



Dart Delivers What You Want... When You Need It!



Since 1963, Dart Controls has been designing and manufacturing variable speed drives, controls, and accessories for electric motors in our Zionsville, Indiana facility.

Our Mission is to be the company you want to do business with. We pursue this goal by continuously seeking ways to improve our quality, efficiency, and services, while maintaining our

commitment to our customers, employees, shareholders and suppliers.

Always seeking ways to provide total value through

innovation Dart recently expanded by adding a new Engineering and R&D facility.

Over the last decade Dart has also implemented the concepts of **lean manufacturing.**

Through the use of lean tools such as Standard Work, Kanban, Kaizen, JIT, Visual Control Systems and Poka-Yoke (error proofing) we continue to improve and refine our processes and practices.



The benefit to our customers is a reduction to their inventory made possible by our flexible support systems allowing us to reliably deliver

any size order with an extremely fast turnaround.

**DART DELIVERS!
PUT US TO THE TEST**



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DARTTM **CONTROLS**

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ISO 9001:2000 REGISTERED RoHS Compliant

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500 Series Variable Speed DC Control

NEMA 4/12



Washdown Duty

"RC" Chassis



cULus
cULus Recognized

Dart's most fully featured analog DC speed control is reliable, versatile, and economical. Rated to 3 horsepower, it provides many standard features typically offered as options.

The Dart 500 Series control combines advanced engineering design, quality component selection and rigorous quality control to deliver an excellent off-the-shelf SCR control.

Dependable, time-proven circuitry offers performance characteristics previously available only in more costly controls.

While providing a wide range of standard features, many options quickly and easily extend the 500 Series' capabilities to meet specific application requirements.

An integral part of a distinguished line of quality products, the 500 Series is representative of Dart's continuing effort to provide reliable, versatile controls to the OEM, distributor, and the industrial markets.



Speed Potentiometer
Kit Included

500 SERIES STANDARD FEATURES

- Dual 120/240 VAC, 50/60Hz via slide selector switch
- Adjustable horsepower settings
- Barrier terminal strip
- Packaged bridge supply (fullwave)
- 1% speed regulation with armature voltage feedback; $\pm 1/2\%$ with tach feedback
- Adjustable Minimum speed (0-30% of max)
- Adjustable Maximum speed (60-120% of base)
- Adjustable IR Compensation
- Adjustable Linear Acceleration (0.3-12 sec.)
- Adjustable Linear Deceleration (0.6-12 sec.)
- Adjustable Current Limit
- Line voltage compensation
- 5K ohm speed potentiometer with 8" leads, dial and knob included
- Power on/off switch and indicator lamp (RE version)
- Power interrupt relays (RC and RE versions). Permits local and/or remote switching of AC power with low current momentary contacts. Prevents automatic restart after interruption of AC power.
- 50:1 speed range
- Overload capacity: 200% for one minute
- Transient voltage protection
- Voltage following mode or DC tachometer follower by supplying ungrounded analog input signal (0-12 VDC)
- DC tachometer feedback (jumper selectable 3V or 7V per 1000 RPM)
- Inhibit circuit - permits start and stop without breaking AC lines
- Shunt field supply provided (1 Amp max; 100V for 120 VAC; 200V for 240 VAC input)
- 2 AC line fuses
- +12 VDC, 12mA power supply, user accessible
- Enclosed models rated NEMA 4/12

500 SERIES SELECTION GUIDE

H.P. RANGE	CHASSIS "C"	ENCLOSED "RE"	CHASSIS WITH RELAY "RC"
115 VAC Single Phase Input, 0-90 VDC Output ¹			
1/8 - 1.0	530BC	530BRE	530BRC
1.5	533BC	Available in chassis only, limited options available.	
230 VAC Single Phase Input, 0-180 VDC Output			
1/4 - 2.0	530BC	530BRE	530BRC
3.0	533BC	Available in chassis only, limited options available.	

Horsepower settings are adjustable, see installation manual. Control is tested and calibrated for maximum horsepower in its category.

1 - Regulated output voltage adjustable to 130 VDC, dependent upon motor horsepower rating.

DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	LENGTH	DEPTH	WEIGHT
<i>English (inches)</i>				
Chassis	6.70	9.00	2.00	40 oz.
Enclosed	6.70	10.00	4.75	56 oz.
<i>Metric (centimeters)</i>				
Chassis	17.02	22.86	5.08	1134 gm.
Enclosed	17.02	25.40	12.07	1422 gm.

OPERATING CONDITIONS

Temperature.....-10° to +45° C.
 AC Input Voltage..... $\pm 10\%$ Rated Line Voltage
 Input Frequency..... 50/60 Hz.

ELECTRICAL SPECIFICATIONS AC INPUT 50/60 HZ

115 VAC Single Phase Input, 0-90 VDC Output

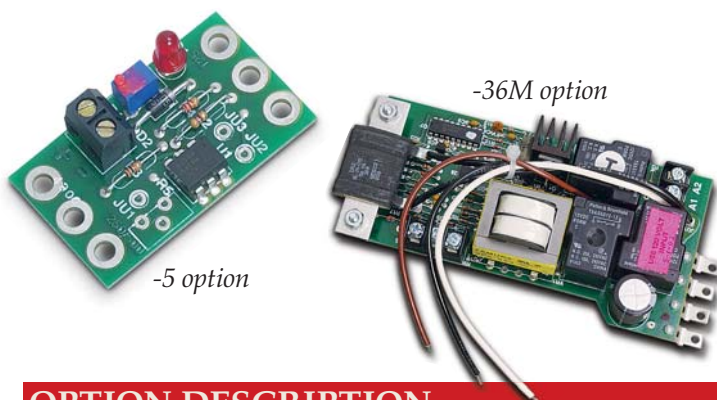
H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/8	1.8	0.22	1.4
1/6	2.6	0.31	2.1
1/4	3.5	0.42	2.7
1/3	4.4	0.53	3.4
1/2	6.5	0.78	5.0
3/4	9.3	1.12	7.2
1.0	13.2	1.58	10.2
1.5	21.5	2.57	14.7

230 VAC Single Phase Input, 0-180 VDC Output

H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/4	1.8	0.42	1.4
1/3	2.2	0.53	1.7
1/2	3.3	0.78	2.5
3/4	4.8	1.15	3.7
1.0	6.5	1.56	5.0
1.5	9.7	2.33	7.5
2.0	12.9	3.10	9.9
3.0	22.0	5.30	15.0

* Minimum Armature Amps: 150mA D.C.

POPULAR OPTIONS



OPTION DESCRIPTION

OPTION	SUFFIX
Jog (enclosed only).....	-4
4-20mA isolated signal follower (chassis only).....	-5*
-5 option with Auto/Manual function.....	-7*
Ten turn speed pot and dial plate (chassis only).....	-11*
Extended linear Accel/Decel range (to 30 sec.).....	-15A
NEMA 4/12 Enclosure.....	Standard
Forward/Reverse with Dynamic brake and zero speed detect. Direction controlled with SPDT switch, relay contact (dry contact switching), or NPN open collector. Once direction change is initiated, cannot be aborted until motor stops; prevents relay contact welding (available through 2 H.P.)	
120 VAC	-36M*/MA ¹
240 VAC	-38M*/MA ¹

Other options are available, please consult factory for your requirement.

* Field installable on chassis version only.

1-"A" version dynamic brake resistor rating - 50W (factory installable only).

250 Series Variable Speed DC Control

Chassis



NEMA 4/12



Washdown Duty

Speed Potentiometer
Kit Included



The 250 Series offers superb flexibility, reliability, and value. A general purpose, economical control rated to 2 horsepower, it provides the ultimate in standard features and versatility including: **dual voltage (120/240 VAC), adjustable H.P. settings, packaged power bridge, barrier terminal strip, fully rated-no auxiliary heatsink required, and chassis or NEMA 4/12 enclosure.** Many options further extend the 250's capabilities.

A logical, easily accessible layout simplifies installation and adjustment. Clean design, quality components and careful assembly are trademarks of Dart Controls.

250 SERIES STANDARD FEATURES

- Dual voltage - 120/240 VAC, 50/60Hz
- Adjustable horsepower settings
- Barrier terminal strip
- Packaged bridge supply (fullwave)
- 1% speed regulation with armature voltage feedback; $\pm 1/2\%$ with tach feedback
- Adjustable Minimum speed (0–30% of max)
- Adjustable Maximum speed (66–110% of base)
- Adjustable IR Compensation
- Adjustable Linear Acceleration (0.5-8 sec.)
- Adjustable Current Limit to 15 Amps
- Line voltage compensation
- 5K ohm speed potentiometer with 8" leads, knob and dial included
- Power on/off switch (enclosed models)
- 50:1 speed range
- Overload capacity: 150% for one minute
- Transient voltage protection
- Voltage following mode or DC tachometer follower by supplying ungrounded analog input signal (0–12 VDC)
- DC tachometer feedback (6V at base speed)
- Inhibit circuit - permits start & stop without breaking AC lines
- Remote start/stop via pot circuit or inhibit circuit
- Shunt field supply provided (1 Amp max; 100V for 120 VAC; 200V for 240 VAC input)
- AC line fuse
- Enclosed models rated NEMA 4/12 w/ threaded conduit holes

250 SERIES SELECTION GUIDE

H.P. RANGE	CHASSIS "C"	ENCLOSED "E"
<i>120 VAC Single Phase Input, 0-90 VDC Output</i>		
1/50 - 1/8	251G-12C	251G-12E
1/8 - 1.0	253G-200C	253G-200E
<i>240 VAC Single Phase Input, 0-180 VDC Output</i>		
1/25 - 1/4	251G-12C	251G-12E
1/4 - 2.0	253G-200C	253G-200E

Horsepower settings are adjustable, 1/50 thru 1/8 and 1/8 thru 2 - see installation manual. Control is tested and calibrated for maximum horsepower in its category.

DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	LENGTH	DEPTH	WEIGHT
<i>English (inches)</i>				
Chassis	5.53	7.00	1.63	14.25 oz.
Enclosed	5.53	7.25	2.75	17.50 oz.
<i>Metric (centimeters)</i>				
Chassis	14.1	17.78	4.14	404 gm.
Enclosed	14.1	18.42	6.98	486 gm.

OPERATING CONDITIONS

Temperature.....-10° to +45° C.
 AC Input Voltage..... $\pm 10\%$ Rated Line Voltage
 Input Frequency..... 50/60 Hz.

ELECTRICAL SPECIFICATIONS AC INPUT 50/60 HZ

120 VAC Single Phase Input, 0-90 VDC Output

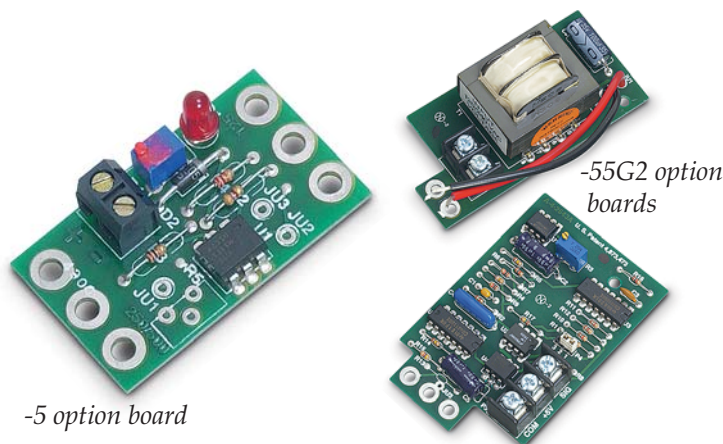
H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/50	0.5	0.06	0.4
1/20	1.0	0.12	0.8
1/8	2.0	0.24	1.6
1/4	3.5	0.42	2.7
1/3	4.4	0.53	3.4
1/2	6.5	0.78	5.0
3/4	9.3	1.12	7.2
1	13.2	1.58	10.2

240 VAC Single Phase Input, 0-180 VDC Output

H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/4	1.8	0.42	1.4
1/3	2.2	0.53	1.7
1/2	3.3	0.78	2.5
3/4	4.8	1.15	3.7
1	6.5	1.56	5.0
1 1/2	9.7	2.33	7.5
2	12.9	3.10	9.9

For dual voltage 250 series, use table for the input voltage you are using.
 * Minimum Armature Amps: 150mA D.C.

POPULAR OPTIONS



OPTION DESCRIPTION

OPTION	SUFFIX
NEMA 4X Enclosure.....	-4X
4-20mA isolated signal follower (chassis only).....	-5*
-5 option with Auto/Manual function.....	-7 ¹
Decel equals Accel time	-17B
Forward-Off-Reverse manual switch (center blocked, no Dynamic Brake-enclosed only)	-29
Forward-Off-Reverse manual switch (center blocked, no Dynamic Brake - chassis only)	-29B
Torque control (enclosed only)	-34A
Isolated voltage follower (120/240 VAC input) - controls speed from any external grounded or ungrounded signal: 0-5 VDC thru 0-250 VDC adjustable (chassis only).....	-55G2*
-55G2 option with Auto/Manual function.....	-56G2 ¹

Other options are available, please consult factory for your requirement.

* Field installable

1-Enclosed version is factory installed only. Chassis version is field installed.

130 Series Reversing Control for PM and Shunt Wound DC Motors through 2 HP



INSTANT REVERSING, QUICK STOPPING, RAPID CYCLING...

The 130 Series reversing control outperforms other dynamic braking and reversing controls by utilizing Dart's unique zero-speed detect and dynamic braking circuits. These circuits eliminate the contact arcing and failed braking problems associated with other reversing and dynamic braking controls. Dart's zero speed detect circuit also eliminates motor plug reversing problems.

In the event of a power loss or emergency stop condition, the 130 Series control will drop into a dynamic brake condition to safely and quickly bring the motor to a stop and remain there until power is reapplied and a run condition is recognized.



Speed Potentiometer
Kit Included

130 SERIES STANDARD FEATURES

- Adjustable horsepower settings
- Barrier terminal blocks
- Full wave bridge supply
- Adjustable Min speed (0-30% of max)
- Adjustable Max speed (60-100% of base)
- Adjustable IR compensation
- Adjustable current limit
- Fixed accel (0.5 sec); or 6 sec "soft start" w/(-K) option
- Line voltage compensation
- 5K speed pot with 8" leads, dial and knob included
- 50:1 speed range
- Overload capacity: 200% for one minute
- Transient voltage protection
- Shunt field supply provided (1 Amp max; 100V for 120 VAC input or 200V for 240 VAC input)
- Onboard dynamic brake resistor
- Automatic dynamic braking on power loss
- 1% speed regulation with armature voltage feedback

130 SERIES OPERATING CONDITIONS

Temperature.....-10° to +45° C
 AC Input Voltage±10% Rated Line Voltage
 Input Frequency50/60 Hz

TYPICAL APPLICATIONS

- Indexers
- Door Openers
- Feeders
- Tapping Machines
- Pumps
- Screen Presses
- Conveyors

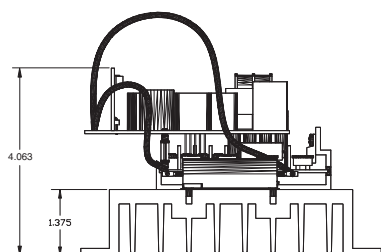
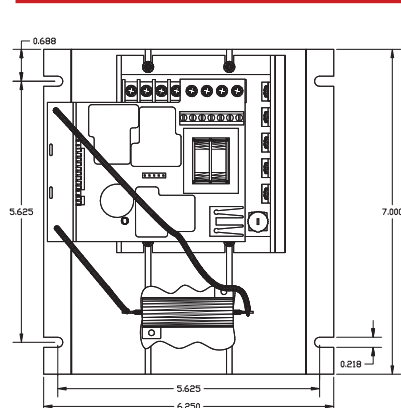
130 SERIES MODEL NUMBERS AND RATINGS

MODEL	INPUT VOLTAGE	OUTPUT HP RANGE	CYCLE AMPS DC	RATE
130LC12	120 VAC	1/15-1/8	1.2	3 C/MIN
130LC100	120 VAC	1/8-1/2	5.5*	3 C/MIN
130HC12	120 VAC	1/15-1/8	1.2	UP TO 30 C/MIN
130HC100	120 VAC	1/8-1.0	10.0	UP TO 30 C/MIN
132LC25	240 VAC	1/25-1/4	1.2	3 C/MIN
132LC200	240 VAC	1/8-1.0	5.5**	3 C/MIN
132HC25	240 VAC	1/25-1/4	1.2	UP TO 30 C/MIN
132HC200	240 VAC	1/4-2.0	10.0	UP TO 30 C/MIN

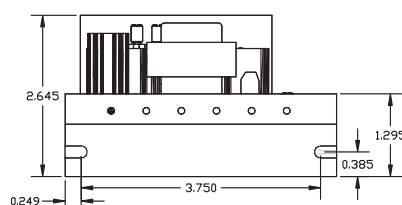
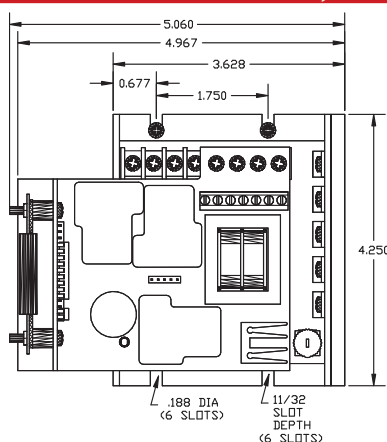
* Up to 10 amps continuous output current at 1 Hp 90VDC with suitable external heat sink.

** Up to 10 amps continuous output current at 2 Hp 180VDC with suitable external heat sink.

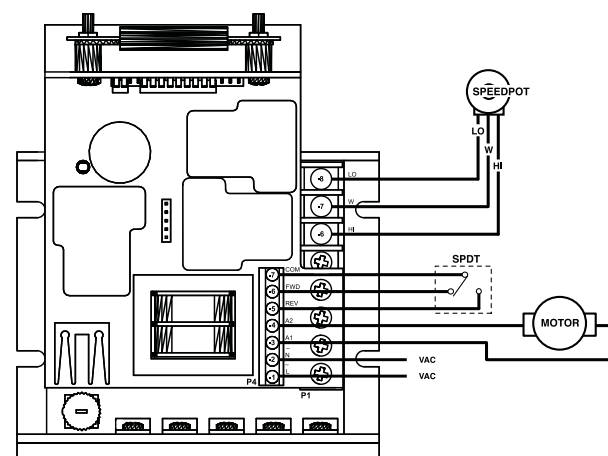
130 SERIES MECHANICAL SPECIFICATIONS, ADJUSTMENTS AND HOOK-UPS



130 Series HC Models



130 Series LC Models



130 Series Hook-up

All dimensions in inches

125 Series Variable Speed DC Control

125DV-C



cULus
cULus Recognized



Speed Potentiometer
Kit Included

The 125 Series is a compact, cost efficient, reliable control for PM, shunt wound, and universal motors that incorporates up-to-date design and engineering into a compact package.

Installation and field adjustments are facilitated using a barrier type terminal strip and large, easily adjusted trimpots. Adjustable horsepower range: 120 VAC; 1/50–1/8 and 1/8–1/2; 240 VAC; 1/25–1/4 and 1/4–1.

The 123D-C model operates on a low input voltage of 24/36 VAC with an output of 150mA–5.5 ADC

Standard features include an inhibit circuit for start-stop operation and 1% speed regulation over a 50:1 speed range. Dual voltage 120/240 VAC or 24/36 VAC models are available.

Long life and quality are assured by 100% full load testing. The 125 Series is ideal for applications such as: office machinery, conveyors, office packaging equipment, printers, process equipment, centrifuges, and exercise equipment.

125 SERIES STANDARD FEATURES

- Dual Voltage 120/240 VAC or 24/36 VAC, 50/60Hz
- Adjustable horsepower settings
- Barrier terminal strip
- Full wave bridge supply
- 1% speed regulation with armature voltage feedback; $\pm 1/2\%$ with tach feedback
- Adjustable Minimum speed (0–30% of max)
- Adjustable Maximum speed (60–110% of base)
- Adjustable IR Compensation
- Adjustable Current Limit
- Fixed Acceleration (0.5 sec.)
- Line voltage compensation
- 5K ohm speed potentiometer with 8" leads, dial & knob included
- 50:1 speed range
- Overload capacity: 200% for one minute
- Transient voltage protection
- Voltage following mode or DC tachometer follower by supplying ungrounded analog input signal (0–12 VDC)
- DC tachometer feedback (6V at base speed)
- Inhibit circuit—permits start & stop without breaking AC lines
- Shunt field supply provided (1 Amp max; 100V for 120 VAC; 200V for 240 VAC input)

125 SERIES SELECTION GUIDE

H.P. RANGE	MODEL	INPUT	OUTPUT
150mA - 5.5ADC	123D-C	24/36 VAC	0-20/30 VDC
1/50 - 1/8	125D-12C	120 VAC	0-90 VDC
1/25 - 1/4		240 VAC	0-180 VDC
1/8 - 1/2*	125DV-C	120 VAC	0-90 VDC
1/4 - 1.0*		240 VAC	0-180 VDC

* With suitable external heatsink. UL rating for output amps can be increased from 5.5 amps DC to 10.0 amps DC.

Horsepower settings are adjustable - see installation manual. Control is tested and calibrated for maximum horsepower in its category.

OPERATING CONDITIONS

Temperature.....-10° to +45° C.
 AC Input Voltage $\pm 10\%$ Rated Line Voltage
 Input Frequency 50/60 Hz.

ELECTRICAL SPECIFICATIONS AC INPUT 50/60 Hz

120 VAC Single Phase Input, 0-90 VDC Output

H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/50	0.5	0.06	0.4
1/20	1.0	0.12	0.8
1/8	2.0	0.24	1.6
1/4	3.5	0.42	2.7
1/3	4.4	0.53	3.4
1/2	6.5	0.78	5.0

240 VAC Single Phase Input, 0-180 VDC Output

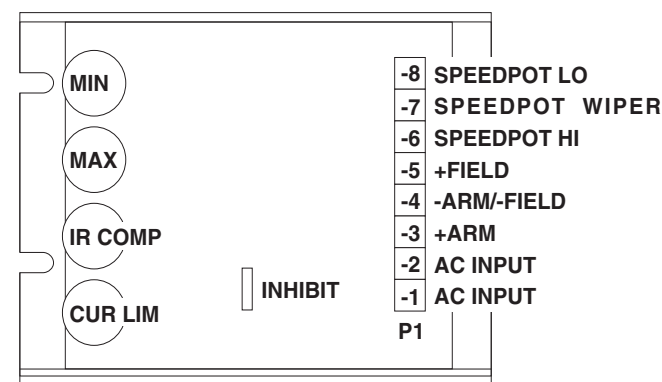
H.P.	MAX. AC AMPS	KVA	MAX. ARM* AMPS DC
1/4	1.8	0.42	1.4
1/3	2.2	0.53	1.7
1/2	3.3	0.78	2.5
3/4	4.8	1.15	3.7
1	6.5	1.56	5.0

* Minimum Armature Amps: 150mA DC

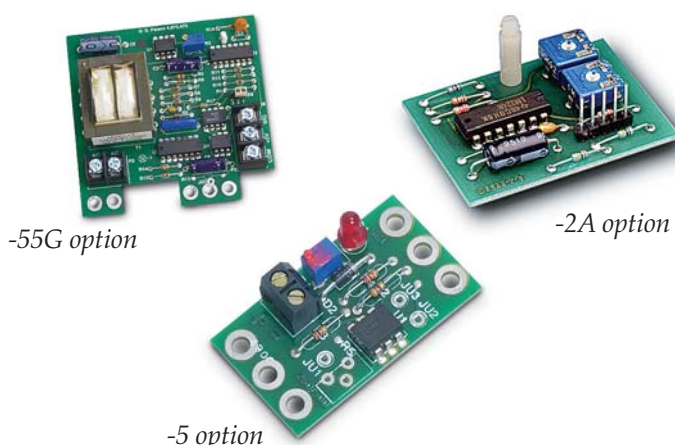
DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH	WEIGHT
<i>English (inches)</i>				
Chassis	3.63	4.25	1.30	8 oz.
<i>Metric (centimeters)</i>				
Chassis	9.20	10.80	3.30	227 gm.

ADJUSTMENTS AND HOOK-UP



POPULAR OPTIONS



OPTION DESCRIPTION

OPTION	SUFFIX
Electronic speed control interlock - when AC power to control is applied, prevents motor from starting until speedpot is first rotated to the zero position, then CW. Also, should AC power be interrupted then restored, prevents automatic restart. (Patent # 4,888,813).....	-1*
Independently adjustable linear accel and decel (0.5 - 8.0 seconds).....	-2A*
4-20mA isolated signal follower.....	-5*
-5 option with Auto/Manual switch.....	-7*
Acceleration time (approx. 4 seconds).....	-15B
Acceleration time (approx. 6 seconds).....	-K
Forward-Off-Reverse manual switch (center blocked, no Dynamic Brake).....	-29B*
Isolated voltage follower (120/240 VAC input)—controls speed from any external grounded or ungrounded signal: 0-5 VDC thru 0-250 VDC adjustable.....	-55G*
-55G option with Auto-Manual function.....	-56G*
Auxiliary heatsink (7" long x 6.25" wide x 1.375" deep).....	-HS(125)*

Other options are available, please consult factory for your requirement.

* Field installable



15 Series Adjustable Speed DC Control

The 15 Series is a general purpose, economical variable speed control for small DC and universal motor applications featuring: **dual input voltages of 12/24 VAC or 120/240 VAC** with a DC output current rating of 2 Amps, adjustable trimpot settings, and quick connect terminal pins. **The 15 Series is available in two compact panel mount styles and a NEMA 4/12 enclosed model.**

15 SERIES STANDARD FEATURES

- Dual voltage models of 12/24 VAC or 120/240 VAC input
- Full wave bridge power supply
- Adjustable Minimum speed (0-30% of max)
- Adjustable Maximum speed (40-145% of base)
- Adjustable IR Compensation
- Fixed Acceleration (0.5 seconds)
- 5K ohm speed potentiometer with leads, knob & dial included
- 25:1 speed range • 1% speed regulation
- Shunt field supply provided (1 Amp max)
 - 10V for 12 VAC; 20V for 24 VAC input,
 - 100V for 120 VAC; 200V for 240 VAC input
- Overload capacity of 200% for 1 minute
- Transient voltage protection
- AC line fuse
- Power on/off switch

} Enclosed Model

15 SERIES SELECTION GUIDE

Suffix -1 and -2 refer to mounting configuration, see diagram below.

MODEL	DC OUTPUT CURRENT	INPUT	OUTPUT
13DV1A	2 Amps*	12/24 VAC	0-11/0-22 VDC
13DV2A	2 Amps*	12/24 VAC	0-11/0-22 VDC
13DV-E	3 Amps	12/24 VAC	0-11/0-22 VDC
15DV1A	2 Amps*	120/240 VAC	0-90/0-180 VDC
15DV2A	2 Amps*	120/240 VAC	0-90/0-180 VDC
15DV-E	3 Amps	120/240 VAC	0-90/0-180 VDC

* Rating for D.C. Output Current can be increased from 2.0 to 4.0 amps w/suitable external heatsink (equiv. to 4" x 4" x .125" aluminum plate).

DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH	WEIGHT
<i>English (inches)</i>				
13DV1A/15DV1A	2.80	1.30	3.30	2.64 oz.
13DV2A/15DV2A	2.80	1.50	3.30	2.94 oz.
13DV-E/15DV-E	3.81	5.50	3.50	10.00 oz.
<i>Metric (centimeters)</i>				
13DV1A/15DV1A	7.20	3.30	8.40	75 gm.
13DV2A/15DV2A	7.20	3.90	8.40	83 gm.
13DV-E/15DV-E	9.68	13.96	8.89	284 gm

OPERATING CONDITIONS

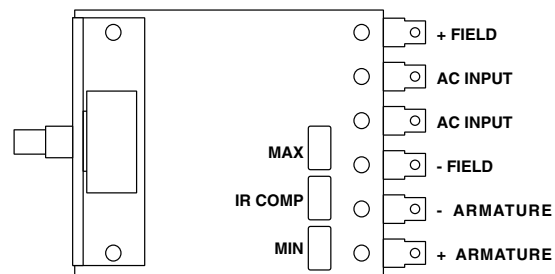
Temperature..... -10° to +45° C.
 AC Input Voltage±10% Rated Line Voltage
 Input Frequency 50/60 Hz.

ELECTRICAL SPECIFICATIONS AC INPUT 50/60 Hz

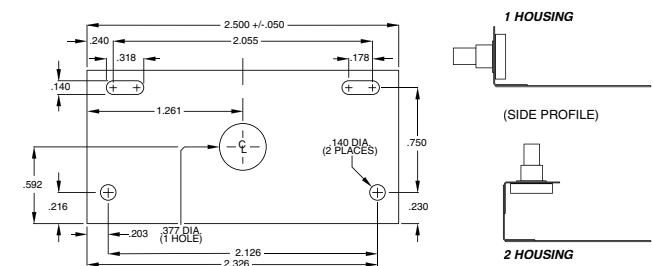
MODEL	MAXIMUM CONTINUOUS AC AMPS	MAX. CONTINUOUS ARM AMPS*	MAX HP
<i>12 VAC Single Phase Input, 0-11 VDC Output</i>			
13DVA	2.6	2.0	1/40
13DV-E	3.9	3.0	1/25
<i>24 VAC Single Phase Input, 0-22 VDC Output</i>			
13DVA	2.6	2.0	1/20
13DV-E	3.9	3.0	1/12
<i>120 VAC Single Phase Input, 0-90 VDC Output</i>			
15DVA	2.6	2.0	1/6
15DV-E	3.9	3.0	1/3
<i>240 VAC Single Phase Input, 0-180 VDC Output</i>			
15DVA	2.6	2.0	1/6
15DV-E	3.9	3.0	2/3

* Minimum Armature Amps: 150mA D.C.

HOOK-UP DIAGRAM



HEATSINK DIMENSIONS AND STYLES



OPTION DESCRIPTION

OPTION	SUFFIX
Single pole AC switch integral with speedpot for 120 VAC application only	-104
3-position terminal strip with speedpot, dial, & knob kit.....	-TS



VSI Series Voltage Signal Isolator*

The Dart VSI (voltage signal isolator) permits the user to control the output of a variable speed motor drive from any external grounded or ungrounded DC input signal. A single model accepts a wide range of input voltages (0-5 through 0-25VDC or 0-25 through 0-250VDC). The GAIN trimpot is used to adjust the output of the VSI to full on when a full speed signal is applied to its input terminals. The VSI incorporates Dart's patented feedback circuit, which virtually eliminates output changes due to the thermal drift

of logic components. The VSI is packaged in an aluminum chassis mount housing and contains an on-board power supply for its logic circuit. An electrical isolation rating of 2500Vrms is achieved by the use of an optically isolated IC package.

The Dart VSI can be used with virtually any motor speed control that has a speed reference circuit of +5 to +15VDC and an input impedance greater than 47K ohms. The output of the VSI is a filtered, pulse width modulated signal that is directly proportional to the input speed signal. The wide input range allows the VSI to follow signals as low as +0-5V logic levels and up to the 180 VDC levels present at the armature leads of a 180 VDC motor. By simply connecting the input terminals across the armature leads of a "master motor", you can use the VSI for master/follower operation. The addition of a scaling pot will provide for proportional follower operation.

* By adding a resistor across signal input, VSI can function as a Current Signal Isolator.

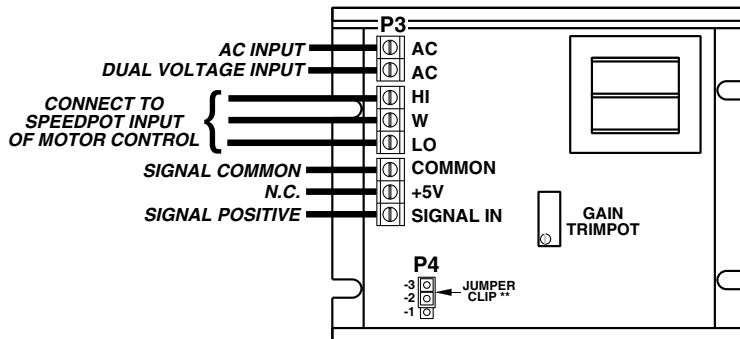
VSI SERIES SELECTION GUIDE

MODEL	SUPPLY VOLTAGE
VSI	120/240VAC 50/60 Hz.

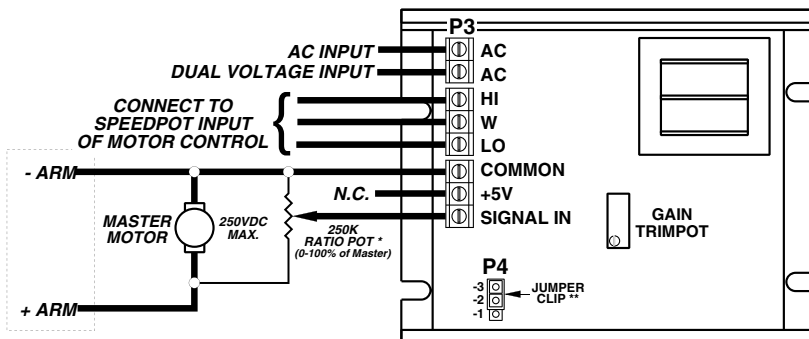
DIMENSIONAL SPECIFICATIONS

WIDTH	LENGTH	DEPTH	WEIGHT
<i>English</i>			
3.630 in	4.250 in	1.650 in	9.8 oz
<i>Metric</i>			
9.220 cm	10.795 cm	4.191 cm	277.3 gm

VSI HOOK-UP CONFIGURATIONS



STANDARD HOOK-UP



FOLLOWER MODE HOOK-UP

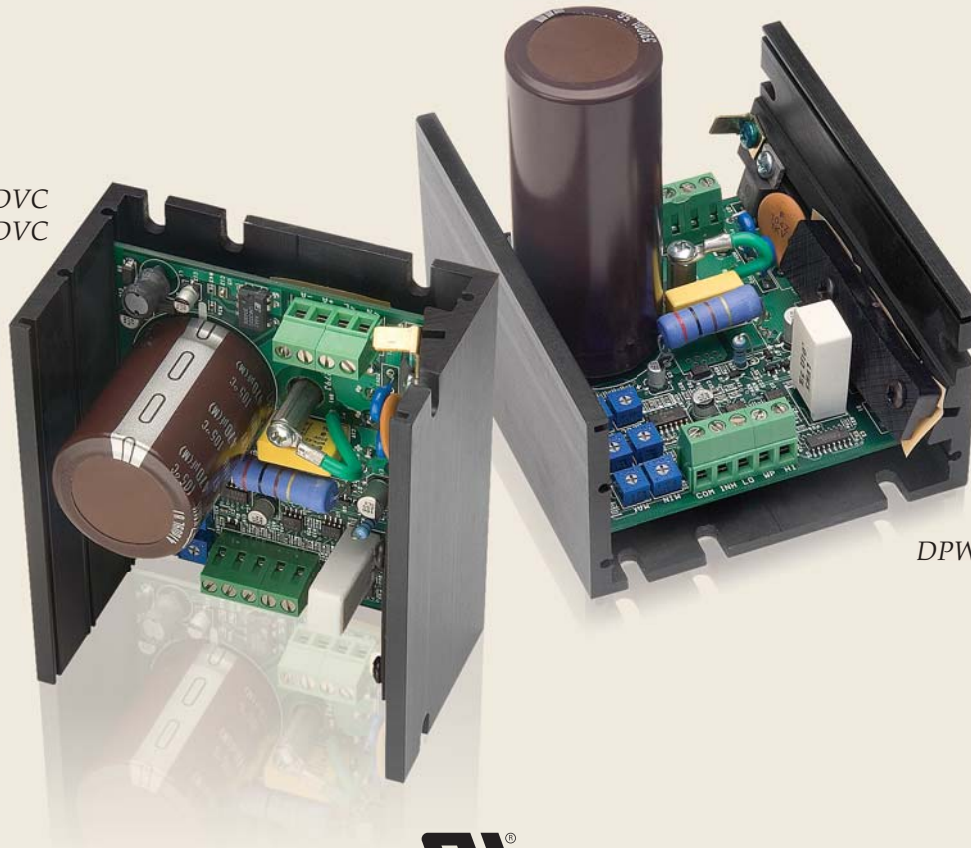
NOTES:

* If ratio of Master is NOT needed, delete the 250K pot and connect +Armature directly to Signal Input.

** Jumper clip is used to select input voltage range. When installed from P4-1 to P4-2, the range is 0-25VDC thru 0-250VDC; when installed from P4-2 to P4-3, range is 0-5VDC thru 0-25VDC.

DPW Series Pulse Width Modulated Variable Speed DC Control

DPW02DVC
DPW05DVC



DPW10DVC



The DPW Series PWM DC controls are designed to meet and exceed the industry standards of reliability and performance that you expect.

- The compact, surface mount design comes in the same industry standard footprint as Dart's popular 125 Series controls.
- Dart's unique "Power Supply Regulator Circuit" keeps the power supply charged during sudden input or output voltage drops. This allows the DPW control to avoid a low voltage lockout resulting in the dramatic output drops and uncontrolled speed jumps experienced in current industry designs.
- The input "Pre-Charge Circuit" allows for control power-up without tripping even the most sensitive GFI breakers due to high inrush current
- The Cycle to Cycle Current Limit circuit enables the DPW control to be less susceptible to short circuit damage.



Speed Potentiometer
Kit Included

DPW SERIES STANDARD FEATURES

- Speed regulation 1% of base speed
- Inhibit circuit terminals, active low – permits start and stop without breaking AC lines
- 5K ohm speed potentiometer with 8" leads, dial & knob included
- 18kHz switching frequency for quiet operation
- Trim pot adjustments for IR comp, Min Speed, Max Speed, Current Limit, Accel, and Decel
- Accel and Decel time range from .5 to 8 Sec. (no load)
- Euro style easy access terminal strips
- Power-on LED
- RoHS compliant
- cULus pending

OPERATING CONDITIONS

- Temperature-10 ° to +45 ° C
- Input impedance.....400 K Ohms
- AC Input voltage120/240 VAC +/-10%
- Input frequency50/60 Hz
- Form Factor 1.05

DPW SERIES SELECTION GUIDE

MODEL	INPUT VOLTAGE (VAC)	OUTPUT VOLTAGE (VDC)	MAX CONTINUOUS AMPS OUT	HP RATING
DPW02DVC	120/240	0-130/0-240	2	1/50-1/4
DPW05DVC	120/240	0-130/0-240	5	1/8-1
DPW10DVC	120/240	0-130/0-240	10	1/2-2

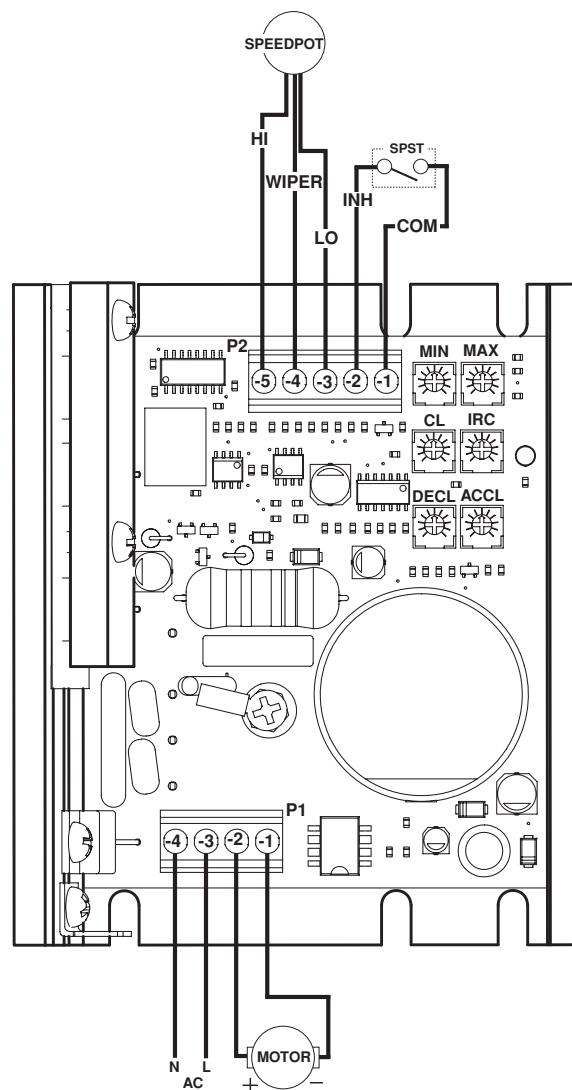
DIMENSIONAL SPECIFICATIONS (INCHES)

MODEL	WIDTH	LENGTH	HEIGHT
DPW02DVC	3.650	4.250	2.200
DPW05DVC	3.650	4.250	2.270
DPW10DVC	3.650	4.250	3.617

TYPICAL APPLICATIONS

- Printing
- Exercise Equipment
- Packaging Machinery
- Sorting Machinery
- Pottery Wheels
- Film Processing
- Conveying
- Medical Lab Equipment

ADJUSTMENTS AND HOOK-UPS





MD3E

MD3P

MD10P



MD Series Digital Closed Loop DC Speed Control

The MD Series is a compact, programmable DC speed control with digital closed loop feedback and LED display for DC motors rated to 2 horsepower. An on-board microprocessor with non-volatile memory, coupled with sophisticated internal software, makes Dart's Micro-Drive the ultimate value in accuracy and control.

Friendly front-panel field programming permits customizing the MD for specific applications. The MD can be set to display the target speed directly in RPM, FPM, GPM, process time, or any other engineering unit. Programmable parameters include maximum and minimum set speed, decimal points, and operating mode (master or follower).

The Micro-Drive is simple to operate: set the desired RPM, rate, or time in the large 1/2" LED display by depressing the "Up" and "Down" pushbuttons on the front panel. Settings can be one digit at a time or fast sweep. The Micro-Drive settings are exact and repeatable. It will precisely control speed to $\pm 1/2$ RPM of set speed, long term. No calibrations of the control are necessary.

The MD10P and MD3P have 1/8 DIN and 1/4 DIN industry standard cutout dimensions respectively, providing easy panel installations.

TYPICAL APPLICATIONS

The flexibility of Dart's Micro-Drive design makes it uniquely suited for many commercial and industrial applications, such as:

- Conveyor ovens used in food preparation, UV curing processes, and heat shrink packaging
- Electronic solder re-flow and drying processes
- Industrial auger and mixing equipment
- Medical lab mixing equipment
- Industrial and commercial spray equipment
- Printing process equipment

MD SERIES STANDARD FEATURES

- Adjustable min/max
- Adjustable accel/decel
- Adjustable equivalent to proportional and integral gains
- Pulse input capacity of 50,000 PPM, 833Hz
- Programmable power-on initial settings
- Inhibit mode is selectable from many input options
- Jog function selectable from many input options
- Non-volatile memory allows all custom settings to be stored for future use
- Factory default function—reset drive to factory setting
- User-default storage capability allows user to store/recall a known good set of parameters while experimenting w/new settings
- User-friendly programming from the front panel with parameter lockout capability
- Programming buttons allow for adjustable display scroll rate in a linear or non-linear mode
- Display is programmable for any engineering unit of measure
- Adjustable display options include decimal point positions and intensity
- Custom front panel artwork available
- Easy panel mounting with 2 or 4 bolts (supplied)
- NEMA 4X Rating (faceplate with supplied gasket)
- Universal power supply supports any AC voltage input 85–265 VAC
- Compatible with Dart line of low-cost digital pick-ups or other suitable pick-ups
- Programmable user output supporting up to 230 VAC @5A form C relay
- Multiple operational modes: Rate, Time, Follower

OPTION DESCRIPTION

OPTION	SUFFIX
Provision for remote pushbutton switches	-1
Blank lexan.....	-9
Pluggable terminal strip.....	-P
Magnetic pick-up input board	-3

MD SERIES SELECTION GUIDE

MODEL NUMBER	MAX. ARM DC AMPS	MAX H.P.	INPUT	OUTPUT
MD10P	5	1/2	120 VAC	0-90 VDC
	5	1	240 VAC	0-180 VDC
MD3P	10	1	120 VAC	0-90 VDC
	10	2	240 VAC	0-180 VDC
MD3E	10	1	120 VAC	0-90 VDC
	10	2	240 VAC	0-180 VDC

- All models accept 85-265 VAC Single Phase Input.
- Peak motor output voltage is equal to peak AC input voltage.
- Requires Dart PU-E or other suitable pick-up.
 - Sensor must have minimum output current of 10 mA.
 - Drive includes supply for external sensor of 5VDC @50 mA max.
 - Shipped set for 0-2400 RPM with one pulse per revolution.

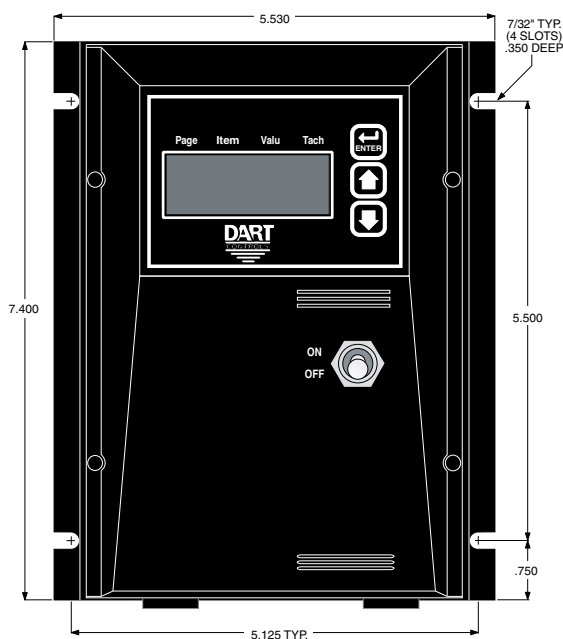
OPERATING SPECIFICATIONS

Temperature.....-10° to +45° C
 AC input voltage..... 85-265 VAC
 Input frequency.....50/60 Hz
 Overload capacity200% for 1 minute
 Transducer signal input.....0-5 to 0-24 VDC
 On-board power supply5 VDC, 50mA

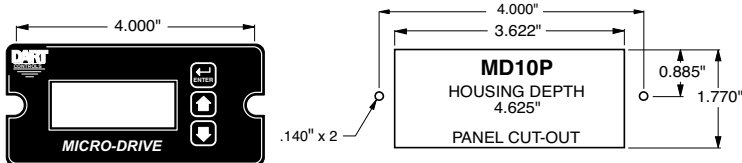
DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH
<i>MD10P inches (millimeters)</i>			
Housing	3.620 (91.95)	1.656 (42.06)	4.625 (117.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)
<i>MD3P inches (millimeters)</i>			
Housing	3.620 (91.95)	3.497 (88.82)	4.625 (117.47)
Lens	4.539 (115.29)	4.179 (106.15)	0.375 (9.52)

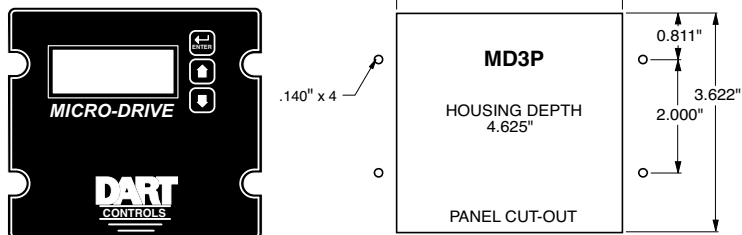
MOUNTING SPECIFICATIONS MD3E



MOUNTING SPECIFICATIONS

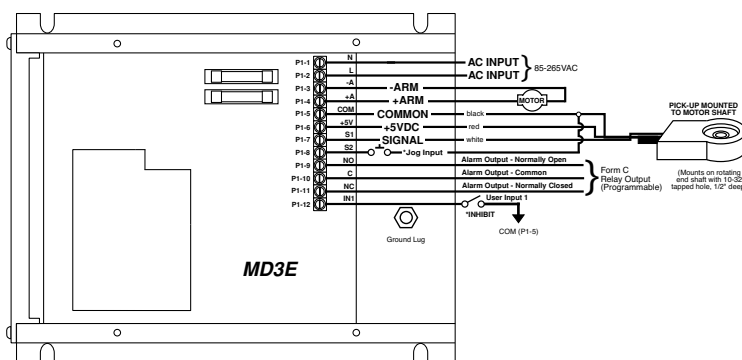


1/8 DIN

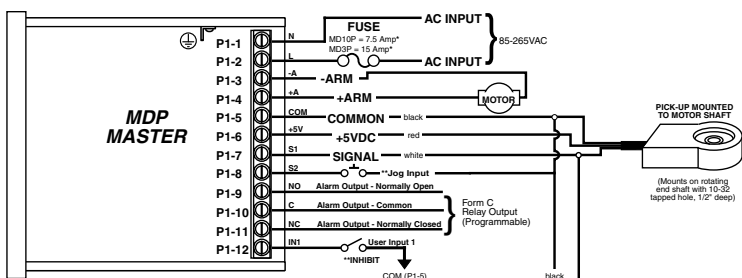


1/4 DIN

WIRING DIAGRAMS

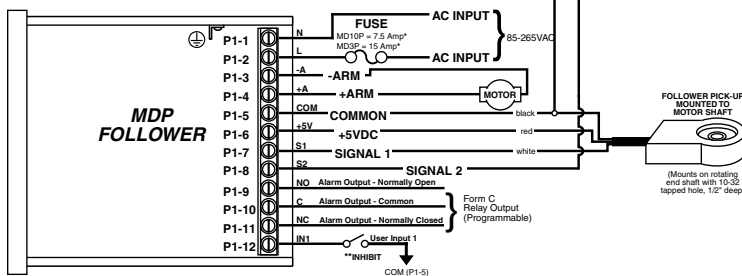


* P1-8 & P1-12 user input may be programmed for a number of functions. Including (jog, inhibit, etc.)



* For AC inputs utilizing two hot lines, both inputs should be protected with appropriately sized fuses or circuit breakers.

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** P1-8 & P1-12 user input may be programmed for a number of functions. Including (jog, inhibit, etc.)

US
MD50P-420 and MD40P-420

UL US LISTED
MD50E-420

MD50P-420

MD40P-420

MD50E-420

MD *plus* Series Digital Closed Loop DC Drive System

Ideal for Metering Pump and other applications requiring an isolated 4-20mA input/output signal

The MD *plus* is a field-programmable closed loop DC drive system employing an advanced velocity-form PID algorithm for accurate and responsive control. The MD *plus* system also features a unique, isolated 4-20mA input and output for easy integration with existing Process Control systems.

The MD *plus* system is ideally suited for metering pump applications by efficiently combining all of the application requirements into a single compact package. The MD *plus* system not only accepts a 4-20mA signal to control the pump speed, but it also provides a 4-20mA output signal back to the Process Control that is proportional to the actual running speed. Both the input and output signals are isolated from each other and from the control itself. The MD *plus* system also has two field-programmable Form C relay contacts that can be set to indicate a wide variety of conditions such as the pump is running, a "fault" condition exists, and many other events.

The MD *plus* system is available in both enclosed and panel-mount versions. The MD50E-420 version comes in a NEMA 4X enclosure complete with an auto/off/manual switch on the cover. The 1/8 DIN MD40P-420 and 1/4 DIN MD50P-420 panel-mount versions come complete with a NEMA 4X rated faceplate, gasket kit, stainless steel mounting hardware, and connections for an external auto/manual switch.

STANDARD FEATURES

- 1/50 to 2.0 HP range
- Universal power supply supports 85-265 VAC input
- 1/8 or 1/4 DIN panel mount with NEMA 4X faceplate, or NEMA 4 stand-alone enclosure
- Front panel field-programming (with lock-out jumper)
- Target and actual speed can be any engineering unit of measure
- Two alarm relay outputs (form C, 5 Amp @ 250 VAC)
- Large 1/2" LED display
- Master/Follower modes
- Displays set point or actual running speed
- Adjustable PID settings

AVAILABLE OPTIONS

- Custom faceplates for your Brand Name
- Pluggable euro-style terminal strip
- Provision for Remote Up/Down pushbutton switches

OPERATING SPECIFICATIONS

Ambient Temp.....	-10° to +45° C
Line Input Frequency	50/60 Hz
Overload Capacity	200% for 1 minute
Transducer Input.....	0-5 to 0-24 VDC
On-board transducer	
Power Supply	5 VDC, 50mA
4-20mA input/output accuracy	±1%

MD plus SERIES SELECTION GUIDE

MODEL NUMBER	MAX. ARM DC AMPS	MAX H.P.	INPUT	OUTPUT
MD40P-420	5	½	120 VAC	0-90 VDC
	5	1.0	240 VAC	0-180 VDC
MD50P-420	10	1.0	120 VAC	0-90 VDC
	10	2.0	240 VAC	0-180 VDC
MD50E-420	10	1.0	120 VAC	0-90 VDC
	10	2.0	240 VAC	0-180VDC

DIMENSIONS (INCHES)

MODEL	WIDTH	HEIGHT	DEPTH
MD40P-420 (1/8 DIN)			
Housing	3.620	1.656	4.625
Lens	4.539	2.289	0.375
MD50P-420 (1/4 DIN)			
Housing	3.620	3.497	4.625
Lens	4.539	4.179	0.375

MD50E-420 (NEMA 4 enclosed)

Same dimensions as MD3E on catalog page 17

APPLICATIONS

The MD *plus* system is ideal in many process applications requiring a closed-loop DC variable speed drive with an isolated 4-20mA input and output.

Typical applications include:

- Waste water treatment
- Chemical metering processes
- Laboratory mixing equipment
- Industrial auger/mixing equipment
- Polymer injection processes

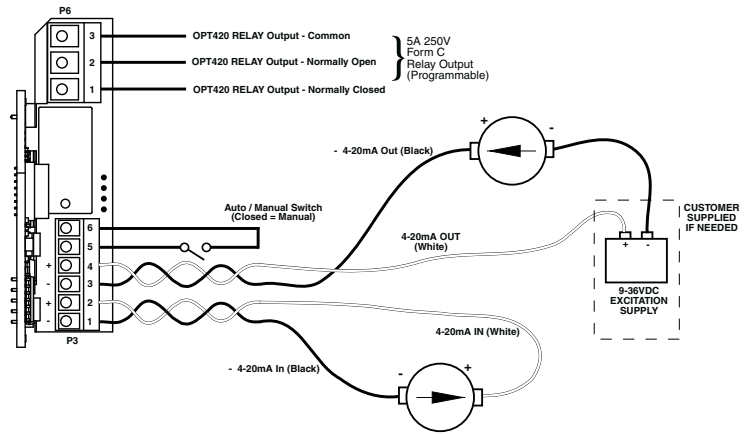
ASP40-420

The ASP40-420 is also available for applications that require a closed-loop digital interface with a 4-20mA input/output and programmable relay outputs, but already have an existing AC or DC drive in the system.

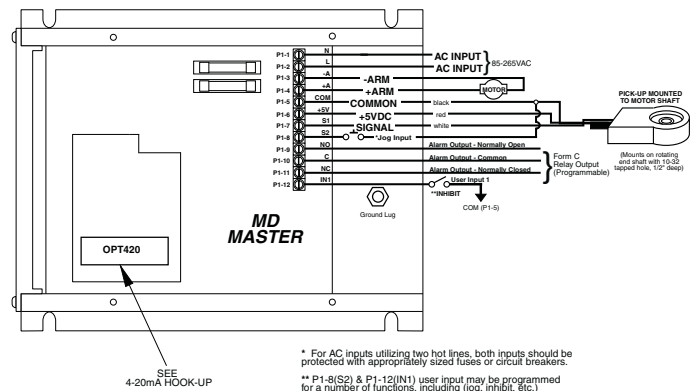


See your Dart Representative for details or call Dart Controls at 317-873-5211.

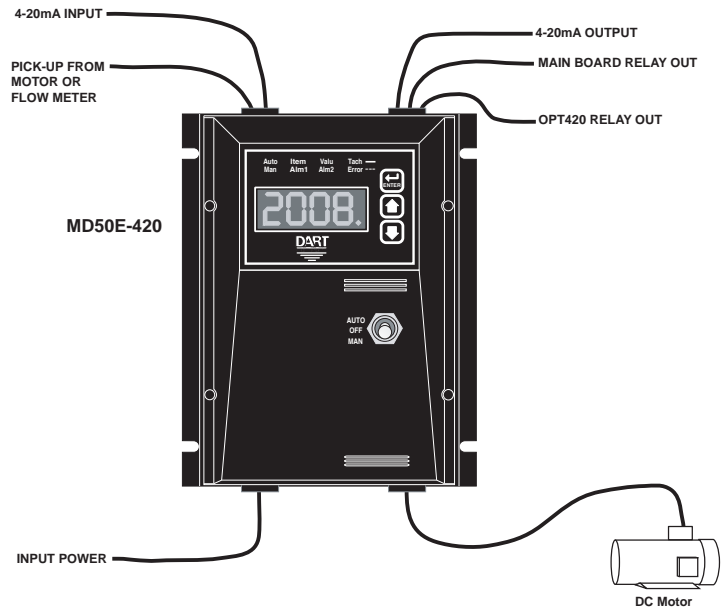
4-20mA HOOK-UP



MD50 DRIVE TYPICAL WIRING DIAGRAM



METERING PUMP APPLICATION





MD20P and MD30P cULus Recognized



MD30E cULus Listed

MDII Series Programmable Digital Closed Loop DC Speed Control with P-I-D and RS Communication

The MDII Series digital motor speed controls, employing an advanced 16-bit microprocessor, is designed for digital closed loop operation of up to 2 horsepower DC permanent magnet motors. This control features a true P-I-D algorithm, for extremely responsive and precise control over a wide variety of desired speeds and applications. **The MDII Series is designed as a companion or direct replacement control to the MD Series, while offering expanded performance features.**

Set or actual speed is displayed directly in RPM, FPM, PROCESS TIME, or other engineering units. Field programming permits customizing specific operating parameters.

The integrated RS485/RS422/RS232 serial interface port is perfect for monitoring or control using almost any computer or process controller. Units can even be attached in a Local Area Network, and can then be controlled and programmed either individually or all at once. Multiple programs allow the user to choose between a "menu" of up to six programmed configurations.

The MDII series is the ultimate answer for precise, responsive, cost-effective and flexible closed loop motor speed control.

COMMUNICATION FEATURES

- RS485; RS422; RS232 serial interface port for remote monitoring/control/programming allows the following:
 - Continuous output of actual shaft speed
 - Remote speed setting
 - Programming or listing of all field programmable parameters
 - Dartnet network allows multiple controls to be attached via one cable. Controls can be individually programmed or integrated.
 - Programmable communication baud rate - 300 to 9600 baud
- Network Follower mode allows widely remote controls to be followed together over single RS485 twisted pair wire or over existing network

STANDARD FEATURES

- Compact 1/8 or 1/4 DIN sturdy aluminum housing for panel mounting; or NEMA 4/12 enclosure
- Microprocessor based; utilizes powerful 16-bit Motorola C68HC11
- Field Programmable operating parameters
- Displays actual or desired speed directly in RPM, FPM, process time, or other engineering units
- P-I-D digital closed loop control; gains settable for optimum system performance; Fast settling time
- Accuracy $\pm 1/2$ RPM of set speed
- Master/Follower operation
- Variety of pick-up inputs; Hall-Effect, Photoelectric, or any TTL; control accepts up to 1.2 million pulses/min. max
- Non-volatile memory retains speed setting and all field programmable parameters
- Internal A/D interface permits using potentiometer, 4 to 20mA or 0 to +5 VDC signal in lieu of digital pick-up signal or to control target speed, current program or frequency generator output
- Inhibit circuit permits start and stop without breaking AC lines; pre-selecting speed, or simultaneous start-up of multiple control units
- Up/down pushbuttons for set points - slow-fast sweep; front panel lockout prevents accidental setting changes
- Self-contained power supply for transducer (+5V, 25mA)
- Transient voltage protection
- Exclusive user assignable outputs - to drive relays, alarms, etc. Can be activated by any combination of conditions; upper speed limit exceeded, etc.
- Independent frequency generator allows units to produce own leader frequency.
- European style terminal strip
- G.E. Lexan™ membrane seals faceplate from environment
- Multi-mode of operation allows multiple constants, settings, and upper/lower limits. Up to six different configurations can be selected from the front panel via the up/down pushbutton switches

PROGRAMMING FEATURES

- All programming from front panel "Menu Driven"
- User selectable "programming protect" prevents unauthorized access
- LED function indicators
- Programmable parameters include:
 - Lower/upper limits for speed setting
 - Accel/decel 0 to 30 seconds for 0-1000 RPM change
 - Pick-up pulses per revolution
 - P-I-D gain settings
 - Constants to allow display in desired user engineering units - rate or time
 - Decimal point or colon
 - "Stall detector" time-out for annunciation and shutdown
 - Multiple programs permit up to six different desired set-ups to be programmed
 - Selectable display blanking point
 - Operation mode (master rate, master time, standard follower, Network Follower)
 - Unit address for multiple control networking
 - Selectable serial communication rate
 - Front panel lockout for speed setting and/or program changes
 - Numerous other features

MDII SERIES SELECTION GUIDE

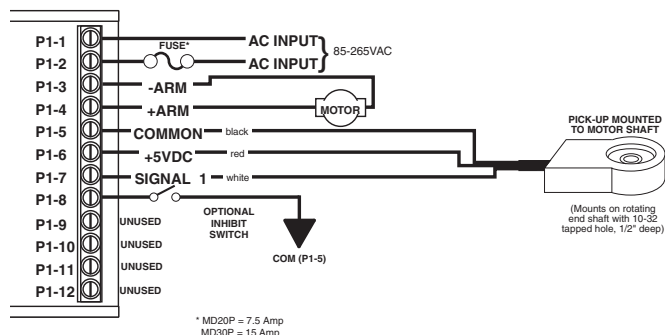
MODEL NUMBER	MAX. ARM DC AMPS	MAX H.P.	INPUT	OUTPUT
MD20P	5	1/2	120 VAC	0-90 VDC
	5	1	240 VAC	0-180 VDC
MD30P	10	1	120 VAC	0-90 VDC
	10	2	240 VAC	0-180 VDC
MD30E	10	1	120 VAC	0-90 VDC
	10	2	240 VAC	0-180 VDC

- All models accept 85-265 VAC Single Phase Input.
- Peak motor output voltage is equal to peak AC input voltage.
- Requires Dart PU-E or other suitable pick-up.
 - Sensor must have minimum output current of 10 mA.
 - Drive includes supply for external sensor of 5VDC @25 mA max.
 - Shipped set for 0-2400 RPM with one pulse per revolution.

OPTION DESCRIPTION

OPTION	SUFFIX
Auto-Off-Manual control for 4-20mA or 0-5 VDC analog signal input (MD30E only)	-7
Magnetic pick-up input board	-3
Blank Lexan (MD20P, MD30P)	-9
Pluggable terminal strip	-P

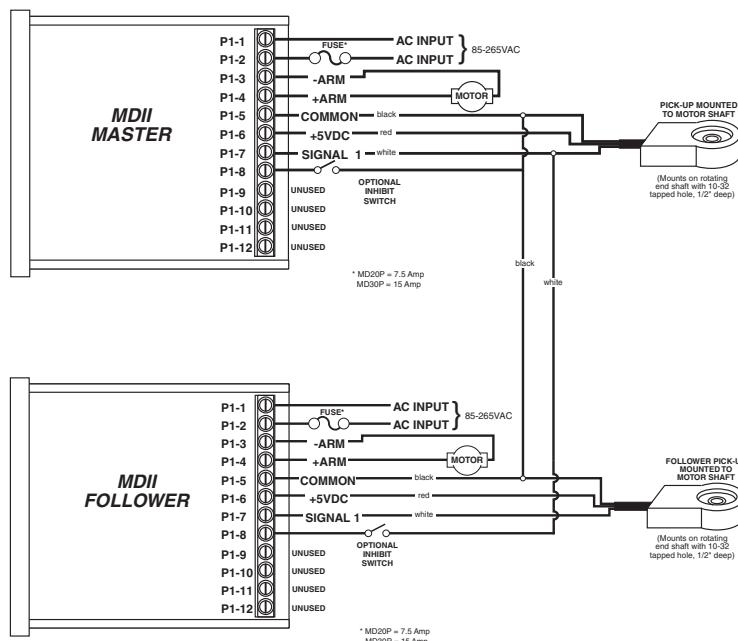
WIRING DIAGRAM - MASTER



OPERATING SPECIFICATIONS

Temperature	-10° to +45° C.
AC Input Voltage	85-265 VAC
Input Frequency	50/60 Hz.
Overload Capacity	200% for 1 minute
Transducer Signal Input	0-5 to 0-25 VDC square wave

WIRING DIAGRAM-MASTER/FOLLOWER

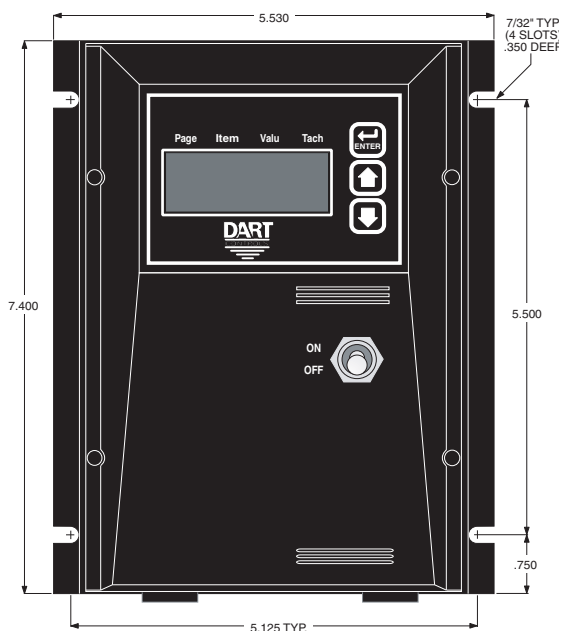


* MD30E uses a 15 Amp fuse and internally mounted on-off switch. No external fusing or switch needed.

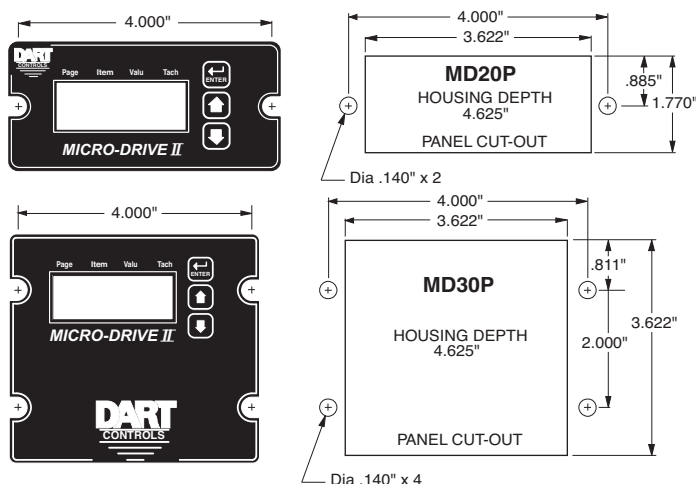
DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH
<i>MD20P inches (millimeters)</i>			
Housing	3.620 (91.95)	1.656 (42.06)	4.625 (117.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)
<i>MD30P inches (millimeters)</i>			
Housing	3.620 (91.95)	3.497 (88.82)	4.625 (117.47)
Lens	4.539 (115.29)	4.179 (106.15)	0.375 (9.52)

MOUNTING SPECIFICATIONS - MD30E



MOUNTING SPECIFICATIONS - MD20P / MD30P



Accu-Set Series

Digital Closed Loop Interface for Improved AC or DC Drive System Performance

The Accu-Set is a compact, economical control that can be used with conventional AC, DC, or Brushless DC adjustable speed drive systems to provide an LED display of set speeds and precise, digital closed loop motor speed control. An on-board microprocessor with non-volatile memory coupled with sophisticated internal software makes Dart's Accu-Set the ultimate in accuracy and control.

Target speeds are displayed directly in RPM, FPM, GPM, process time, or any other engineering unit of measure. Friendly front-panel field programming permits customizing the Accu-Set to the exact specifications for each application; maximum and minimum set speed, decimal points or colon, operating mode (master or follower), and the constant which takes into account motor gear ratios.

The Accu-Set is simple to operate... just set the desired RPM, rate, or time in the large 1/2" LED display by depressing the "up-down" pushbuttons, one digit at a time or fast sweep. The Accu-Set settings are exact and repeatable. It will precisely control speed to a remarkable $\pm 1/2$ RPM of set speed, long term.

The panel mount unit is easy to install in the industry standard cutout dimensions of 1/8 DIN. All wiring connects directly to a European style terminal strip through the easy access rear panel.

TYPICAL APPLICATIONS

Dart's Accu-Set design is ideal for providing the same precise closed loop control and digital readout as the MD Series Micro-Drive in new or retro-fit applications that use an AC, DC, or Brushless DC motor drive system.

OPERATING SPECIFICATIONS

Temperature.....	-10° to +45° C
AC input voltage.....	85-265 VAC
Input frequency	50/60 Hz
Transducer signal input.....	0-5 to 0-24 VDC
On-board power supply	5 VDC, 50mA (for external sensors)

New universal power supply will support any AC input voltage from 85 to 265 VAC



Display adjustable for intensity, decimal point positions, and zero blanking

User can program all configurations through easy-to-use front panel push button switches

Easy access to all rear panel connector terminals



ACCU-SET SERIES STANDARD FEATURES

- Adjustable min/max
- Adjustable accel/decel
- Adjustable equivalent to Proportional & Integral gain setting
- Pulse input capacity of 50,000 PPM, 833Hz
- Programmable power-on initial settings
- Inhibit mode is selectable from many input options
- Jog function selectable from many input options
- User-friendly programming from the front panel with parameter lockout capability
- Programming buttons have adjustable rate and mode; linear or non-linear
- Display is programmable for any engineering unit of measure
- Adjustable display options include decimal point positions and intensity
- Custom front panel artwork available
- Easy panel mounting with 2 bolts (supplied)
- NEMA 4X Rating (faceplate with supplied gasket)
- Universal power supply supports any AC voltage input from 85-265 VAC
- Compatible with Dart's line of low-cost digital pick-ups or other suitable pick-ups
- Programmable user output supporting up to 230 VAC @5A
- Multiple operational modes: Rate, Time, Follower
- Non-volatile memory allows all custom settings to be stored for future use
- Factory default function-reset drive to factory setting
- User-default storage capability allows user to store/recall a known good set of parameters while experimenting with settings

ASP SELECTION GUIDE

MODEL INPUT DISPLAY UNITS STD. SPEED RANGE

ASP10 120/240 VAC Rate or Time Field Programmable*

Requires Dart PU-E or other pick-up.

* Shipped set for 0-2400 RPM with one pulse per revolution

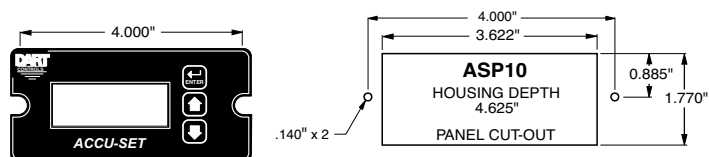
OPTION DESCRIPTION

OPTION	SUFFIX
Provisions for remote pushbutton switches	-1
Pluggable terminal strip.....	-P
Magnetic pick-up input board	-3

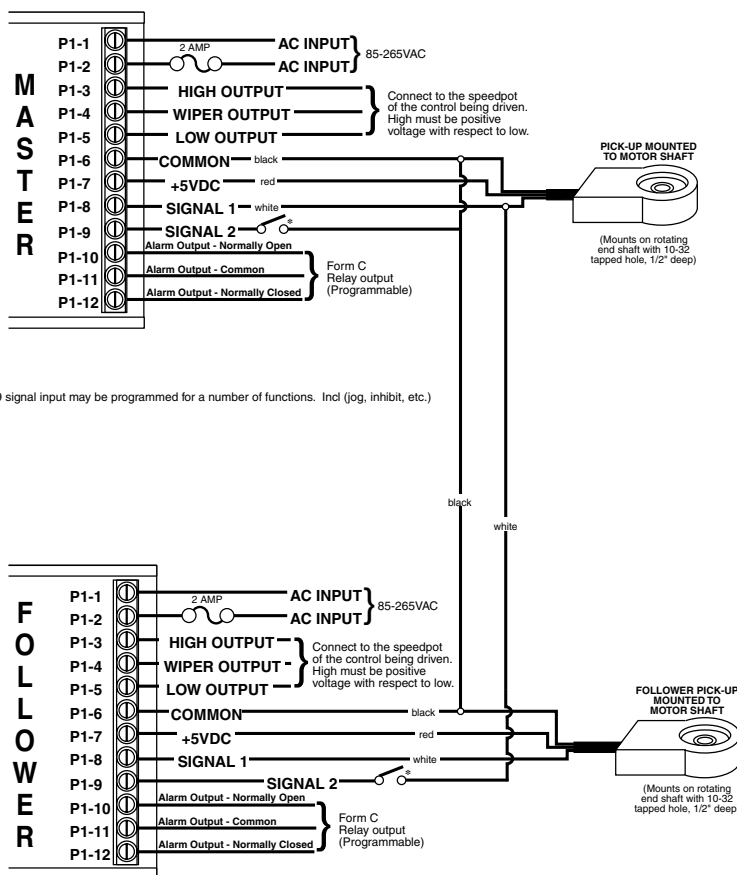
DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH
ASP 10 inches	(millimeters)		
Housing	3.620 (91.95)	1.656 (42.06)	4.625 (117.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)

MOUNTING SPECIFICATIONS

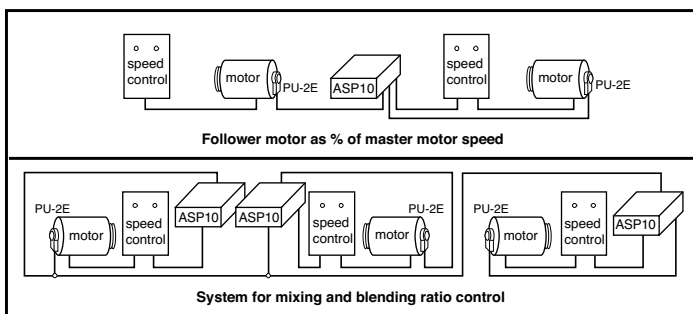
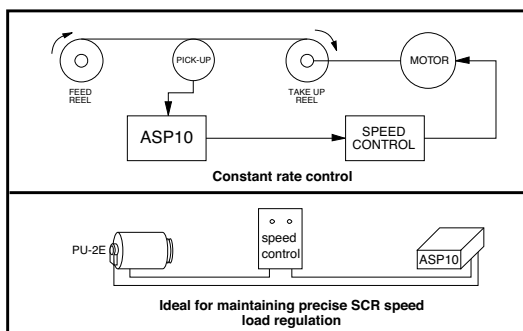


ACCU-SET HOOK-UP- MASTER AND FOLLOWER



* Optional Inhibit Switch

ASP CONFIGURATIONS





Accu-Set II Series Digital Closed Loop System for Use with Conventional AC Frequency or DC Drives

The Accu-Set II Series digital control unit, with an advanced 16-bit Microprocessor, is designed for use with conventional AC frequency or DC drives, any horsepower, to provide: LED display of set or actual speed, closed loop motor speed control, Master or Follower modes, and Serial communications.

The Accu-Set II Series is a companion control to the Accu-Set Series, while offering significantly improved performance. This control features a *true* P-I-D algorithm, for extremely responsive and precise control over a wide variety of desired speeds and applications.

Set or actual speed is displayed directly in RPM, FPM, Process Time, or other engineering units. Field programming permits customizing specific operating parameters.

The integrated RS485/RS422/RS232 serial interface port is perfect for monitoring or control using almost any computer or process controller. Units can even be attached in a Local Area Network, and can then be controlled and programmed either individually or all at once. Multiple programs allow the user to choose between a "menu" of up to six programmed configurations.

The Accu-Set II Series is ideally suited for commercial or industrial applications, including system up-grades.

COMMUNICATION FEATURES

- RS485; RS422; RS232 serial interface port for remote monitoring/control/programming allows the following:
 - Continuous output of actual shaft speed
 - Remote speed setting
 - Programming or listing of all field programmable parameters
 - Dartnet network allows multiple controls to be attached via one cable. Controls can be individually programmed or integrated.
 - Programmable communication baud rate for 300 to 9600 baud
 - Network Follower mode allows widely remote controls to be followed together over single RS485 twisted pair wire or over existing network

ACCU-SET II SERIES STANDARD FEATURES

- Compact 1/8 DIN aluminum housing for panel mounting
- Microprocessor based; utilizes powerful 16-bit Motorola MC68HC11
- Field Programmable operating parameters
- Displays actual or desired speed directly in RPM, FPM, process time, or other engineering units
- P-I-D digital closed loop control; gains setable for optimum system performance; Fast settling time
- Accuracy $\pm 1/2$ RPM of set speed
- Master/Follower operation
- Variety of pick-up inputs; Hall-Effect, Photoelectric, or any TTL; accepts up to 1.2 million pulses/min. maximum
- Non-volatile memory retains speed setting and all field programmable parameters
- Internal A/D interface permits using potentiometer, 4 to 20 mA or 0 to +5 VDC signal in lieu of digital pick-up signal or to control target speed, current program or frequency generator output
- Inhibit circuit permits start and stop without breaking AC lines; pre-selecting speed, or simultaneous start-up of multiple control units
- Up/down pushbuttons for set points - slow-fast sweep; front panel lockout prevents accidental setting changes
- Self-contained power supply for transducer (+5V, 50mA)
- Exclusive user assignable outputs - to drive relays, alarms, etc. Can be activated by any combination of conditions; upper speed limit exceeded, etc.
- Independent frequency generator allows units to produce own leader frequency.
- Barrier type terminal strip
- G.E. Lexan™ membrane seals faceplate from environment
- Multi-mode of operation allows multiple constants, settings, and upper/lower limits. Up to six different configurations can be selected from the front panel via the up/down pushbutton switches

PROGRAMMING FEATURES

- All programming from front panel "Menu Driven"
- User selectable "programming protect" prevents unauthorized access
- LED function indicators
- Programmable parameters include:
 - Lower/upper limits for speed setting
 - Accel/decel 0 to 30 seconds for 0-1000 RPM change
 - Pick-up pulses per revolution
 - P-I-D gain settings
 - Constants to allow display in desired user engineering units- rate or time
 - Decimal point or colon
 - "Stall detector" time-out for annunciation and shutdown
 - Multiple programs permit up to six different desired set-ups to be programmed
 - Selectable display blanking point
 - Operation mode (master rate, master time, standard follower, network follower)
 - Unit address for multiple control networking
 - Selectable serial communication rate
 - Front panel lockout for speed setting and/or program changes
 - Numerous other features

ACCU-SET II SERIES ASP20 SELECTION GUIDE

MODEL	INPUT	DISPLAY UNITS	STD. SPEED RANGE
ASP20	120/240 VAC	Rate or Time	Field Programmable*

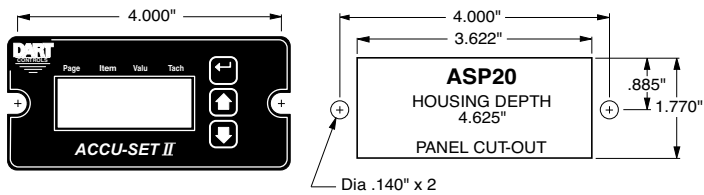
Requires Dart PU-E or other pick-up.

* Shipped set for 0 - 3600 RPM with one pulse per revolution.

OPERATING SPECIFICATIONS

Temperature..... -10° to +45° C.
 AC input voltage..... 85-265 VAC
 Input frequency..... 50/60 Hz.
 Transducer signal input..... 0-5 to 0-24 VDC
 On-board power supply..... 5 VDC, 50mA
 (for external sensors)

MOUNTING SPECIFICATIONS - ASP20



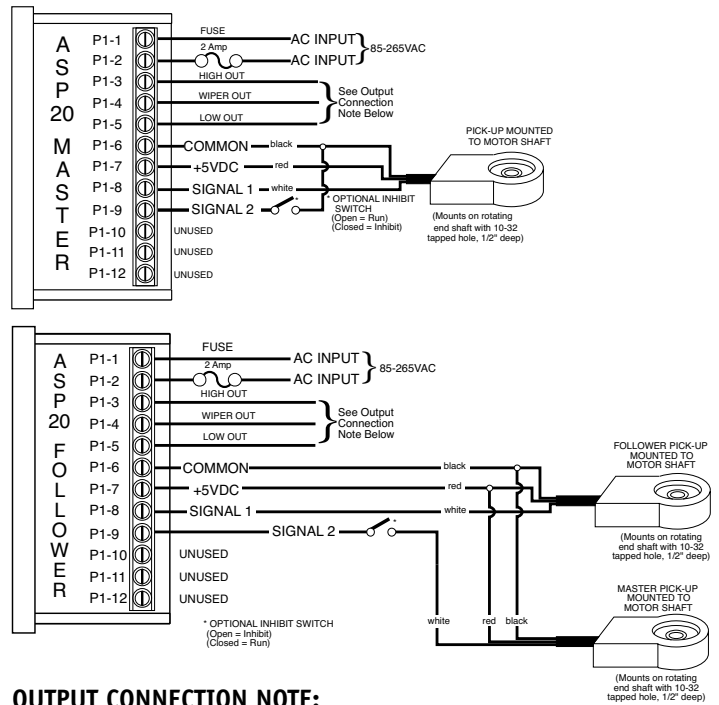
DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH inches (millimeters)	HEIGHT	DEPTH
ASP20			
Housing	3.620 (91.95)	1.656 (42.06)	4.625 (117.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)

OPTION DESCRIPTION

OPTION	SUFFIX
Magnetic pick-up input board	-3
Blank Lexan	-9

HOOK-UP DIAGRAMS - ASP20



OUTPUT CONNECTION NOTE:

Connect to Speedpot input of the device being driven (P1-3 must be positive in respect to P1-5). If driven device has a positive supply, connect P1-3 to the Positive supply terminal (Pot High) and set Page 7 Item 11 -see ASPII/MDII instruction manual- to a value of zero. If driven device has a negative power supply, connect P1-3 to the Common terminal (Pot Low) and set Page 7 Item 11 to a value of 1.

HOOK-UP PROCEDURE:

STEP 1: Connect the proper input voltage to P1-1 and P1-2.

NOTE: Fusing should be added in the AC line to protect the control. A 2 amp fuse is recommended.

STEP 2: Connect the PU-E as shown in hook-up diagram above.

STEP 3: Wire the pot output of the ASP20 to the control being driven.

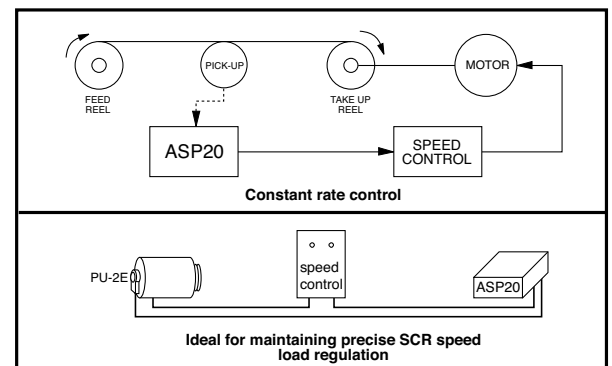
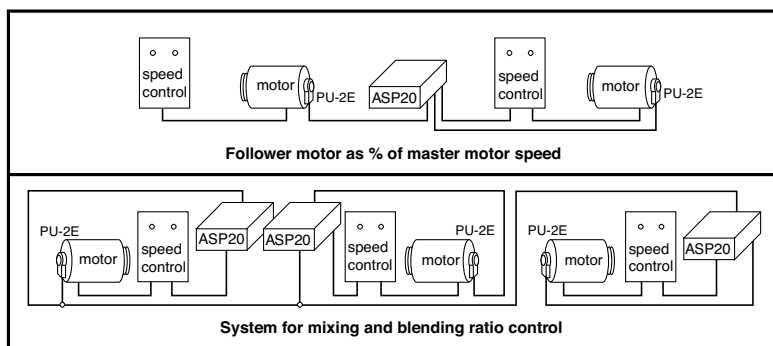
STEP 4: You are now ready to apply power to your system.

NOTE: Shielded cable is recommended for applications where pick-up cord length is in excess of 6 feet.

Connect the shield to the common terminal of the ASP20, leaving the shield at the pick-up end floating.

CAUTION: When pick-up signal is lost, a master ASP20 will run at full speed, while a follower ASP20 will go to zero speed.

ACCU-SET SERIES CONFIGURATIONS



DP4 Series Digital Potentiometer with Scalable Display & User I/O



The DP4 is a microprocessor based digital speed potentiometer that can directly replace a conventional 3-wire analog speedpot or motorized speedpot for most AC and DC drives. The desired set speed is entered into the large 1/2 inch LED display through the convenient front-panel interface, and display units are now programmable for virtually any unit of measure.

The attractive panel mount unit is easy to install in industry standard 1/8 DIN cut-out dimensions. The electrically isolated common signal permits direct wiring from the unit terminal block to the drive's potentiometer terminal points.

The DP4 offers the same enhanced display options and capabilities featured in our other digital control products, as well as the Universal Power Supply and rugged screw type terminal strip.

TYPICAL APPLICATIONS

The DP4 is ideal for new equipment as well as for retrofitting most AC or DC drive systems where precise, repeatable speed setting and digital readout are desired. The DP4 is also ideal in applications where high vibration and other environmental factors can cause normal speedpot settings to drift.

STANDARD FEATURES

- Inhibit function selectable from a number of modes
- Control mode selectable between rate and time
- Jog function selectable from several modes
- Factory default function – reset drive to factory setting
- User-default storage capability allows user to store/recall a known good set of parameters while experimenting with new settings
- NEMA 4X Rating (faceplate with supplied gasket)
- Supports bipolar connections for regenerative drives

DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH
<i>DP4 inches (millimeters)</i>			
Housing	3.620 (91.95)	1.656 (42.06)	4.625 (117.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)

DP4 SELECTION GUIDE

MODEL	INPUT	STD. SPEED RANGE
DP4	120/240 VAC	0–100% (0.1% Increments)

OPTION DESCRIPTION

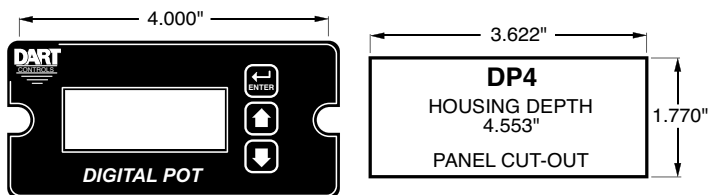
OPTION	SUFFIX
Provisions for remote pushbutton switches	-1
Blank Lexan	-9
Pluggable terminal strip	-P*

*Check factory for availability.

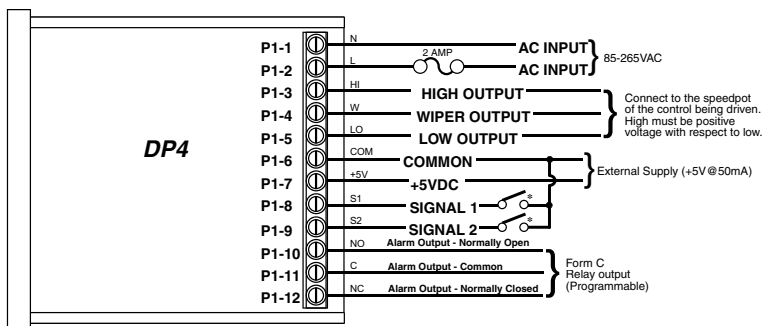
OPERATING SPECIFICATIONS

Temperature.....	-10° to +45° C
AC input voltage.....	85–265 VAC
Input frequency	50/60 Hz
Output compatible.....	any drive input impedance of 1000 ohms to 10,000,000 ohms.
Output support	±10 VDC or lower or 0 to +20 VDC

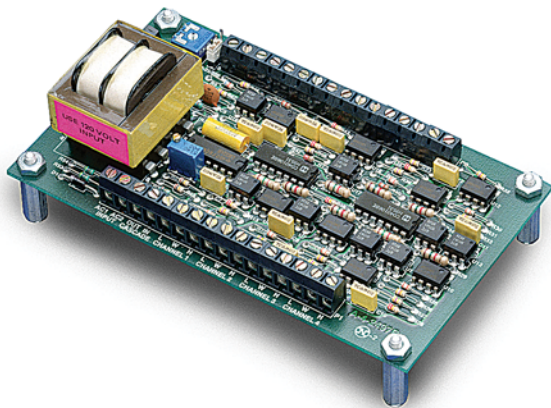
MOUNTING SPECIFICATIONS



DP4 HOOK-UP



* P1-8 & P1-9 signal inputs may be programmed for a number of functions.



MSC38A Series Eight Channel Master Speed Control

A reliable, economical master speed control unit for operating multiple variable speed drives from a single 5K master potentiometer or field selectable DC voltage range of 0-5 through 0-25 VDC OR 0-25 through 0-200 VDC input (grounded or ungrounded).

Drives may be controlled to maintain identical speeds or individually pre-set proportional speeds with respect to the MSC speed setting.

STANDARD FEATURES

- 120 VAC $\pm 10\%$, 50/60 Hz. line source
- Eight (3-wire) output channels - each optically isolated
- MSC38A may be cascaded to operate more than 8 drives
- Master command input circuit electrically isolated from AC
- Rapid response time
- European style terminal block connectors
- Supply voltage of driven unit is 5-25 VDC maximum
- 5K ohm speedpot with 8" leads, dial, and knob for remote mounting included
- Interfaces with Dart 125, 250, or 500 series controls or most other manufacturer's drives
- Outputs are controlled via a 5K ohm master speedpot or a field selectable DC voltage signal (0-5 through 0-25 VDC OR 0-25 through 0-200 VDC)
- Each output is capable of driving input impedances as low as 500 ohm

DIMENSIONAL SPECIFICATIONS

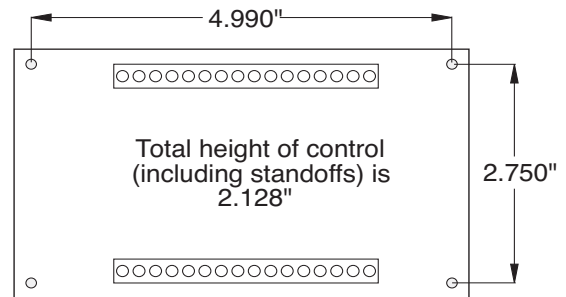
WIDTH	HEIGHT	LENGTH	WEIGHT
<i>English (inches)</i>			
3.13	2.13	5.40	7.4 oz
<i>Metric (centimeters)</i>			
7.95	5.41	13.73	208.3 gm

OPERATING CONDITIONS

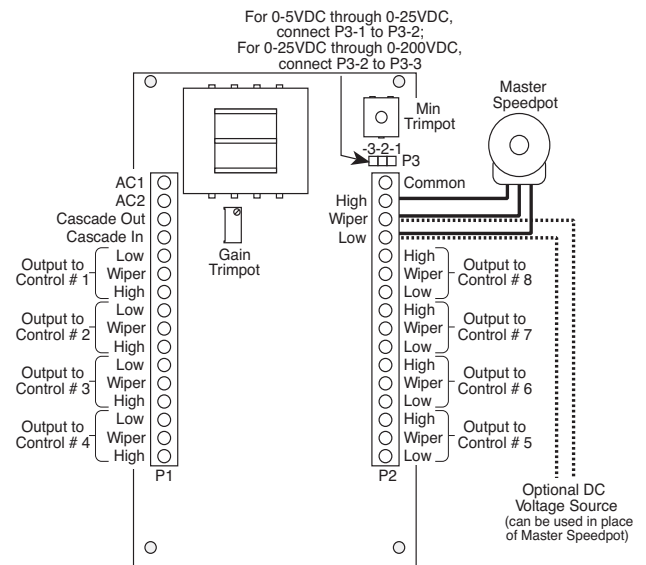
Temperature..... -10° to +45° C. (15° to 113° F.)
 AC Input Voltage $\pm 10\%$ Rated Line Voltage
 Input Frequency 50/60 Hertz
 Output Voltage ... 0-5 through 0-25 VDC each channel
 Output Current 10 mA per channel

www.dartcontrols.com

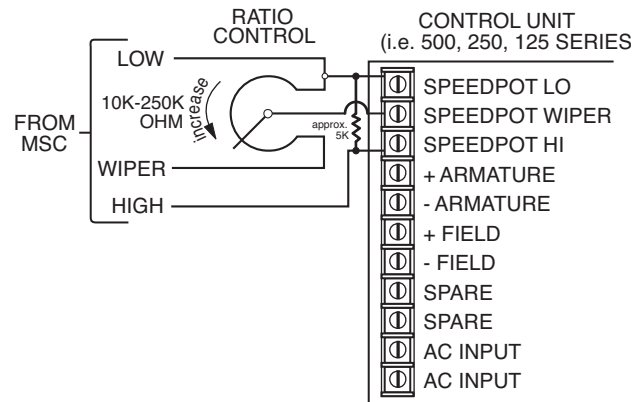
MSC38A MOUNTING DIMENSIONS



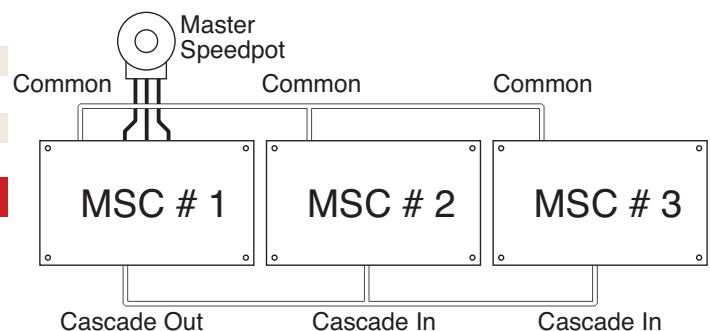
MSC38A HOOK-UP FOR DIRECT OPERATION



INPUT HOOK-UP FOR RATIO OPERATION



CASCADE HOOK-UP FOR BASIC CONTROLS



For more than 8 outputs using a single Master speedpot, controls can be cascaded together via the cascade and common terminals shown above.

DM8000 Series Microprocessor Based Digital Tachometer and Process Meter



The DM8000 is an economical microprocessor-based digital tachometer system capable of measuring shaft speeds lower than 1 RPM. With an on-board microcomputer coupled with sophisticated internal software and a quartz crystal controlled reference frequency, the DM8000 is able to maintain accuracy of $\pm 0.04\%$, even if the shaft is uneven.

The DM8000 is field programmable through the easy-to-use front panel interface and can be configured to display any desired unit of measure. Large 1/2 inch 4-digit LED display numbers allow viewing under the most adverse conditions.

The isolated 5 Amp form C relay output can be configured for many different alarming conditions. Designed to use a variety of inputs, including the Dart patented Hall-Effect solid state PU-E pick-up, the system delivers trouble free operation at an economical cost.

The DM8000 offers the same enhanced display options and capabilities featured in our other digital control products, as well as the Universal Power Supply and rugged European style terminal strip.

DM8000 STANDARD FEATURES

- Selectable alarm relay output: low, high, window or not window (a second alarm option is available)
- User inputs allow for special functions: counter reset, counter gate, and alarm display
- Control modes are selectable between rate, time, and counter
- Factory default function—reset to factory setting
- User-default storage capability allows user to store/recall a known good set of parameters while experimenting with new settings
- Non-volatile memory allows all custom settings to be stored for future use
- NEMA 4X Rating (faceplate with supplied gasket)

TYPICAL APPLICATIONS

The DM8000 can be used in process applications for monitoring speeds and rates, or counting discrete input signals. Process applications using counting may be batching, filling, mixing, punching, cutting, drilling, diverting, or alarming. Process applications using speed or rate monitoring may be conveyors, conveyor ovens, material flow, rotational rpm, and testing.

DM8000 SELECTION GUIDE

MODEL	INPUT	DISPLAY UNITS	STD. SPEED RANGE
DM8000	120/240 VAC	Rate or Time	Field Programmable*

Requires Dart PU-E or other pick-up.

* Shipped set for 0 - 2400 RPM with one pulse per revolution.

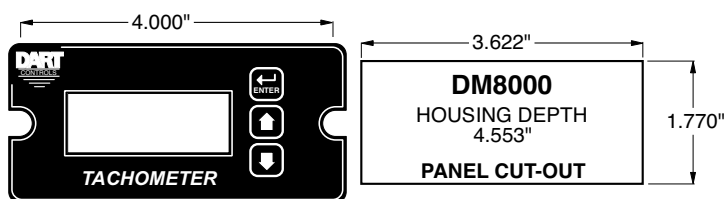
DM8000 OPTION DESCRIPTION

OPTION	SUFFIX
Second alarm output relay (form C)	-R
Provision for remote pushbutton switches	-1
Pluggable terminal strip.....	-P
Magnetic pick-up input board	-3

DM8000 OPERATING SPECIFICATIONS

AC input voltage..... 85–265 VAC
 Input frequency 50/60 Hz
 Input pulse rate 1 to 125,000 input pulses per minute
 Resolution..... from 0.01 RPM
 Accuracy $\pm 0.04\%$ display up-date every pulse
 or 0.5 seconds, whichever is longer
 Isolated high/low alarm output..... 5 Amp 230 VAC
 max settable range: 0 to 9999
 Transducer signal input..... 0-5 to 0-24 VDC square wave

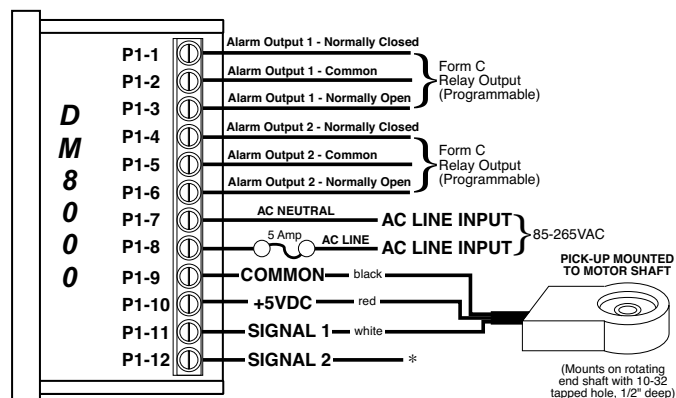
DM8000 MOUNTING SPECIFICATIONS



DM8000 DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	HEIGHT	DEPTH
DM8000 inches (millimeters)			
Housing	3.620 (91.95)	1.656 (42.06)	4.428 (112.47)
Lens	4.539 (115.29)	2.289 (58.13)	0.375 (9.52)

DM8000 HOOK-UP



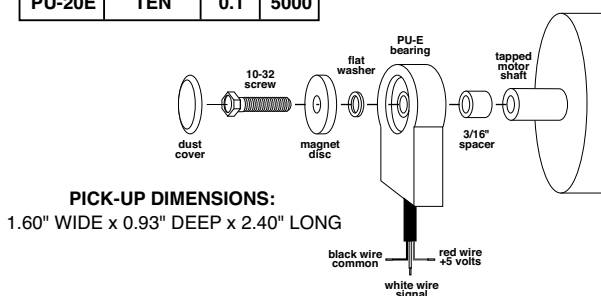
* Used for various functions, including quadrature counter mode.

DART PU-E SELECTION AND MOUNTING

MODEL	PULSES PER REV	MIN. RPM	MAX. RPM
PU-2E	ONE	1.0	5000
PU-20E	TEN	0.1	5000

MOUNTING PROCEDURE

1. Tap motor shaft 10-32 x 1/2" deep.
2. Remove red cap on pick-up screw.
3. Remove black dust cover from PU.
4. See illustration below.



700/Commutrol™ Series DC Brushless Motor Control



703BDC

Speed Potentiometer
Kit Included

Dart's 700/Commutrol™ Series is a family of brushless DC motor controls designed to provide commutated power and variable speed control for standard 3 phase brushless (BLDC) motors. The controls operate in a basic open loop or closed loop configuration with either 60° or 120° brushless D.C. motors. Compact, economical, and efficient, the 700/Commutrol™ Series is ideal where high torque, high speed and quiet operation are needed.

The latest addition to the 700 Series, the 703BDC, has the same compact surface mount layout as the 701BDC with the following added features: Adjustable Accel/Decel plus a bi-directional speedpot control capability (wig-wag).

The 700/Commutrol™ Series controls can also be provided with a pluggable connector and fixed settings for OEM applications.

700/COMMUTROL™ STANDARD FEATURES

- Open loop or integrated closed loop models
- Quiet 15KHz. PWM switching frequency
- MOSFET power devices
- Directional control - forward/reverse
- Internal +6.2, VDC 20 mA supply for motor Hall-Effect .. sensors
- 5K ohm speedpot w/ 8" leads, knob and dial for remote mounting
- Anodized chassis mount heatsink

OPERATING CONDITIONS

Temperature -10° to +45° C.

700/COMMUTROL™ SELECTION GUIDE

For 700B Series	For 710A Series	
Model 700BDC	Model 710ADC	Open Loop
Model 701BDC	Model 711ADC	Closed Loop
Model 703BDC		Closed Loop

700/COMMUTROL™ OPTION DESCRIPTION

OPTION	SUFFIX
Pluggable terminal strip (700B Series only).....	-PA

DIMENSIONAL SPECIFICATIONS

MODEL	WIDTH	LENGTH	DEPTH	WEIGHT
<i>English (inches) Metric (centimeters)</i>				
700BDC	3.63 9.21	4.25 10.80	1.30 3.30	6 oz. 170 gm.
701BDC	3.63 9.21	4.25 10.80	1.30 3.30	6 oz. 170 gm.
703BDC	3.63 9.21	4.25 10.80	1.30 3.30	6 oz. 170 gm.
710ADC	3.62 9.20	7.00 17.78	2.00 5.08	16 oz. 453 gm.
711ADC	3.62 9.20	7.00 17.78	2.00 5.08	16 oz. 453 gm.

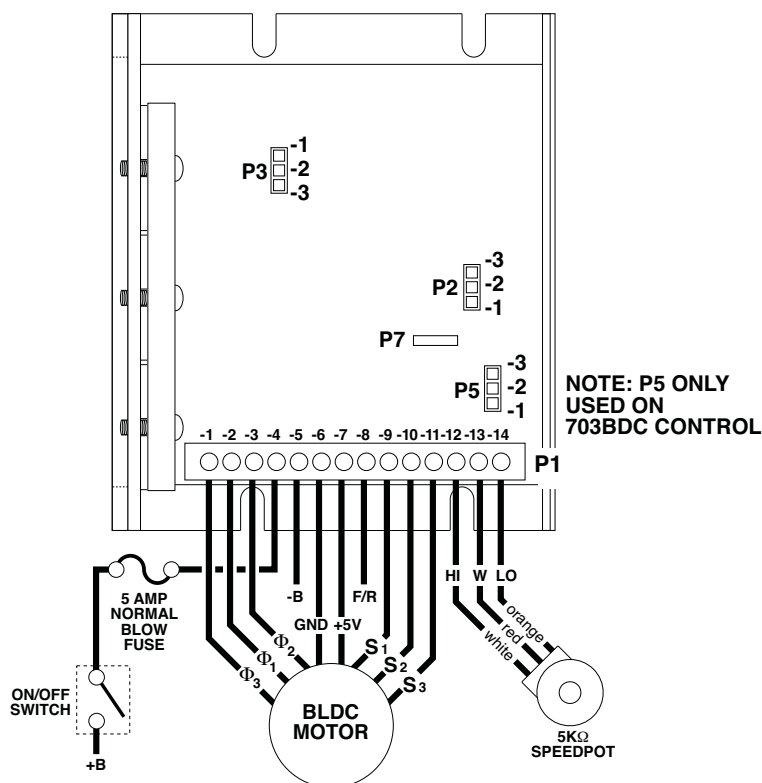
700/COMMUTROL™ SPECIFICATIONS

	700B SERIES	710A SERIES
Input Voltage	11–40 VDC Input ¹	10–54 VDC Input ²
Output Voltage	0–Input Voltage	0–Input Voltage
Load Current	5 Amps continuous	20 Amps continuous
Overload Current	150% for 30 seconds	200% for 30 seconds
Speed Adjustment	Potentiometer or 0–6.2 VDC Analog Input Signal	Potentiometer or 0–6.2 VDC Analog Input Signal
Speed Range	50:1	50:1
Current Limit	Adjustable Trimpot	Adjustable Trimpot
Motor Hall Spacing (electrical degrees)	60 or 120 degrees (field selectable)	60 or 120 degrees (field selectable)
Acceleration	Fixed, fast start Adjustable 0–10 Sec (703 only)	Fixed, fast start
Deceleration	Fixed Adjustable 0–10 Sec (703 only)	Fixed
Min Speed	Adjustable; 0–30% of max.	Adjustable; 0–30% of max.
Max Speed	Adjustable; 60–100% of max.	Adjustable; 60–100% of max.
Input/Output Connections	Terminal block	Terminal block
Speed Regulation	Open loop (700BDC) Closed loop (701BDC, 703BDC) ±1/2% of base speed	Open loop (710ADC) Closed loop (711ADC) ±1/2% of base speed

1 - Field selectable voltage range 11-14 VDC input or 18-40 VDC input.

2 - Field selectable voltage range 10-13.5 VDC input or 18-54 VDC input.

700B SERIES HOOK-UP



65 Series Battery Operated DC Motor Speed Control

65E60



Speed Potentiometer
Kit Included

The 65 Series controls are high performance PWM controls for 12, 24, and 36 volt battery powered equipment providing smooth control with high efficiency operation. The advanced design permits a substantial increase in the equipment running time between charges over conventional techniques. Features include adjustable maximum speed, minimum speed, current limit, I.R. compensation, and acceleration. The adjustable current limit feature protects the control, battery, and motor from sustained overloads. The higher capacity models also provide thermal protection.

65E40/65E20



65E10

Dart's 65 Series controls are designed for heavy duty battery operated PM motor applications, such as: floor scrubbers, small personnel carriers, AGV's, agricultural sprayers and a vast variety of portable equipment.

The newest addition to the 65 Series is the 65E10. Rated for 10 amps continuous current, the 65E10 is packaged in the same compact industry standard footprint as Dart's popular 125 Series DC speed control. The 65E10 also features a quiet operating frequency of 18 kHz.

All the 65 Series controls come standard with a speed pot, knob, and dial plate.

65 SERIES STANDARD FEATURES

- Provides smooth variable speed capability for mobile equipment
- Increases range or running time of battery operated equipment through high efficiency
- Allows reduction in battery size w/out loss of operating range
- Automatic compensation to allow for declining battery voltage
- Speed regulation is $\pm 1\%$ of base speed
- Adjustable maximum speed
- Adjustable minimum speed
- Adjustable I.R. compensation
- Adjustable current limit
- Adjustable acceleration speed
- Maintains variable speed control as batteries discharge
- 5K ohm speedpot with 8" leads, knob and dial included
- Speed adjustment using 5K ohm speedpot or 0-10 VDC analog input signal
- Inhibit terminal permits optional start-stop without breaking battery line

65 SERIES SELECTION GUIDE

MODEL NUMBER CONTINUOUS CURRENT

12 VDC Input, 0-12 VDC Output

65E10-12	10 Amps
65E20-12	20 Amps
65E40-12	40 Amps
65E60-12	60 Amps

24/36 VDC Input, 0-24/0-36 VDC Output

65E10	10 Amps
65E20	20 Amps
65E40	40 Amps
65E60	60 Amps

OPERATING CONDITIONS

Operating Temperature -10°C to $+45^{\circ}\text{C}$ (14°F to 113°F)

Input Frequency D.C.

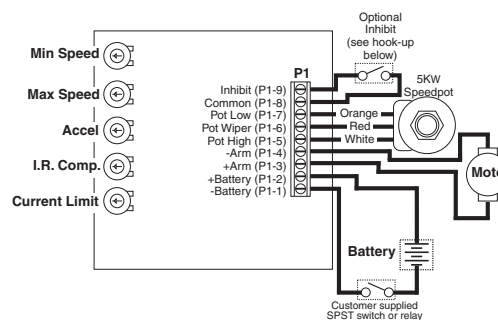
DIMENSIONAL SPECIFICATIONS

MODEL WIDTH LENGTH DEPTH WEIGHT

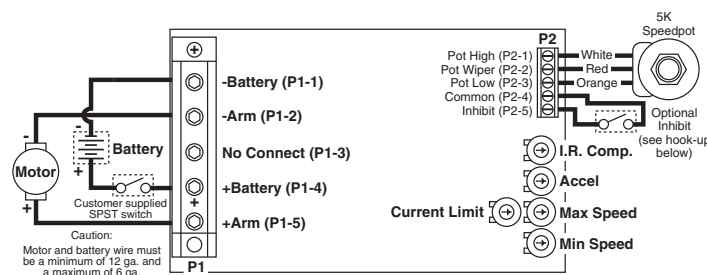
English (inches) Metric (centimeters)

65E10	3.625 9.21	4.25 10.76	1.30 3.30	6.0 oz. 170 gm.
65E20	3.70 9.40	7.00 17.78	1.70 4.32	10.5 oz. 297 gm.
65E40	3.70 9.40	7.00 17.78	1.70 4.32	13.4 oz. 297 gm.
65E60	6.70 17.02	9.00 22.86	2.27 5.77	34.0 oz. 962 gm.

65E10 HOOK-UP DIAGRAM



65E20/40/60 HOOK-UP DIAGRAM



65 SERIES SPECIFICATIONS

	65E10	65E20	65E40	65E60
Load Current (continuous)	10 Amps	20 Amps	40 Amps	60 Amps
Speed Adjustment	5K ohm potentiometer or 0 to +10V DC input signal			
Overload Capacity	200% for 10 seconds; 150% for 1 minute			
Speed Range	30:1			
Current Limit	Adjustable 100% to 200% of full motor load, up to continuous current rating (see above)			
Acceleration	Adjustable - 0 to 10 sec.			
Deceleration	Non-adjustable - 0.5 sec.			
Maximum Speed	Adjustable - 50 to 100% of base speed			
Minimum Speed	Adjustable - 30% of max speed			
Input/Output Connections	Barrier Terminal Block / 12 Ga. to 6 Ga. maximum			
Speed Regulation	1% of base speed			
Package Configuration	Black anodized aluminum extrusion			
Internal Operating Frequency	18K Hertz	Approximately 800 Hz.		
Thermal Protection	Not Available	Current foldback at 80°C . heatsink temperature		

Min speed trim pot

55AC10



55AC and AC03 Series Variable AC Voltage Supplies

A dependable, economical and compact variable AC voltage supply manufactured especially for the vibratory feeder, fan, pump, heating, and lighting industries. All models feature single-phase AC input and fully variable AC output. The enclosed version comes with a rugged housing, power on/off switch, power on indicator lamp, front access fuse, as well as convenient input and output cords and plugs.

The heart of the control is a triac fired in a manner to adjust phase and thereby vary speed. The 55 Series is designed to work with shaded pole, permanent split capacitor, universal motors or any resistive load. It is not designed for capacitor start motors.

55 SERIES SELECTION GUIDE

AC INPUT	CHASSIS MODEL	ENCLOSED MODEL	AC OUTPUT AMPS	WATTS
<i>50/60 Hz, 0-120 VAC OUTPUT</i>				
120 VAC	55AC10	55AC10-21	10	1150
120 VAC	55AC15	55AC15-21	15	1725
<i>50/60 Hz, 0-240 VAC OUTPUT</i>				
240 VAC	57AC10	57AC10-27	10	2300
240 VAC	57AC15	57AC15-27	15	3450

OPTION DESCRIPTION

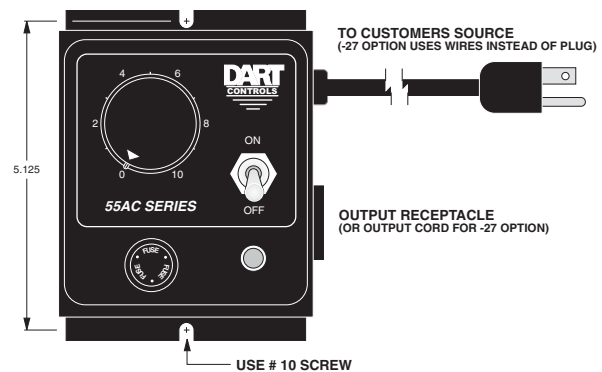
OPTION	SUFFIX
Enclosed version for 55AC10/15 with minimum 15" long AC input cord and AC output receptacle (120V)	-21
Enclosed version for 57AC10/15 with minimum 60" long AC input cord and output cord (240V)	-27
Half-wave DC output available for all chassis versions. Usually utilized in vibratory feeder applications.....	-D*
Half-wave DC output for the appropriate enclosed version.....	-21D, -27D*

* Option compatible with DC PM or universal motors and resistive load.

55 SERIES DIMENSIONAL SPECIFICATIONS

MODEL/OPTION	WIDTH	LENGTH	DEPTH
<i>English (inches)</i>			
55AC10/15	2.90	1.80	2.20
57AC10/15	2.90	3.50	2.20
-21 Option	4.00	5.53	3.80
-27 Option	4.00	5.53	3.80
<i>Metric (centimeters)</i>			
55AC10/15	7.37	4.57	5.59
57AC10/15	7.37	8.89	5.59
-21 Option	10.16	14.07	9.65
-27 Option	10.16	14.07	9.65

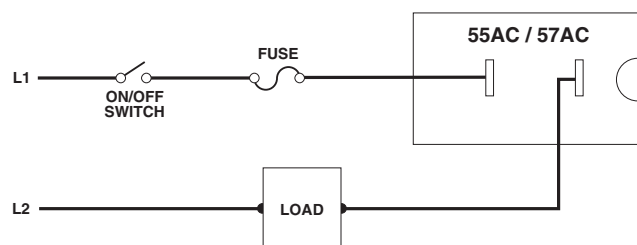
55 SERIES ENCLOSURE DIAGRAM



55 SERIES OPERATING CONDITIONS

Temperature.....-10° to +45° C.
 AC Input Voltage±10% Rated Line Voltage
 Input Frequency..... 50/60 Hz.

55 SERIES HOOK-UP DIAGRAM



NOTE: Switch and fuse furnished with enclosed unit only.

AC03 SERIES SPECIFICATIONS (LOWER CURRENT APPLICATIONS)

Input Voltage 120 VAC
 Output Voltage 0-120 VAC
 Maximum AC Output Current..... 2.5 Amps

- Features
- Controls most single phase AC motors and restrictive loads, not equipped to handle capacitor start motors
 - Speed pot with on/off switch

CAUS
 AC03 cULus
 Recognized



Note: The Speedpot will be secured by a customer supplied 3/8" Tinnerman Clip or 3/8" self threading nut.

www.dartcontrols.com



PATENT # 4,376,915

PU-E Series Hall-Effect Pick-up

The PU-E Series pick-up is an economical and reliable way to **monitor motor speed**. Its patented design provides ease of installation in otherwise difficult to reach areas. The PU-E pick-up operates at a 5 to 24 volt level producing a sharp square wave output, which may be fed into Dart's field programmable tachometer, closed-loop control, counter, or any other digital device.

The PU-E pick-up series also includes a quadrature model to monitor both motor speed and direction by providing two square wave output signals 81° out-of-phase.

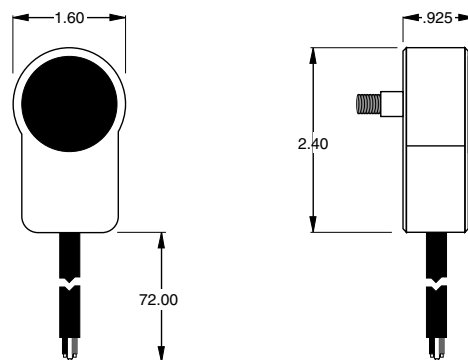
STANDARD FEATURES

- PU-E Series pick-up mounts directly on shaft being monitored using a single 10-32 screw.
- Maximum speed: 5,000 RPM or 50,000 pulses per minute.
- Supply voltage +4.5 VDC to +24 VDC.
- NPN open collector output signal with built-in pull-up resistor. Square wave output, signal voltage equals supply voltage. +5 VDC to 24 VDC supply voltage. Current sink: 50mA absolute maximum.
- Operating temperature: -10° C. to +45° C.
- Stainless steel ball bearing.
- Compact housing of molded "Santoprene" plastic rubber.
- Output cable-6' rubber jacketed, 3-wire 18AWG conductors;
 - red wire: +VDC supply input
 - black wire: Common
 - white wire: Signal A
 - brown wire: Signal B (model PU-20EQUAD only)

PU-E SERIES SELECTION GUIDE

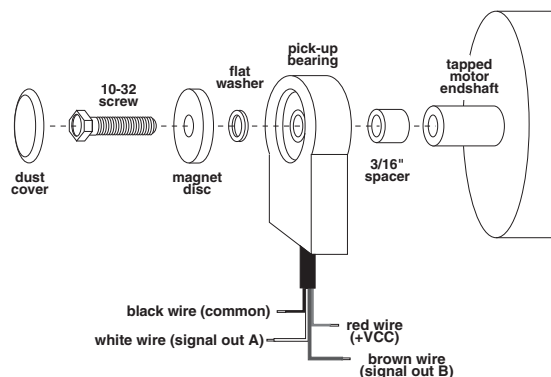
MODEL	PULSES PER REVOLUTION
PU-2E	1
PU-4E	2
PU-20E	10
PU-40E	20
PU-20EQUAD (quadrature pick-up)	10

DIMENSIONAL SPECIFICATIONS



No other mounting brackets or screws are necessary, as the cord will keep the unit from rotating. The PU-E gives a high signal when the south pole of the magnetic disc crosses the Hall-Effect transistor. The signal is switched low when the north pole crosses this same transistor.

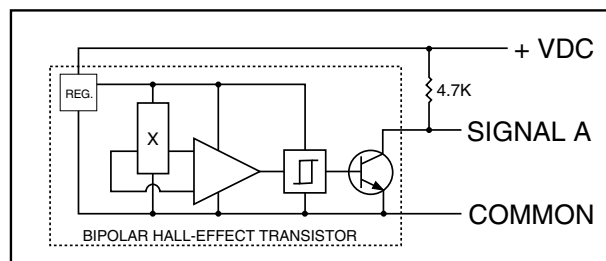
INSTALLATION AND WIRING

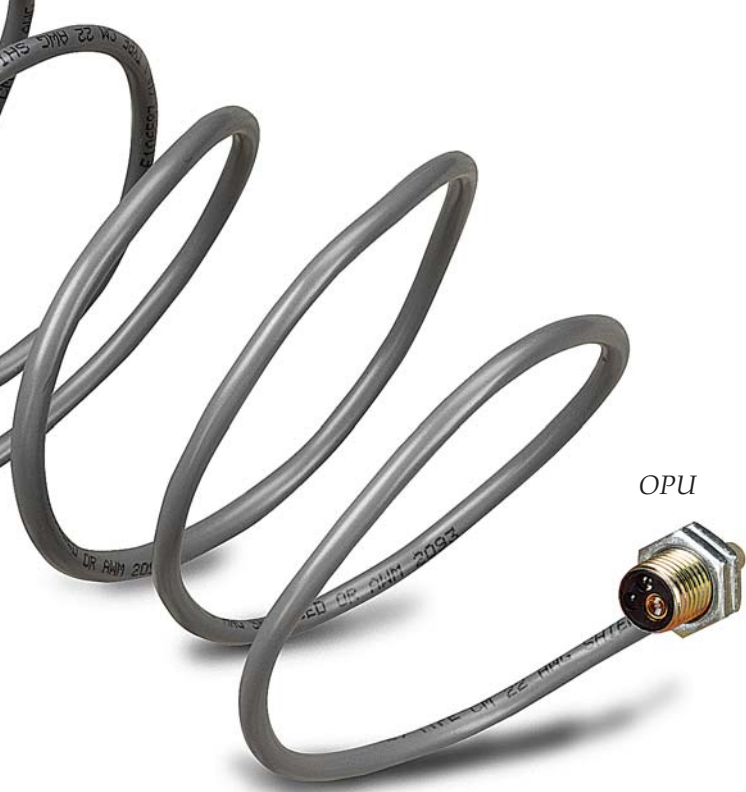


CAUTION: DO NOT OVER TIGHTEN MOUNTING SCREW !!!

CAUTION: The PU-E cord should not be grouped with any other wires or cords. For applications with PU-E wires over 6 feet long, or particularly noisy environments, a **SHIELDED CABLE** is recommended. Connect the shield to the **COMMON** terminal of the control device, leaving the shield at the pick-up end floating.

PU-2E, PU-4E, PU-20E, PU-40E SCHEMATIC





STANDARD FEATURES

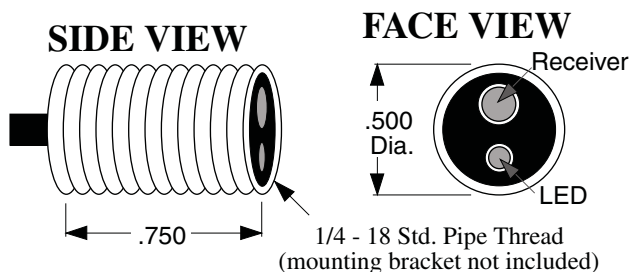
- Detects shaft rotation or any other moving targets without physical contact
- Maximum speed: 600,000 pulses per minute
- Output rise and fall time: 500ns maximum
- Supply voltage +5 VDC (+6 VDC max.)
- Output is a square wave +5 VDC - 0 VDC; open collector NPN transistor capable of sinking 50mA DC maximum
- Compatible with all Dart digital speed controls and tachometers
- Shielded output cable

OPU SERIES SELECTION GUIDE

MODEL PULSES PER REVOLUTION

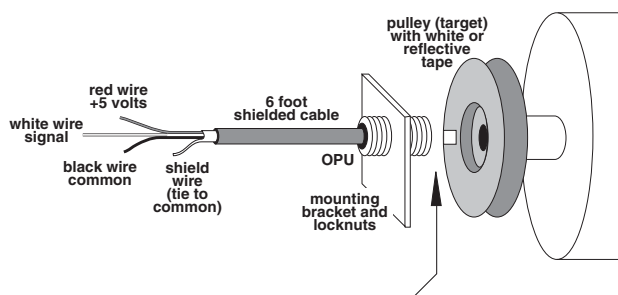
OPU Based on the number of reflective bands on target

DIMENSIONAL SPECIFICATIONS



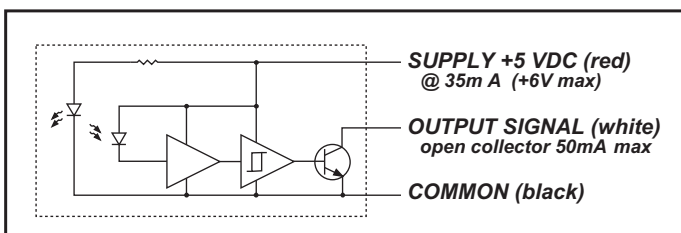
CAUTION: The OPU cable should not be grouped with any other wires or cords. Applications with OPU wires over 6 feet long, or particularly noisy environments may become sensitive to electrical noise.

INSTALLATION AND WIRING



IMPORTANT:
OPTICAL PICK-UP FACE MUST BE 1/8" TO 1" FROM WHITE MARKED SURFACE OR 3/8" TO 4" FROM REFLECTIVE MARKED SURFACE!!

OPU SCHEMATIC



OPU Series Photoelectric Optical Pick-up

The OPU Series pick-up is another motor speed pick-up available from Dart. It can be used in place of the PU-E pick-up, when limited space prevents physical contact with the motor shaft. The OPU is designed for use in applications which are shielded from ambient light, especially sunlight.

The OPU is an infrared LED transceiver which produces a high (+5 Volt max) signal from the reflective (light) target, and a low (0 Volt) signal from a non-reflective (dark) target surface. The result is a square wave with the frequency (number of pulses) dependent on the number of alternating light and dark surfaces on the target. The OPU can monitor not only rotating shafts but belts or virtually any moving surface.



CF Series Hall-Effect Pick-up Kit

The CF SERIES pick-up kit can be used in place of the PU-E or OPU series to monitor motor speeds when access to the motor shaft is otherwise impossible.

The CF series mounts directly to a motor's, NEMA "C" face. It operates at a 4.5 to 24 volt level producing a square wave output which may be used with Dart's tachometers, closed loop controls, or other digital devices.

STANDARD FEATURES

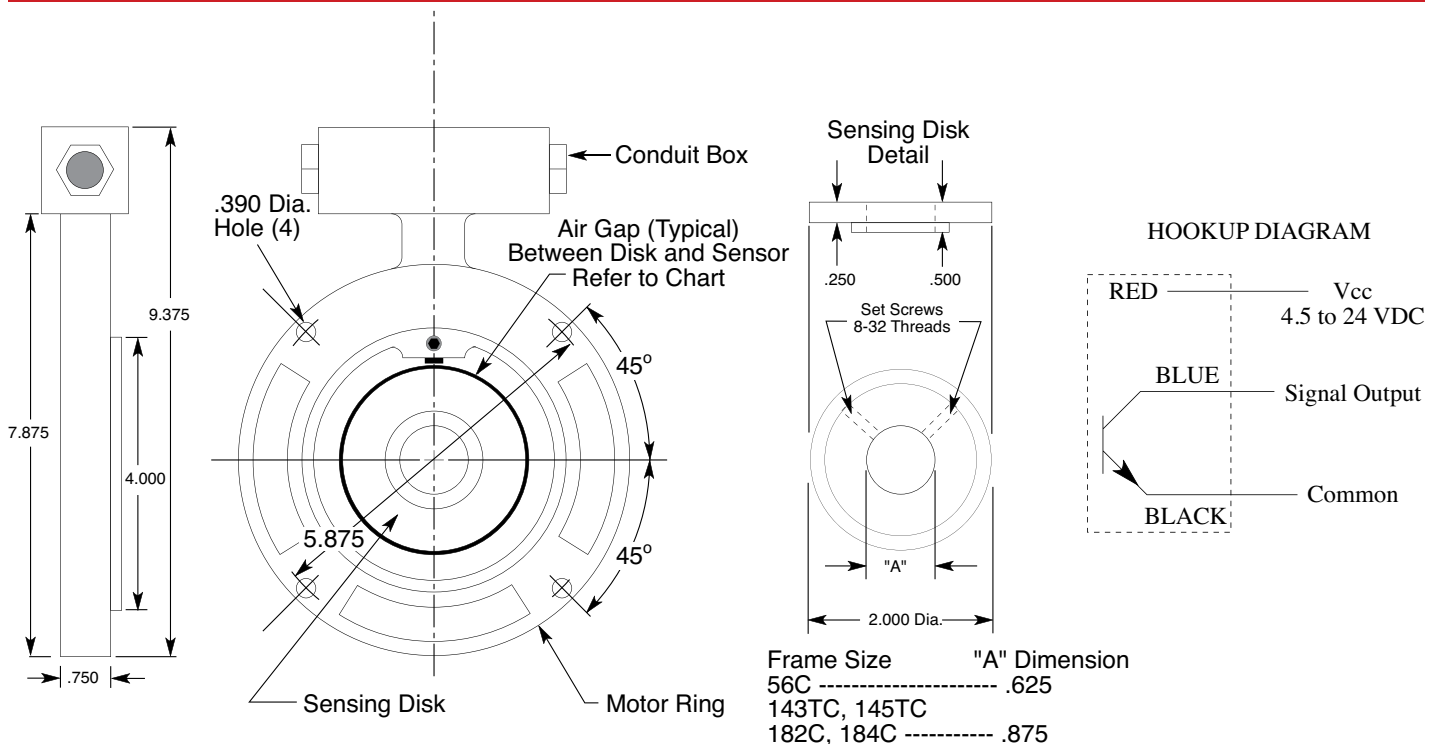
- Complete kit consists of motor face ring, sensor, mounting bolts and sensing disk.
- Molded sensing disk, impervious to dust, oil and water.
- Output connections: 3 wires.
- Supply voltage: +4.5 to 24 VDC.
- Output: NPN open collector capable of sinking 20mA D.C.
- Operating temperature: -40°C to 125°C.

CF SERIES SELECTION GUIDE

MODEL#	DISK ONLY	FRAME SIZE	PULSES PER REVOLUTION
CF-H1	-H1	56C	1
CF-H2	-H2	56C	2
CF-H15	-H15	56C	15
CF-H60	-H60	56C	60
CF-J1	-J1	*	1
CF-J2	-J2	*	2
CF-J15	-J15	*	15
CF-J60	-J60	*	60

* Frame sizes 143TC, 145TC, 182C, 184C

DIMENSIONAL SPECIFICATIONS AND SCHEMATIC (DIMENSIONS IN INCHES)





MPU-A Series Hall-Effect Geartooth Pick-up

The MPU-A Series geartooth speed pick-up provides speed sensing capabilities using an integrated Hall-Effect sensor in conjunction with a permanent magnet which supplies a bias field. This ready-to-use pick-up directly senses rotating ferrous gear and other similar gear-type targets.

The MPU-A Series is capable of sensing various target tooth sizes over wide ranges of airgap. The operational airgap achieved is independent of gear rotation speed. The small module size makes it ideal in applications where space considerations are of concern. The rugged design allows the operation of these sensor assemblies in hostile environments where dirt and oil are major problems.

The MPU-A Series pick-up can be used in place of a PU-E, OPU or CF Series to monitor motor speeds when access to the motor shaft or restraints limit their use.

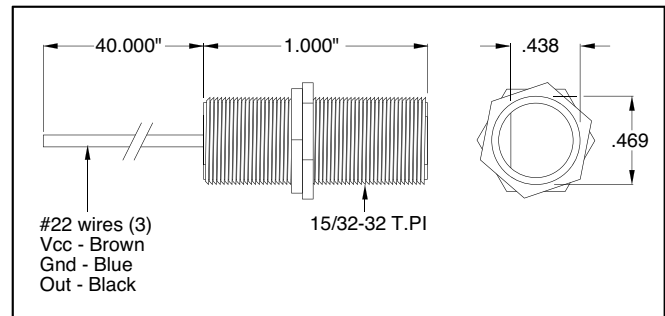
STANDARD FEATURES

- Senses motion of ferrous gear type targets.
- Digital output signal (square wave).
- NPN Open collector output, capable of sinking up to 20mA.
- Zero speed sensing capabilities.
- Larger operational airgap than magnetic pick-ups.
- No additional conditioning electronics needed.
- Immune to hostile environments.
- Operates from +4.5 to +24 volts DC supply.
- Operating temperature range of -40° to +125° C.
- Rugged cylindrical threaded aluminum housing.
- Compatible with all Dart digital speed controls and tachometers.

MPU-A SELECTION GUIDE

MODEL	PULSES PER REVOLUTION
MPU-A	Based on number of teeth on target

DIMENSIONAL SPECIFICATIONS



Caution: The MPU-A cord should not be grouped with any other wires or cords. For applications with MPU-A wires over 6 feet long, or for particularly noisy environments, a SHIELDED CABLE is recommended. Connect the shield to the COMMON terminal on the wire end opposite the MPU-A housing.

INSTALLATION AND WIRING

The MPU-A Series must be installed so that the mounting axis is perpendicular to the direction of rotation. The flat side of the sensor housing must be parallel to the direction of the gear rotation.

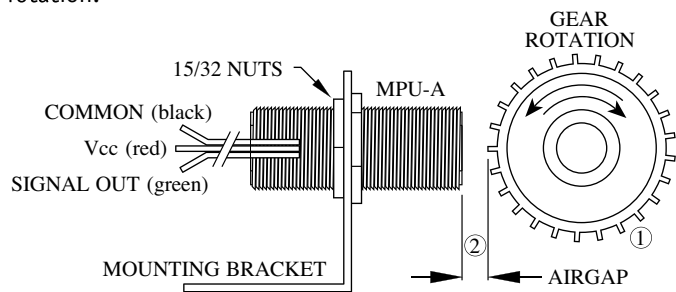


FIGURE 1

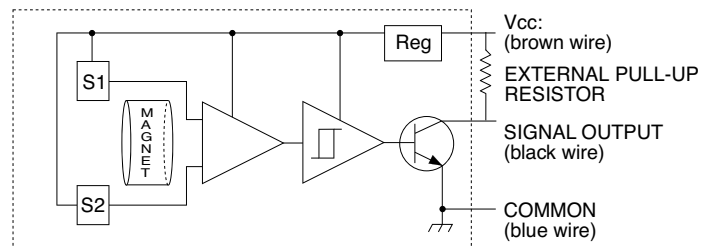
- 1) The practical **minimum** target dimensions are: 0.10" top of tooth, 0.15" tooth depth, and 0.10" spacing between teeth.
- 2) The working airgap for target dimensions approaching the minimum is approximately .005", and up to .100" for larger targets. Optimum airgap performance is achieved using target materials with a high magnetic permeability such as low carbon steels.

All Dart products requiring digital pulse feedback are designed with internal pullup resistors. However, if the MPU-A is being used with a peripheral that does not have a pullup resistor, then the resistor value can be determined below:

$$R = (V_{cc} - 0.2) \div I_{\text{sink}}$$

where I_{sink} is the desired sink current (typically 5 mA, max. 20 mA). For 5 volt V_{cc} and a desired 5 mA sink current, a resistor value of 960 ohm is calculated (1K ohm may be used).

MPU-A SERIES SCHEMATIC



DEFINITION OF TERMS

1. ADJUSTABLE CURRENT LIMITING (TORQUE LIMITING)

This feature permits the operator to adjust the maximum current the motor will draw. This in effect limits the maximum torque the motor will produce.

2. ADJUSTABLE LINEAR ACCELERATION

Allows the operator to adjust the amount of time it takes the motor to come up from stop to the maximum speed setting. This available in time spans up to 12 seconds (model dependent), with longer times available as special items.

3. ADJUSTABLE MINIMUM AND MAXIMUM SPEED

This feature allows the operator to set the minimum and maximum speeds that the motor is to operate. The main speed dial then adjusts the speed between this range.

4. BASIC TYPE OF LOAD

The three basic types of loads, (constant torque, variable torque, and constant horsepower) can be accommodated with Dart controllers when properly selected.

5. CHASSIS MOUNT (LESS ENCLOSURE)

Open construction for mounting in the customers existing enclosures or control consoles.

6. COGGING

Speed change as a result of armature coils entering and leaving magnetic fields.

7. CONSTANT HORSEPOWER

This type of load requires constant horsepower throughout the speed range and the torque increases as the speed decreases. For all constant horsepower loads the horsepower required at the driven equipment's lowest operating speed determines the horsepower of the drive.

8. CONSTANT TORQUE

By far the most common of loads. Torque remains constant throughout the speed range while the horsepower required decreases in direct proportion from maximum to minimum speed. In all constant torque applications, the drive is selected based on the maximum horsepower required by the driven equipment at its maximum speed.

9. CONTROL BY REMOTE SIGNAL

Remote signal controls take the form of voltage or current signals in the following ranges; 4-20mA, and 0-5 thru 0-250 VDC. Remote signal controls are available both electrically isolated and non-isolated. It is important therefore to indicate if the remote signal is not electrically isolated from the power source (grounded).

10. CONTROLLED (TIMED) ACCELERATION

This feature will accelerate the motor to the set speed in a given length of time.

11. DUTY-CYCLE

The relation between the operating time and the rest time of a motor. A motor which continues to operate after it has reached its normal operating (steady) temperature is operating under continuous duty conditions. One which never reaches a steady temperature but is permitted to cool between operations is operating under intermittent duty conditions.

12. DYNAMIC BRAKING

A way of stopping a brush-type motor by first disconnecting the power source. The rotating motor then becomes a generator which is connected to a resistor. The energy of rotation is then dissipated as heat in the resistors.

13. HORSEPOWER OR TORQUE REQUIRED

If the horsepower or torque for a given application is not known, it can usually be calculated using of the following methods:

$$\text{HORSEPOWER} = \frac{\text{Force (lbs)} \times \text{Feet per minute}}{33,000}$$

$$\text{HORSEPOWER} = \frac{\text{Torque (in-lbs)} \times \text{RPM}}{63,025}$$

$$\text{HORSEPOWER} = \frac{\text{Torque (ft-lbs)} \times \text{RPM}}{5,252}$$

$$\text{TORQUE (in-lbs)} = \frac{63,025 \times \text{HP}}{\text{RPM}}$$

$$\text{TORQUE (ft-lbs)} = \frac{5,252 \times \text{HP}}{\text{RPM}}$$

$$\text{FEET/MINUTE} = 262 \times \text{Dia. of wheel (inches)} \times \text{RPM}$$

14. IR COMPENSATION

This function compensates for the resistance change in the armature due to load changes and also increases the speed regulation range.

15. JOGGING

This feature provides a means of inching the motor using a single button. The jog feature is available only when a separate remote station is used (i.e. Start-Stop). A run jog selector is provided along with the jog button itself.

16. LINE VOLTAGE COMPENSATION

Holds the motor speed constant when the line voltage fluctuates over a range of $\pm 10\%$.

17. MULTI-MOTOR CONTROL OR MASTER OVERRIDE

This is accomplished by one of two ways, namely:

A) A master control which controls each individual control and its associated motor. Using this method the master control sets the maximum speed that can be set on the individual unit, maintaining the ratio.

B) Connecting more than one motor to an individual control. Satisfactory results are limited to specific applications using this arrangement. Consult the applications department before specifying this system.

18. PLUG REVERSAL

A method of changing the rotation of a motor by reversing connection polarity as the motor runs. This is not recommended for DC motors – it can damage the control and motor and reduce their life.

19. POTENTIOMETER SPEED INDICATOR

This feature provides a means of speed indication by monitoring the voltage on the speed set control. This meter is accurate to the degree the control will provide. Generally the control is accurate to 2% and the metering circuit is accurate to 3% to give an overall accuracy of 5%. This is used where a meter is desired.

20. PRE-SET SPEED

A selected speed may be set when the control is not in operation. The motor will then accelerate to the pre-set speed when the switch is turned on.

21. PUSHBUTTON SPEED CONTROL

Permits the selection of speed settings via pushbuttons.

22. REVERSING, ELECTRICAL (AUTOMATIC)

Utilizes relays and/or solid state circuitry to automatically provide dynamic braking for a quick stop; and reversal of the armature leads at zero motor speed. Direction is controlled with a SPDT switch, relay contacts (dry contact switching), or NPN open collector.

23. REVERSING, MANUAL

The manual reverse incorporates a switch to reverse the polarity of the armature leads. The switch is constructed so that the leads cannot be reversed without going through a neutral or brake position.

24. SPEED ADJUSTMENT POTENTIOMETER

The standard speed control is a single turn, 300° potentiometer is available.

25. SPEED RANGE

The speed range is defined as the ratio of minimum to maximum speed where the speed regulation published is obtained. The motor speed is always adjustable to zero.

26. SPEED REGULATION

Defined as the change in motor RPM from NO LOAD TO FULL LOAD, and expressed as a percentage of base speed. For close regulation a tachometer generator feedback system or digital closed loop control is suggested.

27. TACHOMETER FEEDBACK

This feature includes the tachometer mounted on the opposite end of the motor. Extremely close regulation is available with tachometer feedback. Practical systems have regulation as close as 1/2%.

28. TACHOMETER FOLLOWER

Permits the speed control to be controlled by a remote tachometer. The speed control maximum trim pot then adjusts the maximum speed at which the motor will run. Note: The tachometer (customer mounted) must run at the speed the motor to be controlled runs.

29. TACHOMETER SPEED REGULATION

This feature normally used in conjunction with Tachometer Feedback (item 27) includes the tachometer mounted on the end shaft of the motor and a meter calibrated to read from 0-100%. Other markings are available. The standard meter scale is 3.5 inches.

30. VARIABLE TORQUE AND HORSEPOWER

Although encountered considerably less often than constant torque, this type load should be recognized as having an increase in horsepower that varies as the square or cube of the increase in speed. With this type of load the horsepower and torque required increases at a greater rate than the increases in driver speed. As with the constant torque load drive the variable torque and the horsepower load drive should be reflected for the maximum horsepower required by the driven equipment at its maximum speed.

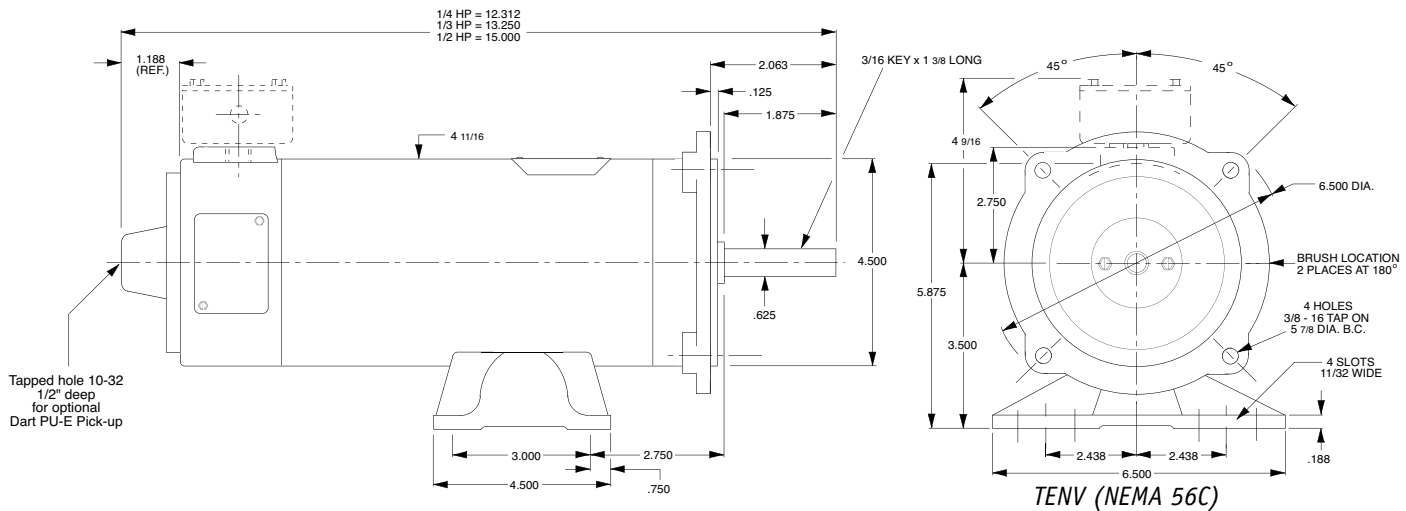


The advantages of DC adjustable speed drives with PM motors for low horsepower applications are: higher starting torque, wider usable speed and torque range, simpler dynamic braking, lower system cost, faster response, smaller size, more efficient and reliable.

Standard features include: permanent magnetic field (1/4 horsepower to 2 horsepower), NEMA56 C-face and bolt-on mounting, 1750 RPM base speed, U.L., C.S.A. and C.E. mark listed, provisions for mounting Dart's PU-E pick-up, available from stock.

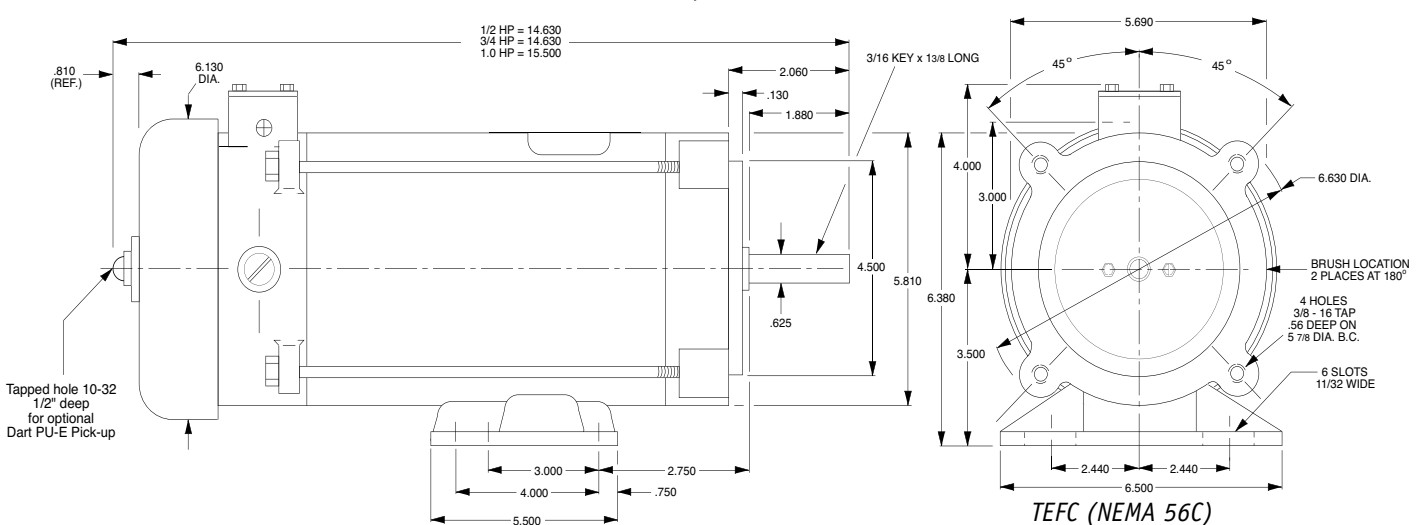
TENV MOTOR SPECIFICATIONS AND SELECTION (DIMENSIONS IN INCHES)

H.P.	ENCLOSURE	BASE SPEED	ARMATURE DC VOLTS	FULL LOAD AMPERAGE	FULL LOAD TORQUE	MOTOR MODEL NUMBER	APPROXIMATE SHIP WEIGHT
1/4	TENV	1750 RPM	90 VDC	2.5 Amps	0.75 lb. ft.	DMS1825B-56BC	26 lbs.
1/3	TENV	1750 RPM	90 VDC	3.2 Amps	1.00 lb. ft.	DMS1833B-56BC	28 lbs.
1/2	TENV	1750 RPM	90 VDC	4.8 Amps	1.50 lb. ft.	DMS1850B-56BC	31 lbs.



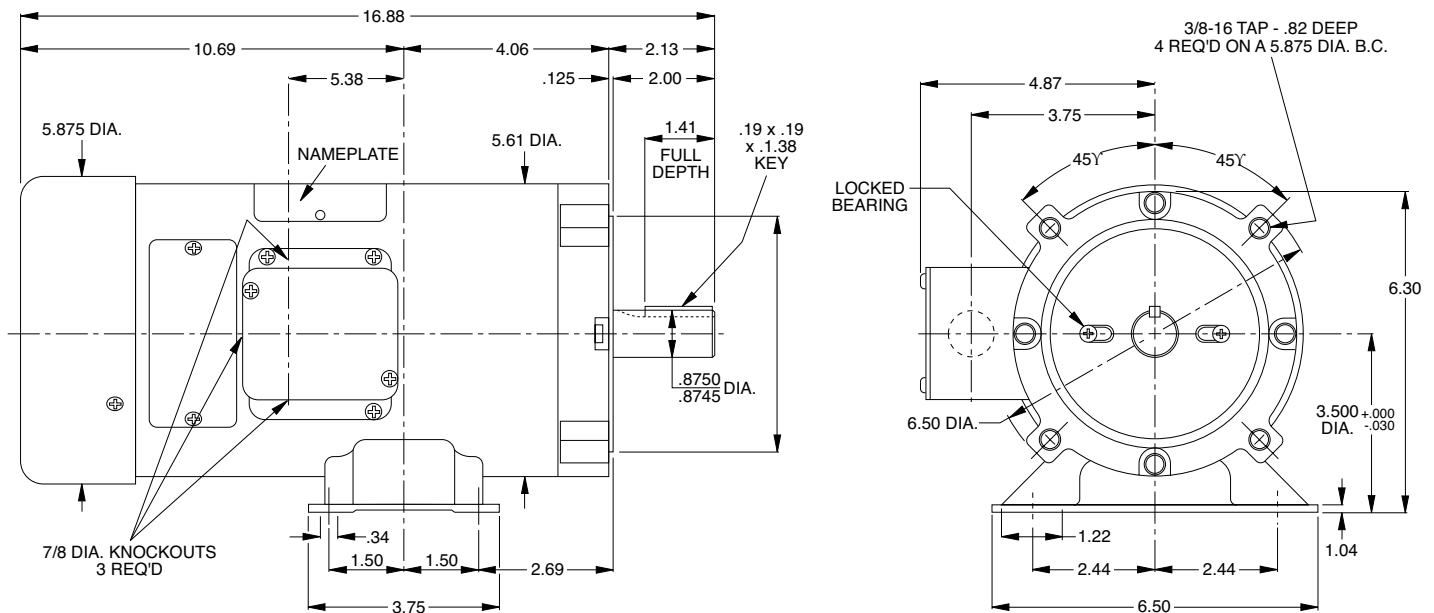
TEFC MOTOR SPECIFICATIONS AND SELECTION (DIMENSIONS IN INCHES)

H.P.	ENCLOSURE	BASE SPEED	ARMATURE DC VOLTS	FULL LOAD AMPERAGE	FULL LOAD TORQUE	MOTOR MODEL NUMBER	APPROXIMATE SHIP WEIGHT
3/4	TEFC	1750 RPM	90 VDC	7.0 Amps	2.25 lb. ft.	DMS1875B-56BC	39 lbs.
1	TEFC	1750 RPM	90 VDC	10.0 Amps	3.00 lb. ft.	DMS1810B-56BC	43 lbs.
1/2	TEFC	1750 RPM	180 VDC	2.5 Amps	1.50 lb. ft.	DMS18500B-56BC	31 lbs.
3/4	TEFC	1750 RPM	180 VDC	3.7 Amps	2.25 lb. ft.	DMS18750B-56BC	36 lbs.
1	TEFC	1750 RPM	180 VDC	5.0 Amps	3.00 lb. ft.	DMS18100B-56BC	42 lbs.



TEFC MOTOR SPECIFICATIONS AND SELECTION* (DIMENSIONS IN INCHES)

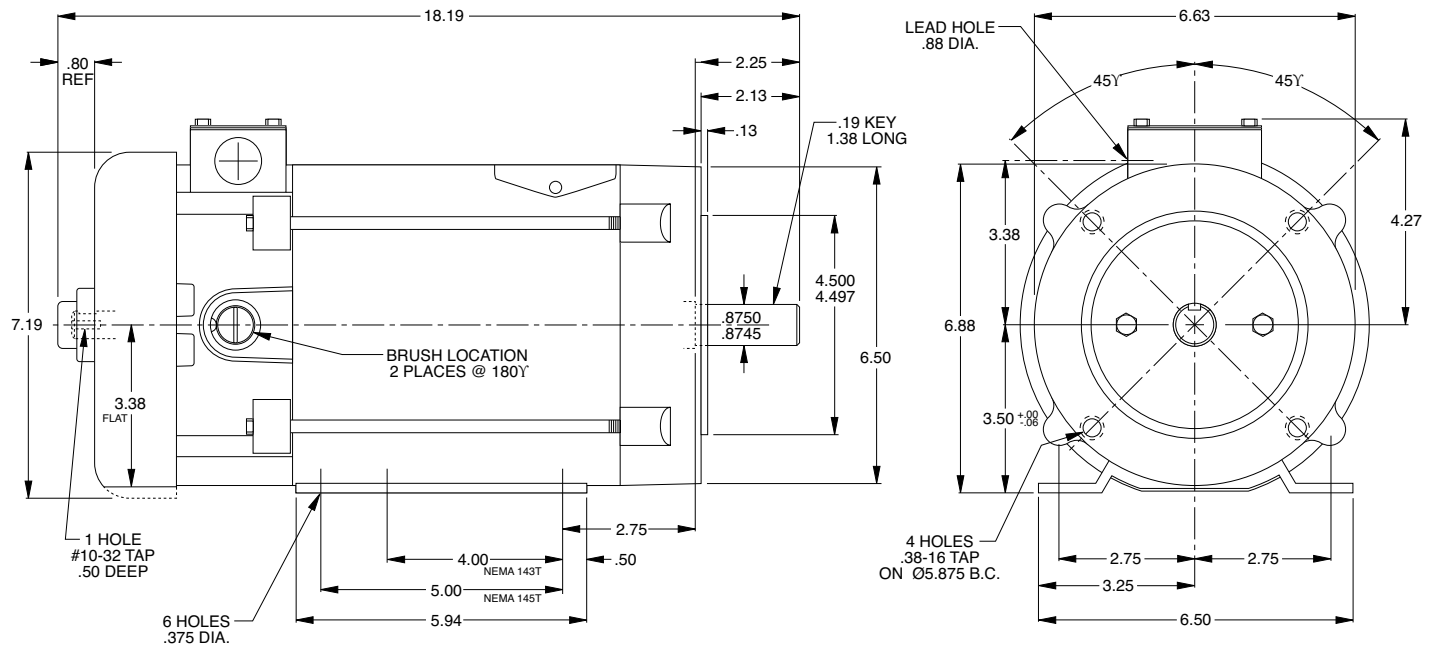
H.P.	ENCLOSURE	BASE SPEED	ARMATURE DC VOLTS	FULL LOAD AMPERAGE	FULL LOAD TORQUE	MOTOR MODEL NUMBER	APPROXIMATE SHIPPING WEIGHT
1.5	TEFC	1750RPM	180 VDC	7.6 Amps	4.50 lb. ft.	DMS18150L-145BC	50 lbs.



* NEMA Frame ZLS56CZ/145TC (NEMA 145TC frame; shaft 7/8" x 2 1/4" and NEMA 56 removable base).

TEFC MOTOR SPECIFICATIONS AND SELECTION* (DIMENSIONS IN INCHES)

H.P.	ENCLOSURE	BASE SPEED	ARMATURE DC VOLTS	FULL LOAD AMPERAGE	FULL LOAD TORQUE	MOTOR MODEL NUMBER	APPROXIMATE SHIPPING WEIGHT
2.0	TEFC	1750 RPM	180 VDC	9.6Amps	6.00lb.ft.	DMS18200B-145TC	75lbs.

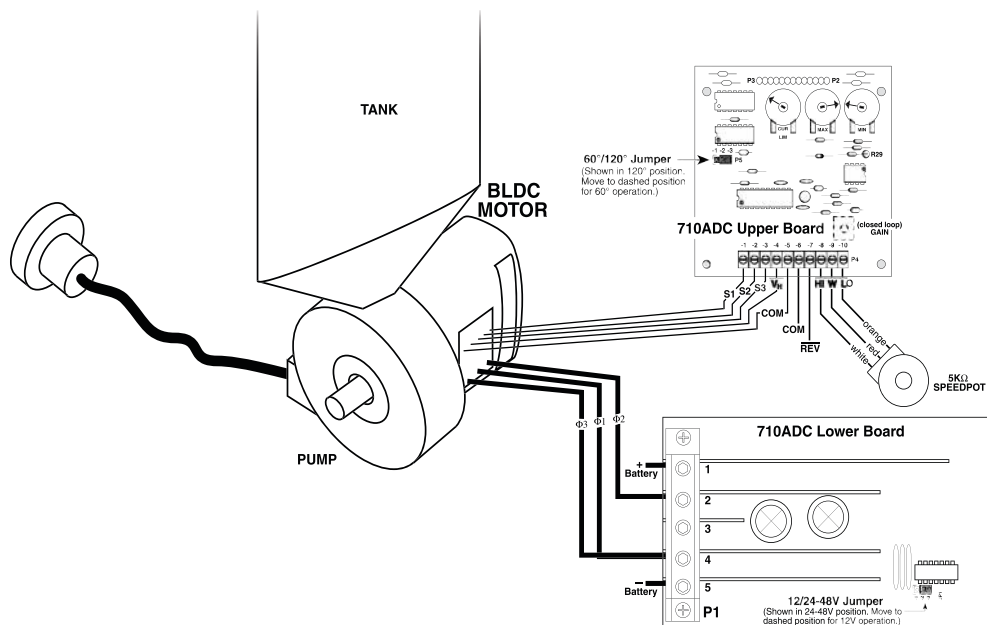


* NEMA frame 145TC.

NOTES - TEFC AND TENV ENCLOSURES

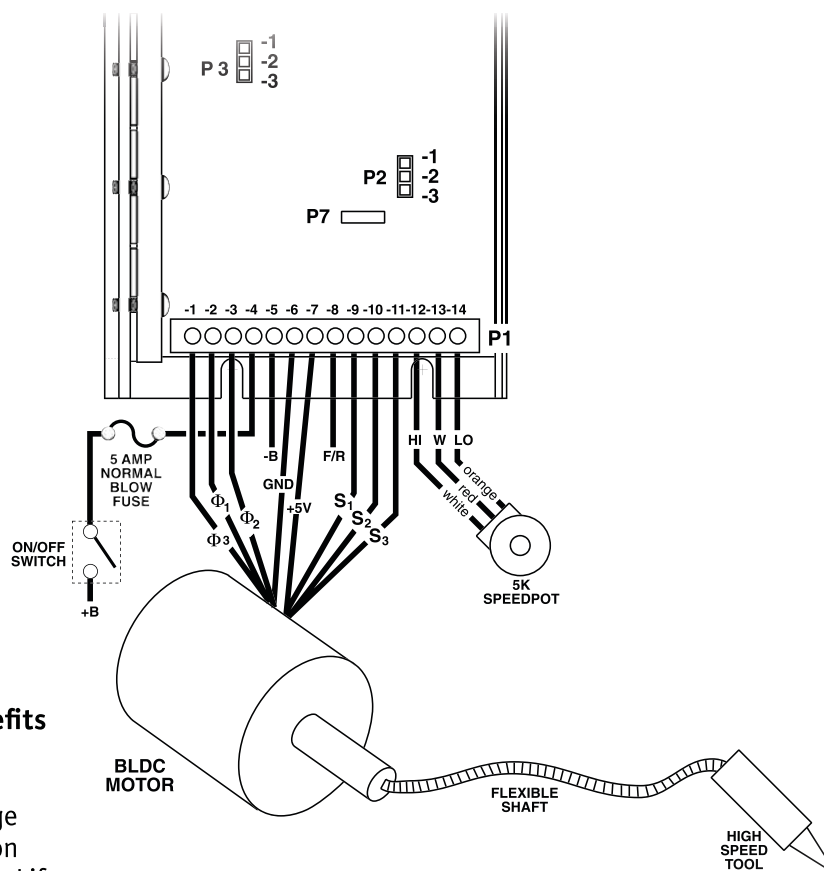
- 1) 20:1 Speed range at constant torque.
- 2) Includes provision for Dart Control's PU-E pick-up, mounted on motor rear end shaft.
- 3) Keyway key and conduit box are supplied with motor.
- 4) Designs and specifications may change without notice.
- 5) All dimensions in inches unless noted otherwise.

Solution: Brushless motors are able to run at high speeds under normal operation and also eliminate the need for brush replacement. A 710ADC can be powered by a standard 12V automotive battery and used to operate a motor. The motor will run a pump to move the liquid at a high speed from the tank to the dispensing nozzle.



High Speed Tools with 700B Series

Solution: A brushless DC motor was used for its high speed capability. The current draw is less than 5A so a 701BDC was used. A flexible shaft is used to keep the hand tool lightweight. The control enables the rotation to be reversed and the speed to be varied.

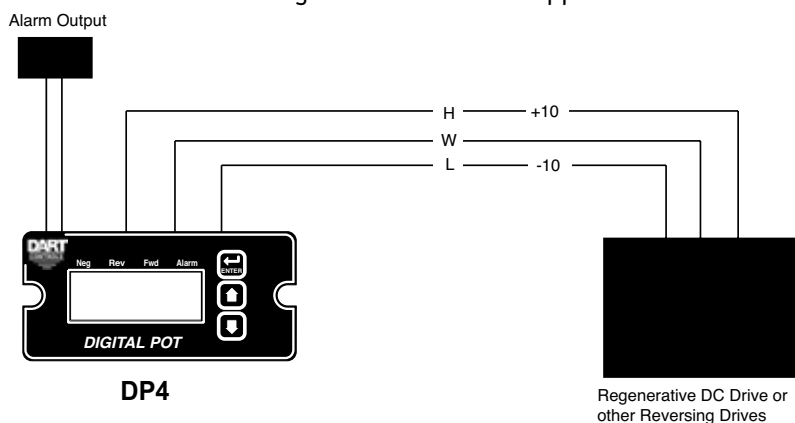


- Quiet Operation
- High Speed Capability
- Full DC Speed/Torque Range
- Great Low Speed Regulation
- Low Maintenance and Long Life

Digital Potentiometer (DP4)/ Regen Drive Combination

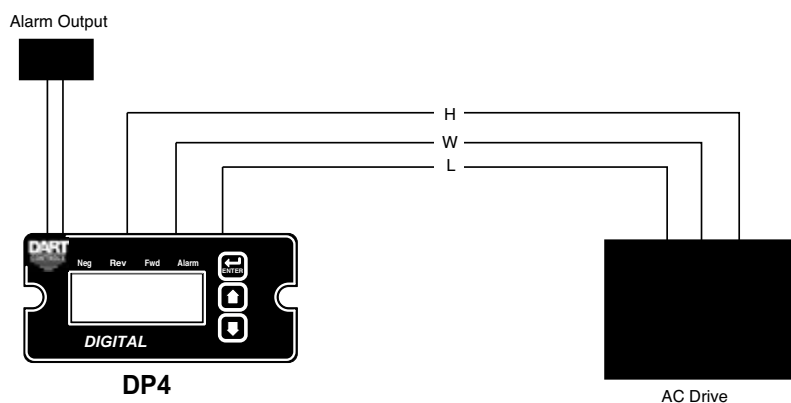
The DP4 can control both the speed and direction of a regenerative DC drive. The output of the DP4 can be configured for a +10 VDC to -10 VDC speed reference signal where +10 VDC corresponds to full speed in the forward direction, 0V corresponds to stop, and -10 VDC corresponds to full speed in the reverse direction.

The DP4 can also control the direction of a non regenerative reversing drive. The relay alarm output can be configured to switch the directional reference contact of a reversing drive. This flexibility allows the DP4 to be used on a wide range of motor control applications.

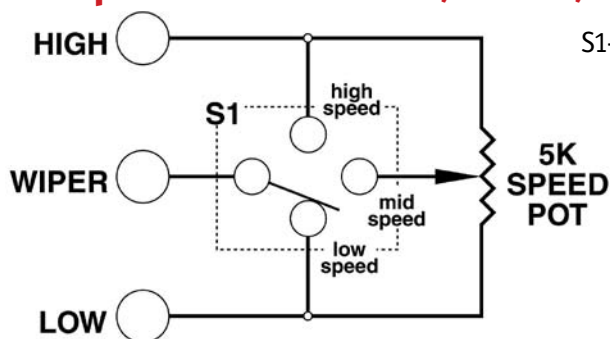


Digital Potentiometer (DP4)/ AC Drive Combination

Using the DP4 with an AC drive adds flexibility and capability to the system. The DP4 has a NEMA 4X rated faceplate and comes complete with a gasket kit allowing it to be mounted in a NEMA 4X panel. The large 1/2" LED display has an adjustable intensity display that can easily be read from across a large room. The relay output of the DP4 can be configured to control the direction of the AC drive, so both speed and direction can be controlled from the up/down arrows on the faceplate.



3 Speed Operation of 125D, 250G, and 530B Series



S1- 3 position switch rated for 12V dry circuit duty
 High speed is set by Max. trimpot
 Mid speed is set by the 5K_ speedpot
 Low speed is set by the Min. trimpot

Controlling Feed Conveyors for Industrial Applications

Controlling mix proportions accurately can save big dollars at:

Concrete Plants
Baking Mix Conveyors
Pet Food Plants

Asphalt Plants
Dry Chemical Mix Plants
Powder Mix Plants

Aggregate Conveyors
Fertilizer Plants
Breakfast Cereal Plants

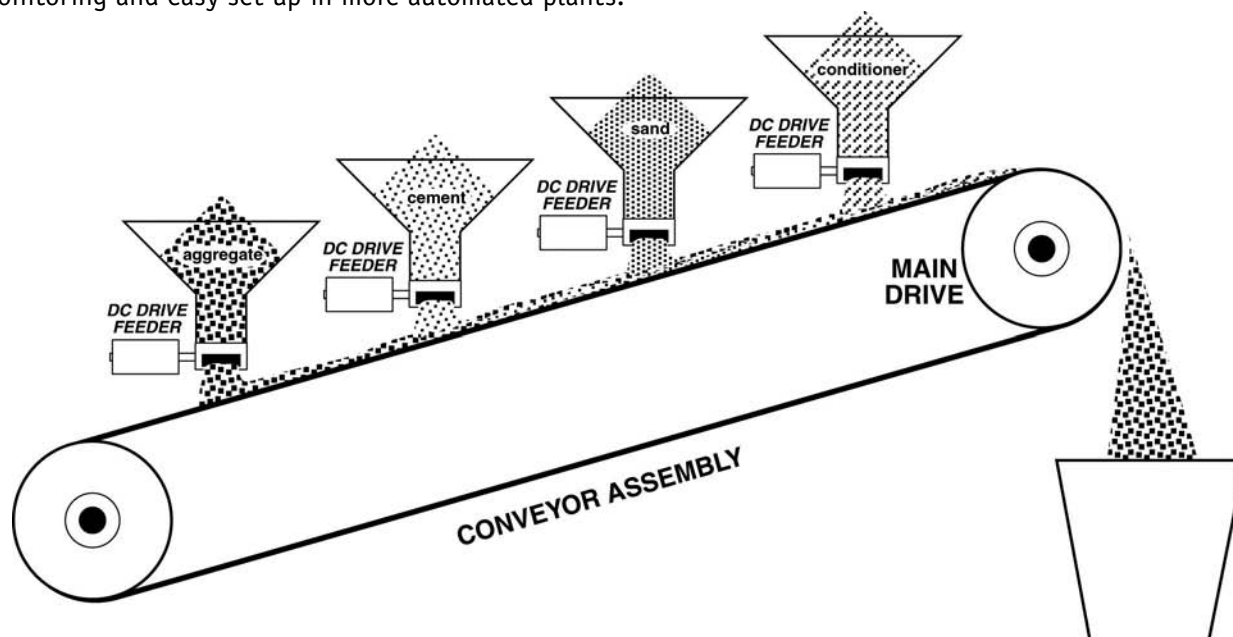
Solution 1:

DC Speed Controls on the feeders are controlled by the **MSC38A** Master Speed Control. The **DM8000** Digital Process Meter can be used to accurately monitor the ratios. The MSC38A allows adjustment of the feeder ratios for correct proportions. An additional problem may be that foreign material may jam the star-wheel feeders.

- A. If the 530BR(X) Series controls are used, the stall causes the interrupt relay to close, shutting down the feeder drives and sounding an alarm.
- B. By using the DM8000 Digital Process Meters, the low speed alarm output can effect the same shut-down protection for the feeders.

Solution 2:

- A. MicroDrive Controls can be used to precisely set and maintain exact mix ratios. The precision of the MicroDrive closed loop control will maximize the savings as well as having the advantage of being a set and forget system.
- B. If the drives must be larger than 2HP, as in asphalt blending, AccuSet controls may be used with larger HP speed controls (AC or DC).
- C. If "jam detect" is required, substitute the MicroDrive II as the control. The stall detect feature conveniently performs the shut-down protection. In addition, the standard serial interface built into the control provides remote monitoring and easy set-up in more automated plants.



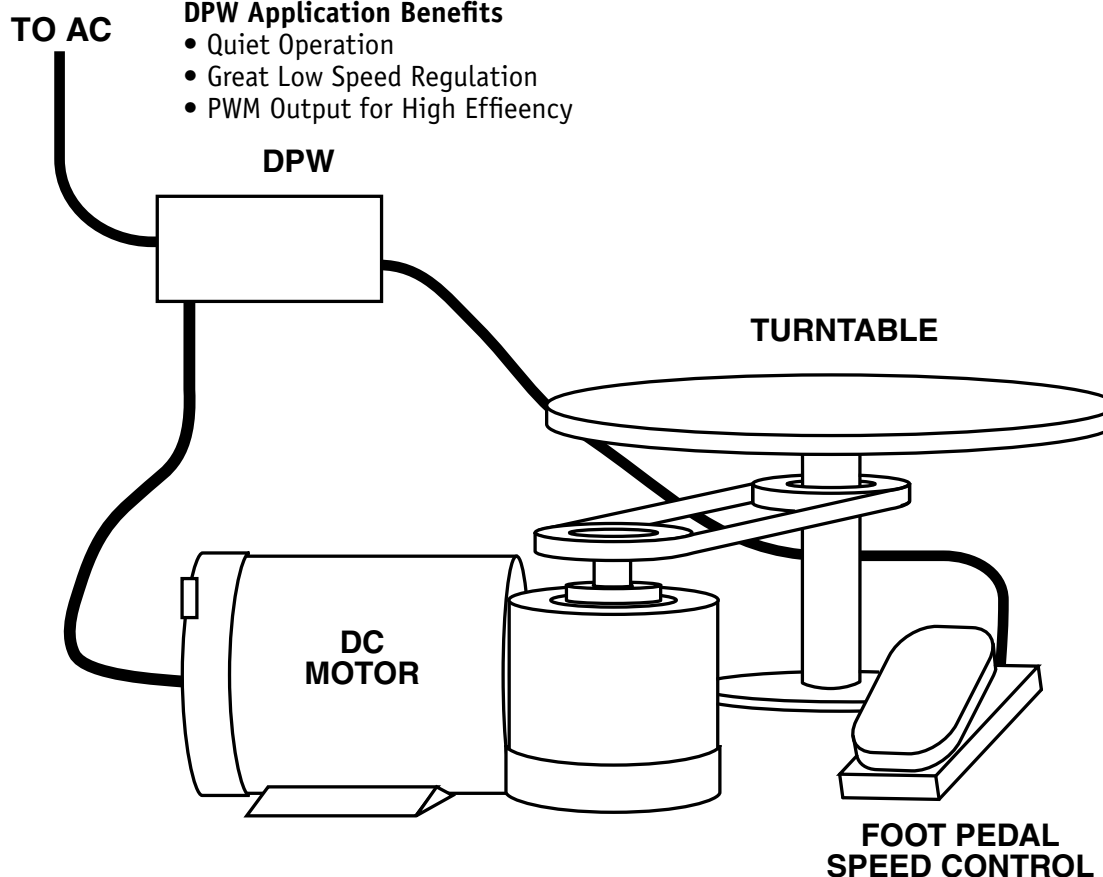
Pottery Wheel with DPW Pulse Width Modulated DC Drive Series

Problem: It is necessary to regulate the speed of a motor at low speeds for use in a pottery wheel.

Solution: The DPW series control has the ability to maintain torque at very low speeds, making it the ideal solution. The drive will be connected to the DC motor that rotates the turntable. Using a pedal rather than a standard potentiometer will allow the user to keep both hands on his work while still changing the speed of the turntable.

DPW Application Benefits

- Quiet Operation
- Great Low Speed Regulation
- PWM Output for High Efficiency



PWM Drive Applications

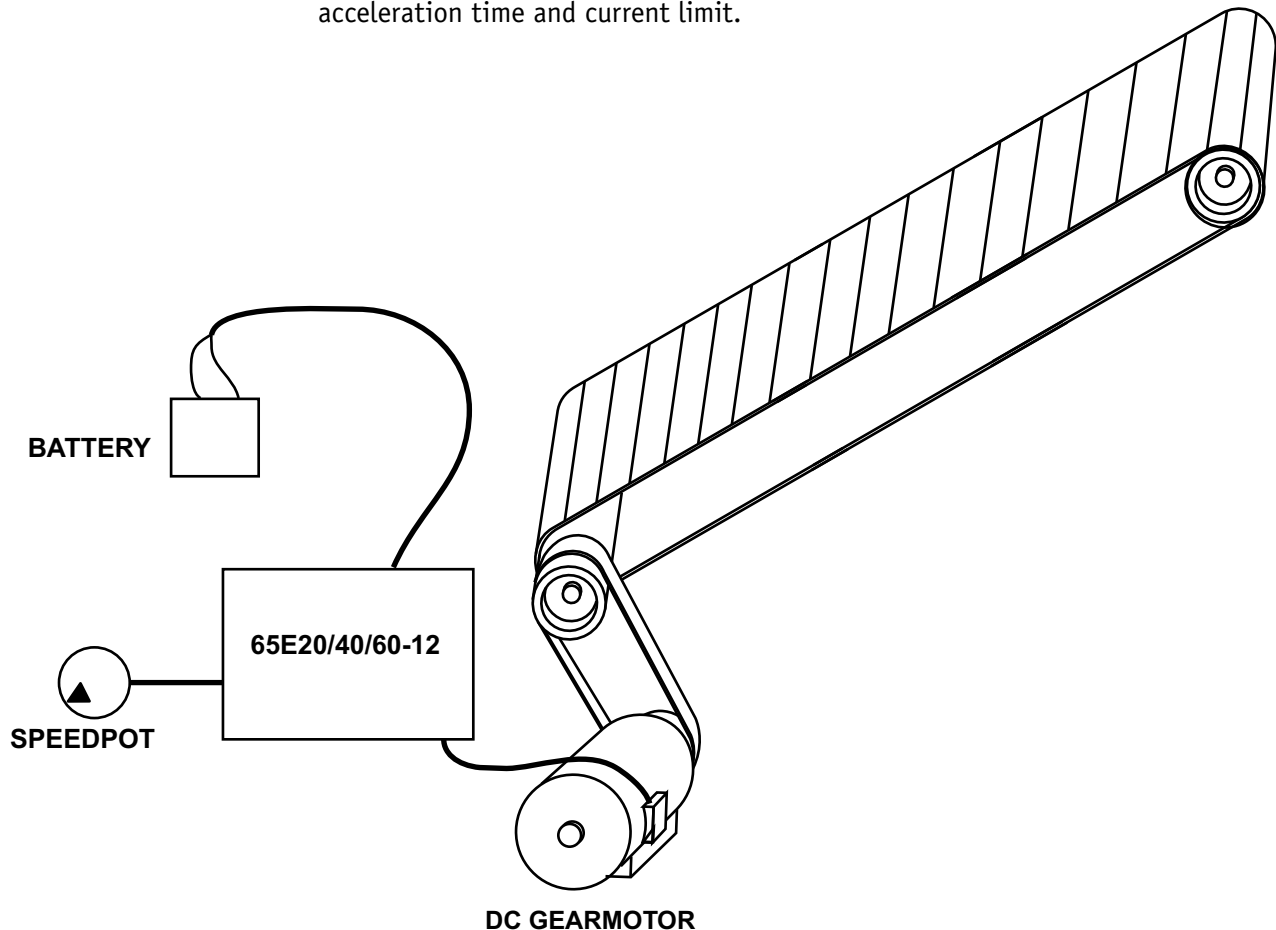
Pulse Width Modulation (PWM) refers to a method of delivering voltage to a load. In the case of DC motors PWM drives have advantages over SCR drives in certain applications. PWM drives provide the power to the motor more efficiently than SCR drives. Also, PWM drives regulate the motor voltage at low speeds. This is due to the faster switching frequency of the output voltage. Finally, PWM drives produce less switching noise on the output and allow for quieter operation.

Dart's new DPW series has features that set it apart from other PWM drives. A "pre-charge" circuit prevents breaker tripping on power up due to large inrush current. The power supply also has low voltage lockout protection to prevent problems associated with sudden voltage drops. Cycle to cycle current limiting is also employed to make the DPW series less susceptible to short circuit damage.

Portable Conveyor with Battery Drive

Problem: A conveyor system is needed in a mobile application that requires battery power.

Solution: The 65E series motor speed control is designed specifically for battery powered applications. Using a 12, 24 or 36 Volt DC gear motor and the appropriate battery supply a conveyor system can be made portable. Using the 65E series control, the desired conveyer speed can be adjusted via a potentiometer. Other adjustments include acceleration time and current limit.



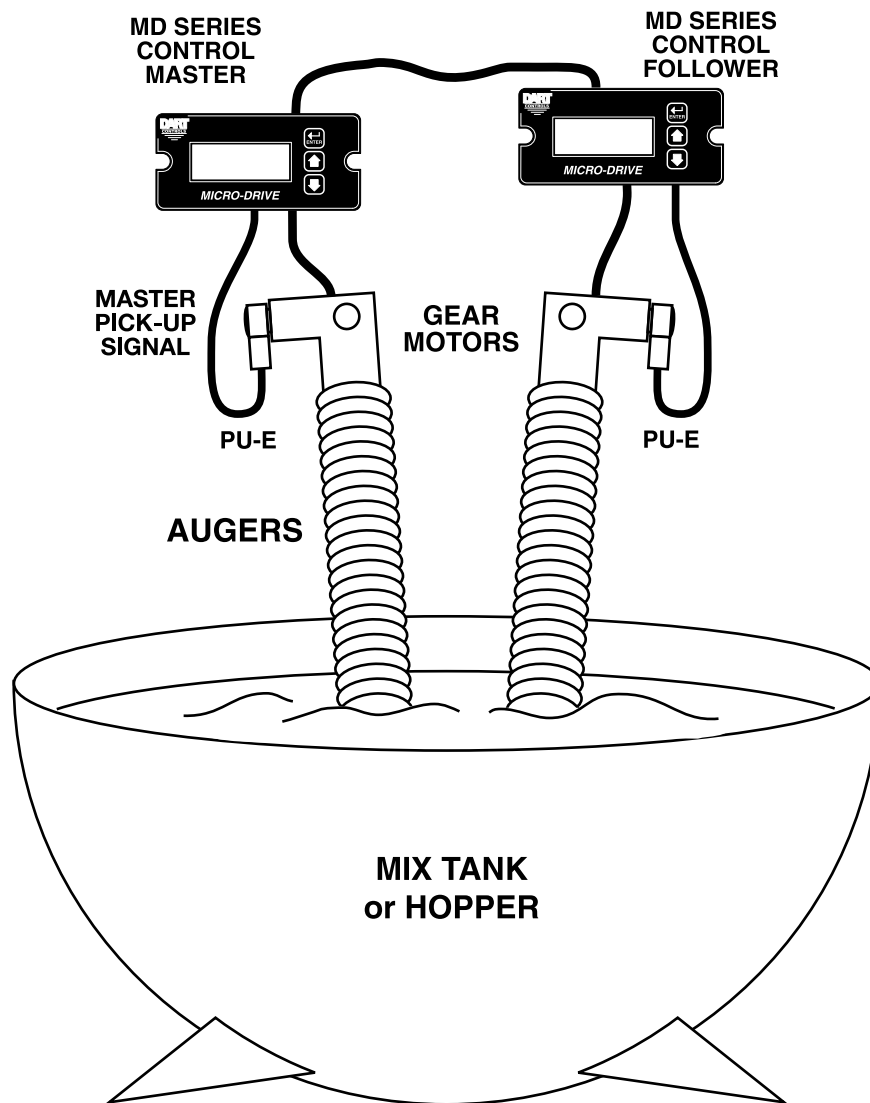
Battery Drive Application Benefits

- Current Limit Protection
- PWM Output for High Efficiency
- Automatic Compensation for Declining Battery Voltage
- Full Range Speed Control

Material Blending with MDP Series

Problem: It is necessary to maintain an accurate ratio when blending materials.

Solution: The MDP digital closed loop control series is selected to ensure precise control of auger speed. The master MD10P can be programmed to display in lbs/min of material dispensed. The follower MD10P will use the pick-up signal from the master as its speed reference. The display of the follower will be in % of master. The master drive will be used to set the entire system's speed and the follower will maintain the ratio of the blend.



MDP Application Benefits

- Precise Speed Control
- +/- 1 RPM Accuracy
- Large Digital Display

Accent on Product

Dart is the most responsive manufacturer of controls anywhere. We listen to our customers' needs and respond with the control product that best fits their special requirements.

For product and application assistance, please contact us.

- **SCR and Digital DC speed controls for AC line voltage to three horsepower**
- **DC reversing controls**
- **PWM DC speed controls**
- **Brushless DC speed controls**
- **Battery operated DC speed controls**
- **Open and closed loop control systems**
- **Digital tachometer for rate and time**
- **Speed sensors**
- **Variable AC voltage supply**
- **Standard stock DC motors**
- **RoHS Compliant Products**

Accent on Service

Dart has refined its lean manufacturing process to be able to schedule production runs in multiple quantities and models.

We can promise shipment the same day on standard products and within five days for specials.

- Local stocking distributors in most major cities, U.S.A., Canada, and selected overseas countries.
- Sales representatives covering 48 states and Canada.

Dart Controls Headquarters Contacts:

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Motor Speed Controls and
Accessories Since 1963.*

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