22
	23

LEGEND

- Programmable Analog
- Programmable Digital
- Non-Programmable

* When terminal 7 is used as an encoder input, digital input 3 is not available

COMMUNICATION CABLES



Use our RS232 or USB to RS485 cable connectors to connect a PC to the RJ45 serial port on the front of the drive. The same cable is used with other Control Techniques products that use a RS485 RJ45 connector such as the Commander SX, GP20 and SK.

Description	Order Code
PC-to-drive Comms Cable	CT-COMMS-CABLE
PC-to-drive Comms Cable	CT-USB-CABLE

IP54 AND IP55 FAN OPTIONS



For those applications using through-panel mounting, and located in demanding environments, Unidrive SP, Commander SK and Commander GP20 can be fitted with optional fans providing either IP54 or IP55 Ingress Protection Ratings. The chart below lists the available fan options.

Drive Frame Size	IP54 Fan Option Order Code	IP55 Fan Option Order Code
1	3251-4824	3251-3824
2	3251-4824	3251-3824
3	N/A	3251-1224
4	3251-7824	N/A
5	Standard	N/A
6	Standard	N/A

Drives fitted with fan options require field wiring.

EXTERNAL EMC FILTERS



EMC filters are used to minimize high frequency power supply line disturbances caused by PWM AC drives that may interfere with proper operation of sensitive electronic equipment. These specific filters have been assessed for conformance with the EMC directive by testing with the appropriate Control Techniques drives. The filters used with Unidrive SP, Commander SL, SK and GP20 have been designed to mount in either footprint or bookend dimensions, allowing the user to optimize panel space.

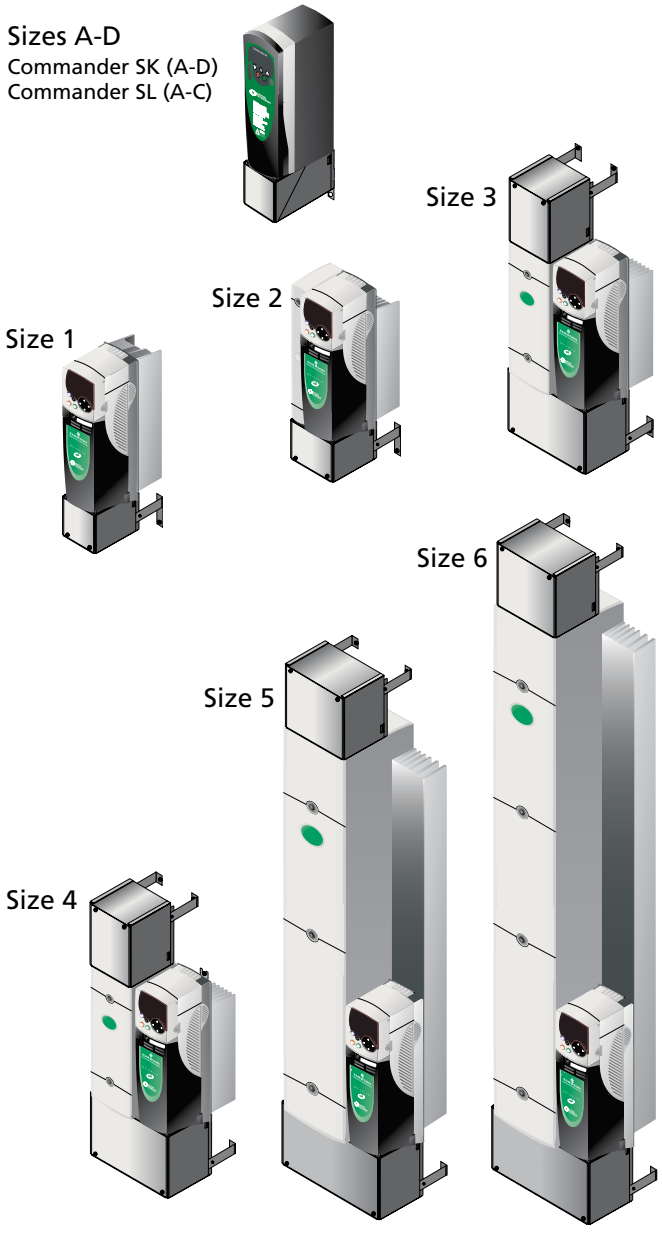
See the Options & Accessories section for details.

CONDUIT BOXES

Conduit plates for Commander SK, SL, GP20 and Unidrive SP (sizes 1-6) panel-mount drives.

Frame Size	Order Code	Overall Dimensions
Size A	SK-NEMA1-KIT-A*	2.09w x 2.4h
Size B	SK-NEMA1-KIT-B*	2.17w x 2.4h
Size C	SK-NEMA1-KIT-C*	2.78w x 2.4h
Size D	SK-NEMA1-KIT-D*	4.29w x 2.4h
Size 1	C-BOX-S1	3.94w x 17.8h
Size 2	C-BOX-S2	6.1w x 17.8h
Size 3	C-BOX-S3B** C-BOX-S3T**	9.9w x 21.7h
Size 4	C-BOX-S4	12.2w x 32h
Size 5	C-BOX-S5	12.2w x 44.2h
Size 6	C-BOX-S6	12.2w x 56.4h

* Includes plastic top and side covers
** C-BOX-S3T (Top) is only necessary when a DC input power or dynamic braking resistor is required.



Power Accessories

INTERNAL DYNAMIC BRAKING RESISTORS

During deceleration, the mechanical energy stored in the spinning mass of the motor and load is converted to electrical energy, which recharges the drive's DC bus. Dynamic braking resistors provide a means of rapidly dissipating that energy so that the drive does not fault from overcharging the DC bus. The ohmic value and power rating of the braking resistor is a function of the drive type and size.



Size 1 Unidrive SP heatsink shown

A Zero-space braking resistor is available for heatsink mounting on Unidrive SP frame sizes 0-2. These resistors are designed for low-inertia loads commonly used in servo type applications. For higher-inertia loads, the heatsink mounted resistor may not have enough braking capacity, and a larger external resistor may be required. No additional thermal protection device is required with these heatsink mounted resistor packages.

Frame Size	DC Resistance	Power Rating	Order Code
0	75 Ω	50W	SM-HEATSINK-DBR0
1	75 Ω	50W	SM-HEATSINK-DBR1
2	37.5 Ω	100W	SM-HEATSINK-DBR2

(Drives Larger than Size 2 do not have this option)

DYNAMIC BRAKING RESISTORS

E-STOP DUTY

E-Stop duty DB resistors are designed for non-cyclic use where energy dissipation from an active drive is required.



CYCLIC DUTY

These heavy-duty kits have been designed to provide dynamic braking for cyclic and continuous braking applications.



See the Options and Accessories section for details

HUMAN MACHINE INTERFACE (HMI)

These operator interface units complement the product line by offering an impressive way of accessing parameters and adding more programming power to your application. The following features make these screens a simple and impressive solution for you... and your customers:

- Graphical full color or monochrome touchscreens
- Menus, submenus, alarms, fault conditions
- Realtime trends and graphs
- Scheduling and background programs
- Modbus RTU and Modbus TCP/IP
- Import pictures and graphics
- Advanced Recipe capabilities



For more information, refer to the Accessories Section.



See the RapidPak pages in the Packaged Drives and Engineered Systems section for details.

AC Inverter Duty Motors

NEW

ACCU-Torq™

Totally Enclosed, Non-Ventilated (TENV)
Vector Duty, C-Face, 2000:1 Constant Torque



Designed for use with inverter and vector drive applications requiring up to a 2000:1 constant torque speed range. This makes it perfect for use with Commander SL, SK, GP20 or Unidrive SP drives. The ACCU-Torq motor may be used for almost any AC drive application from a simple conveyor to those applications requiring the very best speed and torque or position control. Typical applications: winders, material handling, packaging machines, test equipment, and other industrial machinery.

If you need to accurately position the motor, but don't require the high speed and rapid acceleration dynamics of a servo motor, the Unidrive SP with an encoder-equipped AC induction motor may be the optimum performance solution as well as very affordable.

The flexibility and high performance of the Unidrive SP make it possible to control three phase induction motors on applications that previously demanded higher priced servo motors. Point to point indexing and material handling applications are ideal for utilizing this capability, especially when motors above 5 hp are required. The cost savings is significant due to the lower cost of materials used in the induction motor design.

AC induction motors have rotors with more mass and larger diameters than servo motors of the same torque capacity, and therefore higher inertia. This is helpful for high load-to-motor inertia ratios, and in most cases can eliminate the need for inertia matching gear reduction. The higher inertia of these systems also results in greater low-speed stability.

- From 1 to 25 hp
- High performance 2000 to 1 speed range
- Encoder ready with cables
- Constant torque operation from Zero to base speed with vector drives
- Constant hp operation to twice base speed
- Optimized for operation with IGBT and intelligent-power-module drives (NEMA Design-A)
- Class F insulation
- Normally closed thermostats standard
- Shaft grounding ring option on all ratings
- F-1 standard, field convertible to F-2 for 180 frame and above
- Encoder and brake provision on all ratings
- Three year warranty

Benefits of Vector Motor Positioning

- Overcomes high load inertia mismatches with use of larger AC motors without the expense of large servomotors and/or gear reducers
- Provides precise high-speed positioning when rapid accel/decel rates are not required
- Enables low-cost, error-free closed loop performance in applications that would be cost prohibitive where traditional servo systems are used
- Eliminates environmental and maintenance issues associated with hydraulic and pneumatic systems

AC Inverter Duty Motors

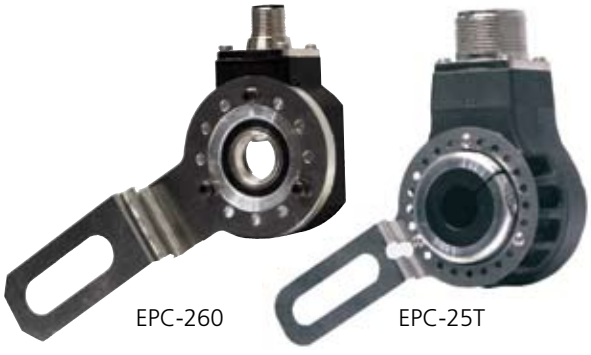
ACCU-Torq™

HP	Base RPM	Max. RPM	Rated Voltage	Frame Size	Catalog Number	F.L Amps	Rated Stall Torque lb-in	Inertia lb-in-sec2	Weight lbs.	Frame Material
0.25	1800	3600	230/460	56C	UN14T2BC	1.0/0.5	37.2	0.026	18.9	Steel
0.33	1800	3600	230/460	56C	UN13T2BC	1.1/0.6	45.6	0.036	18.9	Steel
0.5	1800	3600	230/460	56C	UN12T2BC	1.5/0.7	58.8	0.039	19.3	Steel
	1800	3600	575	56C	UN12T2GC	0.6	58.8	0.039	19.3	Steel
1	1800	3600	230/460	56C	UN1T2BC-a	3.2/1.6	169	0.040	24.3	Steel
	1800	3600	575	56C	UN1T2GC	0.9	168	0.040	24.3	Steel
	1800	3600	230/460	143TC	UN1T2BC	3.2/1.6	169	0.040	26.8	Steel
	1200	2400	230/460	145TC	UN1T3BC	3.6/1.8	163	0.045	41.6	Steel
1.5	1800	3600	230/460	145TC	UN32T2BC	4.6/2.3	278	0.048	41.9	Steel
2	1800	3600	230/460	145TC	UN2T2BC	4.4/2.2	306	0.065	54.3	Steel
	1800	3600	575	145TC	UN2T2GC	2.2	298	0.065	54.3	Steel
	1200	2400	230/460	184TC	UN2T3BC	6.2/3.1	245	0.134	75.3	Aluminum
3	1800	3600	230/460	182TC	UN3T2BC	10.0/5.0	427	0.109	65.2	Aluminum
	1800	3600	575	182TC	UN3T2GC	4.1	434	0.109	65.2	Aluminum
	1200	2400	230/460	213TC	UN3T3BC	9.0/4.5	514	0.254	115.6	Aluminum
5	1800	3600	230/460	184TC	UN5T2BC	14.0/7.0	653	0.176	83.5	Aluminum
	1800	3600	575	184TC	UN5T2GC	5.6	646	0.176	83.5	Aluminum
	1200	2400	230/460	215TC	UN5T3BC	15.8/7.9	1,022	0.344	148.7	Aluminum
7.5	1800	3600	230/460	213TC	UN7T2BC	18.6/9.8	902	0.299	135.2	Aluminum
	1800	3600	575	213TC	UN7T2GC	7.8	883	0.299	135.2	Aluminum
	1200	2400	230/460	254TC	UN7T3BC	20.2/10.1	1,041	0.986	211.1	Aluminum
10	1800	3600	230/460	215TC	UN10T2BC	25.4/12.7	1,477	0.494	143.5	Aluminum
	1800	3600	575	215TC	UN10T2GC	10.2	1,430	0.494	143.5	Aluminum
	1200	2400	230/460	256TC	UN10T3BC	26.0/13.0	1,420	1.298	265.4	Aluminum
15	1800	3600	230/460	254TC	UN15T2BC	36.6/18.3	1,858	0.985	255.2	Aluminum
	1800	3600	575	254TC	UN15T2GC	14.5	1,779	0.985	255.2	Aluminum
20	1800	3600	230/460	256TC	UN20T2BC	55.6/27.8	3,304	1.189	266	Aluminum
	1800	3600	575	256TC	UN20T2GC	22.3	3,297	1.189	266	Aluminum
25	1800	3600	230/460	284TC	UN25T2BC	57.6/28.8	2,381	1.654	482.9	Cast Iron
	1800	3600	575	284TC	UN25T2GC	23.3	2,496	1.654	482.9	Cast Iron

Note: Brakes, encoders and other accessories available.

Encoder Options

Description	Order Code Suffix
EPC-260 2048 ppr Encoder with M12 8 pin connector	-E2
EPC-25T 2048 ppr Encoder with MS 10 pin connector	-E3

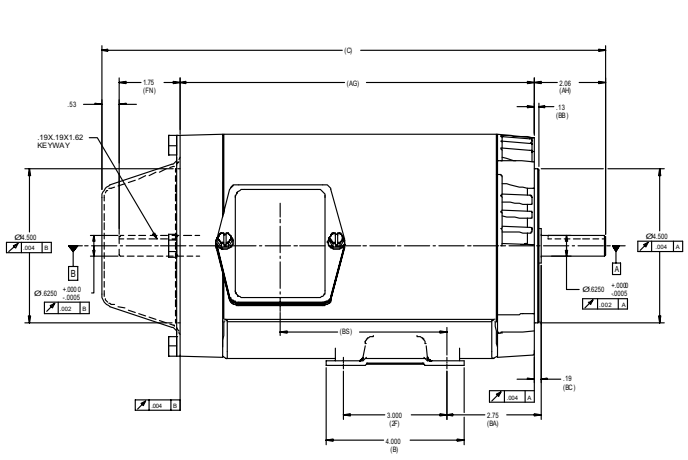


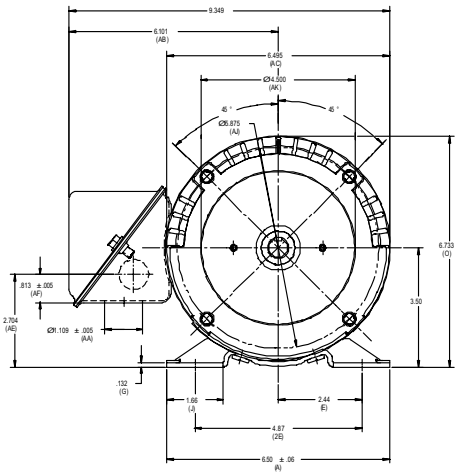
Description	Order Code
Motor Feedback Cable, M12 connector at encoder to DB15 connector on drive end. Custom lengths in 5ft. increments. (EPC-260 Encoder to Unidrive SP)	VUFCS-015
	VUFCS-025
	VUFCS-050
	VUFCS-075
	VUFCS-100
	VUFCS-xxx

Description	Order Code
Motor Feedback Cable. MS 10 pin connector at Encoder to Flying leads, Custom lengths in 5ft increments. (SCSLD, EPC 25T, Marathon & Reliance HS35 Encoders)	ENCO-015
	ENCO-025
	ENCO-050
	ENCO-075
	ENCO-100
	ENCO-xxx

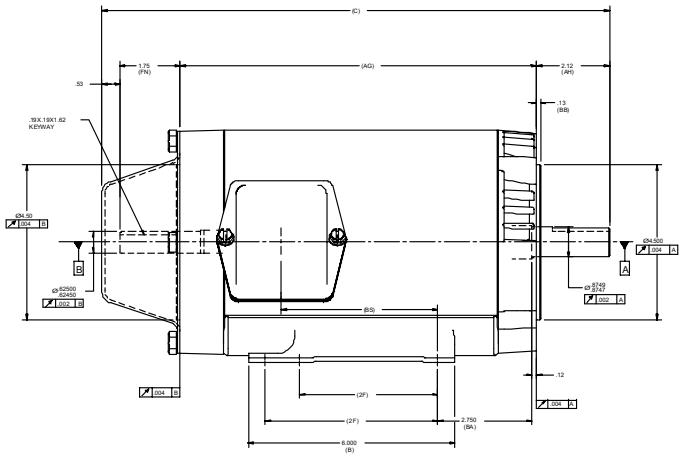
Note: Custom length cables are NOT Returnable

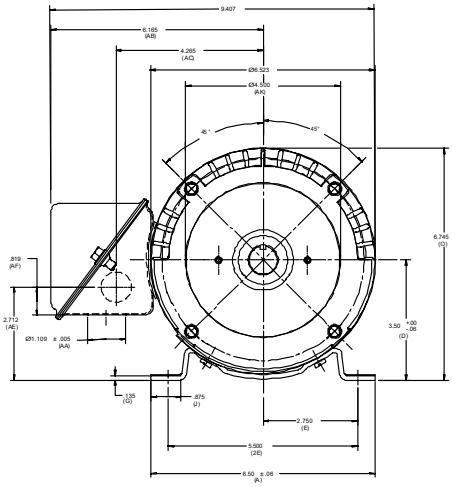
ACCU-Torq™ 56C-FRAME



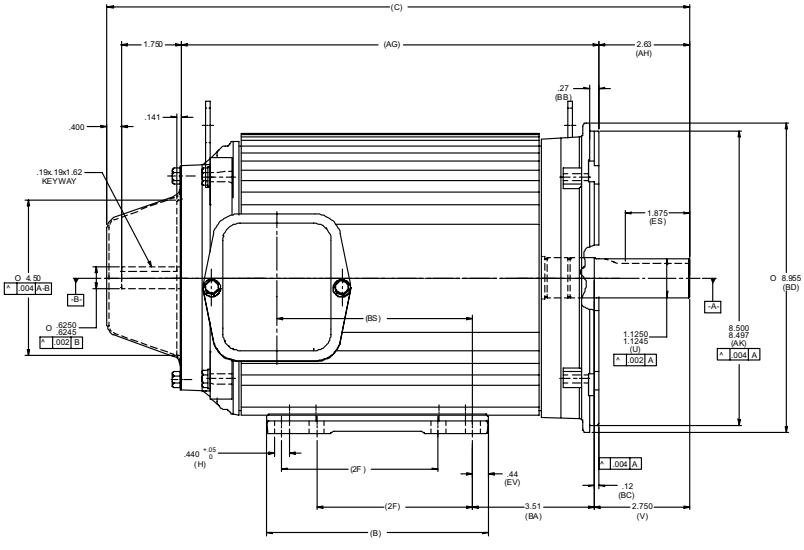


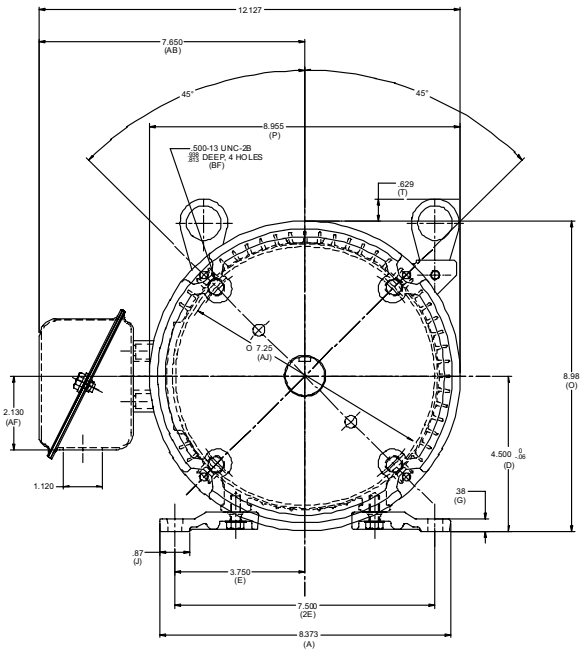
ACCU-Torq™ 140TC-FRAME





ACCU-Torq™ 180TC-FRAME






GUDEL



Motion Control

Featuring Distributed and Centralized Motion Control Solutions

Motion Control

A Comprehensive Selection of Motion Control Solutions

Control Techniques offers the most comprehensive selection of motion control products in the industry. These include products for single, axis-and-a-half and multi-axis servo systems, designed to perform in both distributed and centralized control architectures.

PowerTools Pro software and the Epsilon EP line of compact servo drives continue Emerson's quarter-century tradition of providing machine builders and OEM's with ***"Motion Made Easy"***™ solutions that are economical, reliable, and get applications up and running quickly.

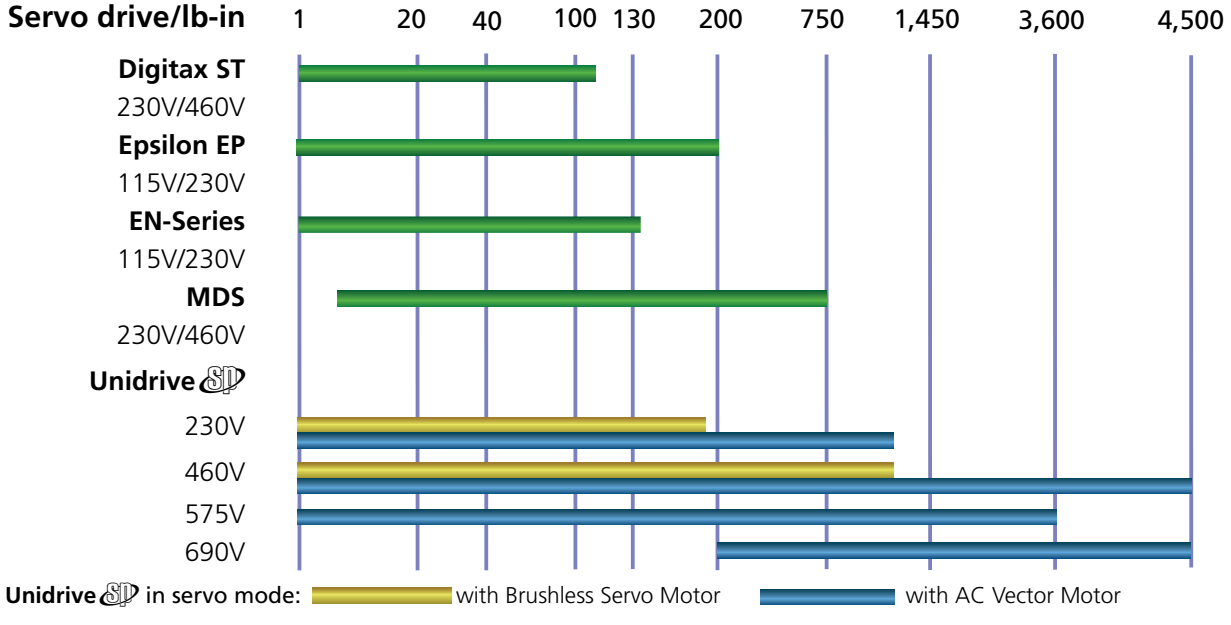
The new **Digitax ST** line of compact servo drives consists of base, indexing drives and fully programmable drives. Software choices are ***Motion Made Easy***™ using our **PowerTools Pro** or IEC-61131-3-compliant ***SyPTPro***. The **Digitax ST** like the **Unidrive SP**, uses **Solution Modules** to provide nearly unlimited I/O and fieldbus options, including the fastest Ethernet protocol available, **EtherCAT**.

The new **FM Series** servo motors expand the capabilities of Control Techniques motion systems with its wide speed, torque and inertia range, multiple shaft and flange options, and support for incremental encoders, absolute encoders, and resolver motor feedback.

The new Digitax ST has four flexible models ... Base, Indexer, EZMotion and Plus.



Continuous Torque





Why motion customers choose Control Techniques' solutions.

- PowerTools Pro greatly reduces programming time
- SyPTPro offers the ultimate programming capability
- Virtually all fieldbus protocols supported, inc. EtherCAT, EtherNet I/P, Modbus TCP/IP and more
- High-speed Peer-to-Peer communications
- 14 feedback types supported as standard, including absolute, plus support for 2nd encoders and resolvers
- A drive for nearly any kind of motor or actuator
- A full line of servo motors, from 1 lb-in to 750 lb-in
- Eliminated need for PLC — all programs are in the drive
- Great support from the Drive and Application Centers
- Control Techniques' solutions lower total system costs
  - *Affordable and highly reliable motors and controls*
  - *Zero-space EMI and dynamic braking options*
  - *No-footprint I/O and multiple fieldbus options*
  - *Through-panel mounting eliminates air conditioning*
- Control Techniques provides "One Source" for all your motion needs.



The New FM line of servo motors are built to your specifications.

The "Right" Solution

To help you find the best motion control solution, the following matrices provide an overview of product specifications, features and benefits.

Servo Drive Matrix

Servo Motor Matrix

Software Matrix

Servo Drive *Product Matrix*

Drive Family	**Digitax ST** *p. 98* 	**Epsilon EP** *p. 122* 
Motors Controlled	Servo motors, Linear Motors, Linear Actuators, Gearmotors	Servo motors, Linear Motors, Linear Actuators, Gearmotors
Control Modes	Analog Velocity, Analog Torque, Digital Velocity Preset, Indexing Pulse/Pulse, Pulse/Direction, and Pulse/Quadrature following. Some models have programmable modes.	Analog Velocity, Analog Torque, Digital Velocity Preset, Summation of A/D Velocity, Pulse/Pulse, Pulse/Direction, and Pulse/Quadrature. Indexing and Programmable Positioning, Analog Positioning - Position Tracker™
Continuous Torque	Up to 109 lb-in	Up to 200 lb-in
AC Voltage 50/60Hz ± 10%	200-240V ±10% 1Ø 200-240V ±10% 3Ø 380-480V ±10% 3Ø	90 to 264 VAC 1Ø, 208 to 240 VAC 3Ø, Epsilon EP 216 only
Motor/Position Feedback	Universal Encoder Port supports 14 feedback devices (including ABS, ENC) Optional Solution Modules for Resolver, Second encoder, and Universal encoder support with simulated encoder output	Incremental Encoders
Input/Output	Input / Output Digital 3 / 3* Analog 3 / 2 Relay / 1 **Selectable input or output*	Input / Output Indexer, Programmable: Digital 16 / 8 Base: Digital 4 / 3 Analog 1 / 2 Pulse Single-Ended 1 / Pulse Dif. 1 / 1
Input/Output options	Extended I/O via a wide range of SM I/O modules up to 32 I/O points	Via on board MODBUS Master
Communication	MODBUS RTU standard Optional Solution Modules for EtherCAT, Profibus DP, DeviceNet, CAN, CANopen, Interbus-S, CTSync, CTNet, EtherNet/IP, and SERCOS	MODBUS RTU Standard all models EP-I: Optional DeviceNet EP-P: Modbus TCP/IP & EtherNet/IP standard Optional: Profibus DP, DeviceNet
Configuration & Programming	CTSoft, SyPTLite, SyPTPro (IEC-61131-3), PowerTools Pro for SM-EZMotion	PowerTools Pro
Application Co-processor	P - Programming - Integrated standard Z - EZMotion - Integrated standard	N/A
Approvals	UL, CE, C-Tick, RoHS, ISO14001, ISO9001:2000	UL, CUL, RoHS Option, CE

Drive Family	**Unidrive SP** *p. 149* 	**EN** *p. 176* 	**MDS** *p. 191* 
Motors Controlled	Servo motors, Linear Motors, Linear Actuators, Gearmotors, Vector Motors	Servo motors, Linear Motors, Linear Actuators, Gearmotors	Servo motors, Linear Motors, Linear Actuators, Gearmotors
Control Modes	Analog Velocity, Analog Torque, Digital Velocity Preset, Summation of A/D Velocity, and with Second Encoder: Pulse/Pulse, Pulse/Direction, and Pulse/Quadrature	Analog Velocity, Analog Torque, Digital Velocity Preset, Summation of A/D Velocity, and Pulse/Pulse, Pulse/Direction, and Pulse/Quadrature	Analog Velocity, Analog Torque, Digital Velocity Preset, Summation of A/D Velocity, and Pulse/Pulse, Pulse/Direction, and Pulse/Quadrature
Continuous Torque	Up to 748 lb-in (brushless) Up to 4,500 lb-in (vector)	Up to 132 lb-in	Up to 748 lb-in
AC Voltage 50/60Hz ± 10%	200-240V ±10% 1Ø & 3Ø 380-480V ±10% 3Ø 575-690V ±10% 3Ø	90 to 264 VAC 1Ø & 3Ø	187 to 528 VAC 3Ø
Motor/Position Feedback	Universal Encoder Port supports 14 feedback devices (including ABS, ENC) Optional Solution Modules for Resolver, Second encoder, and Universal encoder support with simulated encoder output	Incremental Encoders	Incremental Encoders
Input/Output	Input / Output Digital 3 / 3* Analog 3 / 2 Relay / 1 Pulse Dif. with 2nd Encoder **Selectable input or output*	Input / Output Digital 5 / 3 Analog 1 / 2 Pulse Single-Ended 1 Pulse Dif. 1 / 1	Input / Output Digital 5 / 3 Analog 1 / 2 Pulse Single-Ended 1 Pulse Dif. 1 / 1
Input/Output options	Extended I/O via a wide range of SM I/O modules up to 32 I/O points	Extended I/O via FM Modules	Extended I/O via FM Modules
Communication	MODBUS RTU standard Optional Solution Modules for EtherCAT, Profibus DP, DeviceNet, CAN, CANopen, Interbus-S, CTSync, CTNet, EtherNet/IP, and SERCOS	MODBUS RTU standard FM-modules for Profibus DP, DeviceNet, Ethernet, and EtherNet/IP	MODBUS RTU standard FM-modules for Profibus DP, DeviceNet, Ethernet, and EtherNet/IP
Configuration & Programming	CTSoft, SyPTLite, SyPTPro (IEC-61131-3), PowerTools Pro for SM-EZMotion	PowerTools FM PowerTools Pro	PowerTools FM PowerTools Pro
Application Co-processor	SM Application Plus SM Application Lite V2 SM EZMotion Servo Control	FM-modules for Indexing Programmable Positioning	FM-modules for Indexing Programmable Positioning
Approvals	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000	UL, CUL, CE	UL, CUL, CE

Servo Motor *Product Matrix*

Motor Family	**FM Motors** *p. 230* 	**NT Motors** *p. 240* 
AC Supply Voltage	115/230/460	115/230
Frame	55 mm, 75 mm, 95 mm, 115 mm, 142 mm, 190 mm	2", 3"
Flange	IEC (options available)	IEC, NEMA
Continuous Torque	Up to 647 lb-in (73.2 Nm)	Up to 52 lb-in (6.3 Nm)
Peak Torque	Up to 1938 lb-in (219 Nm) High Peak Torque option available (~5x continuous)	Up to 116 lb-in (13.1 Nm)
Standard Rated Speeds	2000, 3000, 4000, 6000 rpm	3000, 4000, 5000 rpm
Brake options	Holding brake High energy dissipation	Holding brake
Connector options	Circular style frame mounted 90 degree rotatable standard Optional 90 degree fixed, vertical, or mixed	MS style frame mounted, MS Style on 40" lead, Flying leads, Drive terminated leads (20ft. Max.)
Inertia	Medium (High inertia option)	Low, Medium
Encoder resolutions	4096 line count standard (2048 55 mm), up to 16 million line count optional Sin/Cos	2048 line count
Feedback options	Incremental encoders, Optical Sin/Cos single & multi-turn, Inductive Sin/Cos single & multi turn, Resolver	Incremental only
Insulation Class	Class H, BS EN 60034-1	Class F, EN 60034-1
Thermal Protection	PTC Thermistor, 145°C switch	Thermostat, 155°C switch
Ingress Protection	IP65	IP65
Approvals	CE, UL	CE, UL (RoHS optional)

* Lead times vary with some non-standard options
** See XV motor IP rating specifications

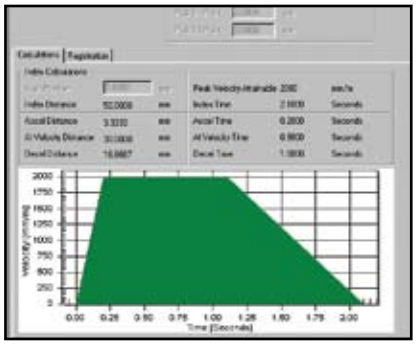
Motor Family	XV Motors *p. 245* 	MG Motors *p. 248* 	MH Motors *p. 251* 
AC Supply Voltage	115/230	115/230	460
Frame	40 mm, 60 mm, 80 mm, 130 mm	2", 3", 4"	3", 4", 6", 8"
Flange	Metric	NEMA, IEC	NEMA, IEC
Continuous Torque	Up to 101 lb-in (11.4 Nm)	Up to 163 lb-in (18.4 Nm)	Up to 748 lb-in (84.5 Nm)
Peak Torque	up to 301 lb-in (34 Nm)	Up to 382 lb-in (43.2 Nm)	Up to 1500 lb-in (170 Nm)
Standard Rated Speeds	2000, 3000, 5000 rpm	3000, 4000, 5000 rpm	2500, 3000, 4000 rpm
Brake options	Holding brake	Holding brake	Holding brake
Connector options	AMP Mat-n-Loc on 1ft. Lead (40-80 mm), MS style frame mounted (130 mm)	MS style frame mounted	MS Style frame mounted
Inertia	Low, Medium	Low	Low
Encoder resolutions	2048 line count	2048 line count	2048 line count
Feedback options	Incremental only	Incremental only	Incremental only
Insulation Class	Class H, BS EN 60034-1	Class F, EN 60034-1	Class F (H 8"), EN 60034-1
Thermal Protection	Drive Algorithm	Thermostat, 155°C switch	Thermostat, 155°C switch
Ingress Protection	IP55, IP65**	IP65	IP65
Approvals	CE, UL, RoHS	CE, UL	CE, UL

* Lead times vary with some non-standard options
** See XV motor IP rating specifications

Software Matirx *Functionality Overview and Feature Matrix*

Software	Description	Fieldbus Support

PowerTools Pro

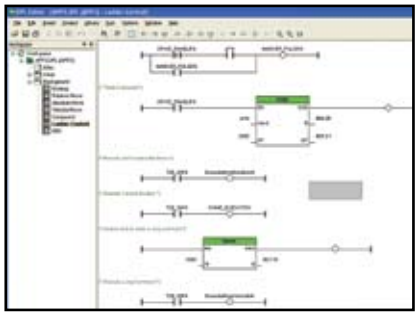


Extremely intuitive configuration and integrated programming toolkit for single axis and axis-and-a-half application development. Features "point and click", "fill in the blank" and "drag & drop" programming for building applications quickly and easily, from point-to-point applications to high-speed labeling. The library of Application Roadmaps provide valuable macros for many common high performance applications.

p.348

Modbus RTU
EtherNet/IP
Modbus TCP/IP
DeviceNet
Profibus

SyPTPro

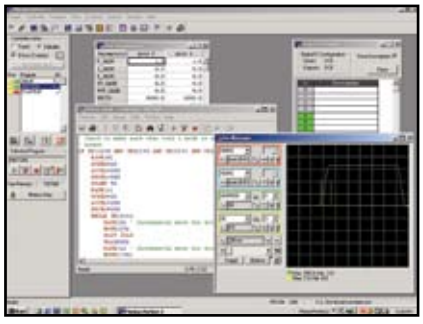


This robust IEC 61131-3 programming environment has all the tools needed to develop high speed, highly coordinated multi-axis applications such as gearless printing presses and automotive assembly systems. Programmers will appreciate its highly capable machine logic and powerful motion control capabilities, and OEM's and integrators will find the intellectual property protection a valuable feature.

p.361

Modbus RTU
EtherNet/IP
EtherCAT
Modbus TCP/IP
DeviceNet
Profibus
CAN
CANOpen
and others

MotionPerfect2

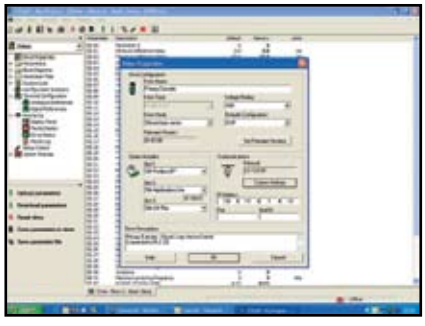


Very powerful, centralized multi-axis programming environment for developing applications having 2 to 24 axis. Powerful programming toolset for fully interpolated control of sophisticated multi-axis motion applications.

p.370

EtherNet/IP
Modbus TCP/IP
Profibus
CAN
SERCOS

CTSoft



Configuration tool for Digitax ST and Unidrive SP drives, and other Control Techniques drives. This free software also can be used to program the Digitax ST-I for single axis indexing applications using the Sequential Flow Chart function.

p.344

Application Development Software
and Hardware Supported

Software Features	PowerTools Pro for Epsilon EP-I, EP-P, and MDS & EN with FM3E, FM4E, Unidrive SP with SM-EZMotion and Digitax ST-Z drives	SyPTPro for Unidrive SP with SM-Applications Plus and Digitax ST-P drives	MOTIONPerfect2 MC206X and MC224 multi-axis controllers
"Motion Made Easy"™ Programming	Yes		
Sequential Function Chart		Yes	
IEC 61131-3 Programmable		Yes	
Ladder Logic Programming		Yes	
PLC Open Function Blocks		Yes	
Text Based Programming	Yes	Yes	Yes
Software Oscilloscope	Yes	Yes	Yes
Software Watch Window	Yes	Yes	Yes
Secure Download	Yes	Yes	
Axis and Axis-and-a-half Control	Yes	Yes	
Multi-Axis Coordination	Yes	Yes	Yes
Multi-Axis Synchronization	Yes	Yes	Yes
Multi-Axis Interpolation			Yes
Intellectual Property Protection	Yes	Yes	
Program Multi-Tasking	Yes	Yes	Yes
Auto-Tune	Yes	Yes	
Parameter Cloning		SmartCard	
Real-Time Programs	Yes	Yes	
Drive to Drive Networking	Ethernet, RS485	CTNet, CTSync, Ethernet, RS485	Yes
Fieldbus Support	Yes*	Yes*	Yes*
Web Page	Yes		
Email	Yes		
User Units	Yes	Yes	Yes
High Speed Inputs	Yes	Yes	Yes
Programmable Limit Switch	Yes	Yes	Yes
S-Curve Ramps	Yes*	Yes	Yes
Indexing - Chained / Compound	Yes*	Yes*	Yes
Synchronized Motion	Yes*	Yes*	Yes
Gearing	Yes*	Yes*	Yes
Camming	Yes*	Yes*	Yes
Timed Index	Yes*	Yes*	Yes
Queuing	Yes*	Yes*	
User Programs	Yes	Yes	Yes
User Variables	Yes	Yes	Yes
Position Capture	Yes	Yes	Yes

** Module or model dependent.*

Digitax ST

NEW

Intelligent Servo Technology

Meeting the demands of modern, lean manufacturing requires smaller more flexible machinery. Digitax ST is the first drive designed to help machine designers and system integrators meet these challenges, the ultimate compact servo drive with an unmatched range of flexible integration features.

Digitax ST is optimized for servo applications requiring high peak torque, dynamic response, ease of use and flexible integration features. Four product variants ensure that the drive's personality perfectly matches your servo applications. Solution Modules (SM) provide zero-space fieldbus and I/O connectivity to other automation components.



- **Internal Motion Processor does not consume an external slot**
- **Flexible voltages 200-230 VAC or 380-460 VAC**
- **1 to 109 lb-in continuous torque up to 3X peak torque**
- **Supports 14 types of encoders, SM-Resolver option**
- **Easy install, setup and operation**
  - **Compact, space saving design**
  - **Pluggable connectors, standard D-Shell and screw terminals**
  - **Safe Torque Off**
  - **Programmable, optically-isolated I/O**
  - **RS485 serial communication interface using Modbus protocol**
- **Many industrial communications protocols supported**
- **Field programmable flash memory firmware (upgrades are free)**
- **Wide variety of motor combinations**
- **Auto-Tune support for any servo motor with encoder feedback**
- **24 VDC on-board logic power supply**

MODBUS TCP/IP

PROFIBUS

EtherNet/IP

MODBUS

EtherCAT

DeviceNet

EnDat

HIPERFACE®

SSI



2 YEAR Digital Drive Warranty

5 YEAR Extended Warranty

FEATURE
Performance Advantage

Four Configurations Available

Digitax ST-B Base drive
Digitax ST-I Indexer
Digitax ST-Z EZMotion
Digitax ST-P Plus

Digitax ST Base Drive – Multiple Operating Modes

Optimized for centralized control, to operate with motion controllers, motion PLC's, and PC-based motion systems using a wide range of digital or analog interface technologies.

Digitax ST Indexer – Simple & Powerful Capabilities

Internal SM-Applications Lite V2. Designed for simple stand alone positioning applications using an onboard position controller using Sequential Function Flowchart software.

Digitax ST EZMotion – Drag-and-Drop Programming

Internal SM-EZMotion. Easy Motion simplifies programming with built-in motion functionality – jogging, indexing, camming, can be done in minutes with PowerTools Pro software and its point-and-click, drag-and-drop motion programming environment. It's "Motion Made Easy"™.

Digitax ST Plus – Provides Advanced Capabilities

Internal SM-Applications Plus. Features a full functionality motion controller, optimized for high performance machine cells requiring drive-to-drive networking and precision synchronization. The motion and communications are configured within a flexible IEC61131-3 software development environment SyPTPro.

Compatible Solution Modules provide Communication, I/O and Feedback expansion options

Communication: Ethernet IP, Modbus TCP/IP, Profibus, DeviceNet, CAN and EtherCAT.

I/O: SM-I/O Plus, SM-I/O Lite, SM-I/O 32, SM-I/O Timer, SM-I/O 120V, SM-I/O PELV and SM-I/O 24V.

Feedback: SM-Universal Encoder, SM-Encoder Plus, SM-Encoder Output Plus and SM-Resolver.

UL US CE RoHS Compliant

Digitax ST Overview

Integration Flexibility with Digitax ST

OPERATOR INTERFACE

CTOPCserver

HMI Operator Interface





CTSoft
CTScope

SyPTPro

PowerTools Pro

SM Keypad Plus (Remote)



DST Keypad



SmartCard



Remove the DST-Keypad & reveal the SmartCard Slot

EXTERNAL CONTROL



Multi-Axis Motion Controller



PLC



PC

INPUT/OUTPUT

SERVO MODE

Servo



Linear Motors



Options

Remote I/O



SM-I/O Plus



SM-I/O 120V



SM-I/O 24V



Standard

5 Analog I/O
6 Digital I/O
1 Safe Torque Off
1 Relay Out

SM-I/O 32



SM-I/O Timer



SM-I/O Lite



SM-PELV



SM-Register



FILTERS

Standard

Internal EMC Filter

Options



External EMC Filter

DYNAMIC BRAKING



Options



Zero Space Internal
Brake Resistor
E-Stop Duty



External Dynamic
Brake Resistor

MOTION CONTROLLER & SOFTWARE

Base	Indexer	EZMotion Programmable	IEC-61131 Programmable
ST-B	ST-I	ST-Z	ST-P
CTSoft	CTSoft	PowerTools Pro	SyPTPro CTSoft

FEEDBACK

Standard

Sin/Cos
Quadrature
Frequency/Direction
Clockwise/Counter Clockwise

EnDat HIPERFACE® SSI

Options

SM-Universal Encoder Plus*



SM-Encoder Output Plus*



SM-Encoder Plus



Quadrature

SM-Resolver



*Accepts or replicates
all standard feedback types

COMMUNICATIONS

Standard



Modbus RTU

Options



PROFIBUS



INTERBUS



CAN



DeviceNet



EtherNet/IP
Modbus TCP/IP



CAN open



CNET
CSYNC
Modbus RTU
Master/Follower



SERCOS



EtherCAT

DC BACK UP POWER SUPPLY



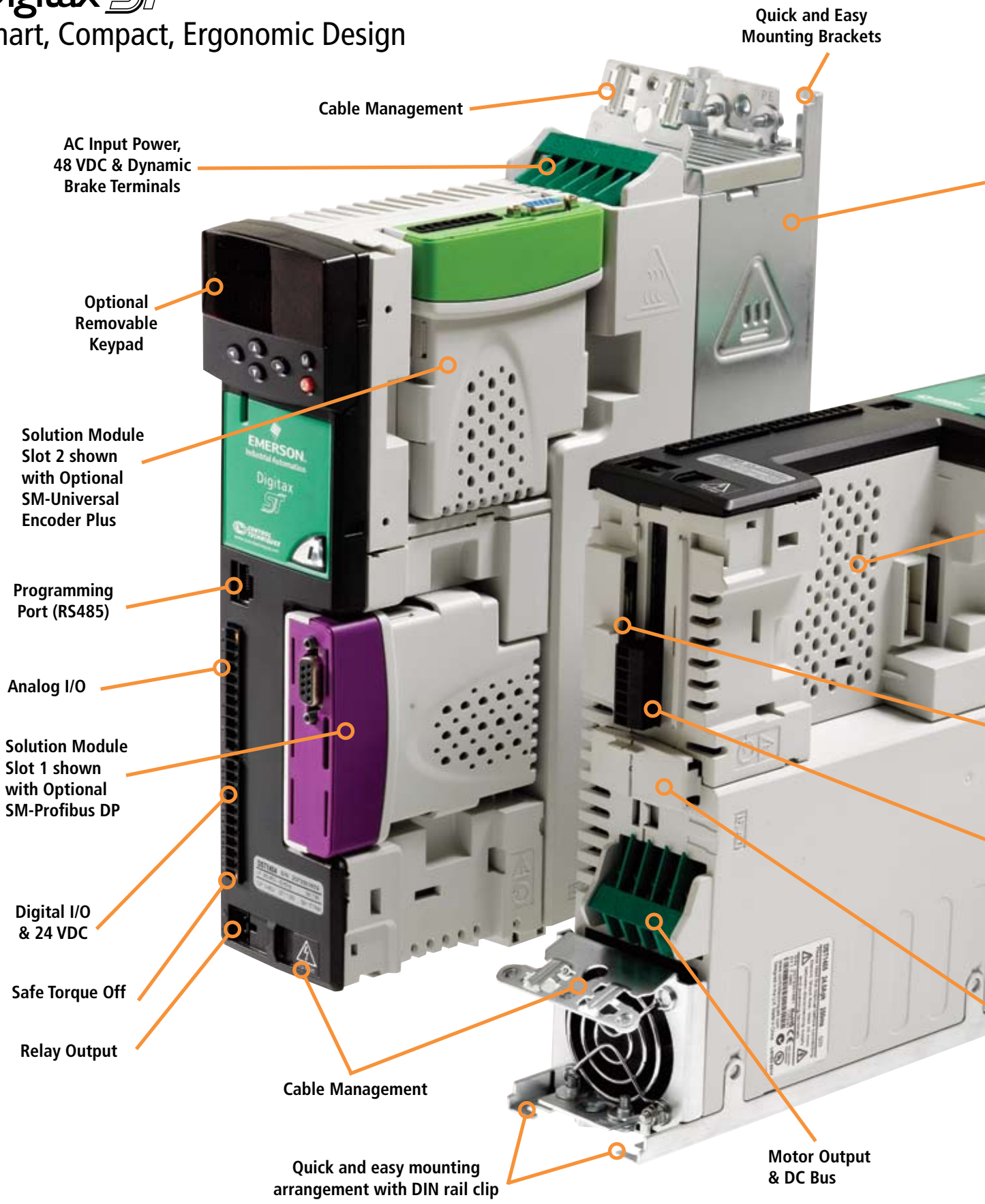
24V Control



48-96V Power

Digitax ST

Smart, Compact, Ergonomic Design



Value Your Time

More Compact Machinery

Digitax ST is an extremely compact servo drive that can be mounted flush against another Digitax ST, resulting in a smaller multiple axis footprint. Onboard features such as synchronized motion control and Safe Torque Off reduce the need for external components further reducing panel size and cost.

Quicker Installation

Innovative mechanical design reduces the installation time considerably. The mounting arrangements enable the bottom of the drive to be quickly clipped onto standard DIN rail and the cable management system features rigid mounting and earthing brackets. Pluggable control terminals enable cables to be easily prepared. Snap-in option modules mean the drive can be customized to your needs at the point of installation without specialized tools and gives the flexibility to customize the functionality at a future time.

Reduced Commissioning Time

FREE Software

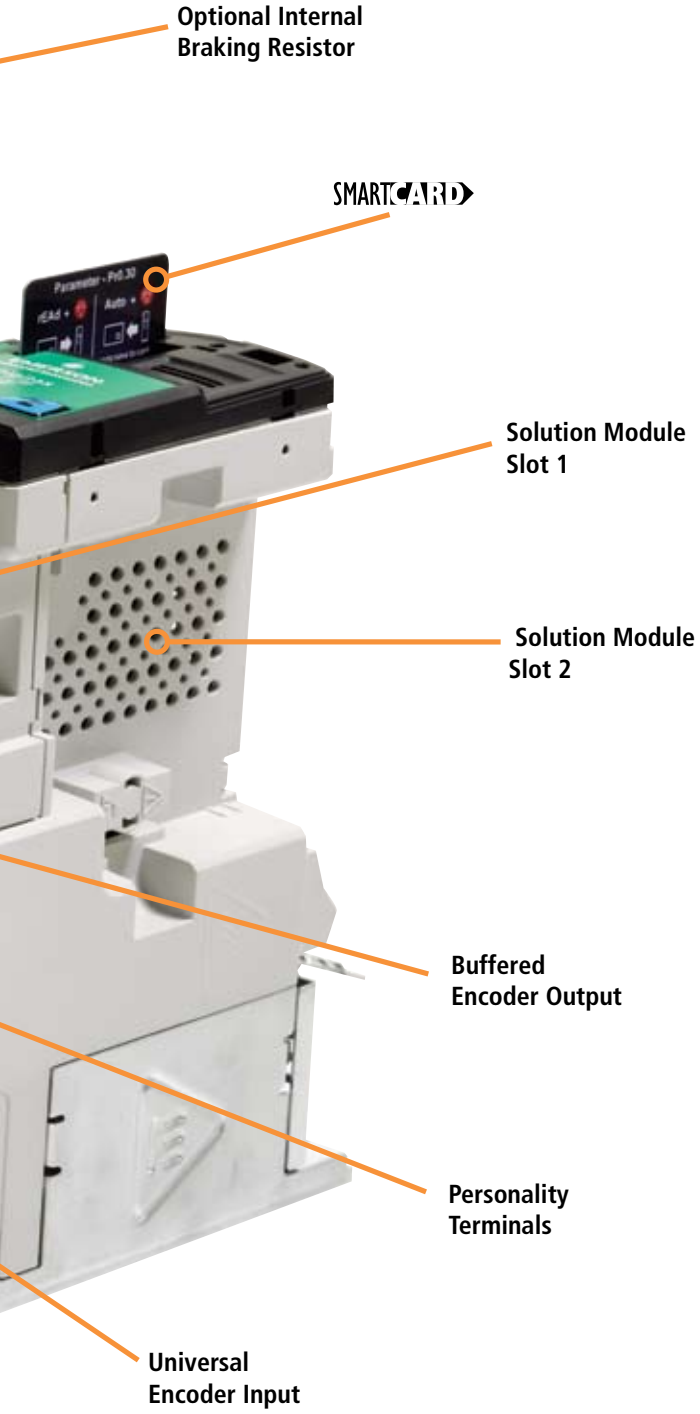
Digitax ST is quick and easy to set-up. The drives may be configured using the removable keypad, SmartCard or the supplied commissioning software to guide the user through the configuration process. Auto-tune features help you to get the best performance by measuring the machine dynamics and automatically optimizing the control loop gains. PowerTools Pro and CTScope software tools provide users with real-time, software oscilloscopes for tuning the drive and monitoring performance.

Smarter Thinking

The SmartCard, included with every drive, enables parameters to be safely stored and copied quickly from one drive to another. This feature significantly reduces the commissioning time when installing multiple servo systems with similar configurations.

SMARTCARD





Digitax ST-B

NEW

Flexible Base Drive

The Digitax ST-B (base) drive is a compact drive that is ideal for use with single and multi-axis controllers, PLCs and host controllers. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The pulse mode is ideal for use with low-cost PLC stepper controllers.

Many control systems use SERCOS fiber optic or EtherCAT for real-time drive control and feedback. Both technologies offer high bandwidth command and control signals over a digital network, greatly simplifying cabling and reducing potential electrical noise issues. Simply snap-in the appropriate SM module and the base drive is SERCOS or EtherCAT compliant.

The drive is configurable for several flexible modes of operation, and the parameters for each mode can be adjusted to tailor the drive to the specific application using CTSoft configuration software or the optional keypad.



- **200-230 VAC or 380-460 VAC input voltage**
- **2 Solution Module (SM) slots for optional Feedback, Comunications or I/O modules**
- **Safe Torque Off / Drive Enable Input**
- **3 Bi-Directional Input/Outputs**
- **3 Dedicated Inputs**
- **1 Relay Output**
- **1 High Resolution Analog Input, 16 bit + sign**
- **2 Standard Analog Inputs, 10 bit + sign**
- **2 Analog Outputs ±10 VDC, 10 bit**
- **Buffered Encoder Output**
- **Universal Encoder Input, supports 14 feedback types**
- **Optional Resolver Input with SM Resolver module**
- **Optional Keypad**
- **CTSoft configuration software**
- **RS485 Serial Port, Modbus RTU**

FREE Software

STANDARD CONTROL MODES

Analog Velocity/Torque Mode

- MC206X, MC224
- Position Controller

± 10 VDC

Digital Velocity Preset

- PLC
- User Logic

Digital I/O

Pulse Mode

- PLC
- Master Axis
- Synchronized Encoder

Digital I/O

EtherCAT

- PLC
- PC

Real-Time Ethernet command and feedback EtherCAT

SERCOS

- PLC
- PC

Real-Time fiber optic command and feedback

Digitax ST-I

NEW

Intelligent Indexing Drive

The Digitax ST-I (Indexer) drive offers sequential flow chart programming for indexing, homing and jogging, in a package that is the same compact size as the base Digitax ST-B drive. Operating information is setup using CTSoft programming and commissioning software. The drive parameter setup can be downloaded, stored on disk, or saved to the SmartCard for drive cloning. The SmartCard saves time and money during installation and makes long term support simple by having all the drive parameters stored on the SmartCard for easy drive cloning. No PC or software is necessary to save or load data on the SmartCard.



WIZARD SETUP!

Using the new CTSoft drive setup wizard makes the Indexer setup quick and simple. The Wizard guides you through setup for the drive setup, motor, encoder, I/O and Sequential Function Chart programming.

- **200-230 VAC or 380-460 VAC input voltage**
- **Internal motion controller programs with free Sequential Function Chart software**
- **2 Solution Module (SM) slots for optional Feedback, Comunications or I/O modules**
- **Safe Torque Off / Drive Enable Input**
- **3 Bi-Directional Input/Outputs**
- **3 Dedicated Inputs**
- **1 Relay Output**
- **1 High Resolution Analog Input, 16 bit + sign**
- **2 Standard Analog Inputs, 10 bit + sign**
- **2 Analog Outputs ±10 VDC, 10 bit**
- **Buffered Encoder Output**
- **Universal Encoder Input, supports 14 feedback types**
- **Optional Resolver Input with SM Resolver module**
- **Optional Keypad**
- **CTSoft configuration software**
- **RS485 Serial Port, Modbus RTU**

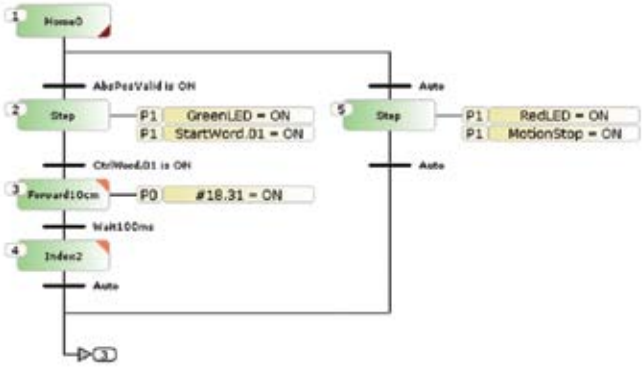
FREE Software

INDEXING

The Digitax ST-I drive is easily programmed to meet a wide variety of indexing and I/O control requirements. Sequential Function Chart programming is straightforward to use and interpret. Pre and Post operations at each step allow flexible I/O control.

- Incremental, Absolute, Registration, Rotary Plus, and Rotary Minus index types
- Parameters for Distance, Velocity, Accel/Decel, Dwell and Registration to Sensor or Torque Levels
- Chaining Options – Counts, Repeat Counts, Repeat Forever, Stop ability

Sequential Function Chart



Digitax ST-Z

NEW

Internal EZMotion Module

The Digitax ST-Z (EZMotion) drive provides a very high level of control by allowing the user to create complete user programs to sequence the motion control along with other machine functionality. The Digitax ST-Z can be used to solve the most complex motion applications and still be easy-to-use because of the PowerTools Pro configuration software. PowerTools Pro uses simple point-and-click, drag-and-drop and fill-in-the-blank views that make setup a snap.

User programs are created using a text based motion language that is as easy to read as it is to program. If you don't know the command, just drag it in from the drop down box and PowerTools Pro will assist you with the syntax. With intuitive software and plenty of online help, programming this servo drive is easy; in fact it's **"Motion Made Easy!"™**

See PowerTools Pro in the Software section for examples of this easy to use program. The examples provided range from simple to advanced applications.

- **200-230 VAC or 380-460 VAC input voltage**
- **Internal SM-EZMotion module**
- **PowerTools Pro configuration software** FREE Software
- **2 Solution Module (SM) slots for optional Feedback, Comunications or I/O modules**
- **Safe Torque Off / Drive Enable Input**
- **3 Bi-Directional Input/Outputs**
- **7 Dedicated Inputs**
- **2 Dedicated Outputs**
- **1 Relay Output**
- **1 High Resolution Analog Input, 16 bit + sign**
- **2 Standard Analog Inputs, 10 bit + sign**
- **2 Analog Outputs ±10 VDC, 10 bit**
- **Buffered Encoder Output**
- **Universal Encoder Input, supports 14 feedback types**
- **Optional Resolver Input with SM Resolver module**
- **Optional Keypad**
- **RS485 Serial Port, Modbus RTU**



POWERFUL SOFTWARE FEATURES!

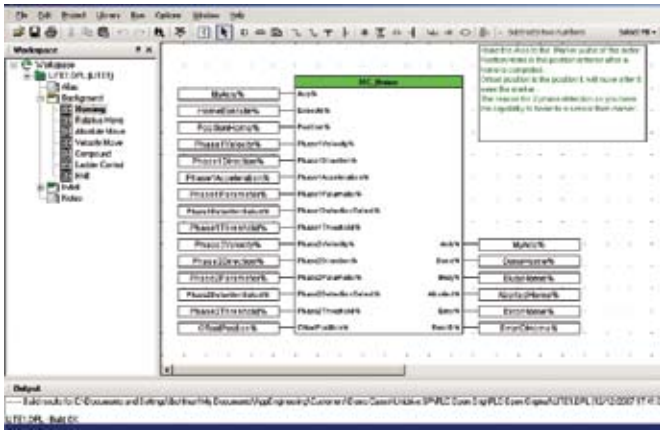
Digitax ST-Z has many powerful software features to meet the most demanding servo application while maintaining ease of use. Complete machine control is now possible with the drive's motion, I/O and communications capabilities.

- Virtual Master - Provides a programmable clock signal for many drives to follow, eliminating mechanical jitter from following a physical axis.
- Modbus Master - Provides drive-to-drive and expanded I/O control with the built in master. The drive is not limited to onboard I/O. Communications to other Modbus slave devices is possible.
  - Multiple drives can share I/O over the networks
  - Stop/Start control such as VFD driven conveyors
  - Use low cost slice I/O to add digital and analog I/O
- Real-Time Programs - Provides deterministic program cycle times for controlling I/O and scheduling program tasks.
- Torque Mode - Switch seamlessly from position or velocity mode into torque mode and back for unlimited flexibility and control for nut running and torque controlled clamps or grippers or any other controlled torque application.
- Electronic Camming - Electronic cams provide unlimited motion profiles to accomplish servo replacement of rigid mechanical cams. Use the internal time base to create a motion profile for custom indexing.

Digitax ST-P
Programmable Motion

NEW

The Digitax ST–P (Plus) features a full functionality motion controller, optimized for high performance machine cells requiring drive-to-drive networking and precision synchronization. The motion and communications are configured within a flexible IEC61131-3 software development environment using PLCopen function blocks. Fieldbus, Ethernet and I/O connectivity enable interfacing with other automation components and Intellectual Property protection ensures that your valuable knowledge remains secure.



- **200-230 VAC or 380-460 VAC input voltage**
- **Internal SM Applications Plus module**
- **SyPTPro motion programming software**
- **2 Solution Module (SM) slots for optional Feedback, Comunications or I/O modules**
- **Safe Torque Off / Drive Enable Input**
- **3 Bi-Directional Input/Outputs**
- **5 Dedicated Inputs**
- **2 Dedicated Outputs**
- **1 Relay Output**
- **1 High Resolution Analog Input, 16 bit + sign**
- **2 Standard Analog Inputs, 10 bit + sign**
- **2 Analog Outputs ±10 VDC, 10 bit**
- **Buffered Encoder Output**
- **Universal Encoder Input, supports 14 feedback types**
- **Optional Resolver Input with SM Resolver module**
- **Optional Keypad**
- **CTSoft configuration software**
- **RS485 Serial Port, Modbus RTU**



POWERFUL SOFTWARE FEATURES!

Digitax ST-P (Plus) offers all of the features available on the indexing drive together with more advanced motion functionality including cam profiling and synchronized motion. Onboard drive-to-drive networking links multiple axes and enables true distributed control. The drive is commissioned using CTSoft, an intuitive drive configuration software that is included free with every drive. The advanced motion features are configured using PLCopen motion function blocks within Control Techniques SyPTPro automation development environment.

On-board position controller ensures superior performance and reduced panel space. Digitax ST-P is configured using Control Techniques market leading development environment, SyPTPro. Standard IEC61131-3 languages, multi-tasking and PLCopen motion function blocks increase familiarity and reduce the development time. SyPTPro can protect your Intellectual Property by downloading only the compiled binary version of your software (not the source code) therefore preventing your customers and competitors from accessing your work. Many machinery users have different site standards for PLCs. This presents you with the challenge of designing standard machine sections that are independent of your customers PLC preference. With on-board intelligence, drive-to-drive synchronization and a wide range of network communication options, Digitax ST makes it easy for you to standardize your designs while retaining full connectivity to any PLC.

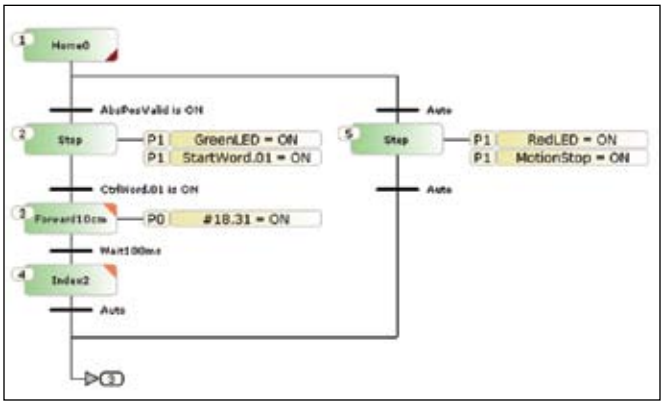
Digitax ST
Software

CTSoft for Digitax ST Base and Digitax ST Indexer

Digitax ST Base and Indexing drives use CTSoft, the Control Techniques drive configuration tool used to commission, optimize and monitor most Control Techniques AC and DC drives.

CTSoft uses wizards to simplify commissioning, manages data stored on the SmartCard, and has robust and graphical tools for monitoring and trouble shooting.

CTSoft also incorporates the industry-standard Sequential Function Chart language for configuring the Digitax Indexer.

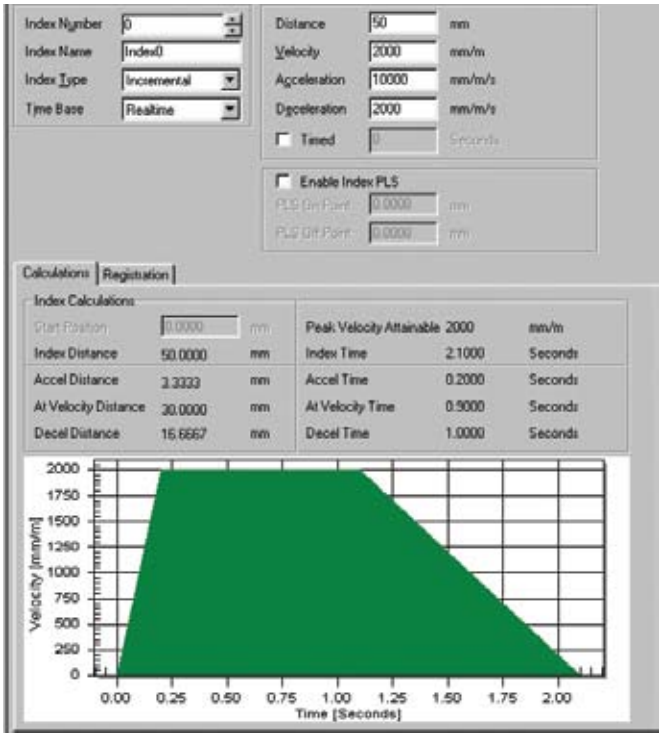


CTSoft Sequential Function Chart with Digitax ST-B and Digitax ST-I

PowerTools Pro "Motion Made Easy"™ software for Digitax ST EZMotion

Developing servo applications with Control Techniques "Motion Made Easy" PowerTools Pro is a simple "five step, top-down process," all displayed within an intuitive Windows™ explorer-like environment—Setup (hardware), I/O Setup, Motion, Programs, and Network.

Although not every step may be needed to create a motion program, each step is configured using simple check boxes, drop down menus, and point-and-click, drag-and-drop operations. A straight-forward text programming language can also be used for custom motion and machine control sequences.



PowerTools Pro with Digitax ST-Z

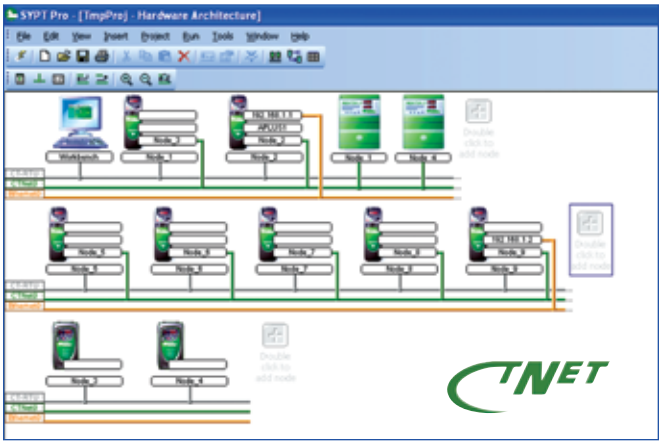
SyPTPro for Digitax ST Plus

SyPTPro is a full-featured, IEC-61131-3-compliant automation development environment that can be used for developing solutions for single or multiple axis applications.

The programming environment supports four industry standard languages: PLC Open, Function Block, Ladder and Structured Text.

CTNet, a high-speed, drive-to-drive network links the drives, SCADA and I/O together form an intelligent networked system, eliminating the need for a PLC and its additional overhead.

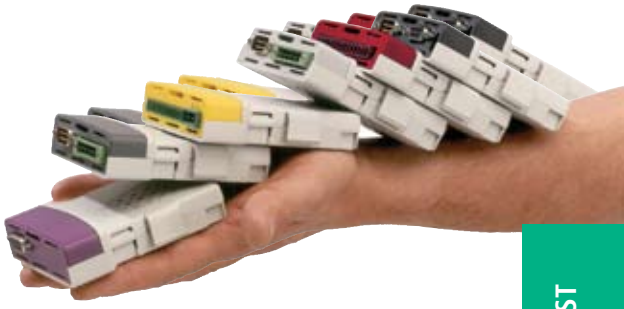
See the Software Section of the catalog for complete software details.



SyPTPro with Digitax ST-P

See page 381 for complete CTNet integration details.

Digitax ST Options



DIGITAX ST OPTIONS AT-A-GLANCE

Options & Accessories	Description	Order Code
Drive Configuration, Programming and Indexing For details see the AC Drives Options & Accessories section	Cloning and Parameter Storage	SMARTCARD-64
	Configuration Software & Indexing	CTSOFT
	Motion Made Easy Programming	POWERTOOLSPRO
	Ladder and Function Blocks	SYPTLITE
	IEC 61131-3 (Ladder, FB, and Text Based)	SYPTPRO
	Communications Cable - RS232/485	CT-COMMS-CABLE
	Communications Cable - USB	CT-USB-CABLE
	Keypad to Drive Cable	SP-LCD-485-XXX
Operator Interfaces	LED Keypad	DST-KEYPAD See page 394 for keypad details
	LCD Keypad	SM-KEYPAD-PLUS (remote mounted only)
	Programmable HMI Panels	See the Options & Accessories section
Power Accessories	Zero-Space Brake Resistor	SM-HEATSINK-DBR0
	E-Stop Duty Braking Resistor	See the Options & Accessories section
	Cyclic Duty Braking Resistor	See the Options & Accessories section
Environmental Protection	Internal EMC Filter	Standard
	External EMC Filters	See the Options & Accessories section
Feedback Solution Modules For details see the Unidrive SP Options section	Universal Encoder Feedback SM-UNIVERSAL ENCODER PLUS	SM-UNI-ENCODER
	Incremental Encoder Input SM-ENCODER PLUS	SM-ENCODER-PLUS
	Incremental Encoder Input & Output SM-ENCODER OUTPUT PLUS	SM-ENCODER-OUT
	Resolver Feedback	SM-RESOLVER
	Screw Terminal Connector	SM-ETC
I/O Solution Modules For details see the AC Drives Options & Accessories section	Extended Analog and Digital I/O	SM-I/O-PLUS
	Extra I/O with Encoder Reference	SM-I/O-LITE
	32 Point Digital I/O	SM-I/O-32
	Extra I/O with RealTime Clock/Calendar	SM-I/O-TIMER
	120/240 Volt AC I/O	SM-I/O-120V
	Double Insulated Extended I/O	SM-I/O-PELV
	Remote Network I/O	See the Options & Accessories section
	24 Volt Protected I/O	SM-I/O-24V
	High Speed Capture & Registration	SM-REGISTER
Communications Solution Modules For details see the Connectivity section	Modbus RTU Follower	Standard
	Modbus RTU Master	Standard (Digitax ST Plus)
	DeviceNet	SM-DEVICENET
	PROFIBUS DP	SM-PROFIBUS-DP
	Ethernet (Modbus TCP/IP, Ethernet IP)	SM-ETHERNET
	Interbus-S	SM-INTERBUS
	CANopen	SM-CANOPEN
	CAN Interface	SM-CAN
	Ethernet (EtherCAT)	SM-ETHERCAT
	SERCOS	SM-SERCOS
	CTNet	Standard (Digitax ST Plus)
	CTSync	Standard (Digitax ST Plus)

DIGITAX ST TERMINALS AND PINOUTS

RS485

Pin Number	Signal
1	120Ω Termination resistor
2	RX TX
3	Isolated OV
4	+24V (100mA)
5	Isolated OV
6	TX Enable
7	RX/ TX/
8	RX/ TX/ (if termination resistors are required, link to pin 1)
9	Isolated 0V

Terminal 1

Pin Number	Signal
1	0V common
2	External 24 VDC
3	0V common
4	10 VDC source
5	Analog 1 +
6	Analog 1 -
7	Analog 2
8	Analog 3
9	Analog Out 1
10	Analog Out 2
11	0V common

Terminal 2

Pin Number	Signal
21	0V common
22	24 VDC Output, selectable
23	0V common
24	I/O 1
25	I/O 2
26	I/O 3
27	Input 4
28	Input 5
29	Input 6
30	0V common
31	Safe Torque Off, Drive enable

Terminal 3

Pin Number	Signal
41	Status Relay
42	Drive OK

Buffer Encoder Output

Pin Number	Signal		
	Quadrature	Freq/ Dir	FWD REV
1	A	F	F
2	A/	F/	F/
3	B	D	R
4	B/	D/	R/
5	Z*		
6	Z/*		
7	n/c		
8	n/c		
9	n/c		
10	n/c		
11	n/c		
12	n/c		
13	n/c		
14	0V		



(Bottom View)

Power

Pin Number	Signal
1	Brake
2	Brake
3	48 VDC+
4	48 VDC-
5	L1
6	L2
7	L3

Z Personality Terminals

Pin Number	Signal	
1	0V Common	
2	Input 1	High Speed Capture Inputs
3	Input 2	
4	Input 3	
5	Input 4	
6	Output 1	
7	Output 2	

P Personality Terminals

Pin Number		
TB1	1	0V RS485
	2	RX/
	3	RX
	4	TX/
	5	TX
TB2	6	A
	7	Shield
	8	B
TB3	9	0V Digital I/O
	10	Input 0 **- Freeze Input**
	11	Input 1
	12	Output 0
	13	Output 1

Encoder Input

Pin Number	INC	ABS	PULSE
1	A	Cos	F
2	A/	Cosref	F/
3	B	Sin	D,R
4	B/	Sinref	D/,R/
5	Z	Data	Z
6	Z/	Data	Z/
7	U	n/c	U
8	U/	n/c	U/
9	V	n/c	V
10	V/	n/c	V/
11	W	Clock	W
12	W/	Clock	W/
13	+V	+V	+V
14	0V	0V	0V
15	thermister	thermister	thermister

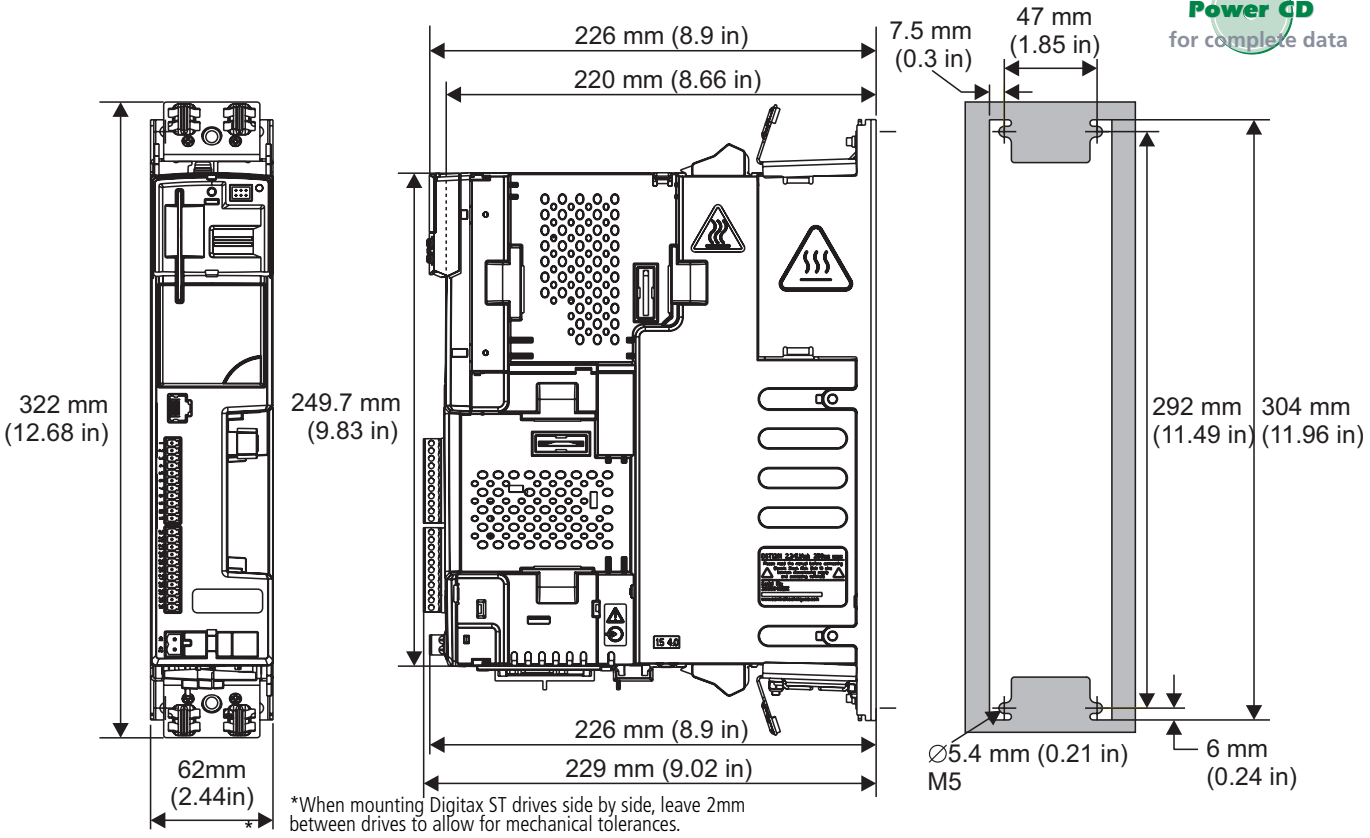
Encoder pin out function is controlled by Pr3.38 see manual for details.

Motor Power

Pin Number	Signal
1	U
2	V
3	W
4	DC Bus +
5	DC Bus -

DIGITAX ST SPECIFICATIONS AND DIMENSIONS

Go to **Power CD** for complete data



*When mounting Digitax ST drives side by side, leave 2mm between drives to allow for mechanical tolerances.

Drive Model Number	Input		Output Current*	
	Voltage Ø	Peak A	Cont. A	Peak A
DST1201	200-230 3Ø	3.5	1.7	5.1
DST1202	200-230 3Ø	7.3	3.8	11.4
DST1203	200-230 3Ø	9.4	5.4	16.2
DST1204	200-230 3Ø	13.4	7.6	22.8
DST1401	380-480 3Ø	2.8	1.5	4.5
DST1402	380-480 3Ø	4.3	2.7	8.1
DST1403	380-480 3Ø	6	4	12
DST1404	380-480 3Ø	8	5.9	17.7
DST1405	380-480 3Ø	9.9	8	24

230/480 VAC @ 6 kHz for rated performance.

*Peak current is duty cycle limited.

Power Requirements

AC Input Voltage: Model dependent: nominal 200-230 or 380-460 VAC 48-65 Hz, ±10%

Switching Frequency 6-12 kHz

System Efficiency 93%

Cooling Method Internal Fan

Drive Control Inputs

Analog, High Precision (1) +/-10 VDC, 16 bit + sign

Analog, General Purpose (2) +/-10 VDC, 0-20 mA, 4-20 mA, 10 bit + sign

Digital (3-6): Selectable. 10-30 VDC, 6 kOhm, Sinking/Sourcing

Safe Torque Off/Drive Disable: Certified EN954-1 Cat. 3

Digitax Z Additional Inputs

Digital (4): 15-30 VDC, 6 kOhm, Sourcing

Digitax P Additional Inputs

Digital (2): 24 VDC, 6 kOhm, Sourcing

Drive Control Outputs

Analog, General Purpose (2) +/-10 VDC, 0-20 mA, 4-20 mA, 10 bit + sign

Digital (0-3): Selectable, 24 VDC, 200 mA total, Sinking/Sourcing

Relay (1): Drive OK contacts, 2A @240 VAC, 4A @30 VDC Resistive load, 0.5A @24 VDC Inductive load

Digitax Z Additional Outputs

Digital (2): 10-30 VDC, 20 mA, Sourcing

Digitax P Additional Outputs

Digital (2): 24 VDC, 20 mA, Sourcing

I/O Supply: 24 VDC ±10%

200 mA max including all digital I/O. Can be switched on or off to act as a fourth digital output

Encoder Output

Quadrature, Quadrature w/ Marker Pulse/Direction, Pulse/Pulse. EIA485 Differential, 512 kHz max, +/-14 VDC

Serial Interface

1 RS-485 Modus RTU, 9600-19.2 k Baud

Digitax P Additional Communications

CTNet and EIA RS485

Environmental

Rated Ambient Temperature: 32-122° F, Derate output above 104° F

Maximum Altitude: 0-9900 ft. Derate output power by 1% per 330 ft over 3300 ft.

Vibration: Tested in accordance with I EC60068-2-29-6/64

Mechanical Shock: Tested in accordance with IEC60068-2-29

Electromagnetic Immunity: Complies with EN61800-3 (2nd Environment)

Electromagnetic Emissions: Complies with EN61800-3 (2nd Environment) with onboard filter. EN61000-6-3 and EN61000-6-4 with optional footprint EMC filter.

Humidity: 95% non-condensing at 104° F

Ingress Protection: IP-20

Weight: 4.4 lbs

HOW TO ORDER

Use one of the next few pages to configure a basic Digitax ST system by selecting one item from each of the four ordering columns, and the fifth column if you are choosing a brake motor. Note that item ❷ motor selection requires additional input as to flange, and on NT systems, connector type. (See the Motor Order String boxes for details.) Items ❸ through ❺ require cable lengths to be provided. The basic systems represented on these pages can be customized with a variety of components depending on your needs. A guide to Digitax ST Options and Accessories can be found at the end of this section.

SELECT SYSTEM AND MOTOR

❶ Select the Digitax ST drive appropriate to the needs of your application and operating environment, either DST-B (Base), DST-I (Indexer), DST-Z (EZMotion) or DST-P (Plus) and the voltage and current ratings.

❷ Select a motor for your drive. The system selection matrix for FM, NT and XV standard motors can be found on the following pages.

CABLE ORDERING OPTIONS

Motor power, feedback and brake cables are fully shielded with connectors and are available in standard and custom lengths. For more information on these and other cables, *see Options and Accessories section*.

Standard lengths of 5, 15, 25, 50 and 100 feet are available from stock. Non-standard lengths require additional lead time. ***Note: Equivalent FM Motor cable lengths are in meters.***

Feet=xxx or meters=yyy with specified lengths. Example: 005 = 5 feet. For applications involving continuous flexing, flexible cables are available. Cable components such as connector kits and raw cable are also available. See Options and Accessories section for details or consult factory for special requirements.

❸ Motor Power Cable Example;
CMDS-xxx 16 AWG for 2-3" motors; connector on motor end, ferrules on drive end

❹ Motor Feedback Cable Example;
UFCS-xxx Connectors on both ends.

❺ Motor Brake Cable Example;
CBMS-xxx Required for motors with brake option; connector on motor end only.

Software

The Control Techniques SM-EZMOTION CD (CT-EZMOTION-CD) is shipped with every product. Software updates are free and can be downloaded from our web site, as are firmware updates.

Note: Digitax (ST-B, ST-I) Base and Indexer drives use CT Soft (free software), Digitax ST-Z EZMotion drive uses PowerTools Pro (free software) and Digitax ST-P Plus drive uses SyPTPro (licensed software).

DIGITAX ST OPTIONS AND ACCESSORIES

Control Techniques provides a complete array of options and accessories to complete your system. For details, see the Options and Accessories section of the catalog.

Brake Relay
BRM-1

Breakout Boards/Cables
SM-ETC

Communications Accessories
ETH-S4, ETH-PATCH-xxx, CT-COMMS-CABLE, CT-USB-CABLE

External Shunt/Resistor
DBR-0

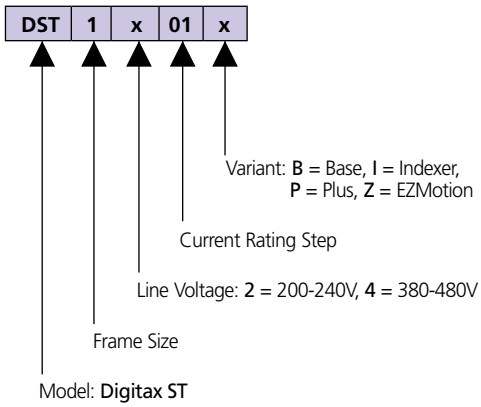
EMC Filters
230V 1Ø = 4200-6000
230V 3Ø = 4200-6001
460V 3Ø = 4200-6002

Synchronization Encoders
SCSLD-4, SCSLD-4R

Operator Interface
CTVue

Extended Warranty
Extends Two Year Warranty to Five Years

Digitax ST Order String



Digitax ST
230V FM Motor Selection

The FM motor line is a medium inertia servo motor suitable for larger inertial load applications. The FM motor line uses a 4096 line encoder for high precision and is designed with low cogging torque to provide smooth operation and excellent velocity regulation. FM motors are available with or without brakes. The system torque range is from 10.6 lb-in (1.2 Nm) to 62 lb-in (7.1 Nm).

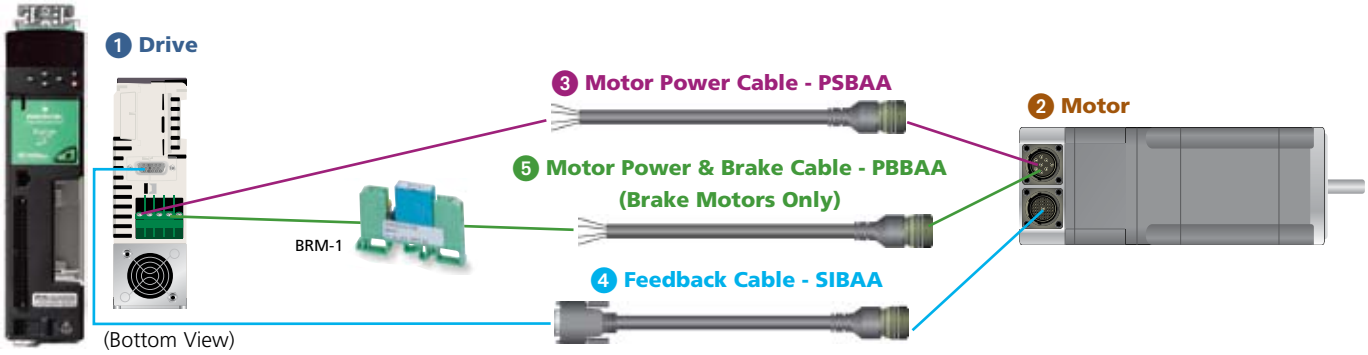
This is a flexible motor line with numerous options available including: feedback, connectors, brake, high inertia and faceplate mounting.

Order String

xxx	E	2	x	xx	x	V	A	CA	A	BCD*	DIA*

- Frame Size: **055, 075, 095, 115, 142, 190**
- Voltage **E** = 230V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A, B, C, D, E, F, G, H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm, **60** = 6,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **V** = Vertical Connectors
- Shaft Key: **A** = With Key
- Feedback Device: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.



Servo System Order Guide

❶ Drive Model x=B,I,P,Z	❷ Motor Model*	❸ Motor Power Cable (yyy=meters)	❹ Feedback Cable** (yyy=meters)	❺ Motor Power & Brake Cable (required w/all brake motors) (yyy= meters)
DST1201x	075E2A400 BACAA075110	PSBAA-yyy	SIBAA-yyy	-
	075E2A401 BACAA075110	-	SIBAA-yyy	PBBAA-yyy
DST1202x	055E2C300 BACPA063110	PSBAA-yyy	SIBAA-yyy	-
	055E2C301 BACPA063110	-	SIBAA-yyy	PBBAA-yyy
DST1202x	075E2B400 BACAA075140	PSBAA-yyy	SIBAA-yyy	-
	075E2B401 BACAA075140	-	SIBAA-yyy	PBBAA-yyy
DST1203x	055E2C600 BACPA063110	PSBAA-yyy	SIBAA-yyy	-
	055E2C601 BACPA063110	-	SIBAA-yyy	PBBAA-yyy
DST1203x	075E2C400 BACAA075140	PSBAA-yyy	SIBAA-yyy	-
	075E2C401 BACAA075140	-	SIBAA-yyy	PBBAA-yyy
DST1204x	095E2D300 BACAA100190	PSBAA-yyy	SIBAA-yyy	-
	095E2D301 BACAA100190	-	SIBAA-yyy	PBBAA-yyy

* Standard motor configuration. (Standard peak torque, No brake, 90° rotatable connectors, Keyed shaft, 4096 incremental encoder, standard PCD and Shaft Diameter)
** Standard feedback cable for use with incremental encoder and Digitax drive.

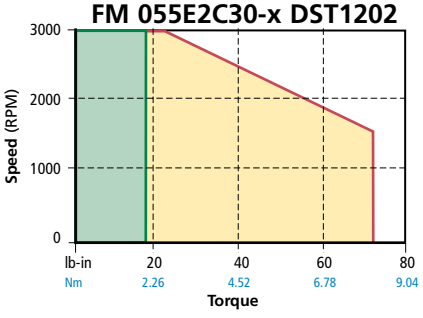
Digitax ST - 230V FM Motor Specifications

Drive Model	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed lb-in / Nm	Rated Power HP / kWatts	Max. Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
DST1201	075E2A40	10.6 / 1.2	31.9 / 3.6	8.9 / 1.0	0.6 / 0.42	4000	4096	0.00062 / 0.70	44	6.37 / 0.72	7.92 / 3.60
DST1202	055E2C30	18.7 / 2.1	73.0 / 8.3	15.9 / 1.8	0.9 / 0.64	3000	4096	0.00030 / 0.34	53	7.61 / 0.86	3.96 / 1.80
DST1202	075E2B40	19.5 / 2.2	58.4 / 6.6	15.0 / 1.7	0.9 / 0.71	4000	4096	0.00106 / 1.20	44	6.37 / 0.72	9.68 / 4.40
DST1203	055E2C60	18.7 / 2.1	63.1 / 7.1	11.9 / 1.4	1.3 / 0.99	6000	4096	0.00030 / 0.34	27	3.89 / 0.44	3.96 / 1.80
DST1203	075E2C40	27.4 / 3.1	82.3 / 9.3	20.4 / 2.3	1.3 / 0.96	4000	4096	0.00142 / 1.60	44	6.37 / 0.72	11.44 / 5.20
DST1204	095E2D30	62.6 / 7.1	187.7 / 21.2	60.2 / 6.8	2.9 / 2.14	3000	4096	0.00451 / 5.10	57	8.23 / 0.93	19.14 / 8.70

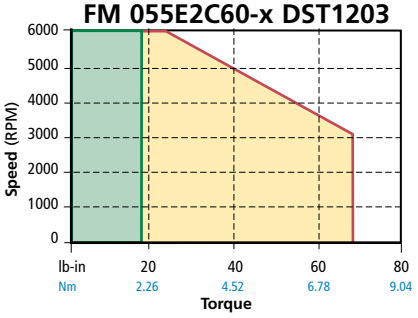
See order guide on previous page for complete motor model number.

Digitax ST - 230V FM Motor Speed Torque Curves

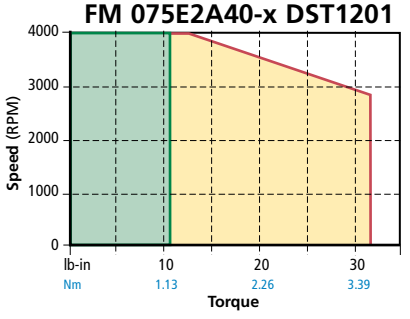
FM 055E2C30-x DST1202



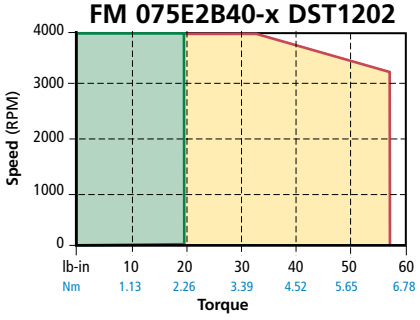
FM 055E2C60-x DST1203



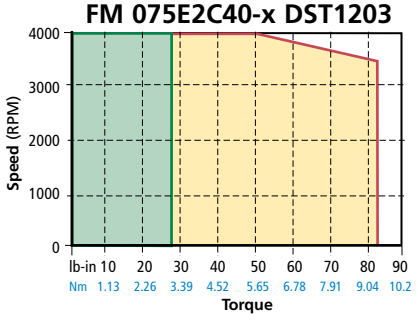
FM 075E2A40-x DST1201



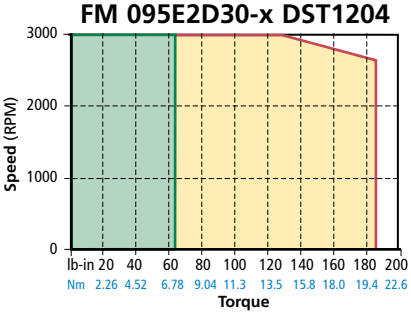
FM 075E2B40-x DST1202



FM 075E2C40-x DST1203



FM 095E2D30-x DST1204



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	6 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

Legend

- Continuous Torque
- Peak Torque

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Digitax ST
460V FM Motor Selection

The FM motor line is a medium inertia servo motor suitable for larger inertial load applications. The FM motor line uses a 4096 line encoder for high precision and is designed with low cogging torque to provide smooth operation and excellent velocity regulation. FM motors are available with or without brakes. The system torque range is from 15.9 lb-in (1.8 Nm) to 109 lb-in (12.4 Nm).

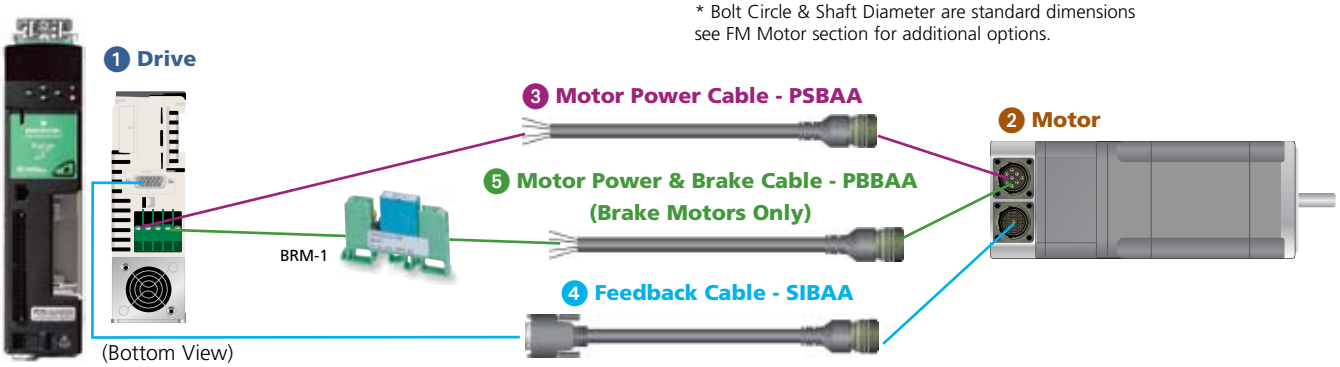
This is a flexible motor line with numerous options available including: feedback, connectors, brake, high inertia and faceplate mounting.

Order String

xxx	U	2	x	xx	x	V	A	CA	A	BCD*	DIA*

- Frame Size: **055, 075, 095, 115, 142, 190**
- Voltage **U** = 460V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A, B, C, D, E, F, G, H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm, **60** = 6,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **V** = Vertical Connectors
- Shaft Key: **A** = With Key
- Feedback Device: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.



Servo System Order Guide

❶ Drive Model x=B,I,P,Z	❷ Motor Model*	❸ Motor Power Cable (yyy=meters)	❹ Feedback Cable** (yyy=meters)	❺ Motor Power & Brake Cable (required w/all brake motors) (yyy= meters)
DST1401x	055U2C300 BACPA063110	PSBAA-yyy	SIBAA-yyy	
	055U2C301 BACPA063110		SIBAA-yyy	PBBAA-yyy
DST1401x	075U2B400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075U2B401 BACAA075140		SIBAA-yyy	PBBAA-yyy
DST1402x	055U2C600 BACPA063110	PSBAA-yyy	SIBAA-yyy	
	055U2C601 BACPA063110		SIBAA-yyy	PBBAA-yyy
DST1402x	075U2C400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075U2C401 BACAA075140		SIBAA-yyy	PBBAA-yyy
DST1403x	095U2B400 BACAA100190	PSBAA-yyy	SIBAA-yyy	
	095U2B401 BACAA100190		SIBAA-yyy	PBBAA-yyy
DST1404x	115U2C300 BACAA115190	PSBAA-yyy	SIBAA-yyy	
	115U2C301 BACAA115190		SIBAA-yyy	PBBAA-yyy
DST1405x	115U2D300 BACAA115240	PSBAA-yyy	SIBAA-yyy	
	115U2D301 BACAA115240		SIBAA-yyy	PBBAA-yyy

* Standard motor configuration. (Standard peak torque, No brake, 90° rotatable connectors, Keyed shaft, 4096 incremental encoder, standard PCD and Shaft Diameter)
** Standard feedback cable for use with incremental encoder and Digitax drive.

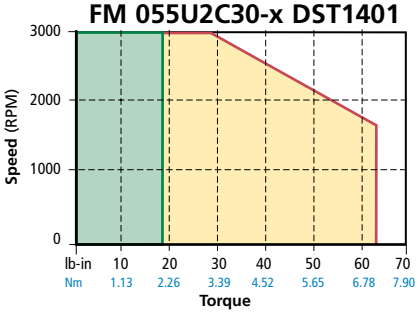
Digitax ST - 460V FM Motor Specifications

Drive Model	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed lb-in / Nm	Rated Power HP / kWatts	Max. Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
DST1401	055U2C30	18.7 / 2.1	62.9 / 7.1	15.9 / 1.8	0.9 / 0.64	3000	4096	0.00030 / 0.34	96	13.98 / 1.58	4.0 / 1.80
DST1401	075U2B40	15.9 / 1.8	47.8 / 5.4	15.0 / 1.7	0.9 / 0.71	4000	4096	0.00106 / 1.20	74	10.62 / 1.20	9.7 / 4.40
DST1402	055U2C60	18.7 / 2.1	56.6 / 6.4	11.9 / 1.4	1.3 / 0.99	6000	4096	0.00030 / 0.34	48	6.99 / 0.79	4.0 / 1.80
DST1402	075U2C40	27.4 / 3.1	82.3 / 9.3	20.4 / 2.3	1.3 / 0.96	4000	4096	0.00142 / 1.60	74	10.62 / 1.20	11.4 / 5.20
DST1403	095U2B40	38.1 / 4.3	114.2 / 12.9	26.5 / 3.0	1.7 / 1.26	4000	4096	0.00257 / 2.90	74	10.62 / 1.20	13.9 / 6.30
DST1404	115U2C30	83.2 / 9.4	249.6 / 28.2	71.7 / 8.1	3.4 / 2.54	3000	4096	0.00797 / 9.00	98	14.16 / 1.60	25.5 / 11.60
DST1405	115U2D30	109.7 / 12.4	329.2 / 37.2	92.0 / 10.4	4.4 / 3.27	3000	4096	0.01009 / 11.40	98	14.16 / 1.60	29.7 / 13.50

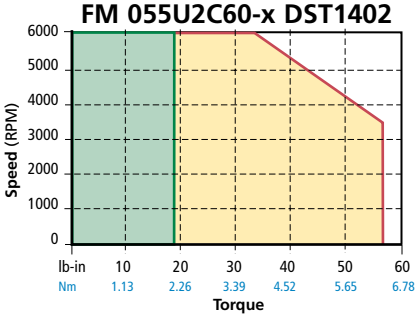
*See order guide on previous page for complete motor model number.

Digitax ST - 460V FM Motor Speed Torque Curves

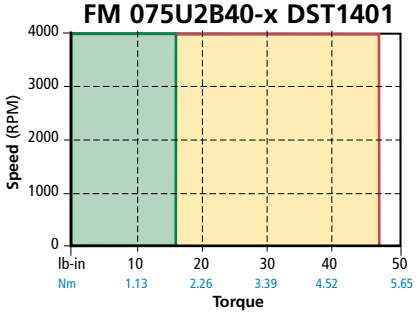
FM 055U2C30-x DST1401



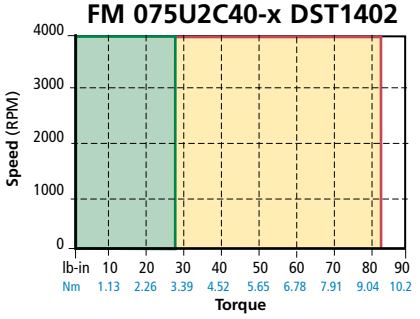
FM 055U2C60-x DST1402



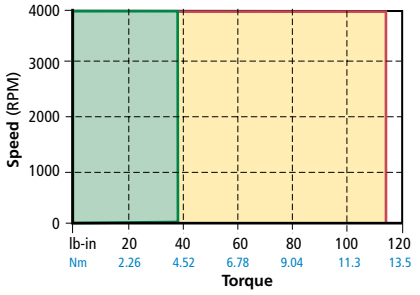
FM 075U2B40-x DST1401



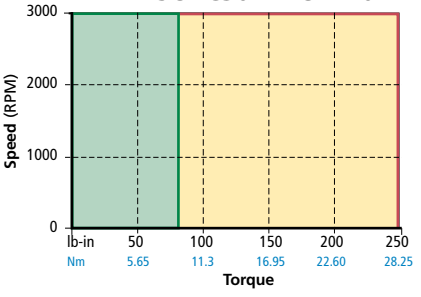
FM 075U2C40-x DST1402



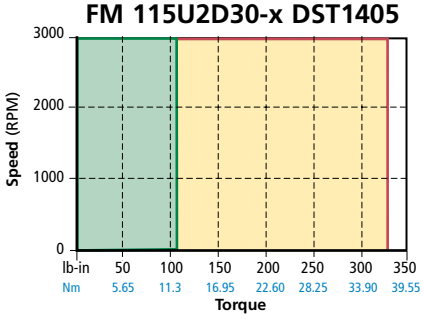
FM 095U2B40-x DST1403



FM 115U2C30-x DST1404



FM 115U2D30-x DST1405



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	6 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

Legend

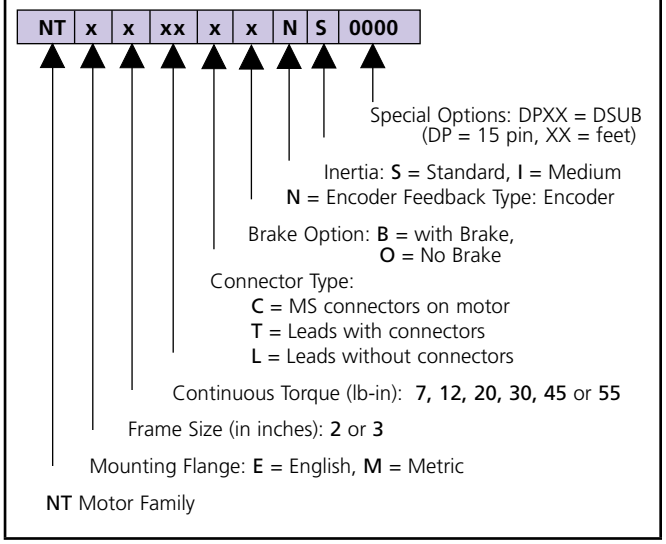
- Continuous Torque
- Peak Torque

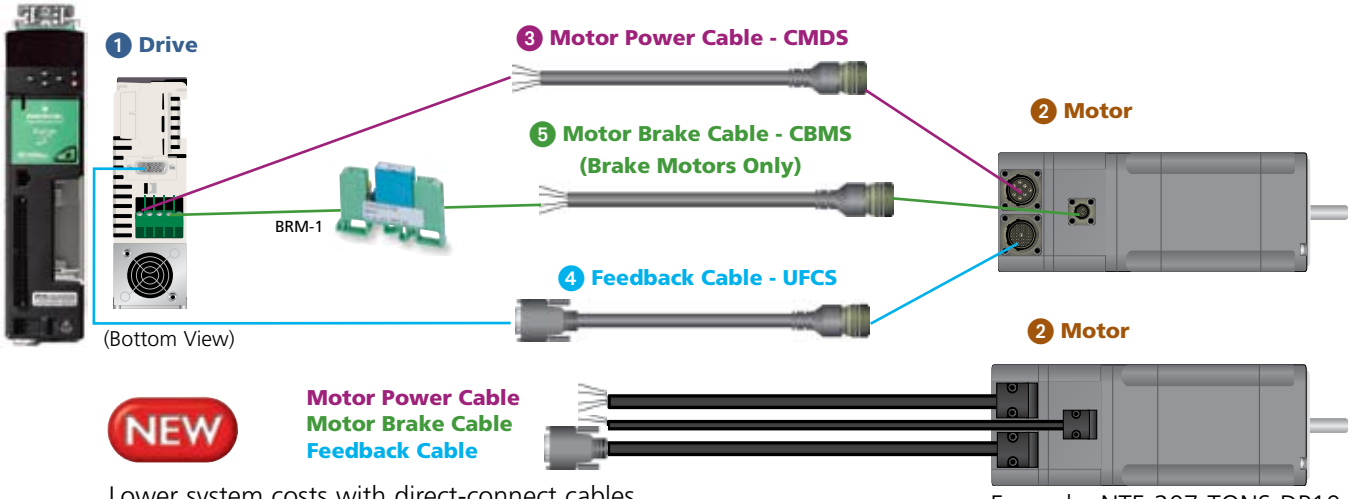
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Digitax ST
230V NT Motor Selection

The NT Series Motors deliver high torque-power to motor-size ratios that were previously impossible. Using the latest motor design and production technology greatly reduces motor size. High-energy neodymium iron born magnets give the NT motor high torque output and low rotor inertia, providing superior dynamic performance for servo applications. The NT motor design delivers up to 46% more torque in 20% less space when compared to standard high-performance motor designs.

Order String





NEW

Motor Power Cable
Motor Brake Cable
Feedback Cable

Lower system costs with direct-connect cables.
Medium interia options see NT Motor details.

Example: NTE-207-TONS-DP10

Servo System Order Guide

❶ Drive Model x=B,I,P,Z	❷ Motor Model (x=Flange, y=Connector z=Brake, ww=Cable Length)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
DST1201x	NTx-207-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-207-yBNS-0001	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-207-TzNS-DPww	Integrated	Integrated	Integrated
DST1202x	NTx-212-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-212-yBNS-0001	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-212-TzNS-DPww	Integrated	Integrated	Integrated
DST1203x	NTx-320-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-320-yBNS-0001	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-320-TzNS-DPww	Integrated	Integrated	Integrated
DST1204x	NTx-355-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-355-yBNS-0001	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-355-TzNS-DPww	Integrated	Integrated	Integrated

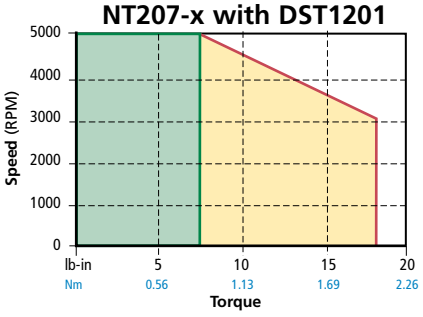
Digitax ST - 230V NT Motor Specifications

Drive Model	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Speed RPM	Encoder Resolution lines/rev	Inertia** lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
DST1201	NT207	7.5 0.8	18.4 2.1	7.5 0.8	0.6 0.45	5000	2048	0.000094 0.11	35	5.12 0.58	3.0 1.36
DST1202	NT212	12.5 1.4	30.7 3.5	12.0 1.4	1.0 0.72	5000	2048	0.000164 0.19	35	5.12 0.58	4.0 1.82
DST1203	NT320	18.5 2.1	56.7 6.4	16.0 1.8	1.0 0.77	4000	2048	0.000328 0.37	29	3.50 0.40	7.3 3.31
DST1204	NT355	48.0 5.4	144.1 16.3	48.0 5.4	2.3 1.72	3000	2048	0.000888 1.00	50	6.32 0.71	12.3 5.58

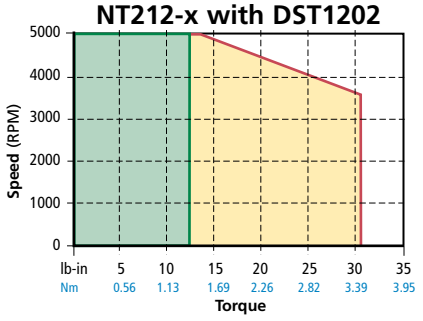
*See order guide on previous page for complete motor model number.
**See NT Motor detail section for medium inertia option details.

Digitax ST - 230V NT Motor Speed Torque Curves

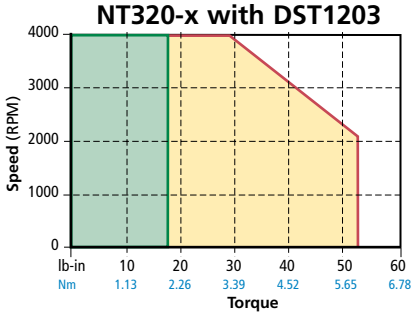
NT207-x with DST1201



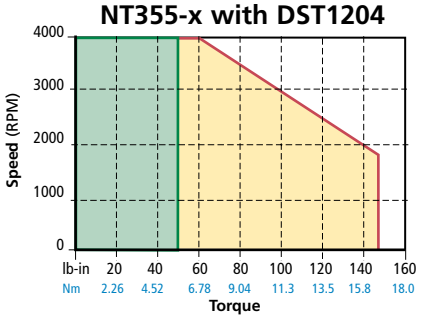
NT212-x with DST1202



NT320-x with DST1203



NT355-x with DST1204



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	6 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

Legend
- Continuous Torque
- Peak Torque

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Digitax ST

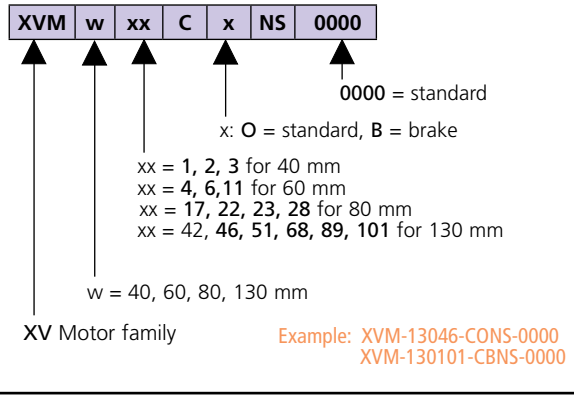
230V XV Motor Selection

The new XV Servo Motor line delivers high-performance, low inertia, and high torque in a compact motor package. It offers a low cost solution with the features of a premium priced servo offering. Intended for higher throughputs and smaller machines, XV motors are available in four frame sizes: 40, 60, 80 and 130 mm with speeds ranging from 2000 to 5000 RPM.

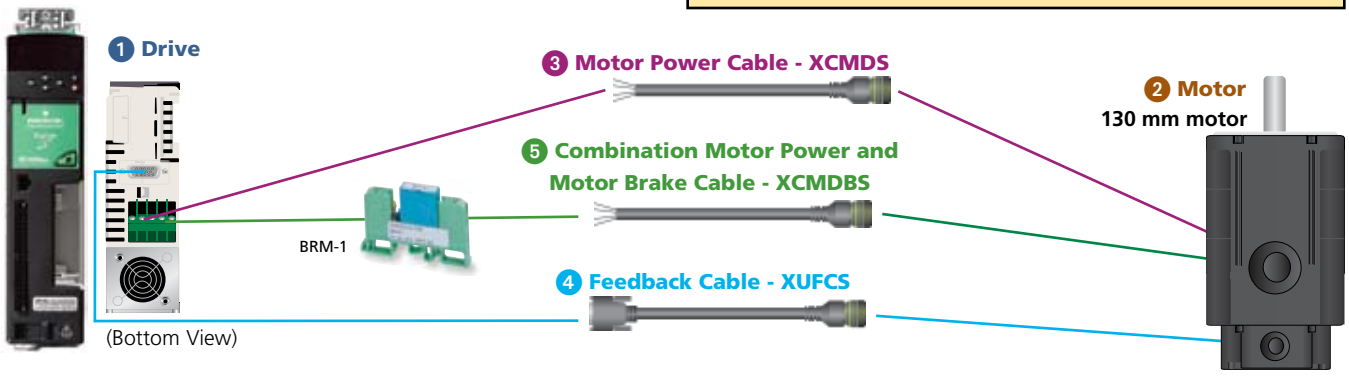
System Torque range is 3.1 lb-in (.3 Nm) to 105 lb-in (11.4 Nm).

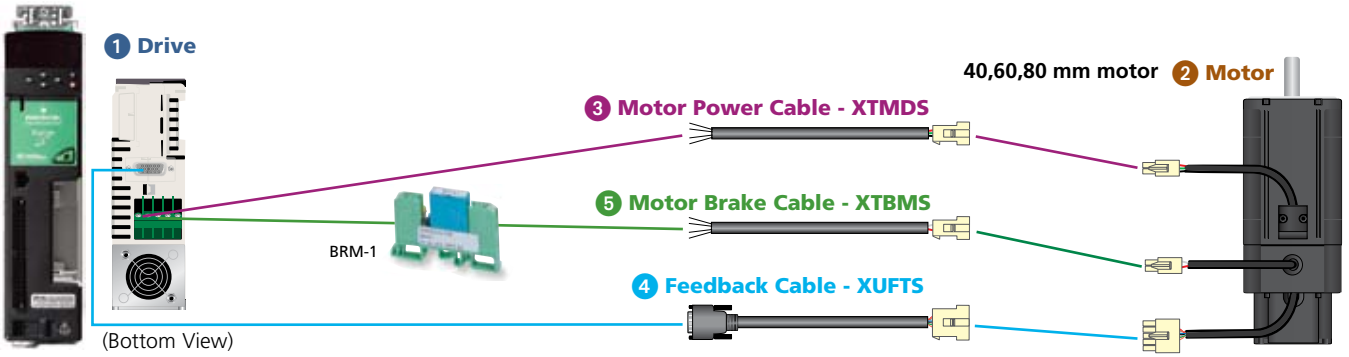
XV motors are CE, UL and RoHS approved.

Order String



For additional motor information see Motors.
For additional cable options see Options.





Servo System Order Guide

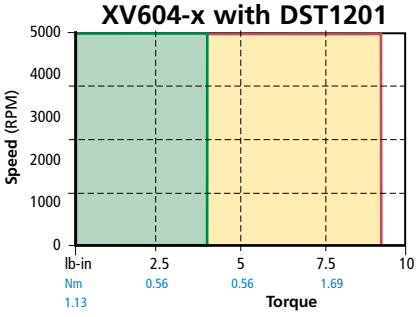
❶ Drive Model x=B,I,P,Z	❷ Motor Model (y: O=Standard, B=Brake)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
DST1201x	XV-604-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
DST1202x	XV-8017-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
DST1203x	XV-8028-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
DST1204x	XV-13042-CONS-0000	XCMDS-xxx	XUFTS-xxx	-
	XV-13042-CBNS-0000	-	XUFTS-xxx	XCMDBS-xxx
DST1204x	XV-13046-CONS-0000	XCMDS-xxx	XUFTS-xxx	-
	XV-13046-CBNS-0000	-	XUFTS-xxx	XCMDBS-xxx
DST1204x	XV-130101-CONS-0000	XCMDS-xxx	XUFTS-xxx	-
	XV-130101-CBNS-0000	-	XUFTS-xxx	XCMDBS-xxx

Digitax ST - 230V XV Motor Specifications

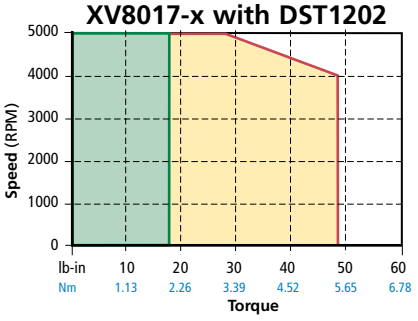
Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
DST1201	XV604	3.1 0.3	8.4 1.0	2.8 0.3	0.1 0.10	5000	2048	0.000101 0.11	14	1.86 0.21	1.8 0.84
DST1202	XV8017	17.9 2.0	48.6 5.5	16.9 1.9	0.8 0.60	5000	2048	0.000960 1.08	35	5.00 0.56	5.4 2.49
DST1203	XV8028	29.9 3.4	81.1 9.2	28.2 3.2	1.3 1.00	5000	2048	0.001705 1.93	39	5.57 0.63	8.3 3.80
DST1204	XV13042	40.7 4.6	122.0 13.8	40.7 4.6	2.0 1.50	5000	2048	0.010611 11.99	39	5.35 0.60	15.8 7.20
DST1204	XV13046	48.4 5.5	137.2 15.5	46.5 5.3	1.5 1.10	3000	2048	0.010611 11.99	53	7.71 0.87	15.8 7.20
DST1204	XV130101	101.0 11.4	296.5 33.5	101.0 11.4	1.6 1.20	2000	2048	0.020007 22.61	90	13.88 1.57	22.4 10.20

Digitax ST - 230V XV Motor Speed Torque Curves

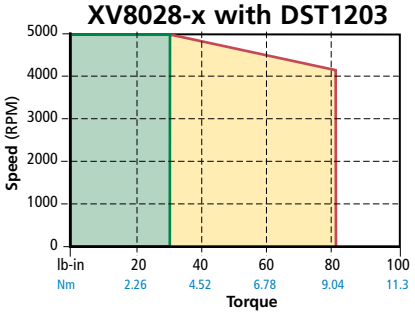
XV604-x with DST1201



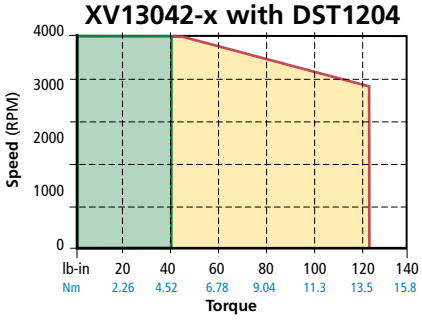
XV8017-x with DST1202



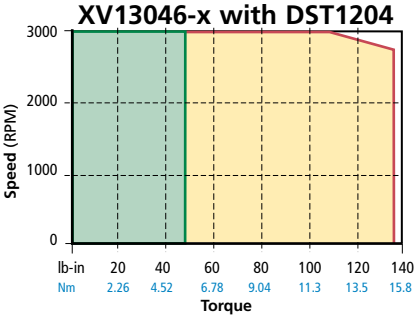
XV8028-x with DST1203



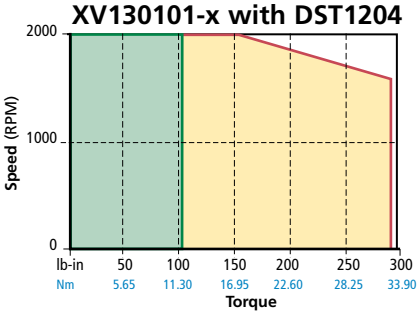
XV13042-x with DST1204



XV13046-x with DST1204



XV130101-x with DST1204



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	6 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	75°C (167°F)

Legend

- Continuous Torque
- Peak Torque

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

CONTROL TECHNIQUES

"One Source" for Motion Control

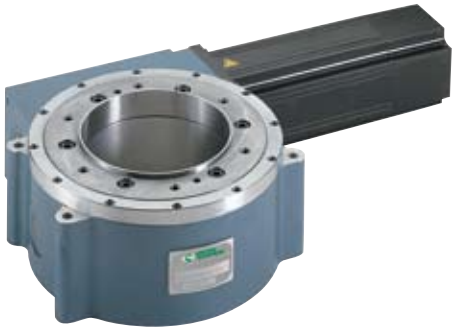
Control Techniques offers its motion control customers industry standard, specialized options and accessories from select leading companies to complement the wide breadth of products we manufacture. This allows our customers to obtain the very best solution from only "One Source" providing piece of mind in their selecting the very best motion solutions available in the industry. For more information, contact your local distributor or sales representative.

ONE SOURCE



Gearing Options

Compact Gear Motors
Precision or Value, Planetary Gears (inline or right angle)
High Torque Worm Gears



Mechanical Cam / Servo Indexers (Rotary)

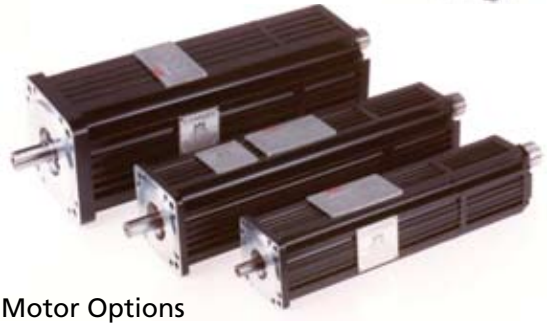
Zero Backlash
High Repeatability
Versatile Mounting



High Performance Actuators (Linear)

Fast
Powerful
Precision
Long Life





Servo Motor Options

Explosion Proof
Food Grade
Gear Motors
Feedback Options (resolver, Sin/Cos absolute encoder)
Customized Finish, Connectors, Mounting
Wide range of IP Ratings
High Flex Cables

Epsilon EP

Compact and Economical

NEW **16 Amp Drive**

The Epsilon EP Series is the most compact digital servo drive in the Control Techniques lineup. Designed to fit in cabinets as small as six inches (152 mm) deep, with cables attached. The Epsilon EP drives possess the same rugged quality and reliability found in our larger drive series.

There are five sizes of each Epsilon EP drive: 2.2 A, 4 A, 6.5 A, 9 A and 16 Amp. The largest drive delivering up to 200 lb-in continuous torque. Each drive contains a 14-segment status display, reset button, removable connectors and utilizes standard "D" type connectors.

RoHS approved option!

Position Tracker™



- **Flexible voltages DC, AC 90V to 264V**
- **5 Drive Power Options: 2.2, 4, 6.5, 9 and 16 Amp**
- **1 to 200 lb-in continuous torque**
- **Drive types: Base, Indexing, and Programmable. Indexing and Programmable can be ordered with optional DeviceNet or Profibus**
- **Easy install, setup and operation**
  - **Compact, space saving design, six-inch (152 mm) panel depth including cables**
  - **Pluggable connectors, Standard D-Shell and Screw Terminals**
  - **State-Space Observer Control, which allows 10-1 inertia mismatch out of the box, and 50-1 with tuning**
  - **Free PowerTools software, and upgrades**
  - **Programmable, optically-isolated I/O**
  - **RS485 serial communication interface using Modbus protocol**
- **Ethernet/IP and Modbus TCP/IP standard on the Epsilon EP-P programmable drive**
- **Field programmable flash memory firmware (upgrades are free)**
- **Wide variety of motor combinations: FM, MG, NT, XV**
- **Auto-Tune support for any servo motor with encoder feedback**
- **24 VDC input for logic power supply**



FEATURE
Performance Advantage

Three Configurations Available
EP-B base drive
EP-I indexing drive
EP-P programming drive

Base – Multiple Operating Modes
Analog Torque, Analog Velocity, Position Tracker™ – Analog, Preset Velocity, Preset Velocity + Analog Velocity, Pulse/Pulse, Pulse/Direction, Pulse/Quadrature.

Indexing – Simple & Powerful Capabilities
16 Indexes with chaining and linking capability, jogging, a multitude of homing routines, user units and Position Tracker™ – Fieldbus Indexing. Optional EP-IDN with DeviceNet.

Programmable – Provides Advanced Capabilities
Complex functionality is easily achieved in the Epsilon EP-P programming environment including Position Tracker™ – Fieldbus Indexing. Online help, application notes and programming examples readily available. Capable of 1½ axis control. Optional EP-PDN (DeviceNet), or EP-PPB (Profibus).

PowerTools Pro Software
Enables "Motion Made Easy" with Drag & Drop, Fill in the Blank, Point & Click set up. Tabbed setup screens and hierarchical views.

FREE Software

Extensive Motors, Cables & Options
FM, MG, NT and XV motors offer a wide range of inertia, torque, speed and cost. Provides "Motion Made Easy" system solution.

Easy to Use Communications
Modbus RTU standard, Ethernet IP, Modbus TCP/IP, Profibus and DeviceNet.

EtherNet/IP™ MODBUS TCP/IP

PROFIBUS MODBUS RTU DeviceNet™

c UL us LISTED UL us CE RoHS Compliant

2 YEAR Digital Drive Warranty 5 YEAR Extended Warranty

Epsilon EP-B
Base Drive Operation

The Epsilon EP-B (base) drive is a compact drive that is ideal for use with single and multi-axis controllers, PLCs and host controllers. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The pulse mode is ideal for use with low-cost PLC stepper controllers. This drive works in a variety of applications where a host control provides a command signal determining the desired motion profile.

The new Analog Position Mode allows the user to replace costly external position control electronics with a simple analog voltage source. The drive accepts an analog command and interprets it as an absolute position command. And of course, it's fully scalable to meet any application requirements.

The drive is configurable for eight flexible modes of operation, and the parameters for each mode can be adjusted to tailor the drive to the specific application using Windows™-based PowerTools Pro software.

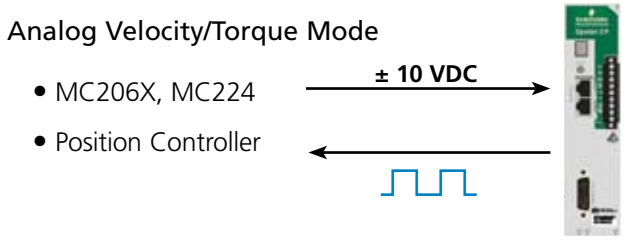
- Position Tracker™ Analog Mode
- Analog Torque Mode
- Analog Velocity Mode
- Digital Velocity Preset
- Pulse Mode
  - Pulse/Pulse
  - Pulse/Direction
  - Pulse/Quadrature
- Summation of Analog Velocity and Digital Velocity

- **Programmable I/O**
  - **5 optically-isolated inputs**
  - **3 optically-isolated outputs**
  - **1 analog input ±10 VDC, 14 bit**
  - **2 analog output ±10 VDC, 10 bit**
- **Programmable encoder output, (up to 2,048 lines per revolution)**
- **Separate stop and travel limit decel ramps**
- **Torque, Travel, Following Error and Velocity Limits**
- **8 user defined speed presets with individual accel/decel rates**
- **2 Programmable Torque Level Outputs**
- **RS485 Dual Serial Port, Modbus RTU**
- **Software Oscilloscope**



STANDARD CONTROL MODES

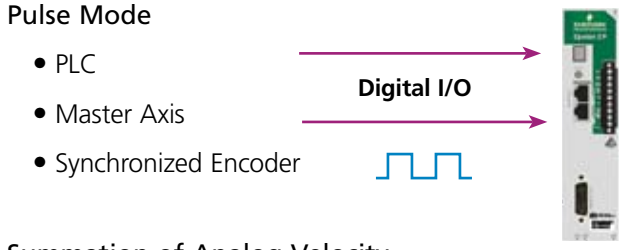
Analog Velocity/Torque Mode



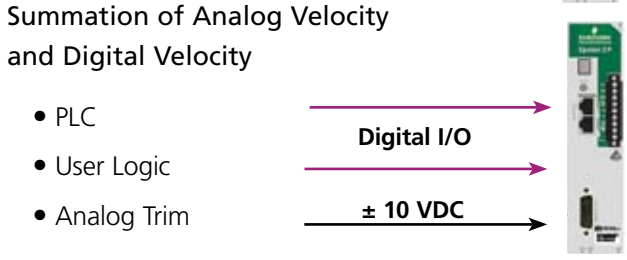
Digital Velocity Preset



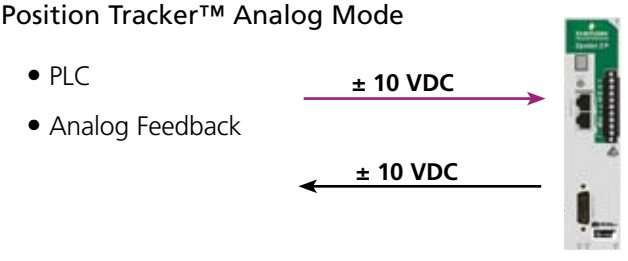
Pulse Mode



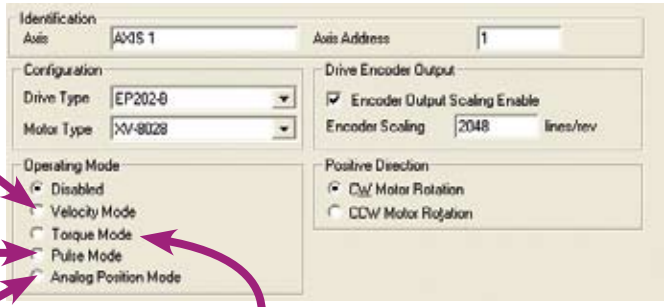
Summation of Analog Velocity and Digital Velocity



Position Tracker™ Analog Mode



The operating mode of the drive is simply selected with one click in the PowerTools Pro Setup view.



VELOCITY MODE

Analog— In Analog Velocity Mode the drive develops a velocity command in proportion to the voltage (±10 VDC) received on the Analog Input. *Note: Analog full scale voltage and offset are programmable.*

Preset Velocity— In this mode one of up to eight digital velocities can be selected using the digital I/O or Modbus. Each preset has its own accel/decel ramps. No analog source is required!

Application Examples

- Clutch-brake replacement
- Phase control with a differential
- Automatic feed control
- Spindle speed control

Velocity Summation— This mode combines the features of Analog Velocity and Preset Velocity in one mode. It allows running a preset velocity and trimming it with an analog input, or vice versa, allowing advanced applications to be solved simply and elegantly without complex controllers.

Application Examples

- Loop/dancer arm control
- Phase advance/retard
- Speed trimming

PULSE MODE

In Pulse Mode the drive will receive pulses from a master source (single-ended or differential), which can be interpreted in three ways:

- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

Application Examples

- PLC pulse command outputs
- Electronic gearing
- Stepper drive replacement
- Web line ratio control

TORQUE MODE

In Analog Torque Mode the drive develops a torque command in proportion to the voltage (±10 VDC) received in the Analog Input. *Note: Analog full scale voltage and offest are programmable.*

Application Examples

- With Position/Velocity Controller
- Tension Control

POSITION TRACKER™ ANALOG MODE

In this Analog Mode the drive moves to an absolute motor position in proportion to the voltage (±10 VDC) received in the Analog Input. *Note: Analog full scale voltage and position are programmable.*

Application Examples

- Position Control with simple analog signal
- Replaces expensive PLC position control modules

FLEXIBLE I/O FUNCTIONALITY

The digital I/O of the drive is completely programmable with the ability to map one or more I/O functions to each I/O point.

Input Functions

Stop
Reset
Travel Limit (+ and -)
Torque Limit Enable
Torque Mode Enable
Velocity Presets (3)
Brake Release
Brake Control
Enable Analog Position
Teach Analog Position
Define Analog Position

Output Functions

Drive OK
At Velocity
Travel Limits (+ and -)
In Motion (+ and -)
Power Stage Enabled
Torque Limit Active
Velocity Limiting Active
Fault
Brake
Shunt Active
Torque Level 1 or 2 Active
Foldback Active
Power Module System Ready

Epsilon EP-I
Compact Indexing Drive

The Epsilon EP-I (Indexing) drive offers user units, indexing, homing and jogging, and additional I/O in a package that is the same compact size as the base Epsilon EP-B Drive. Operating information is setup via a PC. These setup parameters are easily entered and stored with the use of our feature filled Windows™-based PowerTools Pro software. The setup can be downloaded, stored on disk or printed out for documentation. The ease-of-use saves time and money during installation and makes long term support simplistic.

EASY SETUP!

Using PowerTools Pro, the EP-I is easily programmed. Homes, Jogs and Indexes are set up using units representative of the application. This allows for an easy translation of motor revolutions to rotary, linear or other units. Once the desired user units are entered into the user units view, all motion will be based on units specific to the application—not arbitrary units requiring conversion.

- **Programmable I/O**
  - **16 Optically-isolated inputs**
  - **8 Optically-isolated outputs**
- **Indexing**
  - **16 Indexes**
  - **Position Tracker™ – Fieldbus Indexing**
  - **Chaining index capability**
  - **Chain indexes to home**
- **Jogging and Homing**
  - **2 Jog velocities**
  - **Homing (Standard and One-Sided)**
  - **Home to sensor**
  - **Home to marker**
  - **Home to sensor/marker**
- **Alternate Mode**
  - **Analog Velocity**
  - **Analog Torque (with Speed Limit)**
  - **Pulse Mode**
- **Optional DeviceNet Version—EP-IDN**
- **User Units**
  - **Distance**
  - **Velocity**
  - **Time Scale**
  - **Acceleration**

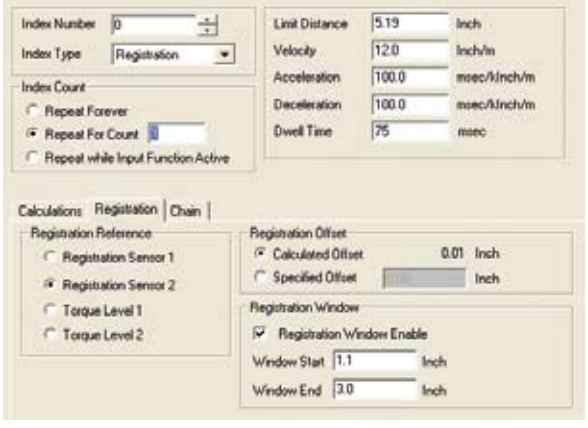


INDEXING

The Epsilon EP-I drive is easily programmed to meet a wide variety of indexing requirements, either using our PowerTools Pro software or with a Modbus Master. Sequencing multiple indexes is possible using the chaining command.

- 16 Indexes – Incremental, Absolute, Registration, Rotary Plus, and Rotary Minus index types
- Position Tracker™ – Fieldbus Indexing
- Parameters for Distance, Velocity, Accel/Decel, Dwell and Registration to Sensor or Torque Levels
- Chaining Options – Counts, Repeat Counts, Repeat Forever, Stop, Start Next Index, Wait for "Run Next Index" input function.

Registration Index



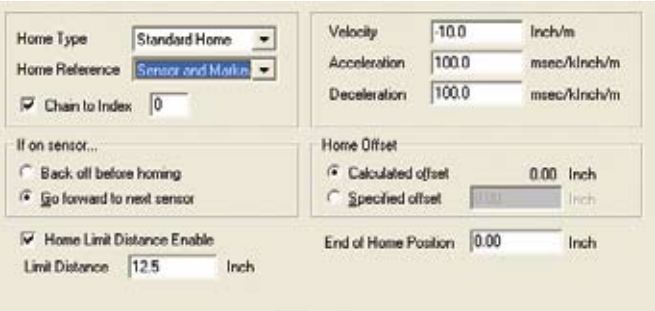
Index Repeats & Chaining



HOMING

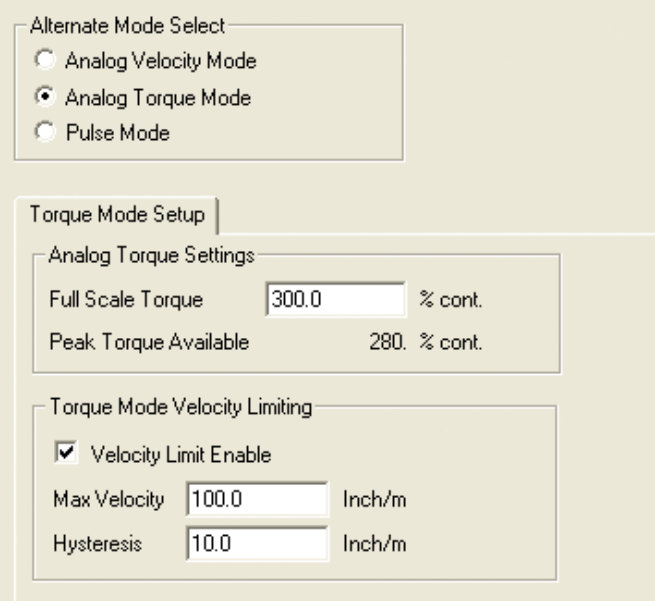
The Homing feature set in the EP-I is very powerful. The large number of parameters gives the user added flexibility and simplifies setting homing functions.

- Home to Sensor, Marker or Sensor & Marker
- If on home sensor, then back off before homing, or go forward to next sensor
- Home Offset distance relative to sensor/marker
- Parameters for Velocity, Accel, Decel, Home Offset, End-of-Home Position and Limit Distance
- Chain to Index Number



ALTERNATE MODE

Alternate Mode adds base drive capabilities to the Indexer. Users may achieve motions such as analog signal following and analog torque control using the Alternative Mode function while retaining the full functionality of a powerful indexing drive.



In Pulse Mode the drive will receive pulses from a master source (single-ended or differential), which can be interpreted three ways:

- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

- **Analog Velocity Mode**

  In Analog Velocity Mode, the drive develops a velocity command in proportion to the voltage (±10 VDC) received on the Analog Input. *Note: Analog full scale voltage and offset are programmable.*

- **Analog Torque Mode**

  In Analog Torque Mode, the drive develops a torque command in proportion to the voltage (±10 VDC) received on the Analog Input. *Note: Analog full scale voltage and offset are programmable.*

FLEXIBLE I/O FUNCTIONALITY

The digital I/O of the drive is completely programmable with the ability to map one or more I/O functions to the I/O points

Input Functions

Index Initiate
Index Select 0
Index Select 1
Index Select 2
Index Select 3
Run Next Index
Home Initiate
Home Sensor
Define Home
Stop
Jog +
Jog -
Jog Fast
Travel Limit +
Travel Limit -
Brake Control
Brake Release
Reset
Registration Sensor 1
Registration Sensor 2
Torque Limit Enable
Alternate Mode Enable
Repeat Current Index
Define Analog Position
Teach Analog Position Min.
Teach Analog Position Max.

Output Functions

Absolute Position Valid
End of Index
End of Index Motion
End of Index Count
End of Chaining Counts
Registration Limit Distance Hit
Home Limit Distance Hit
End of Home
At Velocity
In + Motion
In - Motion
Drive OK
Fault
Brake
Travel Limit +
Travel Limit -
Foldback Active
Shunt Active
Torque Limit Active
Power Stage Enabled
Torque Level 1 Active
Torque Level 2 Active
Index In Position
Torque at Max Velocity
Power Module System Ready

Epsilon EP-P
Programmable Motion

The EP-P (Programmable) drive provides the highest level of control by allowing the user to create complete user programs to sequence the motion control along with other machine functionality. The EP-P can be used to solve the most complex motion applications and still be easy-to-use because of the PowerTools Pro configuration software. PowerTools Pro uses simple drag-and-drop and fill-in-the-blank views that make setup a snap.

User programs are created using a text based motion language that is as easy to read as it is to program. If you don't know the command, just drag it in from the drop down box and PowerTools Pro will assist you with the syntax. With intuitive software and plenty of online help, programming this servo drive is easy; in fact it's **"Motion Made Easy!"™**

FIELDBUS COMMUNICATIONS

- **RS485 Modbus - Standard**

The EP-P has built in RS485 multi drop serial ports. The ports use industrial standard Modbus RTU. Connects easily with many PLC and HMI products.

- **EtherNet/IP and Modbus TCP/IP standard**

The Ethernet port is configured to communicate using two industrial protocols: EtherNet/IP and Modbus TCP/IP. Communication setup is easily done with drag and drop drive information into the Ethernet Mapping.

- **Profibus, DeviceNet - Optional**

The EP-PDN and EP-PPB are EP drives with these industry standard fieldbus options.

- **Position Tracker™ – Fieldbus Indexing**

Replace expensive PLC motion controllers with fieldbus communications. Motion profiles can be dynamically changed on the fly.

- **EtherNet/IP and Modbus TCP/IP standard**
- **RS485 Multi Drop Modbus RTU standard**
- **Synchronized Motion, Gearing, Camming**
- **PLS (Programmable Limit Switch) Outputs**
- **High Speed Capture**
- **Queuing**
- **S-Curve Accel and Decel**
- **Analog Input (1)**
- **Analog Output (2)**
- **User Programs**
- **User Variables**
- **Program Multitasking**



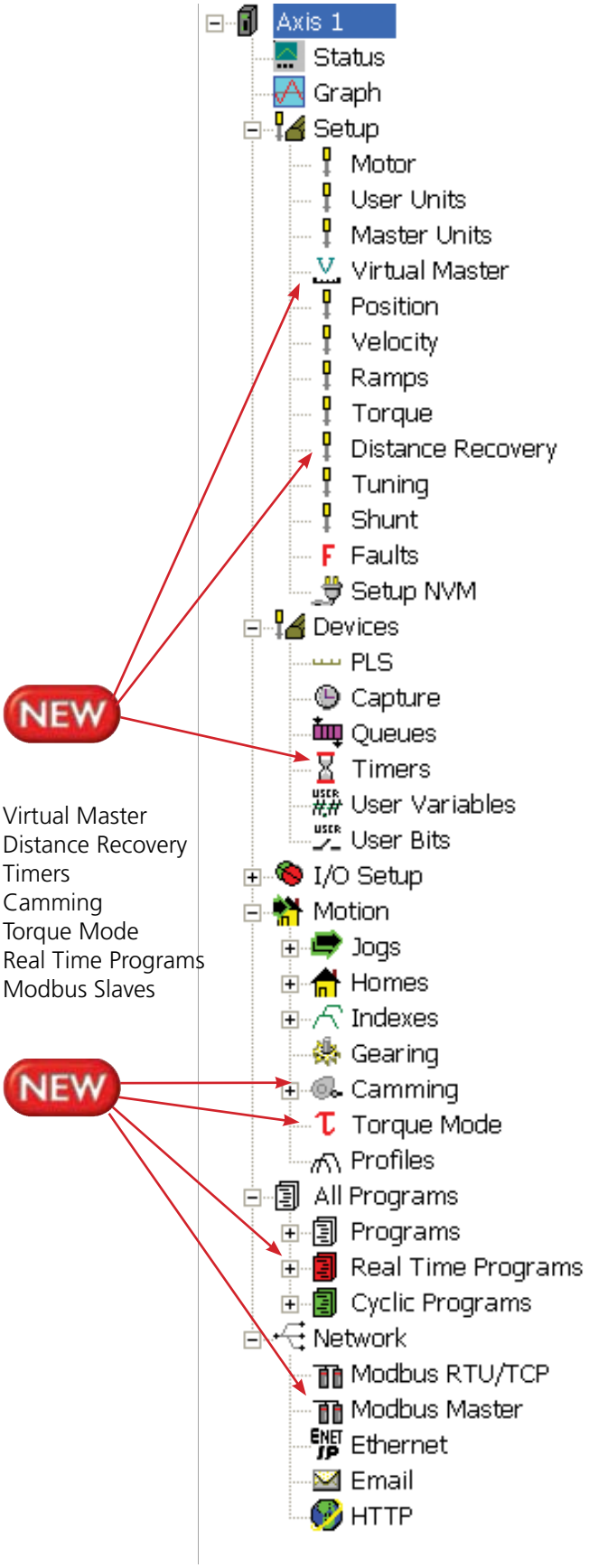
NEW

POWERFUL SOFTWARE FEATURES!

EP-P has been upgraded with many powerful software features to meet the most demanding servo application.

Complete machine control is now possible with the drive's motion, I/O and communications ability.

- Virtual Master - Provides a programmable clock signal for many drives to follow, eliminating mechanical jitter from following a physical axis.
- Modbus Master - Provides drive to drive and expanded I/O control with the built in master. The drive is no longer limited to onboard I/O! Communications to other Modbus slave devices is possible.
  - Multiple drives can share I/O over the networks
  - Stop/Start control such as VFD driven conveyors
  - Use low cost slice I/O to add digital and analog I/O
- Real Time Programs - Provides deterministic program cycle times for controlling I/O and scheduling program tasks.
- Torque Mode - Switch seamlessly from position or velocity mode into torque mode and back for unlimited flexibility and control for nut running and torque controlled clamps or grippers or any other controlled torque application.
- **Electronic Camming -** Electronic cams provide unlimited motion profiles to accomplish servo replacement of rigid mechanical cams. Use the internal time base to create a motion profile for custom indexing.



ADVANCED PROGRAMMING

The EP-P Advanced Programming features take all of the power and features of the EP-I and combines them with advanced functions such as a Position Capture Object, Multiple Profile Summation, Queuing, and Program Multitasking. The EP-P is the perfect solution for applications with complex motion profiles such as a random infeed conveyor, rotary knife, or high speed labeling machine. Using the same software as the other EP drives, PowerTools Pro makes programming quick and easy.

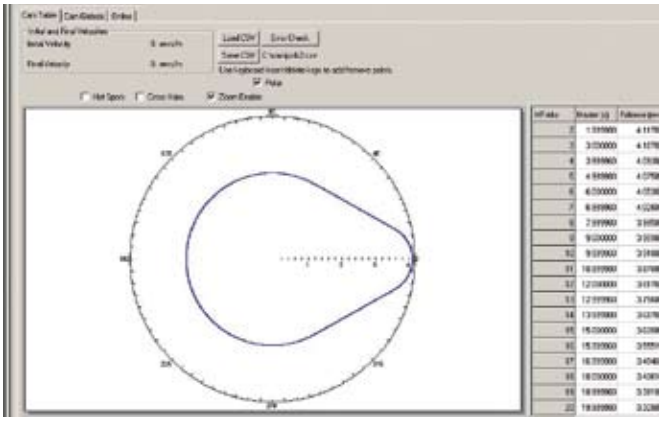
MODBUS MASTER I/O



The Modbus I/O is a simple and flexible IP20 Din rail mountable I/O. The I/O consist of a Modbus TCP/IP Bus coupler and snap-on I/O terminals. There are a variety of digital and analog snap-on terminals to meet specific application needs. One Bus coupler is capable of 256 digital inputs or outputs and up to 100 analog inputs and outputs.

ELECTRONIC CAM Camming

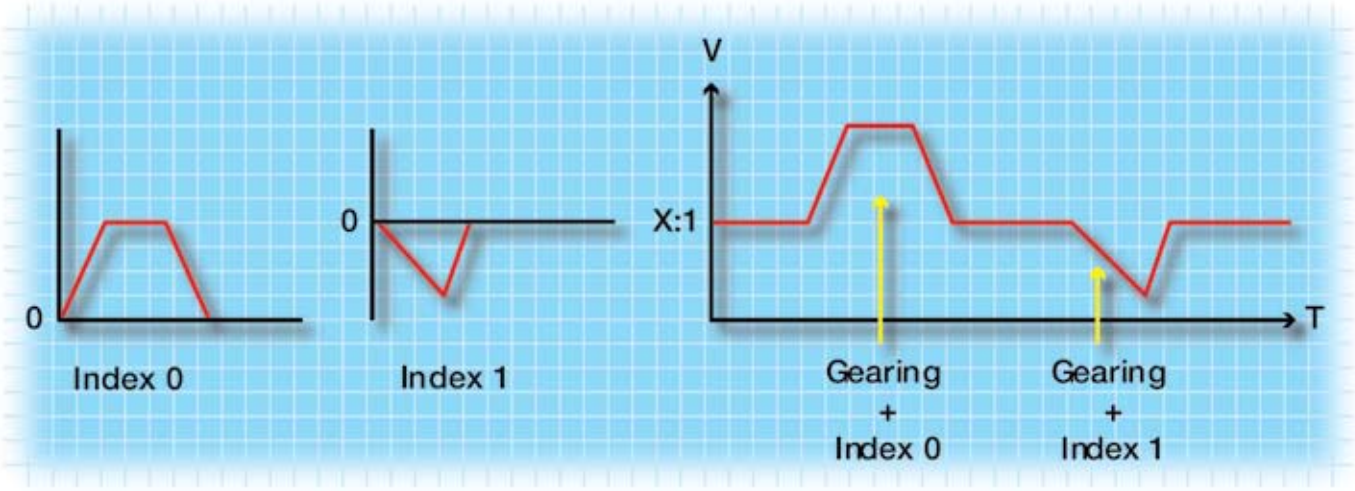
Powerful, flexible cam features make it easy for you to create unlimited motion profiles. You can change cams on the fly or based upon direction. PowerTools makes it simple to import your exported cam system data for mechanical to servo cam replacement.



Electronic Camming

MULTIPLE PROFILE SUMMATION Profiles

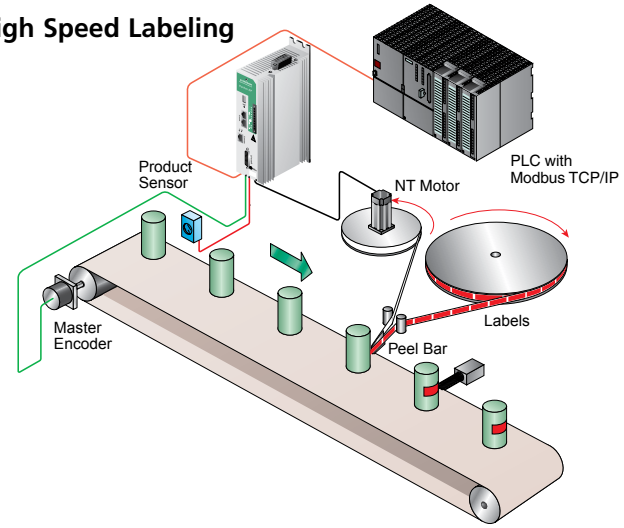
Motor motion or "Axis" motion may be generated from either of two Profiles: Profile.0 and Profile.1. Each of these Profiles can run any type of motion (Index, Jog, Gear, etc) at any time or both of the Profiles can generate motion simultaneously.



QUEUING Queues

Queuing is used when the ability to store data in a temporary memory location is needed. Up to eight Queues are available. Queues are generally found in applications where a sensor is located several product lengths ahead of the actual drive motion. The EP-P stores the captured position with an offset and accesses it using a built-in compare function.

High Speed Labeling

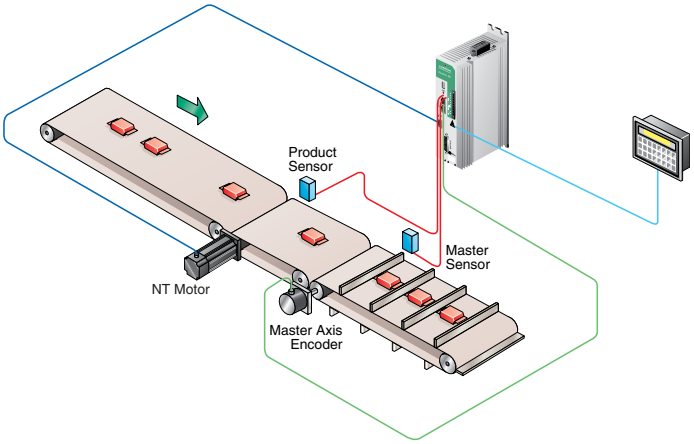


PROGRAM MULTI-TASKING

Because many applications require the operation of a background task that operates outside of the main program loop, but must be consistently processed, the EP-P has the ability to execute multiple tasks.



Random Infeed – Smartbelt



The EP-P is used to speed up or slow down the motor. The product is dropped exactly in the desired position.

Epsilon EP-xDN

DeviceNet-Ready EP-IDN & EP-PDN

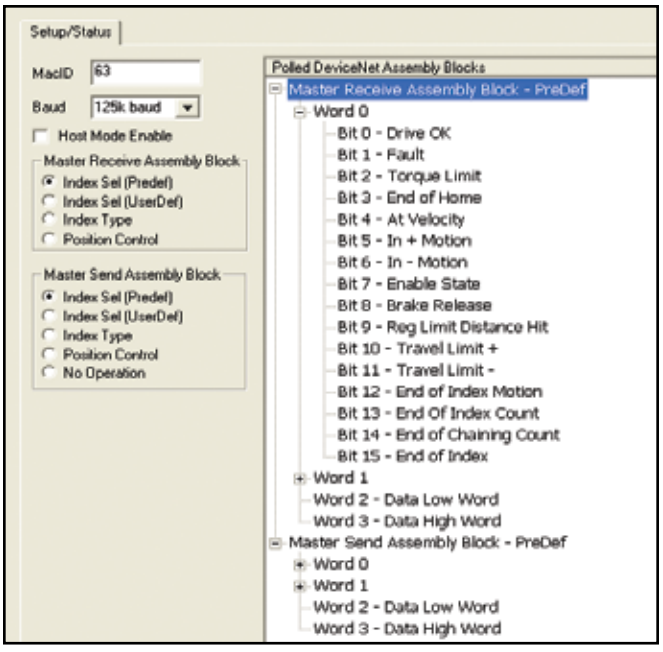


EP-I DN

Both the Indexer and Programmable drives have a DeviceNet option, which makes them a natural fit in any DeviceNet related motion application. The drives retain the same footprint as the standard drive. Both use Polled I/O and Explicit Messages to change or initiate any user parameter in the drive via DeviceNet. With the EP-IDN choose between any one of four predefined DeviceNet word setups:

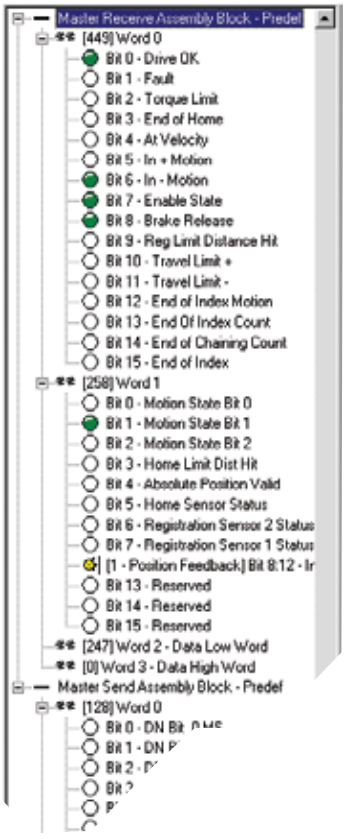
- **Index Select Predefined** (Static DeviceNet Word Block, full EP-I features)
- **Index Select User defined** (Dynamic DeviceNet Word Block, full EP-I features)
- **Index Type** (Position Control with EP-I functionality)
- **Position Control** (Position Control only)
- **Position Tracker™ – Fieldbus Indexing**

- **Same Features as standard drive offering**
- **Supports Explicit Messaging**
- **Polled (8 bytes in, 8 bytes out)**
- **Access to all Motion Parameters within Polled I/O.**
- **Up to 63 devices per network**
- **Baud Rate (125 k, 250 k, 500 k) and MacID configurable via PowerTools Pro or the "one-touch" reset button**
- **Status LEDs located on the front of the drive**
- **25 mA DeviceNet draw**
- **Easy 5-wire terminal block for DeviceNet connection**



Change the nature of the pre-configured assembly blocks by simply changing the mapping of the DN Bits. The DN Bits are user defined bits that can have different I/O functions mapped to them.

PowerTools Pro includes the most advanced diagnostic interface on the market for display of network data. When online, with PowerTools Pro, the online DeviceNet view gives the user a view of the actual data that is being sent and received through the DeviceNet network. Watch functions turn on and off over DeviceNet right in PowerTools Pro. Observe, transmit and receive message counters, check the established connections, even look at the current baud rate, MacID and Master MacID.



Epsilon EP

NEW

Position Tracker™

Use these features, standard in the Epsilon EP to replace an expensive PLC based position control module with a simple analog signal or fieldbus register.

Typically a servo drive controls a motor's velocity or torque based upon an analog command input. An external position controller is needed to calculate the position error and adjust the analog command to cause the motor to adjust its actual position.

With the Position Tracker™ mode, the closed loop feature of the position controller has been brought into the drive itself. The user simply needs to feed the drive an analog or fieldbus signal that is proportional to absolute motor position.

No complex ladder logic to send acceleration, velocity and position information, just predefine the maximum values of acceleration and velocity in PowerTools Pro software and then send the position information, via analog input or over the network (Modbus RTU, Modbus TCP/IP, EtherNet/IP, Profibus DP or DeviceNet), and the drive will command the motor to that exact position.

The CPU continually monitors the register for changes and commands the motor when changes occur. Network or analog signal loss can be enabled for fault detection. This solution offers all of the advantages of a fully closed loop servo without the cost of a traditional position controller.

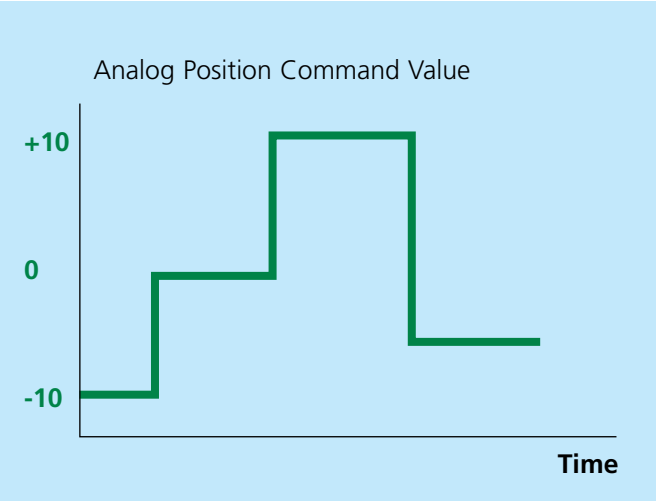
POSITION TRACKER™ – ANALOG MODE

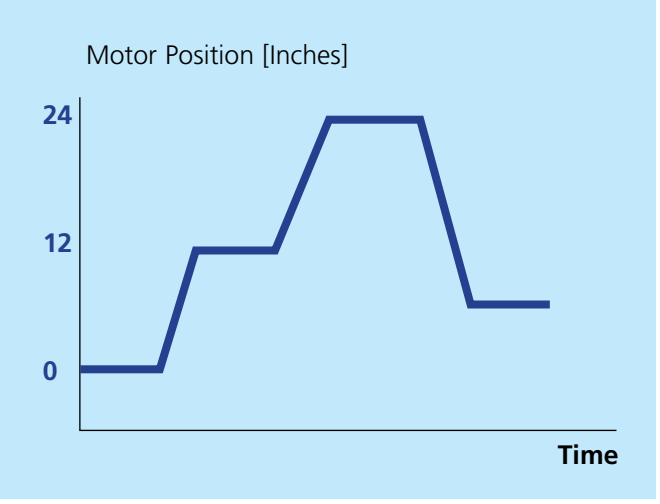
The advantage of the Position Tracker analog mode is that the drive can now use a simple and low cost analog output module from a PLC (or analog joystick, potentiometer, Lab View Analog output, etc.) instead of a costly position control module. Potentially saving the OEM or end user up to $1400 per two axis system, while still allowing for complete programmable position control. Analog feedback is not required, but a feedback is provided with the analog output on the drive.

Analog Position mode has several features that allow its intelligence to go beyond the initial setup. Using the "Motion Made Easy"™ philosophy, Control Techniques developed the Analog Position mode with many advanced features such as: Mode Enable, Velocity Limits, Dead Band, Preset Calibration and Teach functions.

POSITION TRACKER™ – FIELDBUS INDEXING (EP-I, EP-P, SM-EZMOTION)

If you like the simplicity of analog position mode but require a optional command source. Upgrade to the Position Tracker™ – Fieldbus Indexing. This indexing option tracks the updated command and dynamically indexes the motor/load. Just send a single numeric value, using fieldbus communication of choice, to a predefined register and the motor will go to that position and hold it's position until another command is sent. Commands can be sent on-the-fly even when the motor is in motion, positioning to the latest command.





EP SERIES DRIVE TERMINALS AND PINOUTS

RS485 (J2)

Pin Number	Signal
1	120 Ohm Term
2	RX TX
3	Isolated OV
4	+ 15V
5	Isolated OV
6	TX Enable
7	RX/ TX/
8	RX/ TX/
Shell	PE

Ethernet (J4) (EP-P ONLY)

Pin Number	Signal
1	TX+Ve
2	TX-Ve
3	RX+Ve
4	N/C
5	N/C
6	RX-Ve
7	N/C
8	N/C

DeviceNet (J9) (EP-PDN, IDN ONLY)

Pin Number	Signal
1	V-
2	CAN_L
3	Shield
4	CAN_H
5	V+

Profibus (J13) (EP-PPB ONLY)

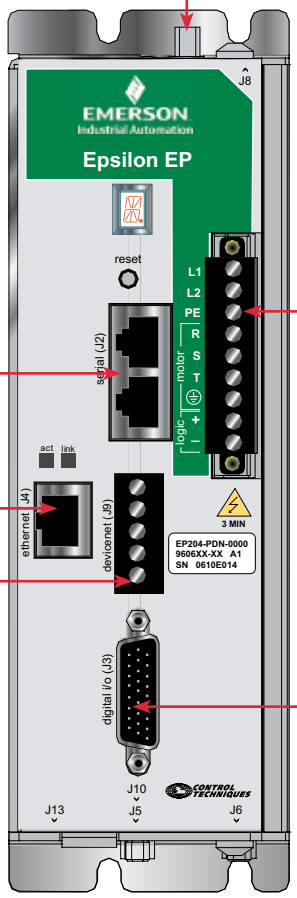
Pin Number	Signal
3	B
8	A

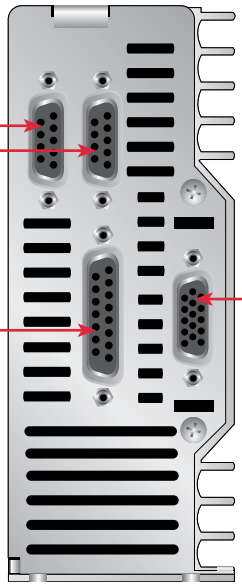
Sync In (J10)

Pin Number	Signal
1	Encoder In A
2	Encoder In A/
3	Encoder In B
4	5 VDC
5	Encoder In B/
6	Encoder In Z
7	Encoder In Z/
8	Logic Common
9	N/C

Analog, Sync Out (J5)

Pin Number	Signal
1	Encoder Out A
2	Encoder Out A/
3	Encoder Out Z
4	Pulse In
5	Analog In +
6	Analog Ground
7	Analog Out 1
8	Logic Common
9	Encoder Out A/
10	Encoder Out B/
11	Encoder Out Z/
12	Direction In
13	Analog In -
14	Analog Ground
15	Analog Out 2





(Bottom View)

Shunt (J10)

Pin Number	Signal
1	B+
2	PE
3	SH
4	PE
5	B-

Power (J1)

Terminal	Signal
L1	AC Input L1
L2	AC Input L2
PE	PE
Motor R	Motor Power R
Motor S	Motor Power S
Motor T	Motor Power T
Gnd	Motor Ground
Logic +	Logic +24 VDC
Logic -	Logic 0 VDC

Digital I/O (J3)

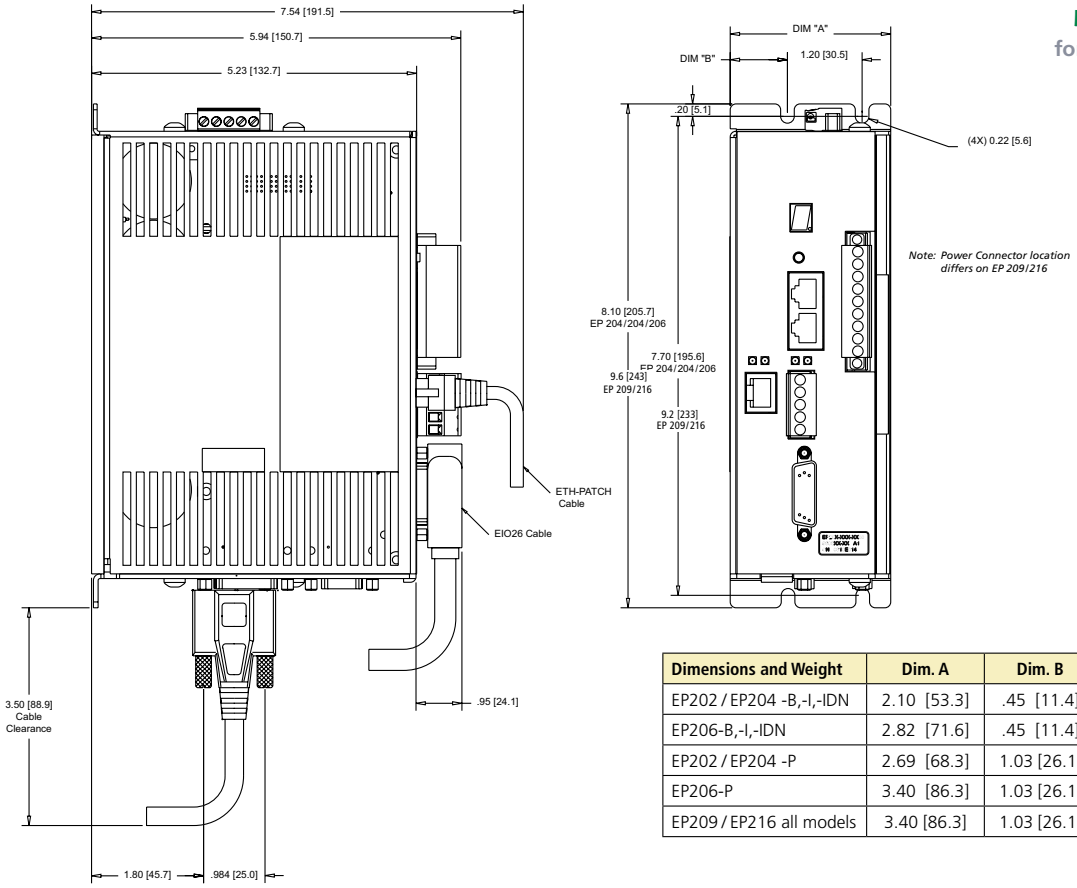
Pin Number	Signal
1	Input 1
11	Input 2
2	Input 3
12	Input 4
3	Input 5
13	Input 6
4	Input 7
14	Input 8
5	Input 9
15	Input 10
6	Input 11
16	Input 12
10	Drive Enable
19	I/O + VDC
20	I/O Common
7	Output 1
17	Output 2
8	Output 3
18	Output 4
9	Output 5
25	Output 6
26	Output 7
21	Output 8
22	Input 13
23	Input 14
24	Input 15

Motor Feedback (J6)

Pin Number	Signal
1	Encoder A
2	Encoder A/
3	Encoder B
4	Encoder B/
5	Encoder Z
6	Encoder Z/
7	Commutation U
8	Commutation U/
9	Commutation V
10	Commutation V/
11	Commutation W
12	Commutation W/
13	5VDC Power
14	Ground
15	Motor OverTemp

EPSILON EP SPECIFICATIONS AND DIMENSIONS

Go to **Power CD** for complete data



Dimensions and Weight	Dim. A	Dim. B	Weight
EP202 / EP204 -B,-I,-IDN	2.10 [53.3]	.45 [11.4]	3.6 lb [1.63]
EP206-B,-I,-IDN	2.82 [71.6]	.45 [11.4]	4.2 lb [1.91]
EP202 / EP204 -P	2.69 [68.3]	1.03 [26.1]	3.9 lb [1.77]
EP206-P	3.40 [86.3]	1.03 [26.1]	4.5 lb [2.04]
EP209 / EP216 all models	3.40 [86.3]	1.03 [26.1]	5.5 lb [2.49]

Power Requirements

AC Input Voltage, 47-63 Hz
EP 202/204/206: 1Ø, 20 to 264 VAC
EP 209: 1Ø, 90 to 264 VAC
EP 216: 3Ø, 90 to 264 VAC

(240 VAC for rated performance) SCCR 10kA

DC Input Voltage
EP 202/204/206: 10-340 VDC
EP 209/216: 140-340VDC

AC Input Current (max. continuous)
EP202: 5.0 Arms (140A for 2 ms inrush)
EP204: 8.5 Arms (140A for 2 ms inrush)
EP206: 12.0 Arms (140A for 2 ms inrush)
EP209: 16 Arms (34A for 5 ms inrush)
EP216: 16 Arms (34A for 5 ms inrush)

Output Current Continuous (rms) / Peak (4 sec.)
EP202: 2.2A / 4.4A
EP204: 4.0A / 8A
EP206: 6.5A / 13A
EP209: 9.0 A / 18A
EP216: 16.0A / 32A

Continuous Output Power
EP202: 0.77 kW
EP204: 1.27 kW
EP206: 1.77 kW
EP209: 2.32 kW
EP216 3Ø: 4.8 kW
EP216 1Ø: 2.32 kW

Switching Frequency 10 kHz
External Logic Supply +18 to 30 VDC @ 0.5A
Encoder Supply Output +5 VDC, 250 mA
I/O Supply +10 to 30 VDC
System Efficency 93%

Cooling Method

Convection EP202 through EP209
Internal Fan EP216

Regeneration

Internal Energy Absorption (115V / 230V)

EP202: 39 Joules / 8 Joules
EP204: 58 Joules / 12 Joules
EP206: 97 Joules / 20 Joules
EP209: 117 Joules / 24 Joules
EP216: 132 Joules / 28 Joules

External: Connection to external resistor,
EP 202-209: 30 Ohm min, 12A peak, 2 kW avg.
EP216: 20 Ohm min, 20A peak, 5 kW avg.

Drive Control Inputs

Analog: (1) +/-10 VDC, 14 bit, 100 kOhm, Differential

Analog Max. Input Rating: Differential +/-14 VDC, Each Input with Reference to Analog Ground +/-14 VDC

Digital: (16) (5 on EP-B) +10 to 30 VDC, 2.8 kOhm, Sourcing, Optically Isolated

Pulse: (1) Differential RS-422, 1 MHz/Channel, 50% Duty Cycle

Single Ended: (1) TTL Schmitt Trigger 500 kHz/ Channel, 50% Duty Cycle

Motor Overtemperature: 0 to +5 VDC, 10 kOhm, single ended

Drive Control Outputs

Analog: (2) +/-10 VDC, 10 bit, Single-ended 20mA

Digital: (8) (3 on EP-B) +10 to 30 VDC, 150 mA, Sourcing Optically Isolated
Short Circuit Protected

Pulse: Differential RS-422 and TTL compatible, 20 mA/Channel Sink or Source

Environmental

Rated Ambient Temperature: 32° to 104°F (0° to 40°C) for rated performance

Maximum Ambient Temperature: 32° to 122°F (0° to 50°C) with power derating of 3.0%/1.8F (1°C) above 104°F (40°C)

Rated Altitude: 3280' (1000 m)

Maximum Altitude: For altitudes >3280' (1000 m) derate output by 1%/328' (100 m)

Vibration: 10 to 2000 Hz @ 2g

Humidity: 10 to 95% non-condensing

Storage Temperature: -13° to 167°F (-25° to 75°C)

Ingress Protection: IP-20

Serial Interface

2 RS485 connectors for multi-drop applications Modbus RTU w/ 32-bit extension, 9600 to 19.2 kBaud

Ethernet Interface (EP-P only)

1 RJ-45, Modbus TCP/IP or EtherNet/IP

DeviceNet (EP-xDN models only)

Power Consumption: 25 mA
Baud Rates: 125, 250 and 500 kps
Node Addresses: 00-63

Profibus-DP (EP-PPB model only)

Baud: 1.5 to 12 Mb
Address Range: 00-126

HOW TO ORDER

Use one of the next few pages to configure a basic Epsilon EP system by selecting one item from each of the four ordering columns, and the fifth column if you are choosing a brake motor. Note that item ❷ motor selection requires additional input as to flange, and on NT systems, connector type. (See the Motor Order String boxes for details.) Items ❸ through ❺ require cable lengths to be provided. The basic systems represented on these pages can be customized with a variety of components depending on your needs. A guide to Epsilon EP Options and Accessories can be found at the end of this section.

SELECT SYSTEM AND MOTOR

❶ Select the Epsilon EP drive appropriate to the needs of your application and operating environment, either EP-B (base), EP-I (indexing) or EP-P (Programmable) and the size of drive: 2 Amp, 4 Amp, 6 Amp, 9 Amp or 16 Amp Epsilon EP (202, 204, 206, 209 and 216 respectively).

❷ Select a motor for your drive. The system selection matrix for NT motors is found on the next page. The matrix with other motors are found on the pages following NT motors.

CABLE ORDERING OPTIONS

Motor power, feedback and brake cables are fully shielded with IP65 molded connectors and are available in standard and custom lengths. For more information on these and other cables, *see Options and Accessories section*.

Standard lengths of 5, 15, 25, 50 and 100 feet are available from stock. Non-standard lengths require additional lead time. ***Note: Equivalent FM Motor cable lengths are in meters.***

Feet=xxx or meters=yyy with specified lengths. Example: 005 = 5 feet. For applications involving continuous flexing, flexible cables are available. Cable components such as connector kits and raw cable are also available. See Options and Accessories section for details or consult factory for special requirements.

❸ Motor Power Cable Example;
CMDS-xxx 16 AWG for 2-3" motors; connector on motor end, ferrules on drive end

❹ Motor Feedback Cable Example;
UFCS-xxx Connectors on both ends.

❺ Motor Brake Cable Example;
CBMS-xxx Required for all motors with brake option; connector on motor end only.

Software is Free!

The Control Techniques "Motion Made Easy"™ Power CD (CT-MME-POWER-CD) is shipped with every product. Software updates are free and can be downloaded from our web site, as are firmware updates.

EPSILON EP OPTIONS AND ACCESSORIES

Control Techniques provides a complete array of options and accessories to complete your system. For details, see the Options and Accessories section of the catalog.

Brake Relay
BRM-1

Breakout Boards/Cables
STI-24IO, STI-SNCOA, STI-SNCI ,EIO26-005

Communications Accessories
ETH-S4, ETH-PATCH-xxx, CT-COMMS-CABLE, CT-USB-CABLE

External Shunt/Resistor
SM-HEATSINK-DBR-1 (see Power Accessories)

AC Line Filters
960307-01

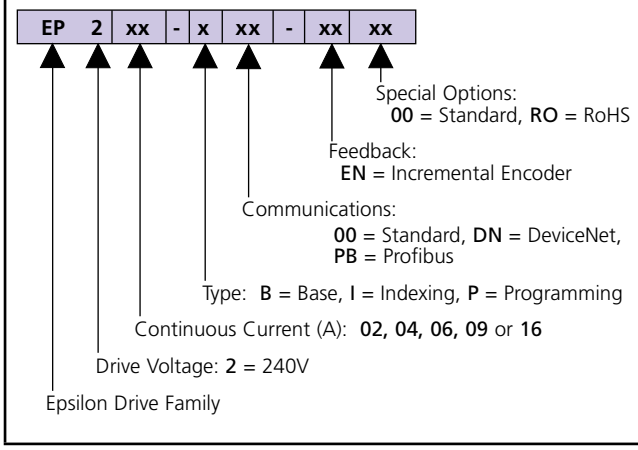
Synchronization Encoders
SCSLD-4, SCSLD-4R

Synchronization Cables
SNCFLI, SNCMD-89-xxx

Operator Interface
OIT, CTIU, CTVue

Extended Warranty
Extends Two Year Warranty to Five Years

Order String



Epsilon EP
230V FM Motor Selection

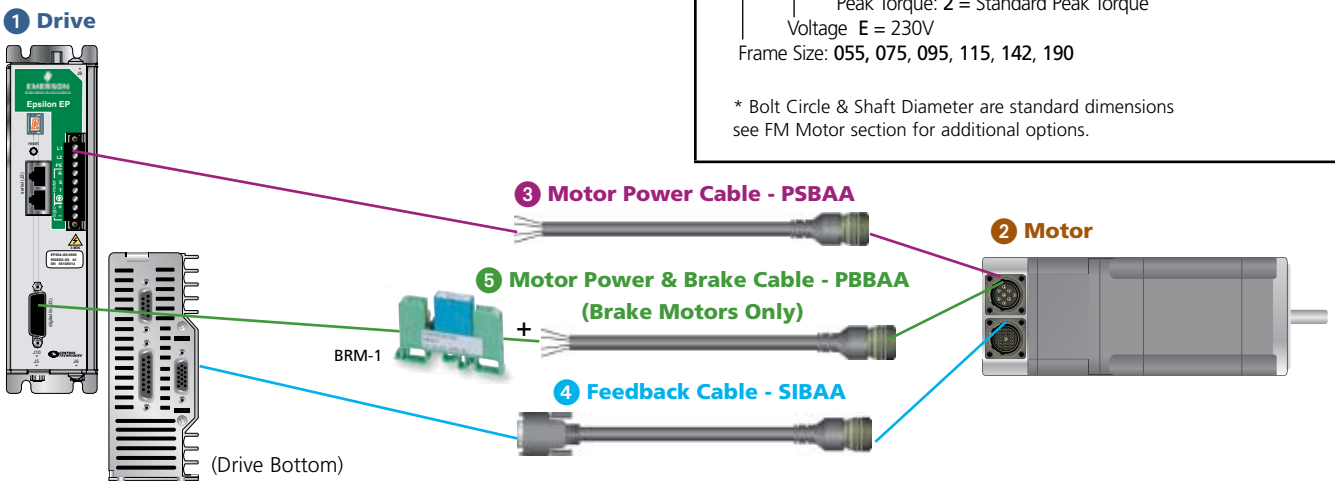
The FM motor line is a medium inertia line for larger load applications. The FM motor line uses a 4096 line encoder for high precision and is designed with low cogging torque to provide smooth operation and excellent velocity regulation. FM motors are available with or without brakes. The system torque range is from 10.6 lb-in (1.2 Nm) to 198 lb-in (22.4 Nm).

Order String

xxx	E	2	x	xx	x	V	A	CA	A	BCD*	DIA*

Frame Size: **055, 075, 095, 115, 142, 190**
Voltage **E** = 230V
Peak Torque: **2** = Standard Peak Torque
Stator Length: **A, B, C, D, E, F, G, H**
Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
Brake: **0** = None, **1** = 24 VDC
Connection Type: **V** = Vertical Connectors
Shaft Key: **A** = With Key
Feedback Device: **CA** = 4096 Incremental Encoder
Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.



Servo System Order Guide

❶ Drive Model x=B,I,P cc=00, DN or PB	❷ Motor Model*	❸ Motor Power Cable** (yyy=meters)	❹ Feedback Cable (yyy=meters)	❺ Motor Power & Brake Cable (required w/all brake motors) (yyy= meters)
EP202-xcc-EN00	055E2C300 BACPA063110	PSBAA-yyy	SIBAA-yyy	-
	075E2A400 BACAA075110	PSBAA-yyy	SIBAA-yyy	-
EP204-xcc-EN00	075E2B400 BACAA075140	PSBAA-yyy	SIBAA-yyy	-
	075E2C400 BACAA075140	PSBAA-yyy	SIBAA-yyy	-
	075E2D300 BACAA075140	PSBAA-yyy	SIBAA-yyy	-
EP206-xcc-EN00	055E2C600 BACPA063110	PSBAA-yyy	SIBAA-yyy	-
	095E2B400 BACAA100190	PSBAA-yyy	SIBAA-yyy	-
EP209-xcc-EN00	095E2D400 BACAA100190	PSBAA-yyy	SIBAA-yyy	-
	095E2D300 BACAA100190	PSBAA-yyy	SIBAA-yyy	-
	095E2E300 BACAA100190	PSBAA-yyy	SIBAA-yyy	-
EP216-xcc-EN00	115E2B600 BACAA115190	PSBAA-yyy	SIBAA-yyy	-
	115E2C400 BACAA115190	PSBAA-yyy	SIBAA-yyy	-
	115E2D400 BACAA115240	PSBAA-yyy	SIBAA-yyy	-
	115E2D300 BACAA115240	PSBAA-yyy	SIBAA-yyy	-
	142E2B400 BACAA165240	PSBAA-yyy	SIBAA-yyy	-
	142E2C300 BACAA165240	PSBAA-yyy	SIBAA-yyy	-
	142E2D200 BACAA165240	PSBAA-yyy	SIBAA-yyy	-
	142E2E200 BACAA165240	PSBAA-yyy	SIBAA-yyy	-
Note: For brake motors: A combination motor power and brake cable (part numbers ending with a 1 in the brake field - i.e. 095E2B401) replaces a standard motor power cable. Example below.				
Drive Model	095E2B401 BACAA100190	-	SIBAA-yyy	PBBAA-yyy

* Standard motor configuration. (230VAC, Standard peak torque, No brake, 90° rotatable connectors, Keyed shaft, 4096 incremental encoder, standard BCD and Shaft Diameter)
** Standard feedback cable for use with incremental encoder and EP drive.

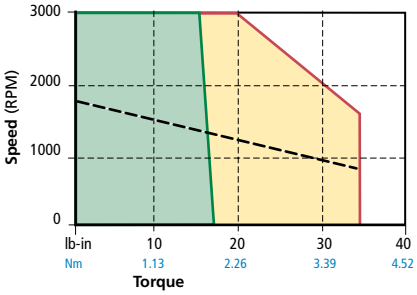
Epsilon EP - 230V FM Motor Specifications

Drive Model EP	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.** Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
-202	055E2C30	16.7 1.9	33.5 3.8	15.9 1.8	0.9 0.64	3000	4096	0.000 0.34	53	7.61 0.86	4.0 1.80
-206	055E2C60	18.7 2.1	50.6 5.7	11.9 1.4	1.3 0.99	6000	4096	0.000 0.34	27	3.89 0.44	4.0 1.80
-202	075E2A40	10.62 1.20	25.49 2.88	8.85 1.00	0.56 0.42	4000	4096	0.00619 0.7	44	6.37 0.72	7.9 3.6
-204	075E2B40	19.5 2.23	50.98 5.76	15.05 1.70	0.95 0.71	4000	4096	0.00106 1.2	44	6.37 0.72	9.7 4.4
-204	075E2C40	25.49 2.88	50.98 5.76	20.35 2.30	1.28 0.96	4000	4096	0.00142 1.6	44	6.37 0.72	11.4 5.2
-204	075E2D30	32.92 3.72	65.84 7.44	30.97 3.50	1.47 1.10	3000	4096	0.00117 2	57	8.23 0.93	13.2 6.0
-206	095E2B40	38.1 4.32	76.46 8.64	26.55 3.00	1.68 1.26	4000	4096	0.00257 2.9	44	6.37 0.72	13.9 6.3
-209	095E2D30	66.4 7.53	148.15 16.74	60.18 6.80	2.85 2.14	3000	4096	0.00451 5.1	57	8.23 0.93	19.1 8.7
-209	095E2D40	57.35 6.48	114.70 12.96	43.37 4.90	2.73 2.05	4000	4096	0.00451 5.1	44	6.37 0.72	19.1 8.7
-209	095E2E30	74.07 8.37	148.15 16.74	71.68 8.10	3.39 2.54	3000	4096	0.00549 6.2	57	8.23 0.93	21.8 9.9
-216	115E2B60	58.2 6.6	133.1 15.0	35.4 4.0	3.3 2.51	6000	4096	0.006 6.70	29	4.16 0.47	21.3 9.70
-216	115E2C40	83.2 9.4	203.9 23.0	55.8 6.3	3.5 2.64	4000	4096	0.008 9.00	44	6.37 0.72	25.5 11.60
-216	115E2D40	102.0 11.5	203.9 23.0	66.4 7.5	4.2 3.14	4000	4096	0.010 11.40	44	6.37 0.72	29.7 13.50
-216	142E2B40	95.6 10.8	203.9 23.0	61.9 7.0	3.9 2.93	4000	4096	0.014 15.60	44	6.37 0.72	29.3 13.30
-216	115E2E30	130.0 14.4	263.4 29.8	111.0 12.3	5.3 3.96	3000	4096	0.012 13.80	57	8.23 0.93	33.9 15.40
-216	142E2C30	131.7 14.9	263.4 29.8	108.0 12.2	5.1 3.83	3000	4096	0.020 22.20	57	8.23 0.93	35.4 16.10
-216	142E2D20	174.7 19.7	396.5 44.8	162.8 18.4	5.1 3.85	2000	4096	0.025 28.80	86	12.39 1.40	41.6 18.90
-216	142E2E20	198.2 22.4	396.5 44.8	188.5 21.3	5.9 4.46	2000	4096	0.031 35.40	86	12.39 1.40	47.7 21.70

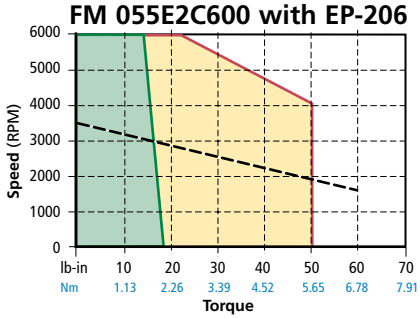
*See order guide on previous page for complete motor model number.
**Rated Speed = Maximum Operating Speed

Epsilon EP - 230V FM Motor Speed Torque Curves

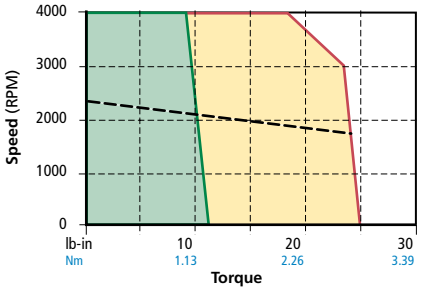
FM 055E2C300 with EP-202



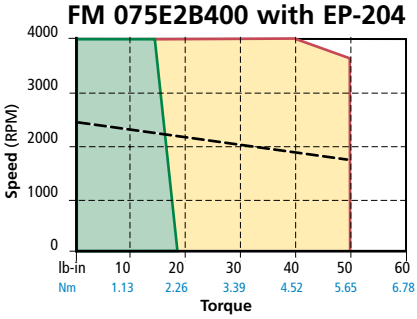
FM 055E2C600 with EP-206



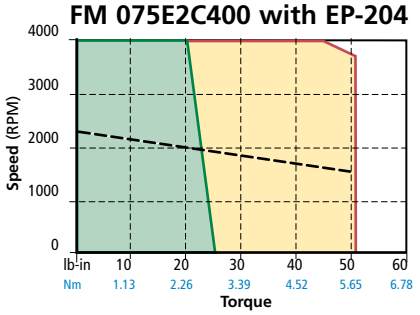
FM 075E2A400 with EP-202



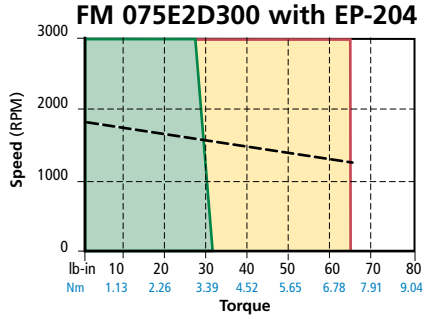
FM 075E2B400 with EP-204



FM 075E2C400 with EP-204

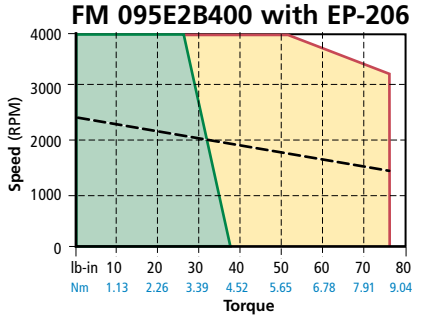


FM 075E2D300 with EP-204

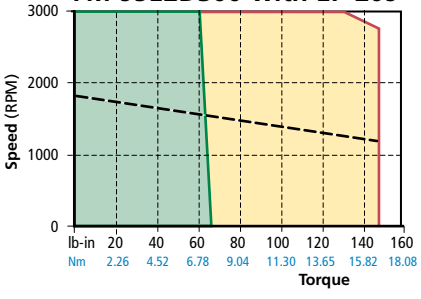


Epsilon EP - 230V FM Motor Speed Torque Curves continued

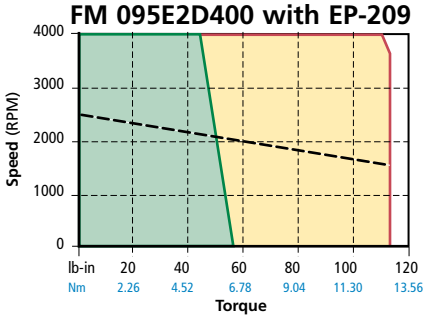
FM 095E2B400 with EP-206



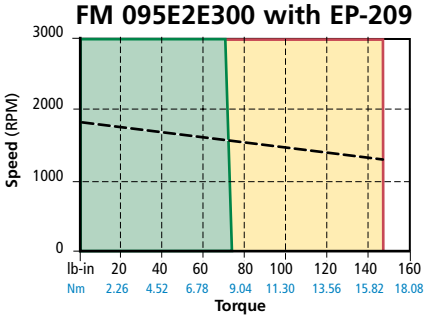
FM 95E2D300 with EP-209



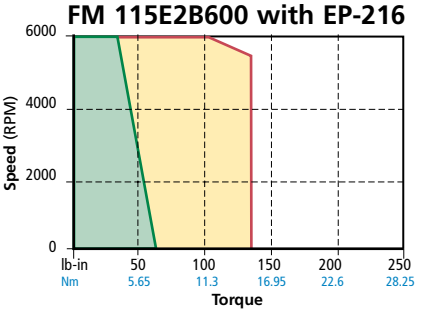
FM 095E2D400 with EP-209



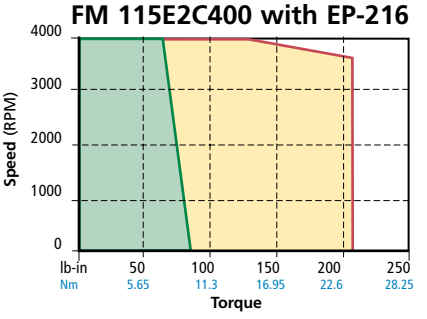
FM 095E2E300 with EP-209



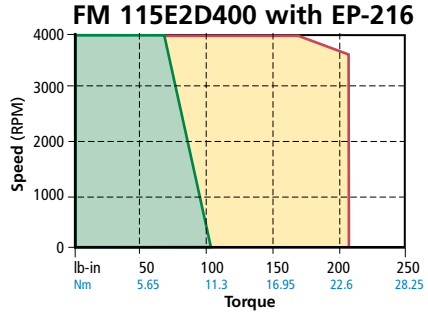
FM 115E2B600 with EP-216



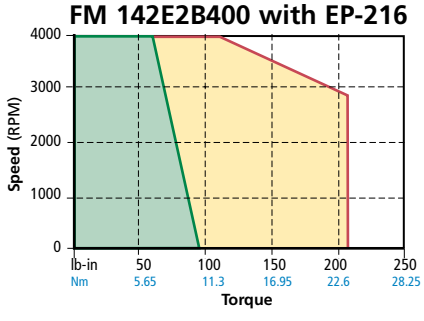
FM 115E2C400 with EP-216



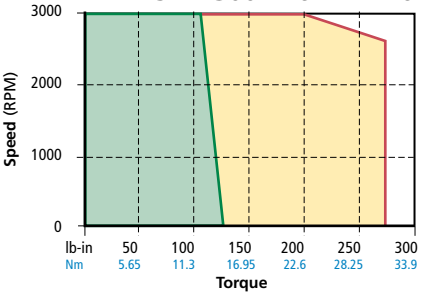
FM 115E2D400 with EP-216



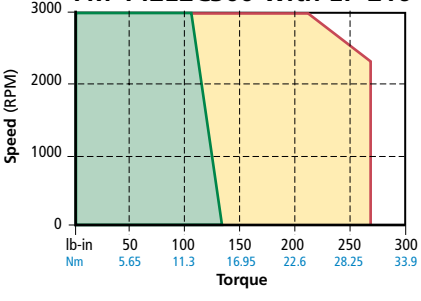
FM 142E2B400 with EP-216



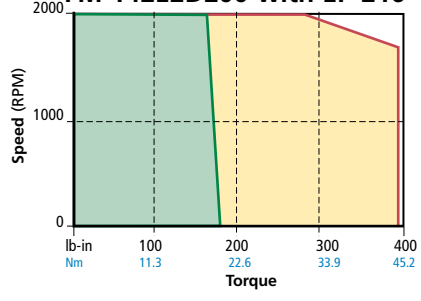
FM 115E2E300 with EP-216



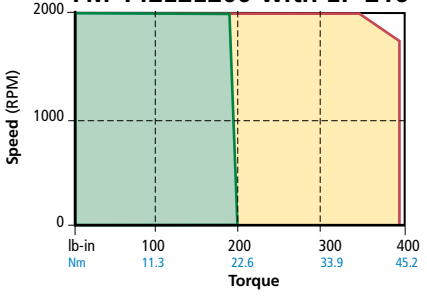
FM 142E2C300 with EP-216



FM 142E2D200 with EP-216



FM 142E2E200 with EP-216



Legend

- Continuous Torque
- Peak Torque
- 120V Curve

SPECIFICATIONS

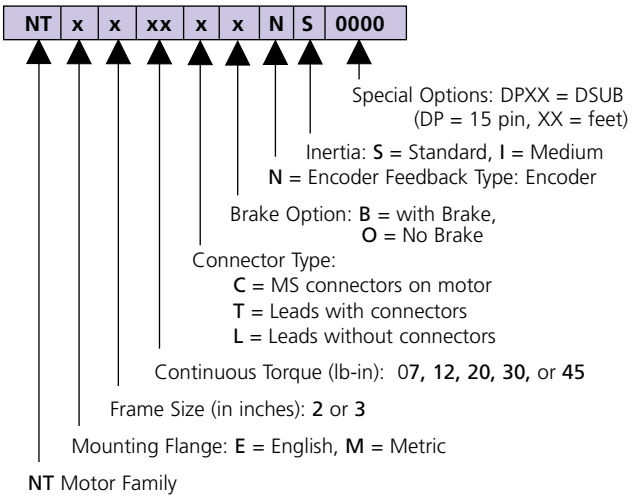
Voltage	240 VAC
Drive Frequency	10 °°°kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

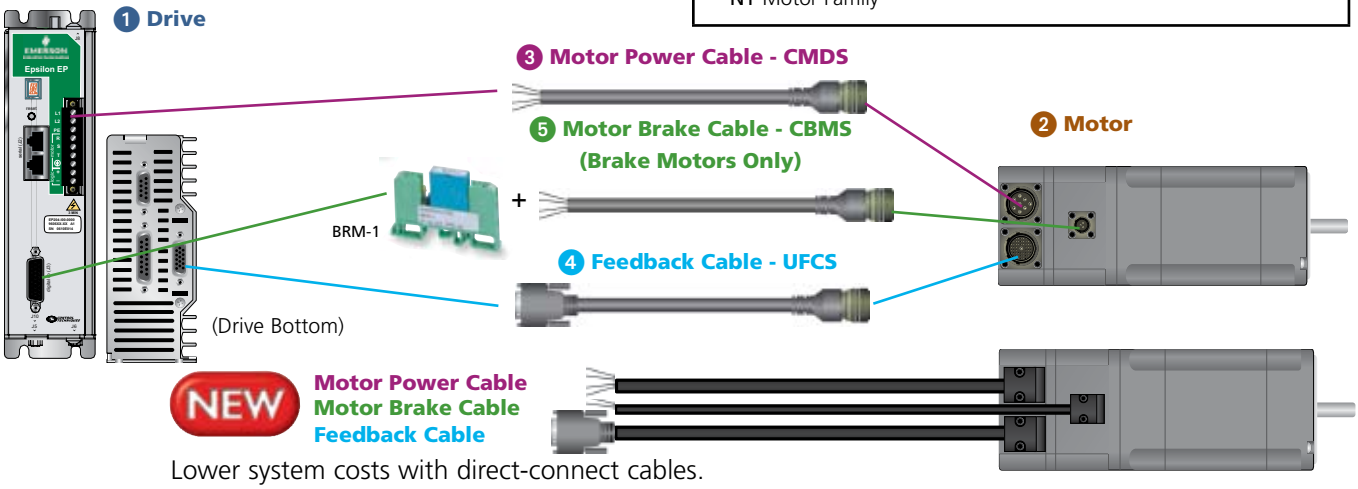
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Epsilon EP
230V NT Motor Selection

The NT motor is a high performance motor utilizing patented technology to maximize torque in a compact package. The NT motor uses powerful Neodymium magnets and is manufactured with a segmented core to maximize stator efficiency. The NT motor has a very low inertia for applications that demand high accel and cycle rates. NT motors are available in English (NEMA 23 or 34) or Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. NT motors can be ordered with MS style connectors, Flying Leads, or Flying Leads with MS or Drive Encoder connectors.

Order String





Lower system costs with direct-connect cables.
Medium interia options see NT Motor details.

Servo System Order Guide

Example: NTE-207-TONS-DP10

❶ Drive Model x=B,I,P cc=00, DN or PB	❷ Motor Model (x=Flange , y=Connector z=Brake, ww=Cable Length)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
EP202-xcc-EN00	NTx-207-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-207-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-207-TzNS-DPww	Integrated	Integrated	Integrated
EP202-xcc-EN00	NTx-212-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-212-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
EP204-xcc-EN00	NTx-212-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-212-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-212-TzNS-DPww	Integrated	Integrated	Integrated
EP206-xcc-EN00	NTx-320-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-320-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-320-TzNS-DPww	Integrated	Integrated	Integrated
EP206-xcc-EN00	NTx-330-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-330-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-330-TzNS-DPww	Integrated	Integrated	Integrated
EP206-xcc-EN00	NTx-345-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-345-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-345-TzNS-DPww	Integrated	Integrated	Integrated
EP209-xcc-EN00	NTx-355-yONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-355-yBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
	NTx-355-TzNS-DPww	Integrated	Integrated	Integrated

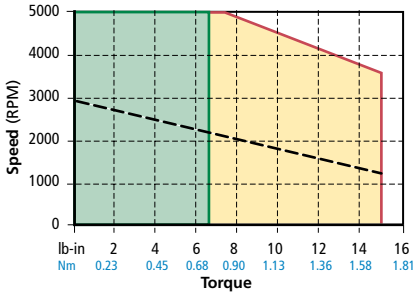
Epsilon EP - 230V NT Motor Specifications

Drive Model EP	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.** Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
-202	NT-207	7.5	15.00	7.50	0.60	5000	2048	0.000094	35	5.12	3.0
		0.85	1.69	0.85	0.44			0.106		0.58	1.4
-204	NT-212	12.5	25.00	12.00	0.95	5000	2048	0.000164	35	5.12	4.0
		1.41	2.82	1.36	0.71			0.185		0.58	1.8
-206	NT-320	18.5	37.00	16.00	1.02	4000	2048	0.000328	29	3.50	6.0
		2.1	4.18	1.81	0.76			0.37		0.40	8.6
-206	NT-330	28.0	56.00	27.00	1.71	4000	2048	0.000438	36	5.04	7.3
		3.2	6.33	3.05	1.28			0.494		0.57	3.3
-206	NT-345	42.0	80.00	36.00	1.71	3000	2048	0.000668	50	6.37	10.0
		4.75	9.04	4.07	1.28			0.754		0.72	4.5
-209	NT-355	48.0	104.00	48.00	2.29	3000	2048	0.000888	50	6.32	12.3
		5.42	11.75	5.42	1.70			1.002		0.71	5.6

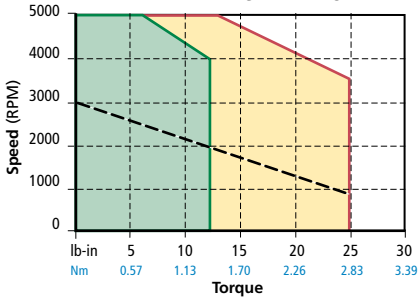
*See order guide on previous page for complete motor model number.
**Rated Speed = Maximum Operating Speed

Epsilon EP - 230V NT Motor Speed Torque Curves

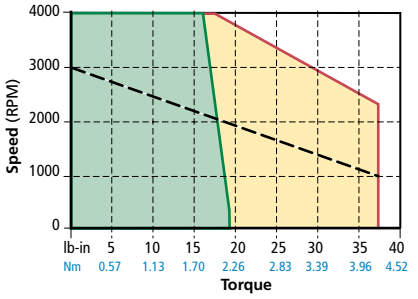
NT-207 with EP-202



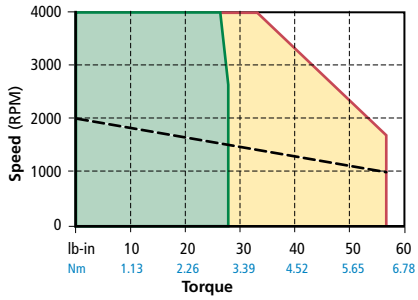
NT-212 with EP-204



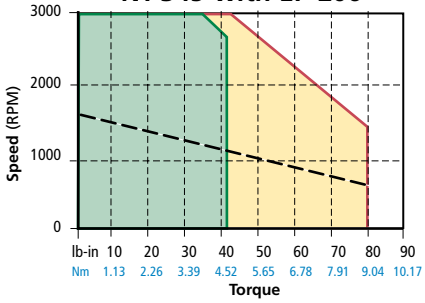
NT-320 with EP-206



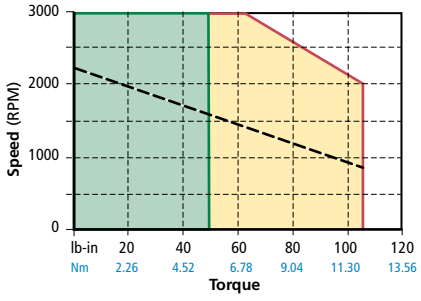
NT-330 with EP-206



NT-345 with EP-206



NT-355 with EP-209



Legend

- Continuous Torque
- Peak Torque
- – – – 120V Curve

SPECIFICATIONS

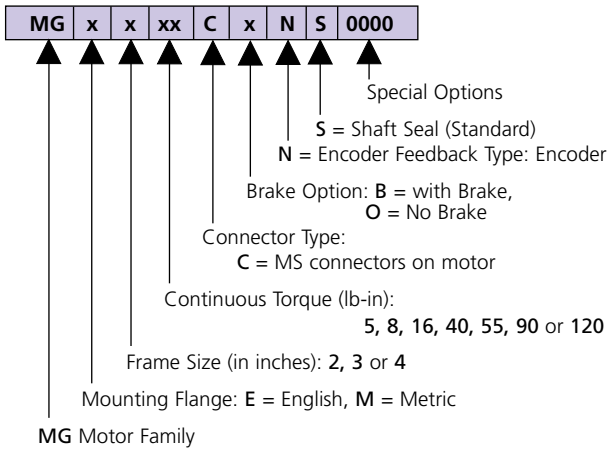
Voltage	240 VAC
Drive Frequency	10 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

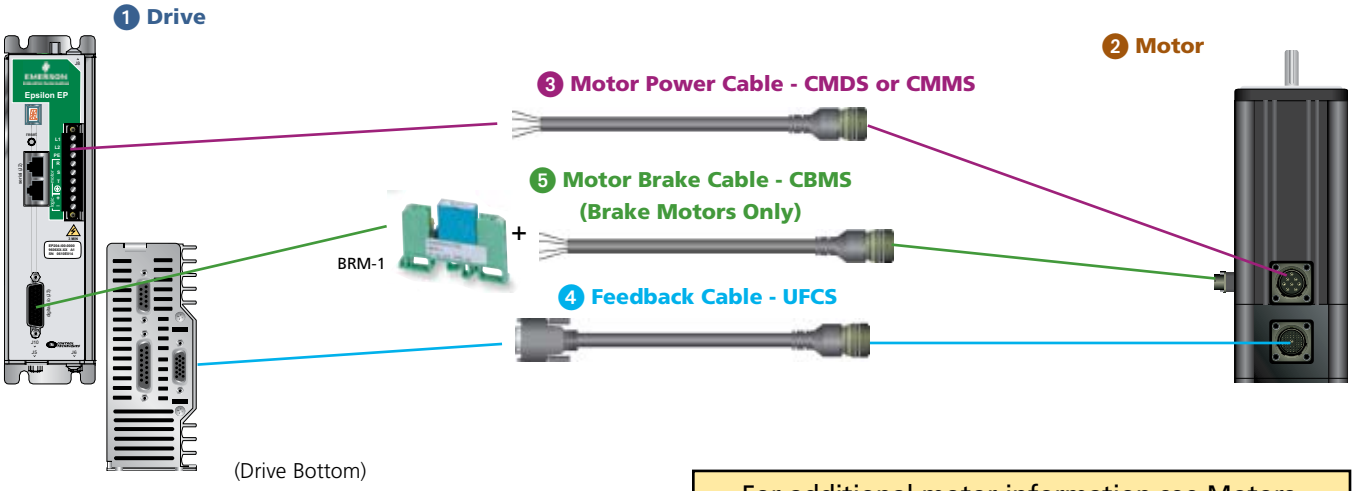
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Epsilon EP
230V MG Motor Selection

The MG motor is a low inertia motor that is great for dynamic applications that have larger load inertias. MG motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors motors. MG motors are available in English (NEMA 23, 34, or 56) and Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. MG motors come standard with MS style connectors. Standard shaft seal provides IP65 rating.

Order String





For additional motor information see Motors.
For additional cable options see Options.

Servo System Order Guide

❶ Drive Model x=B,I,P cc=00, DN or PB	❷ Motor Model (x=Flange)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
EP202-xcc-EN00	MGx-205-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-205-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
EP202-xcc-EN00	MGx-208-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-208-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
EP204-xcc-EN00	MGx-316-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
EP206-xcc-EN00	MGx-340-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-340-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
EP209-xcc-EN00	MGx-455-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx	UFCS-xxx	CBMS-xxx
EP209-xcc-EN00	MGx-490-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-490-CBNS-0000	CMMS-xxx	UFCS-xxx	CBMS-xxx
EP216-xcc-EN00	MGx-4120-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-4120-CBNS-0000	CMMS-xxx	UFCS-xxx	CBMS-xxx

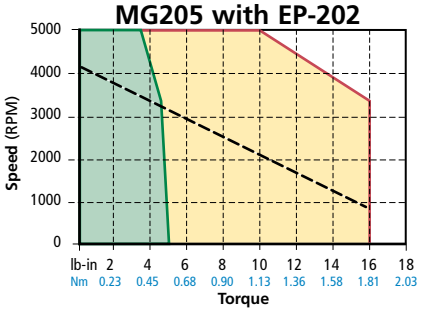
Epsilon EP - 230V MG Motor Specifications

Drive Model EP	Motor Model*	Cont. Stall Torque lb-in Nm	Peak Stall Torque lb-in Nm	Rated Torque @Rated Speed* lb-in Nm	Rated Power HP kWatts	Max.** Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² kg-cm²	Motor Ke Vrms/ krpm	Motor Kt lb-in/Arms Nm/Arms	Motor Weight lb kg
-202	MG-205	5.00 0.56	17.63 1.99	3.70 0.42	0.29 0.22	5000	2048	0.000099 0.112	28	4.10 0.47	3.0 1.3
-202	MG-208	8.00 0.90	18.04 2.04	7.25 0.82	0.58 0.43	5000	2048	0.000169 0.191	28	4.10 0.47	4.0 1.8
-204	MG-316	18.60 2.10	44.00 4.97	16.00 1.81	1.02 0.76	4000	2048	0.00056 0.63	38	5.50 0.62	8.3 3.8
-206	MG-340	45.00 5.08	107.90 12.19	41.00 4.63	1.95 1.45	3000	2048	0.001458 1.646	57	8.30 0.94	14.6 6.6
-209	MG-455	62.00 7.01	158.40 17.90	52.00 5.88	2.48 1.84	3000	2048	0.002658 3.000	60	8.80 0.99	20.0 9.1
-209	MG-490	77.00 8.70	154.80 17.49	60.00 6.78	2.86 2.13	3000	2048	0.005175 5.823	59	8.60 0.97	28.6 13.0
-216	MG-490	88.6 10.0	275.2 31.1	79.7 9.0	3.8 2.86	3000	2048	0.005175 5.823	59	8.60 0.97	28.6 13.00
-216	MG-4120	123.9 14.0	336.0 38.0	111.5 12.6	5.3 4.00	3000	2048	0.007458 8.43	72	10.50 1.19	37.0 16.80

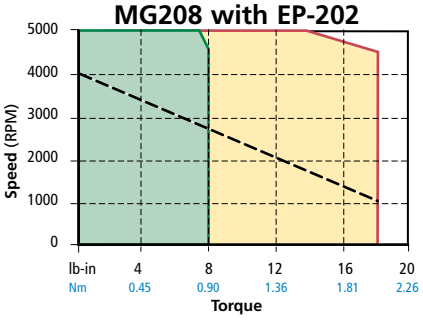
*See order guide on previous page for complete motor model number.
* Rated Speed = Maximum Operating Speed

Epsilon EP - 230V MG Motor Speed Torque Curves

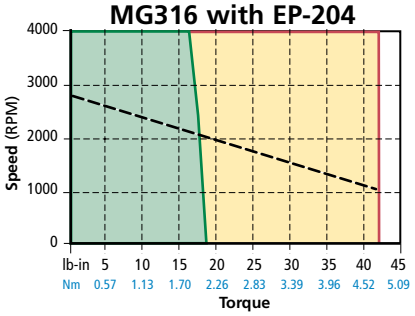
MG205 with EP-202



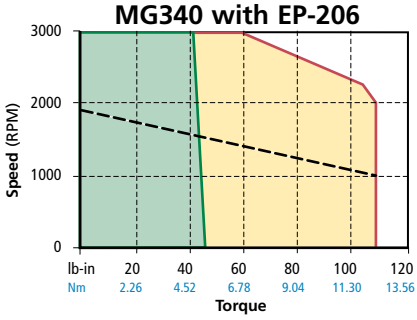
MG208 with EP-202



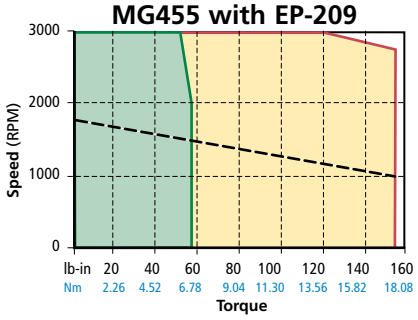
MG316 with EP-204



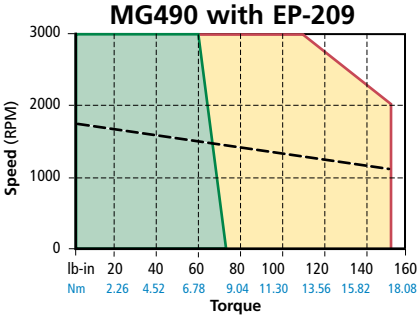
MG340 with EP-206



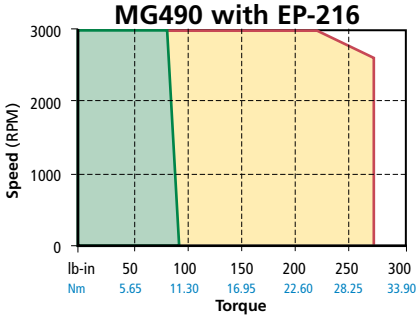
MG455 with EP-209



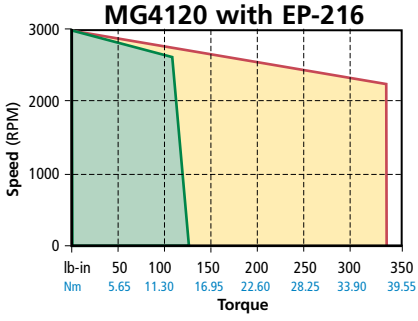
MG490 with EP-209



MG490 with EP-216



MG4120 with EP-216



Legend
- Continuous Torque
- Peak Torque
- – – – 120V Curve

SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	10 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

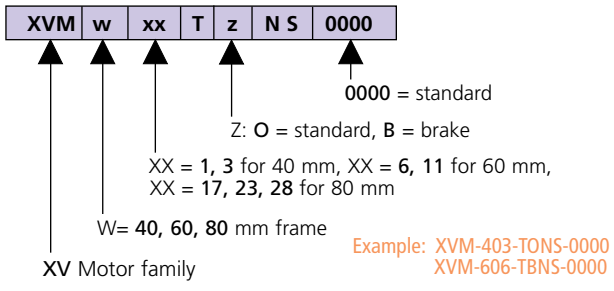
Epsilon EP
230V XV Motor Selection (40, 60, 80 mm)

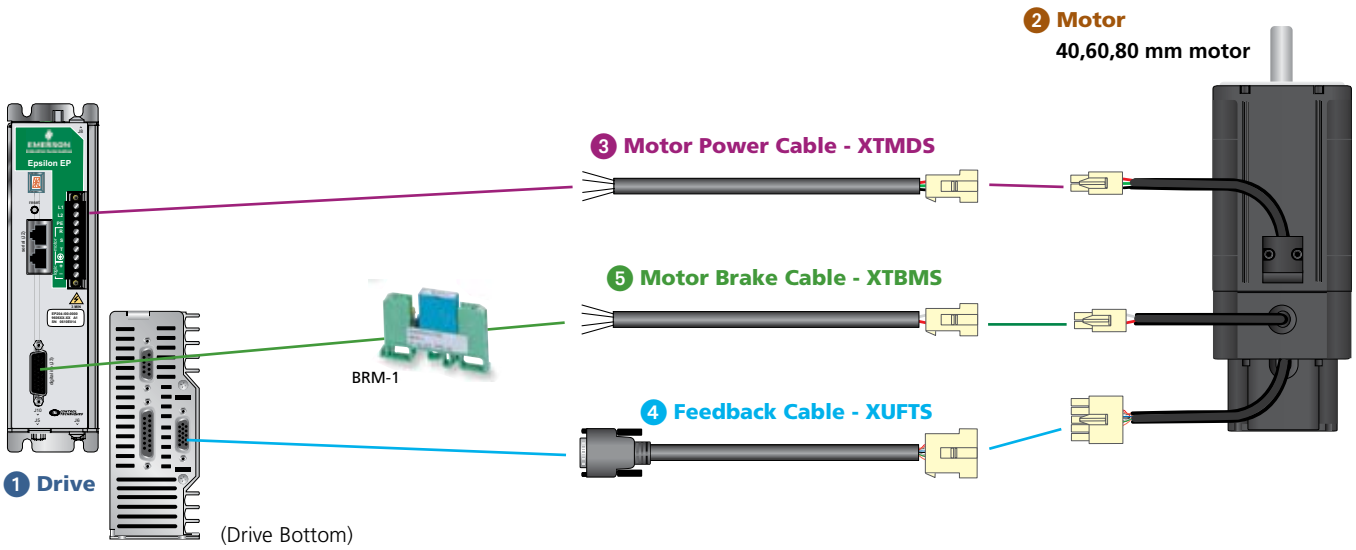
The new XV Servo Motor line delivers high-performance, low inertia, and high torque in a compact motor package. It offers a low cost solution with the features of a premium priced servo offering. Intended for higher throughputs and smaller machines, XV motors are available in four frame sizes: 40, 60, 80 and 130 mm with speeds ranging from 2000 to 5000 rpm.

System torque range from 0.84 lb-in (.09 Nm) to 101 lb-in (11.4 Nm).

XV motors are CE, UL and RoHS approved.

Order String





Servo System Order Guide

❶ Drive Model x=B,I,P cc=00, DN or PB	❷ Motor Model (y: O=standard, B=Brake)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
EP202-xcc-EN00	XVM-401-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
	XVM-403-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
	XVM-606-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
EP204-xcc-EN00	XVM-6011-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
	XVM-8017-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
	XVM-8023-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx
EP206-xcc-EN00	XVM-8028-TyNS-0000	XTMDS-xxx	XUFTS-xxx	XTBMS-xxx

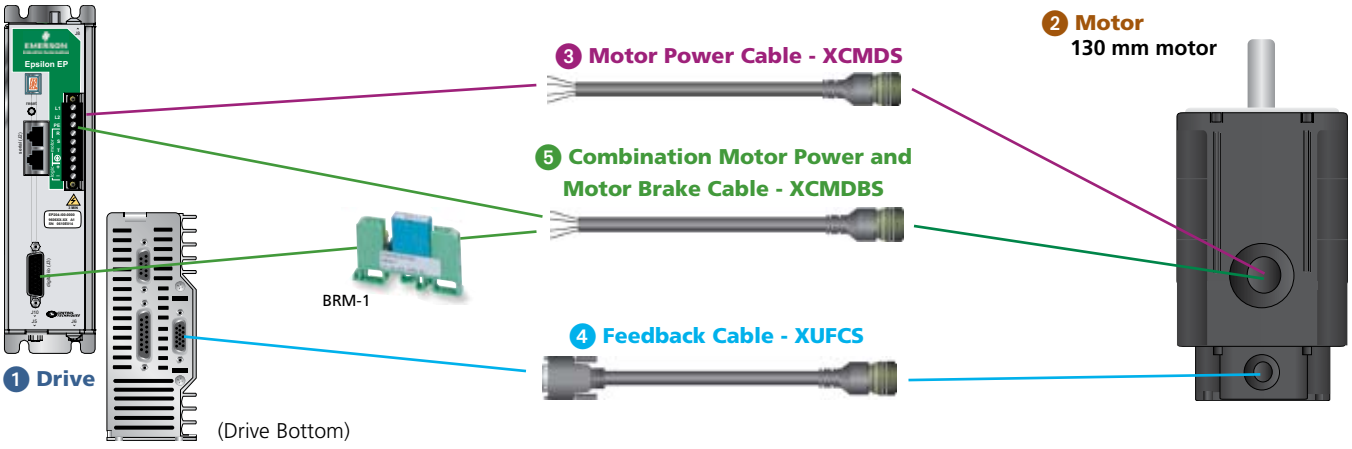
Epsilon EP
230V XV Motor Selection (130 mm)

Order String

XVM	130	xx	C	x	N S	0000

- 0000 = standard
- Z: O = standard, B = brake
- XX = 46, 51, 68, 89, 101 for 130mm
- XV Motor family

Example: XVM-13046-CONS-0000
XVM-130101-CBNS-0000



For additional motor information see Motors.
For additional cable options see Options.

Servo System Order Guide

❶ Drive Model x=B,I,P cc=00, DN or PB	❷ Motor Model	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Power Brake Cable (xxx=feet)
EP204-xcc-EN00	XVM-13051-CONS-0000	XCMDS-xxx	XUFCS-xxx	
	XVM-13051-CBNS-0000		XUFCS-xxx	XCMDBS-xxx
EP209-xcc-EN00	XVM-13068-CONS-0000	XCMDS-xxx	XUFCS-xxx	
	XVM-13068-CBNS-0000		XUFCS-xxx	XCMDBS-xxx
EP206-xcc-EN00	XVM-13089-CONS-0000	XCMDS-xxx	XUFCS-xxx	
	XVM-13089-CBNS-0000		XUFCS-xxx	XCMDBS-xxx
EP209-xcc-EN00	XVM-130101-CONS-0000	XCMDS-xxx	XUFCS-xxx	
	XVM-130101-CBNS-0000		XUFCS-xxx	XCMDBS-xxx

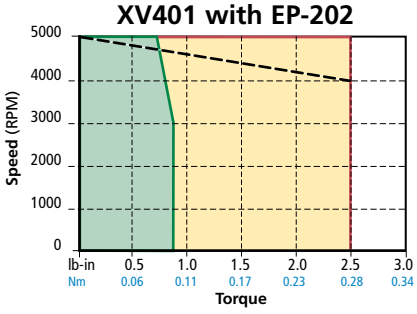
Epsilon EP - 230V XV Motor Specifications

Drive Model EP	Motor Model*	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.** Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/ krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
-202	XV-401	0.84	2.58	0.80	0.06	5000	2048	0.0000097	7.80	0.89	0.7
		0.09	0.29	0.09	0.05			0.011		0.10	0.3
-202	XV-403	2.81	8.51	1.90	0.15	5000	2048	0.00004	12.70	2.24	1.1
		0.32	0.96	0.21	0.11			0.045		0.25	0.5
-202	XV-606	5.60	16.54	4.50	0.36	5000	2048	0.000161	29.20	3.76	2.4
		0.63	1.87	0.51	0.27			0.182		0.42	1.1
-204	XV-6011	11.30	33.20	8.50	0.67	5000	2048	0.000284	29.50	4.15	3.5
		1.28	3.75	0.96	0.50			0.321		0.47	1.6
-204	XV-8017	16.90	40.00	15.00	1.19	5000	2048	0.00096	35.20	5.00	5.4
		1.91	4.52	1.69	0.89			1.092		0.56	2.4
-204	XV-8023	23.30	50.56	20.00	0.95	3000	2048	0.001335	44.60	6.32	6.9
		2.63	5.71	2.26	0.71			1.509		0.71	3.1
-206	XV-8028	28.20	72.41	17.70	1.40	5000	2048	0.001705	39.20	5.57	8.3
		3.19	8.18	2.00	1.05			1.927		0.63	3.8
-206	XV-13046	46.50	100.23	40.00	1.90	3000	2048	0.010611	53.10	7.71	15.8
		5.25	11.33	4.52	1.42			11.99		0.87	7.2
-204	XV-13051	50.60	102.96	39.00	1.24	2000	2048	0.010611	85.80	12.87	15.8
		5.72	11.63	4.41	0.92			11.99		1.45	7.2
-209	XV-13068	67.50	136.62	57.00	2.71	3000	2048	0.015345	54.20	7.59	19.1
		7.63	15.44	6.44	2.02			17.34		0.86	8.7
-206	XV-13089	88.80	202.41	75.00	2.38	2000	2048	0.015345	94.60	15.57	21.3
		10.03	22.87	8.47	1.77			17.34		1.76	9.7
-209	XV-130101	101.00	249.84	85.00	2.70	2000	2048	0.020072	90.00	13.88	22.4
		11.41	28.23	9.60	2.01			22.68		1.57	10.2

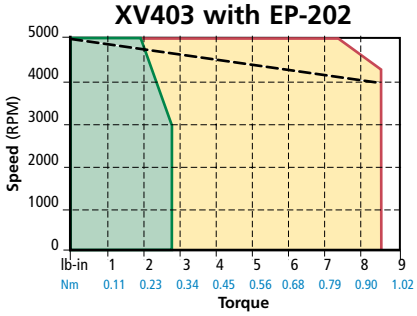
*See order guide on previous page for complete motor model number.
**Rated Speed = maximum operating Speed

Epsilon EP - 230V XV Motor Speed Torque Curves

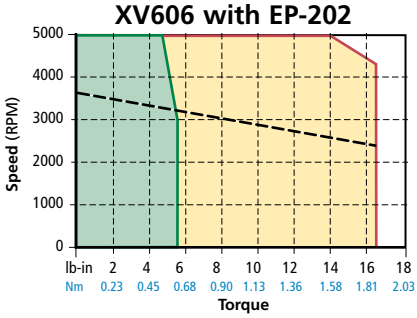
XV401 with EP-202



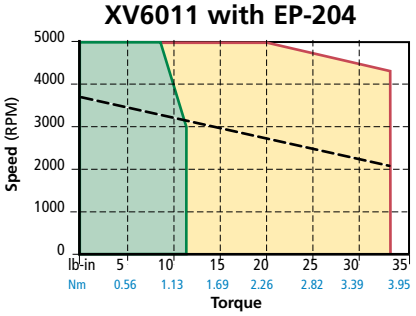
XV403 with EP-202



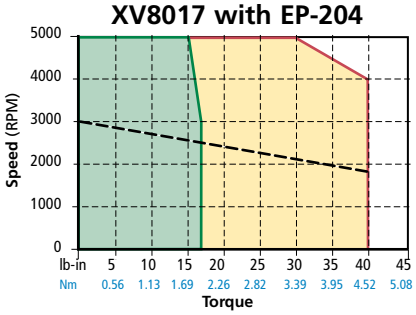
XV606 with EP-202



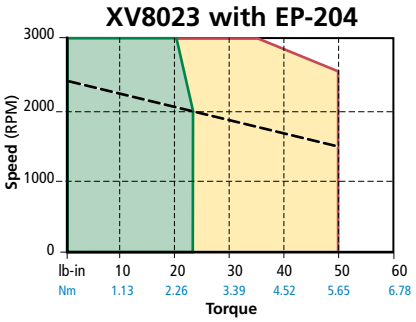
XV6011 with EP-204



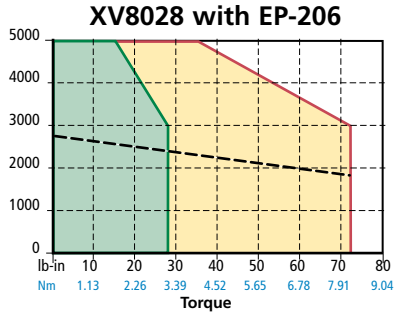
XV8017 with EP-204



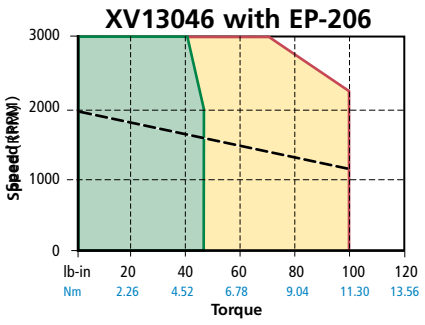
XV8023 with EP-204



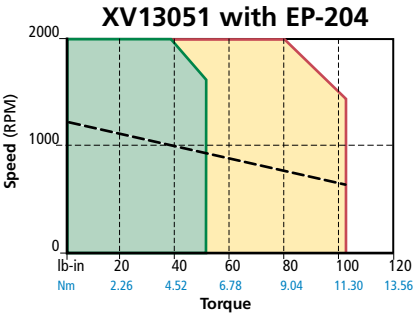
XV8028 with EP-206



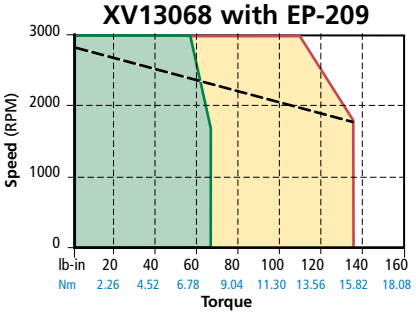
XV13046 with EP-206



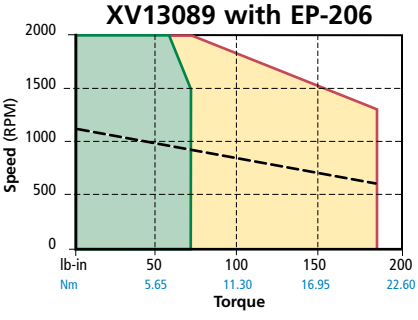
XV13051 with EP-204



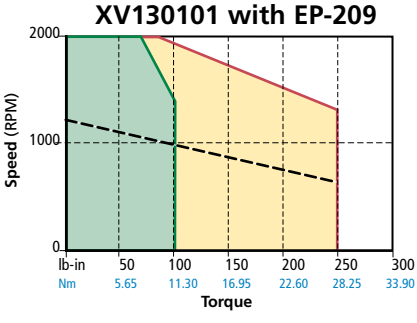
XV13068 with EP-209



XV13089 with EP-206



XV130101 with EP-209



Legend

- Continuous Torque
- Peak Torque
- 120V Curve

SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	10 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	75°C (167°F)

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

Epsilon
1st Generation Compact Drive

The Epsilon Series is a compact digital servo drive in the Control Techniques lineup. Designed to fit in cabinets as small as six inches (152 mm) deep, with cables attached, Epsilon drives possess the rugged quality and reliability found in our larger drive series.

There are three ratings of each Epsilon drive: 2 Amp, 3 Amp and 5 Amp, with the largest drive delivering up to 40 lb-in continuous torque. Each drive contains a 14-segment status display, reset button, removable connectors and utilizes standard "D" type connectors.

- **90 to 264 VAC 1Ø input power**
- **Up to 40 lb-in continuous torque**
- **Drive options: Base, Indexing, and Indexing with DeviceNet**
- **Easy install, setup and operation**
  - **Compact, space saving design, six-inch (152 mm) panel depth including cables**
  - **Pluggable connectors, Standard D-Shell and Screw Terminals**
  - **State-Space Observer Control, which allows 10-1 inertia mismatch out of the box, and 50-1 with tuning**
  - **Free PowerTools software, and upgrades**
- **Programmable, optically-isolated I/O**
- **RS232/485 serial communication interface using Modbus protocol**
- **14-segment status and diagnostic display, time-stamping of last 10 faults for easy troubleshooting**
- **Field programmable flash memory firmware (upgrades are free)**
- **Auto-Tune support for any servo motor with encoder feedback**
- **24 VDC auxiliary input for logic backup**



This Epsilon drive is fully supported and available for customers who prefer not to change their existing design. However, the Epsilon EP is a new, more powerful, lower priced replacement for the Epsilon.

The Epsilon is available as a base drive, the Epsilon Eb; or as a single-axis positioning, indexing drive, the Epsilon Ei. The Epsilon Ei is also available as DeviceNet-ready drive, the Epsilon Ei-DN.

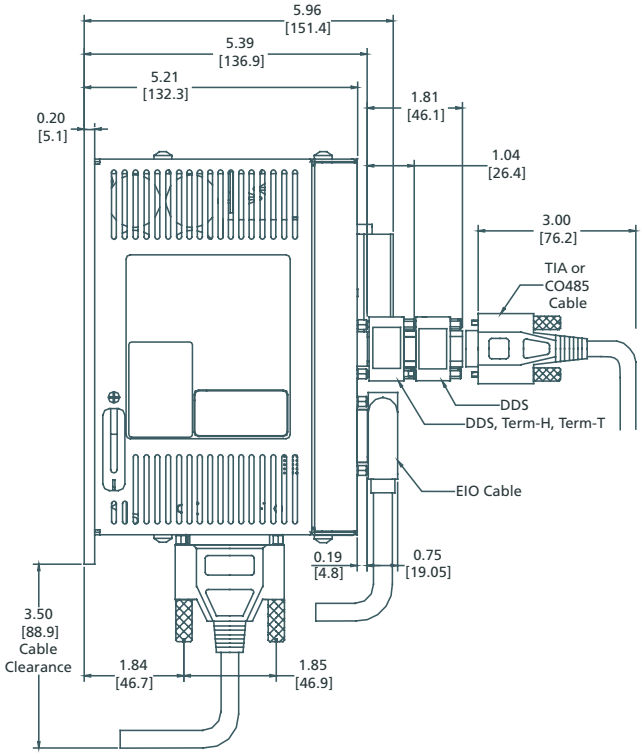
The Epsilon is very easy to commission and program using PowerTools FM software. This Windows-based programming environment makes extensive use of drag and drop editing, tabbed setup screens and hierarchical views. Online help is a mouse click away to answer any questions. Application notes, programming examples and the current version of PowerTools FM software can be downloaded from our web site at no charge. PowerTools FM is used to select the operating mode and motor, configure I/O, set velocity limits and torque levels, and monitor drive and I/O Status.

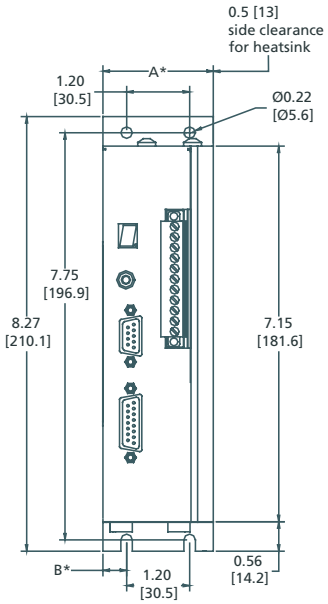
The Base drive can be configured in seven operating modes: Analog Torque, Analog Velocity, Preset Velocity, Preset Velocity + Analog Velocity, Pulse/Pulse, Pulse/Direction and Pulse/Quadrature. For positioning, the indexing version is your choice. The indexing drive gives you 16 Indexes with chaining and linking capability, jogging, a multitude of homing routines, and user units.

Communication is done via RS232 or RS485 Modbus RTU, which is standard on all Control Techniques drives. DeviceNet is available as an option on the indexing model, Ei-DN. The Epsilon is designed to run with Control Techniques NT, MG, EZ Unimotors and FM motors (the EZ Unimotor replacement) and can easily be configured for use with third party motors.

2 YEAR Digital Drive Warranty
5 YEAR Extended Warranty
CE
c UL us LISTED
FREE Software
DeviceNet
MODBUS

EPSILON SPECIFICATIONS AND DIMENSIONS





Go to **Power CD** for complete data

Drive Model	Dimension A	Dimension B
Ɛ-202	2.10 [53.3]	.45 [11.4]
Ɛ-203	2.10 [53.3]	.45 [11.4]
Ɛ-205	3.56 [90.42]	.70 [17.78]

Power Requirements

AC Input Voltage: 1Ø, 90 to 264 VAC, 47 - 63 Hz (240 VAC for rated performance)

AC Input Current

Ɛ-202: 4.3 Arms (140A for 2ms inrush)
Ɛ-203: 6.5 Arms (140A for 2ms inrush)
Ɛ-205: 10.8 Arms(140A for 5ms inrush)

Output Continuous Current (RMS)

Ɛ-202: 1.8 Arms
Ɛ-203: 3 Arms
Ɛ-205: 5 Arms

Output Peak Current (for 4 seconds)

Ɛ-202: 3.6A
Ɛ-203: 6A
Ɛ-205: 10A

Continuous Output Power

Ɛ-202: 0.7 kW
Ɛ-203: 1.2 kW
Ɛ-205: 2.0 kW

Switching Frequency 20 kHz

Logic Supply Internal

Auxiliary Logic Supply +18 to 30 VDC @ 0.5A

Encoder Supply Output +5 VDC, 250 mA

System Efficency 93%

Cooling Method

Ɛ-202: Convection
Ɛ-203: Convection
Ɛ-205: Convection

Regeneration

Internal Energy Absorption (115V)

Ɛ-202: 41 Joules
Ɛ-203: 41 Joules
Ɛ-205: 113 Joules

Internal Energy Absorption (230V)

Ɛ-202: 18 Joules
Ɛ-203: 18 Joules
Ɛ-205: 48 Joules

External: Connection to RSR-2 with external resistor, 20 Ohm min, 15 Arms, 2 kW

Drive Control Inputs

Analog: (1) +/-10 VDC, 14 bit, 100 kOhm, Differential

Analog Max. Input Rating: Differential +/-14 VDC, Each Input with Reference to Analog Ground +/-14 VDC

Digital: (5) +10 to 30 VDC, 2.8 kOhm, Sourcing, Optically Isolated

Pulse: (1) Differential RS422, 2 mHz/Channel, 50% Duty Cycle

Single Ended: (1) TTL Schmitt Trigger 1 MHz/ Channel, 50% Duty Cycle

Motor Overtemperature: 0 to +5 VDC, 10 kOhm, single ended

Drive Control Outputs

Analog: (2) +/-10 VDC, 10 bit, Single-ended 20 mA

Digital: (3) +10 to 30 VDC, 150 mA, Sourcing Optically Isolated

Pulse: Differential RS422 and TTL compatible, 20 mA/Channel Sink or Source

I/O Supply: +10 to 30 VDC

Environmental

Rated Ambient Temperature: 32° to 104°F (0° to 40°C) for rated performance

Maximum Ambient Temperature: 32° to 122°F (0° to 50°C) with power derating of 3.5%/1.8F (1°C) above 104°F (40°C)

Rated Altitude: 3280' (1000 m)

Maximum Altitude: For altitudes >3280' (1000 m) derate output by 1%/328' (100 m)

Vibration: 10 to 2000 Hz @ 2 g

Humidity: 10 to 95% non-condensing

Storage Temperature: -13° to 167°F (-25° to 75°C)

Ingress Protection: IP-20

Serial Interface

RS232/RS485 Modbus RTU w/ 32-bit extension — 9600 to 19.2 kBaud

Internal RS232 to RS485 Converter

Drive Weight

Ɛ-202: 3.3 lb (1.5 kg)
Ɛ-203: 3.3 lb (1.5 kg)
Ɛ-205: 3.7 lb (1.7 kg)

DeviceNet (Optional)

Power Consumption: 25 mA
Baud Rateds: 125, 250 and 500 kps
Node Addresses: 00-63
Messaging: Explicit and Polled I/O



The compact Universal AC drive

Unidrive SP Size Zero

Unidrive SP
Solutions Platform

THE BENCHMARK

Unidrive SP is the true Solutions Platform, offering a wide range of distributed or centralized motion control solutions, giving users unparalleled performance and flexibility. Powering this capability is the SM-EZMotion and SM-Application Plus motion modules, which provide the choice of "Motion Made Easy"™ or Advanced IEC1131 programming.

Unidrive SP with motion functionality

The Unidrive SP features dynamic servo performance with a wide array of power, motor types and snap-in Solution Modules including; programming platforms, distributed or centralized control, I/O, communications and feedback to tailor the solution to your exact needs. For full details on the wide range of solution modules please see the AC Options & Accessories at the end of the AC Drives section.



- Unidrive SP complete power range
- 2 x Programmable Analog Inputs
  - 0-10V or +/-10V
  - 0-20 mA or 4-20 mA
  - Motor Temp input on channel 3
- 1 x 16-bit High Resolution 250 µsec Analog Input
- 3 x 24 VDC digital inputs
- 3 x 24 VDC selectable input/output
- 1 x Relay Output
- 1 x Universal Encoder feedback including
  - Stegmann absolute Sin/Cos with Hiperface
  - Heidenhain absolute Sin/Cos with Endat
  - SSI
  - Incremental Quadrature
  - Endat
- Auto-Tune
- Software Oscilloscope
- Three Expansion Slots
- Expandable I/O
- Safe Torque Off
- Flexible Communications Modules (Modbus RTU standard)

MODBUS TCP/IP

PROFIBUS

EtherNet/IP

MODBUS

EtherCAT

DeviceNet

CANopen



ISO 9001:2000 APPROVAL

c UL us LISTED

2 YEAR DRIVE Warranty

5 YEAR Extended Warranty

FEATURE
Performance Advantage

Dual Duty Ratings–Normal and Heavy
Provides cost effective sizing choices for all applications.

48 VDC Main Power Supply Input
Ideally suited for elevator rescue and machine tool set up.

24 VDC Auxiliary Power Supply Input
Provides an additional means of maintaining control, fieldbus and position loop on mains loss

Comprehensive Auto-Tune
Inertia monitoring and static auto-tune reduce startup time.

Universal Feedback Interface
Supports 14 different feedback configurations, including several absolute encoders. No need for additional components.

High Resolution Analog Input
16-bit, 250 µsec interface for high performance applications. Two additional 10-bit analog inputs for low level controls.

Extensive Fieldbus Connectivity
Modbus RTU (Standard), Profibus-DP (12 Mbit), Ethernet, DeviceNet, CAN, CANopen, EtherCAT, Interbus-S and CTNet optional via zero-space SM modules. Up to four fieldbuses can connect to a single drive, eliminating the need for expensive gateways.

Universal Option Slots
Unidrive SP size zero has 2 slots, sizes one and up have 3 option module slots. SM-Fieldbus, and Application modules fit in any of the open option slots.

Safe Torque Off Function
Conforms to IEC954-1 Category 3 for machine safety with system cost reduction.

SmartCard for Simple Setup and Cloning
Easy-to-use card stores drive configuration for simple startup and parameter cloning. Supplied free with Unidrive SP.

Keypad Options
Choose no keypad, LED keypad or LCD keypad based on the system design and operating environment.

Drive Mounted Brake Resistor
Unidrive SP sizes 0, 1 and 2 feature a drive mounted brake resistor option to reduce panel space requirements.

Unidrive SP
Motion Control



DECENTRALIZED CONTROL

SM-Register



SM-EZMotion



CENTRALIZED CONTROL

CTNET SOLUTION

SM-APPLICATIONS PLUS



CTSYNC



CTNet I/O

SM-APPLICATIONS

COMMUNICATIONS

SM-Profibus



PROFIBUS

SM-DeviceNet



DeviceNet

I/O

FEEDBACK

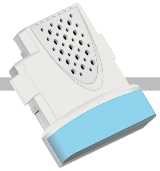
SM-UNIVERSAL ENCODER PLUS



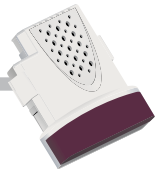
SM-ENCODER PLUS



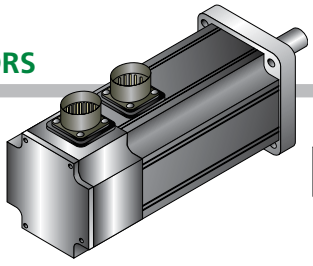
SM-RESOLVER



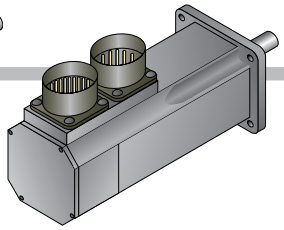
SM-ENCODER OUTPUT PLUS



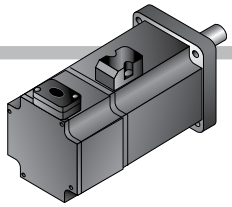
MOTORS



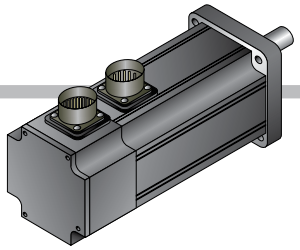
FM Motor



NT Motor



XV Motor



MG/MH Motor

CONTROL TECHNIQUES

SM-APPLICATIONS LITE V2



SM-APPLICATIONS PLUS



CTNET
CTSYNC

MOTION CONTROL SOFTWARE

PowerTools Pro

SyPTPro

CTSoft

MOTIONPerfect2

MC206X



MC224



S PLUS

SM-Ethernet



Ethernet

SM-SERCOS



SERCOS interface

SM-EtherCAT



EtherCAT



CTVue



SM-I/O Plus



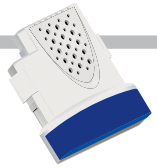
SM-I/O Lite



SM-I/O Timer



SM-I/O 32



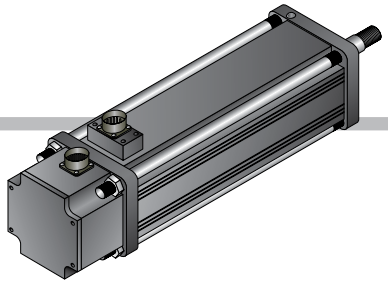
SM-I/O 24V



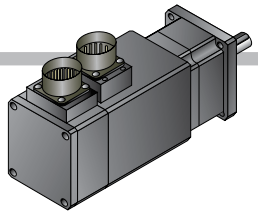
SM-I/O 120V



SM-PLEV



Linear Actuator



Gear Motor



Linear Motor



Vector Motor

Unidrive SP
Base Servo Mode



The base Unidrive SP can be easily controlled with single and multi-axis controllers, PLC's and host controllers for medium to high power applications requiring absolute feedback. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The drive can be controlled over a SERCOS or Profibus network with the addition of an SM-SERCOS or SM-Profibus solution module.

Drive setup parameters can be easily stored on a credit card sized SmartCard. Simple sequencing logic can be accomplished using the onboard ladder editor. Configuration and diagnostics is done using the free CTSoft software tool.

- **Unidrive SP complete power range**
- **2 x Programmable Analog Inputs**
  - **0-10V or +/-10V**
  - **0-20 mA or 4-20 mA**
  - **Motor Temp input on channel 3**
- **1 x 16 bit High Resolution 250 µs Analog Input**
- **3 x 24 VDC digital inputs**
- **3 x 24 VDC selectable input/output**
- **1 x Relay Output**
- **1 x Universal Encoder feedback**
- **Auto-Tune**
- **Software Oscilloscope**
- **Three Expansion Slots**
- **Expandable I/O**
- **Safe Torque Off**
- **Flexible Communications Modules (Modbus RTU standard)**

SM-RESOLVER



- Transformation ratio 3:1 or 2:1

SM-UNIVERSAL ENCODER PLUS



- Supports 14 encoder types
- Easily add additional reference axis
- Input and Output

SM-ENCODER PLUS



- Additional quadrature incremental encoder input

SM-ENCODER OUTPUT PLUS



- Includes Encoder power supply
- Incremental Encoder Output

SM-ETHERCAT



- Real-time Industrial Ethernet
- Dual RJ45 ports, 100Mb

SM-SERCOS



- Up to 16 Mb transfer rate
- Class B Fiber Optic SERCOS compliant

ADDITIONAL I/O CAPABILITIES

- SM-I/O Plus, SM-I/O 32, SM-I/O Lite, SM-I/O 120V, SM-I/O 24V, SM-I/O Timer, SM-I/O PELV

For more details see the Unidrive SP Solution Module pages in the Unidrive SP area of the AC Drive Section.

Unidrive SP
Scalable Applications & Motion Functionality



Unidrive SP is the true Solutions Platform, offering a wide range of distributed or centralized motion control solutions, giving users unparalleled performance and flexibility. Powering this capability is the SM-EZMotion and SM-Application Plus motion modules, which provide the choice of "Motion Made Easy"™ or Advanced IEC1131 programming.

Unidrive SP with motion functionality

The Unidrive SP features dynamic servo performance with a wide array of power, motor types and snap-in Solution Modules including; programming platforms, distributed or centralized control, I/O, communications and feedback to tailor the solution to your exact needs.

FLEXIBLE MOTION AND PROGRAMMING SOLUTIONS

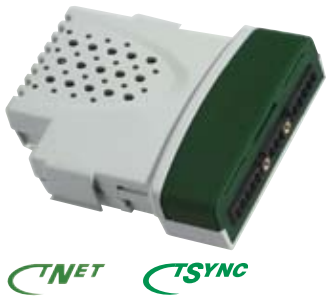
Unidrive SP Base Servo Mode
- **Servo drive with universal flexibility; I/O, connectivity, feedback and power**

SM-APPLICATIONS PLUS
- **Advanced distributed position control**
- **1½ Axis or Multi-Axis (synchronized motion control) using CTNet with user configurable RS485 port and high speed I/O**
- **Open IEC1131 based SyPT programming software**
- **Extensive applications based function block library with PLCopen funtionality**
- **Complete machine control capable with powerful PLC Functionality**

SM-EZMOTION
- **Simple to use distributed position control**
- **1½ Axis motion control**
- **Free "Motion Made Easy" PowerTools Pro software**
- **PowerTools Pro includes a simple yet powerful basic programming language and intuitive drag and drop interface**

MOTION COORDINATOR (MC) CONTROLLER
- **Powerful centralized motion control**
- **Interpolation; linear, circular, helical**
- **2 to 24 axis**
- **Centralized motion programming with MotionPerfect2 software**

SM-Applications Plus



CTNET CTSYNC

SM-Applications Plus Terminals	
Pin Number	
1	0V RS485
2	RX/
3	RX
4	TX/
5	TX
6	A
7	Shield
8	B
9	0V Digital I/O
10	Input 0 - Freeze
11	Input 1
12	Output 0
13	Output 1

SM-EZMotion



SM-EZMotion Terminals		
	Pin Number	Signal
	1	0V Common
High Speed Capture Inputs	2	Input 1
	3	Input 2
	4	Input 3
	5	Input 4
	6	Output 1
	7	Output 2

MC Controller Series



SERCOS interface

Unidrive SP

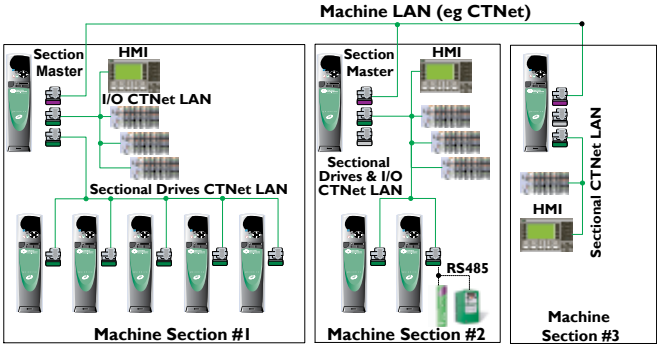
CTNet & CTSync for Multi-Axis Motion Control Synchronization



Motion control, power, performance & flexibility are made possible with these two powerful networking tools. In addition to connecting with almost any fieldbus, the Unidrive SP provides a complete HMI, I/O, and drive machine solution based on CTNet. The CTNet solution can handle even the most complex motion applications while still ensuring components seamlessly work together. The decentralized SM-Applications Plus modules, with CTNet and CTSync provide the greatest flexibility while optimizing available communication bandwidth.

CTNET

CTNet is a proven motion network based on the open ARC protocol standard. CTNet is a decentralized peer to peer system requiring no PLC master controller. Each intelligent node takes turns using a proven token ring data link technology. The integration of drive, HMI, and I/O provide customers with a complete CTNet solution.



See page 381 for complete CTNet integration details.

CTSYNC

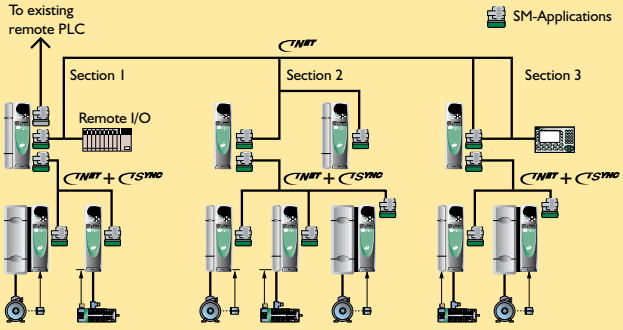
CTSync is standard on SM-Applications Plus and provides drive to drive clock synchronization. The combination of CTSync and decentralized SM-Applications Plus modules, which have CTNet standard, provides true parallel multitasking. Whereas, centralized control systems are inherently preemptive multitasking due to having one processor. Coordinated multi-axis control with < 4 µsec jitter, provides very precise solutions for fast respond in demanding multi-axis applications.

CTNET I/O



The CTNet I/O is a simple and flexible IP20 Din rail mountable I/O. The I/O consist of a CTNet Bus coupler and snap-on I/O terminals. There are a variety of digital and analog snap-on terminals to meet specific application needs. One Bus coupler is capable of 256 digital inputs or outputs and up to 100 analog inputs and outputs.

Example of Decentralized Control



UNIDRIVE SP CURRENT RATINGS

Unidrive SP		Continuos Output Current	Peak Output Current
208/230 VAC		Heavy Duty	
Order Code	Frame	I_H (A)	Closed loop (A)
SP0201-XXX	0	2.2	3.9*
SP0202-XXX		3.1	5.4*
SP0203-XXX		4	7*
SP0204-XXX		5.7	10.2*
SP0205-XXX		7.5	13.1*
SP1201-XXX	1	4.3	7.5
SP1202-XXX		5.8	10.1
SP1203-XXX		7.5	13.1
SP1204-XXX		10.6	18.5
SP2201-XXX	2	12.6	22.0
SP2202-XXX		17	29.7
SP2203-XXX		25	43.7
SP3201-XXX	3	31	54.2
SP3202-XXX		42	73.5
SP4201-XXX	4	56	98
SP4202-XXX		68	119
SP4203-XXX		80	140

Unidrive SP		Continuos Output Current	Peak Output Current
380/480 VAC		Heavy Duty	
Order Code	Frame	I_H (A)	Closed loop (A)
SP0401-XXX	0	1.3	2.3
SP0402-XXX		1.7	3.0
SP0403-XXX		2.1	3.6
SP0404-XXX		3	5.2
SP0405-XXX		4.2	7.3
SP1401-XXX	1	2.1	3.6
SP1402-XXX		3	5.2
SP1403-XXX		4.2	7.3
SP1404-XXX		5.8	10.1
SP1405-XXX		7.6	13.3
SP1406-XXX		9.5	16.6
SP2401-XXX	2	13	22.7
SP2402-XXX		16.5	28.8
SP2403-XXX		25	40.2
SP2404-XXX		29	50.7
SP3401-XXX	3	32	56
SP3402-XXX		40	70
SP3403-XXX		46	80.5
SP4401-XXX	4	60	105
SP4402-XXX		74	129.5
SP4403-XXX		96	168
SP5401-XXX	5	124	217
SP5402-XXX		156	273

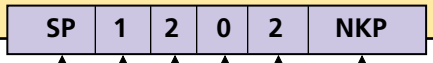
Note: The Unidrive SP Zero is best used for Continuous Duty where the Digitax ST is best used for Pulse Duty.

* Unidrive SP Zero 230 VAC models can operate on single or three phase input power. 175% peak currents are valid only when 3 phase input power is supplied. When supplying single phase input power the maximum peak current is 150%

Note: Motor horsepower ratings are based on typical motor current ratings. Actual motor currents should be checked before selecting a particular drive. For some high efficiency motors, the required full load motor current may allow the selection of a smaller drive than is indicated in the chart. The same consideration would also apply for motors with less common power or voltage ratings.

Heavy Duty	Suitable for demanding applications, current overload is set at up to 175% for 40 seconds. Where motor rated current is less than the drive rated continuous current, higher overloads (200% or greater) are achieved.

Order String



Unidrive SP Product Line
Size 0 to 6 complete inverter drives

Frame Size
Wall Mount sizes range from 0 to 6

Voltage Rating
2 - 200 to 240 VAC
4 - 380 to 480 VAC
5 - 575 VAC
6 - 690 VAC

Configuration
0 - Wall Mount Series

Current Step
Current Rating Step within specified frame size

Keypad Option
NKP - No Keypad
LED - LED Keypad
LCD - LCD Keypad Plus

SPECIFICATIONS

Environment

Ambient Operating Temperature	0° to 40°C (32° to 104°F) 0° to 50°C (32° to 122°F) with derating
Cooling method	Forced convection
Humidity	95% maximum non-condensing at 40°C (104°F)
Storage Temperature	-40° to 50°C (-40° to 122°F)
Altitude	0 to 3000 m (9,900 ft). Derate 1% per 100 m (328 ft) between 1000 m (3280 ft) and 3000 m (9,900 ft).
Vibration	Tested in accordance with IEC 68-2-34
Mechanical Shock	In accordance with IEC 68-2-27
Enclosure	NEMA 1 (IP 20), NEMA 12 (IP 54) through panel mounting
Electromagnetic Immunity	In compliance with IEC801 and EN50082-2, and complies with EN61800-3 with built-in filter
Electromagnetic Emissions	In compliance with EN50081-2 when the recommended RFI filter is used and EMC installation guidelines are followed

AC Supply Requirements

Voltage	200 to 240 VAC ±10% 380 to 480 VAC ±10% 500 to 575 VAC ±10% 500 to 690 VAC ±10%
Phase	3Ø
Phase Imbalance Tolerance	2% negative phase sequence (equivalent to 3% voltage imbalance between phases)
Frequency	48 to 65 Hz
Input Displacement Power Factor	0.93

Control

Carrier Frequency	3, 4, 6, 8, 12,16 kHz
Output Frequency	0 to 3000 Hz (Open loop)
Output Speed	0 to 40,000 RPM (Closed loop)
Frequency Accuracy	±0.01% of full scale
Frequency Resolution	0.001 Hz
Analog Input Resolution	10-Bit + sign (Qty 2); 16-Bit + sign (Qty 1)
Serial Communications	2 or 4-wire RS232 or RS485. Protocol is ANSI x 3.28-2.5-A4, or Modbus RTU Baud rate 300 to 115, 200.
Braking	DC injection braking (stopping and holding) standard. Dynamic braking transistor standard.
Control Power Ride Through	Up to 1 second depending on inertia and decel time

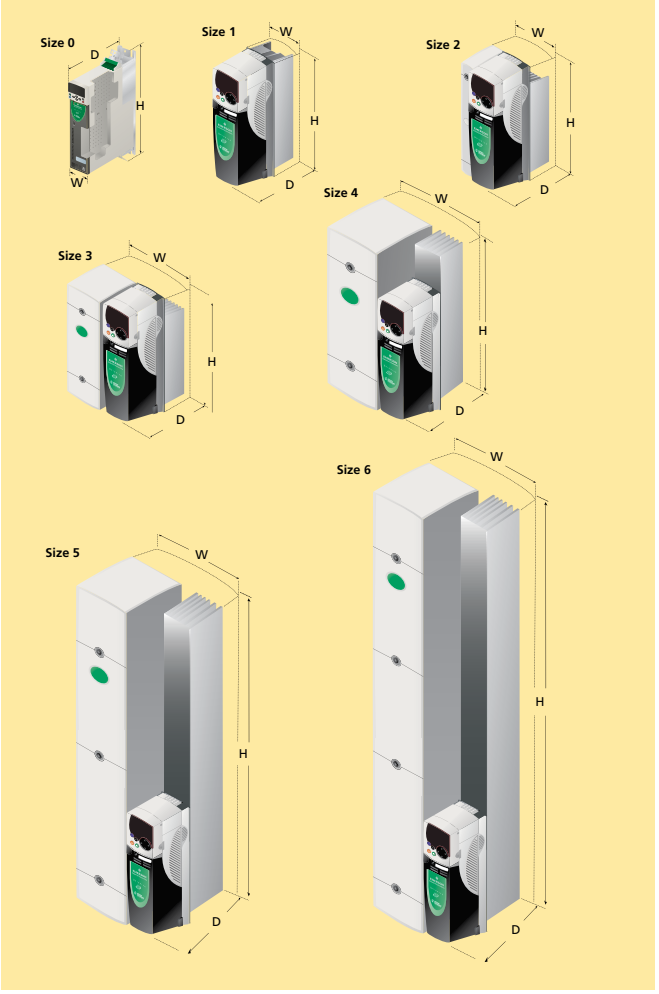
Protection

DC Bus Undervoltage Trip	175 / 350 / 435 VDC (approximately 124 / 247 / 307 VAC line voltage)
DC Bus Overvoltage Trip	415 / 830 / 990 VDC (approximately 293 / 587 / 700 VAC line voltage)
MOV Voltage Transient Protection	160 Joules, 1400 VDC clamping (Line to line and line to ground)
Drive Overload Trip	Current overload value is exceeded. Programmable for Normal Duty or Heavy Duty, Open loop or Closed loop operation
Instantaneous Overcurrent Trip	225% of drive rated current
Phase Loss Trip	DC bus ripple threshold exceeded
Overtemperature Trips	Drive heatsink, control board, and option module(s) monitoring
Short Circuit Trip	Protects against output phase to phase fault
Ground Fault Trip	Protects against output phase to ground fault
Motor Thermal Trip	Electronically protects the motor from overheating due to loading conditions

Approvals & Listings

UL, cUL	UL File #E171230
IEC	Meets IEC Vibration, Mechanical Shock and Electromagnetic Immunity Standards
CE	Designed for marking
NEMA	NEMA 1 enclosure type
VDE	Meets VDE Electromagnetic Emissions Standards
ISO 9002	Certified Manufacturing Facility

DIMENSIONS



Frame Size	H		W		D		Weight	
	in	mm	in	mm	in	mm	lb	kg
0	12.7	322	2.4	62	8.9	226	4.6	2.1
1	15.20	386	3.93	100	8.62	219	12.8	5.8
2	15.32	389	6.10	155	8.62	219	15.4	7.0
3	15.32	389	9.84	250	10.23	260	33.1	15.0
4	21.53	547	12.20	310	11.73	298	66.1	30.0
5	33.75	857	12.20	310	11.73	298	121.3	55.0
6	46.02	1169	12.20	310	11.73	298	165.3	75.0

For through-panel mounting dimensions consult the Unidrive SP User Guide.

Unidrive SP

Positioning - Using Closed Loop Vector Motors



If you need to accurately position the motor, but don't require the high speed and rapid acceleration dynamics of a servo motor, the Unidrive SP with an encoder equipped AC induction motor may be the optimum performance solution.

The flexibility and high performance of the Unidrive SP make it possible to control three phase induction motors on applications that previously demanded higher priced servo motors. Point to point indexing and material handling applications are ideal for utilizing this capability, especially when motors above 5 hp are required. The cost savings is significant due to the lower cost of materials used in the induction rotor design.

AC induction motors have rotors with more mass and larger diameters than servo motors of the same torque capacity, and therefore higher inertia. This is helpful for high load-to-motor inertia ratios, and in most cases can eliminate the need for inertia matching gear reduction. The higher inertia of these systems also results in greater low-speed stability.

Benefits of Vector Motor Positioning

- Overcomes high load inertia mismatches with use of larger AC motors without the expense of large servo motors and/or gear reducers
- Provides precise high-speed positioning when rapid accel/decel rates are not required
- Enables low-cost, error-free closed loop performance in applications that would be cost prohibitive were traditional servo systems used
- Eliminates environmental and maintenance issues associated with hydraulic and pneumatic systems
- Plug-and-play fieldbus integration into full-featured control systems
- Integrated, scalable PLC functionality reduces panel space and wiring costs.
- Simplified programming, quick startup and advanced diagnostics

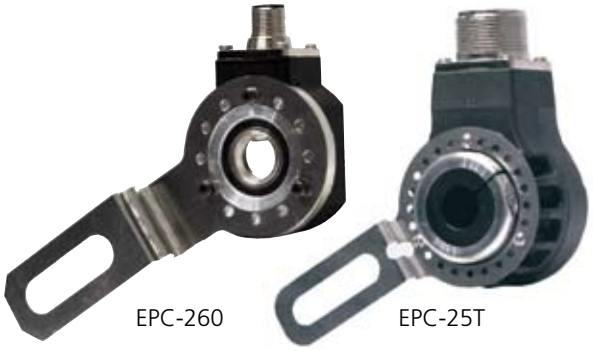
Positioning - Using Closed Loop Vector Motors

Both Unidrive SP motion programming platforms support closed-loop vector motor positioning applications.

"Motion Made Easy", PowerTools Pro software and the SM-EZMotion Module can have your vector positioning application up and running in minutes. Alternatively, our IEC-61131-3-compliant ladder logic and function block programming tool, SyPTPro with either the SM-Applications or SM-Applications Lite modules can be used to take advantage of new, industry-standard PLC Open motion functionality.

Many applications today can benefit from the advanced control capabilities, energy savings, cleanliness, noise reduction and advanced communications that AC Vector Motor Positioning, and the Unidrive SP can provide.

Significant cost and performance advantages are achieved over traditional servo systems, hydraulic and pneumatic solutions. The significant power range of the Unidrive SP provides positioning of closed loop vector motors ranging from 1 to over 2000 hp and powered with a wide range of voltages from 200V to 690V.



EPC-260 EPC-25T

Control Techniques offers a wide selection of Closed Loop Vector motors, which feature an economical incremental encoder and matched cabling. This combination provides users with a "Plug and Play" solution for hundreds of applications that now can be solved using the latest AC motor and control technology to increase performance while lowering overall costs.

CLOSED LOOP VECTOR MOTORS

- **from 1 to 1000 hp**
- **high performance 2000 to 1 speed range**
- **encoder ready with cables**

For complete information on the new ACCU-Torq vector motor see page 85 at the end of the AC Drive Options section.

CTSIZE

To select the correct vector motor for your positioning application, use our free downloadable sizing software, **CTSize**. This simple software tool makes it easy to select the proper motor for your motion application.

More information on CTSize is available in the Software section of this catalog.





ONE SOURCE



1 hp to 25 hp - see the end of the AC Drive Options section for details.

Unidrive SP

NEW **FM**

With FM Motors



FM motors are very smooth, low cogging, medium inertia brushless AC servo motors from Control Techniques. They are 3 phase, 6 or 8 pole, permanent magnet motors exhibiting a sinusoidal back EMF characteristic. Standard options include stack length, parking brake, and cables for motor power and feedback, including incremental, resolver and Sin/Cos absolute encoder.

FM motors can be ordered with smooth shaft or keyed, feedback options, high inertia, and non-standard face plate and shaft diameter options, see the FM motor section for ordering options and details. Standard motors shown are typically stocked.

This motor optimizes torque output and reduces cogging torque. The compact design gives increased torsional stiffness. Laminations and coils are optimized both for high efficiency and to provide low harmonic distortion in the air gap flux. PTC Thermistor for thermal monitoring. IP65 Rated and UL recognized.

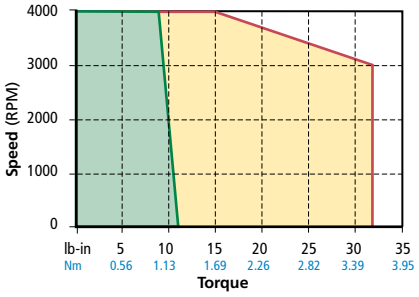
Unidrive SP - 230V FM Motor

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
SP1201	**075E2A400**	10.60	31.86	8.85	0.56	4000	4096	0.00062	44	6.37	7.9
		1.22	3.6	1.00	0.42			0.7		0.72	3.6
SP1201	**075E2B400**	19.50	47.79	15.05	0.95	4000	4096	0.00106	44	6.37	9.7
		2.23	5.40	1.70	0.71			1.2		0.72	4.4
SP1201	**075E2C400**	27.40	47.79	20.35	1.28	4000	4096	0.00142	44	6.37	11.4
		3.10	5.40	2.30	0.96			1.6		0.72	5.2
SP1201	**075E2D300**	34.54	61.73	30.97	1.47	3000	4096	0.00177	57	8.23	13.2
		3.91	6.98	3.50	1.10			2		0.93	6.0
SP1203	**095E2B400**	38.13	83.47	26.55	1.68	4000	4096	0.00257	44	6.37	13.9
		4.32	9.43	3.00	1.26			2.9		0.72	6.3
SP1204	**095E2D400**	66.41	117.9	43.37	2.73	4000	4096	0.00451	44	6.37	19.1
		7.53	13.32	4.90	2.05			5.1		0.72	8.7
SP1204	**115E2C300**	83.25	152.26	71.68	3.39	3000	4096	0.00797	57	8.23	25.5
		9.49	17.21	8.10	2.54			9		0.93	11.6
SP2202	**115E2E300**	135.40	238.68	111.51	5.28	3000	4096	0.01221	57	8.23	33.9
		15.35	26.97	12.60	3.96			13.8		0.93	15.4
SP2203	**142E2D300**	175.21	353.91	139.83	6.61	3000	4096	0.02549	57	8.23	41.6
		19.81	39.99	15.80	4.96			28.8		0.93	18.9
SP2202	**190E2B200**	193.28	359.31	177.00	5.59	2000	4096	0.04310	85.5	12.39	55.7
		21.84	40.60	20.00	4.19			48.7		1.40	25.3
SP3201	**190E2D200**	363.70	669.06	326.57	10.31	2000	4096	0.07646	85.5	0.00	74.6
		41.16	75.60	36.90	7.73			87		1.40	33.9
SP3202	**190E2F200**	519.5	904.47	446.92	14.13	2000	4096	0.10894	85.5	0.00	93.5
		58.7	102.20	50.50	10.60			123.1		1.40	42.5

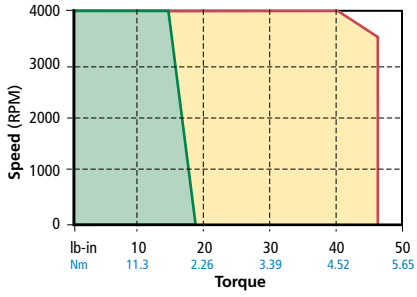
*Rated Speed = Maximum Operating Speed
**See the complete order string in the Servo Motor section.

UNIDRIVE SP - 230V FM Motor Speed Torque Curves

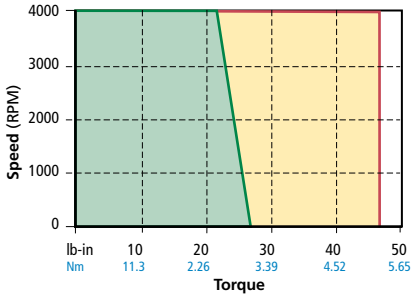
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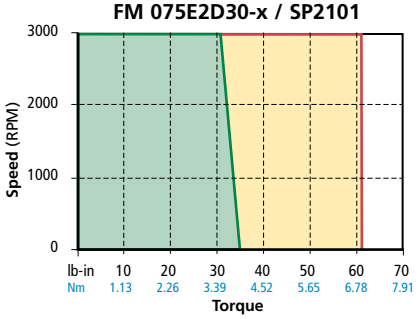
FM 075E2B40-x / SP1201



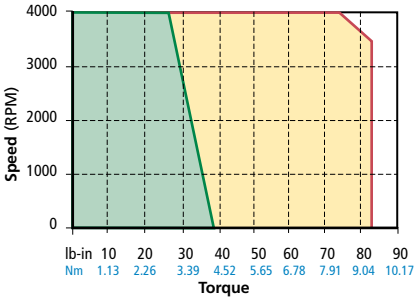
FM 075E2C40-x / SP1201



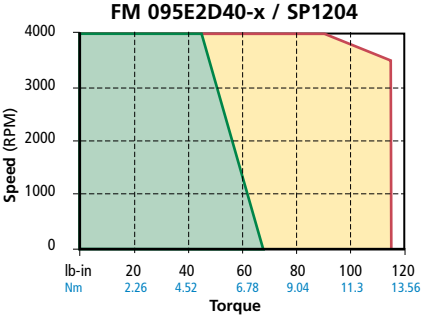
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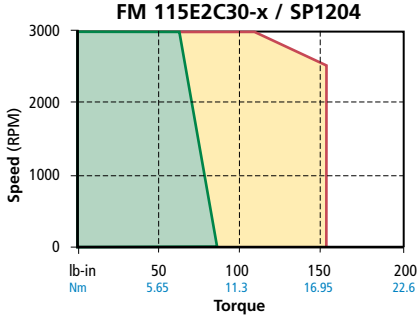
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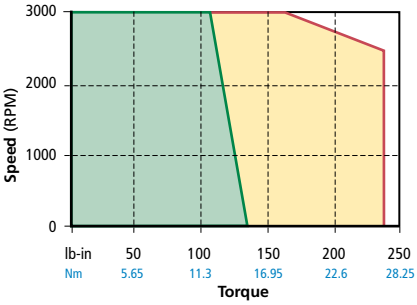
FM 095E2D40-x / SP1204



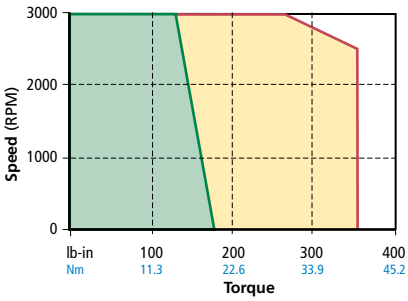
FM 115E2C30-x / SP1204



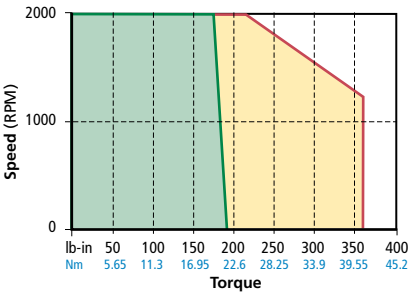
FM 115E2E30-x / SP2202



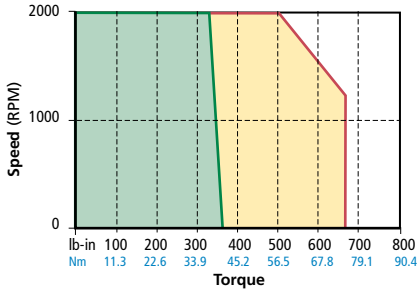
FM 142E2D30-x / SP2203



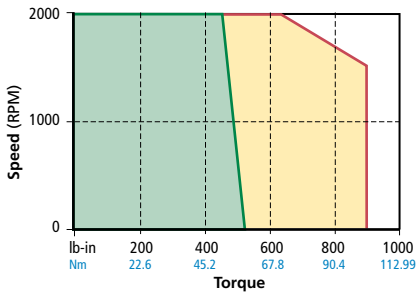
FM 190E2B20-x / SP2202



FM 190E2D20-x / SP3201



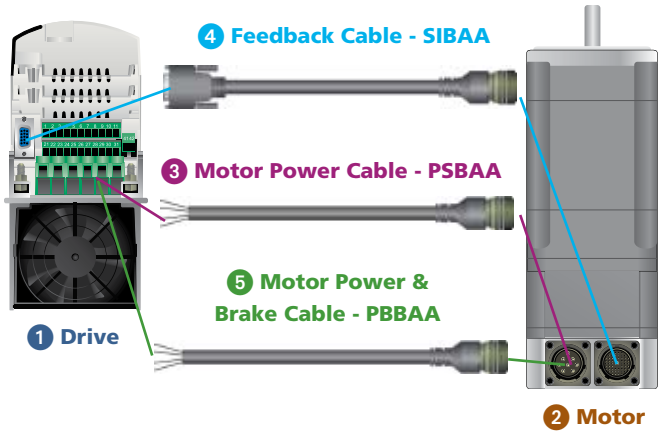
FM 190E2F20-x / SP3202



Notes

- Continuous ratings of the motor are based on 100°C motor case temperature and 40°C ambient with the motor mounted to an aluminum plate.
- Speed torque curves are based on 240 VAC operation at 10 kHz switching frequency.
- All specifications are ±10% due to motor parameter variations.
- Optional motors are available to 6000 RPM.

230V FM MOTOR SELECTION



Order String

xxx	E	2	x	xx	x	B	A	CA	A	BCD*	DIA*

- Frame Size: **075, 095, 115, 142, 190**
- Voltage **E** = 230V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A, B, C, D, E, F, G, H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **B** = 90° Connectors
- Shaft Key: **A** = With Key
- Feedback Device**: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.

** For a complete list of optional feedback devices see the complete order string in the Servo Motor section.

Servo System Order Guide

❶ Drive Model	❷ Motor Model	❸ Motor Power Cable (yyy=length in meters)	❹ Feedback Cable (yyy=meters)	❺ Motor Power/Brake Cable (required w/all brake motors) (yyy=meters)
SP1201	075E2A400 BACAA075110	PSBAA-yyy	SIBAA-yyy	
	075E2A401 BA CAA075110			PBBAA-yyy
SP1201	075E2B400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075E2B401 BACAA075140			PBBAA-yyy
SP1201	075E2C400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075E2C401 BACAA075140			PBBAA-yyy
SP1201	075E2D300 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075E2D301 BACAA075140			PBBAA-yyy
SP1203	095E2B400 BACAA100190	PSBAA-yyy	SIBAA-yyy	
	095E2B401 BACAA100190			PBBAA-yyy
SP1204	95E2D400 BACAA100190	PSBAA-yyy	SIBAA-yyy	
	95E2D401 BACAA100190			PBBAA-yyy
SP1204	115E2C300 BACAA115190	PSBAA-yyy	SIBAA-yyy	
	115E2C301 BACAA115190			PBBAA-yyy
SP2202	115E2E300 BACAA115240	PSBAA-yyy	SIBAA-yyy	
	115E2E301 BACAA115240			PBBAA-yyy
SP2203	142E2D300 BACAA165240	PSBBA-yyy	SIBAA-yyy	
	142E2D301 BACAA165240			PBBBA-yyy
SP2202	190E2B200 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190E2B201 BACAA215320			PBBBK-yyy
SP3201	190E2D200 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190E2D201 BACAA215320			PBBBK-yyy
SP3202	190E2F200 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190E2F201 BACAA215320			PBBBK-yyy

Notes: Drives come with no key pad
Standard motor configuration. (220 VAC, Standard peak torque, No brake, 90° vertical connectors, Keyed shaft, 4096 incremental encoder, standard BCD and Shaft Diameter)
Standard feedback cable for use with incremental encoder and Unidrive SP drive.

Unidrive SP
With 460V FM Motors

UNIDRIVE SP - 460V FM Motor Specifications

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
SP1401	075U2A400	10.62	31.86	8.85	0.56	4000	4096	0.0006195	74	10.62	7.9
		1.20	3.6	1.00	0.42			0.7		1.20	3.6
SP1402	075U2B400	20.18	55.22	15.05	0.95	4000	4096	0.001062	74	10.62	9.7
		2.28	6.24	1.70	0.71			1.2		1.20	4.4
SP1402	075U2C400	27.61	55.22	20.35	1.28	4000	4096	0.001416	74	10.62	11.4
		3.12	6.24	2.30	0.96			1.6		1.20	5.2
SP1402	075U2D300	35.40	73.63	30.97	1.47	3000	4096	0.00177	98	14.16	13.2
		4.00	8.32	3.50	1.10			2		1.60	6.0
SP1405	095U2E400	79.65	141.25	50.45	3.19	4000	4096	0.005487	74	10.62	21.8
		9.00	15.96	5.70	2.39			6.2		1.20	9.9
SP1405	115U2D300	107.62	188.33	92.04	4.36	3000	4096	0.010089	98	14.16	29.7
		12.16	21.28	10.40	3.27			11.4		1.60	13.5
SP1406	115U2E300	134.52	235.06	111.51	5.28	3000	4096	0.012213	98	14.16	33.9
		15.20	26.56	12.60	3.96			13.8		1.60	15.4
SP2401	142U2D300	175.18	321.43	139.83	6.61	3000	4096	0.025488	98	14.16	41.6
		19.84	36.32	15.80	4.96			28.8		1.60	18.9
SP2402	142U2E300	207.15	407.81	159.30	7.53	3000	4096	0.031330	98	14.16	47.7
		23.52	46.08	18.00	5.65			35.4		1.60	21.7
SP2403	190U2C300	274.70	569.23	221.25	10.47	3000	4096	0.0597375	98	14.16	65.1
		31.04	64.32	25.00	7.85			67.5		1.60	29.6
SP2403	190U2D300	354.00	569.23	292.05	13.87	3000	4096	0.076464	98	14.16	74.6
		40.00	64.32	33.00	10.40			86.4		1.60	33.9
SP2403	190U2F200	519.50	853.85	446.92	14.13	2000	4096	0.1089435	147	21.24	93.5
		58.80	96.48	50.50	10.60			123.1		2.40	42.5

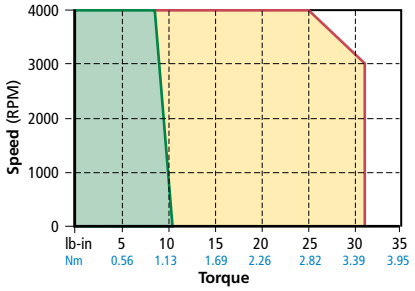
* Rated Speed = Maximum Operating Speed
**See the complete order string in the Servo Motor section.

FM Motor Holding Brake Specifications

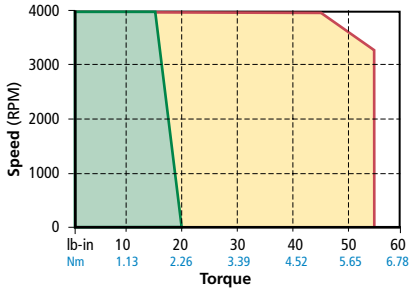
Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released (ms)	Mechanical Engagement Time-Brake Holding (ms)	Added Inertia lb-in-sec²	Added Inertia kg-cm²
75 mm	24	0.26	17.2	2	22	24	0.000027	0.03
95 mm	24	0.67	53.1	6	30	20	0.000257	0.29
115 mm	24	0.67	106.2	12	40	10	0.000434	0.49
142 mm	24	0.96	177	20	85	30	0.00113	1.28
190 mm (A-B)	24	1.04	354	40	95	15	0.00113	1.28
190 mm (C-D)	24	1.04	531	60	120	20	0.00221	2.5

UNIDRIVE SP - 460V FM Motor Speed Torque Curves

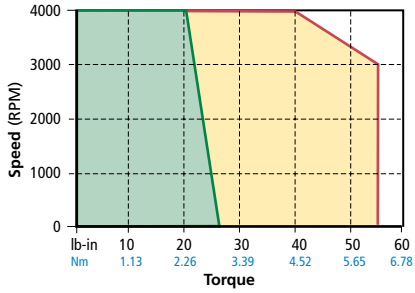
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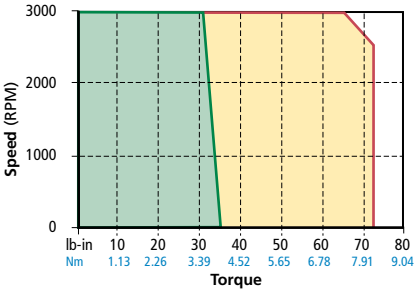
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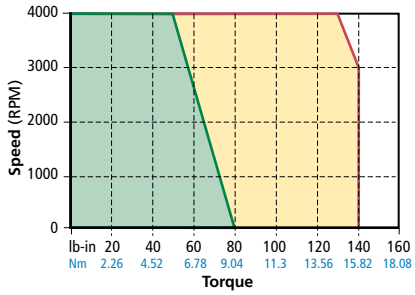
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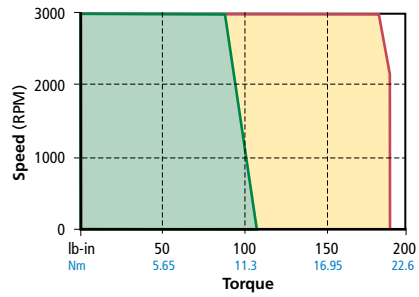
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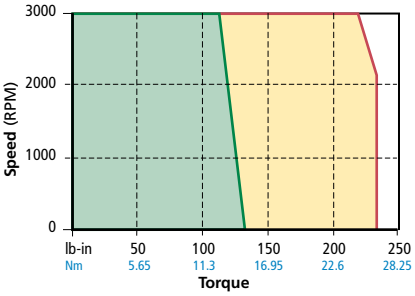
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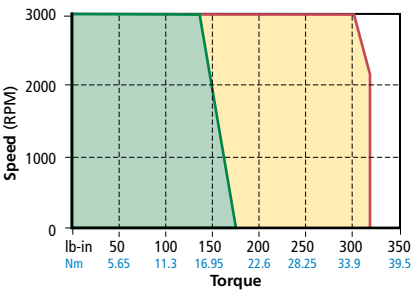
FM 115U2D30-x / SP1405



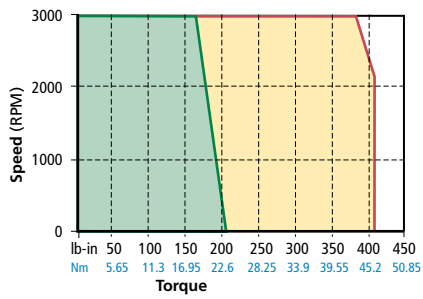
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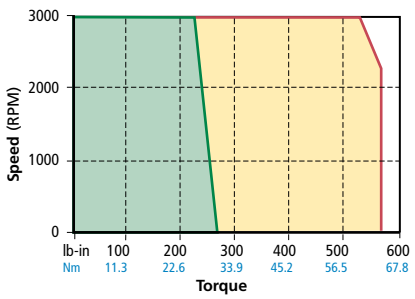
FM 142U2D30-x / SP2401



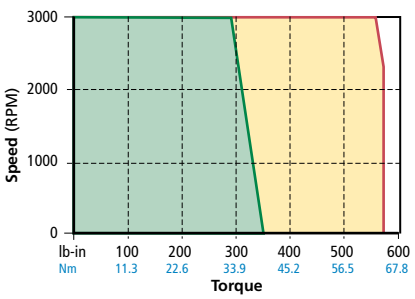
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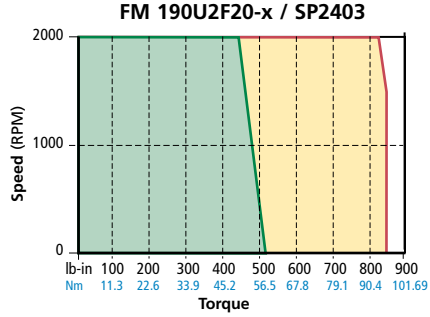
FM 190U2C30-x / SP2403



FM 190U2D300-x / SP2403



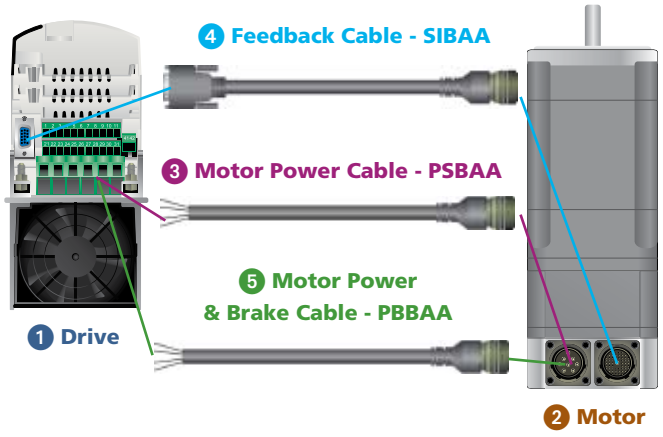
FM 190U2F20-x / SP2403



Notes

- Continuous ratings of the motor are based on 100°C motor case temperature and 40°C ambient with the motor mounted to an aluminum plate.
- Speed torque curves are based on 480 VAC operation at 10 kHz switching frequency.
- All specifications are ±10% due to motor parameter variations.
- Optional motors are available to 6000 RPM.

460V FM MOTOR SELECTION



Order String

xxx	U	2	x	xx	x	B	A	CA	A	BCD*	DIA*

Frame Size: **075, 095, 115, 142, 190**
Voltage **U** = 460V
Peak Torque: **2** = Standard Peak Torque
Stator Length: **A, B, C, D, E, F, G, H**
Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
Brake: **0** = None, **1** = 24 VDC
Connection Type: **B** = 90° Connectors
Shaft Key: **A** = With Key
Feedback Device**: **CA** = 4096 Incremental Encoder
Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.

** For a complete list of optional feedback devices see the complete order string in the Servo Motor section.

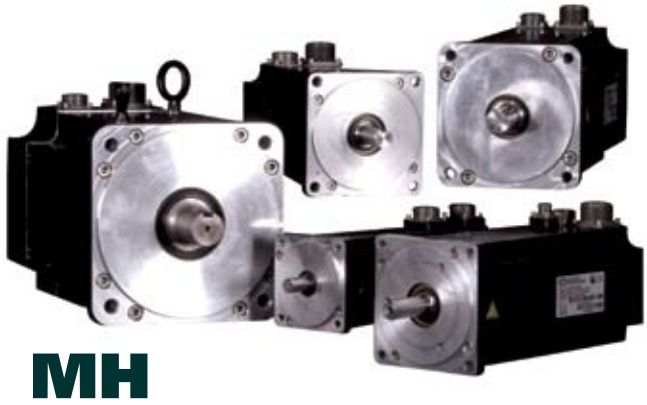
Servo System Order Guide

❶ Drive Model	❷ Motor Model	❸ Motor Power Cable (yyy=length in meters)	❹ Feedback Cable (yyy=meters)	❺ Motor Power/Brake Cable (required w/all brake motors) (yyy=meters)
SP1401	075U2A400 BACAA075110	PSBAA-yyy	SIBAA-yyy	
	075U2A401 BACAA075110			PBBAA-yyy
SP1402	075U2B400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075U2B401 BACAA075140			PBBAA-yyy
SP1402	075U2C400 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075U2C401 BACAA075140			PBBAA-yyy
SP1402	075U2D300 BACAA075140	PSBAA-yyy	SIBAA-yyy	
	075U2D301 BACAA075140			PBBAA-yyy
SP1405	095U2E400 BACAA100190	PSBAA-yyy	SIBAA-yyy	
	095U2E401 BACAA100190			PBBAA-yyy
SP1405	115U2D300 BACAA115240	PSBAA-yyy	SIBAA-yyy	
	115U2D301 BACAA115240			PBBAA-yyy
SP1406	115U2E300 BACAA115240	PSBAA-yyy	SIBAA-yyy	
	115U2E301 BACAA115240			PBBAA-yyy
SP2401	142U2D300 BACAA165240	PSBAA-yyy	SIBAA-yyy	
	142U2D301 BACAA165240			PBBAA-yyy
SP2402	142U2E300 BACAA165240	PSBAA-yyy	SIBAA-yyy	
	142U2E301 BACAA165240			PBBAA-yyy
SP2403	190U2C300 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190U2C301 BACAA215320			PBBBK-yyy
SP2403	190U2D300 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190U2D301 BACAA215320			PBBBK-yyy
SP2403	190U2F200 BACAA215320	PSBBK-yyy	SIBAA-yyy	
	190U2F201 BACAA215320			PBBBK-yyy

Notes: Drives come with no key pad
Standard motor configuration. (480 VAC, Standard peak torque, No brake, 90° vertical connectors, Keyed shaft, 4096 incremental encoder, standard BCD and Shaft Diameter)
Standard feedback cable for use with incremental encoder and Unidrive SP drive.

CONTROL TECHNIQUES

Unidrive SP
with MH and MG Motors



MH



MG

The Magna Series of motors is a range of brushless servo motors offered by Control Techniques. The MH series is a 460 VAC, 3 phase, 6 pole permanent magnet motor with a sinusoidal back EMF. The MG is a 230 VAC, 3 phase, 6 pole permanent magnet motor with sinusoidal back EMF. Options for the Magna Series include brakes and cables for motor power and feedback with MS connectors.

The Magna Motor is a proven performer in a compact design, providing very high performance. The Magna Motor employs industry leading performance features to offer higher torque and better overall performance compared to similar size motors. High-energy neodymium magnets give the Magna Motors high torque output, low rotor inertia, and high torque to motor volume ratio. The low rotor inertia provides superior dynamic performance for point-to-point servo applications.

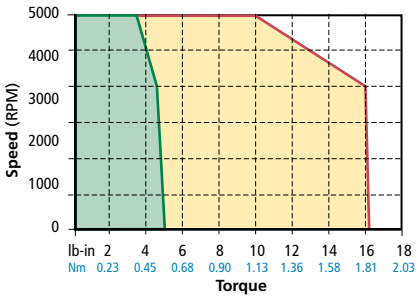
Unidrive SP - 230V MG Motor Specifications

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
SP1201	MG-205	5.0 / 0.6	16.0 / 1.8	3.7 / 0.4	0.29 / 0.22	5000	2048	0.000099 / 0.112	28.0	4.10 / 0.46	3.0 / 1.4
SP1201	MG-208	11.5 / 1.3	27.4 / 3.1	7.1 / 0.8	.56 / 0.42	5000	2048	0.000169 / 0.191	28.0	4.10 / 0.46	4.0 / 1.8
SP1201	MG-316	18.6 / 2.1	41.6 / 4.7	15.9 / 1.8	1.01 / 0.75	4000	2048	0.000560 / 0.633	38.0	5.50 / 0.62	8.8 / 4.0
SP1203	MG-340	50.4 / 5.7	108.9 / 12.3	42.5 / 4.8	2.02 / 1.51	3000	2048	0.001458 / 1.647	57.0	8.30 / 0.94	14.6 / 6.6
SP1204	MG-455	68.1 / 7.7	163.7 / 18.5	51.3 / 5.8	2.44 / 1.82	3000	2048	0.002658 / 3.003	60.0	8.80 / 0.99	20.0 / 9.1
SP2201	MG-490	100.0 / 11.3	190.3 / 21.5	79.7 / 9.0	3.79 / 2.83	3000	2048	0.005175 / 5.847	59.0	8.60 / 0.97	32.4 / 14.7
SP2202	MG-4120	132.0 / 11.4	256.0 / 28.5	120.0 / 13.6	5.71 / 4.26	3000	2048	0.007458 / 8.4	72.0	10.50 / 1.19	37.0 / 16.8

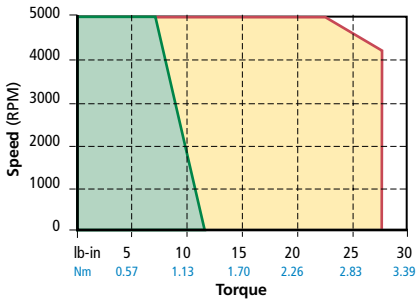
* Rated Speed = Maximum Operating Speed
**See the complete order string in the Servo Motor section.

UNIDRIVE SP - 230V MG Motor Speed Torque Curves

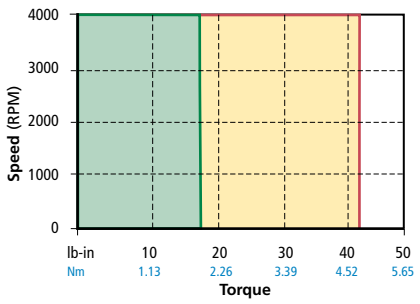
MG-205 with SP1201



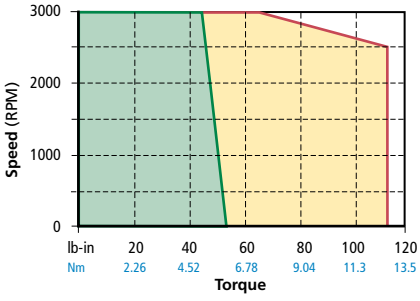
MG-208 with SP1201



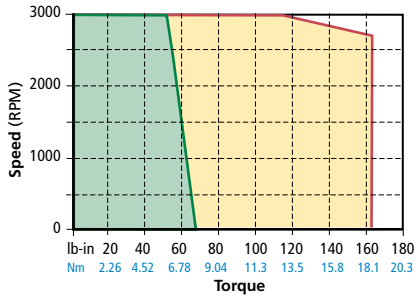
MG-316 with SP1201



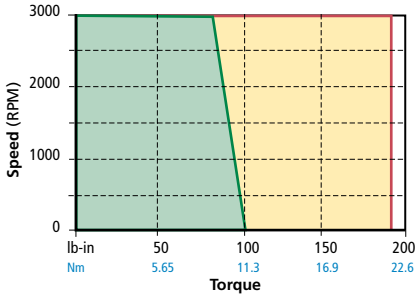
MG-340 with SP1203



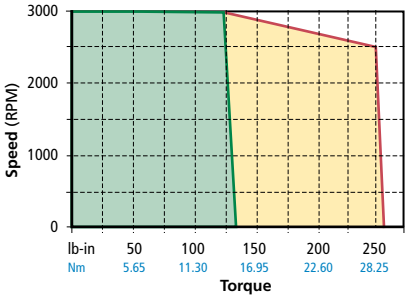
MG-455 with SP1204



MG-490 with SP2201



MG-4120 with SP2202



SPECIFICATIONS

Insulation Class	Class F, EN 60034-1, IEC 664-1
Encoder Density	2048 line incremental
Temperature Monitoring	Thermostat, 155°C switch
Electrical Connections	Connector for power and brake; connector for feedback and thermostat
Flange Mounting	English and Metric
Ingress Protection	IP65

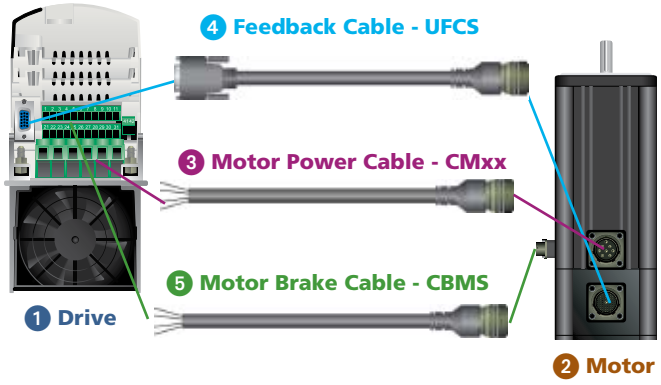
Notes

- Continuous ratings of the motor are based on 100°C motor case temperature and 40°C ambient with the motor mounted to an aluminum plate.
- Speed torque curves are based on 240 VAC operation at 6 kHz switching frequency.
- All specifications are ±10% due to motor parameter variations.

MG Holding Brake Specifications

Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released (ms)	Mechanical Engagement Time-Brake Holding (ms)	Added Inertia lb-in-sec²	Added Inertia kg-cm²
2"	24	0.21	10	1.13	40	25	0.000025	0.028
3"	24	0.52	60	6.78	250	100	0.00015	0.17
4"	24	0.088	240	27.12	250	100	0.00041	0.46

230V MG MAGNA MOTOR SELECTION



Order String

M	G	x	x	xx	C	x	N	S - 0000

- Special Options
- Feedback Type: N = Encoder Feedback
- Brake: O = No Brake, B = 24 VDC
- Connector Type: C = MS Style Connectors
- Approx. Stall Torque: 05, 08, 16, 40, 55, 90, 100, 120 lb-in
- Frame Size: 3 = 3", 4 = 4"
- Flange: E = English, M = Metric
- Motor Voltage Rating: G = 230 VAC
- Magna Motor

Note: All torques are not available for each frame size.

Servo System Order Guide

❶ Drive Model	❷ Motor Model (x=Flange)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
SP1201	MGx-205-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-205-CBNS-0000	CMDS-xxx		CBMS-xxx
SP1201	MGx-208-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-208-CBNS-0000	CMDS-xxx		CBMS-xxx
SP1202	MGx-316-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx		CBMS-xxx
SP1203	MGx-340-CONS-0000	CMDS-xxx	UFCS-xxx	
	MGx-340-CBNS-0000	CMDS-xxx		CBMS-xxx
SP2204	MGx-455-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx		CBMS-xxx
SP2201	MGX-490-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-490-CBNS-0000	CMMS-xxx		CBMS-xxx
SP2202	MGx-4120-CONS-0000	CMMS-xxx	UFCS-xxx	
	MGx-4120-CBNS-0000	CMMS-xxx		CBMS-xxx

Unidrive SP
with 460V MH Motors

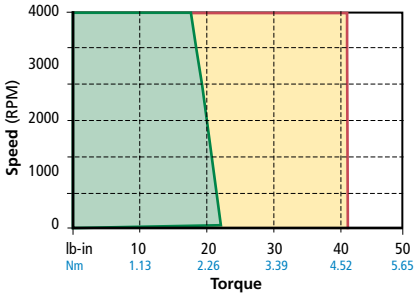
Unidrive SP - 460V MH Motor Specifications

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec^2 / kg-cm^2	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
SP1401	MH-316	21.2 2.4	40.7 4.6	17.7 2.0	1.12 0.84	4000	2048	0.000673 0.8	75.0	10.98 1.24	8.3 3.8
SP1403	MH-340	46.0 5.2	124.8 14.1	37.0 4.2	1.76 1.31	3000	2048	0.001428 1.6	116.0	16.98 1.92	12.4 5.6
SP1404	MH-455	72.6 8.2	178.8 20.2	50.6 5.7	2.41 1.80	3000	2048	0.003557 4.0	120.0	17.57 1.99	18.0 8.2
SP1406	MH-490	105.3 11.9	267.3 30.2	50.0 5.6	2.38 1.77	3000	2048	0.006727 7.6	110.0	16.10 1.82	26.2 11.9
SP1406	MH-6120	117.7 13.3	279.7 31.6	95.6 10.8	4.55 3.39	3000	2048	0.010657 12.0	115.0	16.84 1.90	32.4 14.7
SP2402	MH-6200	233.6 26.4	486.8 55.0	95.6 10.8	4.55 3.39	3000	2048	0.018857 21.3	115.0	16.84 1.90	48.0 21.8
SP2403	MH-6300	299.0 11.4	673.6 28.5	105.4 9.6	5.02 3.74	3000	2048	0.027187 30.7	115.0	16.84 1.90	65.0 29.5
SP2403	MH-8250	285.0 32.2	607.0 68.6	210.0 23.7	10.00 7.45	3000	2048	0.059000 61.4	128.0	18.70 2.11	77.0 34.9
SP3402	MH-8500	530.0 21.6	997.0 60.6	280.0 19.0	13.33 9.94	3000	2048	0.078000 88.1	121.6	17.80 2.01	110.0 49.9
SP3403	MH-8750	748.0 84.5	1500.0 169.5	485.0 54.8	19.24 14.35	2500	2048	0.133000 150.3	162.0	23.70 2.68	171.0 77.6

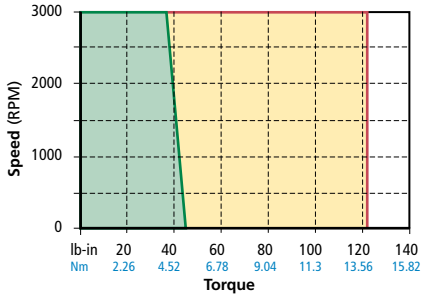
* Rated Speed = Maximum Operating Speed (MH-8750 rated speed = 2900 RPM)
**See the complete order string in the Servo Motor section.

UNIDRIVE SP - 460V MH Motor Speed Torque Curves

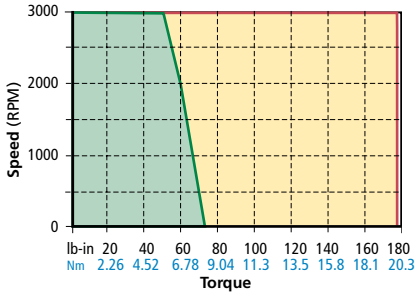
MH-316 with SP1401



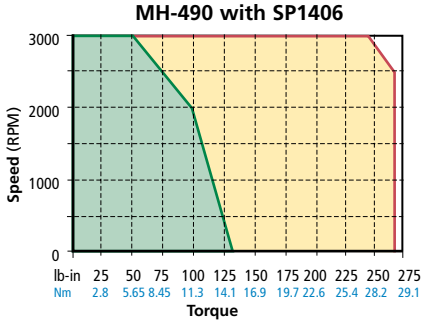
MH-340 with SP1403



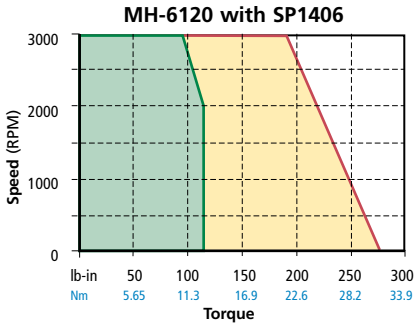
MH-455 with SP1404



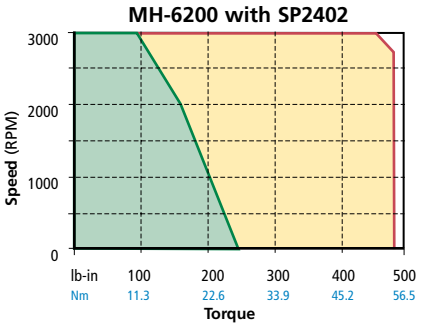
MH-490 with SP1406



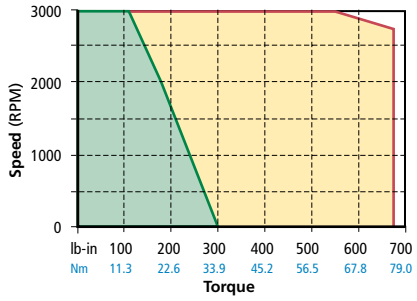
MH-6120 with SP1406



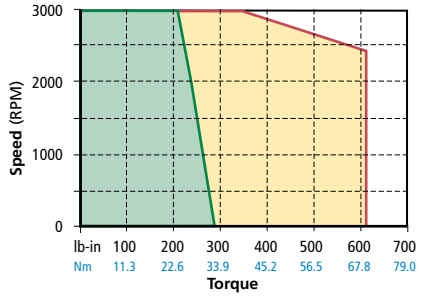
MH-6200 with SP2402



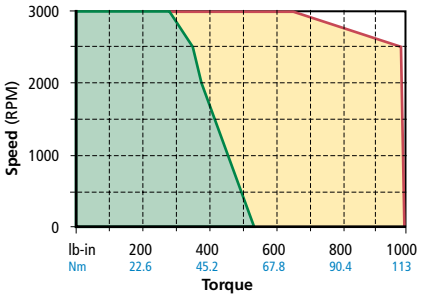
MH-6300 with SP2403



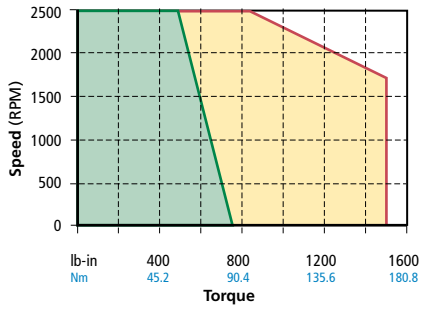
MH-8250 with SP2403



MH-8500 with SP3402



MH-8750 with SP3403



SPECIFICATIONS

Insulation Class	Class F, EN 60034-1, IEC 664-1
Encoder Density	2048 line incremental
Temperature Monitoring	Thermostat, 155°C switch
Electrical Connections	Connector for power and brake; connector for feedback and thermostat
Flange Mounting	English and Metric
Ingress Protection	IP65

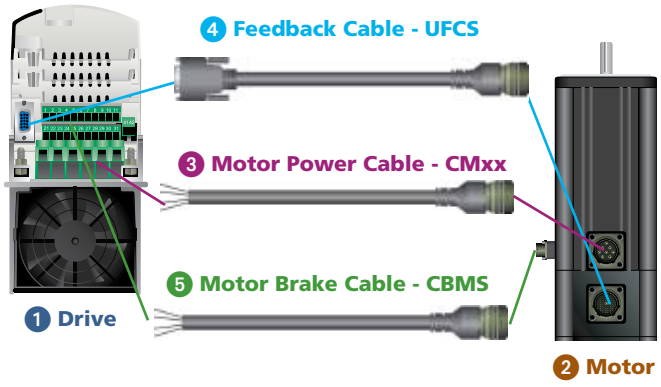
Notes

- Continuous ratings of the motor are based on 100°C motor case temperature and 40°C ambient with the motor mounted to an aluminum plate.
- Speed torque curves are based on 480 VAC operation at 6 kHz switching frequency.
- All specifications are ±10% due to motor parameter variations.
- Optional motors are available to 5000 RPM.

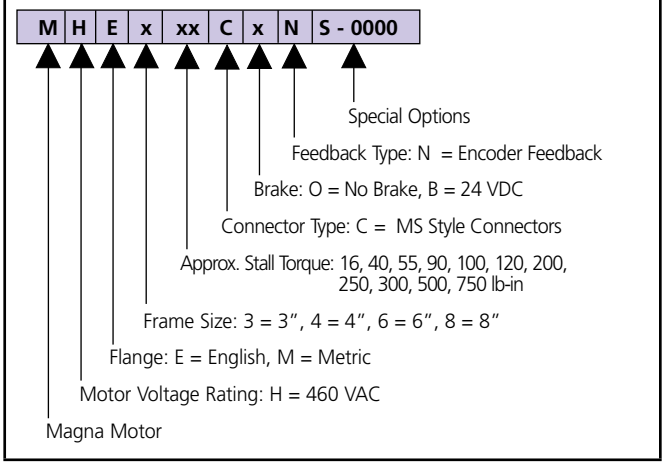
MH Holding Brake Specifications

Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released (ms)	Mechanical Engagement Time-Brake Holding (ms)	Added Inertia lb-in-sec²	Added Inertia kg-cm²
3"	24	0.52	60	6.78	250	100	0.00015	0.16935
4"	24	0.088	240	27.12	250	100	0.0004112	0.464245
6"	24	1.13	360	40.68	100	50	0.00015	2.56283
8"	Consult Factory							

460V MH MAGNA MOTOR SELECTION



Order String



Note: All torques are not available for each frame size.

Servo System Order Guide

❶ Drive Model	❷ Motor Model (x=Flange)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable* (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
SP1401	MHx-316-CONS-0000	CMDS-xxx	UFCS-xxx	
	MHx-316-CBNS-0000	CMDS-xxx		CBMS-xxx
SP1403	MHx-340-CONS-0000	CMDS-xxx	UFCS-xxx	
	MHx-340-CBNS-0000	CMDS-xxx		CBMS-xxx
SP1404	MHx-455-CONS-0000	CMMS-xxx	UFCS-xxx	
	MHx-455-CBNS-0000	CMMS-xxx		CBMS-xxx
SP1406	MHx-490-CONS-0000	CMMS-xxx	UFCS-xxx	
	MHx-490-CBNS-0000	CMMS-xxx		CBMS-xxx
SP1406	MHM-6120-CONS-0000	CMMS-xxx	UFCS-xxx	
	MHM-6120-CBNS-0000	CMMS-xxx		CBMS-xxx
SP2402	MHM-6200-CONS-0000	CMMS-xxx	UFCS-xxx	
	MHM-6200-CBNS-0000	CMMS-xxx		CBMS-xxx
SP2403	MHM-6300-CONS-0000	CMMS-xxx	UFCS-xxx	
	MHM-6300-CBNS-0000	CMMS-xxx		CBMS-xxx
SP2403	MHM-8250-CONS-0000	CMLS-xxx	UFCS-xxx	
	MHM-8250-CBNS-0000	CMLS-xxx		CBMS-xxx
SP3402	MHM-8500-CONS-0000	CMLS-xxx	UFCS-xxx	
	MHM-8500-CBNS-0000	CMLS-xxx		CBMS-xxx
SP3403	MHM-8750-CONS-0000	CMLS-xxx	UFCS-xxx	
	MHM-8750-CBNS-0000	CMLS-xxx		CBMS-xxx

Unidrive SP
with NT Motors

The NT Series of motors is a dynamic range of brushless AC servo motors from Control Techniques. The NT series is 230 VAC, 3 phase, 8 pole, permanent magnet motors with a sinusoidal back EMF. Options for the NT Series include brakes and cables for motor power and feedback connectivity.

The NT Series Motors deliver high torque-power to motor-size ratios that were previously impossible. Using the latest motor design and production technology greatly reduces motor size. High-energy neodymium iron born magnets give the NT motor high torque output and low rotor inertia, providing superior dynamic performance for servo applications. The NT motor design delivers up to 46% more torque in 20% less space when compared to standard high-performance motor designs. The NT motors are a natural choice where small size and high performance are needed.



Unidrive SP - 230V NT Motor Specifications

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max. Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
SP1201	NT-207	7.5 / 0.85	15 / 1.72	7.5 / 0.85	0.60 / 0.44	5000	2048	0.000094 / 0.106	35	5.12 / 0.58	3 / 1.36
SP1201	NT-212	12.5 / 1.41	27 / 3.05	13 / 1.47	1.03 / 0.77	5000	2048	0.000164 / 0.185	35	5.08 / 0.57	4 / 1.82
SP1202	NT-320	20 / 2.22	38 / 4.24	16 / 1.81	1.02 / 0.76	4000	2048	0.000328 / 0.370	29	3.50 / 0.40	6 / 2.72
SP1203	NT-330	27 / 3.05	58 / 6.55	27 / 3.05	1.71 / 1.28	4000	2048	0.000438 / 0.494	36	4.75 / 0.53	7.3 / 3.31
SP1204	NT-345	42 / 4.75	94 / 10.62	42 / 4.75	2.00 / 1.49	3000	2048	0.000668 / 0.754	50	6.73 / 0.72	10 / 4.54
SP1204	NT-355	48 / 5.42	116 / 13.10	48 / 5.42	2.28 / 1.71	3000	2048	0.000888 / 1.0	50	6.32 / 0.71	12.3 / 5.58

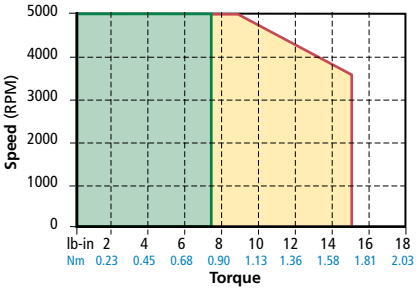
* Rated Speed = Maximum Operating Speed
**See the complete order string in the Servo Motor section.

NT Holding Brake Specifications

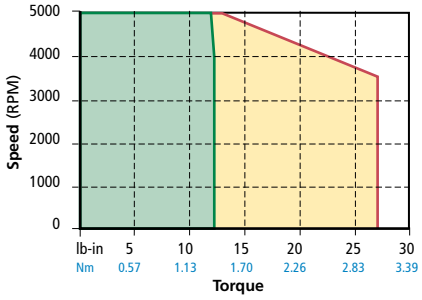
Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released (ms)	Mechanical Engagement Time-Brake Holding (ms)	Added Inertia lb-in-sec²	Added Inertia kg-cm²
2"	24	0.33	20	2.26	28	14	0.000106	0.12
3"	24	0.65	88.5	10	43	13	0.000968	1.093

UNIDRIVE SP - 230V NT Motor Speed Torque Curves

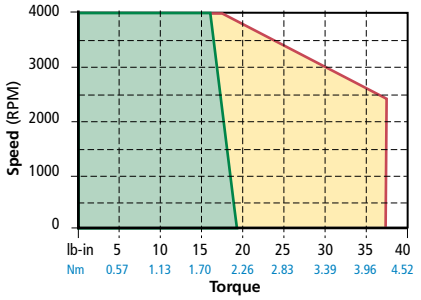
NT-207 with SP1201



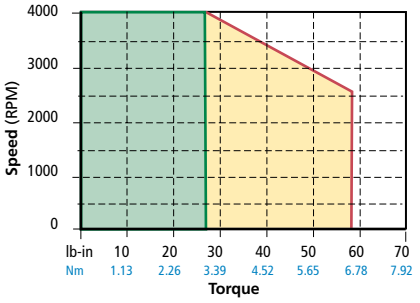
NT-212 with SP1201



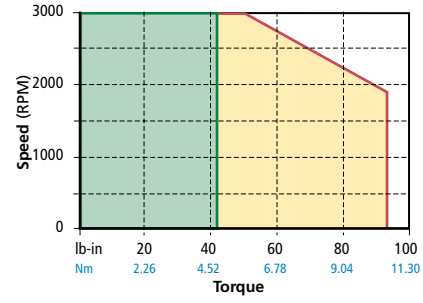
NT-320 with SP1202



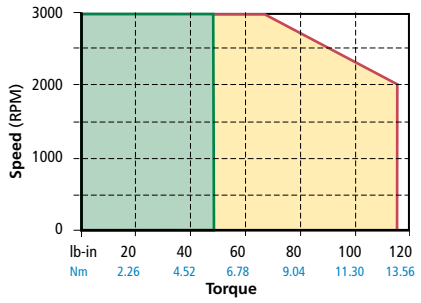
NT-330 with SP1203



NT-345 with SP1204



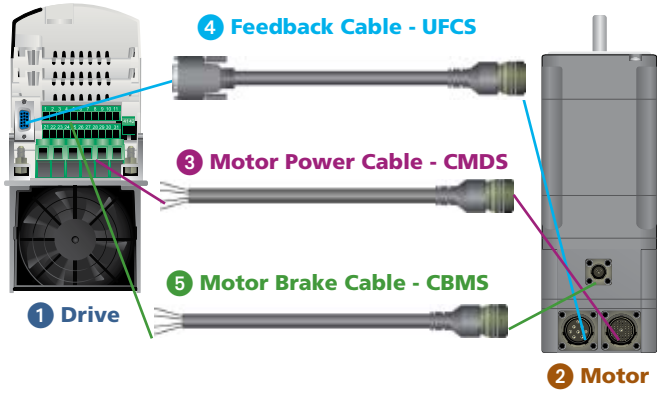
NT-355 with SP1204



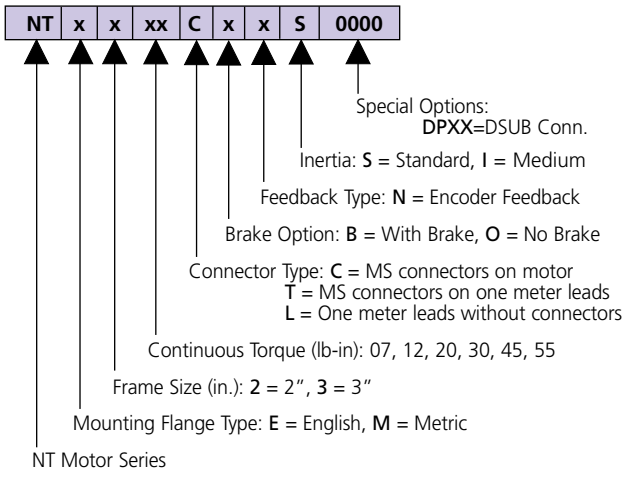
SPECIFICATIONS

Insulation Class	Class F, EN60034-1, IEC 664-1
Encoder Density	2048 line incremental
Temperature Monitoring	Thermostat, 155°C switch temperature
Electrical Connections	Connector for power and brake; connector for feedback and thermostat
Flange Mounting	English and Metric
Ingress Protection	IP65

230V NT MOTOR SELECTION



Order String



Servo System Order Guide

❶ Drive Model	❷ Motor Model (x=Flange)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable* (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
SP1201	NTx-207-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-207-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
SP1201	NTx-212-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-212-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
SP1202	NTx-320-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-320-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
SP1203	NTx-330-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-330-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
SP1204	NTx-345-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-345-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx
SP1204	NTx-355-CONS-0000	CMDS-xxx	UFCS-xxx	
	NTx-355-CBNS-0000	CMDS-xxx	UFCS-xxx	CBMS-xxx

EN
Base Drive Operation

The base EN drive can be easily controlled with single and multi-axis controllers, PLCs and host controllers for medium power applications. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The pulse mode is ideal for use with low-cost PLC stepper controllers. This drive works in a variety of applications where a host control provides a command signal determining the desired motion profile.

The EN Drive is configurable for seven flexible modes of operation, and the parameters for each mode can be adjusted to tailor the drive to the specific application using Windows™-based PowerTools FM software.

Analog Torque Mode

Analog Velocity Mode

Digital Velocity Preset

Pulse Mode

- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

Summation of Analog Velocity and Digital Velocity

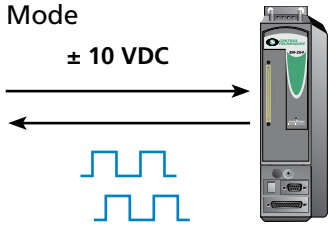
- **Programmable I/O**
  - **5 optically-isolated inputs (1 dedicated)**
  - **3 optically-isolated outputs**
  - **1 analog input ±10 VDC, 14-bit**
  - **2 analog output ±10 VDC, 10-bit**
  - **Programmable encoder output, (up to 8,192 lines per revolution)**
- **Separate stop and travel limit decel ramps**
- **Torque, Travel, Following Error and velocity limits**
- **8 user defined speed presets with individual accel/decel rates**
- **2 Programmable Torque Level Outputs**
- **In Motion Velocity Output**
- **Auto-Tune**
- **Software Oscilloscope**



STANDARD CONTROL MODES

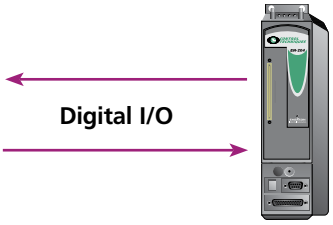
Analog Velocity/Torque Mode

- MC
- Position Controller



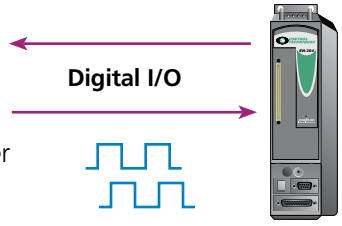
Digital Velocity Preset

- PLC
- User Logic



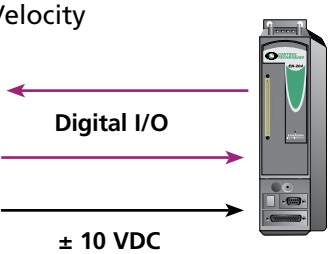
Pulse Mode

- PLC
- Master Axis
- Synchronized Encoder

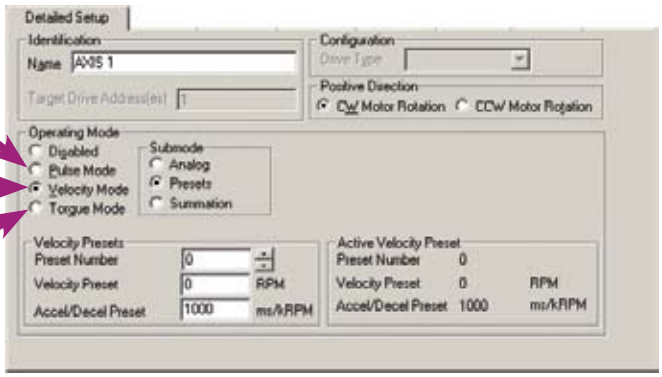


Summation of Analog Velocity and Digital Velocity

- PLC
- User Logic
- Analog Trim



The operating mode of the drive is simply selected with one click in the PowerTools FM Detailed Setup tab.



PULSE MODE

In Pulse Mode the drive will receive pulses from a master source (single-ended or differential), which can be interpreted in three ways:

- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

Application Examples

- PLC pulse command outputs
- Electronic gearing
- Stepper drive replacement
- Web line ratio control

VELOCITY MODE

Analog— in Analog Velocity Mode the drive develops a velocity command in proportion to the voltage (±10 VDC) received on the Analog Input. *Note: Analog full scale voltage and offest are programmable.*

Preset Velocity— In this mode one of up to eight digital velocities can be selected using the digital I/O or Modbus. Each preset has its own accel/decel ramps.

Application Examples

- Clutch-brake replacement
- Phase control with a differential
- Automatic feed control for machining operations
- Spindle speed control

Velocity Summation— This mode combines the features of Analog Velocity and Preset Velocity in one mode. It allows running a preset velocity and trimming it with an analog input, or vice versa, allowing advanced applications to be solved simply and elegantly without complex controllers.

Application Examples

- Loop/dancer arm control
- Phase advance/retard
- Speed trimming

TORQUE MODE

In Analog Torque Mode the drive develops a torque command in proportion to the voltage (±10 VDC) received in the Analog Input. *Note: Analog full scale voltage and offest are programmable.*

Application Examples

- With position/velocity controller
- Tension control

FLEXIBLE I/O FUNCTIONALITY

The digital I/O of the drive is completely programmable with the ability to map one or more I/O functions to the I/O points.

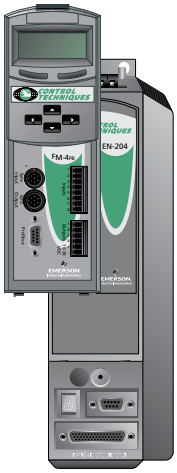
Input Functions

Stop
Reset
Travel Limit (+)
Travel Limit (-)
Torque Limit Enable
Torque Mode Enable
Velocity Presets (3)
Brake Release
Brake Control

Output Functions

Drive OK
At Velocity
Travel Limits (+)
Travel Limits (-)
In Motion (+)
In Motion (-)
Power Stage Enabled
Torque Limit Active
Velocity Limiting Active
Fault
Brake
Shunt Active
Torque Level 1 & 2 Active
Foldback Active

EN
with FM Modules

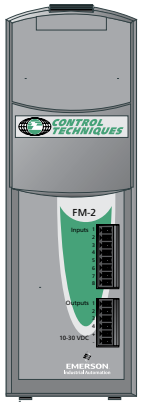




FM control modules (see Controls) provide EN drives with "snap-on" functionality for Indexing (FM-2), Programming (FM-3E), and Advanced Programming (FM-4E). This modular approach allows users to choose the level of advanced machine control they need, based on the applications parameters and not the drive "spec".

For applications requiring traditional multi-axis control, our MC controller is easily integrated with a single cable connection.

FM-2 INDEXING MODULE

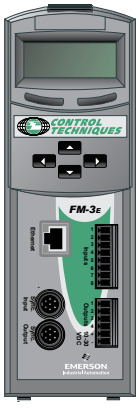


The FM-2 module enhances EN drives by adding positioning capability including Jog, Home, Index functions including Position Tracker™ – Fieldbus Indexing. The FM-2 also includes additional I/O providing 8 digital inputs and 4 digital outputs.

FM-2 Application Examples

- Clutch-brake replacement
- Extend-retract arm
- Indexing table
- Indexing conveyor

FM-3E PROGRAMMING MODULE

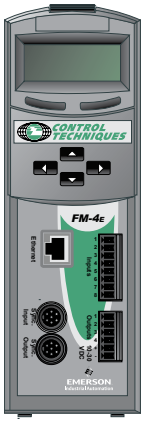


The FM-3E Ethernet module transforms the EN into a fully programmable single-axis motion controller, and adds 8 digital inputs and 4 digital outputs. Profibus (FM-3PB) and DeviceNet (FM-3DN) options are also available.

FM-3E Application Examples

- Tension control
- Flying cut off
- Auger filler
- Registration control
- Slip compensation

FM-4E ADVANCED PROGRAMMING MODULE



The FM-4E Advanced Programming module has taken all of the features and flexibility of the FM-3E, and added the ability to create complex motion profiles for sophisticated applications. The FM-4E adds versatility and extends functionality by including high speed data capture, summation of multiple motion profiles, program multi-tasking, and an array of parameters suitable for even the toughest applications. Profibus (FM-4PB) and DeviceNet (FM-4DN) options are also available.

FM-4E Application Examples

- Random infeed conveyor
- Merge conveyor
- Rotary knife
- High speed labeling
- Phase synchronization
- Electronic gearing
- Point-to-point positioning
- Thermoforming
- Web control

EN DRIVE TERMINALS AND PINOUTS

Serial (J4)

Pin Number	Signal
3	RS232 TX
2	RS232 RX
6	Serial +5 VDC
5	Serial 0V Common
4	RS485+
9	RS485-
1	Shield
7,8	No Connect

Command (J5)

Pin Number	Signal
15	Analog Command In +
14	Analog Command In -
8	Encoder Out A
9	Encoder Out A/
23	Encoder Out B
24	Encoder Out B/
37	Encoder Out Z
38	Encoder Out Z/
27	Pulse In A
41	Pulse In A/
26	Pulse In B
40	Pulse In B/
25	Pulse In Z
39	Pulse In Z/
20	Pulse In A (single ended)
36	Pulse In B (single ended)
16	I/O Input Drive Enable
1	I/O Input 1
2	I/O Input 2
3	I/O Input 3
4	I/O Input 4
19	I/O Output 1
18	I/O Output 2
17	I/O Output 3
33	I/O Supply +
34	I/O Supply +
31	I/O Supply 0V
32	I/O Supply 0V
29	Analog Out 0V
43	Analog Out Channel 1 +
44	Analog Out Channel 2 +
11	External Encoder +5VDC Power
12	External Encoder Common
28	+15V Power Out (10 mA)
6	RS485 +
21	RS485 -
5, 7, 10, 13, 22, 30, 35, 42	No Connect

Motor Power

Terminal	Signal
PE	PE
R	Motor Power R
S	Motor Power S
T	Motor Power T





AC Power

Terminal	Signal
L1	AC Input
L2	AC Input
L3	AC Input
PE	PE

Logic Backup Power (J3)

Terminal	Signal
Aux 1	Logic Supply Backup +
Aux 2	Logic Supply Backup 0V Common

DC Power (J2)

Terminal	Signal
Bus 1	DC Bus +
Bus 2	DC Bus -

Logic Backup Power and DC Power located on top beneath knock out not shown.

Digital I/O (J6)

Pin Number	Signal
1	I/O Supply +
2	I/O Supply 0V
3	Drive Enable
4	Input 1
5	Input 2
6	Input 3
7	Input 4
8	Output 1
9	Output 2
10	Output 3

Feedback (J7)

Pin Number	Signal
1	Motor Encoder A
10	Motor Encoder A/
2	Motor Encoder B
11	Motor Encoder B/
3	Motor Encoder Z
12	Motor Encoder Z/
4	Motor Commutation U
13	Motor Commutation U/
5	Motor Commutation V
14	Motor Commutation V/
6	Motor Commutation W
15	Motor Commutation W/
7,8	Encoder +5 VDC Supply
17	Encoder 0V Common
9	Motor OverTemp
16,18-26	No Connect

HOW TO ORDER

Depending on your motor selection, use one of the next few pages to configure a basic EN system by selecting one item from each of the four ordering columns, and the fifth column if you are choosing a brake motor. Note that item ❷ motor selection requires additional input as to flange, and on NT systems connector type. (See the Motor Order String boxes for details.) Items ❸ through ❺ require cable lengths to be provided. The basic systems represented on these pages can be customized with a variety of components depending on your needs. A guide to EN options and accessories can be found at the end of this page.

SELECT SYSTEM AND MOTOR

❶ Select the EN drive appropriate to the needs of your application.

❷ Select a performance matched motor for your drive. The system selection matrix for motors is found on the following page.

CABLE ORDERING OPTIONS

Motor power, feedback and brake cables use MS style connectors and are fully shielded with IP65 molded connectors and are available in standard and custom lengths. For more information on these and other cables, see the *Options and Accessories* section.

Standard lengths of 5, 15, 25, 50 and 100 feet are available from stock. Non-standard lengths require additional lead time. ***Note: Equivalent FM Motor cable lengths are in meters.***

Feet=xxx or meters=yyy with specified lengths. Example: 005 = 5 feet. For applications involving continuous flexing, flexible cables are available. Cable components such as connector kits and raw cable are also available. See the *Options and Accessories* section for details or consult factory for special requirements.

❸ Motor Power Cables Example;
CMDS-xxx 16 AWG for 2-3" motors or CMMS-xxx 12 AWG for 4" motors, both cables have connectors on the motor end and ferrules on the drive end.
❹ Motor Feedback Cables Example;
CFCS-xxx Connectors on both ends.
❺ Motor Brake Cable Example;
CBMS-xxx Required for all motors with brake option; connector on motor end only.

Software is Free!

The Control Techniques' "Motion Made Easy" Power CD (CT-MME-POWER-CD) is shipped with every product. Software updates are free and can be downloaded from our web site, as are firmware updates.



EN OPTIONS AND ACCESSORIES

Control Techniques provides a complete array of options and accessories to complete your system. For details, see the Options and Accessories section of the catalog.

Brake Relays

BRM-1

Breakout Board

ECI-44, DEMO-FMIO-000, DEMO-DRIO-000

Diagnostics

DGNE

Auxiliary Logic Supplies

ALP-130, ALP-430

External Shunts/Resistors

(see Power Accessories)

AC Line Filters

960304-01 (EN-214), 960305-01 (EN-204, EN-208)

Synchronization Encoders

SCSLD-4, SCSLD-4R

Operator Interface

CTVue, OIT, CTIU

Extended Warranty

Extends Two Year Warranty to Five Years

EN Series
230V FM Motor

The FM 230V line is a medium to high inertia line for larger load applications. It is designed to allow use in many applications and offers a wide range of options. The FM line is offered in metric frame sizes, 75 mm, 95 mm, 115 mm, 142 mm and 190 mm. The standard configured motor has a 4096 line encoder, vertical connectors and non-brake. This configuration is designed with low cogging torque to provide smooth operation and excellent velocity regulation. The torque range available is 19.8 lb-in (2 Nm) to 214 lb-in (24.2 Nm). All models are rated IP65.

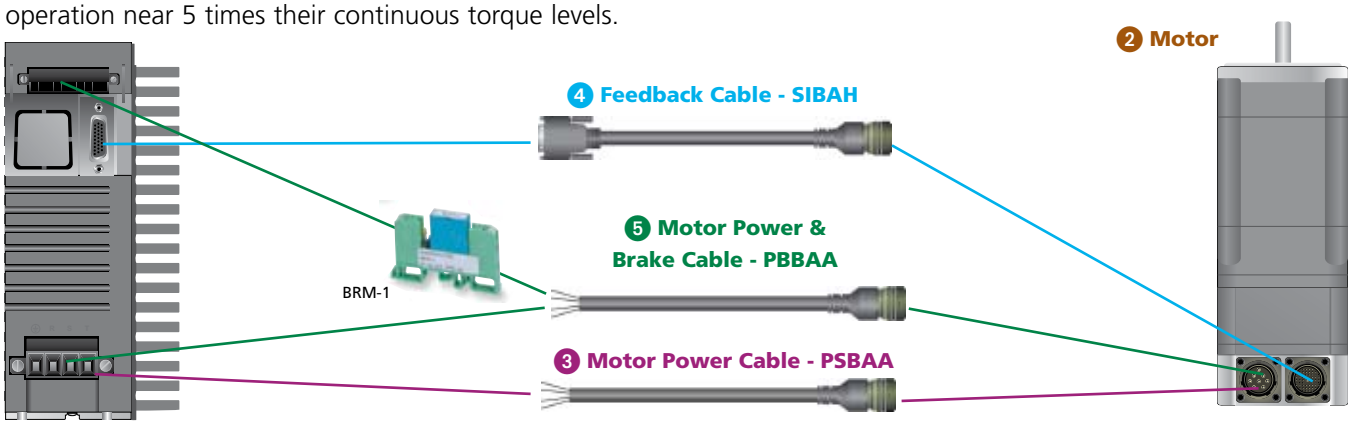
The FM motor is also available with many other options like resolver and Sin/Cos feedback, NEMA flange, different shaft diameters, 90° and rotatable connectors, and a high peak torque option that allows intermittent operation near 5 times their continuous torque levels.

Order String

xxx	E	2	x	xx	x	B	A	CA	A	BCD*	DIA*

- Frame Size: **075**, **095**, **115**, **142**, **190**
- Voltage **E** = 230V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A**, **B**, **C**, **D**, **E**, **F**, **G**, **H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **B** = 90° Connectors
- Shaft Key: **A** = With Key
- Feedback Device: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.



1 **Drive** (Bottom shown)

Servo System Order Guide

Note: Cable lengths in meters.

1 Drive Model	2 Motor Model	3 Motor Power Cable (yyy=meters)	4 Feedback Cable (yyy=meters)	5 Motor Power/Brake Cable (required w/all brake motors) (yyy=meters)
EN-204	075E2B400 BACAA075140	PSBAA-yyy	SIBAH-yyy	
	075E2B401 BACAA075140		SIBAH-yyy	PBBAA-yyy
	075E2D300 BACAA075140	PSBAA-yyy	SIBAH-yyy	
	075E2D301 BACAA075140		SIBAH-yyy	PBBAA-yyy
EN-208	095E2D400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095E2D401 BACAA100190		SIBAH-yyy	PBBAA-yyy
	095E2E300 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095E2E301 BACAA100190		SIBAH-yyy	PBBAA-yyy
EN-214	095E2D400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095E2D401 BACAA100190		SIBAH-yyy	PBBAA-yyy
	115E2C300 BACAA115190	PSBAA-yyy	SIBAH-yyy	
	115E2C301 BACAA115190		SIBAH-yyy	PBBAA-yyy
	115E2E300 BACAA115240	PSBAA-yyy	SIBAH-yyy	
	115E2E301 BACAA115240		SIBAH-yyy	PBBAA-yyy

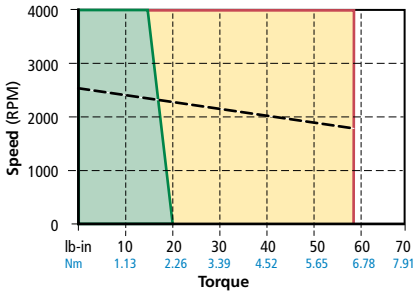
EN - 230V FM Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
EN-204	075E2B400	19.75	57.35	15.05	0.95	4000	4096	0.001062	44	6.37	9.7
		2.23	6.48	1.70	0.71			1.2		0.72	4.4
EN-204	075E2D300	34.57	74.07	30.98	1.47	3000	4096	0.00177	57	8.23	13.2
		3.91	8.37	3.50	1.10			2		0.93	6.0
EN-208	095E2D400	57.35	114.70	43.37	2.73	4000	4096	0.004514	44	6.37	19.1
		6.48	12.96	4.90	2.05			5.1		0.72	8.7
EN-214	095E2D400	66.91	165.67	43.37	2.73	4000	4096	0.004514	44	6.37	19.1
		7.56	18.72	4.90	2.05			5.1		0.72	8.7
EN-208	095E2E300	74.07	148.15	71.69	3.39	3000	4096	0.005487	57	8.23	21.8
		8.37	16.74	8.10	2.54			6.2		0.93	9.9
EN-214	115E2C300	83.95	213.99	71.69	3.39	3000	4096	0.007965	57	8.23	25.5
		9.49	24.18	8.10	2.54			9		0.93	11.6
EN-214	115E2E300	107.00	213.99	107.00	5.07	3000	4096	0.012213	57	8.23	33.9
		12.09	24.18	12.09	3.80			13.8		0.93	15.4

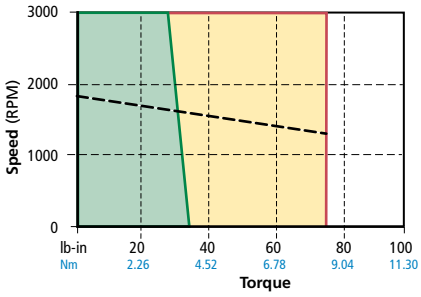
*Rated Speed = Maximum Operating Speed

EN - 230V FM Motor Speed Torque Curves

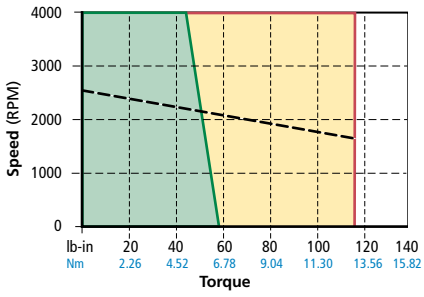
075E2B40-x with EN-204



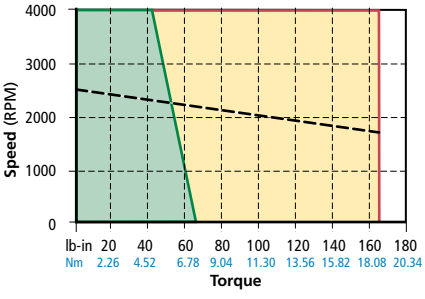
075E2D30-x with EN-204



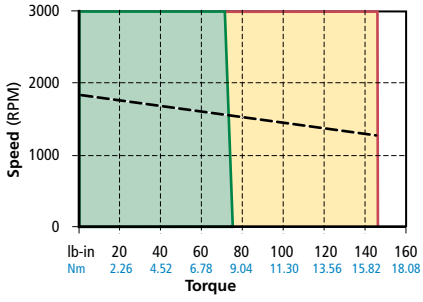
095E2D40-x with EN-208



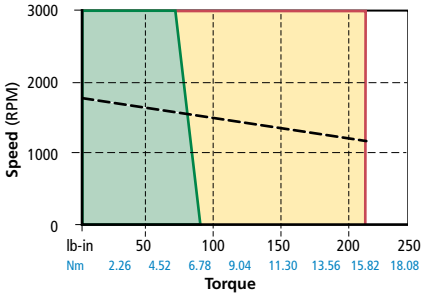
095E2D40-x with EN-214



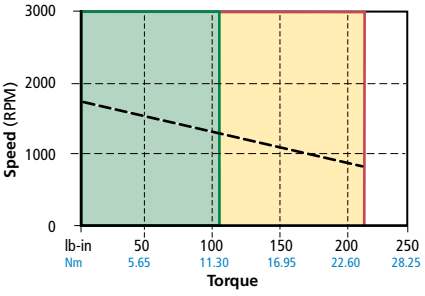
095E2E30-x with EN-208



115E2C30-x with EN-214



115E2E30-x with EN-214



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	10 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

Legend

- Continuous Torque
- Peak Torque
- 120V Curve

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

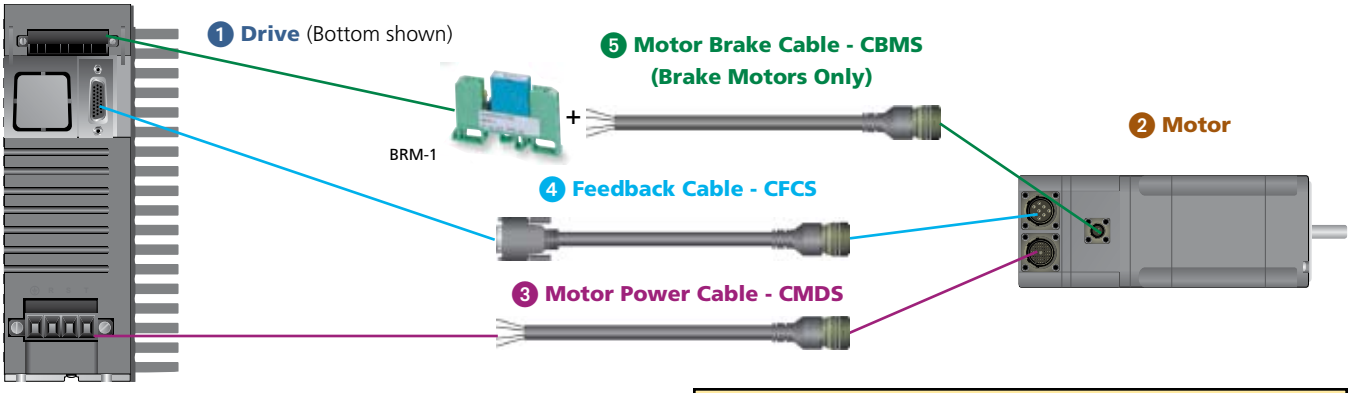
EN Series
230V NT Motor Selection

The NT motor is a high performance motor utilizing patented technology to maximize torque in a compact package. The NT motor uses powerful Neodymium magnets and is manufactured with a segmented core to maximize stator efficiency. The NT motor has a very low inertia for applications that demand high accel and cycle rates. NT motors are available in English (NEMA 23 or 34) or Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. NT motors can be ordered with MS style connectors, 1 m Flying Leads, or 1 m Flying Leads with MS connectors.

Order String

NT	x	x	xx	x	x	N	S	0000

- Special Options: DSXX = DSUB
- Inertia: **S** = Standard, **I** = Medium
- **N** = Encoder Feedback Type: Encoder
- Brake Option: **B** = with Brake, **O** = No Brake
- Connector Type: **C** = MS connectors on motor, **T** = MS connectors on one meter leads, **L** = one meter leads without connectors
- Continuous Torque (lb-in): **7, 12, 20, 30, 45** or **55**
- Frame Size (inches): **2** or **3**
- Mounting Flange: **E** = English, **M** = Metric
- **NT** Motor Family



For additional motor information see Motors.

For additional cable options see Options.

Servo System Order Guide

❶ Drive Model	❷ Motor Model (x=Flange type; y=Connector type)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
EN-204-00-000	NTx-207-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-207-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-212-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-212-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
EN-208-00-000	NTx-320-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-320-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-330-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-330-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-345-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-345-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-355-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-355-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
EN-214-00-000	NTx-345-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-345-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-355-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-355-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx

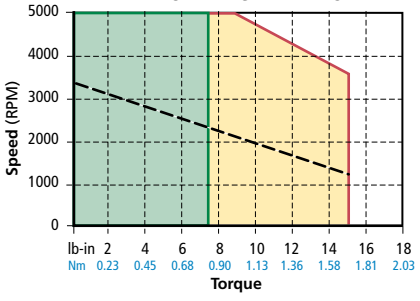
EN - 230V NT Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
EN-204	NT-207	7.5 0.85	15 1.72	7.5 0.85	0.60 0.44	5000	2048	0.000094 0.106	35	5.12 0.58	3 1.36
EN-204	NT-212	12.5 1.41	27 3.05	12 1.4	1.03 0.77	5000	2048	0.000164 0.185	35	5.12 0.58	4 1.82
EN-208	NT-320	20 2.22	38 4.24	16 1.81	1.02 0.76	4000	2048	0.000328 0.370	29	3.50 0.40	6 2.72
EN-208	NT-330	27 3.05	58 6.55	27 3.05	1.71 1.28	4000	2048	0.000438 0.494	36	4.73 0.53	7.3 3.31
EN-208	NT-345	42 4.75	80 9.04	42 4.75	2.00 1.49	3000	2048	0.000668 0.754	50	6.37 0.72	10 4.54
EN-208	NT-355	48 5.42	90 10.17	48 5.42	2.28 1.71	3000	2048	0.000888 1.0	50	6.32 0.71	12.3 5.58
EN-214	NT-345	42 4.75	94 10.62	42 4.75	2.00 1.49	3000	2048	0.000668 0.754	50	6.37 0.72	10 4.54
EN-214	NT-355	48 5.42	116 13.10	48 5.42	228 1.71	3000	2048	0.000888 1.0	50	6.32 0.71	12.3 5.58

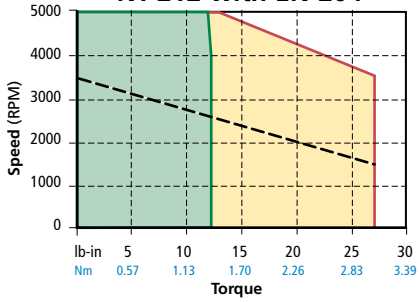
** Rated Speed = Maximum Operating Speed*

EN - 230V NT Motor Speed Torque Curves

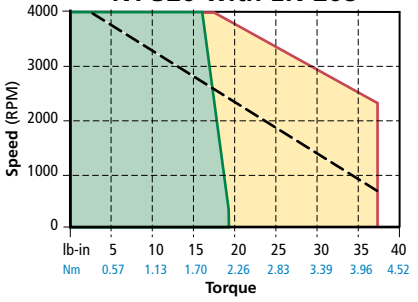
NT-207 with EN-204



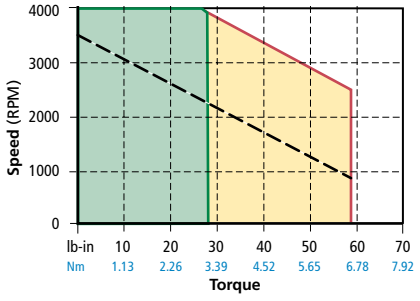
NT-212 with EN-204



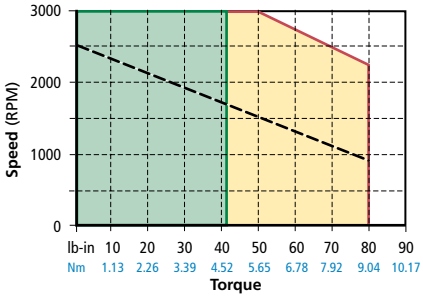
NT-320 with EN-208



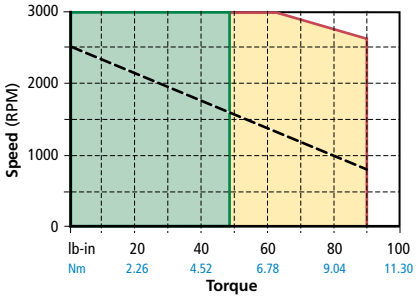
NT-330 with EN-208



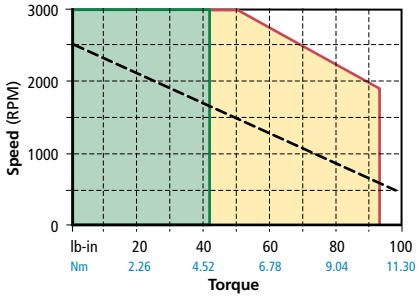
NT-345 with EN-208



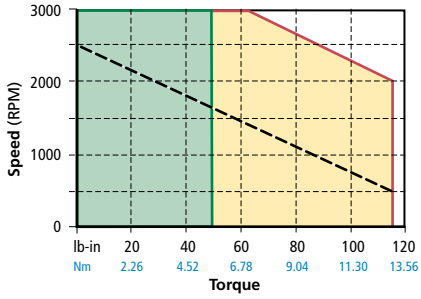
NT-355 with EN-208



NT-345 with EN-214



NT-355 with EN-214



* Dashed line equals 120V curve

SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	20 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

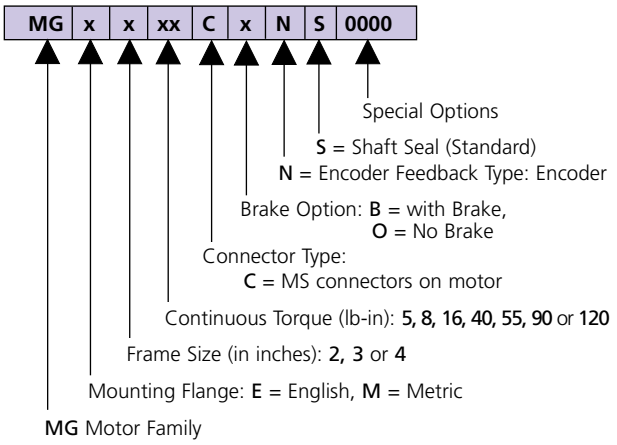
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

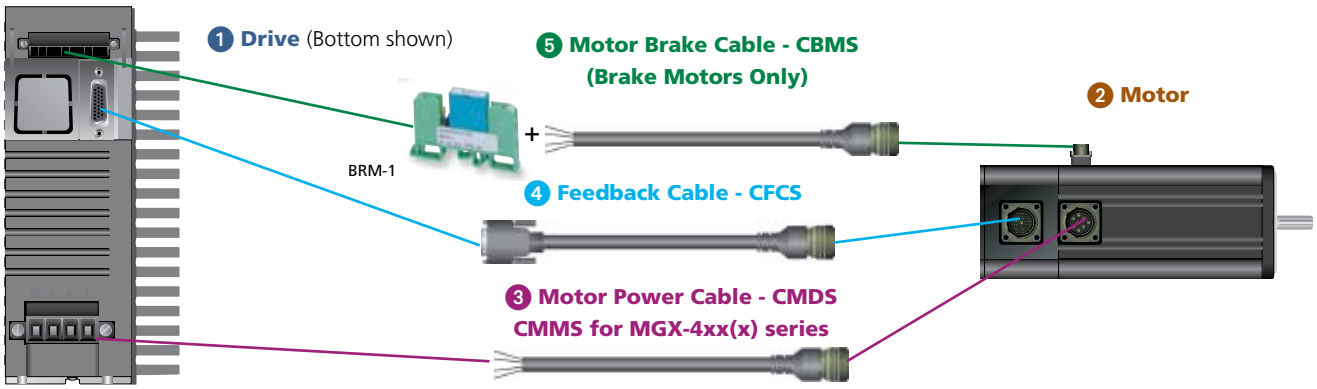
EN Series

230V MG Motor Selection

The MG motor is a low inertia motor that is great for dynamic applications that have larger load inertias. MG motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors motors. MG motors are available in English (NEMA 23, 34, or 56) and Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. MG motors come standard with MS style connectors. For applications that require custom motors the MG line is the choice.

Order String





For additional motor information see Motors.
For additional cable options see Options.

Servo System Order Guide

❶ EN Servo Drive	❷ MG Servo Motor (x=Flange type)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/ all brake motors) (xxx=feet)
EN-204-00-000	MGx-205-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-205-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MGx-208-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-208-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MGx-316-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
EN-208-00-000	MGx-316-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MGx-340-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-340-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MGx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
EN-214-00-000	MGx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MGx-490-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-490-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MGx-4120-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-4120-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx

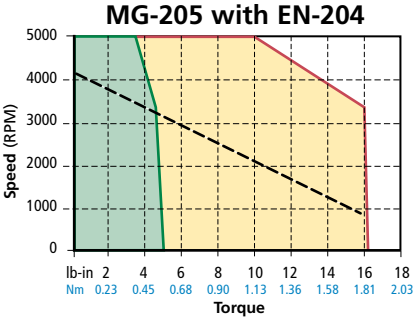
EN - 230V MG Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
EN-204	MG-205	5 0.56	16 1.81	3.7 0.41	0.29 0.22	5000	2048	0.000099 0.112	28	4.1 0.47	3 1.3
EN-204	MG-208	9 1.02	27 3.09	7.5 0.848	0.60 0.44	5000	2048	0.000169 0.191	28	4.1 0.47	4 1.8
EN-204	MG-316	18.6 2.10	42 4.75	16 1.81	1.02 0.76	4000	2048	0.000560 0.630	38	5.5 0.62	8.3 3.8
EN-208	MG-316	18.6 2.10	56 6.33	16 1.81	1.02 0.76	4000	2048	0.000560 0.630	38	5.5 0.62	8.3 3.8
EN-208	MG-340	50 5.65	133 15.03	42 4.75	2.00 1.49	3000	2048	0.001458 1.646	57	8.3 0.94	14.6 6.6
EN-208	MG-455	68 7.68	138 15.40	52 5.84	2.48 1.85	3000	2048	0.002658 3.000	60	8.8 0.99	20 9.1
EN-214	MG-455	68 7.68	200 22.60	52 5.84	2.48 1.85	3000	2048	0.002658 3.000	60	8.8 0.99	20 9.1
EN-214	MG-490	100 11.30	217 24.50	80 9.04	3.81 2.84	3000	2048	0.005175 5.823	59	8.6 0.97	26.8 13
EN-214	MG-4120	132 14.90	256 28.90	120 13.56	5.71 4.26	3000	2048	0.007458 8.4	72	10.5 1.19	37 16.8

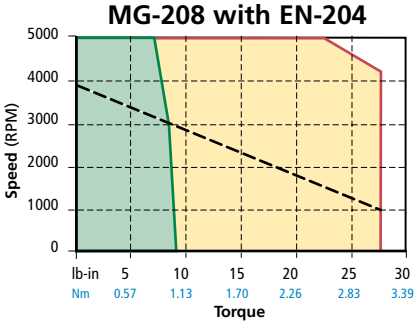
** Rated Speed = Maximum Operating Speed*

EN - 230V MG Motor Speed Torque Curves

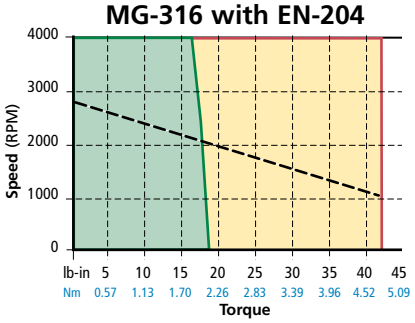
MG-205 with EN-204



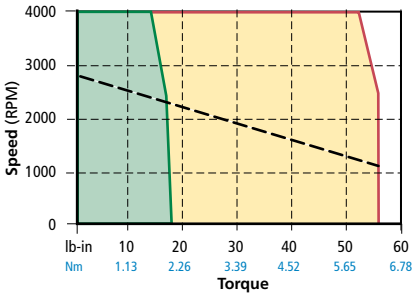
MG-208 with EN-204



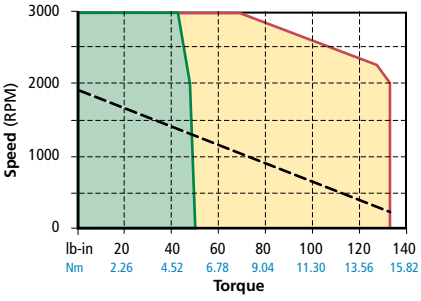
MG-316 with EN-204



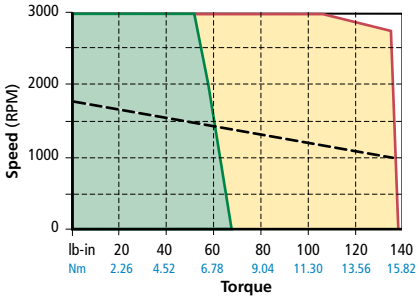
MG-316 with EN-208



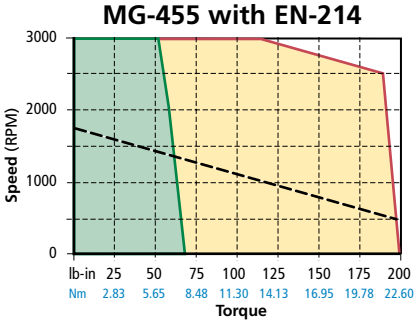
MG-340 with EN-208



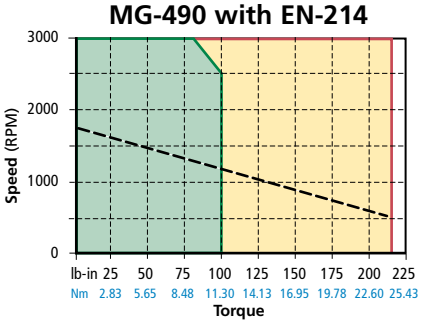
MG-455 with EN-208



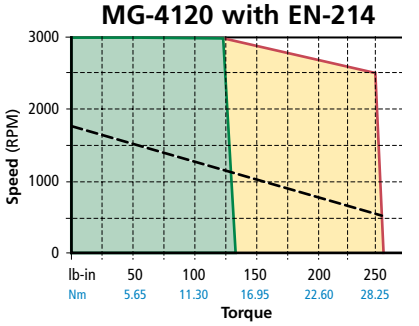
MG-455 with EN-214



MG-490 with EN-214



MG-4120 with EN-214



Dashed line equals 120V curve.

EN Series
230V XV Motor

The new XV Servo Motor line delivers high-performance, low inertia, and high torque in a compact motor package. It offers a low cost solution with the features of a premium priced servo offering. Intended for higher throughputs and smaller machines, XV motors are available in 4 frame sizes: 40, 60, 80 and 130 mm with speeds ranging from 2000 to 5000 RPM.

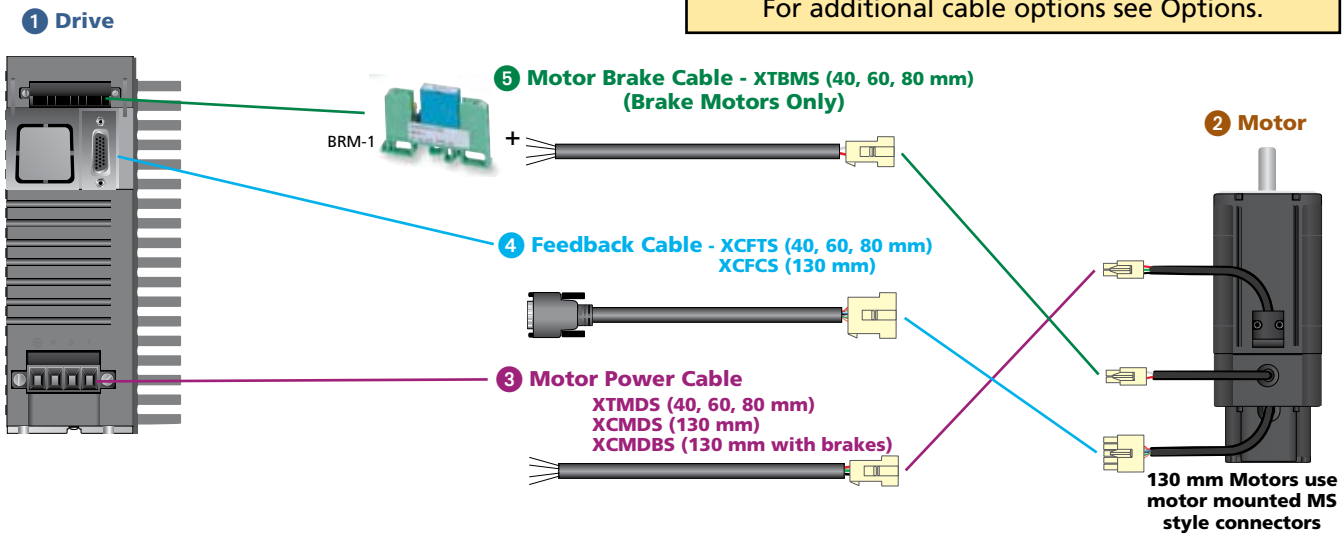
Applications with continuous torque requirements up to 101 lb-in (11.4 Nm) are the perfect match for the XV motors. The XV motor series is CE, UL and RoHS approved.

Order String

XV	M	xxx	xxx	x	x	N	S	0000

- **XV** Motor Family
- Mounting Flange: **M** = Metric
- Frame Size (in millimeters): **40**, **60**, **80** or **130**
- Continuous Torque (lb-in): **1**, **3**, **6**, **11**, **17**, **23**, **28**, **46**, **51**, **68**, **89** or **101**
- Connector Type: **C** = MS connectors on motor, **T** = Flying Lead with Connectors
- Brake Option: **B** = with Brake, **O** = No Brake
- **N** = Incremental Encoder
- **S** = Standard
- Special Options

For additional motor information see Motors.
For additional cable options see Options.



Servo System Order Guide

❶ EN Servo Drive	❷ XV Servo Motor*	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
EN-204-00-000	XVM-6011-TONS-0000 XVM-6011-TBNS-0000	XTMDS-xxx XTMDS-xxx	XCFTS-xxx XCFTS-xxx	XTBMS-xxx
	XVM-8017-TONS-0000 XVM-8017-TBNS-0000	XTMDS-xxx XTMDS-xxx	XCFTS-xxx XCFTS-xxx	XTBMS-xxx
	XVM-8023-TONS-0000 XVM-8023-TBNS-0000	XTMDS-xxx XTMDS-xxx	XCFTS-xxx XCFTS-xxx	XTBMS-xxx
	XVM-8028-TONS-0000 XVM-8028-TBNS-0000	XTMDS-xxx XTMDS-xxx	XCFTS-xxx XCFTS-xxx	XTBMS-xxx
	XVM-13051-CONS-0000 XVM-13051-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
EN-208-00-000	XVM-8028-TONS-0000 XVM-8028-TBNS-0000	XTMDS-xxx XTMDS-xxx	XCFTS-xxx XCFTS-xxx	XTBMS-xxx
	XVM-13046-CONS-0000 XVM-13046-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
	XVM-13089-CONS-0000 XVM-13089-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
	XVM-130101-CONS-0000 XVM-130101-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
EN-214-00-000	XVM-13068-CONS-0000 XVM-13068-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
	XVM-13089-CONS-0000 XVM-13089-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable
	XVM-130101-CONS-0000 XVM-130101-CBNS-0000	XCMDS-xxx XCMDBS-xxx **	XCFCS-xxx XCFCS-xxx	Combination Cable

*Rated Speed = Maximum Operating Speed
** Combination Motor Power and Brake Cable

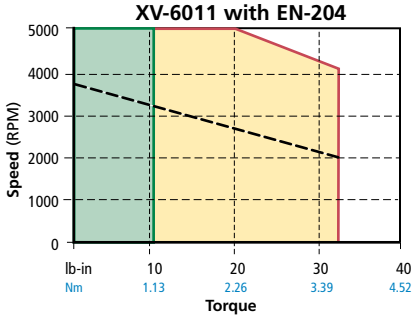
EN - 230V XV Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in Nm	Peak Stall Torque lb-in Nm	Rated Torque @Rated Speed* lb-in Nm	Rated Power HP kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms Nm/Arms	Motor Weight lb kg
EN-204	XV-6011	11.24 1.27	32.3 3.65	11.24 3.65	0.54 0.40	5000	2048	0.000 0.321	29.5	4.15 0.47	3.5 1.63
EN-204	XV-8017	16.9 1.91	42.5 4.8	16.9 1.91	0.80 0.60	5000	2048	0.001 1.092	35.2	5 0.57	5.4 2.49
EN-204	XV-8023	23.3 2.63	54.9 6.2	23.3 2.63	0.74 0.55	3000	2048	0.001 1.59	44.6	6.32 0.71	6.9 3.15
EN-204	XV-8028	23.6 2.67	47.1 5.32	23.6 2.67	1.12 0.84	5000	2048	0.002 1.97	39.2	5.57 0.63	8.3 3.8
EN-204	XV-13051	50.7 5.73	110 12.4	50.7 5.73	0.80 0.60	2000	2048	0.011 11.99	85.8	12.87 1.45	15.8 7.2
EN-208	XV-8028	28.1 3.18	81.1 9.16	28.1 3.18	1.34 1.00	5000	2048	0.002 1.927	39.2	5.57 0.63	8.3 3.8
EN-208	XV-13046	46.5 5.25	133.3 15.1	46.5 5.25	1.48 1.10	3000	2048	0.011 11.99	53.1	7.71 0.87	15.8 7.2
EN-208	XV-13089	88.76 10.03	236.7 26.7	88.76 10.03	1.40 1.05	2000	2048	0.015 17.34	94.6	15.57 1.76	21.3 9.7
EN-208	XV-130101	101.4 11.46	239.2 27	101.4 11.46	1.61 1.20	2000	2048	0.020 22.68	90	13.88 1.57	22.4 10.2
EN-214	XV-13068	67.6 7.64	190.4 21.5	67.6 7.64	2.15 1.60	3000	2048	0.015 17.34	54.2	7.59 0.86	19.1 8.7
EN-214	XV-13089	88.76 10.03	260.4 29.4	88.76 10.03	1.40 1.05	2000	2048	0.015 17.34	94.6	15.57 1.76	21.3 9.7
EN-214	XV-130101	101.4 11.46	296.4 34.5	101.4 11.46	1.61 1.20	2000	2048	0.020 22.68	90	13.88 1.57	22.4 10.2

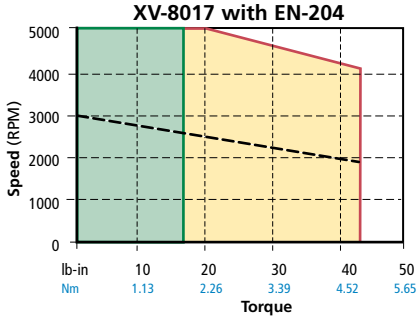
*Rated Speed = Maximum Operating Speed

EN - 230V XV Motor Speed Torque Curves

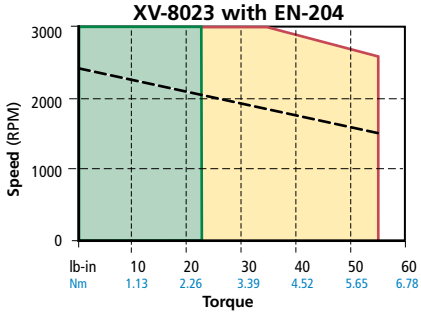
XV-6011 with EN-204



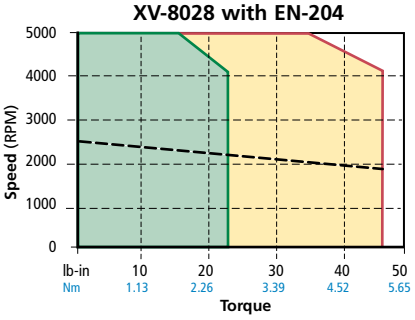
XV-8017 with EN-204



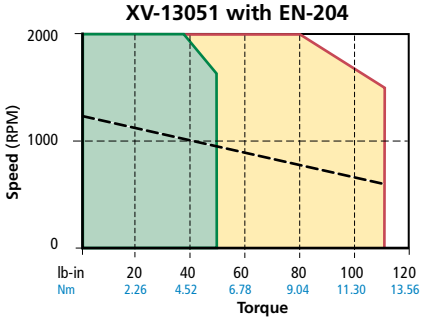
XV-8023 with EN-204



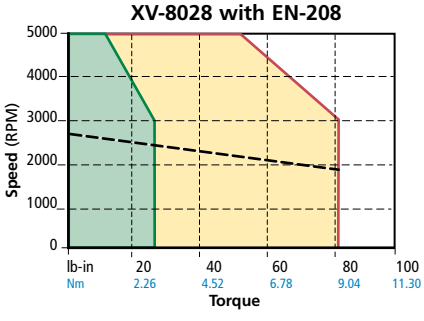
XV-8028 with EN-204



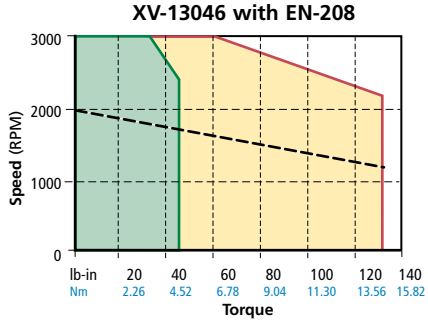
XV-13051 with EN-204



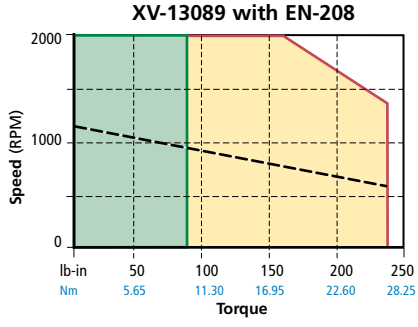
XV-8028 with EN-208



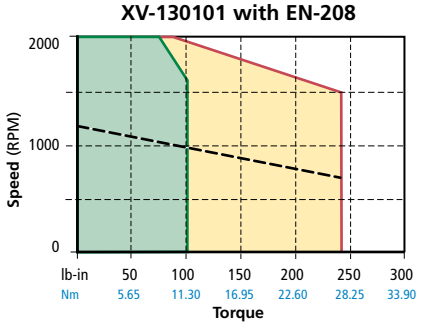
XV-13046 with EN-208



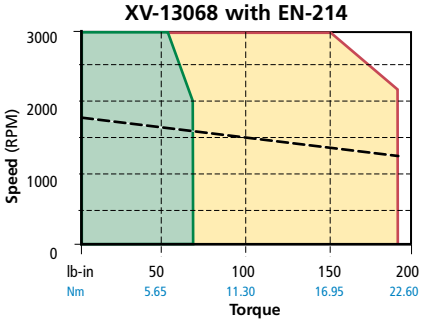
XV-13089 with EN-208



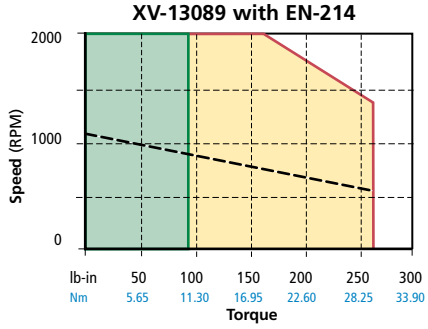
XV-130101 with EN-208



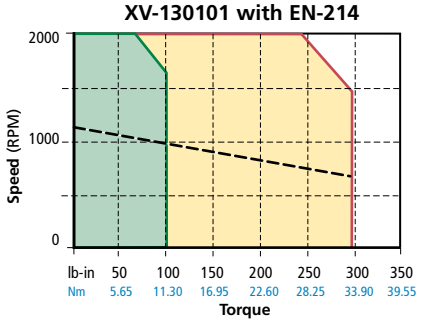
XV-13068 with EN-214



XV-13089 with EN-214



XV-130101 with EN-214



SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	10 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	75°C (167°F)

Legend

- 120V Curve
- Continuous Torque
- Peak Torque

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

EN SPECIFICATIONS AND DIMENSIONS

Power Requirements

AC Input Voltage: 90 to 264 VAC, 47 - 63 Hz (230 VAC for rated performance)

EN-204: 1Ø
EN-208: 1Ø
EN-214: 3Ø (For 1Ø, derate output current by 20%)

AC Input Current:

EN-204: 9.5 Arms (140A for 8 ms inrush)
EN-208: 19 Arms (140A for 8 ms inrush)
EN-214: 20 Arms, 1Ø (140A for 5 ms inrush)
EN-214: 14 Arms, 3Ø (100A for 5 ms inrush)

Ouput Continuous Current (RMS):

EN-204: 4.5 Arms
EN-208: 9 Arms
EN-214: 13 Arms (For 1Ø, derate by 20%)

Output Peak Current:

EN-204: 9A
EN-208: 18A
EN-214: 26A (For 1Ø, derate by 20%)

Continuous Output Power:

EN-204: 1.8 kW
EN-208: 3.6 kW
EN-214: 5.2 kW

Switching Frequency 20 kHz

Logic Supply Internal

Alternate Logic Supply +127 to 373 VDC, 22W

Encoder Supply Output +5 VDC, 250 mA

Efficiency 93%

Regeneration

Internal Energy Absorption (230V):

EN-204: 79 Joules
EN-208: 50 W Resistor plus 79 Joules
EN-214: 50 W Resistor plus 79 Joules

Internal Energy Absorption (115V):

EN-204: 150 Joules
EN-208: 50 W Resistor plus 150 Joules
EN-214: 50 W Resistor plus 150 Joules

External: Connection to RSR-2 with external resistor, 20 Ohm min, 15 Arms, 2 kW

Drive Control Inputs

Analog: (1) +/- 10 VDC 14 bit, 100 kOhm, Differential

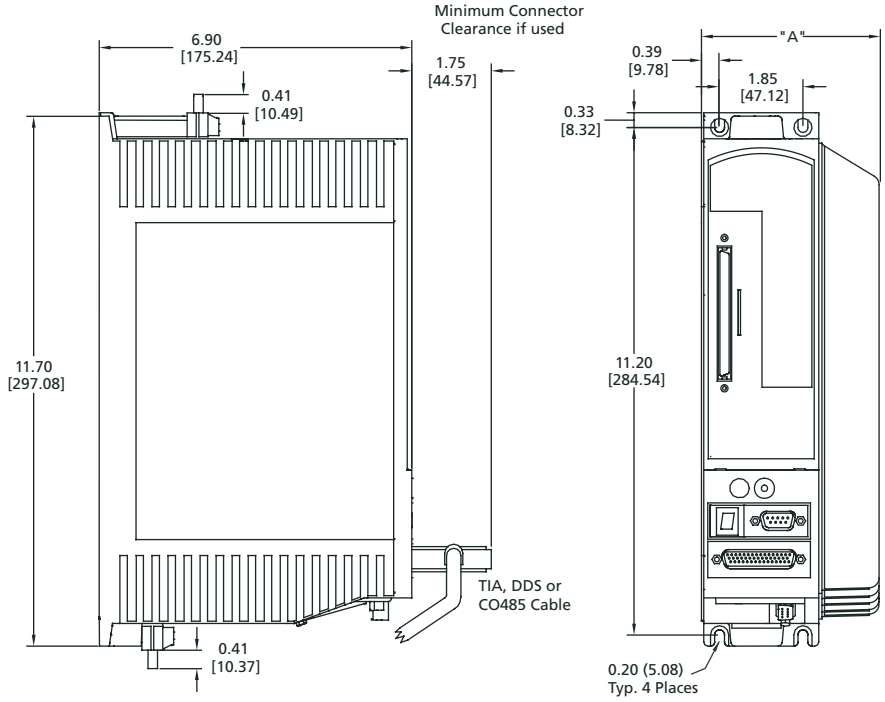
Analog Max Input Rating: Differential +/- 14 VDC, Each Input with Reference to Analog Ground +/- 14 VDC

Digital: (5) +10 to 30 VDC, 2.8 kOHm, Sourcing,Optically isolated

Pulse: (1) Differential: RS422, 2 MHz/ Channel, 50% Duty Cycle

Single Ended: (1) TTL Schmitt Trigger 1 MHz/ Channel 50% Duty Cycle

Motor OverTemperature: (1) 0 to +5 VDC, 10 kOhm, single ended



Drive Model	Dimension A
EN-204	2.93 [74.4]
EN-208	3.43 [87.1]
EN-214	3.93 [99.8]

Drive Control Outputs

Analog: (2) +/- 10 VDC 10-bit, single ended, 20 mA

Digital: (3) +10 to 30 VDC, 150 mA, Sourcing, Optically isolated

Pulse Differential: RS422 and TTL compatible, 20ma/Channel, Sink or Source

I/O Supply +10 to 30 VDC

Environmental

Rated Ambient Temperature: 32° to 104°F (0° to 40°C) for rated performance

Maximum Ambient Temperature: 32° to 122°F (0° to 50°C) with power derating of 3.5%/1.8°F (1°C) above 104°F (40°C)

Rated Altitude: 3280' (1000 m)

Maximum Altitude: For altitudes >3280' (1000 m) derate output by 1%/328' (100 m) not to exceed 7560' (2000 m)

Vibration: 10 to 2000 Hz @ 2g

Humidity: 10 to 95% non-condensing

Storage Temperature: -13° to 167°F (-25° to 75°C)

Ingress Protection: IP-20

Cooling Method

EN-204: Convection
EN-208: Convection
EN-214: Integral Fan

Serial Interface RS232/RS485 Modbus RTU w/32-bit extension 9600 to 19.2 kBaud Internal RS232 to RS485 Converter

Drive Weight

EN-204: 6.4 lb (2.9 kg)
EN-208: 7.7 lb (3.5 kg)
EN-214: 8.9 lb (4.0 kg)

Go to Power CD for complete data

MDS
Modular Drive System

The Modular Drive System, MDS, is a powerful and cost-effective solution for applications with multiple axes. The MDS employs a unique backplane architecture that provides a common bus platform for one of three sizes of power modules and up to eight drive modules. The same MDS modules can operate on a 230V or 460V AC input. Plus, there are five different sizes of drive modules to meet the needs of almost any multiple axis application.

FM control modules, also used in our EN series drives, can be snapped to the front of an MDS drive module to extend drive functionality to the level required by the application. Ethernet, DeviceNet and Profibus FM controls are available for fieldbus communications.

NEW ANALOG POSITION MODE

In Analog Position Mode the drive moves to an absolute motor position in proportion to the voltage (±10 VDC) received in the Analog Input. **Note:** *Analog full scale voltage and position are programmable.*

- **200 to 525 VAC, 3Ø input**
- **Up to 750 lb-in continuous torque**
- **True Common Bus Architecture**
  - **Reduced Part Count and Install Cost**
  - **Innovative backplane makes installing multiple drives quick and easy**
- **Easy install, setup and operate**
  - **Pluggable connectors, Standard D-Shell and Screw Terminals**
  - **State-Space Observer Control, which allows 10:1 inertia mismatch out of the box, and 50:1 with tuning**
  - **Free PowerTools software, and upgrades**

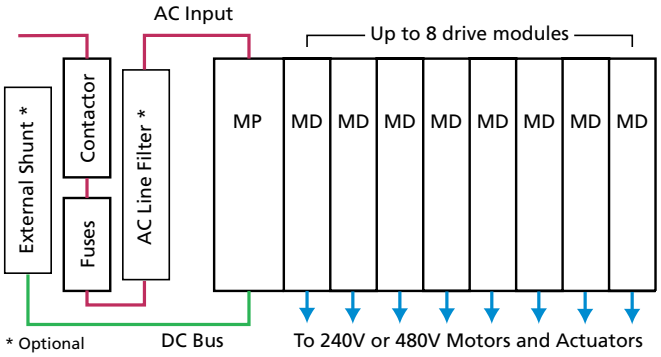
FREE Software

- **Accepts FM control modules for positioning control and enhanced programming capabilities**
- **Programmable, optically-isolated I/O**
- **Field programmable flash memory firmware, upgrades are free**
- **Auto-Tune support for any servo motor with encoder feedback**



INNOVATIVE BACKPLANE

The MDS backplane provides a single AC input for the Power Module, and distributed DC bus and Logic Power for the Drive Modules. Installation time is minimized because the DC bus and Logic Power lines are an integral part of the backplane, so no extra wiring is needed. Fuses come installed on the backplane. Other than connecting motors, the installation is completed when the backplane is mounted on the panel and the power and drive modules are snapped into place and tightened down with a screwdriver.



A very compact installation is possible because the backplane allows drives to be mounted directly next to one another. The use of a single, common power supply for multiple drives also minimizes installation space, and reduces cost, because with an MDS there is only one AC Input, one AC Contactor, one set of AC Fuses, and one AC Line Filter.

2 YEAR Digital Drive Warranty
5 YEAR Extended Warranty

PROFIBUS PROCESS FIELD BUS
DeviceNet
MODBUS
EtherNet/IP
MODBUS TCP/IP

POWER MODULE

MDS is a true common bus system. A single Power Module provides the AC rectification and generates DC bus power for the Drive Modules. This eliminates the problems associated with "pseudo" common bus systems, where each drive has its own power supply. MDS doesn't have power-up conflicts.

Bus inductance is minimized with the use of bus bars, and by having a compact installation. Applications with quick deceleration and/or large loads are easily handled by an integrated microprocessor-controlled shunt transistor, which can be connected to an external resistor to dissipate regenerative energy. For emergency stops, the system can quickly be de-energized via an input that allows the user to instantly activate the shunt transistor. MDS allows for true power supply optimization.

Power Modules are available in three ratings and are designed to accommodate the total, simultaneous demand of the axes. In other words, the sizing of the Power Module is based on the maximum continuous and peak loads of the application at a given time—not the sum of the maximum drive power ratings, as rarely are all axes operating simultaneously or at peak power.

DRIVE MODULE

Five different-sized drive modules are available to provide a full range of performance-matched solutions for a variety of applications, whether needing high acceleration and cycle rates, or heavy torque and load handling capacity (up to 750 lb-in cont. torque). Like all of our "Motion Made Easy" drives, the MDS Drive Modules utilize our "State-Space" control, which enables drives to operate with a 10-to-1 inertia mismatch right out of the box, and up to a 50-to-1 inertia mismatch with optimization.

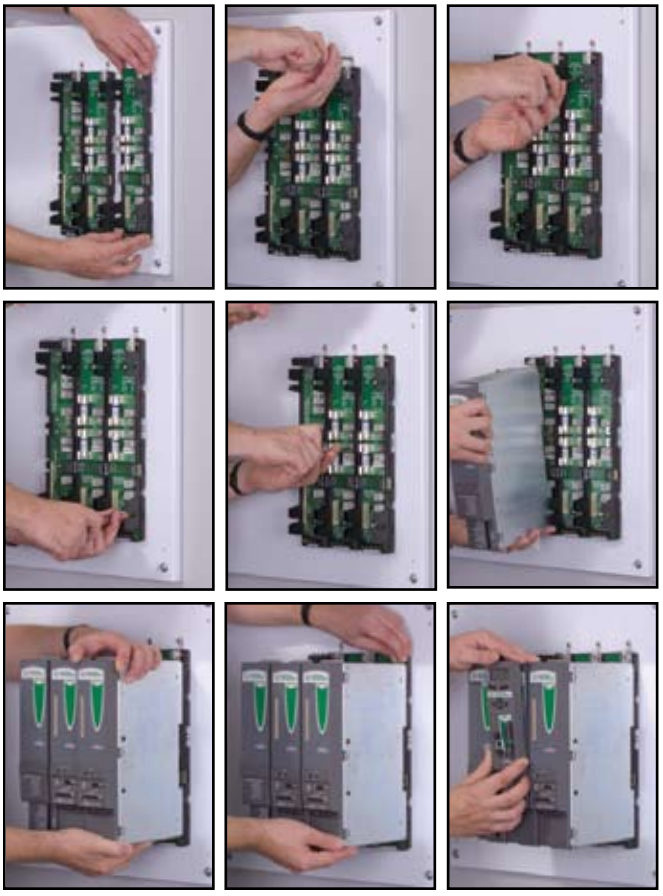
The MDS Drive Modules can operate in any of three modes: Velocity, Torque or Pulse. In the Velocity Mode the Drive Modules can run in Analog, Preset Velocity or Summation Sub-Modes. The Pulse Mode is able to interpret the signals as Pulse/Pulse, Pulse/Direction or Pulse/Quadrature from either Differential or Single-Ended outputs.

For a "Motion Made Easy" solution, our MDS Drive Modules accept the same FM control modules as our EN Series drives. These modules extend control capability of the base drives for advanced applications such as conveyor synchronization and high-speed labeling.

FM MODULES

FM control modules provide MDS Drive Modules with "snap on" functionality for indexing (FM-2), programming (FM-3), and advanced programming (FM-4) applications. The modular approach allows users to choose the level of advanced machine control they need, based on application parameters, not the drive "spec". Because these sophisticated "snap-on" controls are not built into the drive, users can stock drives and not costly controls.

EASY INSTALLATION



***MDS** installation is a snap.*

The backplanes of the drive and power modules snap together and are mounted to the panel with screws. The drives are also grounded with screws. After tightening the bus bar screws, the modules are snapped into place and secured. Wiring is limited to a single AC power connection and wiring the motors to the drives. An external shunt resistor connection is also provided. Advanced control capability is provided by adding FM control modules to the system.

MDS
Base Drive Operation



The MDS drives can be easily implemented with single and multi-axis controllers, PLCs and host controllers for medium power applications. The analog torque or velocity modes can be used with classic position controllers using analog outputs and encoder inputs. The pulse mode is ideal for use with low-cost PLC stepper controllers. This drive works in a variety of applications where a host control provides a command signal determining the desired motion profile.

The drive is configurable for eight flexible modes of operation, and the parameters for each mode can be adjusted to tailor the drive to the specific application using Windows™-based PowerTools Pro software.

Position Tracker™ – Analog Mode

Analog Torque Mode

Analog Velocity Mode

Digital Velocity Preset

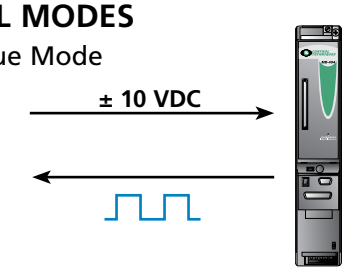
Pulse Mode
- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

Summation of Analog Velocity and Digital Velocity

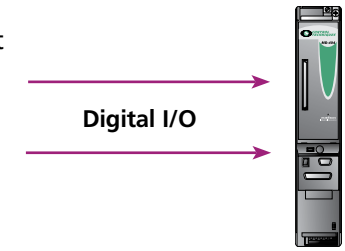
- **Programmable I/O**
  - **5 optically-isolated inputs (1 dedicated)**
  - **3 optically-isolated outputs**
  - **1 analog input ±10 VDC, 14-bit**
  - **2 analog output ±10 VDC, 10-bit**
- **Programmable encoder output, (up to 8,192 lines per revolution)**
- **Separate stop and travel limit decel ramps**
- **Torque, travel, following error and velocity limits**
- **8 user defined speed presets with individual accel/decel rates**
- **2 programmable torque level outputs**
- **In motion velocity output**
- **Software oscilloscope**

STANDARD CONTROL MODES

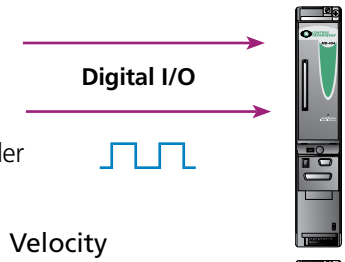
Analog Velocity/Torque Mode



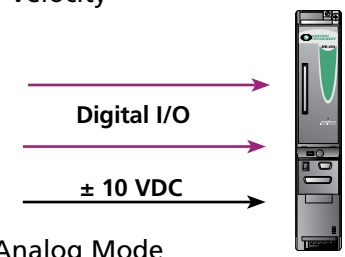
Digital Velocity Preset



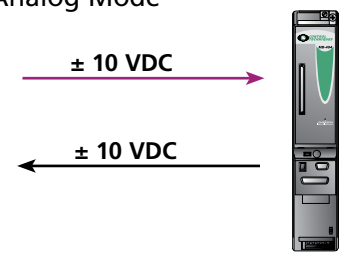
Pulse Mode



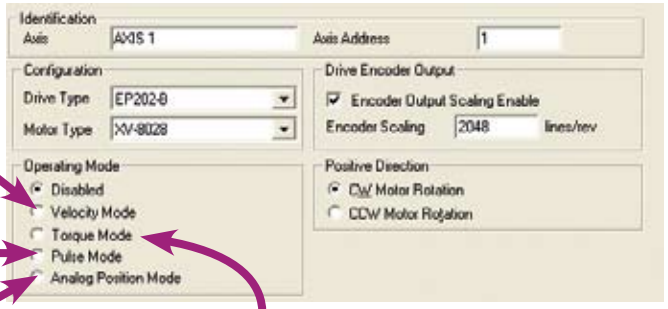
Summation of Analog Velocity and Digital Velocity



Position Tracker™ – Analog Mode



The operating mode of the drive is simply selected with one click in the PowerTools Pro Setup view.



VELOCITY MODE

Analog— In Analog Velocity Mode the drive develops a velocity command in proportion to the voltage (±10 VDC) received on the Analog Input. *Note: Analog full scale voltage and offest are programmable.*

Preset Velocity— In this mode one of up to eight digital velocities can be selected using the digital I/O or Modbus. Each preset has its own accel/decel ramps. No analog source is required!

Application Examples

- Clutch-brake replacement
- Phase control with a differential
- Automatic feed control
- Spindle speed control

Velocity Summation— This mode combines the features of Analog Velocity and Preset Velocity in one mode. It allows running a preset velocity and trimming it with an analog input, or vice versa, allowing advanced applications to be solved simply and elegantly without complex controllers.

Application Examples

- Loop/dancer arm control
- Phase advance/retard
- Speed trimming

PULSE MODE

In Pulse Mode the drive will receive pulses from a master source (single-ended or differential), which can be interpreted in three ways:

- Pulse/Pulse
- Pulse/Direction
- Pulse/Quadrature

Application Examples

- PLC pulse command outputs
- Electronic gearing
- Stepper drive replacement
- Web line ratio control

TORQUE MODE

In Analog Torque Mode the drive develops a torque command in proportion to the voltage (±10 VDC) received in the Analog Input. *Note: Analog full scale voltage and offest are programmable.*

Application Examples

- With position/velocity controller
- Tension control

POSITION TRACKER™ ANALOG MODE

In this Analog Mode the drive moves to an absolute motor position in proportion to the voltage (±10 VDC) received in the Analog Input. *Note: Analog full scale voltage and position are programmable.*

Application Examples

- Position Control with simple analog signal
- Replaces expensive PLC position control modules

FLEXIBLE I/O FUNCTIONALITY

The digital I/O of the drive is completely programmable with the ability to map one or more I/O functions to the I/O points.

Input Functions

Stop
Reset
Travel Limit (+ and -)
Torque Limit Enable
Torque Mode Enable
Velocity Presets (3)
Brake Release
Brake Control
Enable Analog Position
Teach Analog Position
Define Analog Position

Output Functions

Drive OK
At Velocity
Travel Limits (+ and -)
In Motion (+ and -)
Power Stage Enabled
Torque Limit Active
Velocity Limiting Active
Fault
Brake
Shunt Active
Torque Level 1 or 2 Active
Foldback Active

MDS
With FM Modules





FM control modules (see FM Controls) provide MDS-MD drive modules with "snap-on" functionality for Indexing (FM-2), Programming (FM-3E), and Advanced Programming (FM-4E). This modular approach allows users to choose the level of advanced machine control they need, based on the applications parameters and not the drive "spec".

Now programmed using the new PowerTools Pro software. It can also be used with PowerTools FM.

For applications requiring traditional multi-axis control, our MC controller is easily integrated with a single cable connection.

FM-2 INDEXING MODULE

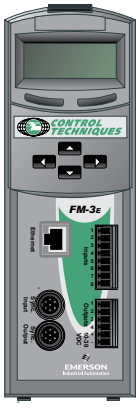


The FM-2 module enhances EN drives by adding positioning capability including Jog, Home, Index functions including Position Tracker™ – Fieldbus Indexing. The FM-2 also includes additional I/O providing 8 digital inputs and 4 digital outputs.

FM-2 Application Examples

- Clutch-brake replacement
- Extend-retract arm
- Indexing table
- Indexing conveyor

FM-3E PROGRAMMING MODULE

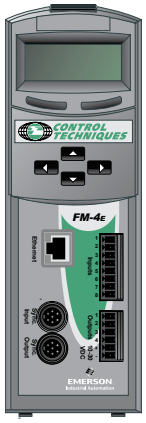


The FM-3E Ethernet module transforms the MDS into a fully programmable single-axis motion controller, and adds 8 digital inputs and 4 digital outputs. Profibus (FM-3PB) and DeviceNet (FM-3DN) options are also available.

FM-3E Application Examples

- Tension control
- Flying cut off
- Auger filler
- Registration control
- Slip compensation

FM-4E ADVANCED PROGRAMMING MODULE



The FM-4E Advanced Programming module has taken all of the features and flexibility of the FM-3E, and added the ability to create complex motion profiles for sophisticated applications. The FM-4E adds versatility and extends functionality by including high speed data capture, summation of multiple motion profiles, program multi-tasking, and an array of parameters suitable for even the toughest applications. Profibus (FM-4PB) and DeviceNet (FM-4DN) options are also available.

FM-4E Application Examples

- Random infeed conveyor
- Merge conveyor
- Rotary knife
- High speed labeling
- Phase synchronization
- Electronic gearing
- Point-to-point positioning
- Thermoforming
- Web control

MDS TERMINALS AND PINOUTS



AC Power

Terminal	Signal
L1	AC Input
L2	AC Input
L3	AC Input
PE	PE

Digital I/O (J1)

Pin Number	Signal
1	System Ready Output
2	Shunt Active Output
3	Shunt Fault Output
4	OverTemp Output
5	High VAC
6	Drive Module Fault Output
7	AC Interlock Relay
8	AC Interlock Relay
9	External Shunt Control
10	Fault Reset Input
11	Logic Supply +24VDC
12	Logic Supply 0V Common
13	PE
14	I/O Supply
15	I/O Supply 0V

DC Power

Terminal	Signal
B+	DC Bus +
SHT	External Shunt Output
B-	DC Bus -

Digital I/O (J6)

Pin Number	Signal
1	I/O Supply +
2	I/O Supply 0V
3	Drive Enable
4	Input 1
5	Input 2
6	Input 3
7	Input 4
8	Output 1
9	Output 2
10	Output 3

Motor Power

Terminal	Signal
PE	PE
T	Motor Power T
S	Motor Power S
R	Motor Power R

Serial (J4)

Pin Number	Signal
3	RS232 TX
2	RS232 RX
6	Serial +5VDC
5	Serial 0V Common
4	RS485+
9	RS485-
1	Shield
7,8	No Connect

Command (J5)

Pin Number	Signal
15	Analog Command In +
14	Analog Command In -
8	Encoder Out A
9	Encoder Out A/
23	Encoder Out B
24	Encoder Out B/
37	Encoder Out Z
38	Encoder Out Z/
27	Pulse In A
41	Pulse In A/
26	Pulse In B
40	Pulse In B/
25	Pulse In Z
39	Pulse In Z/
20	Pulse In A (single ended)
36	Pulse In B (single ended)
16	I/O Input Drive Enable
1	I/O Input 1
2	I/O Input 2
3	I/O Input 3
4	I/O Input 4
19	I/O Output 1
18	I/O Output 2
17	I/O Output 3
33	I/O Supply +
34	I/O Supply +
31	I/O Supply 0V
32	I/O Supply 0V
29	Analog Out 0V
43	Analog Out Channel 1 +
44	Analog Out Channel 2 +
11	External Encoder +5VDC Power
12	External Encoder Common
28	+15V Power Out (10 mA)
6	RS485 +
21	RS485 -
5, 7, 10, 13, 22, 30, 35, 42	No Connect

Feedback Connector below not shown

Feedback (J7)

Pin Number	Signal
1	Motor Encoder A
10	Motor Encoder A/
2	Motor Encoder B
11	Motor Encoder B/
3	Motor Encoder Z
12	Motor Encoder Z/
4	Motor Commutation U
13	Motor Commutation U/
5	Motor Commutation V
14	Motor Commutation V/
6	Motor Commutation W
15	Motor Commutation W/
7,8	Encoder +5 VDC Supply
17	Encoder 0V Common
9	Motor OverTemp
16,18-26	No Connect

MDS SPECIFICATIONS AND DIMENSIONS

Power Requirements

AC Input Voltage: 3Ø, 187 to 528 VAC, 47 - 63 Hz (460 VAC for rated performance)

AC Input Current
MP-1250: 17 Arms (15A @ 100 ms soft start)
MP-2500: 35 Arms (15A @ 100 ms soft start)
MP-5000: 70 Arms (15A @ 100 ms soft start)

Output Continuous Current
MD-404: 4 Arms/2.8 Arms (5 kHz/10 kHz)
MD-407: 7 Arms/5 Arms
MD-410: 10 Arms/6.5 Arms
MD-420: 20 Arms/14 Arms
MD-434: 34 Arms/22 Arms
(Current ratings the same for 460V or 230V operation)

Output Peak Current
MD-404: 8A/5.6A (5 kHz/10 kHz)
MD-407: 14A/10A
MD-410: 20A/13A
MD-420: 40A/28A
MD-434: 68A/44A
(Current ratings the same for 460V or 230V operation)

Continuous Output Power
(Ratings based on 5 kHz, 460V/230V operation)
MP-1250: 12.5 kW/6.25 kW
MP-2500: 25 kW/12.5 kW
MP-5000: 50 kW/25.0 kW
MD-404: 3.3 kW/1.7 kW
MD-407: 5.8 kW/2.9 kW
MD-410: 8.3 kW/4.2 kW
MD-420: 16.7 kW/8.4 kW
MD-434: 28.3 kW/14.2 kW

Switching Frequency: 5 or 10 kHz

Logic Supply: +21.6 to 26.4 VDC, (Required Accessory)

Encoder Supply Output: +5 VDC, 250 mA

System Efficiency: 90%

Regeneration
Internal Energy Absorption—System Bus Capacitance

Power Modules (460V/230V):
MP-1250: 110 Joules / 236 Joules
MP-2500: 183 Joules / 393 Joules
MP-5000: 293 Joules / 629 Joules

Drive Modules (460V/230V):
MD-404: 8 Joules / 17 Joules
MD-407: 17 Joules / 37 Joules
MD-410: 26 Joules / 55 Joules
MD-420: 37 Joules / 79 Joules
MD-434: 37 Joules / 79 Joules

Integral Transistor connected to an external resistor:
MP-1250: 30 Ohm minimum, 6 kW max
MP-2500: 30 Ohm minimum, 6 kW max
MP-5000: 9 Ohm minimum, 12 kW max

I/O Supply: +10 to 30 VDC

Power Module Control Inputs
Digital:(2) +10 to 30 VDC, 2.8 kOhm, Sourcing, Optically Isolated

Power Module Control Outputs
Digital:(6) Digital: +10 to 30 VDC, 150 mA, Sourcing, Optically isolated
Relay Contact:(1) AC Interlock, 24 VDC, 5A

Drive Module Control Inputs
Analog: (1) Analog: +/- 10 VDC 14 bit, 100 kOhm, Differential

Analog Max Input Rating: +/- 14 VDC, Differential or Each Input with Reference to Analog Ground

Digital: (5) +10 to 30 VDC, 2.8 kOHm, Sourcing, Optically isolated

Pulse: (1) Pulse, Differential: RS422, 2 MHz/ Channel, 50 % Duty Cycle (1) Pulse, Single Ended: TTL Schmitt Trigger

Drive Module Control Outputs

Analog: (2) +/- 10 VDC 10-bit, single ended, 20 mA

Digital: (3) +10 to 30 VDC, 150 mA, Sourcing, Optically isolated

Motor OverTemperature: (1) 0 to +5 VDC, single ended

Pulse: Differential: RS422 and TTL compatible, 20 mA/Channel, Sink or Source

Cooling Method
MP-1250: Convection
MP-2500: Integral Fan
MP-5000: Integral Fan
MD-404: Convection
MD-407: Integral Fan
MD-410: Integral Fan
MD-420: Integral Fan
MD-434: Integral Fan

Environmental
Rated Ambient Temperature: 32° to 104°F (0° to 40°C)

Maximum Ambient Temperature: 32° to 122°F (0° to 50°C) with power derating of 3.5% / 1.8°F (1°C) above 104°F (40°C)

Rated Altitude: 3280' (1000 m)

Maximum Altitude: For altitudes >3280' (1000 m) derate output by 1%/328' (100 m)

Vibration: 10 to 2000 Hz @ 2g

Humidity: 10 to 95% non-condensing

Storage Temperature: -13° to 167° (-25° to 75°C)

Ingress Protection: IP-20

Serial Interface
RS232/RS485 Modbus RTU - 9600 to 19.2 kBaud
Internal RS232 to RS485 Converter

Power Module Weight
MP-1250: 8.35 lb (3.78 kg)
MP-2500: 8.35 lb (3.78 kg)
MP-5000: 10.25 lb (4.65 kg)

Drive Module Weight
MD-404: 8.35 lb (3.78 kg)
MD-407: 8.35 lb (3.78 kg)
MD-410: 8.35 lb (3.78 kg)
MD-420: 10.25 lb (4.65 kg)
MD-434: 12.0 lb (5.44 kg)

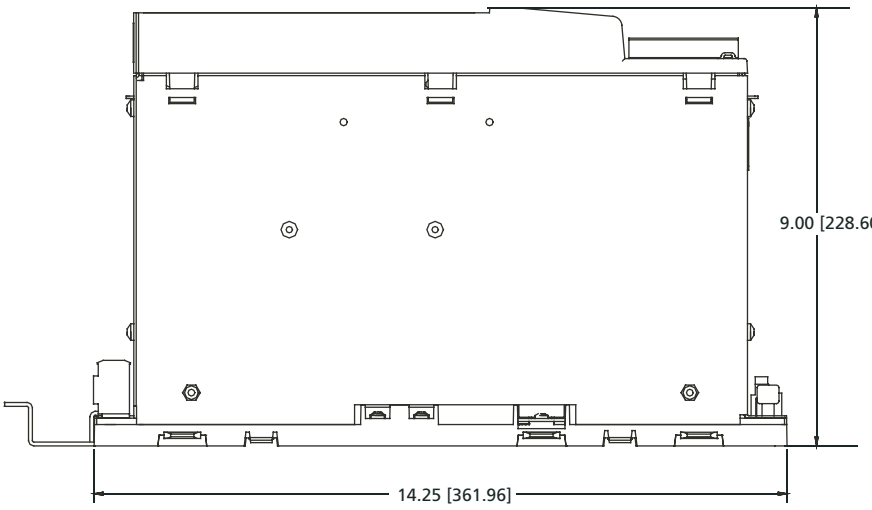
Go to Power CD for complete data

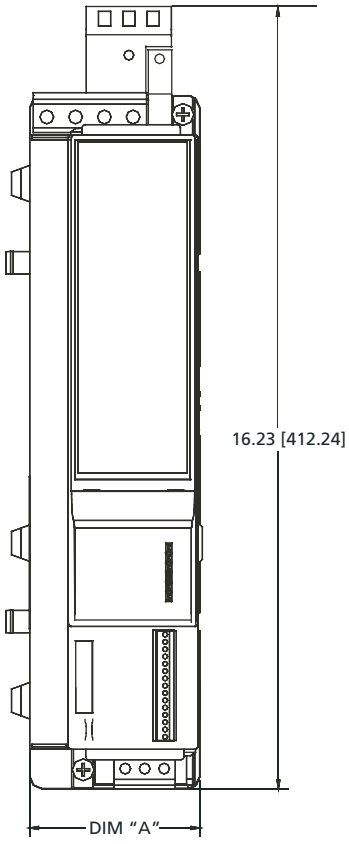
MDS Dimensions

POWER MODULES – MP-5000 SHOWN

Go to **Power CD** for complete data

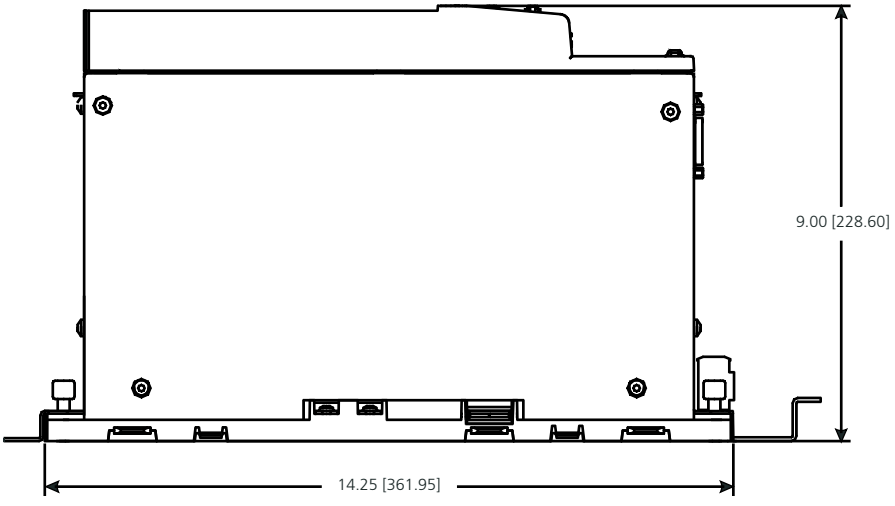
Power Module Model	Dimension A
MP-1250 & MP-2500	2.75 in. [69.85 mm]
MP-5000	3.50 in. [88.90 mm]

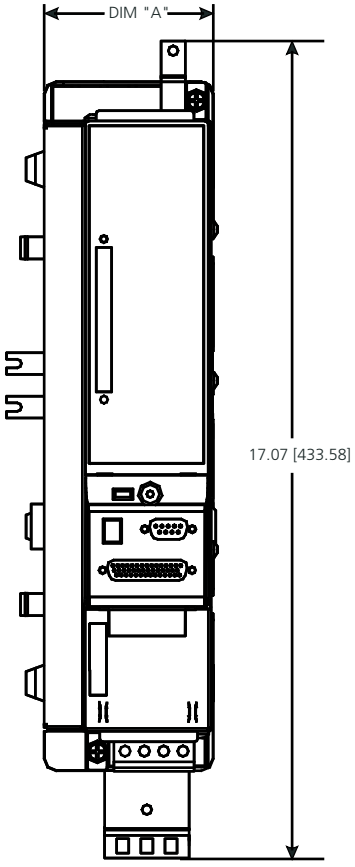




DRIVE MODULES – *MD-420 Shown*

Drive Module Model	Dimension A
MD-404, MD-407 & MD-410	2.75 [69.85]
MD-420	3.50 [88.90]
MD-434	5.49 [139.50]





HOW TO ORDER

Depending on your motor selection, use one of the following drive to motor combination pages, to configure a basic MDS system by selecting one item from each of the four ordering columns, and the fifth column if you are choosing a brake motor. Note that item ❷ motor selection requires additional input as to flange, and on NT systems connector type. (See the Motor Order String boxes for details.) Items ❸ through ❺ require cable lengths to be provided. ❻ After selecting each axis combination, a power module will need to be selected to complete the system. The basic systems represented on the following pages can be customized with a variety of components depending on your needs. A guide to Options and Accessories for MDS can be found on the next page, with details in the *Options and Accessories* section.

SELECT SYSTEM AND MOTOR

❶ Select the MDS Drive Module(s) appropriate to the needs of your application and operating environment, the 4-Amp MD-404, 7-Amp MD-407, 10-Amp MD-410, 20-Amp MD-420, or 34-Amp MD-434.

Note: The current rating for the drive module is the same whether 230V or 460V.

❷ Select the motor model appropriate to the drive module. (Note there are brake and non-brake models.)

CABLE ORDERING OPTIONS

Motor power, feedback and brake cables with MS style connectors are fully shielded with IP65 molded connectors and are available in standard and custom lengths. For more information on these and other cables, see *Options and Accessories* section.

Standard lengths of 5, 15, 25, 50 and 100 feet are available from stock. Non-standard lengths require additional lead time. ***Note: Equivalent FM Motor cable lengths are in meters.***

Feet=xxx or meters=yyy with specified lengths. Example: 005 = 5 feet. For applications involving continuous flexing, flexible cables are available. Cable components such as connector kits and raw cable are also available. See Options section for details or consult factory for special requirements.

❸ Motor Power Cables

Using the selection guide, choose the appropriate power cable for the motor.

❹ Motor Feedback Cables

From this column, choose the appropriate feedback cable for the motor.

❺ Motor Brake Cable

Choose a brake cable if a brake motor is selected.

❻ Power Module Selection

After selecting all of the axis combinations (drive modules and motors), a power module needs to be selected. To select the proper power module, use the Total Axis Power Table below and add up the power (kW) for each axis to determine the system power required. Then, select the power module which has sufficient power.

Drive Module	Motor Model	Total Axis Power (kW)
MD-404	MG-316	0.9
	MH-316	1.0
	MH-340	1.6
	MH-455	2.1
	95U2B400	1.6
	95U2E400	2.5
MD-407	MG-316	1.0
	MG-340	1.8
	NT-320	1.0
	NT-330	1.6
	MH-455	2.2
	MH-490	2.2
	95U2E400	3.0
	115U2C300	4.4
	115U2E300	4.4
	142U2C300	4.4
MD-410	MG-455	2.2
	NT-345	2.0
	NT-355	2.4
	MH-490	2.2
	MH-6120	3.8
	115U2C300	3.2
	115U2E300	5.0
	142U2C300	4.8
	142U2E300	6.3
MD-420	MG-455	2.3
	MG-490	3.4
	MG-4120	5.0
	MH-6200	4.1
	MH-6300	4.5
	MH-8250	8.8
	142U2E300	7.1
	190U2D300	12.6
	190U2F200	12.6
MD-434	MH-8500	11.7
	MH-8750	16.5
	190U2D300	13.0
	190U2F200	13.2

Power Module	Input Power 3Ø 460V	Input Power 3Ø 230V
MP-1250	12.5 kW	6.25 kW
MP-2500	25 kW	12.5 kW
MP-5000	50 kW	25 kW



REQUIRED ACCESSORY

The MDS requires an external logic supply to power the internal logic of the Power Module and Drive Modules. Use the table below to determine the current requirements of the application.



Module	Model Number	(A) RMS Current
Power Module	MP-1250	0.30
	MP-2500	
	MP-5000	
Drive Module	MD-404	0.60/Module
	MD-407	
	MD-410	
	MD-420	
	MD-434	0.80/Module
FM Module	All	0.40/FM Module
Synchronization Feedback Encoder	—	0.07/Encoder

Control Techniques offers the following 24 VDC logic-I/O power supplies:

MLP-002-00
2.1 Amp, +24 VDC, universal input 90 to 264 VAC.

MLP-005-00
5 Amp, +24 VDC, universal input 90 to 264 VAC.

MLP-010-00
10 Amp, +24 VDC, universal input 90 to 264 VAC.

OPTIONS AND ACCESSORIES FOR MDS

Control Techniques provides a complete array of options and accessories to complete your system. For details, see the *Options and Accessories* section of the catalog.

Brake Relays

BRM-1

Breakout Board

ECI-44, DEMO-FMIO-000, DEMO-DRIO-000

Diagnostics

DGNE

Logic Supplies

MLP-002-00, MLP-005-00, MLP-010-00

External Shunts/Resistors

(see Power Accessories)

AC Line Filters

MF-1250-20 (MP-1250), MF-2500-35 (MP-2500), MF-5000-65 (MP-5000)

AC Line Reactor

MLR-2580-00 (MP-5000)
Consult Factory for AC Line Reactors used on MP-1250 and MP-2500

Motor Power Filter

MPF-002-00, MPF-003-00

Synchronization Encoders

SCSLD-4, SCSLD-4R

Operator Interface

CTVue, OIT, CTIU

Extended Warranty

Extends Two Year Warranty to Five Years

MDS

230V FM Motor



The FM 230V line is a medium to high inertia line for larger load applications. It is designed to allow use in many applications and offers a wide range of options. The FM line is offered in metric frame sizes, 75 mm, 95 mm, 115 mm, 142 mm and 190 mm. The standard configured motor has a 4096 line encoder, vertical connectors and non-brake. This configuration is designed with low cogging torque to provide smooth operation and excellent velocity regulation. The torque range available is 19.0 lb-in (2.1 Nm) to 364 lb-in (40.1 Nm). All models are rated IP65.

The FM motor is also available with many other options like resolver and Sin/Cos feedback, NEMA flange, different shaft diameters, 90° and rotatable connectors, and a high peak torque option that allows intermittent operation near 5 times their continuous torque levels.

MDS - 230V FM Motor Specifications

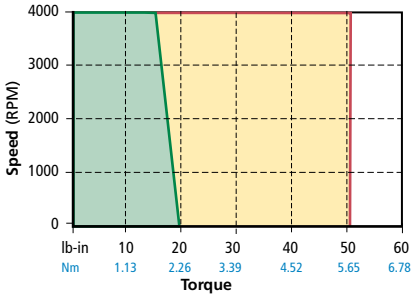
Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/ krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MD-404	075E2B40	19.50	50.98	15.05	0.95	4000	4096	0.001	44	6.37	9.7
		2.23	5.76	1.70	0.71			1.2		0.72	4.4
MD-404	075E2C40	25.49	50.98	20.36	1.28	4000	4096	0.001	44	6.37	11.4
		2.88	5.76	2.30	0.96			1.6		0.72	5.2
MD-407	075E2D30	34.57	103.54	30.98	1.47	3000	4096	0.002	57	8.23	13.2
		3.91	11.70	3.50	1.10			2		0.93	6.0
MD-407	095E2B40	38.13	89.21	26.55	1.68	4000	4096	0.003	44	6.37	13.9
		4.32	10.08	3.00	1.26			2.9		0.72	6.3
MD-410	095E2D40	63.72	127.44	43.37	2.73	4000	4096	0.005	44	6.37	19.1
		7.20	14.40	4.90	2.05			5.1		0.72	8.7
MD-410	115E2C30	82.31	164.61	71.69	3.39	3000	4096	0.008	57	8.23	25.5
		9.30	18.60	8.10	2.54			9		0.93	11.6
MD-420	115E2E30	135.80	329.22	111.51	5.28	3000	4096	0.012	57	8.23	33.9
		15.35	37.20	12.60	3.96			13.8		0.93	15.4
MD-420	142E2D30	164.61	329.22	107.97	6.61	3000	4096	0.024	57	8.23	41.6
		18.60	37.20	12.20	4.96			27.6		0.93	18.9
MD-434	190E2D20	364.27	842.52	326.57	10.31	2000	4096	0.076	85	12.39	74.6
		41.16	95.20	36.90	7.73			86.4		1.40	33.9

*Rated Speed = Maximum Operating Speed

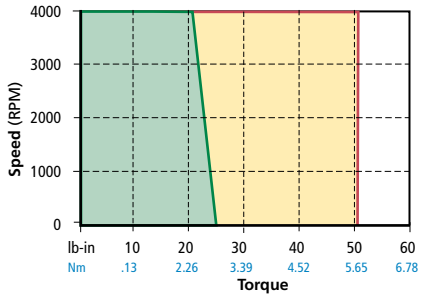
**See the complete order string in the Servo motor section of this catalog.

MDS - 230V FM Motor Speed Torque Curves

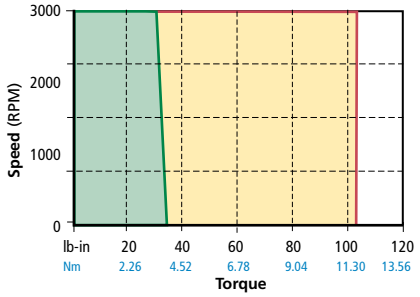
075E2B40-x with MD-404



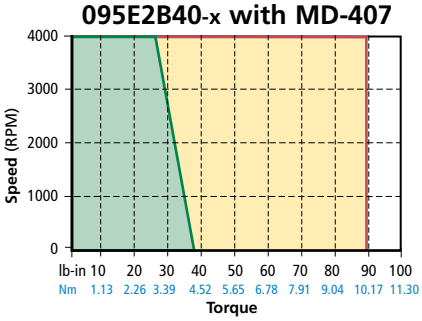
075E2C40-x with MD-404



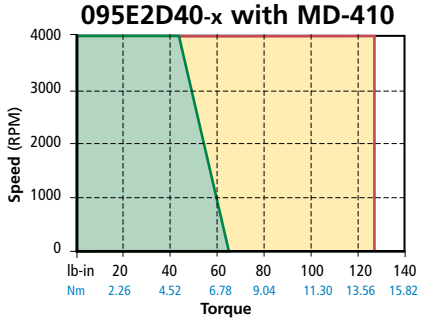
075E2D30-x with MD-407



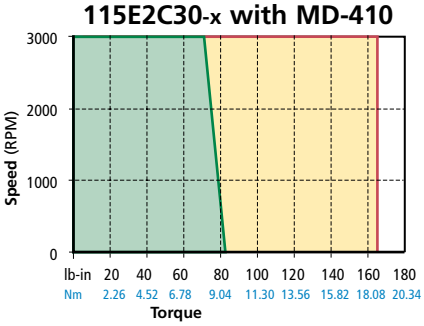
095E2B40-x with MD-407



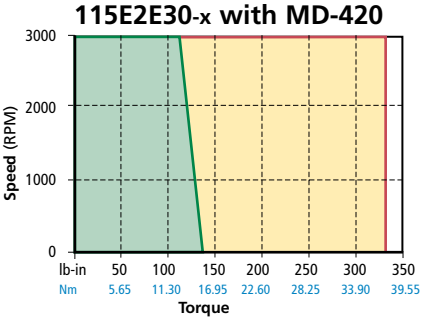
095E2D40-x with MD-410



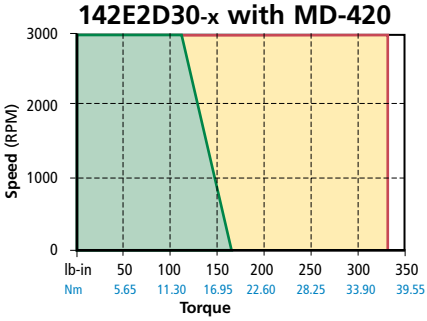
115E2C30-x with MD-410



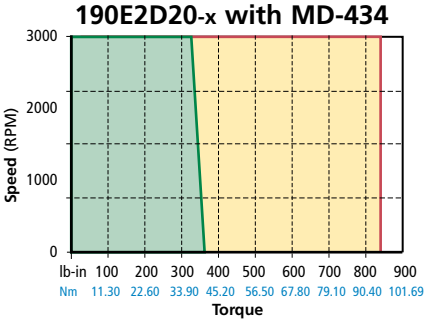
115E2E30-x with MD-420



142E2D30-x with MD-420



190E2D20-x with MD-434



Legend

- Continuous Torque
- Peak Torque

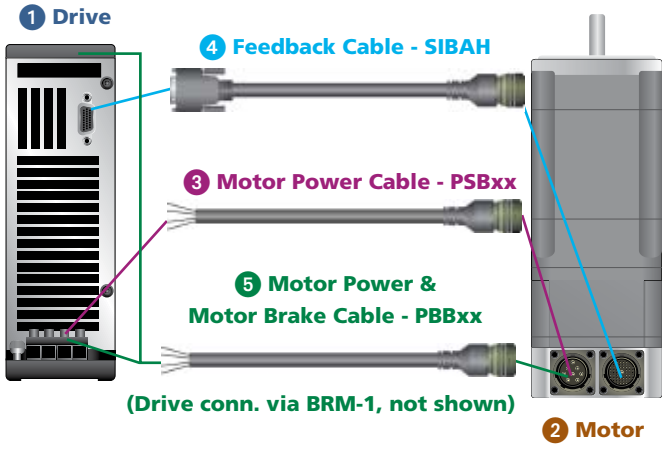
SPECIFICATIONS

Voltage	240 VAC
Drive Frequency	5 kHz
Ambient Temperature	40°C (104°F)
Case Temperature	140°C (284°F)

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

MDS

230V FM Motor Selection



Order String

xxx	E	2	x	xx	x	B	A	CA	A	BCD*	DIA*

- Frame Size: **075, 095, 115, 142, 190**
- Voltage **E** = 230V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A, B, C, D, E, F, G, H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **B** = 90° Connectors
- Shaft Key: **A** = With Key
- Feedback Device: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.

For additional motor information see the Servo Motor area in this section for details. For additional cable options see Options

Servo System Order Guide

❶ Drive Model	❷ Motor Model	❸ Motor Power Cable (yyy=meters)	❹ Feedback Cable (yyy=meters)	❺ Motor Power/Brake Cable (required w/all brake motors) (yyy=meters)
MD-404	075E2B400 BACAA075140	PSBAA-yyy	SIBAH-yyy	
	075E2B401 BACAA075140		SIBAH-yyy	PBBAA-yyy
	075E2C400 BACAA075140	PSBAA-yyy	SIBAH-yyy	
	075E2C401 BACAA075140		SIBAH-yyy	PBBAA-yyy
MD-407	075E2D300 BACAA075140	PSBAA-yyy	SIBAH-yyy	
	075E2D301 BACAA075140		SIBAH-yyy	PBBAA-yyy
	095E2B400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095E2B401 BACAA100190		SIBAH-yyy	PBBAA-yyy
MD-410	095E2D400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095E2D401 BACAA100190		SIBAH-yyy	PBBAA-yyy
	115E2C300 BACAA115190	PSBAA-yyy	SIBAH-yyy	
	115E2C301 BACAA115190		SIBAH-yyy	PBBAA-yyy
MD-420	115E2E300 BACAA115240	PSBAA-yyy	SIBAH-yyy	
	115E2E301 BACAA115240		SIBAH-yyy	PBBAA-yyy
	142E2D300 BACAA165240	PSBAA-yyy	SIBAH-yyy	
	142E2D301 BACAA165240		SIBAH-yyy	PBBAA-yyy
MD-434	190E2D200 BACAA215320	PSBBK-yyy	SIBAH-yyy	
	190E2D201 BACAA215320		SIBAH-yyy	PBBBK-yyy

MDS
230V NT and MG Motors

The NT is an economical, high performance motor manufactured with powerful Neodymium magnets and a patented segmented core to maximize torque and minimize size. The NT motor has a very low inertia for applications that demand high accel and cycle rates. NT motors can be ordered with MS style connectors, 1 m Flying Leads or 1 m Flying Leads with MS connectors.

The MG Motor is a compact, low inertia motor ideal for dynamic applications needing greater torque than the NT. Both the NT and MG are available with English and Metric flanges, with or without brakes. Both have a standard encoder resolution of 2048 lines per rev.



MDS - 230V NT Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MD-407	NT-320	19.5 2.2	38 4.3	16 1.8	1.02 0.8	4000	2048	0.000328 0.370	29	3.50 0.40	6 2.7
MD-407	NT-330	27 3.05	58 6.55	27 3.1	1.71 1.3	4000	2048	0.000438 0.494	36	4.73 0.53	7.3 3.3
MD-410	NT-345	42 4.75	80 9.04	42 4.75	2.00 1.49	3000	2048	0.000668 0.754	50	6.37 0.72	10.0 4.5
MD-410	NT-355	48 5.42	90 10.2	48 5.42	2.28 1.71	3000	2048	0.000888 1.0	50	6.32 0.71	12.3 5.6

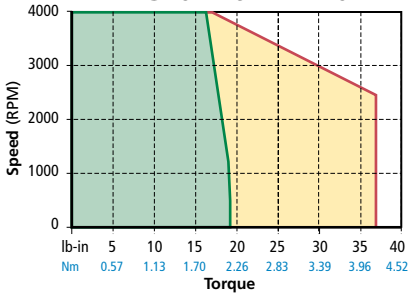
MDS - 230V MG Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MD-404	MG-316	18.6 2.1	42 4.6	16 1.8	1.02 0.8	4000	2048	0.000560 0.630	38	5.5 0.62	8.3 3.8
MD-407	MG-316	18.6 2.1	56 6.3	16 1.8	1.02 0.8	4000	2048	0.000560 0.630	38	5.5 0.62	8.3 3.8
MD-407	MG-340	50 5.7	133 15.0	42 4.8	2.00 1.5	3000	2048	0.001458 1.646	57	8.3 0.94	14.6 6.6
MD-410	MG-455	68 7.7	154 17.5	52 5.8	2.48 1.9	3000	2048	0.002658 3.0	60	8.8 0.99	20.0 9.1
MD-420	MG-455	68 7.7	200 22.6	52 5.8	2.48 1.9	3000	2048	0.002658 3.0	60	8.8 0.99	20.0 9.1
MD-420	MG-490	129 14.57	302 34.1	80 9.0	3.81 2.8	3000	2048	0.005175 5.823	59	8.6 0.97	28.6 13
MD-420	MG-4120	163 18.4	382 43.2	120 13.6	5.71 4.3	3000	2048	0.007458 8.4	72	10.5 1.19	37.0 16.8

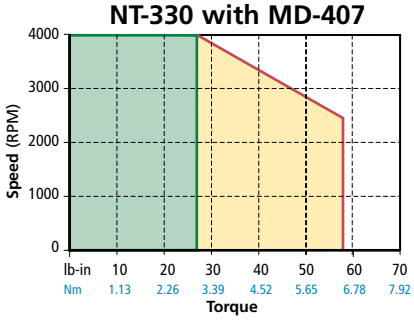
* Rated Speed = Maximum Operating Speed

MDS - 230V NT Motor Speed Torque Curves

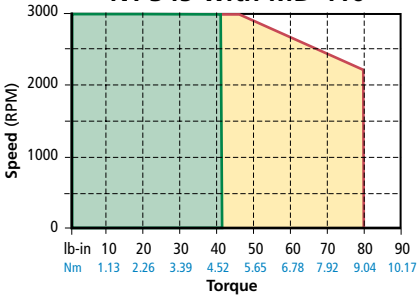
NT-320 with MD-407



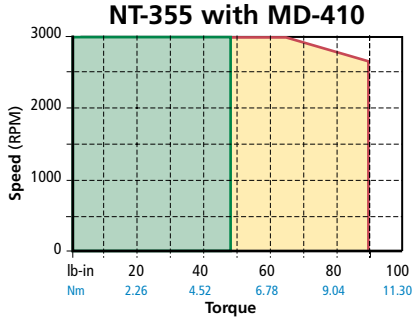
NT-330 with MD-407



NT-345 with MD-410



NT-355 with MD-410



Legend

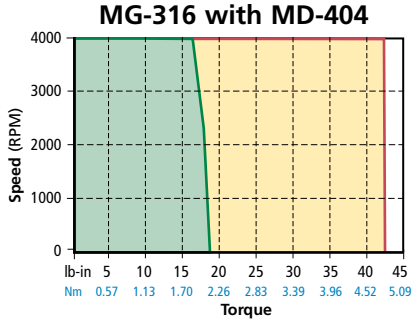
- Continuous Torque
- Peak Torque

SPECIFICATIONS

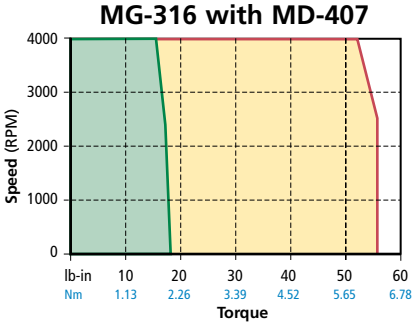
Voltage	240 VAC
Drive Frequency	5 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

MDS - 230V MG Motor Speed Torque Curves

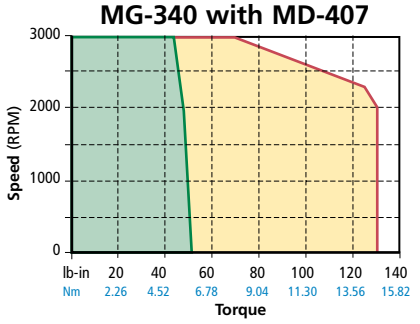
MG-316 with MD-404



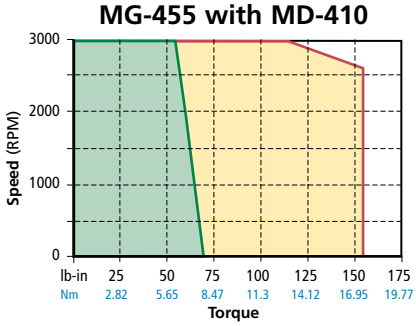
MG-316 with MD-407



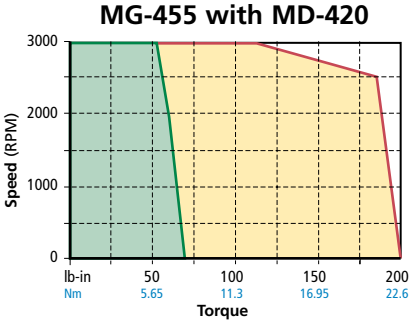
MG-340 with MD-407



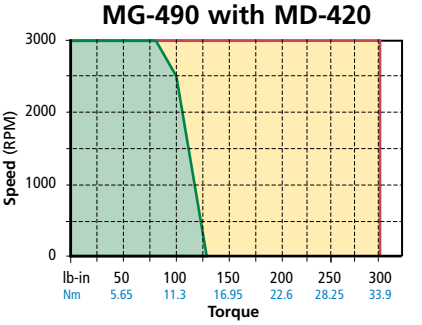
MG-455 with MD-410



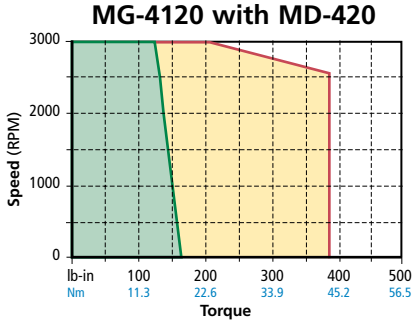
MG-455 with MD-420



MG-490 with MD-420



MG-4120 with MD-420



SPECIFICATIONS

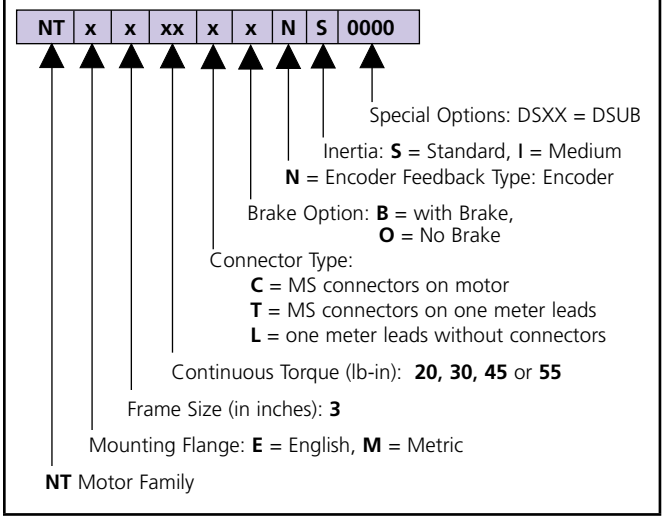
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

MDS

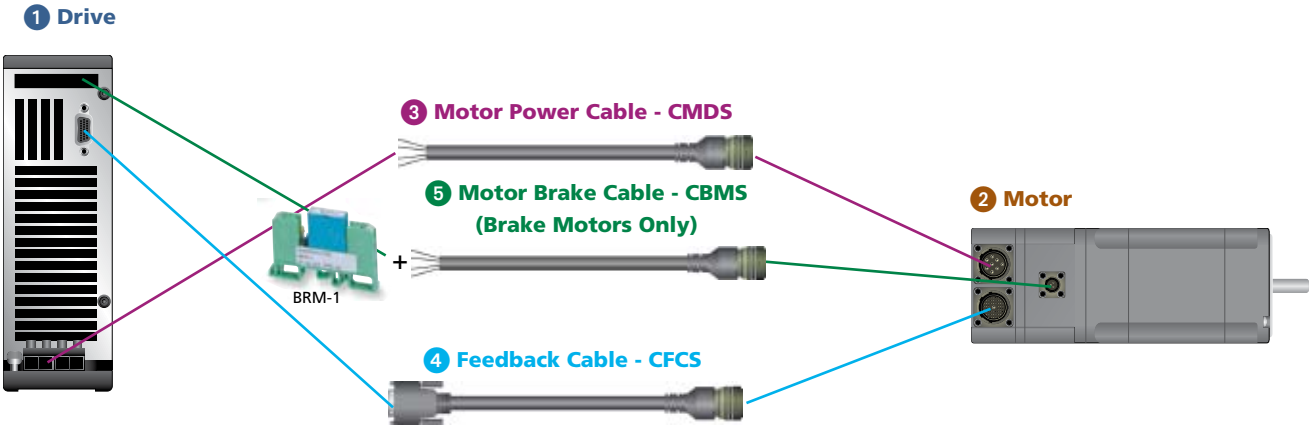
230V NT Motor Selection

The NT motor is a high performance motor utilizing patented technology to maximize torque in a compact package. The NT motor uses powerful Neodymium magnets and is manufactured with a segmented core to maximize stator efficiency. The NT motor has a very low inertia for applications that demand high accel and cycle rates. NT motors are available in English (NEMA 23 or 34) or Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. NT motors can be ordered with MS style connectors, 1 m Flying Leads, or 1 m Flying Leads with MS connectors.

Order String



For additional motor information see the Servo Motor area in this section for details. For additional cable options see Options



Servo System Order Guide

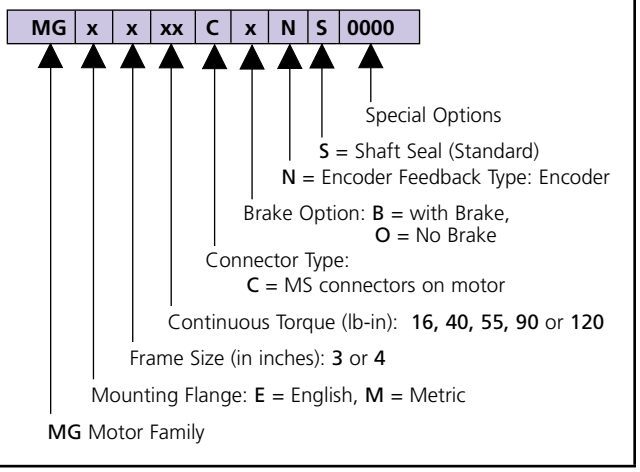
❶ Drive Model	❷ Motor Model (x=Flange type) (y=Connector)	❸ Motor Power Cable (xxx=feet)	❹ Feedback Cable (xxx=feet)	❺ Motor Brake Cable (required w/all brake motors) (xxx=feet)
MD-407-00-000	NTx-320-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-320-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-330-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-330-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
MD-410-00-000	NTx-345-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-345-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	NTx-355-yONS-0000	CMDS-xxx	CFCS-xxx	
	NTx-355-yBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx

MDS

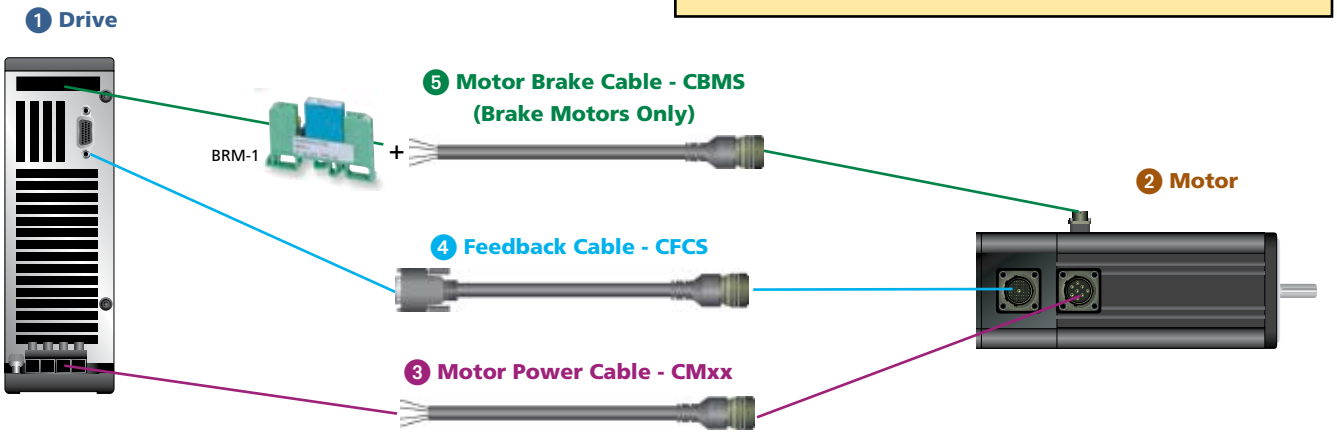
230V MG Motor Selection

The MG motor is a low inertia motor that is great for dynamic applications that have larger load inertias. MG motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors motors. MG motors are available in English (NEMA 23, 34, or 56) and Metric (IEC-72-1) flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. MG motors come standard with MS style connectors. For applications that require custom motors the MG line is the choice.

Order String



For additional motor information see the Servo Motor area in this section for details. For additional cable options see Options



1 Drive Model	2 Motor Model (x=Flange type)	3 Motor Power Cable (xxx=feet)	4 Feedback Cable (xxx=feet)	5 Motor Brake Cable (required w/all brake motors) (xxx=feet)
MD-404-00-000	MGx-316-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
MD-407-00-000	MGx-316-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-316-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MGx-340-CONS-0000	CMDS-xxx	CFCS-xxx	
	MGx-340-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
MD-410-00-000	MGx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
MD-420-00-000	MGx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MGx-490-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-490-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MGx-4120-CONS-0000	CMMS-xxx	CFCS-xxx	
	MGx-4120-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx

MDS
460V FM Motor



The FM 460V line is a medium to high inertia line for larger load applications. It is designed to allow use in many applications and offers a wide range of options. The FM line is offered in metric frame sizes, 75 mm, 95 mm, 115 mm, 142 mm and 190 mm. The standard configured motor has a 4096 line encoder, vertical connectors and non-brake. This configuration is designed with low cogging torque to provide smooth operation and excellent velocity regulation. The torque range available is 38.2 lb-in (4.3 Nm) to 520 lb-in (58.8 Nm). All models are rated IP65.

The FM motor is also available with many other options like resolver and Sin/Cos feedback, NEMA flange, different shaft diameters, 90° and rotatable connectors, and a high peak torque option that allows intermittent operation near 5 times their continuous torque levels.

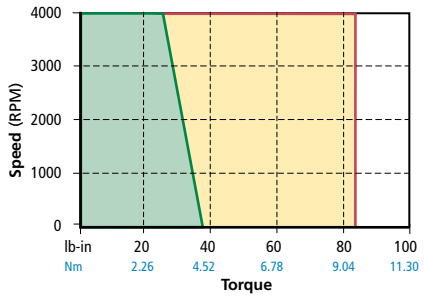
MDS - 460V FM Motor Specifications

Drive Model	Motor Model	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MD-404	095U2B400	38.23	84.96	26.55	1.68	4000	4096	0.002567	74	10.62	6.3
		4.32	9.60	3.00	1.26			2.9		1.20	5.2
MD-404	095U2E400	42.48	84.96	42.48	2.68	4000	4096	0.005487	74	10.62	9.9
		4.80	9.60	4.80	2.01			6.2		1.20	6.0
MD-407	095U2E400	74.34	148.68	50.45	3.19	4000	4096	0.005487	74	10.62	9.9
		8.40	16.80	5.70	2.39			6.2		1.20	6.0
MD-407	115U2C300	83.54	198.24	71.68	3.39	3000	4096	0.007965	98	14.16	11.6
		9.44	22.40	8.10	2.54			9		1.60	6.3
MD-410	115U2E300	135.94	283.20	111.51	5.28	3000	4096	0.012213	98	14.16	15.4
		15.36	32.00	12.60	3.96			13.8		1.60	8.7
MD-407	142U2C300	99.12	198.24	99.12	4.69	3000	4096	0.019647	98	14.16	35.4
		11.20	22.40	11.20	3.52			22.2		1.60	16.1
MD-410	142U2C300	135.94	283.20	107.97	5.11	3000	4096	0.019647	98	14.16	35.4
		15.36	32.00	12.20	3.83			22.2		1.60	16.1
MD-410	142U2E300	141.60	283.20	141.60	6.71	3000	4096	0.031329	98	14.16	47.7
		16.00	32.00	16.00	5.03			35.4		1.60	21.7
MD-420	142U2E300	208.15	566.40	159.30	7.53	3000	4096	0.031329	98	14.16	47.7
		23.52	64.00	18.00	5.65			35.4		1.60	21.7
MD-420	190U2D300	283.20	566.40	283.20	13.40	3000	4096	0.076464	98	14.16	74.6
		32.00	64.00	32.00	10.05			86.4		1.60	33.9
MD-434	190U2D300	363.91	962.88	283.20	13.81	3000	4096	0.076464	98	14.16	74.6
		41.12	108.80	32.00	10.36			86.4		1.60	33.9
MD-434	190U2F200	520.38	1444.32	446.04	14.07	2000	4096	0.108944	147	21.24	93.5
		58.80	163.20	50.40	10.55			123.1		2.40	42.5

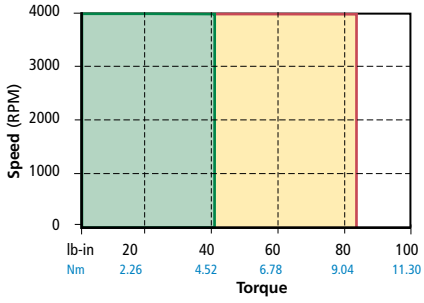
*Rated Speed = Maximum Operating Speed

MDS - 460V FM Motor Speed Torque Curves

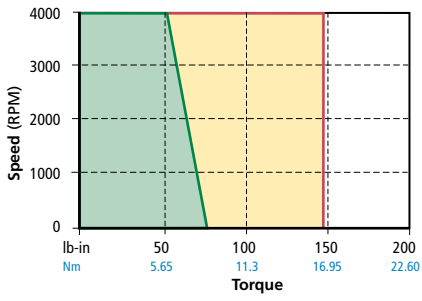
095U2B40-x with MD-404



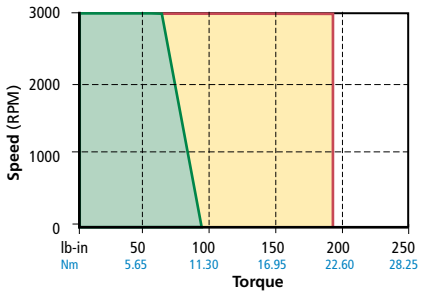
095U2E40-x with MD-404



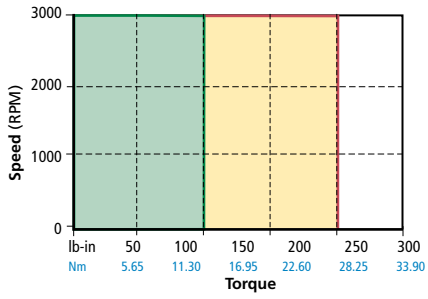
095U2E40-x with MD-407



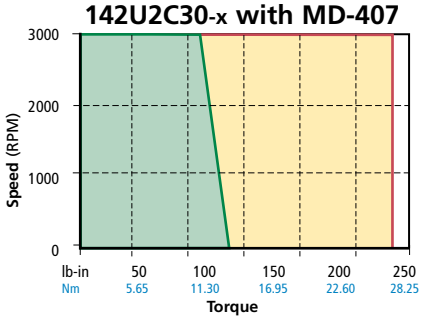
115U2C30-x with MD-407



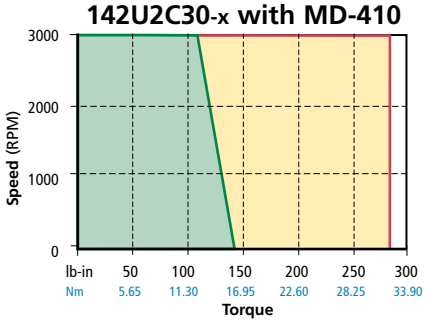
115U2E30-x with MD-410



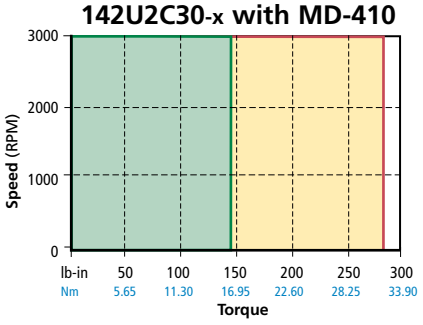
142U2C30-x with MD-407



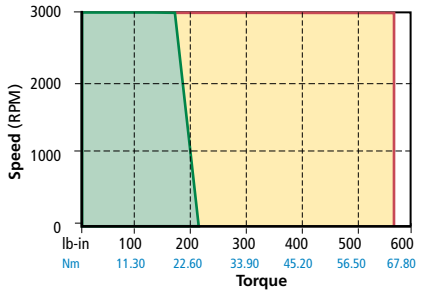
142U2C30-x with MD-410



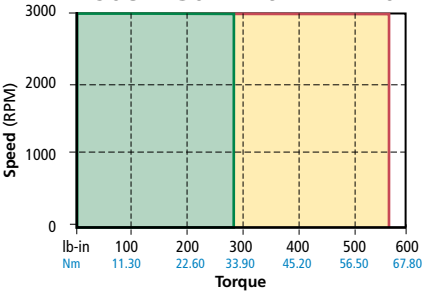
142U2C30-x with MD-410



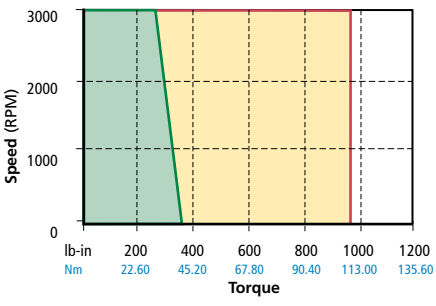
142U2E30-x with MD-420



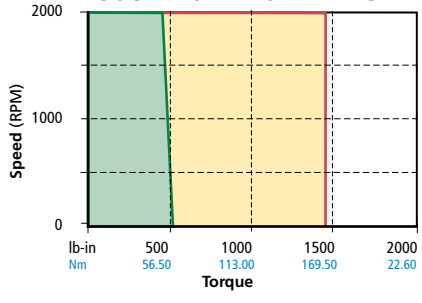
190U2D30-x with MD-420



190U2D30-x with MD-434



190U2F20-x with MD-434



Legend

- Continuous Torque
- Peak Torque

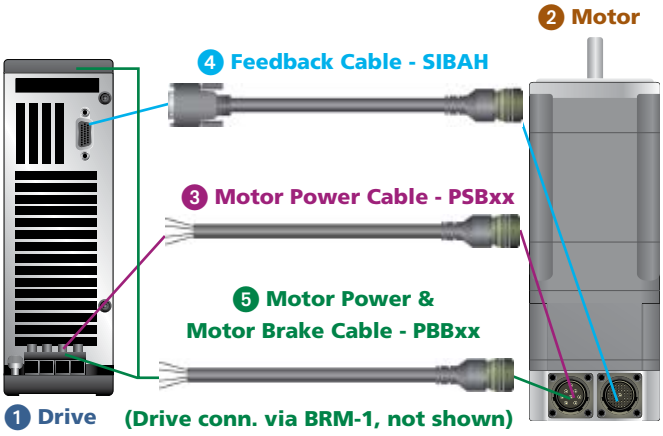
SPECIFICATIONS

Voltage	480 VAC
Drive Frequency	5 kHz
Ambient Temperature	40°C (104°F)
Case Temperature	140°C (284°F)

All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

MDS

460V FM Motor Selection



Order String

xxx	U	2	x	xx	x	B	A	CA	A	BCD*	DIA*

- Frame Size: **075**, **095**, **115**, **142**, **190**
- Voltage **E** = 230V, **U** = 460V
- Peak Torque: **2** = Standard Peak Torque
- Stator Length: **A**, **B**, **C**, **D**, **E**, **F**, **G**, **H**
- Rated Speed: **20** = 2,000 rpm, **30** = 3,000 rpm, **40** = 4,000 rpm, **50** = 5,000 rpm
- Brake: **0** = None, **1** = 24 VDC
- Connection Type: **B** = 90° Connectors
- Shaft Key: **A** = With Key
- Feedback Device: **CA** = 4096 Incremental Encoder
- Inertia: **A** = Standard

* Bolt Circle & Shaft Diameter are standard dimensions see FM Motor section for additional options.

Servo System Order Guide

1 Drive Model	2 Motor Model	3 Motor Power Cable (yyy=meters)	4 Feedback Cable (yyy=meters)	5 Motor Power/Brake Cable (required w/all brake motors) (yyy=meters)
MD-404	095U2E400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095U2E401 BACAA100190		SIBAH-yyy	PBBAA-yyy
MD-407	095U2E400 BACAA100190	PSBAA-yyy	SIBAH-yyy	
	095U2E401 BACAA100190		SIBAH-yyy	PBBAA-yyy
	115U2C300 BACAA115190	PSBAA-yyy	SIBAH-yyy	
	115U2C301 BACAA115190		SIBAH-yyy	PBBAA-yyy
MD-407	115U2E300 BACAA115240	PSBAA-yyy	SIBAH-yyy	
	115U2E301 BACAA115240		SIBAH-yyy	PBBAA-yyy
MD-410	115U2E300 BACAA115240	PSBAA-yyy	SIBAH-yyy	
	115U2E301 BACAA115240		SIBAH-yyy	PBBAA-yyy
MD-407	142U2C300 BACAA165240	PSBAA-yyy	SIBAH-yyy	
	142U2C301 BACAA165240		SIBAH-yyy	PBBAA-yyy
MD-410	142U2C300 BACAA165240	PSBBA-yyy	SIBAH-yyy	
	142U2C301 BACAA165240		SIBAH-yyy	PBBAA-yyy
	142U2E300 BACAA165240	PSBBA-yyy	SIBAH-yyy	
	142U2E301 BACAA165240		SIBAH-yyy	PBBAA-yyy
MD-420	142U2E300 BACAA165240	PSBBA-yyy	SIBAH-yyy	
	142U2E301 BACAA165240		SIBAH-yyy	PBBAA-yyy
	190U2D300 BACAA215320	PSBAK-yyy	SIBAH-yyy	
	190U2D301 BACAA215320		SIBAH-yyy	PBBAK-yyy
MD-434	190U2D300 BACAA215320	PSBCK-yyy	SIBAH-yyy	
	190U2D301 BACAA215320		SIBAH-yyy	PBBCK-yyy
MD-434	190U2F200 BACAA215320	PSBCK-yyy	SIBAH-yyy	
	190U2F201 BACAA215320		SIBAH-yyy	PBBCK-yyy

Motors can be custom ordered with Parking Brake, High energy dissipation brake, fixed or vertical connectors, IEC and NEMA flanges, Incremental, Absolute Sin/Cos Single and Multi-turn encoders, resolvers and extended peak torque range. Custom bolt circle and shaft diameter are also available. Contact Factory for details.

MDS

460V MH Motor

The MH Motor is a low inertia motor that is ideally suited to the MDS operating with 460 VAC Input. Applications with torque requirements between 21.5 lb-in (2.4 Nm) and 748 lb-in (84.5 Nm) can be solved. MH motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors' motors. MH motors are available in English and Metric flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. For applications that require custom motors the MH line is the choice.



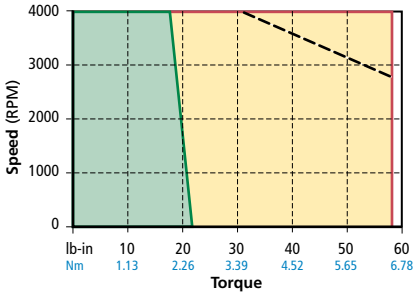
MDS - 460V MH Motor Specifications

Drive Model	Motor Model**	Cont. Stall Torque lb-in / Nm	Peak Stall Torque lb-in / Nm	Rated Torque @Rated Speed* lb-in / Nm	Rated Power HP / kWatts	Max.* Operating Speed RPM	Encoder Resolution lines/rev	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MD-404	MH-316	21.5 2.4	58 6.6	17.5 2	1.11 0.83	4000	2048	0.000673 0.8	75	10.98 1.24	8.3 3.8
MD-404	MH-340	46 5.2	135 15.3	37 4.2	1.76 1.31	3000	2048	0.001428 1.6	116	16.98 1.92	12.4 5.6
MD-404	MH-455	65 7.3	131 14.8	50.6 5.7	2.41 1.8	3000	2048	0.003557 4	120	17.57 1.99	18 8.2
MD-407	MH-455	72.5 8.2	210 23.7	50.6 5.7	2.41 1.8	3000	2048	0.003557 4	120	17.57 1.99	18 8.2
MD-407	MH-490	105 11.9	210 23.7	50 5.7	2.38 1.78	3000	2048	0.006727 7.6	110	16.10 1.82	26.2 11.9
MD-410	MH-490	105 11.9	300 33.9	50 5.7	2.38 1.78	3000	2048	0.006727 7.6	110	16.10 1.82	26.2 11.9
MD-410	MH-6120	119 13.4	336.8 38.1	91.4 10.3	4.35 3.25	3000	2048	0.010657 12	115	16.84 1.9	32.4 14.7
MD-420	MH-6200	234 26.4	673.6 76.1	95.9 10.8	4.57 3.41	3000	2048	0.018857 21.3	115	16.84 1.9	48 21.8
MD-420	MH-6300	299 33.8	673.6 76.1	105.4 11.9	5.02 3.74	3000	2048	0.027187 30.7	115	16.84 1.9	65 29.5
MD-420	MH-8250	285 32.2	607 68.6	210 23.7	10 7.45	3000	2048	0.059 61.4	128	18.70 2.11	77 35
MD-434	MH-8500	530 60.2	997 113.2	280 31.8	13.34 9.95	3000	2048	0.078 87.8	121.6	17.80 2.01	110 49.9
MD-434	MH-8750	748 84.5	1500 170.3	485 54.8	19.24 14.35	2500	2048	0.133 150	162	23.70 2.68	171 77.6

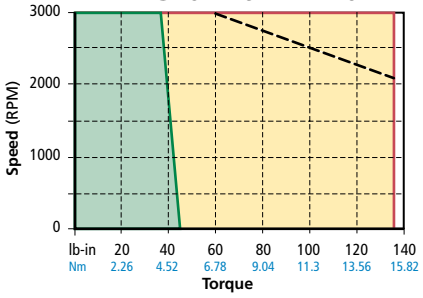
* Rated Speed = Maximum Operating Speed
**See the complete order string in the Servo motor section of this catalog.

MDS - 460V MH Motor Speed Torque Curves

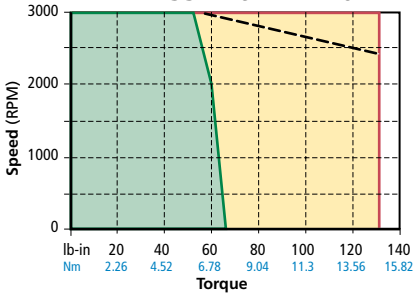
MH-316 with MD-404



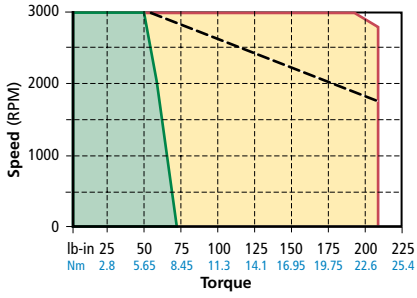
MH-340 with MD-404



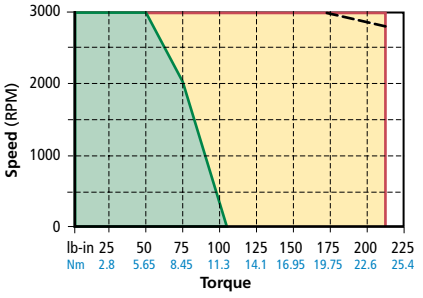
MH-455 with MD-404



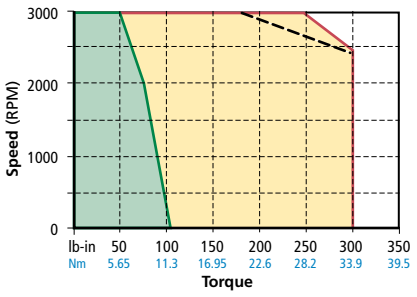
MH-455 with MD-407



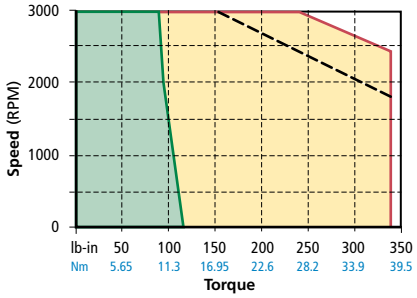
MH-490 with MD-407



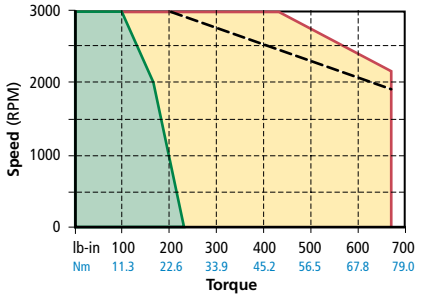
MH-490 with MD-410



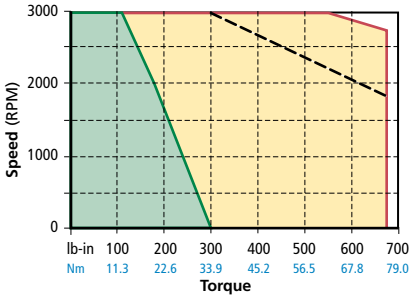
MH-6120 with MD-410



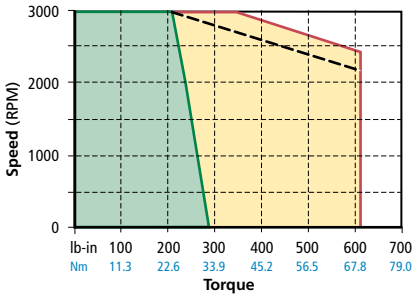
MH-6200 with MD-420



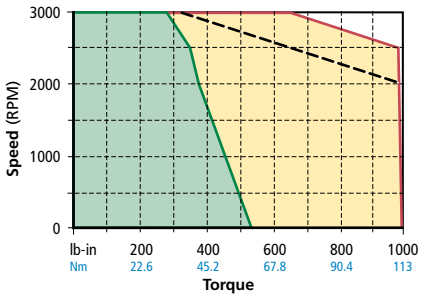
MH-6300 with MD-420



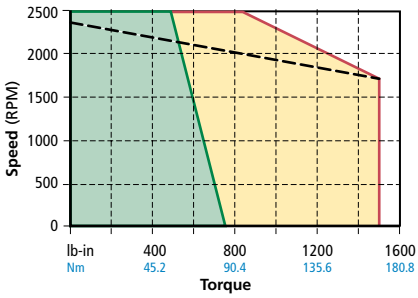
MH-8250 with MD-420



MH-8500 with MD-434



MH-8750 with MD-434



Legend

- – – – 380V Curve
- Continuous Torque
- Peak Torque

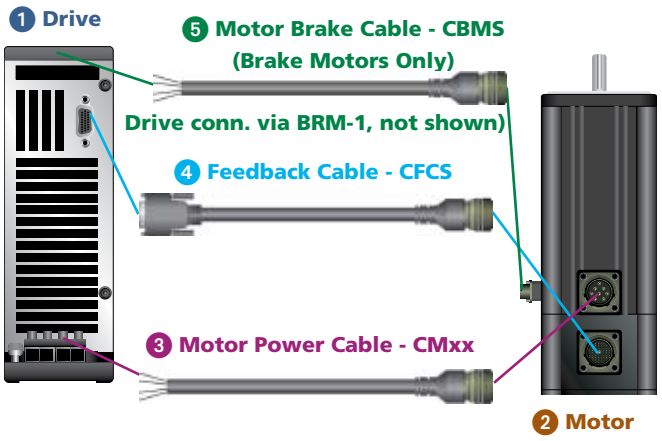
SPECIFICATIONS

Voltage	480 VAC
Drive Frequency	5 kHz
Ambient Temperature	25°C (77°F)
Case Temperature	100°C (212°F)

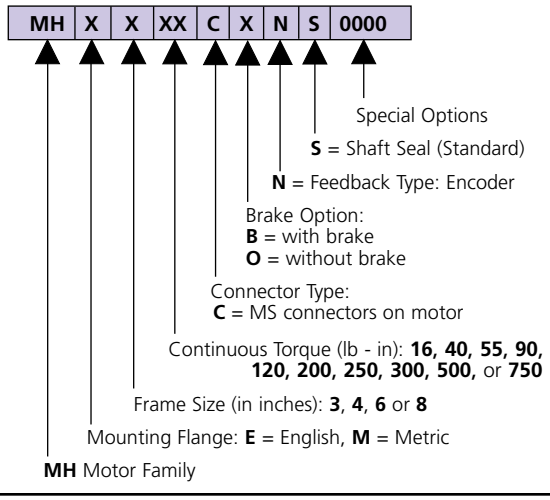
All performance data listed above has a +/-10% tolerance and is subject to change at any time without notice. For more detailed information on performance data and test conditions please refer to the motor section of the catalog. For brake motor information, complete motor specifications and dimensions please refer to our motor section.

MDS

460V MH Motor Selection



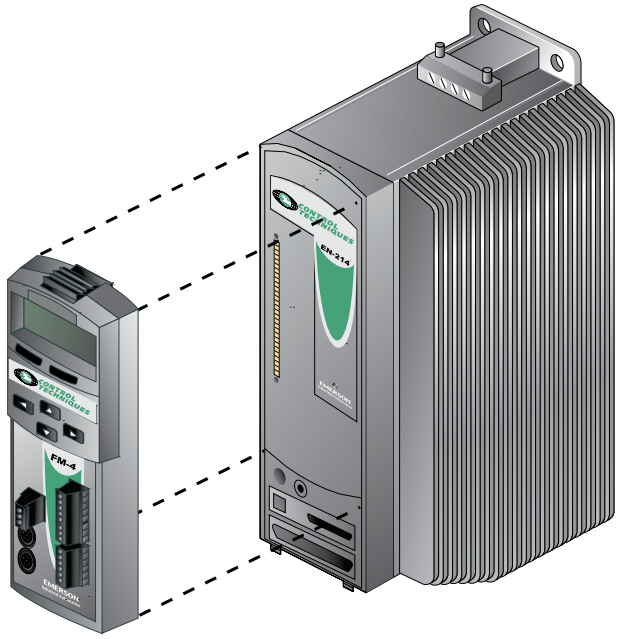
Order String



Servo System Order Guide

1 Drive Model	2 Motor Model (x=flange type)	3 Motor Power Cable (xxx=feet)	4 Feedback Cable (xxx=feet)	5 Motor Brake Cable (required w/all brake motors) (xxx=feet)
MD-404-00-000	MHx-316-CONS-0000	CMDS-xxx	CFCS-xxx	
	MHx-316-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MHx-340-CONS-0000	CMDS-xxx	CFCS-xxx	
	MHx-340-CBNS-0000	CMDS-xxx	CFCS-xxx	CBMS-xxx
	MHx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
MD-407-00-000	MHx-455-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHx-455-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MHx-490-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHx-490-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
MD-410-00-000	MHx-490-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHx-490-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MHM-6120-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHM-6120-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
MD-420-00-000	MHM-6200-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHM-6200-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MHM-6300-CONS-0000	CMMS-xxx	CFCS-xxx	
	MHM-6300-CBNS-0000	CMMS-xxx	CFCS-xxx	CBMS-xxx
	MHM-8250-CONS-0000	CMLS-xxx	CFCS-xxx	
	MHM-8250-CBNS-0000	CMLS-xxx	CFCS-xxx	CBMS-xxx
MD-434-00-000	MHM-8500-CONS-0000	CMLS-xxx	CFCS-xxx	
	MHM-8500-CBNS-0000	CMLS-xxx	CFCS-xxx	CBMS-xxx
	MHM-8750-CONS-0000	CMLS-xxx	CFCS-xxx	
	MHM-8750-CBNS-0000	CMLS-xxx	CFCS-xxx	CBMS-xxx

FM Controls
for MDS and EN Series Drives



FM controls are application modules that provide added functionality to EN Series and MDS Drives. These modules mount directly to the front of any EN Series or MDS drive. This is convenient for existing installations with limited mounting space, and is an economical solution for users wishing to stock drives and not controls. Currently, there are eight FM control modules from which to choose, depending upon the level of control needed.

FM-2 Indexing Module

The FM-2 module enhances EN and MDS operation by adding positioning capability including Jog, Home, and Index functions. The FM-2 also includes additional I/O providing 8 digital inputs and 4 digital outputs.

Every FM module provides
- **Unique Control Enhancements**
- **8 additional optically-isolated digital Inputs for a total of 12**
- **4 additional optically isolated digital Outputs for a total of 7**

Every FM module has
- **Modbus RTU standard via the drive**
- **Free, field upgradable firmware**
- **Free Software and Software Upgrades**
- **Two-Year warranty**

Every FM Module is
- **Easy to Install**
- **Easy to Program**
- **Easy to Use**

FREE Software

2 YEAR Digital Drive Warranty
5 YEAR Extended Warranty
CE
c UL us LISTED
DeviceNet
EtherNet/IP
PROFIBUS PROCESS FIELD BUS
MODBUS TCP/IP

FM-3E Programming Module

The FM-3E Ethernet module transforms the EN or MDS drive into a fully programmable 1½ axis motion controller. For flexibility above and beyond the FM-2, the FM-3E adds motion programming. The FM-3E utilizes PowerTools Pro versatile software giving the user an easy tool to create even the most complex of applications. Profibus (FM-3PB) and DeviceNet (FM-3DN) options are also available.

FM-4E Advanced Programming Module

For the most complex and challenging applications, the FM-4E can "do-it-all" while still maintaining our tradition of "Motion Made Easy". The FM-4E Ethernet module extends beyond FM-3E functionality offering program multitasking, multiple profile summation, high speed position capture, queuing and many more features. Profibus (FM-4PB) and DeviceNet (FM-4DN) options are also available.

Connectivity

FM controls enable EN and MDS drives to seamlessly integrate with Modbus, DeviceNet, Profibus, and Ethernet networks. The "Motion Made Easy" implementation of Ethernet, DeviceNet and Profibus gives the user network setup that is as easy as "drag and drop."

FM-2
Indexing Control



The FM-2 module expands the capability of the EN and MDS drives by adding positioning capabilities, including Jog, Index, and Home functions.

Operating information is set up via our free configuration software PowerTools. The FM-2 is designed to be extremely easy to set up and run. This saves time and money during installation and also makes long term support a breeze. For any simple point to point motion application, the FM-2 indexer is the right choice.

Programmable I/O
- **Unique Control Enhancements**
- **8 additional optically-isolated digital Inputs for a total of 12**
- **4 additional optically isolated digital Outputs for a total of 7**

Indexing
- **16 Indexes**
- **Position Tracker™ – Fieldbus Indexing**
- **Chaining index capability**
- **Chain indexes to home**
- **Compound Indexing**

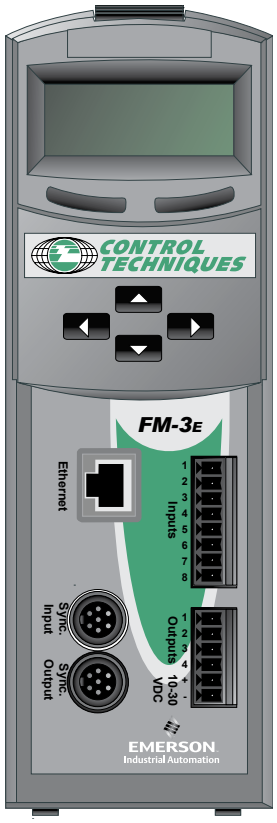
Jogging and Homing
- **2 jog velocities**
- **Homing**
- **Home to sensor**
- **Home to marker**
- **Home to sensor/marker**

Alternate Mode
- **Analog Velocity**
- **Analog Torque (with Speed Limit)**
- **Pulse Mode**

User Units
- **Distance**
- **Velocity**
- **Time Scale**
- **Acceleration**
- **Software Oscilloscope**
- **Auto-Tune**

FM-3E
Programming Control

The FM-3E Ethernet Programming Module allows the user to create programs to sequence motion, I/O control, and other machine operations in one environment. These programs used in conjunction with the Assignments or "virtual wiring" feature, provide the user with a powerful and easy-to-use programming environment.



With removable terminal block connectors for I/O and a pluggable sync cable for master encoder connections, setup of the FM-3E hardware is quick and clean. For diagnostics, the LCD keypad display on the front of the module gives the user a quick and handy way to change parameters, monitor feedback parameters, check module and drive revisions, change baud rates, view I/O states, and much more! Profibus (FM-3PB) and DeviceNet (FM-3DN) options are also available.

- **User-defined Units for Distance, Velocity, Accel/Decel and Torque**
- **User Programs**
- **Synchronized Motion**
- **Global and Index PLS's**
- **S-Curve Accel and Decel**
- **User Variables**
- **Analog Input**
- **Supports 57 Indexes**
- **Ethernet (-3E), DeviceNet (-3DN) or Profibus (-3PB) Options**
- **Software Oscilloscope**
- **Auto-Tune**

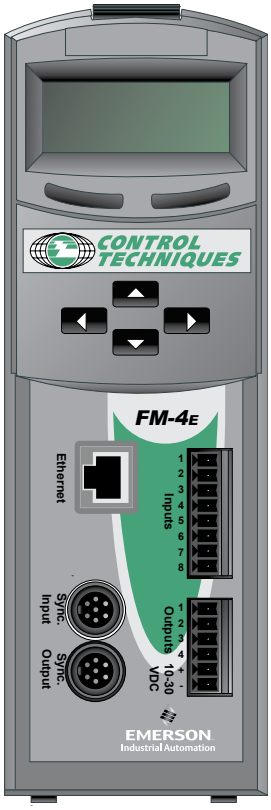
FM-4E
Advanced Programming

The FM-4E Advanced Programming Module with Ethernet takes all of the power and features of the FM-3E and combines them with advanced functions such as a Position Capture Object, Multiple Profile Summation, Queuing, and Program Multitasking.

The FM-4E module is the perfect solution for applications with complex motion profiles such as a random infeed conveyor, rotary knife, or high speed labeling machine.

Using the same software as the FM-3E, PowerTools Pro makes programming the FM-4E quick and easy.

Profibus (FM-4PB) and DeviceNet (FM-4DN) options are also available.



All the Programming Power of the FM-3E module, plus the following benefits:

- **Program Multitasking**
- **Multiple Profile Summation**
- **Queuing**
- **User Configurable Capture Objects**
- **Ethernet (-4E), DeviceNet (-4DN) or Profibus (-4PB) Options**

FM-2 SPECIFICATIONS

Logic I/O Supply
+10 to 30 VDC, 0.75A

Control Inputs
(8) Digital: +10 to 30 VDC, 2.8 kOhm, Sourcing, Optically isolated

Control Outputs
(4) Digital: +10 to 30 VDC, 150 mA, Sourcing, Optically isolated

Environmental
Ambient Temperature: 32° to 122°F (0 to 50°C) for rated performance
Vibration: 10 to 2000 Hz @ 2 g
Humidity: 10 to 95% non-condensing Storage
Temperature: -13° to 167°F (-25° to 75°C)
Ingress Protection: IP-20

Module Weight
0.5 lb (0.23 kg)

FM-3E AND FM-4E SPECIFICATIONS

Logic I/O Supply
+10 to 30 VDC, 0.75A

Control Inputs
Digital: (8) +10 to 30 VDC, 2.8 kOhm, Sourcing, Optically isolated
Pulse: Differential: RS422, 2 MHz/ Channel, 50% Duty Cycle

Control Outputs
Digital: (4) +10 to 30 VDC, 150 mA, Sourcing, Optically isolated
Pulse: Differential: RS422 and TTL compatible, 20 mA/Channel, Sink or Source

Environmental
Ambient Temperature: 32° to 122°F (0 to 50°C) for rated performance
Vibration: 10 to 2000 Hz @ 2 g
Humidity: 10 to 95% non-condensing
Storage Temperature: -13° to 167°F (-25° to 75°C)
Ingress Protection: IP-20

Module Weight
0.5 lb (0.23 kg)

DeviceNet (Optional)
Power Consumption: 25 mA
Baud Rates: 125, 250 and 500 kbps
Node Addresses: 00-63
Messaging: Explicit, Polled I/O, Change of State, Strobed and Cyclic
Connection: 5-wire terminal block

Profibus (Optional)
Baud Rates: Up to 12 Mbps
Node Addresses: 1-127
Messaging: Cyclic
Connector: DB9

Ethernet (Optional)
Data Rate: 10/100 base T
Messaging: Modbus TCP/IP, EtherNet/IP, SMTP, and HTTP
Connector: RJ45

FM CONTROL MODULE PINOUTS AND CONNECTIONS



Inputs	
Pin Number	**Signal**
1	Input 1
2	Input 2
3	Input 3
4	Input 4
5	Input 5
6	Input 6
7	Input 7
8	Input 8

Outputs	
Pin Number	**Signal**
1	Output 1
2	Output 2
3	Output 3
4	Output 4
5	I/O Supply +
6	I/O Supply 0V

Reserved	
Pin Number	**Signal**
1	Reserved
2	Reserved
3	Reserved

Synchronized Input (mini-DIN)

Synchronized Output (mini-DIN)



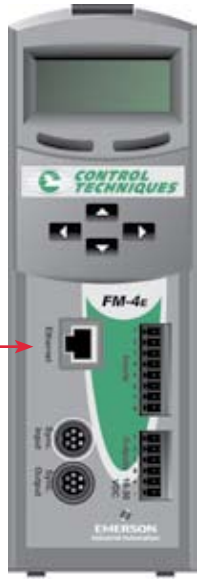


Fieldbus Connectivity Options
(FM-3 and FM-4 only)

Ethernet (FM-3E and FM-4E only)	
Pin Number	**Signal** (RJ45 connector)
1	TxData +
2	TxData -
3	RecvData +
4	NC
5	NC
6	RecvData-
7	NC
8	NC

DeviceNet (FM-3DN and FM-4DN only)	
Pin Number	**Signal**
1	DeviceNet V-
2	DeviceNet CAN_L
3	DeviceNet DRAIN
4	DeviceNet CAN_H
5	DeviceNet V+

Profibus (FM-3PB and FM-4PB only)	
Pin Number	**Signal** (DB9 connector)
1	N/C
2	N/C
3	Signal + (B)
4	RTS
5	Data GND
6	+5 Volts (for Active Termination)
7	N/C
8	Signal - (A)
9	N/C

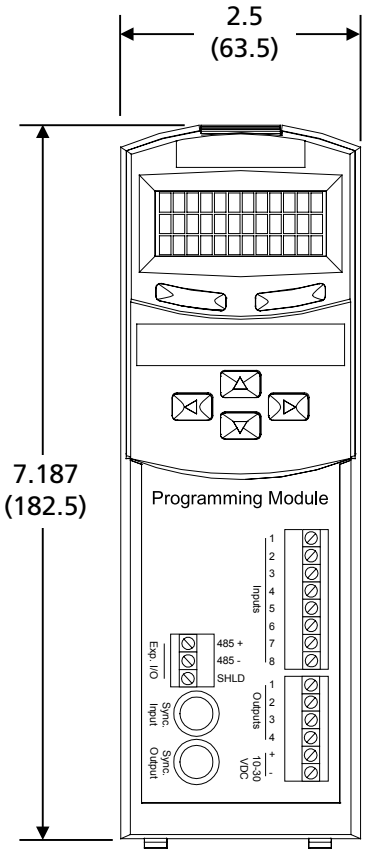


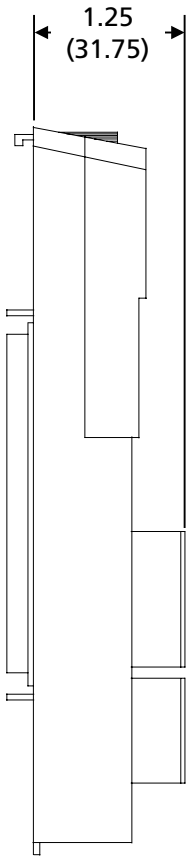




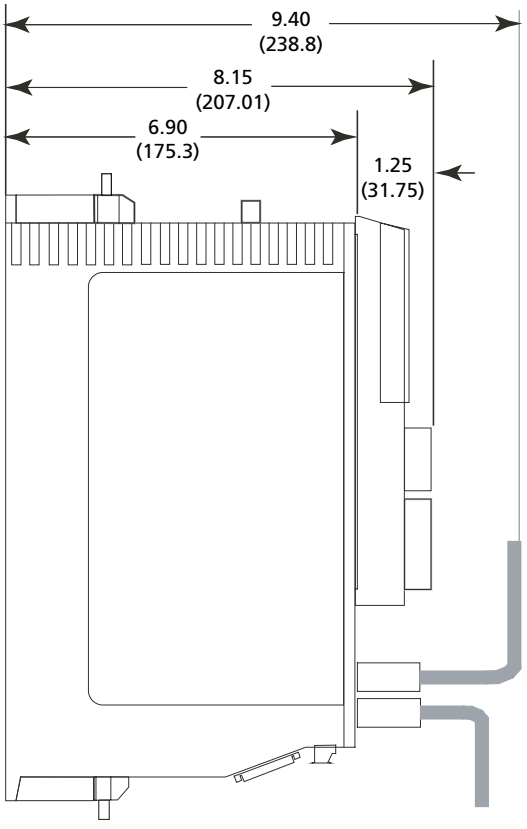
FM DIMENSIONS

Go to Power CD for complete data

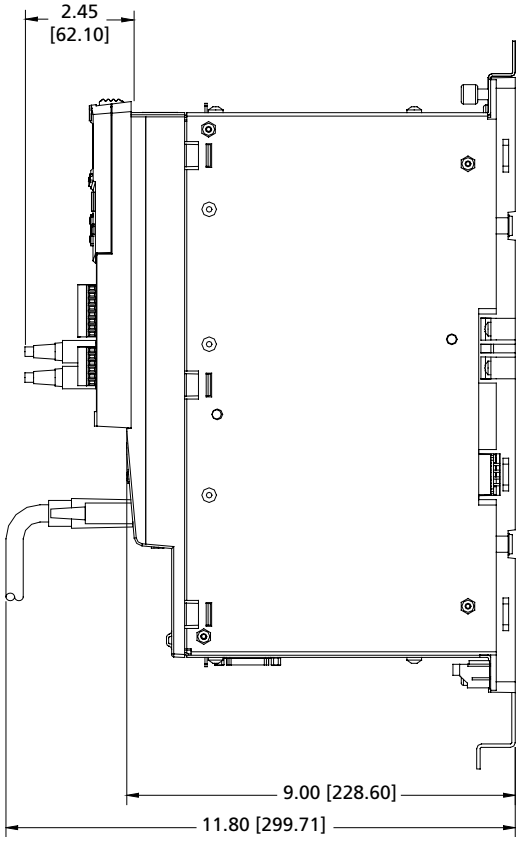




FM on EN Drive

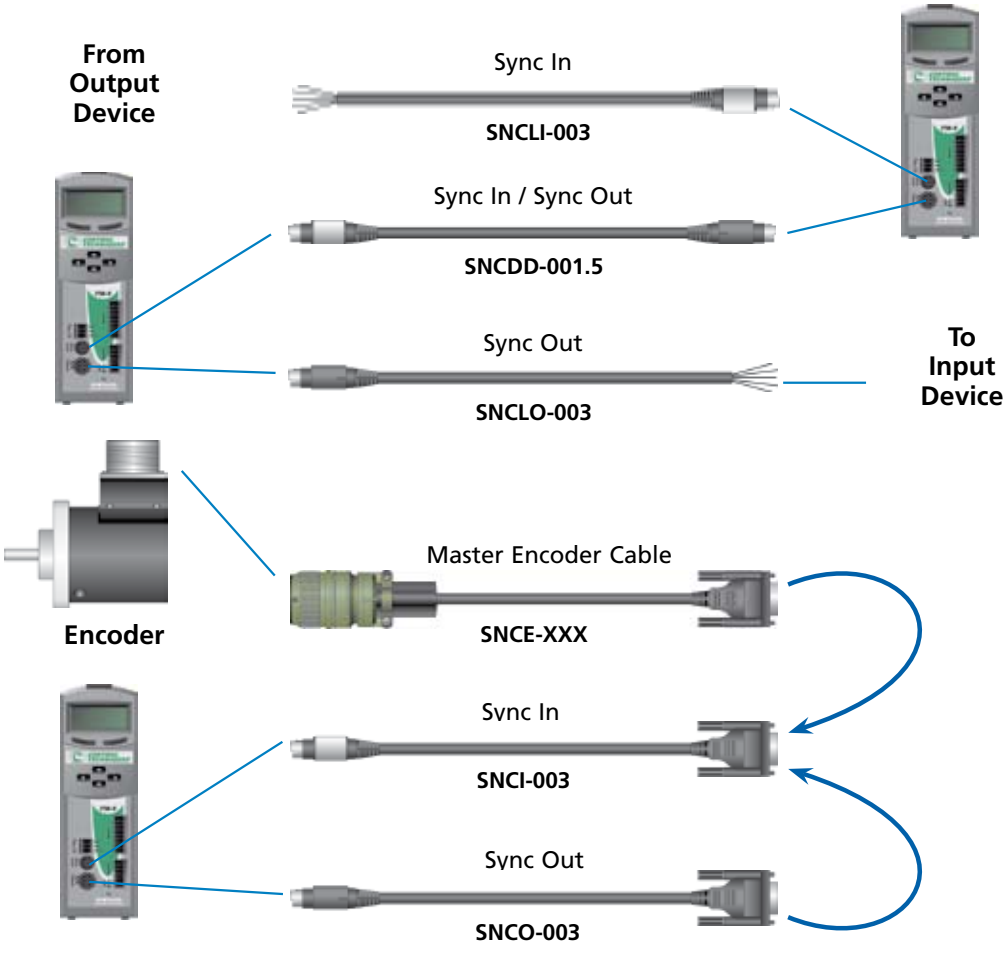


FM on MDS Drive

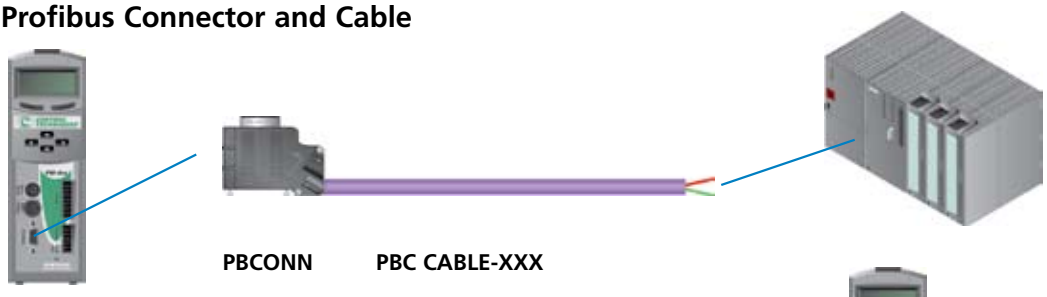


FM Cabling Options (See Options section for more information.)

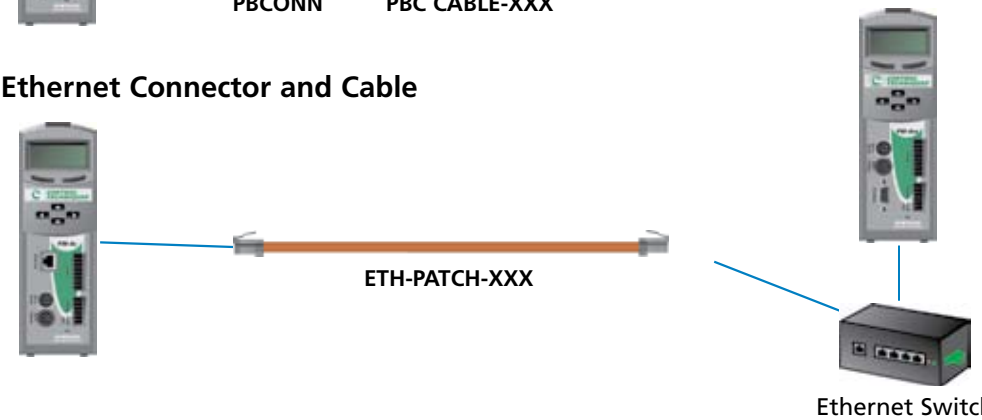
FM SYNCHRONIZATION CABLES—PLUG AND PLAY



FM Profibus Connector and Cable



FM Ethernet Connector and Cable

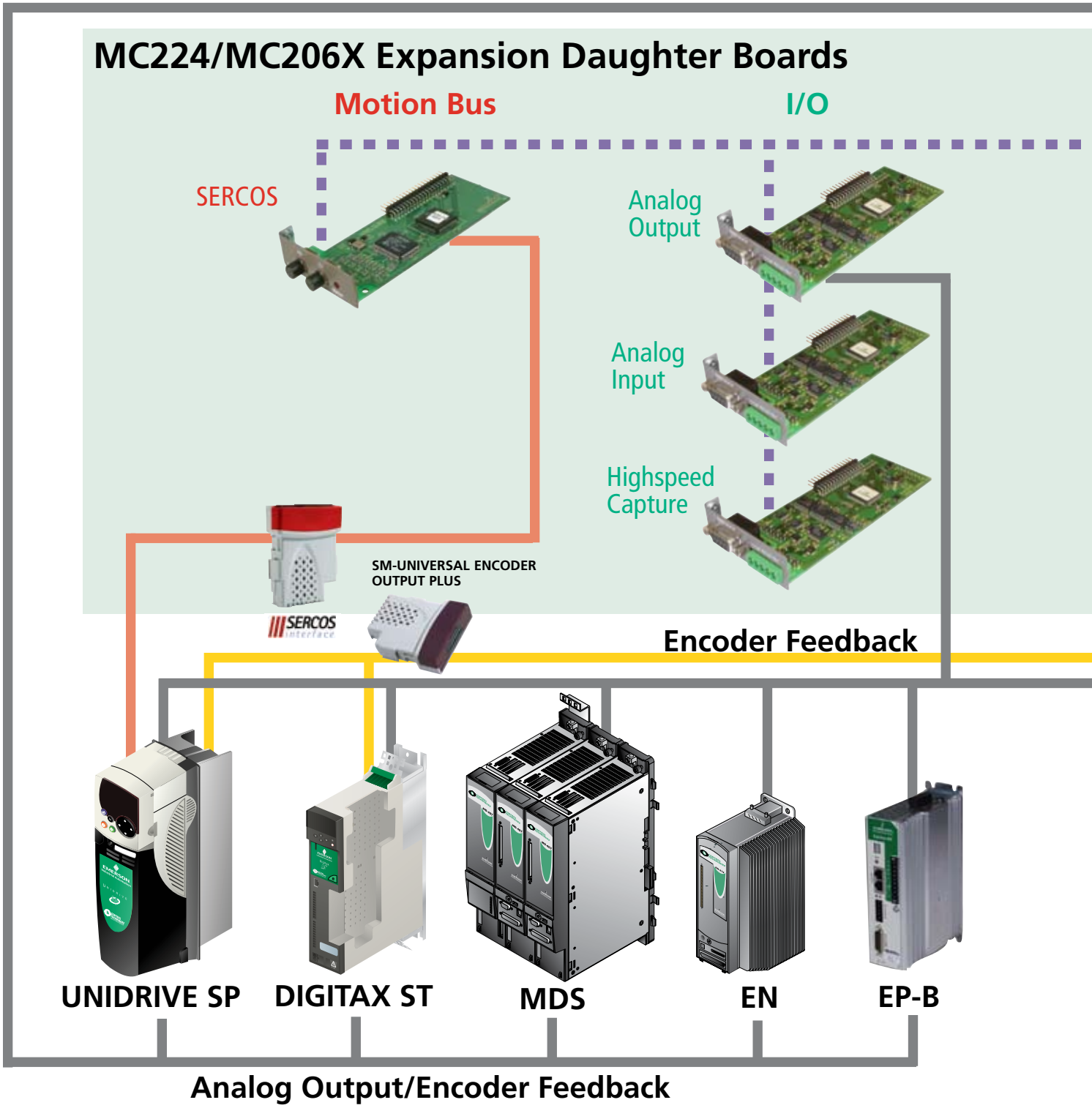


Centralized Multi-Axis Control

Motion Coordinator Series

The Motion Coordinator series of centralized controllers offer scalability, modularity, and flexibility. Scalability is offered through the choice of two different base controllers, four different servo drive series, and over 15 daughter board options.

Furthermore, all Motion Coordinators are programmed with the free MotionPerfect2 software. Modularity is offered by selecting only the daughter board required for your specific application. Finally, flexibility is offered by the controller's ability to perform interpolated, point to point, camming and electronic gearing.





MC224

MC206X



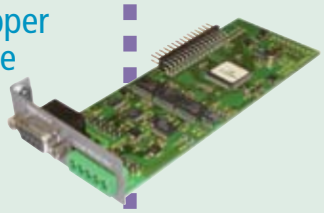
MC Canbus

Stepper

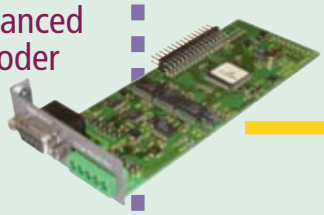
Encoder

Fieldbus

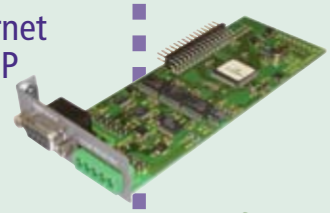
Stepper Pulse



Enhanced Encoder



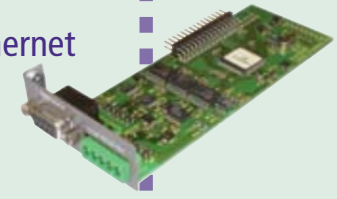
Ethernet TCP/IP



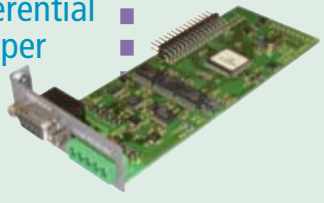
SSI Encoder



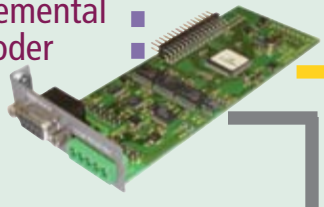
Ethernet IP



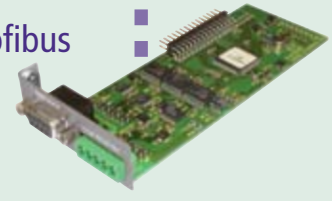
Differential Stepper

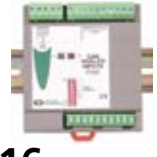


Incremental Encoder

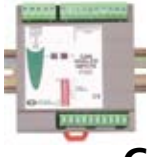


Profibus





CAN-16
24V I/O

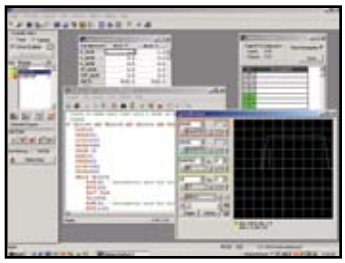


CAN-8
Analog Inputs

MC206X
2-7 Axis Control

The MC206X is a very capable all-in-one motion controller and integrates easily with Control Techniques scalable servo offering. The MC206X can coordinate 2-4 Control Techniques drives via encoder feedback, analog output. The MC206X comes standard with onboard I/O for high speed digital inputs, outputs, analog inputs, and an additional encoder reference signal. The MC206X with a SERCOS Daughter Board can coordinate up to 7 SM-SERCOS equipped Unidrive SP drives. Capable also means, the MC206X is capable of Point to Point motion, Camming, Velocity, Torque, and Circular Interpolated motion all programmed using the simple and free MotionPerfect2 programming software.

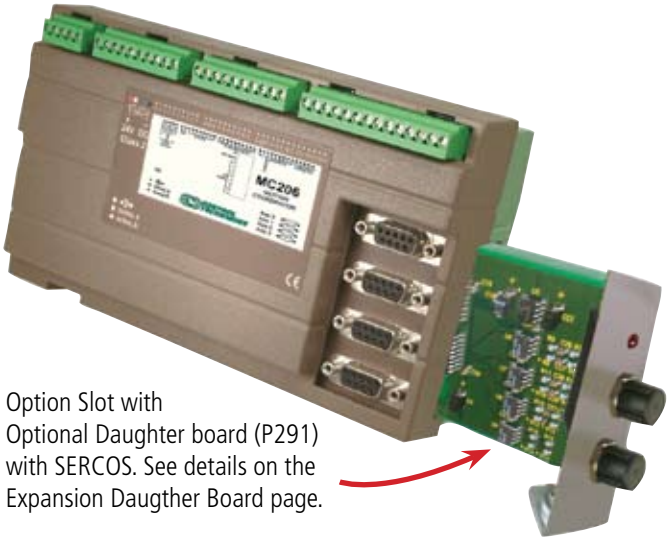
MotionPerfect2 Programming Software



MotionPerfect2 is a powerful and fast multitasking configuration and programming software. MotionPerfect2 provides comprehensive system monitoring and diagnostics tools. See the software and connectivity catalog section for more details.

MC206X Capabilities

- **250 µs, 500 µs, or 1 ms Servo cycle time**
- **Multitasking processor with 7 tasks**
- **Floating point Math**
- **Interpolation; linear, circular, helical**
- **Centralized point to point position controller**
- **Cam Profiles**
- **Electronic Gearing**
- **Accel/Decel S Ramps Controls**
- **4 encoder/analog axis control standard**
- **2 virtual axis standard**
- **1 master encoder standard**
- **High speed latch inputs standard**
- **7 axis control with optional SERCOS Daughter Board**
- **5 axis control with optional encoder/feedback Board**
- **Expandable I/O up to 256**
- **One Daughter Board Expansion Slot**



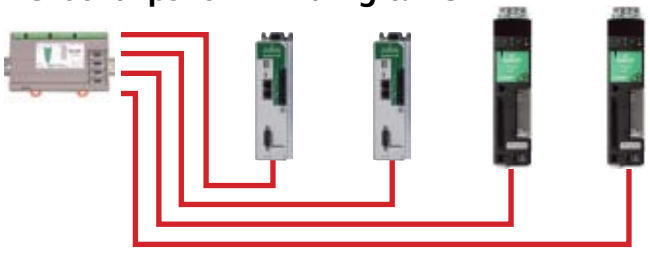
Option Slot with Optional Daughter board (P291) with SERCOS. See details on the Expansion Daugther Board page.

Flexible and Modular Daughter Board Options

The MC206X accepts one of 15 plus daughter board options providing unlimited flexibility. The slot can be used for added axis control such as an additional encoder/analog axis or SERCOS. The slot could also be used to add Ethernet TCP/IP, EtherNet/IP or PROFIBUS.

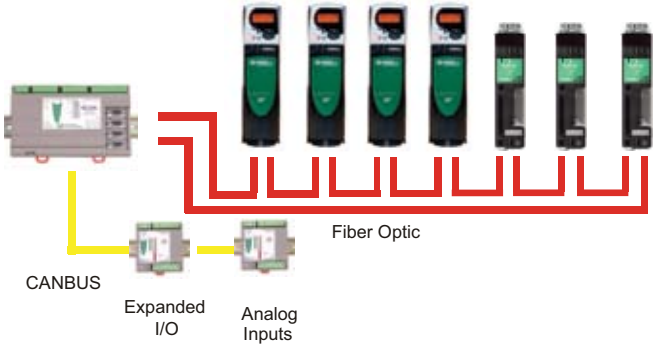
ANALOG

MC206X/Epsilon EP-B/Digitax ST

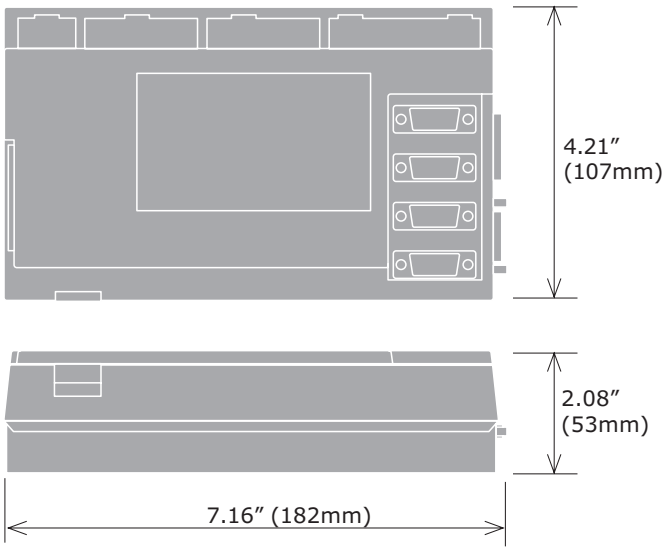


SERCOS

MC206X/Unidrive SP/Digitax ST



MC206X SPECIFICATIONS



• Size	107 mm x 182 mm x 53 mm
• Weight	325 g
• Operating Temp.	0-45° Celsius
• Min Power Consump.	24V @ 300 mA (Nominal)
• Max Power Consump.	24V @ 800 mA
• Axes count	5 analog or 7 with SERCOS
• Encoder Inputs	1 @ 6 MHz (Line Driver)
• Bi-directional Ports	4 @ 6 MHz (Encoder) or 2 MHz (Stepper
• Analog Outputs	4 @ +/-10V 16-bit Resolution
• Servo Cycle Time	1000 µs, 500 µs, or 250 µs
• Inputs	8 x 24V Opto-Isolated
• Outputs	None
• Bi-directional I/O	8 x 24V Opto-Isolated
• Analog Inputs	1 @ 0-10V 10-bit Resolution
• Inputs Functions	Forward Limit / Reverse Limit / Datum / F Hold
• Watchdog Relay	1 Solid State Relay - 24V @ 100 mA
• Serial Ports	RS232 (Programming) / RS232 / RS485 / TTL / USB
• CAN Ports	1 @ 1 MBAUD max
• Daughter board Slots	1 Slot
• User Memory	512 kbytes
• Table Memory	32000 values
• Multi-tasking	2 Fast Tasks + 5 Normal
• EMC Compliance	BS EN61000-6-2 BS EN61000-6-4

General Ordering Information

Base Unit

MC206X	Base Unit, 1 servo axis enabled
P399	MC206X Daughter Board Adapter

Axis control

P201	Enhanced Servo Encoder Daughter Board
P220	Reference Encoder Daughter Board
P291	SERCOS Daughter Board 2 axis enabled Requires SM-SERCOS on either the Unidrive SP or Digitax ST

Fieldbus

P296	EtherNet TCP/IP Daughter Board
P298	EtherNet/IP Daughter Board
P297	Profibus Daughter Board
P316	CAN 16-I/O
P325	CAN 8 Analogue Inputs

Programming Cables

P350	PC to MC RS232 to RS232 programming cable
P361	PC to MC USB programming cable

Enable Codes

P390	Enable Code for Additional Servo Axis
P393	Enable Code for Additional Reference Encoder Input
P70x	Enable additional SERCOS axis 1, 2, 4, 8 or 16

Feedback cables

MC-CEN-xxx	Epsilon, EN, MDS command cable
MC-CEP-xxx	Epsilon EP command cable
MC-EUN-xxx	Unidrive SP command cable requires encoder module on Unidrive SP

Notes:
MC206X has only one option slot.

For "How to Order" information see the last page in this section.

MC224
Up to 24 Axis Control

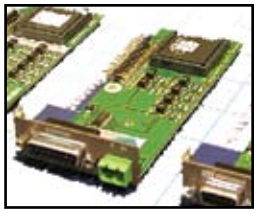


The MC224 is a high performance controller capable of 24 axis of coordinated motion control when combined with Control Techniques scalable servo drive offering. The MC224 motion capabilities include circular interpolation, point to point, camming, electronic gearing and basic accel/decel s-ramp motion profiles. The MC224 is a flexible and modular system which consists of base modules with option slots for flexible daughter board options. A large 16 axis system would consist of a MC224 base module and three expansion modules connected together each with up to 4 flexible daughter boards to fit your application needs.

MC224 Capabilities

- **Control up to 16 axis via analog/encoder or up to 24 axis via SERCOS**
- **250 µs, 500 µs, or 1 ms Servo cycle time**
- **Multitasking processor with 14 tasks**
- **Floating point Math Interpolation**
- **Centralized point to point position controller**
- **Cam Profiles**
- **Electronic Gearing**
- **Accel/Decel S Ramps Controls**
- **Scalable axis via option slots and expansion base**
- **Onboard I/O**
- **Expandable I/O**
- **Programmed using the free MotionPerfect2 Software**

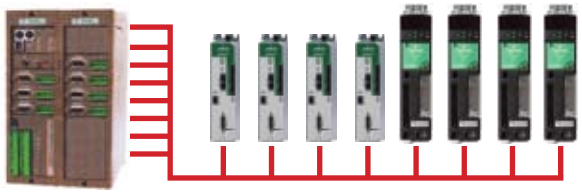
Flexible and Modular Daughter Board Options



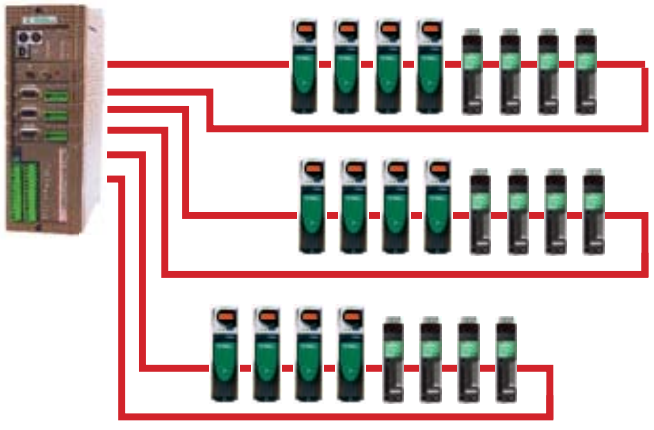
There are four daughter board slots on the MC224 or expansion modules. The slots can be used for added axis control such as an additional encoder/analog axis or a SERCOS daughter board. The slot could also be used to add Ethernet (Modbus TCP/IP, EtherNet/IP) or Profibus.

The MC224 complements the MC206X by offering capability for more than five analog/encoder servo axis or more than seven SERCOS axis. For example, a MC224 with one expansion base and eight encoder daughter boards could control seven analog/encoder Epsilon EP-B servo drives. Additionally, the available slots could be used for SERCOS daughter boards which can control eight axis per board. So a single MC224 with two SERCOS daughter boards could control 16 Unidrive SP axis. A flexible system consisting of a mixture of analog/encoder and SERCOS axes could also be created.

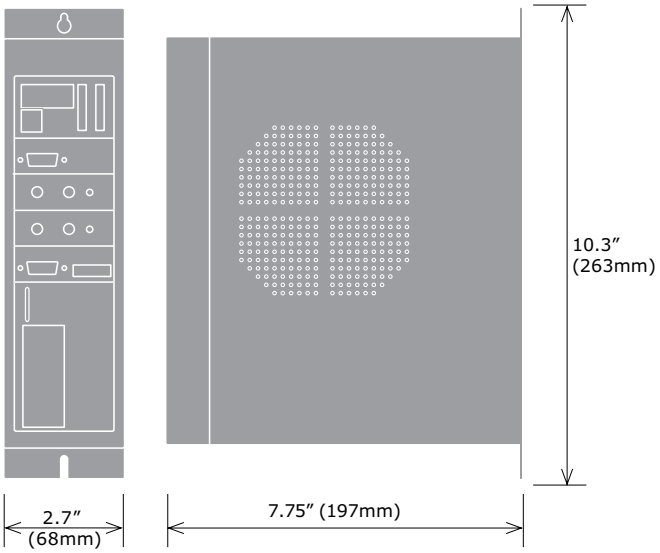
ANALOG
MC224/Epsilon EP-B/Digitax ST



SERCOS
MC224/Unidrive SP/Digitax ST



MC224 SPECIFICATIONS



• Size	263 mm x 68 mm x 197 mm
• Weight	750 g
• Operating Temp.	0-45° Celsius
• Min Power Consump.	24V @ 450 mA (Nominal)
• Max Power Consump.	24V @ 800 mA
• Axes count	16 analog or 24 with SERCOS
• Encoder Inputs	None
• Analog Outputs	None
• Servo Cycle Time	1000 µs, 500 µs, or 250 µs
• Inputs	8 x 24V Opto-Isolated
• Outputs	None
• Bi-directional I/O	8 x 24V Opto-Isolated
• Analog	Inputs 2 @ 0-10V 12-bit Resolution
• Inputs Functions	Forward Limit / Reverse Limit / Datum / F Hold
• Watchdog Relay	2 Solid State Relays - 24V @ 100 mA
• Serial Ports	RS232 / RS485 / TTL / USB
• CAN Ports	1 @ 1 M BAUD max
• Daughter board Slots	4 Slots (expandable)
• User Memory	1 Mbyte max
• Table Memory	250,000 values
• Multi-tasking	2 Fast Tasks + 12 Normal
• EMC Compliance	BS EN61000-6-2 BS EN61000-6-4

General Ordering Information

Base Unit

MC224	Base Unit
P301	MC224 Expander Unit
P355	Expansion cable for adding 1 bay
P360	Expansion cable for adding 2 bays
P365	Expansion cable for adding 3 bays

Axis control

P201	Enhanced Servo Encoder Daughter Board
P220	Reference Encoder Daughter Board
P291	SERCOS Daughter Board 2 axis enabled
P316	CAN 16-I/O
P325	CAN 8 Analog Inputs
P225	Analog input 8 x 16-bit 0-10 VDC
P242	Hardware PSWITCH (4 x 1 µs)

Fieldbus

P296	EtherNet TCP/IP Daughter Board
P298	EtherNet/IP Daughter Board
P297	Profibus Daughter Board

Programming Cables

P350	PC to MC RS232 to RS232 programming cable
P361	PC to MC USB programming cable
P398	MC controller memory stick

Enable Codes

P70x	Enable additional SERCOS axis 1, 2, 4, 8, or 16

Feedback cables

MC-CEN-xxx	Epsilon, EN, MDS command cable
MC-CEP-xxx	Epsilon EP command cable
MC-EUN-xxx	Unidrive SP command cable requires SM-Encoder module on Unidrive SP

For "How To Order" information see the last page of this section.

MC224/MC206X
Expansion Daughter Boards

The MC206X single and MC224 multiple expansion slot accept the modular and flexible range of axis control, I/O, and fieldbus daughter boards listed below. The MC206X has one slot located on the right side of the unit. The MC224 has four slots on the base unit and four slots in each expansion bay.

FIELDBUS OPTION BOARDS



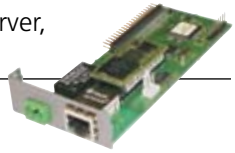
P296 Ethernet TCP/IP Board

Description: Adds 1 channel of Ethernet connectivity with the standard stack

TCP/IP

Network Speed: 10 BaseT

Protocols Supported: Modbus TCP server, native TCP/IP, and ActiveX control

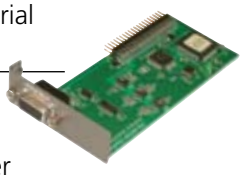


P298 EtherNet/IP Follower Board

Description: Adds 1 channel of Ethernet IP Server or commonly referred to as a follower device and not a scanner.

Network Speed: 10/100 BaseT

Protocols Supported: Common Industrial Protocol (CIP)



P297 Profibus DP Follower Board

Description: Adds Profibus DP follower node for connection to a Profibus Master

Network Speed: Up to 12 Mb auto detection

Data Payload: 16 words input, 16 words output

I/O BOARDS



P225 Analog Input Board

Signal: 8 x 0-10V analog inputs 16-bit



P260 Analog Output Board

Signal: 1 x +/-10V 12-bit resolution analog output



P242 Hardware PSWITCH

Description: 4 1 µs high speed latch inputs and one incremental encoder feedback

Feedback: 5V Line Drive Encoder – 6 MHz qaudrature

For "How To Order" information see following page.

AXIS CONTROL BOARDS



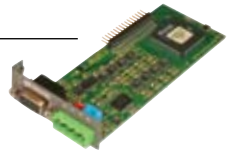
P201 Enhanced Servo Encoder Board

Description: Controls 1 servo axis with analog output and incremental encoder feedback

Encoder Input: 5V Line Drive Encoder – 6 MHz max edge rate

Analog output: +/- 10v 16-bit resolution or 2 Mhz 90° A/B quadrature output

Registration: 2 x 24V inputs @ 1 µs accuracy

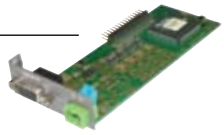


P270 SSI Servo Encoder Board

Description: Controls 1 servo axis with analog output and SSI encoder feedback

Feedback: SSI standard configurable to max 24-bits

Analog: +/- 10v 12-bit resolution

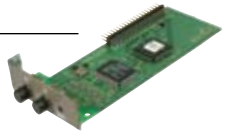


P220 Reference Encoder Board

Description: Input for 1 standard incremental encoder with high speed latch

Feedback: 5V Line Drive Encoder – 6 MHz max edge rate

Registration: 1 x 24V inputs @ 1 µs accuracy



P291 SERCOS Digital Drive Board

Description: SERCOS network master for controlling Unidrive SP with SM-SERCOS module

Number of Axis per Board: 2 standard, 8 Max.

Axis Enable Code: 1, 2, 4, 8,16 axes with order codes P701, P702, P704, P708, P716

Baud Rates: 2, 4, 8, 16 Mb

MC EXPANSION I/O



P316 Input/Output Expansion Module

Description: 16 I/O channels and each channel can be freely configured as 24 VDC input or output.

Communication bus: Proprietary protocol on Can

Bus Speed: 500 kbaud

Max Nodes: Connect up to 16 modules for total of 256 I/O points.

Max Distance: 100 m total distance



P325 Analog Input Expansion Module

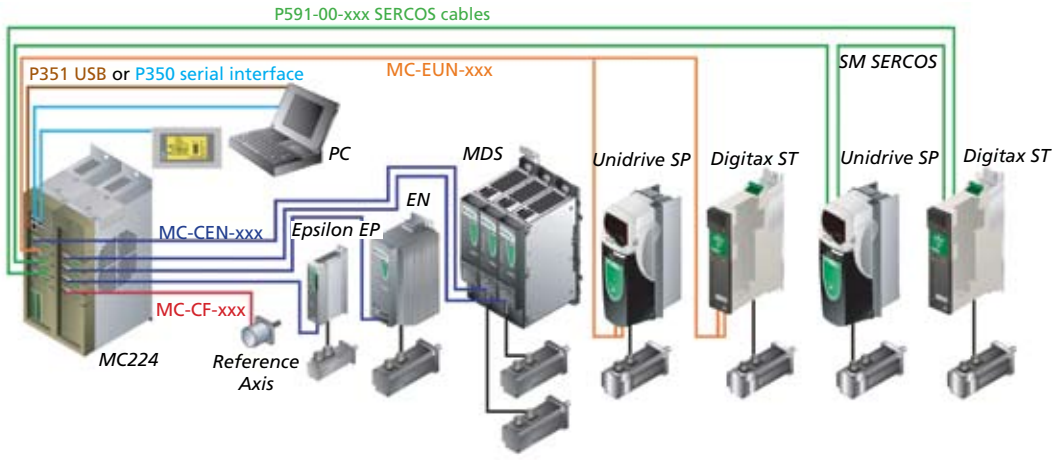
Description: 8 x +/-10V 12-bit resolution analog input channels.

Communication bus: Proprietary protocol on Can

Bus Speed: 500 kbaud

Max Nodes: Connect up to 4 modules for a total of 32 analog input channels.

Max Distance: 100 m total distance



How to Order

1 Select Coordinator

All MC Coordinators are shipped with a CD containing Manuals and Software. Additional information can be found on our web site at www.emersonct.com

Order: MC206X-00-000
1 servo and 1 sync encoder enabled, capable of 4 onboard servo axis Expandable: accepts 1 daughter board.

MC206X Expansion Options	# of Axis / Expansion Slots
Software Enabled code, Order P390-00-000 for each servo axis, or P395-00-000 for each stepper axis.	Up to 3 Additional axis may be added
Daughter Board slot, Using a daughter board on a MC206X requires a P399-00-000 Daughter Board Adapter.	1 Slot

Order: MC224-00-000
Up to 24 Axes*, Accepts 4 Daughter Boards
*Requires Axis Expander(s)

MC224 Expansion Options	Daughter Board Slots available
Expansion Bay 1, Order (qty 1) 300-00-000 Expander and P355-00-000 2 way ribbon cable	4 Slots
Expansion Bay 2, Order (qty 2) 300-00-000 Expander and P360-00-000 3 way ribbon cable	4 Slots
Expansion Bay 3, Order (qty 3) 300-00-000 Expander and P365-00-000 4 way ribbon cable	4 Slots

** MC224 Notes: When using a CAN Bus (P290), USB (P295), EtherNet (P296), SERCOS (P291), or Profibus (P297) Daughter boards, they must be placed in the Base Unit. Expansion Bays do not accept these daughter boards

2 Select Daughter Board(s)

Order: P201-00-000
Servo Encoder w/Registration Input

Order: P220-00-000
Reference Encoder 2 MHz Max Input

Order: P242-00-000
Hardware PSWITCH, Programmable Limit Switch

Order: P260-00-000
Analog Output, 12-bit +/- 10 VDC

Order: P290-00-000**
CAN Bus 4 Axis

Order: P295-00-000**
USB1.1 12 Mbit Rate

Order: P296-00-000**
Ethernet 10 MHz

Order: P297-00-000**
Profibus 12 MHz

Order: P291-00-000
SERCOS INTERFACE
8 Axis per P291
2 Axis Included

Order: P298-00-000
Ethernet IP Follower

3 Select Expansion Option(s)

Order: P390-00-000 (MC206X only) 1 Additional Servo Axis – Software Code Enabled

Order: P399-00-000 (MC206X only) MC206X Daughter Board Adapter

Order: P398-00-000
Memory Stick

Order: P301-00-000 (MC224 only) Expander Bay - Up to 3 Expanders, Accepts 4 Additional Daughter Boards each

Order: P355-00-000 (MC224 only) 2 Way System Ribbon Cable Required for 1 Expander Bay is used

Order: P360-00-000 (MC224 only) 3 Way System Ribbon Cable Required for 2 Expander Bays are used

Order: P365-00-000 (MC224 only) 4 Way System Ribbon Cable Required for 3 Expander Bays are used

Order: P316-00-000
CAN 16-I/O, +24 VDC I/O

Order: P325-00-000
CAN 8 Analog Inputs, +/-10 VDC, 12-bit

Order: P702-00-000
2 additional SERCOS Axes, Software code Enabled

Order: P704-00-000
4 additional SERCOS Axes, Software code Enabled

Order: P708-00-000
8 additional SERCOS Axes, Software code Enabled

Order: P716-00-000
16 additional SERCOS Axes, Software code Enabled

4 Select Cable(s)

Order: MC-CEP-XXX Command & Encoder Feedback Cable for use with Epsilon EP, (1 per Axis) (-002=2 ft, -004=4 ft)

Order: MC-CEN-XXX for MC206X or MC224 Command & Encoder Feedback Cable for use with Epsilon, EN and MDS (1 per Axis) (-002=2 ft, -004=4 ft)

Order: MC-EUN-XXX for MC206X or MC224 Encoder Feedback Cable for Unidrive to controller (-002=2 ft, -004=4 ft)

Order: MC-CF-XXX Bulk Cable for Command or Feedback between Drive and MC Coordinator (xxx = ft)

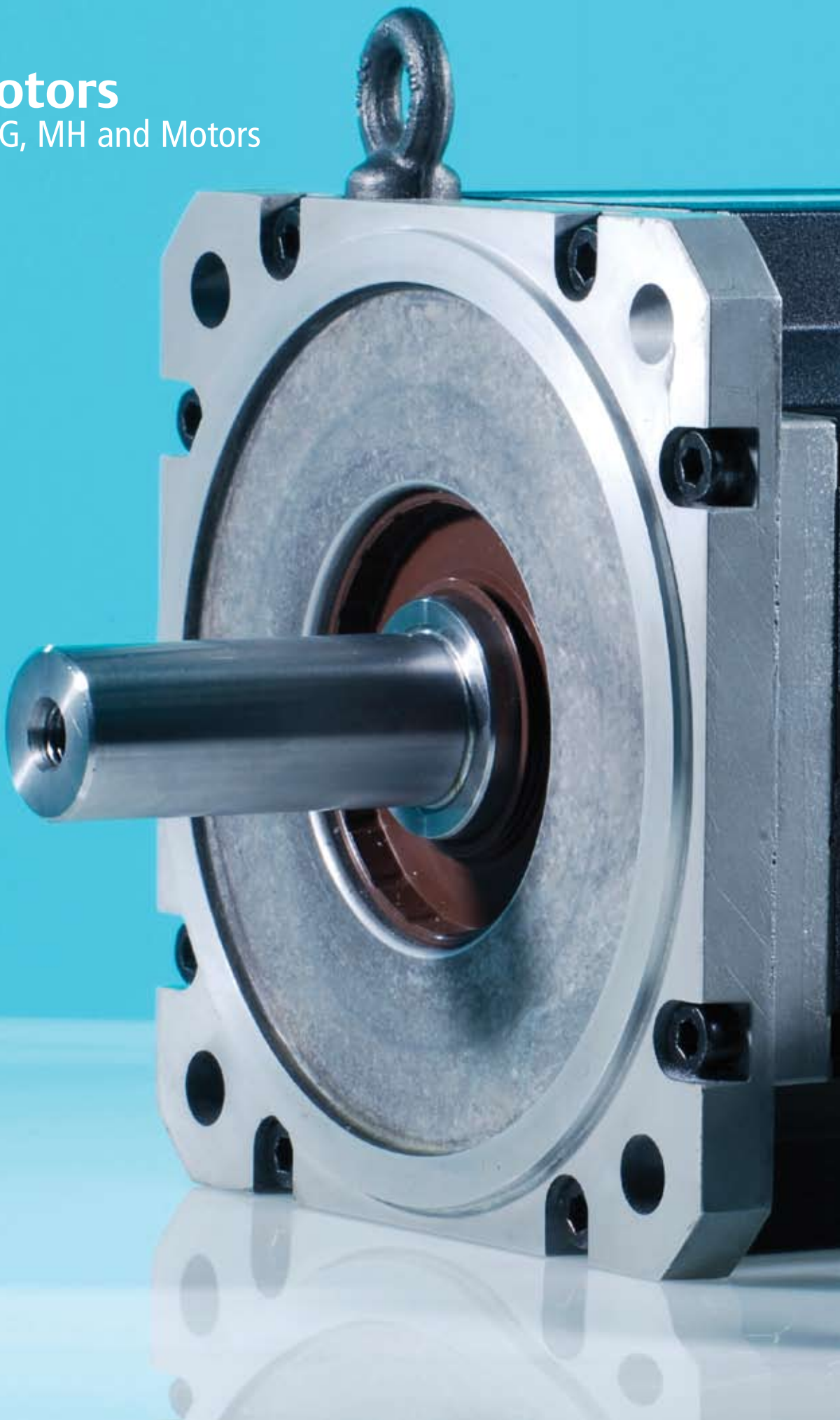
Order: P350-00-000
10ft RS232 Serial Cable PC to MC Controller

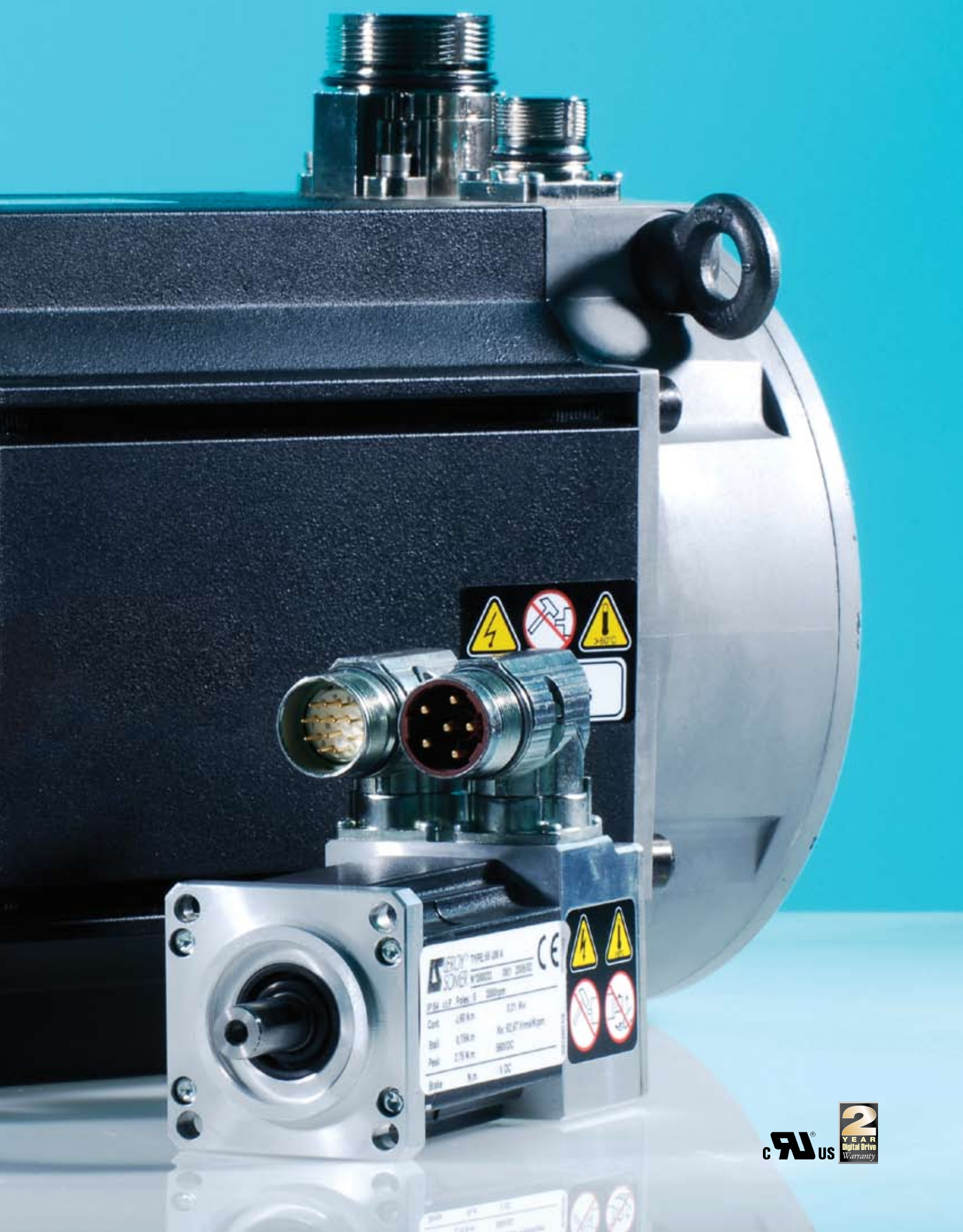
Order: P361-00-000
6 ft USB Cable PC to MC Controller

Order: P59X-00-000
SERCOS Cable (minimum 1 TX, 1 RX)
P591-00-000=1 meter
P592-00-000=2 meter
P595-00-000=5 meter

Servo Motors

FM, NT, XV, MG, MH and Motors




2
YEAR
Digital Drive
Warranty

FM MOTOR—230V & 460V
Performance AC Brushless Servo Motor

The FM motor is a high performance brushless AC servo motor range matched for use with Control Techniques drives. FM is an acronym for Flexible Motor, designed to accommodate a wide range of applications. The motors are available in six frame sizes with various mounting arrangements and motor lengths.

Key Features and Options:

- Wide torque range 6.6 to 647 lb-in (0.75 to 73.2 Nm)
- 4096 ppr encoder standard
- Various Sizes and lengths:
  055, 075, 095, 115, 142 and 190 mm
- Different shaft diameter options
- Various front flange mounting arrangements
- 90 degree connectors (rotatable)
- Brake options
- Sealing to IP65

Benefits:

- Unimotor FM allows various feedback devices to be used, as standard an incremental encoder is fitted as this offers an optimum balance of cost and performance.

- Sin/Cos feedback can be selected for increased resolution and absolute feedback. Resolver feedback is available for increased reliability in extreme environments. New low cost inductive option.

- High peak torque values allow smaller motors to be used where the RMS value is low but the maximum torque is high.

- A wide selection of ready made flex rated cables are available for quick and easy connection to Control Techniques drives.

- High inertia versions are available to allow the motor inertia to be more closely matched to the load inertia for increased control and stability.

- Motor brakes may be integrated within the motor, a choice of parking brake or high energy dissipation brake is available.

- Flexibility of the FM range always ensure the best fit for your application, as well as the various physical sizes and feedback devices available, options extend to the type of connectors fitted.

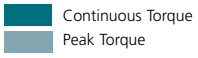
- This configuration is designed with low cogging torque to provide smooth operation and excellent velocity regulation.

FM

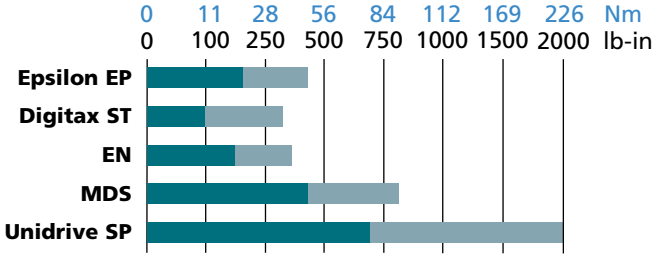
NEW



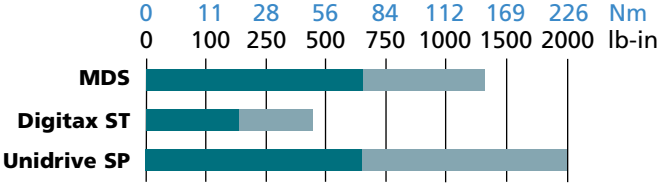
c UL us CE



FM MOTOR—230V



FM MOTOR—460V



Unimotor FM is suitable for applications where precision motion and/or dynamic control is required. Typical applications include:

- High speed machinery
- Flying shear and rotary knife applications
- Pick and place
- Materials handling
- Printing
- Textile machinery

Standard - 230V FM Motor Specifications (Typically Stocked with standard options)

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
055E2C30	18.7 / 2.1	2.5	7.4	9.60	30.90	3000	0.000301 / 0.34	52.5	7.61 / 0.86	4.0 / 1.8
055E2C60	18.7 / 2.1	4.8	14.4	2.50	8.10	6000	0.000301 / 0.34	26.8	3.89 / 0.44	4.0 / 1.8
075E2A40	10.6 / 1.2	1.7	5.0	10.20	24.60	4000	0.000620 / 0.70	44.0	6.37 / 0.72	7.9 / 3.6
075E2B30	19.5 / 2.2	2.4	7.1	6.26	18.40	3000	0.001062 / 1.20	57.0	8.23 / 0.93	9.7 / 4.4
075E2B40	19.5 / 2.2	3.1	9.2	3.39	10.80	4000	0.001062 / 1.20	44.0	6.37 / 0.72	9.7 / 4.4
075E2C40	27.4 / 3.1	4.3	12.9	1.92	7.14	4000	0.001416 / 1.60	44.0	6.37 / 0.72	11.4 / 5.2
075E2D30	34.5 / 3.9	4.2	12.6	2.38	8.82	3000	0.001770 / 2.00	57.0	8.23 / 0.93	13.2 / 6.0
095E2B30	38.1 / 4.3	4.6	13.9	2.68	12.00	3000	0.002567 / 2.90	57.0	8.23 / 0.93	13.9 / 6.3
095E2B40	38.1 / 4.3	6.0	17.9	1.64	6.77	4000	0.002567 / 2.90	44.0	6.37 / 0.72	13.9 / 6.3
095E2D30	66.4 / 7.5	8.1	24.2	1.03	5.60	3000	0.004514 / 5.10	57.0	8.23 / 0.93	19.1 / 8.7
095E2D40	66.4 / 7.5	10.4	31.3	0.62	3.46	4000	0.004514 / 5.10	44.0	6.37 / 0.72	19.1 / 8.7
095E2E30	79.6 / 9.0	9.7	29.0	0.77	4.65	3000	0.005487 / 6.20	57.0	8.23 / 0.93	21.8 / 9.9
115E2B30	58.4 / 6.6	7.1	21.3	1.30	9.16	3000	0.005930 / 6.70	57.0	8.23 / 0.93	21.3 / 9.7
115E2C30	83.2 / 9.4	10.1	30.3	0.73	6.07	3000	0.007965 / 9.00	57.0	8.23 / 0.93	25.5 / 11.6
115E2D30	109.7 / 12.4	13.3	40.0	0.47	4.26	3000	0.010089 / 11.40	57.0	8.23 / 0.93	29.7 / 13.5
115E2E30	135.4 / 15.3	16.5	49.4	0.37	3.49	3000	0.012213 / 13.80	57.0	8.23 / 0.93	33.9 / 15.4
142E2B30	95.6 / 10.8	11.6	34.8	0.59	6.85	3000	0.013806 / 15.60	57.0	8.23 / 0.93	29.3 / 13.3

Standard - 460V FM Motor Specifications (Typically Stocked with standard options)

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
055U2C30	18.7 / 2.1	1.3	4.0	32.00	103.00	3000	0.000301 / 0.34	95.7	13.98 / 1.58	4.0 / 1.8
055U2C60	18.7 / 2.1	2.7	8.0	8.00	25.70	6000	0.000301 / 0.34	47.9	6.99 / 0.79	4.0 / 1.8
075U2B30	19.5 / 2.2	1.4	4.1	20.10	41.80	3000	0.001062 / 1.20	98.0	14.16 / 1.60	9.7 / 4.4
075U2B40	19.5 / 2.2	1.8	5.5	10.50	24.80	4000	0.001062 / 1.20	73.5	10.62 / 1.20	9.7 / 4.4
075U2D30	34.5 / 3.9	2.4	7.3	7.50	19.70	3000	0.001770 / 2.00	98.0	14.16 / 1.60	13.2 / 6.0
095U2B30	38.1 / 4.3	2.7	8.1	6.80	24.30	3000	0.002567 / 2.90	98.0	14.16 / 1.60	13.9 / 6.3
095U2B40	38.1 / 4.3	3.6	10.8	4.08	13.60	4000	0.002567 / 2.90	73.5	10.62 / 1.20	13.9 / 6.3
095U2D30	66.4 / 7.5	4.7	14.1	2.50	10.90	3000	0.004514 / 5.10	98.0	14.16 / 1.60	19.1 / 8.7
095U2E40	79.6 / 9.0	7.5	22.5	1.03	4.80	4000	0.005487 / 6.20	73.5	10.62 / 1.20	21.8 / 9.9
115U2B30	58.4 / 6.6	4.1	12.4	3.86	18.60	3000	0.005930 / 6.70	98.0	14.16 / 1.60	21.3 / 9.7
115U2D30	109.7 / 12.4	7.8	23.3	1.40	8.60	3000	0.010089 / 11.40	98.0	14.16 / 1.60	29.7 / 13.5
115U2E30	135.4 / 15.3	9.6	28.7	1.10	7.40	3000	0.012213 / 13.80	98.0	14.16 / 1.60	33.9 / 15.4
142U2B30	95.6 / 10.8	6.8	20.3	1.72	13.30	3000	0.013806 / 15.60	98.0	14.16 / 1.60	29.3 / 13.3
142U2C30	135.4 / 15.3	9.6	28.7	0.94	8.30	3000	0.019647 / 22.20	98.0	14.16 / 1.60	35.4 / 16.1
142U2D30	175.2 / 19.8	12.4	37.1	0.61	6.10	3000	0.025488 / 28.80	98.0	14.16 / 1.60	41.6 / 18.9
142U2E30	207.1 / 23.4	14.6	43.9	0.44	4.80	3000	0.031329 / 35.40	98.0	14.16 / 1.60	47.7 / 21.7
190U2D30	363.7 / 41.1	25.7	77.1	0.30	6.11	300	0.076464 / 86.40	98.0	14.16 / 1.60	74.6 / 33.9

230V FM Motor Specifications

Motor Frame Size (mm)		055E2			075E2				095E2				
Frame Length		A	B	C	A	B	C	D	A	B	C	D	E
Continuous Stall Torque (lb-in)		6.4	12.4	18.7	10.6	19.5	27.4	34.5	20.4	38.1	52.2	66.4	79.6
Continuous Stall Torque (Nm)		0.72	1.40	2.11	1.2	2.2	3.1	3.9	2.3	4.3	5.9	7.5	9.0
Standard (2) Peak Torque selection max (lb-in)		24.3	48.7	73.0	31.9	58.4	82.3	103.5	61.1	114.2	156.6	199.1	238.9
Standard (2) Peak Torque selection max (Nm)		2.75	5.50	8.25	3.6	6.6	9.3	11.7	6.9	12.9	17.7	22.5	27.0
High (P) Peak Torque selection max (lb-in)		N/A	N/A	N/A	53.1	97.3	137.2	172.6	92.0	171.7	235.4	299.1	358.4
High (P) Peak Torque selection max (Nm)					6	11	15.5	19.5	10.4	19.4	26.6	33.8	40.5
Standard Inertia (lb-in-sec^2)		0.00011	0.00020	0.00030	0.00062	0.00106	0.00142	0.00177	0.00159	0.00257	0.00354	0.00451	0.00549
Standard Inertia (kgcm^2)		0.12	0.23	0.34	0.7	1.2	1.6	2.0	1.8	2.9	4.0	5.1	6.2
High Inertia (lb-in-sec^2)		N/A	N/A	N/A	0.00097	0.00133	0.00177	0.00212	0.00327	0.00425	0.00522	0.00620	0.00717
High Inertia (kgcm^2)					1.1	1.5	2.0	2.4	3.7	4.8	5.9	7.0	8.1
Winding Thermal Time Const. (sec)		N/A	N/A	N/A	81	74	94	100	172	168	183	221	228
Maximum Cogging (lb-in)		0.27	0.44	0.62	0.18	0.27	0.35	0.44	0.27	0.53	0.71	0.89	1.15
Maximum Cogging (Nm)		0.03	0.05	0.07	0.02	0.03	0.04	0.05	0.03	0.06	0.08	0.10	0.13
Standard motor weight unbraked (lbs)		2.64	3.30	3.96	7.92	9.68	11.44	13.20	11.22	13.86	16.50	19.14	21.78
Standard motor weight unbraked (kg)		1.20	1.50	1.80	3.60	4.40	5.20	6.00	5.10	6.30	7.50	8.70	9.90
Standard motor weight braked (lbs)		3.52	4.18	4.84	9.02	10.78	12.54	14.30	12.54	15.18	19.14	20.46	23.10
Standard motor weight braked (kg)		1.60	1.90	2.20	4.10	4.90	5.70	6.50	5.70	6.90	8.70	9.30	10.50
Rated Speed 2000 (rpm)	Kt (lb-in/A, Nm/A) =								Kt (Lb-In/A, Nm/A) =		6.55, 1.4		
	Ke (V/krpm) =								Ke (V/krpm) =		85.5		
Rated Torque (lb-in)		C/F	C/F	C/F	9.7	18.6	26.5	33.6	19.5	35.4	48.7	61.1	72.6
Rated Torque (Nm)					1.1	2.1	3.0	3.8	2.2	4.0	5.5	6.9	8.2
Stall Current (A)					0.9	1.6	2.3	2.8	1.7	3.1	4.3	5.4	6.5
Rated Power (kW)					0.23	0.44	0.63	0.80	0.46	0.84	1.15	1.45	1.72
R (ph-ph) (Ohms)					45.8	15.3	8.5	5.72	19.4	6.2	3.16	2.31	1.71
L (ph-ph) (mH)					98.8	43.4	27.9	20.2	59.2	25.8	16.0	12.6	10.1
Rated Speed 3000 (rpm)	Kt (lb-in/A, Nm/A) =	6.5,0.74	7.35,0.83	7.62,0.86					Kt (Lb-In/A, Nm/A) =		8.23, 0.93		
	Ke (V/krpm) =	45.0	50.5	52.5					Ke (V/krpm) =		57		
Rated Torque (lb-in)		5.3	10.6	15.9	9.7	17.7	24.8	31.0	17.7	34.5	47.8	60.2	71.7
Rated Torque (Nm)		0.60	1.20	1.80	1.1	2.0	2.8	3.5	2.0	3.9	5.4	6.8	8.1
Stall Current (A)		0.98	1.68	2.46	1.3	2.4	3.4	4.2	2.5	4.7	6.4	8.1	9.7
Rated Power (kW)		0.21	0.43	0.64	0.35	0.63	0.88	1.10	0.63	1.23	1.70	2.14	2.54
R (ph-ph) (Ohms)		30.0	14.7	9.6	18.9	6.26	3.50	2.38	8.03	2.68	1.57	1.03	0.77
L (ph-ph) (mH)		67.3	43.0	30.9	42.5	18.4	11.9	8.82	25.6	12.0	7.91	5.60	4.65
Rated Speed 4000 (rpm)	Kt (lb-in/A, Nm/A) =								Kt (Lb-In/A, Nm/A) =		6.73, 0.72		
	Ke (V/krpm) =								Ke (V/krpm) =		44		
Rated Torque (lb-in)		C/F	C/F	C/F	8.9	15.0	20.4	25.7	15.9	26.5	35.4	43.4	50.4
Rated Torque (Nm)					1.0	1.7	2.3	2.9	1.8	3.0	4.0	4.9	5.7
Stall Current (A)					1.7	3.1	4.4	5.5	3.2	6.0	8.2	10.5	12.5
Rated Power (kW)					0.42	0.71	0.96	1.21	0.75	1.26	1.68	2.05	2.39
R (ph-ph) (Ohms)					10.2	3.39	1.92	1.48	5.15	1.64	0.92	0.62	0.43
L (ph-ph) (mH)					24.6	10.8	7.14	5.42	15.5	6.77	4.61	3.46	2.54
Rated Speed 6000 (rpm)	Kt (lb-in/A, Nm/A) =	3.7,0.42	3.7,0.42	3.9,0.44					Kt (Lb-In/A, Nm/A) =		4.16, 0.47		
	Ke (V/krpm) =	25.4	25.6	26.8					Ke (V/krpm) =		28.5		
Rated Torque (lb-in)		4.2	8.1	11.9	8.0	14.2	18.6	23.0	11.5	18.6	24.8	C/F	C/F
Rated Torque (Nm)		0.48	0.91	1.35	0.9	1.6	2.1	2.6	1.3	2.1	2.8		
Stall Current (A)		1.66	3.33	4.80	2.6	4.7	6.6	8.3	4.9	9.2	12.6		
Rated Power (kW)		0.33	0.63	0.99	0.57	1.01	1.32	1.63	0.82	1.32	1.76		
R (ph-ph) (Ohms)		9.6	3.8	2.5	4.5	1.49	0.95	0.65	2.01	0.67	0.35		
L (ph-ph) (mH)		21.5	11.1	8.1	10.7	4.73	3.10	2.33	6.41	3.01	1.77		

C/F= Consult Factory
N/A= Not Available

△t = 100° C winding 40° C maximum ambient
All data subject to ±10% tolerance

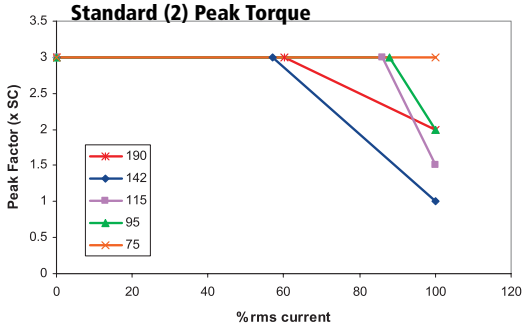
230V & 460V FM Motor Holding Brake Specifications

Motor Frame Size mm	Power Supply DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Engagement Time ms	Added Inertia lb-in-sec^2	Added Inertia kg-cm^2	Added weight kg
55	24	0.27	15.9	1.8	24	0.00003	0.03	0.4
75	24	0.27	17.7	2	24	0.00006	0.07	0.5
95	24	0.67	97.3	11	20	0.00035	0.39	0.6
115	24	0.67	97.3	11	10	0.00039	0.44	1.2
142	24	0.81	159.3	18	30	0.00048	0.54	1.7
190(A-D)	24	1.05	336.3	38	15	0.00272	3.07	2
190(E-H)	24	1.05	531.0	60	15	0.00438	4.95	2

	115E2					142E2						190E2							
	A	B	C	D	E	A	B	C	D	E	F	A	B	C	D	E	F	G	H
	31.0	58.4	83.2	109.7	135.4	50.4	95.6	135.4	175.2	207.1	C/F	C/F	192.9	C/F	363.7	C/F	519.5	C/F	647.8
	3.5	6.6	9.4	12.4	15.3	5.7	10.8	15.3	19.8	23.4			21.8		41.1		58.7		73.2
	92.9	175.2	249.6	329.2	406.2	151.3	286.7	406.2	525.7	621.3			578.8		1088.6		1557.6		1938.1
	10.5	19.8	28.2	37.2	45.9	17.1	32.4	45.9	59.4	70.2			65.4		123.0		176.0		219.0
	123.9	233.6	332.8	439.0	541.6	201.8	382.3	541.6	700.9	828.4			N/A	N/A	N/A	N/A	N/A	N/A	N/A
	14	26.4	37.6	49.6	61.2	22.8	43.2	61.2	79.2	93.6									
	0.00389	0.00593	0.00797	0.01009	0.01221	0.00797	0.01381	0.01965	0.02549	0.03133			0.04310		0.07646		0.10894		0.14319
	4.4	6.7	9.0	11.4	13.8	9.0	15.6	22.2	28.8	35.4			48.7		86.4		123.1		161.8
	0.00841	0.01044	0.01248	0.01469	0.01673	0.02062	0.02646	0.03230	0.03814	0.04398			0.08310		0.11647		0.14895		0.18320
	9.5	11.8	14.1	16.6	18.9	23.3	29.9	36.5	43.1	49.7			93.9		131.6		168.3		207.0
	175	185	198	217	241	213	217	275	301	365			240		242		319		632
	0.53	0.89	1.24	1.59	1.86	0.80	1.42	2.04	2.66	3.10			2.66		4.78		6.37		8.76
	0.06	0.10	0.14	0.18	0.21	0.09	0.16	0.23	0.30	0.35			0.30		0.54		0.72		0.99
	17.16	21.34	25.52	29.70	33.88	22.00	29.26	35.42	41.58	47.74			55.66		74.58		93.50		112.86
	7.80	9.70	11.60	13.50	15.40	10.00	13.30	16.10	18.90	21.70			25.30		33.90		42.50		51.30
	19.80	23.98	28.16	32.34	37.84	26.84	33.00	39.16	43.12	51.48			60.06		78.98		97.90		116.82
	9.00	10.90	12.80	14.70	17.20	12.20	15.00	17.80	19.60	23.40			27.30		35.90		44.50		53.10
	28.3	54.0	77.0	95.6	123.9	46.9	91.2	129.2	162.8	188.5	C/F	C/F	177.0	C/F	326.6	C/F	446.0	C/F	C/F
	3.2	6.1	8.7	10.8	14.0	5.3	10.3	14.6	18.4	21.3			20.0		36.9		50.4		
	2.5	4.8	6.8	8.9	11.0	4.1	7.8	11.0	14.2	16.8			15.6		29.4		42.0		
	0.67	1.28	1.82	2.26	2.93	1.11	2.16	3.06	3.85	4.46			4.19		7.73		10.6		
	9.09	2.82	1.51	0.99	0.82	4.28	1.33	0.75	0.45	0.32			0.50		0.15		0.10		
	47.3	20.6	13.1	9.54	7.86	33.7	15.1	10.3	6.96	5.58			7.98		3.32		2.73		
	26.5	48.7	71.7	92.0	111.5	43.4	79.6	108.0	139.8	N/A	N/A	C/F	169.9	C/F	292.1	C/F	C/F	C/F	
	3.0	5.5	8.1	10.4	12.6	4.9	9.0	12.2	15.8				19.2		33.0				
	3.8	7.1	10.2	13.4	16.5	6.2	11.7	16.5	21.3				23.5		44.2				
	0.94	1.73	2.54	3.27	3.96	1.54	2.83	3.83	4.96				6.03		10.4				
	4.01	1.30	0.73	0.47	0.37	1.90	0.59	0.31	0.20				0.25		0.08				
	20.1	9.16	6.07	4.26	3.49	15.0	6.85	4.20	1.94				3.98		1.87				
	22.1	41.6	55.8	66.4	C/F	31.9	61.9	C/F											
	2.5	4.7	6.3	7.5		3.6	7.0												
	4.9	9.2	13.1	17.3		8.0	15.0												
	1.05	1.97	2.64	3.14		1.51	2.93												
	2.62	0.82	0.44	0.29		1.20	0.36												
	12.6	5.48	3.57	2.53		9.45	4.08												
	19.5	35.4	C/F	N/A	N/A	25.7	C/F												
	2.2	4.0				2.9													
	7.5	14.1				12.2													
	1.38	2.51				1.82													
	0.96	0.30				0.49													
	4.80	2.09				3.96													

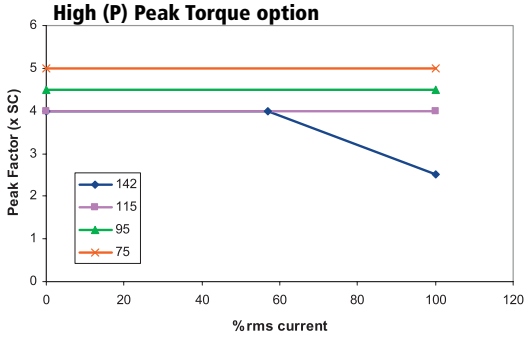
Peak Torque Derating

Standard (2) Peak Torque



Peak Torque Derating

High (P) Peak Torque option



Peak Torque defined for a maximum period of 250 ms, RMS 3000 rpm, △Tmax = 100°C, 40°C ambient
SC = Stall Current

460V FM Motor Specifications

Motor Frame Size (mm)	055U2			075U2				095U2				
Frame Length	A	B	C	A	B	C	D	A	B	C	D	E
Continuous Stall Torque (Lb-In)	6.4	12.4	18.7	10.6	19.5	27.4	34.5	20.4	38.1	52.2	66.4	79.6
Continuous Stall Torque (Nm)	0.72	1.40	2.11	1.2	2.2	3.1	3.9	2.3	4.3	5.9	7.5	9.0
Standard (2) Peak Torque selection max (Lb-In)	24.3	48.7	73.0	31.9	58.4	82.3	103.5	61.1	114.2	156.6	199.1	238.9
Standard (2) Peak Torque selection max (Nm)	2.75	5.50	8.25	3.6	6.6	9.3	11.7	6.9	12.9	17.7	22.5	27.0
High (P) Peak Torque selection max (Lb-In)	N/A	N/A	N/A	53.1	97.3	137.2	172.6	92.0	171.7	235.4	299.1	358.4
High (P) Peak Torque selection max (Nm)				6	11	15.5	19.5	10.4	19.4	26.6	33.8	40.5
Standard Inertia (Lb-In-sec^2)	0.00011	0.00020	0.00030	0.00062	0.00106	0.00142	0.00177	0.00159	0.00257	0.00354	0.00451	0.00549
Standard Inertia (kgcm2)	0.12	0.23	0.34	0.7	1.2	1.6	2.0	1.8	2.9	4.0	5.1	6.2
High Inertia (Lb-In-sec^2)	N/A	N/A	N/A	0.00097	0.00133	0.00177	0.00212	0.00327	0.00425	0.00522	0.00620	0.00717
High Inertia (kgcm2)				1.1	1.5	2.0	2.4	3.7	4.8	5.9	7.0	8.1
Winding Thermal Time Const. (sec)	N/A	N/A	N/A	81	74	94	100	172	168	183	221	228
Maximum Cogging (Lb-In)	0.27	0.44	0.62	0.18	0.27	0.35	0.44	0.27	0.53	0.71	0.89	1.15
Maximum Cogging (Nm)	0.03	0.05	0.07	0.02	0.03	0.04	0.05	0.03	0.06	0.08	0.10	0.13
Standard motor weight unbraked (lbs)	2.64	3.30	3.96	7.92	9.68	11.44	13.20	11.22	13.86	16.50	19.14	21.78
Standard motor weight unbraked (kg)	1.20	1.50	1.80	3.60	4.40	5.20	6.00	5.10	6.30	7.50	8.70	9.90
Standard motor weight braked (lbs)	3.52	4.18	4.84	9.02	10.78	12.54	14.30	12.54	15.18	19.14	20.46	23.10
Standard motor weight braked (kg)	1.60	1.90	2.20	4.10	4.90	5.70	6.50	5.70	6.90	8.70	9.30	10.50
Rated Speed 2000 (rpm) Kt (Lb-In/A, Nm/A) =								Kt (Lb-In/A, Nm/A) =			21, 2.4	
Ke (V/krpm) =								Ke (V/krpm) =			147	
Rated Torque (Lb-In)	C/F	C/F	C/F	9.7	18.6	26.5	33.6	19.5	35.4	48.7	61.1	72.6
Rated Torque (Nm)				1.1	2.1	3.0	3.8	2.2	4.0	5.5	6.9	8.2
Stall Current (A)				0.5	1.0	1.3	1.7	1.0	1.8	2.5	3.2	3.8
Rated Power (kW)				0.23	0.44	0.63	0.80	0.46	0.84	1.15	1.45	1.72
R (ph-ph) (Ohms)				144	48.2	25.0	15.7	59.0	17.0	9.90	6.00	4.30
L (ph-ph) (mH)				214	99.2	59.2	44.7	131	54.5	36.5	25.6	18.9
Rated Speed 3000 (rpm) Kt (Lb-In/A, Nm/A) =	6.5,0.74	13, 1.48	14,1.6					Kt (Lb-In/A, Nm/A) =			14, 1.6	
Ke (V/krpm) =	45.0	89.5	95.7					Ke (V/krpm) =			98.0	
Rated Torque (Lb-In)	5.3	10.6	15.9	9.7	17.7	24.8	31.0	17.7	34.5	47.8	60.2	71.7
Rated Torque (Nm)	0.60	1.20	1.80	1.1	2.0	2.8	3.5	2.0	3.9	5.4	6.8	8.1
Stall Current (A)	0.98	0.95	1.34	0.8	1.4	2.0	2.5	1.5	2.7	3.7	4.7	5.7
Rated Power (kW)	0.21	0.43	0.64	0.35	0.63	0.88	1.10	0.63	1.23	1.70	2.14	2.54
R (ph-ph) (Ohms)	30.0	46.0	32.0	60.8	20.1	10.5	7.5	24.5	6.80	4.00	2.50	2.00
L (ph-ph) (mH)	67.3	132.3	103.0	98.4	41.8	27.6	19.7	57.9	24.3	15.5	10.9	8.50
Rated Speed 4000 (rpm) Kt (Lb-In/A, Nm/A) =								Kt (Lb-In/A, Nm/A) =			11, 1.2	
Ke (V/krpm) =								Ke (V/krpm) =			73.5	
Rated Torque (Lb-In)	C/F	C/F	C/F	8.9	15.0	20.4	25.7	15.9	26.5	35.4	43.4	50.4
Rated Torque (Nm)	C/F	C/F	C/F	1.0	1.7	2.3	2.9	1.8	3.0	4.0	4.9	5.7
Stall Current (A)				1.0	1.9	2.6	3.3	2.0	3.6	5.0	6.3	7.5
Rated Power (kW)				0.42	0.71	0.96	1.21	0.75	1.26	1.68	2.05	2.39
R (ph-ph) (Ohms)				36.8	10.5	6.30	4.20	12.7	4.08	2.10	1.50	1.03
L (ph-ph) (mH)				54.9	24.8	14.9	10.8	31.5	13.6	8.50	6.30	4.80
Rated Speed 6000 (rpm) Kt (Lb-In/A, Nm/A) =	6.5,0.7	6.5,0.7	7,0.8					Kt (Lb-In/A, Nm/A) =			7.1,0.8	
Ke (V/krpm) =	45.0	44.3	47.9					Ke (V/krpm) =			49.0	
Rated Torque (Lb-In)	4.2	8.1	11.9	8.0	14.2	18.6	23.0	11.5	18.6	24.8	C/F	C/F
Rated Torque (Nm)	0.48	0.91	1.35	0.9	1.6	2.1	2.6	1.3	2.1	2.8		
Stall Current (A)	0.98	1.91	2.68	1.5	2.8	3.9	4.9	2.9	5.4	7.4		
Rated Power (kW)	0.33	0.63	0.99	0.57	1.01	1.32	1.63	0.82	1.32	1.76		
R (ph-ph) (Ohms)	30.0	11.4	8.0	15.0	5.00	2.66	1.90	5.45	1.82	1.05		
L (ph-ph) (mH)	67.3	33.1	25.7	24.0	10.6	6.80	4.80	14.1	6.00	3.80		

C/F= Consult Factory
N/A= Not Available

△t = 100° C winding 40° C maximum ambient
All data subject to ±10% tolerance

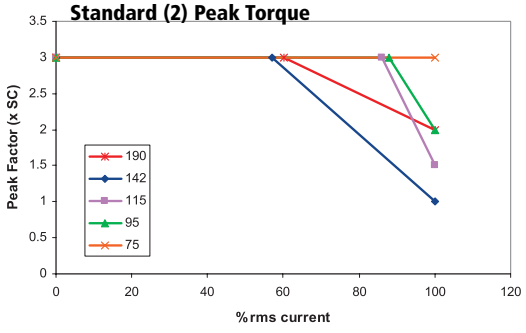
230V & 460V FM Motor Holding Brake Specifications

Motor Frame Size mm	Power Supply DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Engagement Time ms	Added Inertia lb-in-sec^2	Added Inertia kg-cm^2	Added weight kg
55	24	0.27	15.9	1.8	24	0.00003	0.03	0.4
75	24	0.27	17.7	2	24	0.00006	0.07	0.5
95	24	0.67	97.3	11	20	0.00035	0.39	0.6
115	24	0.67	97.3	11	10	0.00039	0.44	1.2
142	24	0.81	159.3	18	30	0.00048	0.54	1.7
190(A-D)	24	1.05	336.3	38	15	0.00272	3.07	2
190(E-H)	24	1.05	531.0	60	15	0.00438	4.95	2

	115U2					142U2						190U2							
	A	B	C	D	E	A	B	C	D	E	F	A	B	C	D	E	F	G	H
	31.0	58.4	83.2	109.7	135.4	50.4	95.6	135.4	175.2	207.1	C/F	85.0	192.9	275.2	363.7	447.8	519.5	584.1	647.8
	3.5	6.6	9.4	12.4	15.3	5.7	10.8	15.3	19.8	23.4		9.6	21.8	31.1	41.1	50.6	58.7	66.0	73.2
	92.9	175.2	249.6	329.2	406.2	151.3	286.7	406.2	525.7	621.3		254.9	578.8	825.7	1088.6	1341.7	1557.6	1752.3	1938.1
	10.5	19.8	28.2	37.2	45.9	17.1	32.4	45.9	59.4	70.2		28.8	65.4	93.3	123	151.6	176	198.0	219
	123.9	233.6	332.8	439.0	541.6	201.8	382.3	541.6	700.9	828.4		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	14	26.4	37.6	49.6	61.2	22.8	43.2	61.2	79.2	93.6									
	0.00389	0.00593	0.00797	0.01009	0.01221	0.00797	0.01381	0.01965	0.02549	0.03133		0.02646	0.04310	0.05974	0.07646	0.09293	0.10894	0.12647	0.14319
	4.4	6.7	9.0	11.4	13.8	9.0	15.6	22.2	28.8	35.4		29.9	48.7	67.5	86.4	105.0	123.1	142.9	161.8
	0.00841	0.01044	0.01248	0.01469	0.01673	0.02062	0.02646	0.03230	0.03814	0.04398		0.06646	0.08310	0.09974	0.11647	0.13293	0.14895	0.16647	0.18320
	9.5	11.8	14.1	16.6	18.9	23.3	29.9	36.5	43.1	49.7		75.1	93.9	112.7	131.6	150.2	168.3	188.1	207
	175	185	198	217	241	213	217	275	301	365		217	240	241	242	281	319	476	632
	0.53	0.89	1.24	1.59	1.86	0.80	1.42	2.04	2.66	3.10		1.06	2.66	3.54	4.78	5.84	6.37	7.61	8.76
	0.06	0.10	0.14	0.18	0.21	0.09	0.16	0.23	0.30	0.35		0.12	0.30	0.40	0.54	0.66	0.72	0.86	0.99
	17.16	21.34	25.52	29.70	33.88	22.00	29.26	35.42	41.58	47.74		46.20	55.66	65.12	74.58	84.04	93.50	102.96	112.86
	7.80	9.70	11.60	13.50	15.40	10.00	13.30	16.10	18.90	21.70		21.00	25.30	29.60	33.90	38.20	42.50	46.80	51.30
	19.80	23.98	28.16	32.34	37.84	26.84	33.00	39.16	43.12	51.48		50.60	60.06	69.52	78.98	88.44	97.90	107.36	116.82
	9.00	10.90	12.80	14.70	17.20	12.20	15.00	17.80	19.60	23.40		23.00	27.30	31.60	35.90	40.20	44.50	48.80	53.10
	28.3	54.0	77.0	95.6	123.9	46.9	91.2	129.2	162.8	188.5	C/F	82.3	177.0	251.3	326.6	387.6	446.0	469.1	484.1
	3.2	6.1	8.7	10.8	14.0	5.3	10.3	14.6	18.4	21.3		9.3	20.0	28.4	36.9	43.8	50.4	53.0	54.7
	1.5	2.8	4.0	5.2	6.4	2.4	4.5	6.4	8.3	9.8		4.0	9.1	13.0	17.2	21.1	24.5	27.5	30.5
	0.67	1.28	1.82	2.26	2.93	1.11	2.16	3.06	3.85	4.46		1.90	4.19	5.90	7.73	9.20	10.6	11.1	11.5
	27.8	8.55	4.55	2.96	2.17	12.5	3.60	2.10	1.35	0.98		6.15	1.80	0.83	0.56	0.39	0.33	0.30	0.23
	94.6	40.5	25.7	18.6	14.7	58.0	29.8	18.7	13.6	10.7		52.90	28.10	15.00	13.0	8.68	8.90	6.73	6.30
	26.5	48.7	71.7	92.0	111.5	43.4	79.6	108.0	139.8	159.3	C/F	77.0	169.9	221.3	292.1	300.9	309.8	318.6	325.7
	3.0	5.5	8.1	10.4	12.6	4.9	9.0	12.2	15.8	18.0		8.7	19.2	25.0	33.0	34.0	35.0	36.0	36.8
	2.2	4.2	5.9	7.8	9.6	3.6	6.8	9.6	12.4	14.7		6.0	13.7	19.4	25.7	31.6	36.7	41.3	45.8
	0.94	1.73	2.54	3.27	3.96	1.54	2.83	3.83	4.96	5.65		2.73	6.03	7.85	10.4	10.7	11.0	11.3	11.6
	12.6	3.86	2.02	1.40	1.10	5.63	1.72	0.94	0.61	0.44		2.73	0.79	0.41	0.30	0.17	0.14	0.13	0.09
	43.1	18.6	11.4	8.60	7.40	31.0	13.3	8.30	6.10	4.80		23.50	13.20	7.35	6.11	3.86	3.60	2.99	2.46
	22.1	41.6	55.8	66.4	77.0	31.9	61.9	78.8	94.7	108.0		C/F	C/F	C/F	C/F				
	2.5	4.7	6.3	7.5	8.7	3.6	7.0	8.9	10.7	12.2									
	3.0	5.5	7.9	10.4	12.8	4.8	9.0	12.8	16.5	19.5									
	1.05	1.97	2.64	3.14	3.64	1.51	2.93	3.73	4.48	5.11									
	6.91	2.14	1.16	0.73	0.57	3.12	1.00	0.53	0.35	0.24									
	23.5	10.2	6.60	4.70	3.90	17.6	7.50	4.70	3.60	2.70									
	19.5	35.4	C/F	C/F	N/A	25.7	39.8	C/F	C/F										
	2.2	4.0				2.9	4.5												
	4.4	8.3				7.2	13.5												
	1.38	2.51				1.82	2.83												
	3.10	0.97				1.42	0.46												
	15.5	4.81				7.72	3.44												

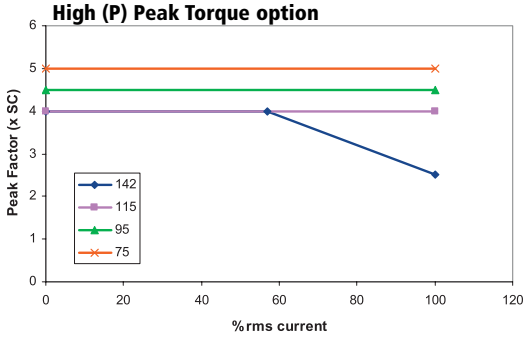
Peak Torque Derating

Standard (2) Peak Torque



Peak Torque Derating

High (P) Peak Torque option



Peak Torque defined for a maximum period of 250 ms, RMS 3000 rpm, △Tmax = 100°C, 40°C ambient
SC = Stall Current

FM Servo Motor Order String (Part Number Configurator)

XXX	X	X	X	XX	X	X

Frame Size	Voltage	Peak Torque	Stator Length	Rated Speed (RPM)	Brake (24 VDC)	Connection Type
055	**E** = 220V	055 Frame only	**A**	055 Frame only	055 Frame only	055 Frame only
075	**U** = 480V	**2** = Standard	**B**	**30** = 3000 Std	**0** = No Brake (std)	**B** = Power & Signal 90° Rotatable (Std)
095	**W** = 575V*	075-190 Frames	**C**	**60** = 6000	**1** = Holding Brake	**C** = Power 90° Rotatable & Signal Vertical
115	*Consult Factory	**2** = Standard	**D**	075-190 Frames	**X** = Special	**V** = Power & Signal Vertical
142		**P** = Peak Torque	**E**	**10** = 1000		**X** = Special
190			**F**	**20** = 2000	075-190 Frames	075-190 Frames
			G	**30** = 3000	**0** = No Brake (std)	**A** = Power & Signal 90° Fixed
			H	**40** = 4000	**1** = Holding Brake	**B** = Power & Signal 90° Rotatable (Std)
				50 = 5000	**5** = High Energy	**C** = Power 90° Rotatable & Signal Vertical
				60 = 6000	**X** = Special	**V** = Power & Signal Vertical
						X = Special

Order Code Example: **115E2B301BACAA130240**

FM Servo Motors - the flexible motors

In addition to the standard stock motors shown in the catalog, all options shown in this chart are available to meet your needs via custom order.

Note: Custom Motors are not returnable.

Power Cable Order String

XX	B	X	X	-	XXX

Cable Type
PS = Power (Standard)
PB = Power (with Brake)

Jacket
B = PUR

Phase & Earth Conductor Size
G = 1.5 mm² 16A
A = 2.5 mm² 22A
B = 4.0 mm² 30A
C* = 6.0 mm² 39A
D* = 10.0 mm² 53A
E* = 16.0 mm² 70A

Cable Length (meters)
Min = **002** (2 meters)
Max = **100** (100 meters)

Connection Details

Code	Motor Type	Drive Type	Motor End	Drive End
U =	FM/UM/EZ/DM 55-190 w/Connectors	Epsilon EP/Digitax ST/Unidrive SP	6 pin size 1 connector	Ferrules/2 ring terminals
A =	FM/UM/EZ 55-142 w/Connectors	Unidrive SP/Epsilon (Eb/Ei)	6 pin size 1 connector	Ferrules/1 ring terminal
C =	UM/EZ 75-190 w/Hybrid Terminal Box	Unidrive SP/Epsilon (Eb/Ei)	Ferrules	Ferrules
K =	FM/UM/EZ 190 w/Connectors	Unidrive SP	6 pin size 1.5 connector	Ferrules
R =	UM/EZ/DM 55-190 w/Hybrid Terminal Box	Epsilon EP/Digitax ST/Unidrive SP	Ferrules for Hybrid Box	Ferrules
F =	FM/UM/EZ 55-142 w/Connectors	FM/UM/EZ connectors	Connector	Panel mount kit
X =	Connection by customer	Connection by customer	Cut end	Cut end

*Ring terminals for drive studs only

X	XX	X	XXX	XXX

Output Shaft	Feedback Device	Inertia	BCD** (mm)	Shaft Diameter (code) (mm)
A = Key (std) **B** = Plain Shaft **X** = Special	055 Frame only **AR** = Resolver **CP** = Incremental Encoder 4096 (use MP over 4000 RPM) **MP** = Incremental Encoder 2048 **TL** = Optical Sin/Cos Multi turn (SKM 36) **TM** = Optical Sin/Cos Muilti turn (EQN 1125) **UL** = Optical Sin/Cos Single turn (SKS 36) **UM** = Optical Sin/Cos Single turn (ECN 1113) **XX** = Special 075-250 Frames **AE** = Resolver **CA** = Incremental Encoder 4096 (use MA over 4000 RPM) **EB** = Optical Sin/Cos Multi turn (EQN 1325) **EC*** = Inductive Sin/Cos Multi turn (EQI 1329) **FB** = Optical Sin/Cos Single turn (ECN 1313) **FC*** = Inductive Sin/Cos Single turn (ECI 1317) **MA** = Incremental Encoder 2048 **RA** = Optical Sin/Cos Multi turn (SRM 50) **SA** = Optical Sin/Cos Single turn (SRS 50) **XX** = Special	**A** = Std **B** = High	055 Frame only **063** Std **070** Opt 075 Frame only **075** Std **080** Opt **085** Opt 095 Frame only **100** Std **098** Opt **115** Opt 115 Frame only **115** Std **130** Opt **145** Opt 142 Frame only **165** Std **149** Opt 190 Frame only **215** Std	055 Frame only **090** 09.0 Opt **110** 11.0 A-C† Standard **140** 14.0 Maximum 075 Frame only **110** 11.0 A† Standard **140** 14.0 B-D† Standard **190** 19.0 Maximum 095 Frame only **140** 14.0 A† Standard **190** 19.0 B-E† Standard **220** 22.0 Maximum 115 Frame only **190** 19.0 A-C† Standard **240** 24.0 D-E† Standard **320** 32.0 Maximum 142 Frame only **240** 24.0 A† Maximum **320** 32.0 A-E† Standard 190 Frame only **320** 32.0 A-H† Standard **420** 42.0 Maximum

NEW

*New low cost inductive Sin/Cos absolute encoder option.

**Optional BCD will have a different pilot diameter than standard.

† Alpha characters A-H above refer to stator length.

Feedback Cable Order String

XX	B	X	X	-	XXX

Cable Type
SI = Incremental Encoder
SR = Resolver
SS = Sin/Cos Encoder

Jacket
B = PUR

Special Options
A = Standard cable
E = Twisted screened SS cable
L = Low cost 8.5mm dia SI cable

Cable Length (meters)
Min = **002** (2 meters)
Max = **100*** (100 meters)
10m for SIBL

Connection Details

Code	Feedback device	Drive Type	Drive End	Motor End
A =	Incremental encoder (SI)	Epsilon EP/Unidrive SP/Digitax ST/Unidrive	15 pin High Density D-Sub	17 pin
H =	Incremental encoder (SI)	Epsilon (Eb/Ei) EN/MDS	26 pin High Density D-Sub	17 pin
P =	Sin/Cos Optical Encoder (SS)*	Unidrive SP/Digitax ST	15 pin High Density D-Sub	12 pin
C =	Resolver (RS)	Unidrive SP/Digitax ST with SM-Resolver	Ferrules	12 pin
C =	Sin/Cos Optical Encoder (SS)*/Resolver (RS)	Unidrive with UD53/UD52	Ferrules	12 pin
GN =	Sin/Cos Inductive Encoder (SS)**	Unidrive SP/Digitax ST	15 pin High Density D-Sub	12 pin
GC =	Sin/Cos Optical Encoder extension (bulk head)		Bulk head connector 7579160	
X =	N/A		Cut End	Cut End

* Sick/Stegmann
** Heidenhain

FM Motor 230V and 460V Dimensions Table

Frame Size Inches (mm)		55		75				95		
	Stator Length**	**A**	**C**	**A**	**B**	**C**	**D**	**B**	**D**	**E**
A	Length Overall (Unbraked)	**4.65 (118)**	**6.54 (166)**	8.23 (209)	9.41 (239)	10.59 (269)	11.78 (299)	10.15 (258)	12.51 (318)	13.69 (348)
A	Length Overall (Braked)	**6.22 (158)**	**8.11 (206)**	10.00 (254)	11.19 (284)	12.37 (314)	13.55 (344)	11.92 (303)	14.28 (363)	15.46 (393)
C	Flange Square	2.17 (55.0)		2.76 (70.0)				3.54 (90.0)		
C1	Motor Housing	2.17 (55.0)		2.95 (75.0)				3.74 (95.0)		
D	Flange Thickness	0.35 (9.0)		0.25 (6.3)				0.23 (5.95)		
E	Pilot Diameter (J6)	1.57 (40.0)		2.36 (60.0)				3.15 (8.0)		
F	Pilot Thickness	0.10 (2.5)		0.10 (2.5)				0.11 (2.9)		
G1	Front Flange to power C/L (Unbraked)	1.89 (48.0)	3.78 (96.0)	6.23 (158)	7.41 (188)	8.59 (218)	9.77 (248)	8.15 (207)	10.51 (267)	11.69 (297)
G1	Front Flange to power C/L (Braked)	3.46 (96.0)	**5.35 (136.0)**	8.00 (203)	9.18 (233)	10.36 (263)	11.54 (293)	9.92 (252)	12.28 (312)	13.46 (342)
H	Bolt Hole Diameter (H14)	0.23 (5.8)		0.24 (6.1)				0.28 (7.0)		
J	Bolt Circle Diameter (BCD)	2.48 (63.0)		2.95 (75.0)				3.94 (100.0)		
K	Overall Height	3.78 (96.0)		5.00 (127.0)				5.22 (133.0)		
N	Shaft Length (front)	0.91 (23)	0.91 (23)	0.91 (23)	1.18 (30)	1.18 (30)	1.18 (30)	1.57 (40)	1.57 (40)	1.57 (40)
P	Shaft Diameter (front)	0.43 (11)	0.43 (11)	0.43 (11)	0.55 (14)	0.55 (14)	0.55 (14)	0.75 (19)	0.75 (19)	0.75 (19)
Shaft key Dimensions										
R	Key Length (Min)	0.71 (18.0)	0.71 (18.0)	0.55 (14.0)	0.87 (22.0)	0.87 (22.0)	0.87 (22.0)	1.26 (32.0)	1.26 (32.0)	1.26 (32.0)
S	Key Height	0.49 (13.0)	0.49 (13.0)	0.49 (13.0)	0.63 (15.9)	0.63 (15.9)	0.63 (15.9)	0.84 (21.4)	0.84 (21.4)	0.84 (21.4)
T	Key to Shaft End	0.06 (1.5)	0.06 (1.5)	0.19 (5.0)	0.19 (4.8)	0.19 (4.8)	0.19 (4.8)	0.19 (4.8)	0.19 (4.8)	0.19 (4.8)
V	Key Width	0.16 (4.0)	0.16 (4.0)	0.16 (4.0)	0.20 (5.0)	0.20 (5.0)	0.20 (5.0)	0.24 (6.0)	0.24 (6.0)	0.24 (6.0)

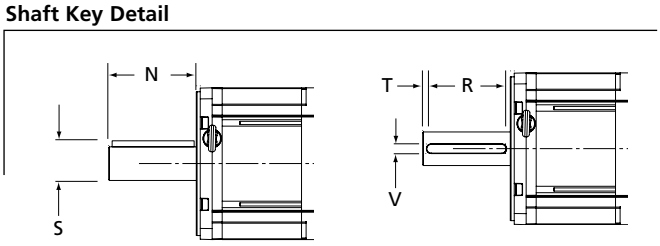
**Motors listed here are catalog items. All other frame/lengths available. Go to Power CD or www.emersonct.com for complete listing of all motor options

FM 230V & 460V MOTOR DIMENSIONS

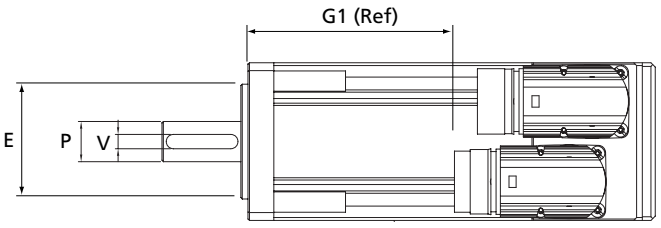
The dimensional information found on these pages is not to be used for design purposes. For complete engineering controlled drawings, please refer to the web site or Power CD.

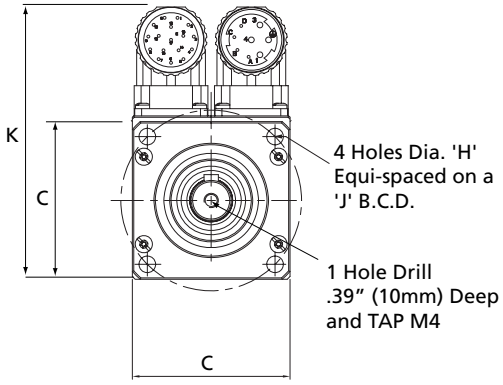
For dimensional data not shown here refer to the FM Motor brochure.

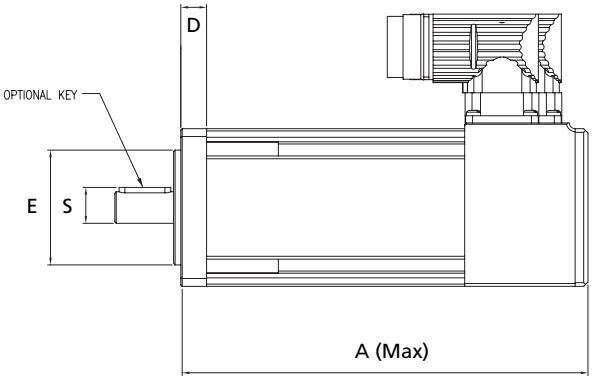
Shaft Key Detail



Frame Size 55



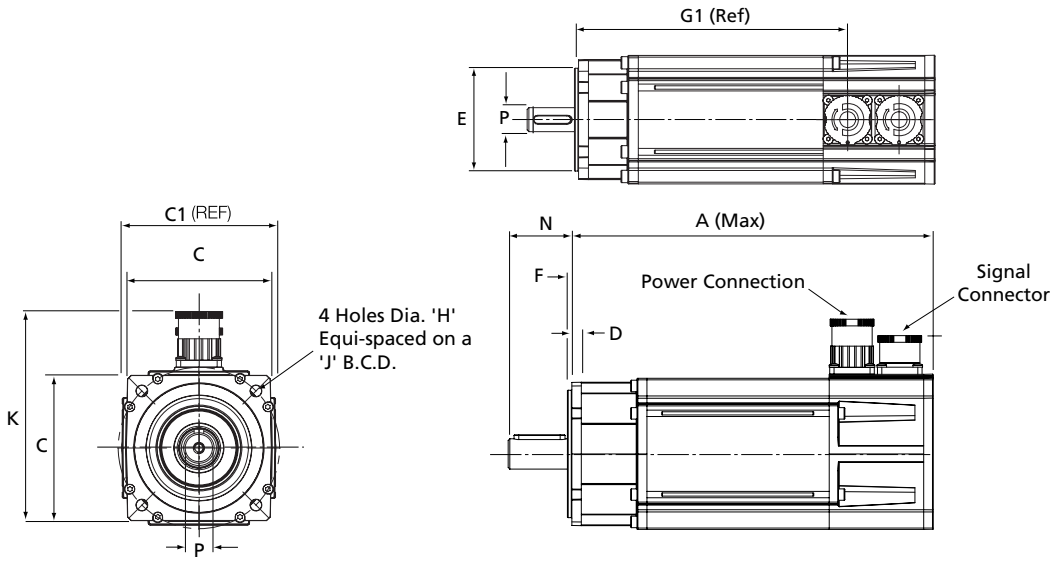




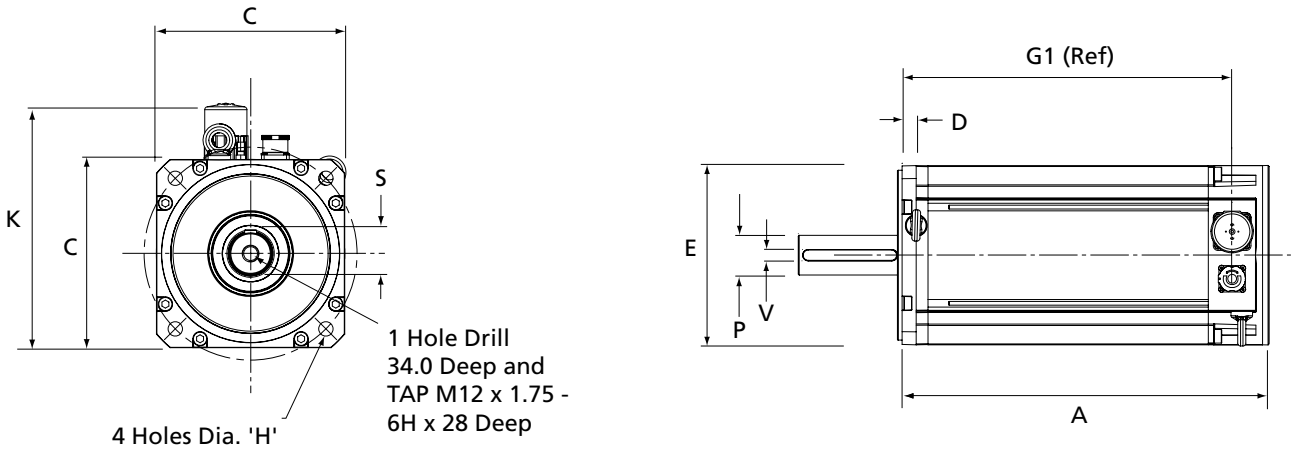
FOR VERTICAL CONNECTORS ALLOW
APPROXIMATELY 175.0MM
CLEARANCE FOR MATING CABLE

115				142				190			
B	C	D	E	B	C	D	E	B	C	D	F
10.87 (276.1)	12.05 (306)	13.23 (336.1)	14.41 (366)	10.12 (257.1)	11.30 (287)	12.48 (317.1)	13.67 (347)	10.44 (265.2)	11.50 (292.2)	12.56 (319)	14.69 (373)
12.64 (321.1)	12.13 (308)	15.00 (381.1)	16.19 (411)	11.89 (302.1)	13.07 (332)	14.26 (362.1)	15.44 (392)	13.63 (346.1)	14.69 (373.1)	15.75 (400)	17.87 (454)
4.13 (105)				5.59 (142)				7.48 (190)			
4.53 (115)				5.59 (142)				7.48 (190)			
0.40 (10)				0.48 (12)				0.61 (16)			
3.74 (95)				5.12 (130)				7.09 (180)			
0.11 (2.9)				0.14 (3.5)				0.16 (4.0)			
9.17 (233.0)	10.35 (263)	11.54 (293.0)	12.72 (323)	8.43 (214)	9.61 (244)	10.79 (274)	11.97 (304)	8.90 (226.1)	9.96 (253.1)	11.02 (280)	13.15 (334)
9.76 (248.0)	12.13 (308)	13.31 (338.0)	14.49 (368)	10.20 (259)	11.38 (289)	12.56 (319)	13.74 (349)	12.09 (307)	13.15 (334)	14.21 (361)	16.33 (415)
0.40 (10)				0.47 (12)				0.57 (14.5)			
4.53 (115)				6.5 (165)				8.46 (215)			
6.20 (157.5)				7.26 (184.5)				9.98 (253.5)			
1.57 (40)	1.57 (40)	1.97 (50)	1.97 (50)	1.57 (40)	1.97 (50)	1.97 (50)	1.97 (50)	3.15 (80)	3.15 (80)	3.15 (80)	3.15 (80)
0.75 (19)	0.75 (19)	0.94 (24)	0.94 (24)	0.75 (19)	0.94 (24)	0.94 (24)	0.94 (24)	1.26 (32)	1.26 (32)	1.26 (32)	1.26 (32)
1.26 (32.0)	1.26 (32.0)	1.57 (40.0)	1.57 (40.0)	1.26 (32)	1.57 (40.0)	1.57 (40.0)	1.57 (40.0)	2.76 (70.0)	2.76 (70.0)	2.76 (70.0)	2.76 (70.0)
0.84 (21.4)	0.84 (21.4)	1.06 (26.9)	1.06 (26.9)	0.84 (21.4)	1.06 (26.9)	1.06 (26.9)	1.06 (26.9)	1.37 (34.9)	1.37 (34.9)	1.37 (34.9)	1.37 (34.9)
0.19 (4.8)	0.19 (4.8)	0.23 (5.8)	0.23 (5.8)	0.19 (4.8)	0.23 (5.8)	0.23 (5.8)	0.23 (5.8)	0.23 (5.8)	0.23 (5.8)	0.23 (5.8)	0.23 (5.8)
0.24 (6.0)	0.24 (6.0)	0.31 (8.0)	0.31 (8.0)	0.24 (6.0)	0.31 (8.0)	0.31 (8.0)	0.31 (8.0)	0.39 (10.0)	0.39 (10.0)	0.39 (10.0)	0.39 (10.0)

Frame Size 75, 95



Frame Size 115, 142, 190



NT MOTOR—230V

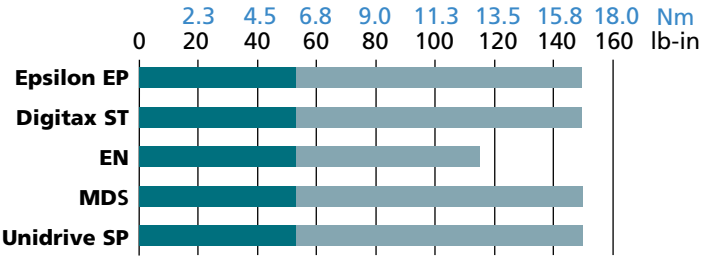
The NT Motor is an economical, high performance motor manufactured to maximize torque and minimize size. The NT motor uses powerful Neodymium magnets and is manufactured with a segmented core to maximize stator efficiency and further reduce size.

- Very low inertia for applications that demand high accel and cycle rates
- English (NEMA 23 or 34) or Metric (IEC- 72-1) flanges
- With or without holding brakes
- The standard encoder resolution is 2048 lines per rev.
- NT motors can be ordered with MS style connectors, 1 meter Flying Leads or 1 meter Flying Leads with MS connectors, direct connect
- All models are rated IP65

NEW

- Medium inertia options
- NT motors are now available with direct motor to drive connector terminations for Epsilon EP, Unidrive SP & Digitax ST. (These low cost DP/DS solutions are not suitable for all applications.)





NT Motor Specifications

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
NT-207	7.5 / .85	1.7	3.6	11.1	39.1	5000	0.000094 / 0.106	35	5.12 / 0.58	3 / 1.36
NT-212	12.5 / 1.4	2.7	6	4.56	18.9	5000	0.000164 / 0.185	35	5.12 / 0.58	4 / 1.82
NT-320	20 / 2.2	5.4	16.2	1.5	16.0	4000	0.000328 / 0.370	29	3.50 / 0.40	6 / 2.72
NT-320 medium inertia	18.0 / 2.0	5.4	16.2	1.5	16.0	4000	0.000558 / 0.63	29	3.50 / 0.40	6.9 / 3.13
NT-330	32 / 3.6	6.25	18.38	1.2	15.0	4000	0.000438 / 0.494	36	4.73 / 0.53	7.3 / 3.31
NT-330 medium inertia	47 / 5.3	6.59	19.8	1.3	17.0	3000	0.000668 / 0.754	50	6.37 / 0.72	10 / 4.54
NT-345	47 / 5.3	6.59	19.8	1.3	17.0	3000	0.000668 / 0.754	50	6.37 / 0.72	10 / 4.54
NT-345 medium inertia	56 / 6.3	7.6	22.8	1	13.0	3000	0.000888 / 1.002	50	6.32 / 0.71	12.3 / 5.58
NT-355	56 / 6.3	7.6	22.8	1	13.0	3000	0.000888 / 1.002	50	6.32 / 0.71	12.3 / 5.58

Note: Encoder resolution 2048 ppr

NT Holding Brake Specifications

Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released ms	Mechanical Engagement Time-Brake Holding ms	Added Inertia lb-in-sec²	Added Inertia kg-cm²
2"	24	0.33	20	2.26	28	14	0.000106	0.12
3"	24	0.65	88.5	10	43	13	0.000968	1.093

NT MOTOR DIMENSIONS

English Dimensions inches (mm)	2"		3"			
	NTE-207	**NTE-212**	**NTE-320**	**NTE-330**	**NTE-345** standard inertia **NTE-330** medium inertia **NTE-320** medium inertia	**NTE-355** standard inertia **NTE-345** medium inertia
A Length Overall - CONS (Max)	5.55 (141)	6.55 (166.4)	5.218 (132.5)	5.818 (147.8)	7.018 (178.26)	9.418 (239.22)
Length Overall - TONS/LONS (Max)	4.39 (111.5)	5.39 (136.9)	5.218 (132.5)	5.818 (147.8)	7.018 (178.26)	9.418 (239.22)
A Length Overall - CBNS (Max)	6.95 (176.4)	7.95 (201.8)	7.24 (184)	7.84 (199.2)	9.043 (229.7)	11.443 (290.65)
Length Overall - TBNS/LBNS (Max)	6.28 (159.4)	7.95 (201.8)	7.24 (184)	7.84 (199.2)	9.043 (229.7)	11.443 (290.65)
B Flange Square	2.27 (57.66)	2.27 (57.66)	3.42 (86.87)	3.42 (86.87)	3.42 (86.87)	3.42 (86.87)
C Flange Thickness	0.3 (7.49)	0.3 (7.49)	0.3 (7.62)	0.3 (7.62)	0.3 (7.62)	0.3 (7.62)
D Pilot Diameter	1.5 (38.1)	1.5 (38.1)	2.875 (73.03)	2.875 (73.03)	2.875 (73.03)	2.875 (73.03)
E Pilot Thickness	0.1 (2.54)	0.1 (2.54)	0.1 (2.54)	0.1 (2.54)	0.1 (2.54)	0.1 (2.54)
F Bolt Hole Diameter	0.205 (5.21)	0.205 (5.21)	0.22 (5.59)	0.22 (5.59)	0.22 (5.59)	0.22 (5.59)
G Bolt Circle Diameter	2.625 (66.68)	2.625 (66.68)	3.875 (98.43)	3.875 (98.43)	3.875 (98.43)	3.875 (98.43)
H Signal Connector Height - CONS (Max)	1.925 (48.89)	1.925 (48.89)	2.45 (62.24)	2.45 (62.24)	2.45 (62.24)	2.45 (62.24)
H Signal Connector Height - TONS/LONS (Max)	1.78 (45.2)	1.78 (45.2)	2.35 (59.69)	2.35 (59.69)	2.35 (59.69)	2.35 (59.69)
H Signal Connector Height - CBNS (Max)	1.98 (50.4)	1.98 (50.4)	2.56 (65)	2.56 (65)	2.56 (65)	2.56 (65)
H Signal Connector Height - TBNS/LBNS (Max)	1.78 (45.2)	1.78 (45.2)	2.5 (63.5)	2.5 (63.5)	2.5 (63.5)	2.5 (63.5)
I Shaft Length	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)
J Shaft Diameter	0.375 (9.525)	0.375 (9.525)	0.5 (12.7)	0.5 (12.7)	0.5 (12.7)	0.5 (12.7)
Shaft key Dimensions						
K Keyway Length (Min)	0.7 (17.78)	0.7 (17.78)	0.84 (21.34)	0.84 (21.34)	0.84 (21.34)	0.84 (21.34)
L Keyway Depth	0.079 (2.007)	0.079 (2.007)	0.077 (1.96)	0.077 (1.96)	0.077 (1.96)	0.077 (1.96)
M Keyway Width	0.126 (3.2)	0.126 (3.2)	0.127 (3.23)	0.127 (3.23)	0.127 (3.23)	0.127 (3.23)

Metric Dimensions inches (mm)	2"		3"			
	NTM-207	**NTM-212**	**NTM-320**	**NTM-330**	**NTM-345** standard inertia **NTM-330** medium inertia **NTM-320** medium inertia	**NTM-355** standard inertia **NTM-345** medium inertia
A Length Overall - CONS (Max)	5.55 (141)	6.55 (166.4)	5.218 (132.5)	5.818 (147.8)	7.018 (178.26)	9.418 (239.22)
Length Overall - TONS/LONS (Max)	4.39 (111.5)	5.39 (136.9)	5.218 (132.5)	5.818 (147.8)	7.018 (178.26)	9.418 (239.22)
A Length Overall - CBNS (Max)	6.95 (176.4)	7.95 (201.8)	7.24 (184)	7.84 (199.2)	9.043 (229.7)	11.443 (290.65)
Length Overall - TBNS/LBNS (Max)	6.28 (159.4)	7.28 (184.8)	7.24 (184)	7.84 (199.2)	9.043 (229.7)	11.443 (290.65)
B Flange Square	2.566 (65.18)	2.566 (65.18)	3.42 (86.87)	3.42 (86.87)	3.42 (86.87)	3.42 (86.87)
C Flange Thickness	0.3 (7.49)	0.3 (7.49)	0.3 (7.62)	0.3 (7.62)	0.3 (7.62)	0.3 (7.62)
D Pilot Diameter	2.363 (60)	2.363 (60)	3.15 (80)	3.15 (80)	3.15 (80)	3.15 (80)
E Pilot Thickness	0.1 (2.54)	0.1 (2.54)	0.12 (3)	0.12 (3)	0.12 (3)	0.12 (3)
F Bolt Hole Diameter	0.228 (5.8)	0.228 (5.8)	0.276 (7.01)	0.276 (7.01)	0.276 (7.01)	0.276 (7.01)
G Bolt Circle Diameter	2.953 (75)	2.953 (75)	3.937 (100)	3.937 (100)	3.937 (100)	3.937 (100)
H Signal Connector Height - CONS (Max)	1.925 (48.89)	1.925 (48.89)	2.45 (62.24)	2.45 (62.24)	2.45 (62.24)	2.45 (62.24)
H Signal Connector Height - TONS/LONS (Max)	1.78 (45.2)	1.78 (45.2)	2.35 (59.69)	2.35 (59.69)	2.35 (59.69)	2.35 (59.69)
H Signal Connector Height - CBNS (Max)	1.98 (50.4)	1.98 (50.4)	2.56 (65)	2.56 (65)	2.56 (65)	2.56 (65)
H Signal Connector Height - TBNS/LBNS (Max)	1.78 (45.2)	1.78 (45.2)	2.5 (63.5)	2.5 (63.5)	2.5 (63.5)	2.5 (63.5)
I Shaft Length	0.926 (23.51)	0.512 (23.51)	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)	1.2 (30.7)
J Shaft Diameter	0.433 (11)	0.433 (11)	0.5512 (14)	0.5512 (14)	0.5512 (14)	0.5512 (14)
Shaft key Dimensions						
K Keyway Length (Min)	0.512 (13)	0.512 (13)	0.79 (20)	0.79 (20)	0.79 (20)	0.79 (20)
L Keyway Depth	0.083 (2.1)	0.083 (2.1)	0.1 (2.55)	0.1 (2.55)	0.1 (2.55)	0.1 (2.55)
M Keyway Width	0.157 (4)	0.157 (4)	0.2 (5.05)	0.2 (5.05)	0.2 (5.05)	0.2 (5.05)

NT MOTOR DIMENSIONS

2" NT Motor

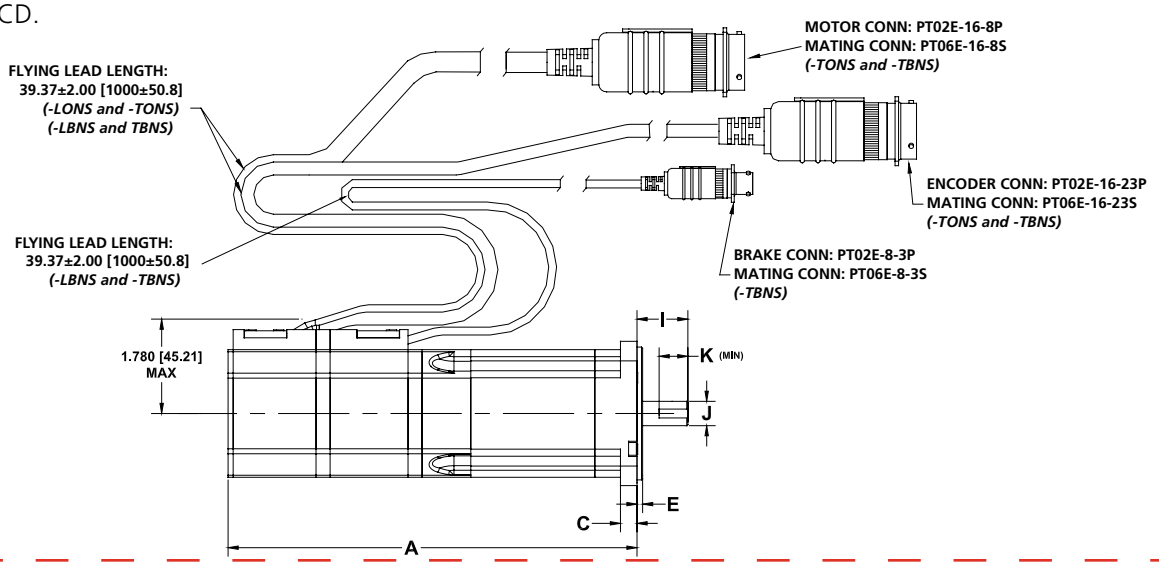
Go to Power CD for complete data

The dimensional information found on these pages is not to be used for design purposes. For complete engineering controlled drawings, please refer to the web site or Power CD.

Motor Connection options

TONS

TBNS



Motor Connection options

TBNS - DS

TBNS - DP

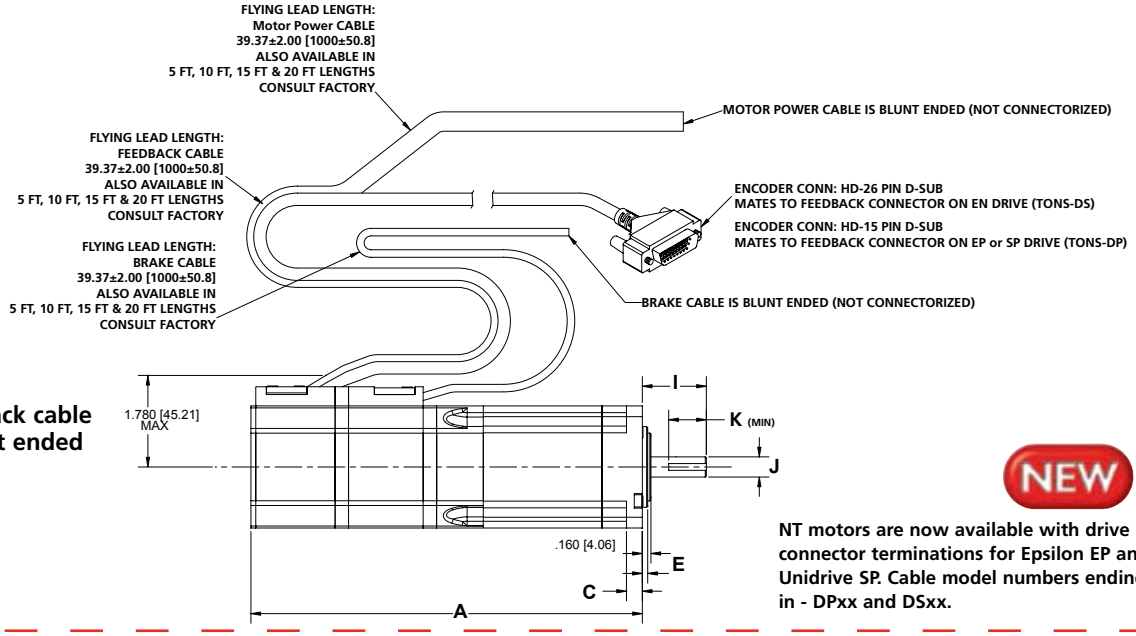
TONS - DS

TONS - DP

LBNS

LONS

} Feedback cable is blunt ended



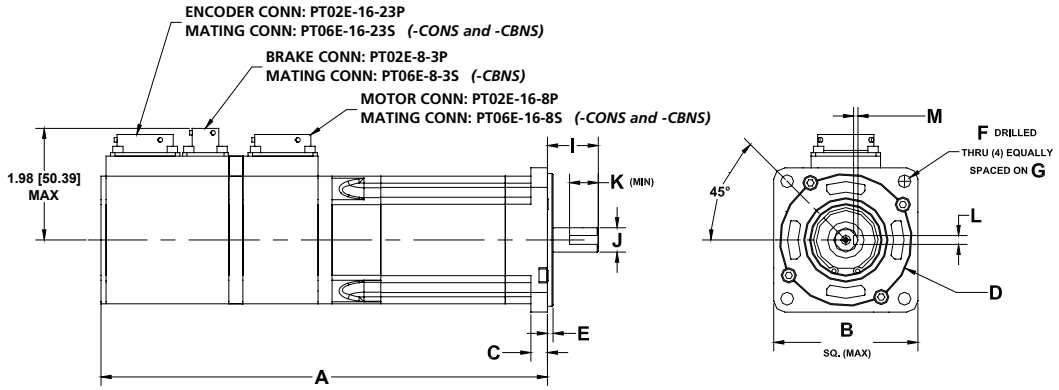
NEW

NT motors are now available with drive connector terminations for Epsilon EP and Unidrive SP. Cable model numbers ending in - DPxx and DSxx.

Motor Connection options

CONS

CBNS



NT MOTOR DIMENSIONS

3" NT Motor

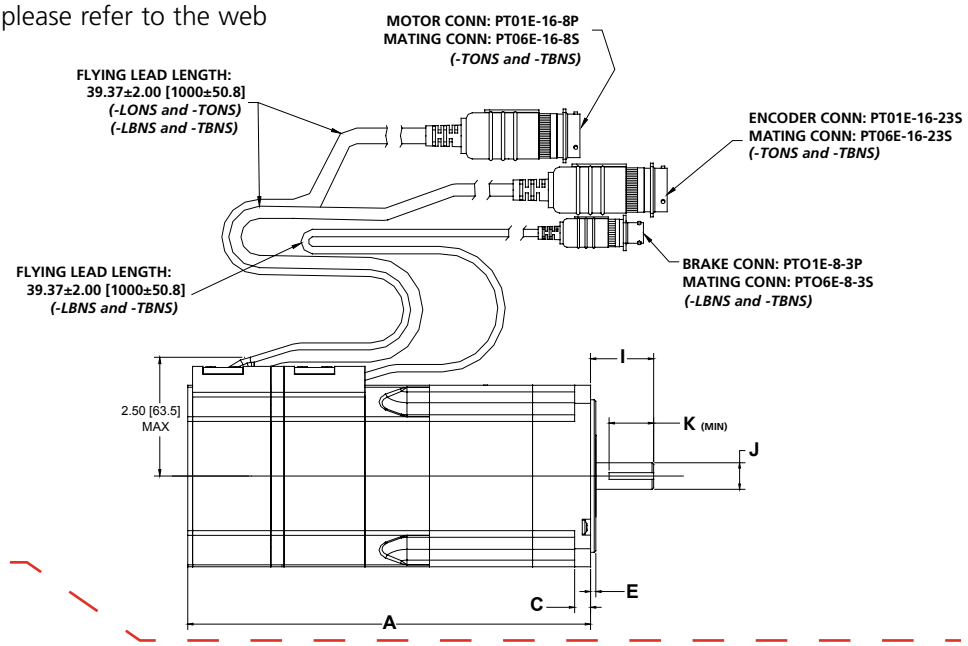
Go to Power CD for complete data

The dimensional information found on these pages is not to be used for design purposes. For complete engineering controlled drawings, please refer to the web site or Power CD.

Motor Connection options

TONS

TBNS



Motor Connection options

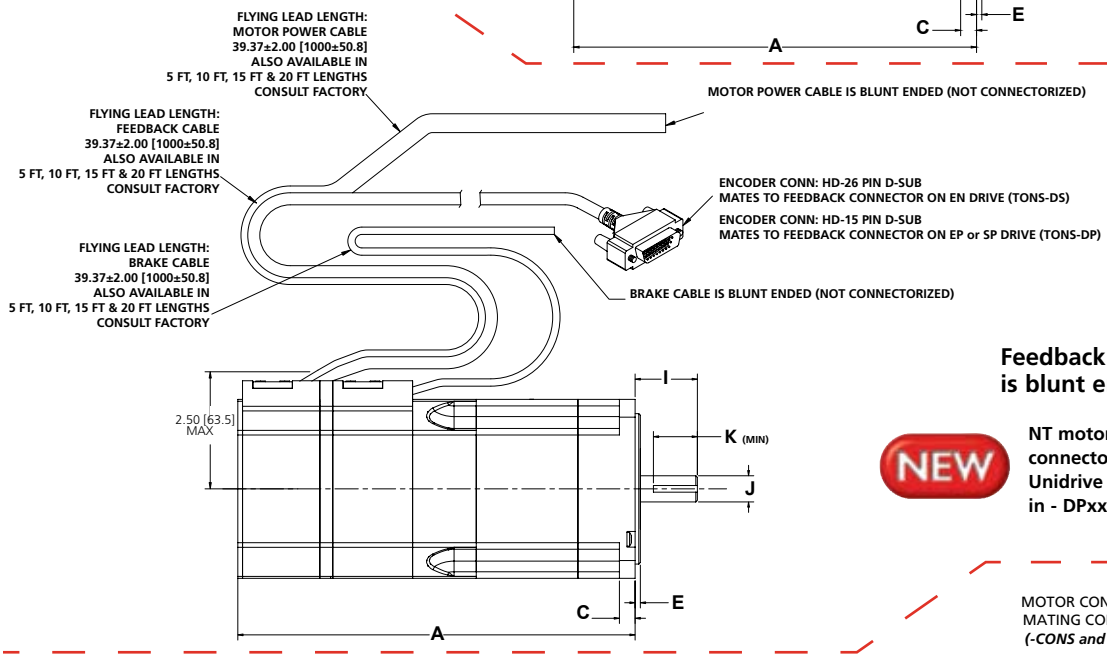
TBNS - DS

TBNS - DP

TONS - DS

TONS - DP

Feedback cable is blunt ended { LBNS, LONS



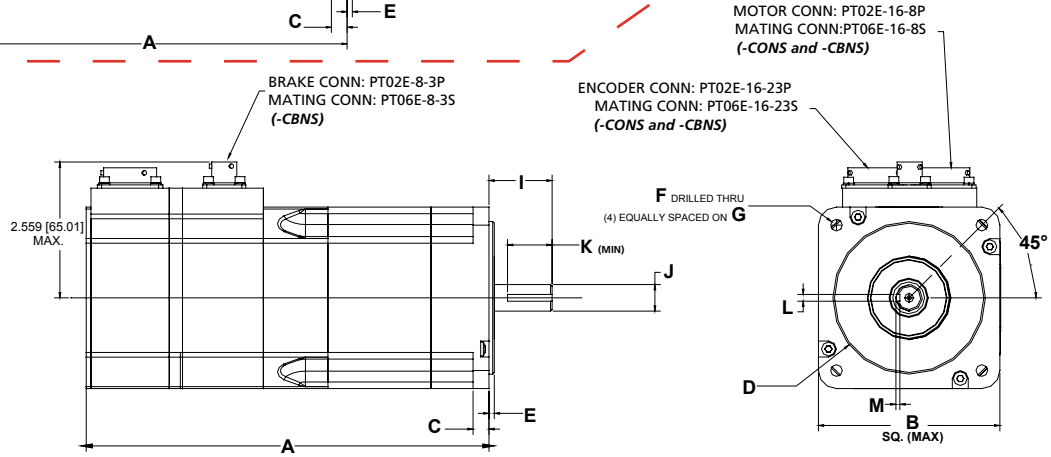
NEW

NT motors are now available with drive connector terminations for Epsilon EP and Unidrive SP. Cable model numbers ending in - DPxx and DSxx.

Motor Connection options

CONS

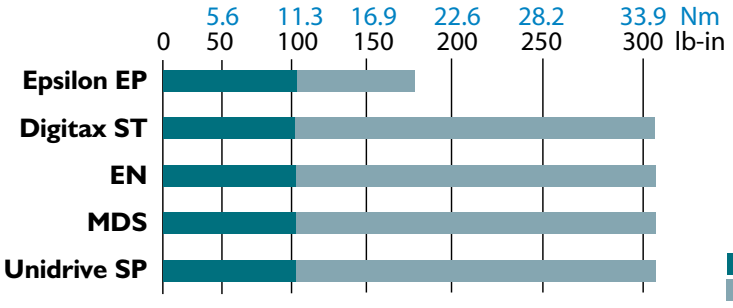
CBNS



XV—230V

The XV Servo Motor series is a high-performance, low inertia, and high torque in a compact motor package. It offers a low cost solution with the features of a premium priced servo offering. Intended for higher throughputs and smaller machines, XV motors are available in 4 Frame Sizes: 40, 60, 80 and 130 mm with speeds ranging from 2000 to 5000 rpm. Applications with Continuous Torque requirements up to 101 lb-in (11.4 Nm) are the perfect match for the XV motors. XV motors are CE, UL and RoHS approved.





XV Motor Specifications

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Amps	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm2	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
XV-401	0.95 0.11	1.07	2.9	11.69	8.54	5000	0.0000097 0.011	7.8	0.89 0.1	0.7 0.3
XV-403	3.09 0.35	1.38	3.8	6.89	6.73	5000	0.00004 0.045	12.7	2.24 0.25	1.1 0.52
XV-606	6.13 0.69	1.63	4.6	4.15	15.21	5000	0.000161 0.182	29.2	3.76 0.43	2.4 1.11
XV-6011	12.0 1.36	2.89	8. 3	1.64	7.32	5000	0.000284 0.321	29.5	4.15 0.47	3.5 1.63
XV-8017	17.9 2.0	3.58	10.3	1.43	9.18	5000	0.00096 1.092	35.2	5 0.57	5.4 2.49
XV-8023	24.1 2.73	3.82	11.0	1.29	9.10	3000	0.001335 1.509	44.6	6.32 0.71	6.9 3.15
XV-8028	29.9 3.38	5.37	15.5	0.75	5.04	5000	0.001705 1.927	39.2	5.57 0.63	8.3 3.8
XV-13046	48.4 5.47	6.28	18.5	0.77	7.76	3000	0.010611 11.99	53.1	7.71 0.87	15.8 7.2
XV-13051	53.4 6.04	4.15	12.1	1.87	20.10	2000	0.010611 11.99	85.8	12.87 1.45	15.8 7.2
XV-13068	70.1 7.92	9.23	27.2	0.47	5.27	3000	0.015345 17.34	54.2	7.59 0.86	19.1 8.7
XV-13089	90.0 10.17	5.78	17.2	1.41	15.99	2000	0.015345 17.34	94.6	15.57 1.76	21.3 9.7
XV-130101	101.0 11.41	7.63	22.3	0.87	10.67	2000	0.0200072 22.68	90.0	13.88 1.57	22.4 10.2

Note: Encoder resolution 2048 ppr



XV Motor Holding Brake Specifications

Motor Frame Size mm	Power Supply DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Engagement Time - Holding Brake ms	Added Inertia lb-in-sec²	Added Inertia kg-cm²	Added wieght kg
40	24	0.25	2.8	0.318	20	0.0000027	0.003	0.2
60	24	0.27	13.0	1.47	50	0.0000425	0.048	0.6
80	24	0.38	28.6	3.23	60	0.0001106	0.125	0.7
130	24	0.29	70.8	8	40	0.0004779	0.54	0.83

XV Motor IP Ratings

Frame size	IP rating	Exclusions
40 mm	IP55*	Shaft through area of face plate and connectors
60 mm	IP55*	Shaft through area of face plate and connectors
80 mm	IP65*	Shaft through area of face plate and connectors
130 mm	IP65*	shaft through area of face plate

* Shafts are not fitted with seals

Thermal Protection

The XV motors do not have and are not offered with a winding thermal temperature sensor. Motor feedback cables have the Motor Temperature Sensor lines defeated (shorted between pin 14 (DNG) and pin 15 (5V)). These cables include cable model numbers: XUFTS-xxx and XUFCS-xxx (XEFTS-xxx and XEFCS-xxx).

All of the servo drives offered by Control Techniques have a current limiting algorithm in the firmware specifically to limit current levels. When properly matched and limited to the motor specifications the drive firmware will fault the drive when the rated RMS current of the motor is exceeded.

Ambient operating temperature: 0° to 40° Celsius
Storage Temperature: -20° to 80° Celsius
Atmosphere: No corrosive gas, flammable gas, oil mist, or dust

XV Motor Dimensions Table

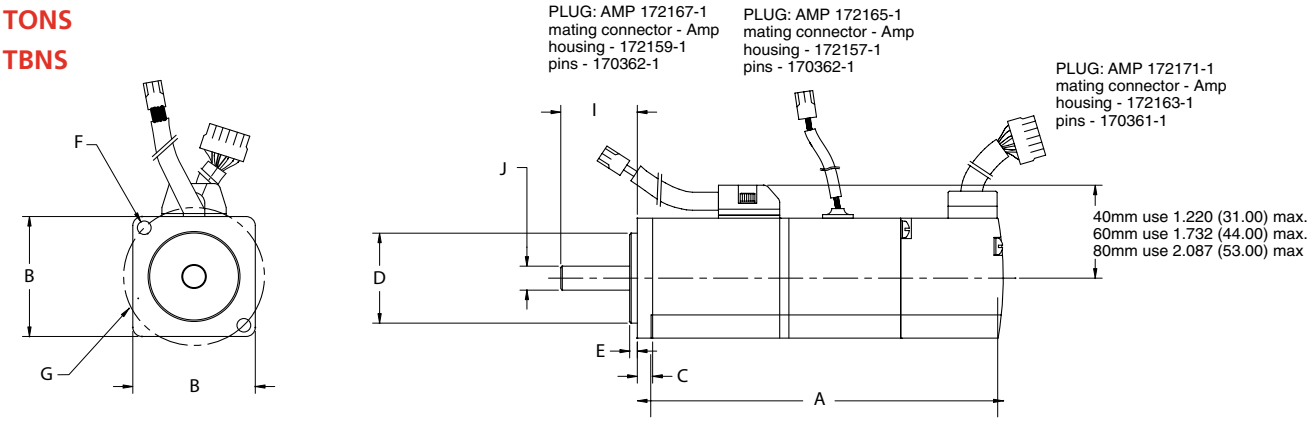
Inches (mm)		40mm		60mm	
		XVM-401	XVM-403	XVM-606	XVM-6011
A	Length Overall - CONS (Max)				
A	Length Overall - TONS (Max)	2.980 (75.7)	3.917 (99.5)	4.173 (106)	5.276 (134)
A	Length Overall - CBNS (Max)				
A	Length Overall - TBNS (Max)	4.409 (112)	5.354 (136)	5.748 (146)	6.850 (174)
B	Flange Square	1.575 (40)	1.575 (40)	2.44 (62)	2.44 (62)
C	Flange Thickness	0.197 (5)	0.197 (5)	0.236 (6)	0.236 (6)
D	Pilot Diameter	1.181 (30)	1.181 (30)	1.969 (50)	1.969 (50)
E	Pilot Thickness	0.098 (2.5)	0.098 (2.5)	0.118 (3)	0.118 (3)
F	Bolt Hole Diameter	0.177 (4.5)	0.177 (4.5)	0.236 (6)	0.236 (6)
G	Bolt Circle Diameter	1.811 (46)	1.811 (46)	2.756 (70)	2.756 (70)
H	Signal Connector Height - CONS (Max)				
H	Signal Connector Height - TONS (Max)	1.220 (31)	1.220 (31)	1.732 (44)	1.732 (44)
H	Signal Connector Height - CBNS (Max)				
H	Signal Connector Height - TBNS (Max)	1.220 (31)	1.220 (31)	1.732 (44)	1.732 (44)
I	Shaft Length	0.984 (25)	0.984 (25)	1.181 (30)	1.181 (30)
J	Shaft Diameter	0.315 (8)	0.315 (8)	0.551 (14)	0.551 (14)
	Shaft key Dimensions				
K	Keyway Length (Min)			0.886 (22.5)	0.886 (22.5)
L	Keyway Depth			0.118 (3)	0.118 (3)
M	Keyway Width			0.197 (5)	0.197 (5)

Inches (mm)		80mm			130mm				
		XVM-8017	XVM-8023	XVM-8028	XVM-13046	XVM-13051	XVM-13068	XVM-13089	XVM-130101
A	Length Overall - CONS (Max)				6.614 (168)	6.614 (168)	7.559 (192)	7.559 (192)	8.501 (216)
A	Length Overall - TONS (Max)	5.433 (138)	6.220 (158)	7.008 (178)					
A	Length Overall - CBNS (Max)				8.110 (206)	8.110 (206)	9.055 (230)	9.055 (230)	10.00 (254)
A	Length Overall - TBNS (Max)	7.008 (178)	7.795 (198)	8.583 (218)					
B	Flange Square	3.150 (80)	3.150 (80)	3.150 (80)	5.118 (130)	5.118 (130)	5.118 (130)	5.118 (130)	5.118 (130)
C	Flange Thickness	0.433 (11)	0.433 (11)	0.433 (11)	0.551 (14)	0.551 (14)	0.551 (14)	0.551 (14)	0.551 (14)
D	Pilot Diameter	2.756 (70)	2.756 (70)	2.756 (70)	4.331 (110)	4.331 (110)	4.331 (110)	4.331 (110)	4.331 (110)
E	Pilot Thickness	0.118 (3)	0.118 (3)	0.118 (3)	0.236 (6)	0.236 (6)	0.236 (6)	0.236 (6)	0.236 (6)
F	Bolt Hole Diameter	0.260 (6.6)	0.260 (6.6)	0.260 (6.6)	0.354 (9)	0.354 (9)	0.354 (9)	0.354 (9)	0.354 (9)
G	Bolt Circle Diameter	3.543 (90)	3.543 (90)	3.543 (90)	5.709 (145)	5.709 (145)	5.709 (145)	5.709 (145)	5.709 (145)
H	Signal Connector Height -CONS (Max)				4.409 (112)	4.409 (112)	4.409 (112)	4.409 (112)	4.409 (112)
H	Signal Connector Height -TONS (Max)	2.087 (53)	2.087 (53)	2.087 (53)					
H	Signal Connector Height -CBNS (Max)				4.409 (112)	4.409 (112)	4.409 (112)	4.409 (112)	4.409 (112)
H	Signal Connector Height -TBNS (Max)	2.087 (53)	2.087 (53)	2.087 (53)					
I	Shaft Length	1.575 (40)	1.575 (40)	1.575 (40)	2.283 (58)	2.283 (58)	2.283 (58)	2.283 (58)	2.283 (58)
J	Shaft Diameter	0.630 (16)	0.630 (16)	0.630 (16)	0.748 (19)	0.748 (19)	0.866 (22)	0.866 (22)	0.866 (22)
	Shaft key Dimensions								
K	Keyway Length (Min)	1.181 (30)	1.181 (30)	1.181 (30)	0.984 (25)	0.984 (25)	0.984 (25)	0.984 (25)	0.984 (25)
L	Keyway Depth	0.118 (3)	0.118 (3)	0.118 (3)	0.118 (3)	0.118 (3)	0.138 (3.5)	0.138 (3.5)	0.138 (3.5)
M	Keyway Width	0.197 (5)	0.197 (5)	0.197 (5)	0.197 (5)	0.197 (5)	0.236 (6)	0.236 (6)	0.236 (6)

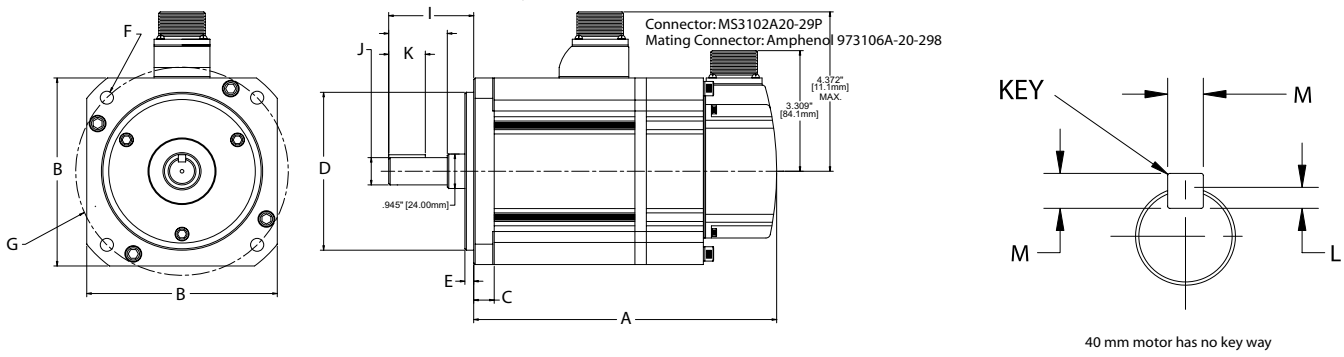
XV MOTOR DIMENSIONS

TONS
TBNS

Fly lead length 12" on 40mm, 60mm and 80mm



CONS
CBNS



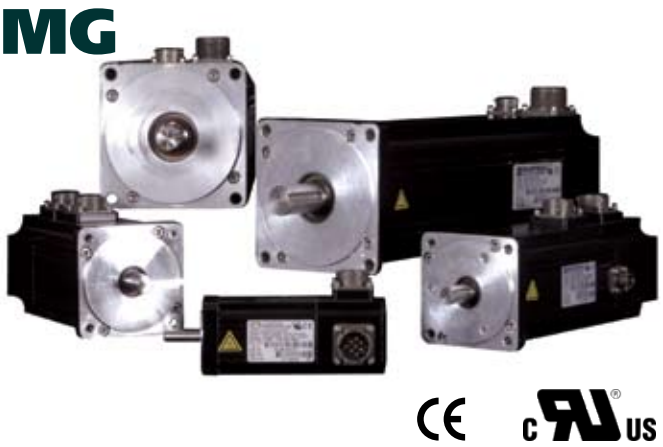
40 mm motor has no key way

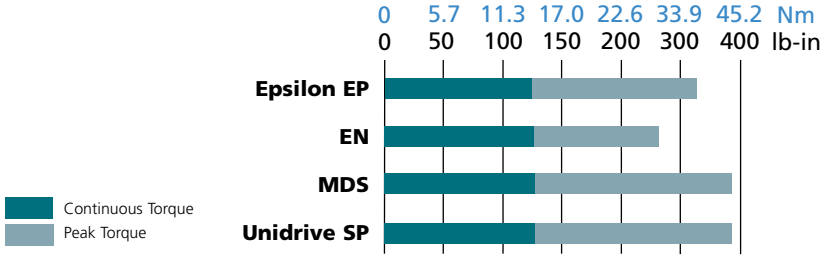
The dimensional information found on these pages is not to be used for design purposes. For complete engineering controlled drawings, please refer to the web site or Power CD.

Go to
Power CD
for complete data

MG MOTOR—230V

The MG Motor is low inertia motor that is ideally suited for dynamic applications with torque requirements between 5 lb-in (0.57 Nm) and 163 lb-in (18.4 Nm). MG motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors' motors. MG motors are available in English (NEMA 23, 34, or 56) and Metric (IEC-72-1) flanges with or without brakes. The standard encoder resolution is 2048 lines per rev. MG motors come standard with MS style connectors. All models are rated IP65.





MG Motor Specifications

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MG-205	5.3 / 0.6	1.3	4.3	18.5	26.40	5000	0.000099 / 0.112	28	4.1 / 0.47	3 / 1.3
MG-208	9.4 / 1.1	2.3	7.8	7.3	12.50	5000	0.000169 / 0.191	28	4.1 / 0.47	4 / 1.8
MG-316	19.3 / 2.2	3.5	12	3.9	9.40	4000	0.000560 / 0.630	38	5.5 / 0.62	8.3 / 3.8
MG-340	47.3 / 5.3	5.7	19.5	1.9	6.80	3000	0.001458 / 1.646	57	8.3 / 0.94	14.6 / 6.6
MG-455	63.4 / 7.2	7.2	26.4	1.1	7.40	3000	0.002658 / 3.000	60	8.8 / 0.99	20 / 9.1
MG-490	88.6 / 10.0	10.3	45	0.4	3.30	3000	0.005175 / 5.823	59	8.6 / 0.97	28.6 / 13.0
MG-4120	123.9 / 14.0	11.8	49.2	0.4	3.20	3000	0.007458 / 8.4	72	10.5 / 1.19	37 / 16.8

Note: Encoder resolution 2048 ppr

MG Holding Brake Specifications

Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released ms	Mechanical Engagement Time-Brake Holding ms	Added Inertia lb-in-sec²	Added Inertia kg-cm²
2"	24	0.21	10	1.13	40	25	0.000025	0.028
3"	24	0.52	60	6.78	250	100	0.00015	0.17
4"	24	0.088	230	27.12	250	100	0.00041	0.46

MG MOTOR DIMENSIONS

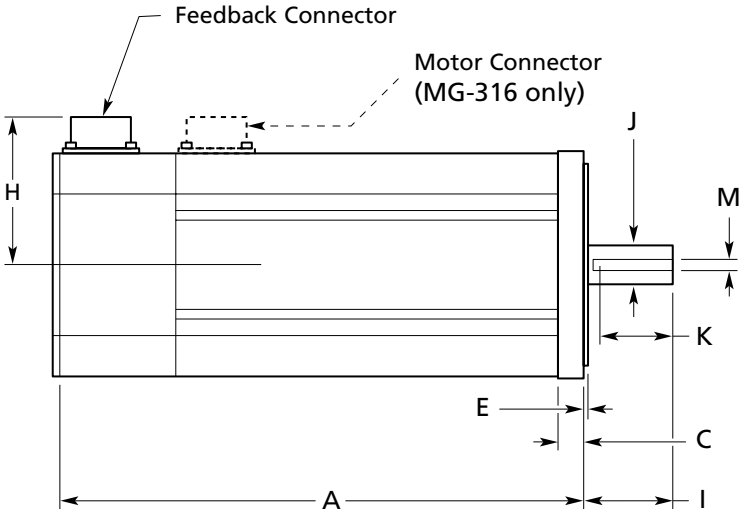
English Dimensions inches (mm)	2"		3"		4"		
	MGE-205	MGE-208	MGE-316	MGE-340	MGE-455	MGE-490	MGE-4120
A Length Overall - Unbraked (Max)	5.55 (141)	6.75 (171.4)	7.24 (183.9)	10.24 (260.1)	8.61 (218.7)	11.11 (282.1)	13.61 (345.7)
A Length Overall - Braked (Max)	-	-	8.74 (222)	-	10.61 (269.5)	13.11 (332.9)	15.61 (396.5)
B Flange Square	2.25 (57.2)	2.25 (57.2)	3.31 (84.1)	3.31 (84.1)	5 (127)	5 (127)	5 (127)
C Flange Thickness	0.46 (11.7)	0.46 (11.7)	0.44 (11.2)	0.44 (11.2)	0.53 (13.5)	0.53 (13.5)	0.53 (13.5)
D Pilot Diameter	1.502 (38.15)	1.502 (38.15)	2.877 (73.08)	2.877 (73.08)	4.5 (114.3)	4.5 (114.3)	4.5 (114.3)
E Pilot Thickness	0.06 (1.6)	0.06 (1.6)	0.06 (1.6)	0.06 (1.6)	0.1 (2.5)	0.1 (2.5)	0.1 (2.5)
F Bolt Hole Diameter	0.205 (5.21)	0.205 (5.21)	0.233 (5.66)	0.233 (5.66)	0.375-16 unc	0.375-16 unc	0.375-16 unc
G Bolt Circle Diameter	2.625 (66.68)	2.625 (66.68)	3.875 (98.43)	3.875 (98.43)	5.875 (149.23)	5.875 (149.23)	5.875 (149.23)
H Signal Connector Height - Unbraked (Max)	2 (51)	2 (51)	2.5 (64)	2.5 (64)	3.2 (81.3)	3.2 (81.3)	3.7 (95)
H Signal Connector Height - Braked (Max)	-	-	2.5 (64)	2.7 (68)	3.3 (83)	3.3 (83)	3.3 (83)
I Shaft Length	1.2 (30.5)	1.2 (30.5)	1.2 (30.5)	1.2 (30.5)	1.9 (48.2)	1.9 (48.2)	1.9 (48.2)
J Shaft Diameter	0.375 (9.53)	0.375 (9.53)	0.4997 (12.7)	0.4997 (12.69)	0.6245 (15.862)	0.875 (22.23)	0.875 (22.225)
Shaft key Dimensions							
K Keyway Length (Min)	0.563 (14.3)	0.563 (14.3)	0.9 (22.9)	0.9 (22.9)	1.5 (38.1)	1.5 (38.1)	1.5 (38.1)
L Keyway Depth	0.3 (7.6)	0.3 (7.6)	0.42 (10.7)	0.42 (10.7)	0.51 (13)	0.77 (19.6)	0.77 (19.6)
M Keyway Width	0.127 (3.23)	0.127 (3.23)	0.1265 (3.2)	0.1265 (3.21)	0.189 (4.801)	0.189 (4.801)	0.189 (4.801)

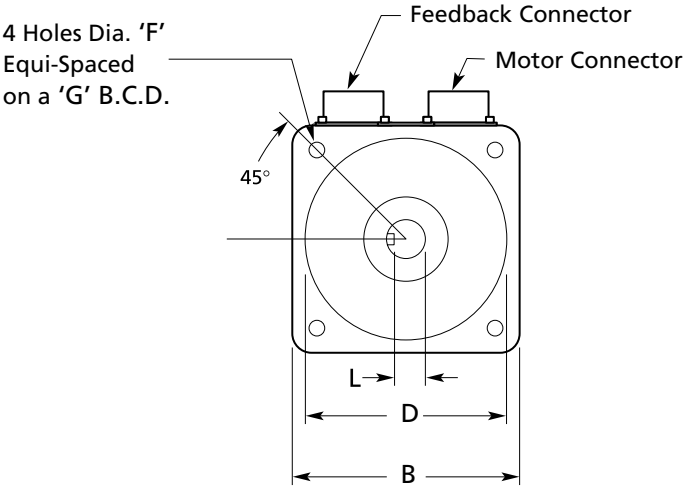
Metric Dimensions inches (mm)	2"		3"		4"		
	MGM-205	MGM-208	MGM-316	MGM-340	MGM-455	MGM-490	MGM-4120
A Length Overall - Unbraked (Max)	5.49 (139.5)	6.69 (170)	7.24 (183.9)	10.24 (260.1)	8.59 (218.2)	11.09 (281.7)	13.59 (345.2)
A Length Overall - Braked (Max)	-	-	8.74 (222)	11.74 (298.2)	10.59 (269)	13.09 (332.5)	15.59 (396.0)
B Flange Square	66 (2.598)	66 (2.598)	3.5 (89)	3.5 (89)	4.76 (121)	4.76 (121)	4.76 (121)
C Flange Thickness	0.4 (10.2)	0.4 (10.2)	0.44 (11.2)	0.44 (11.2)	0.51 (13)	0.51 (13)	0.51 (13)
D Pilot Diameter	1.9685 (50)	1.969 (50)	3.15 (80.01)	3.15 (80.01)	4.331 (110.1)	4.331 (110.1)	4.331 (110.1)
E Pilot Thickness	0.12 (3)	0.12 (3)	0.12 (3)	0.12 (3)	0.12 (3)	0.12 (3)	0.12 (3)
F Bolt Hole Diameter	0.197 (5)	0.197 (5)	0.276 (7.01)	0.276 (7.01)	0.375-16 unc	0.375-16 unc	0.375-16 unc
G Bolt Circle Diameter	3.15 (80)	3.15 (80)	3.937 (100)	3.937 (100)	5.709 (145)	5.709 (145)	5.709 (145)
H Signal Connector Height - Unbraked (Max)	2 (51)	2 (51)	2.5 (64)	2.5 (64)	3.2 (81.3)	3.2 (81.3)	3.2 (81.3)
H Signal Connector Height - Braked (Max)	-	-	2.5 (64)	2.7 (68)	3.3 (83)	3.3 (83)	3.3 (83)
I Shaft Length	1.2 (30.5)	1.2 (30.5)	1.2 (30.5)	1.2 (30.5)	1.99 (50.5)	1.99 (50.5)	1.99 (50.5)
J Shaft Diameter	0.315 (8)	0.315 (8)	0.5512 (14)	0.5512 (14)	0.748 (19)	0.9449 (24)	0.9449 (24)
Shaft key Dimensions							
K Keyway Length (Min)	0.551 (14)	0.551 (14)	0.79 (20)	0.79 (20)	1.58 (40)	1.46 (37)	1.46 (37)
L Keyway Depth	0.26 (6.7)	0.26 (6.7)	0.43 (10.9)	0.43 (10.9)	0.61 (15.49)	0.784 (19.9)	0.784 (19.9)
M Keyway Width	0.0787 (2)	0.0787 (2)	0.2 (5.08)	0.2 (5.08)	0.236 (6)	0.3149 (7.998)	0.3149 (7.998)

MG MOTOR DIMENSIONS

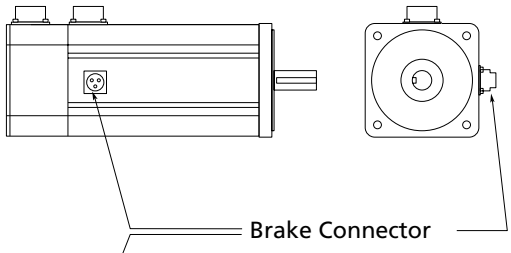
Go to Power CD for complete data

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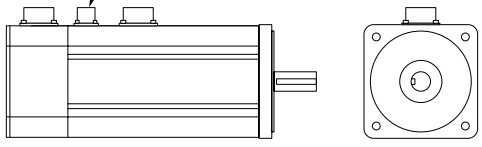




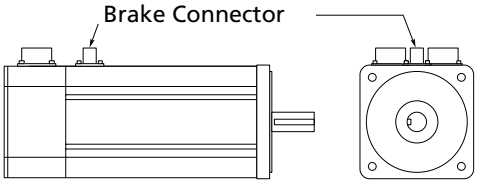
MG-316



MG-340



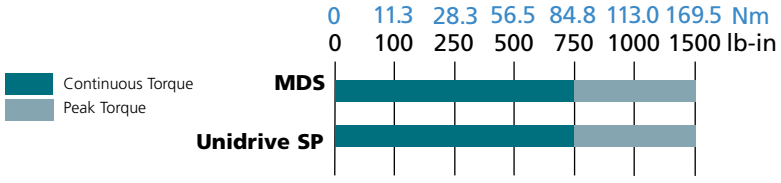
MG-455—MG-4120



MH MOTOR—460V

The MH Motor is a low inertia motor that is ideally suited to the MDS operating with 460 VAC Input. Applications with torque requirements between 16 lb-in (1.8 Nm) and 748 lb-in (84.5 Nm) can be solved. MH motors use Neodymium magnets to achieve a high torque to inertia ratio giving them a size advantage when compared to competitors' motors. MH motors are available in English and Metric flanges, with or without brakes. The standard encoder resolution is 2048 lines per rev. All models are rated IP65.





MH Motor Specifications

Motor Model	Rated Torque lb-in / Nm	Cont. Stall Current Arms	Peak Current Arms	Motor Resistance Ohms	Motor Inductance mH	Max Operating Speed RPM	Inertia lb-in-sec² / kg-cm²	Motor Ke Vrms/krpm	Motor Kt lb-in/Arms / Nm/Arms	Motor Weight lb / kg
MH-316	21.5 2.4	1.97	5.88	15.3	39.7	4000	0.00067 0.759253	75	10.98 1.24	8.3 3.8
MH-340	46 5.2	3	9	7.8	28	3000	0.00143 1.61	116	16.98 1.92	12.4 5.6
MH-455	72.5 8.2	4.34	13.02	4.2	30	3000	0.0036 4.02	120	17.57 1.98	18.0 8.2
MH-490	105 11.8	6.84	20.52	1.8	12.1	3000	0.006727 7.6	110	16.1 1.82	26.2 11.9
MH-6120	120 13.6	7	21	1.9	13	3000	0.01066 12.03	115	16.84 1.9	32.4 14.7
MH-6200	234 26.4	14.43	43.29	0.68	5.6	3000	0.0188 21.3	115	16.84 1.9	48 21.8
MH-6300	299 33.8	18.5	55.5	0.45	4.3	3000	0.0271 30.7	115	16.84 1.9	65 29.5
MH-8250	285 32.2	19	45.9	0.86	10.3	3000	0.54 61.4	128	18.7 2.11	77 35
MH-8500	530 59.9	34	58	0.3	5.2	3000	0.078 87.8	122	17.8 2.01	110 49.9
MH-8750	748 84.5	34	68	0.3	4.7	2500	0.133 150.2	162	23.7 2.68	171 77.6

Note: Encoder resolution 2048 ppr

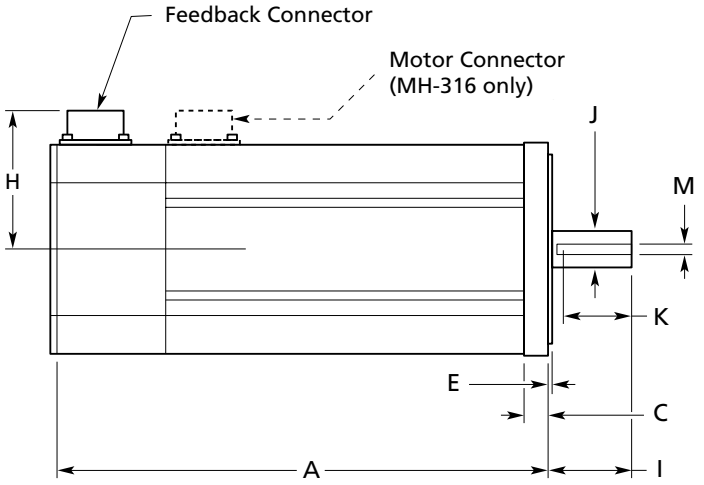
MH Holding Brake Specifications

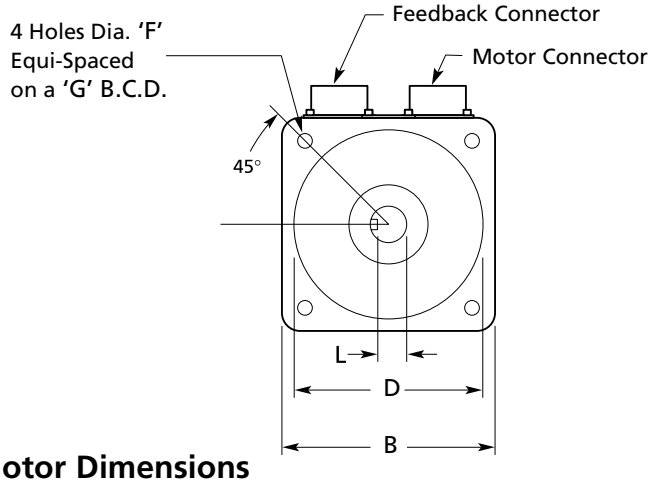
Motor Frame Size	Volt DC	Current (A)	Static Torque lb-in	Static Torque Nm	Mechanical Disengagement Time-Brake Released ms	Mechanical Engagement Time-Brake Holding ms	Added Inertia lb-in-sec²	Added Inertia kg-cm²
3"	24	0.52	60	6.78	250	100	0.00015	0.16935
4"	24	0.088	230	27.12	250	100	0.0004112	0.464245
6"	24	1.13	360	40.68	100	50	0.00015	2.56283
8"	Consult Factory							

MH MOTOR DIMENSIONS

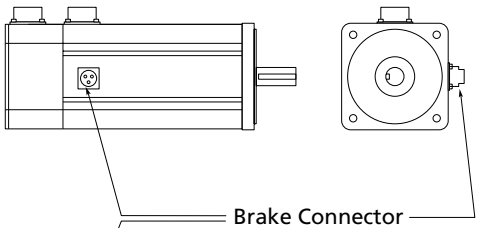
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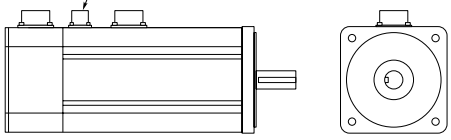




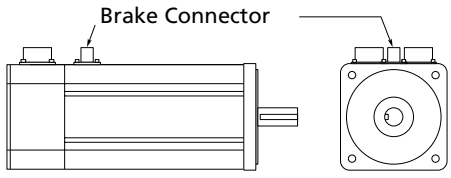
MH-316



MH-340



MH-455—MG-8750

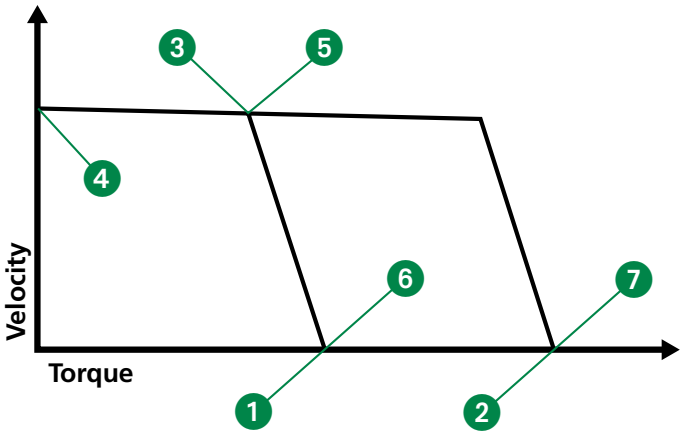


MH Motor Dimensions

(Note: English and Metric 3" and 4" MH motors share the same dimensions as MG motors.)

Metric Dimensions inches (mm)		6"			8"		
		MHM-6120	MHM-6200	MHM-6300	MHM-8250	MHM-8500	MHM-8750
A	Length Overall - Unbraked (Max)	11.29 (286.7)	13.99 (355.3)	16.99 (423.9)	12.65 (321.3)	15.65 (397.5)	21.65 (549.8)
A	Length Overall - Braked (Max)	13.99 (355.3)	16.69 (423.88)	19.69 (492.48)	-	-	-
B	Flange Square	5.59 (142)	5.59 (142)	5.59 (142)	7.48 (190)	7.48 (190)	7.48 (190)
C	Flange Thickness	0.71 (18)	0.71 (18)	0.71 (18)	1 (25.4)	1 (25.4)	1 (25.4)
D	Pilot Diameter	5.118 (130)	5.118 (130)	5.118 (130)	7.09 (180)	7.09 (180)	7.09 (180)
E	Pilot Thickness	0.14 (3.6)	0.14 (3.6)	0.14 (3.6)	0.16 (4)	0.16 (4)	0.16 (4)
F	Bolt Hole Diameter	4.33 (11)	4.33 (11)	4.33 (11)	0.551 (14)	0.551 (14)	0.551 (14)
G	Bolt Circle Diameter	6.496 (165)	6.496 (165)	6.496 (165)	8.46 (215)	8.464 (215)	8.464 (215)
H	Signal Connector Height - No Brake (Max)	3.7 (95)	3.7 (95)	3.7 (95)	4.84 (123)	4.84 (123)	4.84 (123)
H	Signal Connector Height - Brake (Max)	3.7 (95)	3.7 (95)	3.7 (95)	-	-	-
I	Shaft Length	1.99 (50.5)	1.99 (50.5)	1.99 (50.5)	2.3 (58.5)	2.3 (58.5)	3.23 (82)
J	Shaft Diameter	0.9449 (24)	0.9449 (24)	1.2598 (32)	1.26 (32)	1.259 (32)	1.89 (48)
Shaft key Dimensions							
K	Keyway Length (Min)	1.46 (37)	1.46 (37)	1.46 (37)	1.54 (39)	1.54 (39)	2.54 (64.5)
L	Keyway Depth	0.78 (19.9)	0.78 (19.9)	1.06 (26.9)	1.06 (26.9)	1.06(26.9)	1.67 (42.39)
M	Keyway Width	0.3149 (7.998)	0.3149 (7.998)	0.3937 (10)	0.3937 (10)	0.394 (10)	0.55 (14)

PERFORMANCE DATA



1 Continuous Stall Torque

This is the maximum Continuous Torque, typically at or near zero speed. The Continuous Torque is based on a pre-defined case temperature.

2 Peak Torque

This is the maximum torque that can be achieved from the motor when peak current is applied.

3 Rated Torque

The is the Continuous Torque at the Maximum Rated Speed of the motor. Rated Torque will be equal or lower than Continuous Stall Torque

4 Rated Speed

This is the maximum permissible speed of the motor at the rated voltage (Either 230 VAC or 460 VAC)

5 Rated Power

The product of the Rated Speed and Rated Torque. The Rated Power is the maximum continuous power output of a particular motor/drive combination.

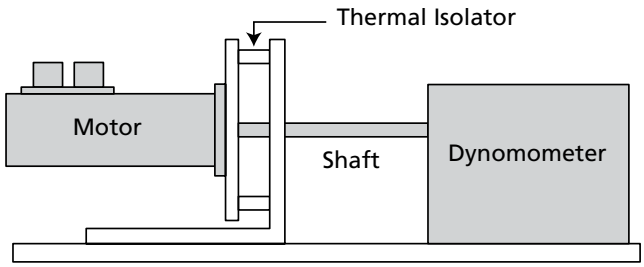
6 Stall Current

The Stall Current is the maximum continuous current of the of the motor at zero speed and thermal limit.

7 Peak Current

The Peak Current is the maximum current that can be applied to the motor without demagnetization of the magnets.

Drive Model	Switching Frequency	AC Input
Epsilon	10 kHz	230 VAC
EN	10 kHz	230 VAC
MDS	5 kHz	230/460 VAC
Ambient	25ºC	
Motor Case	100ºC 120ºC (For MH 8" only) 75ºC (XV motors)	



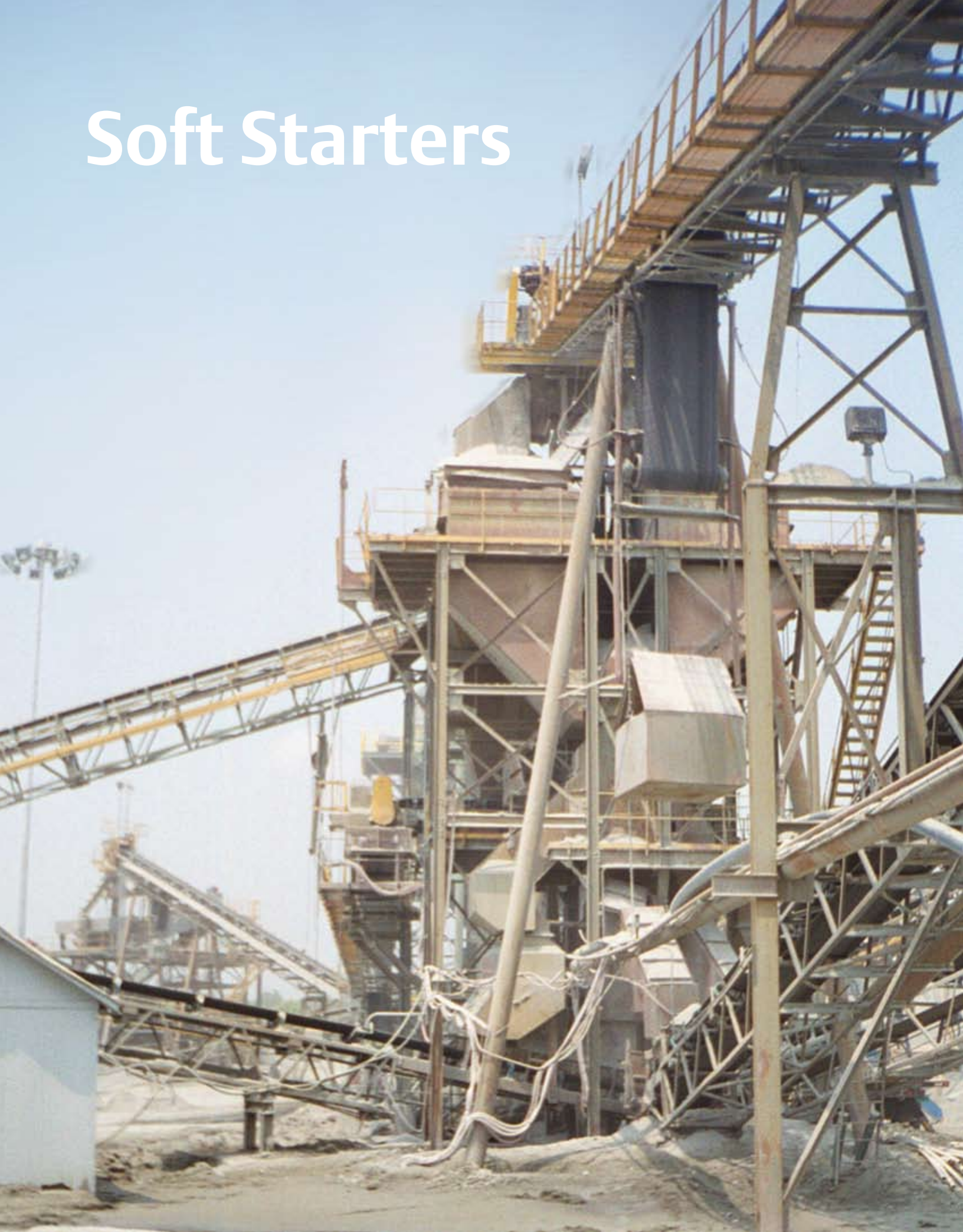
Motor Model	Frame Size	Mounting Plate Dimensions
FM	75 mm	250 mm x 250 mm x 15 mm
	95 mm	250 mm x 250 mm x 15 mm
	115 mm	350 mm x 350 mm x 20 mm
	142 mm	350 mm x 350 mm x 20 mm
	190 mm	500 mm x 500 mm x 20 mm
NT	2"	6" x 6" x 1/4"
	3"	10" x 10"3/8"
XV	40 mm	150 mm x 150 mm x 6 mm
	60 mm	150 mm x 150 mm x 6 mm
	80 mm	250 mm x 250 mm x 10 mm
	130 mm	250 mm x 250 mm x 10 mm
MG	2"	6" x 6" x 1/4"
	3"	10" x 10" x 1/4"
	4"	12" x 12" x 1/2"
MH	3"	10" x 10" x 1/4"
	4" (455,490)	10" x 10" x 1/4"
	4" (4120)	12' x 16" x 1/2"
	6"	12" x 16" x 1/2"
	8"	16" x 20" x 3/4"

OTHER SERVO MOTORS

All the servo drives can use custom motors, so long as the motor has a motor map file. To use an alternative motor, copy the motor map file (*.ddf) into PowerTools Pro it will assist in the configuration of the drive to be optimized to that motor.

The CTSize program enables users to find other drive/motor combinations for solving applications. This easy-to-use software program can be downloaded from the web site at no charge.

Soft Starters

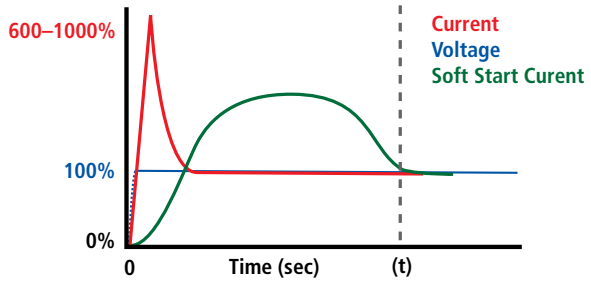


Soft Starters

Saftronics Soft Starters have been providing precise controlled AC motor starting and stopping for decades. We pioneered this motor control technology to limit the current to a motor on both acceleration and deceleration to provide a longer life to both motor and machinery.

Control Techniques offers a complete range of low-voltage AC motor soft starters suitable for both normal and heavy duty applications., plus packaged models such as our "Crusher-Duty" soft starters. Our soft starters feature a universal voltage input which can accommodate 200 – 600 VAC 3Ø input supply. Modbus, Profibus, DeviceNet, RS485, LonWorks and FIPIO options are available.

Solid State Reduced Voltage Starting
vs. Across-the-line Contactor Starting

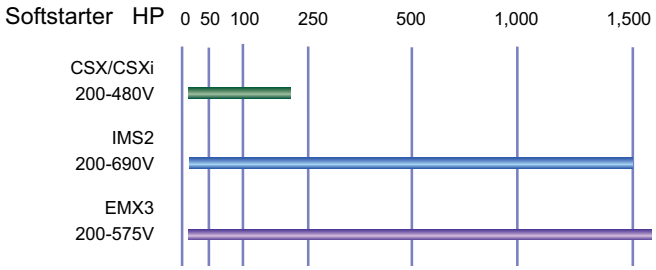


Soft starting extends the current waveform over the start time, which allows the user to limit the current level to what is required to start the load.

Soft Starter Advantages

- "Jerk Free" Machinery Control
- Reduced Maintenance on Machinery, e.g., Bearings, Belts, Gears
- Cost Effective, Quick Payback with Reduced Downtime, Parts and Repairs
- Simple Startup and Installation
- Compact Size, Enables Packaging for Harsh Environments
- Proven Method to Extend Motor Life
- Eliminates Electromechanical Starters and the Maintenance Required for these Devices
- Built-in Bypass for Critical Applications
- Serial and Fieldbus Communications
- Wide Range of Voltage and Current
- Three Product Families-Basic to Advanced

Soft Starters AT-A-GLANCE





The smallest and easiest to use **CSX/ CSXi series** sets up with simple pot adjustments. It has a very small foot print that includes a built-in bypass contactor, resulting in significant space savings.

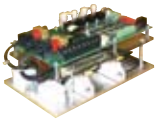


The **IMS2 series** offers a total motor starting solution for higher horsepower range. This digital soft starter combines a high level of functionality with flexibility and ease of use.



The **EMX3 series** utilizes the latest digital technology and feature set in soft starters, including new adaptive acceleration technology for the ultimate in control.

NEW



The **DY5** is an electronic AC motor brake that can be applied to most starters. Installation is simple and fast. Use the DY5 to stop AC motors safely and quickly.

Soft Starter Features	CSX	CSXi	IMS2	EMX3
Compact Unit w/ Built-in Bypass	x	x		x*
X-Line Contactor Replacement for MCC Application	x	x		
Time Voltage Ramp (TVR)	x			
Serial Communication Options	x	x	x	x
Protected Chassis up to 150 hp	x	x	x	x
Current Limit & Current Ramp Starting Modes		x	x	x
Integrated Motor Protection		x	x	x
Simple Digital Operation			x	x
Wide Variety of Start/Stop Modes			x	x
Configurable Bus Bars for Easy Integration			x	x
Protected Chassis up to 1500 hp			x	x
Fwd/Rev Jog & DC Injection Braking				x
DeviceNet Communication Option	x	x	x	x

*THE EMX3 COMES WITH INTEGRAL BYPASS AS STANDARD UP TO 220 AMP AND OPTIONAL ABOVE UP TO 1600 AMP.

CSX

Compact Digital Solid State Soft Start Controller

Our CSX series has one of the smallest foot prints available and includes a built-in bypass contactor, which allows smaller, non-ventilated enclosures, making it ideal for MCC applications.

The CSX is an open loop TVR (Timed Voltage Ramp) controller that reduces the electrical and mechanical strain on the motor and the load, providing soft starts and soft stops for squirrel-cage induction motors. The CSX is designed to be used with an external motor protection device and is ideal for the applications that have an existing full voltage starter or external motor overload. Fieldbus communication modules can be easily snapped on to the side of the CSX module for Modbus, Profibus and DeviceNet protocols.

- **Universal Input Voltage (208-480 VAC) ±10%**
- **Compact Design, Smallest Footprint**
- **Built-in Bypass Contactor**
- **DIN Rail Mounting Up To 60A**
- **2 Wire or 3 Wire Start Stop Control Circuit**
- **Modbus, Profibus and DeviceNet Options**
- **Remote Operator Option**
- **TVR - Terminal Voltage Ramp**
- **Equi-Vec™ Balanced Vector Control Technology**



CSXi

Compact Digital Soft Starter with Motor Protection

CSXi includes all the functionality of the CSX, with the addition of motor protection and current limit/current ramp starting modes.

The CSXi is a closed loop controller (constant current or current ramp) that reduces the electrical and mechanical strain on the motor and the load, providing soft starts and soft stops for squirrel-cage induction motors. CSXi is ideal for high inertia loads, or loads where the starting load torque requirements do not change. Modbus, Profibus and DeviceNet fieldbus communication modules can be easily snapped on to the side of the CSXi module.

- **Motor Current Protection**
- **Universal Input Voltage (200-480 VAC)**
- **Compact Design, Smallest Footprint**
- **Built-in Bypass Contactor**
- **DIN Rail Mounting Up To 60A**
- **2 Wire or 3 Wire Start Stop Control Circuit**
- **Modbus, Profibus and DeviceNet Options**
- **Remote Operator Option**
- **Constant Current Start**
- **Current Ramp Start**
- **Equi-Vec™ Balanced Vector Control Technology**



Modbus RTU DeviceNet PROFIBUS

CSX & CSXi
WEIGHTS & DIMENSIONS (Module Only)

Model	Weights (lbs)	Dimension H x W X D (inches)
CSX-007 to CSX-030 CSXi-007 to CSXi-030	6	8.0 x 3.9 x 6.5
CSX-037 to CSX-055 CSXi-037 to CSXi-055	10	8.5 x 5.7 x 7.6
CSX-075 to CSX-110 CSXi-075 to CSXi-110	16	9.5 x 8.0 x 8.5

CSX & CSXi OPTIONS

Description	Model Number	Order Code
Remote Keypad Kit (remote operator & Serial Interface Module	PIM-RO-01	870-1343
Modbus Interface Module	PIM-MB-01	870-1340
Profibus Interface Module	PIM-PB-01	870-1341
DeviceNet Interface Module	PIM-DN-01	870-1342
RS-485 Serial Interface Module.	PIM-RZ-01	870-1344
Pump Interface Module	PIM-PA-01	870-1383

Note: Serial Communication Modules to be ordered as a separate line item and shipped loose (not installed).

MODULE

CSX & CSXi (NORMAL DUTY RATINGS & ORDER GUIDE)

Normal Duty HP Voltage Code				CSX Module with internal bypass		CSXi Module with internal bypass	
1 208V	2 230V	4 460V	ND Amps	Model Number	Module Only Order Code	Model Number	Module Only Order Code
5	5	**10**	18	CSX-007	870-1300	CSXi-007	870-1320
10	10	**25**	34	CSX-015	870-1301	CSXi-015	870-1321
	15	**30**	42	CSX-018	870-1302	CSXi-018	870-1322
15			48	CSX-022	870-1303	CSXi-022	870-1323
20	20	**40**	60	CSX-030	870-1304	CSXi-030	870-1324
25	25	**50**	75	CSX-037	870-1305	CSXi-037	870-1325
	30	**60**	85	CSX-045	870-1306	CSXi-045	870-1326
30		**75**	100	CSX-055	870-1307	CSXi-055	870-1327
40	50	**100**	140	CSX-075	870-1308	CSXi-075	870-1328
60	60	**125**	170	CSX-090	870-1309	CSXi-090	870-1329
	75	**150**	200	CSX-110	870-1310	CSXi-110	870-1330

CSX & CSXi (HEAVY DUTY RATINGS & ORDER GUIDE)

Heavy Duty HP Voltage Code				CSX Module with internal bypass		CSXi Module with internal bypass	
1 208V	2 230V	4 460V	HD Amps	Model Number	Module Only Order Code	Model Number	Module Only Order Code
5	5	**10**	17	CSX-007	870-1300	CSXi-007	870-1320
7.5	10	**20**	30	CSX-015	870-1301	CSXi-015	870-1321
10		**25**	36	CSX-018	870-1302	CSXi-018	870-1322
		30	40	CSX-022	870-1303	CSXi-022	870-1323
15	15		49	CSX-030	870-1304	CSXi-030	870-1324
20	20	**50**	65	CSX-037	870-1305	CSXi-037	870-1325
	25		73	CSX-045	870-1306	CSXi-045	870-1326
30	30	**75**	96	CSX-055	870-1307	CSXi-055	870-1327
40	40		120	CSX-075	870-1308	CSXi-075	870-1328
	50	**100**	142	CSX-090	870-1309	CSXi-090	870-1329
50	60	**125**	165	CSX-110	870-1310	CSXi-110	870-1330

ND = Normal Duty (Fan/Pump Application)
CSX Series 007-030 Module = 400% / 6 Sec., 354 Sec., between starts.
CSX Series 037-110 Module = 400% / 6 Sec., 594 Sec., between starts.

HD = Heavy Duty (Conveyor Application)
CSX Series 007-030 Module = 400% / 20 Sec., 340 Sec., between starts.
CSX Series 037-110 Module = 400% / 20 Sec., 580 Sec., between starts.

CSX & CSXi MODULE SPECIFICATIONS:

Operating Conditions

Horsepower	5 thru 150 hp
Current range	17A – 200A (nominal)
Line Voltage	3 hp, 200 - 480VAC (+10%/-15%)
Supply Frequency (at start)	45 – 66Hz
Control Voltage	110 to 230 VAC (+10% / -15%)
Rated Insulation Voltage	600V
Enclosure	IP20, NEMA1, Enclosure (CSX-007 to CSX-055)
	IP00, Open Chassis (CSX-075 to CSX-110)
Ambient Temperature	-10 – 60°C (14°F - 140°F) (Operating)
Altitude	1000m (3,300 ft)
Relative Humidity	5% to 95% Non-condensing
Overload Capacity	See Ratings Table
Rated Short Circuit current	5KA (CSX-007 to CSX-037)
	10KA (CSX-045 to CSX-110)
Pollution Degree	Pollution Degree 3
Vibration	IEC 60068 Test Fc Sinusoidal, 4Hz to 13.2 Hz ±1mm displacement
	13.2 Hz to 200 Hz ± 0.7g
Form Designation	Bypassed Semiconductor Motor Starter Form 1

EMC Emission & Immunity

Equipment Class (EMC)	Class A
Conducted Radio Freq. emission	0.15 MHz – 0.5 MHz; < 90 dB (µV)
	0.5 MHz – 5 MHz; < 76 dB (µV)
	5 MHz – 30 MHz; < 80-60 dB (µV)
Radiated Radio Freq. emission	30 MHz – 230 MHz; < 30 dB (µV/m)
	230 MHz – 1000 MHz; < 37 dB (µV/m)
Electrostatic Discharge	4KV contact discharge, 8KV air discharge
Radio Frequency EM Field	0.15 MHz to 1000 MHz; 140 dB (µV)
Fast Transients 5/50 ns	2KV / 5 KHz (Main and control circuits)
Surges (1-2/50µs-8/20ms)	2 KV line to earth, 1 KV line to line (Main & control circuits)
Voltage dip/short time interrupt	5000 ms (at 0% nominal voltage)

Inputs

Control Inputs (Term 01 & 02)	300VAC max.

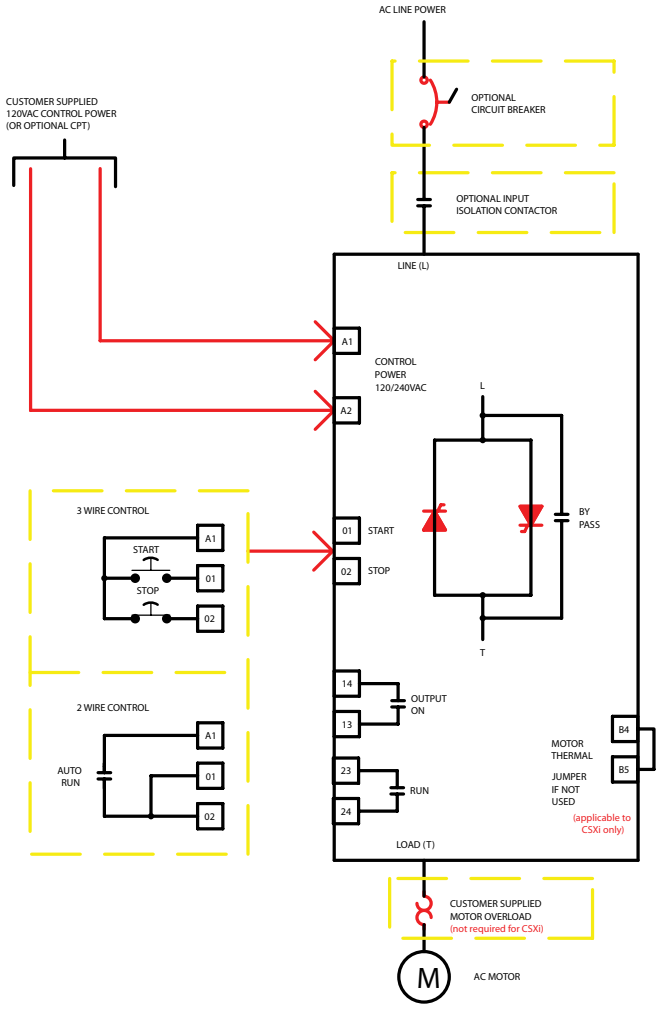
Outputs

Relay Outputs	6A @ 30VDC resistive / 2A, 400VAC, AC11
Analog Output (B10, B11)	4-20mA

Approvals & Listings

UL, cUL CE

CSX & CSXi WIRING DIAGRAM





CSXi set up



CSX set up

IMS2

Flexible Digital Solid State Soft Starter

The **IMS2 series** advanced starter offers a total motor starting solution, combining high level functionality with flexibility and ease of use. This universal source matched starter can accommodate 200-690VAC 3-phase input supply and is available up to 1500 hp at 575VAC. IMS2 starter input and output power termination bus bars are field configurable by the installer (Top-Top, Top, Bottom, etc.) to suit the wiring requirements at site.

- **Universal Input Voltage (208-690VAC, 45 to 66Hz)**
- **Built-In Motor protection**
- **4 wire start stop control**
- **Local/Remote Reset**
- **Numeric Keypad Display**
- **Flexible bus bar configuration**
- **Modbus and DeviceNet Options**
- **Remote Operator Option**
- **Bypass Contactor Option**
- **Constant Current/Ramp/Torque Start**



The IMS2 series starters are available in Panel Mount, NEMA 1, NEMA 3R, NEMA 4, NEMA 12 enclosures. Ratings & order codes are shown for NEMA 1 & NEMA 12 only. For other configurations consult factory. See the Packaged Soft Starter section for more details.



IMS2 WEIGHTS & DIMENSIONS (Module, Chassis & NEMA 12)

Model Number	Module Only		NEMA 1		NEMA 1 C/B or NEMA 12 Bypass		NEMA 12 C/B & BP Including Crusher Duty	
	Dimensions HxWxD (in)	Weight (lbs)	Dimensions HxWxD (in)	Weight (lbs)	Dimensions HxWxD (in)	Weight (lbs)	Dimensions HxWxD (in)	Weight (lbs)
IMS20018 to 0047	15 x 7.3 x 7	13.2	24 x 20 x 12	80	24 x 20 x 12	110	30 x 24 x 12	120
IMS20067 to 0125	15 x 7.3 x 10	27			30 x 24 x 12	160		
IMS20141 to 0238	16.75 x 10.7 x 11	40	30 x 24 x 12	180	36 x 30 x 16	200	36 x 30 x 16	180
IMS20253	16.75 x 15.4 x 11	50.6					48 x 36 x 16	550
IMS20302 to 0405	27.2 x 17 x 11.6	84	36 x 30 x 16	220	48 x 36 x 16	500		
IMS20513 to 0585	27.2 x 17 x 11.6	111	48 x 36 x 16	275				
IMS20628 to 0897	27.2 x 17 x 11.6	117			60 x 36 x 16	800	60 x 36 x 16	800
IMS201153 to 1574	33.3 x 22.6 x 14	267	Call Factory for Quote					

The IMS2 series starters are available in Panel Mount, NEMA 1, NEMA 3R, NEMA 4, and NEMA 12 enclosures. Ratings & order codes are shown for NEMA 1 & NEMA 12 only. Consult factory for other configurations.

IMS2 OPTIONS

Description	Model Number	Order Code
Remote Keypad Kit	RCM01	870-1380
DeviceNet Interface Module	DCM01	870-1382

Note: Modbus Communications in AP ASCII, Modbus RTU and Modbus ASCII protocols are standard.

MODULE

IMS2 (NORMAL DUTY RATINGS & ORDER GUIDE)

Normal Duty HP Voltage Code 1 208V	2 230V	4 460V	5 575V	ND Amps	Module without internal bypass Model Number	Order Code
5	5	**10**	15	18	IMS20018	870-1350
10	10	**25**	30	34	IMS20034	870-1351
		30	40	41	IMS20041	870-1352
15	15			47	IMS20047	870-1353
20	20	**50**	60	67	IMS20067	870-1354
30	30	**60**	75	88	IMS20088	870-1355
		75		96	IMS20096	870-1356
40	40	**100**	125	125	IMS20125	870-1357
	50			141	IMS20141	870-1358
60	75	**150**	200	202	IMS20202	870-1359
75				238	IMS20238	870-1360
	100	**200**	250	253	IMS20253	870-1361
100		**250**	300	302	IMS20302	870-1362
150	150	**300**	400	405	IMS20405	870-1363
	200	**400**	500	513	IMS20513	870-1364
200		**450**	600	585	IMS20585	870-1365
	250	**500**		628	IMS20628	870-1366
250	300	**600**	800	775	IMS20775	870-1367
300	350	**700**	900	897	IMS20897	870-1368
400	450	**900**	1100	1153	IMS21153	870-1369
500		**1100**	1400	1403	IMS21403	870-1370
	600	**1300**	1500	1574	IMS21574	870-1371

ND = Normal Duty (Fan/Pump Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
IMS2 0018 to 1574 = 300% / 10 sec., 360 Sec., between starts.

IMS2 (HEAVY DUTY RATINGS & ORDER GUIDE)

Heavy Duty HP Voltage Code 1 208V	2 230V	4 460V	5 575V	HD Amps	Module without internal bypass Model Number	Order Code
3	3	**7.5**	10	12	IMS20018	870-1350
5	7.5	**15**	20	24	IMS20034	870-1351
	10	**20**	25	28	IMS20041	870-1352
10			30	33	IMS20047	870-1353
	15	**30**	40	46	IMS20067	870-1354
15	20	**40**	50	59	IMS20088	870-1355
20			60	64	IMS20096	870-1356
25	30	**60**	75	84	IMS20125	870-1357
30				94	IMS20141	870-1358
40	50	**100**	125	135	IMS20202	870-1359
50	60	**125**	150	160	IMS20238	870-1360
				167	IMS20253	870-1361
60	75	**150**	200	205	IMS20302	870-1362
100	100	**200**	250	274	IMS20405	870-1363
	125	**250**	350	342	IMS20513	870-1364
125	150	**300**	400	392	IMS20585	870-1365
150		**350**	450	424	IMS20628	870-1366
	200	**450**		521	IMS20775	870-1367
200	250	**500**	600	604	IMS20897	870-1368
250	300	**600**	800	791	IMS21153	870-1369
350	400	**800**	1000	970	IMS21403	870-1370
400	450	**900**	1100	1091	IMS21574	870-1371

HD = Heavy Duty (Conveyor Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
IMS2 0018 to 1574 = 450% / 30 sec., 360 Sec., between starts.

IMS2 MODULE SPECIFICATIONS:

Operating Conditions

Horsepower	3 thru 1500 hp
Current range	12A-1574A (nominal)
Line Voltage	3 hp, 200 - 690 VAC
Supply Frequency (at start)	50 Hz (±2%) or 60 Hz (±2%)
Supply Frequency (during start)	> 45 Hz (50 Hz supply) or > 55 Hz (60 Hz supply)
Supply Frequency (during run)	> 48 Hz (50 Hz supply) or > 58 Hz (60 Hz supply)
Control Voltage	110 VAC (+10% / -15%) or 230 VAC (+10% / -15%)
Enclosure	IP00 (302-1574A), Open Chassis
	IP42 (18-253A), NEMA 2
Ambient Temperature	-5 – 60°C (23°F - 140°F) (Operating)
Altitude	1000 m (3,300 ft)
Relative Humidity	5% to 95% Non-condensing
Overload Capacity	See Ratings Table

Standard Features

Rated Short Circuit current	100 KA (with semiconductor fuses)
Rated Insulation Voltage	690V
Surges	2 KV line to earth, 1 KV line to line
Fast Transients	2KV / 5 KHz
Form Designation	Form 1
Electrostatic Discharge	4 KV contact discharge, 8 KV air discharge
Equipment Class (EMC)	Class A
Radio Frequency EM Field	0.15 MHz – 80 MHz; 140 dBµV; 80MHz - 1GHz: 10V/m
Pollution Degree	Pollution Degree 3

Inputs

Voltage	Active 24 VDC, 8 mA, approx.

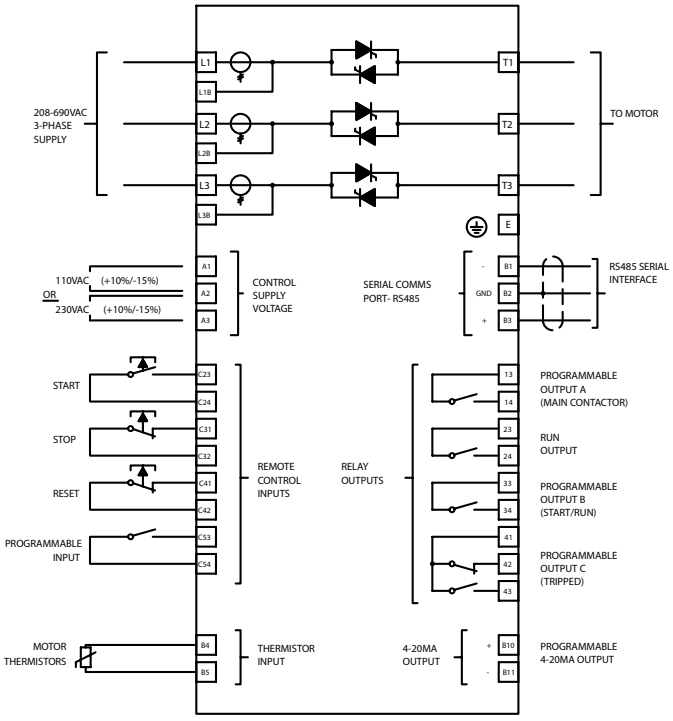
Outputs

Relay Outputs	5A @ 250 VAC / 360 VS, 5A @ 30 VDC resistive
Analog Output (B10, B11)	4-20 mA

Approvals & Listings

CE	IEC 60947-4-2
UL & CUL	UL 508A (size dependant)
C✓	IEC 60947-4-2

IMS2 WIRING DIAGRAM:



Please Consult the Factory
for special Soft Starter Solutions

EMX3

NEW

The Ultimate Soft Starter

The EMX3 utilizes the latest technology in soft starters, including new adaptive acceleration technology for the ultimate in control. The EMX3 is a complete motor starting and management system with an extensive range of features in a single user friendly package. Never before has motor control been so simple for jobs of all sizes and needs, such as pumps, band saws, conveyors and more.

THE EMX3 MEANS MORE CONTROL

The EMX3 soft starter features Constant Current and Current Ramp, and our adaptive acceleration technology, XLR-8, which makes the EMX3 the world's first soft starter to control acceleration.

Depending on application requirements, the user can select between early, constant or late acceleration/ deceleration. This level of control means smarter starts and smoother stops, which reduces downtime and eliminates issues such as water hammer.

EASY TO INSTALL, COMMISSION AND OPERATE

Options for control wiring from the top, bottom or left side provide greater access, plus unique wiring looms and cable retainers make for a faster, cleaner installation.

Quick setup gets machinery running quickly using menu screens that allow users to select from common applications and then fine tune suggested settings to specific needs. Also, informative screens advise operators on motor performance and real language trip messages to pinpoint exactly where any issues may be.

The EMX3 can simulate functions, which enables testing of the soft starter's operation, external control circuits and associated equipment without connecting to line voltage or a motor. Simulation modes include: Run, Protection, and Signalling simulations.



SMARTER STARTING

The EMX3 puts you in control of motor starting. Depending on your application requirements you can select the best soft start control method—voltage ramp, current ramp, acceleration ramp.

For applications requiring precise control of motor start current, the EMX3 offers a choice of Constant Current or Current Ramp start modes. For superior control over acceleration or deceleration choose XLR-8 Adaptive Acceleration Control.

SMOOTHER STOPPING

EMX3 also provides precise control over soft stopping and is ideal for applications requiring a smoother soft stop. EMX3 is ideal for low inertia loads such as pumps in pumping applications and conveyors, and can substantially reduce or eliminate the effects of water hammer.

BRAKING

For high inertia loads, the EMX3 incorporates the latest braking algorithm, letting you take precise control over the motor's stopping time. Shorter stopping times improve your production efficiency by reducing downtime between operating cycles.

- 23 Models from 23A to 1600A
- 200-525VAC and 380-690VAC
- In-line Motor Connections
- Control Voltage 110V-460V
- Adaptive Acceleration Control
- Easy to install
- User friendly controls
- Complete feature set
- Ultimate motor protection
- "Power Through" emergency operation

EMX3 OPTIONS

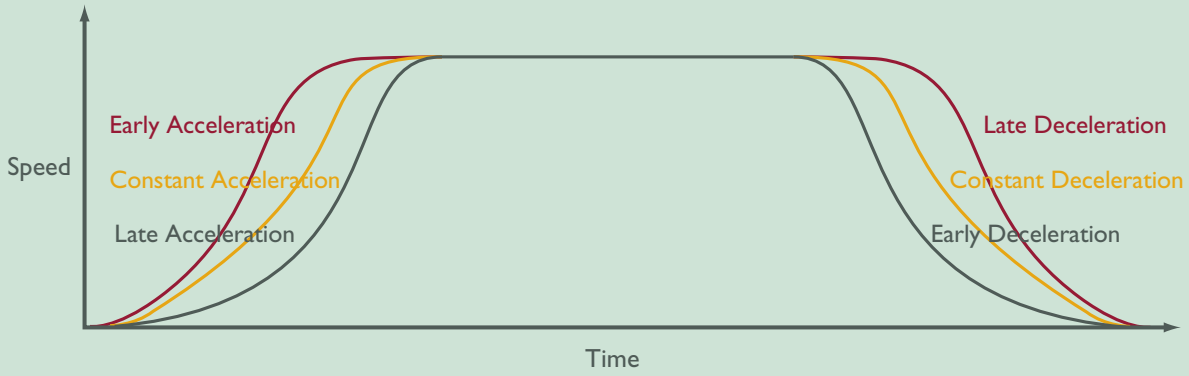
Description	Model Number	Order Code
Remote Keypad Kit (remote operator & Serial Interface Module	PIM-RO-01	870-1346
Modbus Interface Module	PIM-MB-01	870-1340
Profibus Interface Module	PIM-PB-01	870-1341
DeviceNet Interface Module	PIM-DN-01	870-1342

Note: Series Communications Modules to be ordered as a separate line item and shipped loose (not installed).

c UL us LISTED CE N1652

XLR-8 Adaptive Control

Using XLR-8 Adaptive Acceleration Control, the EMX3 learns your motor's performance during start and stop, then adjusts control to optimize performance. Simply select the profile that best matches your load type and the soft starter automatically ensures the smoothest possible acceleration for your load.



EMX3 offers a complete feature set for the ultimate in protection and functionality

Protection Features

- Fully customizable protection
- Motor thermal model
- Motor thermistor input
- Phase sequence
- Undercurrent
- Instantaneous overcurrent
- Auxiliary trip input
- Heatsink overtemperature
- Excess start time
- Supply frequency
- Shorted SCR
- Power circuit
- Motor connection
- RS485 failure
- Motor overload
- Current imbalance
- Ground fault (optional)

Keypad Features

- Remote mounting option
- Status LEDs
- Easy to read screen
- Real language feedback
- Multi-language options
- Shortcut buttons
- Parameter copy other starters

Starting Functions

- XLR-8 adaptive acceleration
- Constant current start mode
- Current ramp start mode
- Kickstart

Stopping Functions

- XLR-8 adaptive deceleration
- TVR soft stop
- Brake mode
- Coast to stop

Additional Features

- Starter communication time out
- Network communication trip
- Auto detection of in line power connection
- Programmable auto start/stop
- 24 VDC auxiliary power supply
- PT100 (RTD) input
- Real time clock with battery backup
- Power through - enables the choice of continuous operation despite a power assembly failure. This allows production to continue while long-term remedial action can be taken.
- Forward and reverse jog function
- I/O expansion card (optional)

Ergonomic and Intelligent Keypad Control



REAL LANGUAGE IN REAL TIME

The EMX3 makes the operator's job easy, providing real-language feedback messages, so they don't have to look up codes to know what's happening. With real-time metering displays and a 99-place event log recording time-stamped details of operation and performance, it has never been easier to monitor a motor.



GRAPHICAL DISPLAY

The graphic display provides real-time performance data, including graphs, to keep operators informed of motor temperature, current, motor power, last start information, date and time, SCR conduction, and trip messages. The display also serves as a programming screen, and the keypad itself can be used to copy parameters to other starters.



REMOTE DISPLAY MOUNTING

The keypad is easily mounted on the exterior of enclosures, using an optional keypad mounting kit. Mounting multiple soft starters in a single enclosure allows centralized control from a single location, with all the relevant information. Mount a number of displays next to each other for quick diagnosis of problems. (IP65 when mounted).

METERING AND MONITORING

As shown below, the EMX3 delivers an extensive range of information to replace an additional power meter (Amps, kW, kVA, pf).

PROGRAM MULTIPLE UNITS

When programming multiple units, simply plug the keypad into different starters for immediate download of your data. No fuss, no trouble – a smoother start in every sense.



MOTOR TEMPERATURE



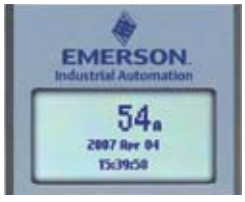
CURRENT



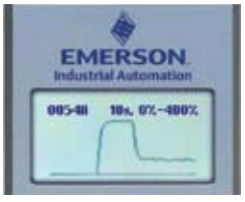
MOTOR POWER



LAST START INFORMATION



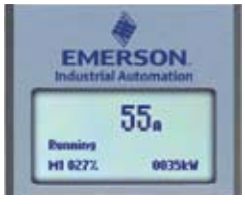
DATE AND TIME



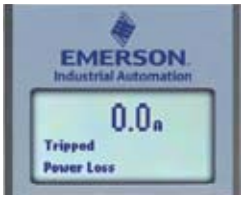
PERFORMANCE GRAPH



SCR CONDUCTION



USER-PROGRAMMABLE SCREEN



TRIP MESSAGES



EMX3 Options



COMMUNICATION MODULES

The EMX3 supports network communication using Profibus-DP, DeviceNet and Modbus RTU protocols, via an easy-to-install communication interface.

INPUT/OUTPUT CARD



These hardware expansion cards suit users who require additional inputs and outputs or advanced functions. Each EMX3 can support one expansion card.

The input/output expansion card adds:

- 2 x inputs
- 1 x analog input
- 3 x relay outputs
- 1 x analog output

VOLTAGE MEASUREMENT CARD



The voltage measurement card allows real-time monitoring of mains voltage, eliminating the need for external devices. The voltage measurement card enhances undervoltage and overvoltage protection.



RTD AND GROUND FAULT

The RTD and ground fault protection card provides the following additional inputs:

- 6 x PT100 RTD inputs
- 1 x ground fault input

To use ground fault protection at 1000:1 a 5 VA current transformer is also required.



FINGER GUARDS

This option ensures personnel safety by preventing accidental contact with live terminals The finger guard kit fits the EMX3-0145B to EMX3-0220B and provides IP20 protection when used with 22 mm plus size cables.

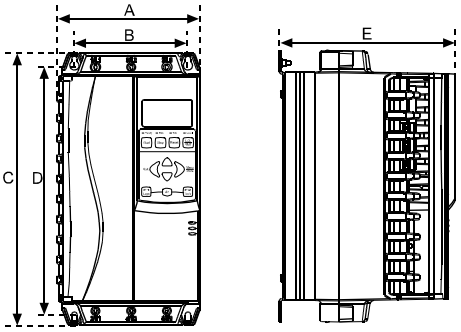
ADJUSTABLE BUS BAR CONFIGURATION



The bus bars on models EMX3-0360C ~ EMX3-1600C can be adjusted for top or bottom input and output as required. This flexibility allows you optimization of your switchboard layout.

DIMENSIONS AND WEIGHTS

Model	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)	Weight lbs. (kg)
EMX3-0023B	6.16 (156.4)	4.88 (124.0)	11.60 (294.6)	10.94 (278.0)	7.57 (192.2)	7.05 (3.2)
EMX3-0043B						
EMX3-0050B						
EMX3-0053B						
EMX3-0076B					8.77 (222.7)	7.22 (3.5)
EMX3-0097B						10.58 (4.8)
EMX3-0100B						
EMX3-0105B						
EMX3-0145B	11.10 (282)	9.84 (250)	17.24 (438)	14.96 (380)	9.84 (250)	35.27 (16)
EMX3-0170B						
EMX3-0200B						
EMX3-0220B						
EMX3-0255C	15.35 (390)	12.60 (320)	16.42 (417)	15.75 (400)	11.06 (281)	55.12 (25)
EMX3-0360C	16.93 (430)	12.60 (320)	21.46 (545)	20.55 (522)	11.77 (299)	111.33 (50.5)
EMX3-0380C						
EMX3-0430C						
EMX3-0620C						
EMX3-0930C						
EMX3-1200C	22.60 (574)	19.69 (500)	29.53 (750)	28.62 (727)	14.21 (361)	299.83 (136)
EMX3-1410C						
EMX3-1600C						



COMPACT DESIGN

The design of the EMX3 allows for multiple units to be mounted side by side, or in a bank of starters due to the flexibility in cabling options. Internally bypassed starters further reduce the overall size of your soft starter.

For EMX3-0145B ~ EMX3-1600C, dimensions A & C are the unit footprint. Bus bars are not included as this dimension will vary with bus bar configuration.

SPECIFICATIONS

General

Current Range ..... 23 A ~ 1600 A (nominal)
Motor connection ..... In-line
Bypass ..... Integrated internal or external

Supply

Mains Voltage (L1, L2, L3)
EMX3-xxxx-V4 ..... 200 VAC ~ 440 VAC (± 10%)
EMX3-xxxx-V7 ..... 380 VAC ~ 690 VAC (± 10%) (in-line conn.)
EMX3-xxxx-V7..... 380 VAC ~ 600 VAC (± 10%)
Control Voltage (A1, A2, A3) ..... 110 ~ 220 VAC (+ 10% / -15%)
..... or 230 ~ 440 VAC (+ 10% / -15%)
Mains Frequency .....45 Hz to 66 Hz

Inputs

Inputs..... Active 24 VDC, 8 mA approx.
Start (C23, C24) ..... Normally open
Stop (C31, C32) ..... Normally closed
Reset (C41, C42) ..... Normally open or closed
Programmable Inputs
Input A (C53, C54) ..... Normally open or closed
Input B (C63, C64) ..... Normally open or closed
Motor Thermistor (B4, B5)
PT100 RTD (B6, B7, B8)

Outputs

Relay outputs..... 10 A at 250 VAC resistive
..... 5 A at 250 VAC, AC15 pf 0.3
Run Relay (23, 24) ..... Normally Open
Programmable Outputs
Relay A (13, 14) ..... Normally Open
Relay B (31, 32, 34) ..... Changeover
Relay C (41, 42, 44) ..... Changeover
Analog Output (B10, B11) ..... 0-20 mA or 4-20 mA
24 VDC Output (P24, COM) ..... 200 mA

Environmental Protection

EMX3-0023B ~ EMX3-0105B..... IP20 & NEMA1
EMX3-0145B ~ EMX3-1600C IP00
Operating temperature ..... -10 °C ~ 60 °C
Storage temperature ..... - 10 °C ~ 60 °C
Humidity..... 5% to 95% Relative Humidity

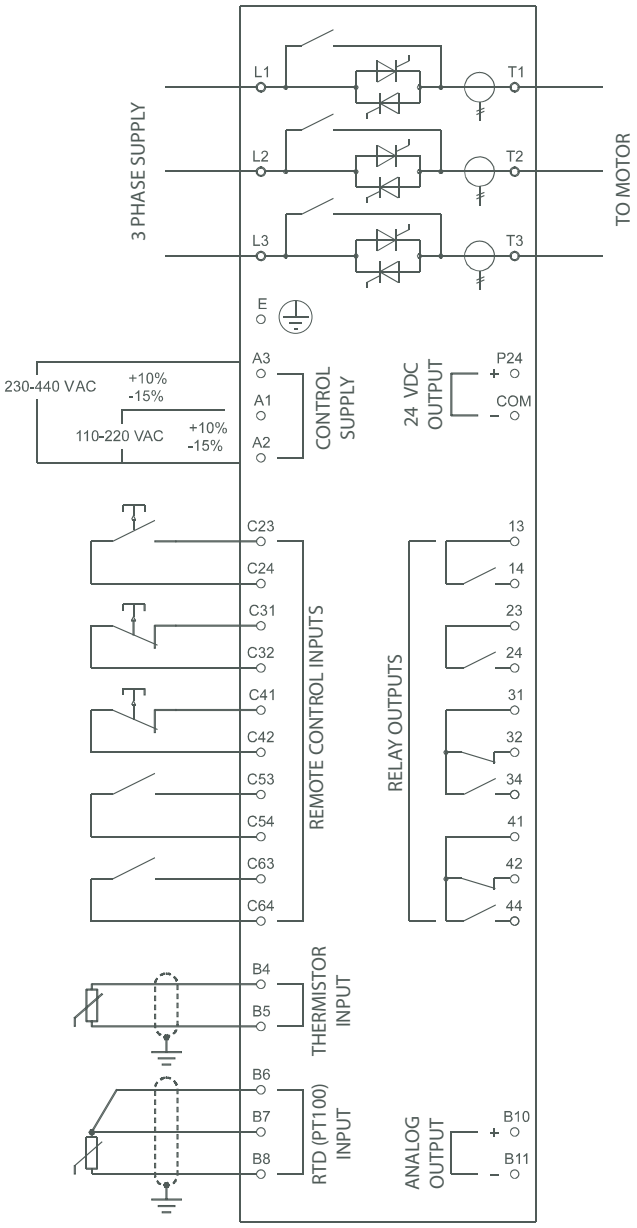
Heat Dissipation

During start ..... 4.5 Watts per ampere
During run
EMX3-0023B ~ EMX3-0053B ..... 39 Watts approx
EMX3-0076B ~ EMX3-0105B .....51 Watts approx
EMX3-0145B ~ EMX3-0220B .....120 Watts approx
EMX3-0255C ~ EMX3-0930C .....4.5 Watts per ampere approx
EMX3-1200C ~ EMX3-1600C ..... 4.5 Watts per ampere approx

Certification

UL/ C-UL ..... UL 508, UL 347
EMX3-0023B ~ EMX3-0105B .....Indoor, Enclosed. Type 1
EMX3-0145B ~ EMX3-1600C .....Indoor, Open Type.
CE ..... IEC 60947-4-2
C✓..... IEC 60947-4-2
CCC ..... GB 14048-6
RoHS ..... Compliant with EU Directive 2002/95/EC
Marine
EMX3-0023B – EMX3-0220B only.....Lloyds Marine No 1 Specification

EMX3 WIRING DIAGRAM



The internal bypass feature is included only on units with the suffix 'B'.

MODULE

EMX3 (NORMAL DUTY RATINGS & ORDER GUIDE)

Normal Duty 300% HP			Module with internal bypass	
208V	230V	ND Amps	Model Number	Order Code
5	7.5	23	EMX30023B	870-1400
10	15	43	EMX30043B	870-1401
15	20	53	EMX30053B	870-1402
25	25	76	EMX30076B	870-1403
30	30	97	EMX30097B	870-1404
	40	105	EMX30105B	870-1405
60	60	170	EMX30170B	870-1406
75	75	220	EMX30220B	870-1407
Normal Duty 300% HP			Module without internal bypass	
208V	230V	ND Amps	Model Number	Order Code
	100	255	EMX30255C	870-1408
125	150	360	EMX30360C	870-1409
150		430	EMX30430C	870-1410
200	250	620	EMX30620C	870-1411
250	300	790	EMX30790C	870-1412
300	350	930	EMX30930C	870-1413
400	500	1200	EMX31200C	870-1414
500	600	1410	EMX31410C	870-1415
	700	1600	EMX31600C	870-1416

Normal Duty 300% HP			Module with internal bypass	
460V	575V	ND Amps	Model Number	Order Code
15	20	23	EMX30023B	870-1500
30	40	43	EMX30043B	870-1501
40	50	53	EMX30053B	870-1502
60	75	76	EMX30076B	870-1503
75	100	97	EMX30097B	870-1504
		105	EMX30105B	870-1505
125	150	170	EMX30170B	870-1506
150	200	220	EMX30220B	870-1507
Normal Duty 300% HP			Module without internal bypass	
460V	575-690V	ND Amps	Model Number	Order Code
200	250	255	EMX30255C	870-1508
300	350	360	EMX30360C	870-1509
350	450	430	EMX30430C	870-1510
500	600	620	EMX30620C	870-1511
600	800	790	EMX30790C	870-1512
700	900	930	EMX30930C	870-1513
1000	1200	1200	EMX31200C	870-1514
1100	1400	1410	EMX31410C	870-1515
1300	1600	1600	EMX31600C	870-1516

ND = Normal Duty (Fan/Pump Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
EMX30023B to 53B = 300% starting current, with a maximum 10 second start time that requires 350 seconds between starts.
EMX30076B to 220B has 590 seconds between starts.
EMX30255C to 1600C, 300% starting current with a maximum 10 second start time that requires 360 seconds between starts.

EMX3 (HEAVY DUTY RATINGS & ORDER GUIDE)

Heavy Duty 450% HP			Module with internal bypass	
208V	230V	HD Amps	Model Number	Order Code
3	5	15	EMX30023B	870-1400
7.5	10	29	EMX30043B	870-1401
10		37	EMX30053B	870-1402
15	15	47	EMX30076B	870-1403
	20	58	EMX30097B	870-1404
25	25	78	EMX30105B	870-1405
30	30	97	EMX30170B	870-1406
50	50	148	EMX30220B	870-1407
Heavy Duty 450% HP			Module without internal bypass	
208V	230V	HD Amps	Model Number	Order Code
60	60	171	EMX30255C	870-1408
75	100	259	EMX30360C	870-1409
100		301	EMX30430C	870-1410
150	150	419	EMX30620C	870-1411
200	200	567	EMX30790C	870-1412
	250	644	EMX30930C	870-1413
350	400	983	EMX31200C	870-1414
		1023	EMX31410C	870-1415
400	500	1227	EMX31600C	870-1416

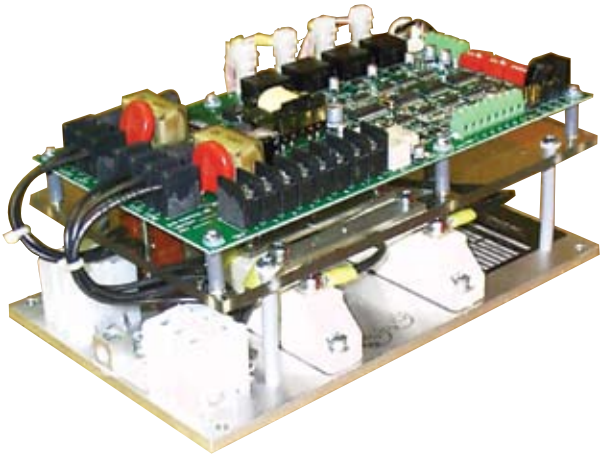
Heavy Duty 450% HP			Module with internal bypass	
460V	575V	HD Amps	Model Number	Order Code
10	10	15	EMX30023B	870-1500
20	25	29	EMX30043B	870-1501
30	30	37	EMX30053B	870-1502
	40	47	EMX30076B	870-1503
40	50	58	EMX30097B	870-1504
60	75	78	EMX30105B	870-1505
75	100	97	EMX30170B	870-1506
100	150	148	EMX30220B	870-1507
Heavy Duty 450% HP			Module without internal bypass	
460V	575V	HD Amps	Model Number	Order Code
125		171	EMX30255C	870-1508
200	250	259	EMX30360C	870-1509
250	300	301	EMX30430C	870-1510
350	450	419	EMX30620C	870-1511
450	500	567	EMX30790C	870-1512
500	600	644	EMX30930C	870-1513
700	1000	983	EMX31200C	870-1514
900	1100	1023	EMX31410C	870-1515
1000	1300	1227	EMX31600C	870-1516

HD = Heavy Duty (Conveyor Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
EMX30023B to 53B = 450% starting current with a maximum 30 second start time that requires 330 seconds between starts.
EMX30076B to 220B has 570 seconds between starts.
EMX30255C to 1600C, 450% starting current with a maximum 30 second start time that requires 360 seconds between starts.

DY5

Electronic Motor Brake

The **DY5** unit is an electronic AC motor brake. Installation is simple and fast. Only four power wires are needed, plus five interconnecting leads to the existing starter. Use the DY5 to stop AC motors safely and quickly.



DY5 brakes can be applied to most full voltage electromechanical starters and solid state soft starts, and can be ordered as an installed option on a Saftronics soft starter.

DY5 Digital Electronic Motor Brakes utilize a microprocessor and 4-SCR Full Wave Bridge to apply regulated DC current to the stator of an AC induction motor causing controlled braking. The DY5 employs zero speed sensing to automatically remove braking current as soon as the motor stops, thus minimizing motor heating and idle time before restarting. The DY5 is designed specifically for applications requiring smooth, rapid braking to reduce motor stopping time and help meet OSHA safety standards. Universal Input Voltage allows the DY5 to operate at line voltages from 200 to 600 VAC and line frequencies between 45 and 65 Hz. PC programmable for custom applications and braking curves.

NOTE: *Electronic indication should never be used as the only indication that it is safe to proceed. Zero speed should be mechanically or visually verified and the machine locked out before proceeding with any operation in which movement of the machine would pose a risk.*

- **Universal Input Voltage**
- **Zero Speed Detection**
- **SMD Technology**
- **Switch Mode Power Supply**
- **Closed loop current feedback**
- **Digital Timer**
- **Common Control Module**
- **SCR with 1600V PIV Rating**
- **MOV/RC Snubber protection**
- **Diagnostics LED's**
  - **Control Power**
  - **Motor On**
  - **Brake On**
  - **Zero Speed Pulse**
- **PC Programming Connection (Optional)**
- **Braking Current: 40-200% Brake Rating**
- **Backup Timer: 1-255 seconds via DIP switch**
- **Zero speed hold time: 0.5-7.5 seconds (delays release of brake after zero speed is sensed) via DIP switch**

RATINGS, WEIGHTS & DIMENSIONS

Model	Maximum Horsepower by Voltage					Chassis			NEMA 12		
	208V	230V	460V	575V	Amps	Order Code	Dimensions H x W x D (inches)	Weight (lbs)	Order Code	Dimensions H x W x D (inches)	Weight (lbs)
DY5 - 15	3	5	10	15	15	**3920-01**	9.5 x 6.25. 5.25	7	**3920-02**	16 x 14 x 10	32
DY5 - 40	10	15	30	40	40	**3921-01**			**3921-02**		
DY5 - 75	20	25	50	75	75	**3922-01**	10 x 7.5 x 6	8	**3922-02**	16 x 14 x 10	33
DY5 - 125	40	50	100	125	125	**3923-01**	13 x 7.5 x 7	17	**3923-02**	24 x 20 x 12	72
DY5 - 180	60	75	150	200	180	**3924-01**			**3924-02**		
DY5 - 480	150	200	400	500	480	**3925-01**	15.25 x 14 x 10	35	**3925-02**	30 x 24 x 16	115
DY5 - 720	250	300	600	700	720	**3926-01**	20 x 17 x 12.5	54	**3926-02**	36 x 30 x 16	175

SPECIFICATIONS:

Operating Conditions

Horsepower	3 thru 700 hp
Current range	15A-720A (nominal)
Line Voltage	3 hp, 200 – 600 VAC
Supply Frequency	45 to 65 Hz
Control Voltage	120 VAC 45 to 65 Hz, 20 VA
Enclosure	Chassis or NEMA12
Ambient Temperature	0 – 40°C (32°F - 104°F) (Operating)
Altitude	1000 m (3,300 ft)
Relative Humidity	5% to 95% Non-condensing

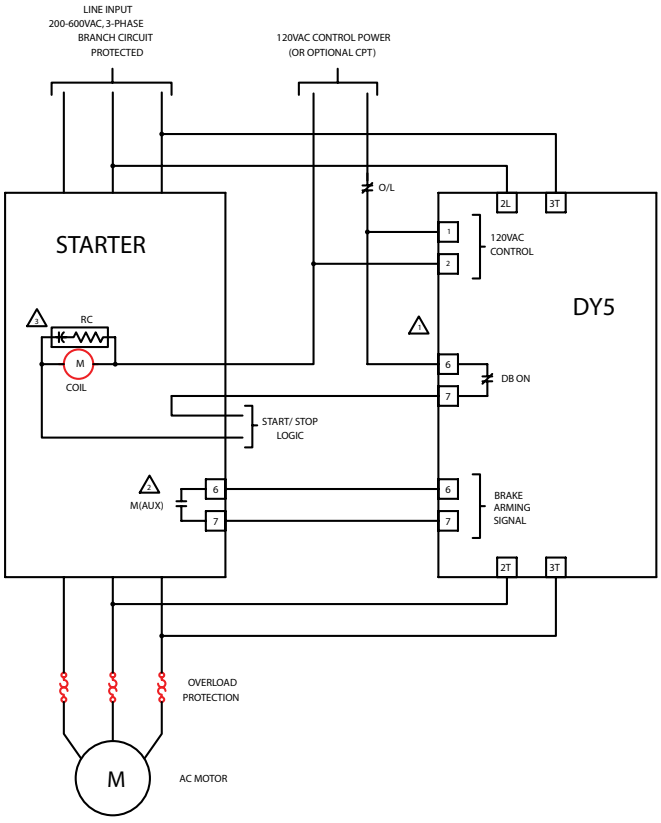
Standard Features

Control	Full Wave Controlled
Overload Capacity	200% for 60 seconds
Duty Cycle	One 30 second stop every 15 minutes at maximum current. Consult factory for suitability of other duty cycles.

Outputs

Relay Outputs	5A @ 250 VAC
Open Collector	24 VDC, 50 mA

DY5 WIRING DIAGRAMS:



1 Interlock to prevent motor starter closing when DY5 is operating.

2 Auxiliary interlock to indicate when motor starter is closed.

3 Motor starter coil must be suppressed.

Packaged Soft Starters NEW

TYPICAL APPLICATIONS

Normal Duty Applications: Fans, Pump (Centrifugal & Submersible), Compressor (Screw type), Grinder, Bottle Washer.

Heavy Duty Applications: Compressor (Reciprocating type), Conveyors, Mixer, Hammer Mill, Palletizer, Separator, Shredder, Bandsaw, Chipper, Sander, Agitator, Rock Crusher.

Combination Packaged Starters (CSXi, IMS2 & EMX3)

Packages include: NEMA -1 (PPBF) & NEMA-12 (TENV) Enclosure,

NEMA-1 is without at speed run bypass contactor,

NEMA-12 is with at speed run bypass contactor, Input line fusing.

Option: Circuit breaker with door operator, 120 VAC control power transformer.



Crusher Duty Packaged Starters (IMS2•4•1 & EMX3•4•1)

The **IMS2•4•1 and EMX3•4•1 are** pre-engineered enclosed soft starter packaged solutions based on the IMS2 and EMX3 Soft Starters. They include the latest in digital technology to provide ease of set-up and reliability needed in this demanding application.

Packages include: NEMA-12 (TENV) Enclosure, Circuit breaker with door operator, Bypass contactor has 2 modes of operation; at speed run bypass or for emergency across-the-line bypass contactor, 120 VAC control power transformer, Emergency Start Switch (mounted inside on panel to select soft starter start mode or across- the- line start mode), Class 20 thermal over-load for across the line start mode, Start / Stop Push button (door mounted), Run Pilot Light (door mounted) , Input line fusing.



COMBINATION PACKAGED STARTERS

CSXi series (NORMAL DUTY RATINGS & ORDER GUIDE)

Module					NEMA 12 w/o CB	NEMA 12 w/ CB
208V (8)	230V (2)	460V (4)	ND Amps	Model Number	Order Code String (4)	Order Code String (4)
5	5	**10**	18	CSXi-007	SCSiN401020	SCSiN401021
7.5	7.5	**15**	34	CSXi-015	SCSiN401520	SCSiN401521
10	10	**20**	34	CSXi-015	SCSiN402020	SCSiN402021
		25	34	CSXi-015	SCSiN402520	SCSiN402521
	15	**30**	42	CSXi-018	SCSiN403020	SCSiN403021
20	20	**40**	60	CSXi-030	SCSiN404020	SCSiN404021
25	25	**50**	75	CSXi-037	SCSiN405020	SCSiN405021
	30	**60**	85	CSXi-045	SCSiN406020	SCSiN406021
30		**75**	100	CSXi-055	SCSiN407520	SCSiN407521
40	50	**100**	140	CSXi-075	SCSiN410020	SCSiN410021
60	60	**125**	170	CSXi-090	SCSiN412520	SCSiN412521
	75	**150**	200	CSXi-110	SCSiN415020	SCSiN415021

CSXi series (HEAVY DUTY RATINGS & ORDER GUIDE)

Module					NEMA 12 w/o CB	NEMA 12 w/ CB
208V (8)	230V (2)	460V (4)	HD Amps	Model Number	Order Code String (4)	Order Code String (4)
5	5	**10**	17	CSXi-007	SCSiH401020	SCSiH401021
		15	30	CSXi-015	SCSiH401520	SCSiH401521
7.5	10	**20**	30	CSXi-015	SCSiH402020	SCSiH402021
10		**25**	36	CSXi-018	SCSiH402520	SCSiH402521
		30	40	CSXi-022	SCSiH403020	SCSiH403021
20	20	**40**	65	CSXi-037	SCSiH404020	SCSiH404021
		50	65	CSXi-037	SCSiH405020	SCSiH405021
25-30	30	**60**	96	CSXi-055	SCSiH406020	SCSiH406021
		75	96	CSXi-055	SCSiH407520	SCSiH407521
	50	**100**	142	CSXi-090	SCSiH410020	SCSiH410021
50	60	**125**	165	CSXi-110	SCSiH412520	SCSiH412521

Numbers in ( ) are the voltage code suffix also used in 6th digit of the package order string.

ND = Normal Duty (Fan/Pump Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
CSX-007 to 030, 400% starting current, with a maximum 6 second start time that requires 354 seconds between starts.
CSX-037 to 110, 400% starting current, with a maximum 6 second start time that requires 594 seconds between starts.

HD = Heavy Duty (Conveyors Application) verify the motor amps, Then select the starter amps to be equal or greater then motor amps.
CSX-007 to 030, 400% starting current, with a maximum 20 second start time that requires 340 seconds between starts.
CSX-037 to 110, 400% starting current, with a maximum 20 second start time that requires 580 seconds between starts.

WEIGHTS & DIMENSIONS (NEMA 12)

NEMA 12	Weight (lbs)	HxWxD (in)
CSXi-007 to CSXi-030	70	20 x 16 x 12
CSXi-037 to CSXi-055	70	20 x 16 x 12
CSXi-075 to CSXi-110	101	24 x 20 x 12
NEMA 12 with C/B	**Weight (lbs)**	**HxWxD (in)**
CSXi-007 to CSXi-030	85	20 x 16 x 12
CSXi-037 to CSXi-055	85	20 x 16 x 12
CSXi-075 to CSXi-110	125	24 x 20 x 12

Consult Factory for higher HP range and Input Voltage.

COMBINATION PACKAGED STARTERS continued

IMS2 series (NORMAL DUTY RATINGS & ORDER GUIDE)

IMS2 Normal Duty 300% HP					Module	NEMA 1 Fan & Filtered without Bypass		NEMA 12 with Bypass	
						w/o CB	w/ CB	w/o CB	w/ CB
208V (8)	230V (2)	460V (4)	575V (5)	ND Amps	Model Number	Order Code String (4)	Order Code String (4)	Order Code String (4)	Order Code String (4)
5	5	**10**	15	18	IMS20018	SIMSN401010	SIMSN401011	SIMSN401020	SIMSN401021
	7.5	**15**	20	34	IMS20034	SIMSN401510	SIMSN401511	SIMSN401520	SIMSN401521
10	10	**20**	25	34	IMS20034	SIMSN402010	SIMSN402011	SIMSN402020	SIMSN402021
		25	30	34	IMS20034	SIMSN402510	SIMSN402511	SIMSN402520	SIMSN402521
		30	40	41	IMS20041	SIMSN403010	SIMSN403011	SIMSN403020	SIMSN403021
20	20	**40**	50	67	IMS20067	SIMSN404010	SIMSN404011	SIMSN404020	SIMSN404021
	25	**50**	60	67	IMS20067	SIMSN405010	SIMSN405011	SIMSN405020	SIMSN405021
30	30	**60**	75	88	IMS20088	SIMSN406010	SIMSN406011	SIMSN406020	SIMSN406021
		75		96	IMS20096	SIMSN407510	SIMSN407511	SIMSN407520	SIMSN407521
40	40	**100**	125	125	IMS20125	SIMSN410010	SIMSN410011	SIMSN410020	SIMSN410021
50	50	**125**	150	202	IMS20202	SIMSN412510	SIMSN412511	SIMSN412520	SIMSN412521
60	75	**150**	200	202	IMS20202	SIMSN415010	SIMSN415011	SIMSN415020	SIMSN415021
	100	**200**	250	253	IMS20253	SIMSN420010	SIMSN420011	SIMSN420020	SIMSN420021
100		**250**	300	302	IMS20302	SIMSN425010	SIMSN425011	SIMSN425020	SIMSN425021
150	150	**300**	400	405	IMS20405	SIMSN430010	SIMSN430011	SIMSN430020	SIMSN430021
		350		513	IMS20513	SIMSN435010	SIMSN435011	SIMSN435020	SIMSN435021
	200	**400**	500	513	IMS20513	SIMSN440010	SIMSN440011	SIMSN440020	SIMSN440021
200		**450**	600	585	IMS20585	SIMSN445010	SIMSN445011	SIMSN445020	SIMSN445021
	250	**500**		628	IMS20628	SIMSN450010	SIMSN450011	SIMSN450020	SIMSN450021
250	300	**600**	800	775	IMS20775	SIMSN460010	SIMSN460011	SIMSN460020	SIMSN460021
300	350	**700**	900	897	IMS20897	SIMSN470010	SIMSN470011	SIMSN470020	SIMSN470021
	400	**800**		1153	IMS21153	SIMSN480010	SIMSN480011	SIMSN480020	SIMSN480021

ND = Normal Duty verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
IMS2018 to 1574, 300% starting current with a maximum 10 second start time that requires 360 seconds between starts.

IMS2 series (HEAVY DUTY RATINGS & ORDER GUIDE)

IMS2 Heavy Duty 450% HP					Module	NEMA 1 Fan & Filtered without Bypass		NEMA 12 with Bypass	
						w/o CB	w/ CB	w/ Bypass	w/ CB
208V (8)	230V (2)	460V (4)	575V (5)	HD Amps	Model Number	Order Code String (4)	Order Code String (4)	Order Code String (4)	Order Code String (4)
3	3	**7.5**	10	12	IMS20018	SIMSH407P510	SIMSH407P511	SIMSH407P520	SIMSH407P521
5	5	**10**	15	24	IMS20034	SIMSH401010	SIMSH401011	SIMSH401020	SIMSH401021
	7.5	**15**	20	24	IMS20034	SIMSH401510	SIMSH401511	SIMSH401520	SIMSH401521
7.5	10	**20**	25	28	IMS20041	SIMSH402010	SIMSH402011	SIMSH402020	SIMSH402021
10		**25**	30	33	IMS20047	SIMSH402510	SIMSH402511	SIMSH402520	SIMSH402521
	15	**30**	40	46	IMS20067	SIMSH403010	SIMSH403011	SIMSH403020	SIMSH403021
15	20	**40**	50	59	IMS20088	SIMSH404010	SIMSH404011	SIMSH404020	SIMSH404021
25	25	**50**		84	IMS20125	SIMSH405010	SIMSH405011	SIMSH405020	SIMSH405021
	30	**60**	75	84	IMS20125	SIMSH406010	SIMSH406011	SIMSH406020	SIMSH406021
		75	100	135	IMS20202	SIMSH407510	SIMSH407511	SIMSH407520	SIMSH407521
40	50	**100**	125	135	IMS20202	SIMSH410010	SIMSH410011	SIMSH410020	SIMSH410021
50	60	**125**	150	160	IMS20238	SIMSH412510	SIMSH412511	SIMSH412520	SIMSH412521
60	75	**150**	200	205	IMS20302	SIMSH415010	SIMSH415011	SIMSH415020	SIMSH415021
100	100	**200**	250	274	IMS20405	SIMSH420010	SIMSH420011	SIMSH420020	SIMSH420021
	125	**250**	350	342	IMS20513	SIMSH425010	SIMSH425011	SIMSH425020	SIMSH425021
125	150	**300**	400	392	IMS20585	SIMSH430010	SIMSH430011	SIMSH430020	SIMSH430021
150		**350**	450	424	IMS20628	SIMSH435010	SIMSH435011	SIMSH435020	SIMSH435021
	200	**400**	500	521	IMS20775	SIMSH440010	SIMSH440011	SIMSH440020	SIMSH440021
		450		521	IMS20775	SIMSH445010	SIMSH445011	SIMSH445020	SIMSH445021
200	250	**500**	600	604	IMS20897	SIMSH450010	SIMSH450011	SIMSH450020	SIMSH450021
250	300	**600**	800	791	IMS21153	SIMSH460010	SIMSH460011	SIMSH460020	SIMSH460021
300	350	**700**	900	970	IMS21403	SIMSH470010	SIMSH470011	SIMSH470020	SIMSH470021
350	400	**800**		970	IMS21403	SIMSH480010	SIMSH480011	SIMSH480020	SIMSH480021

HD = Heavy Duty (Conveyor Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps
IMS2018 to 1574, 450% starting current with a maximum 30 second start time that requires 360 seconds between starts.

Numbers in ( ) are the voltage code suffix also used in 6th digit of the package order string.

Consult Factory for higher HP range and Input Voltage.

COMBINATION PACKAGED STARTERS continued

EMX3 series (NORMAL DUTY RATINGS & ORDER GUIDE)

EMX3 Normal Duty 300% HP					Module	NEMA 1 Fan & Filtered without Bypass		NEMA 12 with Bypass	
						w/o CB	w/ CB	w/ Bypass	w/ CB
208V (8)	230V (2)	460V (4)	575V (5)	ND Amps	Model Number	Order Code String (4)	Order Code String (4)	Order Code String (4)	Order Code String (4)
5	7.5	**15**	20	23	EMX30023B	The standard enclosure offering for this product range with the bypass contactor built into the starter is NEMA- 4/12.		SEMXN401520	SEMXN401521
	10	**20**	25	43	EMX30043B			SEMXN402020	SEMXN402021
10		**25**	30	43	EMX30043B			SEMXN402520	SEMXN402521
	15	**30**	40	43	EMX30043B			SEMXN403020	SEMXN403021
15	20	**40**	50	53	EMX30053B			SEMXN404020	SEMXN404021
	25	**50**	60	76	EMX30076B			SEMXN405020	SEMXN405021
25		**60**	75	76	EMX30076B			SEMXN406020	SEMXN406021
30	30	**75**	100	97	EMX30097B			SEMXN407520	SEMXN407521
	50	**100**	125	170	EMX30170B			SEMXN410020	SEMXN410021
60	60	**125**	150	170	EMX30170B			SEMXN412520	SEMXN412521
75	75	**150**	200	220	EMX30220B			SEMXN415020	SEMXN415021
	100	**200**	250	255	EMX30255C	SEMXN420010	SEMXN420011	SEMXN420020	SEMXN420021
		250	300	360	EMX30360C	SEMXN425010	SEMXN425011	SEMXN425020	SEMXN425021
125	150	**300**	350	360	EMX30360C	SEMXN430010	SEMXN430011	SEMXN430020	SEMXN430021
150		**350**	450	430	EMX30430C	SEMXN435010	SEMXN435011	SEMXN435020	SEMXN435021
200		**400**	500	620	EMX30620C	SEMXN440010	SEMXN440011	SEMXN440020	SEMXN440021
		450		620	EMX30620C	SEMXN445010	SEMXN445011	SEMXN445020	SEMXN445021
	250	**500**	600	620	EMX30620C	SEMXN450010	SEMXN450011	SEMXN450020	SEMXN450021
250	300	**600**	800	790	EMX30790C	SEMXN460010	SEMXN460011	SEMXN460020	SEMXN460021
300	350	**700**	900	930	EMX30930C	SEMXN470010	SEMXN470011	SEMXN470020	SEMXN470021
400	500	**800**		1200	EMX31200C	SEMXN480010	SEMXN480011	SEMXN480020	SEMXN480021

ND = Normal Duty verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
EMX30023B to 53B, 300% starting current with a maximum 10 second start time that requires 350 seconds between starts.
EMX30076B to 220B has 590 seconds between starts.
EMX30255C to 1600C, 300% starting current with a maximum 10 second start time that requires 360 seconds between starts.

EMX3 series (HEAVY DUTY RATINGS & ORDER GUIDE)

EMX3 Heavy Duty 450% HP					Module	NEMA 1 Fan & Filtered w/o Bypass		NEMA 12 w/ Bypass	
						w/o CB	w/ CB	w/o CB	w/ CB
208V (8)	230V (2)	460V (4)	575V (5)	HD Amps	Model Number	Order Code String (4)	Order Code String (4)	Order Code String (4)	Order Code String (4)
3	5	**10**	10	15	EMX30023B	The standard enclosure offering for this product range with the bypass contactor built into the starter is NEMA- 4/12.		SEMXH401020	SEMXH401021
5	7.5	**15**	15	29	EMX30043B			SEMXH401520	SEMXH401521
7.5	10	**20**	25	29	EMX30043B			SEMXH402020	SEMXH402021
10		**25**	30	37	EMX30053B			SEMXH402520	SEMXH402521
		30		37	EMX30053B			SEMXH403020	SEMXH403021
	20	**40**	50	58	EMX30097B			SEMXH404020	SEMXH404021
	25	**50**	60	78	EMX30105B			SEMXH405020	SEMXH405021
25		**60**	75	78	EMX30105B			SEMXH406020	SEMXH406021
30	30	**75**	100	97	EMX30170B			SEMXH407520	SEMXH407521
50	50	**100**	150	148	EMX30220B			SEMXH410020	SEMXH410021
60	60	**125**		171	EMX30255C	SEMXH412510	SEMXH412511	SEMXH412520	SEMXH412521
	75	**150**	200	259	EMX30360C	SEMXH415010	SEMXH415011	SEMXH415020	SEMXH415021
75	100	**200**	250	259	EMX30360C	SEMXH420010	SEMXH420011	SEMXH420020	SEMXH420021
100		**250**	300	301	EMX30430C	SEMXH425010	SEMXH425011	SEMXH425020	SEMXH425021
125	125	**300**	400	419	EMX30620C	SEMXH430010	SEMXH430011	SEMXH430020	SEMXH430021
150	150	**350**	450	419	EMX30620C	SEMXH435010	SEMXH435011	SEMXH435020	SEMXH435021
200	200	**400**		567	EMX30790C	SEMXH440010	SEMXH440011	SEMXH440020	SEMXH440021
		450		567	EMX30790C	SEMXH445010	SEMXH445011	SEMXH445020	SEMXH445021
	250	**500**	600	644	EMX30930C	SEMXH450010	SEMXH450011	SEMXH450020	SEMXH450021
300	300	**600**	700	983	EMX31200C	SEMXH460010	SEMXH460011	SEMXH460020	SEMXH460021
350	350	**700**	800	983	EMX31200C	SEMXH470010	SEMXH470011	SEMXH470020	SEMXH470021
	400	**800**	900	983	EMX31200C	SEMXH480010	SEMXH480011	SEMXH480020	SEMXH480021

HD = Heavy Duty (Conveyor Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.
EMX30023B to 53B, 450% starting current with a maximum 30 second start time that requires 330 seconds between starts.
EMX30076B to 220B has 570 seconds between starts.
EMX30255C to 1600C, 450% starting current with a maximum 30 second start time that requires 360 seconds between starts.

Numbers in ( ) are the voltage code suffix also used in 6th digit of the package order string.

Consult Factory for higher HP range and Input Voltage.

CRUSHER DUTY STARTERS

Applications: Compressor (Reciprocating type), Conveyors, Mixer, Hammer Mill, Palletizer, Separator, Shredder, Bandsaw, Chipper Sander, Agitator, Rock Crusher.

IMS2 series CRUSHER DUTY (HEAVY DUTY RATINGS & ORDER GUIDE)

IMS2 Heavy Duty 450% HP					Module	NEMA 12
208V (8)	230V (2)	460V (4)	575V (5)	HD Amps	Model Number	Order Code String (4)
3	3	**7.5**	5-10	12	IMS20018	SIMSH47P521-ABR
5	5	**10**	15	24	IMS20034	SIMSH401021-ABR
	7.5	**15**	20	24	IMS20034	SIMSH401521-ABR
7.5	10	**20**	25	28	IMS20041	SIMSH402021-ABR
10		**25**	30	33	IMS20047	SIMSH402521-ABR
	15	**30**	40	46	IMS20067	SIMSH403021-ABR
15	20	**40**	50	59	IMS20088	SIMSH404021-ABR
25	25	**50**		84	IMS20125	SIMSH405021-ABR
	30	**60**	75	84	IMS20125	SIMSH406021-ABR
		75	100	135	IMS20202	SIMSH407521-ABR
40	40-50	**100**	125	135	IMS20202	SIMSH410021-ABR
50	60	**125**	150	160	IMS20238	SIMSH412521-ABR
60	75	**150**	200	205	IMS20302	SIMSH415021-ABR
75-100	100	**200**	250	274	IMS20405	SIMSH420021-ABR
	125	**250**	300-350	342	IMS20513	SIMSH425021-ABR
125	150	**300**	400	392	IMS20585	SIMSH430021-ABR
150		**350**	450	424	IMS20628	SIMSH435021-ABR
	200	**400**	500	521	IMS20775	SIMSH440021-ABR
		450		521	IMS20775	SIMSH445021-ABR
200	250	**500**	600	604	IMS20897	SIMSH450021-ABR
250	300	**600**	700-800	791	IMS21153	SIMSH460021-ABR
300	350	**700**	900	970	IMS21403	SIMSH470021-ABR
350	400	**800**		970	IMS21403	SIMSH480021-ABR

EMX3 series CRUSHER DUTY (HEAVY DUTY RATINGS & ORDER GUIDE)

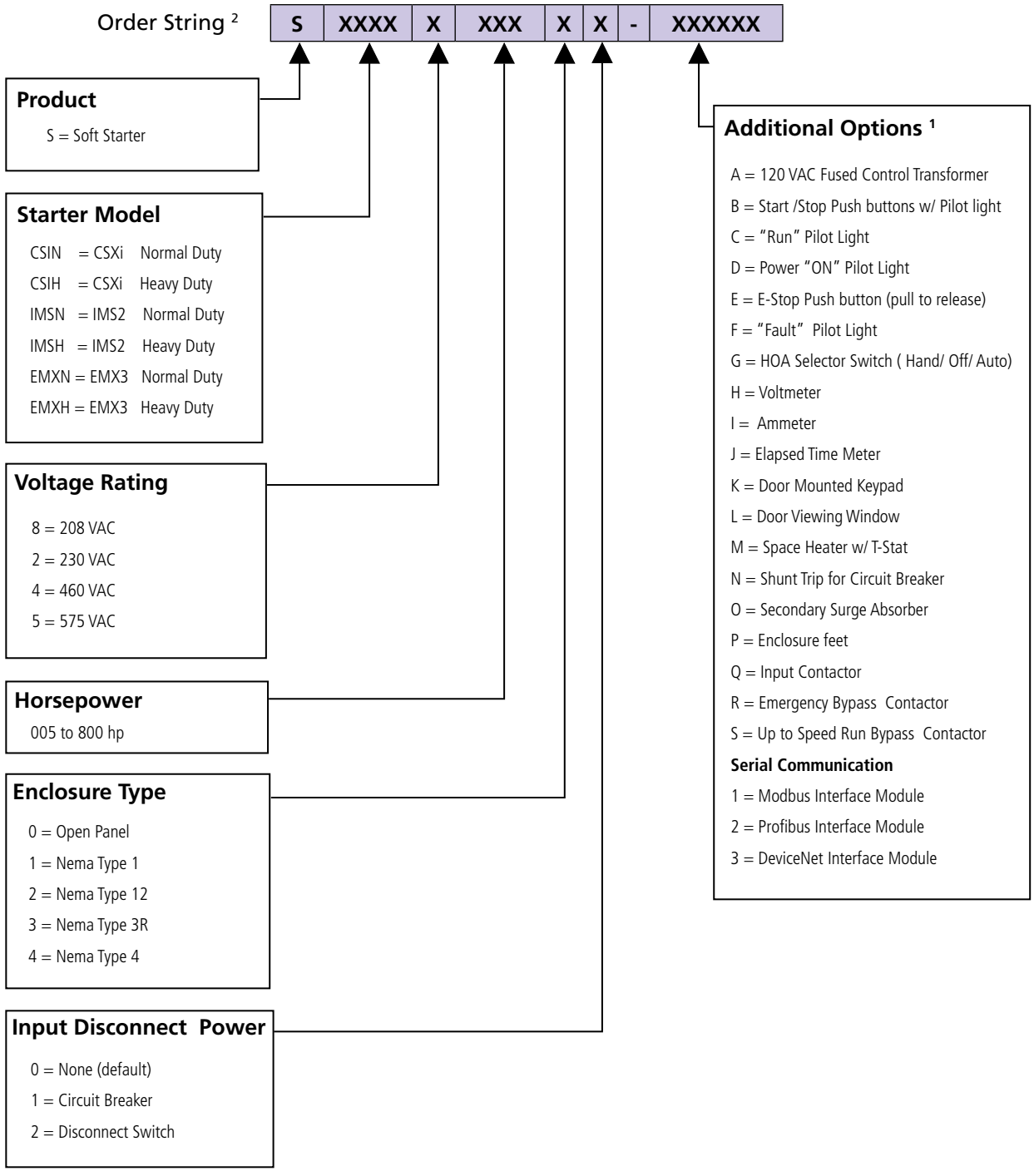
EMX3 Heavy Duty 450% HP					Module	NEMA 12
208V (8)	230V (2)	460V (4)	575V (5)	HD Amps	Model Number	Order Code String (4)
3	5	**10**	10	15	EMX30023B	SEMXH401021-ABR
5	7.5	**15**	15	29	EMX30043B	SEMXH401521-ABR
7.5	10	**20**	25	29	EMX30043B	SEMXH402021-ABR
10		**25**	30	37	EMX30053B	SEMXH402521-ABR
		30		37	EMX30053B	SEMXH403021-ABR
	20	**40**	50	58	EMX30097B	SEMXH404021-ABR
	25	**50**	60	78	EMX30105B	SEMXH405021-ABR
25		**60**	75	78	EMX30105B	SEMXH406021-ABR
30	30	**75**	100	97	EMX30170B	SEMXH407521-ABR
50	50	**100**	150	148	EMX30220B	SEMXH410021-ABR
60	60	**125**		171	EMX30255C	SEMXH412521-ABR
	75	**150**	200	259	EMX30360C	SEMXH415021-ABR
75	100	**200**	250	259	EMX30360C	SEMXH420021-ABR
100		**250**	300	301	EMX30430C	SEMXH425021-ABR
125	125	**300**	400	419	EMX30620C	SEMXH430021-ABR
150	150	**350**	450	419	EMX30620C	SEMXH435021-ABR
200	200	**400**		567	EMX30790C	SEMXH440021-ABR
		450	500	567	EMX30790C	SEMXH445021-ABR
	250	**500**	600	644	EMX30930C	SEMXH450021-ABR
300	300	**600**	700	983	EMX31200C	SEMXH460021-ABR
350	350	**700**	800	983	EMX31200C	SEMXH470021-ABR
	400	**800**	900	983	EMX31200C	SEMXH480021-ABR

Numbers in ( ) are the voltage code suffix also used in 6th digit of the package order string.
HD = Heavy Duty (Conveyor Application) verify the motor amps. Then select the starter amps to be equal or greater then motor amps.

IMS2018 to 1574, 450% starting current with a maximum 30 second start time that requires 360 seconds between starts.
EMX30023B to 53B, 450% starting current with a maximum 30 second start time that requires 330 seconds between starts.
EMX30076B to 220B has 570 seconds between starts.
EMX30255C to 1600C, 450% starting current with a maximum 30 second start time that requires 360 seconds between starts.

Consult Factory for higher HP range and Input Voltage.

Packaged Soft Starter Order Code Configurator



1) E-Stop PB, option E, requires the circuit breaker with a shunt trip to provide isolation between the starter and the motor. Consult Factory for options not listed in the Order Code Configurator.
2) Order string requires 11 character to make up a packaged Order Code.

OPTIONS

Option: Description for the package starter order string

Order Code	Enclosure Description
0	Open Panel: Module mounted on an open chassis panel with additional space for input power option. Open panel without a run bypass contactor requires 4.5 Watts multiplied by motor amps to be dissipated by others. Add the suffix S in the order string.
1	NEMA Type 1: Enclosure is fan and filtered. This option is not available when there is an internal at speed run bypass contactor built into the soft starter. NEMA 1 is available on all IMS2 and the EMX30255C to 1600C modules.
2	NEMA Type 12: Enclosure is (TENV) includes internal or external at speed run bypass contactor.
3	NEMA Type 3R: Enclosure is (TENV) includes internal or external at speed run bypass contactor.
4	NEMA Type 4: Enclosure is (TENV) includes internal or external at speed run bypass contactor.

Input Disconnect Power:

Order Code	Input Power Disconnect Description
0	No Circuit Breaker. (end user is responsible for branch circuit protection)
1	Circuit Breaker (C/B) with through-the-door handle, thermal-magnetic overload protection.
2	Non-Fused Disconnect Switch (NFD) with through-the-door handle. Semiconductor input fusing is included in all the starter packages.

Additional Options:

Option Code	Option Description
A	Control Power Transformer with primary & secondary fusing to provide 120 VAC control supply
B	Start / Stop Lighted Push button with Run Indication
C	"Run" Pilot Light
D	"Power On" Pilot Light
E	Emergency Stop Push button (Pull to Release)
F	"Fault" Pilot Light
G	Hand / Off / Auto Selector Switch
H	AC Voltmeter with Fusing to monitor the voltage in one phase
I	AC Ammeter including Current Transformer to monitor the current in one phase
J	Elapsed Time Meter
K	Door Mounted Keypad
L	Viewing window in door for viewing of keypad inside enclosure.
M	Provides 60 Watt space heater and thermostat to protect against condensation in low temperature non-ventilated applications when starter is not used for long periods.
N	Shunt trip is interlocked with the starter fault contact and overload to automatically trip the circuit breaker and remove power from starter, in the event of a fault. This option only available with a combination starter with circuit breaker.
O	Secondary Surge Absorber, in addition to standard MOV's. Connected to starter inputs to provide a degree of protection against line side transients
P	Enclosure Feet, adds 12" to height of enclosure.
Q	Input Contactor is interlocked with starter to completely isolate starter and motor from line voltage each time the stop circuit is activated. This prevents power line voltage transients from degrading the MOV protection. May affect enclosure size.
R	Emergency Bypass circuit allows full voltage starting in event of soft starter failure. Includes bimetal thermo class 20 overload to protect motor across the line mode. Panel mounted selector switch for soft start / across the line start mode. Only available with the Bypass option for the IMS2 & EMX3 Models
S	Open panel with a speed run bypass contactor.

Serial Communications

Option Code	Serial Communications option Descriptions
1	Modbus Communications Interface Module **CSXi, & EMX3 packages**
2	Profibus-DP Communications Interface Module **CSXi, & EMX3 packages**
3	DeviceNet Communications Interface Module **CSXi, IMS2 & EMX3 packages**

Accessories

CSX & CSXi Models	Model Number	Order Code
Remote Keypad Kit Includes (RCM01) & (PIM-RZ-01)	PIM-RO-01	870-1343
RS485 Serial Interface Module	PIM-RZ-01	870-1344
Remote Keypad	RCM01	870-1345
Pump Application Interface Module	PIM-PA-01	870-1383

EMX3 Models	Model Number	Order Code
Remote Keypad Kit	995-04939-00	870-1346
I/O Expansion Card	995-04803-00	870-1347
RTD/Ground Fault Expansion Card	995-04804-00	870-1348
Finger Guard Kit for the EMX30145 to 0220B only. (prevents accidental contact with live terminals)	995-06348-00	870-1349

IMS2 Models	Model Number	Order Code
Remote Keypad Kit	RCM01	870-1380

Serial Communications

CSX & CSXi & EMX3 Models	Model Number	Order Code
Modbus Interface Module	PIM-MB-01	870-1340
Profibus Interface Module	PIM-PB-01	870-1341
DeviceNet Interface Module	PIM-DN-01	870-1342

IMS2 Models	Model Number	Order Code
DeviceNet Interface Module	DCM01	870-1382

Note: IMS2 Models - Modbus Communications in AP ASCII, Modbus RTU and Modbus ASCII protocols are standard.

Dimensions & Weights (approximate)

CSX/CSXI Module			NEMA 4/12		NEMA 4/12 & CB	
Model # CSX CSXI	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)
7	8 x 4 x 7	5	20 x 16 x 12	70	20 x 16 x 12	85
15						
18						
22						
30						
37	9 x 6 x 8	9				
45						
55						
75	10 x 8 x 9	14	24 x 20 x 12	102	24 x 20 x 12	125
90						
110						

Dimensions & Weights (approximate)

IMS2 Module			NEMA 1		NEMA 1 & CB or NEMA 4/12 Bypass		NEMA 4/12 & CB or Crusher Duty	
Model #	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)
IMS20018	15 x 8 x 7	14	24 x 20 x 12	80	24 x 20 x 12	110	30 x 24 x 12	120
IMS20034								
IMS20041								
IMS20047								
IMS20067	15 x 8 x 10	27		95	30 x 24 x 12	160		160
IMS20088								
IMS20096								
IMS20125								
IMS20141	17 x 11 x 11	40	30 x 24 x 12	180	36 x 30 x 16	200	36 x 30 x 16	180
IMS20202								
IMS20238								
IMS20253	17 x 16 x 11	51		220		500	48 x 36 x 16	550
IMS20302	28 x 17 x 12	84	36 x 30 x 16		48 x 36 x 16			
IMS20405								
IMS20513		111	48 x 36 x 16	275				
IMS20585								
IMS20628		117			60 x 36 x 16	800	60 x 36 x 16	800
IMS20775								
IMS20897								
IMS21153	34 x 23 x 14	267	72 x 36 x 18	550	90 x 36 x 24	1100	90 x 36 x 24	1100
IMS21403								
IMS21574								

EMX3 Module			NEMA 1		NEMA 1 & CB or NEMA 12		NEMA 4/12 & CB or Crusher Duty	
Model #	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)	Dimension H x W x D (in)	Weight (lbs)
EMX30023B	12 x 7 x 8	8	24 x 20 x 12	80	24 x 20 x 12	100	30 x 24 x 12	120
EMX30043B								
EMX30053B								
EMX30076B	12 x 7 x 9	11			30 x 24 x 12	160		
EMX30097B								
EMX30105B								
EMX30170B	18 x 12 x 10	36	30 x 24 x 12	180	36 x 30 x 16	200	36 x 30 x 16	180
EMX30220B								
EMX30255C	17 x 16 x 11	56	36 x 30 x 16	220				
EMX30360C	22 x 17 x 12	112	48 x 36 x 16	275	48 x 36 x 16	500	48 x 36 x 16	550
EMX30430C								
EMX30620C								
EMX30790C					60 x 36 x 16	800	60 x 36 x 16	800
EMX30930C								
EMX31200C	30 x 23 x 15	300	72 x 36 x 18	550	90 x 36 x 24	1100	90 x 36 x 24	1100
EMX31410C								
EMX31600C								

"One Source" for DC products

Every Control Techniques distributor has access to the motors and accessories needed to complete your DC drive application through our "One Source" program. Using the buying power of Emerson, Control Techniques works closely with its distributors and customers to fulfill the promise of delivering the best possible price and performance solution on the market today.

Our DC motors range from 1/4 hp to 1600 hp. Our DC motor enclosures include totally enclosed fan cooled, totally enclosed non ventilated, drip proof guarded and drip proof guarded force ventilated. A variety of armature and field voltages are available along with mechanical and electrical modifications and accessories. We can supply virtually any type of DC motor to meet your needs.

Contact your local distributor or sales person for application assistance.













DC Drives


DC drive hp
0.25
0.5
1
2
3
5
10
20
40
50
100
500
1,000
Fincor Series
115V
230V
Mentor II / Quantum III
230V
460V

Rugged dependability and exceptional value

Control Techniques offers two DC drive series that enable customers to deploy productive, easy-to-use motor control solutions:

Fincor Series DC Drives

Fincor single phase analog DC drives are available to 5 hp with extreme ease of use and reliability. Four different Series of products provide you with just the right solution. The ultra compact Series 2120 offers extreme value in a footprint similar to competitor's smallest drives. The Series 2330 is our most popular non-regenerative drive while the Series 2610 adds advanced control and I/O for the more demanding applications. The Series 2230 Regenerative drive adds reversing without contactors and your fastest possible stopping of the motor. The Fincor drive family includes chassis, bookcase, and NEMA 4/12 enclosures with a choice of operator controls, contactors, and dynamic braking. Fincor single-phase DC drives will get you up and running fast.

Mentor II / Quantum III

Mentor II is a reliable, flexible and powerful digital DC drive that is available both in non-regenerative and regenerative configurations. It accepts a wide range of supply voltage from 208 to 480 VAC. Mentor II drives rated at 525/660 VAC ratings may be special ordered.

It's high-performance characteristics, fast coprocessors, dual encoder inputs, application and communications modules, and high-speed drive-to-drive communications capability place it in many applications requiring powerful motor control and coordination.

- Printing Presses
- Heavy Moveable Structures
- Lumber and Paper Milling
- Paper Converting
- Dual-turret winding
- Plastic and Rubber Extrusion
- Cranes, Hoists, and Cabling
- Iron, Steel and Glassworks
- Tilt Vessels, Coilers, Spoolers
- Metal Fabrication and Wire drawing



Quantum III is a modified Mentor II with added DC loop contactor, high-speed input fuses and 115 VAC control logic, provision to accept AC/DC tachometer feedback and DC output fuse on all regenerative models. It saves engineering time and panel space that makes it ideal for North American customers.



The Mentor II /Quantum III DC drives are also available as packaged control solutions and in system configurations. For details see **Packaged Drives & Engineered Systems.**

DC Drives *Product Matrix*

Drive Family	**Fincor Series** *p. 284* 	
Control Technology	Fincor 2120: Analog, Non-Regen	Fincor 2230: Analog, Regen Fincor 2330: Analog, Non-Regen Fincor 2610: Analog, Non-Regen
Power	1/8 to 3 hp	1/8 to 5 hp
AC Voltage 50/60 Hz ± 10%	115V-230V 1Ø	115V-230V 1Ø
Motor Feedback	Voltage Feedback (CEMF) DC Tachometer (2122, 2122H, 2123)	Voltage Feedback (CEMF) and DC Tachometer
Input/Output	Digital In: 1 Analog In: 1	2230 2330 2610 Digital In: 2 1 2 Analog In: 4 2 4 Analog Out: 4 0 4 Isolated I/O included as standard 2230 - External Signal Follower standard
Input/Output options	External Signal Follower	N/A
Communication	N/A	N/A
Configuration & Programming	N/A	N/A
Application Coprocessor	N/A	N/A
Application Software	N/A	N/A
Power Accessories	N/A	Armature Contactor with Dynamic Braking
Approvals	UL, CUL	UL, CUL

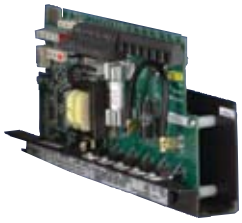
Drive Family	**Mentor II** *p. 303* 	**Quantum III** *p. 310* 
Control Technology	Digital, Non-Regen, Regen, SCR	Digital, Non-Regen, Regen, SCR
Power	5 hp to 1000 hp	5 hp to 1000 hp
AC Voltage 50/60 Hz ± 10%	208-660V 3Ø	208-240V 3Ø 380-480V 3Ø
Motor Feedback	Voltage Feedback (CEMF) DC Tachometer Encoder	Voltage Feedback (CEMF) AC or DC Tachometer Encoder
Input/Output	Input Output Digital 12 7 Analog 5 4	Input Output Digital 9 5 Analog 5 4
Input/Output options	Remote I/O I/O Box	Remote I/O I/O Box
Communication	RS485/232 Communication Cards for MODBUS RTU, DeviceNet, PROFIBUS DP, Interbus-S, CTNet with MD29AN	RS485/232 Communication Cards for MODBUS RTU, DeviceNet, PROFIBUS DP, Interbus-S, CTNet with MD29AN
Configuration & Programming	MentorSoft	MentorSoft
Application Coprocessor	MD29 32bit-coprocessor MD29AN s/a with CTNet	MD29 32bit-coprocessor MD29AN s/a with CTNet
Application Software	SyPT Pro IEC61131-3 ladder and function block programming or DPL (Drive Programming Language)	SyPT Pro IEC61131-3 ladder and function block programming or DPL (Drive Programming Language)
Power Accessories	Optional Field Regulator	Includes line fuses, motor contactor, and 120V control logic board as standard. Optional Field Regulator
Approvals	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000	UL, CUL, CE, C-Tick, ISO14001, ISO9001:2000

Fincor DC Drives
Flexible & Powerful

NEW







Fincor single-phase DC drives provide a complete family solution – from the compact Series 2120 chassis drive to the powerful Series 2230 and it's feature rich application specific options.

Series 2230, 2330, and 2610 drives offer many features not found on competitive drives. These features promote safety and improved performance. They include:

• **Isolated Regulator** protects internal control circuits from the AC power source, operators and equipment. The control reference input common may be grounded or connected without additional isolation to additional drives or grounded external sources. Isolation eliminates the common condition of line voltage to ground potential being present at the operator station potentiometer.

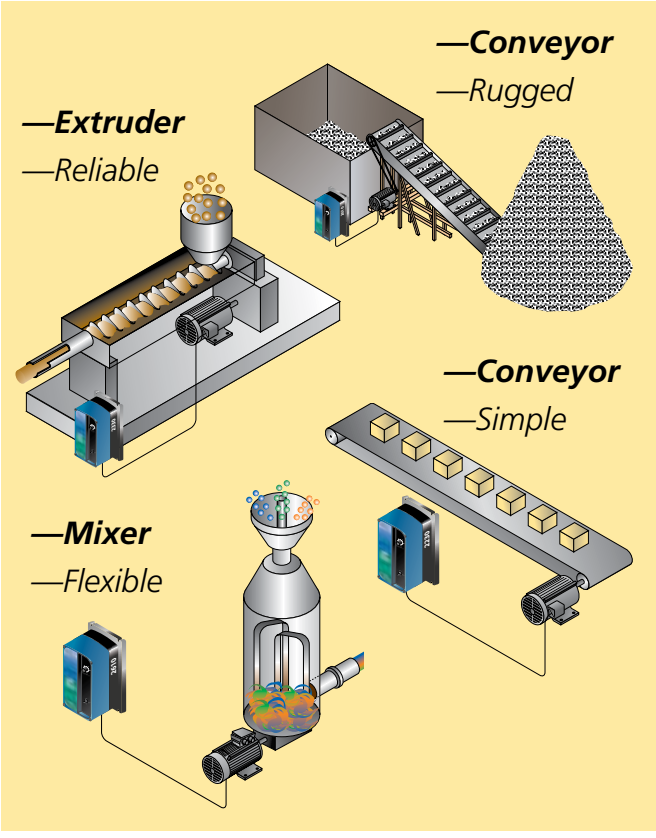
• **External DC Signal Follower** includes isolation and impedance matching circuitry to interface an externally supplied grounded or ungrounded, isolated or non isolated 0-5 VDC, 0-10 VDC or 4-20 mA DC signal source, with the motor controller reference input. This provides a linear transfer of the external signal to motor speed.

• **AC Line Starting (Auto-Restart) selection** simplifies restart control wiring requirements. This selection also permits run-stop control of unidirectional models by using an external AC line contactor. Smooth starting capabilities are included.

• **DC Tachometer Feedback** provides wider speed range, improved speed regulation with load changes and reduced sensitivity to operating conditions such as line voltage variations, ambient temperature changes, motor field heating and other operating variables. The controller will automatically transfer to counter EMF voltage feedback to prevent run away if the tachometer circuit is disconnected. Tachometers producing 7 to 150 VDC at maximum motor speed may be used.

- **Analog DC Drive**
- **1/8 to 5 hp (115-230 VAC)**
- **Non-Regen and Regen Models**
- **Chassis, Bookshelf or NEMA 4/12**
- **Tachometer or Armature Feedback**
- **Complete Motor Solutions**

TYPICAL APPLICATIONS



Contact factory for "Operator Stations"

c UL us LISTED

2 YEAR DRIVE Warranty

CHOOSE NON-REGEN OR REGENERATIVE

Non-regenerative drives are used when friction or a dynamic brake stopping is adequate. A contactor may be used to achieve reversing operation. Non-regen drives are less expensive than Regen drives when reversing is not required.

Regenerative drives include static reversing and are used when you need four quadrant control or Forward & Reverse operation from a bidirectional control signal (+/- 10 VDC). It will stop the load smoothly and faster than a dynamic brake for fast stop or emergency stop requirements and it will regenerate power to the supply if the load is overhauling (wanting to go faster than the motor set speed).

CHOOSE DRIVE SERIES

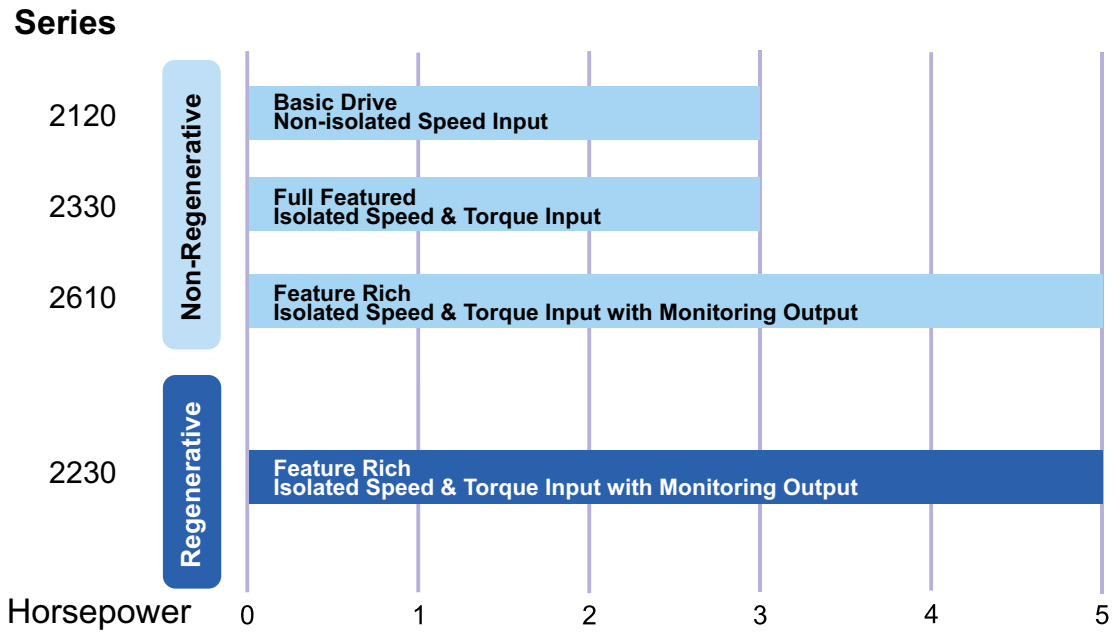
Now choose the drive series from either Non-Regen or Regen product pages. The chart below compares features and horsepower ratings, with the simplest and least expensive drive at the top and highest horsepower range and flexibility towards the bottom.

Order String

2	x	x	x	x	x	x

- Operator Controls:
  - **0** = No Controls
  - **1** = Speed Pot, Run-Stop-Jog
  - **2** = Speed Pot, Run-Stop-Jog, & Fwd-Rev Switch Reversing
  - **3** = Speed Pot, Run-Stop-Jog, & Fwd-Rev Contactor Reversing
  - **7** = Speed Pot, Run-Stop-Jog, & Auto-Manual
- Enclosure: **No Letter** = Chassis, **P** = Enclosed (top cover)
- Armature Contactor: **No Letter** = None, **A** = Armature Contactor Reversing with DB, **B** = Armature Contactor with DB
- Current Step
- Drive Series Revision Level
- **1** = 2120 Ultra Compact, **2** = 2230 Regen Feature Rich, **3** = 2330 Non-Regen Full Featured, **6** = 2610 Non-Regen Feature Rich
- **2** = Single Phase Input Drive Model

Fincor Single Phase DC Selection Chart



Contact your local Distributor, Control Techniques' Representative or see www.emersonct.com for upgrade and cross reference information regarding Focus, Puma or Lynx series DC drives.

Fincor Non-Regen Drives

Non-regenerative drives are typically used on applications which primarily motor in one direction and stopping is achieved through friction or infrequent use of a dynamic braking resistor. These drives may provide speed or torque control from a potentiometer or unidirectional (0-10 VDC or 4-20 mA) control signal. Reversing requires a switch or contact closure to initiate the change. Upon the reversing signal, the drive will allow the motor to coast to a stop (or perform a control stop under a decel ramp with control stop option) or utilize a dynamic braking resistor to pull it to a stop before switching the motor leads with a contactor and starting the motor in the opposite direction.

Fincor Series 2120

Fincor Series 2100 drives feature compact size and lowest pricing. Chassis units are dimensionally interchangeable with many competitive units and are ideal for the OEM or panel builder who builds a custom system by integrating the drive into an enclosure with special logic or auxiliary control devices. NEMA 1 enclosed units are complete self-contained packages ready for wall or machine mounting.

- **1/8 to 3 hp (115 -230V)**
- **Budget Priced**
- **Speed Control**
- **Current Limit**
- **UL Listed**



RATINGS: 1/8 TO 3 hp (115-230 VAC)

Series 2100 Non-Regenerative DC Drives								
Model	**Motor HP** [2]	**Input**		**Output**				**RUN-STOP**
		AC Volts	**Amps**	**DC Volts**		**Amps**		**Order Code**
				Arm	**Field**	**Arm**	**Field**	
Chassis[1]	1/8-1/2	115	8.7	90	50/100	5.4	1.0	2121
	1/8-1/2	115	8.7	90	50/100	5.4	1.0	2122
	1/2-1.0	230	8.8	180	100/200	5.5	1.0	
	1/8-1.0	115	15	90	50/100	10.5	1.0	2122H
	1/2-2.0	230	15.8	180	100/200	11.6	1.0	
	1/8-1.0	115	15	90	50/100	10.5	1.0	2123
	1/2-3.0	230	24	180	100/200	16	1.0	
NEMA 1 Enclosed	1/8-1/2	115	8.7	90	50/100	5.4	1.0	2121P1
	1/2-1.0	230	8.7	180	100/200	5.4	1.0	2122P1

(2) Units may be easily recalibrated using trimpots for any standard rating within the hp range.

Option Description	Order Code
Knob and Dial Plate Kit — This option provides a knob and a dial face graduated 0-100% for use with the potentiometer provided with Series 2120 chassis drives.	2067109
External Signal Follower/Isolation — For use with isolated or non isolated 4-20 mA DC, 0-10 VDC signals. Includes a scaling potentiometer for offset adjustment. Dimensions 1.5" (38) X 3.38" (86) X .75" (19).	106409401

Fincor Series 2120

SPECIFICATIONS:

Operating Conditions

Horsepower	1/8 thru 3 hp , Trim Pot Selectable
Line Voltage	115-230 VAC ±10%, Bi Voltage Input*
Rated Frequency	50/60 Hz ±2%
Enclosure	Chassis, NEMA 1
Ambient Temperature	0 – 40°C (32°F - 104°F) (*Enclosed*)
	0 – 55°C (32°F - 131°F) (*Chassis*)
Altitude	1000 m (3,300 ft)
Relative Humidity	95% Non condensing
Overload Capacity	150% for 1 minute

Standard Features

Regulator Function	Speed Regulated
Power Conversion	2 SCR plus Freewheeling Diode
Field Supply	Full Wave
Protection	MOV Voltage Transient Suppression High Interrupting Capacity Line Fuse
Speed Regulation	Armature or DC Tach Feedback*

Control

Control Logic Power	Common for Maintained Switch
Speed Potentiometer	5K Ohms, ½ Watt
Input Reference	0 – 10 VDC
Speed Regulation (95% Load Change)	2% with Armature Feedback 1% with Tachometer Feedback*

Adjustments

Maximum Speed	60% – 100% of Motor Base Speed
Minimum Speed	0% – 40% of Motor Base Speed
Current Limit	0 – 150% of Full Load
IR Compensation	0 – 100% Boost
Acceleration/Deceleration	0-4 Seconds*

Efficiency

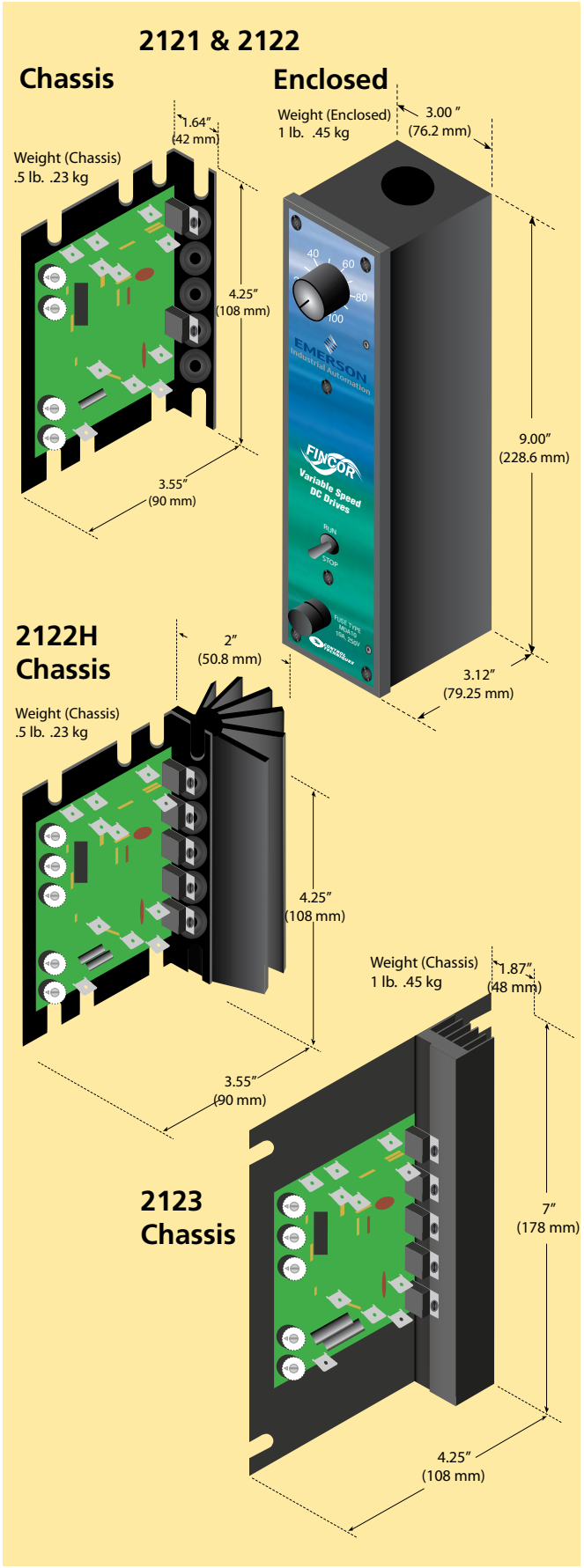
Controller (only)	98%
With Motor (typical)	85%

Approvals & Listings

UL and cUL

* The 2121, 2121P1 and 2122P1 are single input voltage (115, 115 & 230 VAC respectively), do not offer DC Tach Feedback, and have fixed acceleration and deceleration rates.

DIMENSIONS



Fincor Series 2330

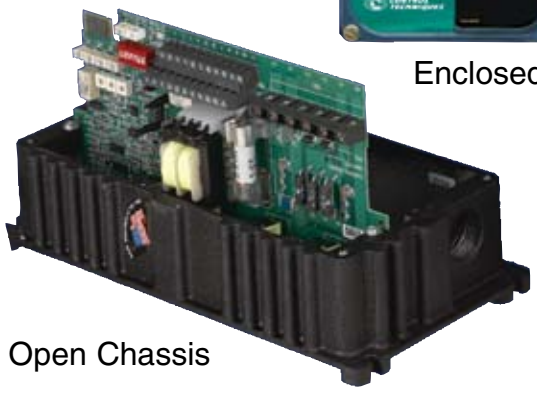
Fincor Series 2330 drives features a fully isolated regulator using surface mount technology. It includes an isolated customer run contact, low voltage operator control circuitry, and full wave power conversion.



Bookcase



Enclosed



Open Chassis

- **1/8 to 5 hp (115-230V)**
- **Fully Isolated Regulator**
- **Speed or Torque Control**
- **0-10 VDC or 4-20 mA Input Signal**
- **Fused Input**
- **Line Start (Auto Restart)**
- **Dual Field Supply**
- **Tachometer Input standard**

RATINGS: 1/8 TO 5 hp (115-230 VAC)

Series 2330 Non-Regenerative DC Drives

Model	Motor HP	Input		Output				Run-Stop, (Basic)	Run-Stop, Arm. Cont. DB	Run-Stop, Arm. Cont., Rev. & DB
		AC Volts	Amps	DC Volts		Amps		Order Code	Order Code	Order Code
				Arm	Field	Arm	Field			
Chassis w/o Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2331	2331B	2331A
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2332	2332B	2332A
	1/2-3.0	230	22	180	100/200	15.1	1.0			
Bookcase w/o Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2335	2235B	2235A
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2336	2336B	2336A
	1/2-3.0	230	22	180	100/200	15.1	1.0			
NEMA 4/12 w/o Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2331P0	2331BP0	2331AP0
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
NEMA 4/12 with Integral Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2331P1*	2331BP1*	2331AP3
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0			2331P2*
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			

Units shipped calibrated for desired hp rating but jumpers can be adjusted for others. Units shipped ready for 230VAC but may be reconnected for 115VAC.

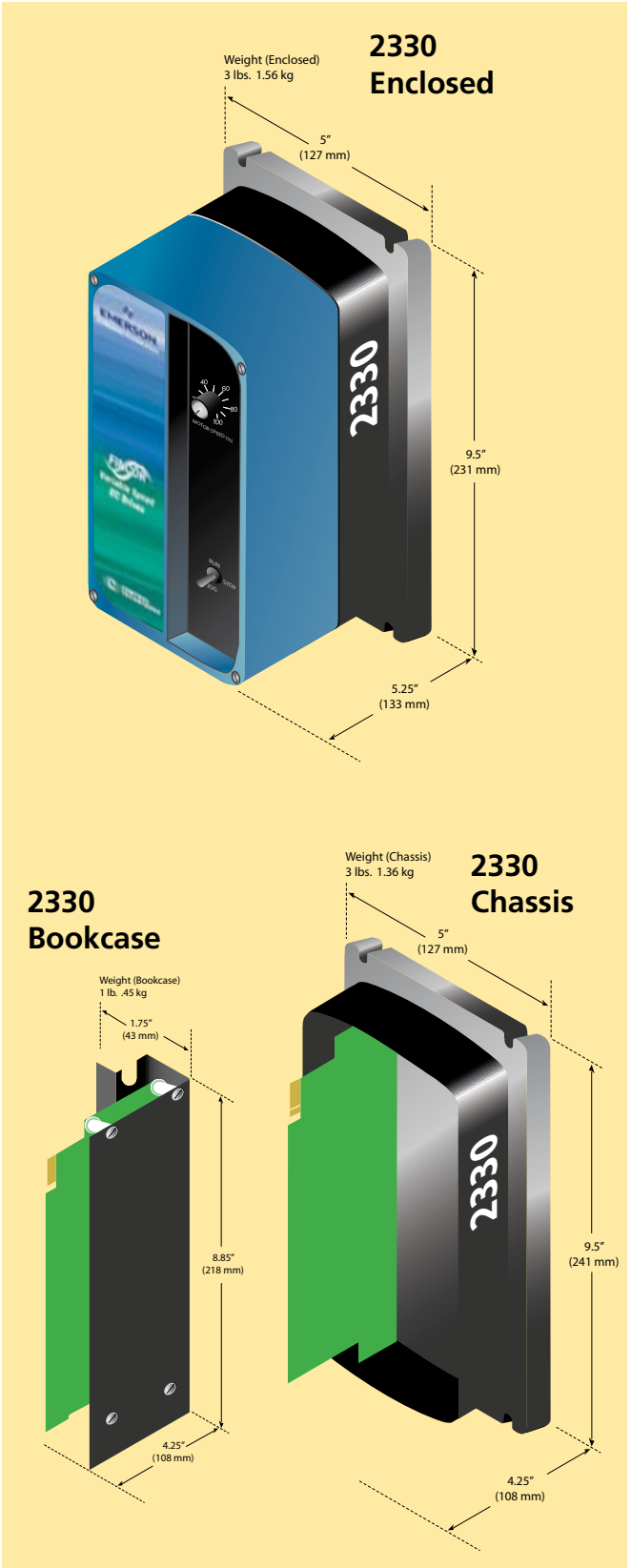
* P1, BP1, & P2 have additional Jog controls. 2331P2 includes switch reversing (not contactor) without DB.

Fincor Series 2330

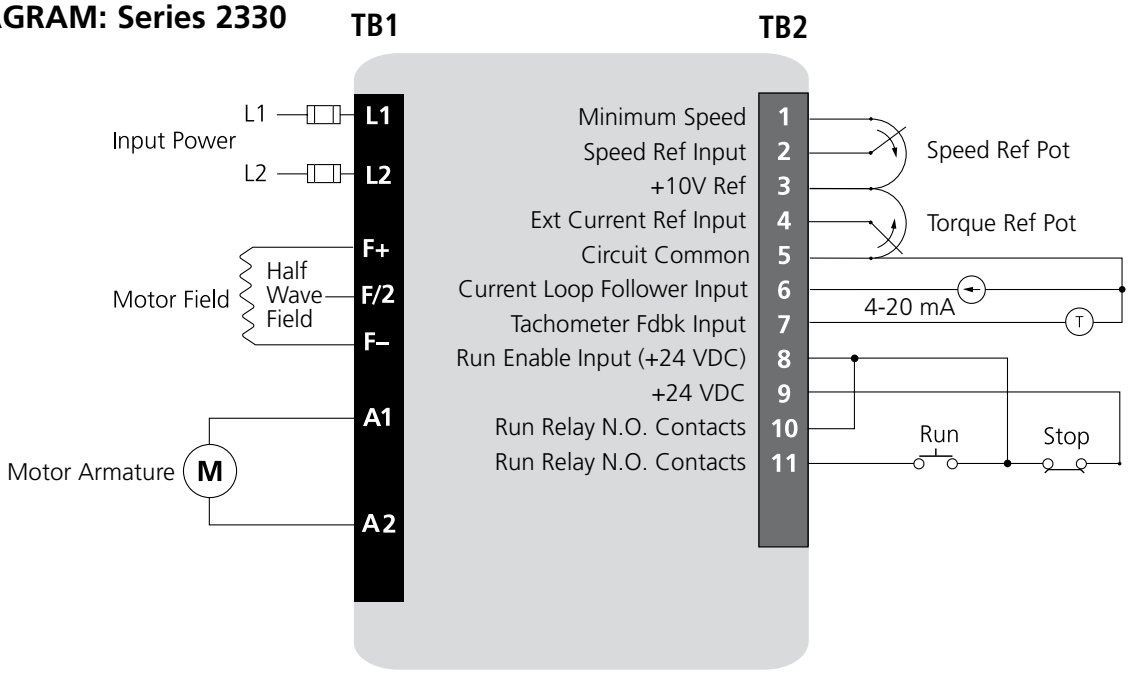
SPECIFICATIONS:

Operating Conditions	
Horsepower	1/8 thru 3 hp, Jumper Selectable
Line Voltage	115-230 VAC ±10%, Jumper Selectable
Rated Frequency	50/60 Hz ±2%
Enclosure	Chassis, Bookcase, NEMA 4/12
Ambient Temperature	0 – 40°C (32°F - 104°F) (*Enclosed*)
	0 – 55°C (32°F - 131°F) (*Chassis*)
Altitude	1000 m (3,300 ft)
Relative Humidity	95% Non condensing
Overload Capacity	150% for 1 minute (UL Listed Motor Overload Protection) (120% Timing Threshold)
Standard Features	
Isolated Regulator Circuit	Grounded I/O signals possible
Regulator Function	Speed or Torque selectable
Power Conversion	4 SCR plus Freewheeling Diode
Field Supply	Full or Half Wave
Protection	MOV Voltage Transient Suppression High Interrupting Capacity Line Fuse
Speed Regulation	Armature or DC Tach Feedback
Line Start	Selectable for Auto Restart
Diagnostic LED	Green Normal – Red Current Limit
Option Connector	Connects Additional Option Boards
Control	
Control Logic Power	24 VDC for Maintained Switch or Push button Operation
Speed Potentiometer	5 KOhms, ½ Watt
Input Reference	0 – 10 VDC or 4 – 20 mA
Speed Regulation (95% Load Change)	2% with Armature Feedback 0.5% with Tachometer Feedback
Adjustments	
Maximum Speed	50% – 100% of Motor Base Speed
Minimum Speed	0% – 40% of Motor Base Speed
Current Limit	0 – 150% of Full Load
IR Compensation	0 – 100% Boost
Acceleration/Deceleration	0.2 – 30 Seconds
Efficiency	
Controller (only)	98%
With Motor (typical)	85%
Approvals & Listings	
UL and cUL	

DIMENSIONS



TERMINAL DIAGRAM: Series 2330



TERMINAL DESCRIPTION

TB1

Pin#	Type	Notes
L1	Line Voltage Input	115 or 230 VAC J1 Selectable
L2	Line Voltage Input	115 or 230 VAC J1 Selectable
F+	Field Voltage Output	+100 VDC @ 115 VAC or +200 VDC @230 VAC Input
F/2	Field Voltage (Half-Wave) Output	+50 VDC @ 115 VAC or +100 VDC @230 VAC Input
F-	Field Voltage Output	Field Minus Output
A1	Armature + Output	0 to +90 VDC @ 115 VAC or 0 to +180 VDC @ 230 VAC Input
A2	Armature - Output	Armature Minus Output

TB2

Pin#	Type	Notes
1	Speed Reference Pot '0' End	With On-board Min Speed Pot Active
2	Speed Reference Input	200 KΩ Input Resistance
3	+10V Reference Output	5mA max
4	External Current Reference Input FWD	Refer to DIP Switch SW3-
5	Circuit Common	Isolated From Line – Can be connected to Earth
6	Current Loop Follower Input	Refer to DIP Switch SW3-2 (1 – 5 mA, 4 – 20 mA, 5 – 50 mA)
7	Tachometer Input (Speed Feedback)	Polarity Insensitive for Reversing Applications (3-30 Vdc, 31-175 VDC)
8	Enable Input (+24 VDC) – Run Relay	24 VDC @ 6ma Input
9	+24 VDC	For drive enable use only
10	Run Relay N.O. Contacts	Form A Contact Rated 0.5 A @ 115 VAC or 2 A @ 30 VDC
11	Run Relay N.O. Contacts	

Fincor Series 2610

Fincor Series 2610 drives feature a fully isolated regulator using surface mount technology. It includes additional inputs and outputs with advanced control capabilities.

- **1/8 to 5 hp (115 – 230 VAC)**
- **Fully Isolated Regulator**
- **Speed or Torque Control**
- **0 – 10 VDC or 4 – 20 mA input signal**
- **PID / Speed Trim Control**
- **Monitoring Output (0 – 10 VDC or 4 – 20 mA)**
- **Line Start /Auto Restart Enable/Disable**
- **Dual Field Supply**
- **DC-Tachometer Input**

2610 Enclosed



Open Chassis

RATINGS: 1/8 TO 5 hp (115-230 VAC)

Series 2610 Non-Regenerative DC Drives										
Model	**Motor HP**	**Input**		**Output**				**Run-Stop, (Basic)**	**Run-Stop, Arm. Cont. DB**	**Run-Stop, Arm. Cont., Rev. & DB**
		AC Volts	**Amps**	**DC Volts**		**Amps**		**Order Code**	**Order Code**	**Order Code**
				Arm	**Field**	**Arm**	**Field**			
Chassis	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2611	2611B	2611A
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2612	2612B	2612A
	1/2-3.0	230	22	180	100/200	15.1	1.5			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2613	2613B	2613A
	1/2 -5.0	230	32	180	100/200	25	2.0			
Bookcase w/o Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2615	2615B	2615A
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
NEMA 4/12 w/o Integral Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2611P0	2611BP0	2611AP0
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2613P0	2613BP0	2613AP0
	1/2-5.0	230	32	180	100/200	25	2.0			
NEMA 4/12 with Integral Operator Controls	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2611P1*	2611BP1*	2611AP3*
	1/2-2.0	230	15.8	180	100/200	10.5	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2613P1*	2613BP1	2613AP3*
	1/2-5.0	230	32	180	100/200	25	2.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0			2611P2*
	1/2-2.0	230	15.8	180	100/200	11.6	1.0			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2611P7	2611BP7	Manual / Auto Switch.
	1/2-2.0	230	22	180	100/200	15.1	1.5			
	1/8-1.0	115	15.8	90	50/100	10.5	1.0	2613P7	2613BP7	
	1/2-5.0	230	32	180	100/200	25	2.0			

Units shipped calibrated for desired hp rating but jumpers can be adjusted for others. Units shipped ready for 230 VAC but may be reconnected for 115 VAC.

* P1, PB1, AP3, P2 have additional Jog controls. 2611P2 includes switch reversing (not contactor) without DB.

Fincor Series 2610

SPECIFICATIONS:

Operating Conditions

Horsepower	1/8 thru 5 hp, Jumper Selectable
Line Voltage	115-230 VAC ±10%, Jumper Selectable
Rated Frequency	50/60 Hz ±2%
Enclosure	Chassis, Bookcase, NEMA 4/12
Ambient Temperature	0 – 40°C (32°F - 104°F) (*Enclosed*) 0 – 55°C (32°F - 131°F) (*Chassis*)
Altitude	1000 m (3,300 ft)
Relative Humidity	95% Non condensing
Overload Capacity	150% for 1 minute (UL Listed Motor Overload Protection – File # E184521) (120% Timing Threshold)

Standard Features

Isolated Regulator Function	Grounded I/O signals possible
Regulator Function	Speed or Torque selectable
Power Conversion	4 SCR plus Freewheeling Diode
Field Supply	Full or Half Wave
Protection	MOV Voltage Transient Suppression High Interrupting Capacity Line Fuse
Speed Regulation	Armature or DC Tach Feedback
Line Start	Selectable for Auto-Restart
Controlled Stop	Provides ramp to stop function
Zero Speed Indication	Open Collector – Active Low
Speed Regulation Node	External PID Input or Speed Trim
Speed Outputs	0 – 10 VDC and 4 – 20 mA
Torque Outputs	0 – 10 VDC and 4 – 20 mA
Diagnostic LED	Green Normal – Red Current Limit
Option Connector	Connects Additional Option Boards

Control

Control Logic Power	24 VDC for Maintained Switch or Push button Operation
Speed Potentiometer	5 kOhms, ½ Watt
Input Reference	0 – 10 VDC or -10 – +10 VDC
Speed Regulation (95% Load Change)	2% with Armature Feedback 0.5% with Tachometer Feedback

Adjustments

Maximum Speed	50% – 100% of Motor Base Speed
Minimum Speed	50% – 40% of Motor Base Speed
Current Torque Limit	0% – 150% of Full Load
IR Compensation	0 – 10% Boost
Acceleration/Deceleration	0.1 – 30 Seconds
Voltage (Speed) Stability	Speed Gain Fine Tune
Current (Torque) Stability	Current Gain Fine Tune

Efficiency

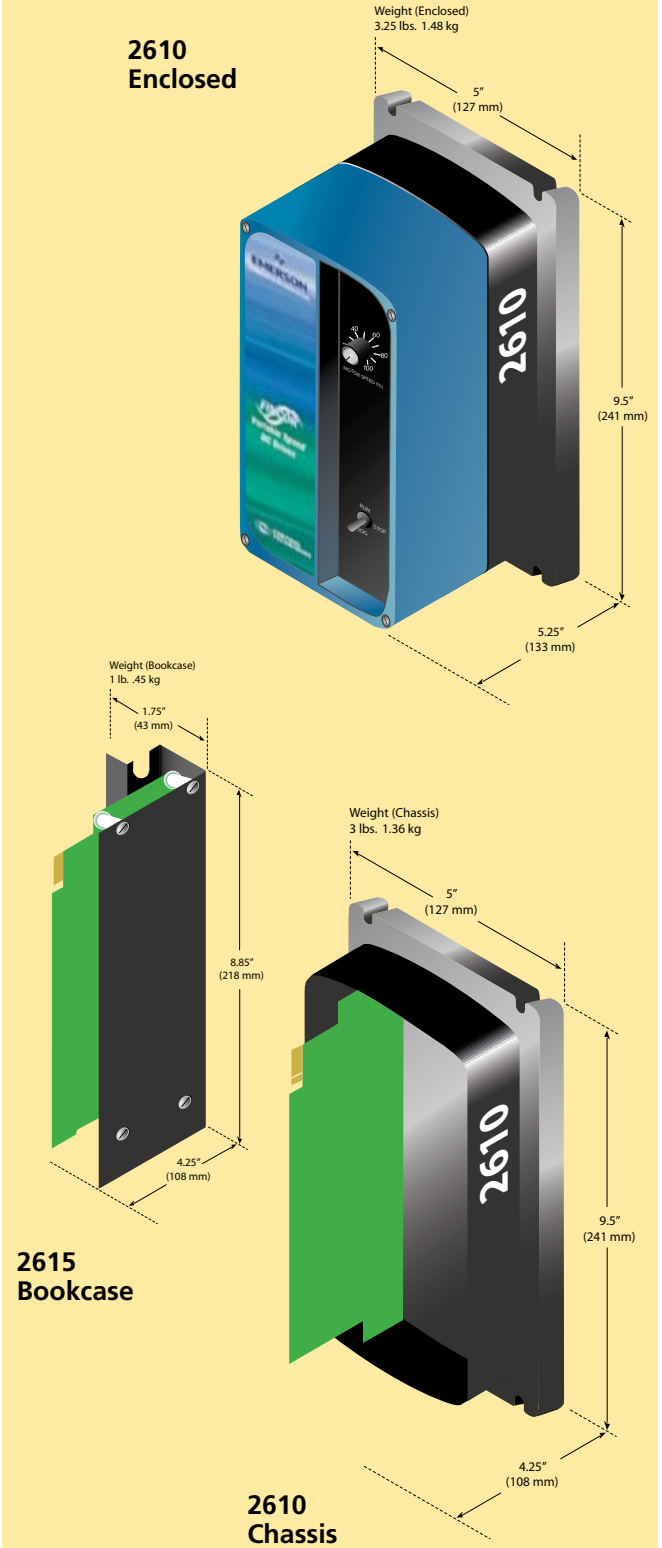
Controller (only)	98%
With Motor (typical)	85%

Approvals & Listings

UL and cUL

DIMENSIONS

2613Px Enclosed and
2613 Chassis see page 293



Fincor Series 2613 & 2233 5 hp drive dimensions

NEW





The new 5 hp rating in the 2613 non-regenerative series and the 2233 regenerative series combine industry leading Fincor electronics with the Control Techniques Focus series enclosure to achieve more customer value.

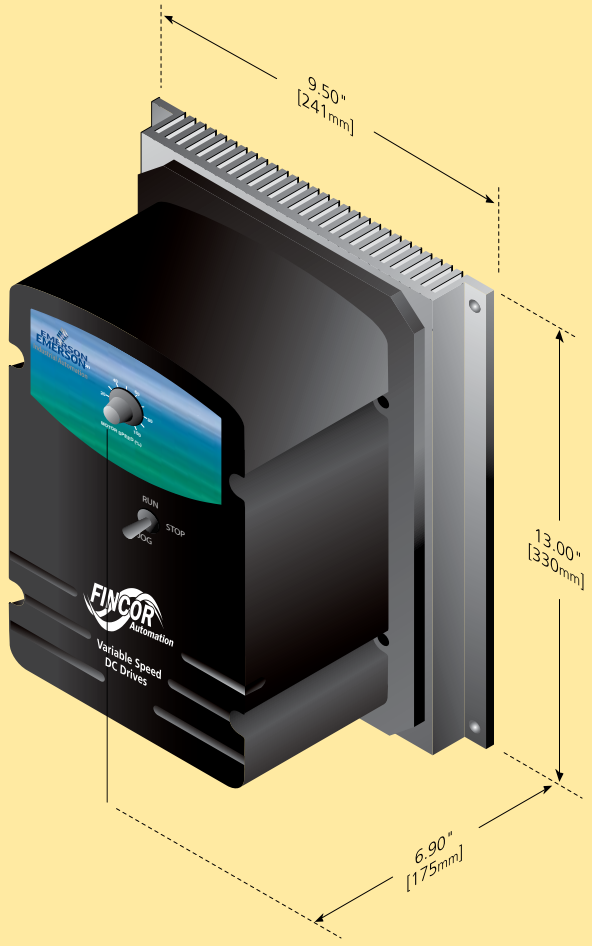
Standard features include a fully isolated circuit board using surface mount technology, speed or torque control, PID/Speed Trim control, Monitoring Output, and DC Tachometer Input.

Please see the respective 2610 series and 2230 series sections for specifications and more details regarding these drives..

DIMENSIONS

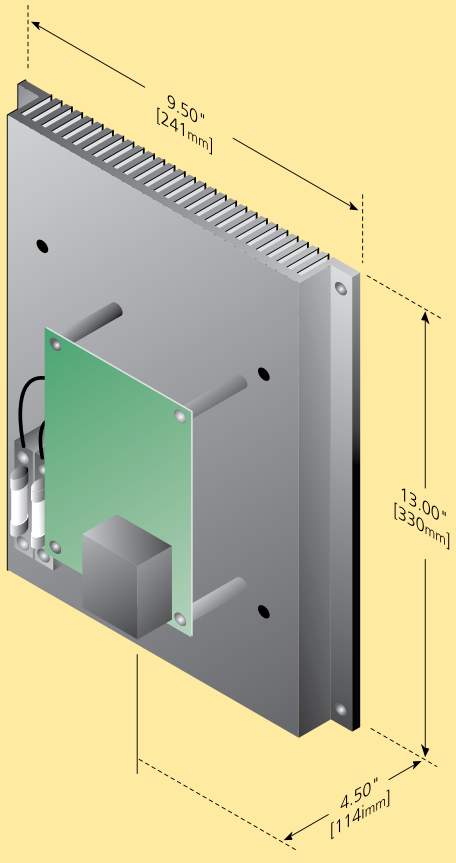
2613
2233
Enclosed

Weight (Enclosed)
14 lbs., 6.4 kg

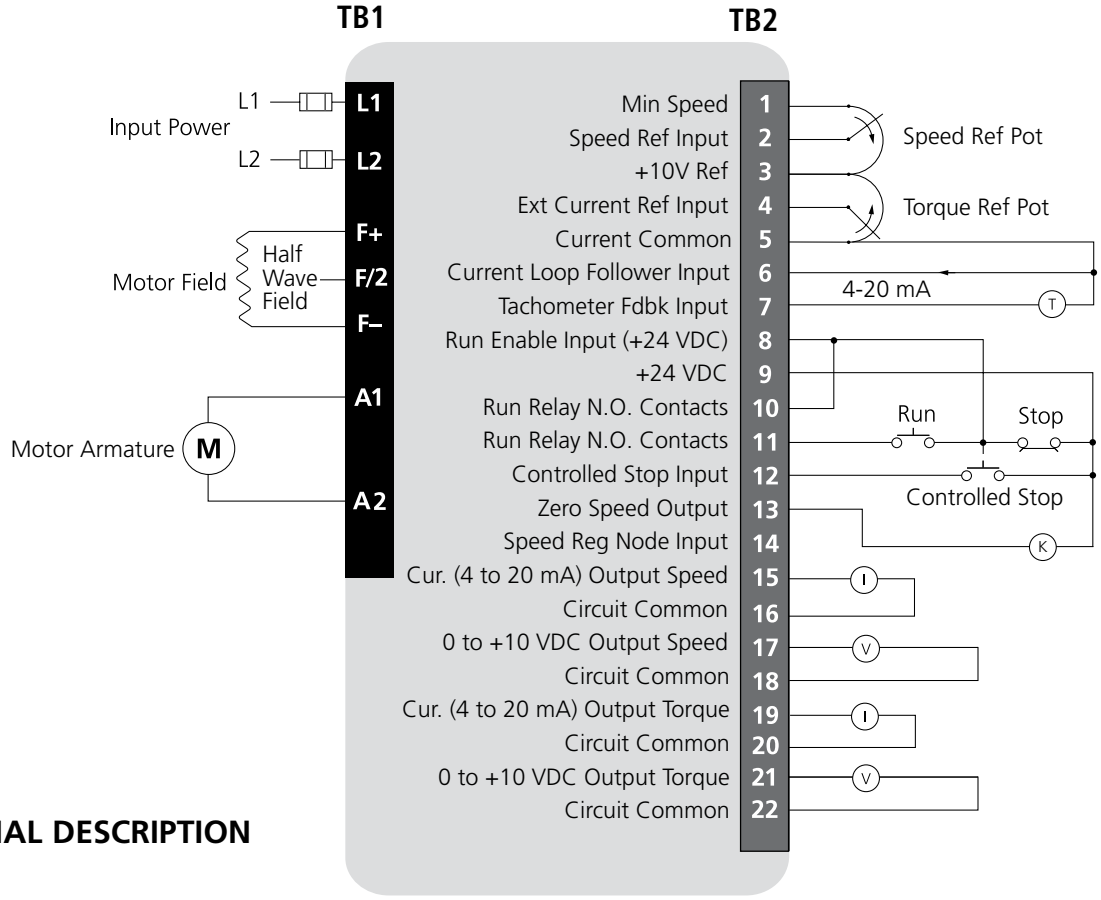


2613
2233
Chassis

Weight (Chassis)
12 lbs., 5.4 kg



TERMINAL DIAGRAM: Series 2610



TERMINAL DESCRIPTION

TB1

Pin#	Type	Notes
L1	Line Voltage Input	115 or 230 VAC J1 Selectable
L2	Line Voltage Input	115 or 230 VAC J1 Selectable
F+	Field Voltage Output	+100 VDC @ 115 VAC or +200 VDC @230 VAC Input
F/2	Field Voltage (Half-Wave) Output	+50 VDC @ 115 VAC or +100 VDC @230 VAC Input
F-	Field Voltage Output	Field Minus Output
A1	Armature + Output	0 to +90 VDC @ 115 VAC or 0 to +180 VDC @ 230 VAC Input
A2	Armature - Output	Armature Minus Output

TB2

Pin#	Type	Notes
1	Speed Reference Pot '0' End	With On-board Min Speed Pot Active
2	Speed Reference Input	200 KΩ Input Resistance
3	+10V Reference Output	5ma max
4	External Current Reference Input	Refer to DIP Switch SW3-2 (1 – 5 mA, 4 – 20 mA, 5 – 50 mA)
5	Circuit Common	Isolated From Line – Can be connected to Earth
6	Current Loop Follower Input	Refer to DIP Switch SW3-2 (1 – 5 mA, 4 – 20 mA, 5 – 50 mA)
7	Tachometer Input (Speed Feedback)	Polarity Insensitive for Reversing Applications (3-30 VDC, 31-175 VDC)

TB2 Continued

Pin#	Type	Notes
8	Enable Input (+24 VDC) – Run Relay	24 VDC @ 6 mA Input
9	+24 VDC	For drive enable use only
10	Run Relay N.O. Contacts	Form A Contact Rated 0.5A @ 115 VAC or 2A @ 30 VDC
11	Run Relay N.O. Contacts	
12	Controlled Stop Input (+24 VDC)	Momentary +24 VDC Input to Initiate Controlled (Ramp) to Stop
13	Zero Speed Indication Output	Open Collector, Active Low, Rated 24 VDC @ 50 mA
14	Speed Regulator Node Input	Speed Trim or External PID Input (Bypasses Accel/Decel Ramps)
15	Current Loop Output	4 to 20 mA – Speed (Arm Volts)
16	Current Loop Output	4 to 20 mA – Speed (Arm Volts)
17	Voltage Output	0 to 10 VDC – Speed (Arm Volts)
18	Voltage Output Common	Isolated From Line – Can be connected to Earth
19	Current Loop	Output 4 to 20 mA – Torque (Arm Amps)
20	Current Loop	
21	Voltage Output	0 to 10 VDC – Load (Arm Amps)
22	Voltage Output Common	Isolated From Line – Can be connected to Earth

Fincor Regenerative DC Drives

Regenerative adjustable speed drives also known as four-quadrant drives, are capable of controlling not only the speed and direction of motor rotation, but also the direction of motor torque. This is illustrated below.

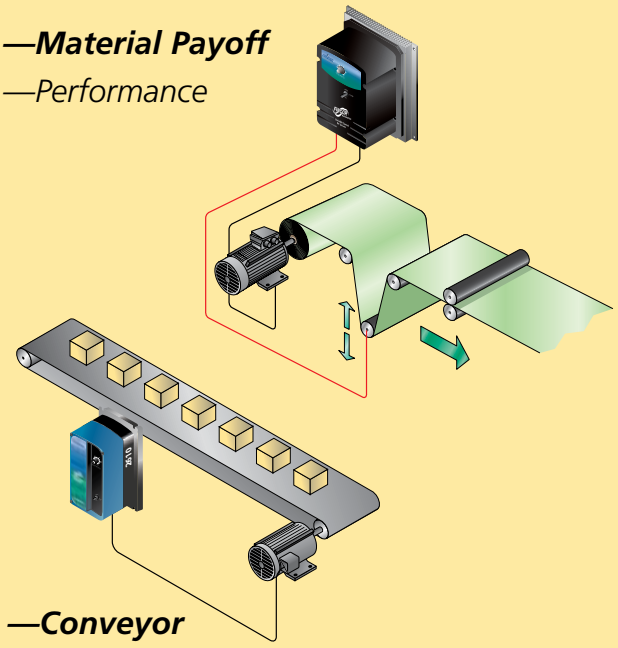
The term regenerative describes the ability of the drive under braking conditions to convert the mechanical energy of the motor and connected load into electrical energy which is returned (or regenerated) to the AC power source.

When the drive is operating in Quadrants I & III, both motor rotation and torque are in the same direction and it functions as a conventional non-regenerative drive. The unique characteristics of a regenerative drive are apparent in Quadrants II & IV. In these quadrants, the motor torque opposes the direction of motor rotation which provides a controlled braking or retarding force. A high performance regenerative drive, such as the Series 2230, is able to switch rapidly from motoring to braking modes while simultaneously controlling the direction of motor rotation.

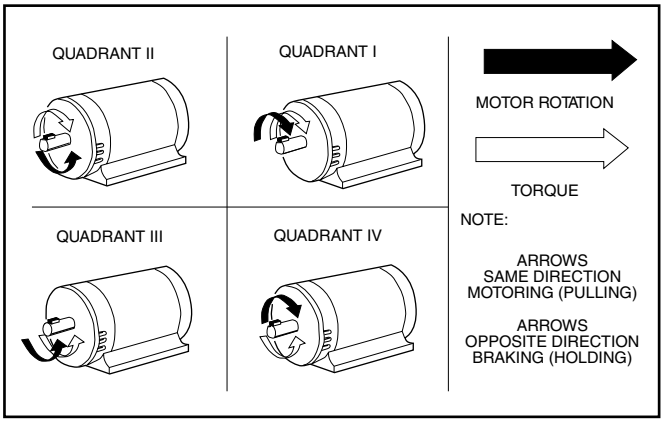


TYPICAL APPLICATIONS

—Material Payoff
—Performance



—Conveyor
—Reliable



Regenerative drives provide reversing without the use of a contactor. This reduces system cost while eliminating moving parts and greatly improving reversing and braking performance.

Although the regenerative drive eliminates the requirement of a contactor for reversing or normal operational braking, a contactor is used if dynamic braking is still required. Although regenerative braking stops the motor and it's load faster under normal conditions, a dynamic brake may be required to stop the motor and it's connected load in emergency stop conditions such as drive failure or if the drive enable is removed before the motor comes to a complete stop.

Fincor Series 2230

Fincor Series 2230 regenerative drives are ideal for your more demanding application with ratings up to 5 horsepower. Regenerative drives handle reversing without contactors and are able to stop faster. They feature a fully isolated regulator using surface mount technology.

- **1/8 to 5 hp (115-230V)**
- **Fully Isolated Regulator**
- **Speed or Torque Control**
- **0-10 VDC or +/- 10 VDC Input Signal**
- **PID / Speed Trim Control**
- **Current Stability Adjust**
- **Speed or Current Monitoring (0-10 VDC or 4-20 mA)**
- **Fused Input**
- **Line Start / Auto Restart Enable / Disable**
- **Dual Field Supply**
- **DC Tachometer Input**
- **Diagnostic LED**

2230 Enclosed



Open Chassis Bookcase

RATINGS: 1/8 TO 5 hp (115-230 VAC)

Series 2230 Regenerative DC Drives									
Model	**Motor HP**	**Input**		**Output**				**Run-Stop- Jog ***	**Run-Stop-Jog, DB ****
		AC Volts	**Amps**	**DC Volts**		**Amps**		**Order Code**	**Order Code**
				Arm	**Field**	**Arm**	**Field**		
Chassis w/o Integral Operator Controls	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2231	2231B
	1/2 - 2.0	230	15.8	180	100/200	11.6	1.0		
	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2232	2232B
	1/2 - 3.0	230	22	180	100/200	15.1	1.0		
	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2233	2233B
	1/2 - 5.0	230	32	180	100/200	25	2.0		
Book Case w/o Integral Operator Controls	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2235	2235B
	1/2 - 2.0	230	15.8	180	100/200	11.6	1.0		
	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2236	2236B
	1/2 - 3.0	230	22	180	100/200	15.1	1.0		
NEMA 4/12 w/o Operator Controls	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2231P0	2231BP0
	1/2 - 2.0	230	15.8	180	100/200	11.6	1.0		
	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2233P0	2233BP0
	1/2 - 5.0	230	32	180	100/200	25	2.0		
NEMA 4/12 with Integral Operator Controls	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2231P1	2231BP1
	1/2 - 2.0	230	15.8	180	100/200	11.6	1.0		
	1/8 - 1.0	115	15.8	90	50/100	10.5	1.0	2233P1	2233BP1
	1/2 - 5.0	230	32	180	100/200	25	2.0		

Units shipped calibrated for desired hp rating but jumpers can be adjusted for others. Units shipped ready for 230 VAC but may be reconnected for 115 VAC.

* Run-Stop-Jog with Static (Contactor-less) Reversing using -100 to 100% Speed Potentiometer
** Run-Stop-Jog with Armature Contactor and Dynamic Braking. Reversing uses -100 to 100% Speed Potentiometer

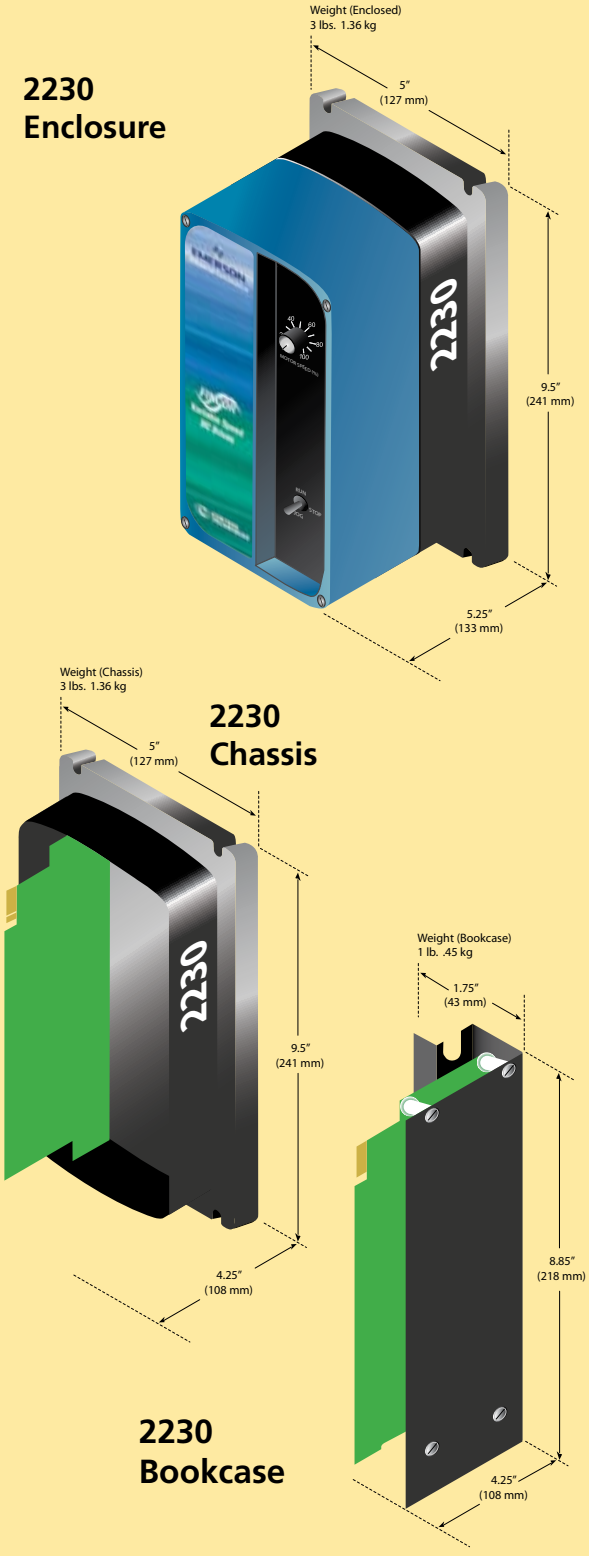
Fincor Series 2230

SPECIFICATIONS:

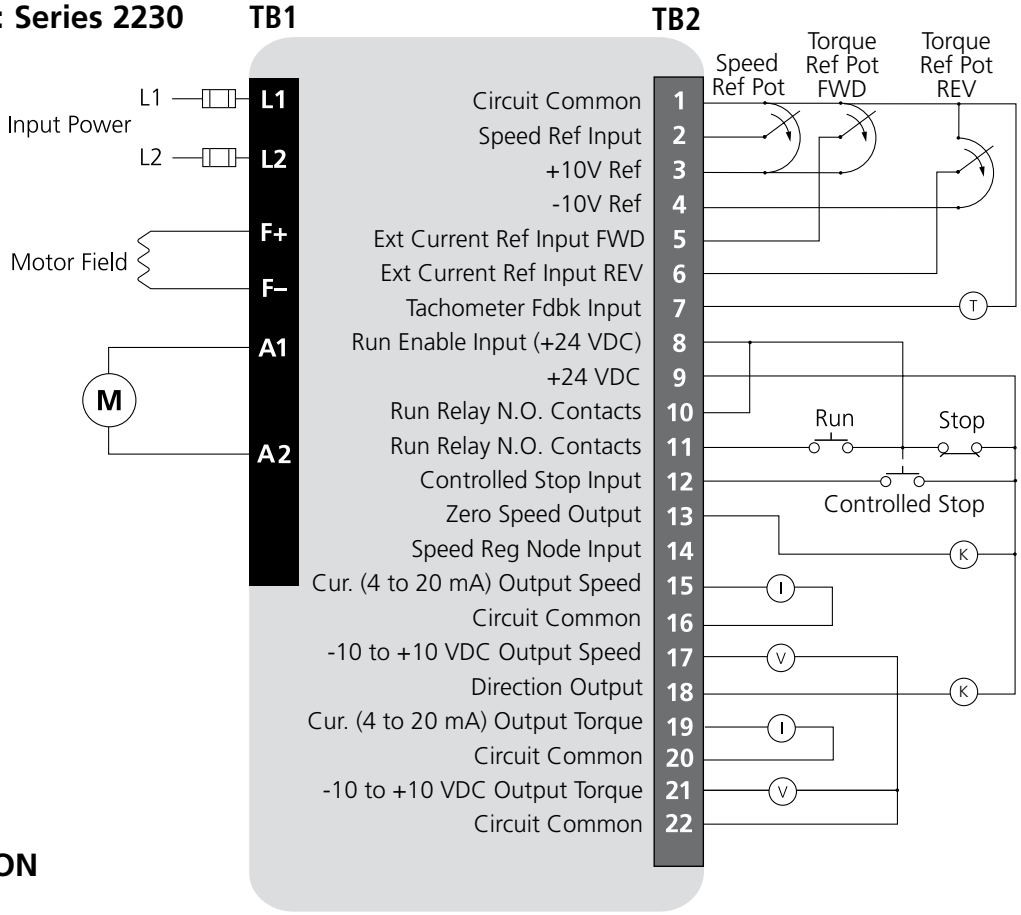
Operating Conditions	
Horsepower	1/8 thru 5 hp, Jumper Selectable
Line Voltage	115-230 VAC ±10%, Jumper Selectable
Enclosure	Chassis, Bookcase, NEMA 4/12
Rated Frequency	50/60 Hz ±2% Selectable
Ambient Temperature	0 – 40°C (32°F - 104°F) (*Enclosed*) 0 – 55°C (32°F - 131°F) (*Chassis*)
Altitude	1000 m (3,300 ft)
Relative Humidity	95% Non condensing
Overload Capacity	150% for 1 minute (UL Listed Motor Overload Protection – File # E184521) (120% Timing Threshold)
Standard Features	
Isolated Regulator Circuit	Grounded I/O signals possible
Regulator Function	Speed or Torque selectable
Power Conversion	8 SCR Full Wave - Four Quadrant
Field Supply	Full Wave
Protection	MOV Voltage Transient Suppression High Interrupting Capacity Line Fuse
Speed Regulation	Armature or DC Tach Feedback
Line Start	Selectable for Auto-Restart
Controlled Stop	Provides Ramp to Stop Function
Zero Speed Deadband	Selectable 2% or Off
Zero Speed Indication	Open Collector – Active Low
Direction Indication	Open Collector – Active Low = FWD
Speed Regulator Node	External PID Input or Speed Trim
Speed Outputs	-10 – 10 VDC and 4 – 20 mA
Torque Outputs	-10 – 10 VDC and 4 – 20 mA
Diagnostic LED	Green Normal – Red Current Limit
Option Connector	Connects Additional Option Boards
Control	
Control Logic Power	24 VDC for Maintained Switch or Push button Operation
Speed Potentiometer	5 kOhms, ½ Watt
Input Reference	0 – 10 VDC or -10 – +10 VDC
Speed Regulation	2% with Armature Feedback
(95% Load Change)	0.5% with Tachometer Feedback
Adjustments	
Maximum Speed	50% – 100% of Motor Base Speed
Current Limit FWD	0 – 150% of Full Load
Current Limit REV	0 – 150% of Full Load
IR Comp/Tach Scaling	0 – 10% IR or 0 – 100% Tach
Acceleration/Deceleration	0.1 – 30 Seconds
Voltage (Speed) Stability	Speed Gain Fine Tune
Current Stability FWD	Current Gain FWD Fine Tune
Current Stability REV	Current Gain REV Fine Tune
Efficiency	
Controller (only)	98%
With Motor (typical)	85%
Approvals & Listings	
UL and cUL	

DIMENSIONS

2233Px Enclosed and
2233 Chassis see page 293



TERMINAL DIAGRAM: Series 2230



TERMINAL DESCRIPTION

TB1

Pin#	Type	Notes
L1	Line Voltage Input	115 or 230 VAC J1 Selectable
L2	Line Voltage Input	115 or 230 VAC J1 Selectable
F+	Field Voltage Output	+100 VDC @ 115 VAC or +200 VDC @230 VAC Input
F/2	Field Voltage (Half-Wave) Output	+50 VDC @ 115 VAC or +100 VDC @230 VAC Input
F-	Field Voltage Output	Field Minus Output
A1	Armature Output	-90 to +90 VDC @ 115 VAC or -180 to +180 VDC @ 230 VAC Input
A2	Armature Output	

TB2

Pin#	Type	Notes
1	Speed Reference Pot '0' End	Speed Pot Common for Unidirectional Operation
2	Speed Reference Input	200 KΩ Input Resistance
3	+10V Reference Output	5 mA max
4	-10V Reference Output	5 mA max
5	External Current Reference Input FWD	Refer to DIP Switch SW3-2
6	External Current Reference Input REV	Refer to DIP Switch SW3-7
7	Tachometer Input (Speed Feedback)	3-30 VDC, 31-175 VDC

TB2 Continued

Pin#	Type	Notes
8	Enable Input (+24 VDC) – Run Relay	24 VDC @ 6 mA Input
9	+24 VDC	For drive enable use only
10	Run Relay N.O. Contacts	Form A Contact Rated 0.5A @ 115 VAC or 2A @ 30 VDC
11	Run Relay N.O. Contacts	
12	Controlled Stop Input (+24 VDC)	Momentary +24 VDC Input to Initiate Controlled (Ramp) to Stop
13	Zero Speed Indication Output	Open Collector, Active Low, Rated 24 VDC @ 50ma
14	Speed Regulator Node Input	Speed Trim or External PID Input (Bypasses Accel/Decel Ramps)
15	Current Loop Output	4 to 20 mA – Speed (Arm Volts)
16	Current Loop Output	4 to 20 mA – Speed (Arm Volts)
17	Voltage Output	-10 to 10 VDC – Speed (Arm Volts)
18	Direction Indicator Output	Open Collector, Active Low for FWD; Rated 24 VDC @ 50 mA
19	Current Loop	Output 4 to 20 mA – Torque (Arm Amps)
20	Current Loop	
21	Voltage Output	-10 to 10 VDC – Load (Arm Amps)
22	Voltage Output Common	Isolated From Line – Can be connected to Earth

Fincor DC Motors

Shunt Wound DC Motors - Series 9200



Fincor Series 9200 motors are industrial rated general purpose DC motors designed for use with single-phase DC drives. Series 9200 motors are shunt-wound, or stabilized shunt-wound and are suitable for constant torque-adjustable speed operation by armature voltage control to base speed. The field winding is typically excited by a separate power supply. With constant armature voltage and field excitation, a shunt-wound motor offers relatively flat speed-torque characteristics.

Shunt Wound DC Motors - Series 9200

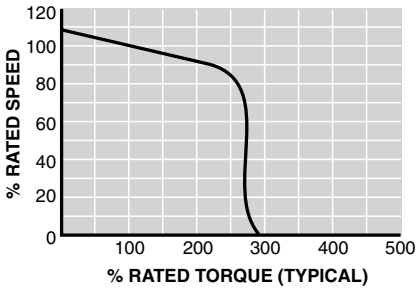
HP	Base Speed	Armature Volts	Armature Amps	Field Volts	Enclosure	Frame	Stock Number	Order Code	Weight (lbs)
1/6	1750	90	2	50/100	TEFC	56C	5002698	9201609TFB	23
1/4	1750	90	2.8	50/100	TEFC	56C	5002319	9202509TFB	24
1/3	1750	90	3.5	50/100	TEFC	56C	5002396	9203309TFB	24
1/2	1750	90	5.4	50/100	TEFC	56C	5002291	9205009TFB	29
		180	2.6	100/200	TEFC	56C	5002454	9205018TFB	29
3/4	1750	90	8.1	50/100	TEFC	56C	5002320	9207509TFB	34
		180	3.8	100/200	TEFC	56C	5002292	9207518TFB	34
1	1750	90	10.5	50/100	TEFC	56C	5002401	9210009TFB	52
		180	5.5	100/200	TEFC	56C	5002649	9210018TFB	53
1.5	1750	180	8.2	100/200	DPG	184C	5002378	9215018DPB	84
					TEFC	184C	5002648	9215018TFB	84
2	1750	180	11.6	100/200	DPG	184C	5002631	9220018DPB	98
					TEFC	184C	5002632	9220018TFB	98
3	1750	180	15.1	100/200	DPG	215C	5002248	9230018DPB	137
					TEFC	215C	5002284	9230018TFB	137
5	1750	180	24	100/200	DPG	256UC	5002297	9250018DPB	304
					TEFC	256UC	5002296	9250018TFB	304

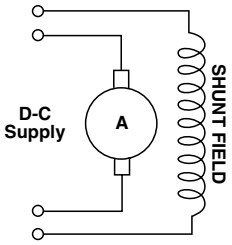
Options for Model TFB & DPB Series 9200 DC Motors

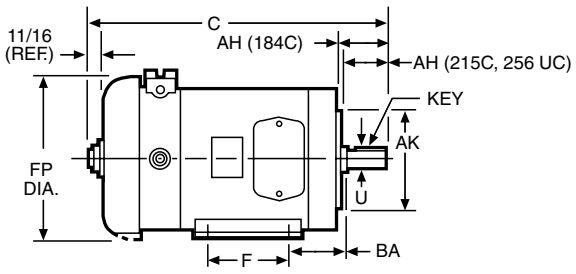
Description		Field Installed Order Code	Factory Installed Order Suffix
DC Tachometer Generator Type XPY, 50V/1000 rpm with mounting hardware	1/6 to 3/4 hp	106343222	-B5056
	1 hp	106343223	
	1.5 to 2 hp	106343224	
	3 hp DPG	106343225	
	3 hp TEFC	106343226	
	5 hp DPG	106343227	
	5 hp TEFC	106343228	
Mounting Hardware Only for XPY or Fincor DC Tachometer Generator for	1/6 to 3/4 hp	104355801	-B5063A
	1 hp	104355809	
	1.5 to 2 hp	104355808	
	3 hp DPG	104355804	
	3 hp TEFC	104355805	
	5 hp DPG	104355806	
	5 hp TEFC	104355807	
Thermostats			-B5064A

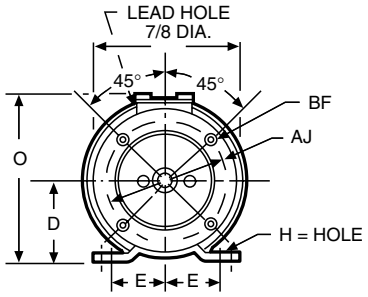
Field Installed items are shipped "loose" for customer mounting
Consult Factory for Availability

SPEED TORQUE CURVE



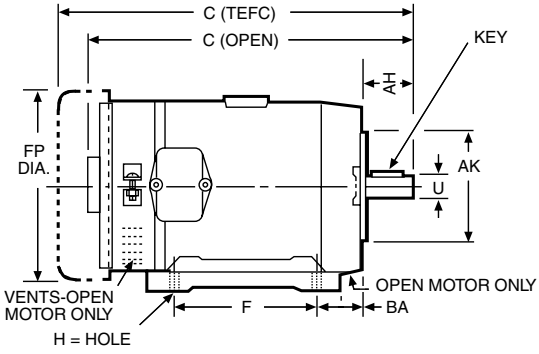


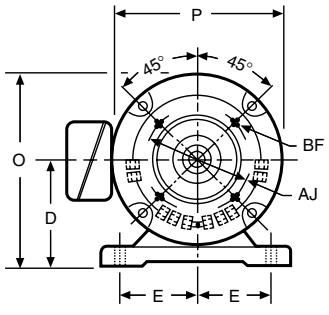




TBF Models

HP	Frame Size [1]	Model Number	Dimensions, Inches [2]														
			C	D	E	F	H	Key	O	P	U	AH	AJ	AK	BA	BF(tap)	FP
1/6	56C	9201609TFB	13.25	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
1/4		9202509TFB	13.25	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
1/3		9203309TFB	13.25	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
1/2		9205009TFB	14.25	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
		9205018TFB	14.25	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
3/4		9207509TFB	14.75	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
		9207518TFB	14.75	3.5	2.438	3.0 or 4.0	0.344 slot	0.188	7.25	5.688	0.625	2.06	5.875	4.5	2.75	3/8-16	6.125
1		9210009TFB	16.125	3.5	2.438	3.0	0.406 slot	0.188	7.75	6.625	0.625	2.06	5.875	4.5	2.75	3/8-16	7.188
		9210018TFB	16.125	3.5	2.438	3.0	0.406 slot	0.188	7.75	6.625	0.625	2.06	5.875	4.5	2.75	3/8-16	7.188





TBF & DPB Models

HP	Frame Size [1]	Model Number	Dimensions, Inches [2]														
			C	D	E	F	H	Key	O	P	U	AH	AJ	AK	BA	BF(tap)	FP
1-1/2	184C	9215018DPB	15.438	4.5	3.75	5.5	0.406	0.188	8.375	7.75	0.875	2.125	5.875	4.5	2.75	3/8-16	–
		9215018TFB	17.375	4.5	3.75	5.5	0.406	0.188	8.375	7.75	0.875	2.125	5.875	4.5	2.75	3/8-16	8.5
2		9220018DPB	18.625	4.5	3.75	5.5	0.406	0.188	8.375	7.875	0.875	2.125	5.875	4.5	2.75	3/8-16	8.5
		9220018TFB	18.625	4.5	3.75	5.5	0.406	0.188	8.375	7.75	0.875	2.125	5.875	4.5	2.75	3/8-16	8.5
3	215C	9230018DPB	20.938	5.25	4.25	7.0	0.406	0.25	9.938	9.375	1.125	2.75	7.25	8.5	3.5	1/2-13	–
		9230018TFB	21.188	5.25	4.25	7.0	0.406	0.25	9.938	9.375	1.125	2.75	7.25	8.5	3.5	1/2-13	10.188
5	256UC	9250018DPB	24.75	6.25	5.0	10.0	0.531	0.313	11.938	11.375	1.375	3.50	7.25	8.5	4.25	1/2-13	–
		9250018TFB	25.875	6.25	5.0	10.0	0.531	0.313	11.938	11.375	1.375	3.50	7.25	8.5	4.25	1/2-13	12.375

Notes:
1 1750 RPM Base Speed only.
2 Dimensions for estimating only.

Fincor DC Motors

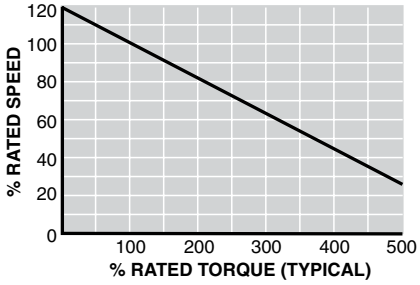
Permanent Magnet DC Motors
Series 9300

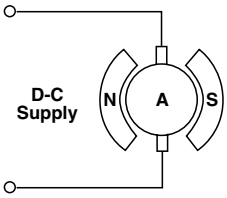


Fincor Series 9300 permanent magnet motors are industrial rated general purpose DC motors designed for use with single-phase DC drives. They provide constant-torque adjustable-speed operation by armature voltage control to base speed. The motors are suitable for a wide range of applications including full power start-stop conditions, continuous high speed operation, precision speed regulation, regenerative braking and reversing, low speed contactor reversing, power off dynamic braking, and crawling duty.

Series 9300 motors feature a permanent magnet field with a conventional wound armature and feature excellent starting torque, speed regulation, dynamic response, and heat dissipation. Series 9300 motors should only be plug reversed when reversing currents are limited to less than locked rotor current.

SPEED TORQUE CURVE





Permanent Magnet DC Motors - Series 9300

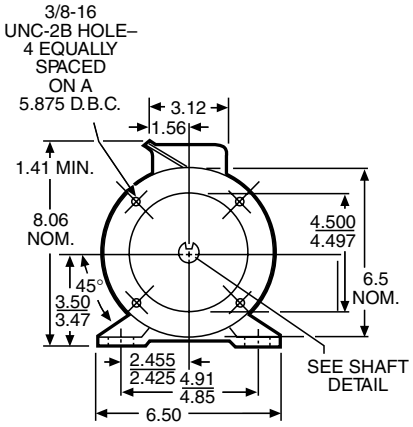
HP	Base Speed	Armature Volts	Armature Amps	Enclosure	Frame	Stock Number	Order Code	Weight (lbs)
1/6	1725	90	2.2	TENV	56C	5009322	9301609TNL	15
1/4	1725	90	2.5	TENV	56C	5009323	9302509TNL	17
1/3	1725	90	3.5	TENV	56C	5009324	9303309TNL	21
1/2	1725	90	5	TEFC	56C	5009325	9305009TFL	25
		180	2.5	TEFC	56C	5009326	9305018TFL	25
3/4	1725	90	7.3	TEFC	56C	5009327	9307509TFL	32
		180	3.8	TEFC	56C	5009328	9307518TFL	32
1	1725	90	10.6	TEFC	56C	5009329	9310009TFL	39
		180	5	TEFC	56C	5009330	9310018TFL	39
1.5	1750	180	7.5	TEFC	145TC	5009331	9315018TFL	68
2	1750	180	9.5	TEFC	145TC	5009332	9320018TFL	73
3	1750	180	12.9	TEFC	182/45TC	5009333	9330018TFL	93
5	1750	180	19.6	TEFC	1810ATC	5008070	9350018TFB	157

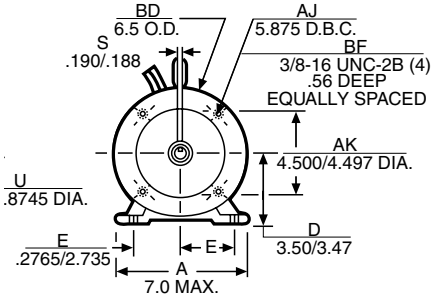
Removable Mounting Feet are Included
All items normally stocked

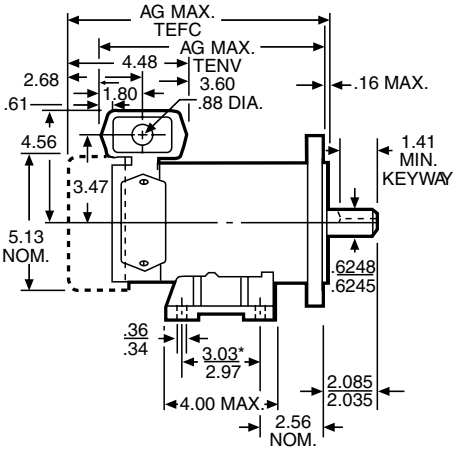
Options for Model TNL, TFL Series 9300 DC Motors

Description		Field Installed Order Code	Factory Installed Order Code
DC Tachometer Generator Type XPY, 50V/1000 rpm with mounting hardware	1/6 to 3/4 hp	106890101	-5056
	1 hp	106890102	
	182/145TC motor frames	106890103	
Mounting Hardware Only for XPY or DC Tachometer	1/6 to 3/4 hp	106890301	-5063A
	1 hp	106890302	
	182/145TC motor frames	106890303	
Thermostat			-5064A

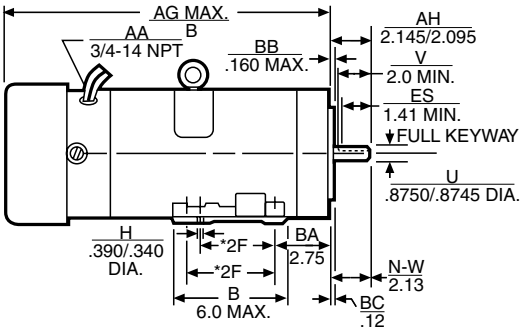
All motors are designed to comply with standard NEMA mounting dimensions, and manufactured to meet or exceed NEMA electrical and mechanical specifications and test procedures.







* MOUNTING FEET ARE OPTIONAL.



*The optional mounting feet have six mounting holes for mounting either the 143TC or 145TC Frame.
2F: 143TC Frame 4.030/3.970
2F: 145TC Frame 5.030/4.970

TNL & TFL Models

HP	Model Number	AG Maximum [1] ªA°	AG Maximum [1] ªB°	Wt. (lbs.) [2]	Enclosure
1/6	9301609TNL	7.13	–	15	TENV
1/4	9302509TNL	7.66	–	17	
1/3	9303309TNL	8.16	–	21	
1/2	9305009TFL	–	9.875	25	TEFC
	9305018TFL	–	9.875		
3/4	9307509TFL	–	12.375	32	
	9307518TFL	–	12.375		
1	9310009TFL	–	14.375	39	
	9310018TFL	–	14.375		

TFL Models

HP	Model Number	AG Maximum [1] ªB°	Wt. (lbs.) [2]	Enclosure
1 1/2	9315018TFL	16.35	68	TEFC
2	9320018TFL	17.35	73	
3	9330018TFL	19.75	93	

Notes:
1 To convert dimension figures shown to metric equivalents (mm) multiply by 25.4.
2 To convert weights shown to metric equivalents (kgs) multiply by 0.45.

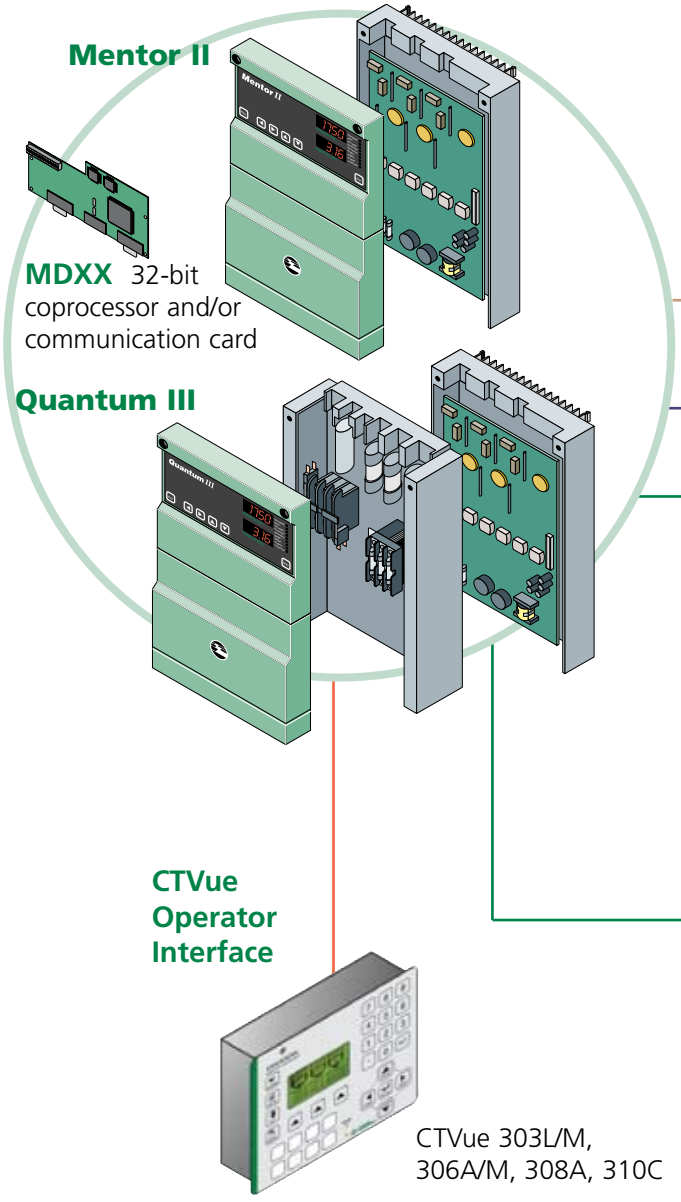
Mentor II & Quantum III

High Performance DC Drives

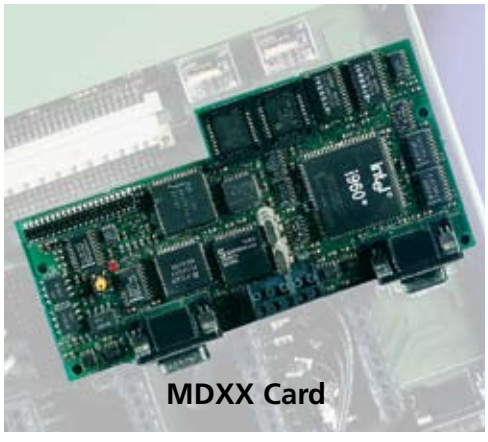


High Performance

Quantum / Mentor 32-bit Processor






MDXX Card

Communication Cards

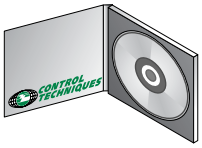
RS485	Standard
9729-9000	Modbus RTU
MD29AN	CTNet
MD-IBS	Interbus-S
MD24	Profibus-DP
MD25	DeviceNet
9500-9001	Modbus Plus

Distributed Control Cards

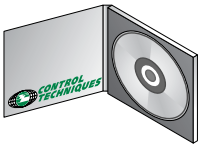
MD29 (9729-9000)
MD29AN

FREE Software

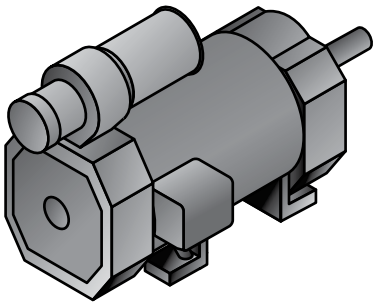
MentorSoft –
Drive configuration tool



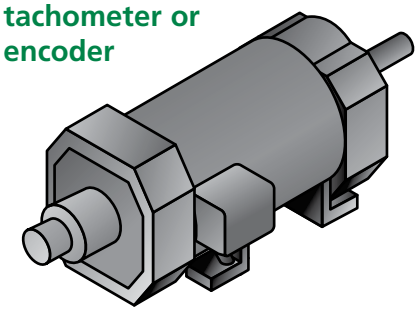
SyPTPro –
System programming Toolkit



DC motor

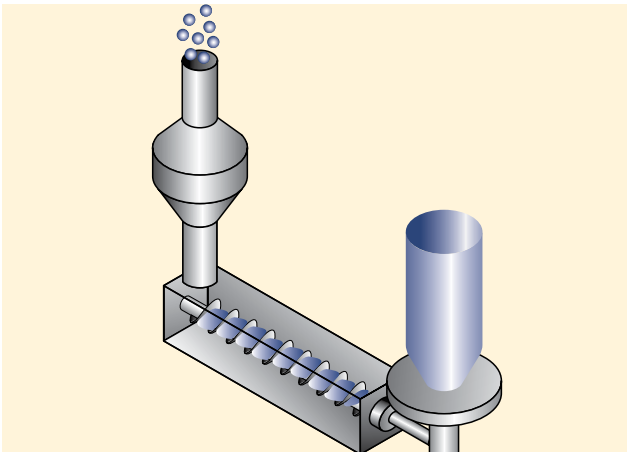


DC motor with tachometer or encoder

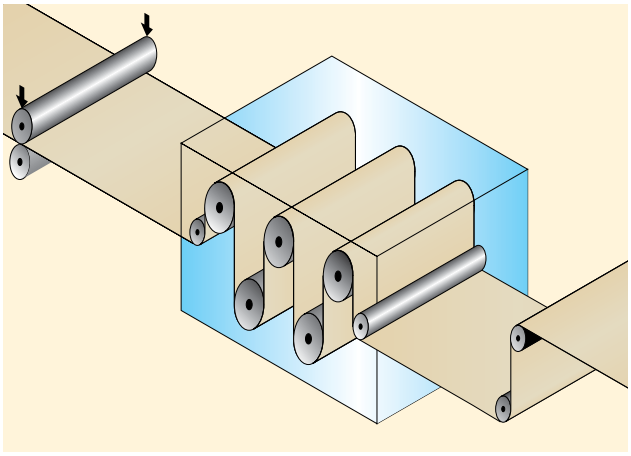


High Performance Applications

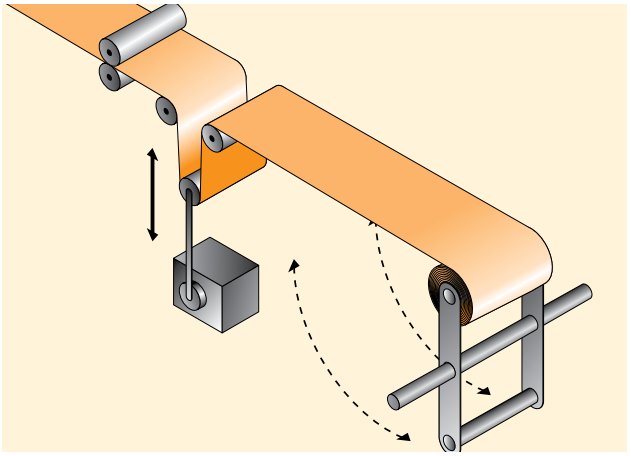
Extruder



Cooling Rolls



Turret Unwind/Rewind



Mentor II

The Intelligent DC Drive



DC drives are widely used in applications that require regeneration, precise speed control, dynamic performance, and constant torque over wide speed ranges. The Mentor II delivers the universal DC drive solution.

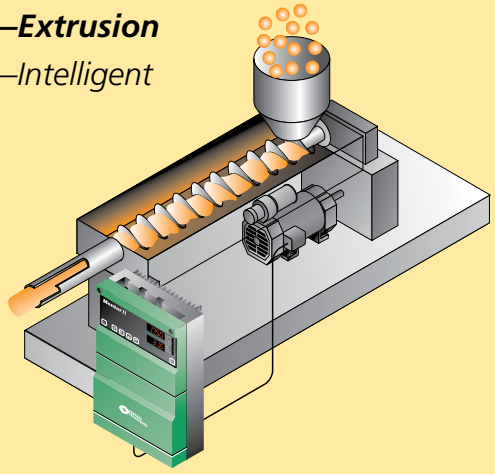
Simple stand-alone applications are easily configured to control motor speed, voltage or current using standard internal settings. Set-up is convenient using the drive keypad, or MentorSoft, a Windows™-based drive configuration tool. The Mentor II has extensive diagnostic and communication abilities that enhance system reliability. The drive's standard yet powerful microprocessor is a versatile system component that can eliminate the need for a PLC with integral functions such as thresholds, timers and logic gates that perform basic control.

The simple addition of the MD29, a 32-bit application coprocessor card, provides high performance drive systems with local intelligence for true distributed control. The MD29 enables users to incorporate custom or proprietary process control application programs to their drive. The Mentor II also provides a wide range of communication protocol options.

Mentor II systems have proven to be extremely reliable and are ideally suited to web handling, winders, slitters, extruders, wire drawing, converting lines, and plastics production. The Mentor II's integrated design and highly programmable features make it an ideal choice for OEMs and System Integrators, as well as replacement or retrofit drives for End Users.

—Extrusion

—Intelligent



- **Microprocessor Based Digital DC Drive**
- **5 to 1000 hp, 3 phase, 208 to 660 VAC input**
- **Regenerative and non-regenerative models**
- **RS485 serial communications**
- **Extensive fieldbus communication capabilities**
- **Plug-in 32-bit application coprocessor card (MD29)**
- **MentorSoft Windows-based drive configuration tool**
- **Complete Motor Solutions**

FREE Software

ISO 9002 APPROVAL · CE · N1652 · c UL us LISTED · 2 YEAR Digital Drive Warranty · 5 YEAR Extended Warranty

Note: UL only available through 400 hp @ 460V and 200 hp @ 230V

FEATURE/PERFORMANCE ADVANTAGE

Accepts wide range of supply voltage (208 to 660 VAC)
Can be applied to worldwide voltages

Non-regen and regen models share the same footprint up to M825
Allows for common mechanical design and mounting

MentorSoft Windows-based drive configuration tool
Provides easy programming and diagnostics of the drive

32-bit application coprocessor card (MD29)
Enables customized applications for distributed control system architectures

Profibus-DP, Modbus Plus, Modbus RTU, Interbus-S, DeviceNet, and CTNet plug-in communication cards
Communicates on user's preferred network

Built-in RS485 serial communications
Allows for easy programming and control of drive

Extensive and configurable analog and digital I/O
Customizes drive to specific applications

Programmable boolean logic (AND, NAND, OR, NOR) gates with delay outputs
Assists with general system interface logic needs, expanding application possibilities

Programmable threshold comparators
Expands application possibilities by providing a pair of independent numerical comparators with adjustable hysteresis

Accepts DC tachometer and encoder feedback
Enables precise speed control

Built-in digital lock function for frequency following
Allows accurate master/follower applications
Includes reference encoder connector

Extensive diagnostics and fault indicators

Special Field supply option

Three Phase Input	Field Output
(208-230 VAC)	(240 VDC)

RATINGS: MENTOR II

THREE PHASE INPUT	DC Arm Output	Field Output
3 to 500 hp (208-230 VAC)	(240 VDC)	(150 VDC)
5 to 1000 hp (380-460 VAC)	(500 VDC)	(300 VDC)

Special Order (525 / 660 VAC), Models M350(R)–M1850(R) only)

208 / 240 VAC

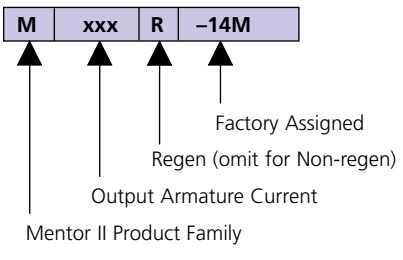
Motor HP	Output Current (A) (@40°C)	Output Current (A) (@55°C)	Field Output Current	Non-Regen Order Code	Regen Order Code
3 - 7	25	20	8A Current Regulated	M25-14M	M25R-14M
7.5 - 10	45	38		M45-14M	M45R-14M
15	75	55		M75-14M	M75R-14M
20 - 35	105	89		M105-14M	M105R-14M
30	155	125		M155-14M	M155R-14M
40 - 50	210	172		M210-14M	M210R-14M
75	350	255	10A Fixed Voltage ①	M350-14M	M350R-14M
100	420	338		M420-14M	M420R-14M
125	550	428		M550-14M	M550R-14M
150	700	508		M700-14M	M700R-14M
200	825	675		M825-14M	M825R-14M
250	900	820	20A Fixed Voltage ①	M900-14M	M900R-14M
300 - 350	1200	1150		M1200-14M	M1200R-14M
400 - 500	1850	1620		M1850-14M	M1850R-14M

380 / 480 VAC

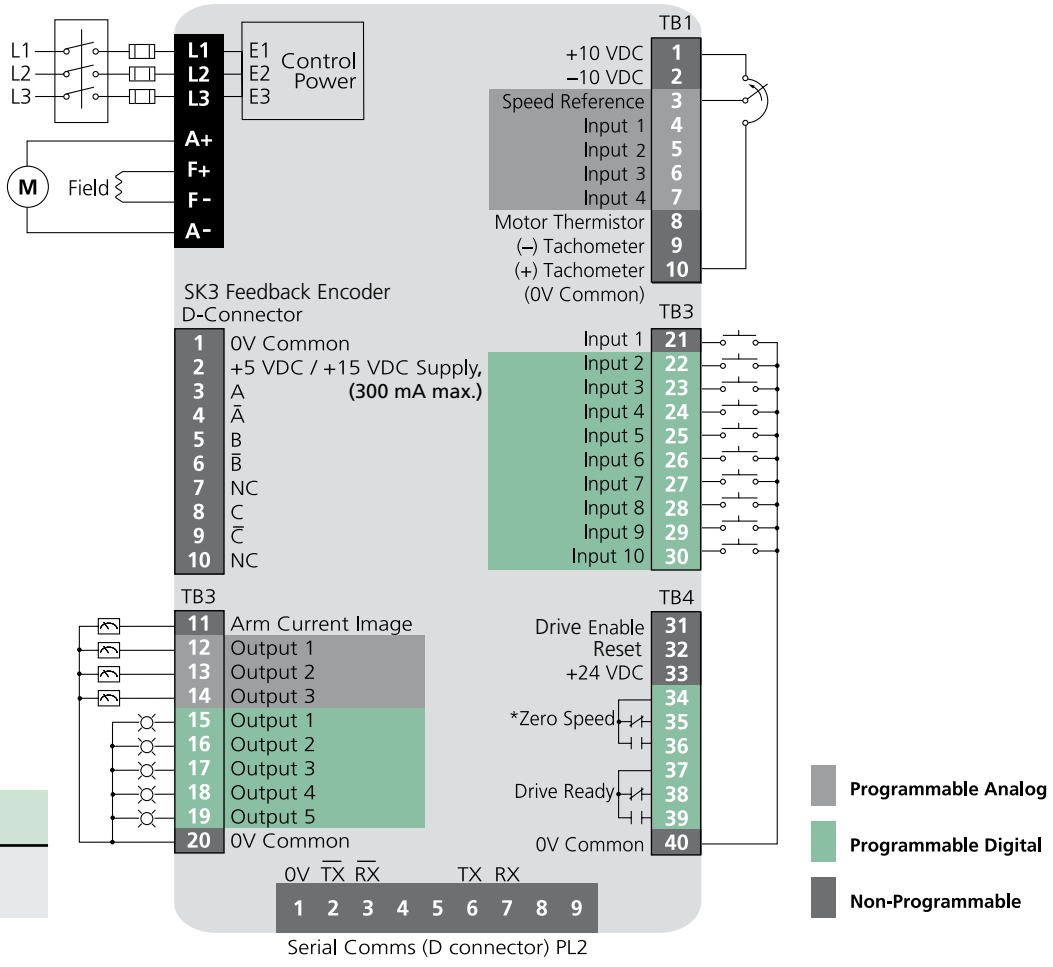
Motor HP	Output Current (A) (@40°C)	Output Current (A) (@55°C)	Field Output Current	Non-Regen Order Code	Regen Order Code
5 - 10	25	20	8A Current Regulated	M25-14M	M25R-14M
15 - 20	45	38		M45-14M	M45R-14M
25 - 30	75	55		M75-14M	M75R-14M
40 - 50	105	89		M105-14M	M105R-14M
60 - 75	155	125		M155-14M	M155R-14M
100	210	172		M210-14M	M210R-14M
150	350	255	10A Fixed Voltage ①	M350-14M	M350R-14M
200	420	338		M420-14M	M420R-14M
250	550	428		M550-14M	M550R-14M
300	700	508		M700-14M	M700R-14M
400	825	675		M825-14M	M825R-14M
500	900	820	20A Fixed Voltage ①	M900-14M	M900R-14M
600 - 700	1200	1150		M1200-14M	M1200R-14M
800 - 1000	1850	1620		M1850-14M	M1850R-14M

① For field control, add external field regulator P/N 9500-9035.

Order String



TERMINAL DIAGRAM: MENTOR II



NOTE

* Zero Speed Relay Programmable.

Terminal Description

Pin#	Function	Type/Description	Notes
1	+10 VDC	Reference Supply	10 mA max
2	-10 VDC		
3	Speed Reference	Analog Input, 12 bit	±10 VDC, 100 kOhms or 4-20 mA, 100 Ohms
4	Analog Input # 1	Analog Input Bi-polar, 10 bit + sign	±10 VDC, 100 kOhms
5	# 2		
6	# 3		
7	# 4		
8	Motor Thermistor	Analog Input	3k Ohms trip point, 1.8k Ohm reset level
9	DC Tachometer (-)	Analog Input	
10	DC Tachometer (+)	Circuit Common	
11	Armature Current Image	Analog Output	6.6 VDC @ 150% current
12	Analog Output # 1	Analog Output Bi-polar, 10 bit + sign	±10 VDC, 5 mA
13	# 2		
14	# 3		
15	Digital Output # 1	Digital Output Open Collector	+24 VDC, 100 mA
16	# 2		
17	# 3		
18	# 4		
19	# 5		

Pin#	Function	Type/Description	Notes
20	0V Common	Circuit Common	
21	F1 (Run Permit)	Digital Input	+24 VDC, 10 kOhms
22	F2 (Inch / Jog Reverse)	Digital Input	+24 VDC, 10 kOhms
23	F3 (Inch / Jog Forward)		
24	F4 (Run Reverse (latched))		
25	F5 (Run Forward (latched))		
26	Digital Input F6		
27	F7		
28	F8		
29	F9		
30	F10		
31	Drive Enable	Digital Input	30 mSec inhibit delay
32	Reset	Digital Input	Fault Reset
33	+24 VDC Supply	User Supply	200 mA max
34	Form C Status Relay (Zero Speed)	Relay Common	110 VAC, 5A resistive
35		N. C. Contact	
36		N. O. Contact	
37	Form C Status Relay (Drive Ready)	Relay Common	110 VAC, 5A resistive
38		N. C. Contact	
39		N. O. Contact	
40	0V Common	Circuit Common	

Programmable Analog Programmable Digital All Analog I/O is scalable

SPECIFICATIONS: MENTOR II

Environment

Ambient Operating Temperature	0 to 40°C (32 to 104°F) Derate current 1.5% per °C to 55°C (32 to131°F)
Cooling Method	Convection and forced convection, model dependent
Humidity	95% non-condensing at 40°C (104°F)
Storage Temperature	-40 to 55°C (-40 to 131°F)
Altitude	0 to 4000 m (13,120 ft). Derate 1% per 100 m (328 ft) between 1000 m (3,280 ft) and 4000 m (13,120 ft).
Enclosure	Chassis (IP00)

AC Supply Requirements

Voltage	208 to 480 VAC -5%, +10% 525/575/660 VAC ±10% (Optional M350 and above)
Phase	3Ø
Frequency	45 to 62 Hz
Efficiency	98%
Standard Field Output Voltage	Size 1 – 0.9 X input VAC (Regulated), Size 2-3 – .67 X input VAC (Non-Regulated) Non-Standard Field – Consult Factory
Armature Output Voltage	Non-Regen – 1.15 X input VAC, Regen – 1.05 X input VAC

Control

Feedback Methods	Armature Voltage (resolution .83 volts) DC Tachometer (resolution 0.1%) Encoder (resolution .01%)
Field Control	Current regulated 8 Amps max (M210/M210R and smaller) Voltage regulated .675 or .9 X Line-to-line voltage (M350/M350R and larger)
Analog Input Resolution	12-bit (Qty 1), 10-bit (Qty 4)
Serial Communications	4-wire RS422 or RS485, optically-isolated Protocol is ANSI x 3.28-2.5-A4 Baud rate is 4800 or 9600

Protection

AC Line Undervoltage Trip	180 VAC
MOV Voltage Transient Protection	Input transient suppression
Instantaneous Overcurrent Trip	300% armature current
Armature Open Circuit	Armature circuit is open
Drive Overload Trip	Inverse time, 150% for 30 seconds
Phase Loss Trip	Loss of input phase
Overtemperature Trip	Heatsink exceeds 100°C (212°F)
Motor Thermal Trip	Motor over-temp switch or Thermistor
Feedback Loss	Loss of motor feedback
Feedback Reversal	Tachometer or Encoder wired backwards
Field Loss	No field current
Field On	Field current during auto-tune
Field Overcurrent	Field current greater than field demand
Current Loop Loss	Loss of 4-20 mA reference
External Power Supply	Short circuit on +24 VDC user power supply
Power Supply	Internal power supply out of tolerance

Protection *continued*

Serial Communications Loss	Mode 3 serial comms data loss
Processor 1 Watchdog Trip	Main control processor fault
Processor 2 Watchdog Trip	Second control processor fault (MD29)
Hardware Fault	Hardware malfunction on control board
Memory Fault	Stored parameter checksum fault
External Trip	User interlock fault (programmed)
Software Fault (A29)	MD29 software fault

Approvals & Listings

UL, cUL	File #E58592 Vol. 5C Section 1 (M25 to M825 and M25R to M825R)
CE	Designed for marking

DIMENSIONS



Size	Order Code	Size* (in) H x W x D	Approx. Weight (lbs.)
1	M25-14M thru M75-14M	15 x 10 x 6	22
	M25R-14M thru M75R-14M	15 x 10 x 6	24
	M105-14M thru M210-14M	15 x 10 x 8	31
	M105R-14M thru M210R-14M	15 x 10 x 8	33
2	M350-14M thru M420-14M	16 x 18 x 11	48
	M350R-14M thru M420R-14M	16 x 18 x 11	51
	M550-14M thru M825-14M	17 x 18 x 11	59
	M550R-14M thru M825R-14M	17 x 18 x 11	66
3	M900-14M thru M1850-14M	41 x 18 x 20	154
	M900R-14M thru M1850R-14M	61 x 18 x 20	264

* Approximate, not to be used for construction purposes.

Quantum III

Compact DC Drive Package

The Quantum III delivers a DC drive package that integrates the intelligence of the Mentor II with a space saving design that incorporates many accessories typically required in the North American market.

Quantum III drives are ready to install and run DC motors. Like the Mentor II, they are easily configurable to control motor speed, voltage or current using standard internal settings. Set-up is convenient using the drive keypad, or MentorSoft, a Windows™-based drive configuration tool. These drives have powerful diagnostic and communication abilities.
The simple addition of the MD29 applications card enables users to incorporate custom or proprietary process control application programs to their drive. The Quantum III also provides extensive communication protocol options.

The powerful microprocessor based Mentor is the central component of the Quantum package. The integrated design includes fuses, a DC loop contactor, and 115 VAC interface logic control, making it an ideal choice for end users with space constraints. The Quantum III offers a compact DC package solution. You'll also find the Quantum III on OEM equipment and integrated systems.

DC drive technology has proven to be extremely reliable and is ideally suited to web handling, winders, slitters, extruders, wire drawing, converting lines, and plastics production. The Quantum III meets the many requirements of these industries.

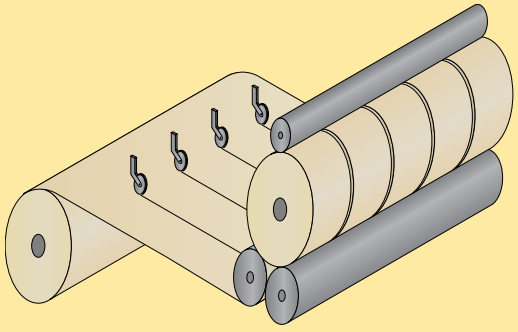
In addition to the features of the Mentor II, the Quantum III drive includes:

- *High speed semiconductor fusing*
- *115 VAC control interface*
- *DC loop contactor (with DB pole up to 250 hp @ 480 VAC)*
- *Accepts AC or DC tachometer feedback, and encoder feedback*
- *DC output fuse on all regen models*



—Slitter

—DC Drive Package



- **Microprocessor Based Digital DC Drive**
- **5 to 1000 hp, 3 phase, 208 / 230 / 380 / 480 VAC input**
- **Regenerative and non-regenerative models**
- **RS485 serial communications**
- **Extensive fieldbus communication capabilities**
- **Plug-in 32-bit application coprocessor card (MD29)**
- **MentorSoft, Windows-based drive configuration tool**
- **Complete Motor Solutions**

FREE Software

c UL us LISTED

2 YEAR Digital Drive Warranty

5 YEAR Extended Warranty

Note: UL only available through 400 hp @ 460V and 200 hp @ 230V

FEATURE/PERFORMANCE ADVANTAGE

High-speed semiconductor fusing
Provides short circuit protection for SCRs

DC loop contactor (with DB pole up to 250 hp @ 480 VAC)
Enables easy addition of dynamic braking resistors

115 VAC control interface
Allows use with standard remote operator devices

Profibus-DP, Modbus Plus, Modbus RTU, Interbus-S, DeviceNet, and CTNet plug-in communication cards
Communicates on user's preferred network

Programmable threshold comparators
Expands application possibilities by providing a pair of independent numerical comparators with adjustable hysteresis

Extensive and configurable analog and digital I/O
Customizes drive to specific applications

Programmable boolean logic (AND, NAND, OR, NOR) gates with delay outputs
Assists with general system interface logic needs, expanding application possibilities

Built-in digital lock function for frequency following
Allows accurate master / follower applications

Accommodates AC or DC tachometer and encoder feedback
Enables precise speed control

Extensive diagnostics and fault indicators
Used for accurate drive system diagnosis

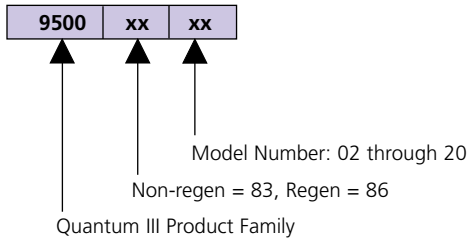
Accepts wide range of supply voltage (208 to 480 VAC)
Can be applied to worldwide voltages

Non-regen and regen models share the same footprint
Provides for common mechanical design and mounting

Special Field supply option

Three Phase Input	Field Output
(208-230 VAC)	(240 VDC)

Order String



RATINGS: QUANTUM III

THREE PHASE INPUT	DC Arm Output	Field Output
3 to 500 hp (208-230 VAC)	(240 VDC)	(150 VDC)
5 to 1000 hp (380-460 VAC)	(500 VDC)	(300 VDC)

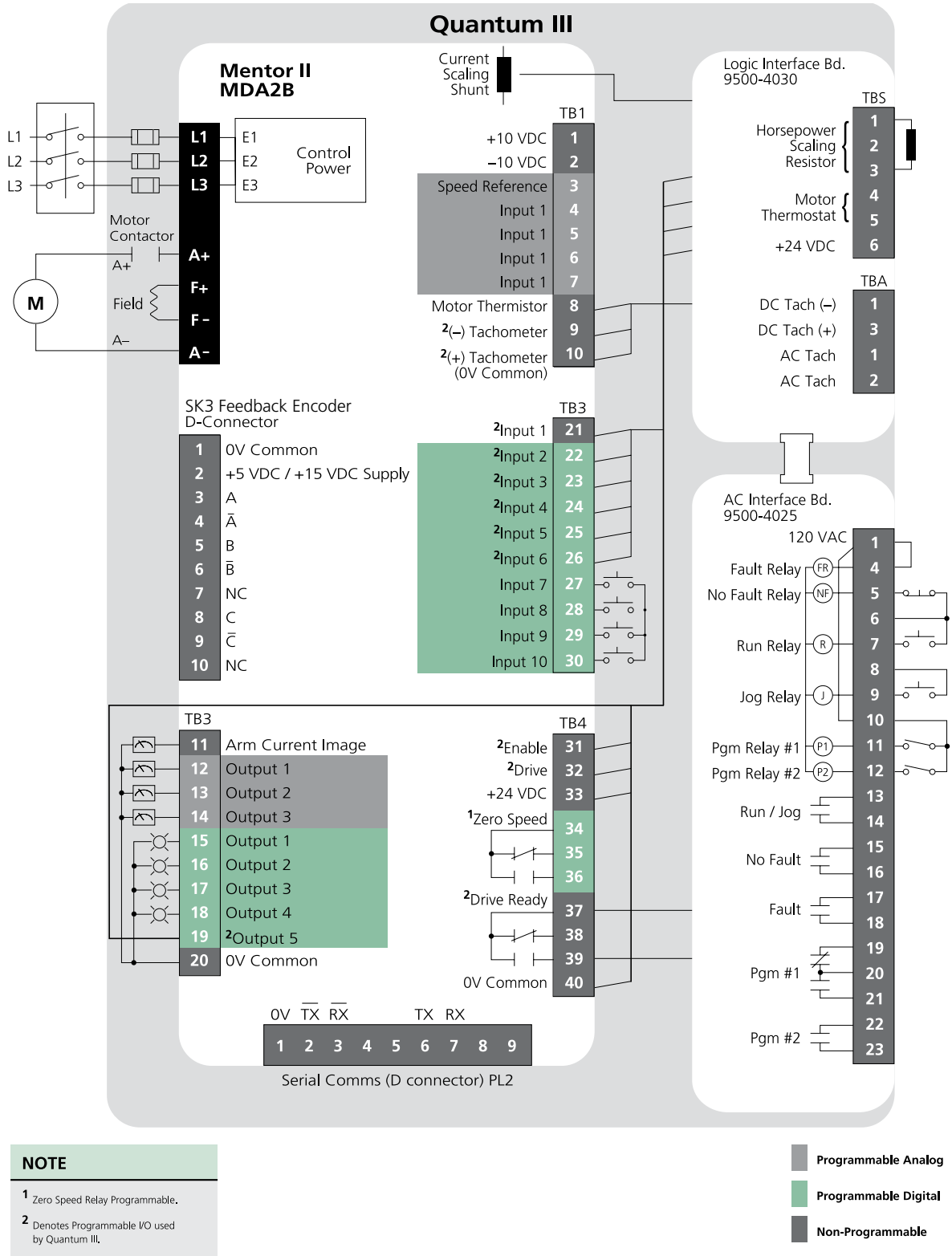
240 / 480 VAC

Motor HP 240 VAC	Motor HP 480 VAC	Output Current③ (A)	Field Output Current	Non-Regen Order Code①	Regen Order Code①
3 to 10	5 to 20	38	8A Current Regulated	9500-8302	9500-8602
15	25 to 30	55		9500-8303	9500-8603
20 to 30	40 to 60	106		9500-8305	9500-8605
40 to 50	75 to 100	172		9500-8306	9500-8606
75	150	255	10A Fixed Voltage ②	9500-8307	9500-8607
100	200	338		9500-8308	9500-8608
125	250	428		9500-8309	9500-8609
150	300	508		9500-8310	9500-8610
200	400	675		9500-8311	9500-8611
250	500	820	20A Fixed Voltage ②	9500-8315	9500-8615
300	600	985		9500-8316	9500-8616
-	700	1150		9500-8317	9500-8617
400	800	1250		9500-8318	9500-8618
-	900	1470		9500-8319	9500-8619
500	1000	1620		9500-8320	9500-8620

① Drive includes DC loop contactor, input fuses and 120 VAC interface.
② For field control, add external field regulator P/N 9500-9035.
③ Ambient temperature is 55°C.



TERMINAL DIAGRAM: QUANTUM III



NOTE

1 Zero Speed Relay Programmable.

2 Denotes Programmable I/O used by Quantum III.

Programmable Analog
Programmable Digital
Non-Programmable

LOGIC INTERFACE BOARD (9500-4030)

TBS			
Pin#	**Function**	**Type/Description**	**Notes**
1, 3	Shunt Resistor Connection	Horsepower Programming	Used up through 9500-8306 / 8606
2	No Internal Connection		
4, 5	Optional Motor Thermostat	Contact Input	Provides thermal trip
6	+24 VDC Supply	User Supply	100 mA max

TBA			
Pin#	**Function**	**Type/Description**	**Notes**
1	DC Tachometer Input (-)	Analog Input	300 VDC max
3	DC Tachometer Input (+)		
1, 2	AC Tachometer Input	Analog Input	200 VAC max

Mentor II Control board (MDA2B)			
Pin#	**Function**	**Type/Description**	**Notes**
1	+10 VDC	Reference Supply	10 mA max
2	-10 VDC	Reference Supply	10 mA max
3	Speed Reference	Analog Input, 12-bit	±10 VDC, 100 kOhms or 4 - 20 mA, 100 Ohms
4	Analog Input # 1	Analog Input Bi-polar, 10-bit + sign	±10 VDC, 100 kOhms
5	# 2		
6	# 3		
7	# 4		
8, 9, 10	For Internal Use		
11	Armature Current Image	Analog Output	6.6 VDC @ 150% current
12	Analog Output # 1	Analog Output Bi-polar, 10-bit + sign	±10 VDC, 5 mA
13	# 2		
14	# 3		
15	Digital Output # 1	Digital Output Open Collector	+24 VDC, 100 mA
16	# 2		
17	# 3		
18	# 4		
19	For Internal Use		
20	0V Common	Circuit Common	
21 to 26	For Internal Use		
27	Digital Input F7	Digital Input	+24 VDC, 10 kOhms
28	F8		
29	F9		
30	F10		
31	For Internal Use		
34	Form C Status Relay (Zero Speed)	Relay Common	110 VAC, 5A resistive
35		N.C. Contact	
36		N.O. Contact	
37, 38, 39	For Internal Use		
40	0V Common	Circuit Common	

Programmable Analog Programmable Digital All Analog I/O is scalable

Terminal Descriptions: Quantum III

120 VAC Interface Board (9500-4025)			
Pin#	**Function**	**Type/Description**	**Notes**
1	120 VAC high side (fused)	Power Supply	120 VAC
2, 3	Tie Point	No Internal Connection	Customer Use
4	External Trip / Motor Thermostat Input	120 VAC Input (Fault relay coil)	
5	120 VAC (when drive OK)	120 VAC Output	
6	Stop / Seal-in Input	Contact Input	For 3-wire Stop / Start control
7	Run Input	Input (Run relay coil)	120 VAC
8, 9	Jog Input	Input (Jog relay coil)	120 VAC
10	120 VAC high side (fused)	Power Supply	120 VAC
11	Input # 1 (Reverse)	Programmable Input (# 1 relay coil)	120 VAC
12	Input # 2 (Drive Reset)	Programmable Input (# 2 relay coil)	120 VAC
13, 14	Run / Jog Contact	N.O. Output Contact	120 VAC
15, 16	No Fault Contact	N.O. or N.C. Contact (selectable)	120 VAC
17, 18	Fault Relay Contact		
19	Programmable Form C	Common Connection (arm)	120 VAC
20		N.C. Connection	
21	Relay Contact # 1	N.O. Connection	
22, 23	Programmable Relay Contact # 2	N.O. or N.C. Contact (selectable)	120 VAC
24	Drive ON	Output	120 VAC, 6 VA max
25	120 VAC low side	120 VAC Common Connection	Earth ground



See the Packaged Drives and Engineered Systems section for details on our DC Packaged solutions.

SPECIFICATIONS: QUANTUM III

Environment

Ambient Operating Temperature	0 to 55°C (32 to 131°F)
Cooling Method	Convection and forced convection, model dependent
Humidity	95% non-condensing at 55°C (131°F)
Storage Temperature	-40 to 55°C (-40 to 131°F)
Altitude	0 to 4000 m (13,120 ft). Derate 1% per 100 m (328 ft) between 1000 m (3,280 ft) and 4000 m (13,120 ft).
Enclosure	Chassis (IP00)

AC Supply Requirements

Voltage	208 to 480 VAC -5%, +10%
Phase	3Ø
Frequency	45 to 62 Hz
Efficiency	98%
Standard Field Output Voltage	Size 1 – 0.9 X input VAC (Regulated), Size 2-3 – .67 X input VAC (Non-Regulated) Non-Standard Field – Consult Factory
Armature Output Voltage	Non-Regen – 1.15 X input VAC, Regen – 1.05 X input VAC

Control

Feedback Methods	Armature Voltage (resolution .83 volts)
	DC Tachometer (resolution 0.1%)
	Encoder (resolution .01%)
Field Control	Current regulated (9500-8306 / 8606 and smaller) Voltage Regulated (9500-8307 / 8607 and larger)
Analog Input Resolution	12-bit (Qty 1), 10-bit (Qty 4)
Serial Communications	4-wire RS422 or RS485, optically-isolated Protocol is ANSI x 3.28-2.5-A4 Baud rate is 4800 or 9600

Protection

AC Line Undervoltage Trip	180 VAC
MOV Voltage Transient Protection	Input transient suppression
Instantaneous Overcurrent Trip	300% armature current
Armature Open Circuit	Armature circuit is open
Drive Overload Trip	Inverse time, 150% for 30 seconds
Phase Loss Trip	Loss of input phase
Overtemperature Trip	Heatsink exceeds 100°C (212°F)
Motor Thermal Trip	Motor over-temp switch or Thermistor
Feedback Loss	Loss of motor feedback
Feedback Reversal	Tachometer or Encoder wired backwards
Field Loss	No field current
Field On	Field current during auto-tune
Field Overcurrent	Field current greater than field demand
Current Loop Loss	Loss of 4-20 mA reference
External Power Supply	Short circuit on +24 VDC user power supply
Power Supply	Internal power supply out of tolerance
Serial	Mode 3 serial comms data loss

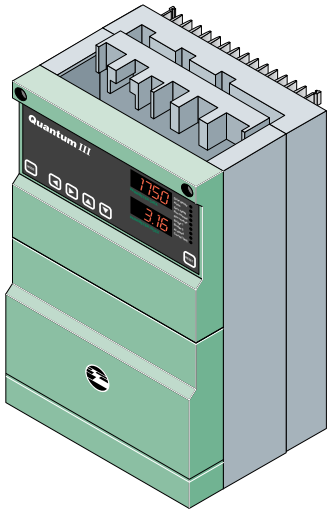
Protection *continued*

Communications Loss	
Processor 1 Watchdog Trip	Main control processor fault
Processor 2 Watchdog Trip	Second control processor fault (MD29)
Hardware Fault	Hardware malfunction on control board
Memory Fault	Stored parameter checksum fault
External Trip	User interlock fault (programmed)
Software Fault (A29)	MD29 software fault

Approvals & Listings

UL, cUL	File #E58592 Vol. 1 Section 19 (9500-8302 to 9500-8311 and 9500-8602 to 9500-8611)
CE	Designed for marking
ISO 9002	Certified Manufacturing Facility

Dimensions



Size	Order Code	Size* (in) H x W x D	Approx. Weight (lbs.)
1	9500-8302 thru 9500-8303	15 x 10 x 10.5	44
	9500-8602 thru 9500-8603	15 x 10 x 10.5	44
	9500-8305 thru 9500-8306	15 x 10 x 12.3	53
	9500-8605 thru 9500-8606	15 x 10 x 12.3	53
2	9500-8307 thru 9500-8309	35 x 20.3 x 12	110
	9500-8607 thru 9500-8609	35 x 20.3 x 12	110
	9500-8310 thru 9500-8311	36 x 20.3 x 14	155
	9500-8610 thru 9500-8611	36 x 20.3 x 14	155
3	9500-8315 thru 9500-8318	54 x 34 x 19	397
	9500-8615 thru 9500-8618	72 x 34 x 19	475
	9500-8319 thru 9500-8320	54 x 34 x 19	443
	9500-8619 thru 9500-8620	72 x 34 x 19	525

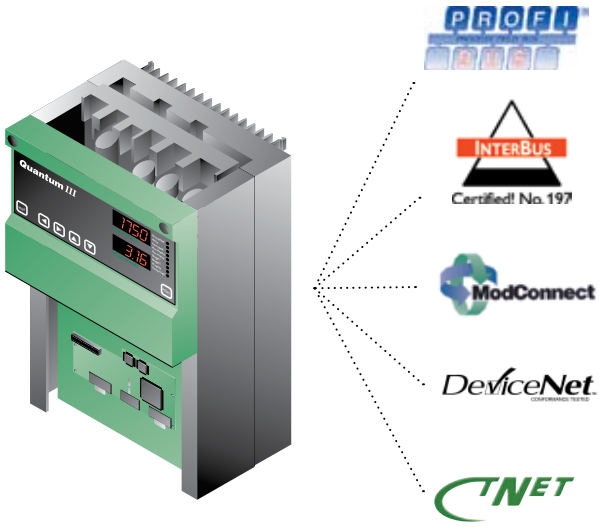
* Approximate, not to be used for construction purposes.

Mentor II/Quantum III
Options / Software / Accessories

NETWORK COMMUNICATION CARDS

The fieldbus interface cards provide high-speed communications using the popular networks and protocol. These networks allow large amounts of data to be transferred quickly to and from network nodes. The RS485 channel is optically isolated (CTNet is transformer isolated) for added protection.

Network Communications



Communication Protocol	Interface Module Order Code	System Configuration
Profibus-DP	MD-24	Master / Follower
Interbus-S	MDIBS	Master / Follower
CTNet*	MD-29AN*	Peer-to-peer
DeviceNet	MD-25	Master / Follower
Modbus RTU*	9729-9000	Master / Follower
Modbus Plus	9500-9100	Master / Follower

* CTNet and Modbus RTU cards contain full coprocessor ability.
Refer to the Application Cards (MD29 and MD29AN) for more information.

See page 381 for complete CTNet integration details.

APPLICATION CARDS (MD29 & MD29AN)

The MD29 and MD29AN application cards contain a high-speed microprocessor which provides a low-cost facility for a system designer to write application specific programs without needing a PLC or other stand-alone controller. The add-on cards fit into a 40-pin header within the Mentor II and Quantum III drive. It is programmed (via the RS232 port) using our Control Techniques SyPTPro (System Programming Toolkit) that complies with IEC 61131-3 Ladder / Function Block or DPL (Drive Programming Language). In addition to the application coprocessor, the MD29AN CTNet card supports peer-to-peer cyclic and broadcast messaging at rates up to 5M baud.

The application cards use dual port RAM to provide intimate high-speed bidirectional access. They can read and modify any parameter within the drive, enabling customized real-time calculations under a multi-tasking run-time environment. The Intel i960 32-bit RISC processor and 256 K of user program FLASH memory (equivalent to >2000 lines of ladder logic or basic instruction code) provide a powerful base for a designer to accomplish complex algorithms for demanding time-critical process control.

The optically isolated RS485 channel serves as a communication port for our CTIU operator interface units. It is fully configurable, supporting multiple communication modes including an ANSI 2 or 4-wire protocol at data rates up to 38.4k baud. A Modbus protocol with RTU and ASCII follower modes is also available.

32-bit coprocessor (MD-29) 9729-9000

32-bit coprocessor with CTNet.....MD29AN-RevD



MD-29



MD-29AN

Mentor II/Quantum III

PC to Drive Accessories

DRIVE CONFIGURATION TOOL (MENTORSOFT)

MentorSoft is a complimentary Windows-based drive configuration tool designed to enable the complete control and display of all parameters within a Mentor II or Quantum III. Functions within MentorSoft allow data to be uploaded, viewed and saved or retrieved from disk, modified and printed. It can be used offline in the office or online on the plant floor. MentorSoft communicates with the drive via the computer's serial port to the drive's RS485 port using a communications cable — order code (CTD-PC-485-XXX). (XXX=ft.).

See Software Section for details including CTScope digital oscilloscope software.



OPERATOR INTERFACE (CTVue)

The powerful CTVue HMI line and integrated drivers for Control Technique drives make it easy to integrate HMI with CT drives. The broad offering of CTVue HMI's are easy to program with the free and easy to use CTVue configurator software. The broad hardware offering also ensures there is a CTVue HMI that balances your price and functionality needs.

The CTVue configuration software includes built in parameter list for the Mentor II & Quantum III drives. Standard pre-manufactured cables are available to connect between the CTVue and drive.

For more information, refer to the Options and Accessories Section.

REMOTE I/O BOX (I/O BOX)



The I/O Box expands the I/O capabilities of the Mentor II and Quantum III drives. The I/O Box is connected to the drive through the MD29/AN application card using an optically isolated RS485 serial link.

Remote I/O Box Specifications

Voltage	110 to 240 VAC ±10%
Frequency	48 to 62 Hz
Phase	1Ø
RS485 interface	Supports binary protocol at data rates up to 38.4kbaud for connection to a single drive.

Qty	Type / Description	Notes
1	Analog Input (12-bit)	±10 VDC, 100k Ohms or 4-20 mA, 100 Ohms
4	Analog Input (10-bit)	±10 VDC, 100k Ohms
3	Analog Output (10-bit)	±10 VDC, 5 mA
8	Digital Input	+24 VDC, 10k Ohms
8	Digital Output	+24 VDC, 100 mA (200 mA total for all outputs)

FIELD REGULATORS (FXM FAMILY)



The FXM family of field regulators is designed to control the field current of DC motors up to 90 amps. When used in conjunction with either the Mentor II or Quantum III variable speed DC drives, the field regulator is controlled directly via the drive parameters. This allows full customization of the field control for any application. The FXMs can be also be used as stand-alone units when retrofitting existing applications.

The field regulators are single phase, controlled thyristor rectifier bridges with a control logic PC board. The bridge can be configured by jumpers to operate in half (single quadrant) or full (two quadrant) control mode.

FXMs may be independently controlled by an external reference, or set for automatic field weakening (constant horsepower) or constant field current. Field economy control via contact or logic input and a field loss relay for protection are provided for stand-alone operation. The unit also has a bar graph display (10% increments of the selected range) for field current magnitude.

Order Code	Current A	Frequency Hz	Input Voltage VAC	Output Voltage* VDC
9500-9035	20	50 60	220 / 380 / 440 240 / 480	198 / 342 / 396 216 / 432
9500-9032	50	50 60	220 / 380 / 440 240 / 480	198 / 342 / 396 216 / 432
9500-9033	90	50 60	220 / 380 / 440 240 / 480	198 / 342 / 396 216 / 432

* Maximum output voltage equals 90% of input RMS line voltage.
Field current is the controlled variable.

CRITICAL COMPONENTS

Minimize Your Machine Downtime Delays



All too often, spare parts are over-looked which results in a panic search, no less the possibility of costly Next Day shipping expenses. Having these items on hand can reduce the associated stress of machine downtime. To facilitate this effort, Control Techniques has assembled several levels of Critical Component kits to fit within your maintenance budget constraints. These pre-assembled kits represent a significant savings over purchasing the same items separately.

Mentor II Spare Part Kit Ordering Information

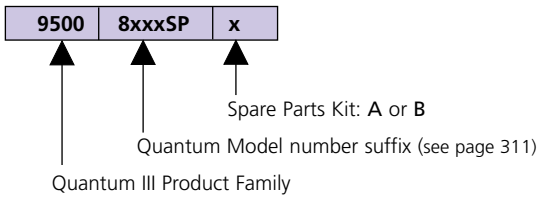
Frame Size	Order Code	Description
M25 – M210 (non-regen and regen)	M25-210-SP	1 – MDA1 Control board 1 – MDA2B Interface board 6 – Power board fuses
M350 – M825 (non-regen and regen)	M350-825-SP	1 – MDA1 Control board 1 – MDA2B Interface board 6 – Fuses for MDA5 Filter board 6 – Fuses for MDA6 Power board
M900 – M1850 (non-regen)	M900-1850-SP	1 – MDA1 Control board 1 – MDA2B Interface board 1 – SCR heatsink assembly 6 – 6A fuses for MDA6 board 2 – 2A fuses for SD1 board 2 – 30A fuses for SD1 board
M900R–M1850R (regen)	M900R-1850R-SP	

Quantum III Spare Part Ordering Information

Spare Part Order String

A	B
1 – Set of burden resistors 6 – Line fuses (1- 3FU) (unless noted) 2 – Armature fuses (regen only) 6 – Transformer fuses 6 – Power board fuses (12 for 150-400 hp / 480V)	1 – Interface board (9500-4025) 1 – MDA-1 Control board 1 – MC Contactor (unless noted) 6 – Line fuses (1 - 3FU) (unless noted) 2 – Armature fuses (regen only) 6 – Transformer fuses 6 – Power board fuses (12 for 150-400 hp/480V)

Quantum Spare Part Order String



EXTENDED WARRANTY

An industry-leading two-year warranty is standard for Mentor II and Quantum III drives. The extended warranty increases the warranty period to five years.

Mentor II Model	Order Code
M25	M25WE
M45	M45WE
M75	M75WE
M105	M105WE
M155	M155WE
M210	M210WE
M350	M350WE
M420	M420WE
M550	M550WE
M700	M700WE
M825	M825WE
M900	M900WE
M1200	M1200WE
M1850	M1850WE

Quantum III Regen	Order Code
9500-8602	9500-8602WE
9500-8603	9500-8603WE
9500-8605	9500-8605WE
9500-8606	9500-8606WE
9500-8607	9500-8607WE
9500-8608	9500-8608WE
9500-8609	9500-8609WE
9500-8610	9500-8610WE
9500-8611	9500-8611WE
9500-8615	9500-8615WE
9500-8616	9500-8616WE
9500-8617	9500-8617WE
9500-8618	9500-8618WE
9500-8619	9500-8619WE
9500-8620	9500-8620WE

Quantum III Non-Regen	Order Code
9500-8302	9500-8302WE
9500-8303	9500-8303WE
9500-8305	9500-8305WE
9500-8306	9500-8306WE
9500-8307	9500-8307WE
9500-8308	9500-8308WE
9500-8309	9500-8309WE
9500-8310	9500-8310WE
9500-8311	9500-8311WE
9500-8315	9500-8315WE
9500-8316	9500-8316WE
9500-8317	9500-8317WE
9500-8318	9500-8318WE
9500-8319	9500-8319WE
9500-8320	9500-8320WE

Packaged Drives and Engineered Systems



Packaged Drives and Engineered Systems

Control Techniques known worldwide for packaged drives and engineered systems now offers an even wider variety of enclosure, power, and control options.

From the simple to the complex, we offer six levels of turn-key solutions to meet your requirements.

- AC RapidPaks
- DC StandardPaks
- AC & DC CustomPaks
- Unidrive SP Freestanding Drives
- Large Enclosed Drives
- Engineered Systems

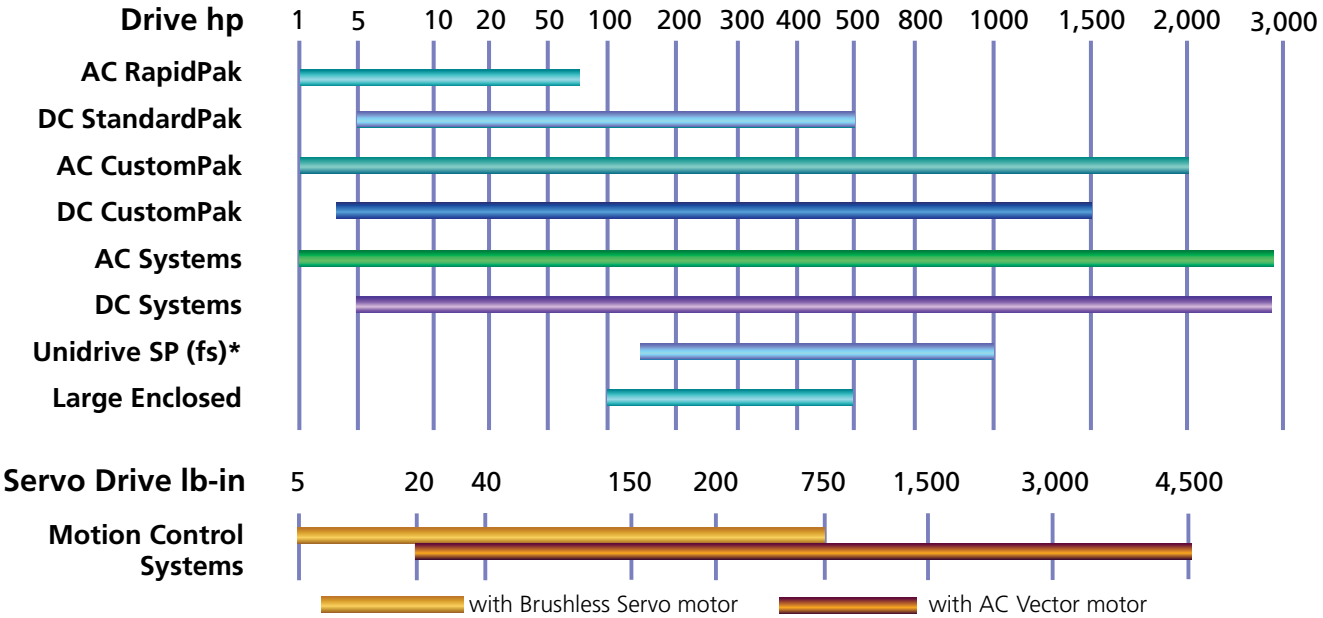
Our engineered solutions are built with the quality and reliability you expect from a leading world-wide supplier and UL Certified shop. Our quick-turn custom engineered packaged products allow us to respond to the most demanding requirements with delivery lead times among the shortest in the industry. Both packaged products and system solutions are backed by formal engineering documentation and drawings. Our refined processes, combined with robust after-sale support programs, result in a single-source solution, with single source accountability.

Total Systems Solutions

When the requirement is for a total system solution, our Engineered Systems group is ready to fulfill your needs. Our team consists of industry experts who know what is required for a successful drive application. Our unparalleled technology coupled with the expertise of our engineering, field installation and service teams have made Control Techniques the choice for thousands of engineered drive systems worldwide.



Packaged Drives and Engineered Systems Power Range (460 VAC)



*(fs) = Freestanding Drives

RapidPaks and CustomPaks

RapidPaks

Think RapidPak, when you need a packaged drive fast.

The AC RapidPak has a one week standard lead time and express lead time in as little as 24 hours. Designed to be easily tailored to a multitude of applications, these pre-engineered AC drive packages feature the most popular choices for operator controls, keypads, fusing, reactors and disconnects. The N12 (PPBF) or N3R RapidPak enclosure will have you up and running fast.

AC RapidPaks are offered with the Commander SK, Commander GP20 and the Unidrive SP. Voltages options are 208V to 460V models. Horsepower extends up to 75 hp, and to 2,000 hp as a **CustomPak.**

Extensive RapidPak Options

With over 40 options available, customers have the opportunity to create a RapidPak or CustomPak that meets most single-drive control system needs.



*See our **Packaged Soft Starters** including Crusher Duty solutions to 1,500 hp in the **Soft Starter** Section.*

StandardPaks

DC StandardPaks are offered with the Mentor II and Quantum III digital DC drive. Voltage options are 208V to 480V Models. Horsepower range 5 to 500 hp @ 480V, 5 to 200 hp @ 240V input. Standard lead time is one to three weeks depending on options.

CustomPaks

Think CustomPak when you need custom configured AC or DC drive package. CustomPaks are ideal when higher horse powers and higher voltages are needed, and when there are special needs. CustomPaks include 18 pulse—low harmonic drives, stainless steel enclosures, enclosure heating and air conditioning, lighting and outlets, all built to your requirements, and fully documented.

These engineered packages are be tailored to meet the needs of the most demanding applications. Lead time is typically four to six weeks.

Large Enclosed Drives

Our large enclosed drives are a high-horsepower NEMA12 Positive Pressure Blown and Filtered AC drive system with all the state-of-the-art integration features of the Unidrive SP. The robust Unidrive SPM technology from Control Techniques gives users the power, performance, and the ultimate in flexibility for all AC applications from 100 hp to 500 hp.

This cost competitive, pre-engineered "AC In – AC Out" solution is a perfect match for both high-performance, and standard drive applications, such as fans, pumps and conveyors.

Unidrive SP Free Standing Drives

The Unidrive SP Free Standing AC drives extend the power range of "**the Benchmark"** solution platform to 1000 hp, while providing users with the same integration options as the standard, panel-mount Unidrive SP. Packaged in an IP21 or IP23 enclosure, these Free Standing drives deliver maximum horsepower density for physical size, and include rectifier, inverter and inductor. In addition, an "Incomer" enclosure is available with line power bus bars included to integrate fuse switch/MCCB etc.

AC RapidPak

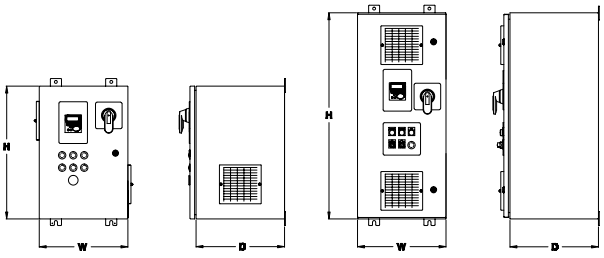
With our RapidPak solutions, and one of the shortest lead times in the industry, you will have an expertly packaged complete drive solution within days of placing your order. One week lead time is standard with a 24 hour option available.

Use the intuitive Order Code Configurator on the following pages to customize the package to your exact requirements. Choose between the simple and flexible Commander SK, the general purpose Commander GP20, and the high performance Unidrive SP. Each of these drives is available in either the space saving "Cube" style or the option abundant "Slimline" enclosure. A main disconnect, door-mounted keypad, input and output reactors, and a variety of door mounted operator's are only the beginning of the long list of options. Combine these with an SM Solutions Module for fieldbus connectivity, additional I/O, or a scalable PLC to solve the most difficult applications. Please see the AC Drives Section for SM Module options and drive compatibility.

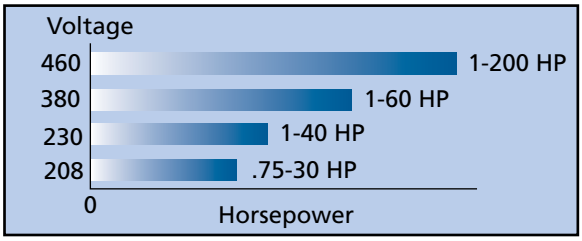
These UL508A approved drive packages come standard with a 2 year Drive Warranty.



Slimline, 460VAC, 15 HP, OP Stn #5, Keypad, CB, Input reactor, 3 contactor Bypass



Cube Style *Slimline Style*



Standard Features

- Open or Closed Loop Vector, V/Hz, Rotor Flux Control (RFC) performance
- Input Voltage 208-460 VAC, 50/60 Hz
- Cube or Slimline Enclosure, Nema -12 (PPBF), fully gasketed, (PPBF) Positive Pressure Blown and Filtered
- AC Line Fusing
- Input Main lugs for customer termination
- Standard lead time in one week
- CT Soft Windows™-based programming tool

Enclosure Design

- Cube: smallest possible package drive and input disconnect option.
- Slimline: compact packaging suitable for side-by side mounting (only ½" spacing required)
- Textured, beige powder coat
- Nema -12 (PPBF), fully gasketed, (PPBF) Positive Pressure Blown and Filtered
- 14 gauge steel

Options

- Normal Duty rating (110% for 1 minute)
- Heavy Duty rating (150% for 1 minute)
- 3%, AC Line Reactor
- 3%, AC Output Reactor
- Auto or Manual 3-Contactor Bypass
- Blower motor starter with adjustable overload
- Nema 3R, Enclosure
- Door mounted operator devices.
- Circuit breaker or Non-fused disconnect switch
- Door mounted LCD (SM – Keypad Plus) with three lines of text.
- SM-Modules not included in the Order Code configurator, please consult with factory.

Normal Duty 208 VAC, 3-Phase Input and Output, 50/60 Hz Input

Normal Duty 110% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
1	5.2	RSxxN8001xxx-x	38x16x16	135	RCxxN8001xxx-x	24x16x16	65
1.5	6.8	RSxxN81P5xxx-x	38x16x16	135	RCxxN81P5xxx-x	24x16x16	65
2	9.6	RSxxN8002xxx-x	38x16x16	135	RCxxN8002xxx-x	24x16x16	65
3	15.5	RSxxN8003xxx-x	38x16x16	140	RCxxN8003xxx-x	24x16x16	70
5	22	RSxxN8005xxx-x	38x16x16	140	RCxxN8005xxx-x	24x16x16	70
7.5	28	RSxxN87P5xxx-x	38x16x16	140	RCxxN87P5xxx-x	24x16x16	70
10	42	RSxxN8010xxx-x	56x16x16	210	RCxxN8010xxx-x	30x24x16	180
15	54	RSxxN8015xxx-x	56x16x16	210	RCxxN8015xxx-x	30x24x16	180
20	68	RSxxN8020xxx-x	72x21x16	240	RCxxN8020xxx-x	39x30x16	145
25	80	RSxxN8025xxx-x	72x21x16	300	RCxxN8025xxx-x	39x30x16	200
30	104	RSxxN8030xxx-x	72x21x16	300	RCxxN8030xxx-x	39x30x16	200

Heavy Duty 208 VAC, 3-Phase Input and Output, 50/60 Hz Input

Heavy Duty 110% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
.75	4.3	RSxxH80P7xxx-x	38x16x16	135	RCxxH80P7xxx-x	24x16x16	65
1	5.8	RSxxH8001xxx-x	38x16x16	135	RCxxH8001xxx-x	24x16x16	65
1.5	7.5	RSxxH81P5xxx-x	38x16x16	135	RCxxH81P5xxx-x	24x16x16	65
2	10.6	RSxxH8002xxx-x	38x16x16	140	RCxxH8002xxx-x	24x16x16	70
3	17	RSxxH8003xxx-x	38x16x16	140	RCxxH8003xxx-x	24x16x16	70
5	25	RSxxH8005xxx-x	38x16x16	140	RCxxH8005xxx-x	24x16x16	70
7.5	31	RSxxH87P5xxx-x	56x16x16	140	RCxxH87P5xxx-x	30x24x16	70
10	42	RSxxH8010xxx-x	56x16x16	210	RCxxH8010xxx-x	30x24x16	145
15	56	RSxxH8015xxx-x	72x21x16	210	RCxxH8015xxx-x	39x30x16	145
20	68	RSxxH8020xxx-x	72x21x16	300	RCxxH8020xxx-x	39x30x16	200
25	80	RSxxH8025xxx-x	72x21x16	300	RCxxH8025xxx-x	39x30x16	200

Normal Duty 230 VAC, 3-Phase Input and Output, 50/60 Hz Input

Normal Duty 110% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
1.5	5.2	RSxxN21P5xxx-x	38x16x16	135	RCxxN21P5xxx-x	24x16x16	65
2	6.8	RSxxN2002xxx-x	38x16x16	135	RCxxN2002xxx-x	24x16x16	65
3	9.6	RSxxN2003xxx-x	38x16x16	135	RCxxN2003xxx-x	24x16x16	65
5	15.5	RSxxN2005xxx-x	38x16x16	140	RCxxN2005xxx-x	24x16x16	70
7.5	22	RSxxN27P5xxx-x	38x16x16	140	RCxxN27P5xxx-x	24x16x16	70
10	28	RSxxN2010xxx-x	38x16x16	140	RCxxN2010xxx-x	24x16x16	70
15	42	RSxxN2015xxx-x	56x16x16	210	RCxxN2015xxx-x	30x24x16	180
20	54	RSxxN2020xxx-x	56x16x16	210	RCxxN2020xxx-x	30x24x16	180
25	68	RSxxN2025xxx-x	72x21x16	240	RCxxN2025xxx-x	39x30x16	145
30	80	RSxxN2030xxx-x	72x21x16	300	RCxxN2030xxx-x	39x30x16	200
40	104	RSxxN2040xxx-x	72x21x16	300	RCxxN2040xxx-x	39x30x16	200

Order string: The base Order Code requires a minimum of 12 characters in sequence to create the order string.

Heavy Duty 230 VAC, 3-Phase Input and Output, 50/60 Hz Input

Heavy Duty 150% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
1	4.3	RSxxH2001xxx-x	38x16x16	135	RCxxH2001xxx-x	24x16x16	65
1.5	5.8	RSxxH21P5xxx-x	38x16x16	135	RCxxH21P5xxx-x	24x16x16	65
2	7.5	RSxxH2002xxx-x	38x16x16	135	RCxxH2002xxx-x	24x16x16	65
3	10.6	RSxxH2003xxx-x	38x16x16	140	RCxxH2003xxx-x	24x16x16	70
5	17	RSxxH2005xxx-x	38x16x16	140	RCxxH2005xxx-x	24x16x16	70
7.5	25	RSxxH27P5xxx-x	38x16x16	140	RCxxH27P5xxx-x	24x16x16	70
10	31	RSxxH2010xxx-x	56x16x16	140	RCxxH2010xxx-x	30x24x16	70
15	42	RSxxH2015xxx-x	56x16x16	210	RCxxH2015xxx-x	30x24x16	145
20	56	RSxxH2020xxx-x	72x21x16	210	RCxxH2020xxx-x	39x30x16	145
25	68	RSxxH2025xxx-x	72x21x16	300	RCxxH2025xxx-x	39x30x16	200
30	80	RSxxH2030xxx-x	72x21x16	300	RCxxH2030xxx-x	39x30x16	200

Normal Duty 460 VAC, 3-Phase Input and Output, 50/60 Hz Input

Normal Duty 110% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
1.5	2.8	RSxxN41P5xxx-x	38x16x16	135	RCxxN41P5xxx-x	24x16x16	70
2	3.8	RSxxN4002xxx-x	38x16x16	135	RCxxN4002xxx-x	24x16x16	70
3	5	RSxxN4003xxx-x	38x16x16	135	RCxxN4003xxx-x	24x16x16	70
5	8.8	RSxxN4005xxx-x	38x16x16	135	RCxxN4005xxx-x	24x16x16	70
7.5	11	RSxxN47P5xxx-x	38x16x16	135	RCxxN47P5xxx-x	24x16x16	70
10	15.3	RSxxN4010xxx-x	38x16x16	140	RCxxN4010xxx-x	24x16x16	70
15	21	RSxxN4015xxx-x	38x16x16	140	RCxxN4015xxx-x	24x16x16	70
20	29	RSxxN4020xxx-x	38x16x16	140	RCxxN4020xxx-x	24x16x16	70
25	35	RSxxN4025xxx-x	56x16x16	140	RCxxN4025xxx-x	30x24x16	150
30	43	RSxxN4030xxx-x	56x16x16	210	RCxxN4030xxx-x	30x24x16	150
40	56	RSxxN4040xxx-x	56x16x16	210	RCxxN4040xxx-x	30x24x16	250
50	68	RSxxN4050xxx-x	72x21x16	300	RCxxN4050xxx-x	39x30x16	280
60	83	RSxxN4060xxx-x	72x21x16	350	RCxxN4060xxx-x	39x30x16	280
75	104	RSxxN4075xxx-x	72x21x16	350	RCxxN4075xxx-x	39x30x16	280
100	138	RSxxN4100xxx-x	72x36x18	550	n/a		
125	168	RSxxN4125xxx-x	72x36x18	550			
150	202	RSxxN4150xxx-x	90x36x20	700			
200	236	RSxxN4200xxx-x	90x36x20	700			

Note: Weight does not include options.

Order string: The base Order Code requires a minimum of 12 characters in sequence to create the order string.

Heavy Duty 460 VAC, 3-Phase Input and Output, 50/60 Hz Input

Heavy Duty 150% for 1 minute		Slim Enclosure			Cube Enclosure		
HP	Amps	Order Code	Dimensions HxWxD (in)	Weight (lbs)	Order Code	Dimensions HxWxD (in)	Weight (lbs)
1	2.1	RSxxH4001xxx-x	38x16x16	135	RCxxH4001xxx-x	24x16x16	70
1.5	3	RSxxH41P5xxx-x	38x16x16	135	RCxxH41P5xxx-x	24x16x16	70
3	5.8	RSxxH4003xxx-x	38x16x16	135	RCxxH4003xxx-x	24x16x16	70
5	7.6	RSxxH4005xxx-x	38x16x16	135	RCxxH4005xxx-x	24x16x16	70
7.5	13	RSxxH47P5xxx-x	38x16x16	135	RCxxH47P5xxx-x	24x16x16	70
10	16.5	RSxxH4010xxx-x	38x16x16	140	RCxxH4010xxx-x	24x16x16	70
15	25	RSxxH4015xxx-x	38x16x16	140	RCxxH4015xxx-x	24x16x16	70
20	29	RSxxH4020xxx-x	38x16x16	140	RCxxH4020xxx-x	24x16x16	70
25	32	RSxxH4025xxx-x	56x16x16	140	RCxxH4025xxx-x	30x24x16	70
30	40	RSxxH4030xxx-x	56x16x16	210	RCxxH4030xxx-x	30x24x16	150
40	60	RSxxH4040xxx-x	72x21x16	210	RCxxH4040xxx-x	39x30x16	150
50	74	RSxxH4050xxx-x	72x21x16	300	RCxxH4050xxx-x	39x30x16	250
75	96	RSxxH4075xxx-x	72x21x16	300	RCxxH4075xxx-x	39x30x16	280
100	124	RSxxH4100xxx-x	72x36x18	550	n/a		
125	156	RSxxH4125xxx-x	72x36x18	550			
150	180	RSxxH4150xxx-x	90x36x20	700			

Note: Weight does not include options.

AC RapidPaks are available with Commander SK, Commander GP20 and Unidrive SP

Definition - RapidPak AC Order Code Configurator

Item	Description
Enclosure Style C = Cube enclosure S = Slimline enclosure	Cube enclosure option allows only the circuit breaker, non-fused disconnect switch and door operator devices. The Slimline enclosure allows all the options unless bypass is selected, then there is a limit of either an input or output reactor.
Drive Type SKN = SK Normal Duty, SKH = SK Heavy Duty, CGN = GP20 Normal Duty, CGH = GP20 Heavy Duty, SPN = SP Normal Duty, SPH = SP Heavy Duty,	Three drive models: Commander SK, Commander GP20 & Unidrive SP, AC drives with a Normal duty, current overload rating of 110% for 60 seconds. Heavy duty, current overloads rating of 150% for 1 minute.
Voltage Rating 8=208 VAC, 2=230 VAC, 3=380 VAC, 4=460 VAC	AC Input line voltage, 3 hp, 50/60 Hz, equals AC output rating for motor.
HP Rating	Motor hp ratings are based on typical motor current ratings. Actual motor currents and the type of applications should be reviewed before selecting drive size.
Door Mounted Operator Station 0 = Blank 1 = Stop PB, Start PB, Fault Light, Pot. 2 = # 1 & Jog PB, Fwd/Rev SS 3 = # 2 & Power On Light 4 = HOA SS, Pot, Power On, VFD Run, Fault Light 5 = HOA SS, Plus Bypass	The blank option defines that the devices are remote mounted. Selection #1 to #5 defines that the devices are door mounted and wired to the drive terminals.
Input Power 0 = Main Lugs with Input Fusing 1 = Circuit breaker (CB) 2 = Non-fused disconnect (NFD)	0 = Input Main lugs for customer termination with input fusing standard. 1 = CB with through the door operator, Thermal-magnetic overload protection and main circuit disconnect. Includes drive input semiconductor fuses. 2 = NFD with through the door operator, main circuit disconnect. Includes drive fusing.

AC RapidPak Order Code Configurator

Order String

R	x	xxx	x	xxx	x	x	x	-	xxxxx

Product
R = RapidPak

Enclosure Style
S = Slimline[2]
C = Cube[1]

Drive Model
SKN = SK Normal Duty
SKH = SK Heavy Duty
CGN = GP20 Normal Duty
CGH = GP20 Heavy Duty
SPN = SP Normal Duty
SPH = SP Heavy Duty

Voltage Rating
8 = 208 V / 3 / 60
2 = 230 V / 3 / 60
3 = 380 V / 3 / 60
4 = 460 V / 3 / 60

Horsepower
see Order Code tables

Additional Options (if required)
1 = AC Input Reactor
2 = AC Output Reactor
4 = Auto 3-Contactor Bypass
5 = Blower Motor Starter
A = Manual Three-Contactor Bypass
F = NEMA-3R Enclosure

Input Power
0 = Main Lugs with Input Fusing
1 = Thru-Door Disconnect C/B
2 = Thru-Door Disconnect Switch

Keypad
N = Keypad on Drive
K = Keypad on Door

Door Mounted Operator Station[3]
0 = Blank
1 = Stop PB, Start PB, Fault Light, Pot
2 = #1 + JOG PB, Fwd/Rev SS
3 = #2 + Power On Light
4 = HOA SS, Power On, VFD Run, Fault Light, Pot
5 = HOA SS plus Bypass

1 Cube Enclosure Style does not allow for additional options (insufficient space)
2 Smallest Slimline Enclosure Style allows all the options unless bypass is selected, then there is a limit of either an input or output reactor.
3 Abbreviation Key: PB = Push button; SS = Selector Switch; HOA = Hand-Off-Auto

Order string: The base Order Code requires a minimum of 12 characters in sequence to create the order string.

Additional Order Code

AC Input Reactor	3% impedance input line reactor. Reduces harmonics to line. **Slimline only**
AC Output Reactor	3% impedance output line reactor. Increases motor insulation life by reducing dV/dt. **Slimline only**
Auto Three-Contactor Bypass	Used in applications where full speed operation is required if drive becomes inoperable. Automatically switches upon drive fault. Requires Operator Station #5. **Slimline only**
Blower Motor Starter	Controls separately powered motor blower on TEBC and DPFV motors used for wide speed range applications. Not available with Bypass Options. **Slimline only**
Manual Three-Contactor Bypass	Used in applications where full speed operation is required if drive becomes inoperable. Manual (operator) activated via Operator Station #5. **Slimline only**
Nema 3R Enclosure	Enclosure intended for outdoor use. Provides a degree of protection against falling rain, sleet, and external ice.

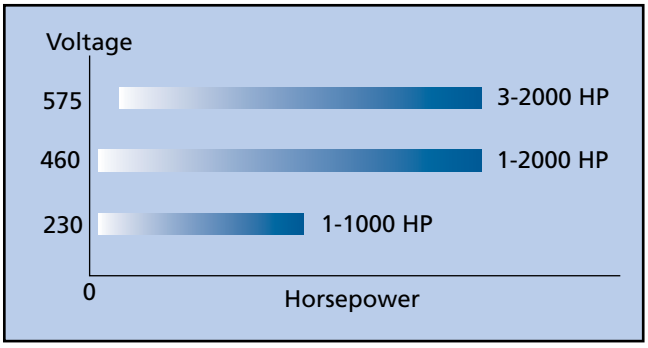
For options not included in the Order Code configurator, please consult factory.

AC CustomPak

In addition to our pre-engineered AC RapidPak solutions, we offer the AC CustomPak solution, when the stand alone module or packaged drives can't answer the need. Available with the full range of Emerson / Control Techniques products, this engineered product can be customized to meet a wide variety of power and control configurations. With power ranges up to 2000 hp and voltages ranging from 208V to 575V. The Saftronics Packaged Drive Center can deliver a comprehensive and cost–effective design that meets the needs of the most exotic packaged drive configuration. It features Non-Regenerative AC drives, fieldbus communication & coprocessor accessories for the demanding applications. This package solution has several optional features including; AC line contactor, AC line fusing, Input and Output reactors, 12, 18 or 24 pulse operation for harmonic reduction.



UL1, Ventilated Encl., SPM, 600 hp, 460VAC



Standard Features

- Input Voltage 208-460-575 VAC, 50/60 HZ
- Standard Enclosure, NEMA-12 (PPBF), Fully Gasketed, (PPBF) Positive Pressure Blown and Filtered.
- CT Soft Windows™ based Programming Tool

Enclosure Design

- NEMA 3R, Enclosure, Fully Gasketed, (PPBF) Positive Pressure Blown and Filtered
- N4, N4X or N12, (TENV) Enclosure, with or without Air Conditioner Depending on Size of the Drive.
- 14 Gauge Steel

Options

- Normal Duty Rating (110% for 1 minute)
- Heavy Duty Rating (150% for 1 minute)
- 3%, AC Line Reactors
- 3%, AC Output Reactor
- Auto or Manual 3-Contactor Bypass
- Blower Motor Starter with Adjustable Overload
- Door Mounted Operator Devices.
- Circuit Breaker or Non-fused Disconnect Switch
- Input Main Lugs with Input Fusing
- Door Mounted LCD (SM – Keypad Plus) with Three Lines of Text.
- SM-Modules
- Air Conditioner
- Space Heater
- 18 Pulse Operation

DC StandardPak

NEW

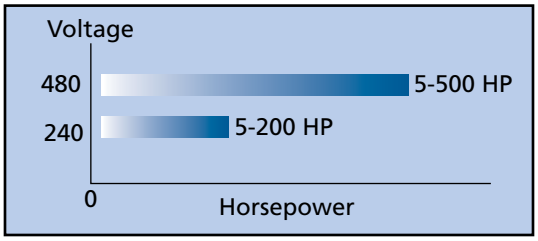




MentorPak PN: DEN4255AN1A0-E
Nema -12 (PPBF), Ventilated Encl., 150 hp, 460 VAC, Non-Regen, Circuit Breaker, AC Contactor, BMS

The DC StandardPak is a highly reliable, superior performing DC drive package. Featuring the Mentor II and Quantum III DC drive (depending on the options selected), this package is fully equipped with everything you would need to power and precisely control a DC motor. It features non-regenerative or regenerative operation, high speed fusing, field power supply, DC or AC contactor and control power. It also offers optional fieldbus communications & coprocessor accessories for demanding applications. This packaged solution has several optional features including; a circuit breaker, non-fused disconnect switch, fused blower motor starter, door mounted devices and remote mount dynamic braking resistor.

The DC StandardPak has one of the shortest lead times in the industry and can provide an expertly packaged, DC drive solution within days of placing your order. Standard lead time for the DC StandardPak is 1-3 weeks depending on options.



Standard Features

- Input Voltage 208-480 VAC
- Enclosure or Panel
- 120 VAC Control Logic
- AC Line semiconductor Fuse
- DC Output Fuse for Regenerative Drives.
- Standard field voltage - 240 VAC = 150 VDC
  480 VAC = 300 VDC
- CT Soft Windows™-based Programming Tool

QuantumPak
- DC Contactor with DB pole (5-100 hp @ 500 VDC)
- DC/AC or Encoder Feedback
- 55°C Drive Ambient

MentorPak
- AC Contactor (125-500 hp @ 500 VDC)
- DC or Encoder Feedback
- 40°C Drive Ambient

Enclosure Design

- Standard Enclosure N12 (PPBF), Fully Gasketed, (PPBF), Positive Pressure Blown and Filtered
- Painted with ANSI-61 Grey Paint
- Panel Design is with all the Standard Features and Options on a Back Panel
- 14 Gauge Steel

Options

- Door Mounted Operator Devices
- Circuit Breaker or Non-fused Disconnect Switch
- Fused Blower Motor Starter
- Non-Standard 240 VDC Field Supply
- 20 Amp Field Regulator
- Dynamic Braking Resistor (shipped loose)
- Door Mounted Keypad

Approvals

- UL508A

Non-Regenerative 208-240-380-480 VAC, 3-Phase Input, 50/60 Hz

QuantumPak: Panel or N12 (PPBF) Enclosure, DC Drive, 120 VAC CPT, DC contactor with DB contact, Input fusing.

HP 240 VDC	HP 500 VDC	Armature Amps @ 40 ° C	Armature Amps @ 55 ° C	Field Amps	Panel Order Code	Enclosure Order Code
3-10	5-20	n/a	38	Max 8A Field Current Regulator	DPNx038B0-x	DENx038B0-x
15	25-30		55		DPNx055B0-x	DENx055B0-x
20-30	40-60		106		DPNx106B0-x	DENx106B0-x
40-50	75-100		172		DPNx172B0-x	DENx172B0-x

MentorPak: Panel or N12 (PPBF) Enclosure, DC Drive, 120VAC CPT, AC Input contactor without DB contact, Input fusing.

HP 240 VDC	HP 500 VDC	Armature Amps @ 40 ° C	Armature Amps @ 55 ° C	Field Amps	Panel Order Code	Enclosure Order Code
60	125	210	Call Factory	Max 8A Field Current Regulator	DPNx210A0-x	DENx210A0-x
75	150	255		Max 10A Fixed Field Supply	DPNx255A0-x	DENx255A0-x
100	200	350			DPNx350A0-x	DENx350A0-x
125	250	420			DPNx420A0-x	DENx420A0-x
150	300	550			DPNx550A0-x	DENx550A0-x
200	400	700			DPNx700A0-x	DENx700A0-x
	500	825			DPNx825A0-x	DENx825A0-x

Regenerative 208-240-380-480 VAC, 3-Phase Input, 50/60 Hz

QuantumPak: Panel or N12 (PPBF) Enclosure, DC Drive, 120 VAC CPT, DC contactor with DB contact, Input fusing.

HP 240 VDC	HP 500 VDC	Armature Amps @ 40 ° C	Armature Amps @ 55 ° C	Field Amps	Panel Order Code	Enclosure Order Code
3-10	15-20	n/a	38	Max 8A Field Current Regulator	DPRx038B0-x	DERx038B0-x
15	25-30		55		DPRx055B0-x	DERx055B0-x
20-30	40-60		106		DPRx106B0-x	DERx106B0-x
40-50	100		172		DPRx172B0-x	DERx172B0-x

MentorPak: Panel or N12 (PPBF) Enclosure, DC Drive, 120 VAC cntrl logic, AC Input contactor without DB contact, Input fusing.

HP 240 VDC	HP 500 VDC	Armature Amps @ 40 ° C	Armature Amps @ 55 ° C	Field Amps	Panel Order Code	Enclosure Order Code
60	125	210	Call Factory	Max 8A Field Current Regulator	DPRx210A0-x	DERx210A0-x
75	150	255		Max 10A Fixed Field Supply	DPRx255A0-x	DERx255A0-x
100	200	350			DPRx350A0-x	DERx350A0-x
125	250	420			DPRx420A0-x	DERx420A0-x
150	300	550			DPRx550A0-x	DERx550A0-x
200	400	700			DPRx700A0-x	DERx700A0-x
	500	825			DPRx825A0-x	DERx825A0-x

Notes:
1) HP rating is a guide, please verify the motor armature amps at 40° or 55° C, then select the drive amps to be equal or greater then the motor amps.
2) The voltage code suffix is the 4th digit in the order string.

Dimensions & Weights

Armature Amps @ 40° C	Armature Amps @ 55° C	Dimensions H x W x D (inches) Panel	Dimensions H x W x D (inches) Enclosure	Weights (lbs) Panel	Weights (lbs) Enclosure
n/a	38	33x27x13	36x30x16	75	170
	55				
	106				
	172				
210	Call Factory	45x33x12	48x36x16	125	400
255					
350					
420		60x32x14	72x36x18 or 90x36x20 with NFD	210	600
550					
700					
825					

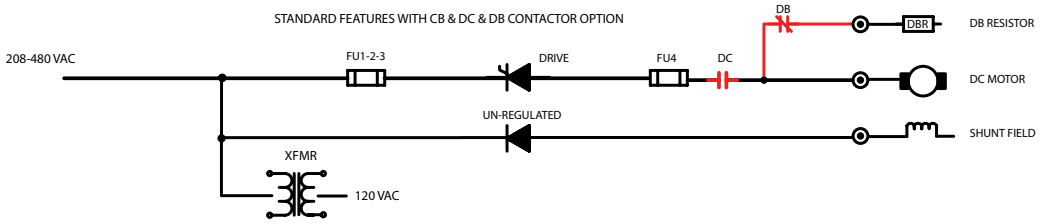
Note: Package Size 2, when adding the FXM5 option to the panel or enclosure the package size changes to Size 3.

DB Braking Resistor[1]			
Motor HP		DB Resistor for 240 VDC Order Code	DB Resistor for 500 VDC Order Code
240 VDC	500 VDC		
5	7.5	005-4301	005-4351
7.5	10	005-4302	005-4352
10	15	005-4303	005-4353
15	20	005-4304	005-4354
20	25	005-4305	005-4355
25	30	005-4306	005-4356
30	40	005-4307	005-4357
40	50	005-4308	005-4358
50	60	005-4309	005-4359
	75		005-4360
	100		005-4361
60	125	005-4310	005-4362
75	150	005-4311	005-4363
100	200	005-4312	005-4364
125	250	call factory	005-4365
150	300	call factory	005-4366
200	400	call factory	005-4367

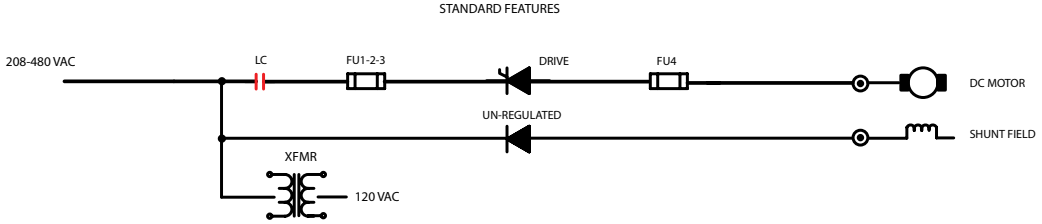
(1) The Nema 1 DB resistor is shipped loose and is to be mounted externally to the StandardPak by the customer to meet UL508A.

Power One Line Diagram

QuantumPak
DC Contactor with DB pole



MentorPak
AC Input Line Contactor



DC StandardPak Order Code Configurator

Order String

D	x	x	x	xxx	x	x	-	xxxxxxxx

Product
D = DC SandardPak

Enclosure Style
P = Panel
E = Enclosure

Drive Model
N = Non-Regenerative
R = Regenerative

Voltage Rating
8 = 208 VAC
2 = 240 VAC
3 = 380 VAC
4 = 480 VAC

Amp Rating
Amps are based on drive size

Dynamic Braking [1]
A = AC Input Contactor
B = DC Contactor with DB pole

Input Power
0 = None (default)
1 = Circuit Breaker (C/B)
2 = Non Fused Disconnect Switch (NFD)

Additional Options (if required)

Fused Bower Motor Starter
1 = Range 0.4-0.65A
2 = Range 0.6 - 1.1A
3 = Range 1.0 -1.5A
4 = Range 1.3-1.9A
5 = Range 1.8-2.7A
6 = Range 2.5-4.1A
7 = Range 4.0-6.3A

Field Supply Options
A = 20A FXM-5 Field Current Regulator [2]
B = 240 VDC @ 2A [3]
C = 240 VDC @ 8A [3]
D = 240 VDC @ 20A [3]

Door Mounted Devices [4]
E = E-Stop, Start PB, Stop PB, Speed Pot
F = Fwd/Rev Switch [5]
H = HOA Selector Switch
J = Jog PB
K = Keypad (CTVue-303)
P = Drive Power "ON" PL
R = Reset PB
V = Analog Armature Ammeter & Voltmeter
W = Analog Field Ammeter & Voltmeter

Encoder Cable [6]
Y = DB9 Encoder Cable to Terminal Block

(1) E-Stop Braking option requires a DB contactor and an external DB resistor.
Consult factory for DC contactor for DC drives rated 210 Amps and up.
(2) Drives 255A and greater have fixed voltage field supply.
A field current regulator is required to operate above base motor speed.
(3) For 240 VAC application requiring 240 VDC armature and 240VDC Field Voltage.
(4) To meet UL508A for industrial applications the E-Stop PB is required when door mounted devices are selected.
(5) The Fwd/Rev Selector Switch applies to regenerative drives only.
(6) Encoder feedback requires DB9 connector at drive. This option includes cable from DB9 connector to a terminal block.

Standard Enclosure is UL1 rated (NEMA 12 - PPBF (Positive Pressure Blown and Filtered))

Order String requires a minimum of 9 characters.
Examples:

Standard Order Code for Non-Regen: 200 hp @ 480 VAC, N12-(PPBF) enclosure, at 40˚ C
PN = DEN4350A0

Standard Order Code as above with the following options: Circuit Breaker, Fused Blower Motor Starter, Field Regulator, Start/Stop PB, Reset PB, Armature Ammeter, Field Ammeter, Encoder Cable.
PN = DEN4350A1-4ARVWY

Definition - DC StandardPak Order Code Configurator

Item	Description
Enclosure Style P = Panel E = Enclosure	P = Panel allows additional options to be added to the Quantum III module. E = The enclosure option is a UL1 rated, ventilated Nema -12 (PPBF), positive pressure blown and filtered. 14 gauge steel enclosure.
Drive Type N = Non-regenerative R = Regenerative	N for Non-regenerative DC drive or R for Regenerative DC drive. Regenerative provides FWD and REV direction with a controlled braking action. Non-Regenerative is unidirectional and will have a coast to a stop action, unless dynamic braking is used.
Voltage Rating 8 = 208 VAC 2 = 240 VAC 3 = 380 VAC 4 = 480 VAC	 240 VAC for 240 VDC motor armature. 480 VAC for 500 VDC motor armature.
Drive Amp Rating - Armature	Motor hp ratings are based on typical motor current ratings. Actual motor currents and the type of applications should be reviewed before selecting drive size.
Dynamic Braking (DB) A = AC Input Contactor B = DC Contactor with DB pole	QuantumPak supplied with DC contactor (B), MentorPak supplied with AC contactor (A) as standard. Consult Factory for drives 210A or above with DC contactor. A = AC Input Contactor (210-825A) B = DC Contactor with DB pole (38-172A)
Input Power Disconnect 0 = None 1 = Circuit breaker (CB) 2 = Non-fused disconnect (NFD)	1 – CB with through the door operator, Thermal-magnetic overload protection and main circuit disconnect. Includes drive input semiconductor fuses. 2 – NFD with through the door operator, main circuit disconnect. Includes drive input semiconductor fuses.

ADDITIONAL OPTIONS

Item	Description
Blower Motor Starter 1 to 7	Select the correct blower motor amps. The value must be selected to complete the Order Code for order entry.
Door Mounted Devices E = E-Stop, Start PB, Stop PB, Speed Pot F = Fwd/Rev Switch [5] H = HOA Selector Switch J = Jog PB K = Keypad (CTVue-303) P = Drive Power "ON" PL R = Reset PB V = Analog Armature Ammeter & Voltmeter W = Analog Field Ammeter & Voltmeter	To meet UL508A for industrial locations the E-Stop push button is required with door mounted devices. E = E-Stop, Start, & Stop Push buttons, Speed Potentiometer F = Forward / Reverse Switch - FWD/REV Selector Switch applies to regenerative drives only. H = Hand (Manual) - Off - Automatic Switch J = Jog Push button K – Keypad (CTVUE-303 with standard program, mounted and wired on the door) P = Drive Power "ON" pilot light indicates drive running. R = Drive can be reset by means of the door mounted push button (PB), Remote (PB) or (PB) on the cover of the drive. V = Analog Armature Ammeter (150%) & Voltmeter (100%). W = Analog Field Ammeter (100%) & Voltmeter (100%)
Encoder Cable Y = Encoder cable	The drive has a DB9 connector for encoder feedback. The encoder cable is supplied with the DB9 connector wired to a terminal block.

For options not included in the Order Code configurator, please consult factory.

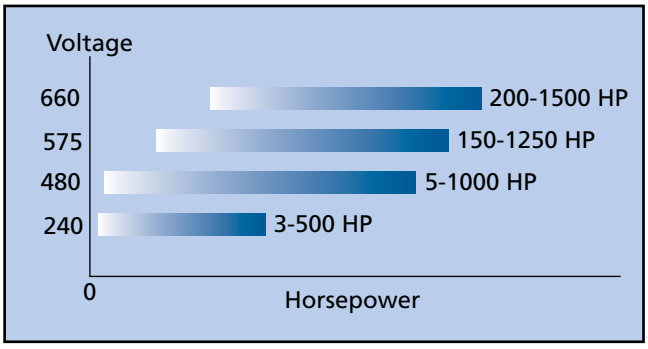
DC CustomPak

In addition to our pre-engineered DC StanardPak solutions, we offer a DC CustomPak solution. Featuring the Mentor II or the Quantum III DC drive, this engineered product can be customized to meet a wide variety of power and control configurations. With power ranges up to 1500 hp and voltages ranging from 240V to 660V, our custom engineered DC packaged solution can meet the needs of the most demanding packaged drive configuration. It features non-regenerative or regenerative operation, high speed fusing, field power supply regulated and unregulated, DC or AC contactor and control power. It also offers optional fieldbus communications & coprocessor accessories for demanding applications.

This packaged solution has several optional features including; a circuit breaker, AC line contactor, DC/DB contactor, fused blower motor starter, door mounted devices, line reactors, 12 pulse operation for harmonic reduction, and higher horsepower range.



Nema -12 (PPBF), Ventilated Encl., 500 hp, 460 VAC, Non-Regen, Circuit Breaker, DC Contactor, Field Regulator



Standard Features

- Input Voltage 208-240-380-480-575-660 VAC
- Enclosure or Panel
- 120 VAC control logic
- AC Line semiconductor fuse
- DC output fuse for regenerative drives
- AC, DC, DB contactor
- 2, 8 amp field regulator
- 10, 20A field supply
- DC, AC Tach or Encoder feedback
- Standard field voltage - 240 VAC = 150 VDC
  480 VAC = 300 VDC
- CT Soft Windows™ based programming tool

Approvals

- UL508A up to 150 hp @ 240 VAC, 500 hp @ 480 VAC, 40° C

Options

- Door mounted operator devices and meters
- Circuit Breaker or Non-fused disconnect
- Fused blower motor starter
- Non-Standard field volts
- 20, 50, 90 Amp field regulator
- Line Reactor
- DC Choke
- 12 Pulse
- Dynamic braking resistor
- Air conditioner
- Door mounted keypad

Enclosure Design

- Standard Enclosure is (Nema 12 –PPBF) positive pressure blower and filter
- ANSI-61 grey paint
- 14 gauge steel
- Nema 3R, fully gasketed, (PPBF), Positive Pressure Blown and Filtered

UL LISTED

2 YEAR DRIVE Warranty

Large Enclosed AC Drives

NEW

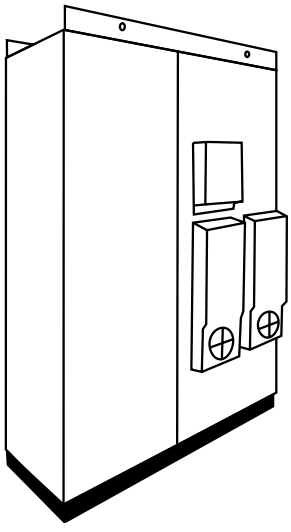
Users requiring quick delivery of a high-horsepower NEMA 12 Positive Pressure Blown and Filtered AC drive system, now have an Emerson Solution.

Robust Unidrive SPM technology from Control Techniques gives users the power, performance, and the ultimate in flexibility for all AC applications from 100 hp to 500 hp. For custom built higher horsepower configurations please consult your sales representative.



Features

- All the state-of-the-art integration features of the Unidrive SP
- A cost competitive, pre-engineered "AC In – AC Out" solution
- A perfect match for both high-performance, and standard drive applications, such as fans, pumps and conveyors
- Industry standard NEMA 12 filtered and ventilated enclosures
- Simplicity in ordering, installing and configuring
- An extensive array of options, including...
  - Circuit Breaker Disconnect
  - Line / Load Reactors
  - Door Mounted Operator Controls
  - Door Mounted Keypad



Dimensions

Cabinet Dimensions (inches)				
460V Horsepower	Duty	Height	Width	Depth
100–125 hp	Normal	78.75	23.6	23.6
100–125 hp	Heavy			
150–250 hp	Normal	78.75	31.5	27.5
150–250 hp	Heavy			
300–500 hp	Normal	78.75	55.1	27.5
300–450 hp	Heavy			
500 hp	Heavy	78.75	63	27.5

Note: Depth dimensions for the cabinets in the table include through-panel heatsinks and blowers on the back of the cabinet.

460 VAC Large Enclosed Drives Horsepower Ratings

Model	Normal Duty Rating (110%)			Heavy Duty Rating (150%)		
	hp 460 VAC	Continuous Amps	Peak Amps	hp 460 VAC	Continuous Amps	Closed Loop Peak Amps
LESPx4100	100	138	151	100	124	217
LESPx4125	125	168	184	125	156	273
LESPx4150	150	205	226	150	210	315
LESPx4200	200	236	260	200	246	369
LESPx4250	250	290	319	250	290	435
LESPx4300	300	335	369	300	342	513
LESPx4350	350	448	492	350	399	599
LESPx4400	400	470	517	400	470	682
LESPx4450	450	551	606	450	551	827
LESPx4500	500	637	701	500	599	898

Maximum permissible current output @ 40°C and 3kHz switching frequency. Consult factory for higher horsepower drives.

Order String

L | E | XXX | X | XXX | X | X | X | - | XXXXX

Product
L = Large Enclosed Drive

Package Type
E = NEMA 12 Enclosure

Drive Model
SPN= SP Normal Duty
SPH= SP Heavy Duty

Voltage Rating
8 = 208 VAC (future)
2 = 230 VAC (future)
3 = 380 VAC (future)
4 = 460 VAC

Horsepower Rating

100 = 100 hp	125 = 125 hp
150 = 150 hp	200 = 200 hp
250 = 250 hp	300 = 300 hp
350 = 350 hp	400 = 400 hp
450 = 450 hp	500 = 500 hp

Options
0 = None
1 = AC Input Reactor (2)
2 = AC Output Reactor (3)
5 = Blower Motor Starter
F = Nema-3R Enclosure (future)

Input Power
0 = Main Lugs (1)
1 = Thru Door Disconnect Circuit Breaker(1)
2 = Thru Door Non-Fused Disconnect Switch(1)

Door Mounted Keypad
0 = LED Keypad on drive
K = LCD Keypad mounted on door
N = LCD Keypad on drive

Door Mounted Operator Station
0= No Operators
1 = Stop PB, Start PB, Fault Lamp, Potentiometer
2 = #1 + Jog PB, Fwd/Rev SS
3 = #2 + Power On Lamp
4 = HOA SS, Power On Lt, VFD Run, Fault Lamp, Potentiometer

Ordering Notes: (1) Drive line fuses are included as standard
(2) Input reactors are included on 200 hp HD, and all 250 to 500 hp drives
(3) Output reactors are included on all 300 to 500 hp drives

Unidrive SPM — 60 hp to 2900 hp

Modular drives ideal for system integrators and OEMs



The Unidrive SPM — Solution Platform Modular systems give integrators and OEMs added flexibility to design and build high power AC drives that meet their exact requirements.

The Unidrive SPM platform offers all of the standard and optional features available on the panel mount SP drives and is integrated using the same software tools for commissioning and programming.

The modular nature of the power circuit allows drive systems to be constructed in non-standard enclosures. For example, it is possible to implement a drive system of between 60 and 2900 hp in an enclosure no taller than 36 in.

FEATURES	BENEFITS
• Control high current motors by paralleling output inverter modules	▪ Build customized high power drives with standard volume produced modules
• Compact IP20 input and output power modules	▪ Create a comprehensive range of custom power systems
• Utilize an existing DC supply	▪ Economic integration with existing plant
• Return braking energy to AC supply with standard inverter modules	▪ Reduce running cost
• Recycle energy between simultaneously motoring and regenerating drives	▪ Ideal for unwinding / winding processes
• Enable a single AC power entry	▪ Simplify installation and minimize cabling
• Minimize harmonics with 12-, 18- and 24-pulse rectifier configurations	▪ Meet more demanding supply regulations
• Eliminate harmonics with an active front end	▪ Comply with supply regulations
• IP54 heatsink with through panel mounting	▪ Allows smaller enclosure size, reduces cooling requirements

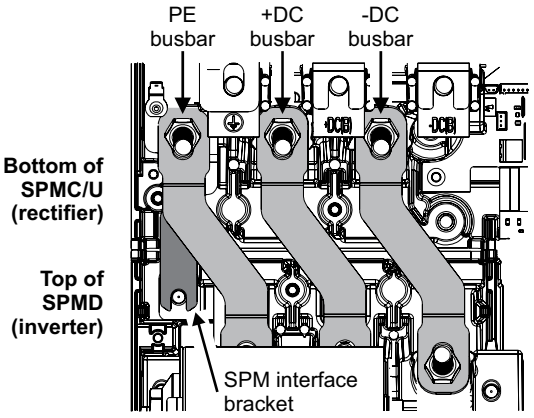
SPM MODULE DESCRIPTIONS

SPM**A** - Is a complete inverter drive (**A**C in, AC out) with internal rectifier capable of being parallel connected with SPMA modules of equal rating. DC connections are present for regen and common bus applications.

SPM**D** - Inverter module (**D**C in, AC out) that requires a DC power supply from either an SPMC/U or an existing source.

SPM**C** - **C**ontrolled rectifier bridge module (AC in, DC out) used as a front end power supply to the SPMD inverter module.

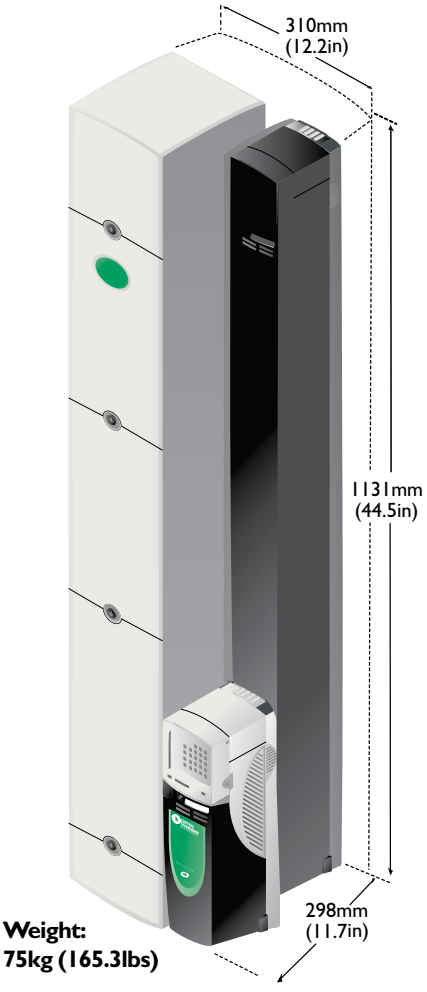
SPM**U** - **U**ncontrolled rectifier bridge (AC in, DC out) used as a front end power supply to the SPMD inverter module. A separate soft start must be provided.



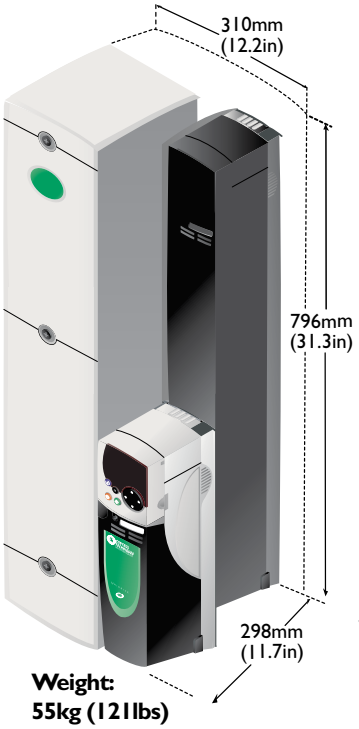
Docking kits are available that provide the necessary hardware to directly mount the SPMC to an SPMD.

Input line reactors and output sharing chokes are specified and available.

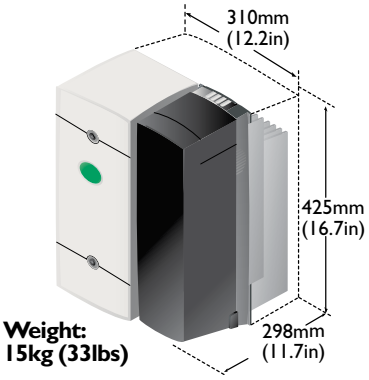
SPMA



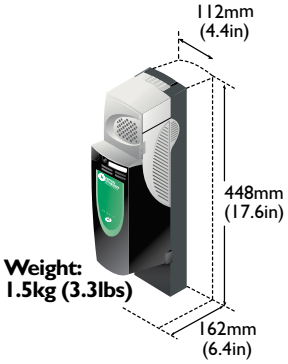
SPMD



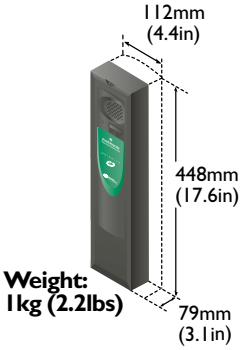
SPMC/U



SM-Control Master



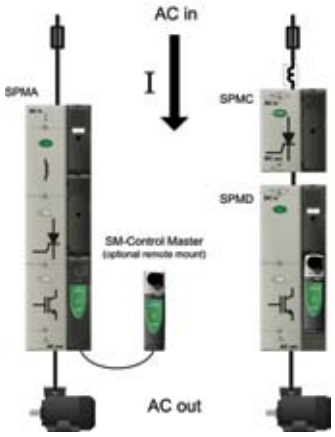
SM-Control Follower



Basic Configurations

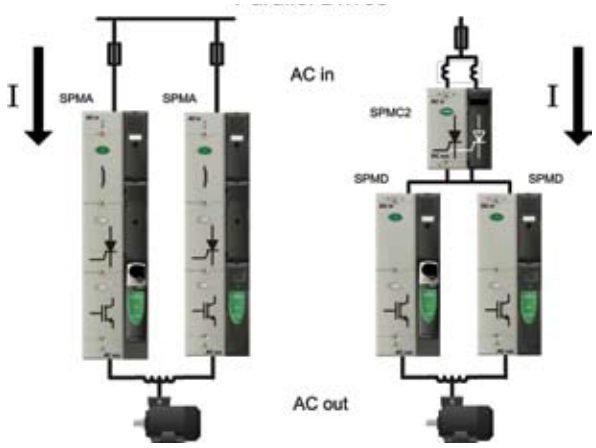
The examples below demonstrate the versatility of the Unidrive SPM in creating a wide range of High Power AC drives.

Single Drives



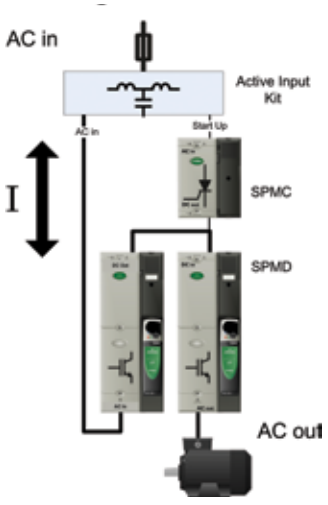
The SPMA solution will be lower cost but the SPMD solution may give site standardization. The master control module on the drive may be replaced by a follower module and the master can be remotely mounted, as the application requires.

Parallel Drives



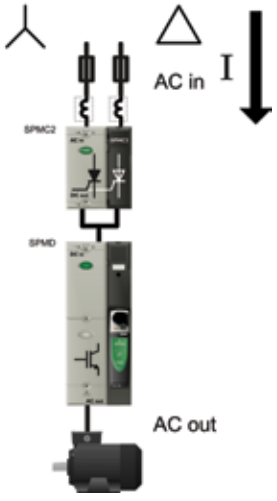
For higher currents multiple SPMAs or SPMDs may be configured in parallel. The SPMA may give shorter installation time with less interconnections but the SPMD may give lower cost. Site standardization may also be a factor.

Active Input and Regeneration



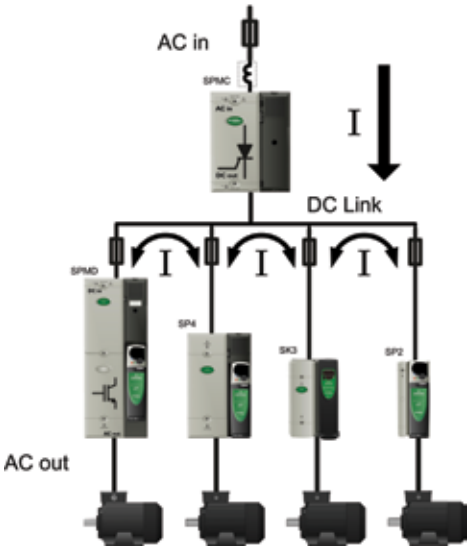
Active inputs for harmonic elimination and regenerating excess energy can be configured with standard drive modules, configured as motoring or regenerating.

12 Pulse Input Current



Multi-pulse rectifiers can be configured (12, 18 and 24 etc.), to minimise input harmonics and help to meet local supply authority regulations.

Common DC bus

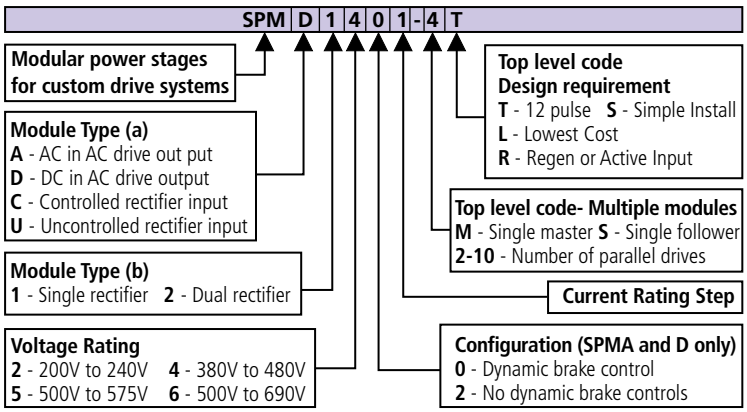


Drives from the Unidrive and Commander families can be connected on a common DC bus system, in order to circulate energy between drives with opposing energy flow, supplied from a controlled rectifier input (SPMC), an active input (SPMA or SPMD) or an existing DC source.

	Drive	Output Module Selection							DC Fuse Selection	Input Module Selection					AC Fuse Selection
		Normal Duty			Heavy Duty			24 VDC Input [3]		Controlled		Uncontrolled		24V DC Input [3]	
		Max Cont. Current	Typical Motor Output		Max Cont. Current	Typical Motor Output				Single	Dual	Single [3]	Dual [3]		
	Order Code	A	220V kW	230V hp	A	220V kW	230V hp	A	A					A	A
200-240 VAC +/- 10%	SPMD1201	**192**	55	75	**156**	45	60	3.3	400	na	na	SPMU1402	SPMU2402	3.0	400
	SPMD1202	**248**	75	100	**192**	55	75	3.3	550	na	na				
	SPMD1203	**312**	90	125	**250**	75	100	5.0	550	na	na				
	SPMD1204	**350**[1]	110[1]	150[1]	**290**	90	125	5.0	550	na	na				
		A	400V kW	400V hp	**A**	400V kW	400V hp								
380-480 VAC +/- 10%	SPMA1401	**205**	110	150	**180**	90	150	3.3	na	na	na	na	na	na	315
	SPMA1402	**236**	132	200	**210**	110	150	3.3	na	na	na	na	na	na	350
	SPMD1401	**205**	110	150	**180**	90	150	3.3	400	SPMC1402	SPMC2402	SPMU1402	SPMU2402	3.0	400
	SPMD1402	**246**	132	200	**210**	110	150	3.3	560						
	SPMD1403	**290**	160	250	**246**	132	200	5.0	560						
	SPMD1404	**350**[1]	200[1]	300[1]	**290**	160	250	5.0	560						
		A	575V kW	575V hp	**A**	575V kW	575V hp								
500-575 VAC +/- 10%	SPMA1601[2]	**125**	90	125	**100**	75	100	3.3	na	na	na	na	na	na	200
	SPMA1602[2]	**144**	110	150	**125**	90	125	3.3	na	na	na	na	na	na	200
	SPMD1601[2]	**125**	90	125	**100**	75	100	3.3	250	SPMC1601	SPMC2601	SPMU1601	SPMU2601	3.0	250
	SPMD1602[2]	**144**	110	150	**125**	90	125	3.3	315						
	SPMD1603[2]	**168**	110	150	**144**	110	150	5.0	350						
	SPMD1604[2]	**192**	150	200	**168**	110	150	5.0	400						
		A	600V kW	600V hp	**A**	600V kW	600V hp								
500-690 VAC +/- 10%	SPMA1601	**125**	110	150	**100**	90	125	3.3	na	na	na	na	na	na	200
	SPMA1602	**144**	132	175	**125**	110	150	3.3	na	na	na	na	na	na	200
	SPMA1601	**125**	110	150	**100**	90	125	3.3	250	SPMC1601	SPMC2601	SPMU1601	SPMU2601	3.0	250
	SPMA1602	**144**	132	175	**125**	110	150	3.3	315						
	SPMA1603	**168**	160	200	**144**	132	175	5.0	350						
	SPMA1604	**192**	185	250	**168**	160	200	5.0	400						

Option Reference	Order Code
SM-Control Master	SM-Control Master
SM-Control Follower	SM-Control Follower [4]
24V DC Supply - 10A	8510-0000
SPM Docking Kit	3470-0012

Normal Duty	Suitable for most applications, current overload is set at 110% for 60 seconds. Where motor rated current is less than the drive continuous current, higher overloads are achieved.
Heavy Duty (Rotor Flux Control and Closed Loop)	Suitable for demanding applications, current overload is set at up to 150% for 60 seconds. Where motor rated current is less than the drive rated continuous current overloads (200% or greater) are achieved.



Notes:
[1] The full rating is only possible when the SPMD is mounted separately to the SMPC. That is, a single module can deliver 350A with a separate airflow path for each module and Tambient = <35°C. Otherwise the limit is 335A.
[2] The same model can be used on a 575V or a 690V supply and has two different output ratings. e.g. At Normal Duty, SPMD1601 is suitable for a 90 kW output motor on a 575V but is suitable for a 110 kW output motor on 690V.
[3] All SPM modules require a 24 VDC power supply for the cooling fans. The total 24 VDC current required can be assessed in the table and a 24 VDC supply chosen.
[4] For paralleling, the necessary interface cable that connects a follower to a master or another follower is delivered with the follower module.
[5] A separate soft start must be provided for the DC link. Please contact your supplier.
[6] Input inductance may be incorporated in star-delta transformer.
[7] Only 400A AC and DC fuses are stocked by Control Techniques, as these are used with other products.
[8] For more information, contact your supplier.

Engineered Systems

Total Systems Solutions

When your motion application demands more than panel mount, free-standing, or packaged drives, our Drive Centers stand ready to deliver a comprehensive and cost-effective design, build and start up solution. Our more than 50 Drive Centers worldwide, eight in the United States, provide an invaluable, industrial application knowledge base to apply to our customers' needs. Forty years of building electronic-based drive systems has given us the expertise to build solutions for nearly any application.





Control Techniques engineering and systems centers are located around the country and are staffed by engineers providing expertise to a wide variety of industries:

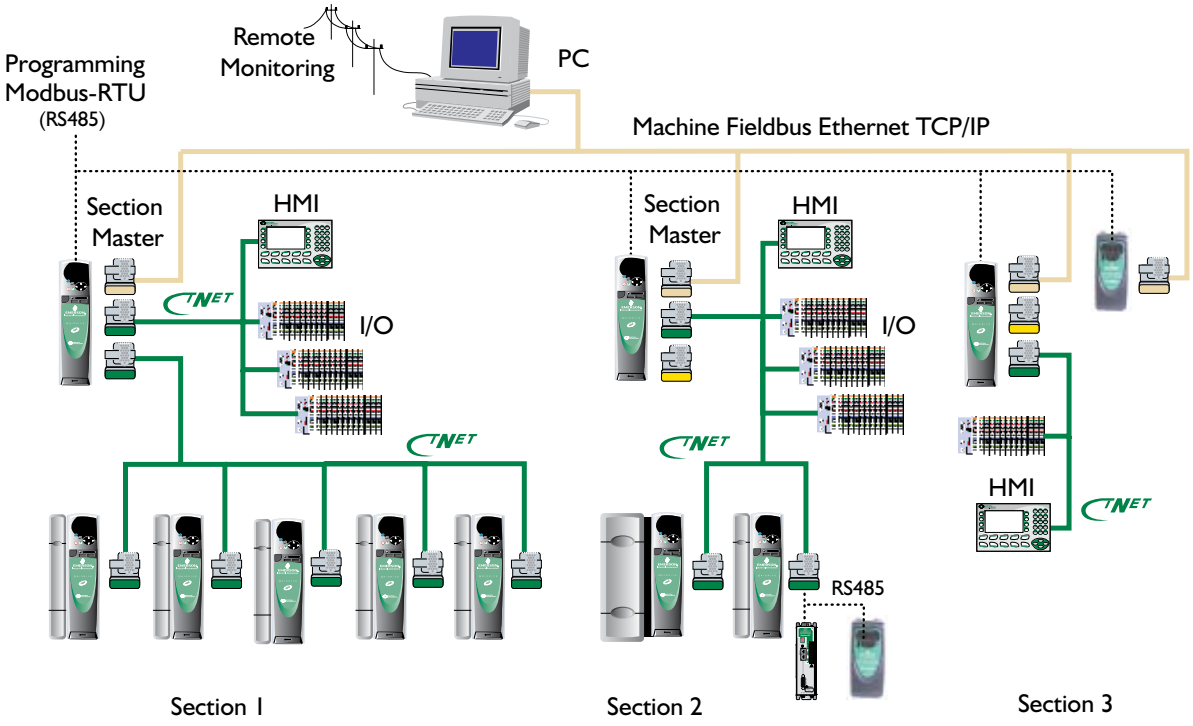
- Automotive Assembly and Testing
- Mining and Aggregates
- Oil and Gas
- Metals Processing
- Glass
- Plastics and Rubber
- Heavy Moveable Structures
- Water/Wastewater Pumping
- Web Handling
- Power Generation
- Converting
- Packaging
- Printing
- Forestry
- Irrigation
- Ski Lifts

Flexible control architecture

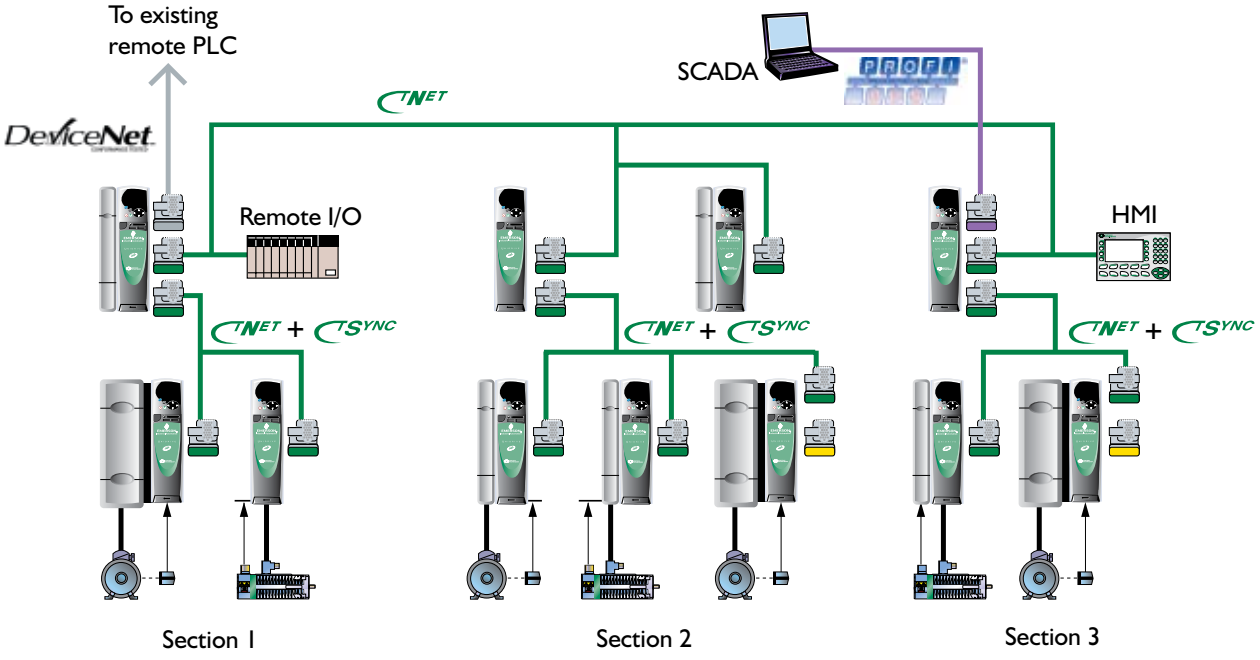
Our drives systems are designed for any control architecture: centralized, distributed, or fully decentralized. The options of scalable PLC functionality within the drive; high speed, peer-to-peer networking; extended I/O capability, and support for all major field-buses, greatly simplifies system integration regardless of the control scheme.

- SM-Applications Plus
- SM-I/O Plus
- SM-PROFIBUS-DP
- SM-DeviceNet
- SM-Ethernet

Distributed Sectional Control — featuring CTNet and Ethernet communications



Decentralized Control — featuring CTSync drive-to-drive synchronization with less than 250μsec jitter



Engineered Systems provides its customers with totally integrated systems, which can include:

- Coordinated Drive/Servo Systems
- Four-quadrant Regenerative Systems
- 18-Pulse and 24-Pulse Drives
- PLC and PC-based Control Systems
- Switch gear, e.g., automatic transfer switches
- Custom Fabrication
- Climate Controlled MCC's and E-Houses
- Electrical Control and Instrumentation
- Power Distribution
- Operator Interfaces (HMI)
- Industrial Communications Platforms
- Custom Enclosures





The typical engineered systems program consists of the following components:

- Initial Applications Review
- Proposal and Review
- Order and Project Scheduling
- Hardware Design and Review
- Software Design and design review
- System Training
- Field Startup Assistance

Systems/Features	AC Systems	Motion Control Systems	DC Systems
Control Technology	High Performance open loop and closed loop vector, regen	Rotary and linear servo, and AC Vector Servo	Digital open loop and closed loop, regen and non-regen
Power	.5 hp to 2900 hp	Servo: To 750 lb-in Vector: To 4,500 lb-in	5 hp to 2000 hp
AC Voltage 50/60Hz ± 10%	200V to 690V 3Ø	90V to 690V 1Ø, 3Ø	208-660V 3Ø
Motor Feedback	All major feedback devices supported.		Voltage Feedback (CEMF) AC or DC Tachometer, Encoder
Communication	All major communication protocols supported.		
Enclosures	NEMA 1, NEMA 3R, NEMA 4, NEMA 4X, NEMA 12, and NEMA 12–Positive Pressure, Custom		
Key Options	Operator control stations, Industrial CRT workstations, HMI programming, PLC's, Switch gear, Power distribution, Common DC bus, Speed reducers		

Software and Connectivity

Tools for Selection, Programming and Commissioning

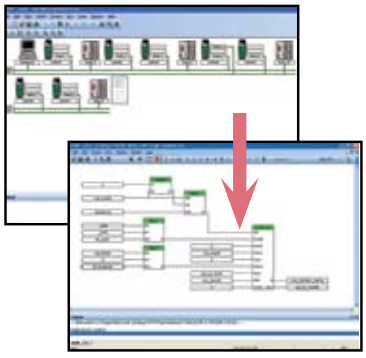
Easy-to-use Software

While every AC and DC drive can be setup using the drive's keypad, Control Techniques free setup software can speed the configuration process. Our CTSize utility software enables users to effectively size servo drives and motors to an application, and CTSave lets users gauge their energy usage, savings and payback period.



SyPTPro, PowerTools Pro and Motion Perfect software, can all be used to program motion control on the Unidrive SP. Details on these software solutions are covered in the Motion Control section of this catalog. In this way Control Techniques provides users the option to choose the software tool best suited for their drive and motion application needs.

The software tools to develop sophisticated applications include SyPTLite and SyPTPro, which comply with the IEC-61131-3 standard for ladder logic and function block programs; and "Motion Made Easy"™ servo software, PowerTools Pro.



FREE Software

With the exception of SyPTPro, all Control Techniques software is free of charge, and is available for download from our web site, www.emersonct.com. SyPTLite is also available from the SyPTLite Users Group web site, www.syptlite.com.

Drive Commissioning Tools		Page
CTSoft	Parameter Configuration for Commander SK, Commander GP20, Digitax ST-B, Digitax ST-I & Unidrive SP	344
SXSoft	Parameter Configuration for Commander SX Drives	344
MentorSoft	Parameter Configuration for Mentor II and Quantum III Drives	344
SL Parameter Tool	Parameter Configuration for Commander SL Drives	344
CTScope	Drive Diagnostic Tool for Plotting/Tracing Drive Parameters on Unidrive SP, Commander GP20, Commander SK, Mentor II, Quantum III and Digitax ST	346

Drive, Module, and Controller Programming Tools		Page
PowerTools Pro	Advanced Motion Control Programming for Epsilon EP, FM-3 and FM-4 modules, and for Unidrive SP, Digitax ST-Z with the SM-EZMotion module	348
SyPTPro	Advanced Applications Programming for Unidrive SP and Digitax ST-P with SM-Applications Lite V2, SM-Lite Plus and Unidrive SP and Digitax ST-Z with SM-Applications Plus module	361
SyPTLite	Applications Programming for Commander SK with Logic Stick, and for Unidrive SP, Commander GP20 or Unidrive SP with SM-Applications Lite V2 module	369
MotionPerfect2	Motion Control Programming for the MC multi-axis controller	370

Drive Selection Tools		Page
CTSize	Drive and Motor Selection Tool for Motion Control Applications	372
CTSave	Energy Savings Estimator	373

Connectivity Software Tools		Page
CTOPC Server	Software for interfacing to SCADA and PC Based Control Systems	374

Fieldbus Communications

Fieldbus communications enable control systems to exchange data with remote sensors, actuators and drives using a common protocol and communications bus. The benefits are often better control, and reduced installation, cabling and maintenance costs.

Modbus RTU is the standard fieldbus protocol on all Control Techniques drives with communications capability.

Programming drives for communications is a simple and straight forward process, with "Motion Made Easy"™ setting up a fieldbus is primarily a "point and click" and "drag and drop" operation.





The SM-Profibus, SM-DeviceNet and SM-CANOpen Solution Modules have been fitted to this 75 hp Unidrive SP allowing it to do double duty as a communications gateway for these three fieldbus protocols.

Communications and Fieldbus Protocols

	Drive / Controller	Modbus	Ethernet	DeviceNet	CANopen	CAN	Profibus DP	Interbus-S	SERCOS	CTNet	CTSync	EtherCAT
AC Drives	Commander SX	●										
	Commander SK	●	●	●	●		●	●				●
	Commander GP20	●	●	●	●		●	●				●
Motion Control	Unidrive SP	●	●	●	●	●*	●	●	●	●	●	●
	Digitax ST	●	●	●	●	●*	●	●	●	●	●	●
	MDS Series	●	●	●			●					
	EN Series	●	●	●			●					
	Epsilon EP Series	●	●	●			●					
	MC Series	●	●	●	●	●	●		●			
DC Drives	Mentor II	●		●			●	●		●		
	Quantum III	●		●			●	●		●		

* Also requires SM-Applications Lite V2 or an SM-Applications Plus module.

Drive Commissioning Tools

Control Techniques provides software packages used to commission the various drive hardware platforms. While each drive can be configured for basic operation using the keypad controls on the front of the drive, these software tools allow access to every parameter in the drive, and also offer setup wizards and diagnostics screens.

For your convenience, each of these software packages are provided free with the drive, or can be downloaded free-of-charge from Control Techniques web site at www.emersonct.com.

Note: while some of our software support multiple drive platforms, others are dedicated to only a single drive hardware platform. Use the chart below right to select the proper Software based on the chosen drive platform, as well as the correct programming cable for your drive.

CTSoft, MentorSoft, SXSoft and the SL Parameter Tool

CTSoft, MentorSoft, and SXSoft are complimentary Windows™-based drive configuration tools designed to simplify the process of drive system design, set up, and diagnostics. The software enables the complete control and display of all parameters within a drive. The software provides valuable drive data storage, retrieval and programming functions. CTSoft can be used offline, in the office, or online on the plant floor.

Parameter programming and monitoring may be done using the parameter tables or dynamic graphical flow diagrams. Like on the drives, parameters are grouped into logical menus of related parameters. Help menus and parameter descriptions are accessible by simply double clicking on the parameter of interest once you have installed the documentation package.

CTSoft, has a Drive Set-up Wizard that walks you through the basic set-up of a Commander SK, Commander GP20, Unidrive SP, and the Digitax ST. It also includes a Motor Database that may be modified to include the customer's motors. CTSoft conveniently provides a method to save multiple drive setups in one project group. Its multiple window viewing capability makes CTSoft the ideal commissioning tool.

FREE Software

ALL Software IS PROVIDED FREE WITH THE DRIVE OR VISIT www.emersonct.com

Some of its many features include:

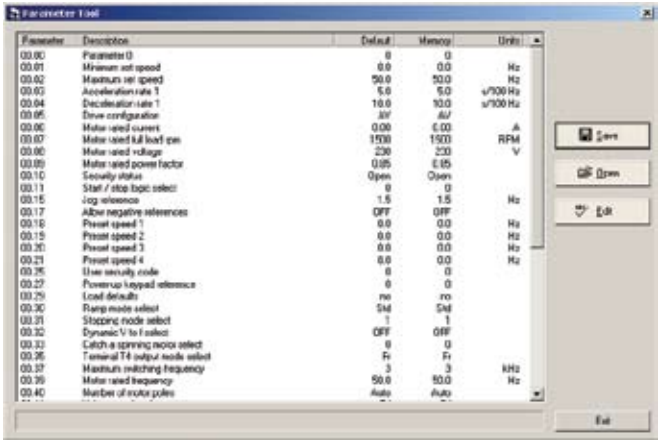
- Built-in reference manuals and search functions that provide extensive "Help" files for both the drive and the software
- Graphical and dynamic illustrations of analog and digital I/O and internal signal flow
- Drive can be reset, set back to factory defaults and configurations stored via the software

PC Specifications:

- Microsoft Windows™ 3.1X, Windows 95 / 98 / 2000 / Windows NT 4.0 / XP; CTSoft requires 2000/XP or higher
- 486 processor (minimum); Pentium processor or higher recommended
- 8 MB RAM, 4 MB free hard disk space, RS232 Ethernet or USB port

Parameter Tool for Commander SL

The Parameter Tool is complementary software offered by Control Techniques to copy, clone, save and modify Commander SL drive parameters. This software comes as part of "Easy Commissioning Pack", which also has an EIA485 (RJ45) Comms Adaptor. The Comms adaptor connects to the slot in the front of Commander SL and provides an RJ45 port for communication. A CT Comms Cable or a CT USB cable is necessary.



Drive	Software	Cable Part Numbers
Commander SL	SL Parameter Tool	CT-COMMS-CABLE, CT-USB-CABLE
Commander SX	SXSoft	
Commander SK	CTSoft	
Commander GP20	CTSoft	
Unidrive SP	CTSoft	
Digitax ST	CTSoft	
Mentor II/Quantum III	MentorSoft	CTD-PC-485

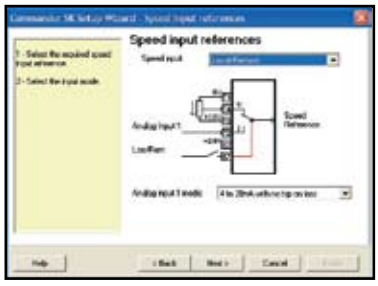
CTSoft WIZARD SET UP SCREENS



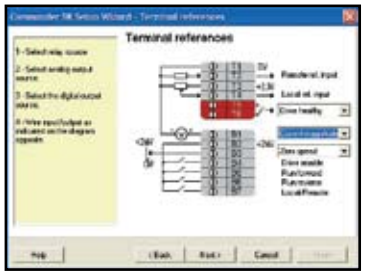
Welcome



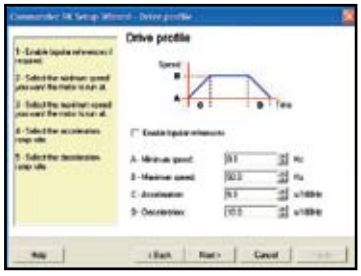
Motor Map



Speed Input



Terminal Set Up



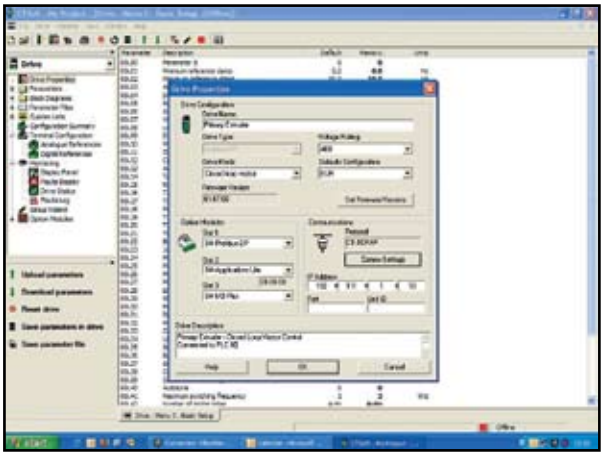
Drive Profile



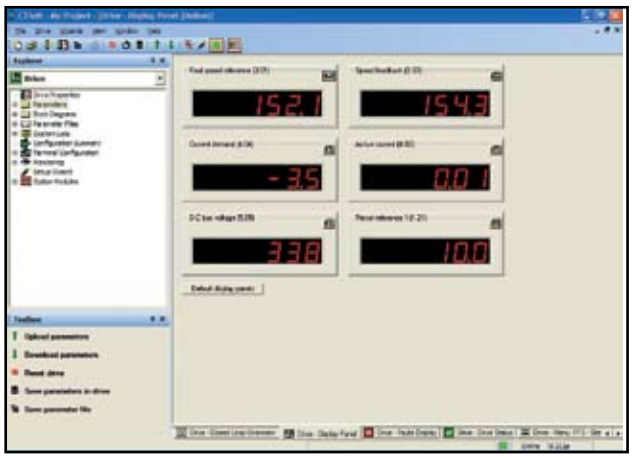
Download

CTSoft USER SCREEN EXAMPLES

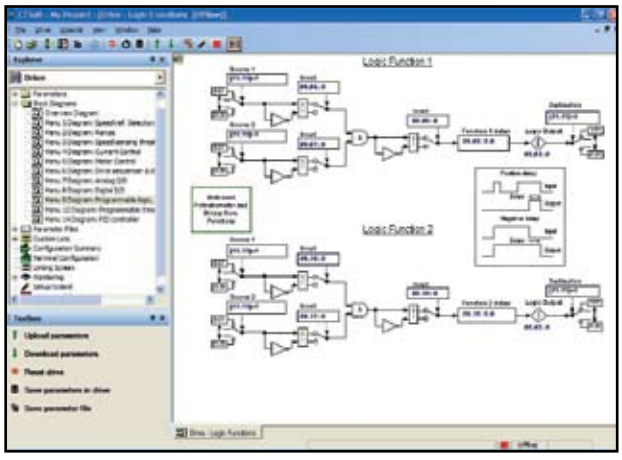
Basic Set Up - Offline



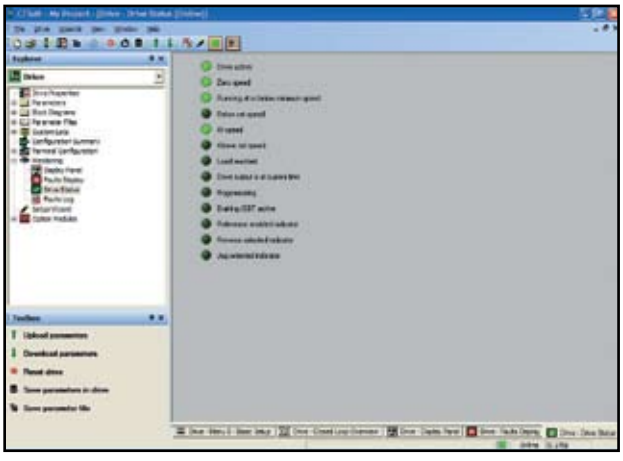
Monitoring Key Parameters



Logic Diagram



Drive Status Monitoring

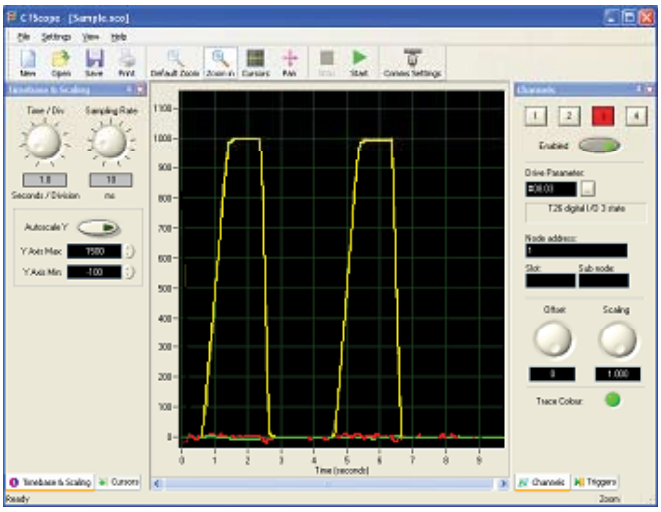


CTScope FREE Software

CTScope is a Windows™-based software utility designed to trend/trace the value of parameters on Control Techniques' drives and option modules. CTScope has the look and the feel of a hardware oscilloscope, and can plot up to four channels of data simultaneously.

Other features of CTScope include:

- All channel data on a single scope view for easy comparison.
- Each channel can obtain the parameter value from a different node address.
- Start and Stop Triggers are available, e.g. start on the rising edge of a parameter value.
- The data for a channel can be offset or scaled to allow data with different magnitudes to be shown e.g. comparing a digital input with an encoder count.
- Cursors are provided to measure differences between points on traced data.
- The scope view can be zoomed to examine small data artifacts.
- The scope view can be scrolled or panned to examine past recorded data.
- Scope files can be saved, with or without recorded data, for future use.





Drive, Module, and Controller Programming Tools

Control Techniques provides software tools used to program the drive and/or control modules above and beyond the basic drive setup parameters. These tools can be divided into three distinct categories: System Programming Tools software, "Motion Made Easy"™ software, and MotionPerfect2 software.


Commander SK


Commander GP20


Unidrive SP


Mentor II / Quantum III

System Programming Tools—SyPT

SyPT (System Programming Tools) are available in two forms, SyPTLite (Commander SK, GP20) and SyPTPro (Unidrive SP, Digitax ST and Mentor/Quantum). SyPT is used for applications ranging from very basic logic controls to highly complex, complete machine control systems.

"Motion Made Easy"™—PowerTools Pro

"Motion Made Easy" software consists of the PowerTools software platform. The phrase Motion Made Easy defines Control Techniques' philosophy of creating the easiest to use motion control software in the industry. PowerTools software can be used with all dedicated motion control drives. Users can use drag-and-drop, point-and-click and fill-in-the-blank programming for base and indexing set-up plus easy to use macros for more complex applications.


MDS


EN


Epsilon EP


Digitax ST

MotionPerfect2

The Multi-Axis Controller software is called MotionPerfect2, and is used solely to program the MC multi-axis controller hardware.


MC-Controller

For your convenience, each of these software products can be downloaded free-of-charge from Control Techniques web site at www.emersonct.com, with the exception of SyPTPro.

SyPTLite can be downloaded from the SyPTLite User Group site, www.syptlite.com.

Drive / Module / Controller	Control Software	Cable Order Code
Commander SK + Logic Stick	SyPTLite	CT-COMMS-CABLE, CT-USB-CABLE
Commander GP20		
Unidrive SP		
Unidrive SP + SM-Applications Lite V2	SyPTLite or SyPTPro	
Unidrive SP + SM-Applications Plus	SyPTPro	
Unidrive SP + SM-EZMotion	PowerTools Pro	
Epsilon EP		
Digitax ST-B, ST-I	CTSoft	
Digitax ST-Z	PowerTools Pro	
Digitax ST-P	SyPTPro	
En Drive, MDS, with FM-2 Module	PowerTools Pro	TIA-xxx
FM-3 or FM-4 Module (including all comms variants)		TIA-xxx
Mentor II/Quantum III + MD29/MD29AN	SyPTPro	CTD-PC-232
MC Controllers - MC206X, MC224	MotionPerfect2	P350, P351

Note that some of the software tools above support multiple drives and controllers, while others are dedicated to only a single hardware platform. Use the chart below to select the proper software based on the chosen hardware platform, as well as select the correct programming cable for your parts list.

PowerTools Pro

"Motion Made Easy"™ Programming for Applications

FREE Software

PowerTools Pro



Our free PowerTools Pro software enables you to fully realize the power of our SM-EZMotion, FM modules and Epsilon EP servo systems. A familiar Microsoft® Windows™ interface provides operators and machine builders with the tools needed to access everything they need for complete servo control—PLS, Queueing, Analog-In, User Variables, High-Speed Capture, Electronic Gearing, and more.

THE EASY MOTION PHILOSOPHY

Control Techniques' "Motion Made Easy"™ is more than just motion products. It is a complete philosophy focused around providing a motion control system that is easy to Select, Setup, Program, and Service.

Easy selection is achieved through the scalable choice of Digitax ST, Epsilon EP, EN, MDS, or the powerful Unidrive SP servo drives. Control Techniques makes motor and drive selection easier by providing motor and drive matched speed torque curves. Furthermore, cable and accessory selection is easy as all necessary components are provided in easy to read graphical diagrams.

Selecting motion capabilities is easy with the modular selection of the Digitax ST series Z variant, or the Epsilon EP, which comes in base, indexing, or programming or the scalable FM modules for the EN and MDS servo drive families. And the SM-EZMotion module fully integrates the Unidrive SP into the "Motion Made Easy" product family.

Selection is made easy with free CTSize software. Setup and Programming is made easy with the free, drag and drop, PowerTools software which programs the entire "Motion Made Easy" product family.

- **Provides quick and easy application development, from the simple to the complex**
- **Hierarchy View provides for an easy, flexible, and powerful programming environment**
- **Familiar Windows™-based processes simplify entering data**
  - **"Point and Click" Radio Buttons**
  - **"Scrolling" Menu Selections**
  - **"Drag and Drop" parameters and I/O assignments**
  - **"Fill in the blank"**
- **Software oscilloscope and online Watch window for diagnostic, fault, and parameter updates**
- **Compatible with these products:**
  - **Digitax ST-Z**
  - **All Epsilon EP Drives**
  - **SM-EZMotion Module**
  - **FM-3 Programming**
  - **FM-3E with Ethernet**
  - **FM-3DN with DeviceNet**
  - **FM-3PB with Profibus**
  - **FM-4 Advanced Programming**
  - **FM-4E with Ethernet**
  - **FM-4DN with DeviceNet**
  - **FM-4PB with Profibus**
  - **FM-2 on a MDS system**

MATCHING CONTROLS TO APPLICATIONS

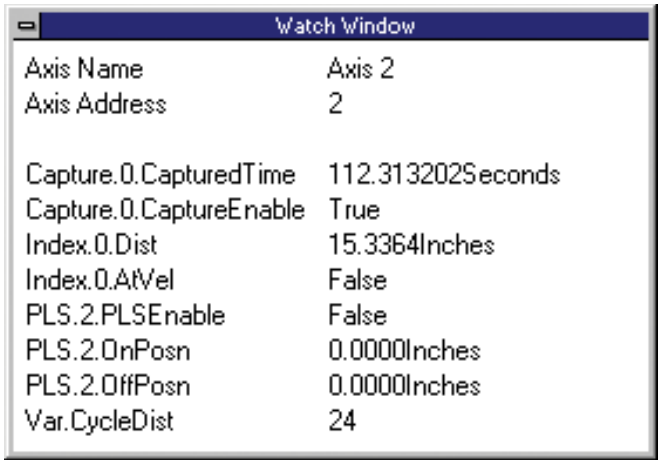
A properly matched servo drive and motor could run hundreds of different applications. What differentiates these applications is the type of control needed to insure the correct operation and performance.

The "Motion Made Easy" family of control modules allows you to specify the amount and type of control you need for your application. From simple speed control to complex synchronized motion control, you can choose a module with the features you need to get the high performance you expect from a Control Techniques drive.

Functions	Epsilon EP-I		Epsilon EP-P	Digitax ST-Z Unidrive SP
	FM-2	FM-3	FM-4	SM-EZMotion
Analog Input Control	✓	✓	✓	✓
Analog Output	✓	✓	✓	✓
Auto-tune	✓	✓	✓	✓
Custom Motors	✓	✓	✓	✓
DeviceNet Option	✓	✓	✓	✓
Homing	✓	✓	✓	✓
Index Chaining, Compounding	✓	✓	✓	✓
Indexing	✓	✓	✓	✓
Jogging	✓	✓	✓	✓
Modbus RTU	✓	✓	✓	✓
Motor Brake Control	✓	✓	✓	✓
Position, Velocity Mode	✓	✓	✓	✓
Rotary Rollover	✓	✓	✓	✓
Software Oscilloscope	✓	✓	✓	✓
Software Watch Window	✓	✓	✓	✓
Torque Level Flags	✓	✓	✓	✓
Torque Limit	✓	✓	✓	✓
User Units	✓	✓	✓	✓
Ethernet Option		✓	✓	✓
Feedhold, Feedrate Override		✓	✓	✓
Gearing		✓	✓	✓
LCD Keypad/Display		✓		✓
NVM Parameter Storage		✓	✓	✓
Position Capture		✓	✓	✓
Profibus Option		✓	✓	✓
Programmable Limit Switch		✓	✓	✓
S-Curve Ramps		✓	✓	✓
Secure Download		✓	✓	✓
Synchronized Motion		✓	✓	✓
Timed Index		✓	✓	✓
User Programs		✓	✓	✓
User Variables, User bits		✓	✓	✓
Camming			✓	✓
Modbus Master			✓	✓
Multiple Profile Summation			✓	✓
Position Capture Object			✓	✓
Program Multi-tasking			✓	✓
Queuing			✓	✓
Timers			✓	✓
Torque Mode			✓	✓
Vitual Master			✓	✓
Absolute Encoder Feedback				✓
Dual Loop Mode				✓

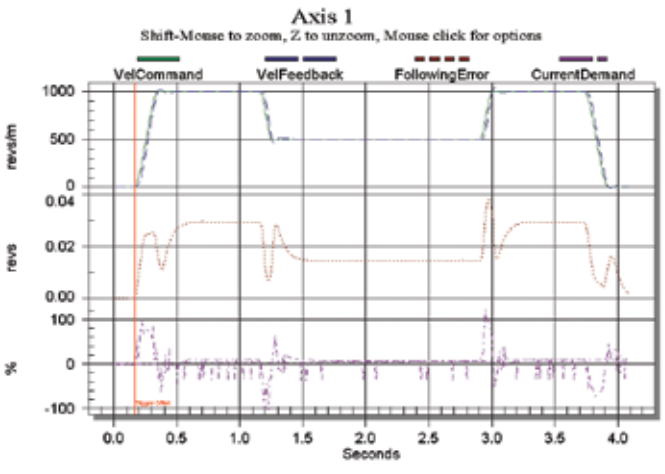
MONITORING PARAMETERS

PowerTools Pro allows the user to monitor motion in many flexible ways. Many of the views have online sections for displaying the latest value currently being used in a drive. Using PowerTools Pro and its Watch Window, troubleshooting an application is greatly simplified.

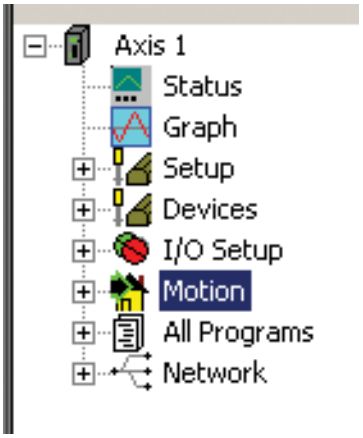


Graphical data capture function allows real-time drive data of up to four channels.

- Initial Configuration
- Tuning
- Debug



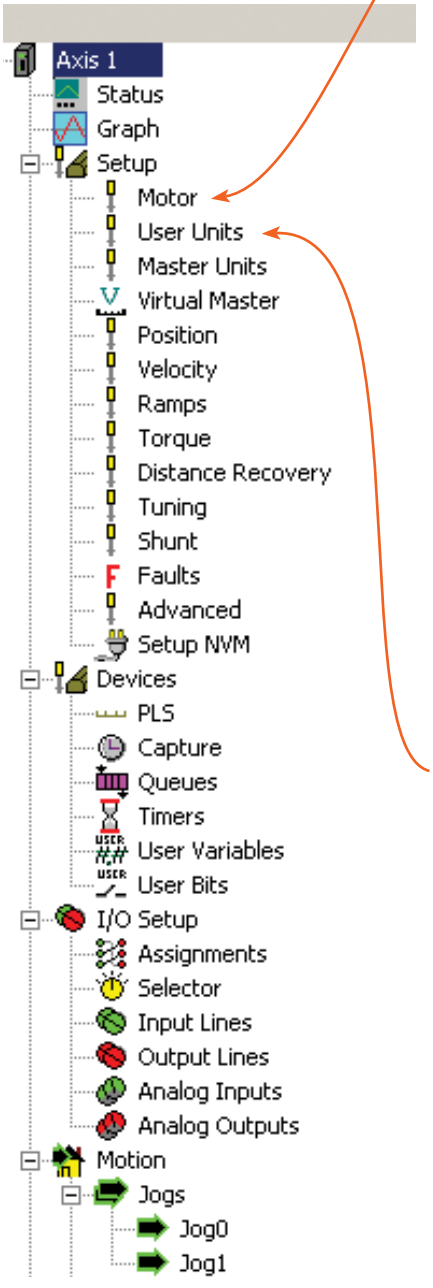
High speed data capture allows PowerTools Pro to obtain traces while online with the drive.



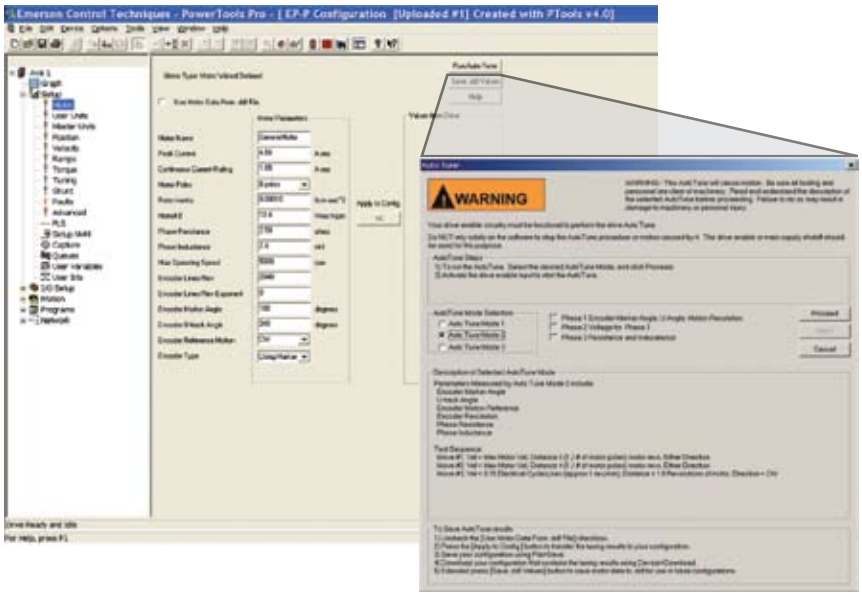
POWERTOOLS PRO HIERARCHY TREE
TOP LEVEL

Developing applications with PowerTools Pro is an easy "six-step, top-down" process that quickly gets your applications running. The six task areas that need to be completed in order are found in the Windows™ Explorer-like Hierarchy Tree—Setup, I/O Setup, Motion, Programs and Network. Some areas may not need completing, as some applications, such as a "flying cutoff" neither require "programming" nor network parameters to operate.

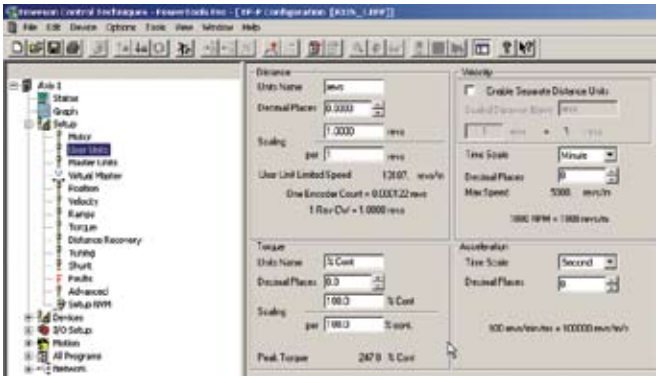
EASY SETUP



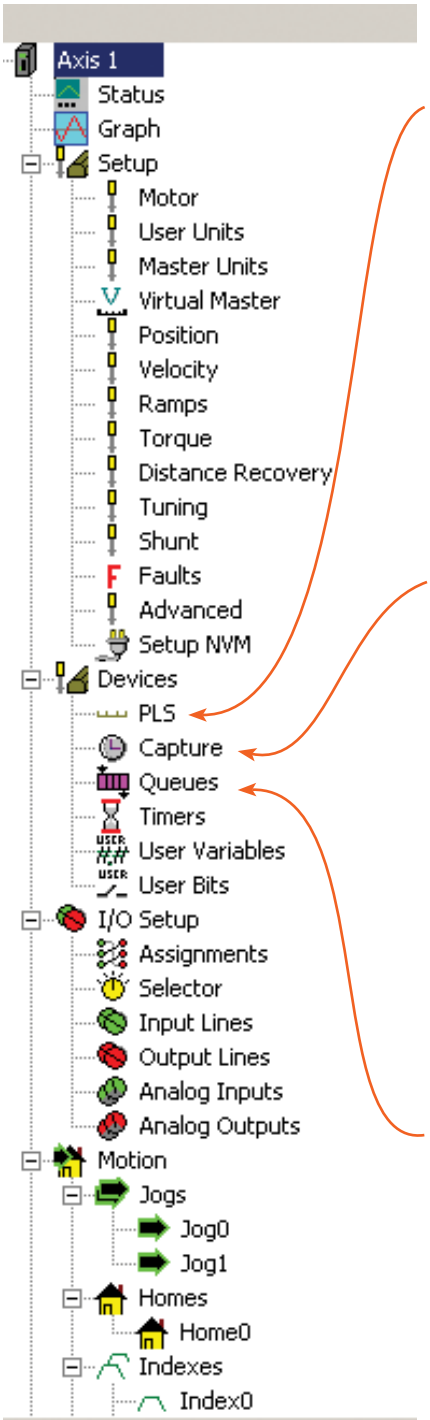
Motor Selection and Tuning – Select motor data for Control Techniques supported motors or use the motor auto tuning routine for third party motors. Each motion is capable of having a real time or encoder generated time base and all are accessible via programs, I/O, PowerTools online screen, as well as Modbus, DeviceNet, Profibus, and Ethernet.



Units Set Up – All motion is configured in user units which the user selects based on real machine parameters. Select inches, millimeters, degrees, or whatever your application calls for. Simply scale your units into units of revolutions once, and the rest is done for you.

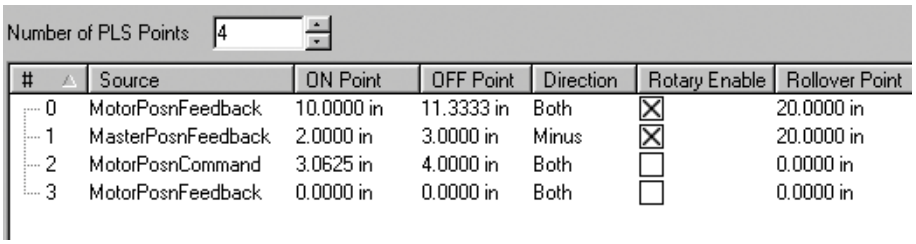


POWERTOOLS PRO HIERARCHY TREE

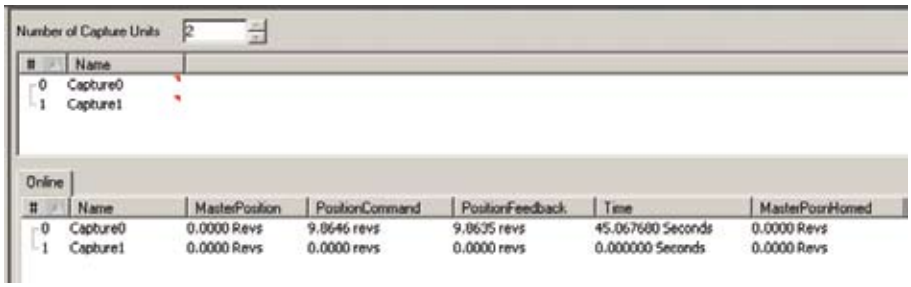


EASY DEVICE SET UP

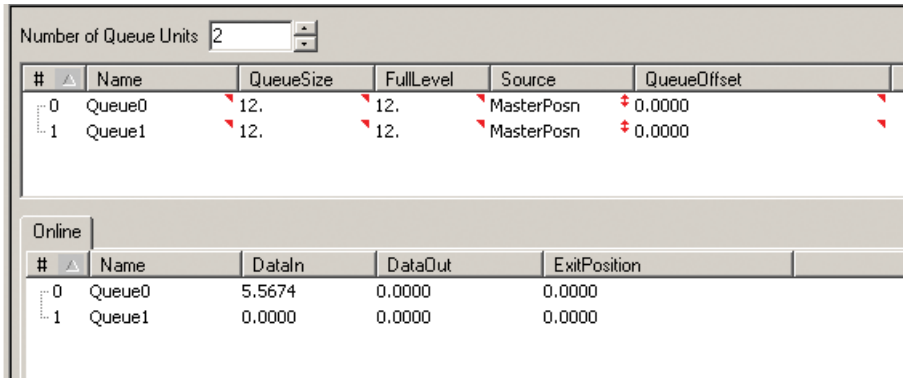
PLS – Configurable PLS functionality adds advanced flexibility that is normally found on complex PC based systems. In addition to local PLS functionality which may be configured for every index, users may add up to 8 configurable global PLS's. Sources for the global PLS's include, Motor Position Feedback, Motor Position Command, and Master Position Feedback.



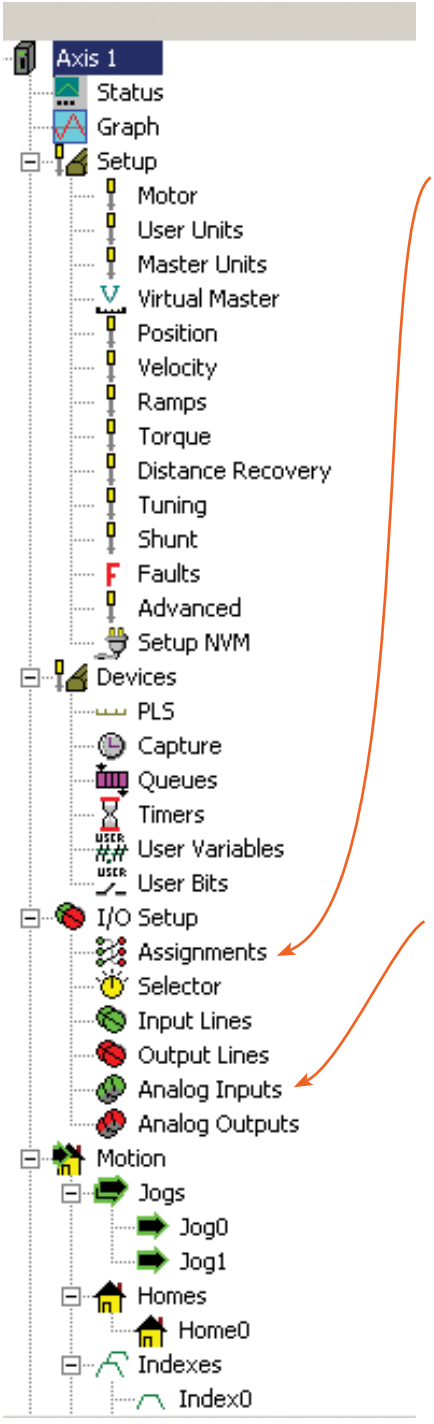
Capture – Many high-speed applications require the ability to accurately capture a position at a specified moment in time, so that a motion profile can be initialized. Enter the Position Capture object. The capture component is fully controlled by the user and when activated it captures and stores (within 1 to 2 µsec): Time, Command Position, Feedback Position, and Master Feedback Position.



Queues – The Queue is used in applications where multiple products exist between the incoming product sensor and the location where the process takes place (i.e. applying labels, bar code printing, vision inspection, part rejection, etc.). Up to eight Queues can be used simultaneously to control all of the processes in your application.

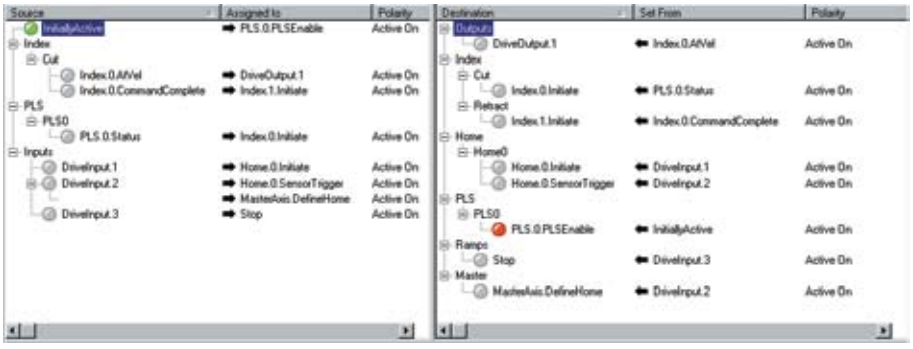


POWERTOOLS PRO HIERARCHY TREE

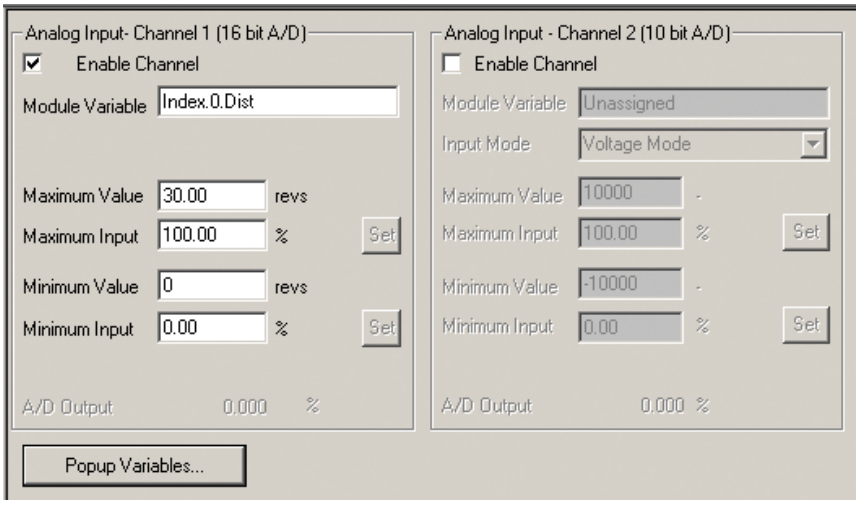


EASY I/O SETUP

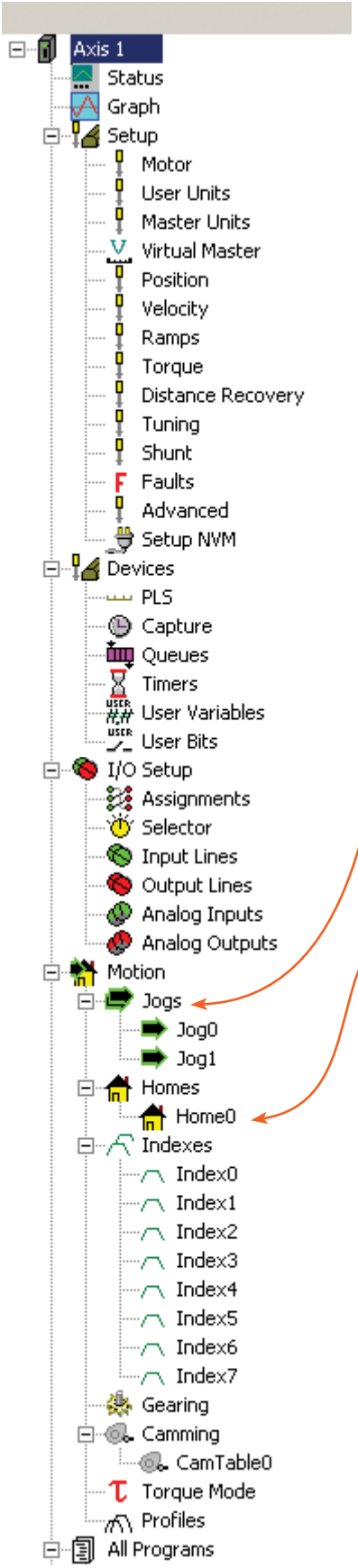
Assignments – Use our "Virtual Wiring" to create programs right out of the box, without writing a "line of code." For example, the assignment view below shows how easily a flying cutoff routine can be created.



Analog Inputs – Use the Analog Input to adjust velocity, torque, distance, or any other parameter in the module. No more trying to convert Volts into other units. Simply enter the max. and min. voltages and the corresponding max. and min. value in your application units, and the 14-bit analog to digital signal is automatically scaled into your user units. The easy to use PowerTools Pro Analog Inputs view allows you to configure your analog input in no time.

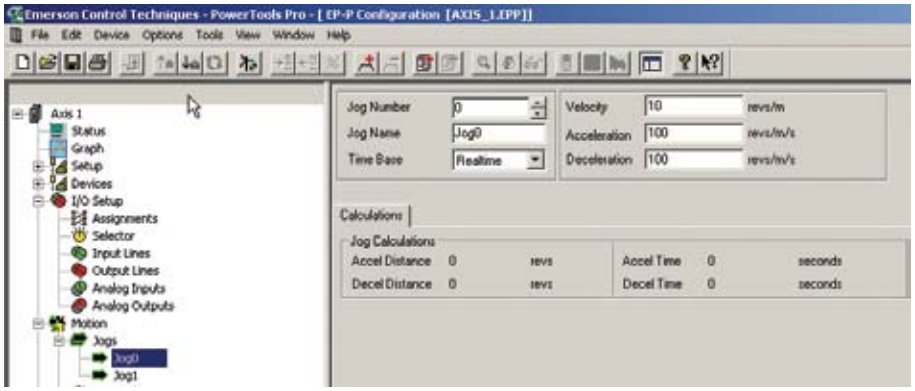


POWERTOOLS PRO HIERARCHY TREE

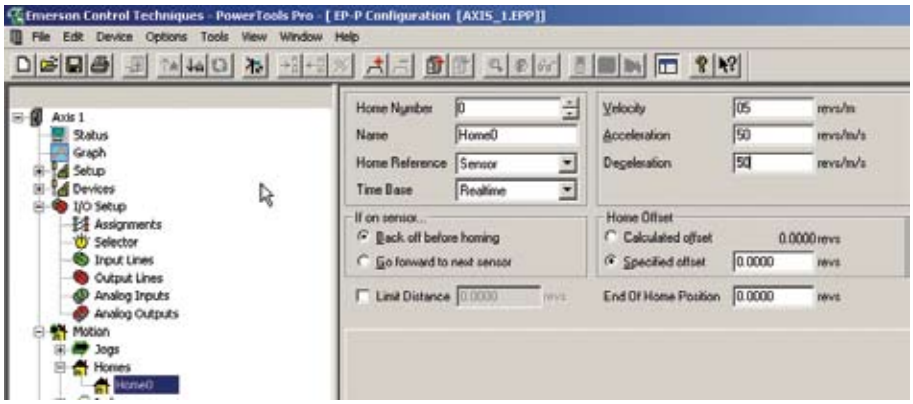


EASY MOTION SET UP

Jog Set Up – Select from two jogs, each with their own Velocity, Acceleration, and Deceleration. Select from Real time or Synchronized (referenced to master encoder) time base. Initiate Jogs from a user program, an Assignment (I/O Control), or a fieldbus.



Homing Routines – The advanced "Motion Made Easy" solutions include flexible yet easy homing routines. Define the reference type for the home function, selecting from Encoder Marker, Sensor, or Sensor then Encoder Marker. A completely dynamic home allows full programmability enabling users to define the Home Velocity, Acceleration, and Deceleration, as well as Home Offset (distance traveled after reference) and End of Home Position. Initiate from a user program, an Assignment, or from a fieldbus.



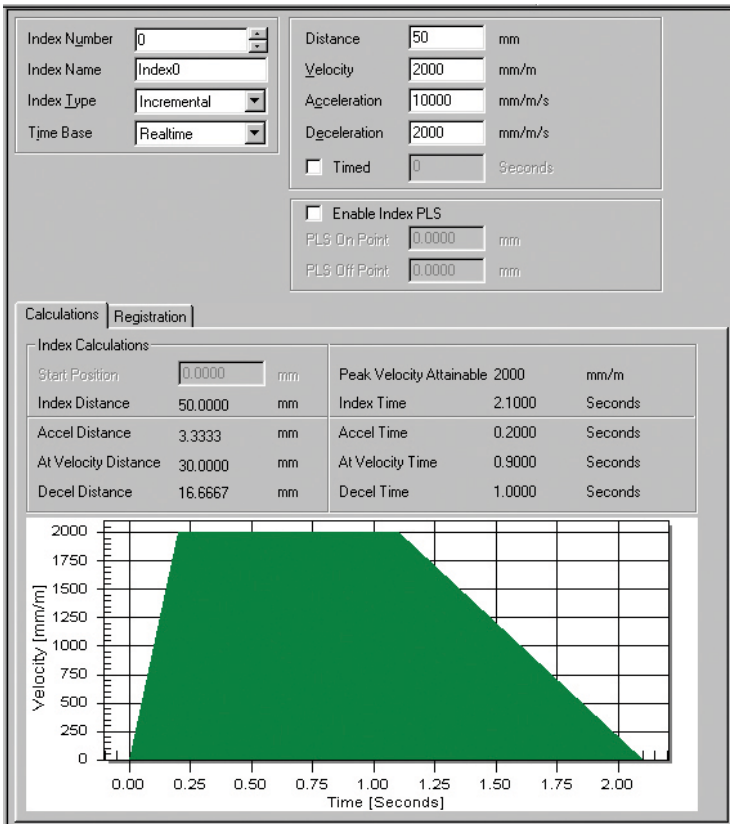
PowerTools

POWERTOOLS PRO HIERARCHY TREE

- Setup
  - Motor
  - User Units
  - Master Units
  - Virtual Master
  - Position
  - Velocity
  - Ramps
  - Torque
  - Distance Recovery
  - Tuning
  - Shunt
  - Faults
  - Advanced
  - Setup NVM
- Devices
  - PLS
  - Capture
  - Queues
  - Timers
  - User Variables
  - User Bits
- I/O Setup
  - Assignments
  - Selector
  - Input Lines
  - Output Lines
  - Analog Inputs
  - Analog Outputs
- Motion
  - Jogs
    - Jog0
    - Jog1
  - Homes
    - Home0
  - Indexes
    - Index0
    - Index1
    - Index2
    - Index3
    - Index4
    - Index5
    - Index6
    - Index7
  - Gearing
  - Camming
    - CamTable0
  - Torque Mode
  - Profiles
- All Programs

MOTION

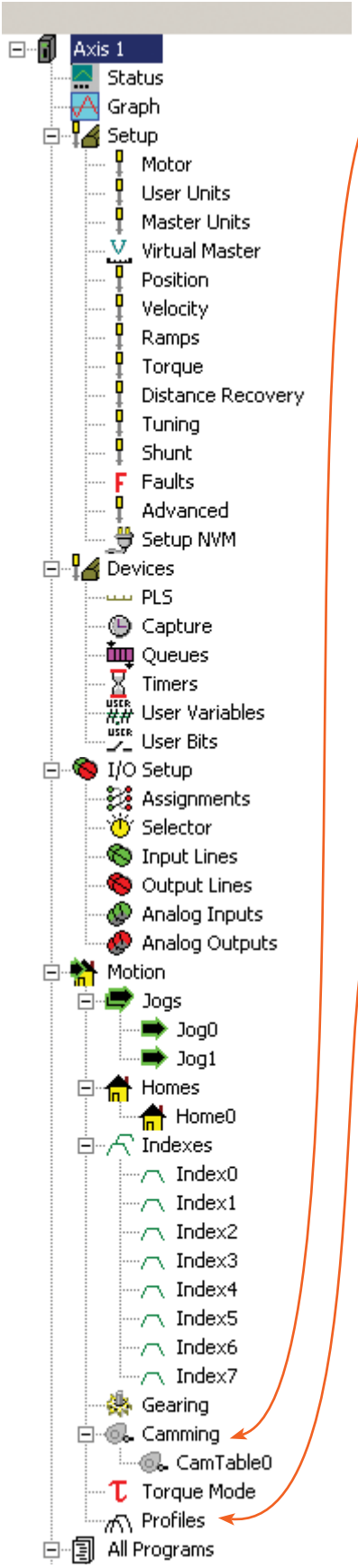
Indexes – Setting up indexes is easily accomplished by filling in the blanks to create an index profile. Select from Incremental, Absolute, Registration, Rotary Plus, or Rotary Minus types. Choose the time base of the index by selecting either real time or synchronized to a master.



Gearing – Perform electronic line shafting applications using the EP-P, FM-3E, FM-4E, or SM-EZMotion by defining a ratio between master and follower axes. Once a ratio is defined, follower axis motion is linked to master axis motion at a specified ratio while the gearing function is active. Master can change velocity and direction and follower maintains geared relationship.

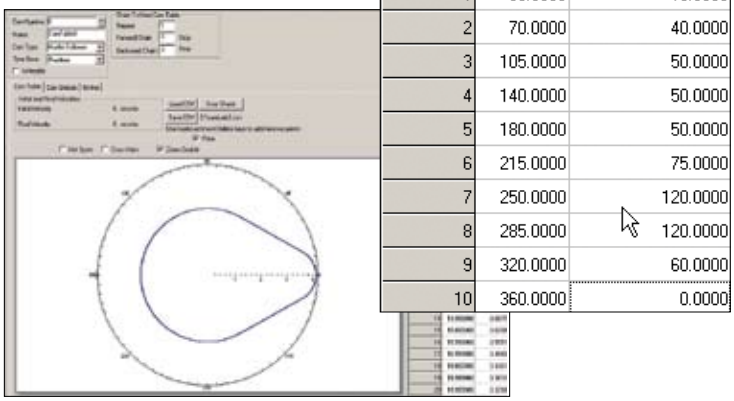
```
Gear.initiate on Profile.0
Index.0.Initiate on Profile.1
Wait for Index.0.CommandComplete
Wait for Time .25 'second
Index.1.Initiate on Profile.1
```

POWERTOOLS PRO HIERARCHY TREE



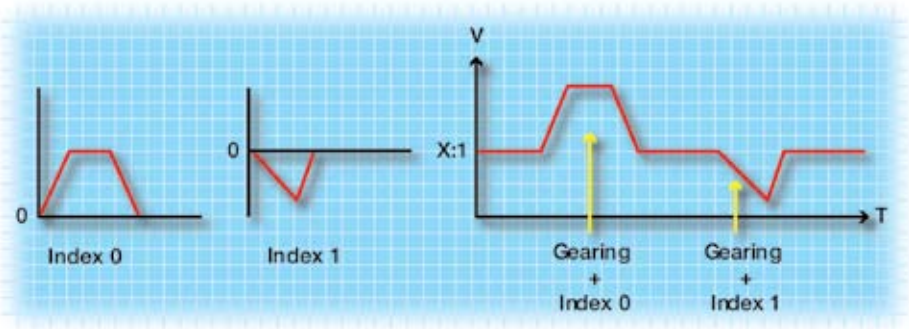
MOTION

Camming – Cams make setup and programming of complex motion profiles easy. Using real-time programs allow the user the ability to switch between cam profiles on the fly, with smooth transitions.

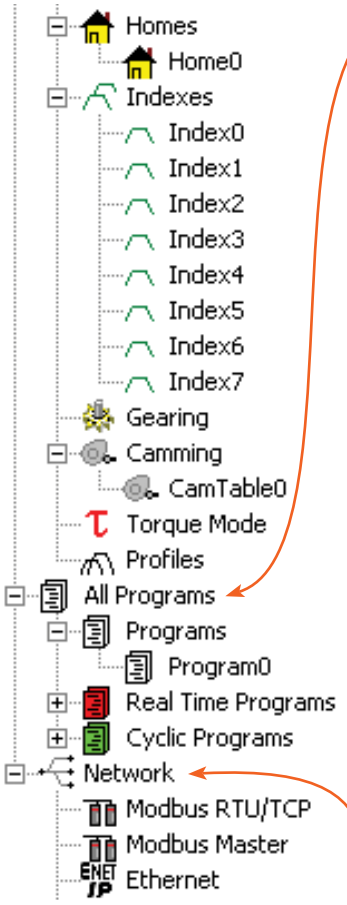


MF-Abs	Master (Rev	Follower (deg)
0	0.0000	0.0000
1	35.0000	10.0000
2	70.0000	40.0000
3	105.0000	50.0000
4	140.0000	50.0000
5	180.0000	50.0000
6	215.0000	75.0000
7	250.0000	120.0000
8	285.0000	120.0000
9	320.0000	60.0000
10	360.0000	0.0000

Profiles – PowerTools Pro allows the user to simultaneously execute any two motion types together resulting in a summed profile (i.e. Gear + Index, Jog + Index, Index + Index, etc.). Summing profiles is ideal for phasing applications such as Random Infeed, Rotary Knife, Merge Conveyor, and any number of other applications. S-curve acceleration is available for a "jerk-free" application.

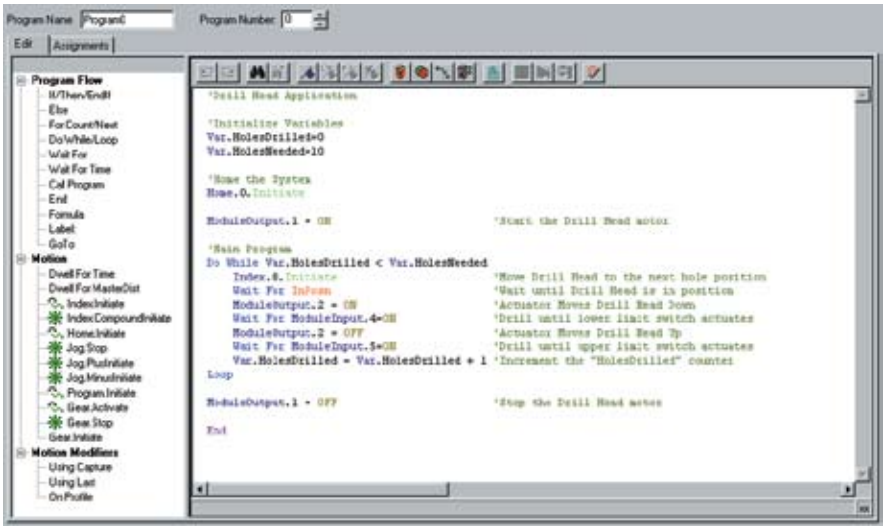


PORTION OF HIERARCHY TREE



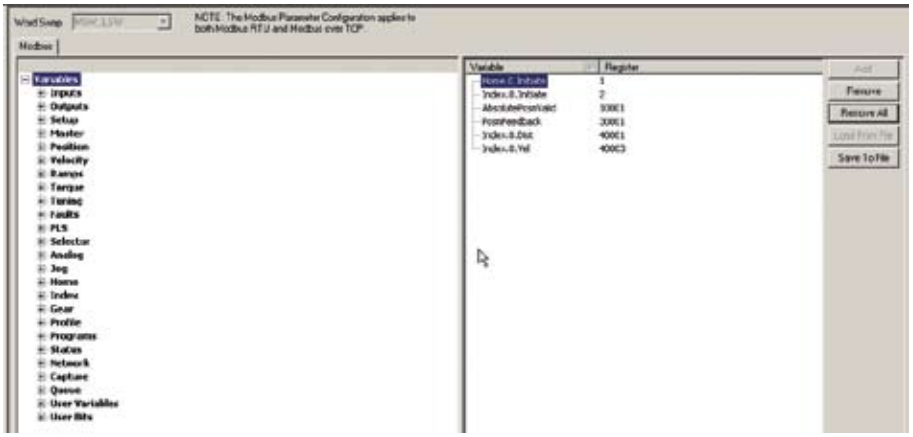
PROGRAMS

Programs – Combine program flow and motion instructions to create fully customized user programs up to 1,000 lines of code. Use conditional branching, wait for, program calls, formulas, user variables, and numerous motion instructions to solve your complex applications. Easily create programs, such as the drill head positioning program below, by dragging and dropping, or typing program instructions, variables, I/O, and formula operands into your program screen.



NETWORK

Network – Drag and drop fuctionality with fill-in-the-blank capabilities allows easy network configuration. Supported networks are: Modbus RTU, TCP/IP (Modbus Master) and EtherNet/IP among other industrial standard protocols.



YOU CAN DOWNLOAD PowerTools FROM
www.emersonct.com

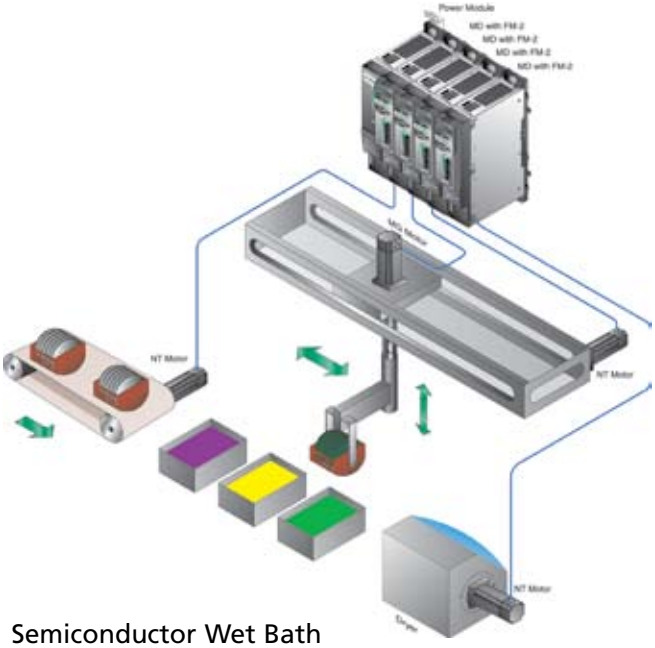
"Motion Made Easy"™

Application Roadmaps

Almost regardless of your servo application, there is a "Motion Made Easy"™ solution to get you there. Using the software help files found in PowerTools, and our Application Roadmaps, even those unfamiliar with creating motion control applications can get one up and running quickly.

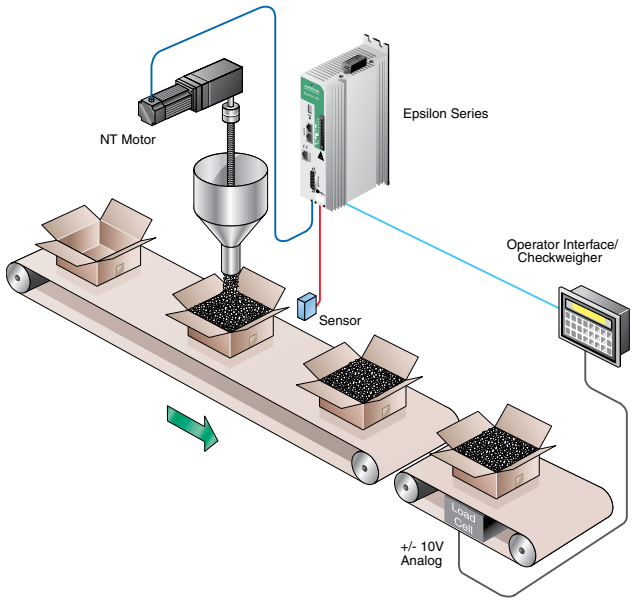
Note that several of the following applications reference "Application Notes" (AT-Ref.-xx) found in the downloads section of our web site. These application notes have been prepared by our engineers to solve some of the more common applications used in industry.

If you are working on an application, not found here or on our web site, then feel free to call our application engineers for assistance. The number to call to speak to one of our engineers is 1-800-893-2321.



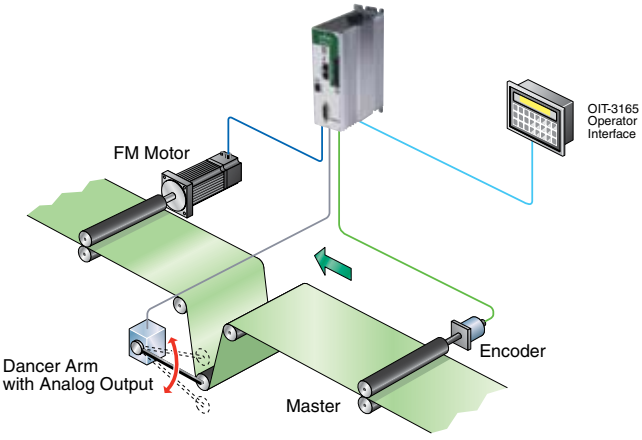
Semiconductor Wet Bath

The MDS displays its many benefits in those applications that employ more than one axis. Here the compact installation of an MDS has its drives equipped with the enhanced indexing control of our FM-2 modules.



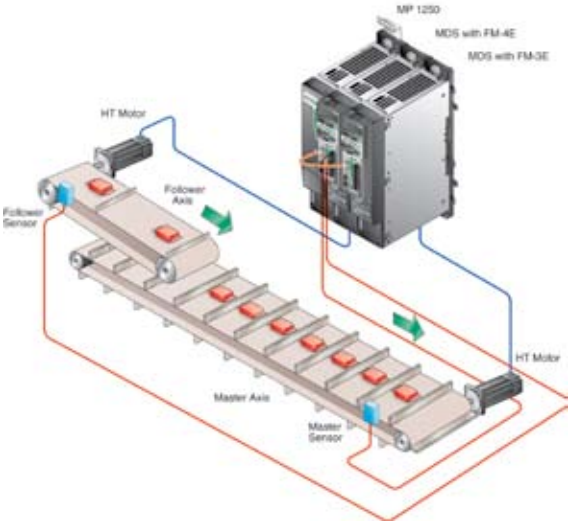
Auger Filler Analog Check Weight Ref. AT-8

The Epsilon EP Family of drives with its analog input capability and user programs makes an easy and effective solution for applications requiring accurate filling requirements.



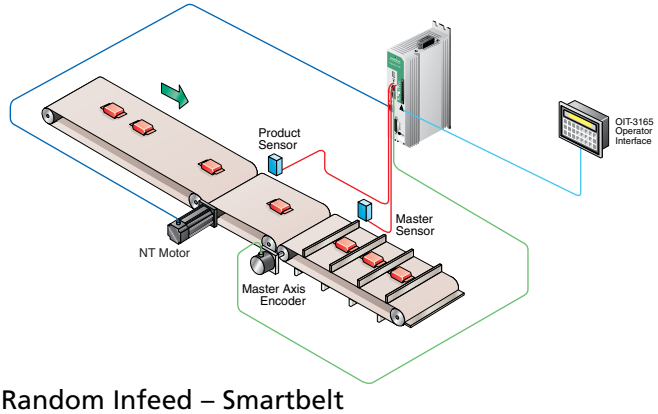
Dancer Arm Loop Control Ref. AT-4

The versatility of the Epsilon EP-P with user created programs, the ability to accept an external encoder input as well as an analog input, make it the perfect choice for dancer arm loop control.



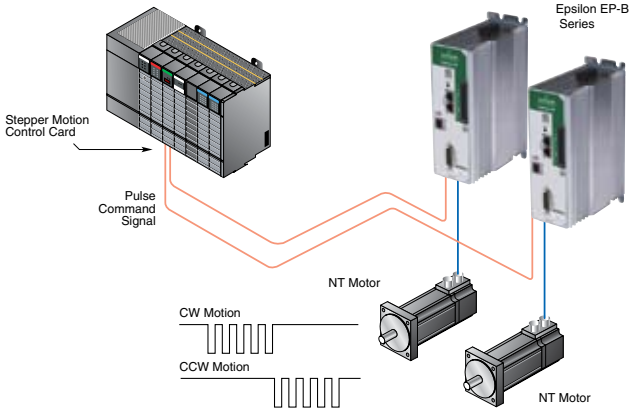
Phase Synchronization **Ref. AT-16, AT-19**

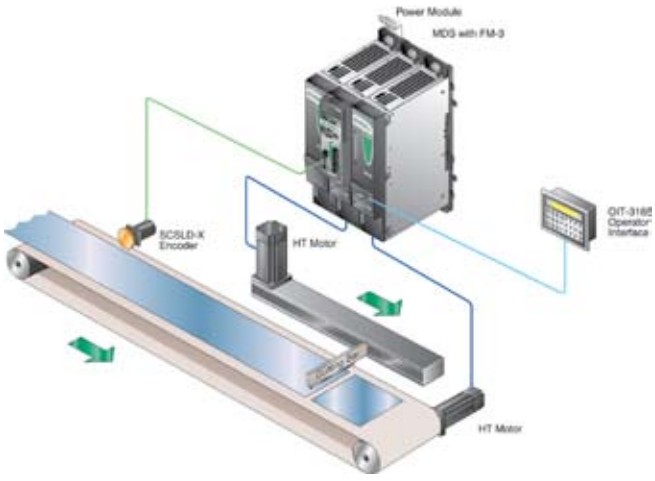
FM-3E and FM-4E modules used on a MDS system provide a compact and easy to implement solution for most phase synchronization application needs. The peer-to-peer networking capability of the FM Ethernet modules allows for high-speed data transfer between the drives.



Random Infeed – Smartbelt

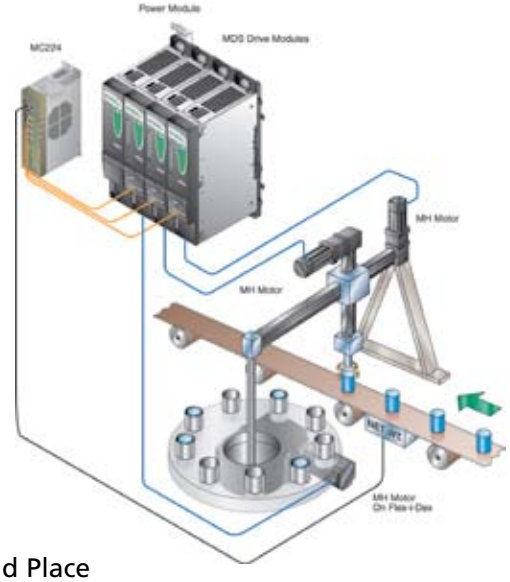
The Epsilon EP-P user programs provide users a unique flexibility with the ability to solve many different random infeed applications also commonly referred to as smartbelt applications.





Flying Shear **Ref. AT-12**

MDS drive modules combined with the FM-3 make a compact and efficient solution for in-line flying shear applications. Adding an OIT-3165 Operator Interface Terminal increases overall system flexibility by allowing the operator to change parameters such as cut length.

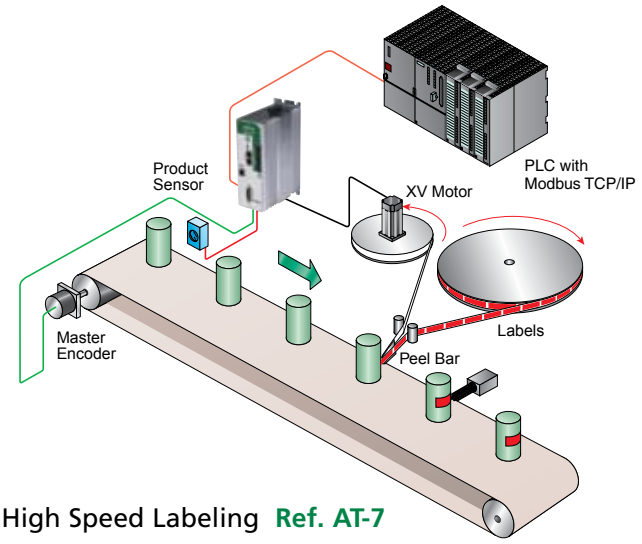


Pick and Place

MDS system components when combined with the MC multi-axis controller create a complete multi-axis system where coordinated motion is required.

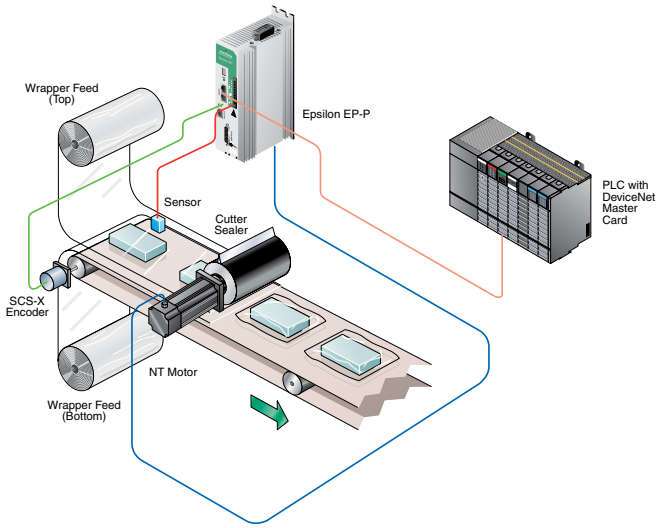
◀ Pulse Follower (Stepper Replacement)

The cost effectiveness and small product footprint of the Epsilon EP-B (Base) drive make it a superior choice for stepper drive and motor replacement.



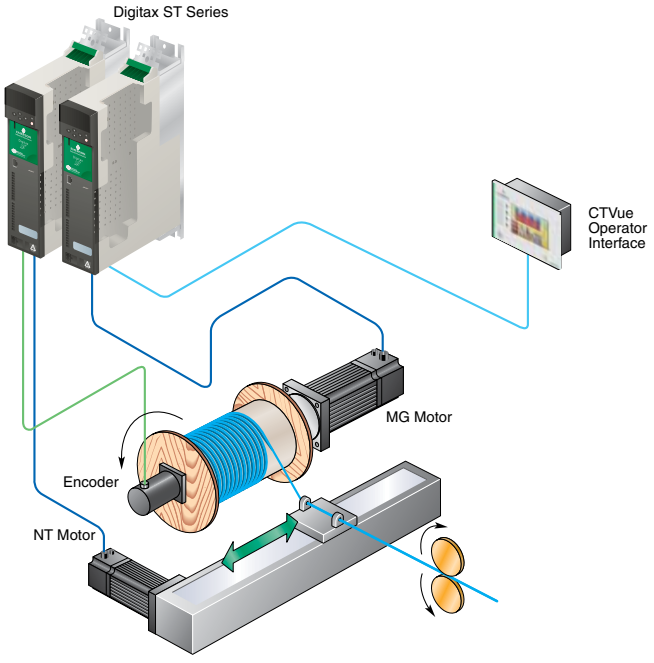
High Speed Labeling **Ref. AT-7**

The programming power of the Epsilon EP-PPB can solve even the toughest high speed labeling applications. The high-speed Profibus protocol in the drive adds increased communication flexibility along with the ease of set up and use found in all "Motion Made Easy" products.



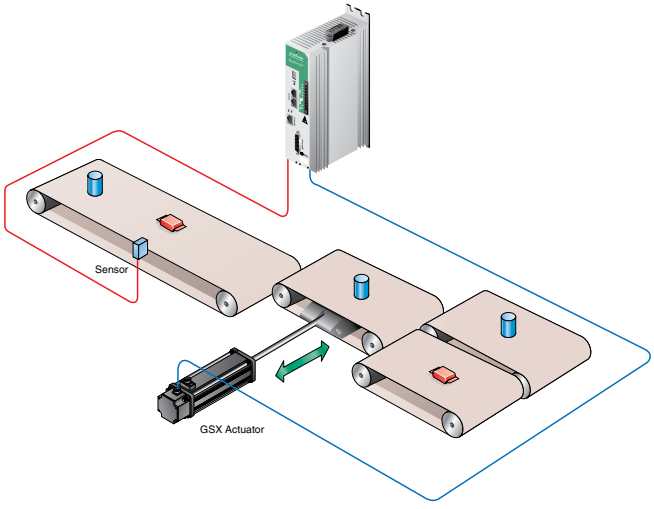
Rotary Knife **Ref. AT-22**

Versatility of the Epsilon EP-PDN Programmable Drive with DeviceNet can be shown in many rotary knife applications. The ability of the DeviceNet communications protocol gives the user added flexibility for statistical process control.



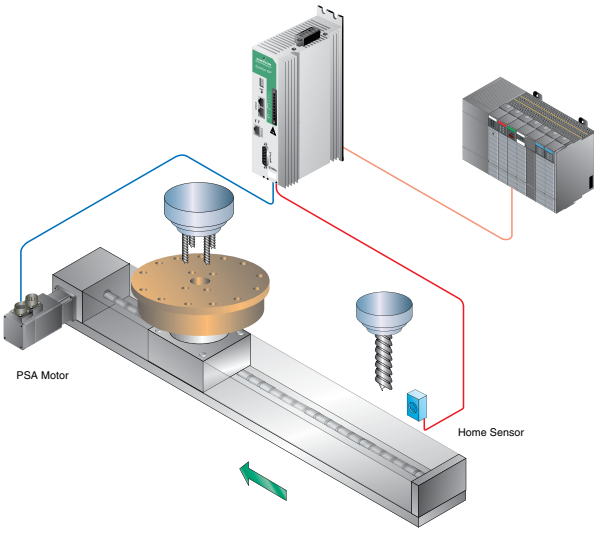
Traverse Winder

The power of Digitax ST Series drives teamed with the flexible, easy to use Control Techniques' software is a great solution for traverse winder applications.



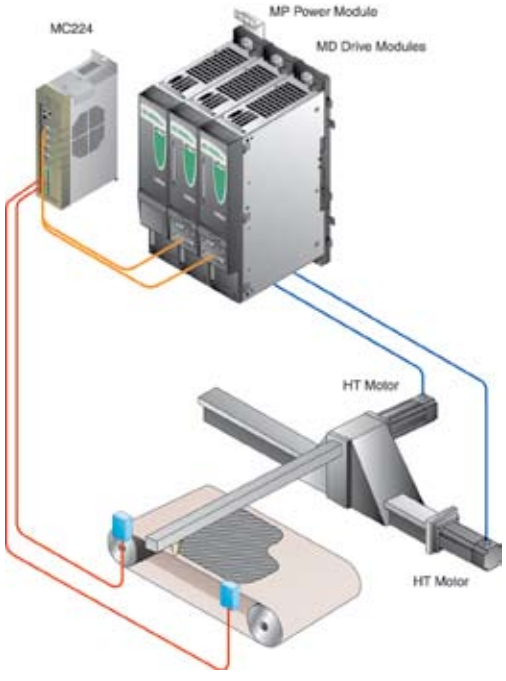
Extend–Retract

Epsilon EP-I (indexing) drives and Exlar GSX Series Linear Actuators provide a long term solution for the most demanding applications requiring precise and repeatable linear motion.



Positioning via DeviceNet **Ref. AT-16, AT-19**

The EP-IDN combines the compactness of the Epsilon EP Series Drive with DeviceNet protocol to provide an easy to use, low cost solution for many types of indexing applications with requirements for DeviceNet communications.



Gluing Application

MDS system components when combined with the MC206X or MC224 multi-axis controller create a complete multi-axis system that delivers true interpolated motion.

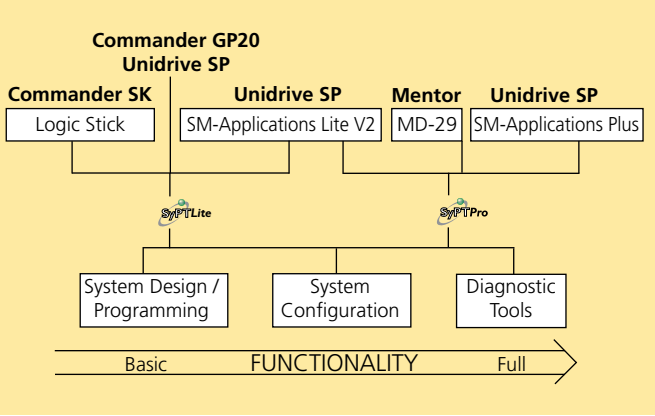


SyPT–Systems Programming Tool

SyPTPro

SyPTLite

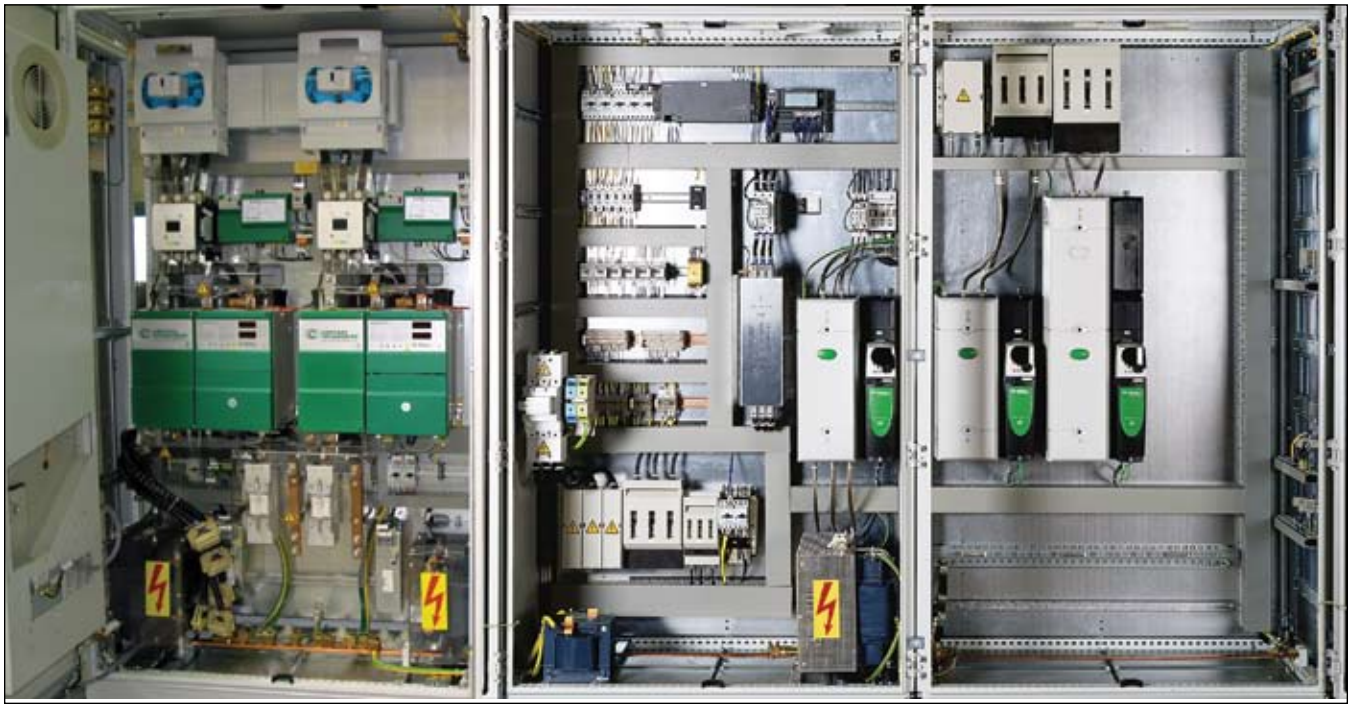
SyPT functionality - from the simple to the complex



Control Techniques has developed a flexible and powerful programming tool called SyPT (or System Programming Tool) for OEM's and End Users alike. SyPT allows the user to maximize the functionality of Control Techniques' range of AC and DC Drives. Whether programming a simple single-drive application that requires Run and Stop controls, or fully networked multi-drive control systems for machine and process control applications, SyPT helps the user to program the application.

To cover the wide range of application complexity, SyPT is available in two versions called SyPTLite and SyPTPro. SyPTLite is used to create simple Ladder Logic programs that can be used to control the drive, and even to replace small PLC's that control machine I/O. SyPTPro is for the advanced machine programmer, and gives the user IEC61131-3 style programming with Ladder Logic, Function Block, and DPL (text based) editors. SyPTPro is used for complete distributed machine control and/or motion control by configuring all drives and control modules, as well as replacing costly PLC's used for machine I/O.

Both SyPTLite and SyPTPro can be used with several different hardware configurations to achieve the exact level of control required for your machine. The chart on the following page shows the capabilities of the various combinations of software and hardware to help you select the correct Control Techniques' products.



PLC Functionality using SyPT

Unidrive SP, the "Benchmark" AC and Servo drive is the true Solutions Platform, offering a wide range of PLC (Programmable Logic Controller) solutions giving users unparalleled flexibility in configuring PLC logic and implementing applications. Real cost and space savings are quickly achievable with the flexible modular approach of selecting hardware and IEC61131-3 software for the Unidrive SP. (Level 1 PLC functionality is also available with the Commander GP20 or with the Commander SK + LogicStick option.)

Drive Based PLC functionality

Intergrated PLC functionality reduces panel space, simplifies wiring and maximizes your productivity and profitability by offering performance and features that make your machine run faster and under tighter control.



SM-Applications functionality whether integrated (Digitax ST-P) or via SM modules (Unidrive SP) convert your drive into a high-performance automation controller, removing the requirement for expensive PLC hardware and giving you the power and performance to enhance the productivity of your machine and factory.

PLC configuration of up to four levels is accomplished using either SyPTLite or SyPTPro software products. These programming tools make it easy to bring PLC functionality to your application by allowing you access to real-time processing and diagnostic controls.



The LogicStick unlocks PLC functionality within the Commander SK, enabling this small drive to deliver cost-saving PLC control to many general purpose applications.

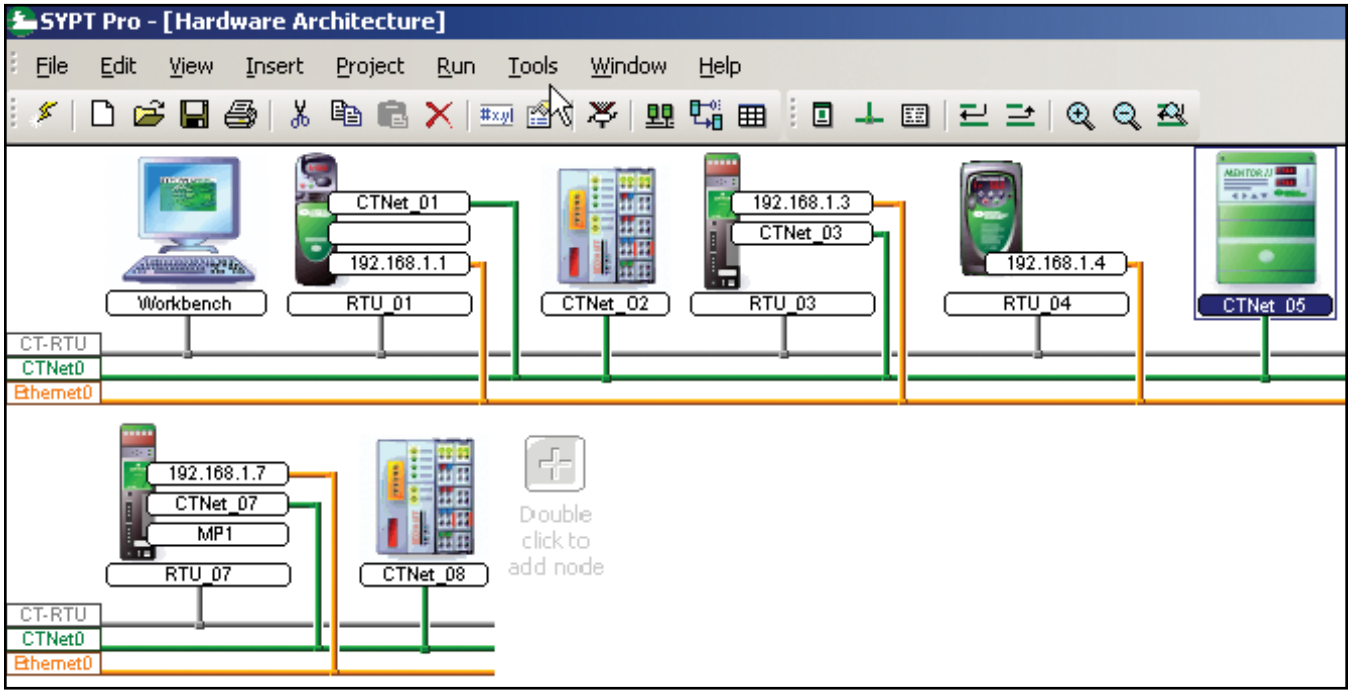
SyPT enables programming up to four levels of PLC functionality

	AC Drives				DC Drives
Software	SyPTLite	SyPTLite	SyPTPro	SyPTPro	SyPTPro
Hardware	Unidrive SP or Commander GP20 or Commander SK + Logic Stick	Unidrive SP + SM-Applications Lite V2	Unidrive SP + SM-Applications Lite V2	Unidrive SP + SM-Applications Plus Digitax ST-P (integrated)	Mentor II or Quantum III + MD29 or MD29AN
Editor(s)	Ladder Logic	Ladder Logic Function Blocks Text Editor (DPL)	Ladder Logic Function Blocks Text Editor (DPL)	Ladder Logic Function Blocks Text Editor (DPL)	Ladder Logic Function Blocks Text Editor (DPL)
Memory	4 kb (3 kb for SK)	10 kb	100 kb	384 kb	96 kb
Max. Rungs of Ladder Logic	50	150	>500	>5000	500
Task Update Rate (Approx)	10-64 msec	1-200 msec	250 µsec - 8 msec	250 µsec - 8 msec	2.5 msec
Tasks Available	Background	Initial Background Clock	Initial Background Clock Position Loop Event Error	Initial Background Clock Position Loop Event Error	Initial Background Clock Encoder Event Error
Additional Digital I/O				2 Inputs 2 Outputs Expander I/O over CTNet optional	2 Inputs 1 Output Expanded I/O over RS485 (MD29 only) Expander I/O over CTNet optional (MD29AN only)
Additional Connectivity				RS485 CTNet CTSync	RS485 CTNet (MD29AN only)
Typical Applications	Auxiliary Pumps Fans Control Valves Interlock Logic Non-Time-Critical Switches	Time-Critical Switches Cam Switches Hoist Control Crane Control Basic Conveyor Positioning	Centralized Control Applications Simple Winder/ Undwinder Camming Control Point-to-Point Positioning Complex Speed Control	Distributed Control Applications Printing Machines Paper/Web Control Rolling Mills Converting Automotive Motion Control	Distributed Control Applications Printing Winding Hoist Motion Control

SyPTPro—System Programming Toolkit

SyPTPro is the professional drive programming toolkit for OEM's and End Users who wish to maximize the performance of their machines and factory. This IEC61131-3 programming software offers greatly enhanced functionality allowing you to connect drives, operator interfaces and I/O to a network and configure how they exchange data. SyPTPro enables you to program in your choice of three different languages, with a real-time multi-tasking environment. A suite of monitoring and diagnostic features help you reduce development time allowing you to get your machine into service faster.

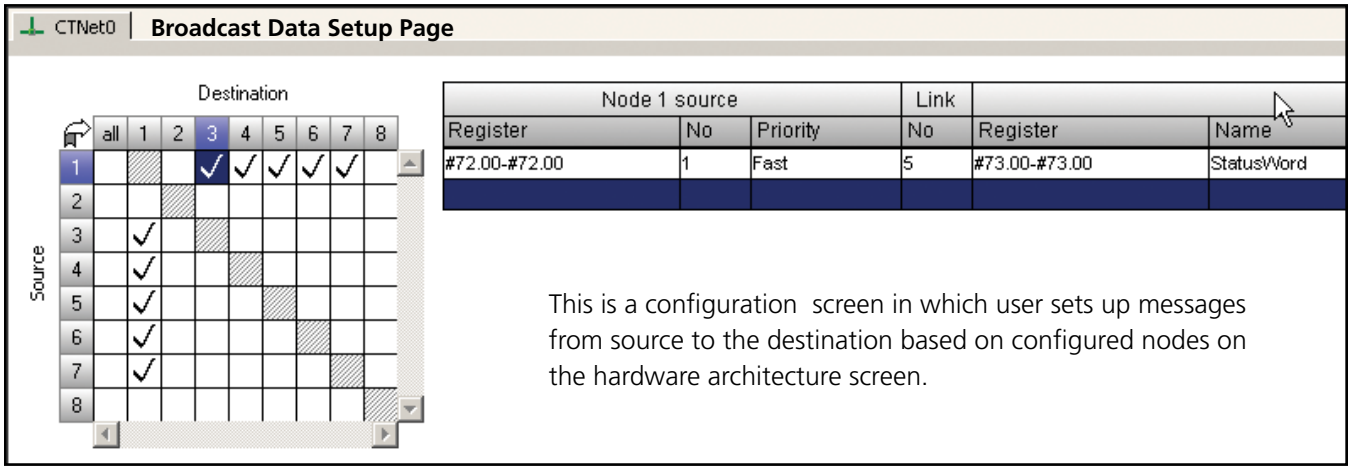
SyPTPro is used to program Unidrive SP with SM-Applications Plus and SM-Applications Lite V2 option modules, and either the Mentor II or Quantum III DC drives equipped with an MD29 option modules.



INDUSTRIAL NETWORK

With SyPTPro you can configure a single drive or a complete drive system connected to networks including CTNet, Ethernet, and Modbus RTU.

CTNet is an industrial network designed to be deterministic, robust and tolerant to noise and interference. See the Connectivity section for more details.

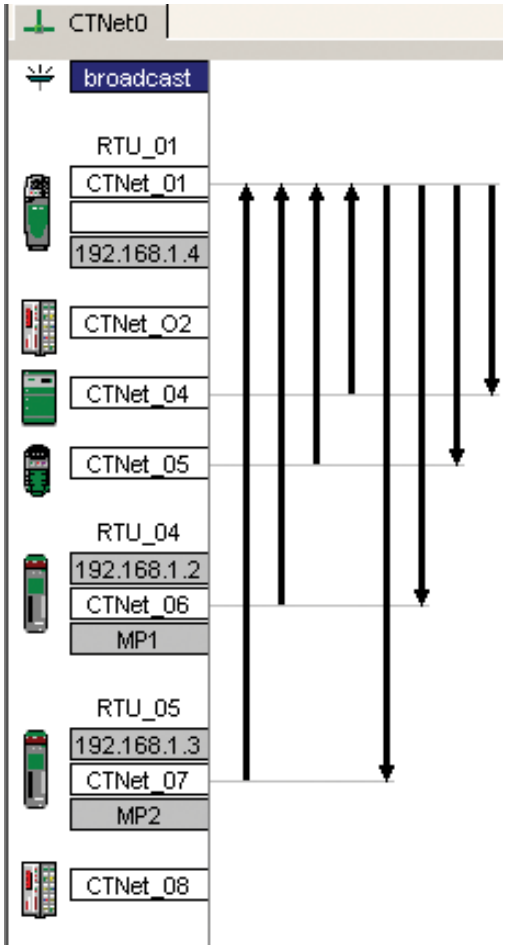


This is a configuration screen in which user sets up messages from source to the destination based on configured nodes on the hardware architecture screen.

CYCLIC DATA LINKS

The Cyclic Data links view is an architectural representation of the nodes on the network as well as data links that are created. The user can then manage data links from this view by drawing in links, and defining data in the links as desired. This becomes very helpful when planning and configuring your network data.

Data Links

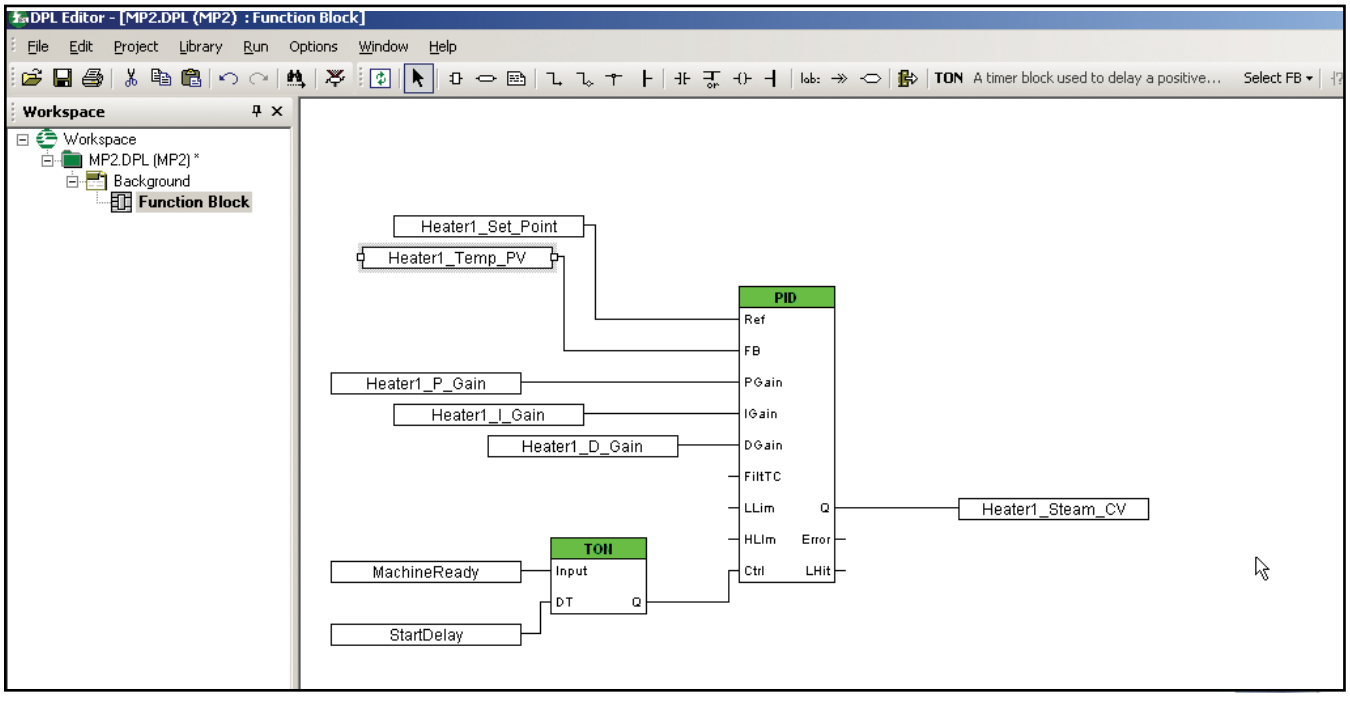


PROGRAMMING FLEXIBILITY

SyPTPro allows you to program in your choice of three programming languages; Function block diagram, Ladder diagram and DPL (Drive Programming Language). And offer a multi-tasking environment where the tasks are scheduled according to the required speed of execution or triggered by events.

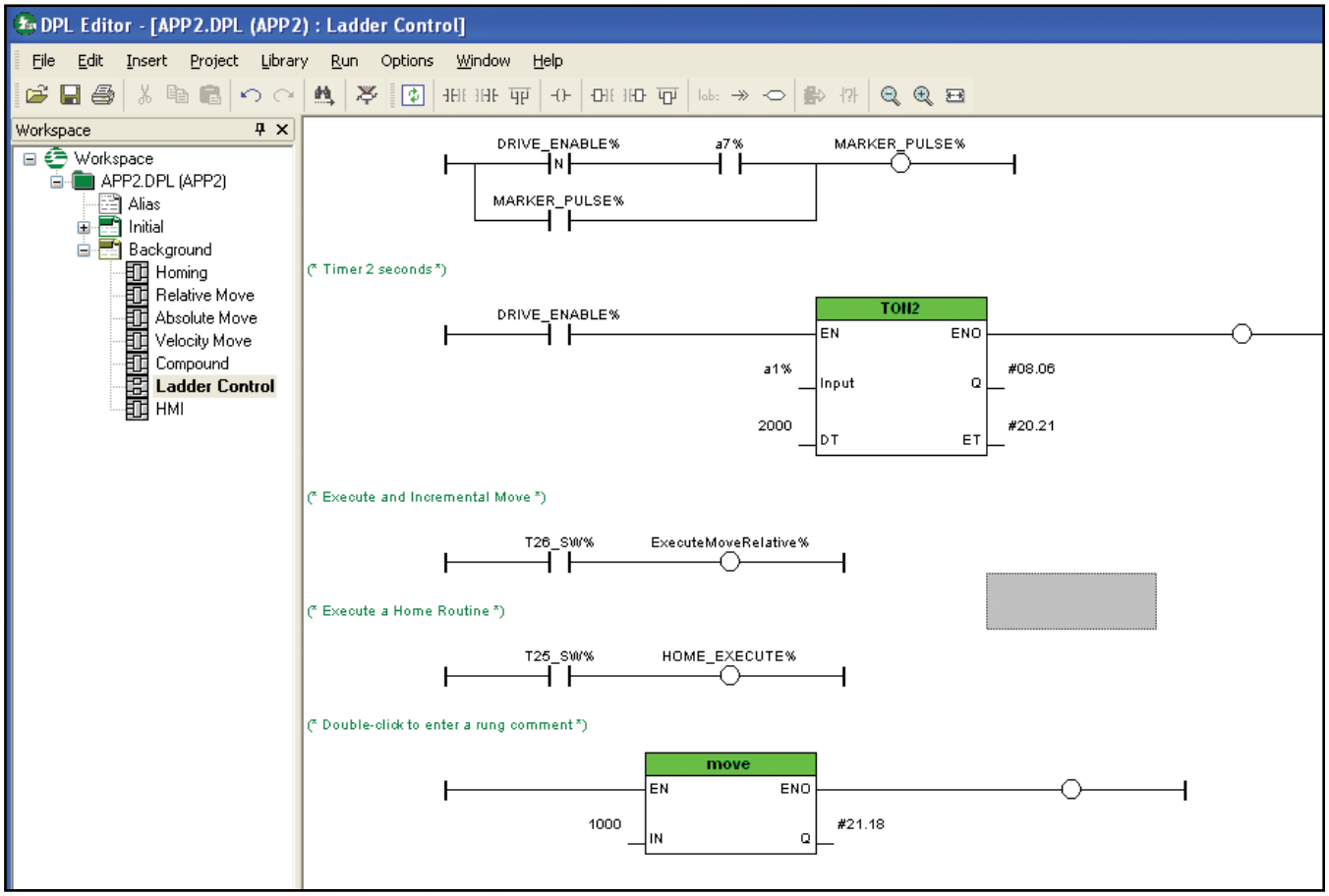
FUNCTION BLOCKS

SyPTPro incorporates an IEC61131-3 function block diagram editor, and comes with a library of more than 380 function blocks for both simple and complex functions. These embed years of application experience to make your software easier to write and easy to re-use. In addition to the defined function blocks, users can create User Defined Function Blocks (UDFB). This feature opens the door to creating special functions. Use pre-defined function block inside the UDFB is also possible. Intellectual property can be protected by creating UDFB allowing access to source code users only.



LADDER LOGIC

SyPTPro incorporates an IEC 61131-3 style ladder logic editor. This form of programming will be familiar to all PLC programmers and is the ideal format for sequencing and I/O control. Using an SM-Applications Plus module over 5000 rungs of logic may be stored and executed. All of the normal ladder logic functions are available plus high level blocks for communications, word manipulation, math operands, and much more.



DPL

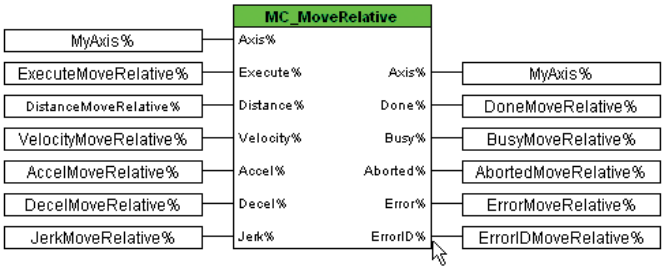
Drive Programming Language is a structured text language, as easy to use as BASIC, incorporating many standard constructs, such as IF, THEN, ELSE, FOR and NEXT loops. DPL is ideal for initializing, configuration and general programming. DPL may be mixed through out the program with the other graphical editors such as ladder.

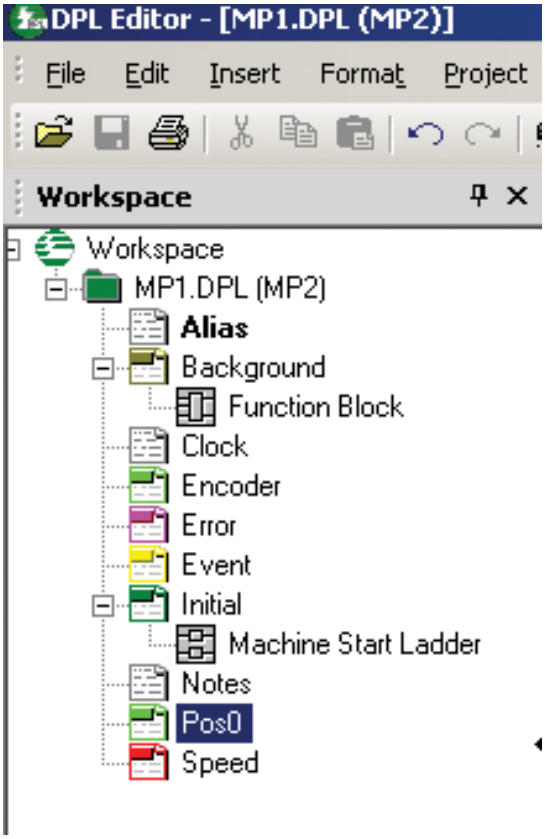
```
IF #01.11 = 1 THEN

    If (MasterControlWord%.0 = 1) Then
        Master_Ref% = -(MasterReference1%-Master_Buffer%)
        Pos_Ref% = Master_Ref% + Offset%
    Else
            Pos_Ref% = 0
            Master_Ref% = 0
            Master_Buffer% = MasterReference1%
```

PLCopen – OPEN MOTION PROGRAMMING

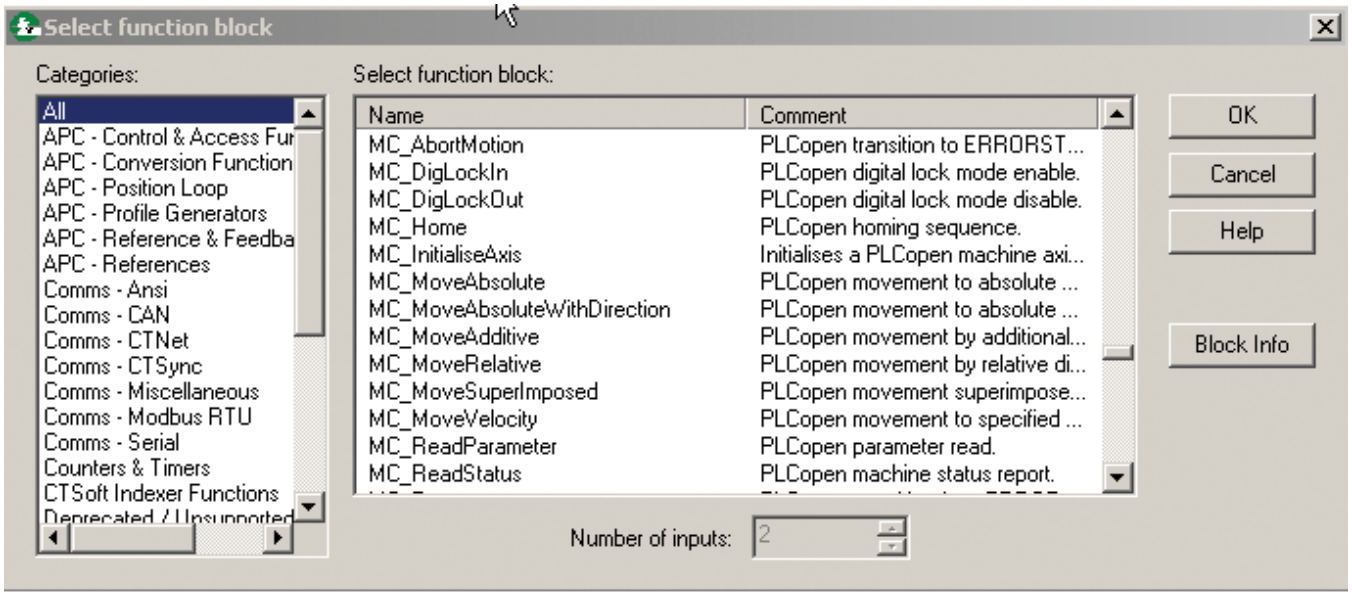
PLCopen style programming for motion control uses industry standard function blocks for motion control. A reduction in development time is realized by taking advantage of this integrated feature in SyPT Pro.





Shown on right is the DPL editor hierarchy tree. Create and edit tasks from this workspace window. Choose from several different types of tasks. For example code that is non-critical can be created in a Background task, while critical code is created in a Pos0 task.

PLC Open standard function blocks are listed in the function block library shown below. These function blocks are among the 380 function built in to SyPT Pro software package.



DIAGNOSTICS AND DEBUGGING

SyPTPro contains a suite of diagnostic tools that help you to find problems with the system or software quickly and easily. Output Window-after compiling the code the window will display file size. In the event of compiler errors, the error and link to line where the error occurred allows the programmer to quickly locate and correct errors.

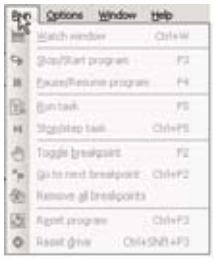


Break Points- add break points into DPL program and run code in sections.

Single Step- run code one line at a time.

Bookmarks- add books marks to quickly navigate to piece of code.





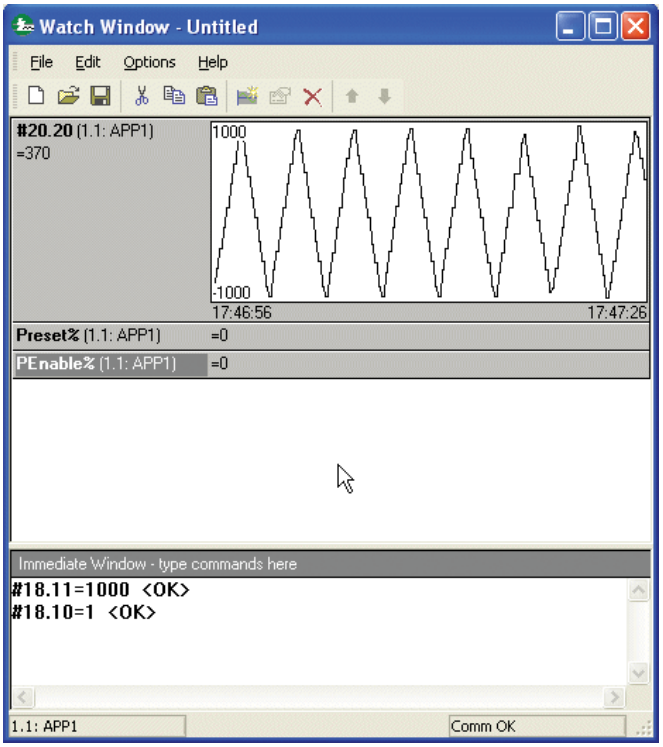
Other tools include Start/Stop programs, Pause/Resume programs, and change variables directly from DPL editor.

SYSTEM WATCH WINDOW

In the watch list window, variables can appear with the following information:

- Variable name Node to which it belongs
- Value in decimal format
- Value in hexadecimal format
- Bit field
- Graphic curve representing its value

An immediate Window allows user to change drive parameters and program variables.

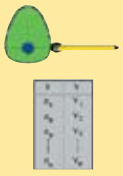


Motion Functionality with Unidrive SP and SyPTPro

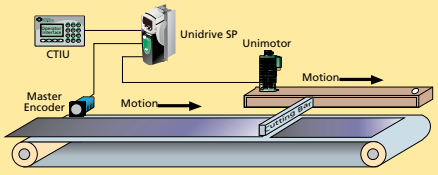
CAM-Application: Any synchronous motion applications, flying shear, rotary knife, etc.

- Multiple interpolations between each coordinate of the master and follower
  - Linear – Constant velocity
  - Square – Linear ramped velocity
  - Cosine – Sine ramped velocity
  - All the above can be from 0 velocity or an offset velocity
- Single shot or continuous cycling of the CAM modes
- Dynamic change of CAM segment, e.g. start and finish
- Master and Follower coordinates are entered as array elements, which can be dynamically changed on the fly or fixed in flash memory

CAM



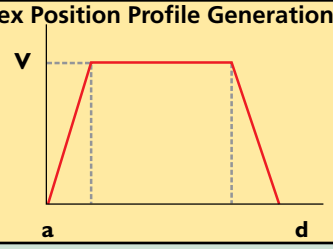
Flying Shear In Line



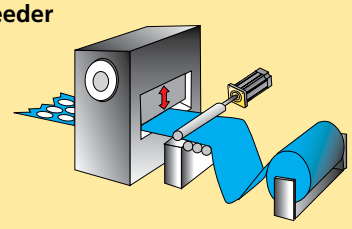
Position Profile Generator – Applications: indexing & point to point

- Linear ramps
- Acceleration, max speed and jerk parameters can be dynamically changed on the fly

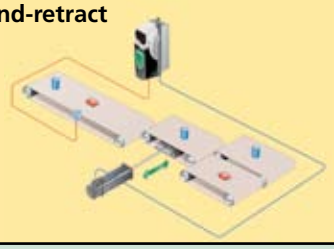
Index Position Profile Generation



Feeder



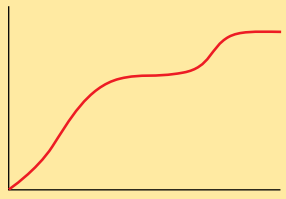
Extend-retract



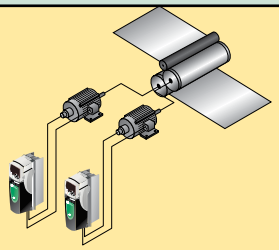
Speed Profile Generator – Applications: jogging, homing

- Linear or 'S' ramps
- Acceleration, max speed and jerk parameters can be dynamically changed on the fly

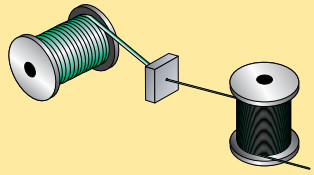
Speed Profile Generation



Bridle



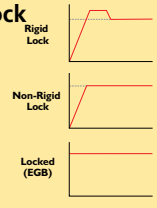
Wire Drawing



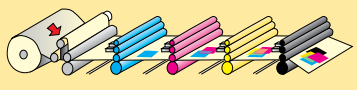
Electronic Gear Box (Digital Lock) – Applications: Master follower applications, conveyors, etc..

- Wide range of Gear ratios, 32 bit integer Numerator/Denominator
- Rigid Lock - ramp to ratio line speed and recover lost position during acceleration, then lock into line position
- Non-Rigid Lock - ramped to ratio line speed and lock into line position
- Lock, No ramps, lock into line position, like a true gearbox

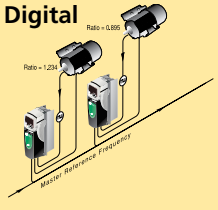
Digital-Lock



Shaftless Offset Printing



Unidrive Digital Lock
Electronic Lineshaft



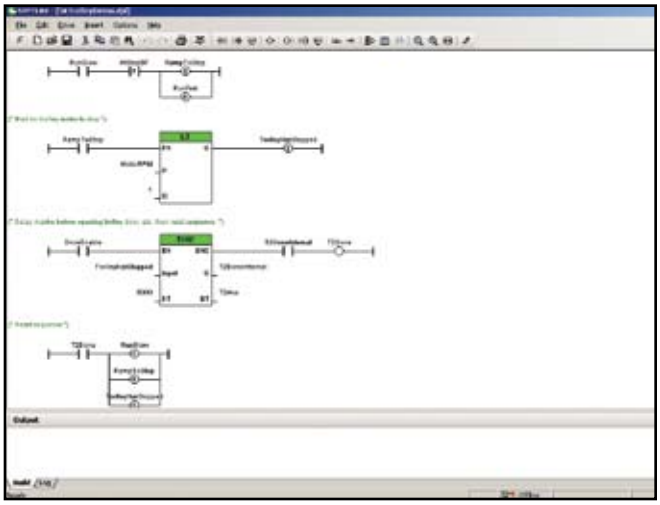
SyPT

SyPTLite

FREE Software

SyPTLite Programming Software

SyPTLite is a ladder diagram editor that allows you to develop programs that can be executed onboard Commander SK with LogicStick, onboard the Unidrive SP built-in PLC or on SM-Applications Lite V2 option modules. SyPTLite is designed to meet the needs of the majority of automation users wishing to extend the functionality of the drive to add simple PLC functionality such as drive control and sequencing. The software has been developed with a focus on intuitive ease of use allowing you to access all of the drives parameters and to monitor and debug your program on line.



SyPTLite contains a comprehensive library of functions that are based on a subset of those available in the full SyPTPro programming tool. These include:

- Arithmetic Blocks
- Timers
- Multiplexers
- Bit Manipulation
- Comparison Blocks
- Counters
- Latches
- SmartCard

SyPTLite with Commander SK Logic Stick

Commander SK is Control Techniques simple and easy-to-use general-purpose drive. However, the Commander SK contains features and functions that you may not expect to find on a low-cost drive, such as the flexibility to program PLC applications onboard the drive. By inserting a logic stick into the front of the drive, you quickly add memory for program storage that allows you to write a PLC program using SyPTLite. The drive is prioritized to execute all motor control related functions first and will use any remaining processing time to execute the SyPTLite ladder diagram as a background activity.

SyPTLite with Commander GP20's or Unidrive SP's onboard PLC

These drives support ladder-programming capability, i.e. the drive itself is capable of storing and executing a SyPTLite program without the requirement for additional option modules. The drive is prioritized to execute all motor control related functions first and will use any remaining processing time to execute the SyPTLite ladder diagram as a background activity. The SyPTLite program may be copied to or from the Smartcard on the drive, allowing the data to be safely stored or retrieved for serial machine manufacture and maintenance purposes.



SyPTLite with Unidrive SP and the SM-Applications modules

The SM-Applications Lite V2 contains it's own high-performance microprocessor giving you access to PLC power and more than doubling the program size available up to 10 kb. Using this option module gives you the flexibility to decide how your program task will run, either background or cyclic. The cyclic task means that the program will start on a fixed time-base that is synchronized with the drives own internal control loops. The time-base is selectable between 1 – 200 ms. The SM-Applications Lite V2 module and SyPTLite offer a compelling alternative to traditional mini-PLC systems, in applications where cost, foot print size or performance is important.



Notes: SM-Applications Plus and SM-Applications Lite V2 modules can only be used with Unidrive SP.

SM-Applications Plus requires SyPTPro.

FREE Software

SyPTLite IS SUPPLIED WITH THE DRIVE OR YOU CAN DOWNLOAD FROM www.syptlite.com

MotionPerfect2

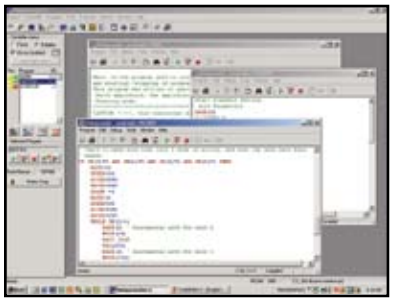
POWERFUL INTERPOLATED, MULTI-AXIS APPLICATION DEVELOPMENT SOFTWARE

For use with the MC Series, see the Motion Coordinator section – look for the tab labeled MC Controllers.

The MC Series is programmed with a powerful and fast multi-tasking BASIC language. Programs are stored on the MC as full programs and use an innovative on-the-fly compiling technique. The on-the-fly compiling technique provides all the performance benefits of compiled machine code while allowing for upload and full program access, without the need for source code download. Because of true preemptive multi-tasking, 3, 7 or 14 processes can be executed within an MC controller simultaneously, depending on the model. This enables parts of a complex application to be developed, tested and run independently, even though the tasks may be sharing data and motion control hardware.

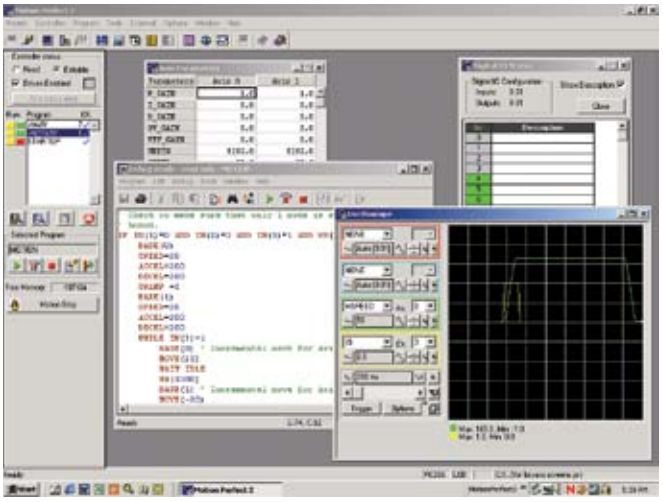
The syntax of MC Basic language is similar to that of other structured BASIC systems. MC Basic has over 200 commands designed to make programming motion functions very flexible. A PC is used to develop and test the application program that coordinates all the required motions and machine functions. Once complete, the PC may be removed and the controller set to run standalone or within a network.

Using the powerful **MC Basic** language, each axis can perform any move type independently while the other axes each simultaneously perform their programmed moves. Groups of axes can be controlled together using interpolation or software gearboxes. Moves can be run on axes that are not physically present in the system and these can be added to superimpose two or more motion commands on to an axis.



The screen above shows a MotionPerfect2 programming screen with three program text editor windows open. In addition to the options and tools available on the menu bar, the program manager on the left provides quick access to program control.

The diagnostic screen (below), shows the oscilloscope, I/O and program windows open.



A powerful suite of software tools enables the MC Series to be programmed to meet almost any application need. At the core of this software suite is MotionPerfect2.

MotionPerfect2 is a Windows™-based application development environment. The program provides all the features required to setup, program and archive applications. The program communicates with an MC Series controller via an RS232 serial port, a USB port or Ethernet connection.

FREE Software

MotionPerfect2

- ***Programming software for MC series***
- ***Project manager loads/saves programs***
- ***Multi-program screen editor***
- ***Multiple terminal windows***
- ***4-Channel oscilloscope to monitor parameters & I/O***
- ***Axis Setup and status display***
- ***Automatically generate initialization program***
- ***Multi-program "Windows™" style screen editor***
- ***Display/Change Inputs, outputs and flags***
- ***Keypad Emulation***
- ***Program Debugger***
- ***Load and save variables/tables to PC***
- ***Graphical view of table data***
- ***Online help with MotionPerfect2 and MC basic***
- ***Configure and initialize distributed I/O***
- ***Controls to set baud rate, display, ports, etc.***

All the Tools Needed to Develop Robust, High-Performance Applications!

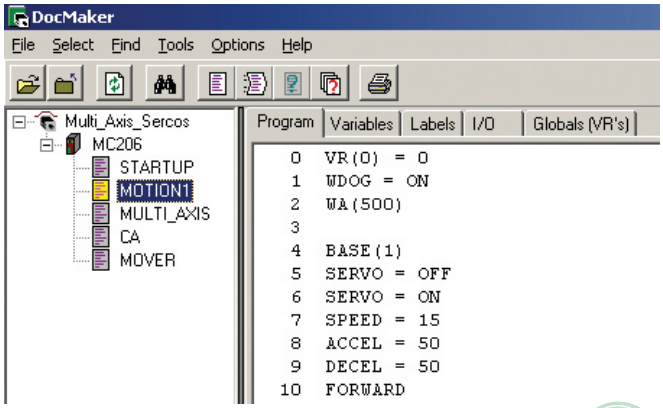
ADDITIONAL SUPPORT SOFTWARE

There are three supporting software packages, which round out the free MC Series software suite. These additional packages are DOCMaker, CAD2Motion and CAMGen.

DOCMaker

FREE Software

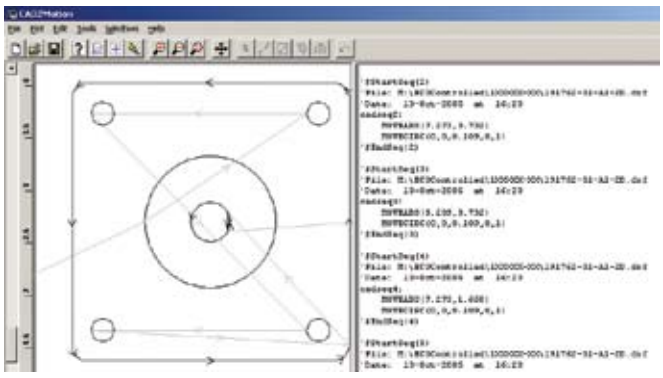
- Analyzes MotionPerfect2 project files
- Assists in documenting and printing all aspects of MotionPerfect2 project file
- Error checks project and warns user of possible error

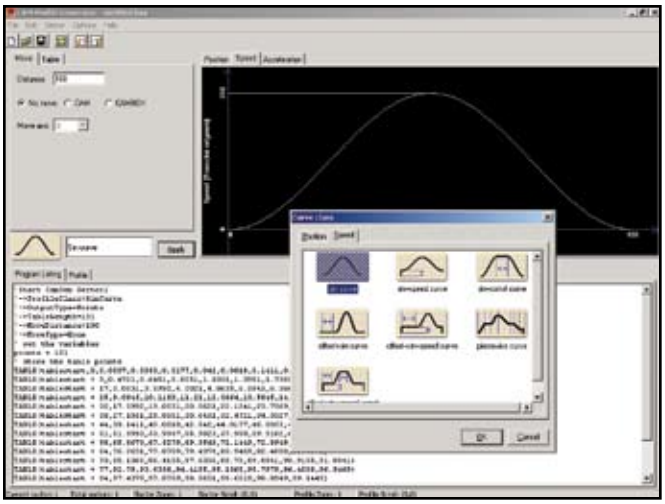


CAD2Motion

FREE Software

- Translates CAD, generates 2 dimensional motion paths into MC Basic code
- Used by the MC programmer to make initial configuration easier
- Translated program can be edited prior to sending it to MC
- Graphical display at motion path



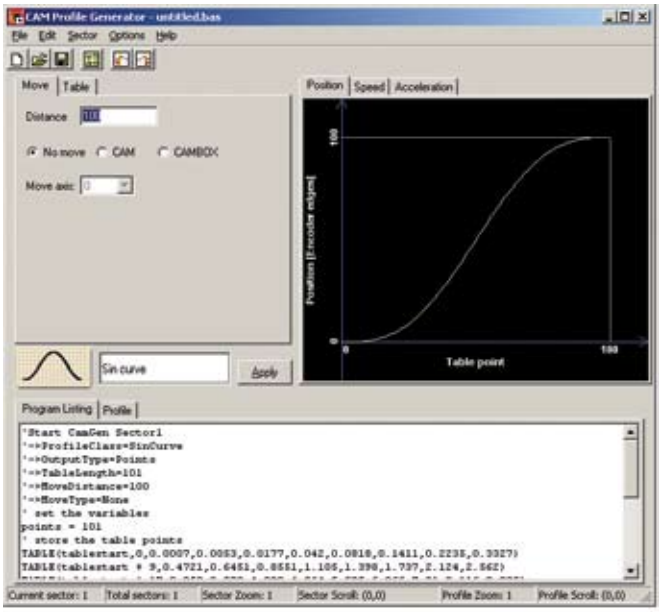


Cam Gen Screen

CAMGen

FREE Software

- Create a CAM profile for the MC Controller
- Import CAMs from Microsoft Excel files
- Generates Real Time and synchronized CAMs. (CAM, CAMBOX)



Drive Selection and Analysis Tools

Control Techniques offers a series of software products to help the user throughout the entire life cycle of an application. Beginning with tools to help the user select the correct drive and motor combination, then a utility to help calculate Return-On-Investment for the chosen hardware, and ending with diagnostic tools to help the user verify that the machine is running smoothly. For your convenience, each of these software packages can be downloaded from www.emersonct.com.

CTSize

FREE Software

DRIVE SIZING SOFTWARE FOR SERVOS

Sizing your application is made easy with the free CTSize sizing software. Selecting the optimum system is simply done by going through the five tabs: Load, Motion, Reduction, Selection and Results.

1. Start by selecting one of the six pre-configured load types: Leadscrew, Rack and Pinion, Conveyor, Cylinder, Feedroll and User Defined.



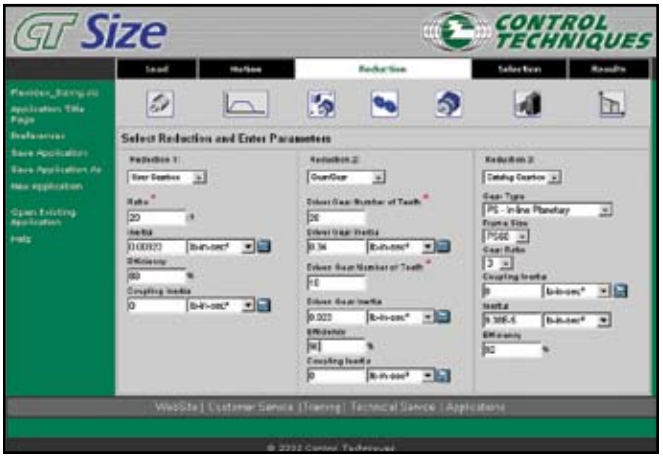
2. Fill in the load details on the load tab.



3. Next, enter the load's motion profile, making use of profile type shortcuts or creating multi-segment profiles.



4. For speed reduction select from Belt/Pulley, Gear/Gear, Chain/Sprocket, or Gearbox for up to three separate stages of reduction.

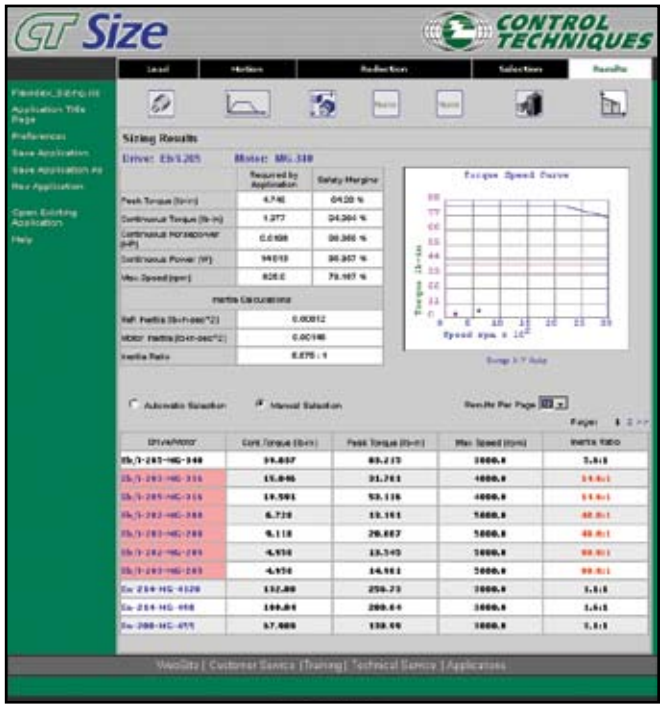


CTSize (continued)

5. Use the selection tab to select from all products or narrow your search to a specific drive and/or motor.



6. The results tab will display the optimum motor/drive combination for your application.



FREE Software

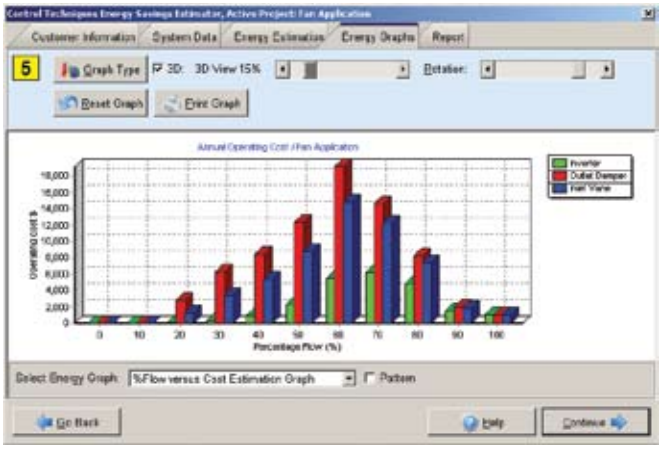
YOU CAN DOWNLOAD CTSize AND OTHER CONTROL TECHNIQUES SOFTWARE FROM
www.emersonct.com

Energy Saving Estimator

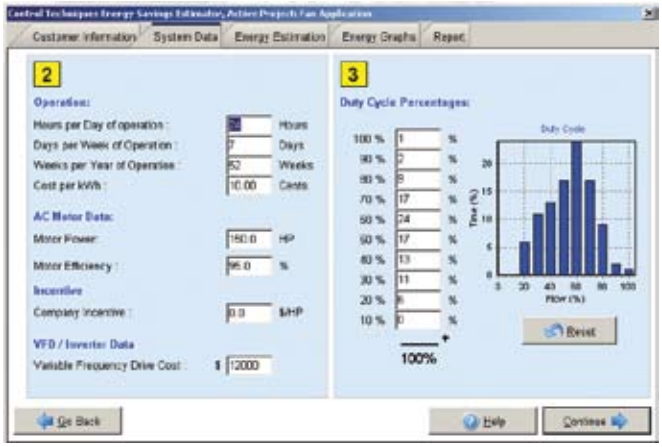
For fan and pump applications

FREE Software

This tool is a complimentary Windows™-based software designed to display the energy and money saved by users who utilize CT drives instead of conventional products. Information required by the program includes type of application (pump, inlet guide vanes, dampers with forward or backward curve centrifugal fan), operational information, cost of electricity, motor horsepower and duty cycle.



As the user enters or modifies the data, the savings at various flow rates are displayed graphically alongside the financial detail of savings, including the payback period. Both the data used in calculations and the results may be saved, recalled, edited and printed as required.



CTOPC server

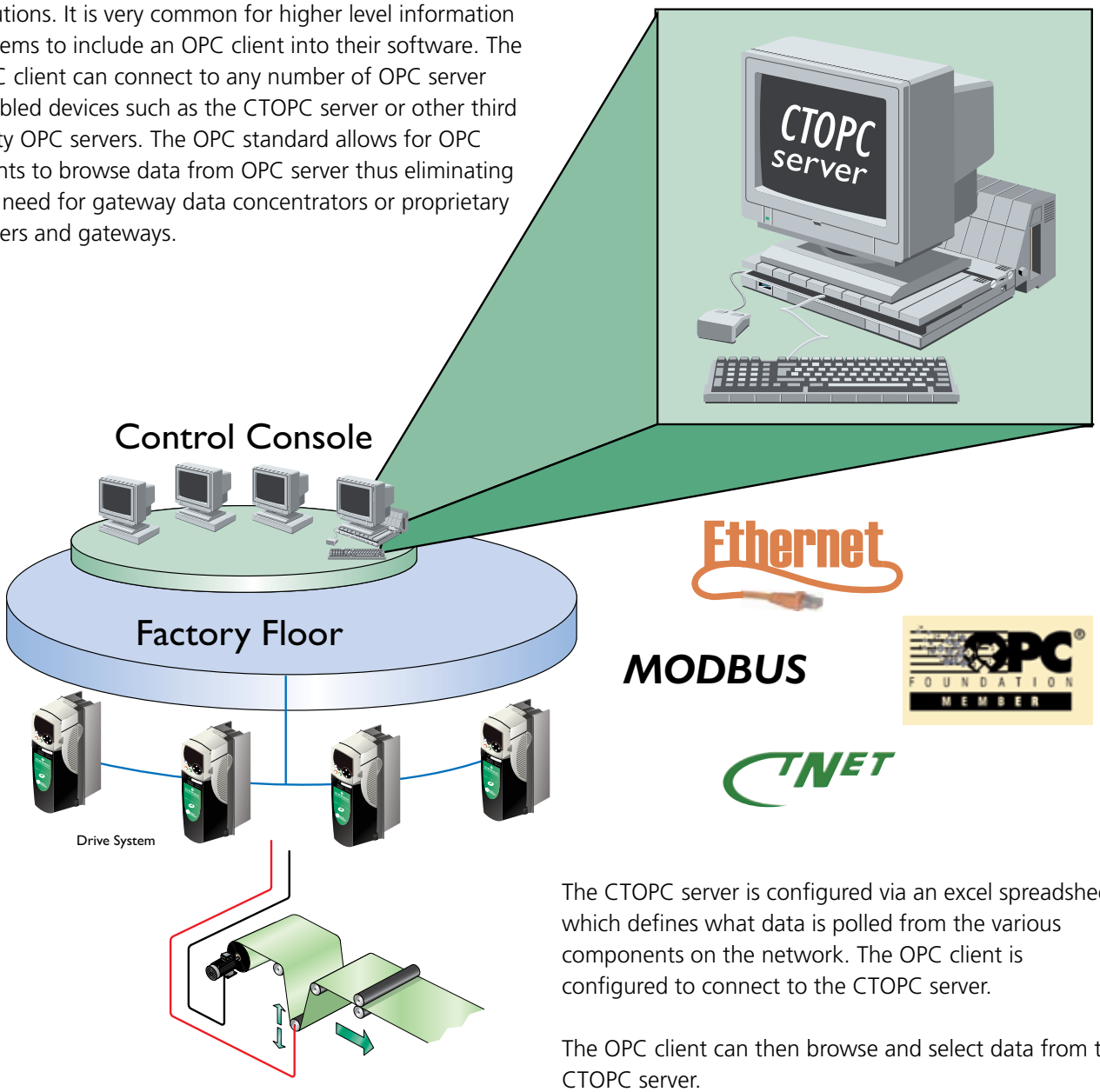
FREE Software

CTOPC server runs on a Windows® PC and allows for open and transparent data exchange with higher level information systems.

OPC has become the industry standard for connecting industrial automation components to higher level information systems. The higher level information systems include SCADA (Supervisory, Control, and Data Access), MRP (Manufacturing Resource Planning), ERP (Enterprise Resource Planning), and other productivity solutions. It is very common for higher level information systems to include an OPC client into their software. The OPC client can connect to any number of OPC server enabled devices such as the CTOPC server or other third party OPC servers. The OPC standard allows for OPC clients to browse data from OPC server thus eliminating the need for gateway data concentrators or proprietary drivers and gateways.

The CTOPC server is installed on a PC running Windows™. The CTOPC server "serves" data to the various OPC clients. Typically the CTOPC server will reside on the same PC as the OPC client. The CTOPC Server then polls data from all the Control Technique components connected via Modbus RTU, Modbus TCP/IP or CTNet.

- Unidrive SP Drive
- CTNet I/O
- SM-Applications Plus Module
- Mentor Drive



The CTOPC server is configured via an excel spreadsheet which defines what data is polled from the various components on the network. The OPC client is configured to connect to the CTOPC server.

The OPC client can then browse and select data from the CTOPC server.

Connectivity

Choose the Fieldbus that fits you AND your application.

At Control Techniques, we recognize the importance of simplicity in fieldbus communications. Incorporating a vast range of fieldbus options onto our drives has been an important step in making system configuration and troubleshooting quick and easy. From Solutions Modules (SM's), to Function Modules (FM's), to built in drive communications, Control Techniques offers our customers fieldbus solutions that are so flexible and easy that some customers have used drives as network gateways! A wide array of communications options are available for your application:

MODBUS

PROFIBUS

CANopen

CAN

INTERBUS

TNET

MODBUS TCP/IP

DeviceNet

SERCOS interface

EtherNet/IP

TSYNC

EtherCAT

Choose your master controller, choose your fieldbus of choice, and then choose the most flexible drives available, Control Techniques.



HOW DOES A FIELDBUS WORK?

Fieldbus networks exchange data using one of two methods. Cyclic or Acyclic data. Cyclic data is information that is pre-configured to pass from one device to another at a known rate. Cyclic data is expected on both the sender and the receiver end of the message, therefore if this cyclic data is not delivered with the proper timing, faults will occur on the network that may be monitored for reliability assurance.

Acyclic messages are messages that are sent and received at any time as they are generated by the sender. Acyclic messages generally have a lower priority than cyclic messages and they incorporate a "request" and "response" communications scheme where the message sender waits to receive a response from the target before generating another message. This response tells the sender whether or not the message was successfully transmitted over the network.

MODBUS RTU

Modbus RTU (Remote Terminal Unit) is the Control Techniques standard for serial communications. Initially developed for Modicon PLC communications, Modbus RTU has grown into an industrial automation standard supported by most PLC and HMI manufacturers. Modbus uses an acyclic message structure to allow access to all drive parameters. Modbus RTU comes standard on nearly all Control Techniques' drive products making integration with other devices simple and seamless.



Commander SK showing connection to the serial port

Commander SK
- Access to all menu parameters
- Multidrop drives easily using RJ45-5
- Baud rates up to 38.4 k baud

Commander GP20
- Access to all menu parameters
- Multi-drop drives easily using RJ45-5
- Baud Rates up to 115.2K baud

Unidrive SP / Digitax ST
- Access to all menu parameters
- Modbus RTU through comm. port on SM-Applications Plus module
- Modbus master capabilities with an SM-Applications Plus module
- Multi-drop drives easily using RJ45-5
- Baud rates up to 115.2 k baud

Epsilon EP / FM-3 / FM-4
- Fully configurable Modbus mappings (via PowerTools Pro)
- All user parameters accessible
- Drag and Drop Modbus configuration

Epsilon EP-B / Epsilon EP-I / FM-2 / EN / MDS
- Preconfigured Modbus registers
- Access to all user parameters

Quantum/Mentor
- MD-29 required
- Rates up to 38.4 K band

Modbus

Drive	Hardware	Parameter Access	Serial Type	Network Operation	Cyclic Data Size	Acyclic Data
Commander SX	Built in	Full	RS485	Follower	N/A	Yes
Commander SK	Built in	Full	RS485	Follower	N/A	Yes
Commander GP20	Built in	Full	RS485	Follower	N/A	Yes
Unidrive SP	Built in	Full	RS485	Follower	N/A	Yes
Unidrive SP	SM-Applications Plus	Full	RS485	Master/Follower	N/A	Yes
Digitax ST	Built in	Full	RS485	Follower	N/A	Yes
Epsilon EP	Built in	Full	RS485	Follower	N/A	Yes
EN	Built in	Full	RS232/RS485	Follower	N/A	Yes
MDS	Built in	Full	RS232/RS485	Follower	N/A	Yes
FM-2	Built in	Full	RS232/RS485	Follower	N/A	Yes
FM-3(DN,PB,E)	Built in	Full	RS232/RS485	Follower	N/A	Yes
FM-4(DN,PB,E)	Built in	Full	RS232/RS485	Follower	N/A	Yes
Mentor	9729-9000 (MD-29)	Full	RS485	Follower	N/A	Yes
Quantum	9729-9000 (MD-29)	Full	RS485	Follower	N/A	Yes

EtherNet/IP MODBUS TCP/IP

Ethernet communications has migrated from the office floor to the plant floor providing a new level of networking control and flexibility that can be extended across an entire company and the globe. Our Ethernet connectivity offering is feature packed, but you don't need to be an IT professional to understand it. Control Techniques makes Ethernet communications easy.

Unidrive SP / Digitax ST
Commander GP20 / Commander SK

- Ethernet/IP
- Modbus TCP/IP support
  - Access to all parameters
- 10/100 Mbits/s auto-negotiation, auto cross-over protection
- HTTP Web Server allows full access to drive configuration
- Superior security features
- User created/defined web page capabilities
- FTP Upgrade capabilities
- Remote Programming Options
  - CTSoft
  - CTScope
  - SyPTLite
  - SyPTPro (Unidrive SP only)
  - PowerTools Pro (Unidrive SP only)
  - CT OPC Server

Epsilon EP-P / FM-3E / FM-4E

- Modbus TCP/IP Support
  - Access to all parameters
- EtherNet/IP Support
  - Up to 122 words produced
  - Up to 122 words consumed
- 10/100 Mbits/s auto-negotiation
- HTTP Web Server allows access to select parameters
- Remote Programming Options
  - PowerTools Pro

Drive	Required Modules	Network Operation	Hardware	Ethernet/IP Cyclic Data Access	Ethernet/IP Non-cyclic Messaging	Modbus TCP/IP
Commander SX	SM-Ethernet	Follower	RJ-45	Yes	Yes	Yes
Commander SK	SM-Ethernet	Follower	RJ-45	Yes	Yes	Yes
Commander GP20	SM-Ethernet	Follower	RJ-45	Yes	Yes	Yes
Unidrive SP	SM-Ethernet	Follower	RJ-45	Yes	Yes	Yes
Epsilon EP-P	None	Follower / Peer to Peer	RJ-45	122 Words IN / Out	Yes	Yes
EN	FM-3/4E					
MDS	FM-3/4E					

DeviceNet

DeviceNet is a high speed communications network protocol that uses Controller Area Network (CAN) hardware layer and signaling. The CAN hardware layer specifies a 5 wire connection and includes 24 Volts between two of these wires. Supported baud rates include: 125 k, 250 k, and 500 k baud. DeviceNet networks require a master controller usually a PLC "scanner" with all network communications controlled by the master device.

Unidrive SP / Digitax ST
Commander GP20 / Commander SK

- Access to all menu parameters
- Polled I/O 28 words IN / 28 words OUT (Cyclic data)
- Explicit Message Support for all parameters

FM-3 / 4DN

- Polled I/O connection support (Cyclic data)
- Drag and Drop DeviceNet Configuration
- Explicit Messaging (Acyclic data)

Epsilon EP-IDN, EP-PDN

- Polled I/O connection support (Cyclic data)
- Explicit Messaging (Acyclic data)

Quantum / Mentor

- Access to all user parameters
- Polled I/O support (Cyclic data)
- Explicit message support
- MD-25 required

Drive	Required Modules	Network Operation	Cyclic Data Access	Explicit Messaging Access
Commander SX	SM-DeviceNet	Follower	28 Words IN / 28 Words Out	Yes
Commander SK	SM-DeviceNet	Follower	28 Words IN / 28 Words Out	Yes
Commander GP20	SM-DeviceNet	Follower	28 Words IN / 28 Words Out	Yes
Unidrive SP	SM-DeviceNet	Follower	28 Words IN / 28 Words Out	Yes
Epsilon EP-IDN	N/A	Follower	4 Words IN / 4 Words Out	Yes
EN	FM-3/4DN	Follower	12 Words IN / 12 Words Out	Yes
MDS	FM-3/4DN	Follower	12 Words IN / 12 Words Out	Yes
Mentor II	MD25	Follower	3 Words IN / 3 Words Out	Yes
Quantum III	MD25	Follower	3 Words IN / 3 Words Out	Yes

EtherCAT®

NEW

EtherCAT slave option module for high performance servo applications. EtherCAT is a real time industrial Ethernet fieldbus. The bus system modifies the standard Ethernet hardware and uses a bus type structure to pass the data from device to device. Protocol efficiencies are gained by embedding the data for many devices within one Ethernet frame obtaining 90% efficiency from the available bandwidth.

EtherCAT is an open, real-time industrial Ethernet solution using modified Ethernet hardware and a pass through type packet that allows extremely fast and deterministic update rates.

The SM-EtherCAT module is for use with Control Techniques' Commander SK, Commander GP20, Unidrive SP, and Digitax ST drives.

Drive	Required Modules	Network Operation
Commander SK	SM-EtherCAT	Follower
Commander GP20	SM-EtherCAT	Follower
Unidrive SP	SM-EtherCAT	Follower
Digitax ST	SM-EtherCAT	Follower

The SM-EtherCAT module can read and write cyclic data of five, 32 bit drive parameters every 250 µs, synchronizing the drive's position or speed loop with the communications network and improving overall system performance.

Unidrive SP / Digitax ST
Commander GP20 / Commander SK

- Up to 64535 nodes on a segment
- Data rate of 100 Mbps (100 BASE-TX)
- Update 40 axes in 200 µs (assuming 2 words command data and 3 words feedback data per axis, a control word and basic cyclic synchronisation data)
- Jitter of less than 1 µs (less than 500 ns with Unidrive SP 3, 6 and 12 kHz switching frequencies)
- Non-cyclic data using the CoE mailbox
- CANopen DS-402 profile supported (drives and motion control)
- Non-cyclic data can be realized using CoE
- The DSP-402 profile for motion control and drives is supported
- 2 RJ45 ports



Profibus-DP is a high speed communications network protocol that allows large amounts of data to be transferred quickly (up to 12 MB/s). The Profibus-DP interface detects the network data rate and automatically synchronizes to it. Profibus-DP systems are centralized and consist of a master controller controlling all communications with follower nodes on the network.

Unidrive SP / Digitax ST
Commander GP20 / Commander SK

- Access to all user parameters
- Cyclic I/O 32 words IN / 32 words OUT
- Non-cyclic Message Support for all parameters
- DPV0, DPV1 functionality including Profidrive profile support

Epsilon EP-PB / FM-3PB /FM-4PB

- Cyclic I/O connection support
- Drag and Drop DeviceNet Configuration
- Non-cyclic Message Support

Quantum / Mentor

- Access to all parameters
- Cyclic I/O support
- MD-24 required

Drive	Required Modules	Network Operation	Cyclic Data Access	Non-cyclic Messaging Access
Commander SK	SM-Profibus	Follower	32 Words IN / 32 Words Out	Yes
Commander GP20	SM-Profibus	Follower	32 Words IN / 32 Words Out	Yes
Unidrive SP	SM-Profibus	Follower	32 Words IN / 32 Words Out	Yes
Digitax ST	SM-Profibus	Follower	32 Words IN / 32 Words Out	Yes
Epsilon EP-PB	None	Follower	12 Words IN / 12 Words Out	Yes
EN	FM-3/4PB	Follower	12 Words IN / 12 Words Out	Yes
MDS	FM-3/4PB	Follower	12 Words IN / 12 Words Out	Yes
Mentor II	MD24	Follower	4 Words IN / 4 Words Out	Yes
Quantum III	MD24	Follower	4 Words IN / 4 Words Out	Yes

The SM-SERCOS module is class B compliant, supporting the torque, velocity and position control modes. This flexible module also supports probing cycle additional functions (Position registration) and user-defined telegrams.



The SM-SERCOS module is configurable through Unidrive SP parameters — there are no hardware configuration switches.

The SM-SERCOS module uses the standard fibre optic ring topology, using standard transmit and receive optical connectors.

- All SERCOS baud rates supported — (16 Mbps Default), 8 Mbps, 4 Mbps, 2 Mbps.
- Network cycle times support: 250 µs, 500 µs and 1 to 65 ms (In 1 ms increments).
- Four optical power levels are available for transmission, and it is possible to disable the network repeater in the module (breaking the network at the point).
- Provides two freeze inputs used for SERCOS probing cycle functionality.

Drive	Required Modules	Network Operation	Cyclic Data Access	Acyclic Messaging Access
Unidrive SP	SM-SERCOS	Follower	Closed Loop Data	Yes
Digitax ST	SM-SERCOS	Follower	Closed Loop Data	Yes

The CANopen interface has been tested and awarded full Product Conformance Certification by CiA (CAN In Automation), the controlling body for CANopen. Conveniently, the CANopen interface is configured as a slot-in card to the interface module which gives the Unidrive SP its flexibility in high level control and communication systems.

The CANopen interface enables OEMs and users to harness the comprehensive facilities of CANopen for use in industrial automation systems where Unidrives may be called upon to network with other CANopen compliant "intelligent" devices such as sensors and actuators.

It allows process data to be regularly updated in remote network nodes, and removes the need for extensive digital and analog I/O wiring. Supported data rates for CANopen range from 10 K bits/sec to 1 M bit/sec.

Drive	Modules	Network Operation	Cyclic Data Access	Acyclic Messaging Access
Commander SX	SM-CANopen	Follower	4 Words IN / 4 Words Out	Yes
Commander SK	SM-CANopen	Follower	4 Words IN / 4 Words Out	Yes
Commander GP20	SM-CANopen	Follower	4 Words IN / 4 Words Out	Yes
Unidrive SP	SM-CANopen	Follower	4 Words IN / 4 Words Out	Yes
Digitax ST	SM-CANopen	Follower	4 Words IN / 4 Words Out	Yes

CAN INTERFACE

The Unidrive SP SM-CAN interface allows any CAN protocol to be implemented for Unidrive using DPL (Drive Programming Language) code or the Function Block Editor within SyPTPro (System Programming Tool). Function blocks are available for the SyPTPro Workbench that provide full access to the CAN controller from the DPL program.

Due to the way CAN works, it is ideal for designing and implementing networks with "peer-to-peer" communications, where nodes are allowed to transmit data over the network at data rates from 10K bits/sec to 1 M bit/sec, without the need for an overall master controller.

The CAN controller used in the Unidrive SP CAN module has full message filtering features built in, which allows the CAN controller to filter out unwanted messages, thus reducing the loading on the CPU.

Drive	Required Modules	Network Operation	Cyclic Data Access	Acyclic Messaging Access
Unidrive SP Digitax ST-P	SM-CAN*	Master/ Follower	User Configurable	User Configurable

*Also requires SM-Applications Plus module

INTERBUS-S

Interbus-S networks are 'centralized' systems, requiring a master controller (usually a PLC) which controls all communications with follower nodes on the network. The Interbus-S interface enables the drive to function as these network nodes, with the advantage for users that it does not require any change to its default setting to operate on a configured network.

The master controller scans the network during network initialization, and assigns addresses to each node depending on their physical location on the network. The data rate for Interbus-S is fixed at 500 K bit/sec.

Drive	Modules	Network Operation	Cyclic Data Access	Non-cyclic Messaging Access
Commander SX	SM-INTERBUS	Follower	10 Words IN / 10 Words Out	Yes
Commander SK	SM-INTERBUS	Follower	10 Words IN / 10 Words Out	Yes
Commander GP20	SM-INTERBUS	Follower	10 Words IN / 10 Words Out	Yes
Unidrive SP	SM-INTERBUS	Follower	10 Words IN / 10 Words Out	Yes
Digitax ST	SM-INTERBUS	Follower	10 Words IN / 10 Words Out	Yes
Mentor II	MDIBS	Follower	3 Words IN / 3 Words Out	Yes
Quantum III	MDIBS	Follower	3 Words IN / 3 Words Out	Yes

CTNET

Highly Deterministic Distributed Control

Control Techniques CTNet interface enables users to leverage the facilities of the Unidrive SP and Mentor II, Applications coprocessor modules, for real time decentralized control. CTNet was developed specifically for highly dynamic applications, over trunk lengths generally exceeding 100 m, using proven token ring data link technology. CTNet is a "decentralized peer-to-peer" system, requiring no master PLC controller, with each intelligent node taking its turn to control the network, and communicate directly, and in real-time, with other network nodes at data transfer rate of up to 5 M bits/sec. CTNet supports up to 255 nodes and provides an intelligent drive-oriented approach to systems integration based on decentralized control, universal communications and graphical software.

Unidrive SP / Digitax ST enable a CTNet gateway to industrial networks such as Profibus-DP, Interbus-S, DeviceNet, Ethernet, and SERCOS.

Drive	Modules	Parameter Access	Hardware	Cyclic Data Size	Non-cyclic Messaging Access
Unidrive SP	SM-Applications Plus	Full	ARCNET	N/A	Yes
Digitax ST-P	Integrated	Full	ARCNET	N/A	Yes
Mentor II	MD-29AN	Full	ARCNET	N/A	Yes
Quantum III	MD-29AN	Full	ARCNET	N/A	Yes

Drive Integration with CTNet

Decenteralized Control Solution

CTNet is a comprehensive line of equipment enabling the design engineer to create high performance and cost effective decentralized control solutions. The CTNet product range supports intelligent co-processors installed in Control Techniques' AC and DC drives with a high-speed peer-to-peer fieldbus that enables the control set up required by an application distributed.

The CTNet fieldbus is a 5 Mbit token ring network that supports peer-to-peer communications. Utilizing the field-proven ANSI/ATA 878.1 ARCNET standard as a foundation, CTNet includes a custom protocol stack that supports cyclic data and non-cyclic "one shot" transactions. The CTNet fieldbus employs an RS485 transformer-isolated physical layer to allow usage of a convenient and inexpensive two-wire shielded, non-phasic cable.

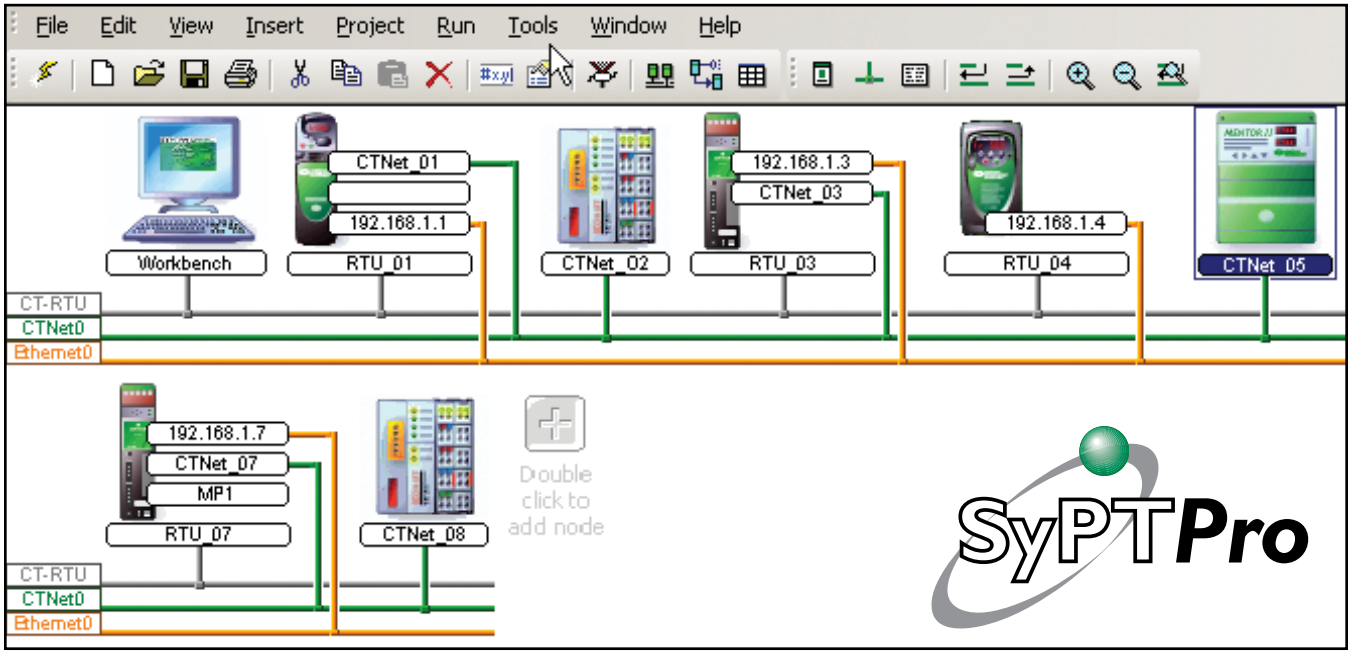
Two methods of data exchange are supported: cyclic data and Acyclic data. Cyclic data exchanges are pre-programmed block transfers (20 registers max.) between coprocessors at either a fast or slow rate. Acyclic exchanges are asynchronous transfers initiated by application programs or SCADA / HMI devices.

CTNet is used in conjunction with SyPTPro programs.

CTNET INTERGRATION AT-A-GLANCE

Function	Description	Order Code
Application Co-processor Modules	Includes CTNet fieldbus connections & Co-processor	SM-Applications Plus (Unidrive SP & Digitax ST-P), MD29AN RevD* (Mentor)
Network Accessories	3 port Hub, provides Connectivity to 3 CTNet segments	CTNet-Hub-RevD*
	Fibre optic Repeater	CTNet-FIB-RevD*
	3 port Hybrid Hub, for connectivity between current and previous CTNet versions	CTNet-Hybrid-Hub
	CTNet bulk cable	CTNet-XXX
PC Network Card	USB22-CTNet - Computer USB port to CTNet communications interface	4500-0100
Remote I/O	Beckhoff bus coupler	SSP7200-RevD
HMI Display Operator Interface	Operator Interface Unit	CTIU200
	CTNet comms card	CTIU200-CTnet-RevC
Application Programming Software	Systems Programming Toolkit	SYPTPRO
Power Supply	24 VDC Power Supply	Consult Drive Center
Network Bridges	Bridge between CTNet and DeviceNet, PROFIBUS DP, INTERBUS, Modbus, Sercos, Ethernet, and CANopen	Unidrive SP (Gateway Feature)

* CTNet components sold prior to January 2003 utilizes a different product revision than shown above, Rev D. Please contact Control Techniques when purchasing components for older installations.

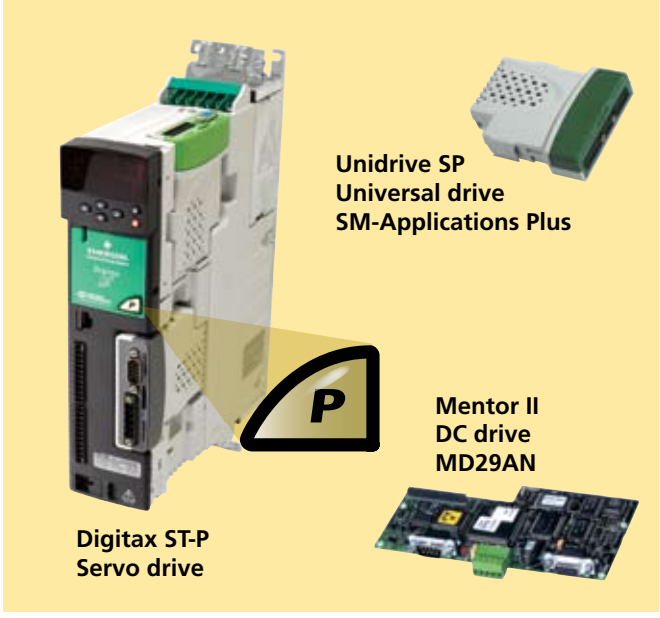


APPLICATION CO-PROCESSOR PLATFORMS

SM-Applications Plus / MD29AN / Digitax ST-P

SM-Applications Plus Unidrive SP, MD29AN (Mentor II / Quantum III) plug-in co-processors, and integrated in the Digitax ST-P include the CTNet high-speed peer-to-peer fieldbus to allow the modules to communicate with one another.

The CTNet-equipped co-processors are based on a high performance microprocessor with up to 384 Kbytes of program storage and 80 Kbytes of variable storage for user applications. In addition to the CTNet fieldbus, serial ports are available for RS485 communications. The co-processors also include a built-in counter-timer unit and a position controller capability.



NETWORK ACCESSORIES

Repeaters

For extending CTNet cable segments and creating star topologies, there are three types of repeaters available:



Description	Order Code
Two-output (3-port) Repeater (Hub)	CTNet-Hub-Rev D
Twisted-pair to Fibre Optic Repeater	CTNet FIB-Rev D
Hybrid Hub for connecting previous versions of CTNet hardware to current versions	CTNet Hybrid Hub

CTNET CABLE



Control Techniques supplies a high quality shielded twisted-pair cable suitable for high-speed data transmission. It is available in three standard lengths or any specified non-standard length.

Description	Order Code
100 meters	CTNet-100
Non-Standard (bulk in meters)	CTNet-xxx*

* XXX= number of meters

PC NETWORK INTERFACE CARD



For desktop and laptop computers, use the USB22-CTNet network card. This interface card permits user specification of the node address, baud rate and IRQ (where applicable).

Network Application Card	Order Code
USB22-CTNet	4500-0100

REMOTE I/O



The high-quality Beckhoff I/O system is available for CTNet systems. Beckhoff systems for CTNet include a bus coupler and a large variety of snap-on terminal blocks allowing up to 256 digital inputs or outputs and up to 100 analog inputs and outputs per bus coupler. Up to 64 Beckhoff I/O systems can be attached to a CTNet network. I/O points can be easily read or written. (Beckhoff I/O for other networks available.)

Description	Order Code
Beckhoff Bus Coupler	SSP7200-RevD

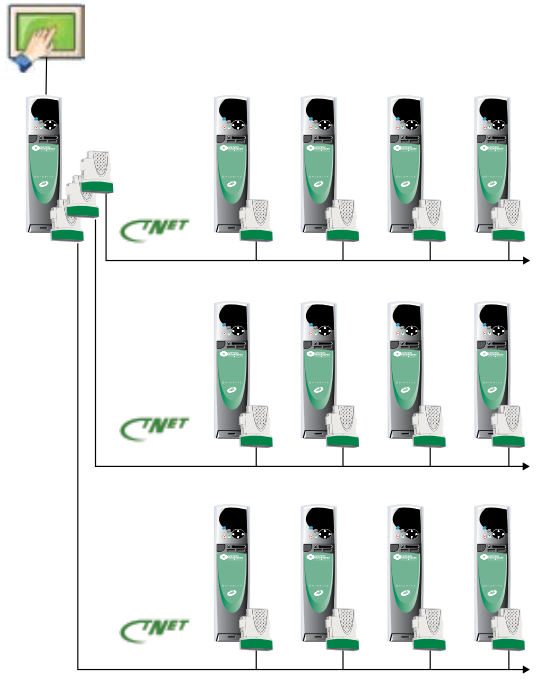
Contact Control Techniques for details on the range of Beckhoff Remote I/O options available, including:

- Digital input terminals in 5, 24, and 48 VDC, 120 VAC
- Digital output terminals 5 and 24 VDC, Relay Output (115-400 VAC)
- Analog input and output terminals for a wide array of applications. All standard voltages, mA, RTD, thermocouple, etc.

HMI OPERATOR INTERFACE

CTNet Modbus function codes

CTNet Modbus function codes allow the operator interface to access any Control Techniques drive connected to CTNet network via a standard RS485 serial connection. In the example below the operator panel is connected at a high-baud rate to the drives serial port and can obtain drive parameters from any of the drives on the three CTNet networks. This is possible using special Modbus function codes that pass the data through the drive to the CTNet network. This gives significant cost reductions and allows the operator panel to be a standard-off-the-shelf model with no additional hardware



SyPTPro SYSTEM PROGRAMMING TOOLKIT

- **Auto Detection**
  When is connected to your drive system it will:
  – Automatically interrogate your network
  – Discover which components are connected
  – Let you upload to the PC the software from the option modules



- **Simplicity of Connection**
  SyPTPro may be connected via CTNet using a USB adapter direct to the CTNet network or through the standard RJ45 programming port on the drive. In both cases you get total visibility of the complete CTNet network for programming and diagnostics.

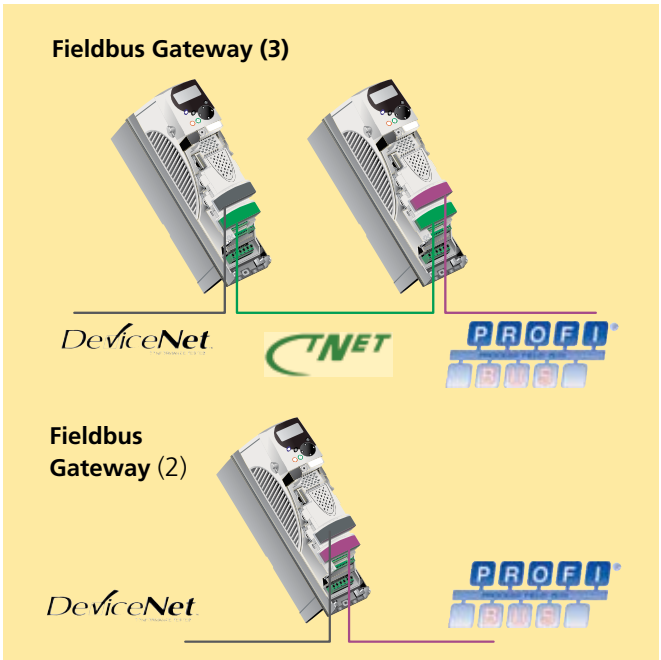
- **Multiple - CTNet Networks**
  For the ultimate multi-tasking and multi-processing fit multiple SM-Applications Plus modules to your Unidrive SP or Digitax ST-P, this allows you to increase the processing power where required, and support multiple CTNet networks in a system. Even if you do not need to now, it is reassuring to know that you can expand your drive system to incorporate any future modification.

- **Multi-point Programming**
  More than one programming station may be resident on a CTNet network allowing work to be done on different parts of the system simultaneously and so allowing commissioning times to be minimized.

NETWORK BRIDGES

The Unidrive SP provides unrivaled fieldbus flexibility. In addition to the standard Modbus RTU port, up to three fieldbus option modules can be installed in the Unidrive SP's option slots. This provides the capability to control and monitor a Unidrive SP on multiple fieldbus networks. For example, a single Unidrive SP can be configured to communicate on both DeviceNet and Profibus networks simultaneously.

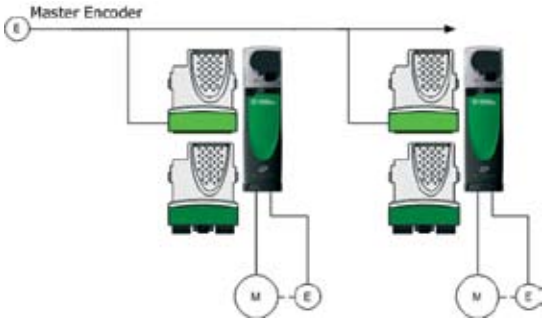
In the example shown, CTNet is used to provide real-time coordination between two Unidrive SP modules. The DeviceNet and Profibus connections allow data to be passed to the controllers in a machine line.



CTSYNC

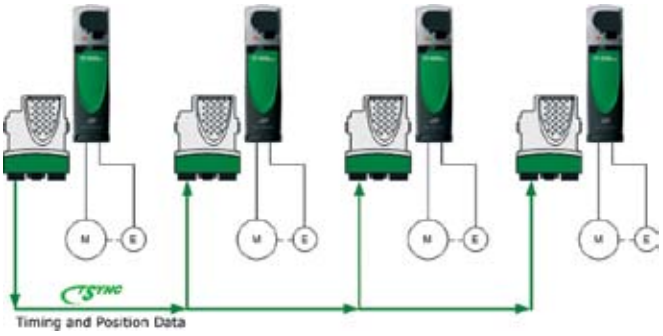
CTSync is a high performance communication link that can improve your machine's performance and reduce the cost of your control system. CTSync is standard with SM-Applications Plus. It provides synchronization between drive control loops thus allowing the creation of a virtual master reference.

TRADITIONAL MASTER / FOLLOWER SYNCHRONIZATION



USING A VIRTUAL MASTER REFERENCE:

Example: Motion control with 4 axis linear interpolation



DISADVANTAGES OF TRADITIONAL MASTER / FOLLOWER:

- High resolution Sin/Cos encoders cannot be multi-dropped
- Difficult connections required for many encoder types, minimum of 6 wires
- Expensive encoder options required on every follower
- Drives software and control loops not synchronized between all drives preventing effective co-ordinated multi axis position control
- Not always possible to connect a master encoder

ADVANTAGES OF 'VIRTUAL MASTER':

- Co-ordinated multi-axis control with < 4 µsec jitter
- Solution for when a real encoder cannot be physically fitted to a machine
- Cleaner noise free signal for guaranteed performance
- Compensation with feed-forward
- Choice of encoder resolution
- Simple 2-wire connection



Drive Integration

Automation Hierarchy Selection

It is rare that an industrial drive stands alone in an application. In the majority of cases, drives are part of a system. As such it is necessary for the parts of the system to communicate with one another, transmitting commands and/or data. This communication can be in many forms from traditional analog signals to wireless communication systems. Control Techniques produces lower cost, higher performance drives, with flexible and dynamic interfaces to products such as PLC's, HMI's etc.

Traditionally systems have been controlled by powerful Centralized Controllers at the Process Level. As the cost of PLC's reduced, control was distributed to the Machine level. As PLC's continue to fall in price, further distribution of control is happening. However, the threat to PLC's in this role comes from drives which have considerable processing power, and direct contact with much of the critical variables of the system thereby offering new opportunities in terms of optimized system control.

In all applications it is worth considering the relative benefits of Centralized and Decentralized Control. This assessment needs to be done prior to deciding on the most appropriate fieldbus for the application.

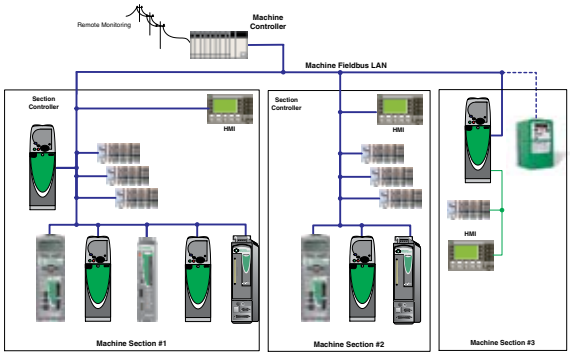


CENTRALIZED CONTROL SYSTEMS

Centralized control requires a powerful Machine Controller, (usually a PLC or PC) with centralized programming and configuring software tools to provide:

- Gateway to the process layer
- Machine co-ordination and sequencing
- Machine real-time control algorithms for one or a number of devices (including drives)
- A high speed and medium bandwidth communication system and/or support a lot of inputs and outputs for plant based devices
- Service data to and from devices

The communication throughout the system is via the machine fieldbus Local Area Network (LAN). The dynamic speed of such a network depends not only on the choice of fieldbus, but also on the number of nodes connected. Great care is needed in specifying such a system if the system requirements are not to be compromised. The specification of such a network is the most common problem during system commissioning, and can be responsible for some serious project delays.
A typical configuration for a centralized control system is shown below.



Advantages:

- Simple architecture
- One learning curve for programming and configuration tools
- Efficient, one point bridge to process layer
- Usually a lot of applications support available from controller suppliers and integrators

Disadvantages:

- Expensive hardware and software (Machine Controllers are expensive on large systems and software tools)
- The central controller is a commissioning bottleneck
- Redundancy is very expensive to build in
- A broad family of controllers needed for cost effective adoption across a factory

DECENTRALIZED CONTROL SYSTEM

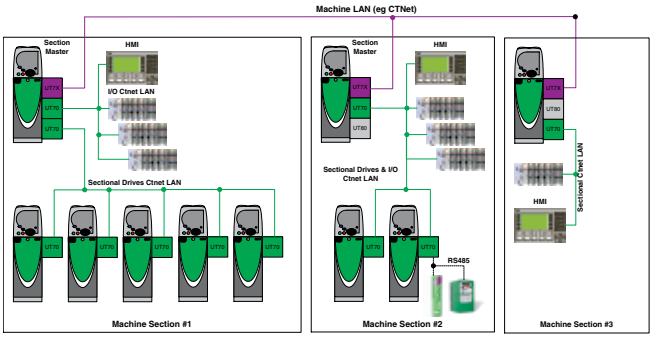
This alternative approach is also referred to as a Distributed Control System. This requires:

- Peer to peer communications (devices to talk with one another)
- "Intelligence" in some devices
- A gateway to support the Process layer interfaces
- A common and flexible programming, configuration, commissioning and visualization software tool

Advantages:

- Low cost
- Small control panel size
- Easier design and maintenance – Modular software
- Opportunity for faster response times than with centralized control (Better Performance)
- Inherent system redundancy possible
- Multi-commissioning access reduces set-up time
- No machine controller
- Modular software readily facilitates re-use
- System is scalable

Fully Decentralized Control



Disadvantages:

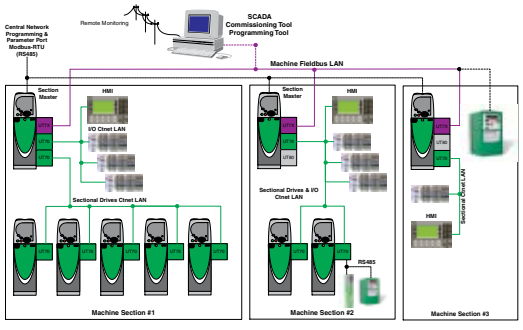
- Needs high level commissioning and programming tools (Need to realize sections and device functions)
- Gateway to Process layer required
- Process layer can access all machine devices (no filtering)
- High degree of system determinism may be required
- High system communication bandwidth may be required

HYBRID CONTROL SOLUTION

A Hybrid solution, sometimes known as Distributed Sectional or Cluster Control, is now receiving significant attention. This requires:

- A medium processing power Machine Controller to provide:
  - Gateway to the Process layer
  - Machine co-ordination and sequencing
  - Support a lot of system inputs and outputs (digital and analog) – High Speed and medium band width to and from each section
- A medium processing power Sectional Controller to provide:
  - Gateway to the Machine controller
  - Section co-ordination, sequencing and if necessary synchronisation
  - Support a lot of system inputs and outputs (digital and analog) – High Speed and medium band width to and from each section. Service data to and from each device
  - Master-Follower or Peer-Peer architectures can be adopted
  - Common programming, configuration and commissioning software tools

Hybrid Control (Distributed Sectional Control)



Advantages:

- Very cost effective solution for medium/large systems
- Simple architecture – each section controller is responsible for its own sectional devices
- Efficient, one point bridge to the Process layer
- Modular software – Easier development, maintenance and re-use
- Common server and marshalling
- Inherent sectional redundancy
- Multi-commissioning access
- Tight control with fast updates for Sectional control
- Common programming and commissioning software

Disadvantages:

- Potentially higher cost for small systems
- Without common software tools system (machine and sectional) visibility is restricted – solved with SyPTPro

Drive Integration

Automation Hierarchy Selection (continued)



Having looked at these system implementations the opportunity for 'solutions platform' drives emerges. No single control configuration can be considered "the best" for all occasions the driving factor is the application itself. In the illustrations, there is not a wide proliferation of PLC's, indeed their absence is striking. In the decentralized and hybrid solutions however, there is a considerable requirement for decentralized "intelligence", and this is contained within Unidrive SP.

The capability of the Unidrive SP to undertake real-time control functions is critical. For example a winder-unwind controller may need to be embedded or a complete elevator control including call handling, speed/acceleration ramps, positioning etc. Windows™-based software tools (based on IEC61131-3) makes programming, commissioning and maintenance a straight forward task for operators familiar with PLC programming.

In all solutions, the need for the Unidrive SP to support modern high speed fieldbus communications is implicit.

In the hybrid solution, the drive acts as both a communications bridge (linking the Machine fieldbus LAN to the Sectional LAN) and as the sectional controller. It also provides a further LAN to interface with the Sectional I/O. Further sub-LANs are also illustrated. This layering of LANs greatly simplifies the communications network and leads to great benefits in terms of system performance and visibility. The design is simplified by breaking the tasks into modules. This modular design lends itself to the important practice of re-use both of software but also hardware.

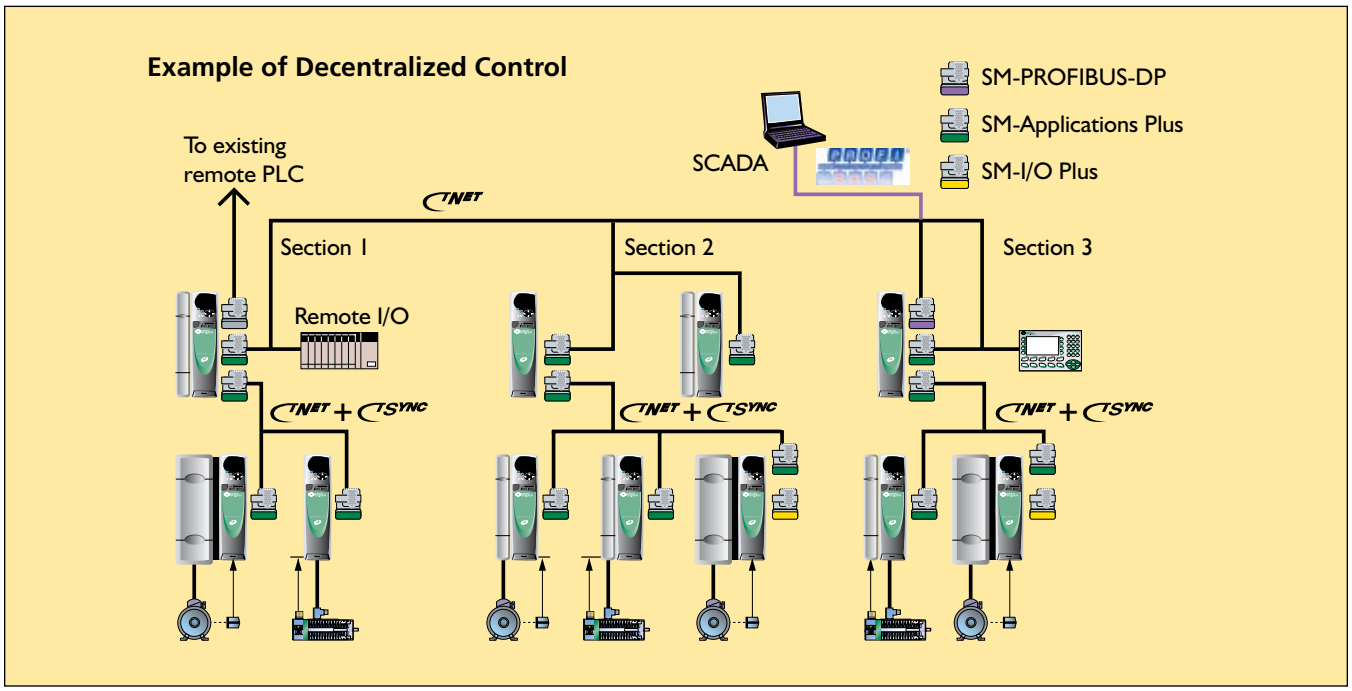
System performance is enhanced by tight synchronization of control loops and between the Unidrive SP and its option modules.

ULTIMATE FLEXIBILTITY

The flexibility of the Unidrive SP together with the option module range makes it the perfect Solutions Platform for any automation system.

The SM-Applications option modules can be used in almost unlimited combinations with fieldbus and I/O options in order to neatly dovetail into existing automation systems.

Alternatively, when starting out with a clean sheet of paper, the Unidrive SP can achieve the necessary cost and space savings by allowing the Project Engineer to accurately match the PLC and I/O requirements.



Options and Accessories

Everything else you need for a successful application



ONE SOURCE

Control Techniques and its distributors and integrators participate in the "One Source" program to assist customers in getting the best price for matched drive system peripherals. This includes motors, actuators, reducers, encoders, and other items typically found in electronic drive applications.



Training, Field Service, Repairs, and on-going Support

Control Techniques provides factory authorized repairs and field services for both new and legacy Control Techniques and Emerson products. We offer a wide variety of support services from application engineering and startup, to emergency service, and custom service agreements. In addition, Control Techniques also provides an array of training opportunities online, in our Drive and Service Center classrooms, and on the factory floor.

For complete and up-to-date information on training opportunities, go to: www.emersonct.com and select Support/Downloads, then Training.



Operator Interfaces

Optional keypads, remote keypads, operator interface terminals enable greater control and oversight of your drives and applications. Our unique open communications platform allows drive-to-drive, drive-to-PLC, drive-to-I/O, and drive-to-operator interface communication. HMI offerings extend from 2-line terminals to color-touch screen panels.



Cabling and Connectors

All the interconnect components necessary for single and multiple motor systems, feedback devices, single- and multi-drop communications, I/O, routers, software and operator interface connections can be found in this section. To assist you in finding the right cabling and connectors, refer to the cabling diagrams on the following Interconnect Component pages.

Power Accessories

Control Techniques provides dynamic braking resistors, isolation transformers, filters, and line and load reactors that protect your drive system, and enhance safe operation. The tables in this section will help you match the right component to your system requirements.

ONE SOURCE



"One Source" for AC products

Control Techniques can supply AC motors from 1/4 hp to 1500 hp. Motor enclosures include totally open drip proof, totally enclosed fan cooled, totally enclosed nonventilated, and totally enclosed blower cooled. A variety of voltages are available along with mechanical and electrical modifications and accessories. Control Techniques can supply virtually any type of AC variable speed motor to meet your needs.



"One Source" for DC products

Every Control Techniques distributor has access to the motors and accessories needed to complete your DC drive application through our "One Source" program. Using the buying power of Emerson, Control Techniques works closely with its distributors and customers to fulfill the promise of delivering the best possible price and performance solution on the market today.

Our DC motors range from 1/4 hp to 1600 hp. Our DC motor enclosures include totally enclosed fan cooled, totally enclosed nonventilated, drip proof guarded and drip proof guarded force ventilated. A variety of armature and field voltages are available along with mechanical and electrical modifications and accessories. We can supply virtually any type of DC motor to meet your needs.



"One Source" for Motion Control

Control Techniques offers its motion control customers industry standard, specialized options and accessories from select leading companies to complement the wide breadth of products we manufacture. This allows our customers to obtain the very best solution from only "One Source" providing piece of mind in their selecting the very best motion solutions available in the industry.

Support Services

Training, Field Service, Repairs and After Market Solutions

Start up

Control Techniques' Engineers can **install, commission** and **start up** your new system – on time and on budget. Our experienced Field Service Engineers commission and validate each device in your system. They work with your personnel during start-up to assure the integrity of the system and its operating parameters. Call 1-800-893-2321 and ask for Start Up Service. Go to Support at www.emersonct.com for Start Up Fixed Pricing.



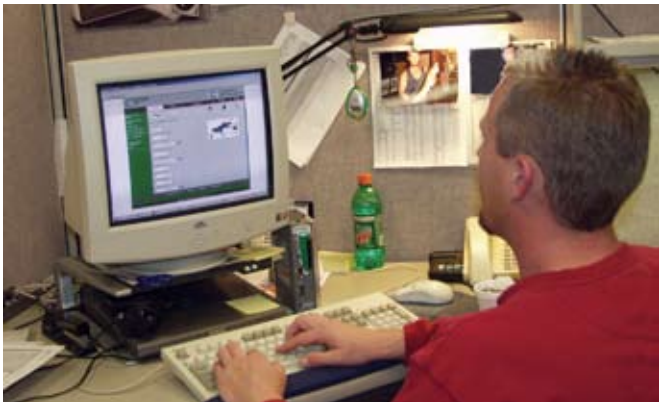
Training

Support your drives with **comprehensive instruction** on programming and diagnostics. Control Techniques training programs help new and experienced users learn how to use and gain the most value from our products. Custom training programs can also be provided at your facility. Our classes are designed for audiences ranging from maintenance personnel to automation engineers. For more information visit the web site, or email or call the Grand Island Training center at training@emersonct.com 1-800-893-2321.



Warranty Service

Rely on our extended coverage options long after your initial investment. Control Techniques offers you the **best warranty** coverage in the industry. We recommend our optional Three Year Extended Product Warranty on high performance drives, for a total of up to five years of worry-free coverage. You can purchase the three year extension anytime during the original warranty, provided your drive is in proper working condition. Call 1-800-893-2321.



Application Support

The **Application Support** Program helps customers who don't have the time or resources to learn new software and at the same time implement a new drive system by developing their applications. For details, go to Application Support on the web site and download the Application Support PDF.

Authorized Factory Service

Come to Control Techniques for your only source of **Authorized Factory Repairs**. All repairs include the latest product updates, are certified to current factory specifications. All repairs carry a one-year warranty. Guaranteed standard repair is five days, emergency repair is 48 hrs. Call 1-800-893-2321. Policies, procedures and RMA available on the web site. Call on local technicians for expert servicing and support. Factory authorized support is just a phone call away.



Control Techniques services its legacy drives, and those of past Emerson companies, such as US Motors, Burton, WER, Emerson Industrial Controls, Browning and Morse.

Field Service

From start-up assistance to **emergency field service** or technical assistance our experienced Engineers stand ready to answer your calls around the clock, any day of the week, at 800-893-2321.





Custom Service Programs

Control Techniques develops **customized service programs** to meet your exact needs. Our skilled Engineers know best how to maximize uptime for your system, freeing up your maintenance staff for other duties. We offer one, three and five-year agreements, encompassing a broad range of services. Our preventive maintenance program can include your drives, motors, interface devices, networks and system components. Call 1-800-893-2321 and ask for Service Programs.

Critical Spares

Safeguard your productivity with an on-site supply of **essential parts and/or spares**. In addition to fully warranted, reconditioned drives, Control Techniques offers a full range of parts to support both current and legacy products. Most orders are processed and shipped the same day received. Our customized replacement Parts Kits provide the key components for timely replacement. Call 1-800-893-2321. Use our web site to search legacy product information.

Upgrade Assistance

Technology constantly changes, and so do the demands on your system. When you're ready to take your process to the next level, our experts can help by performing a comprehensive review of your process, identifying opportunities for improvement, and preparing a comprehensive plan from goals through production. Call 1-800-893-2321 to schedule **upgrade assistance.**

Operator Interfaces

CTVue – Graphical HMI

The powerful CTVue HMI line and integrated drivers for Control Technique drives make it easy to integrate HMI with CT drives. The broad offering of CTVue HMI's are easy to program with the free and easy to use CTVue configurator software. The broad hardware offering also ensures there is a CTVue HMI that balances your price and functionality needs.

For small displays, the economical 303L and 303M provide a 3" monochrome graphical LCD display. The 303L is the low cost choice with only one RS485 port. The 303M is full featured with one Ethernet, two RS232, one RS485 and one Compact Flash port.

The Compact Flash port allows for storage and transfer of data from a variety of external data sources using a standard compact flash card (not included).

For medium displays, the 306M/A 6" and 308A 8", graphical touch screens provide larger screens for better display of graphics. 306 and 308 versions include Ethernet, one RS485, two RS232, and one compact flash port. The TFT active matrix "A" version provides the brightest, clearest, widest viewable display while the TFT "C" versions provide color touch graphics. The LCD "M" version is a low cost monochrome graphical display.

For large displays, the 310C and 315C graphical color touch screens provide the most graphical display area while offering all the connectivity and features of the 306 and 308 series. A super bright NEMA 4X outdoor version of the 310S is available upon request.

- **Integrated Control Techniques Drivers**
- **Remote Web and FTP access**
- **Powerful Protocol Converter**
- **USB Programming Port**
- **Alarming and Data Logging**
- **Bright TFT Color Display Offerings**
- **Free Programming Software**
- **Simple To Use Software**
- **Flexible Compact Flash Slot**
- **Security User Levels/Passwords**
- **Available Front Foil Customization**
- **Large 4 Mb/8 Mb Onboard Flash Memory**
- **For Use in Hazardous Locations**



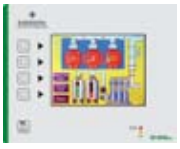
Easily create your customized machine interface with the free CTVue configurator software.

CTVUE-303L/M/S



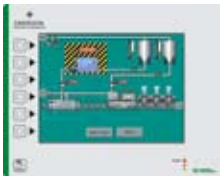
- 3", 128 x 64, LCD Display
- Ethernet (M), RS485, and RS232 (L) port, Outdoor version available (S)
- 8 x Customizable Function Keys
- Compact Flash Slot
- 4 Mb Non-Volatile FLASH memory

CTVUE-306M/A



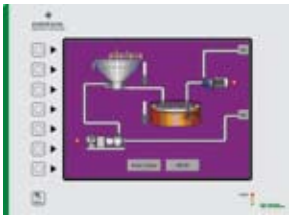
- 5.7" Graphic Touch Display
- TFT (A) - 320 x 240, 256 color
- LCD (M) 320 x 240, Monochrome
- Ethernet Port, RS485 and RS232
- Compact flash Slot, 4/8 Mb onboard Flash

CTVUE-308A



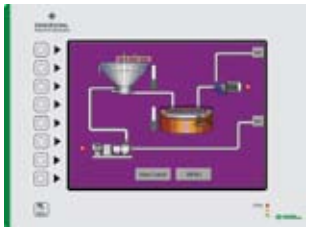
- 8.4" Graphic Touch TFT
- Ethernet, RS485, RS232
- Compact Flash Slot, 8 Mb onboard Flash

CTVUE-310C



- 10.4" Graphic Color Touch
- 640 x 480, TFT 256 colors
- Compact Flash Slot, 8 Mb onboard Flash
- Outdoor Version Available Upon Request

CTVUE-315C



- 15" Graphic Color Touch
- 1024 x 768, TFT 32K colors
- Ethernet Port, (2) RS485, (2) RS232
- Compact Flash Slot, 32 Mb onboard Flash

CTVUE ORDERING CODES

Order Code	Description	Width in mm	Height in mm	Depth in mm
CTVUE-303L	3" 128 x 64 LCD , 1 x RS485	7.45 190	5.85 150	2.1 52
CTVUE-303M	3" 128 x 64 LCD, Ethernet, RS485, RS232, compact flash	7.45 190	5.85 150	2.1 52
CTVUE-303S	3" 128 x 64 LCD, Ethernet, RS485, RS232, compact flash with UV protection for outdoor use	7.45 190	5.85 150	2.1 52
CTVUE-306M	5.7" LCD Monochrome touch - Ethernet, RS485, RS232	8.83 224	7.08 178	2.3 58
CTVUE-306A	5.7" TFT 256 color touch - Ethernet, RS485, RS232	8.83 224	7.08 178	2.3 58
CTVUE-308A	8.4" TFT 256 color touch - Ethernet, RS485, RS232	10.32 261	8.18 208	2.2 66
CTVUE-310C, -310S* (*UV protection)	10.4" TFT 256 color touch - Ethernet, RS485, RS232	12.83 327	9.5 242	2.2 56
CTVUE-315C	15" TFT 32K color touch - Ethernet, RS485, RS232	16 404	13 330	2.8 71
CTVUE-CF512	512 MB Industrial CF Memory			
CTVUE-CF1000	1 GB Industrial CF Memory			
CTVUE-CONFIG-CD	Free Programming Software CD			
CTVUE-USB	Programming cable PC to CTVue			
CTVUE-EP-485-xxx*	Cable from CTVue to Epsilon EP, Unidrive SP or Commander SK			
CTVUE-MME-485-xxx*	Cable from CTVue to EN-series, Epsilon, and MDS			
CTVUE-DC-485-xxx*	Cable from CTVue to Mentor II or Quantum III			
CTVUE-MC-485-xxx*	Cable from CTVue to MC Series			
CTVUE-RS00	RS232 / RS485 Communications Option Card			
CTVUE-CN00	CANOpen Communications Option Card			
CTVUE-PBDP	Profibus-DP Communications Option Card			
CTVUE-DN00	DeviceNet Communications Option Card			

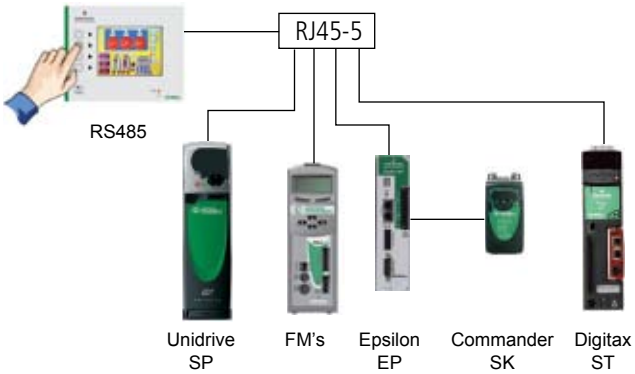
*Standard cable lengths are 5, 15, 25 ft (-005) (-015) (-025)

CTVUE CONNECTIVITY AND FUNCTIONALITY

The CTVue color touchscreens are easy to setup and connect to your application.

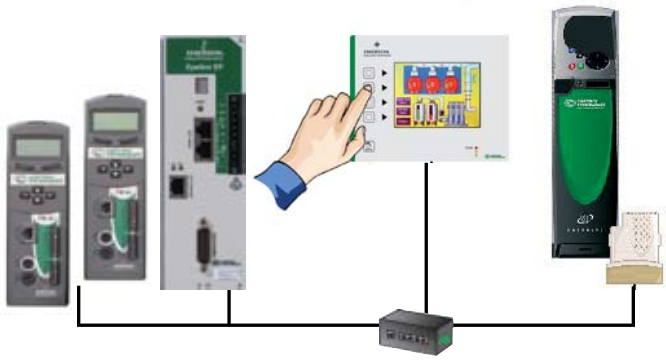
Connection to the serial port

The operator interface is connected directly to the RJ45 connection on the serial port. RS485 is a multi-drop protocol and so may be connected to multiple drives if required.



Connecting via Ethernet

The Epsilon EP-P, or FM-3/4E and SM-Ethernet Option modules allow the operator interface to be connected to the drive using Modbus TCP/IP.



CTVUE SPECIFICATIONS

Power Input	24 VDC
Temperature	0-50° Celsius
Environmental	IP66 / NEMA 4X - FOR USE IN HAZARDOUS LOCATIONS: Class I, Division 2, Groups A, B, C, and D Class II, Division 2, Groups F and G Class III, Division 2
Operating Humidity	80% relative maximum from 0-50° Celsius

LED Keypads

The SM-Keypad, SP-Keypad and DST-Keypad are designed for use with Unidrive SP and Digitax ST. They have two rows of 7 segment LED displays. These keypads are very easy to read at a distance or in poor lighting conditions. The upper row shows the drive status or the current menu and parameter number. The lower row displays the parameter value or the specific trip type. These optional keypads are ordered separately from the drives.

SM-Keypad - Unidrive SP (size 1-6)
The SM-Keypad was designed for use with the Unidrive SP sizes 1-6.
Order Code: SM-KEYPAD



SP-Keypad - Unidrive SP (size 0)

The SP-Keypad was designed for use with the Unidrive SP size Zero.
Order Code: KEYPAD-SP0



Unidrive SP size Zero LED Keypad

DST-Keypad - Digitax ST

The DST-Keypad was designed for use with the Digitax-ST series servo drives.
Order Code: DST-KEYPAD



Digitax ST LED Keypad

LCD Keypads

SM-Keypad Plus, designed for use with Unidrive SP and Commander SK (remote only), has a multi-lingual backlit LCD display with three lines of text. Line 1 shows drive status or current menu and parameter number plus parameter value or the specific trip. Lines 2 and 3 show the parameter name or the help text.

SM-Keypad Plus



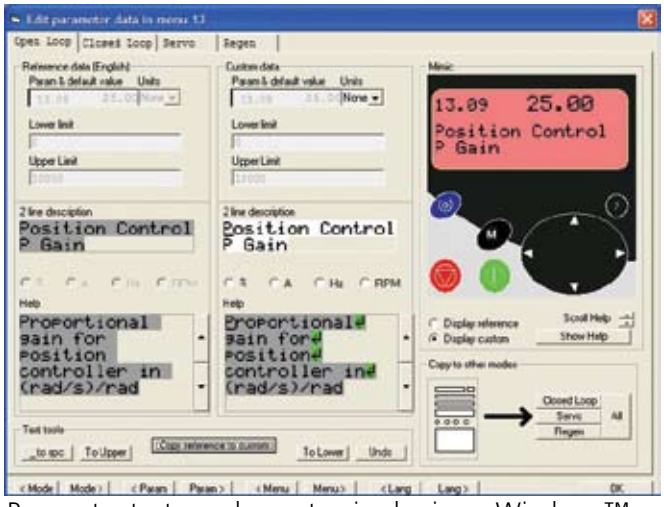
There are five text databases as standard: French, Italian, German, Spanish and English plus a custom database for application specific text. Help text is available at the press of a button. The parameter set that may be browsed can be filtered, to tailor a drive to a specific application or industry. With the standard communications cable and Windows™ text string tool from Control Techniques, you can customize the human-machine interface of SM-Keypad Plus to your own specific application, and make it your own.

CGP-Keypad

The CGP-Keypad is designed for use with the Commander GP20.
Order Code: CGP-KEYPAD-PLUS



Commander GP20 Keypad

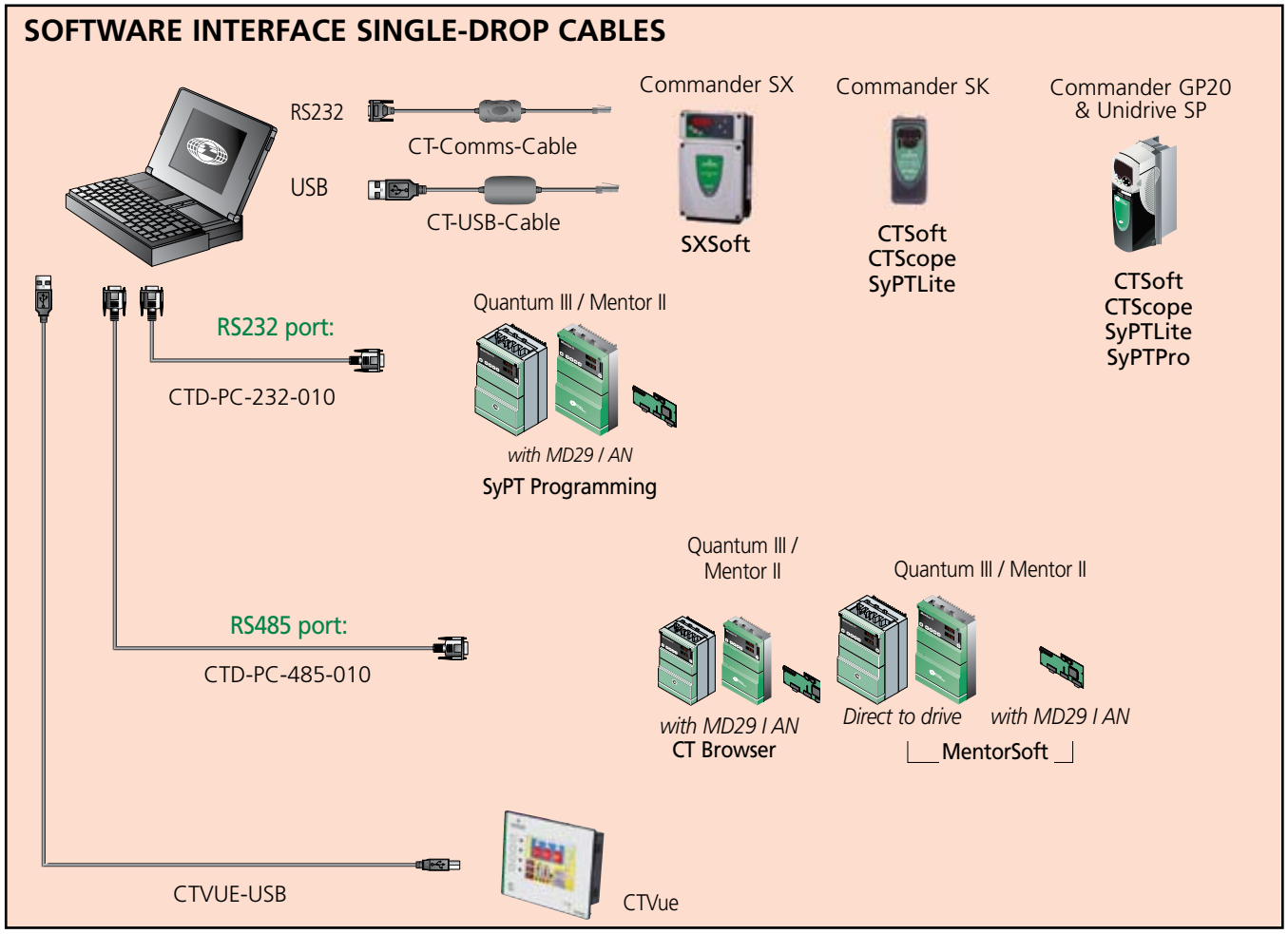


Parameter text may be customized using a Windows™ tool, for applications or further languages.

Interconnect Components

AC and DC Drives

SOFTWARE INTERFACE SINGLE-DROP CABLES



CT-Comms-Cable

RS232/485 serial interface cable; 6 ft.; DB9 female connector on computer end; RJ45 connector on drive end.

CT-USB-Cable

Connects the Modbus port on the drive directly to the USB port of your PC. USB to RS485 conversion.

CTD-PC-232-010

RS232 serial interface cable; DB9 female connector on computer end; DB9-P male connector on drive end, 10 ft.

CTD-PC-485-010

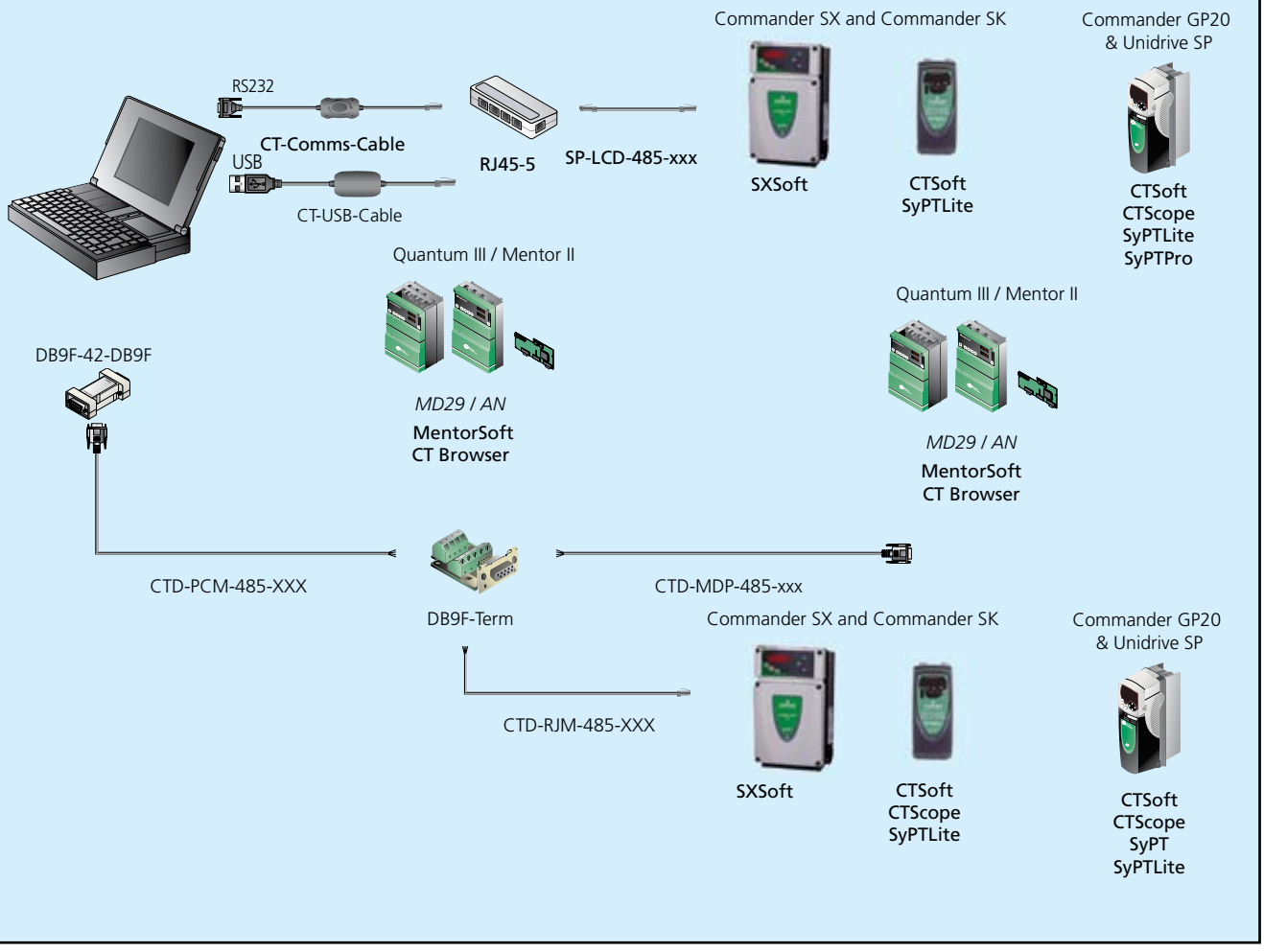
Pseudo RS232/485 serial interface cable; labeled DB9 female connectors on both ends, 10 ft.

CTVUE-USB

CTVue USB programming cable. USB connectors on both ends.

Interconnect Components
AC and DC Drives

SOFTWARE INTERFACE MULTI-DROP CABLES



SP-LCD-485-xxx

RS485 multi-drop cable with RJ45 connectors on both ends.

CTD-PCM-485-xxx

RS485 cable for PC to DB9F-Terminal . Connects to DB9F-42-DB9F at PC end.

CT-Comms-Cable

Connects the RJ45 Modbus port on the drive to the DB9 RS232/485 Serial port on your PC.

CT-USB-Cable

Connects the RJ45 Modbus port on the drive to the USB port on your PC. Includes USB to RS485 conversion.

CTD-MDP-485-xxx

RS485 cable for DB9F-Term to CTD connection.

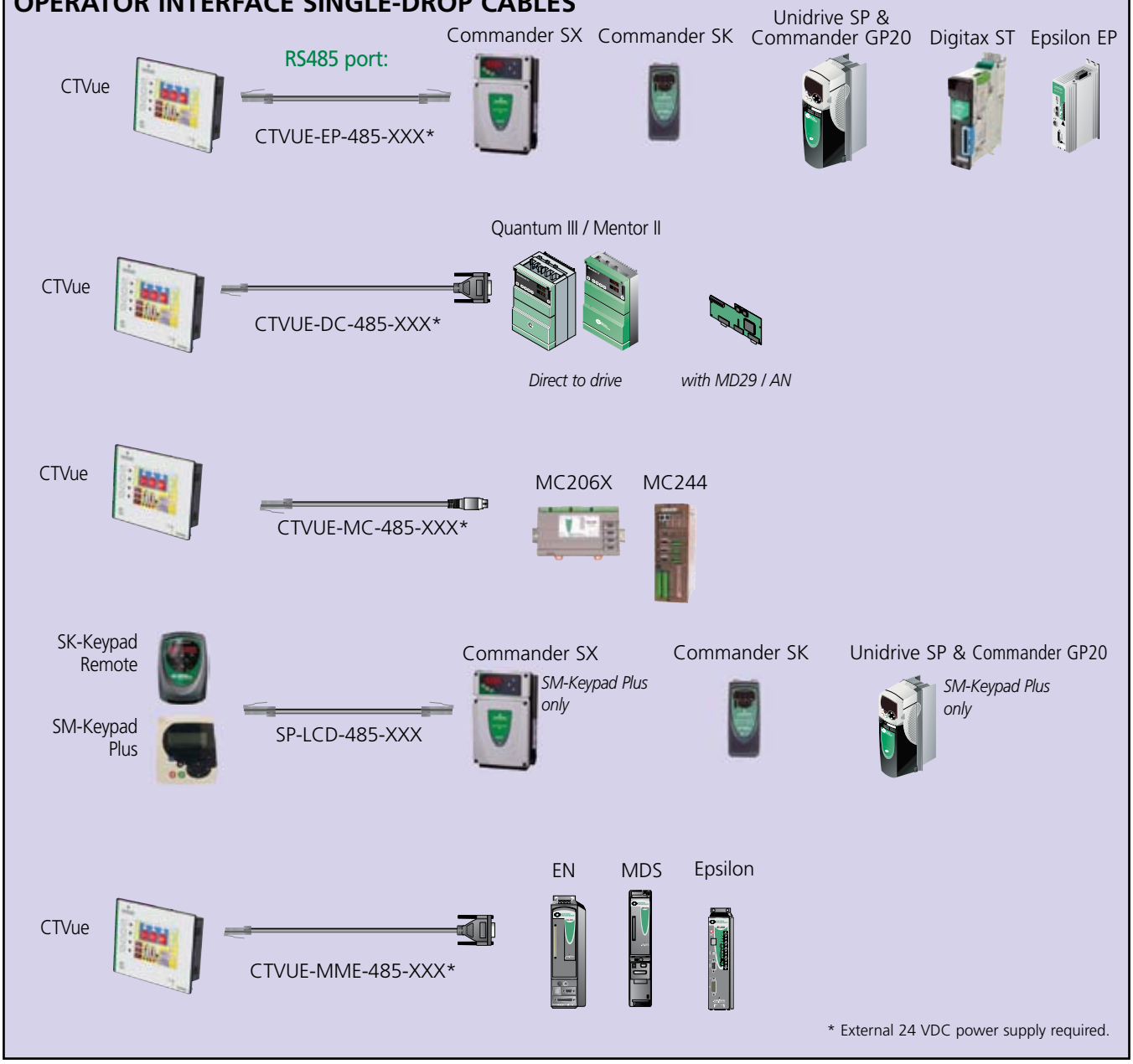
CTD-RJM-485-xxx

RS485 cable for DB9F-Term to RJ45 connection.

XXX = length in feet
-005 = 5 ft.; -010 = 10 ft.; -015 = 15 ft.; -025 = 25 ft.

Interconnect Components
AC, DC and Servo Drives

OPERATOR INTERFACE SINGLE-DROP CABLES



* External 24 VDC power supply required.

CTVUE-EP-485-XXX



RS485 cable, RJ45 to RJ45

CTVUE-DC-485-XXX



RS485 cable; 9pin to RJ45 connector

CTVUE-MC-485-XXX



RS485 cable; Din8 to RJ45 connector

SP-LCD-485-XXX



RS485 cable with RJ45 connector on both ends for LCD Keypad and Unidrive SP.

CTVUE-MME-485-XXX



RS485 cable; 9pin to RJ45 connector

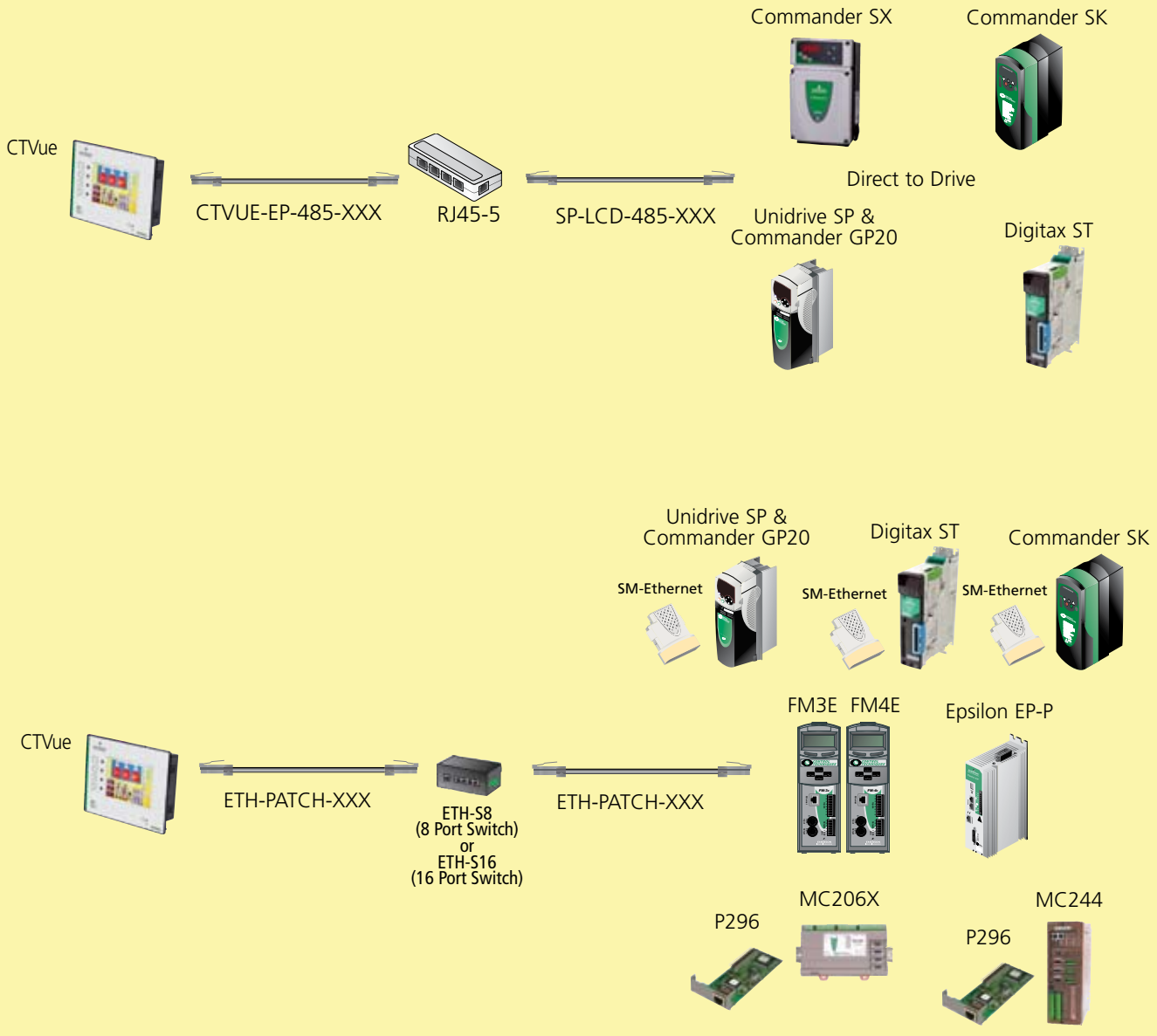
XXX = length in feet

-005 = 5 ft.; -010 = 10 ft.; -015 = 15 ft.; -025 = 25 ft.

Interconnect Components

AC, DC and Servo Drives

OPERATOR INTERFACE MULTI-DROP CABLES



CTVUE-EP-485-XXX

RJ45 to RJ45, RS485 cable

SP-LCD-485-XXX

RS485 cable for multidrop. RJ45 connector on both ends.

ETH-PATCH-XXX

RS485 multidrop cable. Wires dressed at both ends.

XXX = length in feet

-005 = 5 ft.; -015 = 15 ft.; -025 = 25 ft.

Interconnect Components

AC and DC Drives

I/O BOX CABLES

I/O Box



RB-CTD-485-XXX

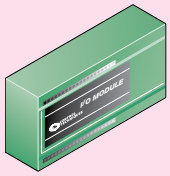


Quantum III / Mentor II



With MD29 / AN
(PL1 connector)

I/O Box



RB-MDP-485-XXX



Unidrive SP



With SM-Applications Plus

Quantum III / Mentor II



With MD29
(TB1 connector)

RB-CTD-485-XXX



RS485 cable dressed at I/O Box end, DB9-D male connector at drive end.

RB-MDP-485-XXX



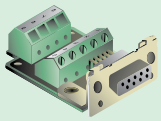
RS485 multidrop cable dressed at I/O Box end and drive end.

XXX = length in feet
-005 = 5 ft.; -015 = 15 ft.; -025 = 25 ft.

CONNECTORS

DB9F–Term

RS485 network connector; DB9 female connector with terminal strip on cable end.



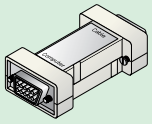
DB9M-2I-DB9F

RS232 optical isolator; DB9 female connector on computer end; DB9 male connector on cable end. No power supply needed in most applications.



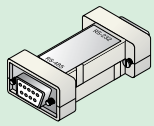
DB9M-2I-DB9F-D

For Desktop computers only, the RS-232 optical isolator; DB9 female connector on computer end; DB9 male connector on cable end.



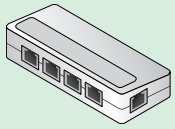
DB9F-42-DB9F

RS232/485 adaptor; DB9 female connector on RS485 end; DB9 female connector on RS232 end.



RJ45-5

RJ45 Splitter; accepts one RJ45 connector of input and 4 RJ45 connectors for output.

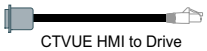


Interconnect Components

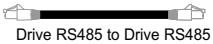
Epsilon EP



CTVUE-303L, -303M, -306A, -306C, -308A, or -310C



CTVUE HMI to Drive CTVUE-EP-485-xxx



Drive RS485 to Drive RS485 DDC-RJ45-xxx



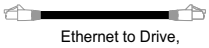
PC RS232 to Drive RS485 Serial Interface Cable, CT-COMMS



PC USB Port to Drive RS485 Serial Interface Cable CT-USB-CABLE



Windows 98, NT 4.0, 2000 XP (32-bit) or Vista (32-bit) Compatible Computer (Customer Supplied)



Ethernet to Drive, ETH-PATCH--xxx



Ethernet 8-port Switch, ETH-S8

CT-MME-POWER-CD

Contains ***PowerTools Pro***

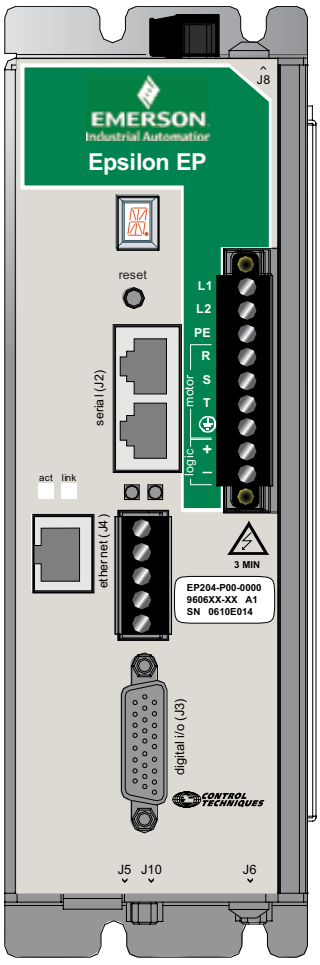


Epsilon EP I/O Cable, EIO26-xxx

FREE Software



STI-24IO





Braking Resistor, SM-Heatsink DBR1



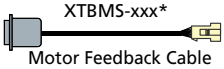
Drive Brake Relay BRM-1



Motor Power Cable XTMDS-xxx*



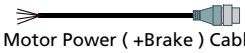
Motor Brake Cable XTBMS-xxx*



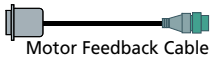
Motor Feedback Cable XUFTS-xxx*

40, 60, 80 mm XV Motors





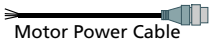
Motor Power (+Brake) Cable XCMDS-xxx or XCMDBS-xxx*



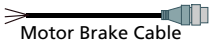
Motor Feedback Cable XUFCS-xxx*

130 mm XV Motors





Motor Power Cable CMDS-xxx or CMMS-xxx*



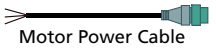
Motor Brake Cable CBMS-xxx*



Motor Feedback Cable UFCS-xxx*

NT Motors





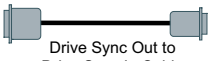
Motor Power Cable PSBAA-xxx, PBBAA-xxx**



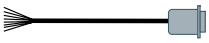
Motor Feedback SIBAA-xxx**

FM Motors

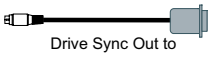




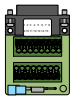
Drive Sync Out to Drive Sync In Cable, SNCDD-915-xxx



Drive Sync Out Cable, SNCFLOA-xxx



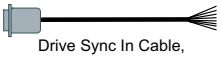
Drive Sync Out to FM-3/4 Module In Cable, SNCMD-815-xxx



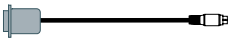
Drive Sync Out Breakout Board, STI-SNCOA



Drive Sync In to Drive Sync Out Cable, SNCDD-915-xxx



Drive Sync In Cable, SNCFLI-xxx



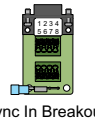
Drive Sync In from FM-3/4 Module Out Cable, SNCMD-89-xxx



Master Synchronization Encoder SCSLD



Motor Feedback Breakout Board, STI-ENC



Drive Sync In Breakout Board, STI-SNCI

Cable Notes

* Flex duty versions available

** Flex duty cable

Interconnect Components

Digitax ST



CTVue-303L, 303M, 306A, 306C, 308A, 310C



Windows 98, NT 4.0, 2000, XP or Vista 32 Compatible Computer (Customer Supplied)



Digitax ST CD, CT-EZMotion-CD, or CT-MME-POWER-CD with *PowerTools Pro*

Master Synchronization Encoder SCSLD



Data Storage DST-SMARTCARD



LED Keypad, DST-KEYPAD





Internal Braking Resistor, SM-Heatsink DBR0



Drive Brake Relay BRM-1

CTVue HMI to Drive CTVUE-EP-485-xxx



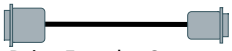
Ethernet to SM-Ethernet ETH-PATCH-xxx***



PC RS232 to Drive RS485 Serial Interface Cable CT-COMMS CABLE



PC USB Port to Drive RS485 Serial Interface Cable CT-USB-CABLE



Drive Encoder Output to SM-Encoder Plus Input SNC-DST-SM-xxx



SM-Encoder Plus Output to SM-Encoder Plus Input SNC-SM-SM-xxx

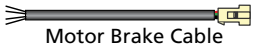


SCSLD Encoder to SM-Encoder Plus Input SNC-ENC-SM-xxx

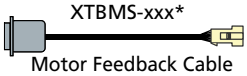




Motor Power Cable XTMDS-xxx*



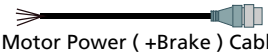
Motor Brake Cable XTBMS-xxx*



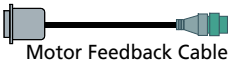
Motor Feedback Cable XUFTS-xxx*

40, 60, 80 mm XV Motors





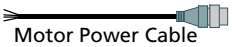
Motor Power (+Brake) Cable XCMDS-xxx or XCMDBS-xxx*



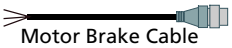
Motor Feedback Cable XUFCS-xxx*

130 mm XV Motors





Motor Power Cable CMDS-xxx or CMMS-xxx*



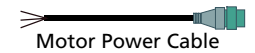
Motor Brake Cable CBMS-xxx*



Motor Feedback Cable UFCS-xxx*

NT Motors





Motor Power Cable PSBAA-xxx, PBBAA-xxx**



Motor Feedback SIBAA-xxx**

FM Motors



Cable Notes

* Flex duty versions available

** Flex duty cable

*** Requires SM-Ethernet module



SM Option Modules[1]

Communications[2]

SM-Ethernet
SM-DeviceNet
SM-Profibus-DP
SM-SERCOS
SM-CANopen
SM-CAN
SM-EtherCAT

Feedback[3]

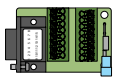
SM-Encoder Plus
SM-Resolver

I/O

SM-I/O Plus
SM-I/O 120V
SM-I/O 32
SM-I/O 24V
SM- I/O Timer

Co-processors

SM-Applications Lite V2
SM-Applications Plus
SM-EZMotion



Motor Feedback Breakout Board, SM-ETC



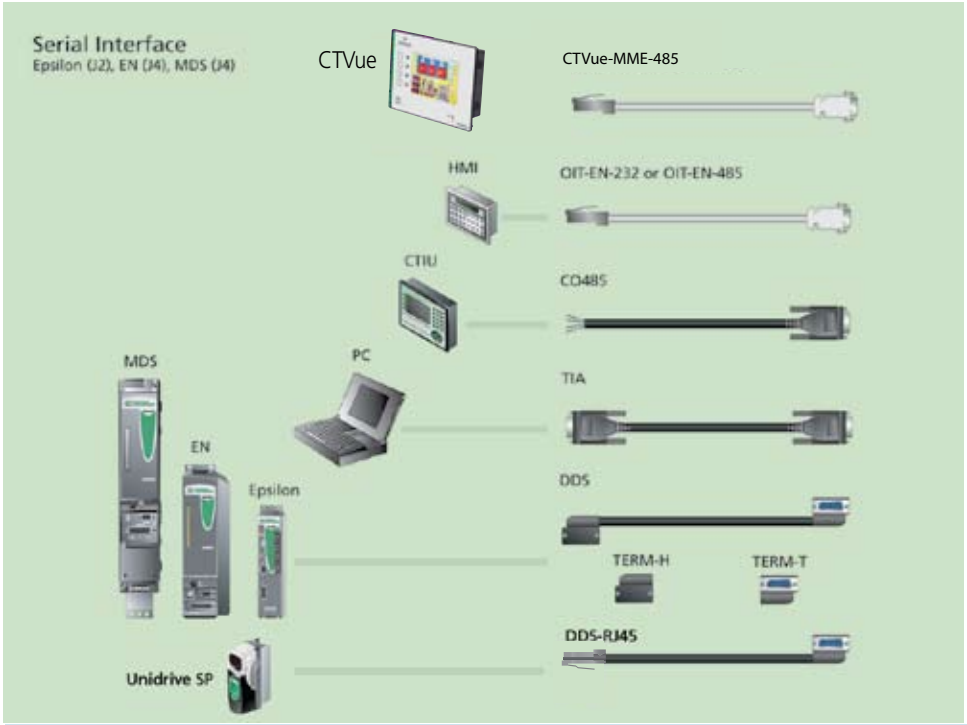
EMC Filters

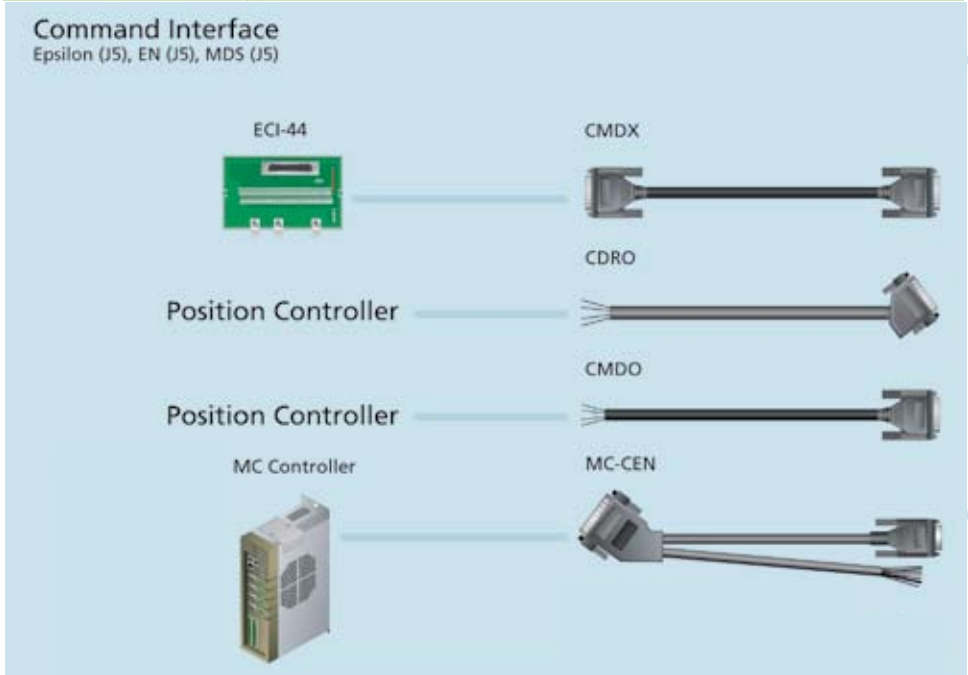
230V 1Ø = 4200-6000
230V 3Ø = 4200-6001
460V 3Ø = 4200-6002

1 Digitax ST models can accommodate up to two (2) SM option modules.
2 Modbus RTU is standard. SM Ethernet conforms to both EtherNet/IP and Modbus TCP/IP protocols.
3 The drive supports 14 feedback device types as standard via encoder input.

Interconnect Components

Motion Control





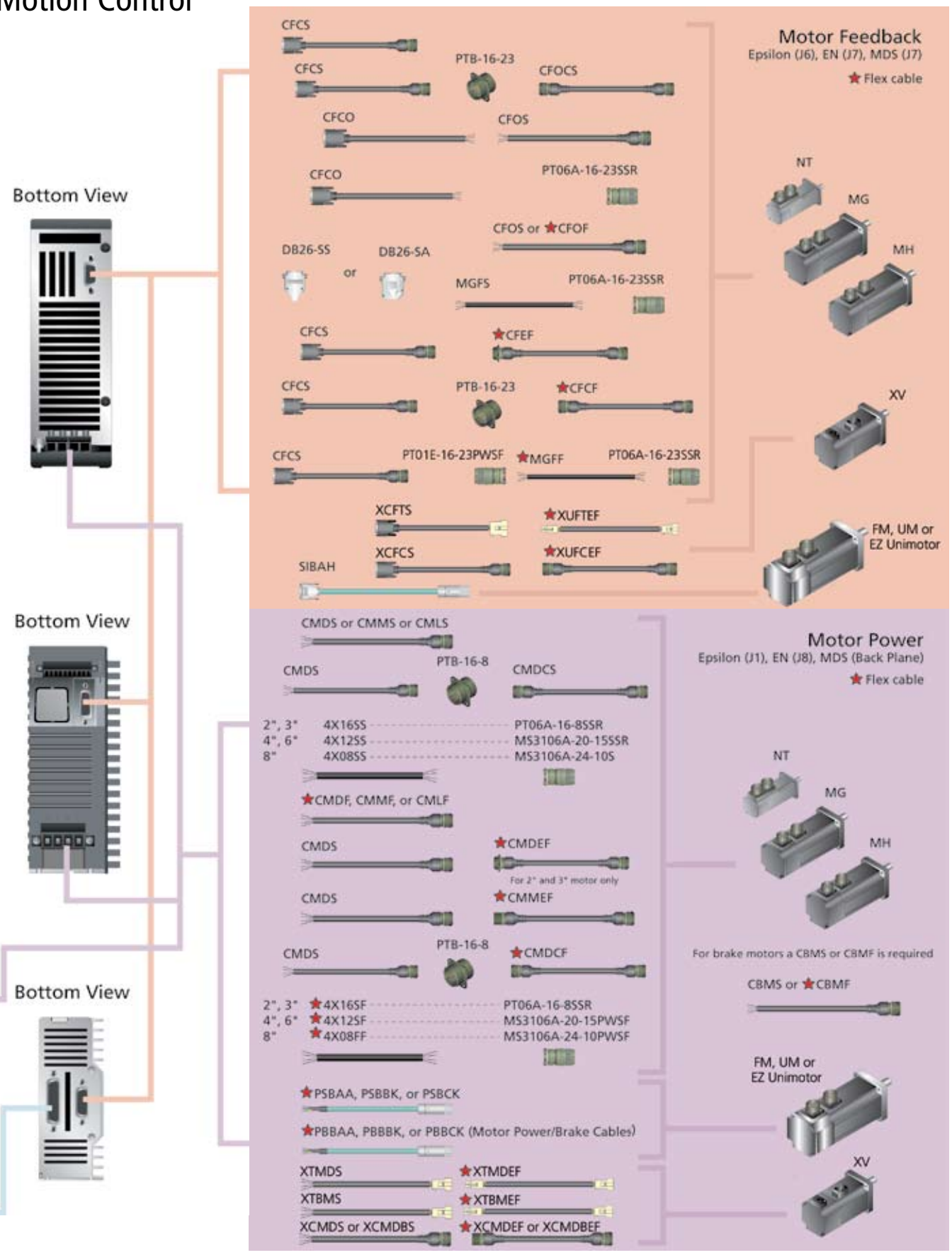




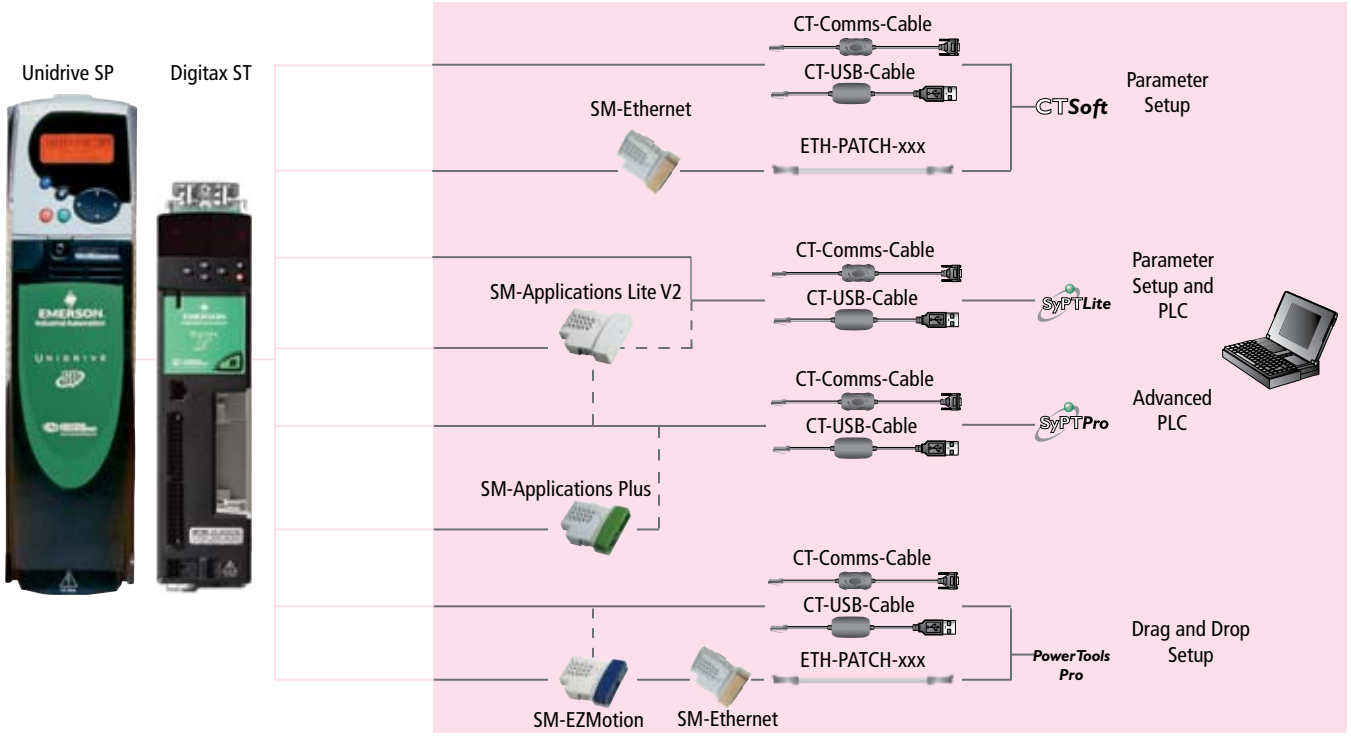


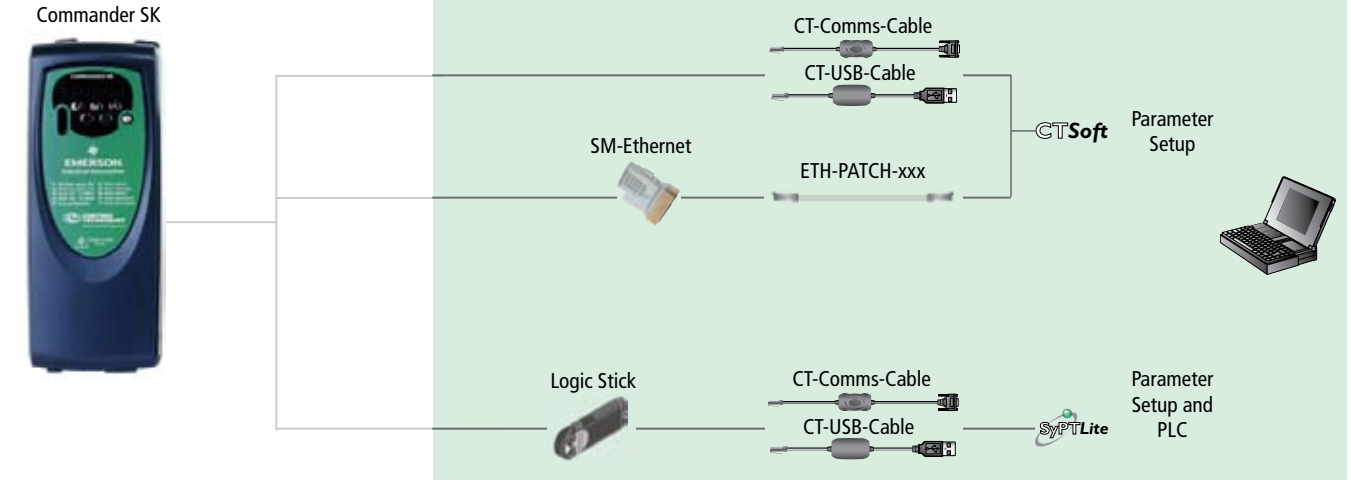


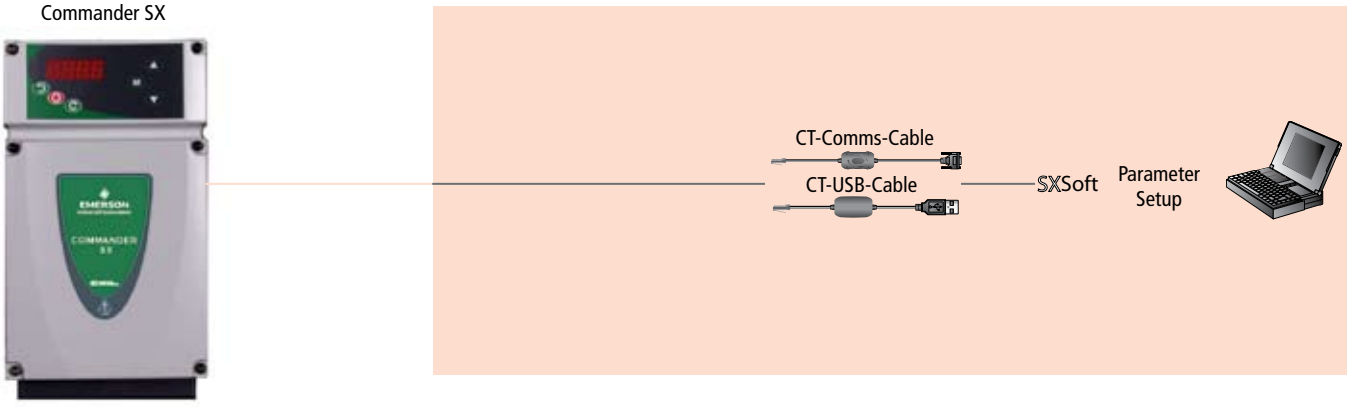
Interconnect Components
Motion Control



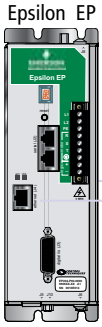
Set Up & Configuration Software







Epsilon EP



ETH-S4

CT-Comms-Cable

CT-USB-Cable

ETH-PATCH-xxx

PowerTools Pro

Base, Indexing and Program-mable Applications

Epsilon



EN



MDS



TIA-xxx

PowerTools FM

Base and Indexing Applications

FM-3/4 (DN, PB, E)

TIA-xxx

PowerTools Pro

Advanced Programming

FM-3/4 E

ETH-PATCH-xxx

Mentor II



CTD-PC-485

MentorSoft

Parameter Setup

MD29

CTD-PC-232-xxx

SyPTPro

Advanced PLC

Cables & Accessories
Motion Control

Control Techniques builds its cables to the highest standards. Drives are engineered so that connections are easily accessible and, in many cases, no wiring is involved, simply plug and play.

Legend to Cable/Accessory Descriptions:
Product Group **(or Accessory Name)**

CABLE OR ACCESSORY ILLUSTRATION

Cable length in feet, ★ = Custom lengths available
Text description of cable or accessory
Product that uses Cable or Accessory in Green.
Connections are read left to right based on illustration.

Command Cables

CMDX



-003, -005, -015 ★
Command cable; 18 pair; DB44M straight connectors on both ends.
EN, Epsilon, MDS to ECI-44

CMDO



-005, -015 ★
Command cable to position controller; 18 pair; DB44M straight connector on drive end; pigtails on other end for screw terminals.
EN, Epsilon, MDS to Position Controller, PLC

CDRO



-005, -010.-015 ★
Command cable to position controller; 13 pair; 45° angle connector at drive (DB44M) pigtails on other end for screw terminals.
EN, Epsilon, MDS to Position Controller, PLC

MC-CEN



-002, -004, -010 ★
Command cable required to connect drives with MC Controllers. 45° angle connectors on drive end.
EN, Epsilon, MDS to MC Controllers

MC-CEP



-002, -004, -010 ★
Command cable required to connect Epsilon EP with MC Controllers. 45° angle connectors on drive end.
Epsilon EP, Unidrive SP, Digitax ST to MC Controllers

Bulk Command Cables



13PX26SS ★
Command cable 13 pair, 26 AWG w/shield; 0.380" (9.7 mm) diameter.
DB44P-SA

18PX26SS ★
Command cable 18 pair, 26 AWG w/shield; 0.410" (10.4 mm) diameter
DB44P-SA

Serial Interface Cables

TIA



-010, -025, -050 ★
RS232 serial interface cable; DB9-S straight molded connector on computer end; DB9-P straight molded connector on drive end.
EN, Epsilon, MDS to PC, HMI, PLC (Modbus Master)

CO485



-010, -025, -050
RS485 serial interface cable;DB9-P straight, molded connector on drive end and flying leads on computer end. Black PVC outer jacket.
EN, Epsilon, MDS to PC, HMI, PLC (Modbus Master)

Serial Interface Cables *(continued)*

CT-COMMS



★

Connects the 9 pin RS232 serial port of a PC to the RJ45 port of the drive. RS232 to RS-485 conversion.
Epsilon EP, Unidrive SP, Digitax ST to PC

CT-USB



★

Connects the Modbus port on the drive directly to the USB port of your PC. USB to RS485 conversion.
Epsilon EP, Unidrive SP, Digitax ST to PC

DDS



-001, -005, -010, -020 ★

Standard multi-drop drive to drive serial interface cable. Use with TERM-H and TERM-T termination plugs at both ends if total multi-drop serial cable length is greater than 50 feet.
EN, Epsilon, MDS to EN, MDS

TERM H



Terminator block for head of serial string.
EN, Epsilon, MDS

TERM T



Terminator block for tail of serial string.
EN, Epsilon, MDS

Digital I/O Interface Cable

EIO26-xxx



-005, -010, -015

I/O interface cable provides access to all digital I/O points while maintaining 6" drive installation depth.
Epsilon, Epsilon EP to Position Controller, PLC

Connectors for Command Cables

DB44P-SA

For command cable; DB44 pin male; 45° cable outlet; metallized plastic backshell.



DB26P-SS

For feedback cable; DB26 pin male; straight cable outlet; metallized plastic backshell.



DB26P-SA

For feedback cable; DB26 pin male; 45° cable outlet; metallized plastic backshell.



Connectors for Serial Interface

DB9P-SS

For serial cable; DB9 pin male; straight cable outlet; metallized plastic backshell.



DB9P-SA

For serial cable; DB9 pin male; 45° cable outlet; metallized plastic backshell.



Motor Power Cables (NT, MG, MH)

CMDS



-005, -015, -025, -050, -100 ★

16 AWG for 2" and 3" motors, connector on motor end, ferrules on drive end. Fully shielded with IP-65 molded connector.
NT, MG, MH Motor Connector

CMMS



-005, -015, -025, -050, -100 ★

12 AWG for 4" and 6" motors, connector on motor end, ferrules on drive end. Fully shielded with IP-65 molded connector.
MG, MH Motor Connector

CMLS



-015, 025, -050, -100 ★

8 AWG for 8" motors, connector on motor end, ferrules on drive end. Fully shielded with IP-65 molded connector.
MDS to MH Motor Connector

Motor Power Extension Cable

CMDCS



★

Cable to be connected to bulkhead connector on one end and motor connector on the other end for 2" and 3" motors.

PTB-16-8 to NT, MG, MH

Bulk Power Cables & Connectors

4X16SS ★



Motor power cable for 2" and 3" motors, 4-wire, 16 AWG w/shield; 0.380" (9.7 mm) diameter.

EN, Epsilon, MDS to PT06A-16-8SSR

4X12SS ★

Motor power cable for 4" and 6" motors, 4-wire 12AWG w/shield; 0.440' (11.2 mm) diameter.

EN, MDS to MS3106A-20-15SSR

PT06A-16-8SSR

Motor power connector for 2" & 3" NT, MG, MH motors, female, not IP-65, not shielded.



MS3106A-20-15SSR

Motor power connector for 4" & 6" NT, MG, MH motors, female, not IP-65, not shielded.



Consult Factory for options regarding Bulk Power Cable and connectors for 8" motors.

PTB-16-8

Motor bulkhead connector for 2" and 3" motors.



Feedback Cables (NT, MG, MH)

UFCS



-005, -015, -025, -050, -100 ★

Motor feedback cable, connector both ends.

Epsilon EP, Unidrive SP to NT, MG, MH

CFCS



-005, -015, -025, -050, -100 ★

Motor feedback cable, connector both ends.

EN, Epsilon, MDS to NT, MG, MH, PTB-16-23

CFCO



-005, -015, -025, -050, -100 ★

Motor feedback cable, connector at drive only (use PTO6A-16-23SSR for motor feedback.

EN, Epsilon, MDS to PT06A-16-23SSR

CFOS



-005, -015, -025, -050, -100 ★

Motor feedback cable, connector at motor only.

DB26P-SS, DB26P-SA, PT06E-16-23PWS to NT, MG, MH

Feedback Extension Cable (NT, MG, MH)

CFOCS



★

Cable to be connected to bulkhead connector on end and motor connector on the other end (2", 3", 4", 6" and 8" motors).

PTB-16-23 to NT, MG, MH

Bulk Feedback Cables & Connectors (NT, MG, MH)

MGFS



★

Standard duty motor feedback cable for 2" and 3" motors, 8 pair w/shield.

DB26P-SS, DB26P-SA to PT06A-16-23-SSR

PT06A-16-23SSR

Female connector for motor feedback cable, not IP-65, not shielded.



NT, MG, MH Feedback Connector

PT06E-16-23PWS

Male connector for standard motor feedback cable, use at enclosure end w/PTB-16-23, IP-65, shielded.



NT, MG, MH Feedback Connector

PTB-16-23

Through the wall bulkhead connector for feedback cables.



Brake Cables (NT, MG, MH)

CBMS



-005, -015, -025, -050, -100 ★

Motor brake cable, molded standard duty, connector at motor only.

BRM-1 to NT, MG, MH

Brake Extension Cable (NT, MG, MH)

CBMCS



★

Cable to be connected to bulkhead connector on one end and motor connector on the other end.

PTB-8-3 to NT, MG, MH

Motor Connectors for Brake Cables (NT, MG, MH)

PT06A-8-3SSR

Motor brake connector kit.

Bulkhead Connectors for Brake Cables

PTB-8-3

Brake bulkhead connector.



Flex Power Cables (NT, MG, MH)

Note: All Flex Cables are rated for 9,000,000 cycles when installation recommendations are followed. See Flex Cable Installation Manual.

CMDF



-005, -015, -025 ★

Molded flex motor power cable, connector at motor end for 2" and 3" motors. Min. Bend radius 5.6 in.

NT, MG, MH Motor Connector

CMMF



-005, -015, -025 ★

Molded flex motor power cable, connector at motor end for 4" and 6" motors. Min. Bend radius 9.0 in. for flexing, 6" for stationary.

NT, MG, MH Motor Connector

CMLF



-005, -015, -025 ★

Molded flex motor power cable, connector at motor end for 8" motors. Min. Bend radius 9 in. for flexing, 6" for stationary. Min. Bend radius 9.2 in. for flexing, 6" for stationary.

MH Motor Connector

Flex Power Extension Cables (NT, MG, MH)

CMDEF



-005, -015, -025 ★

Molded flex motor power extension cable, connectors at both ends for 2" & 3" motors. Min. Bend radius 5.6 in.

CMDS to NT, MG, MH

CMMEF



-005, -015, -025 ★

Molded flex motor power extension cable, connectors at both ends for 4" and 6" motors. Min. Bend radius 9.0 in. for flexing, 6" for stationary.

CMMS to MG, MH

CMDCF



-005, -015, -025 ★

Molded flex motor power cable to be connected to bulkhead on one end and motor connector on the other end for 2" and 3" motors. Min. Bend radius 5.6 in.

PTB-16-8 to NT, MG, MH

Bulk Flex Power Cables & Connectors (NT, MG, MH)



4X16SF ★ 20 ft. min.

Flex duty motor power cable for 2" and 3" motors, 4 wire, 16AWG, w/shield. Min. Bend radius 5.6 in.

EN, Epsilon, MDS to PT06A-16-8SWSF

4X12SF ★ 20 ft. min.

Flex duty motor power cable for 4" and 6" motors, 4 wire, 12AWG, w/shield. Min. Bend radius 9.0 in.

EN, MDS to MS3106A-20-15PWSF

4X08SF ★ 20 ft. min.

Flex duty motor power cable for 8" motors, 4 wire, 8AWG, w/shield. Min. Bend radius 9.2 in. for flexing

MDS to MH

Bulk Flex Power Cables & Connectors (NT, MG, MH) *(continued)*

PT06E-16-8SWSF
Motor end power cable, female, w/backshell, IP-65, shielded for 2" and 3" motors.



PT01E-16-8PWSF
Power Cable extension, male, mates with motor end of motor cable, IP-65, shielded, for 2" and 3" motors.



MS3106A-20-15SWSF
4" motor power connector, female, not IP-65, not shielded.



MS3101A-20-15PWSF
Power cable extension plug for 4" motors, male. Mates with motor end of motor cable



Flex Feedback Extension Cables (NT, MG, MH)

CFEF



-005, -015, -025 ★

Molded flex motor feedback extension cable for all encoder feedback motors w/circular connectors at both ends. Min. Bend radius 5.6 in. for flexing, 6" for stationary.
NT, MG, MH to CFCS, CFOS

CFOF



5 ft. min. ★

Motor feedback cable, connector at motor only. Min. Bend radius 5.6 in. for flexing, 6" for stationary.
DB26P-SS, DB26P-SA, PT06E-16-23PWS to NT, MG, MH

CFCF



-005, -015, -025 ★

Molded flex motor feedback cable for mating w/ through the wall bulkhead connector for all encoder feedback motors. Min. Bend radius 5.6 in. for flexing, 6" for stationary.
PTB-16-23 to NT, MG, MH

Bulk Flex Feedback Cable

MGFF



20 ft. min. ★

Flex duty motor feedback cable for 2" and 3" motors, 8 pair w/shield. Min. Bend radius 5.6 in. for flexing, 6" for stationary.
PT01A-16-23SSR to NT, MG, MH

Flex Brake Cable (NT, MG, MH)

CBMF



-005, -015, -025, -050, -100 ★

Motor brake cable, flex duty, connector at drive, leads at motor, IP-65 for 2", 3", 4", 6" motors.
Min. bend radius 3 in.
BRM-1 to NT, MG, MH Brake Motor Connector

Connectors for Brake Cables

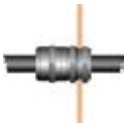
PT06E-16-23PWSF
Enclosure end feedback plug, male, w/ backshell and lock ring, IP-65, shielded.



PT01E-16-23PWSF
Feedback cable extension, female, mates w/motor end of the motor feedback cable, IP-65, shielded.



Through Wall Grommets with Shield



CGS-047
Cable grommet, 0.197-0.472 ID.
ENCO, CMDS, CFOS, MGFS, CMDF, 4X16SF/SS

CGS-069
Cable grommet, 0.433-0.689 ID.
4X12SF/SS, CMMS, CMDO, MGFS, CDRO, CMMF, CFCF, CFOF-A, MGFF

CGS-098
Cable grommet, 0.630-0.984 ID.
CMLS

XV Motor Cables

XTMDS



-005, -015, -025, -050, -100 ★

Motor power cable.
XV, 40, 60, 80 mm brake motors

XCMDS



-005, -015, -025 ★

Motor power cable.
XV 130 mm motors

XCMDBS



-005, -015, -025 ★

Motor power and brake cable.
XV 130 mm brake motors

XTBMS



-005, -015, -025, -050, -100 ★

Motor brake cable, standard duty, connector at motor only.
BRM-1 to XV 40, 60, 80 mm brake motors

XV Motor Feedback Cables

XUFTS



-005, -015, -025, -050, -100 ★

XV 40, 60, 80 mm motor to DSUB connector on drive end. Feedback cable, 15 pin high density socket.
Epsilon EP, Unidrive SP to 40, 60, 80 mm XV motors

XUFCS



-005, -015, -025, -050, -100 ★

XV Motor Feedback cable.
Epsilon EP, Unidrive SP to XV 130 mm motor

Note: All Flex Cables are rated for 9,000,000 cycles when installation recommendations are followed. See Flex Cable Installation Manual.

XV Flex Cables

XTMDEF



-005, -015, -025 ★

Flex motor power cable extension. For use with XTMDS. Min. Bend radius 5.6 in.
XV 40, 60, 80 mm motors

XCMDEF



-005, -015, -025 ★

Flex motor power cable extension. For use with XCMDS. Min. Bend radius 5.6 in.
XV 130 mm motors

XCMDBEF



-005, -015, -025 ★

Flex motor brake cable extension. For use with XCMDBS. Min. Bend radius 5.6 in.
XV 130 mm brake motors

XUFTEF



-005, -015, -025 ★

Flex motor feedback extension cable for use with XEFTS cable. Min. Bend radius 5.6 in.
XV 40, 60, 80 mm motors

XTBMEF



-005, -015, -025, -050, -100 ★

Flex duty motor brake cable for use with XTMBS cable. Min. bend radius 3 in.
XV, 40, 60, 80 mm brake motors

XUFCEF



-005, -015, -025 ★

Molded flex motor feedback extension cable for use with XEFCS cable. Min. Bend radius 5.6 in.
XV 130 mm motors

Motor Power Cables (FM, EZ, UM)

PSBAA (55 to 142 Frame Size)
PSBAK, PSBBK and PSBCK (190 Frame Size)



(meters) -003, -005, -010, -015, -020 ★
Flex Rated Min. Bend radius 4.75 in

Power and Brake Cable (FM, EZ, UM)

PBBAA (55 to 142 Frame Size)
PBBAK, PBBBK and PBBCK (190 Frame Size)



(meters) -003, -005, -010, -015, -020 ★
Flex Rated Min. Bend radius 4.75 in

Feedback Cable (FM, EZ, UM)

SIBAH



(meters) -003, -005, -010, -015, -020 ★
Flex Rated Min. Bend radius 4.75 in

EN, MDS

SIBAA



(meters) -003, -005, -010, -015, -020 ★
Flex Rated Min. Bend radius 4.75 in

Epsilon EP, Unidrive SP, Digitax ST

Master Synchronization Cable

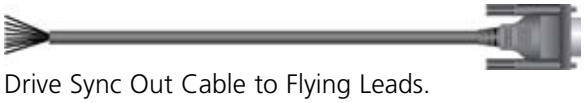
SNCDD-915-xxx



-003

Drive Sync Out to Drive Sync In Cable.
Epsilon EP to Epsilon EP

SNCFLOA-xxx



-003

Drive Sync Out Cable to Flying Leads.
Epsilon EP

SNCMD-815-xxx



-001.5

Drive Sync Out to FM-3/4 Module Sync In Cable.
Epsilon EP to FM-3/4

SNCFLI-xxx



-003

Drive Sync In Cable.
Epsilon EP, STI-SNCOA Breakout Board

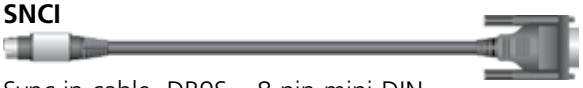
SNCMD-89-xxx



-001.5

Drive Sync In from FM-3/4 Module Sync Out Cable.
Epsilon EP to FM-3/4

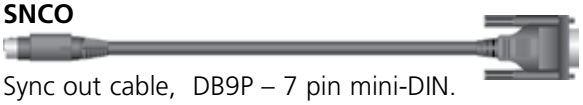
SNCI



-003

Sync in cable, DB9S – 8 pin mini-DIN.
FM-3/4 to SNCE, SNCO

SNCO



-003

Sync out cable, DB9P – 7 pin mini-DIN.
FM-3/4 to SNCI

SNCDD



-001.5

Sync in/out cable, 7 pin mini-DIN, 8 pin mini-DIN, for use between to FM-3/4 modules.
FM-3/4 to FM-3/4

SNCLI



-003

Sync in cable, Bare leads to 8 pin mini-DIN for use from ECI-44 terminal block to the FM-3/4 sync in.
FM-3/4 to PLC, Master Encoder, User Device

SNCLO



-003

Sync out cable, 7 pin mini-DIN.
FM-3/4 to PLC, User Device

SNCE



-015, -025, -050 ★

Sync cable to SNCI, Encoder connector to D9P connector.
SCSLD (-4, -4R, -3, -3R) to SNCI, or Epsilon EP Sync In

SNC-ENC-SM

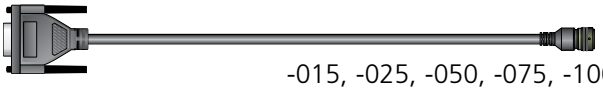


-015, -025, -050 ★

Sync cable to Universal Encoder Plus, Encoder connector to D15P connector.
SCSLD (-4, -4R, -3, -3R) to Universal Encoder Plus

Encoder Feedback Cable (AC motors)

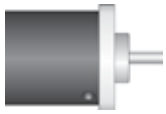
VUFCS & ENCO



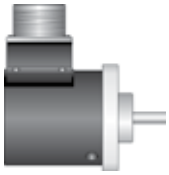
-015, -025, -050, -075, -100 ★

AC Motor Encoder Feedback Cable,
VUFCS (M12) connector or **ENCO** (M10) connector on motor end to DB15 connector on drive end.
Unidrive SP

Encoders

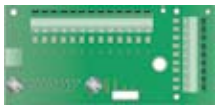


SCSLD-4
Master Synchronization Encoder, 3000 Line (12,000 counts per line) with right angle connection. Other line count encoders are available: SCSLD-3R (2,500 line) and SCSLD-2R (1,000 line)
SNCE

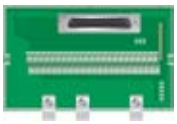


SCSLD-4R
Same SCSLD-4 with right angle connector.
SNCE

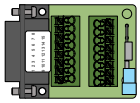
Interface Terminals



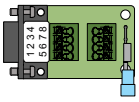
STI-EIO
Screw Terminal Interface, breakout board plugs directly into Epsilon drive I/O connector (J3), 13 input and 7 output lines are labeled and LEDs for easy field wiring and troubleshooting.
Epsilon, Epsilon EP



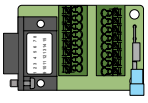
ECI-44
External connection interface terminal strip; provides a convenient field wire screw terminal strip for all connections available on the drive's command connector. Requires a CMDX to connect to the drive. Includes labeled terminals and provisions for DIN rail mounting.
EN, Epsilon, MDS



STI-SNCOA
Drive Sync Out and Analog In/Out Breakout Board. DB9S
Epsilon EP



STI-SNCI
Drive Sync In Breakout Board. DB9S
Epsilon EP



STI-ENC
Motor Feedback Breakout Board. DB15S
Epsilon EP



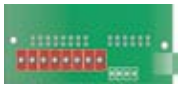
STI-24IO
Screw Terminal Interface, breakout board plugs directly into Epsilon EP drive I/O connector (J3), 16 input and 8 output lines are labeled and LEDs for easy field wiring and troubleshooting.
Epsilon EP

Brake Relay

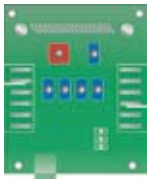


BRM-1
Brake relay module, 24V 1 contact, 6 Amp, DIN rail mounting.
EP, EN, Epsilon, MDS to Motor/Brake Cable Brake Leads

Digital I/O Boards



DEMO-FMIO-000
Demo board to plug on FM-3/FM-4 to use digital I/O.
FM-3/4



DEMO-DRIO-000
Demo board to plug on EN or MDS to use digital I/O.
EN, MDS

Diagnostic Cable

DGNE



Diagnostic analog output connection cable provides a convenient method of connecting test equipment such as an oscilloscope to the diagnostic analog outputs on the drive.
EN, MDS Epsilon to Oscilloscope, Meter

Logic and I/O Power Supplies



MLP-002-00
2.1 Amp, +24 VDC, universal input 90 to 264 VAC.
EN, Epsilon, MDS

MLP-005-00
5 Amp, +24 VDC, universal input 90 to 264 VAC.
EN, Epsilon, MDS, Unidrive SP size 6

MLP-010-00
10 Amp, +24 VDC, universal input 90 to 264 VAC.
EN, Epsilon, MDS, Unidrive SP size 6



Logic and I/O Power Supplies Continued



ALP-130
30 Watt auxiliary logic backup power supply, supports one drive. (140 VDC output, 120-240 VAC input.)
EN

ALP-430
MP-5000
4x20 Watt auxiliary logic backup power supply, supports four drives. (140 VDC output, 120-240 VAC input.)
EN

AC Line Filters



960304-01
3Ø, 16 Amp, 240 VAC.
EN-214

960305-01
1Ø, 16 Amp, 240 VAC.
EN-204, EN-208

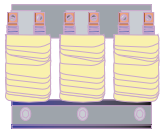
960307-01
1Ø, 10 Amp, 240 VAC.

MF-1250-20
3Ø, 20 Amp, 480 VAC
MP-1250

MF-2500-35
3Ø, 35 Amp, 480 VAC
MP-2500

MF-5000-65
3Ø, 65 Amp, 480 VAC
MP-5000

AC Line Reactor



See the following AC and DC Line Reactor pages for details and order codes

MLR-2580-0 0
0.25 mH, 80 amp, 3Ø
MP-5000 (Consult Factory for AC Line Reactors for the MP-1250 and MP-2500)

Motor Power Filter



For long lead lengths.
MPF-002-00 Used with 2", 3", 4" and 6" motors
MPF-003-00-Used with 8" motors

Power Accessories
For AC and DC Drives

DYNAMIC BRAKING (DB) RESISTORS

The DC bus voltage level of a drive increases while the motor is re-generating, i.e. ramping to a stop. Dynamic braking resistors provide a means of rapidly stopping a rotating motor and load while maintaining an acceptable bus voltage level. The mechanical energy stored in the spinning mass is converted into electrical energy and quickly dissipated as heat through a resistor. Control Techniques offers resistor kits available for both AC and DC drives.

Dynamic Braking for DC Drives

DC drives provide an exponential stopping profile when a dynamic brake resistor is applied across the motor's armature circuit (when the motor acts as a DC generator). This type of braking can occur only when the drive is configured for coast stop and power has been removed from the motor (stop commanded). To apply a dynamic brake resistor to a DC drive, a motor contactor with a DB pole is required. This motor contactor is standard on Quantum III DC drives up through 250 hp.

Regen to line is also a preferred way to handle dynamic braking and is an option on Fincor 2230, Mentor II and Quantum III DC drives.



Galvanized NEMA1 with Normally Closed Thermostat

Dynamic Braking for AC Drives

AC drives provide a constant torque stopping profile when a dynamic brake resistor is applied across the DC bus circuit. Dynamic braking can be employed under a stop command or anytime a decrease in motor speed is commanded, provided the AC drive is enabled and programmed for ramp stop (fast ramp mode).

Control Techniques offers two types of dynamic braking kits for AC Drives. The E-stop duty kits provide a means of quickly stopping a motor / load as well as providing the ability to dissipate energy created by either a change in motor speed or a line transient.

The cyclic duty kits are intended for more severe applications that need the capability to dissipate regenerated energy on a more continuous or repetitive basis such as indexers, feeders and dynamometers.

E-STOP DUTY

E-stop duty DB resistors are designed for non-cyclic use where energy dissipation from an active drive is required. Resistors are supplied with mounting hardware unless otherwise noted.

These kits are designed to meet or exceed NEMA standard 7-15-1970, which states "DB resistors will not exceed their rated temperature rise when the drive is braked from maximum speed to standstill three times in rapid succession with a load inertia equal to or less than the motor inertia". They are designed to provide 150% braking torque (peak at max speed for DC drives, constant for AC drives) for 1800 rpm base speed motors.

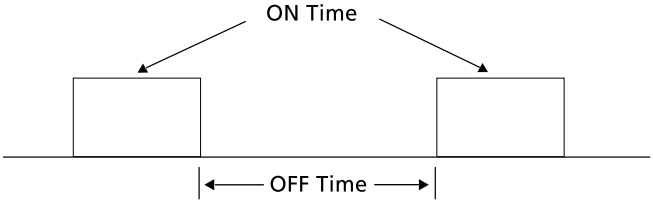
CYCLIC DUTY

NEMA 1 DB resistor kits include a wall mount enclosure with built-in junction box, a terminal strip, a normally closed thermal contact (klixon switch) and resistors pre-wired with high-temperature Teflon wire.

These heavy-duty kits have been designed to provide dynamic braking for cyclic and continuous braking applications. There are three levels available: 10%, 25% and 50%. These levels refer to the continuous allowable braking level (ie. 25% equals 25% of rated motor braking torque) or the maximum allowable duty cycle rates with maximum specified "on-time" limitations (refer to illustration below).

Duty Cycle

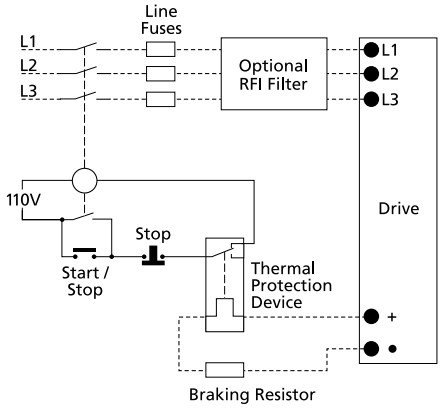
$$\text{Duty Cycle} = \frac{\text{On Time } (\leq \text{ max "on" time})}{\text{On Time + Off Time}}$$



DB Resistors for AC Drives

The brake is active anytime the system is enabled. Therefore, the braking circuit must be protected with an overload device. The Commander SK, Commander GP20 and Unidrive SP drives are equipped standard with built-in dynamic braking transistors. Simply select the proper braking resistor needed for the size of drive and duty cycle.

Overload Protection



INTERNAL DYNAMIC BRAKING RESISTORS

The Commander SK, Commander GP20 and Unidrive SP Size 0, 1 and 2 can be equipped with a zero-space, heatsink mountable DB resistors.



Size 1 Unidrive SP heatsink shown

INTERNAL DYNAMIC BRAKING RESISTORS
Commander SK (size 2), GP20 and Unidrive SP

Frame Size	DC Resistance	Power Rating	Order Code
0	70 Ω	50W	SM-Heatsink-DBR0
1	75 Ω	50W	SM-Heatsink-DBR1
2	37.5 Ω	100W	SM-Heatsink-DBR2

E-STOP DUTY - PANEL MOUNT

Control Techniques E-Stop duty panel mount dynamic braking resistors provide the energy dissipation required for a drive system while keeping the installation as compact as possible.



Panel Mounted DB Resistor Specifications for AC Drives

Panel Mounted, 18" High Temperature Silicone Leads

Drive Order Code	Case Resistor Order Code	Dimensions (in.) H x W x D
DST12xx	DBR-0500-00300-P	9 x 3 x 1.5
SKA1xxxxxx	DBR-1200-00300-P	9 x 3 x 1.5
SKB1xxxxxx	DBR-0500-00300-P	9 x 3 x 1.5
SKBDxxxxxx	DBR-0500-00300-P	9 x 3 x 1.5
SKCD200220	DBR-0500-00300-P	9 x 3 x 1.5
SKDD200300	DBR-0300-00400-P	12 x 3 x 1.5
SKD3200400	DBR-0300-00400-P	12 x 3 x 1.5
SP0xxx	DBR-0500-00300-P	9 x 3 x 1.5
z12xx	DBR-0500-00300-P	9 x 3 x 1.5
y22xx	DBR-0300-00400-P	12 x 3 x 1.5
SKB34xxxxx	DBR-1200-00300-P	9 x 3 x 1.5
SKC3400220	DBR-1200-00300-P	9 x 3 x 1.5
SKC3400300	DBR-0600-00400-P	12 x 3 x 1.5
SKC3400400	DBR-0600-00400-P	12 x 3 x 1.5
SKD34xxxxx	DBR-0600-00400-P	12 x 3 x 1.5
SP04xx	DBR-1200-00300-P	9 x 3 x 1.5
z1401	DBR-1200-00300-P	9 x 3 x 1.5
z1402	DBR-1200-00300-P	9 x 3 x 1.5
z1403	DBR-1200-00300-P	9 x 3 x 1.5
z1404	DBR-1200-00300-P	9 x 3 x 1.5
z1405	DBR-0600-00400-P	12 x 3 x 1.5
z1406	DBR-0600-00400-P	12 x 3 x 1.5

DRIVE ORDER CODE LEGEND
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

Enclosed DB Resistor Specifications for AC Drives

Galvanized NEMA1 with Normally Closed Thermostat



DRIVE ORDER CODE LEGEND
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

COMMANDER SK, COMMANDER GP20 & UNIDRIVE SP DRIVES

230 VAC Drive Order Code	Duty Cycle / Order Code / Dimensions (H x W x D in inches)							
	E-Stop Duty Order Code	Dimensions HxWxD	10% Duty Cycle Order Code	Dimensions HxWxD	25% Duty Cycle Order Code	Dimensions HxWxD	50% Duty Cycle Order Code	Dimensions HxWxD
SKB1100075*	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-00500-ENC	5x14x7
SKB1100110*	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-01000-ENC	5x14x10
SKA1200025	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4
SKA1200037	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4
SKA1200055	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4
SKA1200075	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00600-ENC	5x14x7
SKBD200110	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-01000-ENC	5x14x10
SKBD200150	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-01000-ENC	5x14x10
SKCD200220	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-01000-ENC	5x14x10	DBR-0400-01000-ENC	5x14x10
SKDD200300	DBR-0200-00400-ENC	5x14x4	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13
SKD3200400	DBR-0200-00400-ENC	5x14x4	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
SP0201	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4
SP0202	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7
SP0203	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-00500-ENC	5x14x7
SP0204	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0400-00500-ENC	5x14x7
SP0205	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0400-00500-ENC	5x14x7	DBR-0500-01500-ENC	5x14x13
z1201	DBR-0500-00300-ENC	5x14x4	DBR-0500-00300-ENC	5x14x4	DBR-0500-00500-ENC	5x14x7	DBR-0500-01500-ENC	5x14x13
z1202	DBR-0500-00300-ENC	5x14x4	DBR-0500-00300-ENC	5x14x4	DBR-0500-00500-ENC	5x14x7	DBR-0500-01500-ENC	5x14x13
z1203	DBR-0500-00300-ENC	5x14x4	DBR-0500-00300-ENC	5x14x4	DBR-0500-00500-ENC	5x14x7	DBR-0500-01500-ENC	5x14x13
z1204	DBR-0400-00300-ENC	5x14x4	DBR-0400-00300-ENC	5x14x4	DBR-0350-01500-ENC	5x14x13	DBR-0350-01500-ENC	5x14x13
y2201	DBR-0200-00400-ENC	5x14x4	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13
y2202	DBR-0200-00400-ENC	5x14x4	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
y2203	DBR-0200-00400-ENC	5x14x4	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
y3201	DBR-0055-00600-ENC	5x14x7	DBR-0055-02000-ENC	5x14x13	DBR-0055-03000-ENC	5x21x13	DBR-0055-04500-ENC	5x28x13
y3202	DBR-0055-00600-ENC	5x14x7	DBR-0055-02000-ENC	5x14x13	DBR-0055-03000-ENC	5x21x13	DBR-0055-06000-ENC	7x29x18
y4201	DBR-0055-02000-ENC	5x14x13	DBR-0055-02000-ENC	5x14x13	DBR-0055-04500-ENC	5x28x13	DBR-0055-09000-ENC	7x29x18
y4202	DBR-0055-02000-ENC	5x14x13	DBR-0055-03000-ENC	5x21x13	DBR-0055-06000-ENC	7x29x18	DBR-0055-09000-ENC	7x29x18
y4203	DBR-0055-02000-ENC	5x14x13	DBR-0055-03000-ENC	5x21x13	DBR-0055-06000-ENC	7x29x18	DBR-0055-12000-ENC	14x29x18
SP5201	DBR-0055-02000-ENC	5x14x13	DBR-0055-03000-ENC	5x21x13	DBR-0055-09000-ENC	7x29x18	DBR-0055-18000-ENC	14x29x18
SP5202	DBR-0055-02000-ENC	5x14x13	DBR-0055-04500-ENC	5x28x13	DBR-0055-12000-ENC	14x29x18	DBR-0055-18000-ENC	14x29x18

*115V input

For larger drives and SPM modules please consult factory.

Enclosed DB Resistor Specifications for AC Drives

Galvanized NEMA1 with Normally Closed Thermostat



COMMANDER SK, COMMANDER GP20 & UNIDRIVE SP DRIVES

460 VAC Drive Order Code	Duty Cycle / Order Code / Dimensions (H x W x D in inches)							
	E-Stop Duty Order Code	Dimensions HxWxD	10% Duty Cycle Order Code	Dimensions HxWxD	25% Duty Cycle Order Code	Dimensions HxWxD	50% Duty Cycle Order Code	Dimensions HxWxD
SKB3400037	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4
SKB3400055	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7
SKB3400075	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-00800-ENC	5x14x7
SKB3400110	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-01500-ENC	5x14x13
SKB3400150	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-01500-ENC	5x14x13
SKC3400220	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-01500-ENC	5x14x13	DBR-1200-01500-ENC	5x14x13
SKC3400300	DBR-0600-00400-ENC	5x14x4	DBR-0600-00400-ENC	5x14x4	DBR-0600-01500-ENC	5x14x13	DBR-0600-01500-ENC	5x14x13
SKC3400400	DBR-0600-00400-ENC	5x14x4	DBR-0600-00400-ENC	5x14x4	DBR-0600-01500-ENC	5x14x13	DBR-0600-03000-ENC	5x28x13
SKD3400550	DBR-0600-00400-ENC	5x14x4	DBR-0600-01000-ENC	5x14x10	DBR-0600-01500-ENC	5x14x13	DBR-0600-03000-ENC	5x28x13
SKD3400750	DBR-0600-00400-ENC	5x14x4	DBR-0600-01000-ENC	5x14x10	DBR-0600-01500-ENC	5x14x13	DBR-0600-04500-ENC	7x29x18
SP0401	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4
SP0402	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7
SP0403	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-00800-ENC	5x14x7
SP0404	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-00800-ENC	5x14x7
SP0405	DBR-1200-00300-ENC	5x14x4	DBR-1200-00300-ENC	5x14x4	DBR-1200-00800-ENC	5x14x7	DBR-1200-01500-ENC	5x14x13
z1401	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00600-ENC	5x14x7	DBR-0800-00600-ENC	5x14x7
z1402	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00600-ENC	5x14x7	DBR-0800-00600-ENC	5x14x7
z1403	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-00600-ENC	5x14x7	DBR-0800-01500-ENC	5x14x13
z1404	DBR-0800-00300-ENC	5x14x4	DBR-0800-00300-ENC	5x14x4	DBR-0800-01500-ENC	5x14x13	DBR-0800-01500-ENC	5x14x13
z1405	DBR-0600-00400-ENC	5x14x4	DBR-0600-00600-ENC	5x14x7	DBR-0600-01500-ENC	5x14x13	DBR-0600-01500-ENC	5x14x13
z1406	DBR-0600-00400-ENC	5x14x4	DBR-0600-00600-ENC	5x14x7	DBR-0600-01500-ENC	5x14x13	DBR-0600-03000-ENC	5x28x13
y2401	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
y2402	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-04500-ENC	7x29x18
y2403	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-06000-ENC	7x29x18
y2404	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-04500-ENC	7x29x18	DBR-0200-09000-ENC	7x29x18
y3401	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-04500-ENC	7x29x18	DBR-0200-09000-ENC	7x29x18
y3402	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-06000-ENC	7x29x18	DBR-0200-09000-ENC	7x29x18
y3403	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-06000-ENC	7x29x18	DBR-0200-12000-ENC	14x29x18
y4401	DBR-0120-03000-ENC	5x21x13	DBR-0120-03000-ENC	5x21x13	DBR-0120-09000-ENC	7x29x18	DBR-0120-18000-ENC	14x29x18
y4402	DBR-0120-03000-ENC	5x21x13	DBR-0120-04500-ENC	5x28x13	DBR-0120-12000-ENC	14x29x18	DBR-0120-18000-ENC	14x29x18
y4403	DBR-0100-03000-ENC	5x21x13	DBR-0100-06000-ENC	7x29x18	DBR-0100-12000-ENC	14x29x18	DBR-0100-24000-ENC	14x29x18
y5401	DBR-0100-04500-ENC	5x28x13	DBR-0100-06000-ENC	7x29x18	DBR-0100-18000-ENC	14x29x18	DBR-0100-36000-ENC	21x29x18
y5402	DBR-0100-06000-ENC	7x29x18	DBR-0100-09000-ENC	7x29x18	DBR-0100-24000-ENC	14x29x18	DBR-0100-36000-ENC	21x29x18
y6401	DBR-0055-06000-ENC	7x29x18	DBR-0055-12000-ENC	14x29x18	DBR-0055-24000-ENC	14x29x18	DBR-0055-50000-ENC	28x29x18
y6402	DBR-0055-09000-ENC	7x29x18	DBR-0055-12000-ENC	14x29x18	DBR-0055-36000-ENC	21x29x18	DBR-0055-60000-ENC	35x29x18

DRIVE ORDER CODE LEGEND
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

For larger drives and SPM modules please consult factory.

Enclosed DB Resistor Specifications for AC Drives

Galvanized NEMA1 with Normally Closed Thermostat



UNIDRIVE SP DRIVES

460 VAC Drive Order Code	Duty Cycle / Order Code / Dimensions (H x W x D in inches)							
	E-Stop Duty Order Code	Dimensions HxWxD	10% Duty Cycle Order Code	Dimensions HxWxD	25% Duty Cycle Order Code	Dimensions HxWxD	50% Duty Cycle Order Code	Dimensions HxWxD
SP6411	DBR-0055-06000-ENC	7x29x18	DBR-0055-12000-ENC	14x29x18	DBR-0055-24000-ENC	14x29x18	DBR-0055-50000-ENC	28x29x18
SP6412	DBR-0055-09000-ENC	7x29x18	DBR-0055-12000-ENC	14x29x18	DBR-0055-36000-ENC	21x29x18	DBR-0055-60000-ENC	35x29x18
SP7411	DBR-0055-12000-ENC	14x29x18	Call Factory					
SP7412	DBR-0055-12000-ENC	14x29x18						
SP8411	2x DBR-0055-06000-ENC	7x29x18						
SP8412	2x DBR-0055-09000-ENC	7x29x18						
SP8413	2x DBR-0055-12000-ENC	14x29x18						
SP8414	2x DBR-0055-12000-ENC	14x29x18						
SP9411	4x DBR-0055-06000-ENC	7x29x18						
SP9413	4x DBR-0055-09000-ENC	7x29x18						
SP9414	4x DBR-0055-12000-ENC	14x29x18						
SP9415	4x DBR-0055-12000-ENC	14x29x18						

575 VAC Drive Order Code	Duty Cycle / Order Code / Dimensions (H x W x D in inches)							
	E-Stop Duty Order Code	Dimensions HxWxD	10% Duty Cycle Order Code	Dimensions HxWxD	25% Duty Cycle Order Code	Dimensions HxWxD	50% Duty Cycle Order Code	Dimensions HxWxD
SP3501	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13
SP3502	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13
SP3503	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
SP3504	DBR-0200-00600-ENC	5x14x7	DBR-0200-00600-ENC	5x14x7	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13
SP3505	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-04500-ENC	7x29x18
SP3506	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-03000-ENC	5x28x13	DBR-0200-06000-ENC	7x29x18
SP3507	DBR-0200-01500-ENC	5x14x13	DBR-0200-01500-ENC	5x14x13	DBR-0200-04500-ENC	7x29x18	DBR-0200-09000-ENC	7x29x18

575 VAC or 690 VAC Drive Order Code	Duty Cycle / Order Code / Dimensions (H x W x D in inches)							
	E-Stop Duty Order Code	Dimensions HxWxD	10% Duty Cycle Order Code	Dimensions HxWxD	25% Duty Cycle Order Code	Dimensions HxWxD	50% Duty Cycle Order Code	Dimensions HxWxD
SP4601	DBR-0150-01500-ENC	5x14x13	DBR-0150-01500-ENC	5x14x13	DBR-0150-04500-ENC	5x28x13	DBR-0150-09000-ENC	7x29x18
SP4602	DBR-0150-01500-ENC	5x14x13	DBR-0150-03000-ENC	5x21x13	DBR-0150-06000-ENC	7x29x18	DBR-0150-09000-ENC	7x29x18
SP4603	DBR-0150-01500-ENC	5x14x13	DBR-0150-03000-ENC	5x21x13	DBR-0150-06000-ENC	7x29x18	DBR-0150-12000-ENC	14x29x18
SP4604	DBR-0150-03000-ENC	5x21x13	DBR-0150-03000-ENC	5x21x13	DBR-0150-09000-ENC	7x29x18	DBR-0150-18000-ENC	14x29x18
SP4605	DBR-0150-03000-ENC	5x21x13	DBR-0150-04500-ENC	5x28x13	DBR-0150-12000-ENC	14x29x18	DBR-0150-18000-ENC	14x29x18
SP4606	DBR-0150-03000-ENC	5x21x13	DBR-0150-06000-ENC	7x29x18	DBR-0150-12000-ENC	14x29x18	DBR-0150-24000-ENC	21x29x18
SP5601	DBR-0120-4500-ENC	5x28x13	DBR-0120-06000-ENC	7x29x18	DBR-0120-18000-ENC	14x29x18	DBR-0120-36000-ENC	21x29x18
SP5602	DBR-0120-4500-ENC	5x28x13	DBR-0120-09000-ENC	7x29x18	DBR-0120-24000-ENC	14x29x18	DBR-0120-36000-ENC	21x29x18
SP6601	DBR-0130-06000-ENC	7x29x18	DBR-0120-12000-ENC	14x29x18	DBR-0120-24000-ENC	14x29x18	DBR-0120-50000-ENC	28x29x18
SP6602	DBR-0130-06000-ENC	7x29x18	DBR-0120-12000-ENC	14x29x18	DBR-0120-36000-ENC	21x29x18	DBR-0130-60000-ENC	35x29x18

For larger drives and SPM modules please consult factory.

DRIVE ORDER CODE LEGEND
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

Enclosed DB Resistor Specifications for Servo Drives

DIGITAX ST, EPSILON EP, MDS & EN DRIVES



Galvanized NEMA1 with Normally Closed Thermostat

				DB Resistor Options								
				Heatsink/Internally Mounted			500 Watt (UL Listed)			500 Watt		
Drive/Module Order Code	Drive Kw	Internal Energy Absorption (Joules)	Min resistance (Ohm)	Order Code (UL Listed)	Watts	Ohms	Order Code	Ohms	Dimensions (HxWxD)	Order Code	Ohms	Dimensions (HxWxD)
DST1201	0.5	26/7 (115V/230V)	23	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
DST1202	1.2	52/14 (115V/230V)	23	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
DST1203	1.6	52/14 (115V/230V)	23	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
DST1204	2.3	78/21 (115V/230V)	16	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
DST1401	0.8	13/4 (115V/230V)	111	DBR0**	50	70				DBR-1200-00800-ENC	120	5x14x7
DST1402	1.4	13/4 (115V/230V)	111	DBR0**	50	70				DBR-1200-00800-ENC	120	5x14x7
DST1403	2	13/4 (115V/230V)	75	DBR0**	50	70				DBR-0800-00600-ENC	80	5x14x7
DST1404	3	13/4 (115V/230V)	28	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
DST1405	4.1	13/4 (115V/230V)	28	DBR0**	50	70	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
EP202	0.77	39/8 (115V/230V)	30									
EP204	1.27	58/12 (115V/230V)	30	DBR1**	50	33	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
EP206	1.77	97/20 (115V/230V)	30	DBR1**	50	33	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
EP209	2.32	117/24 (115V/230V)	30	DBR1**	50	33	MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
EP216	2.32/4.8	132/28 (115V/230V)	20	DBR1**	50	33	MS-530-00-000	30	13.7x3.4x9.7	DBR-0200-00600-ENC	20	5x14x7
MP-1250	12.5	236/110 (230V/460V)	30				MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
MP-2500	25	393/183(230V/460V)	30				MS-530-00-000	30	13.7x3.4x9.7	DBR-0400-00500-ENC	40	5x14x7
MP-5000	50	629/293(230V/460V)	9				MS-510-00-000	30	13.7x3.4x9.7	DBR-0200-00600-ENC	20	5x14x7
EN-204*	1.8	150/79 (115V/230V)	20				ES-20-500	20	7x14x5			
EN-208*	3.6	150/79+50W (115V/230V)	20				ES-20-500	20	7x14x5			
EN-214*	5.2	150/79+50W (115V/230V)	20				ES-20-500	20	7x14x5			

DB Resistor Options												
	1k Watt				2k Watt				3k Watt			
Drive/Module Order Code	Order Code	Watts	Ohms	Dimensions (HxWxD)	Order Code	Watts	Ohms	Dimensions (HxWxD)	Order Code	Watts	Ohms	Dimensions (HxWxD)
DST1201												
DST1202												
DST1203	DBR-0400-01000-ENC	1000	40	5x14xx10								
DST1204	DBR-0400-01000-ENC	1000	40	5x14xx10								
DST1401												
DST1402												
DST1403												
DST1404												
DST1405												
EP202												
EP204												
EP206												
EP209	DBR-0400-01000-ENC	1000	40	5x14xx10								
EP216	DBR-0200-01500-ENC	1500	20	5x14xx13	DBR-0200-03000-ENC	3000	20	5x28x13				
MP-1250	DBR-0400-01000-ENC	1000	40	5x14xx10	DBR-0300-02000-ENC	2000	30	5x21x10				
MP-2500	DBR-0400-01000-ENC	1000	40	5x14xx10	DBR-0300-02000-ENC	2000	30	5x21x10				
MP-5000	DBR-0200-01500-ENC	1500	20	5x14xx13	DBR-0100-02000-ENC	2000	10	5x14x13	DBR-0150-03000-ENC	3000	15	5x21x13
EN-204*	ES-20-1K	1000	20	13x14x5	ES-20-2K	2000	20	13x14x5				
EN-208*	ES-20-1K	1000	20	13x14x5	ES-20-2K	2000	20	13x14x5				
EN-214*	ES-20-1K	1000	20	13x14x5	ES-20-2K	2000	20	13x14x5				

* Requires RSR-2 Module and External Resistor

**For the complete order code add the prefix SM-HEATSINK — i.e. SM-HEATSINK-DBR0 or SM-HEATSINK-DBR1

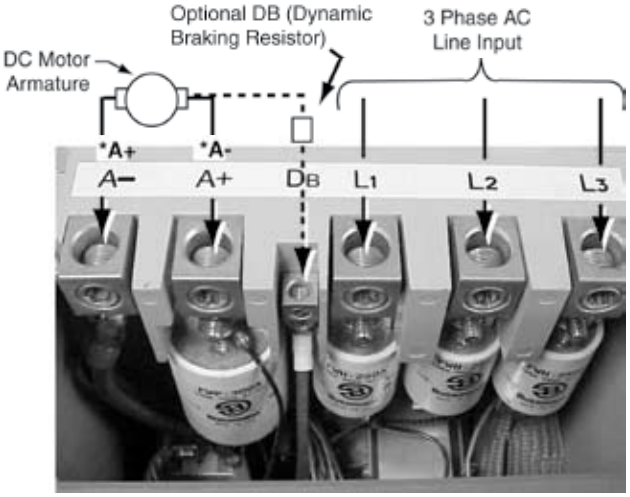
For Unidrive SP drives see the AC Drive DB Resistors tables

DB Resistors for DC Drives

E-stop duty dynamic braking resistors are available to provide for the fast stopping of DC motors.

Quantum III DC drives come supplied with a DB Resistor Pole, which is conveniently located adjacent to the either A- on non-regen models, or A+ in regen models.

DB resistors are shipped loose and mounted external to the drive (by customer). NEMA 1 Enclosure is Galvanized Steel and meets UL508A standard.



230 VAC DB Resistors

HP	Chassis		NEMA 1	
	Order Code	Dimensions (in.) H x W x D	Order Code	Dimensions (in.) H x W x D
5	8200-00100	10.25 x 2 x 2.75	005-4301	5 x 14 x 4
7.5	8200-00101		005-4302	
10	8200-00102		005-4303	
15	8200-00103		005-4304	
20	8200-00104		005-4305	
25	8200-00105		005-4306	
30	8200-00106*	14 x 4 x 5	005-4307	
40	8200-00107*		005-4308	5 x 14 x 7
50	8200-00108*		005-4309	
60	8200-00109*		005-4310	5 x 14 x 4
75	8200-00110*		005-4311	
100	8200-00111*	14 x 10 x 5	005-4312	5 x 14 x 10
125	8200-00112*	14 x 13 x 5	n/a	

460 VAC DB Resistors

HP	Chassis		NEMA 1	
	Order Code	Dimensions (in.) H x W x D	Order Code	Dimensions (in.) H x W x D
5-7.5	8200-00115	10.25 x 2 x 2.75	005-4351	5 x 12 x 4
10	8200-00116		005-4352	
15	8200-00117		005-4353	
20	8200-00118		005-4354	5 x 14 x 7
25	8200-00119		005-4355	
30	8200-00120	10.25 x 2 x 5.5	005-4356	
40	8200-00121		005-4357	5 x 14 x 10
50	8200-00122		005-4358	
60	8200-00124*	14 x 7 x 5	005-4359	
75			005-4360	
100	8200-00125*	14 x 10 x 5	005-4361	5 x 14 x 13
125	8200-00126*	14 x 13 x 5	005-4362	5 x 21 x 10
150	8200-00127*		005-4363	
200	8200-00128*		005-4364	
250	8200-00129*		005-4365	

The DC Dynamic braking components have been sized for occasional non-repeated use, assuming load inertia is equal to or less than motor inertia. The Dynamic resistor will be sized at approximately 150% of rated motor current. The DB enclosures are galvanized NEMA 1 enclosure shipped loose and mounted external to the drive to meet UL508A standard. The DC drive will also require a DB contactor option for dynamic braking action.

* Resistor is wall mounted, not panel mounted.

ISOLATION TRANSFORMERS

Drive isolation transformers add an extra margin of protection for AC and DC drives. They are sized to the drive KVA requirements and are designed to withstand the mechanical stresses of current reversals and short circuits associated with power semiconductor type AC and DC drives.

- Three coil, delta-wye configuration with fully rated NEMA 1 enclosure
- ±5% fully rated taps on primary winding
- Ambient temperature: 40°C (104°F)
- Standards: ANSI C89.2, NEMA ST-20, UL506, UL1561

Isolation Transformers:

- **Provide electrical isolation between the incoming line and the drive electronics.**
- **Convert input line voltage to standard drive input voltages.**
- **Minimize line disturbances caused by SCR power converters.**
- **Reduce power line harmonics caused by drives.**
- **Protect the motor controller by reducing available short circuit potential. This may be a UL requirement in installations with high levels of short circuit potential.**

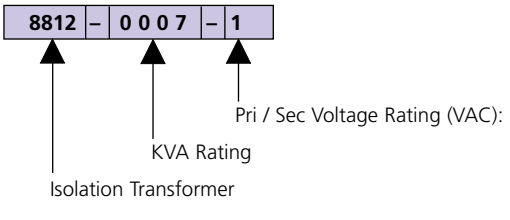


HP	KVA	Primary Voltage	Secondary Voltage 230 VAC	Secondary Voltage 460 VAC	Wt.* (lbs.)	Size
5	7.5	230	8812-0007-1	8812-0007-2	152	A
		460	8812-0007-3	8812-0007-4		
7.5	11	230	8812-0011-1	8812-0011-2		
		460	8812-0011-3	8812-0011-4		
10	14	230	8812-0015-1	8812-0015-2		
		460	8812-0015-3	8812-0015-4		
15	20	230	8812-0020-1	8812-0020-2	230	B
		460	8812-0020-3	8812-0020-4		
20	27	230	8812-0027-1	8812-0027-2		
		460	8812-0027-3	8812-0027-4		
25	34	230	8812-0034-1	8812-0034-2	310	
		460	8812-0034-3	8812-0034-4		
30	40	230	8812-0040-1	8812-0040-2		
		460	8812-0040-3	8812-0040-4		
40	51	230	8812-0051-1	8812-0051-2	480	C
		460	8812-0051-3	8812-0051-4		
50	63	230	8812-0063-1	8812-0063-2		
		460	8812-0063-3	8812-0063-4		
60	75	230	8812-0075-1	8812-0075-2		
		460	8812-0075-3	8812-0075-4		
75	93	230	8812-0093-1	8812-0093-2	600	
		460	8812-0093-3	8812-0093-4		
100	118	230	8812-0118-1	8812-0118-2	760	D
		460	8812-0118-3	8812-0118-4		
125	145	230	8812-0145-1	8812-0145-2		
		460	8812-0145-3	8812-0145-4		
150	175	230	8812-0175-1	8812-0175-2	1100	E
		460	8812-0175-3	8812-0175-4		
200	220	230	8812-0220-1	8812-0220-2	1200	
		460	8812-0220-3	8812-0220-4		
250	275	230	8812-0275-1	8812-0275-2	1300	
		460	8812-0275-3	8812-0275-4		
300	330	230	8812-0330-1	8812-0330-2	2200	F
		460	8812-0330-3	8812-0330-4		
400	440	460	XXX	8812-0440-4		
500	550	460	XXX	8812-0550-4	2900	

* Approximate shipping weight.

Size	Dims. (in.) H x W x D
A	25 x 20.125 x 14.125
B	30.125 x 20.125 x 14.125
C	39.375 x 26.125 x 19.125
D	46.5 x 26.125 x 20.125
E	56 x 31.25 x 24.25
F	75 x 44.5 x 36

Order String



ELECTROMAGNETIC COMPATIBILITY FILTERS

EMC filters are used to minimize high frequency power supply line disturbances caused by PWM AC drives that may interfere with proper operation of sensitive electronic equipment. These specific filters have been assessed for conformance with the EMC directive by testing with the appropriate CT drives.

EMC data sheets are available for digital drive products. These data sheets list the applicable harmonized standards and give recommended installation techniques and further information on EMC behavior in typical situations. The filters are built and tested to the safety standard EN-33200 and to meet NEMA 1 standards.

Mounting Style

- Bookend: filter mounts next to the drive with the smallest dimension being the width of the filter
- Footprint: filter mounts between the drive heatsink and the panel or enclosure
- Panel: filter mounts on the panel near the drive

Filter Type

- Low Leakage: designed for use in industrial or residential applications* with motor lead lengths <15 m (49 ft)
- Standard: designed for use in industrial or residential applications* with motor lead lengths <75 m (246 ft)

* As defined by CE standards for EMC compliance



2 YEAR Digital Drive Warranty

Commander SL, Commander SK / External, Surface Mount EMC Standard Filter Selection

Drive Order Code	RFI Filter Order Code	Mounting Style	Current (A)	Dims. (in.) H x W x D	Weight Lbs.
115 VAC, Single Phase 50/60 Hz Input					
SKA1100025	4200-6122	Footprint/Bookend	12	8 x 3 x 1.6	0.9
SKA1100037	4200-6122				
SKB1100075	4200-6216	Footprint/Bookend	27	10.2 x 3.2 x 1.6	1.5
SKB1100110	4200-6216				
230 VAC, Single Phase 50/60 Hz Input					
wA1200025	4200-6122	Footprint/Bookend	12	8 x 3 x 1.6	0.9
wA1200037	4200-6122				
wA1200055	4200-6122				
wA1200075	4200-6122				
wBD200110	4200-6212	Footprint/Bookend	20	8 x 3 x 1.6	1.3
wBD200150	4200-6212				
wCD200220	4200-6310	Footprint/Bookend	24	12.2 x 3.7 x 1.8	1.9
SKDD200300	4200-6409	Footprint/Bookend	24	16.4 x 4.5 x 2.0	3.6
230 VAC, 3-Phase 50/60 Hz Input					
wBD200110	4200-6213	Footprint/Bookend	10	10.2 x 3.2 x 1.6	1.4
wBD200150	4200-6213				
wCD200220	4200-6311	Footprint/Bookend	14	12.2 x 3.7 x 1.8	1.7
SKD3200400	4200-6411	Footprint/Bookend	Consult Factory		
SKDD200300	4200-6411	Footprint/Bookend	24	16.4 x 4.5 x 2.0	3.4
460 VAC, 3-Phase 50/60 Hz Input					
wB3400037	4200-6213	Footprint/Bookend	10	10.2 x 3.2 x 1.6	1.4
wB3400055	4200-6213				
wB3400075	4200-6213				
wB3400110	4200-6213				
wB3400150	4200-6213				
wC3400220	4200-6311	Footprint/Bookend	14	12.2 x 3.7 x 1.8	1.7
wC3400400					
SKD3400550	4200-6411	Footprint/Bookend	Consult Factory		
SKD3400750	4200-6411				

Commander SL, Commander SK / External, Surface Mount EMC Low Leakage Filter Selection

Drive Order Code	RFI Filter Order Code	Mounting Style	Current (A)	Dims. (in.) H x W x D	Weight Lbs.
115 VAC, Single Phase 50/60 Hz Input					
SKA1100025	4200-6123	Footprint/Bookend	12	8 x 3 x 1.6	0.9
SKA1100037	4200-6123				
230 VAC, Single Phase 50/60 Hz Input					
wA1200025	4200-6123	Footprint/Bookend	12	8 x 3 x 1.6	1.0
wA1200037					
wA1200055					
wA1200075					
wBD200110	4200-6214	Footprint/Bookend	20	8 x 3 x 1.6	1.4
wBD200150					
wCD200220	4200-6312	Footprint/Bookend	24	12.2 x 3.7 x 1.8	2.0
SKDD200300	4200-6410	Footprint/Bookend	24	16.4 x 4.5 x 2.0	3.6
230 VAC, 3-Phase 50/60 Hz Input					
wBD200110	4200-6215	Footprint/Bookend	10	10.2 x 3.2 x 1.6	1.4
wBD200150					
wCD200220	4200-6217	Footprint/Bookend	14	12.2 x 3.7 x 1.8	1.6
SKD3200400	4200-6412	Footprint/Bookend	Consult Factory		
SKDD200300	4200-6412	Footprint/Bookend	24	16.4 x 4.5 x 2.0	3.4
460 VAC, 3-Phase 50/60 Hz Input					
wB3400037	4200-6215	Footprint/Bookend	10	10.2 x 3.2 x 1.6	1.4
wB3400055	4200-6215				
wB3400075	4200-6215				
wB3400110	4200-6215				
wB3400150	4200-6215				
wC3400220	4200-6217	Footprint/Bookend	14	12.2 x 3.7 x 1.8	1.6
wC3400400	4200-6217				
SKD3400550	4200-6412	Footprint/Bookend	Consult Factory		
SKD3400750	4200-6412				

Commander SK, Commander GP20 and Unidrive SP / External, Surface Mount EMC Filter Selection

Drive Order Code	RFI Filter Order Code	Mounting Style	Current (A)	Dims. (in.) H x W x D	Weight Lbs.
230 VAC, Single Phase 50/60 Hz Input					
SP0201-SP0205	4200-6000	Footprint/Bookend	19	14.1 x 2.4 x 1.2	1.4
230 VAC, 3-Phase 50/60 Hz Input					
SP0201-SP0205	4200-6001	Footprint/Bookend	17	14.1 x 2.4 x 1.2	1.4
z1201	4200-6118	Footprint/Bookend	10	17.4 x 4 x 1.8	3.1
z1202	4200-6118				
z1203	4200-6119	Footprint/Bookend	16	17.4 x 4 x 1.8	3.1
z1204	4200-6119				
y2201	4200-6210	Footprint/Bookend	32	17 x 6.1 x 2.2	4.4
y2202	4200-6210				
y2203	4200-6210				
y3201	4200-6307	Footprint/Bookend	75	16.3 x 10 x 2.4	7.7
y3202	4200-6307				
y4201	4200-6406	Footprint/Bookend	101	11.8 x 9 x 4	8.8
y4202	4200-6406				
y4203	4200-6406				
SP5201	4200-6503	Footprint/Bookend	164	11.8 x 9.8 x 4.7	15
SP5202	4200-6503				

DRIVE ORDER CODE LEGEND
w=SL for Commander SL, or SK for Commander SK
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

Commander SK, Commander GP20 and Unidrive SP / External, Surface Mount EMC Filter Selection

Drive Order Code	RFI Filter Order Code	Mounting Style	Current (A)	Dims. (in.) H x W x D	Weight Lbs.
460 VAC, 3-Phase 50/60 Hz Input					
SP0401-SP0405	4200-6002	Footprint/Bookend	11	14.1 x 2.4 x 1.2	1.4
z1401	4200-6118	Footprint/Bookend	10	17.4 x 4 x 1.8	3.1
z1402	4200-6118				
z1403	4200-6118				
z1404	4200-6118				
z1405	4200-6119	Footprint/Bookend	16		3.1
z1406	4200-6119				
y2401	4200-6210	Footprint/Bookend	32	17 x 6.1 x 2.2	4.4
y2402	4200-6210				
y2403	4200-6210				
y2404	4200-6210				
y3401	4200-6305	Footprint/Bookend	62	16.3 x 10 x 2.4	7.7
y3402	4200-6305				
y3403	4200-6305				
y4401	4200-6406	Footprint/Bookend	101	11.8 x 9 x 4	8.8
y4402	4200-6406				
y4403	4200-6406				
y5401	4200-6503	Footprint/Bookend	164	11.8 x 9.8 x 4.8	15
y5402	4200-6503				
y6401	4200-6603	Footprint/Bookend	260	11.6 x 9 x 5.4	11.6
y6411	4200-6603				
y6402	4200-6603				
y6412	4200-6603				
575 VAC & 690 VAC, 3-Phase 50/60 Hz Input					
y3501	4200-6309	Footprint/Bookend	30	16.3 x 10 x 2.4	7.7
y3502	4200-6309				
y3503	4200-6309				
y3504	4200-6309				
y3505	4200-6309				
y3506	4200-6309				
y3507	4200-6309				
y4601	4200-6408	Footprint/Bookend	58	11.8 x 9 x 4	8.4
y4602	4200-6408				
y4603	4200-6408				
y4604	4200-6408				
y4605	4200-6408				
y4606	4200-6408				
y5601	4200-6504	Footprint/Bookend	95	11.8 x 9 x 4	9.7
y5602	4200-6504				
y6601	4200-6604	Footprint/Bookend	Consult Factory		
y6602	4200-6604				

DRIVE ORDER CODE LEGEND
y= SK for Commander SK, or CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP

Notes: A zero-space EMC filter adequate for most applications is standard on the drive. Alternate filters are available on request.

Mentor / EMC Filter Selection

Drive Order Code	RFI Filter Catalog Number	Mounting Style	Current (A)	Dimensions (in.) H x W x D	Weight Lbs.
M25x-14M	4200-6116	Bookend	50	13.3 x 3.9 x 3.5	9
M45x-14M	4200-6116				
M75x-14M	4200-6117	Bookend	63	14.8 x 4.0 x 5.9	9
M105x-14M	4200-6106	Bookend	100	15 x 4.2 x 5.9	17
M155x-14M	4200-6107	Bookend	150	16.3 x 5.3 x 6.9	17
M210x-14M	4200-6111	Bookend	180	19.8 x 6.2 x 6.7	33
M350x-14M	4200-6115	Bookend	300	25.8 x 6.1 x 9.0	35
M420x-14M **M550x-14M** **M700x-14M** **M825x-14M** **M900x-14M** **M1200x-14M** **M1850x-14M**	**Consult Factory**				

Quantum / EMC Filter Selection

Drive Order Code	RFI Filter Catalog Number	Mounting Style	Current (A)	Dimensions (in.) H x W x D	Weight Lbs.
9500-8x02	4200-6116	Bookend	50	13.3 x 3.94 x 3.54	9
9500-8x03	4200-6116				
9500-8x05	4200-6106	Bookend	100	15 x 4.21 x 5.91	9
9500-8x06	4200-6107	Bookend	150	16.3 x 5.32 x 6.89	17
9500-8x07	4200-6112	Bookend	220	20.6 x 6.18 x 6.69	33
9500-8x08	4200-6115	Bookend	300	25.8 x 6.14 x 9.06	35
9500-8x09 **9500-8x10** **9500-8x11** **9500-8x15** **9500-8x16** **9500-8x17** **9500-8x18** **9500-8x19** **9500-8x20**	**Consult Factory**				

LINE AND LOAD REACTORS

Line reactors (sometimes called line chokes) are a common power accessory for electronic variable speed drives. These components add an extra margin of protection for AC and DC drives. Load reactors are also used on the output of AC Drives to reduce the effects of high motor wiring capacitance and to "soften" the dv / dt (high rates of change of voltage) applied to the motor windings.



Voltage	600 VAC maximum
Ambient Temperature	40°C (104°F)
Overload	200% for 3 minutes
Standards	CSA UL / cUL Recognized

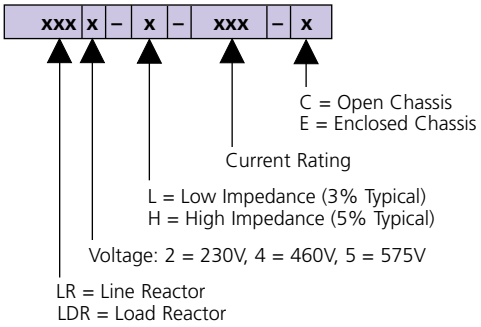
Reactors in AC drive applications:

- Help meet IEEE 519 criteria by reducing harmonic distortion of the input line current.
- Improve input line current balance.
- Reduce nuisance drive over-voltage trips caused by transient voltage spikes and power line notches.
- Protect input rectifiers from in-rush current caused by sudden power line surges and sags.
- Extend the life of the DC bus capacitor bank by reducing the internal heating caused by ripple current.
- Protect motor windings from long lead effects when used on the drive output.

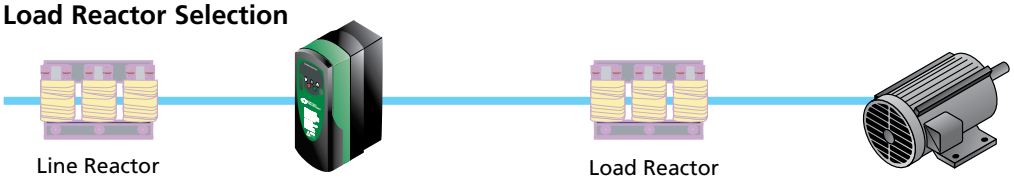
Line Reactors in DC drive applications:

- Minimize crosstalk between multiple SCR drives by reducing line notching and subsequent dv/dt misfiring / bridge failures.
- Eliminate SCR failures caused by high dv/dt levels associated with stiff or power factor corrected power lines.
- Protect other line-powered sensitive electronic equipment by filtering electrical noise / interference caused by drives on the power line.

Order String



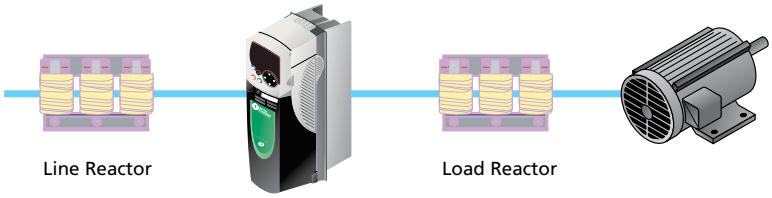
Commander SK Line and Load Reactor Selection



Motor Power (HP)	Order Code	Input Line Reactor Order Code	Current (A)	Output Load Reactor Order Code	Current (A)
115 VAC 1Ø					
0.33	**SKA1100025**			LDR2-L-004-X	4.2
0.5	**SKA1100037**			LDR2-L-004-X	4.2
230 VAC 1Ø					
0.33	**SKA1200025**	4402-0224	6.5	LDR2-L-004-X	4.2
0.5	**SKA1200037**	4402-0224	6.5	LDR2-L-004-X	4.2
0.75	**SKA1200055**	4402-0225	15.1	LDR2-L-004-X	4.2
1.0	**SKA1200075**	4402-0225	15.1	LDR2-L-006-X	6
1.5	**SKBD200110**	4402-0225	15.1	LDR2-L-006-X	6
2.0	**SKBD200150**	4402-0226	26.2	LDR2-L-010-X	9.6
3.0	**SKCD200220**	4402-0226	26.2	LDR2-L-015-X	15.2
3.0	**SKDD200300**	4402-0226	26.2	LDR2-L-015-X	15.2
230 VAC 3Ø					
1.5	**SKBD200110**	LR2-L-010-X	9.6	LDR2-L-006-X	6
2	**SKBD200150**	LR2-L-015-X	15.2	LDR2-L-010-X	9.6
3	**SKCD200220**	LR2-L-022-X	22	LDR2-L-015-X	15.2
3.0	**SKDD200300**	LR2-L-015-X	15.2	LDR2-L-015-X	15.2
5	**SKD3200400**	LR2-L-022-X	22	LDR2-L-022-X	22
460 VAC 3Ø					
0.5	**SKB3400037**	LR4-L-003-X	3.4	LDR4-L-003-X	3.4
0.75	**SKB3400055**	LR4-L-003-X	3.4	LDR4-L-003-X	3.4
1	**SKB3400075**	LR4-L-003-X	3.4	LDR4-L-003-X	3.4
1.5	**SKB3400110**	LR4-L-005-X	4.8	LDR4-L-003-X	3.4
2	**SKB3400150**	LR4-L-008-X	7.6	LDR4-L-005-X	4.8
3	**SKC3400220**	LR4-L-011-X	11	LDR4-L-008-X	7.6
5	**SKC3400400**	LR4-L-014-X	14	LDR4-L-014-X	14
7.5	**SKD3400550**	LR4-L-014-X	14	LDR4-L-014-X	14
10	**SKD3400750**	LR4-L-021-X	21	LDR4-L-021-X	21

Line and Load Reactor Selection

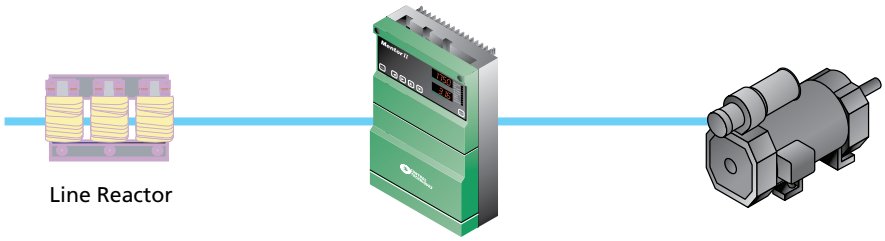
DRIVE ORDER CODE LEGEND
w=SL for Commander SL, or SK for Commander SK
y= SK for Commander SK, or
CGP for Commander GP20, or SP for Unidrive SP
z= CGP for Commander GP20, or SP for Unidrive SP



Motor Power (HP)		Drive Order Code	Input Line Reactor Order Code	Current (A)	Output Load Reactor Order Code	Current (A)
Normal Duty	Heavy Duty					
230 VAC 3Ø						
1.5	1	z1201	LR2-L-010-X	9.6	LDR2-L-006-X	6
2	1.5	z1202	LR2-L-015-X	15.2	LDR2-L-010-X	9.6
3	2	z1203	LR2-L-022-X	22	LDR2-L-010-X	9.6
4	4	z1204	LR2-L-022-X	22	LDR2-L-015-X	15.2
5	4	y2201	LR2-L-022-X	22	LDR2-L-022-X	22
7.5	5	y2202	LR2-L-028-X	28	LDR2-L-022-X	22
10	7.5	y2203	LR2-L-042-X	42	LDR2-L-028-X	28
15	10	y3201	LR2-L-054-X	54	LDR2-L-042-X	42
20	15	y3202	LR2-L-068-X	68	LDR2-L-054-X	54
25	20	y4201	LR2-L-080-X	80	LDR2-L-077-X	77
30	25	y4202	LR2-L-080-X	80	LDR2-L-096-X	96
40	30	y4203	LR2-L-104-X	104	LDR2-L-130-X	130
50	40	y5201	LR2-L-130-X	130	LDR2-L-130-X	130
60	50	y5202	LR2-L-154-X	154	LDR2-L-154-X	154
460 VAC 3Ø						
1.5	1	z1401	LR4-L-005-X	4.8	LDR4-L-003-X	3.4
2	2	z1402	LR4-L-008-X	7.6	LDR4-L-005-X	4.8
3	3	z1403	LR4-L-008-X	7.6	LDR4-L-008-X	7.6
5	4	z1404	LR4-L-011-X	11	LDR4-L-008-X	7.6
5	5	z1405	LR4-L-011-X	11	LDR4-L-011-X	11
7.5	5	z1406	LR4-L-014-X	14	LDR4-L-011-X	11
10	10	y2401	LR4-L-021-X	21	LDR4-L-021-X	21
15	10	y2402	LR4-L-027-X	27	LDR4-L-021-X	21
20	15	y2403	LR4-L-034-X	34	LDR4-L-034-X	34
20	20	y2404	LR4-L-034-X	34	LDR4-L-034-X	34
25	25	y3401	LR4-L-040-X	40	LDR4-L-040-X	40
30	30	y3402	LR4-L-052-X	52	LDR4-L-052-X	52
40	30	y3403	LR4-L-065-X	65	LDR4-L-065-X	65
50	50	y4401	LR4-L-065-X	65	LDR4-L-077-X	77
60	60	y4402	LR4-L-096-X	96	LDR4-L-096-X	96
75	75	y4403	LR4-L-124-X	124	LDR4-L-124-X	124
100	100	y5401	LR4-L-156-X	156	LDR4-L-156-X	156
150	125	y5402	LR4-L-156-X	156	LDR4-L-180-X	180
150	150	y6401	LR4-L-240-X	240	LDR4-L-240-X	240
200	150	y6402	LR4-L-302-X	302	LDR4-L-240-X	240
575 VAC 3Ø						
5	3	y3501	LR5-L-009-X	9	LDR5-L-006-X	6.1
5	5	y3502	LR5-L-009-X	9	LDR5-L-006-X	6.1
7.5	5	y3503	LR5-L-011-X	11	LDR5-L-009-X	9
10	7.5	y3504	LR5-L-017-X	17	LDR5-L-011-X	11
15	10	y3505	LR5-L-022-X	22	LDR5-L-017-X	17
20	15	y3506	LR5-L-027-X	27	LDR5-L-022-X	22
25	20	y3507	LR5-L-027-X	27	LDR5-L-027-X	27
30	25	y4603	LR5-L-041-X	41	LDR5-L-041-X	41
40	30	y4604	LR5-L-041-X	41	LDR5-L-041-X	41
50	40	y4605	LR5-L-052-X	52	LDR5-L-052-X	52
60	50	y4606	LR5-L-062-X	62	LDR5-L-062-X	62
75	60	y5601	LR5-L-099-X	99	LDR5-L-099-X	99
100	75	y5602	LR5-L-099-X	99	LDR5-L-099-X	99
125	100	y6601	LR5-L-144-X	144	LDR5-L-144-X	144
150	125	y6602	LR5-L-192-X	192	LDR5-L-192-X	192

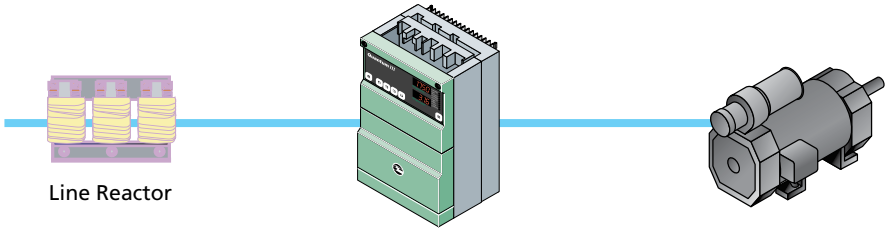
For larger horsepower Unidrive SP drives please consult factory.

Mentor Line Reactor Selection



Drive Order Code	Input Line Reactor Order Code	Current (A)	Input Line Reactor Order Code	Current (A)
	230 VAC		460 VAC	
M25x-14M	LR2-L-022-X	22	LR4-L-021-X	21
M45x-14M	LR2-L-042-X	42	LR4-L-040-X	40
M75x-14M	LR2-L-068-X	68	LR4-L-065-X	65
M105x-14M	LR2-L-104-X	104	LR4-L-096-X	96
M155x-14M	LR2-L-130-X	130	LR4-L-156-X	156
M210x-14M	LR2-L-192-X	192	LR4-L-180-X	180
M350x-14M	LR2-L-312-X	312	LR4-L-302-X	302
M420x-14M	LR2-L-360-X	360	LR4-L-361-X	361
M550x-14M	LR2-L-480-X	480	LR4-L-477-X	477
M700x-14M thru M1850x-14M	**Consult Factory**			

Quantum Line Reactor Selection



Drive Order Code	Input Line Reactor Order Code	Current (A)	Input Line Reactor Order Code	Current (A)
	230 VAC		460 VAC	
9500-8x02	LR2-L-042-X	42	LR4-L-034-X	34
9500-8x03	LR2-L-054-X	54	LR4-L-052-X	52
9500-8x05	LR2-L-104-X	104	LR4-L-096-X	96
9500-8x06	LR2-L-154-X	154	LR4-L-156-X	156
9500-8x07	LR2-L-248-X	248	LR4-L-240-X	240
9500-8x08	LR2-L-312-X	312	LR4-L-302-X	302
9500-8x09	LR2-L-360-X	360	LR4-L-361-X	361
9500-8x10	LR2-L-480-X	480	LR4-L-477-X	477
9500-8x11 thru 9500-8x20	**Consult Factory**			

Symbols & Formulae

SI UNITS AND SYMBOLS

SI Base Units

Quantity	Unit Symbol	Unit Name
Length	m	meter
Mass	kg	kilogram
Time	s	second
Electric current	A	Ampere
Temperature	K	Kelvin
Luminous intensity	cd	candela

Decimal Multiples and Sub-multiples

Factor	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

DERIVED UNITS

Geometrical

Symbol	Quantity	Symbol	Unit Name
l,s	length, distance	m	meter
A	area	m^2	square meter
V	volume	m^3	cubic meter
α, β, γ, etc.	plane angle	rad	radian
		°	degree
α, β, γ, etc.	solid angle		steradian

Time-related

Symbol	Quantity	Unit Symbol	Unit name
t	time	s	second
τ	time constant	s	second
u,v	velocity	ms^{-1}	meter per second
a	acceleration	ms^{-2}	meter per second per second
ω	angular velocity	rad s^{-1}	radian per second
α	angular acceleration	rad s^{-2}	radian per second per second
f	frequency	Hz	Hertz
n	rotational frequency	s^{-1}	(revolution) per second

Mechanical

Symbol	Quantity	Unit Symbol	Unit name
m	mass	kg	kilogram
F	force	N	Newton
G (W)	weight	N	Newton
J	moment of inertia	kgm^2	kilogram meter squared
M (T)	torque	kgm	kilogram meter
W (E)	work (energy)	J	Joule
P	power	W	Watt
p	pressure	Pa	Pascal
E	modulus of elasticity	Pa	Pascal
σ	stress	Pa	Pascal
ρ	density	kgm^{-3}	kilogram per cubic meter
δx	rate of flow	m^3s^{-1}	cubic meter per second
k, k_1, etc.	any constant factor		

Protective Enclosures

IP AND NEMA

Protective Enclosures - Non-hazardous Areas IP Protection

IP Protection is a European system of classification which is widely accepted internationally, and indicates the degree of protection against the ingress of solid objects, dust, liquids and personal contact.

The first numeral indicates the degree of protection against the ingress of solid objects (including parts of the body) and dust. The second numeral indicates the degree of protection against the ingress of water.

IP Enclosure - First Numeral

1st Numeral	Degree of Protection	
	Short Description	Definition
0	Non-protected	No special protection
1	Protected against solid objects greater than 50mm	A large surface of the body, such as a hand (but no protection against deliberate access). Solid objects exceeding 50mm in diameter.
2	Protected against solid objects greater than 12mm	Fingers or similar objects not exceeding 80mm in length. Solid objects exceeding 12mm in diameter.
3	Protected against solid objects greater than 2.5mm	Tools, wires, etc. of diameter or thickness greater than 2.5mm. Solid objects exceeding 2.5mm in diameter.
4	Protected against solid objects greater than 1.0mm	Wires, or strips of thickness greater than 1.0mm. Solid objects exceeding 1.0mm in diameter.
5	Dust-protected	Ingress of dust is not totally prevented but does not enter in sufficient quantity to interfere with satisfactory operation of the equipment.
6	Dust-tight	No ingress of dust.

IP Enclosure - Second Numeral

2nd Numeral	Degree of Protection	
	Short Description	Definition
0	Non-protected	No special protection
1	Protected against dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	Protected against dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at any angle up to 15° from its normal position.
3	Protected against spraying water	Water falling as a spray at an angle up to 60° from the vertical shall have no harmful effect.
4	Protected against splashing water	Water sprayed against the enclosure from any direction shall have no harmful effect.
5	Protected against water jets	Water projected by a nozzle against the enclosure from any direction shall have no harmful effect.
6	Projected against heavy seas	Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities.
7	Protected against the effects of immersion	Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time.

NEMA and UL Standards

The North American Electrical Manufacturers Association (NEMA) and Underwriters Laboratories Inc. (UL) enclosure standards designate by means of a type number the environmental conditions for which an enclosure is suitable. A particular enclosure may have more than one type number.

The table below summarizes the type designations of NEMA 250; the designators specified by UL50 and UL508 are substantially the same, with differences of detail only in the description; for further information, reference should be made to the standard specification.

NEMA Standards 250 1.109. 1979

Type Designation	Intended Use and Description
1	Enclosure intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.
2	Enclosure intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.
3	Enclosure intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet and external ice formation.
3R	Enclosure intended for outdoor use primarily to provide a degree of protection against falling rain, sleet and external ice formation.
4	Enclosure intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water and hose-directed water.
4X	Enclosure intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water and hose-directed water.
12	Enclosure intended for indoor use primarily to provide a degree of protection against dust, falling dirt and dripping non-corrosive liquid.
13	Enclosure intended for outdoor use primarily to provide a degree of protection against dust, spraying water, oil and non-corrosive liquid.

Comparison of NEMA Type Numbers to IEC Classification Designations

Not to be used to convert IEC Classifications Designations to NEMA Numbers

NEMA Enclosure Type Number	IEC Enclosure Classification Designation
1	IP10
2	IP11
3	IP54
3R	IP14
3S	IP54
4 and 4X	IP56
5	IP52
6 and 6P	IP 67
12 and 12K	IP 52
13	IP54

Note:This comparison is based on tests specified in IEC Publication 529; 1976.

Electrical Formulae

Electrical Quantities

Quantity	Symbol	Unit Name	Unit Symbol
Electromotive force	E, e*	Volt	V
Potential difference	V, v*	Volt	V
Current	I, i*	Ampere	A
Magnetic flux	Φ	Weber	Weber
Frequency	f	Hertz	Hz
Flux linkage	λ	Weber-turns	-
Resistance	R	Ohm	Ω
Inductance	L	Henry	H
Capacitance	C	Farad	F
Impedance	Z	Ohm	Ω
Reactance	X	Ohm	Ω
Power,dc,or active	P	Watt	W
Power, reactive	Q	Volt-ampere reactive	VAr, var
Power, total or apparent	S	Volt-ampere	VA
Power factor angle	φ	-	°, deg.
Angular velocity	ω	Radians per second	$rads^{-1}$
Rotational velocity	n	Revolutions per second	s^{-1} ,rev s^{-1}
		Revolutions per minute	min^{-1}, rpm
Efficiency	η	-	
Number of pairs of poles	p	-	

** Capital and small letters designate rms and instantaneous value respectively.*

AC Single-Phase

All quantities r.m.s. values:

$V = I\ Z$

Total or apparent power in VA = $V_I = I^2Z = V^2/Z$

Active power in watts, W = $V_I \cos \varphi$

Reactive power in VAr = $V_I \sin \varphi$

AC Three-Phase

(Assuming Balanced Symmetrical Waveform)

All quantities r.m.s values:

V_l = Line-to-line voltage

V_p = Phase voltage (line-to-neutral)

I_l = line current (wye)

I_p = Phase current (delta)

In a WYE connected circuit, $V_p = V_l/\sqrt{3}$, $V_l = \sqrt{3}V_p$, $I_l = I_p$

In a DELTA connected circuit: $I_p = I_l/\sqrt{3}$, $I_l = \sqrt{3}\ I_p$ $V_l = V_p$

Total of apparent power in VA = $\sqrt{3}\ V_l\ I_l$

Active power in watts,W = $\sqrt{3}\ V_l I_l \cos \varphi$

Reactive power in VAr = $\sqrt{3}\ V_l\ I_l \sin \varphi$

Power factor (pf) = $\cos \varphi$

= Active power / Apparent power

= W / VAr

Three-Phase Induction Motors

All quantities rms values:

kW_{mech} = horsepower x 0.746

$kW_{elec} = \sqrt{3}\ V_l\ I_l \cos \varphi$ at rated speed and load

where V_l = supply voltage I_l = rated full load current

$\cos \varphi$ = rated full load power factor

Efficiency, $\eta = (kW_{mech} / kW_{elec}) \times 100$ per cent

Phase current $I_p = I_l$ for wye connection

$I_p = I_l/\sqrt{3}$ for delta connection

Loads (phase values)

Resistance R, measured in Ohms (no energy storage)

Inductive reactance, $X_L = \omega L = 2\pi fL$ Ohms (stores energy)

Where f = frequency (Hz), L = Inductance (H)

Capacitative reactance, $X_C = 1/(\omega C) = 1/(2\pi fC)$

Where f = frequency (Hz), C = Capacitance (F)

Impedance

Impedance is the algebraic sum of the separate load values thus:

$$Z = \sqrt{(R^2 + X_L^2)} \text{ or } \sqrt{(R^2 + X_C^2)}$$

If R, X_L and X_C are present in series in the same circuit then X_L and X_C may be summated, treating X_C as negative, thus

$$Z = \sqrt{(R^2 + (X_L - X_C)^2)}$$

Electrical Formulae

Ohms Law

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}} \quad \text{or} \quad \text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{or} \quad \text{Volts} = \text{Amperes} \times \text{Ohms}$$

Power in DC Circuits

$$\text{Horsepower} = \frac{\text{Volts} \times \text{Amperes}}{746}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

$$\text{Kilowatts} = \frac{\text{Volts} \times \text{Amperes}}{1{,}000}$$

$$\text{Kilowatts-Hours} = \frac{\text{Volts} \times \text{Amperes} \times \text{Hours}}{1{,}000}$$

Power in AC Circuits

Kilovolt-Amperes (KVA):

$$\text{kVA (1Ø)} = \frac{\text{Volts} \times \text{Amperes}}{1{,}000}$$

$$\text{kVA (3Ø)} = \frac{\text{Volts} \times \text{Amperes} \times 1.73}{1{,}000}$$

Kilowatts (Kw)

$$\text{kW (1Ø)} = \frac{\text{Volts} \times \text{Amperes} \times \text{Power Factor}}{1{,}000}$$

$$\text{kW (3Ø)} = \frac{\text{Volts} \times \text{Amperes} \times \text{Power Factor} \times 1.73}{1{,}000}$$

$$\text{Power Factor} = \frac{\text{Kilowatts}}{\text{Kilovolts} \times \text{Amperes}}$$

Other Useful Formulae

Three-Phase (3Ø) Circuits

$$\text{HP} = \frac{E \times I \times \sqrt{3} \times \text{Eff} \times \text{PF}}{746}$$

$$\text{Motor Amps} = \frac{\text{HP} \times 746}{E \times \sqrt{3} \times \text{Eff} \times \text{PF}}$$

$$\text{Motor Amps} = \frac{\text{kVA} \times 1000}{\sqrt{3} \times E}$$

$$\text{Motor Amps} = \frac{\text{kW} \times 1000}{\sqrt{3} \times E \times \text{PF}}$$

$$\text{Power Factor} = \frac{\text{kW} \times 1000}{E \times I \times \sqrt{3}}$$

$$\text{Kilowatt Hours} = \frac{E \times I \times \text{Hours} \times \sqrt{3} \times \text{PF}}{1000}$$

$$\text{Power (Watts)} = E \times I \times \sqrt{3} \times \text{PF}$$

Mechanical Variables

Material Densities		
Materials	**lb/in^3**	**gm/cm^3**
Aluminum	0.096	2.66
Brass	0.299	8.3
Bronze	0.295	8.17
Copper	0.322	8.91
Hard Wood	0.029	0.8
Soft Wood	0.018	0.48
Plastic	0.04	1.11
Glass	0.079-0.090	2.2-2.5
Titanium	0.163	4.51
Paper	0.025-0.043	0.7-1.2
Polyvinyl chloride	0.047-0.050	1.3-1.4
Rubber	0.033-0.036	0.92-0.99
Silicone Rubber, without filler	0.043	1.2
Cast Iron, gray	0.274	7.6
Steel	0.28	7.75

Friction Coefficients Ffr=μWL	
Materials	**μ**
Steel on Steel (greased)	~0.15
Plastic on Steel	~0.15-0.25
Copper on Steel	~0.30
Brass on Steel	~0.35
Aluminum on Steel	~0.45
Steel on Steel	~0.58
Mechanism	μ
Ball Bushings	<0.001
Linear Bearings	<0.001
Dove-tail Slides	~0.2++
Gibb Ways	~0.5++

Mechanism Efficiencies	
Acme screw with brass nut	~0.35-0.65
Acme screw with plastic nut	~0.50-0.85
Ballscrew	~0.85-0.95
Chain and Sprocket	~0.95-0.98
Preloaded Ballscrew	~0.75-0.85
Spur or Bevel gears	~0.90
Timing Belts	~0.96-0.98
Worm Gears	~0.45-0.85
Helical Gear (1 reduction)	~0.92

Mechanical Formulae

Term	Description	Unit
d	Diameter	m
F	Force	N
g	Acceleration due to gravity	ms^{-2}
J	Total inertia	kgm^2
J_L	Load inertia	kgm^2
J_M	Motor inertia	kgm^2
m	Mass	kg
M	Motor torque	Nm
M_a	Accelerating torque	Nm
M_L	Load torque	Nm
n	Rotational frequency	rpm*
$n1$	- input	rpm*
$n2$	- output	rpm*
Δn	Change of rotational frequency	rpm*
p	Pitch	m
P	Motor power	kW
P_a	Accelerating power	kW
P_L	Load power absorbed	kW
r	Radius	m
s	Distance	m
t	Acceleration time	s
Δt	Acceleration period	s
v	Linear velocity	m/min*
Δv	Change of linear velocity	m/min*
V	Traction capacity	M^3s^{-1}
W	Energy	J (Joule)
η	Efficiency	-
μ	Coefficient of friction	-

Note: For practical convenience, some of the units in the formulae following are not S1 units; for example, rotational frequency is commonly measured in revolutions per minute, although the S1 unit is revolutions per second. In these Servo Formulae, the terms used are as tabulated above.Those which are in non-S1 units are marked *.

Linear Motion

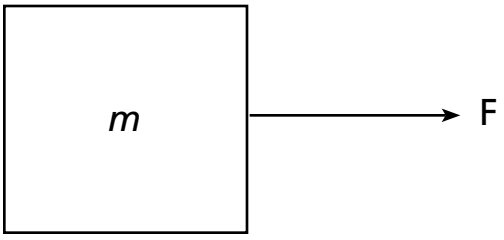


Fig. A

Consider a body mass m acted upon by a single force F, Fig A. The body accelerates in the direction in which the force is acting, at a rate given by:

$$A = F/m$$

After a time t has elapsed, the body has achieved a velocity v, where:

$$v = u + at$$

(u is the initial velocity, before the force F was applied. If the body was initially at rest, u is zero)

The distance, s, travelled by the body during time t is

$$s = ut + at^2/2$$

Distance and velocity are related by the following equation, derived from the two previous ones:

$$v^2 - u^2 = 2as$$

The work done by the force in accelerating the body is the product of force and distance:

$$W = Fs$$

The kinetic energy of the body, ie the energy which it possesses by virtue of its motion, is the product of its mass and the square of its velocity:

$$E_k = mv^2/2$$

Furthermore, since energy is conserved, the work done by the force is equal to the change in the body's kinetic energy (neglecting losses):

$$W = m(v^2 - u^2)/2$$

Power is the rate at which work is done, therefore it is the product of force and velocity:

$$P = Fv$$

Rotational or Angular Motion

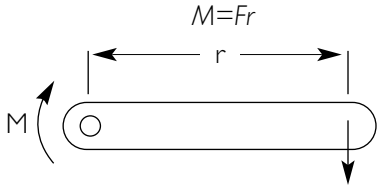


Fig A.11
The concept of torque

A force acting perpendicular to a pivoted lever, Fig A.11, causes a turning effect or torque at the fulcrum. The torque is the product of the force and the radius at which it is applied.

$$M = Fr$$

If a torque is applied to a body which is free to rotate, as in Fig A.12, an acceleration results in a way which is analogous to the example of linear motion above. Indeed a similarity will be noticed between the equations of motion.

Any body which is capable of rotating possesses a property known as Moment of Inertia which tends to resist acceleration in the same way as does the mass of a body in linear motion. The moment of inertia is related not only to the mass of the body, but also to the distribution of that mass with respect to radius.

The moment of inertia of a solid cylinder of radius r is given by:

$$J = mr^2/2$$

By comparison, the moment of inertia of a hollow cylinder, of inner and outer radii respectively, is as follows:

$$J = m(r_o^2 - r_i^2)/2$$

It can be seen that, for a given outer radius, the moment of inertia of a hollow cylinder is greater than that of a solid cylinder of the same mass. In Fig A.12, a body having a moment of inertia J is acted upon by a torque M. Its angular acceleration is:

$$\alpha = M/J$$

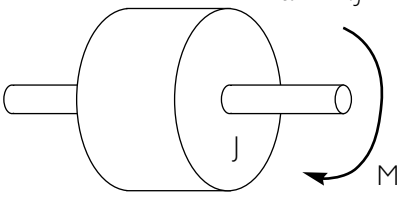


Fig A.12
The Action of torque on a body

After a time t has elapsed, the angular velocity, ω (rate of change of angle) is given by:

$$\omega = \omega_o + \alpha t$$

(wo is the initial angular velocity, before the torque M was applied. If the body was initially at rest, ω_o is zero)

The angle, g, through which the body rotates in time t is:

$$\gamma = \omega_o t + \alpha t^2/2$$

Angle and angular velocity are related by the following equation:

$$\omega^2 - \omega_o^2 = 2\alpha\gamma$$

The work done in accelerating the body is the product of torque and angle of rotation:

$$W = M\gamma$$

The kinetic energy of the body is the product of its moment of inertia and the square of its angular velocity:

$$E_k = J\omega^2/2$$

Since energy is conserved, the work done is equal to the change in kinetic energy (neglecting losses):

$$W = J(\omega^2 - \omega_o^2)/2$$

Power is the product of torque and angular velocity, i.e. the rate at which work is being done:

$$P = M\omega$$

Relationship between linear and angular motion

Consider a body of mass *m* moving in a circle of radius *r* with an angular velocity ω, Fig A.13.

When the body has rotated through an angle γ, it has covered a distance *s* along circumference of the circle, where:

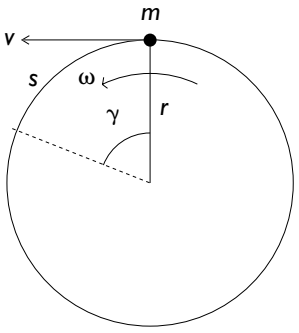


Fig A.13
Relationship between linear and angular motion

Similarly, the tangential velocity or peripheral speed v, being the quotient of distance and time, is given by:

$$v = s/t = \gamma r/t$$

Angular velocity w is the quotient of angle and time;

$$w = \gamma/t$$

Therefore

$$v = wr$$

Similarly, for acceleration:

$$a = v/t = wr/t$$

$$\alpha = w$$

Therefore

$$a = \alpha r$$

The moment of inertia is given by

$$J = mr^2$$

Motor Application Formulae

Calculating Horsepower

Once the machine torque requirement is determined, horsepower can be calculated using the formula:

$$HP = \frac{T \times N}{5{,}250}$$

where,

HP = Horsepower
T = Torque (ft-lb)
N = Base speed of motor (rpm)

If the calculated horsepower falls between standard available motor ratings, select the higher available horsepower rating. It is good practice to allow some margin when selecting the motor horsepower.

For many applications, it is possible to calculate the horsepower required without actually measuring the torque required. The following useful formulae will help:

Conveyors

$$HP\ (\text{Vertical}) = \frac{\text{Weight (lb)} \times \text{Velocity (FPM)}}{33{,}000}$$

$$HP\ (\text{Horizontal}) = \frac{\text{Weight (lb)} \times \text{Velocity (FPM)} \times \text{Coefficient of Friction}}{33{,}000}$$

Web Transport Systems and Surface Winders

$$HP = \frac{\text{Tension (lb)} \times \text{Velocity (FPM)}}{33{,}000}$$

Note: The tension value used in this calculation is the actual web tension for surface winder applications. For sectional drives, it is the tension differential: downstream tension – upstream tension.

Center Winders (Control to Base Speed Only)

$$HP = \frac{\text{Tension (lb)} \times \text{Line Speed (FPM)} \times \text{Buildup}}{33{,}000 \times \text{Taper}}$$

Center Winders (Field Control)

If Taper x Field Range $\geq$ Buildup, then,

$$HP = \frac{\text{Tension (lb)} \times \text{Line Speed (FPM)}}{33{,}000}$$

If Taper x Field Range $\leq$ Buildup, then,

$$HP = \frac{\text{Tension (lb)} \times \text{Line Speed (FPM)} \times \text{Buildup}}{33{,}000 \times \text{Taper} \times \text{Field Range}}$$

NOTE: The preceding formulae for calculating horsepower do not include any allowance for machine function windage or other factors. These factors must be considered when selecting a drive for a machine application.

Fans and Blowers

$$HP = \frac{\text{CFM} \times \text{Pressure (lb/ft}^2\text{)}}{33{,}000 \times \text{Efficiency of Fan}}$$

Effect of Speed on HP:

$HP = K_1 (RPM)^3$ — Horsepower varies as the 3rd power of power of speed.

$T = K_2 (RPM)^2$ — Torque varies as the 2nd power of speed

$Flow = K_3 (RPM)$ — Flow varies directly as the speed

$$HP = \frac{\text{CFM} \times \text{Pressure (lb/in}^2\text{)}}{229 \times \text{Efficiency of Fan}}$$

$$HP = \frac{\text{CFM} \times \text{Inches of Water Gauge}}{6356 \times \text{Efficiency of Fan}}$$

Pumps

$$HP = \frac{\text{GPM} \times \text{Head (ft)} \times \text{Specific Gravity}}{3960 \times \%\ \text{Efficiency of Pump}}$$

Specific Gravity of Water = 1.0
1 ft^3 per sec. = 448 GPM
1 PSI = A head of 2.309 ft for water weighing 62.36 lb/ft^3 at 62°F

Constant Displacement Pumps

Effect of Speed on HP:

$HP = K (RPM)$ — Horsepower and capacity vary directly as the speed.

Displacement pumps under constant head require approximately constant torque at all speeds.

Centrifugal Pumps

Effect of Speed on HP:

$HP = K_1 (RPM)^3$ — Horsepower varies as the 3rd power of speed.

$T = K_2 (RPM)^2$ — Torque varies as the 2nd power of speed.

$Flow = K_3 (RPM)$ — Flow varies directly as the speed.

Efficiency:

500 to 1,000 gal/min	= 70% to 75%
1,000 to 1,500 gal/min	= 75% to 80%
Larger than 1,500 gal/min	= 80% to 85%

Displacement pumps may vary between 50% and 80% efficiency, depending on size of pumps.

Mechanical Conversion Table

Length

	mm	cm	m	inch	foot	yard	km	Mile
mm	1	10^{-1}	10^{-3}	3.937×10^{-2}	3.280×10^{-3}	1.093×10^{-3}	10^{-6}	6.213×10^{-7}
cm	10	1	10^{-2}	3.937×10^{-1}	3.280×10^{-2}	1.093×10^{-2}	10^{-5}	6.213×10^{-6}
m	1000	100	1	39.370	3.28084	1.09361	10^{-3}	6.213×10^{-4}
Inch	25.4	2.54	2.54×10^{-2}	1	8.333×10^{-2}	2.777×10^{-2}	2.54×10^{-5}	1.578×10^{-5}
foot	304.8	30.48	3.048×10^{-1}	12	1	3.333×10^{-1}	3.048×10^{-4}	1.893×10^{-4}
yard	914.4	91.44	9.144×10^{-1}	36	3	1	9.144×10^{-4}	5.681×10^{-4}
km	10^{6}	10^{5}	1000	39370.1	3280.84	1093.61	1	6.213×10^{-1}
mile	1.609×10^{6}	160934	1609.34	63360	5280	1760	1.609	1

Mass

	g	kg	oz	lb	US ton
g	1	10^{-3}	3.5274×10^{-2}	2.204×10^{-3}	1.102×10^{-6}
kg	1000	1	35.274	2.20462	1.102×10^{-3}
oz	28.2495	2.835×10^{-2}	1	6.25×10^{-2}	3.125×10^{-5}
lb	453.592	4.536×10^{-1}	16	1	5×10^{-4}
US ton	907185	907.185	32	2000	1

Energy

	J	Wh	kp m	k cal	BTU
J	1	2778×10^{-4}	1.019×10^{-1}	2.388×10^{-4}	9.478×10^{-4}
Wh	3600	1	367.098	8.598×10^{-1}	3.412
kp m	9.807	2.724×10^{-3}	1	2.342×10^{-3}	9.295×10^{-3}
k cal	4186.8	1.163	426.935	1	3.968
BTU	1055.06	$2.93\ 1 \times 10^{-1}$	107.586	2.519×10^{-1}	1

Area

	cm^2	m^2	are	hect.	km^2	$inch^2$	$foot^2$	$yard^2$	$mile^2$	acre
cm^2	1	10^{-4}	10^{-6}	10^{-8}	10^{-10}	1.55×10^{-1}	1.076×10^{-3}	1.196×10^{-4}	3.861×10^{-11}	2.471×10^{-8}
m^2	10000	1	10^{-2}	10^{-4}	10^{-6}	1550	10.7639	1.19599	3.861×10^{-7}	2.471×10^{-4}
are	10^{6}	100	1	10^{-2}	10^{-4}	155000	1076.39	119599	3.861×10^{-5}	2.471×10^{-2}
hectare	10^{8}	10000	100	1	10^{-2}	1.55×10^{7}	107639	11959.9	3.861×10^{-3}	2.47105
km^2	10^{10}	10^{6}	10000	100	1	1.55×10^{9}	1.076×10^{7}	1.196×10^{6}	3.861×10^{-1}	247.105
$inch^2$	6.4516	6.4516×10^{-4}	6.4516×10^{-6}	6.4516×10^{-8}	6.4516×10^{-10}	1	6.944×10^{-3}	7.716×10^{-4}	2.491×10^{-10}	1.594×10^{-7}
$foot^2$	929.03	9.2903×10^{-2}	9.2903×10^{-4}	9.2903×10^{-6}	9.2903×10^{-8}	144	1	1.1111×10^{-1}	3.587×10^{-8}	2.295×10^{-5}
$yard^2$	8.36127	8.36127×10^{-1}	8.36127×10^{-3}	8.36127×10^{-5}	8.36127×10^{-7}	1296	9	1	3.228×10^{-7}	2.066×10^{-4}
$mile^2$	2.589×10^{10}	2.589×10^{6}	25899.9	258.999	2.58999	4.014×10^{9}	2.787×10^{7}	2.0976×10^{6}	1	640
acre	4.046×10^{7}	4046.86	40.4686	4.04686×10^{-1}	4.04686×10^{-3}	6.272×106	43560	4840	1.5625×10^{-3}	1

Volume

	cm^3	dm^3 (=litre)	$inch^3$	$foot^3$	$yard^3$	US fl oz	Imp fl oz	US gal	Imp gal	Imp pint
cm^3	1	10^{-3}	6.102×10^{-2}	3.531×10^{-5}	1.308×10^{-6}	3.3814×10^{-2}	3.519×10^{-2}	2.641×10^{-4}	2.199×10^{-4}	1.759×10^{-3}
dm^3	1000	1	61.0237	3.531×10^{-2}	1.308×10^{-3}	33.814	35.1951	2.641×10^{-1}	2.199×10^{-1}	1.75975
$inch^3$	16.3871	1.638×10^{-2}	1	5.787×10^{-4}	2.143×10^{-5}	5.541×10^{-1}	5.767×10^{-1}	4.329×10^{-3}	3.604×10^{-3}	2.883×10^{-2}
$foot^3$	28316.8	28.3168	1728	1	3.7037×10^{2}	957.506	996.614	7.48052	6.22884	49.8307
$yard^3$	764555	764.555	46656	27	1	25852.7	26.908.6	201.974	168.179	1345.43
US fl oz	29.5735	2.957×10^{-2}	1.80469	1.044×10^{-3}	3.868×10^{-5}	1	1.04084	7.8125×10^{-3}	6.505×10^{-3}	5.204×10^{-2}
Imp fl oz	28.4131	2.841×10^{-2}	1.73387	1.003×10^{-3}	3.716×10^{-5}	9.6076×10^{-1}	1	7.506×10^{-3}	6.25×10^{-3}	5×10^{-2}
US gal	3785.41	3.78541	231	1.336×10^{-1}	4.951×10^{-3}	128	133.228	1	8.326×10^{-1}	6.66139
Imp gal	4546.09	4.54609	277.149	1.605×10^{-1}	5.946×10^{-3}	153.772	160	1.20095	1	8
Imp pint	568.261	5.682×10^{-1}	34.6774	2.0068×10^{-2}	7.432×10^{-4}	19.2152	20	1.501×10^{-1}	1.25×10^{-1}	1

CONTROL TECHNIQUES

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Inertia

	kg cm^2	kp cm s^2	kg m^2	kp m s^2	oz in^2	oz in s^2	lb in^2	lb in s^2	lb ft^2	lb ft s^2
kg cm^2	1	1.019×10^{-3}	10^{-4}	1.019×10^{-5}	5.467	1.416×10^{-2}	3.417×10^{-1}	8.850×10^{-4}	2.373×10^{-3}	7.375×10^{-5}
kp cm s^2	980.665	1	9.806×10^{-12}	10^{-2}	5361.76	13.8874	335.11	8.679×10^{-1}	2.32715	7.233×10^{-2}
kg m^2	10^4	10.1927	1	1.019×10^{-1}	54674.8	141.612	3417.17	8.851	23.7304	7.375×10^{-1}
kp m s^2	98066.5	100	9.86065	1	536176	1388.74	33.511	86.796	232.715	7.23301
oz in^2	1.829×10^{-1}	1.865×10^{-4}	1.829×10^{-5}	1.865×10^{-6}	1	2.590×10^{-3}	6.25×10^{-2}	1.6188×10^{-4}	2.340×10^{-4}	7.349×10^{-5}
oz in s^2	70.6155	7.201×10^{-2}	7.061×10^{-3}	7.200×10^{-4}	386.089	1	24.1305	6.25×10^{-2}	1.675×10^{-1}	5.208×10^{-3}
lb in^2	2.926	2.984×10^{-3}	2.9264×10^{-4}	2.984×10^{-5}	16	4.144×10^{-2}	1	2.590×10^{-3}	6.944×10^{-3}	2.1548×10^{-4}
lb in s^2	1129.85	1.15212	1.29×10^{-1}	1.152×10^{-2}	6177.42	16	386.089	1	2.68117	8.333×10^{-2}
lb ft^2	421.401	4.297×10^{-1}	4.214×10^{-2}	4.2971×10^{-3}	2304	5.96754	144	3.729×10^{-1}	1	3.108×10^{-2}
lb ft s^2	13558.2	13.826	1.355	1.382×10^{-1}	74129	192	4633.06	12	32.174	1

Torque

	N cm	Nm	kp cm	kp m	p cm	oz in	in lb	ft lb
N cm	1	10-2	1.019×10^{-1}	1.019×10^{-3}	101.972	1.41612	8.850×10^{-2}	7.375×10^{-3}
Nm	100	1	10.1972	1.019×10^{-1}	10197.2	141.612	8.851	7.375×10^{-1}
kp cm	9.80665	9.806×10^{-2}	1	10^{-2}	1000	13.8874	8.679×10^{-1}	7.233×10^{-2}
kp m	980.665	9.80665	100	1	10^5	1388.74	86.7962	7.233
p cm	9.806×10^{-3}	9.806×10^{-5}	10^{-3}	10^{-5}	1	1.388×10^{-2}	8.679×10^{-4}	7.233×10^{-5}
oz in	7.061×10^{-1}	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.0078	1	6.25×10^{-2}	5.208×10^{-3}
in lb	11.2985	1.129×10^{-1}	1.15212	1.152×10^{-2}	1152.12	16	1	8.333×10^{-2}
ft lb	135.582	1.35582	13.8225	1.382×10^{-1}	13825.5	192	12	1

Force

	N	kp	p	oz	lbf
N	1	1.019×10^{-1}	101.972	3.59694	2.248×10^{-1}
kp	9.80665	1	1000	35.274	2.20462
p	9.806×10^{-3}	10^{-3}	1	3.5274×10^{-2}	2.204×10^{-3}
oz	2.780×10^{-1}	2.835×10^{-2}	28.3595	1	6.25×10^{-2}
lbf	4.44822	4.536×10^{-1}	453.592	16	1

Power

	kW	PS	hp	kp m s^{-1}	kcal s^{-1}
kW	1	1.35962	1.34102	101972	2.388×10^{-1}
PS	7.355×10^{-1}	1	9.8632×10^{-1}	75	1.756×10^{-1}
hp	7.457×10^{-1}	1.01387	1	76.0402	1.781×10^{-1}
kp ms^{-1}	9.806×10^{-3}	1.333×10^{-2}	1.35 15 $\times 10^{-2}$	1	2.342×10^{-3}
$kcals^{-1}$	4.1868	5.69246	5.61459	426.935	1

General Conversation Tables

Length

SI UNIT - meter (m)		
To convert from:	**To:**	**Multiply by:**
Mile	m	1609.344
Nautical Mile	m	1853
km	m	10^{3}
cm	m	10^{-2}
mm	m	10^{-3}
yd	m	0.914
ft	m	0.305
in	m	2.54×10^{-2}
mil	m	2.54×10^{-5}

Area

SI UNIT - square meter (m^2)		
To convert from:	**To:**	**Multiply by:**
Square Miles	m^2	2.59×10^{6}
Acre	m^2	4047
Hectare ha	m^2	10^{4}
Km^2 (sq. km)	m^2	10^{6}
cm^2	m^2	10^{-4}
mm^2	m^2	10^{-6}
yd^2	m^2	0.836
ft^2	m^2	9.29×10^{-2}
in^2	m^2	6.45×10^{-4}
mil^2	m^2	6.45×10^{-10}

Volume

SI UNIT - cubic meter (m^3)		
To convert from:	**To:**	**Multiply by:**
yd^3	m^3	0.765
ft^3	m^3	2.83×10^{-2}
in^3	m^3	1.64×10^{-4}
dm^3	m^3	10^{-3}
Litre	m^3	10^{-3}
Gallon (Imperial)	m^3	4.55×10^{-3}
Gallon (U.S.)	m^3	3.79×10^{-3}
Pint (Imperial)	m^3	5.68×10^{-4}
Pint (U.S.)	m^3	4.73×10^{-4}

Mass

SI UNIT - kilogram (kg)		
To convert from:	**To:**	**Multiply by:**
ton (Imperial)	kg	1016
ton (U.S.)	kg	907.2
tonne (metric)	kg	10^{3}
slug	kg	14.59
lb	kg	0.454
oz	kg	2.84×10^{-2}
g	kg	10^{-3}

Force and Weight

SI UNIT - Newton (N)		
To convert from:	**To:**	**Multiply by:**
tonf (ton wt)	N	9964
lbf (lb wt)	N	4.448
poundal	N	0.138
ozf (oz wt)	N	0.278
kp	N	9.807
p	N	9.81×10^{-2}
kgf (kg wt)	N	9.807
gf (g wt)	N	9.81×10^{-2}
dyn	N	10^{-5}

Pressure and Stress

SI UNIT - Pascal (Pa)		
To convert from:	**To:**	**Multiply by:**
at (technical atmosphere)	Pa	9.81×10^{3}
in WG	Pa	248.9
mm WG	Pa	10.34
in HG	Pa	3385
mm HG (torr)	Pa	131
kp cm^{-2}	Pa	9.81×10^{3}
Nm^{-2}	Pa	1
bar	Pa	10^{5}
lbf ft^{-2}	Pa	47.88
lbf in^{-2}	Pa	6895
kgf m^{-2}	Pa	9.807
kgf cm^{-2}	Pa	9.81×10^{4}

Velocity (Linear)

SI UNIT - meter per second (ms^{-1})		
To convert from:	**To:**	**Multiply by:**
mph (mile per hour)	ms^{-1}	0.447
ft min^{-1}	ms^{-1}	5.08×10^{-3}
fts^{-1}	ms^{-1}	0.305
km h^{-1}	ms^{-1}	0.278
m min^{-1}	ms^{-1}	1.67×10^{-2}
knot	ms^{-1}	0.515

Velocity (Angular)

SI UNIT - radians per second (rad s-1)		
To convert from:	**To:**	**Multiply by:**
rpm (revolutions per min)	$rads^{-1}$	0.1037 ($2\pi/60$)
rs^{-1} (revolutions per sec)	$rads^{-1}$	6.283 (2π)
$°s^{-1}$ (degrees per sec)	$rads^{-1}$	1.75×10^{-2} ($2\pi/360$)

Torque

SI UNIT - Newton meter (Nm)		
To convert from:	**To:**	**Multiply by:**
lbf ft	Nm	1.356
lbf in	Nm	0.113
ozf in	Nm	7.062×10^{-3}
kgf m	Nm	9.807
kp m	Nm	9.807

Energy

SI UNIT - Joule (J)		
To convert from:	**To:**	**Multiply by:**
Btu	J	1.055×10^{3}
therm (10^5 btu)	J	1.055×10^{8}
cal	J	4.187
ft lbf (ft lb wt)	J	1.356
ft poundal	J	0.042

Power

SI UNIT - kilowatt (kW)		
To convert from:	**To:**	**Multiply by:**
hp	kW	0.746
ps	kW	0.736
ch, CV	kW	0.736
Btu s^{-1}	kW	1.055
kcal s^{-1}	kW	4.187
ft lbf s^{-1}	kW	1.36×10^{-3}

Force

SI UNIT - Newton (N)		
To convert from:	To:	Multiply by:
lb(f)	N	4.448
N	lb(f)	0.225

Moment of Inertia

SI UNIT - Kilogram meter² (kgm^2)		
To convert from:	**To:**	**Multiply by:**
lb in s^2	kgm^2	0.113
oz in s^2	kgm^2	7.06155×10^{-2}
kg m^2	lb in s^2	8.85075
kg m^2	oz in s^2	141.612
kg cm^2	kgm^2	10^{-4}
kgf m^2 (GD^2)	kgm^2	0.25
lbf ft^2 (WK^2)	kgm^2	4.21×10^{-2}
kp m s^2	kgm^2	9.807
ft lbf s^2	kgm^2	1.356
lbf in^2	kgm^2	2.926×10^{-4}
ozf in^2	kgm^2	1.829×10^{-5}

Temperature

SI UNIT - Kelvin (K)		
To convert from:	**To:**	**Multiply by:**
°C	K	x 1
t°C	K	t+273.15
°F	K	x 0.5555
t°F	K	(t-32) x 0.5555

Flow

SI UNIT - cubic meter per second (m^3s^{-1})		
To convert from:	**To:**	**Multiply by:**
gallon per hour (Imp)	m^3s^{-1}	1.26×10^{-6}
gallon per hour (US)	m^3s^{-1}	1.05×10^{-6}
litre per hour	m^3s^{-1}	1.67×10^{-5}
litre per second	m^3s^{-1}	10^{-3}
cfm	m^3s^{-1}	4.72×10^{-4}
m^3h^{-1}	m^3s^{-1}	2.78×10^{-4}
m^3min^{-1}	m^3s^{-1}	1.67×10^{-2}

Torque

SI UNIT - Newton meter (Nm)		
To convert from:	**To:**	**Multiply by:**
lb ft	Nm	1.356
lb in	Nm	0.113
oz in	Nm	7.062×10^{-3}
Nm	lb ft	0.738
Nm	lb ft	8.857
Nm	oz in	141.6

Linear Acceleration

SI UNIT - meter per second² (ms^{-2})		
To convert from:	**To:**	**Multiply by:**
ins^{-2}	ms^{-2}	2.54×10^{-2}
fts^{-2}	ms^{-2}	0.305
ms^{-2}	ins^{-2}	39.37
ms^{-2}	fts^{-2}	3.281

Part Number Index

The identifying part number or part number prefix is provided to assist users in finding the key page(s) in the catalog where the product is found.

Order Code	Catalog Page Number
8200	421
8800	422
96030	135
005-xxxx	329
005-xxxx	421
055xxxxxx	230-239
075xxxxxx	230-239
115xxxxxx	230-239
142xxxxxx	230-239
190xxxxxx	230-239
21xx	286
22xx	296
23xx	288
26xx	291
30Hxxxxxx	260
3100-MCM	200
3150-MCM	200
3251-xxxx	73
32Hxxxxxx	257
392x-xx	268
4200-xxxx	423
870-13xx	257, 260, 262
870-14xx	267
870-15xx	267
92xxxxxx	299
93xxxxxx	301
9500-0078	13
9500-8xxx	310-314
9500-8xxxxxx	317
9500-903	316
9500-9100	315
95xxxxxx	230-239
9729-xxxx	315
ACCU-Torq	85-87
BRM-1	135
CBOX	37, 50, 74, 83
CBxx-xxx	400
CDRO	402
CGP-Keypad-Plus	44, 50
CGP-SmartCard	44, 50
CGPxxxx	46-47
CMDO	402
CMDS	403
CMDX	402
CMxx-xxx	400
Commander GP20	40-51
Commander SK	24-39
Commander SL	10-13
Commander SX	14-23
CSX(i)	256-258
CT COMMS CABLE	13, 22, 50, 73, 83
CTD-xx-xxx	395
CTIU	135
CTNET	156, 380-383
CTOPC Server	374
CTSCOPE	346
CTSIZE	372
CTSOFT	35, 50, 77, 334
CTSYNC	156, 384
CT-USB-CABLE	13, 22, 50, 73, 83
CTVUE	135
CTVue	392
CTVue-MME-xxx	402
DB	135

Order Code	Catalog Page Number
DB9	399
DBR	416-420
DDC-xxx	400
DDS	402
DExxxxxxx	328
Digitax ST	98-120
DPxxxxxxx	328
DST1xxxx	111, 113-120
DST-KEYPAD	72, 394
DY5	268
EIO26-xxx	400
EMX3	262-266
EN	176-190
ENCO-xxx	86
Energy Savings	373
EP2	136-146
EP-B	124
EP-I	126
EP-IDN	131
EP-P	128-130
EP-PDN	131
Epsilon EP	122-146
ETH-	219
E-XXX	147
FM Motors	230-239
FM-x	214-219
FS 6376-16-07	22
GP20	40-51
I/O BOX	316
ISM2	259-261
LDx-xxx	428
LExxxxxxxxxx	334
LogicStick	38, 39
LRx-xxx	428
M25-14M to M1850R-14M	306-309
MC	155, 220-227
MC-CEN	402
MC-CEP	400
MD-2x	315
MD-4	197-199
MDS	191-213
MD-xxx	197-199
Mentor	306-309
MentorSoft	344
MG Motors	248-250
MH Motors	251-253
MLP	135
Modbus RTU	all drives, 376
MotionPerfect2	370
MP-xxx	197-199
NT Motors	240-243
OIT	135
OIT-EN-232	402
One Source	389
P2x to P7x	227
PBC-xxx	219
PIM-xxxxx	261, 262
Position Tracker	132
PowerTools Pro	348-360
PSxxx-xxx	400
PX	22-23
Quamtum	310-314
RB-xxxxx	399
RCxxxxxx	322-324
RFC	44
RJ45-5	399
RSxxxxxx	322-324
Safe Torque Off	56
SCSLD	135
SCSxxxxxxx	271

Order Code	Catalog Page Number
SEMxxxxxxx	273, 274
SIBAA-xxx	400
SIMxxxxxxx	272, 274
SK COVER	37
SK NEMA1 KIT	37, 83
SK-KEYPAD REMOTE	36
SKxxxxxx	24-39
SLxxxxxx	11
SM-APPLICATIONS LITE V2	75, 155
SM-APPLICATIONS PLUS	75, 155
SmartCard	76
SmartStick	35
SM-BIPOLAR	37
SM-CAN	79, 380
SM-CANOPEN	37, 50, 74, 154, 379
SM-DEVICENET	37, 50, 74, 154, 377
SM-ENCODER OUT	74, 109, 154
SM-ENCODER OUT PLUS	74, 109, 154
SM-ENCODER PLUS	74, 109, 154
SM-ETC	73
SM-ETHERCAT	37, 50, 74, 154, 378
SM-ETHERNET	37, 50, 74, 154, 377
SM-EZMOTION	75, 155
SM-HEATSINK-xxxx	51, 72, 84
SM-I/O 120V	37, 50, 74, 81, 154
SM-I/O 32	37, 50, 74, 82, 154
SM-I/O LITE	37, 50, 74, 82, 154
SM-I/O PLUS	37, 50, 74, 154
SM-I/O PLUS	50, 74, 154
SM-I/O TIMER	37, 50, 74, 82, 154
SM-I/O-24V	37, 50, 74, 80, 154
SM-INTERBUS	37, 50, 74, 154, 380
SM-KEYPAD	72
SM-KEYPAD PLUS	36, 72
SM-PELV	37, 50, 74, 81, 154

Order Code	Catalog Page Number
SM-PROFIBUS	37, 50, 74, 154, 379
SM-REGISTER	75
SM-RESOLVER	74, 109, 154
SM-RJM-485-xxx	396
SM-SERCOS	74, 154, 379
SM-UNI ENCODER	74, 109, 154
SM-UNIVERSAL ENCODER PLUS	74, 109, 154
SNC	135
SPxxxx	52-77
SP-KEYPAD	72, 394
SP-KEYPAD	72
SP-LCD-485	34, 44, 72
SPMxxxxx	335-338
SPxxxx-xxx	59-67
SSP7200	382
STI-xxxx	135
SX	14-23
SXSOFT	22, 344
SYPTLITE	77, 361-369
SYPTPRO	77, 107, 155, 361-368
TERM	402
TIA	402
UFCS-xxx	400
Unidrive SP	52-77
UNxxxxxx	86
VUFCS-xxx	86
XCxxx-xxx	400
XPRESSKEY	22
XTxxx-xxx	400
XUxxx-xxx	400
XV Motors	244-247

EMERSON
Industrial Automation

Drive and Soft Starter Application Questionnaire

CONTROL TECHNIQUES

Your Name & Company:_____ Date:____ / ____ / ____

Best contact method: _____

Salesperson / Organization: _____ Application/REF: _____

This form is designed to help select a product to a specific application. Answer as many of the questions as possible, then send the form to a Control Techniques distributor or sales representative for action. Thank you.

1. Briefly describe the application (conveyor, extruder, fan, pump, etc.): _____

_____

2. Are there any unusual characteristics of this application, please describe: _____

_____

3. Enclosure / Environmental considerations:

IP 20 _____ NEMA 1_____ NEMA 3R_____ NEMA 4_____ NEMA 4X_____ NEMA 12____
UL Type 1____ UL Type 12____ Other: _____

Ambient Temperature_____ Humidity_____ Indoor_____ Outdoor_____

Corrosive atmosphere_____ High vibration / shock_____ Altitude (if over 1000 meters) _____

Other_____

4. Desired Solution: AC Drive____ Soft Starter____ DC Drive____ Preferred Model_____

5. Input voltage (circle answer): 115 208 230 380 460 575 690V Phase 1Ø or 3Ø Other_____

6. Single motor____ , or multiple motor ____ application?

7. Motor data/Description/Type:_____

AC Motor	**DC Motor**
HP / kW _____	HP / kW _____
Base Speed _____	Base Speed _____
Min Cont Speed _____	Min Cont Speed_____
Maximum Speed _____	Maximum Speed _____
Base Volts_____	Armature Volts _____
Base Frequency_____	Armature Amps_____
Full Load Amps (FLA)_____	Field Volts _____
NEMA Design _____	Field Amps _____

8. What drive train method or mechanical system is being used? _____

Direct Drive____ Chain / Sprocket____ Belt / Sheave_____ Gear Ratio____ Other_____

9. Any unusual load characteristics (high inertia, load changes, etc.)? _____

_____

10. Minimum acceleration time? _____ Minimum deceleration time?_____

11. Reversing required? Yes_____ No _____

12. How will the motor be stopped? Coast_____ Ramped_____ Braking_____

If braking, type required: DC Injection_____ DB Resistors_____ Regenerative_____ Mechanical_____

13. Drive / Starter to motor cable length:_____

14. Will the drive / starter be required to communicate to a PLC? Yes_____ No_____

If yes: Modbus RTU___ Modbus TCP/IP ___ EtherNet/IP___ EtherCAT___ CTNet___ Profibus___

DeviceNet___ CANopen___ LONworks___ Sercos___ Other, specify _____

Drives only

15. Feedback Device: None___ Encoder_____ DC Tach___ AC Tach___ Resolver_____ Other_____

15a. If encoder, is it single ended or differential (circle) PPR_____

Circle type: Standard Incremental, Sin/Cos, SSI, Endat, Hyper Face, Other_____

15b. If tach, _____V / 1000 RPM

15c. If resolver, #poles_____ excitation voltage_____ ratio_____

16. Is the drive controlling? Speed_____ Torque_____ Tension _____ Position _____ Other_____

17. What is the expected regulation / accuracy of the control? Percent_____ RPM_____ Other_____

18. Will this drive coordinate with other drives and / or motors? Yes_____ No_____

If Yes, describe (speed following, master-follower, load sharing): _____

_____

19. What type of speed reference(s) will be used (check all that apply)?

Local (keypad, display, HMI)___ Potentiometer___ 0-10Vdc___ 4-20mA___ Other___

Master Encoder___ Pulse Train___ Serial or Network Comms, Specify_____

Is the signal source Isolated? Yes___ No____

Application Sketch / Notes