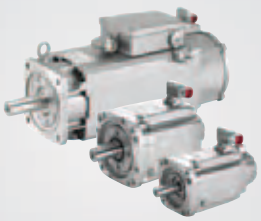

SINUMERIK 828D BASIC T/BASIC M
SINAMICS S120 Combi
1FK7 and 1PH8 motors

Catalog NC 82 · 2011

Motion Control

Answers for industry.

SIEMENS

Related catalogs

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Industry Mall
Information and ordering platform in the Internet:
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1) Language: German.

Motion Control

SINUMERIK 828D BASIC T
SINUMERIK 828D BASIC M
SINAMICS S120 Combi
1FK7 and 1PH8 motors

Catalog NC 82 · 2011

The products and systems described in this catalog are distributed under application of a certified quality and environmental management system in accordance with DIN EN ISO 9001 (Certified Registration No. 001258 QM) and DIN EN ISO 14001 (Certified Registration No. 001258 UM). The certificate is recognized by all IQNet countries.

Refer to the Industry Mall for current updates of this catalog:
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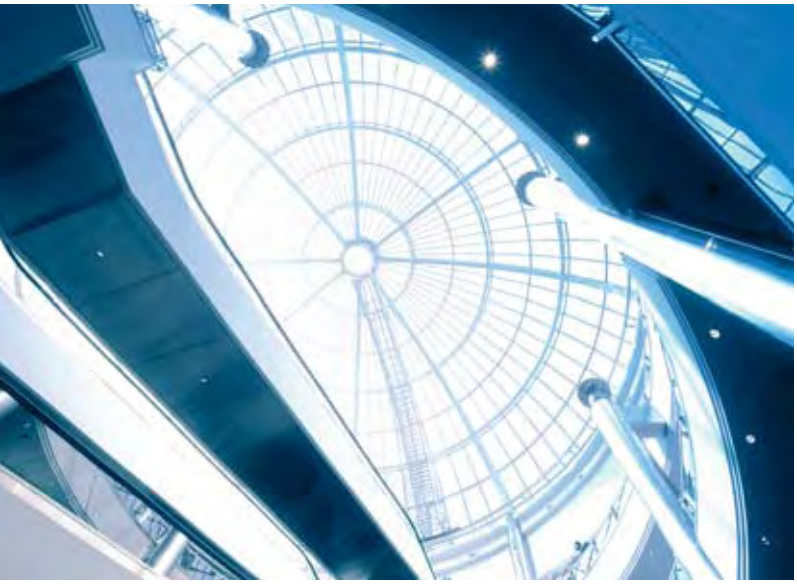
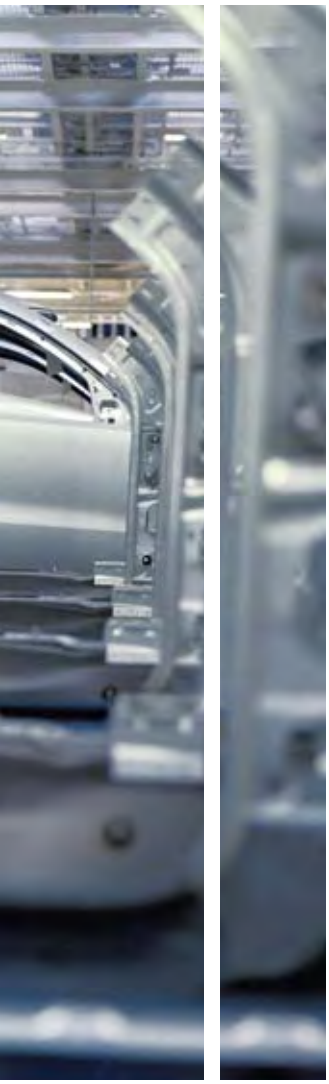




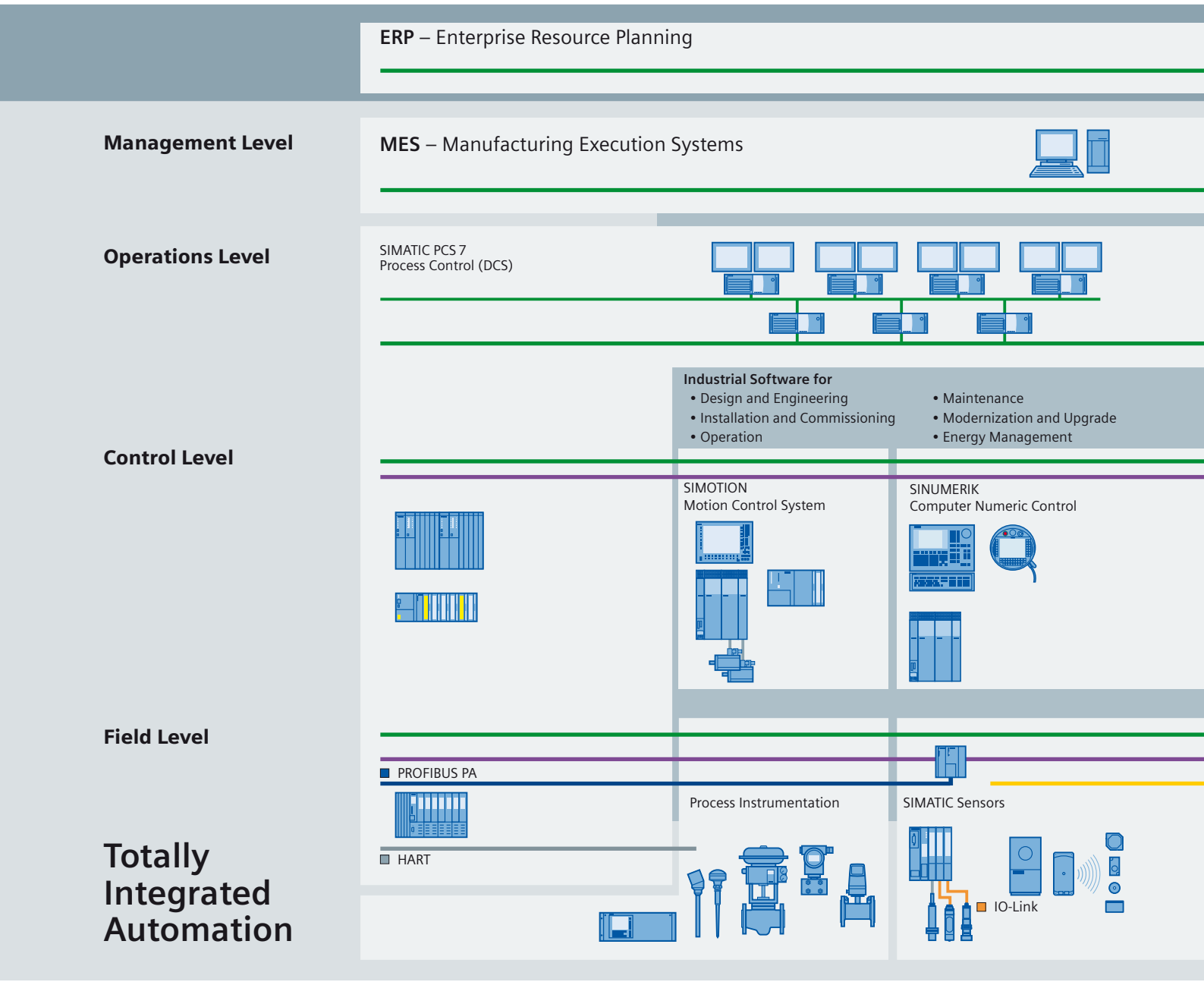
Answers for industry.

Siemens Industry answers the challenges in the manufacturing and the process industry as well as in the building automation business. Our drive and automation solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) are employed in all kinds of industry. In the manufacturing and the process industry. In industrial as well as in functional buildings.

Siemens offers automation, drive, and low-voltage switching technology as well as industrial software from standard products up to entire industry solutions. The industry software enables our industry customers to optimize the entire value chain – from product design and development through manufacture and sales up to after-sales service. Our electrical and mechanical components offer integrated technologies for the entire drive train – from couplings to gear units, from motors to control and drive solutions for all engineering industries. Our technology platform TIP offers robust solutions for power distribution.

The high quality of our products sets industry-wide benchmarks. High environmental aims are part of our eco-management, and we implement these aims consistently. Right from product design, possible effects on the environment are examined. Hence many of our products and systems are RoHS compliant (Restriction of Hazardous Substances). As a matter of course, our production sites are certified according to DIN EN ISO 14001, but to us, environmental protection also means most efficient utilization of valuable resources. The best example are our energy-efficient drives with energy savings up to 60 %.

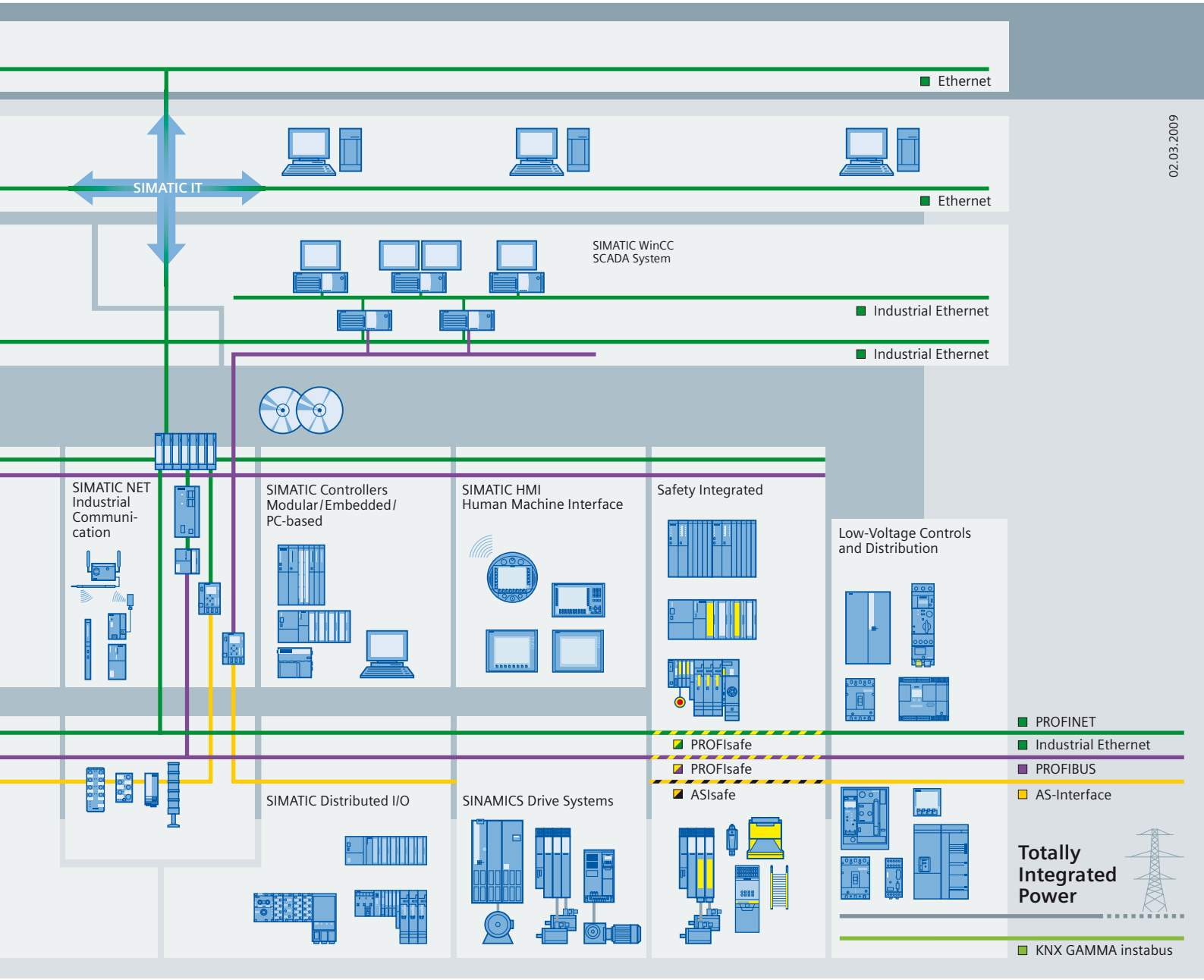
Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.



Setting standards in productivity and competitiveness.

Totally Integrated Automation.

Thanks to Totally Integrated Automation, Siemens is the only provider of an integrated basis for implementation of customized automation solutions – in all industries from inbound to outbound.



TIA is characterized by its unique continuity.

It provides maximum transparency at all levels with reduced interfacing requirements – covering the field level, production control level, up to the corporate management level. With TIA you also profit throughout the complete life cycle of your plant – starting with the initial planning steps through operation up to modernization, where we offer a high measure of investment security resulting from continuity in the further development of our products and from reducing the number of interfaces to a minimum.

The unique continuity is already a defined characteristic at the development stage of our products and systems.

The result: maximum interoperability – covering the controller, HMI, drives, up to the process control system. This reduces the complexity of the automation solution in your plant. You will experience this, for example, in the engineering phase of the automation solution in the form of reduced time requirements and cost, or during operation using the continuous diagnostics facilities of Totally Integrated Automation for increasing the availability of your plant.

Much more than a catalog. The Industry Mall.

You have a catalog in your hands that will serve you well for selecting and ordering your products. But have you heard of the electronic online catalog (the Industry Mall) and all its benefits? Take a look around it sometime:

www.siemens.com/industrymall

Selecting

Find your products in the structure tree, in the new "Bread-crumb" navigation or with the integral search machine with expert functions. Electronic configurators are also integrated into the Mall. Enter the various characteristic values and the appropriate product will be displayed with the relevant order numbers. You can save configurations, load them and reset them to their initial status.

Ordering

You can load the products that you have selected in this way into the shopping basket at a click of the mouse. You can create your own templates and you will be informed about the availability of the products in your shopping cart. You can load the completed parts lists directly into Excel or Word.

Delivery status

When you have sent the order, you will receive a short e-mail confirmation which you can print out or save. With a click on "Carrier", you will be directly connected to the website of the carrier where you can easily track the delivery status.

Added value due to additional information

So you have found your product and want more information about it? In just a few clicks of the mouse, you will arrive at the image data base, manuals and operating instructions. Create your own user documentation with My Documentation Manager.
Also available are FAQs, software downloads, certificates and technical data sheets as well as our training programs. In the image database you will find, depending on the product, 2D/3Dgraphics, dimension drawings and exploded drawings, characteristic curves or circuit diagrams which you can download.

Convinced? We look forward to your visit!

Introduction

SINUMERIK 828D BASIC T and BASIC M

Overview

Compact, strong, simple – simply perfect

The compact, operator-panel-based SINUMERIK 828D BASIC T/BASIC M CNCs are extremely rugged and very easy to maintain.

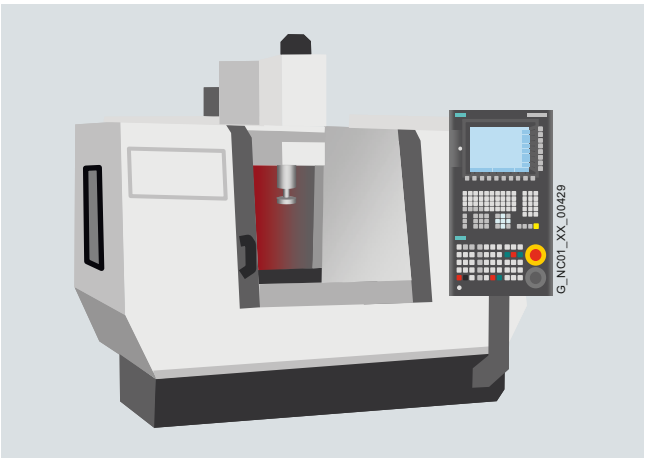
Powerful CNC functions coupled with a unique 80-bit NANO^{FP} accuracy permit excellent workpiece precision to be achieved in very short machining times. Thanks to a flexible CNC programming language as well as the unique machining step programming package ShopTurn/ShopMill, it is possible to program and machine mass-production parts or single workpieces with highest efficiency. Preconfigured technology-specific system software and unique service functions reduce the costs for commissioning and service to an absolute minimum.

Tailored for standard turning machines …

The SINUMERIK 828D BASIC T CNC is perfectly tailored to meet the requirements of modern standard turning machines. With powerful kinematic transformations and an extensive range of technology cycles, the SINUMERIK 828D BASIC T is also ideal for demanding machining applications with driven tools.

Perfectly tailored and preconfigured for:

- Up to 5 axes/spindles in one machining channel
- Face end machining with driven tools
- Peripheral surface machining with driven tools

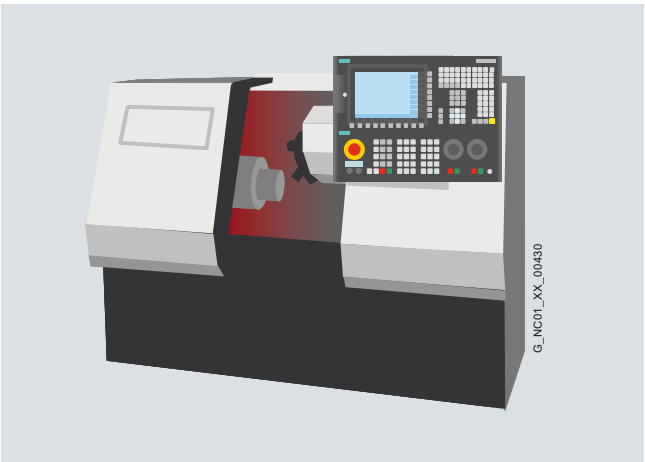


... and standard milling machines

The SINUMERIK 828D BASIC M CNC is perfectly tailored to meet the requirements of modern standard milling machines. With its integral technology package SINUMERIK MDynamics including the new intelligent motion and velocity control Advanced Surface, the SINUMERIK 828D BASIC M is also ideally equipped for the machining of molded workpieces.

Perfectly tailored and preconfigured for:

- Up to 5 axes/spindles in one machining channel
- Peripheral surface machining with A axis
- Machining and application in mold making



Overview

The new drive class for compact machine concepts

The SINAMICS S120 Combi drive system offers the usual SINAMICS functionality in a multi-axis drive module tailored for compact turning and milling machines. With a host of technical highlights, the SINAMICS S120 Combi sets new standards in this drive class.

SINAMICS S120 Combi integrates a line infeed with regenerative feedback capability as well as 3 or 4 Motor Modules for spindle and feed motors in one Power Module. The power spectrum extends up to 16 kW spindle power (S1) and up to 12 A current (S1) for feed motors.

SINAMICS S120 Combi thus covers the typical range of power ratings of compact standard turning and milling machines and is therefore the perfect drive partner for the SINUMERIK 828D BASIC T/BASIC M compact controls.

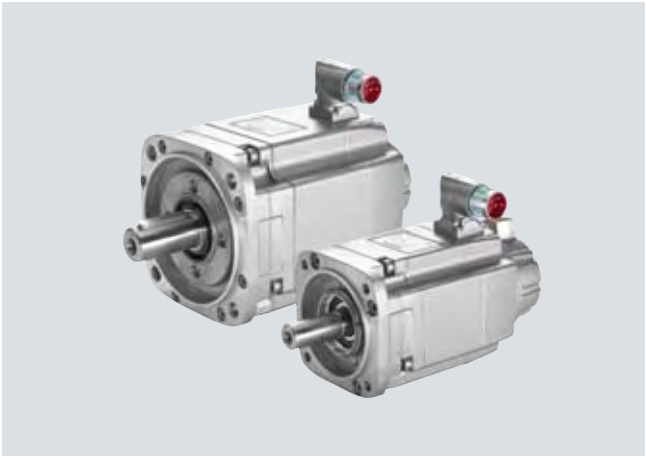
The solution for machines with higher power ratings

For machine concepts beyond the power limit of the SINAMICS S120 Combi, we naturally offer another solution. As an alternative to SINAMICS 120 Combi, you can connect the modular SINAMICS S120 drive system to the SINUMERIK 828D BASIC T/BASIC M.

To configure your equipment, use our SIZER configuration tool or seek advice from your Siemens sales representative. The technical specifications as well as the order numbers can be found in our catalog NC 61 or the Siemens Industry Mall.

www.siemens.com/industrymall

Overview

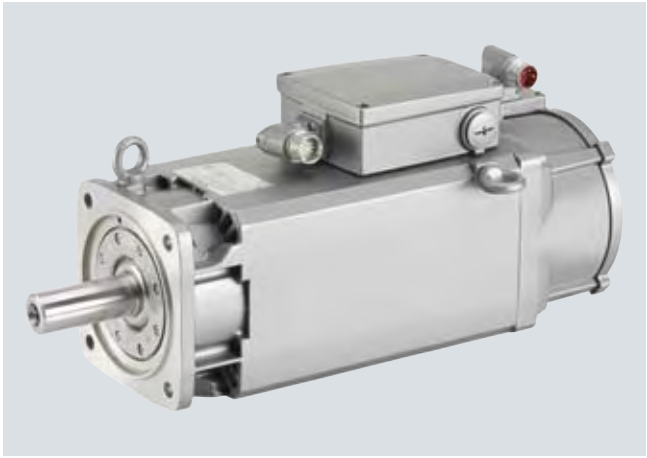


1FK7 feed motors – maximum precision in the machine

The performance and accuracy of the CNC control and drive are useful only if they can be transferred to the machine axes. It is exactly for this purpose that the 1FK7 feed motors with their unique dynamic response and accuracy are required.

An additional range of motors can be found in our catalog NC 61 or in the Industry Mall.

www.siemens.com/industrymall



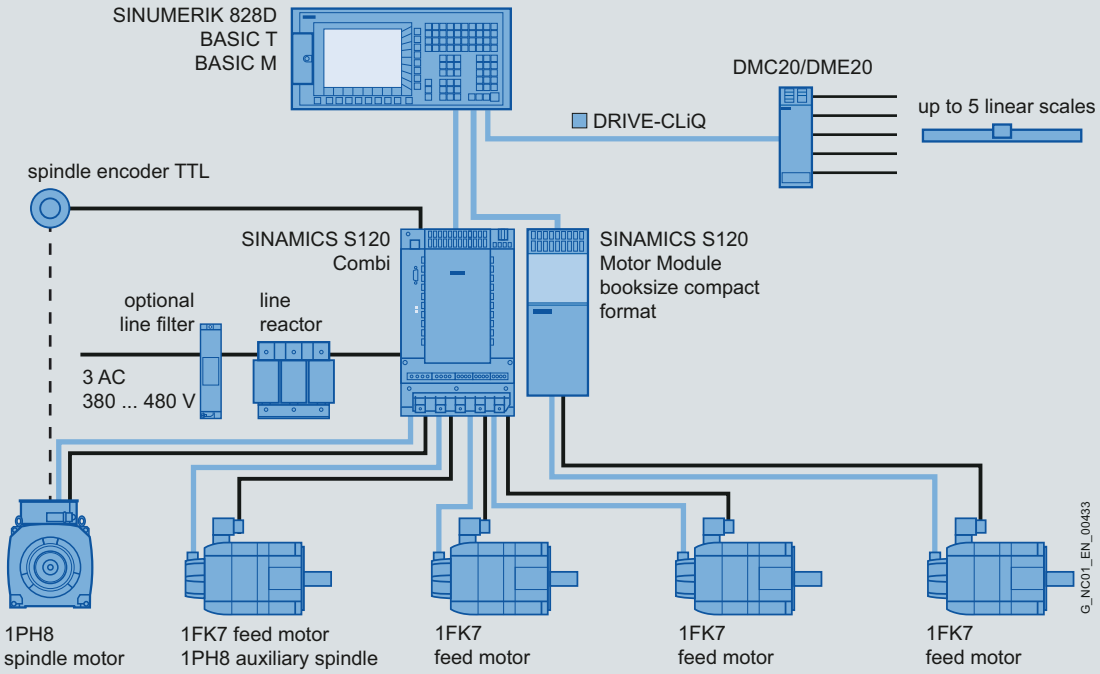
1PH8 spindle motors – peak performance for the spindle

What is the power center of a machine? The spindle of course. With the 1PH8 spindle motors we offer the perfect solution for this purpose. Very fast acceleration times and a wide speed range with high output guarantee maximum productivity of your machine.

We can also provide customized solutions

In addition to the range of motors described, we offer a comprehensive range of solutions for feed and spindle applications. Your Siemens sales representative will be happy to advise you on how to configure your individual equipment.

Overview



The perfect basis for safe machine concepts

With Safety Integrated, the SINUMERIK 828D BASIC T/BASIC M offers an optimum platform for the implementation of safe machine concepts. Operation when protective doors are open? A safe speed monitoring function makes it possible to manage requirements of this type.

The Safety Integrated functions of the SINUMERIK 828D BASIC T/BASIC M conform to Machinery Directive 2006/42/EC. As a result, it is possible to comply economically and efficiently with the machine safety regulations applicable in Europe or other countries.

Perfectly coordinated configurations – Quick Packages

We have already combined the SINUMERIK 828D BASIC T/BASIC M, SINAMICS S120 Combi and 1FK7 feed motors and 1PH8 spindle motors into Quick Packages.

You can, of course, assemble your own individual equipment package. To configure your equipment, use our SIZER configuration tool or seek advice from your Siemens sales representative.

24 months material warranty and on-site service

For the worst-case scenario, you will receive a material warranty and a free on-site service period for the SINUMERIK 828D BASIC T/BASIC M and the associated components (except for complete motor spindles) by Siemens Industry Sector, IA & DT.

You benefit because we eliminate any defects on our components free of charge on site, i.e. directly at the site of installation of your machine.

Further information about the conditions and the scope of the warranty and the on-site service can be found at:

www.siemens.com/automation/rsc

SIZER configuration tool

Overview

Intelligent configuring of equipment

The SIZER configuration tool allows you to configure your CNC system interactively from a range of equipment including the SINUMERIK CNC, SINAMICS drive system and motors as well as accessories such as machine control panel and cables. A comprehensive online help provides you with important technical information on the individual equipment components as well as the dimensioning process. In addition, SIZER presents you with the necessary decision-making criteria for selecting the most suitable components.

SIZER also helps to optimize the energy efficiency of the CNC equipment by selecting the drive configuration with the lowest energy consumption.

Perfect equipment – step by step

Thanks to its intelligent workflow, SIZER guides you step by step to a perfectly dimensioned equipment package:

- Selection of the spindle and feed motors on the basis of the mechanical properties and power rating of your machine
- Assignment of the SINAMICS drive components, including additional components such as filters, line reactors and connecting cables
- Selection of the CNC control including system software and CNC options
- Selection of the CNC accessories such as PLC I/Os, machine control panels, and handheld units

All data readily available

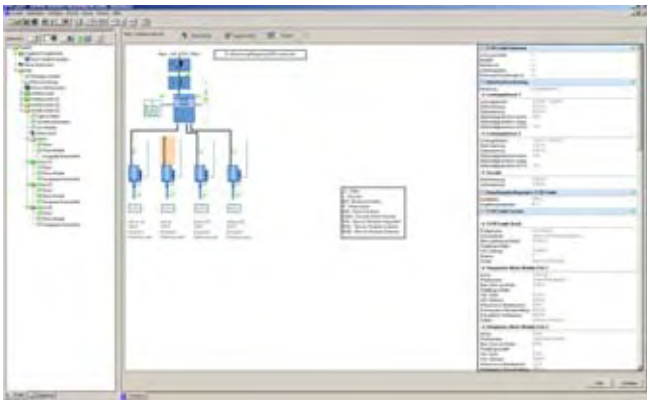
Once you have finished the configuration, SIZER supplies all the important data needed for the next stage in the configuring process:

- Parts list of all equipment components with order numbers
- Technical specification of the system
- Motor characteristics
- Layout diagram for drive and CNC components
- Dimensional drawings of the hardware components in CAD format
- Single-line diagram for comparing the energy consumption of individual drive configurations

For a nominal charge, SIZER can be ordered on DVD-ROM or downloaded free of charge from the Internet under the following link.

www.siemens.com/sizer

SIZER configuration tool: SINUMERIK 828D PPU 240.2



SIZER configuration tool: SINAMICS S120 Combi

Overview of functions

2

The following overview lists all the functions which are available with the SINUMERIK 828D BASIC T and SINUMERIK 828D BASIC M.

The functionality of the SINUMERIK 828D BASIC T and BASIC M complies with the export list restrictions. Accordingly, these CNC controls do not require official approval as a result of their type in accordance with EU or German law.

The information in the overview of functions of SINUMERIK 828D BASIC T/BASIC M controls is based on the following software versions:

Control	Software version
PPU 240.2	4.3
PPU 241.2	4.3

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Control structure and configuration			
Panel-based control system comprising			
• Compact Operator Panel		✓	✓
• CNC/PLC Control Unit		✓	✓
• Closed-loop Control Unit for drives, up to		5	5
Drive-based design		–	–
PC-based design		–	–
Compact Operator Panel			
• Horizontal		✓	✓
• Vertical		✓	✓
• Color display		8.4"	8.4"
• Integrated QWERTY keyboard		✓	✓
SINUMERIK operator panels with			
• TCU		–	–
• PCU		–	–
System software on CF card for SINUMERIK 828D PPU 240.2/PPU 241.2			
• System software Turning Export version with license	**6FC5835-1GY40-.YA0**	O	–
• System software Milling Export version with license	**6FC5835-2GY40-.YA0**	–	O
Embedded HMI SINUMERIK Operate		✓	✓
Windows-based HMI		–	–
Drive interface DRIVE-CLiQ		✓	✓
Numeric Control Extension NX10.3 For applications > 8 axes (turning only)	**6SL3040-1NC00-0AA0**	–	–
Channels/mode groups MG			
• Maximum configuration		1	1
• Mode group MG, each additional		–	–
• Machining channel, each additional		–	–
CNC user memory (buffered) for CNC part programs		1 MB	1 MB
CNC user memory, maximum configuration		1 MB	1 MB
Additional CNC user memory on user CF card (CF card not supplied as standard)		✓	✓
HMI user memory, additional 256 MB on CF card of PPU		–	–
Axes/spindles or positioning axes/auxiliary spindle			
• Basic quantity of axes/spindles		3	4
• Maximum configuration axes/spindles		5	5
Axis/spindle, each additional	**6FC5800-0AC20-0YB0**	O	O
Positioning axis/auxiliary spindle, each additional	**6FC5800-0AC30-0YB0**	O	O
PLC-controlled axis		✓	✓
PLC positioning axis via			
• PROFIBUS		–	–
• PROFINET DP		–	–

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Drives			
SINAMICS S120 Motor Modules via DRIVE-CLiQ	See NC 61	✓	✓
SINAMICS S120 DRIVE-CLiQ on motor		O	O
SINAMICS S120 Sensor Module Cabinet	See NC 61	O	O
• SINAMICS S120 SMC20	See NC 61/NC 82	O	O
• SINAMICS S120 SMC10	See NC 61	O	O
• SINAMICS S120 SMC30	See NC 61	O	O
SINAMICS S120 SME Sensor Module External	See NC 61	O	O
• SINAMICS S120 SME20	See NC 61	O	O
• SINAMICS S120 SME25	See NC 61	O	O
• SINAMICS S120 SME120	See NC 61	O	O
• SINAMICS S120 SME125	See NC 61	O	O
SINAMICS S120 expansion module	See NC 61	O	O
• SINAMICS S120 DMC20	See NC 61	O	O
SINAMICS S120 Motor Modules in booksize format	See NC 61	O	O
• Internal air cooling	See NC 61	O	O
• External air cooling	See NC 61	O	O
• Cold plate cooling	See NC 61	O	O
SINAMICS S120 Active Line Modules in booksize format	See NC 61	O	O
• Internal air cooling	See NC 61	O	O
• External air cooling	See NC 61	O	O
• Cold plate cooling	See NC 61	O	O
SINAMICS S120 Smart Line Modules in booksize format	See NC 61	O	O
• Internal air cooling	See NC 61	O	O
• External air cooling	See NC 61	O	O
• Cold plate cooling	See NC 61	O	O
SINAMICS S120 Motor Modules in chassis format, internal air cooling (rated pulse frequency 2 kHz)		On request	On request
Analog Drive Interface for 4 axes ADI 4		–	–
Connectable measuring systems			
Number of measuring systems per axis, max.		2	2
Incremental encoder installed in 1FT7/1FK7/1PH8 motors		✓	✓
Absolute encoder installed in 1FT7/1FK7/1PH8 motors		✓	✓
Absolute encoder with SSI interface		–	–
Rotary measuring systems with			
• RS422 (TTL)		✓	✓
• sin/cos 1 V_{pp}		✓	✓
• Distance-coded reference marks		✓	✓
• EnDat 2.1		✓	✓
Linear scale LMS with		✓	✓
• sin/cos 1 V_{pp}		✓	✓
• Distance-coded reference marks		✓	✓
• EnDat 2.1		✓	✓

Overview of functions

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version
O Option
– Not available

	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	**BASIC M**
Axis functions			
Feedrate override		0 ... 200 %	0 ... 200 %
Feedrate override axis-specific		0 ... 200 %	0 ... 200 %
Traversing range decades		± 9	± 9
Rotary axis, turning endlessly		✓	✓
Velocity, max.		300 m/s	300 m/s
Acceleration with jerk limitation		✓	✓
Programmable acceleration		✓	✓
Follow-up mode		✓	✓
Measuring systems 1 and 2, selectable		✓	✓
Feedrate interpolation		✓	✓
Separate path feed for corners and chamfers		✓	✓
Travel to fixed stop		✓	✓
Travel to fixed stop with Force Control	**6FC5800-0AM01-0YB0**	O	O
Analog axis		–	–
Setpoint exchange		–	–
Tangential control		–	–
Path switch signals/cam controller		–	–
Advanced Position Control APC		–	–
Spindle functions			
Spindle speed, analog		–	–
Spindle speed, digital		✓	✓
Spindle speed, max. programmable value range (display: ± 999999999.9999)		10^6 ... 0.0001	10^6 ... 0.0001
Spindle override		0 ... 200 %	0 ... 200 %
Gear stages		5	5
Intermediate gear		✓	✓
Automatic gear stage selection		✓	✓
Oriented spindle stop		✓	✓
Spindle speed limitation min./max.		✓	✓
Constant cutting rate		✓	✓
Spindle control via PLC (positioning, oscillation)		✓	✓
Changeover to axis mode		✓	✓
Axis synchronization on-the-fly		✓	✓
Thread run-in and run-out programmable		✓	✓
Thread cutting with constant or variable pitch		✓	✓
Tapping with compensating chuck/rigid tapping		✓	✓

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2 BASIC T	 BASIC M
Interpolations			
Linear interpolation axes, max.		4	4
Circle via center point and end point		✓	✓
Circle via interpolation point		✓	✓
Helical interpolation		✓	✓
Universal interpolator NURBS (non-uniform rational B splines)		✓	✓
Continuous-path mode with programmable rounding clearance		✓	✓
Multi-axis interpolation (> 4 interpolating axes)		–	–
Advanced Surface		–	✓
Spline interpolation (A, B and C splines)	**6FC5800-0AS16-0YB0**	O	O
Compressor for 3-axis machining		–	✓
Polynomial interpolation		–	–
Involute interpolation		–	–
Crank interpolation CRIP		–	–
Couplings			
Pair of synchronized axes (gantry axes), basic	**6FC5800-0AS51-0YB0**	O	O
Master/slave for drives, basic	**6FC5800-0AS52-0YB0**	O	–
Generic coupling static, CP Static, e.g. counter-spindle	**6FC5800-0AM75-0YB0**	–	–
Generic coupling basic, CP Basic, e.g. multi-edge turning	**6FC5800-0AM72-0YB0**		
• Axis pairs in simultaneous coupled motion		O 4	–
• Synchronous spindle/multi-edge turning		O 1	–
• Master-value coupling/curve table interpolation		–	–
Transformations			
Cartesian point-to-point travel PTP		✓	✓
TRANSMIT/Peripheral surface transformation	**6FC5800-0AM27-0YB0**	O	O
Inclined axis	**6FC5800-0AM28-0YB0**	–	–
Concatenated transformations (inclined axis TRAANG following TRAORI/cardan millhead/TRANSMIT/TRACYL)		–	–
Measuring functions/measuring cycles			
Measuring stage 1 Number of probes (switching) with/without deletion of distance-to-go		2	2
Measuring cycles for drilling/milling and turning (calibrate workpiece probe, workpiece measurement, tool measurement)	**6FC5800-0AP28-0YB0**	O	O
Measure kinematics (determine transformation data of rotary axes)		–	–
Technologies			
Handwheel override		✓	✓
Contour handwheel	**6FC5800-0AM08-0YB0**	O	O
SINUMERIK MDynamics		–	✓
• Advanced Surface		–	✓
• High Speed Settings		–	✓
• Extension of user memory via optional user CF card		–	✓

Overview of functions

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Motion-synchronous actions			
CNC inputs/outputs, high-speed			
• Digital inputs drive onboard		12	12
• Digital inputs/outputs drive onboard		8	8
• Digital inputs CNC onboard		8	8
• Digital outputs CNC onboard		8	8
Synchronized actions and high-speed auxiliary function output incl. 3 synchronous functions		✓	✓
Positioning axes and spindles via synchronized actions (command axes)		✓	✓
Analog value control in interpolation cycle		–	–
Evaluation of internal drive variables	**6FC5800-0AS53-0YB0**	O	O
Asynchronous subroutines ASUB		✓	✓
Interrupt routines with fast retraction from the contour		✓	✓
Cross-mode actions (ASUBs and synchronized actions in all operating modes)		✓	✓
Display of active synchronous actions in HMI (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
Open Architecture			
OA Easy Screen			
• Free screen forms		5	5
SINUMERIK Operate runtime license OA Easy Screen			
• > 5 screen forms, extended functions	**6FC5800-0AP64-0YB0**	O	O
CNC programming language			
Programming language (DIN 66025 and high-level language expansion)		✓	✓
Main program call from main program and subroutine		✓	✓
Subroutine levels, max.		11	11
Interrupt routines, max.		4	4
Number of subroutine passes		≤ 9999	≤ 9999
Number of levels for skip blocks		2	2
Number of levels for skip blocks (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O 10	O 10
Polar coordinates		✓	✓
1/2/3-point contours		✓	✓
Dimensions metric/inch, changeover			
• Manually		✓	✓
• Via program		✓	✓
Inverse-time feedrate		✓	✓
Auxiliary function output			
• Via M word, max. programmable value range		INT 231^{-1}	INT 231^{-1}
• Via H word, max. programmable value range REAL ± 3.4028 ex 38 (display ± 999999999.9999)		INT -231 to 231^{-1}	INT -231 to 231^{-1}
Program functions			
• Dynamic preprocessing memory FIFO		✓	✓
• Look ahead (number of sets)		1	50
• Frame concept		✓	✓
• Inclined-surface machining with swivel cycle		–	✓
• Axis/spindle replacement		✓	✓
• Geometry axes, switchable online in the CNC program		✓	✓
• Program preprocessing		✓	✓

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	**BASIC M**
CNC programming language (continued)			
High-level CNC language with			
• User variables, configurable		✓	✓
• Predefined user variables (arithmetic parameters)		✓	✓
• Predefined user variables (arithmetic parameters), configurable		✓	✓
• Read/write system variables		✓	✓
• Indirect programming		✓	✓
• Program jumps and branches		✓	✓
• Program coordination with WAIT, START, INIT		–	–
• Arithmetic and trigonometric functions		✓	✓
• Compare operations and logic combinations		✓	✓
• Macro techniques		✓	✓
• Control structures IF-ELSE-ENDIF		✓	✓
• Control structures WHILE, FOR, REPEAT, LOOP		✓	✓
• Commands to HMI		✓	✓
• STRING functions		✓	✓
Online ISO dialect interpreter		✓	✓
Program/workpiece management			
• Part programs on PPU, max. number		300	300
• Workpieces on PPU, max. number		100	100
• On additional plug-in CF card		✓	✓
• On USB storage medium, e.g. disk drive, USB stick		✓	✓
• On network drive (CNC option: Network drive management)	**6FC5800-0AP01-0YB0**	O	O
• Templates for workpieces, programs and INI files		✓	✓
• Job lists		✓	✓
Basic frames, max. number		1	1
Settable offsets, max. number		50	50
Zero/work offsets, programmable (frames)		✓	✓
Scratching, determining zero/work offset		✓	✓
Zero/work offsets, external (PLC)		✓	✓
Global and local user data		✓	✓
Global program user data		✓	✓
Display system variables (also via online configurable display) and log them		–	–

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Programming support			
Program editor			
• Programming support programGUIDE for cycles		✓	✓
• CNC editor with editing functions: Marking, copying, deleting		✓	✓
• Geometry processor with programming graphics/free contour input (contour calculator)		✓	✓
• Screens for 1/2/3-point contours (contour definition programming)		–	–
• Machining step programming ShopTurn/ShopMill	**6FC5800-0AP17-0YB0**	O	O
• Save workpiece setup data (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
Technology cycles for drilling/milling (basic scope)		✓	✓
Technology cycles for turning (basic scope)		✓	–
Advanded Technology (expansion of technology cycles for turning and milling)	**6FC5800-0AP58-0YB0**	O	O
Pocket milling with free contour definition and islands		O	O
Stock removal cycles with free contour definition		O	–
Residual material detection and machining for contour pockets and cutting	**6FC5800-0AP13-0YB0**	O	O
Access protection for cycles	**6FC5800-0AP54-0YB0**	–	–
Programming support can be extended, e.g. customer cycles		✓	✓
CAD Reader for PC	See NC 61	O	O
Simulation			
Simulation of program X, while program Y is being executed		–	–
2D simulation		✓	✓
3D simulation, finished part	**6FC5800-0AP25-0YB0**	O	O
3D simulation, finished part and working area		–	–
3D simulation, finished part with collision check		–	–
Simultaneous recording (real-time simulation of current machining operation)	**6FC5800-0AP22-0YB0**	O	O

✓ Basic version
O Option
– Not available

	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Operating modes			
JOG			
• Handwheel selection		✓	✓
• Switchover: inch/metric		✓	✓
• Manual measurement of zero/work offset		✓	✓
• Additional measuring versions beyond standard scope - Setting the workpiece zero in standard scope: set edge, align edge, right-angled corner, 1 hole and 1 circular spigot - Expansion of measurement windows via combination field (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	–	O
• Manual measurement of tool offset		✓	✓
• Automatic tool/workpiece measurement		✓	✓
• Reference point approach, automatic/via CNC program		✓	✓
MDA			
• Input in text editor		✓	✓
• Load/save MDA program (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	✓	✓
• Input screen forms for technology and positioning, cycle support		✓	✓
Teach-in (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
Automatic			
• Execution from storage medium connected to CF card interface on operator panel front		✓	✓
• Execution from storage medium connected to USB interface on operator panel front, e.g. card reader, memory stick		✓	✓
• Execution from network drive (CNC option: Network drive management)	**6FC5800-0AP01-0YB0**	O	O
• Program control		✓	✓
• Program editing		✓	✓
• Overstoring (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
• DRF offset (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
• Block search with/without calculation		✓	✓
• Extended block search (program, search pointer, level up or down, interrupt position) (CNC option: Extended operator functions)	**6FC5800-0AP16-0YB0**	O	O
Repos (repositioning on the contour)			
• With operator command/semi-automatically		✓	✓
• Program-controlled		✓	✓
Preset			
Set actual value		✓	✓
Tools			
Tool types			
• Turning		✓	–
• Drilling/milling		✓	✓
• Groove sawing		✓	✓
Tool radius compensations in plane			
• With approach and retract strategies		✓	✓
• With transition circle/ellipse on outer edges		✓	✓
Configurable intermediate blocks with tool radius compensation active		✓	✓
3D tool radius compensation		–	–
Tool carrier with orientation capability		–	✓
Look-ahead detection of contour violations		✓	✓

Overview of functions
CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	**BASIC M**
Tool management			
• Operation with tool management		✓	✓
• Real magazines, maximum number		1	1
• Tool list		✓	✓
• Extendable tool list		–	–
• Tools/cutting edges in tool list		80/160	80/160
• Tool offset selection via T and D numbers		✓	✓
• Magazine list		✓	✓
• Configurable magazine list		✓	✓
• Magazine data		✓	✓
• Vacant position search and positioning		✓	✓
• Easy vacant position search using softkeys		✓	✓
• Loading and unloading of tools		✓	✓
• Tool cabinet and tool catalog		–	–
• Loading and unloading via code carrier system		–	–
• Adapter data		✓	–
• Local compensations		–	–
• Monitoring of tool life and workpiece count		✓	✓
• Replacement tools for tool management	**6FC5800-0AM78-0YB0**	O	O
Tool management functions TDI for individual machines and networked machines		–	–
Communication/data management			
Data on storage medium on rear USB interface of TCU/PCU, e.g. card reader, memory stick		✓	✓
Data on storage medium on front USB interface of operator panel, e.g. memory stick		✓	✓
Data on front CF card interface of operator panel		✓	✓
Manage additional drives			
• Via Ethernet, max.	**6FC5800-0AP01-0YB0**	O 4	O 4
• Via USB		✓	✓
• CF card of the OP		✓	✓
Serial interface RS232C		✓	✓
Data backup for system software and user data (backup/restore) on user CF card		✓	✓
I/O interface via PROFINET (via I/O modules PP 72/48D PN and PP 72/48D 2/2A PN only)		✓	✓
Connection to external PROFINET network with SIMATIC DP PN/PN coupler	**6ES7158-3AD00-0XA0**	O	O
RPC SINUMERIK		–	–
Automation Data Management ADDM		–	–
Production data evaluation			
Machine Data Acquisition MDA Machine and operating data acquisition		–	–

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Operation			
SINUMERIK 828D BASIC operator panel			
• Vertical		✓	✓
• Horizontal		✓	✓
• Color display		8.4"	8.4"
• Integrated QWERTY keyboard (short-stroke keys)		✓	✓
SINUMERIK operator panels with			
• TCU		–	–
• PCU		–	–
SINUMERIK PCU 50.3		–	–
Connection for			
• Standard monitor (DVI), VGA via ext. adapter, as for PCU 50.3		–	–
• SIMATIC OP		–	–
Control unit management			
• One operator panel per CNC		✓	✓
• Combination of multiple operator panels and CNCs		–	–
Handheld units			
• SINUMERIK HT 8 handheld terminal		–	–
• SINUMERIK HT 2 handheld terminal		–	–
• Mini handheld unit with coiled connecting cable, 3.5 m	**6FX2007-1AD03**	O	O
• Mini handheld unit with straight connecting cable, 5 m	**6FX2007-1AD13**	O	O
• Connection kit for mini handheld unit, without Industrial Ethernet	**6FX2006-1BG03**	O	O
• Connection kit for mini handheld unit, with Industrial Ethernet	**6FX2006-1BG11**	O	O
• Holder for mini handheld unit	**6FX2006-1BG70**	O	O
• Handwheel connection module PROFIBUS/PROFINET		–	–
Machine control panels			
• SINUMERIK MCP 802D sl machine control panel		–	–
• SINUMERIK machine control panel MCPA module		–	–
• SINUMERIK MCP 310C PN machine control panel	**6FC5303-0AF23-0AA1**	O	O
• SINUMERIK MCP 483C PN machine control panel	**6FC5303-0AF22-0AA1**	O	O
• SINUMERIK MPP Machine Push Button Panel		–	–
Electronic handwheels			
• With 120 mm × 120 mm front panel, 5 V DC	**6FC9320-5DB01**	O	O
• With 76.2 mm × 76.2 mm front panel, 5 V DC	**6FC9320-5DC01**	O	O
• With 76.2 mm × 76.2 mm front panel, 24 V DC, HTL		–	–
• Without front panel, without setting wheel, 5 V DC	**6FC9320-5DF01**	O	O
• Without front panel, with setting wheel, 5 V DC	**6FC9320-5DM00**	O	O
• Portable in housing, coiled cable 2.5 m	**6FC9320-5DE02**	O	O
• Flange socket for portable handwheel	**6FC9341-1AQ**	O	O
• Cable distributor		–	–
Connection for electronic handwheels		2	2
Keyboards			
• Integrated QWERTY keyboard		✓	✓
• External SINUMERIK keyboards		–	–
• KBPC CG US standard PC keyboard		–	–
Storage devices			
• Disk drive 3.5"/1.44 MB with USB interface		✓	✓
• Card reader for CF/SD storage media with USB interface		✓	✓

Overview of functions

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2	
		BASIC T	BASIC M
Functions			
Plain text display of user variables		✓	✓
Multi-channel display		–	–
2D representation of 3D protection areas/work areas		–	–
Actual-value system for workpiece		✓	✓
Menu selection via the PLC		✓	✓
CNC program messages		✓	✓
Online help for programming, alarms and machine data, expandable		✓	✓
Screen blanking		✓	✓
Access protection levels		8	8
Operating software languages			
• Chinese Simplified, Chinese Traditional, English, French, German, Italian, Korean, Portuguese, Spanish		✓	✓
• Additional languages, use of language extensions		✓	✓
• Language extensions for operating software SINUMERIK Operate on DVD-ROM, without license, e.g. Czech, Danish, Dutch, Finnish, Hungarian, Polish, Romanian, Russian, Slovakian, Swedish, Turkish	**6FC5860-0YC20-1YA8**	O	O
Monitoring functions			
Working area limitation		✓	✓
Limit switch monitoring Software and hardware limit switches		✓	✓
Position monitoring		✓	✓
Standstill (zero-speed) monitoring		✓	✓
Clamping monitoring		✓	✓
2D/3D protection zones		✓	✓
Contour monitoring		✓	✓
Contour monitoring with tunnel function		–	–
Path length evaluation		–	–
Axis limitation from the PLC		✓	✓
Spindle speed limitation		✓	✓
Collision check		–	–
Generator operation		–	–
Extended stop and retract ESR, incl. generator operation		–	–
Integrated tool monitoring and diagnostics IDM		–	–
Compensations			
Backlash compensation		✓	✓
Leadscrew error compensation		✓	✓
Measuring system error compensation		✓	✓
Sag compensation, multi-dimensional (bidirectional error compensation)	**6FC5800-0AM55-0YB0**	O	O
Quadrant error compensation per operator input		–	–
Graphical monitoring of quadrant error compensation using circularity test		–	–
Temperature compensation		✓	✓
Feedforward control			
• Velocity-dependent		✓	✓
• Acceleration-dependent		–	–

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2 BASIC T	 BASIC M
PLC			
SIMATIC S7-300		–	–
SIMATIC S7-200 integrated		✓	✓
Fixed cycle time for PLC		9 ms	9 ms
Reaction time to process events (terminal to terminal)		7.5 ms	7.5 ms
Ladder Steps memory configuration		24000	24000
PLC programming language			
• LAD ladder diagram		✓	✓
• FBD function block diagram		–	–
• STL statement list		–	–
PLC programming tool for Integrated PLC	On toolbox CD-ROM	✓	✓
PLC Ladder Add-On editor on PPU		✓	✓
I/O modules			
• PP 72/48D PN I/O module (digital), max. number		O 3	O 3
• PP 72/48D 2/2A PN I/O module (digital/analog), max. number		O 3	O 3
• General I/Os via PROFIBUS/PROFINET		–	–
• General SIMATIC PROFINET PLC I/Os		–	–
• Analog Drive Interface for 4 axes ADI 4		–	–
Digital inputs, max. number		216	216
Digital outputs, max. number		144	144
Analog inputs, max. number		6	6
Analog outputs, max. number		6	6
PLC alarms/messages, max. number		248	248
Bit memories, number		512 bytes	512 bytes
Timers, number		128	128
Counters, number		64	64
Subroutines		256	256
FB, FC		–	–
DB, highest number, max. number		64	64
Cyclic function block		✓	✓
Cyclic function block servo-synchronous		✓	✓
User machine data for configuring the PLC user program		✓	✓
Safety functions			
SINUMERIK Safety Integrated Safety functions for personnel and machine protection			
• Safe Torque Off (STO)		✓	✓
• Safe Brake Control (SBC)		✓	✓
• Safe Stop 1 (SS1)		✓	✓
• Safety Integrated Extended Functions for one CNC axis - Safe Operating Stop (SOS) - Safe Stop 2 (SS2) - Safely Limited Speed (SLS) - Safe Speed Monitor (SSM) - Safe Acceleration Monitor (SAM)	**6FC5800-0AC50-0YB0**	O	O
• SINAMICS S120 Terminal Module Cabinet TM54F for the control of SOS, SS2, SLS, SSM and SAM	**6SL3055-0AA00-3BA0**	O	O

Overview of functions

CNC controls SINUMERIK 828D BASIC T/BASIC M

CNC control

✓ Basic version O Option – Not available	Order No.	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2 BASIC T	 BASIC M
Commissioning			
Commissioning software for drive system SINAMICS S120 is integrated		✓	✓
Auto Servo Tuning AST, fully automatic speed and position controller optimization		✓	✓
Commissioning trace (drive optimization without an additional oscilloscope)			
• Integrated		✓	✓
• Commissioning software for SINAMICS S120	On toolbox CD-ROM	✓	✓
Standard commissioning via serial interface		–	–
Standard commissioning via USB interface with storage medium, e.g. memory stick	Read in/out INI file	✓	✓
Standard commissioning via network drive		✓	✓
Standard commissioning via user CF card		✓	✓
Standard commissioning via RCS Commander		✓	✓
STARTER commissioning tool on PC/PG for SINAMICS S120	On STARTER DVD-ROM	✓	✓
SinuCom commissioning/service tools for SINUMERIK 840D sl		–	–
Diagnostic functions			
Alarms and messages		✓	✓
Action log can be activated for diagnostic purposes		✓	✓
PLC status		✓	✓
LAD display		✓	✓
PLC remote diagnostics via modem		✓	✓
PLC remote diagnostics via Ethernet		✓	✓
Easy Message machine status transmission via text messages SMS requires optional SINAUT Modem with antenna and cable	**6NH9720-3AA00** **6NH9860-1AA00** **6NH7701-5AN**	O	O
Remote Control System RCS remote diagnostics			
• RCS Host remote diagnostics function	**6FC5800-0AP30-0YB0**	O	O
• RCS Commander (viewer function)	RCS Commander for PC/PG on CD-ROM	✓	✓
Service and maintenance			
ePS Network Services		–	–
Total Productive Maintenance TPM Servicing and maintenance support		–	–
Integrated service planner for monitoring of service intervals		✓	✓
Easy Extend Easy extension of optional machine components		✓	✓

Function	SINUMERIK 828D BASIC PPU 240.2/PPU 241.2 BASIC T	 BASIC M
DRIVE-CLiQ ports	3	3
Number of axes/spindles	3	4
Number of axes/spindles, max.	5	5
Number of axes with Drive Based Extended Safety, max.	5	5
Min. block change time, approx.	9 ms	9 ms
Position control cycle clock	3 ms	3 ms
Speed/current regulation cycle	125 µs	125 µs
Non-Volatile Random-Access Memory NVRAM		
• For OEM cycles	512 kB	512 kB
• For user data	1 MB	1 MB

CNC controls

SINUMERIK 828D BASIC T

Overview

SINUMERIK 828D BASIC T PPU 241.2, horizontal

SINUMERIK 828D BASIC T PPU 240.2, vertical

The SINUMERIK 828D BASIC T is a operator-panel-based CNC, tailored for use in modern standard turning machines.

Benefits

- Compact, rugged, and maintenance-free operator-panel CNC with dedicated system software for turning technologies
- Highest machining precision with 80 bit NANO^{FP} accuracy
- The new user interface SINUMERIK Operate: same look and feel as SINUMERIK 840D sl
- Intelligent kinematic transformations for milling and drilling processes on the front and peripheral surfaces of the workpiece
- ShopTurn: Very fast programming time in the production of individual parts and small batches
- programGUIDE: Very fast machining times and maximum flexibility in the manufacture of workpieces in large batch sizes
- Unique spectrum of technology cycles – ranging from the machining of any turning and milling contours with residual material detection to in-process measurements
- Animated Elements: Unique operating and programming support with moving picture sequences
- State-of-the-art data transmission via USB stick, CompactFlash card and plant network (Ethernet)
- Easy Message: Maximum machine availability thanks to process monitoring based on text messaging (SMS)

Function

- 2 operator panel variants for horizontal and vertical operator panel housings
- Integrated QWERTY full CNC keyboard with short-stroke keys
- CF card, USB and Ethernet interfaces on the operator panel front
- Additional Ethernet interface on rear of CNC for connection to factory network
- GSM/GPRS modem connection: Easy Message (option)
- Integrated PLC based on the SIMATIC S7-200 command set with ladder logic programming
- I/O interface based on PROFINET for the connection of PLC I/O devices and a machine control panel
- CNC options subject to license
- Up to 5 axes/spindles
- 1 machining channel/mode group
- Integrated tool management with tool life monitoring
- Management of replacement tools (option)
- Graphical machining step programming ShopTurn (option)
- Configurable user screens Easy Screen
- Integrated data archiving procedure for simple data updates
- Faults will be remedied for a period of 24 months following 2nd commissioning on all system components in accordance with the repair service contract performance description.

Integration

The following components can be connected to the SINUMERIK 828D BASIC T:

- Up to 2 electronic handwheels
- Mini handheld unit with handwheel
- Up to 3 I/O modules PP 72/48D PN or PP 72/48D 2/2A PN
- MCP 310C PN or MCP 483C PN machine control panel
- GSM/GPRS modem
- SINAMICS S120 Combi drive system via DRIVE-CLiQ

Technical specifications

	SINUMERIK 828D BASIC T PPU 240.2 vertical 6FC5370-4AT20-0AA0	**SINUMERIK 828D BASIC T PPU 241.2 horizontal** 6FC5370-3AT20-0AA0
Input voltage	24 V DC, + 20 %/- 15 %	24 V DC, + 20 %/- 15 %
Power consumption, max.	60 W	60 W
Mains buffering time	3 ms (20 ms with SITOP smart)	3 ms (20 ms with SITOP smart)
Degree of protection according to EN 60529 (IEC 60529)		
• Operator panel front	IP65 (with closed front cover)	IP65 (with closed front cover)
• PPU	IP20 (rear)	IP20 (rear)
Relative humidity		
• Storage	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Transport	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Operation	5 … 90 % at 25 °C (no condensation)	5 … 90 % at 25 °C (no condensation)
Ambient temperature		
• Storage	-20 … +55 °C	-20 … +55 °C
• Transport	-20 … +70 °C	-20 … +70 °C
• Operation	0 ... 45 °C (rear 0 ... 55 °C)	0 ... 45 °C (rear 0 ... 55 °C)
Dimensions		
• Width	483 mm	310 mm
• Height	220 mm	380 mm
• Depth	105 mm	105 mm
Weight, approx.	4.5 kg	4.5 kg

SINUMERIK 828D BASIC T

3

Selection and ordering data

Description	Order No.
Hardware components	
SINUMERIK 828D BASIC T PPU 240.2 vertical Without system software	**6FC5370-4AT20-0AA0**
SINUMERIK 828D BASIC T PPU 241.2 horizontal Without system software	**6FC5370-3AT20-0AA0**
Set of clamps (9 units) As replacement	**6FC5248-0AF14-0AA0**
CompactFlash card, 1 GB, empty To expand the user memory	**6FC5313-5AG00-0AA1**
Software components	
System software Turning for SINUMERIK 828D BASIC T PPU 240.2/PPU 241.2 On CF card with license current software version Export	**6FC5835-1GY40-■YA0**
SINUMERIK 828D toolbox On CD-ROM	**6FC5830-0CY40-0YA8**
SINUMERIK HMI RCS Commander For PC/PG on CD-ROM current software version	**6FC5860-7YC00-0YA0**
Language extensions for operating software SINUMERIK Operate On DVD-ROM specific software version	**6FC5860-0YC20-1YA8**
STARTER commissioning tool For SINAMICS and MICROMASTER on DVD-ROM Languages: English, French, German, Italian, Spanish	**6SL3072-0AA00-0AG0**
SIZER configuration tool For SINAMICS and MICROMASTER on DVD-ROM Languages: English, French, German, Italian	**6SL3070-0AA00-0AG0**

Example of specific software version 4.3:
6FC5835-1GY4**0**-**0**YA0

Options

CNC options for SINUMERIK 828D BASIC T PPU 240.2/PPU 241.2	
Description	Order No.
Manufacturer options	
Axis/spindle, each additional	**6FC5800-0AC20-0YB0**
Positioning axis/auxiliary spindle, each additional	**6FC5800-0AC30-0YB0**
TRANSMIT/Peripheral surface transformation	**6FC5800-0AM27-0YB0**
Pair of synchronized axes (gantry axes), basic	**6FC5800-0AS51-0YB0**
Travel to fixed stop with Force Control	**6FC5800-0AM01-0YB0**
Generic coupling basic CP Basic[1)]	**6FC5800-0AM72-0YB0**
Sag compensation, multi-dimensional (bidirectional error compensation)	**6FC5800-0AM55-0YB0**
Master/slave for drives, basic	**6FC5800-0AS52-0YB0**
Evaluation of internal drive variables	**6FC5800-0AS53-0YB0**
SINUMERIK Operate runtime license OA Easy Screen	**6FC5800-0AP64-0YB0**
Safety Integrated Extended Functions	**6FC5800-0AC50-0YB0**
User options	
Advanced Technology (expansion of the technology cycles for turning and milling)[2)]	**6FC5800-0AP58-0YB0**
Extended operator functions[3)]	**6FC5800-0AP16-0YB0**
Machining step programming ShopTurn/ShopMill	**6FC5800-0AP17-0YB0**
Residual material detection and machining for contour pockets and cutting	**6FC5800-0AP13-0YB0**
3D simulation of the finished part	**6FC5800-0AP25-0YB0**
Simultaneous recording (real-time simulation of current machining operation)	**6FC5800-0AP22-0YB0**
Measuring cycles for drilling/milling and turning	**6FC5800-0AP28-0YB0**
Network drive management	**6FC5800-0AP01-0YB0**
Replacement tools for tool management	**6FC5800-0AM78-0YB0**
RCS Host remote diagnostics function	**6FC5800-0AP30-0YB0**
Contour handwheel	**6FC5800-0AM08-0YB0**
Spline interpolation (A, B and C splines)	**6FC5800-0AS16-0YB0**

1) For multi-edge turning in turning machines.

2) The CNC option extended technology functions provides you with the following technology cycles for the additional machining operations listed below:
- Asymmetric grooves
- Drill and thread milling
- Thread milling
- Multi-edge milling
- Engraving
- Extended stock removal along contour with segmentation of blank
- Contour grooving and plunge turning
- Milling of contour pockets and spigots (with up to 12 islands)

3) The operator functions in the basic scope of the SINUMERIK 828D BASIC T are dimensioned for standard applications. With the CNC option extended operator functions, the following additional operator functions can be enabled:
- Overstoring
- Teach-in
- DRF offset
- Extended block search
- Save workpiece setup data
- Display of active synchronous actions in HMI
- Number of levels for skip blocks 10
- Load/save MDA program

Overview

SINUMERIK 828D BASIC M PPU 241.2, horizontal

SINUMERIK 828D BASIC M PPU 240.2, vertical

The SINUMERIK 828D BASIC M is an operator-panel-based CNC, tailored for use in modern standard milling machines.

Benefits

- Compact, rugged, and maintenance-free operator-panel CNC with dedicated system software for milling technologies
- Highest machining precision with 80 bit NANO^{FP} accuracy
- The new user interface SINUMERIK Operate: same look and feel as SINUMERIK 840D sl
- Intelligent kinematic transformations for the machining of cylindrical workpieces
- Technology package SINUMERIK MDynamics with the new function Advanced Surface: Perfect workpiece surfaces and very fast machining times in the production of moldmaking workpieces
- ShopMill: Very fast programming time in the production of individual parts and small batches
- programGUIDE: Very fast machining times and maximum flexibility in the manufacture of workpieces in large batch sizes
- Unique spectrum of technology cycles – ranging from the machining of any milling contours with residual material detection to in-process measurements
- Animated Elements: Unique operating and programming support with moving picture sequences
- State-of-the-art data transmission via USB stick, CompactFlash card and plant network (Ethernet)
- Easy Message: Maximum machine availability thanks to process monitoring based on text messaging (SMS)

SINUMERIK 828D BASIC M

Function

- 2 operator panel variants for horizontal and vertical operator panel housings
- Integrated QWERTY full CNC keyboard with short-stroke keys
- CF card, USB and Ethernet interface on the operator panel front
- Additional Ethernet interface on rear of CNC for connection to factory network
- GSM/GPRS modem connection: Easy Message (option)
- Integrated PLC based on the SIMATIC S7-200 command set with ladder logic programming
- I/O interface based on PROFINET for the connection of PLC I/O devices and a machine control panel
- CNC options subject to license
- Up to 5 axes/spindles
- 1 machining channel/mode group
- Integrated tool management with tool life monitoring
- Management of replacement tools (option)
- Graphical machining step programming ShopMill (option)
- Configurable user screens Easy Screen
- Integrated data archiving procedure for simple data updates
- Faults will be remedied for a period of 24 months following 2nd commissioning on all system components in accordance with the repair service contract performance description.

Integration

The following components can be connected to the SINUMERIK 828D BASIC M:

- Up to 2 electronic handwheels
- Mini handheld unit with handwheel
- Up to 3 I/O modules PP 72/48D PN or PP 72/48D 2/2A PN
- MCP 310C PN or MCP 483C PN machine control panel
- GSM/GPRS modem
- SINAMICS S120 Combi drive system via DRIVE-CLiQ

Technical specifications

	SINUMERIK 828D BASIC M PPU 240.2 vertical 6FC5370-4AM20-0AA0	**SINUMERIK 828D BASIC M PPU 241.2 horizontal** 6FC5370-3AM20-0AA0
Input voltage	24 V DC, + 20 %/- 15 %	24 V DC, + 20 %/- 15 %
Power consumption, max.	60 W	60 W
Mains buffering time	3 ms (20 ms with SITOP smart)	3 ms (20 ms with SITOP smart)
Degree of protection according to EN 60529 (IEC 60529)		
• Operator panel front	IP65 (with closed front cover)	IP65 (with closed front cover)
• PPU	IP20 (rear)	IP20 (rear)
Relative humidity		
• Storage	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Transport	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Operation	5 … 90 % at 25 °C (no condensation)	5 … 90 % at 25 °C (no condensation)
Ambient temperature		
• Storage	-20 … +55 °C	-20 … +55 °C
• Transport	-20 … +70 °C	-20 … +70 °C
• Operation	0 ... 45 °C (rear 0 ... 55 °C)	0 ... 45 °C (rear 0 ... 55 °C)
Dimensions		
• Width	483 mm	310 mm
• Height	220 mm	380 mm
• Depth	105 mm	105 mm
Weight, approx.	4.5 kg	4.5 kg

Selection and ordering data

Description	Order No.
Hardware components	
SINUMERIK 828D BASIC M PPU 240.2 vertical Without system software	**6FC5370-4AM20-0AA0**
SINUMERIK 828D BASIC M PPU 241.2 horizontal Without system software	**6FC5370-3AM20-0AA0**
Set of clamps (9 units) As replacement	**6FC5248-0AF14-0AA0**
CompactFlash card, 1 GB, empty To expand the user memory	**6FC5313-5AG00-0AA1**
Software components	
System software Milling for SINUMERIK 828D BASIC M PPU 240.2/PPU 241.2 On CF card with license current software version Export	**6FC5835-2GY40-■YA0**
SINUMERIK 828D toolbox On CD-ROM	**6FC5830-0CY40-0YA8**
SINUMERIK HMI RCS Commander For PC/PG on CD-ROM current software version	**6FC5860-7YC00-0YA0**
Language extensions for operating software SINUMERIK Operate On DVD-ROM specific software version	**6FC5860-0YC20-1YA8**
STARTER commissioning tool For SINAMICS and MICROMASTER on DVD-ROM Languages: English, French, German, Italian, Spanish	**6SL3072-0AA00-0AG0**
SIZER configuration tool For SINAMICS and MICROMASTER on DVD-ROM Languages: English, French, German, Italian	**6SL3070-0AA00-0AG0**

Example of specific software version 4.3:
6FC5835-2GY4**0**-**0**YA0

Options

CNC options for SINUMERIK 828D BASIC M PPU 240.2/PPU 241.2

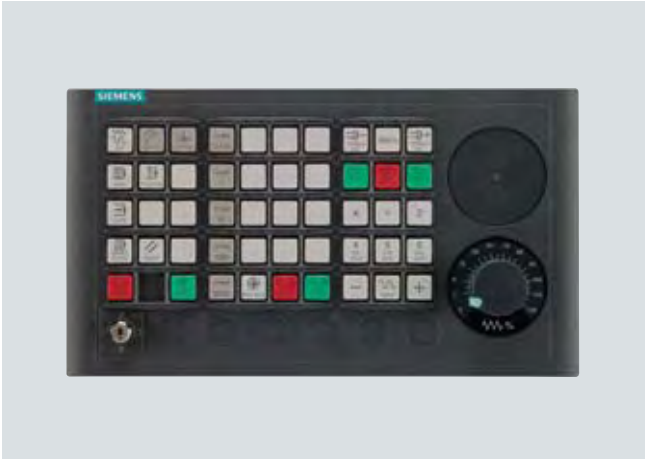
Description	Order No.
Manufacturer options	
Axis/spindle, each additional	**6FC5800-0AC20-0YB0**
Positioning axis/auxiliary spindle, each additional	**6FC5800-0AC30-0YB0**
TRANSMIT/Peripheral surface transformation	**6FC5800-0AM27-0YB0**
Pair of synchronized axes (gantry axes), basic	**6FC5800-0AS51-0YB0**
Travel to fixed stop with Force Control	**6FC5800-0AM01-0YB0**
Sag compensation, multi-dimensional (bidirectional error compensation)	**6FC5800-0AM55-0YB0**
Evaluation of internal drive variables	**6FC5800-0AS53-0YB0**
SINUMERIK Operate runtime license OA Easy Screen	**6FC5800-0AP64-0YB0**
Safety Integrated Extended Functions	**6FC5800-0AC50-0YB0**
User options	
Advanced Technology (expansion of the technology cycles for turning and milling)[1]	**6FC5800-0AP58-0YB0**
Extended operator functions[2]	**6FC5800-0AP16-0YB0**
Machining step programming ShopTurn/ShopMill	**6FC5800-0AP17-0YB0**
Residual material detection and machining for contour pockets and cutting	**6FC5800-0AP13-0YB0**
3D simulation of the finished part	**6FC5800-0AP25-0YB0**
Simultaneous recording (real-time simulation of current machining operation)	**6FC5800-0AP22-0YB0**
Measuring cycles for drilling/milling and turning	**6FC5800-0AP28-0YB0**
Network drive management	**6FC5800-0AP01-0YB0**
Replacement tools for tool management	**6FC5800-0AM78-0YB0**
RCS Host remote diagnostics function	**6FC5800-0AP30-0YB0**
Contour handwheel	**6FC5800-0AM08-0YB0**
Advanced Surface	Basic scope
Spline interpolation (A, B and C splines)	**6FC5800-0AS16-0YB0**

[1] The CNC option extended technology functions provides you with the following technology cycles for the additional machining operations listed below:
- Drill and thread milling
- Thread milling
- Multi-edge milling
- Engraving
- Milling of contour pockets and spigots (with up to 12 islands)

[2] The operator functions in the basic scope of the SINUMERIK 828D BASIC M are dimensioned for standard applications. With the CNC option extended operator functions, the following additional operator functions can be enabled:
- Overstoring
- Teach-in
- DRF offset
- Extended block search
- Save workpiece setup data
- Additional measuring versions beyond standard scope
  - Setting the workpiece zero in standard scope: set edge, align edge, right-angled corner, 1 hole and 1 circular spigot
  - Expansion of measurement windows via combination field
- Display of active synchronous actions in HMI
- Number of levels for skip blocks 10
- Load/save MDA program

SINUMERIK MCP 310C PN

Overview



SINUMERIK MCP 310C PN machine control panel

The SINUMERIK MCP 310C PN machine control panel with mechanical keys is designed to permit user-friendly, well-structured operation of the machine functions. It is suitable for machine-level operation of milling, turning, grinding and special machines.

SINUMERIK MCP 310C PN has, apart from PROFINET functionality, also complete Industrial Ethernet functionality. The network technology can be switched using DIP switches.

All keys are designed with replaceable key covers for machine-specific adaptations. The key covers can be freely inscribed using laser. Transparent key covers can be used as an alternative.

The machine control panel is mounted from the rear using special clamps.

Included in the scope of delivery are the clamps, key caps (30 × ergo gray, 30 × clear, 9 × labeled) and a backing plate for the emergency stop.

Design

Control elements:

- Mode and function keys
  - 49 keys with LEDs
  - Direction keys for milling machines with rapid traverse override (key covers for the direction keys for turning machines are supplied in the included accessories pack)
  - 16 user-labled standard user keys
- Feed control with feed/rapid traverse override (rotary switch with 23 positions)
- Key switch (4 positions and 3 different keys)

Key type:

- Mechanical keys

Interfaces:

- PROFINET/Industrial Ethernet
- 9 inputs/6 outputs for 9 control devices (additional cable set required for control devices)
- For 2 handwheels in conjunction with SINUMERIK 840D sl

Expansion facilities:

- 6 slots for control devices (d = 16 mm)
- 1 slot for emergency stop button or rotary override switch (up to d = 22 mm)

Integration

The SINUMERIK MCP 310C PN machine control panel can be used for:

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINUMERIK 840D sl

Technical specifications

SINUMERIK MCP 310C PN machine control panel 6FC5303-0AF23-0AA1	
Input voltage	24 V DC
Power consumption, max.	5 W
Degree of protection according to EN 60529 (IEC 60529)	
• Front	IP54
• Rear	IP00
Humidity rating based on EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C.
Relative humidity	
• Storage	5 ... 95 % at 25 °C
• Transport	5 ... 95 % at 25 °C
• Operation	5 ... 80 % at 25 °C
Ambient temperature	
• Storage	-25 ... +55 °C
• Transport	-40 ... +70 °C
• Operation	
- Front	0 ... 45 °C
- Rear	0 ... 55 °C
Distance	100 m
Dimensions	
• Width	310 mm
• Height	175 mm
• Depth	54 mm
Panel cutout	
• Width	285 mm
• Height	155 mm
• Tolerance	+ 1 mm
Weight, approx.	1.2 kg
Approvals, according to	CE, cULus

SINUMERIK MCP 310C PN

Selection and ordering data

Description	Order No.
SINUMERIK MCP 310C PN machine control panel PROFINET/Industrial Ethernet Width 310 mm, with mechanical keys	**6FC5303-0AF23-0AA1**
Accessories	
Square key cover, for labeling 1 set comprising of: 90 × ergo gray, 20 × red, 20 × yellow, 20 × green, 20 × mid-gray	**6FC5248-0AF12-0AA0**
Square key cover, for labeling 90 × transparent	**6FC5248-0AF21-0AA0**
Actuating element, 22 mm Latching mushroom pushbutton, red and non-illuminated with 40 mm protection against lifting and tilting, incl. holder	**3SB3000-1HA20**
Contact block with 2 contacts 1 NO + 1 NC, 2-pole screw terminal	**3SB3400-0A**
Key set (10 sets) For machine control panel	**6FC5148-0AA03-0AA0**
Spindle/rapid traverse override rotary switch 1 × 16G, T=24, cap, button, pointer, and rapid traverse and spindle dials	**6FC5247-0AF12-1AA0**
Feed/rapid traverse override rotary switch 1 × 23G, T=32, cap, button, pointer, and rapid traverse and feed dials	**6FC5247-0AF13-1AA0**
Cable set (60 units) For additional control devices of the machine control panels Length: 500 mm	**6FC5247-0AA35-0AA0**
Signal cable, pre-assembled For connection of electronic handwheel[1)] Length, max. 25 m	**6FX8002-2CP00-….**
Set of clamps (9 units) For operating components with 2.5 mm profile Length: 20 mm	**6FC5248-0AF14-0AA0**

Example:

16G: Latching at position 16
T=24: 24 positions for 360°

SINUMERIK MCP 483C PN

Overview

SINUMERIK MCP 483C PN machine control panel

The SINUMERIK MCP 483C PN machine control panel permits user-friendly operation of the machine functions. It is suitable for machine-level operation of milling, turning, grinding and special machines.

SINUMERIK MCP 483C PN has, apart from PROFINET functionality, also complete Industrial Ethernet functionality. The network technology can be switched using DIP switches.

All keys are designed with replaceable key covers for machine-specific adaptations. The key covers can be freely inscribed using laser. Transparent key covers can be used as an alternative.

The machine control panel is mounted from the rear using special clamps supplied with the panel.

Design

Control elements:

- Mode and function keys
  - 50 keys with LEDs
  - Direction keys for milling machines with rapid traverse override (key covers for the direction keys for turning machines are supplied in the included accessories pack)
- Spindle control with spindle override (rotary switch with 16 positions)
- Feed control with feed/rapid traverse override (rotary switch with 23 positions)
- Key switch (4 positions and 3 different keys)
- Emergency stop button (2 × (1 NO + 1 NC))

Key type:

- Mechanical keys

Interfaces:

- PROFINET/Industrial Ethernet
- 9 inputs/6 outputs for 9 control devices (additional cable set required for control devices)
- For 2 handwheels in conjunction with SINUMERIK 840D sl

Expansion facility:

- 2 slots for control devices (d = 16 mm)

1) For length code, see Connection system MOTION-CONNECT.

SINUMERIK MCP 483C PN

Integration

The SINUMERIK MCP 483C PN machine control panel can be used for:

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINUMERIK 840D sl

Technical specifications

SINUMERIK MCP 483C PN machine control panel 6FC5303-0AF22-0AA1	
Input voltage	24 V DC
Power consumption, max.	5 W
Degree of protection according to EN 60529 (IEC 60529)	
• Front	IP54
• Rear	IP00
Humidity rating based on EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C.
Relative humidity	
• Storage	5 ... 95 % at 25 °C
• Transport	5 ... 95 % at 25 °C
• Operation	5 ... 85 % at 25 °C
Ambient temperature	
• Storage	-25 ... +55 °C
• Transport	-25 ... +55 °C
• Operation	
- Front	0 ... 45 °C
- Rear	0 ... 55 °C
Distance	100 m
Dimensions	
• Width	483 mm
• Height	155 mm
• Depth	55 mm
Panel cutout	
• Width	450 mm
• Height	135 mm
• Tolerance	+ 1 mm
Weight, approx.	2 kg
Approvals, according to	CE, cULus

Selection and ordering data

Description	Order No.
SINUMERIK MCP 483C PN machine control panel PROFINET/Industrial Ethernet, width 19", with mechanical keys, emergency stop 22 mm	**6FC5303-0AF22-0AA1**
Accessories	
Square key cover, for labeling 1 set comprising of: 90 × ergo gray, 20 × red, 20 × yellow, 20 × green, 20 × mid-gray	**6FC5248-0AF12-0AA0**
Square key cover, for labeling 90 × transparent	**6FC5248-0AF21-0AA0**
Actuating element, 22 mm Latching mushroom pushbutton, red and non-illuminated with 40 mm protection against lifting and tilting, incl. holder	**3SB3000-1HA20**
Contact block with 2 contacts 1 NO + 1 NC, 2-pole screw terminal	**3SB3400-0A**
Key set (10 sets) For machine control panel	**6FC5148-0AA03-0AA0**
Rapid traverse dial (1 set = 20 units) for MCP 483C 16-position rotary switch	**6FC5248-0AF30-0AA0**
Spindle/rapid traverse override rotary switch 1 × 16G, T=24, cap, button, pointer, and rapid traverse and spindle dials	**6FC5247-0AF12-1AA0**
Feed/rapid traverse override rotary switch 1 × 23G, T=32, cap, button, pointer, and rapid traverse and feed dials	**6FC5247-0AF13-1AA0**
Cable set (60 units) For additional control devices of the machine control panels Length: 500 mm	**6FC5247-0AA35-0AA0**
Set of clamps (9 units) For operating components with 2.5 mm profile Length: 20 mm	**6FC5248-0AF14-0AA0**

Example:

16G: Latching at position 16
T=24: 24 positions for 360°

Overview

Mini handheld unit

The convenient, ergonomically designed mini handheld unit with rugged metal connector is suitable for setting up and operating standard machines in the Jobshop area.

Benefits

Since coarse, medium and fine infeed can easily be graduated, the operator control concept offers fast, increment-precise positioning. The signals are guided in parallel (without MPI) to the CNC.

Design

In addition to the 2-channel emergency stop and acknowledgement keys, a rapid traverse key and two +/- keys as well as a handwheel to traverse the axes in jog mode are available. Emergency stop has a 4-wire connection. The 3-step acknowledgement key has a 3-wire connection. Up to 5 axes can be selected via a rotary switch. Customer-specific applications can be implemented via 3 user-assignable function keys. If necessary, the customer can use slide-in labels to mark the keys specifically.

For the connection, the connection kit, which must be ordered separately, is required.

To change the cable outlet direction, we offer an angle socket for the connection kit. The angle socket allows the flange socket of the connection kit to be mounted 90° rotated. The angle socket can be used only in conjunction with the connection kit non-assembled.

The mini handheld unit can be fixed on metal surfaces by means of the integrated magnetic clamp. A holder is available as an option.

Integration

The mini handheld unit can be used for:

- SINUMERIK 802D sl
- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINUMERIK 840D sl

Technical specifications

Mini handheld unit with coiled connecting cable 6FX2007-1AD03 **Mini handheld unit with straight connecting cable** 6FX2007-1AD13	
Input voltage (emergency stop and enabling)	24 V DC
Handwheel operating voltage	5 V DC
Handwheel	100 S/R, RS422
Degree of protection according to EN 60529 (IEC 60529)	IP65
Humidity rating based on EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C.
Ambient temperature	
• Storage/Transport	-20 … +60 °C
• Operation	0 ... 55 °C
Distance between handwheel and NCU (when handwheel is used), max.	25 m
Dimensions	
• Length (incl. emergency stop button)	175 mm
• Width	85 mm
• Height	70 mm
Weight, approx. (without connecting cable)	0.5 kg
Approvals, according to	CE, UL

Selection and ordering data

Description	Order No.
Mini handheld unit 3-step acknowledgement key incl. magnetic clamps and connecting cable with metal connector	
• Coiled connecting cable Length: 1.5 m, stretches to 3.5 m	**6FX2007-1AD03**
• Straight cable Length: 5 m	**6FX2007-1AD13**
Accessories	
Connection kit for mini handheld unit, non-assembled Version for metal connector, for connection to machine control panel without Industrial Ethernet, with terminating connector	**6FX2006-1BG03**
Connection kit for mini handheld unit, assembled Version for metal connector, for connection to machine control panel with Industrial Ethernet, with terminating connector	**6FX2006-1BG11**
90° angle socket For connection kit, non-assembled 6FX2006-1BG03 Metal version	**6FX2006-1BG56**
Holder For mini handheld units 6FX2007-1AD.3 and electronic handwheel in housing 6FC9320-5DE02	**6FX2006-1BG70**

Electronic handwheel

Overview

Electronic handwheel

This encoder generates signals which correspond to the movements of the handwheel as it is turned. The axis selected via the control can be positioned paraxially. The handwheels are equipped with a magnetic latching mechanism that supports traversing with incremental accuracy. The front panel can be removed.

The portable handheld handwheel is connected via a flange socket using the coiled connecting cable. The enclosure is fitted with a magnetic clamp. A holder is available to provide a place to store the handwheel on non-metallic surfaces.

Selection and ordering data

Description	Order No.
Electronic handwheel	
• With front panel 120 mm × 120 mm, with setting wheel 5 V DC, RS422	**6FC9320-5DB01**
• With front panel 76.2 mm × 76.2 mm, with setting wheel 5 V DC, RS422	**6FC9320-5DC01**
• Without front panel, with small setting wheel 5 V DC, RS422	**6FC9320-5DM00**
• Without front panel, without setting wheel, for installation 5 V DC, RS422	**6FC9320-5DF01**
• Portable in housing, with setting wheel , coiled cable 2.5 m 5 V DC, RS422	**6FC9320-5DE02**
Adapter set For installation in front panel with 3-hole fixing	**6FC9320-5DN00**
Flange socket For portable handwheel	**6FC9341-1AQ**
Holder For mini handheld units 6FX2007-1AD.3 and electronic handwheel in housing 6FC9320-5DE02	**6FX2006-1BG70**

Technical specifications

	Electronic handwheel 6FC9320-5DB01	6FC9320-5DC01/ 6FC9320-5DF01/ 6FC9320-5DM00	6FC9320-5DE02
Rated voltage	5 V DC ± 5 %	5 V DC ± 5 %	5 V DC ± 5 %
Rated current, max.	60 mA	60 mA	60 mA
Interface	RS422 (TTL)	RS422 (TTL)	RS422 (TTL)
Phase angle of pulse sequence A to B	90° electrical	90° electrical	90° electrical
Pulses	2 × 100 S/R	2 × 100 S/R	2 × 100 S/R
Actuating force	8 Ncm	4 Ncm	4 Ncm
Output frequency, max.	2 kHz	2 kHz	2 kHz
Distance to NCU	25 m	25 m	20 m
Degree of protection according to EN 60529 (IEC 60529)			
• Front	IP65	IP65	IP65
• Rear	IP50	IP50	IP50
Relative humidity			
• Storage/Transport	10 ... 95 % at 25 °C	10 ... 95 % at 25 °C	10 ... 95 % at 25 °C
• Operation	5 ... 80 % at 25 °C	5 ... 80 % at 25 °C	5 ... 80 % at 25 °C
Ambient temperature			
• Storage/Transport	-40 ... +85 °C	-40 ... +85 °C	-40 ... +85 °C
• Operation	0 ... 70 °C	0 ... 70 °C	0 ... 70 °C
Weight, approx.	0.6 kg	0.4 kg	1.3 kg
Approvals, according to	cULus	cULus	cULus

Overview

SINUMERIK PP 72/48D PN I/O module

The PP 72/48D PN I/O module is available in a digital variant with 72 inputs and 48 outputs, and in a digital/analog variant PP 72/48D 2/2A PN with 2 additional analog inputs and 2 additional analog outputs.

The I/O modules are connected to the CNC via an I/O interface based on PROFINET. The digital inputs and outputs are connected by means of three 50-pole ribbon cables. Terminal strip converters can be used or the direct connection of Distribution Boards, for example, is possible.

Benefits

- Easy connection via I/O interface based on PROFINET
- Mounting plate for easy module installation in the control cabinet
- Automatic module detection by the CNC, no complex configuring required
- Easy connection of terminal strip converters to plug connectors
- Integrated 24 V DC power supply with electrical isolation between the inputs and outputs and PROFINET

Integration

The PP 72/48D PN and PP 72/48D 2/2A PN I/O modules can be used for the following CNCs:

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINUMERIK 840D sl

Selection and ordering data

Description	Order No.
SINUMERIK PP 72/48D PN I/O module 72 digital inputs and 48 digital outputs	**6FC5311-0AA00-0AA0**
SINUMERIK PP 72/48D 2/2A PN I/O module 72 digital inputs and 48 digital outputs 2 analog inputs and 2 analog outputs	**6FC5311-0AA00-1AA0**
Accessories	
Terminal strip converter 50-pole	**6EP5406-5AA00**
Cable set Ribbon cable, 50-pole, length: 6 m 8 insulation displacement connectors, 50-pole	**6EP5306-5BG00**
DRIVE-CLiQ signal cable, pre-assembled For PROFINET connection Connector in IP20 degree of protection	
• By the meter[1)]	**6FX2002-1DC00-1..0**
• In fixed lengths[1)]	**6SL3060-4A..0-0AA0**

[1)] For length code, see Connection system MOTION-CONNECT.

SINUMERIK PP 72/48D PN I/O module

Technical specifications

	I/O module PP 72/48D PN 6FC5311-0AA00-0AA0	**I/O module PP 72/48D 2/2A PN** 6FC5311-0AA00-1AA0
Input voltage	24 V DC + 20 %/- 15 %	24 V DC + 20 %/- 15 %
Power consumption, max.	17 W	19 W
Digital inputs/outputs	72/48	72/48
• Connection method	Connector acc. to MIL-C-83-503/DIN 41-651	Connector acc. to MIL-C-83-503/DIN 41-651
• Demand factor of outputs	100 % at I_{out} = 250 mA per output	100 % at I_{out} = 250 mA per output
Analog inputs	–	2
• Connection method	–	PHOENIX MINI COMBICON, spring cage connector, core cross-section 0.5 mm^2
• Type of analog inputs	–	± 10 V, 0 ... 10 V, ± 20 mA, 4 ... 20 mA, PT100
• Resolution	–	16 bit incl. sign
Analog outputs	–	2
• Connection method	–	PHOENIX MINI COMBICON, spring cage connector, core cross-section 0.5 mm^2
• Type of analog outputs	–	± 10 V, ± 20 mA (max. 600 Ω)
• Resolution	–	16 bit incl. sign
Degree of protection to EN 60529 (IEC 60529)	IP00	IP00
Relative humidity		
• Storage	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Transport	5 … 95 % at 25 °C	5 … 95 % at 25 °C
• Operation	10 … 80 % at 25 °C	10 … 80 % at 25 °C
Ambient temperature		
• Storage	-40 ... +70 °C	-40 ... +70 °C
• Transport	-40 ... +70 °C	-40 ... +70 °C
• Operation	0 ... 55 °C	0 ... 55 °C
Dimensions		
• Width	300 mm	300 mm
• Height	150 mm	150 mm
• Depth	35 mm	35 mm
Weight, approx.	0.9 kg	0.9 kg

SINAUT MD 720-3 GSM/GPRS modem

Overview

SINAUT MD720-3 GSM/GPRS modem

The SINAUT MD720-3 GSM/GPRS modem transmits the text messages into the GSM network of the mobile radio operator. By inserting the appropriate SIM card into the SINAUT MD720-3 GSM/GPRS modem, it is possible to freely select the required mobile radio operator.

With Easy Message the SINUMERIK 828D BASIC T/BASIC M CNCs provide a means of transmitting process data using text messages (SMS). This makes it possible to send messages to various mobile phones of the operating and maintenance personnel to notify them, for example, of the workpiece counter reading or the fact that a tool has reached its wear limit.

Benefits

- Rugged GSM modem for industrial use
- High-quality signal transmission thanks to powerful external antenna
- Simple mounting on standard mounting rails in the control cabinet or operator panel housing

Design

The SINAUT MD720-3 GSM/GPRS modem features the following interfaces as standard:

- 9-pin Sub-D socket for connection to the CNC (RS232C interface)
- 4-pin screw terminal for connection to a 24 V DC supply voltage
- SMA antenna connection socket for GSM/GPRS antenna
- Slot for inserting a GSM SIM card

The SINAUT MD720-3 has diagnostic LEDs for modem status, field strength and connection control.

Easy Message provides the following functions:

- Input of PIN number
- Configuration of user profiles
- Display of modem status and field strength
- Generation of outgoing text messages (SMS)
- Processing of incoming text messages (SMS)
- Visualization of transmission protocol

Integration

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- Modem cable for RS232C interface
- SINAUT ANT 794-4MR antenna

Technical specifications

SINAUT MD720-3 GSM/GPRS modem 6NH9720-3AA00	
Input voltage	12 ... 30 V DC
Power loss	
• Typical	5 W
• Maximum	6.2 W
Frequency range (Quad-Band)	850/900/1800/1900 MHz
Transmit output power	
• At 850/900 MHz	2 W
• At 1800/1900 MHz	1 W
Interfaces	
• RS232C	9-pin SUB-D socket
• Antenna connection	SMA antenna socket (50 Ω)
Degree of protection according to EN 60529 (IEC 60529)	IP40
Relative humidity, max.	95 % at 25 °C
Ambient temperature	
• Storage	-25 ... +85 °C
• Transport	-25 ... +85 °C
• Operation	-20 ... +60 °C
Dimensions	
• Width	22.5 mm
• Height	99 mm
• Depth	114 mm
Weight, approx.	150 g
Approvals, according to	Current approvals can be found on the Internet at www.siemens.com/simatic-net/ik-info

Selection and ordering data

Description	Order No.
SINAUT MD720-3 GSM/GPRS modem	**6NH9720-3AA00**
SINAUT ANT 794-4MR antenna	**6NH9860-1AA00**
Modem cable For RS232C interface Length: 2.5 m	**6NH7701-5AN**

More information

You can find additional information on the Internet at:

www.siemens.com/industrymall

SITOP power supply

Overview

Stabilized power supply units

SITOP power supply units

The 24 V power supply units from the SITOP range are optimized for industrial use and operate on the switched-mode principle. Due to the precisely regulated output voltage, the devices are even suitable for the connection of sensitive sensors. Different versions are available depending on the output current and field of application.

SITOP smart

Slimline dimensions, strong performance. SITOP smart requires little space on the mounting rail and offers high performance at a reasonable price. With its tolerant overload response, even loads with a high inrush current can be smoothly switched on. If required, 50 % extra power is made available for 5 seconds.

Benefits

- High efficiency
- Low space requirements and easy installation
- Exact output voltage and low residual ripple
- Integrated short-circuit protection and safe electrical separation
- National and international approvals
- No release of silicon

Selection and ordering data

Description	Order No.
Stabilized power supply SITOP smart 10 A 24 V DC, 1-phase Input voltage: 120 V/230 V AC (85 … 132 V/170 ... 264 V AC) Output voltage: 24 V DC ± 3% Approvals: cULus, CSA	**6EP1334-2BA01**
Stabilized power supply PSU300S 24 V DC, 3-phase Input voltage: 400 ... 500 V 3 AC (340 … 550 V 3 AC) Output voltage: 24 V DC ± 3% Approvals: cULus	
• 10 A	**6EP1434-2BA10**
• 20 A	**6EP1436-2BA10**
Power supply unit PSA100E 12 A 24 V DC, 1-phase Input voltage: 230 V AC (187 … 264 V) Output voltage: 24 V DC ± 3% Approvals: cULus	**6EP1234-1AA00**

More information

You can find additional information in Catalog KT 10.1 or on the Internet at:

www.siemens.com/sitop

www.siemens.com/industrymall

Drive system

Power Module

Overview

SINAMICS S120 Combi Power Module

SINAMICS S120 Combi is a very compact and rugged drive system tailored for use in compact turning and milling machines. SINAMICS S120 Combi integrates a line infeed with regenerative feedback capability, power units for spindles and feed motors as well as a TTL encoder interface into a single Power Module.

Benefits

- Multi-axis drive module with line infeed capable of regenerative feedback and power units for 3 or 4 axes
- Drive system tailor-made for use in compact standard turning and milling machines
- Requires very little mounting space in control cabinet (incl. fan unit, shield connection terminals and ventilation clearances)
- Optimized for weak supply networks with frequent undervoltage, network imbalances and large frequency fluctuations
- Optimized for harsh operating conditions with increased cabinet temperature and increased humidity
- Rugged Power Module resistant to short-circuits, overvoltage and ground faults
- Rugged and easy-to-fit screw-type terminals with integrated shield connection for the power cables
- Perfect expandability thanks to additional Motor Modules in booksize compact format
- Low energy consumption thanks to state-of-the-art 400 V technology
- Excellent dynamic response and machining precision thanks to Dynamic Servo Control (DSC)
- Simple cabling thanks to intelligent DRIVE-CLiQ interface
- Very simple commissioning thanks to predefined topologies

Function

- Power Module with 3 or 4 integrated power units
- Integrated line infeed with regenerative feedback capability
- Integrated TTL encoder interface
- Integrated motor brake control for one axis
- Integrated fan power supply
- Line connection voltage 380 to 480 V 3 AC
- Supply types TT, TN and IT
- Integrated shield connection terminals
- Heat dissipation concept with an external heat sink for extremely low power loss in the control cabinet
- Easy-to-mount fan module optimized for harsh environments
- Increased availability thanks to fan monitoring
- Derating only from 45 °C cabinet temperature
- Power cable connection via screw terminals

Integration

The following components can be connected to the SINAMICS S120 Combi drive system:

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- 3 or 4 spindles/feed motors
- 3 or 4 motor encoders
- 3 or 4 direct encoders via DMC20
- Direct spindle encoder directly via TTL or sin/cos via SMC20
- External fan module
- Up to two additional Motor Modules in booksize compact format via DC link connection and 24 V DC busbars
- Braking Module with braking resistor via DC link connection[1)]
- Control Supply Module via DC link connection and 24 V DC busbars[1)]
- One safe motor brake control
- 5 or 6 DRIVE-CLiQ sockets
- 24 V electronics power supply via connector
- 1 safe standstill input for the infeed (enable pulses)
- 1 safe standstill input for the spindle and feeds (enable pulses)
- 1 temperature sensor input for the spindle (KTY84-130 or PTC)
- PE/protective conductor connections

The scope of supply of the SINAMICS S120 Combi Power Modules includes:

- SINAMICS S120 Combi Power Module
- Accessories pack comprising:
  - 4 DRIVE-CLiQ dust-proof blanking plugs
  - Connector X224 for electronics power supply
  - Connector X11 for motor brake control
  - Connector X21 enable pulses infeed
  - Connector X22 enable pulses drives/temp.
  - 5 shield connection terminals for power cables
  - Shield connection terminal for signal cable

[1)] For information about the Braking Module and Control Supply Module, please refer to Catalog NC 61 or the Siemens Industry Mall.

Selection and ordering data

Rated power infeed	Rated output current spindle	Rated output current feed 1	Rated output current feed 2	Rated output current feed 3	
kW	A	A	A	A	Order No.
SINAMICS S120 Combi Power Module (3 power units)					
16	18	5	5	–	**6SL3111-3VE21-6FA0**
16	24	9	9	–	**6SL3111-3VE21-6EA0**
20	30	9	9	–	**6SL3111-3VE22-0HA0**
SINAMICS S120 Combi Power Module (4 power units)					
16	18	9	5	5	**6SL3111-4VE21-6FA0**
16	24	9	9	9	**6SL3111-4VE21-6EA0**
20	30	12	9	9	**6SL3111-4VE22-0HA0**

Accessories

Description	Order No.
SINAMICS S120 Combi accessories pack Comprising: 4 × DRIVE-CLiQ dust-proof blanking plugs Connector X224 for electronics power supply Connector X11 for motor brake control Connector X21 enable pulses infeed Connector X22 enable pulses drive/temp. 5 × shield connection terminals for power cables Shield connection terminal for signal cable	**6SL3161-8AP00-0AA0**

Technical specifications

General technical specifications SINAMICS S120 Combi Power Module	
DC link voltage	1.35 × line voltage[1)]
Output voltage	0 ... 0.7 × DC link voltage[1)]
Line power factor at rated power	
• Fundamental power factor ($\cos \varphi_1$)	> 0.96
• Total (λ)	0.65 … 0.90
Radio interference suppression	
• Standard	No radio interference suppression
• With line filter	Category C2 according to EN 61800-3
Degree of protection	IP20
Installation altitude	Up to 1000 m above sea level without derating, > 1000 ... 4000 m with derating
Conformity	CE (Low-Voltage and EMC Directives)
Approvals, according to	cURus
Safety Integrated	Safety Integrity Level 2 (SIL 2) according to IEC 61508, Control Category 3 according to EN 954-1

1) The DC link voltage adjusts itself to the mean value of the rectified line voltage.

Technical specifications (continued)

External air cooling		3-axis Power Module 6SL3111-3VE21-6FA0	6SL3111-3VE21-6EA0	6SL3111-3VE22-0HA0
Infeed	**16**	**16**	**20**	**20**
• Rated power P_{rated} (S1)	16	16	20	20
• Infeed power P_{S6} (S6-40 %)	21	21	26.5	26.5
• Peak infeed power P_{max}	35	35	40	40
Regenerative feedback				
• Rated power P_{rated} (S1)	kW	16	16	20
• Peak regenerative feedback power P_{max}	kW	35	35	40
Supply voltages				
• Line voltage	V	380 V 3 AC – 10 % ... 480 V 3 AC + 10 % up to 2000 m above sea level		
• Line frequency	Hz	45 ... 66		
• Electronics power supply	V	24 DC (20.4 ... 28.8 DC)		
Rated input current				
• At 400 V 3 AC	A	28	28	34
• At 380 V/480 V 3 AC	A	29/25	29/25	35/30
• At 400 V 3 AC (S6-40%)	A	35.5	35.5	44
• Peak current at 400 V 3 AC	A	56	56	63.5
Pulse frequency	kHz	4	4	4
Output voltage AC	V	0 ... 0.7 × DC link voltage		
Spindle	**A**	**18**	**24**	**30**
• Rated output current AC I_{rated}	A	18	24	30
• Intermittent-duty operating current $AC_{S6-40\%}$	A	24	32	40
• Peak current AC I_{rmax}	A	36	48	56
Rated power				
• At 540 V DC link voltage	kW	8.7	11.7	14.4
• At 600 V DC link voltage	kW	9.7	13	16
Feed 1/feed 2	**A**	**5**	**9**	**9**
• Rated output current AC I_{rated}	A	5	9	9
• Intermittent-duty operating current $AC_{S6-40\%}$	A	6.5	12	12
• Peak current AC I_{rmax}	A	10	18	18
Rated power				
• At 540 V DC link voltage	kW	2.4	4.3	4.3
• At 600 V DC link voltage	kW	2.7	4.8	4.8
Output for expansion axis				
• DC link output current DC I_{rated}	A	40		
• DC link voltage DC	V	460 ... 720		
• Electronics output current for an expansion axis 24 V DC	A	20		
Electronics current consumption at 24 V DC				
• Without external fan module	A	1.5	1.5	1.5
• With external fan module	A	2.3	2.3	2.3
Total power loss (incl. electronics losses)	W	425	537	634
• Internal	W	81	91	102
• External	W	344	446	532

Technical specifications (continued)

		3-axis Power Module (continued)		
External air cooling		6SL3111-3VE21-6FA0	6SL3111-3VE21-6EA0	6SL3111-3VE22-0HA0
Ambient temperature, max.				
• Without derating	°C	45	45	45
• With derating	°C	55	55	55
DC link voltage DC	V	460 ... 720		
• Overvoltage trip DC	V	820 ± 2 %		
• Undervoltage trip DC	V	380 ± 2 %		
DC link capacitance	µF	1645	1880	2115
Circuit breaker (UL)				
• Type		3VL2105-2KN30-....	3VL2105-2KN30-....	3VL2106-2KN30-....
• Rated current	A	50	50	60
• Rated short-circuit current SCCR at 480 V 3 AC, resulting	kA	65	65	65
Safety fuses (UL)				
• Type		AJT 35	AJT 35	AJT 60
• Rated current	A	35	35	60
• Rated short-circuit current SCCR, resulting				
- At 480 V 3 AC	kA	65	65	65
- At 600 V 3 AC	kA	200	200	200
Cooling air requirement	m^3/h	160	160	160
Dimensions				
• Width	mm	260	260	260
• Height	mm	380	380	380
• Depth	mm	304	304	304
Weight, approx.	kg	18.35	18.4	18.5

Technical specifications (continued)

External air cooling		4-axis Power Module 6SL3111-4VE21-6FA0	6SL3111-4VE21-6EA0	6SL3111-4VE22-0HA0
Infeed	**kW**	**16**	**16**	**20**
• Rated power P_{rated} (S1)	kW	16	16	20
• Infeed power P_{S6} (S6-40 %)	kW	21	21	26.5
• Peak infeed power P_{max}	kW	35	35	40
Regenerative feedback				
• Rated power P_{rated} (S1)	kW	16	16	20
• Peak regenerative feedback power P_{max}	kW	35	35	40
Supply voltages				
• Line voltage	V	380 V 3 AC – 10 % ... 480 V 3 AC + 10 % up to 2000 m above sea level		
• Line frequency	Hz	45 ... 66		
• Electronics power supply	V	24 DC (20.4 ... 28.8 DC)		
Rated input current				
• At 400 V 3 AC	A	28	28	34
• At 380 V/480 V 3 AC	A	29/25	29/25	35/30
• At 400 V 3 AC (S6-40 %)	A	35.5	35.5	44
• Peak current at 400 V 3 AC	A	56	56	63.5
Pulse frequency	kHz	4	4	4
Output voltage AC	V	0 ... 0.7 × DC link voltage		
Spindle	**A**	**18**	**24**	**30**
• Rated output current AC I_{rated}	A	18	24	30
• Intermittent-duty operating current $AC_{S6-40\%}$	A	24	32	40
• Peak current AC I_{rmax}	A	36	48	56
Rated power				
• At 540 V DC link voltage	kW	8.7	11.7	14.4
• At 600 V DC link voltage	kW	9.7	13	16
Feed 1	**A**	**9**	**9**	**12**
• Rated output current AC I_{rated}	A	9	9	12
• Intermittent-duty operating current $AC_{S6-40\%}$	A	12	12	16
• Peak current AC I_{rmax}	A	18	18	24
Rated power				
• At 540 V DC link voltage	kW	4.3	4.3	5.8
• At 600 V DC link voltage	kW	4.8	4.8	6.5
Feed 2/feed 3	**A**	**5**	**9**	**9**
• Rated output current AC I_{rated}	A	5	9	9
• Intermittent-duty operating current $AC_{S6-40\%}$	A	6.5	12	12
• Peak current AC I_{rmax}	A	10	18	18
Rated power				
• At 540 V DC link voltage	kW	2.4	4.3	4.3
• At 600 V DC link voltage	kW	2.7	4.8	4.8
Output for expansion axis				
• DC link output current DC I_{rated}	A	40		
• DC link voltage DC	V	460 ... 720		
• Electronics output current for an expansion axis 24 V DC	A	20		
Electronics current consumption at 24 V DC				
• Without external fan module	A	1.6	1.6	1.6
• With external fan module	A	2.4	2.4	2.4
Total power loss (incl. electronics losses)	W	492	607	733
• Internal	W	87	100	113
• External	W	405	507	620

Technical specifications (continued)

		4-axis Power Module (continued)		
External air cooling		6SL3111-4VE21-6FA0	6SL3111-4VE21-6EA0	6SL3111-4VE22-0HA0
Ambient temperature, max.				
• Without derating	°C	45	45	45
• With derating	°C	55	55	55
DC link voltage DC	V	460 ... 720		
• Overvoltage trip DC	V	820 ± 2 %		
• Undervoltage trip DC	V	380 ± 2 %		
DC link capacitance	µF	1645	2115	2520
Circuit breaker (UL)				
• Type		3VL2105-2KN30-....	3VL2105-2KN30-....	3VL2106-2KN30-....
• Rated current	A	50	50	60
• Rated short-circuit current SCCR at 480 V 3 AC, resulting	kA	65	65	65
Safety fuses (UL)				
• Type		AJT 35	AJT 35	AJT 60
• Rated current	A	35	35	60
• Rated short-circuit current SCCR, resulting				
- At 480 V 3 AC	kA	65	65	65
- At 600 V 3 AC	kA	200	200	200
Cooling air requirement	m^3/h	160	160	160
Dimensions				
• Width	mm	260	260	260
• Height	mm	380	380	380
• Depth	mm	304	304	304
Weight, approx.	kg	18.9	18.95	19.05

Power Module
External fan module, reinforcement plates

Overview

External fan module

External fan module

The external fan module combined with the reinforcement plates is employed to provide perfect cooling of a SINAMICS S120 Combi Power Module.

To cool the SINAMICS S120 Combi Power Module, a volumetric flow of air of at least 160 m^3/h through the heatsink is required.

The external fan module supplies a volumetric flow of up to 290 m^3/h. This dimensioning ensures an adequate air flow rate, even on a lower supply voltage or with a slightly soiled heatsink.

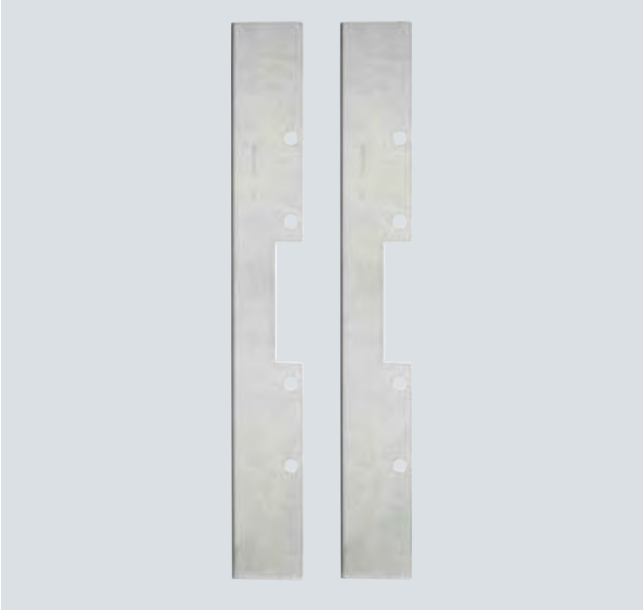
Due to the encapsulated electronics and the ball-bearing-mounted closed rotor, the fan module can be used even under exacting environmental conditions. The fans are equipped with electronic reverse-polarity, blocking and overload protection systems. To ensure maximum machine availability, the fan speed is monitored. A user alarm is displayed if the fan stops.

Technical specifications

External fan module 6SL3161-0EP00-0AA0	
Rated voltage	24 V DC
Voltage range	20.4 … 28.8 V DC
Volumetric flow, max.	290 m^3/h
Current consumption	0.8 A
Power consumption	18 W
Ambient temperature, permissible	-20 ... +70 °C
Service life	
• At 55 °C	50000 h
• At 70 °C	20000 h
Degree of protection	IP54
Dimensions	
• Height	258 mm
• Width	104 mm
• Depth	86 mm
Weight, approx.	1.5 kg
Approvals, according to	VDE, CSA, UL

Overview

Reinforcement plates



Reinforcement plates

It is essential to ensure that the air actually flows through the heatsink. The gap between the fan module and heatsink must therefore be closed. The reinforcement plates must be used for this purpose where possible.

The reinforcement plates

- close the gap between the fan module and heatsink
- reinforce the rear wall of the control cabinet for sealed installation
- guarantee ideal ventilation spaces

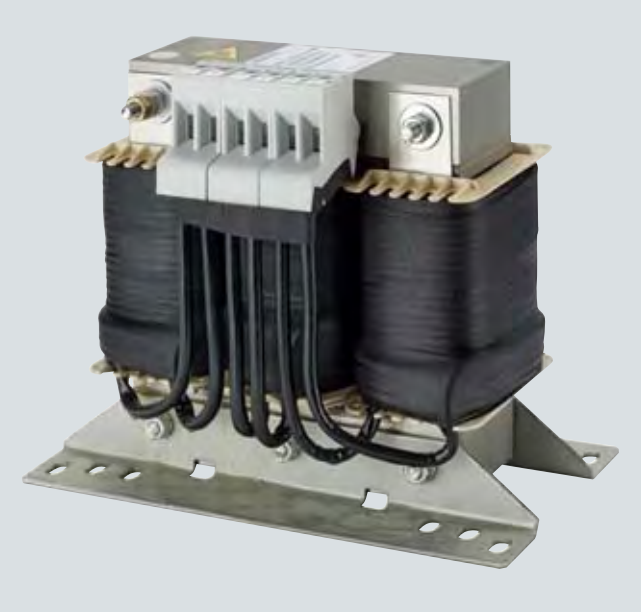
Technical specifications

Reinforcement plate 6SL3161-1LP00-0AA0	
Dimensions	
• Height	575 mm
• Width	15 mm
• Depth	75 mm
Weight, approx.	0.75 kg

Selection and ordering data

Description	Order No.
SINAMICS S120 Combi External fan module	**6SL3161-0EP00-0AA0**
Accessories	
SINAMICS S120 Combi Reinforcement plates (2 units)	**6SL3161-1LP00-0AA0**

Overview



Line reactor

The SINAMICS S120 Combi Power Module is not warranted to operate without the line reactors. The use of other makes of line reactor can lead to malfunctions or irreparable damage to equipment.

Selection and ordering data

Rated power infeed	Suitable for SINAMICS S120 Combi Power Module	**Line reactor**
kW	Type	Order No.
16	6SL3111-3VE21-6FA0 6SL3111-3VE21-6EA0 6SL3111-4VE21-6FA0 6SL3111-4VE21-6EA0	**6SL3100-0EE21-6AA0**
20	6SL3111-3VE22-0HA0 6SL3111-4VE22-0HA0	**6SL3100-0EE22-0AA0**

Technical specifications

		Line reactors	
		6SL3100-0EE21-6AA0	6SL3100-0EE22-0AA0
Rated power	kW	16	20
Rated current	A	28	33
Power loss	W	75	98
Line/load connection 1U1, 1V1, 1W1/1U2, 1V2, 1W2		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	4	10
PE connection		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	4	10
Degree of protection		IP20	IP20
Dimensions			
• Width	mm	219	219
• Height	mm	176	176
• Depth	mm	120	130
Weight, approx.	kg	10.7	10.9
Approvals, according to		cURus	cURus

Power Module
Line filters

Overview

Line filter

In plants with strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the SINAMICS S120 Combi Power Modules to the limit values of Class A1 as defined in EN 55011 and Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Technical specifications

Line filter 6SL3000-0BE21-6DA0	
Rated current	36 A
Power loss	6 W
Line/load connection L1, L2, L3/U, V, W	Screw-type terminals
• Conductor cross-section	10 mm^2
PE connection	M6 screw stud
Degree of protection	IP20
Dimensions	
• Width	50 mm
• Height	429 mm
• Depth	226 mm
Weight, approx.	5 kg
Approvals, according to	cURus

Selection and ordering data

Rated power infeed	Suitable for SINAMICS S120 Combi Power Module	**Line filter**
kW	Type	Order No.
16	6SL3111-3VE21-6FA0 6SL3111-3VE21-6EA0 6SL3111-3VE22-0HA0	**6SL3000-0BE21-6DA0**
20	6SL3111-4VE21-6FA0 6SL3111-4VE21-6EA0 6SL3111-4VE22-0HA0	

Benefits

The SINAMICS S120 Combi Power Module can be extended by the SINAMICS S120 Motor Modules in booksize compact format.

- Simple addition of supplementary machine components when using the SINAMICS S120 Combi drive system
- Expansion axes can interpolate freely with the SINAMICS S120 Combi axes
- Connection of the Motor Modules by simple connection of DC link busbars and 24 V busbars
- Motor Modules are supplied via the infeed integrated in the SINAMICS S120 Combi
- Energy exchange between Motor Modules and the Power Module integrated in the SINAMICS S120 Combi due to a common DC link
- Simple connection to the DRIVE-CLiQ interface

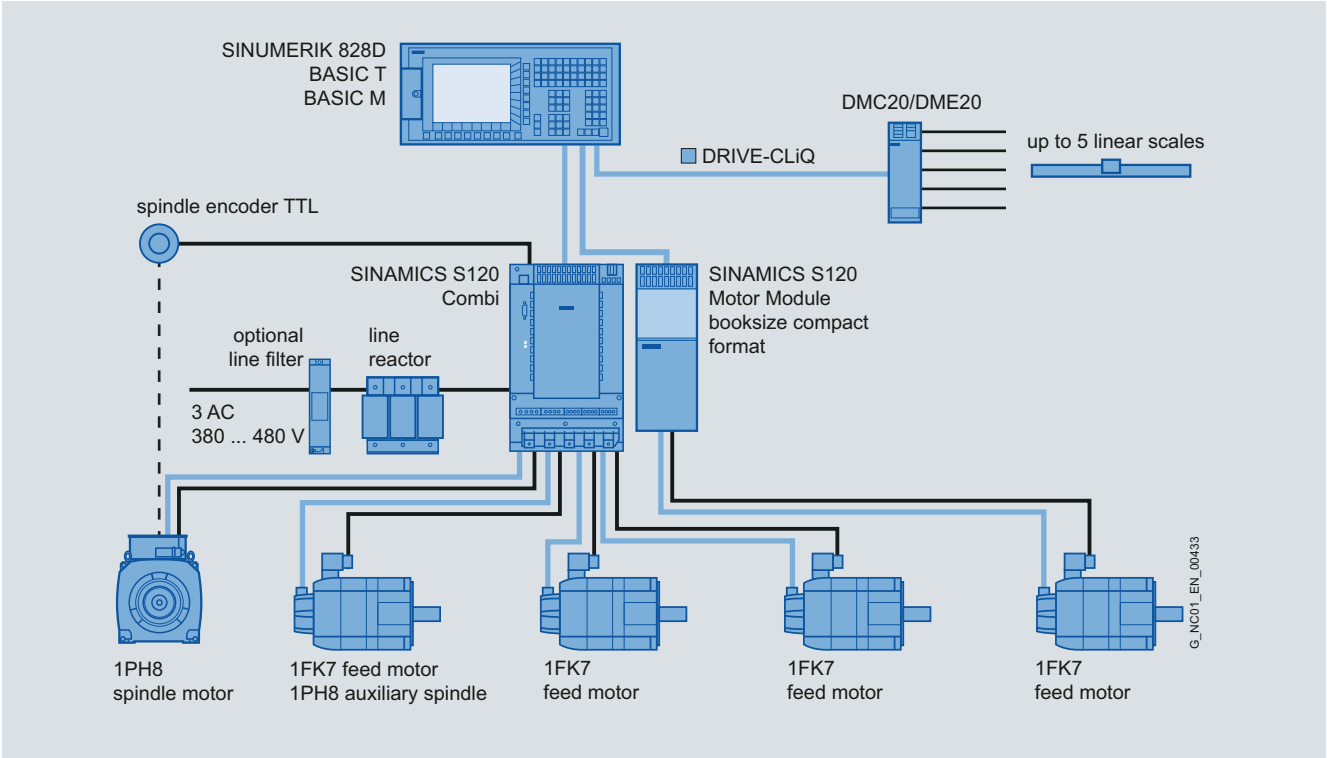
Function

- Up to 6 axes/spindles in one drive line-up[1)]
- Up to 6 motor encoders[1)]
- Up to 6 direct encoders (5 via DMC20 + 1 on the SINAMICS S120 Combi)[1)]
- Connection of up to two SINAMICS S120 Motor Modules in booksize compact format to the integrated line infeed of the SINAMICS S120 Combi Power Modules[2)]

Technical specifications

Single Motor Module in booksize compact format 6SL3420-1TE...	
Double Motor Module in booksize compact format 6SL3420-2TE...	
DC link voltage Up to 2000 m above sea level	510 ... 720 V DC (line voltage 380 ... 480 V 3 AC)
Electronics power supply	24 V DC -15 %/+20 %
Type of cooling	Internal air cooling (power units with forced air cooling through built-in fans)
Ambient and coolant temperature (air), perm. During operation for line-side components, Line Modules and Motor Modules	0 … 40 °C without derating, > 40 … 55 °C with derating
Installation altitude	Up to 1000 m above sea level without derating, > 1000 ... 4000 m above sea level with derating
Degree of protection	IP20
Conformity	CE (Low-Voltage and EMC Directives)
Approvals, according to	cURus
Safety Integrated	Safety Integrity Level 2 (SIL2) according to IEC 61508, control category 3 according to EN 954-1

Integration



1) Please note that the number of controllable axes and spindles is limited to 5 in conjunction with SINUMERIK 828D BASIC T/BASIC M.

2) Please note the simultaneity factor of the axis grouping for the infeed power of the SINAMICS S120 Combi Power Modules.

SINAMICS S120 in booksize compact format
Single Motor Modules

Design

Single Motor Modules

The Single Motor Modules in booksize compact format feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 1 electronics power supply connection via integrated 24 V DC busbars
- 3 DRIVE-CLiQ sockets
- 1 motor connection via connector
- 1 safe standstill input (enable pulses)
- 1 safe motor brake controller
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 PE/protective conductor connections

Design (continued)

The status of the Motor Modules is indicated via two multi-color LEDs.

The shield of the motor cable is connected via the motor connector.

The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. type KLBÜ 3-8 SC from Weidmüller.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable (length depends on module width) to connect Motor Module to adjacent Motor Module, length 0.11 m for 50 mm wide Motor Modules or length 0.16 m for 75 mm wide Motor Modules.
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connector X21
- Connector X11 for motor brake connection
- Connector X1 for motor connection
- 1 set of warning signs in foreign languages
- 1 heat conducting foil

Selection and ordering data

Rated output current	Type rating	**Single Motor Module in booksize compact format**
		Internal air cooling
A	kW	Order No.
DC link voltage 510 … 720 V DC		
3	1.6	**6SL3420-1TE13-0AA0**
5	2.7	**6SL3420-1TE15-0AA0**
9	4.8	**6SL3420-1TE21-0AA0**
18	9.7	**6SL3420-1TE21-8AA0**

Technical specifications

DC link voltage 510 … 720 V DC		**Single Motor Module in booksize compact format**			
Internal air cooling		6SL3420-1TE13-0AA0	6SL3420-1TE15-0AA0	6SL3420-1TE21-0AA0	6SL3420-1TE21-8AA0
Output current					
• Rated current I_{rated}	A	3	5	9	18
• I_{max}	A	9	15	27	54
Rated power	kW	1.6	2.7	4.8	9.7
DC link current I_d[1]	A	3.6	6	11	22
Current requirement At 24 V DC, max.	A	0.85	0.85	0.85	0.85
Power loss[2]					
• With internal air cooling in control cabinet	kW	0.07	0.1	0.1	0.18
Dimensions					
• Width	mm	50	50	50	75
• Height	mm	270	270	270	270
• Depth	mm	226	226	226	226
Weight, approx.	kg	2.7	2.7	2.7	3.4

[1] Rated DC link current for dimensioning an external DC connection.

[2] Power loss of Motor Module at rated power including losses of 24 V DC electronics power supply.

Design

Double Motor Modules

Double Motor Modules feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 2 electronics power supply connections via integrated 24 V DC bars
- 4 DRIVE-CLiQ sockets
- 2 motor connections via connector
- 2 safe standstill inputs (1 input per axis)
- 2 safe motor brake controllers
- 2 temperature sensor inputs (KTY84-130 or PTC)
- 3 PE/protective conductor connections

The status of the Motor Modules is indicated via two multi-color LEDs.

Design (continued)

The shield of the motor cables is connected via the motor connectors.

The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. type KLBÜ 3-8 SC by Weidmüller.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable for connecting to the adjacent Motor Module, length 0.16 m
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connectors X21 and X22
- Connectors X1 and X2 for motor connection
- 1 set of warning signs in foreign languages
- 1 heat conducting foil

Selection and ordering data

Rated output current	Type rating	**Double Motor Module in booksize compact format**
		Internal air cooling
A	kW	Order No.
DC link voltage 510 … 720 V DC		
2 × 1.7	2 × 0.9	**6SL3420-2TE11-7AA0**
2 × 3	2 × 1.6	**6SL3420-2TE13-0AA0**
2 × 5	2 × 2.7	**6SL3420-2TE15-0AA0**

Technical specifications

DC link voltage 510 … 720 V DC		**Double Motor Module in booksize compact format**		
Internal air cooling		6SL3420-2TE11-7AA0	6SL3420-2TE13-0AA0	6SL3420-2TE15-0AA0
Output current				
• Rated current I_{rated}	A	2 × 1.7	2 × 3	2 × 5
• I_{max}	A	2 × 5.1	2 × 9	2 × 15
Rated power	kW	2 × 0.9	2 × 1.6	2 × 2.7
DC link current I_d[1]	A	4.1	7.2	12
Power loss[2]				
• With internal air cooling in control cabinet	kW	0.11	0.13	0.19
Dimensions				
• Width	mm	50	75	75
• Height	mm	270	270	270
• Depth	mm	226	226	226
Weight, approx.	kg	3.4	3.4	3.4

[1] Rated DC link current for dimensioning an external DC connection.

[2] Power loss of Motor Module at rated power including losses of 24 V DC electronics power supply.

Supplementary system components
DMC20 DRIVE-CLiQ Hub Module

Overview

DMC20 DRIVE-CLiQ Hub Module

The DMC20 DRIVE-CLiQ Hub Module is used to connect direct encoders.

Design

The following are located on the DMC20 DRIVE-CLiQ Hub Module:

- 6 DRIVE-CLiQ sockets for connecting 5 DRIVE-CLiQ devices
- 1 connection for the electronics power supply via the 24 V DC supply connector

The status of the DMC20 DRIVE-CLiQ Hub Module is indicated via a multi-color LED.

Integration

The DRIVE-CLiQ Hub Module can be connected to the signals of the direct measuring systems.

A direct spindle encoder with TTL signals is connected directly to the SINAMICS S120 Combi Power Module.

Technical specifications

DMC20 DRIVE-CLiQ Hub Module 6SL3055-0AA00-6AA0	
Current requirement, max. At 24 V DC without DRIVE-CLiQ supply	0.15 A
• Conductor cross-section, max.	2.5 mm^2
Degree of protection	IP20
Dimensions	
• Width	50 mm
• Height	150 mm
• Depth	111 mm
Weight, approx.	0.8 kg
Approvals, according to	cULus

Selection and ordering data

Description	Order No.
DMC20 DRIVE-CLiQ Hub Module Without DRIVE-CLiQ cable	**6SL3055-0AA00-6AA0**
Accessories for re-ordering	
Dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

Overview

TM54F Terminal Module

The TM54F Terminal Module is a dual-processor I/O interface with 4 fail-safe digital outputs and 10 fail-safe digital inputs for utilization of the Safety Integrated functions of the SINAMICS S120 drive system in conjunction with external actuators and sensors.

Every available safety function integrated in the drive can be controlled via the fail-safe digital inputs on the TM54F Terminal Module. In cases where the parameterized safety functions of multiple drives operated on a SINUMERIK 828D BASIC T/ BASIC M, SINUMERIK 828D, CU320-2 or SIMOTION D4x5 must be executed on a group basis, the relevant drives can be combined into groups in the TM54F Terminal Module. The advantage of this approach is that only one fail-safe digital input needs to be connected for these drives.

The fail-safe digital inputs and outputs are redundantly configured with internal, cross-over data comparison using the two processors. A fail-safe digital output consists of one current sourcing and one current sinking output as well as a digital input for reading back the switching state. A fail-safe digital input consists of two digital inputs.

Safety sensors can be connected over two switchable 24 V sensor supplies and can be evaluated over the fail-safe digital inputs. The switchable 24 V sensor supply ensures that the fail-safe digital inputs can be dynamized for error discovery (dynamization allows switch-off signal paths to be checked). An unswitchable 24 V sensor supply is additionally provided by the TM54F Terminal Module for connecting undynamizable safety sensors.

Design

The following are located on the TM54F Terminal Module:

- 4 fail-safe digital outputs
- 10 fail-safe digital inputs
- 4 LEDs, single color for indicating the status of the read back channel of the fail-safe digital outputs
- 4 LEDs, dual-color for indicating the status of the fail-safe digital outputs
- 20 LEDs, dual-color for indicating the status of the fail-safe digital inputs
- 3 LEDs, single color for indicating the status of the 24 V sensor supplies
- 2 DRIVE-CLiQ sockets
- 2 connections for 24 V sensor supply, switchable
- 1 connection for 24 V sensor supply, not switchable
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 connection for the 24 V power supply to digital outputs and sensors
- 1 PE/protective conductor connection

The TM54F Terminal Module can be snapped onto a TH 35 top-hat rail according to EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM54F Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM54F Terminal Module is indicated via a multi-color LED.

Pins for connector coding are included in the scope of supply of the TM54F Terminal Module.

Integration

The following components can be directly connected to the TM54F Terminal Module via a DRIVE-CLiQ cable:

- CU310, CU320-2 Control Units
- SIMOTION D
- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D

Only one TM54F Terminal Module can be assigned to each Control Unit. It is not permissible to make the TM54F connection via another DRIVE-CLiQ device, e.g. a Motor Module or Line Module.

Selection and ordering data

Description	Order No.
TM54F Terminal Module Without DRIVE-CLiQ cable	**6SL3055-0AA00-3BA0**
Accessories	
Dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

Technical specifications

TM54F Terminal Module 6SL3055-0AA00-3BA0	
Current requirement (X524 at 24 V DC) without DRIVE-CLiQ supply	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Current requirement ext. 24 V, max. For supplying the digital outputs and 24 V sensor supply (X514 at 24 V DC)	4 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
I/O	
• Number of fail-safe digital inputs	10
• Number of fail-safe digital outputs	4
• 24 V sensor supply	3, of which 2 can be temporarily shut down using an internal test routine for dynamizing fail-safe digital inputs, current carrying capacity 0.5 A each
• Connection system	Plug-in screw-type terminals
• Conductor cross-section, max.	1.5 mm^2
Digital inputs According to IEC 61131-2 Type 1, with isolation	
• Voltage	-3 … +30 V
• Low level (an open digital input is interpreted as low)	-3 … +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC, typ.	> 2 mA
• Delay time of digital inputs, approx.[1]	
- L → H, typ.	30 µs
- H → L, typ.	60 µs
• Safe state	Low level (for inputs that can be inverted: without inversion)

TM54F Terminal Module 6SL3055-0AA00-3BA0	
Digital outputs	Sustained short-circuit strength
• Voltage	24 V DC
• Load current per fail-safe digital output, max.[2]	0.5 A
• Delay times (ohmic load)[1]	
- L → H, typ.	300 µs
- H → L, typ.	350 µs
• Safe state	Output switched off
Scanning cycle t_{SI} For fail-safe digital inputs or fail-safe digital outputs	4 ... 25 ms (adjustable)
PE connection	M4 screw
Dimensions	
• Width	50 mm
• Height	150 mm
• Depth	111 mm
Weight, approx.	0.9 kg
Approvals, according to	cULus
Safety Integrated	Safety Integrity Level 2 (SIL2) according to IEC 61508, control category 3 according to EN 954-1

[1] The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input/output is processed.

[2] The total current of all fail-safe digital outputs must not exceed 5.33 A.

Overview

SMC20 Sensor Module Cabinet-Mounted

The SMC20 Sensor Module Cabinet-Mounted is required to evaluate the encoder signals of motors without a DRIVE-CLiQ interface. External encoders can also be connected via the SMC20.

The following encoder signals can be evaluated:

- Incremental encoder sin/cos 1 V_{pp}
- Absolute encoder EnDat
- SSI encoder with incremental signals sin/cos 1 V_{pp}

The motor temperature can also be detected using KTY84-130 or PTC thermistors.

Design

The SMC20 Sensor Module Cabinet-Mounted features the following interfaces as standard:

- 1 DRIVE-CLiQ interface
- 1 encoder connection, including motor temperature detection (KTY84-130 or PTC) via SUB-D connector
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/protective conductor connection

The status of the SMC20 Sensor Module Cabinet-Mounted is indicated via a multi-color LED.

The SMC20 Sensor Module Cabinet-Mounted can be snapped onto a TH 35 top-hat rail according to EN 60715 (IEC 60715).

The signal cable shield is connected via the encoder system connector and can also be connected to the SMC20 Sensor Module Cabinet-Mounted via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

Integration

The SMC20 Sensor Module Cabinet-Mounted communicates with a Control Unit via DRIVE-CLiQ.

Technical specifications

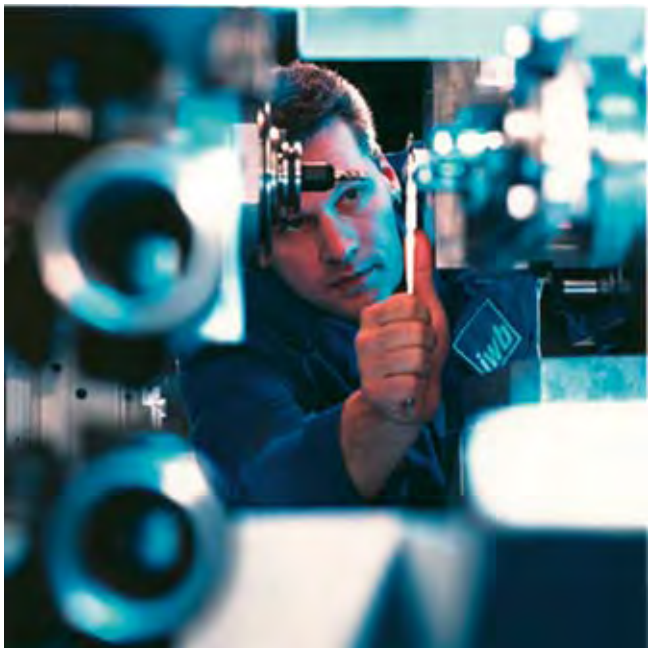
SMC20 Sensor Module Cabinet-Mounted 6SL3055-0AA00-5BA3	
Current requirement, max. At 24 V DC, not taking encoder into account	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Power loss, max.	10 W
Encoders which can be evaluated	• Incremental encoder sin/cos 1 V_{pp} • Absolute encoder EnDat • SSI encoder with incremental signals sin/cos 1 V_{pp}
• Encoder supply	5 V DC/0.35 A
• Encoder frequency incremental signals, max.	500 kHz
• Signal subdivision (interpolation), max.	16384 times (14 bit)
• SSI baud rate	100 kBaud
• Cable length to encoder, max.	100 m
PE connection	M4 screw
Dimensions	
• Width	30 mm
• Height	150 mm
• Depth	111 mm
Weight, approx.	0.45 kg
Approvals, according to	cULus

Selection and ordering data

Description	Order No.
SMC20 Sensor Module Cabinet-Mounted Without DRIVE-CLiQ cable	**6SL3055-0AA00-5BA3**

Drive Based Safety Integrated

Overview



Drive Based Safety Integrated provides integrated safety functions that support the implementation of highly effective personnel and machine protection. The safety functions comply with the requirements of Category 3 as well as Performance Level PL d according to EN ISO 13849-1 and safety integrity level SIL 2 according to EN 61508. Consequently, important functional safety requirements can be implemented easily and economically. The range of functions includes, for example:

- Functions for safe monitoring of standstill
- Functions for safe monitoring of speed

Benefits

- High level of safety:
  Full implementation of the safety functions in Category 3/SIL 2/PL d
- High level of flexibility:
  Practical safety and operating concepts can be implemented
- Faster commissioning using integrated safety functions

Function

The safety functions are available in all modes and can communicate with the process using safety-oriented input/output signals. These can be implemented individually for each axis and spindle. The following Safety Integrated functions are available (terms in accordance with IEC 61800-5-2):

Safety Integrated basic functions

- Safe Torque Off (STO)
  Prevention of unexpected startup by internal cancellation of the drive pulses.
- Safe Brake Control (SBC)
  Safe brake control of holding brakes which are operative at zero current, e.g. motor holding brakes.
- Safe Stop 1 (SS1)
  Safe stopping of the drive with subsequent prevention of unexpected startup (STO).

Extended Safety Integrated functions

- Safe Operating Stop (SOS)
  Monitors drives for standstill. The drives remain fully functional for position control.
- Safe Stop 2 (SS2)
  Safe stopping of the drive with subsequent monitoring for standstill (SOS).
- Safely Limited Speed (SLS)
  Monitoring of configurable velocity limit values, e.g. during setup.
- Safe Speed Monitor (SSM)
  Safe checkback signal when a value falls below a settable speed limit, e.g. for enabling a protective door.
- Safe Acceleration Monitor (SAM)
  Prompt detection of a new axis acceleration during braking (SS1 and SS2).

The Safety Integrated basic functions are license-free. The Extended Safety Integrated functions require a software license in the form of a CNC option per axis with Safety functions.

The Safety Integrated basic functions are controlled via existing terminals on the SINAMICS S120 Combi Power Modules or the SINAMICS S120 Motor Modules in booksize compact format and the SINUMERIK 828D BASIC T/BASIC M. A TM54F Terminal Module is required to control the Extended Safety Integrated functions.

For the formation of the safe control logic, fail-safe 3TK28 or 3RK3 safety relays are recommended. See Catalog SI 10 or Siemens Industry Mall.

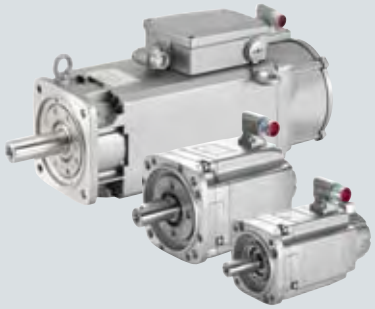
www.siemens.com/industrymall

Integration

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINAMICS S120 Combi Power Module or SINAMICS S120 Motor Module in booksize compact format
- Motors with encoders which comply with the Safety Integrated specification: 1PH8 or 1FK7 motors
- Encoder systems
  For information on suitable encoder systems for SINUMERIK Safety Integrated, please contact your local Siemens branch.
- Signal cables which comply with the SINAMICS S120 specification: MOTION-CONNECT
- Control of the Extended Safety Integrated functions: TM54F Terminal Module
- CNC software license required per axis for the Extended Safety functions see SINUMERIK 828D BASIC
- 3TK28 or 3RK3 safety relays

Motors

5



CAD CREATOR
Dimension drawing and 2D/3D CAD generator
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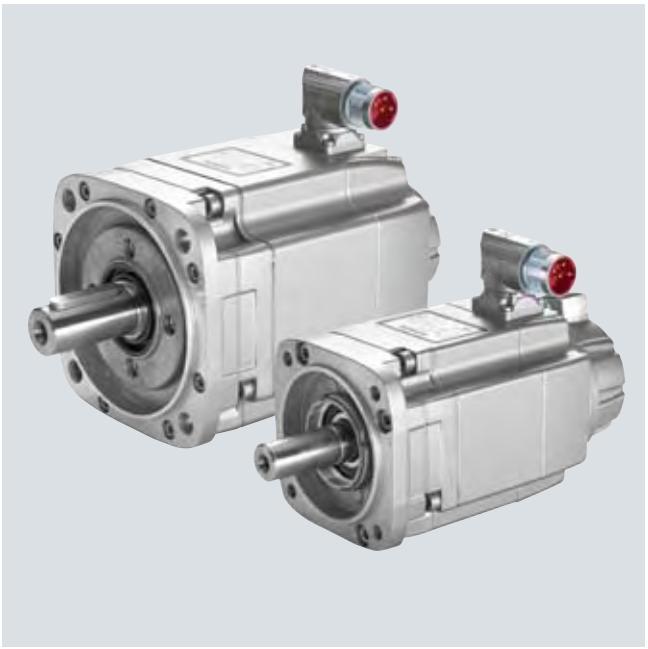
Feed motors for SINAMICS S120 Combi

1FK7 Compact/1FK7 High Inertia synchronous motors – Natural cooling

Overview



Feed motors 1FK7 in SH 63/SH 48 with DQI encoder

1FK7 motors are compact permanent-magnet synchronous motors. 1FK7 motors can be combined with the SINAMICS S120 drive system to create a powerful system with high functionality. The motors are designed for operation without external cooling and the heat is dissipated through the motor surface.
1FK7 motors have a high overload capability.
The 1FK7 feed motors are perfectly adapted to the SINAMICS S120 Combi drive system.

Benefits

- Maximum machine dynamics thanks to optimum relation between torque and motor moment of inertia.
- Very high torque even at high speeds as a result of the special field weakening concept
- Excellent machine precision thanks to high resolution of motor encoder, low torque ripple and high-precision shaft and flange mounting
- Very fast acceleration thanks to triple electrical overload capability
- High degree of ruggedness because encoder is decoupled from the motor shaft
- Maintenance-free absolute encoder without battery
- High energy efficiency

Function

- Compact synchronous servomotors
- Torque M_0: 3 to 48 Nm
- Shaft heights: 48 to 100
- Rated speed: 2000 to 6000 rpm
- Easily replaceable encoders with 20 bit resolution
- Electronic rating plate in motor encoder
- Naturally-cooled type of construction without fan
- Plug connection for power cable
- DRIVE-CLiQ interface for signal cable
- Degree of protection IP65

Technical specifications

1FK7 Compact/1FK7 High Inertia motor	
Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Cooling	Natural cooling
Temperature monitoring	KTY84 temperature sensor in the stator winding
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of ΔT = 100 K at an ambient temperature of 40 °C.
Type of construction in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP65
Shaft extension on the drive end (DE) in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft/ fitted key and keyway (half-key balancing)
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1)[1]	Tolerance N
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade A is maintained up to rated speed
Sound pressure level L_{pA} (1 m) in accordance with EN ISO 1680, max.	
• 1FK704	55 dB
• 1FK706	65 dB
• 1FK708/1FK710	70 dB
Connection	Connectors for signals and power, can be rotated
Paint finish	Anthracite RAL 7016
2nd rating plate	Enclosed separately
Holding brake	Without/with
Approvals, according to	cURus

[1] Shaft extension run-out, concentricity of spigot and shaft and perpendicularity of flange to shaft.

Selection and ordering data

Static torque	Rated speed	Shaft height	Rated power	1FK7 synchronous motors	Moment of inertia of rotor		Weight	
					without brake	with brake	without brake	with brake
M_0 at ΔT = 100 K	n_{rated}	SH	P_{rated} at ΔT = 100 K		J	J	m	m
Nm			kW	Order No.	10^{-4} kgm^2	10^{-4} kgm^2	kg	kg
1FK7 Compact								
6	3000	63	1.5	**1FK7060-2AF71-1 ■■1**	7.7	8.7	7.1	8.5
8	3000	80	2.1	**1FK7080-2AF71-1 ■■1**	14.2	17.5	10.3	13.3
11	2000	63	1.9	**1FK7063-2AC71-1 ■■1**	14.7	15.7	11.1	12.5
	3000	63	2.3	**1FK7063-2AF71-1 ■■1**	14.7	15.7	11.1	12.5
16	2000	80	2.6	**1FK7083-2AC71-1 ■■1**	26	29.5	15.6	18.6
	3000	80	3.3	**1FK7083-2AF71-1 ■■1**	26	29.5	15.6	18.6
18	2000	100	3.1	**1FK7100-2AC71-1 ■■1**	54	62	17.6	21
	3000	100	3.8	**1FK7100-2AF71-1 ■■1**	54	62	17.6	21.3
20	2000	80	3.1	**1FK7084-2AC71-1 ■■1**	32.5	35.5	18.3	21.3
	3000	80	3.1	**1FK7084-2AF71-1 ■■1**	32.5	35.5	18.3	21.3
27	2000	100	4.3	**1FK7101-2AC71-1 ■■1**	79	87	23.0	27.5
36	2000	100	5.2	**1FK7103-2AC71-1 ■■1**	104	112	28.5	33.0
48	2000	100	7.7	**1FK7105-2AC71-1 ■■1**	154	161	39.0	43.5
1FK7 High Inertia								
3	6000	48	0.9	**1FK7042-3BK71-1 ■■1**	5.1	5.4	5.1	5.8
6	3000	63	1.5	**1FK7060-3BF71-1 ■■1**	12.5	13.5	7.9	9.3
8.5	3000	63	1.9	**1FK7062-3BF71-1 ■■1**	23.5	24.5	10.7	12.1
12	3000	80	2.7	**1FK7081-3BF71-1 ■■1**	49	52	15.2	18.2
20	2000	80	3.1	**1FK7084-3BC71-1 ■■1**	99	102	23.0	26.0
	3000	80	3.1	**1FK7084-3BF71-1 ■■1**	99	102	23.0	26.0

Encoder systems for motors with DRIVE-CLiQ interface

20 bit absolute encoder single-turn (encoder AS20DQI)	**Q**
20 bit absolute encoder single-turn +12 bit multi-turn (encoder AM20DQI)	**R**

Shaft extension	Shaft and flange accuracy	Holding brake	
Fitted key and keyway	Tolerance N	Without	**A**
Fitted key and keyway	Tolerance N	With	**B**
Plain shaft	Tolerance N	Without	**G**
Plain shaft	Tolerance N	With	**H**

Motor type (repeated)	Efficiency[1]	Static current	SINAMICS S120 Combi Power Module	SINAMICS S120 Motor Module Booksize compact format	Power cable with complete shield Motor connection and brake connection via power connector	
			Rated output current	Rated output current	Power connector	Cable cross-section[2]
	η	I_0 at M_0 at ΔT = 100 K	I_{rated}	I_{rated}		
	%	A	A	A	Size	mm^2
1FK7060-2AF71-...	90	4.45	5	5	1	4 × 1.5
1FK7080-2AF71-...	92	4.9	5	5	1	4 × 1.5
1FK7063-2AC71-...	91	5.3	5	5	1	4 × 1.5
1FK7063-2AF71-...	91	8.0	9	9	1	4 × 1.5
1FK7083-2AC71-...	93	7.5	9	9	1	4 × 1.5
1FK7083-2AF71-...	93	10.1	12	18	1	4 × 1.5
1FK7100-2AC71-...	92	8.4	9	9	1	4 × 1.5
1FK7100-2AF71-...	92	11.1	12	18	1	4 × 1.5
1FK7084-2AC71-...	93	8.5	9	9	1	4 × 1.5
1FK7084-2AF71-...	93	12.1	12	18	1	4 × 1.5
1FK7101-2AC71-...	93	12.3	12	18	1.5	4 × 1.5
1FK7103-2AC71-...	93	14.4	–	18	1.5	4 × 1.5
1FK7105-2AC71-...	93	20.0	–	18	1.5	4 × 2.5
1FK7042-3BK71-...	89	4.4	5	5	1	4 × 1.5
1FK7060-3BF71-...	90	4.45	5	5	1	4 × 1.5
1FK7062-3BF71-...	91	5.3	5	5	1	4 × 1.5
1FK7081-3BF71-...	93	8.7	9	9	1	4 × 1.5
1FK7084-3BC71-...	93	8.5	9	9	1	4 × 1.5
1FK7084-3BF71-...	93	12.1	12	18	1	4 × 1.5

Further information about the cables can be found in chapter Connection system MOTION-CONNECT.

[1] Optimum efficiency in continuous duty.

[2] The current carrying capacity of the power cables complies with EN 60204-1 for installation type C, for continuous duty at an ambient air temperature of 40 °C.

Spindle motors for SINAMICS S120 Combi

1PH8 asynchronous motors
SH 80 to SH 132 – Forced ventilation

Overview

1PH808 spindle motor with forced ventilation

1PH8 motors are compact squirrel-cage asynchronous motors with degree of protection IP55. They have been designed specifically for use in conjunction with the SINAMICS S120 drive system. Depending on the control requirements, appropriate encoder systems are available for the motors for sensing the motor speed and indirect position.
1PH8 spindle motors are perfectly adapted to the SINAMICS S120 Combi drive system.

Application

- Main spindles for standard milling and turning machines
- Driven tools for standard turning machines

Benefits

- Maximum power over an extremely wide speed range as a result of intelligent winding design and optimized field weakening and heat dissipation concept
- Very fast spindle acceleration rates and maximum cutting forces thanks to special lamination structure and high overload factor
- Long-lasting motor bearings for high radial forces with belt drives
- High degree of protection, including motor fan

Function

- Compact asynchronous spindle motors
- Spindle power: 2.8 to 12 kW
- Shaft heights: 80 to 132
- Maximum speed: 15000 rpm
- Electronic rating plate in motor encoder
- Integrated, easily replaceable fan
- Integrated terminal box for power cable
- DRIVE-CLiQ interface for signal cable
- IP55 degree of protection (including fan)
- Vibration magnitude grade S/A
- High rotational accuracy < 10 µm
- Optimized bearing design for high cantilever forces

Technical specifications

1PH8 motor	
Cooling	Forced ventilation
Ambient temperature, admissible	-15 ... +40 °C
Temperature monitoring	KTY84 temperature sensor in stator winding
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	For an ambient temperature of up to 40 °C
• 1PH808/1PH810/1PH813	Temperature class 155 (F)
Motor fan ratings	
• 1PH808	230 V ± 10 %, 50 Hz 265 V ± 10 %, 60 Hz
• 1PH810/1PH813	400 V 3 AC ± 10 %, 50 Hz 480 V 3 AC ± 10 %, 60 Hz
Encoder system, built-in	DRIVE-CLiQ interface
• 1PH8...-1D...	22 bit incremental encoder (resolution 4194304, internal 2048 S/R) + commutation position 11 bit (encoder IC22DQ)[1]
• 1PH8...-1U...	20 bit incremental encoder (resolution 1048576, internal 512 S/R) without commutation position (encoder IN20DQ)[2]
Sound pressure level L_{pA} (1 m) in accordance with EN ISO 1680 Tolerance + 3 dB	Rated pulse frequency 4 kHz
• 1PH808/1PH810	70 dB
• 1PH813	72 dB
Connection	
• 1PH808/1PH810/1PH813	Terminal box
• Fan	
- 1PH808	Power connector
- 1PH810/1PH813	Terminals in terminal box
• Encoder system	Connector for signals (without mating connector) or DRIVE-CLiQ
Vibration magnitude	In accordance with Siemens/EN 60034-14 (IEC 60034-14)
Shaft and flange accuracy[3]	In accordance with Siemens/DIN 42955 (IEC 60072-1)
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	
• 1PH808/1PH810/1PH813	IP55
• Fan	IP55
Rating plate	1 unit attached to motor 1 unit supplied loose in terminal box
Paint finish	Anthracite RAL 7016
Approvals, according to	cURus

Terminal box assignment, max. connectable conductor cross-sections

1PH8 motor		Terminal box	Cable entry		Outer cable diameter, max.[4]	Number of main terminals	Cross-section per terminal, max.	Rated current, max.[5]
Type		Type	Power	External signals	mm		mm^2	A
1PH808	Forced ventilation	gk803	1 × M25 × 1.5	1 × Ø 22 mm[6]	20	Phases: 3 × M5 Grounding: 2 × M5	1 × 10	50
1PH810	Forced ventilation	gk813	1 × M32 × 1.5	1 × Ø 22 mm[6]	24.2	Phases: 3 × M5 Grounding: 2 × M5	1 × 16	66
1PH813	Forced ventilation	gk833	1 × M40 × 1.5	1 × Ø 22 mm[6]	32	Phases: 3 × M6 Grounding: 2 × M6	1 × 35	104

1) Maximum speed n_{max} = 12000 rpm.
2) Maximum speed n_{max} = 15000 rpm.
3) Shaft extension run-out, concentricity of spigot and shaft and perpendicularity of flange to shaft.
4) Dependent on the design of the metric cable gland.
5) Current-carrying capacity based on EN 60204-1 and IEC 60364-5-52, according to installation type C.
6) Hole with diameter 22 mm, at 90° to signal connection.

1PH8 asynchronous motors
SH 80 to SH 132 – Forced ventilation

Selection and ordering data

Rated speed	Continuous speed, max.	Rated power for S1 duty	Rated torque	Static torque	1PH8 asynchronous motor Forced ventilation DE → NDE Terminal box top	Efficiency	Moment of inertia	Weight, approx.
n_{rated} rpm	n_{max1} rpm	P_{rated} kW	M_{rated} Nm	M_0 Nm	Order No.	η %	J kgm^2	m kg
Shaft height SH 80 – Line voltage 400 V 3 AC								
1500	10000	**2.8**	18	21	**1PH8083-1DF0 ■ - ■ CA1**	80.9	0.0064	32
1500	12000	**2.8**	18	21	**1PH8083-1DF0 ■ - ■ LA1**	80.9	0.0064	32
2000	10000	**3.7**	18	21	**1PH8083-1DG0 ■ - ■ CA1**	83.2	0.0064	32
2000	15000	**3.7**	18	21	**1PH8083-1UG0 ■ - ■ LA1**	83.2	0.0064	32
3000	10000	**4.1**	13	21	**1PH8083-1DM0 ■ - ■ CA1**	86.9	0.0064	32
3000	15000	**4.1**	13	21	**1PH8083-1UM0 ■ - ■ LA1**	86.9	0.0064	32
4500	10000	**4.8**	10	19	**1PH8083-1DN0 ■ - ■ CA1**	86.4	0.0064	32
4500	15000	**4.8**	10	19	**1PH8083-1UN0 ■ - ■ LA1**	86.4	0.0064	32
1500	10000	**3.7**	24	27	**1PH8087-1DF0 ■ - ■ CA1**	81.7	0.0089	39
1500	14000	**3.7**	24	27	**1PH8087-1UF0 ■ - ■ LA1**	81.7	0.0089	39
2000	10000	**4.9**	23	27	**1PH8087-1DG0 ■ - ■ CA1**	85.3	0.0089	39
2000	15000	**4.9**	23	27	**1PH8087-1UG0 ■ - ■ LA1**	85.3	0.0089	39
3000	10000	**4.8**	15	27	**1PH8087-1DM0 ■ - ■ CA1**	87.1	0.0089	39
3000	15000	**4.8**	15	27	**1PH8087-1UM0 ■ - ■ LA1**	87.1	0.0089	39
4500	10000	**5.8**	12	25	**1PH8087-1DN0 ■ - ■ CA1**	86.8	0.0089	39
4500	15000	**5.8**	12	25	**1PH8087-1UN0 ■ - ■ LA1**	86.8	0.0089	39
Shaft height SH 100 – Line voltage 400 V 3 AC								
1500	9000	**3.7**	24	29	**1PH8101-1DF0 ■ - ■ CA1**	83.5	0.0138	42
1500	12000	**3.7**	24	29	**1PH8101-1DF0 ■ - ■ LA1**	83.5	0.0138	42
1000	9000	**3.7**	35	38	**1PH8103-1DD0 ■ - ■ CA1**	81.4	0.0172	51
1000	12000	**3.7**	35	38	**1PH8103-1DD0 ■ - ■ LA1**	81.4	0.0172	51
1500	9000	**5.5**	35	38	**1PH8103-1DF0 ■ - ■ CA1**	85.2	0.0172	51
1500	12000	**5.5**	35	38	**1PH8103-1DF0 ■ - ■ LA1**	85.2	0.0172	51
2000	9000	**7**	33	38	**1PH8103-1DG0 ■ - ■ CA1**	87.7	0.0172	51
2000	12000	**7**	33	38	**1PH8103-1DG0 ■ - ■ LA1**	87.7	0.0172	51
3000	9000	**8.4**	27	38	**1PH8103-1DM0 ■ - ■ CA1**	90.0	0.0172	51
3000	12000	**8.4**	27	38	**1PH8103-1DM0 ■ - ■ LA1**	90.0	0.0172	51
1500	9000	**7**	45	52	**1PH8105-1DF0 ■ - ■ CA1**	86.7	0.0252	65
1500	12000	**7**	45	52	**1PH8105-1DF0 ■ - ■ LA1**	86.7	0.0252	65
1000	9000	**6.3**	60	63	**1PH8107-1DD0 ■ - ■ CA1**	83.4	0.0289	73
1000	12000	**6.3**	60	63	**1PH8107-1DD0 ■ - ■ LA1**	83.4	0.0289	73
1500	9000	**9**	57	63	**1PH8107-1DF0 ■ - ■ CA1**	86.9	0.0289	73
1500	12000	**9**	57	63	**1PH8107-1DF0 ■ - ■ LA1**	86.9	0.0289	73
2000	9000	**10.5**	50	63	**1PH8107-1DG0 ■ - ■ CA1**	89.7	0.0289	73
2000	12000	**10.5**	50	63	**1PH8107-1DG0 ■ - ■ LA1**	89.7	0.0289	73
Shaft height SH 132 – Line voltage 400 V 3 AC								
1500	8000	**11**	70	96	**1PH8131-1DF0 ■ - ■ CA1**	89.9	0.059	89
1500	10000	**11**	70	96	**1PH8131-1DF0 ■ - ■ LA1**	89.9	0.059	89
1000	8000	**12**	115	128	**1PH8133-1DD0 ■ - ■ CA1**	87.1	0.076	106
1000	10000	**12**	115	128	**1PH8133-1DD0 ■ - ■ LA1**	87.1	0.076	106

Type of construction						
IM B3 (IM V5, IM V6)		**0**				
IM B5 (IM V1, IM V3)		**2**				
Shaft extension DE	**Balancing**			**Bearing version**	**Vibration magnitude acc. to Siemens[1]/ EN 60034-14**	**Shaft and flange accuracy**
Plain shaft	–	**0**	**C**	Standard	S/A	R
Fitted key	Full-key	**1**	**L**	Performance	SPECIAL/B	SPECIAL
Fitted key	Half-key	**2**				

Motor type (repeated)	Rated current for S1 duty	Static current	SINAMICS S120 Combi						
			Rated output current for S1 duty	3-axis Power Modules Order No.			4-axis Power Modules Order No.		
	I_{rated} A	I_0 A	I_{rated} A	6SL3111-3VE21-6FA0	6SL3111-3VE21-6EA0	6SL3111-3VE22-0HA0	6SL3111-4VE21-6FA0	6SL3111-4VE21-6EA0	6SL3111-4VE22-0HA0
1PH8083-1.F...	**7.5**	8	9	O	O/●	O/●	O/●	O/●	O/●
1PH8083-1.F...	**7.5**	8	9	O	O/●	O/●	O/●	O/●	O/●
1PH8083-1.G...	**11.6**	12	12	O	O	O	O	O	O/●
1PH8083-1.G...	**11.6**	12	12	O	O	O	O	O	O/●
1PH8083-1.M...	**13.6**	17	18	O	O	O	O	O	O/●[2]
1PH8083-1.M...	**13.6**	17	18	O	O	O	O	O	O/●[2]
1PH8083-1.N...	**17**	23	18	✓	O	O	✓	O	O
1PH8083-1.N...	**17**	23	18	✓	O	O	✓	O	O
1PH8087-1.F...	**10**	11	12	O	O/●[2]	O/●[2]	O/●[2]	O/●[2]	O/●
1PH8087-1.F...	**10**	11	12	O	O/●[2]	O/●[2]	O/●[2]	O/●[2]	O/●
1PH8087-1.G...	**14.1**	15	18	O	O	O	O	O	O
1PH8087-1.G...	**14.1**	15	18	O	O	O	O	O	O
1PH8087-1.M...	**17.3**	23	18	✓	O	O	✓	O	O
1PH8087-1.M...	**17.3**	23	18	✓	O	O	✓	O	O
1PH8087-1.N...	**19.5**	28	30	✓[2]	O	O	✓[2]	O	O
1PH8087-1.N...	**19.5**	28	30	✓[2]	O	O	✓[2]	O	O
1PH8101-1.F...	**12.5**	14	12	O	O	O	O	O	O/●
1PH8101-1.F...	**12.5**	14	12	O	O	O	O	O	O/●
1PH8103-1.D...	**10**	11	12	O	O/●[2]	O/●[2]	O/●[2]	O/●[2]	O/●
1PH8103-1.D...	**10**	11	12	O	O/●[2]	O/●[2]	O/●[2]	O/●[2]	O/●
1PH8103-1.F...	**13.5**	14	18	O	O	O	O	O	O/●[2]
1PH8103-1.F...	**13.5**	14	18	O	O	O	O	O	O/●[2]
1PH8103-1.G...	**17.5**	19	18	✓	O	O	✓	O	O
1PH8103-1.G...	**17.5**	19	18	✓	O	O	✓	O	O
1PH8103-1.M...	**25.7**	31	30	–	✓[2]	O	–	✓[2]	O
1PH8103-1.M...	**25.7**	31	30	–	✓[2]	O	–	✓[2]	O
1PH8105-1.F...	**17.5**	20	18	✓	O	O	✓	O	O
1PH8105-1.F...	**17.5**	20	18	✓	O	O	✓	O	O
1PH8107-1.D...	**17.5**	19	18	✓	O	O	✓	O	O
1PH8107-1.D...	**17.5**	19	18	✓	O	O	✓	O	O
1PH8107-1.F...	**23.5**	25	24	–	✓	O	–	✓	O
1PH8107-1.F...	**23.5**	25	24	–	✓	O	–	✓	O
1PH8107-1.G...	**26**	29	30	–	✓[2]	✓	–	✓[2]	✓
1PH8107-1.G...	**26**	29	30	–	✓[2]	✓	–	✓[2]	✓
1PH8131-1.F...	**24**	30	24	–	✓	O	–	✓	O
1PH8131-1.F...	**24**	30	24	–	✓	O	–	✓	O
1PH8133-1.D...	**30**	32	30	–	–	✓	–	–	✓
1PH8133-1.D...	**30**	32	30	–	–	✓	–	–	✓

Motor is part of quick packages.

✓ fits perfectly as main spindle
O fits as main spindle
● fits perfectly as driven tool
– does not fit

[1] For a definition of vibration magnitude according to Siemens, please see 1PH8 Motors Configuration Manual.
[2] With derating.

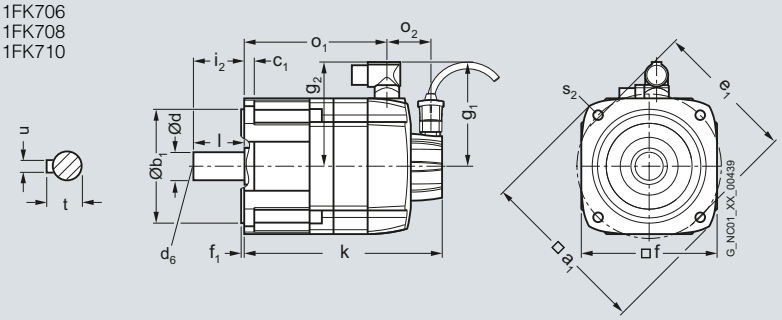
1FK7 Compact synchronous motors with DRIVE-CLiQ – Natural cooling

Dimensional drawings

For motor			Dimensions in mm (inches)									Shaft extension DE				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	s_2 S	**d** **D**	d_6 –	l E	t GA	u F
1FK7 Compact, natural cooling, DQI encoder with DRIVE-CLiQ, without/with brake															
63	1FK706.-2A		155 (6.10)	110 (4.33)	10 (0.39)	130 (5.12)	126 (4.96)	3.5 (0.14)	50 (1.97)	9 (0.35)	**24** **(0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
80	1FK708.-2A		194 (7.64)	130 (5.12)	11.5 (0.45)	165 (6.50)	155 (6.10)	3.5 (0.14)	58 (2.28)	11 (0.43)	**32** **(1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
100	1FK710.-2A		245 (9.65)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	80 (3.15)	14 (0.55)	**38** **(1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)

			DQI encoder system with DRIVE-CLiQ						
				without brake		with brake			
Shaft height	Type	DIN IEC	o_2 –	k LB	o_1 –	k LB	o_1 –	g_1 –	g_2 –
63	1FK7060-2A		50 (1.97)	168 (6.61)	106 (4.17)	203 (7.99)	141 (5.55)	104 (4.09)	104 (4.09)
	1FK7063-2A		50 (1.97)	213 (8.39)	151 (5.94)	248 (9.76)	186 (7.32)	104 (4.09)	104 (4.09)
80	1FK7080-2A		48 (1.89)	171 (6.73)	111 (4.37)	223 (8.78)	163 (6.42)	119 (4.69)	119 (4.69)
	1FK7083-2A		48 (1.89)	209 (8.23)	149 (5.87)	261 (10.28)	201 (7.91)	119 (4.69)	119 (4.69)
	1FK7084-2A		48 (1.89)	229 (9.02)	168 (6.61)	281 (11.06)	221 (8.70)	119 (4.69)	119 (4.69)
100	1FK7100-2A		53 (2.09)	183 (7.20)	118 (4.65)	220 (8.66)	170 (6.69)	137 (5.39)	137 (5.39)
	1FK7101-2A		53 (2.09)	209 (8.23)	144 (5.67)	261 (10.28)	196 (7.72)	137 (5.39)	158 (6.22)
	1FK7103-2A		53 (2.09)	235 (9.25)	170 (6.69)	287 (11.30)	222 (8.74)	137 (5.39)	158 (6.22)
	1FK7105-2A		53 (2.09)	287 (11.30)	222 (8.74)	339 (13.35)	274 (10.79)	137 (5.39)	158 (6.22)

1FK706
1FK708
1FK710



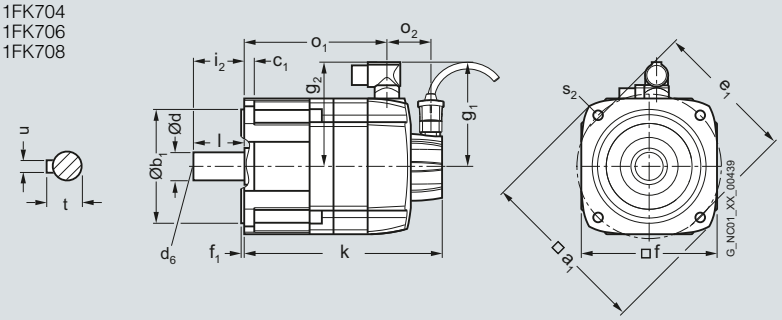
Dimensional drawings

For motor — Dimensions in mm (inches)

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	s_2 S	Shaft extension DE: **d D**	d_6 –	l E	t GA	u F
1FK7 High Inertia, natural cooling, DQI encoder with DRIVE-CLiQ, without/with brake															
48	1FK704.-3B		120 (4.72)	80 (3.15)	10 (0.39)	100 (3.94)	96 (3.78)	3 (0.12)	40 (1.57)	6.5 (0.26)	**19 (0.75)**	M6	40 (1.57)	21.5 (0.85)	6 (0.24)
63	1FK706.-3B		155 (6.10)	110 (4.33)	10 (0.39)	130 (5.12)	126 (4.96)	3.5 (0.14)	50 (1.97)	9 (0.35)	**24 (0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
80	1FK708.-3B		194 (7.64)	130 (5.12)	11.5 (0.45)	165 (6.50)	155 (6.10)	3.5 (0.14)	58 (2.28)	11 (0.43)	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.38)

Shaft height	Type	DIN IEC	DQI encoder system with DRIVE-CLiQ: o_2 –	without brake: k LB	o_1 –	with brake: k LB	o_1 –	g_1 –	g_2 –
48	1FK7042-3B		50 (1.97)	187 (7.36)	125 (4.92)	219 (8.62)	157 (6.18)	90 (3.54)	90 (3.54)
63	1FK7060-3B		50 (1.97)	182 (7.17)	120 (4.72)	217 (8.54)	155 (6.10)	104 (4.09)	104 (4.09)
	1FK7062-3B		50 (1.97)	216 (8.50)	153 (6.02)	251 (9.88)	189 (7.44)	104 (4.09)	104 (4.09)
80	1FK7081-3B		48 (1.89)	211 (8.31)	151 (5.94)	264 (10.39)	203 (7.99)	119 (4.69)	119 (4.69)
	1FK7084-3B		48 (1.89)	270 (10.63)	209 (8.23)	322 (12.68)	262 (10.31)	119 (4.69)	119 (4.69)

1FK704
1FK706
1FK708

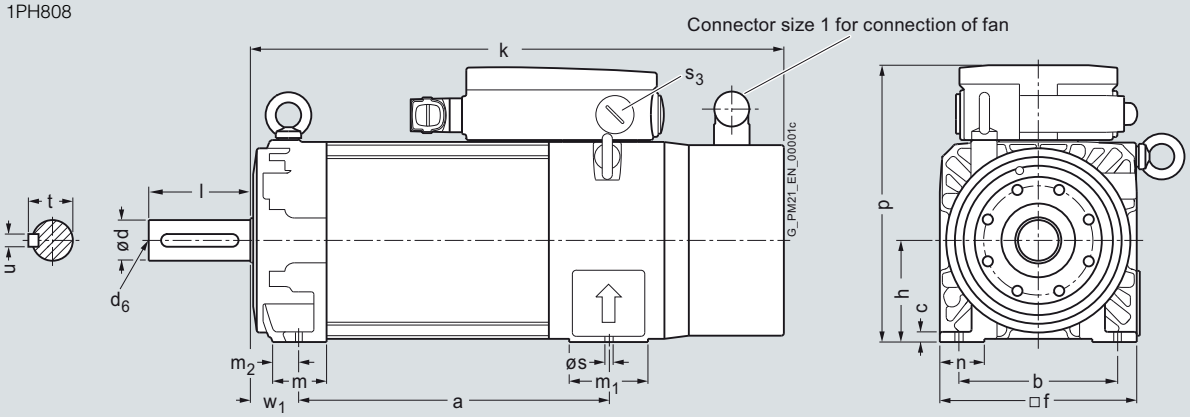


1PH8 asynchronous motors
Shaft height 80 – Forced ventilation

Dimensional drawings

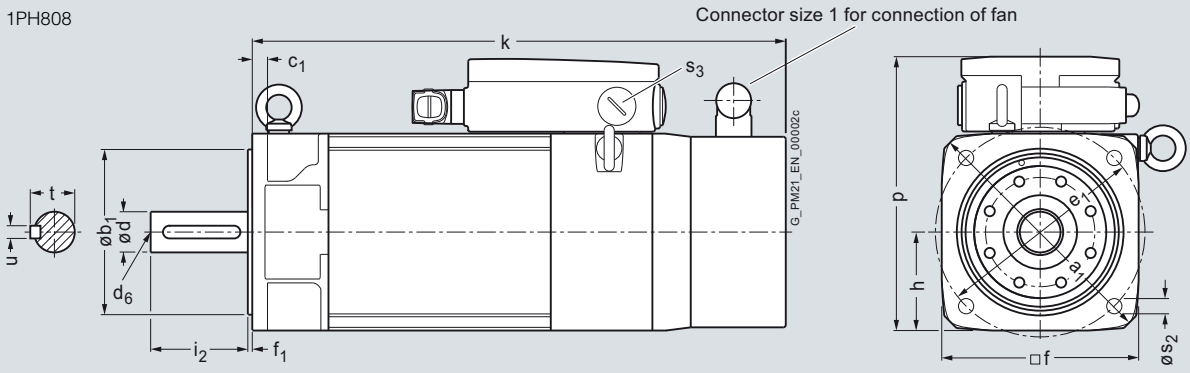
For motor		Dimensions in mm (inches)													
Shaft height	Type	DIN a IEC B	b A	c HA	f AB	h H	k LB	m BA	m_1 –	m_2 –	n AA	p HD	s K	s_3 –	w_1 C
1PH8, type of construction IM B3, forced ventilation															
80	1PH8083	194 (7.64)	125 (4.92)	8 (0.31)	155 (6.10)	80 (3.15)	375 (14.76)	42 (1.65)	62 (2.44)	20 (0.79)	35 (1.38)	216 (8.50)	10 (0.39)	M25 × 1.5	38 (1.50)
	1PH8087	244 (9.61)					425 (16.73)								

1PH808



For motor		Dimensions in mm (inches)										
Shaft height	Type	DIN a_1 IEC P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	h H	k LB	p HD	s_2 –	s_3 –
1PH8, type of construction IM B5, forced ventilation												
80	1PH8083	200 (7.87)	130 (5.12)	12 (0.47)	165 (6.50)	155 (6.10)	3.5 (0.14)	77.5 (3.05)	375 (14.76)	213.5 (8.41)	12 (0.47)	M25 × 1.5
	1PH8087								425 (16.73)			

1PH808



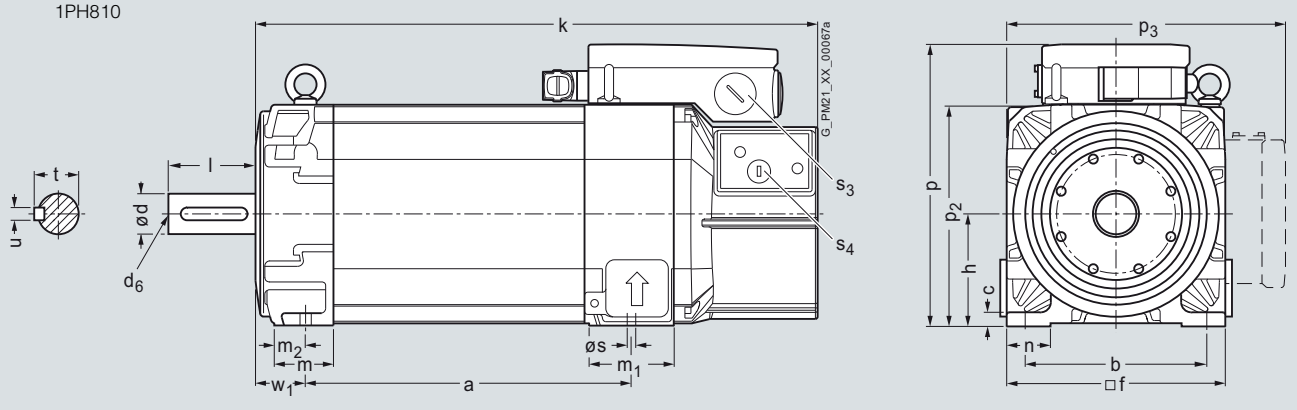
		Shaft extension DE					
Shaft height	Type	DIN **d** IEC **D**	d_6 –	i_2 E	l E	t GA	u F
80	1PH8083 1PH8087	**32** **(1.26)**	M12	80 (3.15)	80 (3.15)	35 (1.38)	10 (0.39)

Dimensional drawings

For motor — Dimensions in mm (inches)

Shaft height	Type	DIN IEC	a B	b A	c HA	f AB	h H	k LB	m BA	m_1 –	m_2 –	n AA	p HD	p_2 –	p_3 –	s K	s_3 –	s_4 –	w_1 C
1PH8, type of construction IM B3, forced ventilation																			
100	1PH8101		167 (6.57)	160 (6.30)	11 (0.43)	196 (7.72)	100 (3.94)	369.5 (14.55)	49 (1.93)	74 (2.91)	24 (0.94)	40 (1.57)	252 (9.92)	198 (7.80)	276.5 (10.89)	12 (0.47)	M32 × 1.5	M20 × 1.5	43 (1.69)
	1PH8103		202.5 (7.97)					405 (15.94)											
	1PH8105		262 (10.31)					464.5 (18.29)											
	1PH8107		297.5 (11.71)					500 (19.69)											

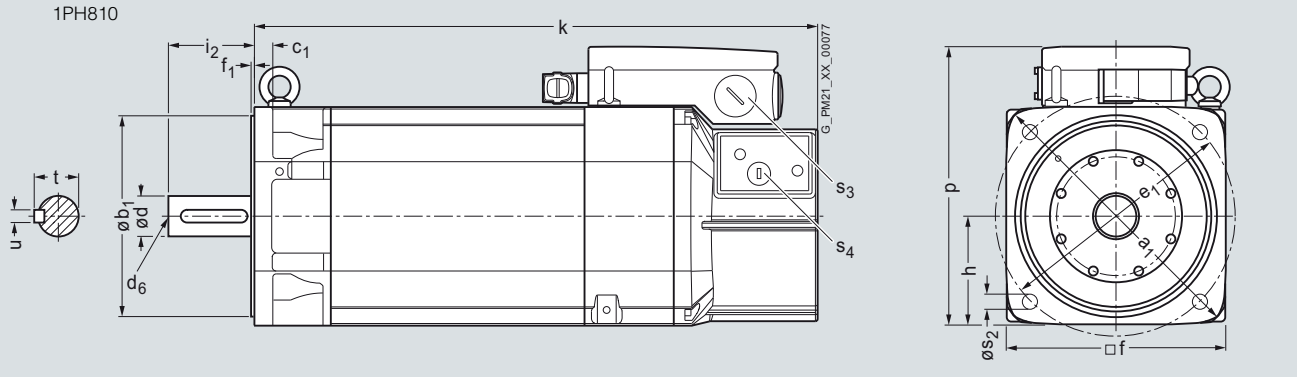
1PH810



For motor — Dimensions in mm (inches)

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	h H	k LB	p HD	s_2 –	s_3 –	s_4 –
1PH8, type of construction IM B5, forced ventilation														
100	1PH8101		250 (9.84)	180 (7.09)	16 (0.63)	215 (8.46)	196 (7.72)	4 (0.16)	98 (3.86)	369.5 (14.55)	250 (9.84)	14 (0.55)	M32 × 1.5	M20 × 1.5
	1PH8103									405 (15.94)				
	1PH8105									464.5 (18.29)				
	1PH8107									500 (19.69)				

1PH810



Shaft extension DE

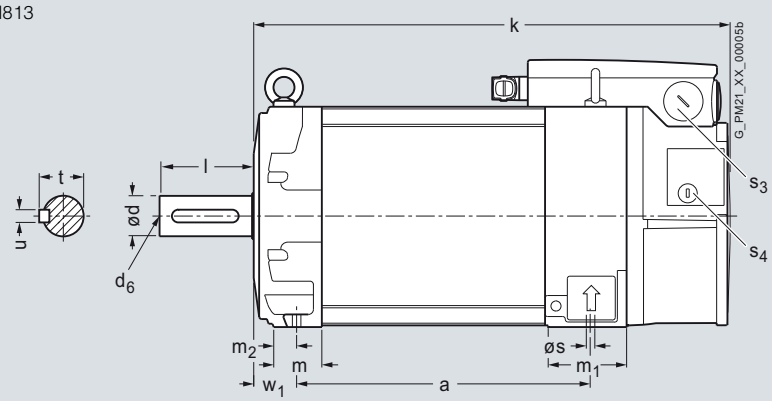
Shaft height	Type	DIN IEC	**d** **D**	d_6 –	i_2 E	l E	t GA	u F
100	1PH8101 1PH8103 1PH8105 1PH8107		**38 (1.50)**	M12	80 (3.15)	80 (3.15)	41 (1.61)	10 (0.39)

1PH8 asynchronous motors
Shaft height 132 – Forced ventilation

Dimensional drawings

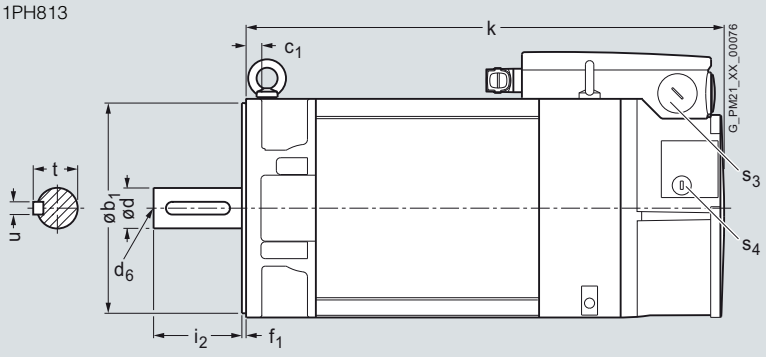
For motor		Dimensions in mm (inches)																	
Shaft height	Type	DIN a IEC B	b A	c HA	f AB	h H	k LB	m BA	m_1 –	m_2 –	n AA	p HD	p_2 –	p_3 –	s K	s_3 –	s_4 –	w_1 C
1PH8, type of construction IM B3, forced ventilation																		
132	1PH8131	220.5 (8.68)	216 (8.50)	15 (0.59)	260 (10.24)	132 (5.20)	439 (17.28)	57 (2.24)	93 (3.66)	27 (1.06)	52 (2.05)	317.5 (12.50)	262 (10.31)	357.5 (14.07)	12 (0.47)	M40 × 1.5	M20 × 1.5	53 (2.09)
	1PH8133	265.5 (10.45)					484 (19.06)											

1PH813



For motor		Dimensions in mm (inches)												
Shaft height	Type	DIN a_1 IEC P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	h H	k LB	p HD	s_2 –	s_3 –	s_4 –	
1PH8, type of construction IM B5, forced ventilation														
132	1PH8131	340 (13.39)	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	130 (5.12)	439 (17.28)	315.5 (12.42)	18 (0.71)	M40 × 1.5	M20 × 1.5	
	1PH8133								484 (19.06)					

1PH813



		Shaft extension DE					
Shaft height	Type	DIN **d** IEC **D**	d_6 –	i_2 E	l E	t GA	u F
132	1PH8131 1PH8133	**48** **(1.89)**	M16	110 (4.33)	110 (4.33)	51.5 (2.03)	14 (0.55)

Introduction

Incremental encoders

Overview

Absolute encoders, incremental encoders and mounting accessories

The built-on optoelectronic rotary encoders measure paths, angles of rotation or speeds in machines. They can be used in conjunction with computerized numerical controls, programmable logic controllers, drives and position displays, e.g. for:

- SINUMERIK CNCs
- SIMOTION Motion Control Systems
- SIMATIC programmable logic controllers
- SINAMICS drive systems
- SIMODRIVE drive systems
- SIMOVERT MASTERDRIVES drive systems

Application

A distinction is made between incremental and absolute measuring procedures:

- In the case of incremental encoders, the machine must travel to a reference point after each power-off state, as the position is not usually stored in the controller, and movements of the machine while the power is off are not recorded.
- Absolute encoders, on the other hand, also record these movements while the power is off and return the actual position with power On. Travel to a reference point is not necessary.

Design

All encoders are available in Synchro flange and supported flange joint versions. Encoders with a Synchro flange can be attached to the machine with 3 clamp straps or mounted with axial screws. The encoder is driven by means of a plug-in coupling or a spring disk coupling. Alternatively, pulleys can also be used.

The encoder supply voltage is 5 V DC or alternatively 10 V to 30 V DC. The 10 V to 30 V DC version supports longer cable lengths. Most control systems apply the supply voltage directly on the measuring circuit connector. With SINAMICS, the power supply for the measuring systems is provided via the Sensor Modules.

For rotary encoders with cables, the cable length including the connector is 1 m.

The following bending radii for the cables at the encoder must be complied with:

- One-time bending: ≥ 20 mm
- Continuous bending: ≥ 75 mm

Function

Incremental encoders (sin/cos 1 V_{pp}/RS422) with cable and connector or Synchro flange

Incremental encoders deliver a defined number of electrical pulses per rotation, which represent the measurement of the traveled distance or angle.

Incremental encoders operate on the principle of optoelectronic scanning of dividing disks with the transmitted light principle. The light source is a light emitting diode (LED). The light-dark modulation generated as the encoder shaft rotates is picked up by photoelectronic elements. With an appropriate arrangement of the line pattern on the dividing disk connected to the shaft and the fixed aperture, the photoelectronic elements provide two trace signals A and B at 90° to one another, as well as a reference signal R. The encoder electronics amplify these signals and convert them into different output levels.

The following output levels are available:

- sin/cos 1 V_{pp} analog signals
  Better resolution can be achieved for encoders with sinusoidal signals by interpolating them in the higher-level controller.
- RS422 difference signals (TTL)
  In the case of RS422 incremental encoders (TTL), the resolution can be improved by a factor of four by means of edge evaluation.

Technical specifications

	sin/cos 1 V_{pp} incremental encoder 6FX2001-3....	**RS422 (TTL) incremental encoder** 6FX2001-2....
Operating voltage U_p on encoder	5 V DC ± 10 %	5 V DC ± 10 % or 10 ... 30 V DC
Limit frequency, typical	≥ 180 kHz (-3 dB) ≥ 450 kHz (-6 dB)	–
Scanning frequency, max.	–	300 kHz
No-load current consumption, max.	150 mA	150 mA
Signal level	Sinusoidal 1 V_{pp}	TTL (RS422)
Outputs protected against short-circuit to 0 V	Yes	Yes
Switching time (10 ... 90 %) (1 m cable and recommended input circuit)	–	Rise/fall time t_+/t_- ≤ 50 ns
Phase angle, signal A to B Edge spacing, min. at	90° ± 10°el.	90°
• 300 kHz	–	≥ 0.45 µs

Technical specifications (continued)

	sin/cos 1 V_{pp} incremental encoder	RS422 (TTL) incremental encoder
	6FX2001-3....	6FX2001-2....
Cable length to downstream electronics, max.[1]	150 m	100 m
LED failure monitoring	–	High-resistance driver
Resolution, max.	2500 S/R	5000 S/R
Accuracy (in angular seconds)	± 18 mech. × 3600/ number of signals/ revolution *z*	± 18 mech. × 3600/ number of signals/ revolution *z*
Speed, max.		
• Electrical	(27×10^6 rpm)/ number of signals/ revolution (at -6 dB)	(18×10^6 rpm)/ number of signals/ revolution
• Mechanical	12000 rpm	12000 rpm
Friction torque (at 20 °C)	≤ 0.01 Nm	≤ 0.01 Nm
Starting torque (at 20 °C)	≤ 0.01 Nm	≤ 0.01 Nm
Shaft loading capacity		
• n > 6000 rpm		
- Axial	10 N	10 N
- Radial at shaft extension	20 N	20 N
• n ≤ 6000 rpm		
- Axial	40 N	40 N
- Radial at shaft extension	60 N	60 N
Angular acceleration, max.	10^5 rad/s^2	10^5 rad/s^2
Moment of inertia of rotor	1.45×10^{-6} kgm^2	1.45×10^{-6} kgm^2
Vibration (55 ... 2000 Hz) to EN 60068-2-6	≤ 300 m/s^2	≤ 300 m/s^2
Shock to EN 60068-2-27		
• 2 ms	≤ 2000 m/s^2	≤ 2000 m/s^2
• 6 ms	≤ 1000 m/s^2	≤ 1000 m/s^2
Degree of protection to EN 60529 (IEC 60529)		
• Without shaft input	IP67	IP67
• With shaft input	IP64	IP64
Ambient temperature		
Operation		
• Flange outlet or fixed cable		
- At U_p = 5 V ± 10 %	-40 ... +100 °C	-40 ... +100 °C
- At U_p = 10 … 30 V	–	-40 ... +70 °C
• Flexible cable		
- At U_p = 5 V ± 10 %	-10 ... +100 °C	-10 ... +100 °C
- At U_p = 10 … 30 V	–	-10 ... +70 °C
Weight, approx.	0.25 kg	0.25 kg
EMC	Tested in accordance with the guidelines for electromagnetic compatibility 89/336/EEC and the regulations of the EMC guidelines (applicable basic standards)	
Approvals, according to	CE, cULus	CE, cULus

S/R = signals/revolution

Selection and ordering data

Description	Order No.
sin/cos 1 V_{pp} incremental encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-3G** ■■■
• Radial flange outlet	**6FX2001-3E** ■■■
• Cable 1 m with connector[2]	**6FX2001-3C** ■■■
Resolution	
1000 S/R	**B 0 0**
1024 S/R	**B 0 2**
2500 S/R	**C 5 0**
RS422 (TTL) incremental encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2G** ■■■
• Radial flange outlet	**6FX2001-2E** ■■■
• Cable 1 m with connector[2]	**6FX2001-2C** ■■■
Synchro flange and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2H** ■■■
• Radial flange outlet	**6FX2001-2F** ■■■
• Cable 1 m with connector[2]	**6FX2001-2D** ■■■
Supported flange joint and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2R** ■■■
• Radial flange outlet	**6FX2001-2P** ■■■
• Cable 1 m with connector[2]	**6FX2001-2M** ■■■
Supported flange joint and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2S** ■■■
• Radial flange outlet	**6FX2001-2Q** ■■■
• Cable 1 m with connector[2]	**6FX2001-2N** ■■■
Resolution	
500 S/R	**A 5 0**
1000 S/R	**B 0 0**
1024 S/R	**B 0 2**
1250 S/R	**B 2 5**
1500 S/R	**B 5 0**
2000 S/R	**C 0 0**
2048 S/R	**C 0 4**
2500 S/R	**C 5 0**
3600 S/R	**D 6 0**
5000 S/R	**F 0 0**

S/R = signals/revolution

[1] With recommended cable and input circuitry of the downstream electronics, observe max. permissible cable length of module to be evaluated.

[2] Universal integrated cable outlet for axial and radial outlet direction.

Absolute encoders

Function

DRIVE-CLiQ absolute encoder

Absolute encoders (absolute shaft encoders) are designed on the same scanning principle as incremental encoders, but have a greater number of tracks. For example, if there are 13 tracks, then 2^{13} = 8192 steps are coded in the case of single-turn encoders. The code used is a one-step code (gray code), which prevents any scanning errors from occurring.

After switching on the machine, the position value is transmitted immediately to the controller. There is no need to travel to a reference point.

Single-turn encoders

Single-turn encoders divide one rotation (360 degrees mechanical) into a specific number of steps, e.g. 8192. A unique code word is assigned to each position. After 360° the position values are repeated.

Multi-turn encoders

Multi-turn encoders also record the number of revolutions, in addition to the absolute position within one revolution. To do this, further code discs which are coupled via gear steps with the encoder shaft are scanned. When evaluating 12 additional tracks, this means that 2^{12} = 4096 revolutions can be coded.

Technical specifications

Absolute encoder with DRIVE-CLiQ	
6FX2001-5.D..-0AA1	
Operating voltage U_p on encoder	24 V DC - 15 % + 20 %
Power consumption, approx.	
• Single-turn	245 mA
• Multi-turn	325 mA
Interface	DRIVE-CLiQ
Data output	DRIVE-CLiQ
Short-circuit strength	Yes
Data transfer rate	100 Mbit
Speed, max.	
• Electrical	14000 rpm
• Mechanical	
- Single-turn	12000 rpm
- Multi-turn	10000 rpm
Cable length to down-stream electronics, max. [1]	100 m
Connection	DRIVE-CLiQ connector, radial
Resolution	
• Single-turn	22 bit
• Multi-turn	34 bit (22 bit single-turn + 12 bit multi-turn)
Incremental track	2048 S/R, 1 V_{pp} (encoder-internal only)
Code type	
• Sampling	Gray
• Transfer	DRIVE-CLiQ
Parameterization capability	
• Counting direction	Yes
Accuracy (in angular seconds)	± 36
Friction torque (at 20 °C)	≤ 0.01 Nm
Starting torque (at 20 °C)	≤ 0.01 Nm
Shaft loading capacity	
• n > 6000 rpm	
- Axial	10 N
- Radial at shaft extension	20 N
• n ≤ 6000 rpm	
- Axial	40 N
- Radial at shaft extension	60 N

S/R = signals/revolution

[1] Observe the maximum permissible cable length of the connected module.

Technical specifications (continued)

Absolute encoder with DRIVE-CLiQ 6FX2001-5.D..-0AA1	
Angular acceleration, max.	10^5 rad/s^2
Moment of inertia of rotor	
• Solid shaft	1.90×10^{-6} kgm^2
• Hollow shaft	2.80×10^{-6} kgm^2
Vibration (55 … 2000 Hz) to EN 60068-2-6	≤ 100 m/s^2
Shock to EN 60068-2-27	
• 2 ms	≤ 2000 m/s^2
• 6 ms	≤ 1000 m/s^2
Degree of protection to EN 60529 (IEC 60529)	
• Without shaft input	IP67
• With shaft input	IP64
Ambient temperature	
• Operation	-20 ... +100 °C
Weight, approx.	
• Single-turn	0.40 kg
• Multi-turn	0.44 kg
EMC	Tested in accordance with EN 50081 and EN 50082
Approvals, according to	CE, cULus

Selection and ordering data

Description	Order No.
Absolute encoder with DRIVE-CLiQ	
24 V DC supply voltage Radial connection	
• Synchro flange Solid shaft 6 mm	**6FX2001-5FD■■-0AA1**
• Supported flange joint Solid shaft 10 mm	**6FX2001-5QD■■-0AA1**
• Torque bracket Hollow shaft 10 mm	**6FX2001-5VD■■-0AA1**
• Torque bracket Hollow shaft 12 mm	**6FX2001-5WD■■-0AA1**
Resolution	
• Single-turn 22 bit	**1 3**
• Multi-turn 34 bit	**2 5**

6

Overview

Couplings and clamp straps

Couplings/clamp straps

Couplings and clamp straps are available as mounting accessories for the built-on rotary encoders. The clamp straps are used to fix the encoders with Synchro flange.

Signal connector as mating connector

A signal connector is available as mating connector for encoders with flange outlet or with cable and connector. The connector with 12 contacts is suitable for all incremental encoders.

Signal connector

A signal connector is available as replacement for encoders with cable and connector.

Technical specifications

	Spring disk coupling	Plug-in coupling
	6FX2001-7KF10 6FX2001-7KF06	6FX2001-7KS06 6FX2001-7KS10
Transmission torque, max.	0.8 Nm	0.7 Nm
Shaft diameter	6 mm both ends or d_1 = 6 mm, d_2 = 5 mm	6 mm both ends or 10 mm both ends
Center offset of shafts, max.	0.4 mm	0.5 mm
Axial offset	± 0.4 mm	± 0.5 mm
Angular displacement of shafts, max.	3°	1°
Torsional rigidity	150 Nm/rad	31 Nm/rad
Lateral spring stiffness	6 N/mm	10 N/mm
Moment of inertia	19 gcm^2	20 gcm^2
Speed, max.	12000 rpm	12000 rpm
Ambient temperature		
• Operation	-40 ... +150 °C	-40 ... +80 °C
Weight, approx.	16 g	20 g

Selection and ordering data

Description	Order No.
Spring disk coupling Shaft diameter:	
• 6 mm/6 mm	**6FX2001-7KF10**
• 6 mm/5 mm	**6FX2001-7KF06**
Plug-in coupling Shaft diameter:	
• 6 mm/6 mm	**6FX2001-7KS06**
• 10 mm/10 mm	**6FX2001-7KS10**
Clamp strap (1 unit) For double-track encoders and encoders with Synchro flange (3 units are required.)	**6FX2001-7KP01**
Signal connector with cap nut (1 unit) Mating connector for TTL and sin/cos 1 V_{pp} incremental encoders 12-pin, insulator with 12 socket contacts 0.08 ... 0.22 mm^2 and 0.20 ... 0.56 mm^2, 2 × cable clamping 6.5 ... 10 mm and 10.1 ... 13 mm	**6FX2003-0SU12**
Signal connector with external thread for encoders with cable (1 unit) Replacement connector for RS422 and sin/cos 1 V_{pp} incremental encoders 12-pin, insulator with 12 contact pins 0.20 ... 0.56 mm^2, 2 × cable clamping 6.5 ... 10 mm and 10.1 ... 13 mm	**6FX2003-0SA12**

Connection system MOTION-CONNECT

7

General information

Overview

MOTION-CONNECT cables are suitable for use with many different types of machine tool and production machine.

The power cables and signal cables can be ordered by the meter or pre-assembled.

The following MOTION-CONNECT cable designs are available:

- **MOTION-CONNECT 500** is the option for mainly fixed installation.
- **MOTION-CONNECT 800** meets all high mechanical requirements for use in cable carriers for machine tools and production machines. The cables are resistant to cutting oils.

Benefits

SPEED-CONNECT

The new pre-assembled cables with SPEED-CONNECT connectors support a fast, stable and reliable connection. With a short rotation as far as the stop, the lock nut of the connector secures the connection.

The cables with SPEED-CONNECT connectors supplement the previously offered MOTION-CONNECT cables with full-thread connectors.

The use of pre-assembled MOTION-CONNECT cables will ensure high quality and system-tested, problem-free operation.

Application

Degree of protection of pre-assembled power and signal cables and their extensions is IP67 when closed and connected.

When cable lengths (basic cables and extensions) are determined for the systems and applications described in this catalog, the technically permissible maximum cable lengths (e.g. 25 m) specified in the catalog must be observed. Malfunctions can occur if longer cables are used.

Siemens AG assumes no liability for correct transmission of signals or power in this case.

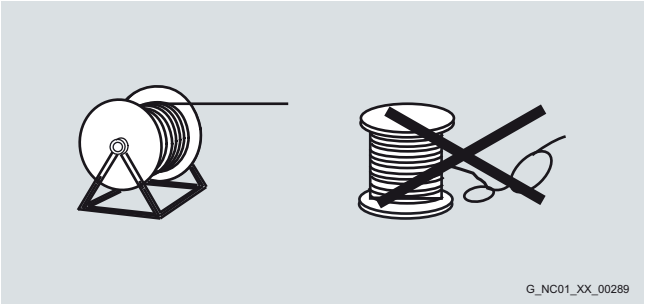
When the power cables with brake cores and signal cables include more than one additional intermediate connection, the maximum permissible cable length is reduced by 2 m for each interruption point.

The pre-assembled cables can be ordered in length units of 10 cm and can be extended, if necessary.

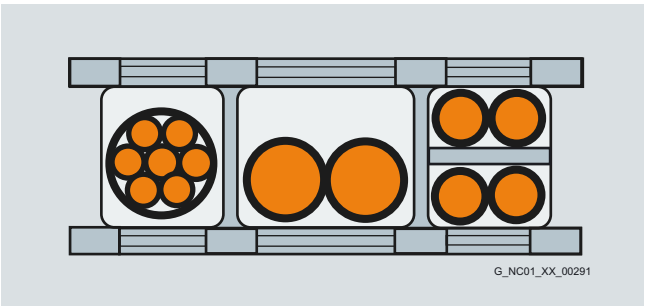
MOTION-CONNECT cables are not suitable for outdoor use.

MOTION-CONNECT cables are approved for a maximum horizontal travel distance of 5 m.

Function



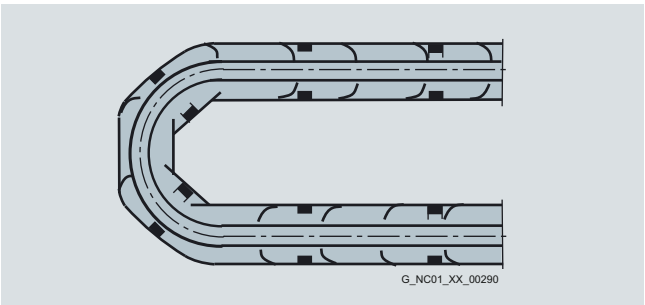
The cables must be removed from the drum without twisting, i.e. the cables must be unwound and must never be lifted over the drum flange in loops.



To maximize the service life of the cable carrier and cables, cables in the carrier made from different materials must be separated in the cable carrier by means of spacers. The spacers must be filled evenly to ensure that the position of the cables does not change during operation. The cables should be distributed as symmetrically as possible according to their weights and dimensions. Cables with very different outer diameters should be separated by spacers as well.

When inserting pre-assembled cables into the cable carrier, do **not** pull at the connector, as this may damage the strain relief or cable clamping.

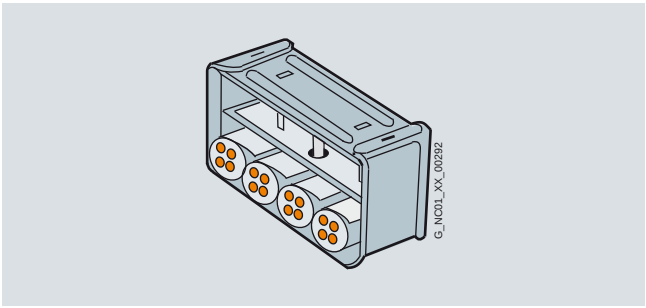
The cables must not be fixed in the cable carrier. They must be freely movable.



The cables must be able to be moved without applying force in particular in the bending radii of the carrier. The specified minimum bending radii must be adhered to.

The cable fixings must be attached at both ends at an appropriate distance away from the end points of the moving parts in a dead zone.

Function (continued)



MOTION-CONNECT cables are tested in a cable carrier. The cables are attached to the moving ends of the cable carrier with strain relief. Strain relief is applied over a wide area of the cable jacket surface without crimping the cable.

Cables must be installed in accordance with the instructions supplied by the cable carrier manufacturer.

Notes:

If, for example, pre-assembled cables are installed in a cable carrier in such a way that the connector would inhibit assembly, pre-assembled cables without assembled connectors can also be supplied (power and signal cables[1]). In this case, the contacts of the cables are crimped and the connector enclosure is supplied separately. After installing the cables, the customer assembles the connector enclosure.

In case of vibration load and with horizontal or vertical cable entries, we recommend that the cable is additionally fixed if between the cable strain relief on the cable carrier and the terminal at the motor part of the cable is hanging loose or is not routed. To prevent machine vibrations being transmitted to the connectors, the cable should be fixed at the moving part where the motor is mounted.

Representation in connection overviews

Symbol	Explanation
	Connector with pin contacts
	Connector with socket contacts
	Exposed core ends
	The cable is not included in the scope of supply. It must be provided by the customer.

More information

Current carrying capacity for power and signal cables

The current carrying capacity of PVC-/PUR-insulated copper cables is specified in the table for installation type C under continuous operating conditions with reference to an ambient air temperature of 40 °C. For other ambient temperatures, the values must be corrected by the derating factors from the table.

	Current carrying capacity of cables with copper cores according to EN 60204-1 rms AC 50/60 Hz or DC in A for installation type C Multi-core cables, vertically or horizontally on walls/ open, without protection tubes and installation ducts/ with contact
Cross-section mm^2	Current **A**
Electronics (One control circuit pair.)	
0.20	4.4
0.30	7.5
0.75	9.5
Power (One symmetrically loaded AC cable.)	
0.75	9.8
1.00	11.7
1.50	15.2
2.50	21
4	28
6	36

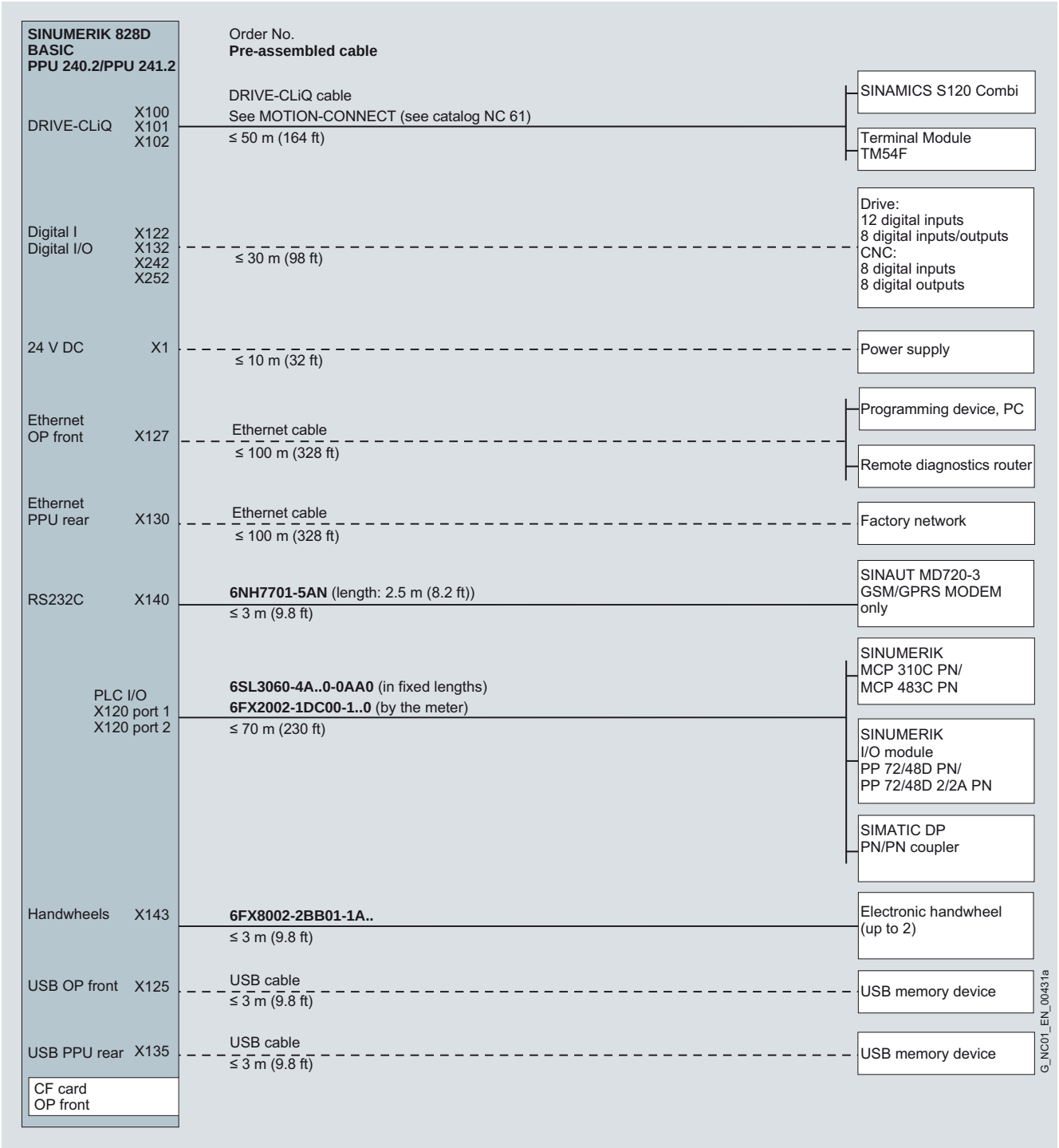
Derating factors for power and signal cables

Ambient air temperature °C	**Derating factor** according to EN 60204-1, Table D.1
30	1.15
35	1.08
40	1.00
45	0.91
50	0.82
55	0.71
60	0.58

[1] Not for DRIVE-CLiQ signal cables.

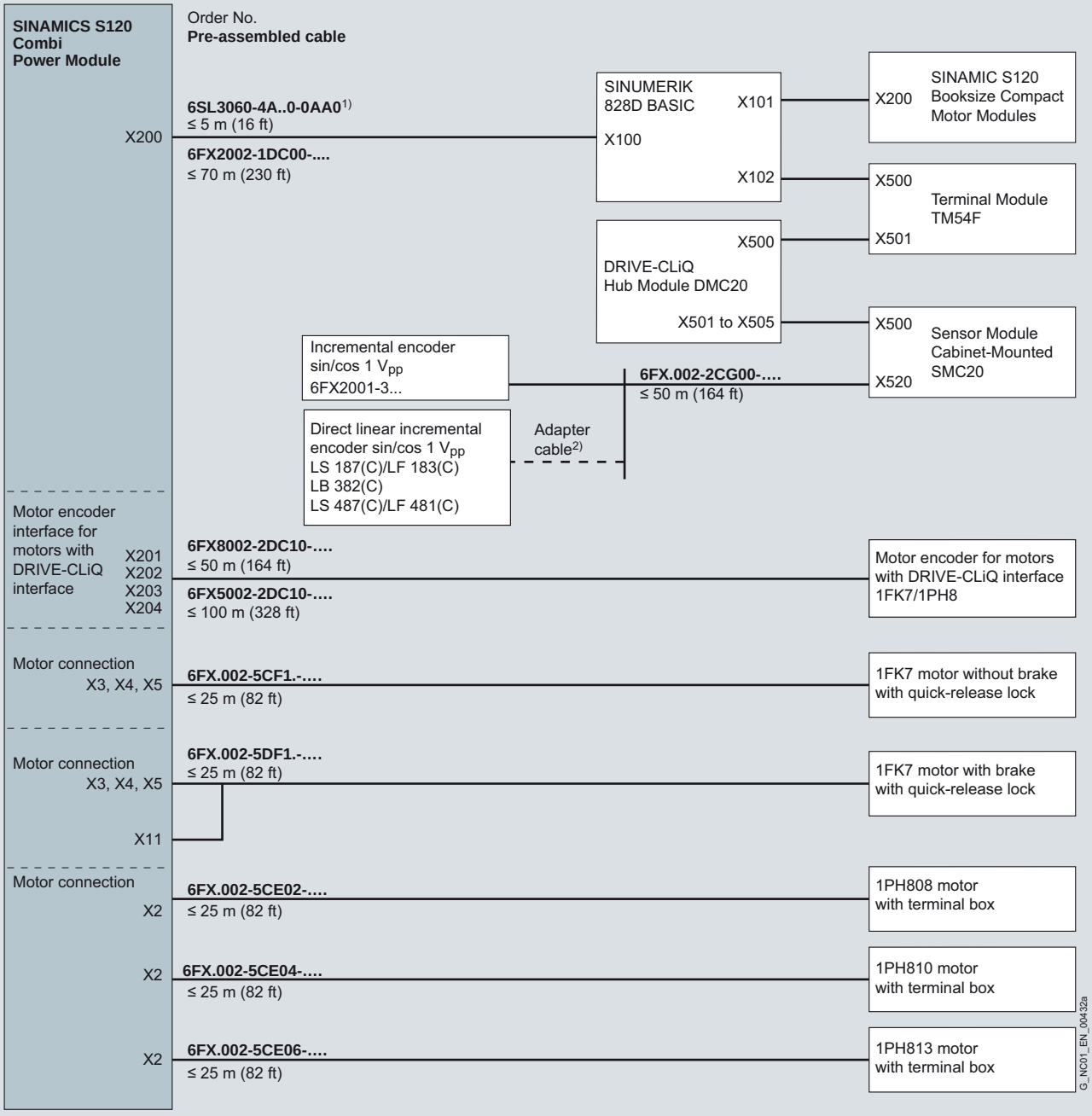
SINUMERIK 828D BASIC T/BASIC M

Integration



Connection overview of SINUMERIK 828D BASIC T/BASIC M

Integration (continued)

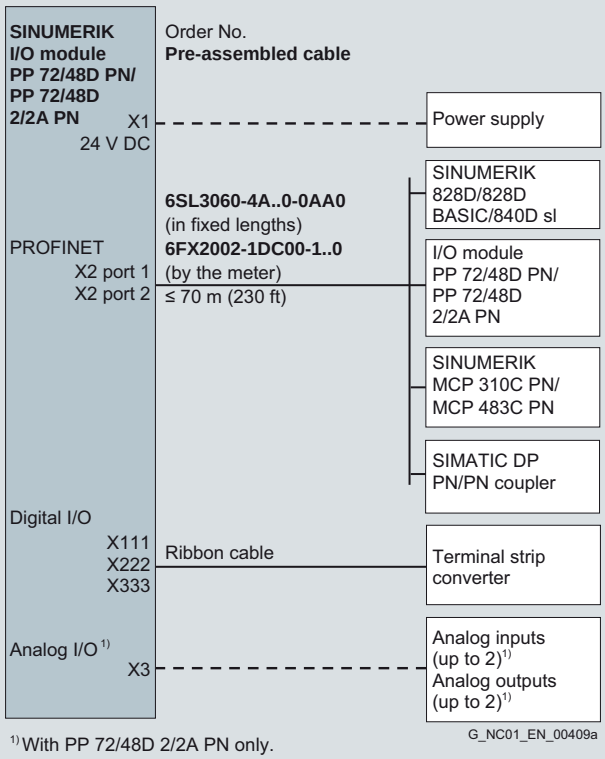


1) For standard configuration with the modules mounted directly adjacent to one another.
2) Adapter cable available from measuring system manufacturer.

Connection overview of SINAMICS S120 Combi Power Modules

SINUMERIK I/O modules PP 72/48D PN and PP 72/48D 2/2A PN

Integration (continued)



Connection overview of SINUMERIK I/O modules PP 72/48D PN and PP 72/48D 2/2A PN

7

Overview

Power cable for connecting a 1FK7 motor with SPEED-CONNECT connector to SINAMICS S120 Combi Power Modules

The synchronous and asynchronous motors are connected to the Motor Modules or Power Modules by means of MOTION-CONNECT power cables.

The pre-assembled MOTION-CONNECT power cables are of high quality and offer safety with problem-free functioning.

Type of delivery of pre-assembled power cables

Pre-assembled power cables can be ordered in units of 10 cm up to a maximum length of 299.8 m.

Cables up to 30 kg or 100 m are supplied as coils; above this, they are supplied on drums. This applies to both pre-assembled power cables and to those sold by the meter.

Type of delivery of power cables sold by the meter

Fixed lengths

Cross-section	**MOTION-CONNECT 500** **MOTION-CONNECT 800**
1.5 mm^2 and 2.5 mm^2	50 m, 100 m, 200 m, 500 m

Variable length, sold by the meter

4 mm^2 and 6 mm^2	≤ 500 m

Technical specifications

Power cables	**MOTION-CONNECT 500** 6FX500.-.....-....	**MOTION-CONNECT 800** 6FX800.-.....-....
Approvals, according to		
• VDE[1]/RoHS conformity	Yes	Yes
• cURus or UR/CSA[2]	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90
Rated voltage U_0/U		
• Power conductors	600 V/1000 V	600 V/1000 V
• Signal conductors	24 V (EN) 1000 V (UL/CSA)	24 V (EN) 1000 V (UL/CSA)
Test voltage, rms		
• Power conductors	4 kV	4 kV
• Signal conductors	2 kV	2 kV
Operating temperature on the surface		
• Fixed installation	-20 … +80 °C	-50 … +80 °C
• Flexible installation	0 … 60 °C	-20 … +60 °C
Tensile stress, max.		
• Fixed installation	50 N/mm^2	50 N/mm^2
• Flexible installation	20 N/mm^2	20 N/mm^2
Smallest bending radius		
• Fixed installation	5 × D_{max}	6 × D_{max}
• Flexible installation	See power cables	See power cables
Torsional stress	Absolute 30°/m	Absolute 30°/m
Bending	100000	10 million / from 10 mm^2: 3 million
Traversing velocity	30 m/min	180 m/min / from 10 mm^2: 100 m/min
Acceleration	2 m/s^2	5 m/s^2 (5 m) / 10 m/s^2 (2.5 m)
Insulation material, incl. jacket	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815
Oil resistance	EN 60811-2-1 (mineral oil only)	EN 60811-2-1
Outer jacket	PVC DESINA color orange RAL 2003	PUR, HD22.10 S2 (VDE 0282, Part 10) DESINA color orange RAL 2003
Flame-retardant	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

[1] The respective registration number is printed on the cable jacket.

[2] The UR-CSA File No. is printed on the cable jacket.

Power cables for 1FK7/1PH8 motors

Selection and ordering data

Power cables for 1FK7 motors with SPEED-CONNECT connector

Connection method, Power/Motor Module end	No. of cores × cross-section	Connector size, motor end	**Pre-assembled cable with SPEED-CONNECT connector**	D_{max}		**Cable sold by the meter**[1]	Weight (without connector)		Smallest perm. bending radius[2]	
				6FX5	**6FX8**		**6FX5**	**6FX8**	**6FX5**	**6FX8**
	mm²		Order No.	mm	mm	Order No.	kg/m	kg/m	mm	mm
1FK7 motors without brake on SINAMICS S120 Combi Power Modules										
Exposed core ends[3]	4 × 1.5	1	**6FX■002-5CF10-....**	8.4	9.5	**6FX■008-1BB11-....**	0.12	0.16	155	75
		1.5	**6FX■002-5CF14-....**							
1FK7 motors with brake on SINAMICS S120 Combi Power Modules										
Exposed core ends[3]	4 × 1.5+2 × 1.5	1	**6FX■002-5DF10-....**	10.8	12	**6FX■008-1BA11-....**	0.22	0.25	195	90
		1.5	**6FX■002-5DF14-....**							
1FK7 motors without brake on SINAMICS S120 Motor Modules in booksize compact format										
Exposed core ends	4 × 1.5	1	**6FX■002-5CG10-....**	8.4	9.5	**6FX■008-1BB11-....**	0.12	0.16	155	75
		1.5	**6FX■002-5CG22-....**							
	4 × 2.5	1	**6FX■002-5CG12-....**	10	11	**6FX■008-1BB21-....**	0.21	0.23	180	90
		1.5	**6FX■002-5CG32-....**							
1FK7 motors with brake on SINAMICS S120 Motor Modules in booksize compact format										
Exposed core ends	4 × 1.5+2 × 1.5	1	**6FX■002-5DG10-....**	10.8	12	**6FX■008-1BA11-....**	0.22	0.25	195	90
		1.5	**6FX■002-5DG22-....**							
	4 × 2.5+2 × 1.5	1	**6FX■002-5DG12-....**	12.4	13.8	**6FX■008-1BA21-....**	0.25	0.31	225	105
		1.5	**6FX■002-5DG32-....**							

MOTION-CONNECT 500			**5**					**5**		
MOTION-CONNECT 800			**8**					**8**		
Length code			**....**					**....**		

Power cables for 1PH8 motors with terminal box

Motor	Thread	No. of cores × cross-section	Connection method Power/Motor Module end	**Pre-assembled cable**	D_{max}		**Cable sold by the meter**[1]	Weight (without cable gland)		Smallest perm. bending radius[2]	
					6FX5	**6FX8**		**6FX5**	**6FX8**	**6FX5**	**6FX8**
Type		mm²		Order No.	mm	mm	Order No.	kg/m	kg/m	mm	mm
1PH8 motors with terminal box on SINAMICS S120 Combi Power Modules											
1PH808	M25	4 × 2.5	Exposed core ends[3]	**6FX■002-5CE02-....**	11	11	**6FX8008-1BB21-....**	0.21	0.23	180	90
1PH810	M32	4 × 4	Exposed core ends[3]	**6FX■002-5CE04-....**	11.4	12.3	**6FX8008-1BB31-....**	0.27	0.31	210	100
1PH813	M40	4 × 6	Exposed core ends[3]	**6FX■002-5CE06-....**	20	15.1	**6FX8008-1BB51-....**	0.37	0.42	245	120
1PH8 motors with terminal box on SINAMICS S120 Motor Modules in booksize compact format											
1PH808	M25	4 × 2.5	Exposed core ends[4]	**6FX8002-5CR10-....**	–	11	**6FX8008-1BB21-....**	–	0.23	–	90
1PH810	M32	4 × 2.5	Exposed core ends[4]	**6FX8002-5CR11-....**	–	11	**6FX8008-1BB21-....**	–	0.23	–	90

MOTION-CONNECT 500			**5**							
MOTION-CONNECT 800			**8**							
Length code			**....**							

[1] Note type of delivery.
[2] Valid for installation in a cable carrier.
[3] Length of core ends for power is 55 mm and length of brake core ends is 250 mm.
[4] Length of core ends: 300 mm. 4 M8 cable lugs and 4 M6 cable lugs are also included in the scope of supply of the cables.

Overview

MOTION-CONNECT DRIVE-CLiQ signal cable with IP20/IP67 connector

Signal cables are pre-assembled and are sold by the meter for the connection of a variety of components.

The following different types of cable are available:

- DRIVE-CLiQ signal cables
- MOTION-CONNECT DRIVE-CLiQ signal cables
- Pre-assembled MOTION-CONNECT signal cables

Type of delivery of pre-assembled signal cables

Pre-assembled signal cables can be ordered in units of 10 cm. Cables up to 30 kg or 100 m are supplied as coils; above this, they are supplied on drums.

Application

DRIVE-CLiQ signal cables without 24 V DC cores

are used to connect components with DRIVE-CLiQ connections which have a separate or external 24 V DC power supply, e.g. the SINUMERIK 828D and the SINAMICS S120 Combi Power Module.

MOTION-CONNECT DRIVE-CLiQ signal cables with 24 V DC cores

are used whenever components with DRIVE-CLiQ connections must meet high requirements such as mechanical stress and oil resistance, e.g. for a connection between Power Modules/Motor Modules and 1FK7/1PH8 motors with DRIVE-CLiQ interface.

MOTION-CONNECT DRIVE-CLiQ signal cables have 24 V DC cores.

MOTION-CONNECT signal cables

are used whenever motor encoders on motors without DRIVE-CLiQ interface are connected to Power Modules or Sensor Modules.

Technical specifications

DRIVE-CLiQ signal cables	DRIVE-CLiQ	DRIVE-CLiQ MOTION-CONNECT 500	DRIVE-CLiQ MOTION-CONNECT 800
	6FX2...-1DC..-....	6FX5...-.DC..-....	6FX8...-.DC..-....
Approvals, according to			
• cURus or UR/CSA[1)]	UL STYLE 2502/CSA-N.210.2-M90	UL STYLE 2502/CSA-N.210.2-M90	UL STYLE 2502/CSA-N.210.2-M90
• RoHS conformity	Yes	Yes	Yes
Rated voltage	30 V	30 V	30 V
Test voltage, rms	500 V	500 V	500 V
Operating temperature on the surface			
• Fixed installation	-20 … +80 °C	-20 … +80 °C	-20 … +80 °C
• Flexible installation	–	0 … 60 °C	-20 … +60 °C
Tensile stress, max.			
• Fixed installation	45 N/mm^2	80 N/mm^2	50 N/mm^2
• Flexible installation	–	30 N/mm^2	20 N/mm^2
Smallest bending radius			
• Fixed installation	50 mm	35 mm	35 mm
• Flexible installation	–	125 mm	75 mm

1) The UR-CSA File No. is printed on the cable jacket.

Technical specifications (continued)

DRIVE-CLiQ signal cables	DRIVE-CLiQ	DRIVE-CLiQ MOTION-CONNECT 500	DRIVE-CLiQ MOTION-CONNECT 800
	6FX2...-1DC..-....	6FX5...-.DC..-....	6FX8...-.DC..-....
Torsional stress	–	Absolute 30°/m	Absolute 30°/m
Bending	–	100000	10 million
Traversing velocity	–	30 m/min	180 m/min
Acceleration	–	2 m/s^2	5 m/s^2 (5 m) 10 m/s^2 (2.5 m)
Insulation material, incl. jacket	CFC/silicone-free	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815
Oil resistance	EN 60811-2-1	EN 60811-2-1 (mineral oil only)	EN 60811-2-1
Outer jacket	PVC	PVC	PUR, HD22.10 S2 (VDE 0282, Part 10)
	Gray RAL 7032	DESINA color green RAL 6018	DESINA color green RAL 6018
Flame-retardant	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

Signal cables	MOTION-CONNECT 500	MOTION-CONNECT 800
	6FX500.-.....-....	6FX800.-.....-....
Approvals, according to		
• cURus or UR/CSA[1)]	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90
• RoHS conformity	Yes	Yes
Rated voltage	30 V	30 V
Test voltage, rms	500 V	500 V
Operating temperature on the surface		
• Fixed installation	-20 … +80 °C	-50 … +80 °C
• Flexible installation	0 … 60 °C	-20 … +60 °C
Tensile stress, max.		
• Fixed installation	50 N/mm^2	50 N/mm^2
• Flexible installation	20 N/mm^2	20 N/mm^2
Smallest bending radius		
• Fixed installation	60 mm	60 mm
• Flexible installation	100 mm	100 mm
Torsional stress	Absolute 30°/m	Absolute 30°/m
Bending	2 million	10 million
Traversing velocity	180 m/min	180 m/min
Acceleration	5 m/s^2	5 m/s^2 (5 m) 10 m/s^2 (2.5 m)
Insulation material, incl. jacket	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815
Oil resistance	EN 60811-2-1 (mineral oil only)	EN 60811-2-1
Outer jacket	PVC	PUR, HD22.10 S2 (VDE 0282, Part 10)
	DESINA color green RAL 6018	DESINA color green RAL 6018
Flame-retardant	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

1) The UR-CSA File No. is printed on the cable jacket.

Selection and ordering data

Pre-assembled DRIVE-CLiQ signal cables without 24 V DC cores

Type	Length	D_{max}	Degree of protection Connector	**DRIVE-CLiQ signal cable** without 24 V DC cores
	m	mm		Order No.
Fixed lengths 	0.11		IP20/IP20	**6SL3060-4AB00-0AA0**
	0.16			**6SL3060-4AD00-0AA0**
	0.21			**6SL3060-4AF00-0AA0**
	0.26			**6SL3060-4AH00-0AA0**
	0.31			**6SL3060-4AK00-0AA0**
	0.36			**6SL3060-4AM00-0AA0**
	0.41			**6SL3060-4AP00-0AA0**
	0.60			**6SL3060-4AU00-0AA0**
	0.95			**6SL3060-4AA10-0AA0**
	1.20			**6SL3060-4AW00-0AA0**
	1.45			**6SL3060-4AF10-0AA0**
	2.80			**6SL3060-4AJ20-0AA0**
	5.00			**6SL3060-4AA50-0AA0**
To the meter 	max. 70	7.0	IP20/IP20	**6FX2002-1DC00-....**

Pre-assembled MOTION-CONNECT DRIVE-CLiQ signal cables with 24 V DC cores

Type	Application	Length, max.	D_{max}	Degree of protection Connector	**MOTION-CONNECT DRIVE-CLiQ signal cable** with 24 V DC cores
		m	mm		Order No.
To the meter 	For encoder systems with DRIVE-CLiQ, built into or onto 1FK7/1PH8 motors For connecting the motors to SINAMICS S120 Motor Modules	50	7.1	IP20/IP67	**6FX8002-2DC10-....**
		100	7.1	IP20/IP67	**6FX5002-2DC10-....**

Pre-assembled MOTION-CONNECT signal cables for motors with full-thread connector

Encoder system	Connection via	Length, max.	D_{max}	Degree of protection Connector	**MOTION-CONNECT signal cables**
		m	mm		Order No.
RS422 (TTL) incremental encoder 6FX2001-2					
• 5 V DC	Power Module	100	9.3	IP20/IP67	**6FX■002-2CR00-....**
• 24 V DC	Power Module	100	9.3	IP20/IP67	**6FX■002-2CD24-....**
sin/cos 1 V_{pp} incremental encoder 6FX2001-3	SMC20	50	9.3	IP20/IP67	**6FX■002-2CG00-....**
Signal cable for handwheel		3	6.7		**6FX8002-2BB01-1A..**

MOTION-CONNECT 500	**5**	
MOTION-CONNECT 800	**8**	
Length code		**....**

Length code

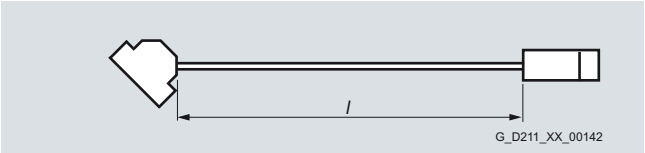
Overview

Description	Order No. supplement				
Length code for pre-assembled cables	**6FX....-.....-**	■	■	■	■
0 m		**1**			
100 m		**2**			
200 m		**3**			
0 m			**A**		
10 m			**B**		
20 m			**C**		
30 m			**D**		
40 m			**E**		
50 m			**F**		
60 m			**G**		
70 m			**H**		
80 m			**J**		
90 m			**K**		
0 m				**A**	
1 m				**B**	
2 m				**C**	
3 m				**D**	
4 m				**E**	
5 m				**F**	
6 m				**G**	
7 m				**H**	
8 m				**J**	
9 m				**K**	
0 m					**0**
0.1 m					**1**
0.2 m					**2**
0.3 m					**3**
0.4 m					**4**
0.5 m					**5**
0.6 m					**6**
0.7 m					**7**
0.8 m					**8**
Examples:	1.0 m :	1	A	B	0
	2.2 m :	1	A	C	2
	8.0 m :	1	A	J	0
	299.0 m :	3	K	K	0

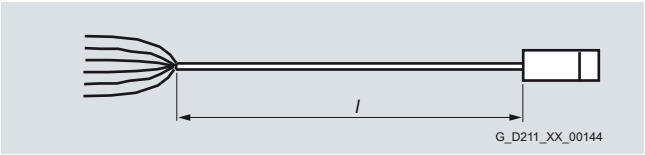
Description	Order No. supplement				
Length code for power and signal cables, sold by the meter[1)]	**6FX.008-.....-**	■	■	**A**	**0**
50 m		**1**	**F**		
100 m		**2**	**A**		
200 m		**3**	**A**		
500 m		**6**	**A**		

More information

Definition of lengths for pre-assembled cables



Signal cables



Power cables

Tolerances:

- Cable lengths up to 10 m: ± 2 %
- Cable lengths of 10 m and longer: ± 1 %

[1)] Note type of delivery.

Services and training

8

Material warranty and on-site service

Overview

Equipment package SINUMERIK 828D BASIC, SINAMICS S120 Combi, 1PH8 motor and 1FK7 motors

Material warranty and on-site service

For the SINUMERIK 828D BASIC T/BASIC M and the associated components[1] by Siemens Industry Sector, IA & DT, you will receive a material warranty and free on-site service of 24 months[2] after end user notification.

Benefits

You benefit because the warranty period does not commence until the machine has received the final acceptance from your customer. So none of the warranty period expires while your machine is being shipped or stored.

If required, the warranty and on-site service can be extended by 6 or 12 months.

Selection and ordering data

Description	Order No.
Warranty and on-site service extension by 6 or 12 months	**6FC8506-0RX0** ■ - ■ **AA2**
For SINUMERIK 828D BASIC T/BASIC M and the associated components by Siemens I IA&DT on machine tools for countries in country groups 1 to 3[3]	
• Number of measurement circuits[4]	
- 0 to 4	**1**
- 5	**2**
• Contract extension by 6 months	**6**
• Contract extension by 12 months	**1**

More information

Further information about the conditions and the scope of the repair service contract can be found at:

www.siemens.com/automation/rsc

[1] Not applicable to complete motor spindles.

[2] A maximum of 36 months from delivery ex works.

[3] The country list can be found at www.siemens.com/automation/rsc

[4] Physical axes and spindles count as measurement circuits.

Overview

Comprehensive documentation is available for the SINUMERIK 828D BASIC T/BASIC M CNC controls and the SINAMICS S120 Combi drive system. This documentation includes Operator's Guides, Programming Guides or Configuration Guides, as well as Installation Guides.

Information is available in the following formats:

- Paper version, printed copy
- PDF file available on the Internet as DOConWEB application with 'search all documents' function

www.siemens.com/automation/doconweb

You can find additional information on the Internet at:

www.siemens.com/motioncontrol/docu

Please send any queries or suggestions to:

docu.motioncontrol@siemens.com

Selection and ordering data

Description	Order No.
Specific documentation for SINUMERIK 828D/SINAMICS S120	
Equipment Manual PPU SINUMERIK 828D	
• German	**6FC5397-2DP40-0AA0**
• English	**6FC5397-2DP40-0BA0**
• Korean	**6FC5397-2DP40-0LA0**
• Traditional Chinese	**6FC5397-2DP40-0MA0**
• Simplified Chinese	**6FC5397-2DP40-0RA0**
Commissioning Manual SINUMERIK 828D Turning and Milling	
• German	**6FC5397-3DP40-0AA0**
• English	**6FC5397-3DP40-0BA0**
• Korean	**6FC5397-3DP40-0LA0**
• Traditional Chinese	**6FC5397-3DP40-0MA0**
• Simplified Chinese	**6FC5397-3DP40-0RA0**
Service Manual SINUMERIK 828D	
• German	**6FC5397-5DP20-0AA0**
• English	**6FC5397-5DP20-0BA0**
• Italian	**6FC5397-5DP20-0CA0**
• French	**6FC5397-5DP20-0DA0**
• Spanish	**6FC5397-5DP20-0EA0**
• Portuguese	**6FC5397-5DP20-0KA0**
• Korean	**6FC5397-5DP20-0LA0**
• Traditional Chinese	**6FC5397-5DP20-0MA0**
• Simplified Chinese	**6FC5397-5DP20-0RA0**
Parameter Manual SINUMERIK 828D	
• German	**6FC5397-8DP40-0AA0**
• English	**6FC5397-8DP40-0BA0**
• Simplified Chinese	**6FC5397-8DP40-0RA0**

Selection and ordering data (continued)

Description	Order No.
Specific documentation for SINUMERIK 828D/SINAMICS S120	
Diagnostics Manual SINUMERIK 828D/ SINAMICS S120	
• German	**6FC5398-8BP40-0AA0**
• English	**6FC5398-8BP40-0BA0**
• Italian	**6FC5398-8BP40-0CA0**
• French	**6FC5398-8BP40-0DA0**
• Spanish	**6FC5398-8BP40-0EA0**
• Portuguese	**6FC5398-8BP40-0KA0**
• Simplified Chinese	**6FC5398-8BP40-0RA0**
Parameter Manual Machine Data and Interface Signals SINUMERIK 828D/SINAMICS S120	
• German	**6FC5397-4DP40-0AA0**
• English	**6FC5397-4DP40-0BA0**
Specific documentation for SINAMICS S120 Combi	
Manual SINAMICS S120 Combi	
• German	**6SL3097-4AV00-0AP0**
• English	**6SL3097-4AV00-0BP0**
• Simplified Chinese	**6SL3097-4AV00-0RP0**

Selection and ordering data (continued)

Description	Order No.
General documentation for SINUMERIK 828D	
Operating Manual SINUMERIK 840D sl/828D Turning	
• German	**6FC5398-8CP40-0AA0**
• English	**6FC5398-8CP40-0BA0**
• Italian	**6FC5398-8CP40-0CA0**
• French	**6FC5398-8CP40-0DA0**
• Spanish	**6FC5398-8CP40-0EA0**
• Portuguese	**6FC5398-8CP40-0KA0**
• Korean	**6FC5398-8CP40-0LA0**
• Traditional Chinese	**6FC5398-8CP40-0MA0**
• Simplified Chinese	**6FC5398-8CP40-0RA0**
Operating Manual SINUMERIK 840D sl/828D Milling	
• German	**6FC5398-7CP40-0AA0**
• English	**6FC5398-7CP40-0BA0**
• Italian	**6FC5398-7CP40-0CA0**
• French	**6FC5398-7CP40-0DA0**
• Spanish	**6FC5398-7CP40-0EA0**
• Portuguese	**6FC5398-7CP40-0KA0**
• Korean	**6FC5398-7CP40-0LA0**
• Traditional Chinese	**6FC5398-7CP40-0MA0**
• Simplified Chinese	**6FC5398-7CP40-0RA0**
Programming Manual Fundamentals SINUMERIK 840D sl/828D	
• German	**6FC5398-1BP40-0AA0**
• English	**6FC5398-1BP40-0BA0**
• Italian	**6FC5398-1BP40-0CA0**
• French	**6FC5398-1BP40-0DA0**
• Spanish	**6FC5398-1BP40-0EA0**
• Portuguese	**6FC5398-1BP40-0KA0**
• Korean	**6FC5398-1BP40-0LA0**
• Traditional Chinese	**6FC5398-1BP40-0MA0**
• Simplified Chinese	**6FC5398-1BP40-0RA0**
Programming Manual Job Planning SINUMERIK 840D sl/828D	
• German	**6FC5398-2BP40-0AA0**
• English	**6FC5398-2BP40-0BA0**
• Italian	**6FC5398-2BP40-0CA0**
• French	**6FC5398-2BP40-0DA0**
• Spanish	**6FC5398-2BP40-0EA0**
• Portuguese	**6FC5398-2BP40-0KA0**
• Korean	**6FC5398-2BP40-0LA0**
• Traditional Chinese	**6FC5398-2BP40-0MA0**
• Simplified Chinese	**6FC5398-2BP40-0RA0**

Description	Order No.
General documentation for SINUMERIK 828D	
Programming Manual ISO Turning SINUMERIK 840D sl/840Di sl/ 828D/802D sl	
• German	**6FC5398-5BP10-1AA0**
• English	**6FC5398-5BP10-1BA0**
• Italian	**6FC5398-5BP10-1CA0**
• French	**6FC5398-5BP10-1DA0**
• Spanish	**6FC5398-5BP10-1EA0**
• Portuguese	**6FC5398-5BP10-1KA0**
• Korean	**6FC5398-5BP10-1LA0**
• Traditional Chinese	**6FC5398-5BP10-1MA0**
• Simplified Chinese	**6FC5398-5BP10-1RA0**
Programming Manual ISO Milling SINUMERIK 840D sl/840Di sl/ 828D/802D sl	
• German	**6FC5398-7BP10-1AA0**
• English	**6FC5398-7BP10-1BA0**
• Italian	**6FC5398-7BP10-1CA0**
• French	**6FC5398-7BP10-1DA0**
• Spanish	**6FC5398-7BP10-1EA0**
• Portuguese	**6FC5398-7BP10-1KA0**
• Korean	**6FC5398-7BP10-1LA0**
• Traditional Chinese	**6FC5398-7BP10-1MA0**
• Simplified Chinese	**6FC5398-7BP10-1RA0**
Programming Manual Measuring cycles SINUMERIK 840D sl	
• German	**6FC5398-4BP20-2AA0**
• English	**6FC5398-4BP20-2BA0**
• Italian	**6FC5398-4BP20-2CA0**
• French	**6FC5398-4BP20-2DA0**
• Spanish	**6FC5398-4BP20-2EA0**
• Korean	**6FC5398-4BP20-2LA0**
• Traditional Chinese	**6FC5398-4BP20-2MA0**
• Simplified Chinese	**6FC5398-4BP20-2RA0**
Function Manual Basic Functions	
• German	**6FC5397-0BP40-0AA0**
• English	**6FC5397-0BP40-0BA0**
Function Manual Extended Functions	
• German	**6FC5397-1BP40-0AA0**
• English	**6FC5397-1BP40-0BA0**
Function Manual ISO Dialects	
• German	**6FC5397-7BP10-1AA0**
• English	**6FC5397-7BP10-1BA0**
SIMATIC NET GPRS/GSM Modem SINAUT MD720-3 System Manual	On product CD in scope of supply of modem
• English/German	
SIMATIC NET Quad-Band GSM Antenna SINAUT 794-4MR Operating Instructions	On product CD in scope of supply of modem
• English/German	

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Faster and more applicable know-how: Hands-on training from the manufacturer

SITRAIN – the Siemens Training for Automation and Industrial Solutions – provides you with comprehensive support in solving your tasks.

Training by the market leader in automation and plant engineering enables you to make independent decisions with confidence. Especially where the optimum and efficient use of products and plants are concerned. You can eliminate deficiencies in existing plants, and exclude expensive faulty planning right from the beginning.

First-class know-how directly pays for itself: In shorter startup times, high-quality end products, faster troubleshooting and reduced downtimes. In other words, increased profits and lower costs.

Achieve more with SITRAIN

- Shorter times for startup, maintenance and servicing
- Optimized production operations
- Reliable configuration and startup
- Minimization of plant downtimes
- Flexible plant adaptation to market requirements
- Compliance with quality standards in production
- Increased employee satisfaction and motivation
- Shorter familiarization times following changes in technology and staff

Contact

Visit our site on the Internet at:

www.siemens.com/sitrain

or let us advise you personally.

SITRAIN Customer Support Germany:

Phone: +49 (0) 911 / 895 7575

Fax: +49 (0) 911 / 895 7576

E-Mail: info@sitrain.com

SITRAIN highlights

Top trainers

Our trainers are skilled teachers with direct practical experience. Course developers have close contact with product development, and directly pass on their knowledge to the trainers.

Practical experience

The practical experience of our trainers enables them to teach theory effectively. But since theory can be pretty drab, we attach great importance to practical exercises which can comprise up to half of of the course time. You can therefore immediately implement your new knowledge in practice. We train you on state-of-the-art methodically/didactically designed training equipment. This training approach will give you all the confidence you need.

Wide variety

With a total of about 300 local attendance courses, we train the complete range of Siemens Industry products as well as interaction of the products in systems.

Tailor-made training

We are only a short distance away. You can find us at more than 50 locations in Germany, and in 62 countries worldwide. You wish to have individual training instead of one of our 300 courses? Our solution: We will provide a program tailored exactly to your personal requirements. Training can be carried out in our Training Centers or at your company.

The right mixture: Blended learning

"Blended learning" means a combination of various training media and sequences. For example, a local attendance course in a Training Center can be optimally supplemented by a teach-yourself program as preparation or follow-up. Additional effect: Reduced traveling costs and periods of absence.

SinuTrain for SINUMERIK Operate

Overview

SinuTrain for SINUMERIK Operate is a PC-based CNC training/programming software package. SinuTrain for SINUMERIK Operate enables completely identical operator control and CNC programming as on SINUMERIK CNC systems that are equipped with graphical user interface SINUMERIK Operate.

SinuTrain for SINUMERIK Operate can be used for the following applications:

- Self-study or professional training of SINUMERIK operation and CNC programming
- Offline CNC program creation and simulation
- Professional presentation of SINUMERIK operation and CNC programming

To allow you to experience the advantages of using SinuTrain for SINUMERIK Operate, we can provide a trial version for 60 days. The trial version can be ordered on DVD-ROM for a nominal charge, or downloaded free of charge from the Internet.

Benefits

- User-friendly, control-identical simulation of operation and CNC programming of SINUMERIK controls on the PC
- Maximum compatibility thanks to integrated original SINUMERIK CNC software
- Accurate simulation of machine operation with inexpensive virtual machine control panel
- State-of-the-art fully graphical CNC user interface with moving picture sequences for clarification of technological sequences (Animated Elements)
- Optimum training software with a wide CNC programming spectrum – from ISO and CNC high-level language to fully graphical machining step programming
- High process safety through realistic graphical CNC simulation – including multi-channel machining operations

Function

Technologies

SinuTrain for SINUMERIK Operate can be used for the following machining technologies:

- Milling
  (SinuTrain ShopMill and SinuTrain complete package)
- Turning
  (SinuTrain ShopTurn and SinuTrain complete package)
- Other technologies[1)] and multi-channel capability
  (SinuTrain complete package)

Adaptation to the machine

CNC programs created with SinuTrain for SINUMERIK Operate can be used on real machines. However, this requires SinuTrain to be adapted to the SINUMERIK configuration of the machine. This adaptation can be made either by the user with the configuration tool or by a Siemens service specialist. To allow operation of a larger array of machinery, several different configurations can be stored in SinuTrain for SINUMERIK Operate. In order to ensure maximum compatibility with different SINUMERIK software versions on the machine, multiple copies of SinuTrain for SINUMERIK Operate can be installed in the relevant software versions on one PC.

Accurate simulation of real operator control on the machine

With its fully-fledged, virtual machine control panel, SinuTrain for SINUMERIK Operate offers functions such as CNC Start, CNC Stop or feedrate and spindle override and can therefore be operated just like a real machine.

Online help

Like a SINUMERIK CNC, SinuTrain for SINUMERIK Operate also offers a comprehensive online help. In addition, the SinuTrain DVD-ROM includes training manuals for the self-study of SINUMERIK operating and programming procedures.

Programming, simulation and printing

- DIN/ISO programming with programGUIDE
- ShopMill/ShopTurn machining step programming
- Multi-channel programming with programSYNC
  (SinuTrain complete package only)
- Fully-fledged graphical CNC simulation
- TCP/IP Ethernet networking with machines
- Print function for DIN/ISO and ShopMill/ShopTurn machining step programs
- Integrated CAD reader for importing DXF files

1) For other technologies, consultation with the relevant machine manufacturer is recommended to ensure that the software can be optimally adapted to the CNC of the machine.

Integration

SinuTrain for SINUMERIK Operate can be used for:

- SINUMERIK 828D BASIC T
- SINUMERIK 828D BASIC M
- SINUMERIK 828D from CNC software release 4.3
- SINUMERIK 840D sl from CNC software release 2.6 SP1

Preconditions:

Hardware

- PC with 1.5 GHz processor (single core)
- RAM: 1 GB
- Hard disk: 2 GB of free memory space
- DVD drive for installation from DVD
- Graphics card: Minimum resolution 640 × 480 pixels
- USB interface
- Mouse, keyboard
- Training keyboard (optional)

Software

- Operating system Windows XP SP3 32-bit Professional/ Home Edition
  (operating system Windows 7 32/64-bit (available soon)
- Adobe Acrobat Reader

Selection and ordering data

Description	Order No.
SinuTrain for SINUMERIK Operate for SINUMERIK 828D/840D sl	
On DVD-ROM Languages: Simplified Chinese, English, French, German, Italian, Spanish	
• SinuTrain trial version for 60 days Specific software version	**6FC5870-0YC2■-■YA0**
SinuTrain ShopMill	
On DVD-ROM Languages: Simplified Chinese, English, French, German, Italian, Spanish	
• Single-user license Specific software version	**6FC5870-2YC2■-■YA0**
• Classroom license Specific software version	**6FC5870-6YC2■-■YA0**
SinuTrain ShopTurn	
On DVD-ROM Languages: Simplified Chinese, English, French, German, Italian, Spanish	
• Single-user license Specific software version	**6FC5870-3YC2■-■YA0**
• Classroom license Specific software version	**6FC5870-7YC2■-■YA0**

Example of specific software version SINUMERIK 828D 4.3:
6FC5870-0YC2**0**-**0**YA0

More information

The first steps in working with SINUMERIK Operate can be learned quickly and easily through a web-based training program.

You can download a free trial version of SinuTrain for SINUMERIK Operate from the Internet.

You can find additional information on the Internet at:

www.cnc4you.siemens.com

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SINUMERIK 828D BASIC T/BASIC M training cases

Overview

SINUMERIK 828D BASIC T training case

The training cases for SINUMERIK 828D BASIC T and SINUMERIK 828D BASIC M are used to provide practical training in operation, programming, commissioning and servicing.

Design

SINUMERIK 828D BASIC training case

- SINUMERIK 828D BASIC T PPU 241.2 or SINUMERIK 828D BASIC M PPU 241.2 including system software and software options
- SINUMERIK MCP 483 PN machine control panel
- SINUMERIK PP 72/48D 2/2A PN I/O module
- SINAUT MD720-3 GSM/GPRS modem including antenna

The SINUMERIK 828D BASIC T/BASIC M training cases are designed for table set-up and can be operated independently without a SINAMICS S120 Combi training rack.

Technical specifications

SINUMERIK 828D BASIC T/BASIC M training case 6AG1067-1AA24-0AA0/6AG1067-1AA20-0AA0	
Supply voltage	230 V AC
Degree of protection to DIN VDE 0470 Part 1/ EN 60529/IEC 60529	IP00
Ambient temperature	
• Storage/Transport	-20 ... +60 °C
• Operation	5 ... 40 °C
Dimensions (W × H × D)	650 × 500 × 250 mm
Weight, approx.	23 kg

Selection and ordering data

Description	Order No.
SINUMERIK 828D BASIC T training case	**6AG1067-1AA24-0AA0**
SINUMERIK 828D BASIC M training case	**6AG1067-1AA20-0AA0**

SINAMICS S120 Combi training rack

Overview

SINAMICS S120 Combi training rack

The SINAMICS S120 Combi training rack is used in conjunction with the training cases SINUMERIK 828D BASIC T or SINUMERIK 828D BASIC M to provide practical training in operation, programming and commissioning.

Design

SINAMICS S120 Combi training rack

- SINAMICS S120 Combi Power Module 16 kW, 18 A/9 A/5 A/5 A
- SINAMICS S120 Booksize Compact Motor Module 9 A
- Line filter and line reactor
- 1PH8 spindle motor with 2.8 kW
- 4 feed motors 1FK7 with 0.85 Nm

The SINAMICS S120 Combi training rack is designed as a standing device on rollers and can be operated only in conjunction with the SINUMERIK 828D BASIC T or SINUMERIK 828D BASIC M training cases.

Technical specifications

SINAMICS S120 Combi training rack 6AG1067-1AA21-0AA0	
Supply voltage	380 ... 480 V 3 AC
Degree of protection to DIN VDE 0470 Part 1/ EN 60529/IEC 60529	IP00
Ambient temperature	
• Storage/Transport	-20 ... +60 °C
• Operation	5 ... 40 °C
Dimensions (W × H × D)	615 × 1150 × 615 mm
Weight, approx.	120 kg

Selection and ordering data

Description	Order No.
SINAMICS S120 Combi training rack	**6AG1067-1AA21-0AA0**

Overview

The following drives and controls can be engineered in a user-friendly fashion using the SIZER configuration tool:

- SINAMICS Low Voltage, MICROMASTER 4, DYNAVERT T, SIMATIC ET 200S FC and SIMATIC ET 200pro FC drive systems
- Motor starters for network configuring
- SINUMERIK CNC control
- SIMOTION Motion Control System
- SIMATIC Technology

It provides support when setting up the technologies involved in the hardware and firmware components required for a drive task. SIZER supports the complete configuration of the drive system, from simple individual drives to complex multi-axis applications.

SIZER supports all of the configuring steps in a workflow:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring the drive components
- Compiling the required accessories
- Selecting the line-side and motor-side power options, e.g. cables, filters, and reactors

When SIZER was being designed, particular importance was placed on a high degree of usability and a universal, function-based approach to the drive application. The extensive user guidance makes using the tool easy. Status information keeps you continually informed about the progress of the configuration process.

The drive configuration is saved in a project. In the project, the components and functions used are displayed in a hierarchical tree structure.

The project view permits the configuration of drive systems and the copying/inserting/modifying of drives already configured.

Overview (continued)

The configuration process produces the following results:

- A parts list of the required components (export to Excel, use of the Excel data sheet for import to SAP)
- Technical specifications of the system
- Characteristic curves
- Comments on system reactions
- Mounting arrangement of drive and control components and dimension drawings of motors

These results are displayed in a results tree and can be reused for documentation purposes.

Technological online help is available:

- Detailed technical data
- Information about the drive systems and their components
- Decision-making criteria for the selection of components
- Online help in German, English, French, Italian, Chinese and Japanese

Minimum system requirements

- PG or PC with Pentium III 500 MHz (Windows XP)
- 512 MB RAM (1024 MB RAM recommended)
- At least 4.1 GB of free hard disk space
- An additional 100 MB of free hard disk space on Windows system drive
- Screen resolution 1024 × 768 pixels
- Windows XP Professional SP2 / XP Home Edition SP2 / Windows Vista Business
- Microsoft Internet Explorer 5.5 SP2

Selection and ordering data

Description	Order No.
SIZER configuration tool For SINAMICS and MICROMASTER on DVD-ROM Languages: English, French, German, Italian	**6SL3070-0AA00-0AG0**

More information

The SIZER configuration tool is available free of charge on the Internet at:

www.siemens.com/sizer

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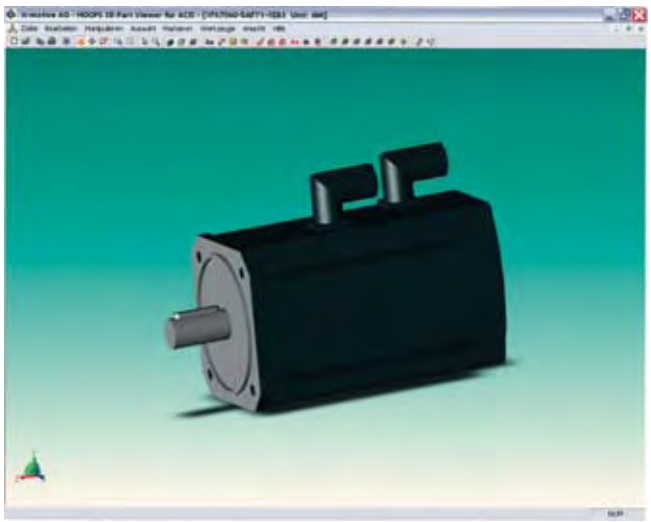
CAD CREATOR

Overview

CAD CREATOR – Dimension drawing and 2D/3D CAD generator



Thanks to the user-friendly operator interface of the CAD CREATOR, it is easy to configure controls, drives and motors. With the support of the CAD CREATOR, product-specific dimension drawings and 2D/3D CAD models can be created quickly. The CAD CREATOR assists the machine manufacturer's designers, offer drafting engineers and project engineers.

Benefits

- Provision of dimension drawings as 2D/3D CAD models in mm and inches
- Display of CAD models and dimension drawings by integrated viewers
- Support for all general geometry interfaces STEP, IGES, Parasolid, SAT, VDA, and for special interfaces such as Ideas, NX, Solid Edge, Pro/Engineer, Autocad, Inventor, Mechanical Desktop, Catia and Solidworks
- Multilingual operator interface in English, French, German, Italian and Spanish
- Dimension drawings and 2D/3D CAD models for
  - Motors
    - 1FT6/1FT7/1FK7 synchronous motors
    - 1FE1 built-in synchronous motors
    - 1FW3 torque motors
    - 1FW6 built-in torque motors
    - 1FT6/1FT7/1FK7/1FK7 DYA geared motors
    - 1PH8 synchronous/asynchronous motors
    - 1PH7/1PH4/1PL6/1PM4/1PM6 asynchronous motors
    - 2SP1 motor spindles
    - 1FN3 linear motors
  - SINAMICS S120
    - Control Units
    - Power Modules (Booksize/Chassis)
    - Line Modules (Booksize/Chassis)
    - Line-side components
    - Motor Modules (Booksize/Chassis)
    - DC link components
    - Supplementary system components
    - Load-side power components
    - Encoder system connection
    - Connection system MOTION-CONNECT
  - SINUMERIK
    - CNC controls
    - Operator components for CNC controls
  - SIMOTION
    - SIMOTION D
    - SIMOTION C

The CAD CREATOR offers a variety of options for configuring, as well as different methods for searching for a product:

- According to order number
- According to technical description

After successful configuration of the product, the dimension drawings (2D/3D CAD models) are displayed with the integrated viewers and made available for export.

Selection and ordering data

Description	Order No.
CAD CREATOR Dimension drawing and 2D/3D CAD generator on DVD-ROM Languages: English, French, German, Italian, Spanish	**6SL3075-0AA00-0AG0**

More information

The CAD CREATOR is available on DVD-ROM and as an Internet application.

You can find additional information on the Internet at:

www.siemens.com/cadcreator

Quick Packages

Overview

Quick Packages are predefined packages for standard turning and milling machines which comprise drive and motors.
Quick Packages are optimally tailored to the mechanical properties of standard turning and milling machines, comprising the SINAMICS S120 Combi drive system, 1FK7 feed motors and 1PH8 spindle motors.
Depending upon the machine model, a SINUMERIK 828D BASIC T/BASIC M CNC as well as the accessories listed in this catalog are added to the Quick Package.

Benefits

- Optimally matched components for turning and milling machines
- Drive packages suggested by Siemens mechatronics specialists
- Simple and fast dimensioning of the SINAMICS S120 Combi drive system
- Optimized logistics chain thanks to reduced variance

Configuration

Determining the package number using the subsequent package overview

- Technology selection: Turning or milling
- Selection of the drive configuration based on the electrical characteristics of the feed and spindle motors on the basis of the package overview
- Based on the characteristics of the 1FK7 feed motors, the corresponding row is selected in the package overview: With or without brake
- Based on the characteristics of the 1PH8 spindle motor, the corresponding row is selected in the package overview: Type of construction IM B3 or IM B5
- The appropriate SINAMICS S120 Combi drive system as well as the number required to order the package can be found at the intersection between the row and column. The package number must be stated in the order.

Selection of the CNC and additional components from this catalog

- Selection of the CNC variant: Horizontal or vertical
- Addition of system software on CF card and any CNC options
- Addition of the MOTION-CONNECT connection system
- Addition of other accessories

For easier selection of the CNC system and additional components, use of the SIZER configuring tool is recommended.

Example for ordering a Quick Package for milling machines:

1. Choose motors for feed, e.g. 11 Nm/16 Nm/ 16 Nm, with holding brake, in the package overview.	1FK7063-2AF71-1RH1 1FK7083-2AC71-1RH1 1FK7083-2AC71-1RH1
2. Choose motor for spindle, e.g. 7 kW, type of construction IM B3, in the package overview.	1PH8105-1DF00-0LA1
3. Find SINAMICS S120 Combi drive system in the package overview.	6SL3111-4VE21-6EA0
4. Use SIZER to determine the complete configuration including the motor selection from step 1 and step 2. During the configuration, verify whether the drive system corresponds to step 3.	
5. Find package number in the package overview and specify this together with the parts list in the order.	QMB3140407

Motor versions for Quick Packages

1FK7 feed motors

- Compact or High Inertia
- 20 bit absolute encoder + 12 bit multi-turn (encoder AM20DQI)
- DE shaft extension: Plain shaft
- Shaft and flange accuracy: Tolerance N
- Holding brake: With or without
- Degree of protection IP65
- Paint finish: Anthracite RAL 7016

1PH8 spindle motors for turning machines

- 22 bit incremental encoder with commutation position 11 bit (encoder IC22DQ)
- Cooling: Forced ventilation from DE to NDE
- Type of construction: IM B3 or IM B5
- DE shaft extension: Plain shaft
- Bearing version: Standard
- Vibration magnitude: Grade S/A
- Shaft and flange accuracy: Tolerance R
- Cable connection: Terminal box top/cable entry from right/ signal connection DE

1PH8 spindle motors for milling machines

- 1PH808: 20 bit incremental encoder without commutation position (encoder IN20DQ)
- 1PH810/1PH813: 22 bit incremental encoder + commutation position 11 bit (encoder IC22DQ)
- Cooling: Forced ventilation from DE to NDE
- Type of construction: IM B3 or IM B5
- DE shaft extension: Plain shaft
- Bearing version: Performance
- Vibration magnitude: Grade SPECIAL/B
- Shaft and flange accuracy: Tolerance SPECIAL
- Cable connection: Terminal box top/cable entry from right/ signal connection DE

Package overview

Feed motors

CT Compact
HI High Inertia

Axis 1				Axis 2			
Static torque M_0	Rated speed n_{rated}			Static torque M_0	Rated speed n_{rated}		
Nm	rpm	Type	Order No.	Nm	rpm	Type	Order No.
6	3000	HI	1FK7060-3BF71-1R.1	6	3000	CT	1FK7060-2AF71-1R.1
6	3000	CT	1FK7060-2AF71-1R.1	6	3000	CT	1FK7060-2AF71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	8	3000	CT	1FK7080-2AF71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	CT	1FK7080-2AF71-1R.1
8	3000	CT	1FK7080-2AF71-1R.1	8	3000	CT	1FK7080-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1

Spindle motors

Rated power P_{rated}	Static torque M_0	Rated current for S1 duty I_{rated}	Rated speed n_{rated}	
kW	Nm	A	rpm	Order No.
3.7	21	11.6	2000	1PH8083-1DG0.-0CA1
4.8	27	17.3	3000	1PH8087-1DM0.-0CA1
5.5	38	13.5	1500	1PH8103-1DF0.-0CA1
7	52	17.5	1500	1PH8105-1DF0.-0CA1
9	63	23.5	1500	1PH8107-1DF0.-0CA1
11	96	24	1500	1PH8131-1DF0.-0CA1
12	128	30	1000	1PH8133-1DD0.-0CA1

1FK7...-...71-1R■1

G Without holding brake
H With holding brake

1PH8...-1..0 ■-0CA1

0 Type of construction IM B3
2 Type of construction IM B5

Quick Packages for turning machines including SINAMICS S120 Combi Power Module for 3 axes

Package No.						
QTB2120004	QTB2120005	QTB2120006	QTB2120007			
QTB2020004	QTB2020005	QTB2020006	QTB2020007			
QTB2125004	QTB2125005	QTB2125006	QTB2125007			
		QTB2130006	QTB2130007			
		QTB2131006	QTB2131007			
				QTB2140009	QTB2140001	QTB2140002
QTB2625004	QTB2625005	QTB2625006	QTB2625007			
QTB2525004	QTB2525005	QTB2525006	QTB2525007			
		QTB2630006	QTB2630007			
			QTB2635007	QTB2635009	QTB2635001	
		QTB3030006	QTB3030007			
		QTB3131006	QTB3131007	QTB3131009	QTB3131001	QTB3131002
				QTB3135009	QTB3135001	QTB3135002
				QTB3140009	QTB3140001	QTB3140002
				QTB3151009	QTB3151001	QTB3151002
				QTB4040009	QTB4040001	QTB4040002

SINAMICS S120 Combi Power Modules for 3 axes

- 6SL3111-3VE21-6FA0
- 6SL3111-3VE21-6EA0
- 6SL3111-3VE22-0HA0

Package overview

Feed motors

CT Compact
HI High Inertia

Axis 1				Axis 2				Axis 3			
Static torque M_0	Rated speed n_{rated}			Static torque M_0	Rated speed n_{rated}			Static torque M_0	Rated speed n_{rated}		
Nm	rpm	Type	Order No.	Nm	rpm	Type	Order No.	Nm	rpm	Type	Order No.
6	3000	HI	1FK7060-3BF71-1R.1	6	3000	HI	1FK7060-3BF71-1R.1	8	3000	CT	1FK7080-2AF71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	6	3000	HI	1FK7060-3BF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	6	3000	HI	1FK7060-3BF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
6	3000	HI	1FK7060-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	8	3000	CT	1FK7080-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	16	3000	CT	1FK7083-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	18	3000	CT	1FK7100-2AF71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	8	3000	HI	1FK7062-3BF71-1R.1	27	2000	CT	1FK7101-2AC71-1R.1
8	3000	HI	1FK7062-3BF71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1
11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
11	2000	CT	1FK7063-2AC71-1R.1	11	2000	CT	1FK7063-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	16	3000	CT	1FK7083-2AF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	18	3000	CT	1FK7100-2AF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	20	2000	CT	1FK7084-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	20	3000	CT	1FK7084-2AF71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	11	3000	CT	1FK7063-2AF71-1R.1	27	2000	CT	1FK7101-2AC71-1R.1
11	3000	CT	1FK7063-2AF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1

Spindle motors

Rated power P_{rated}	Static torque M_0	Rated current for S1 duty I_{rated}	Rated speed n_{rated}	
kW	Nm	A	rpm	Order No.
3.7	21	11.6	2000	1PH8083-1UG0.-0LA1
4.8	27	17.3	3000	1PH8087-1UM0.-0LA1
5.5	38	13.5	1500	1PH8103-1DF0.-0LA1
7	52	17.5	1500	1PH8105-1DF0.-0LA1
9	63	23.5	1500	1PH8107-1DF0.-0LA1
11	96	24	1500	1PH8131-1DF0.-0LA1
12	128	30	1000	1PH8133-1DD0.-0LA1

1FK7...-...71-1R■1

G Without holding brake
H With holding brake

1PH8...-1..0 ■-0LA1

0 Type of construction IM B3
2 Type of construction IM B5

Quick Packages for milling machines including SINAMICS S120 Combi Power Module for 4 axes

Package No.						
QMB2121254	QMB2121255	QMB2121256	QMB2121257	QMB2121259		
QMB2121314	QMB2121315	QMB2121316	QMB2121317	QMB2121319		
QMB2121404	QMB2121405	QMB2121406	QMB2121407	QMB2121409		
QMB2126314	QMB2126315	QMB2126316	QMB2126317	QMB2126319		
QMB2626254	QMB2626255	QMB2626256	QMB2626257	QMB2626259		
QMB2626314	QMB2626315	QMB2626316	QMB2626317	QMB2626319		
QMB2626354	QMB2626355	QMB2626356	QMB2626357	QMB2626359		
QMB2626404	QMB2626405	QMB2626406	QMB2626407	QMB2626409		
				QMB2626419	QMB2626411	QMB2626412
				QMB2626459	QMB2626451	QMB2626452
				QMB2626559	QMB2626551	QMB2626552
QMB2630354	QMB2630355	QMB2630356	QMB2630357	QMB2630359		
QMB3030304	QMB3030305	QMB3030306	QMB3030307	QMB3030309		
QMB3030314	QMB3030315	QMB3030316	QMB3030317	QMB3030319		
QMB3030354	QMB3030355	QMB3030356	QMB3030357	QMB3030359		
QMB3030404	QMB3030405	QMB3030406	QMB3030407	QMB3030409		
QMB3131314	QMB3131315	QMB3131316	QMB3131317	QMB3131319	QMB3131311	
		QMB3131406	QMB3131407	QMB3131409	QMB3131401	
		QMB3131416	QMB3131417	QMB3131419	QMB3131411	QMB3131412
				QMB3131459	QMB3131451	QMB3131452
			QMB3131507	QMB3131509	QMB3131501	
				QMB3131529	QMB3131521	QMB3131522
				QMB3131559	QMB3131551	QMB3131552
			QMB3140407	QMB3140409	QMB3140401	

SINAMICS S120 Combi Power Modules for 4 axes

- 6SL3111-4VE21-6FA0
- 6SL3111-4VE21-6EA0
- 6SL3111-4VE22-0HA0

Milling machines

Package overview

Feed motors

CT Compact
HI High Inertia

Axis 1				Axis 2				Axis 3			
Static torque	Rated speed			Static torque	Rated speed			Static torque	Rated speed		
M_0	n_{rated}			M_0	n_{rated}			M_0	n_{rated}		
Nm	rpm	Type	Order No.	Nm	rpm	Type	Order No.	Nm	rpm	Type	Order No.
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	16	3000	CT	1FK7083-2AF71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	18	3000	CT	1FK7100-2AF71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	20	2000	CT	1FK7084-2AC71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	20	3000	CT	1FK7084-2AF71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	12	3000	HI	1FK7081-3BF71-1R.1	27	2000	CT	1FK7101-2AC71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	20	2000	CT	1FK7084-2AC71-1R.1
12	3000	HI	1FK7081-3BF71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	20	3000	CT	1FK7084-2AF71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	16	3000	CT	1FK7083-2AF71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	18	3000	CT	1FK7100-2AF71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	20	2000	CT	1FK7084-2AC71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	20	3000	CT	1FK7084-2AF71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	16	2000	CT	1FK7083-2AC71-1R.1	27	2000	CT	1FK7101-2AC71-1R.1
16	2000	CT	1FK7083-2AC71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1
20	2000	HI	1FK7084-3BC71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	20	2000	CT	1FK7084-2AC71-1R.1
20	2000	HI	1FK7084-3BC71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	20	3000	CT	1FK7084-2AF71-1R.1
20	2000	HI	1FK7084-3BC71-1R.1	20	2000	HI	1FK7084-3BC71-1R.1	27	2000	CT	1FK7101-2AC71-1R.1

Spindle motors

Rated power	Static torque	Rated current for S1 duty	Rated speed	
P_{rated}	M_0	I_{rated}	n_{rated}	
kW	Nm	A	rpm	Order No.
7	52	17.5	1500	1PH8105-1DF0.-0LA1
9	63	23.5	1500	1PH8107-1DF0.-0LA1
11	96	24	1500	1PH8131-1DF0.-0LA1
12	128	30	1000	1PH8133-1DD0.-0LA1

1FK7...-...71-1R■1

G Without holding brake
H With holding brake

1PH8...-1..0 ■-0LA1

0 Type of construction IM B3
2 Type of construction IM B5

Quick Packages for milling machines including SINAMICS S120 Combi Power Module for 4 axes

Package No.				
QMB3535357	QMB3535359	QMB3535351		
QMB3535407	QMB3535409	QMB3535401		
	QMB3535419	QMB3535411		QMB3535412
	QMB3535459	QMB3535451		QMB3535452
QMB3535507	QMB3535509	QMB3535501		
	QMB3535529	QMB3535521		QMB3535522
	QMB3535559	QMB3535551		QMB3535552
QMB3551507	QMB3551509	QMB3551501		
	QMB3551529	QMB3551521		QMB3551522
QMB4040407	QMB4040409	QMB4040401		
	QMB4040419	QMB4040411		QMB4040412
	QMB4040459	QMB4040451		QMB4040452
QMB4040507	QMB4040509	QMB4040501		
	QMB4040529	QMB4040521		QMB4040522
	QMB4040559	QMB4040551		QMB4040552
QMB4051517	QMB4051519	QMB4051511		
QMB5151507	QMB5151509	QMB5151501		
	QMB5151529	QMB4051521		QMB5151522
	QMB5151559	QMB5151551		QMB5151552

SINAMICS S120 Combi Power Modules for 4 axes

6SL3111-4VE21-6EA0

6SL3111-4VE22-0HA0

Notes

Appendix

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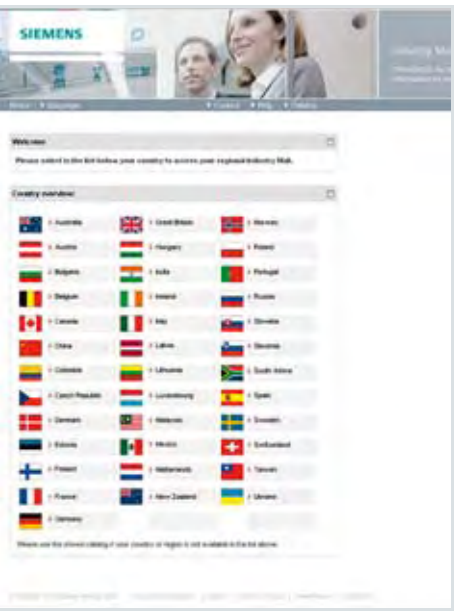

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Many products in this catalog are in compliance with UL/CSA requirements and are labeled with the appropriate certification markings.

All certifications, certificates, declarations of conformance, test certificates, e.g. CE, UL, Safety Integrated have been performed with the associated system components as they are described in the Catalogs and Configuration Manuals.

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Independent public testing institution in North America

Approval marks:

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- **cUL** for end products, tested by UL in accordance with CSA standard
- **cULus** for end products, tested by UL in accordance with UL and CSA standards
- **UR** for mounting parts in end products, tested by UL in accordance with UL standard
- **cUR** for mounting parts in end products, tested by UL in accordance with CSA standard
- **cURus** for mounting parts in end-products, tested by UL in accordance with UL and CSA standards

Test standards:

- SINUMERIK: Standard UL 508
- SINAMICS: Standard UL 508C
- Motors: Standard UL 547

Product category/File No.:

- SINUMERIK: E164110
- SINAMICS: E192450
- Motors: E93429

TUV: TUV Rheinland of North America Inc.
Independent public testing institution in North America
National recognized testing laboratory (NRTL)

Approval mark:

- **cTUVus** tested by TUV in accordance with UL and CSA standards

CSA: Canadian Standards Association
Independent public testing institution in Canada

Approval mark:

- **CSA** tested by CSA in accordance with CSA standard

Test standard:

- Standard CAN/CSA-C22.2/No. 0-M91/No. 14-05/No. 142-M1987

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- Rental license
- Trial license
- Factory license

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- Upgrade

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A separate upgrade must be purchased for each original license of the software to be upgraded.

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Order
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Delivery
When a software update service is ordered, you will be sent the contractual conditions of this service and the price is due for payment. At the same time, you will be included in a delivery list for the software product to be updated. If Siemens releases a new software version for the corresponding software product for general sale (function version or product version), it will be delivered automatically to the goods recipient specified in the delivery address within the contract period.

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Appendix
Conversion tables

Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in^2	lb-ft^2	lb-in-s^2	lb-ft-s^2 slug-ft^2	kg-cm^2	kg-cm-s^2	gm-cm^2	gm-cm-s^2	oz-in^2	oz-in-s^2
lb-in^2	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^{3}	2.984	16	4.14×10^{-2}
lb-ft^2	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^{5}	429.71	2304	5.967
lb-in-s^2	386.08	2.681	1	8.33×10^{-2}	1.129×10^{3}	1.152	1.129×10^{6}	1.152×10^{3}	6.177×10^{3}	16
lb-ft-s^2 slug-ft^2	4.63×10^{3}	32.17	12	1	1.35×10^{4}	13.825	1.355×10^{7}	1.38×10^{4}	7.41×10^{4}	192
kg-cm^2	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.41×10^{-2}
kg-cm-s^2	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^{5}	1000	5.36×10^{3}	13.887
gm-cm^2	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s^2	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in^2	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s^2	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^{4}	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	kg-cm	kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^{3}	1.129×10^{6}
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^{4}	1.355×10^{7}
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^{4}
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^{4}	1×10^{7}
kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^{5}
kg-m	86.796	7.233	1.388×10^{3}	9.806	100	1	1×10^{5}	9.806×10^{7}
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	inches	feet	cm	yd	mm	m
inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Power (to convert from A to B, multiply by entry in table)

A \ B	HP	Watts
HP (English)	1	745.7
(lb-in) (deg./s)	2.645×10^{-6}	1.972×10^{-3}
(lb-in) (rpm)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft) (deg./s)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft) (rpm)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^{5}	4.4482
oz	0.0625	1	28.35	2.780×10^{4}	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	980.7	1	0.00001
N	0.22481	3.5967	N.A.	100000	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	kg	slug
lb	1	16	453.6	0.4536	0.0311
oz	6.25×10^{-2}	1	28.35	0.02835	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-2}	1	10^{-3}	6.852×10^{-5}
kg	2.205	35.27	10^{3}	1	6.852×10^{-2}
slug	32.17	514.8	1.459×10^{4}	14.59	1

Rotation (to convert from A to B, multiply by entry in table)

A \ B	rpm	rad/s	degrees/s
rpm	1	0.105	6.0
rad/s	9.55	1	57.30
degrees/s	0.167	1.745×10^{-2}	1

Temperature Conversion

°F	°C	°C	°F
0	–17.8	–10	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $^5/_9$		multiply by $^9/_5$ and add 32	

Mechanism Efficiencies

Acme-screw with brass nut	~0.35–0.65
Acme-screw with plastic nut	~0.50–0.85
Ball-screw	~0.85–0.95
Chain and sprocket	~0.95–0.98
Preloaded ball-screw	~0.75–0.85
Spur or bevel-gears	~0.90
Timing belts	~0.96–0.98
Worm gears	~0.45–0.85
Helical gear (1 reduction)	~0.92

Friction Coefficients

Materials	μ
Steel on steel (greased)	~0.15
Plastic on steel	~0.15–0.25
Copper on steel	~0.30
Brass on steel	~0.35
Aluminum on steel	~0.45
Steel on steel	~0.58

Mechanism	μ
Ball bushings	<0.001
Linear bearings	<0.001
Dove-tail slides	~0.2++
Gibb ways	~0.5++

Material Densities

Material	lb-in^3	gm-cm^3
Aluminum	0.096	2.66
Brass	0.299	8.30
Bronze	0.295	8.17
Copper	0.322	8.91
Hard wood	0.029	0.80
Soft wood	0.018	0.48
Plastic	0.040	1.11
Glass	0.079–0.090	2.2–2.5
Titanium	0.163	4.51
Paper	0.025–0.043	0.7–1.2
Polyvinyl chloride	0.047–0.050	1.3–1.4
Rubber	0.033–0.036	0.92–0.99
Silicone rubber, without filler	0.043	1.2
Cast iron, gray	0.274	7.6
Steel	0.280	7.75

Wire Gauges[1)]

Cross-section mm^2	Standard Wire Gauge (SWG)	American Wire Gauge (AWG)
0.2	25	24
0.3	23	22
0.5	21	20
0.75	20	19
1.0	19	18
1.5	17	16
2.5	15	13
4	13	11
6	12	9
10	9	7
16	7	6
25	5	3
35	3	2
50	0	1/0
70	000	2/0
95	00000	3/0
120	0000000	4/0
150	–	6/0
185	–	7/0

1) The table shows approximate SWG/AWG sizes nearest to standard metric sizes; the cross-sections do not match exactly.

Explanation of the metal factor

Surcharges will be added to the prices of products that contain silver, copper, aluminum, lead and/or gold if the respective basic official prices for these metals are exceeded.

The surcharges will be determined based on the following criteria:

- Official price of the metal
- Official price on the day prior to receipt of the order or prior to the release order (=daily price) for
  - silver (sale price of the processed material),
  - gold (sale price of the processed material)

  Source: Umicore, Hanau
  www.metalsmanagement.umicore.com

  and for
  - copper (low DEL notation + 1 %),
  - aluminum (aluminum in cables) and
  - lead (lead in cables)

  Source: German Trade Association for Cables and Conductors
  www.kabelverband.org
- Metal factor of the products
- Certain products are assigned a metal factor. The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used (weight or percentage method). An exact explanation is given below.

Structure of the metal factor

The metal factor consists of several digits; the first digit indicates whether the method of calculation refers to the list price or a discounted price (customer net price)
(L = list price / N = customer net price).

The remaining digits indicate the method of calculation used for the respective metal. If no surcharge is added, a "-" is used.

1st digit	List or customer net price using the percentage method
2nd digit	for silver (AG)
3rd digit	for copper (CU)
4th digit	for aluminum (AL)
5th digit	for lead (PB)
6th digit	for gold (AU)

Weight method

The weight method uses the basic official price, the daily price and the raw material weight. In order to calculate the surcharge, the basic official price must be subtracted from the daily price. The result is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (2 to 9) of the respective digit of the metal factor. The raw material weight can be found in the respective product descriptions.

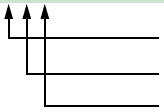
Percentage method

Use of the percentage method is indicated by the letters A-Z at the respective digit of the metal factor.

The surcharge is increased - dependent on the deviation of the daily price compared with the basic official price - using the percentage method in "steps" and consequently offers surcharges that remain constant within the framework of this "step range". A higher percentage rate is charged for each new step. The respective percentage level can be found in the table below.

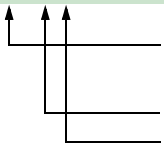
Metal factor examples

L E A – – –



Basis for % surcharge: List price
Silver: basis 150 €, step range 50 €, 0.5 %
Copper: basis 150 €, step range 50 €, 0.1 %
No surcharge for aluminum
No surcharge for lead
No surcharge for gold

N – A 6 – –



Basis for % surcharge: Customer net price
No surcharge for silver
Copper: basis 150 €, step range 50 €, 0.1 %
Aluminum acc. to weight, basic offic. price 225 €
No surcharge for lead
No surcharge for gold

– – 3 – – –

No basis necessary
No surcharge for silver
Copper acc. to weight, basic official price150 €
No surcharge for aluminum
No surcharge for lead
No surcharge for gold

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Values of the metal factor

Percentage method	Basic official price	Step range	% surcharge 1st step	% surcharge 2nd step	% surcharge 3rd step	% surcharge 4th step	% surcharge per additional step
			Official price 151 € – 200 €	Official price 201 € – 250 €	Official price 251 € – 300 €	Official price 301 € – 350 €	
A	150	50	0.1	0.2	0.3	0.4	0.1
B	150	50	0.2	0.4	0.6	0.8	0.2
C	150	50	0.3	0.6	0.9	1.2	0.3
D	150	50	0.4	0.8	1.2	1.6	0.4
E	150	50	0.5	1.0	1.5	2.0	0.5
F	150	50	0.6	1.2	1.8	2.4	0.6
H	150	50	1.2	2.4	3.6	4.8	1.2
J	150	50	1.8	3.6	5.4	7.2	1.8
			176 € – 225 €	226 € – 275 €	276 € – 325 €	326 € – 375 €	
O	175	50	0.1	0.2	0.3	0.4	0.1
P	175	50	0.2	0.4	0.6	0.8	0.2
R	175	50	0.5	1.0	1.5	2.0	0.5
			226 € – 275 €	276 € – 325 €	326 € – 375 €	376 € – 425 €	
S	225	50	0.2	0.4	0.6	0.8	0.2
U	225	50	1.0	2.0	3.0	4.0	1.0
V	225	50	1.0	1.5	2.0	3.0	1.0
W	225	50	1.2	2.5	3.5	4.5	1.0
			151 € – 175 €	176 € – 200 €	201 € – 225 €	226 € – 250 €	
Y	150	25	0.3	0.6	0.9	1.2	0.3
			401 € – 425 €	426 € – 450 €	451 € – 475 €	476 € – 500 €	
Z	400	25	0.1	0.2	0.3	0.4	0.1
	Price basis (1st digit)						
L	Charged on the list price						
N	Charged on the customer net price or discounted list price						

Weight method	Basic official price	
2	100	Calculation based on raw material weight
3	150	
4	175	
5	200	
6	225	
7	300	
8	400	
9	555	
Misc.		
-	No metal surcharge	

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