



sinumerik 802D sl



SIEMENS

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SINUMERIK & SINAMICS NC 61
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¹⁾ Language: German.

²⁾ Languages: German/English.

SINUMERIK 802D sl

Catalog NC 802D sl · 2007



Supersedes:
Catalog NC 802D sl · 2006

The products contained in this catalog
can also be found in the
e-Catalog CA 01

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Detailed information on motors, SINAMICS and MOTION-CONNECT connection system can be found in Catalog NC 61.

Siemens Automation and Drives. Welcome

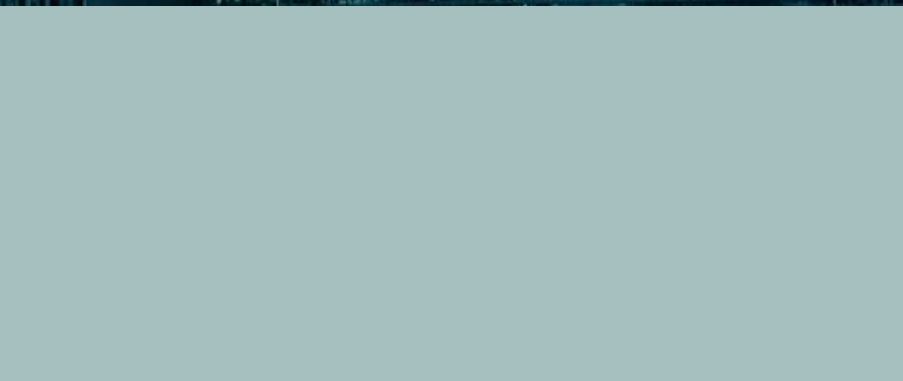
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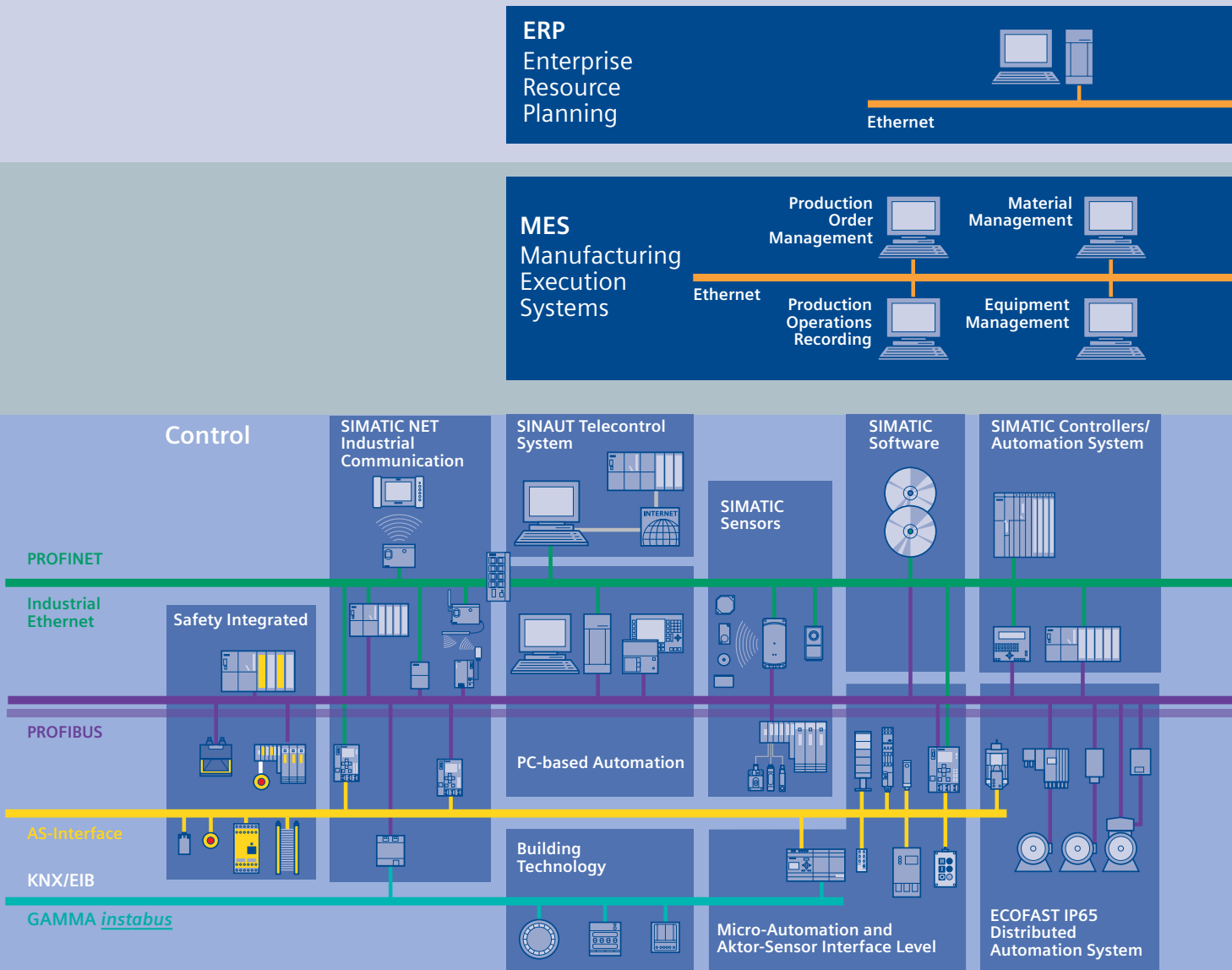




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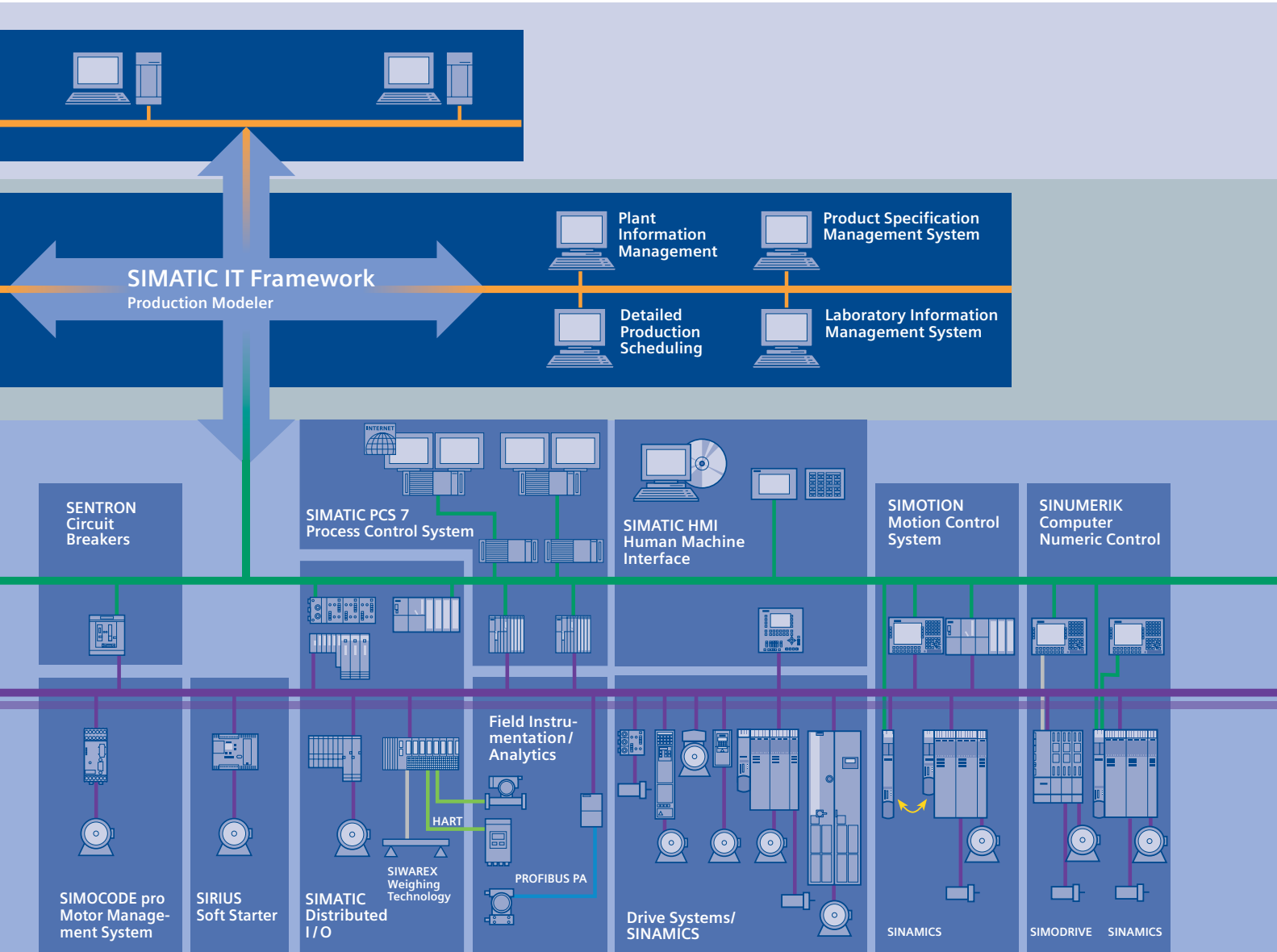
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Topology

SINUMERIK 802D sl



DRIVE-CLiQ – the digital interface between all components

All components of the SINUMERIK 802D sl and SINAMICS S120 systems, as well as the motors and encoders, are now interconnected via a shared serial interface DRIVE-CLiQ. A standardized connector system reduces the multiplicity of connection components and eases stockkeeping. Cable connections are simpler and easier to install.

Integrated closed-loop control

With the closed-loop control for up to 6 drives that is now integrated in the control system, the SINUMERIK 802D sl is forging a new path. It is no longer necessary to exchange data between the CNC and drive control in order to implement motion control tasks. This is now performed directly as an internal cross-drive function, saving the time and effort previously required to configure the connections. An ever increasing number of tasks relating to the drive can be solved directly in the control, making the start-up process even easier.



SIZER PC tool – Intelligent configuration of SINUMERIK solution line and SINAMICS components

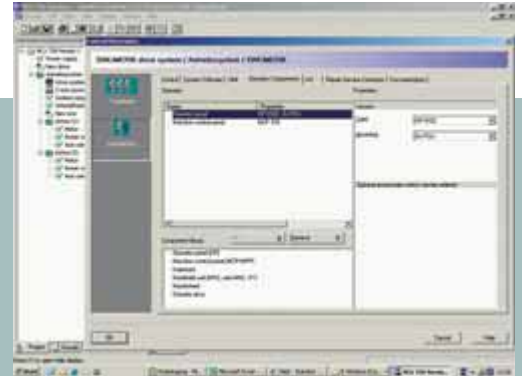
The SIZER PC tool facilitates the configuration of the SINAMICS drive family and SINUMERIK solution line CNC control. The SIZER assists in the technical dimensioning of the hardware and software components required for a drive and control task.

SIZER supports all of the engineering steps in a workflow:

- Configuration of the line supply
- Motor and gearbox dimensioning including calculation of mechanical transmission elements
- Configuration of the drive components
- Selection of the line-side and motor-side power options (e. g. cables, filters, reactors)
- Selection of the CNC control
- Selection of the operator components
- Selection of HMI software
- Selection of the required accessories

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

The SIZER user interface is available in English and German.



The drive and control configuration is stored in a project. The components and functions used are displayed in a tree structure illustrating their assignment.

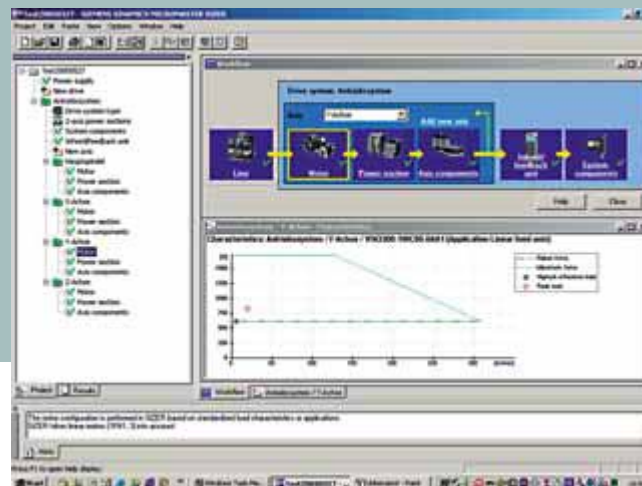
The configuration process produces the following results:

- A parts list of the components required
- Technical specifications of the system
- Characteristics
- Location diagram of the drive and control components and dimension drawings of the motor

These results are displayed in a results tree and can be printed out.

User support is provided by technological online help, which provides the following information:

- Detailed technical specifications
- Information about the drives, the CNC control and associated components
- Decision-making criteria for the selection of components
- Online help in English and German



CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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Control structure/application

		T/M value	T/M plus	T/M pro	G/N plus	G/N pro
Panel-based design		●	●	●	●	●
Drives	See Drive System					
• SINAMICS S120 in booksize format linked via DRIVE-CLiQ		●	●	●	●	●
Channels/mode groups (MGs)		1	1	1	1	1
• Maximum configuration		1	1	1	1	1
CNC <u>main</u> memory (buffered) for programs and data in MB		0.5	1	3	1	3
CNC <u>main</u> memory, maximum configuration in MB		0.5	1	3	1	3
CNC memory, expansion with CF card		●	●	●	●	●
Axes/spindles		● 3)	● 1)	● 1)	● 4)	● 4)
• Maximum configuration of axes		4	5	5	5	5
• Maximum configuration of spindles		1	2	2	2	2
• Maximum configuration of axes and spindles		4	5	5	5	5
• Configuration per channel axes incl. spindles		4	5	5	5	5
PLC-controlled axis		–	1	1	1	1

Measuring systems that can be connected

		T/M value	T/M plus	T/M pro	G/N plus	G/N pro
Max. number		2	2	2	2	2
Incremental rotary measuring systems with RS 422 (TTL)		● 2)	● 2)	● 2)	● 2)	● 2)
Linear scale LMS with sin/cos 1 V _{pp}		●	●	●	●	●
• via SINAMICS Sensor Module SMC						
Linear scale LMS with distance-coded reference marks		–	–	–	–	–
• via SINAMICS Sensor Module SMC						
Linear scale LMS with EnDat		●	●	●	●	●
• via SINAMICS Sensor Module SMC						
Rotary measuring systems with distance-coded reference marks		–	–	–	–	–
• via SINAMICS Sensor Module SMC						
Absolute encoder connection with EnDat		●	●	●	●	●
• via SINAMICS Sensor Module SMC						
Absolute/incremental encoder installed in 1FK7		●	●	●	●	●
• integrated in motor via SINAMICS S120 + Sensor Module						
Incremental encoder with sin/cos 1 V _{pp}		●	●	●	●	●
• via SINAMICS Sensor Module SMC						
Resolver integrated in 1FK7		–	–	–	–	–
• via SINAMICS S120 with Sensor Module SMC/motor-integrated						

1) 4 axes + 1 spindle or 3 axes + 1 spindle + 2nd spindle for rotating tool and one additional PLC axis.

2) SINAMICS Sensor Module SMC required for max. one measuring system (spindle).

3) 3 axes + 1 spindle.

4) N = 5 axes, no spindle; G = 4 (3) axes, 1 (2) spindle(s) and one additional PLC axis each.

CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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CNC functionality: Program functions

Dynamic preprocessing memory (FIFO) ¹⁾	●	●	●	●	●
Look ahead	20	50	100	50	100
Frame system	●	●	●	●	●

CNC functionality: Axis functions

Feedrate override of 0 ... 200%	●	●	●	●	●
Traversing range 9 decades (display: 999999999)	●	●	●	●	●
Rotary axis, turning endlessly	–	●	●	●	●
Velocity, max. 300 m/s	●	●	●	●	●
Acceleration with jerk limitation	–	●	●	●	●
Programmable acceleration	●	●	●	●	●
Follow-up mode	●	●	●	●	●
Separate path feed for corners and chamfers	●	●	●	●	●
Traversing to fixed stop	–	●	●	●	●

CNC functionality: Spindle functions

Analog spindle speed	● 2)	● 2)	● 2)	● 2)	● 2)
Digital spindle speed	●	●	●	●	●
Spindle speed, max. programmable value range (display: 999999999.9)	●	●	●	●	●
Spindle override of 0 ... 200%	●	●	●	●	●
5 gear stages	●	●	●	●	●
Automatic gear stage selection	●	●	●	●	●
Oriented spindle stop	●	●	●	●	●
Spindle speed limitation (min. and max.)	●	●	●	●	●
Constant cutting rate	●	●	●	●	●
Spindle control via PLC (positioning, reciprocation)	●	●	●	–	–
Thread cutting with constant or variable pitch	●	●	●	–	–
Tapping with compensating chuck/rigid tapping	●	●	●	–	–

CNC functionality: Interpolations

Linear interpolation axes	● 3	● 4	● 4	● 4	● 4
● Maximum	3	4	4	4	4
Circle via center point and end point	●	●	●	●	●
Circle via interpolation point	●	●	●	●	●
Helical interpolation	2D+1	2D+2	2D+2	–	–

¹⁾ Cannot be changed.

²⁾ With ADI4 or MCPA module.

CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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CNC functionality: Transformations

TRANSMIT/peripheral surface transformation	–	●	●	–	–
Inclined axis	–	–	–	●	●

CNC functionality: Measuring

Measuring stage 1	–	●	●	●	●
1 probe (touch trigger)	–	●	●	●	●

CNC functionality: Motion-synchronous actions

High-speed CNC inputs/outputs	–	8	8	8	8
• Digital inputs (on-board)	–	8	8	8	8
• Digital inputs or outputs (on-board)	–	8	8	8	8

CNC programming: Language

Programming language (DIN 66025 and high-level language expansion)	●	●	●	●	●
Subroutine levels and interrupt routines, max.	8/0	8/0	8/0	8/0	8/0
Number of subroutine repetitions ≤ 9999	●	●	●	●	●
Number of levels for skippable blocks (/0 to /...)	1	1	1	1	1
Polar coordinates	●	●	●	●	●
1/2/3-point contours	●	●	●	–	–
Dimensions metric/inch, changeover manually or via program	●	●	●	●	●
Auxiliary function output	●	●	●	●	●
• Via M word, max. programmable value range: INT $2^{31} - 1$	●	●	●	●	●
• Via H word, max. programmable value range: REAL $\pm 3.4028 \times 10^{38}$ (display: ± 999999999.9999) INT -2^{31} to $2^{31} - 1$	–	●	●	●	●
High-level language CNC with	●	●	●	●	●
• Predefined user variables (arithmetic parameters)	●	●	●	●	●
• Indirect programming	●	●	●	●	●
• Program jumps and branches	●	●	●	●	●
• Arithmetic and trigonometric functions	●	●	●	●	●
• Comparing operations and logic combinations	●	●	●	●	●
• Control structures IF-ELSE-ENDIF	●	●	●	●	●
Online ISO dialect interpreter	●	●	●	–	–
Program/workpiece management	●	●	●	●	●
• On supplementary CF card	●	●	●	●	●
• On network drive	–	–	●	–	●
• Number of part programs on NC, max.	99	99	99	99	99

CNC programming: Cycles

Process-oriented cycles for drilling/milling and turning	●	●	●	–	–
Technology cycles for grinding (external cylindrical)	–	–	–	●	●
Access protection for cycles	●	●	●	●	●

CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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CNC programming: Programming support

Program editor					
• Text editor with editing functions: Select, copy, delete, ...	●	●	●	●	●
Programming support for geometry entries					
• Geometry processor with programming graphics/ Free contour input (contour calculator)	–	●	●	–	–
• Screens for 1/2/3-point contours	●	–	–	–	–
Programming support for cycles					
• Screens and stationary auxiliary displays (e. g. customer cycles)	○ 1)	○ 1)	○ 1)	○ 1)	○ 1)
• Programming support expandable (e.g. "custom" displays)	○ 1)	○ 1)	○ 1)	○ 1)	○ 1)

Parameters

Number of basic frames, max.		1	1	1	1	1
Number of settable offsets, max.		6	6	6	6	6
Scratching, determining zero offset		●	●	●	●	●

Simulation

Drilling/milling (toolholder vertical to the workpiece)					
• Single-sided 2D view, dynamic	●	●	●	–	–
Turning (toolholder vertical to the workpiece)					
• Traverse path simulation without model (broken-line graphics)	●	●	●	–	–
Grinding					
• Traverse path simulation (broken-line graphics)	–	–	–	●	●
Nibbling					
• Traverse path simulation with tool form (broken-line graphics)	–	–	–	●	●

Operating modes

JOG					
• Handwheel selection	●	●	●	●	●
• Inch/metric changeover	●	●	●	●	●
• Manual measurement of zero offset	●	●	●	–	–
• Manual measurement of tool offset	●	●	●	–	–
• Automatic tool measurement	●	●	●	–	–
• Dressing of the grinding wheels	–	–	–	●	●
• Reference point approach, automatic/via CNC program	●	●	●	●	●
MDA					
• Input in text editor	●	●	●	●	●
• Save MDA program	●	●	●	●	●
Automatic					
• Execute from internal memory and/or CF card	●	●	●	●	●
• Execute from RS 232 C interface	–	–	–	–	–
• Execute from network drive	–	–	●	–	●
• Program control	●	●	●	●	●
• Program editing	●	●	●	●	●
• Block search with/without calculation	●	●	●	●	●

1) On request.

CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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Operating modes (continued)

Teach In		●	●	●	–	–
• Teach positions in MDA buffer, loadable		●	●	●	–	–
REPOS (repositioning)		●	●	●	●	●
• With operator command/semi-automatically		–	–	–	–	–
• Program-controlled		●	●	●	●	●

Tools

Tool types						
• Turning		●	●	●	–	–
• Drilling/milling		●	●	●	–	–
• Grinding		–	–	–	●	●
• Nibbling		–	–	–	●	●
Tool radius compensations in plane						
• With transition circle/ellipse on outer edges		●	●	●	–	–
Tool change via T number		●	●	●	●	●
Operation <u>without</u> tool management						
• Editing of tool data		●	●	●	●	●
• Tool offset selection via T and D numbers		●	●	●	●	●
• Number of tools		32	64	128	64	128
• Cutting edges in tool list		32	64	128	64	128
Monitoring of tool life and workpiece count		–	●	●	–	–

Communication and data management

Serial interfaces RS 232 C		●	●	●	●	●
Ethernet connection		–	–	●	–	●
I/O interfacing via PROFIBUS DP		●	●	●	●	●
Save data to internal memory and/or CF card		●	●	●	●	●
Save data via RS 232 C interface		●	●	●	●	●
Save data to network drive (Ethernet)		–	–	●	–	●

Operation

SINUMERIK 802D sl operator panel, 10.4", color	See CNC control	●	●	●	●	●
Handheld units						
• Mini handheld unit with coiled connecting cable	6FX2007-1AD02	○	○	○	○	○
• Mini handheld unit with straight connecting cable	6FX2007-1AD12	○	○	○	○	○
Machine control panels						
• MCP machine control panel	6FC5603-0AD00-0AA2	○	○	○	○	○
• MCP 802D sl machine control panel ¹⁾	6FC5303-0AF30-1AA0	○	○	○	○	○
• Machine Control Panel analog, MCPA module for MCP 802D sl	6FC5312-0DA01-0AA0	○	○	○	○	○

¹⁾ MCPA module is required.

CNC control

Overview of functions

	Order No.	SINUMERIK 802D sl				
		T/M value	T/M plus	T/M pro	G/N plus	G/N pro

- Standard (basic functionality)
- Option
- Not available

Operation (continued)

Connection of electronic handwheels		2	2	2	2	2
• with 120 mm x 120 mm front panel, 5 V operating voltage	6FC9320-5DB01	○	○	○	○	○
• with 76 mm x 76 mm front panel, 5 V operating voltage	6FC9320-5DC01	○	○	○	○	○
Keyboards						
• Full CNC keyboard 802D sl, horizontal format	6FC5303-0DM13-1AA0	○	○	○	○	○
• Full CNC keyboard 802D sl, vertical format	6FC5303-0DT12-1AA0	○	○	○	○	○
CNC program messages		●	●	●	●	●
Online help for programming, alarms and machine data (expandable)		●	●	●	●	●
Access protection, 8 levels		●	●	●	●	●
Operating software languages						
• 2 languages switchable online		●	●	●	●	●
• Chinese Simplified, Chinese Traditional, English, German, Korean		●	●	●	●	●
• Czech, Dutch, Finnish, French, Hungarian, Italian, Polish, Portuguese (Braz.), Russian, Spanish		●	●	●	●	●

Axis monitoring

Working area limitation		●	●	●	●	●
Software and hardware limit switch monitoring		●	●	●	●	●
Position monitoring		●	●	●	●	●
Stoppage monitoring		●	●	●	●	●
Clamping monitoring		●	●	●	●	●
Contour monitoring		●	●	●	●	●
Clamp protection for nibbling		–	–	–	●	●

Compensations

Backlash compensation		●	●	●	●	●
Leadscrew error compensation		●	●	●	●	●
Measuring system error compensation		●	●	●	●	●
Feedforward control, speed-dependent		–	–	●	–	●
Friction compensation		●	●	●	●	●

CNC control

Overview of functions

- Standard (basic functionality)
- Option
- Not available

Order No.

SINUMERIK 802D sl

T/M value	T/M plus	T/M pro	G/N plus	G/N pro
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PLC area

SIMATIC S7-200 integrated		●	●	●	●	●
Machining time, typically in ms/KI for bit operations ¹⁾		0.1	0.1	0.1	0.1	0.1
Machining time, typically in ms/KI for word operations ¹⁾		0.2	0.2	0.2	0.2	0.2
Ladder steps memory configuration		4000	6000	6000	6000	6000
• LAD ladder diagram		●	●	●	●	●
PLC programming tool, PLC program examples, standard machine data and alarm text editor on Toolbox		●	●	●	●	●
PP 72/48 I/O module, max. number	6FC5611-0CA01-0AA0	○ 3	○ 3	○ 3	○ 3	○ 3
ADI 4 (Analog Drive Interface for 4 Axes)	6FC5211-0BA01-0AA2	○	○	○	○	○
Digital inputs, max.		216	216	216	216	216
Digital outputs, max.		144	144	144	144	144
Bit memories, max. number		2048	3072	3072	3072	3072
Timers, max. number		40	40	64	40	64
Counters, max. number		32	32	64	32	64
Subroutines		64	64	64	64	64

Monitoring functions

Spindle speed limitation		●	●	●	●	●
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Commissioning

Commissioning software integrated for SINAMICS S120 drive system		●	●	●	●	●
Series commissioning via a serial interface		●	●	●	●	●
Series commissioning via CF card		●	●	●	●	●
PLC library (PLC templates)		●	●	●	●	●
Starter commissioning tool for SINAMICS	6SL3072-0AA00-0AG0	●	●	●	●	●

Diagnostic functions

Alarms and messages		●	●	●	●	●
Action log can be activated for diagnostic purposes		● 2)	● 2)	● 2)	● 2)	● 2)
PLC status		●	●	●	●	●
LAD display		●	●	●	●	●
PLC remote diagnostics via Ethernet on the control		–	–	● 3)	–	● 3)
RCS 802 PC license for each accessing PC (Remote Control System, remote diagnostics for SINUMERIK 802D sl)	6FC6000-6DA51-0AA0	–	–	○	–	○

¹⁾ 1 KI = 1024 instructions, corresponds to approx. 3 KB.

²⁾ Logbook for alarms/keys.

³⁾ RCS 802 required.

Overview



The SINUMERIK 802D sl is an operator panel control combining all the components of a CNC (NC, PLC, HMI) and drive control in a single unit. The full CNC keyboard (vertical or horizontal format) can be connected directly. The I/Os are operated via the PROFIBUS DP system.

The motors can be connected easily to the digital drives via DRIVE-CLiQ. In combination with the modular structure of the SINAMICS S120 drive system, this design is conceived to ensure easy and rugged installation with minimum wiring.

The performance range of the control is ideally suited to applications on standardized machine tools – from one-off production runs to industrial scale manufacture.

Benefits

- Easy operation thanks to DIN programming and ISO code
- High reliability
- Compact control with very simple, interference-immune wiring
- Components delivered for individual construction
- Comprehensive programming aids
- Digital drive technology via DRIVE-CLiQ
- Maintenance-free: no battery or fan
- Remote diagnostics via RCS 802 (pro version)
- Easy startup
- CF card for series startup and program memory/program execution

Function

- 6 digital drives (plus and pro versions)
4 digital drives (value version)
- One additional positioning axis (plus and pro versions)
- Turning, milling, nibbling or grinding can be freely selected
- A bipolar or a unipolar analog spindle can be used
- RS 232 C interface
- Ethernet onboard (pro version)
- Pre-assigned machine data
- Sample program and PLC library included in scope of supply
- Easy PLC (SIMATIC S7-200) with ladder programming
- 216 digital inputs and 144 digital outputs (0.25 A)
- User interface with cycle support for T/M and G (external cylindrical)

Integration

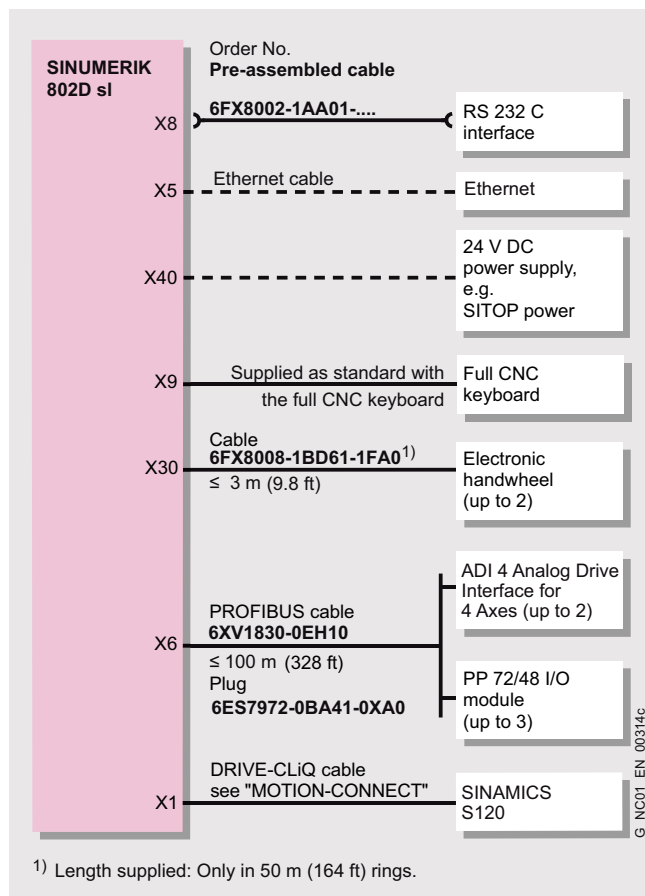
The following components can be connected to the SINUMERIK 802D sl:

- Full CNC keyboard (vertical or horizontal format)
- Up to 2 electronic handwheels
- One mini handheld unit (contains one handwheel)
- Up to 3 PP 72/48 I/O modules
- Up to 2 ADI 4 interface modules (Analog Drive Interface for 4 axes)
- One MCPA module for connecting an analog spindle via a ± 10 V interface
- One MCP machine control panel via a PP 72/48 I/O module or one MCP 802D sl machine control panel via the MCPA module
- SINAMICS S120 drive system via DRIVE-CLiQ

CNC control

SINUMERIK 802D sl

Integration (continued)



Connection overview for SINUMERIK 802D sl

Maximum permissible cable lengths (e.g. ≤ 25 m/82 ft) must be observed. Function faults can occur if longer cables are used.

Selection and Ordering Data

Designation	Order No.
Hardware components	
SINUMERIK 802D sl operator panel CNC (PCU) including logbook, toolbox and current system software	
• Version T/M value	6FC5370-0AA00-1AA0
• Version T/M plus	6FC5370-0AA00-2AA0
• Version T/M pro	6FC5370-0AA00-3AA0
• Version G/N plus	6FC5370-0AA00-2BA0
• Version G/N pro	6FC5370-0AA00-3BA0
Full CNC keyboard, vertical format for mounting on the side of the PCU incl. connecting cable Length: 1.5 m (4.92 ft)	6FC5303-0DT12-1AA0
Full CNC keyboard, horizontal format for mounting under the PCU incl. connecting cable Length: 1.5 m (4.92 ft)	6FC5303-0DM13-1AA0
Terminal strip converter 50-pole	6EP5406-5AA00
Cable set 6 m (19.69 ft) ribbon cable, 50-pole 8 insulation displacement connectors, 50-pole	6EP5306-5BG00
CompactFlash card for series startup and program memory/program execution	
• 512 Mbyte, empty	6FC5313-4AG00-0AA1
Software	
SINUMERIK 802D sl Toolbox T/M on CD-ROM incl.	6FC5810-0YC12-0YA8
• Cycles • Languages • Starter (stand alone) • PLC 802 programming tool • RCS 802 • PLC library • Adobe Reader	
SINUMERIK 802D sl Toolbox G/N on CD-ROM incl.	6FC5810-0YC11-0YA8
• Cycles for G version • Languages • Starter (stand alone) • PLC 802 programming tool • RCS 802 • PLC library • Adobe Reader	
SINUMERIK RCS 802 PC license on disk for enabling a PC for	6FC6000-6DA51-0AA0
• remote control • snap shots via Ethernet for the SINUMERIK 802D sl pro control	

Technical specifications

Order No.	6FC5370-0AA00-1AA0	6FC5370-0AA00-2AA0	6FC5370-0AA00-3AA0	6FC5370-0AA00-2BA0	6FC5370-0AA00-3BA0
Product name	SINUMERIK 802D sl T/M value	SINUMERIK 802D sl T/M plus	SINUMERIK 802D sl T/M pro	SINUMERIK 802D sl G/N plus	SINUMERIK 802D sl G/N pro
Input voltage	24 V DC				
Power consumption, max.	50 W				
Degree of protection to EN 60529 (IEC 60529)					
• Front	IP65				
• Rear	IP20				
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).				
Relative humidity					
• Storage	5 ... 95%				
• Transport	5 ... 95%				
• Operation	5 ... 95%				
Ambient temperature					
• Storage	-20 ... +60 °C (-4 ... +140 °F)				
• Transport	-20 ... +60 °C (-4 ... +140 °F)				
• Operation	0 ... 50 °C (+32 ... +122 °F)				
Dimensions					
• Width	310 mm (12.20 in)				
• Height	330 mm (12.99 in)				
• Depth	70 mm (2.76 in)				
Weight, approx.	4.9 kg (10.8 lb)				
Order No.	6FC5303-ODT12-1AA0		6FC5303-ODM13-1AA0		
Product name	SINUMERIK 802D sl, full CNC keyboard, for vertical mounting		SINUMERIK 802D sl, full CNC keyboard, for horizontal mounting		
Input voltage	Via the PCU				
Degree of protection to EN 60529 (IEC 60529)					
• Front	IP65				
• Rear	IP20				
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).				
Relative humidity					
• Storage	5 ... 95%				
• Transport	5 ... 95%				
• Operation	5 ... 95%				
Ambient temperature					
• Storage	-20 ... +60 °C (-4 ... +140 °F)				
• Transport	-20 ... +60 °C (-4 ... +140 °F)				
• Operation	0 ... 50 °C (+32 ... +122 °F)				
Dimensions					
• Width	172 mm (6.77 in)		310 mm (12.20 in)		
• Height	330 mm (12.99 in)		175 mm (6.89 in)		
• Depth	70 mm (2.76 in)		70 mm (2.76 in)		
Weight, approx.	0.8 kg (1.76 lb)				

CNC control

Operator components

MCP machine control panel

Overview



The MCP machine control panel for the SINUMERIK 802D controls offers a simple solution for machine tools. This panel includes all the keys required to operate the machine; these can be connected directly to the PP 72/48 I/O module by means of a ribbon cable. The connections are at the 24 V DC level for easier implementation.

Benefits

- Easily connected using ribbon cables and post links
- Suitable dimensions for the SINUMERIK 802D/802D sl controls
- Fully equipped with all the necessary function elements

Function

- 24 V DC supply level
- Can be adapted to applications by means of replaceable keys
- User-assignable keys with LED indicator
- Emergency stop button with NO and NC contact elements
- 2 override rotary switches for feedrate and spindle drive

Integration

The MCP machine control panel can be used with the following CNC systems:

- SINUMERIK 802D
- SINUMERIK 802D base line
- SINUMERIK 802D sl

Technical specifications

Order No.	6FC5603-0AD00-0AA2
Product name	MCP machine control panel vertical format
Input voltage	24 V DC
Power consumption, max.	5 W
Degree of protection to EN 60529 (IEC 60529)	
• Front	IP54
• Rear	IP00
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).
Relative humidity	
• Storage	5 ... 95%
• Transport	5 ... 95%
• Operation	5 ... 95%
Ambient temperature	
• Storage	-20 ... +60 °C (-4 ... +140 °F)
• Transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	0 ... 50 °C (+32 ... +122 °F)
Dimensions	
• Width	172 mm (6.77 in)
• Height	330 mm (12.99 in)
• Depth	70 mm (2.76 in)
Weight, approx.	0.7 kg (1.54 lb)

Selection and Ordering Data

Designation	Order No.
MCP machine control panel for SINUMERIK 802D controls	6FC5603-0AD00-0AA2
Accessories	
2nd switching element for emergency stop button with 2 contacts 1 NO + 1 NC, 2-pole screw terminal	3SB3400-0A

CNC control

Operator components

MCP 802D sl machine control panel

Overview



The MCP 802D sl machine control panel for the SINUMERIK 802D sl offers a simple solution for machine tools. The panel includes all the keys required to operate the machine. The cables for installing the MCP next to the SINUMERIK 802D sl operator panel are included in the scope of supply. The MCP can be connected only via the MCPA module.

Benefits

- Easily connected using ribbon cables and post links on the MCPA module
- Suitable dimensions for the SINUMERIK 802D sl
- Fully equipped with all the necessary function elements

Function

- Can be adapted to applications by means of replaceable keys
- User-assignable keys with LED indicator
- Emergency stop button with NO and NC contact elements
- 2 override rotary switches for feedrate and spindle drive

Integration

The MCP 802D sl machine control panel can be used with the CNC system:

- SINUMERIK 802D sl

Technical specifications

Order No.	6FC5303-0AF30-1AA0
Product name	MCP 802D sl machine control panel
Input voltage	5 V DC +20%/-15%
Power consumption	5 W
Inputs/outputs	Connector acc. to MIL-C-83-503/DIN 41-651
Degree of protection to EN 60529 (IEC 60529)	
• Front	IP54
• Rear	IP00
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).
Ambient temperature	
• Storage	-20 ... +60 °C (-4 ... +140 °F)
• Transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	0 ... 50 °C (+32 ... +122 °F)
Dimensions	
• Width	172 mm (6.77 in)
• Height	330 mm (12.99 in)
• Depth	70 mm (2.76 in)
Weight, approx.	0.7 kg (1.54 lb)

Selection and Ordering Data

Designation	Order No.
MCP 802D sl machine control panel Vertical format for side mounting on PCU incl. ribbon cable	6FC5303-0AF30-1AA0
MCPA module for MCP 802D sl connection and with ± 10 V interface for an analog spindle	6FC5312-0DA01-0AA0
Accessories	
2nd switching element for emergency stop button with 2 contacts 1 NO + 1 NC, 2-pole screw terminal	3SB3400-0A

CNC control

I/Os

MCPA module

Overview



The MCPA module features interfaces for the connection of an analog spindle, the MCP 802D sl machine control panel and terminal strips for additional, high-speed NC inputs and outputs. The MCPA is mounted on the rear side of the PCU of the SINUMERIK 802D sl. The specially provided mounting location is protected by a cover. The installation kit is included in the scope of supply.

Benefits

- ± 10 V interface for one analog spindle (connector)
- Connecting plug (post link) for the MCP 802D sl
- 2 terminal strips (screw-type terminals) for 8 additional high-speed NC inputs and 8 additional high-speed NC outputs each

Integration

The MCPA module can be used in conjunction with the CNC control:

- SINUMERIK 802D sl

Technical specifications

Order No.	6FC5312-0DA01-0AA0
Product name	Machine control panel analog, MCPA module
Inputs/outputs, high-speed	16
Voltage at inputs/outputs	24 V DC
Degree of protection to EN 60529 (IEC 60529)	
• Front	IP00
• Rear	IP00
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).
Relative humidity	
• Storage	5 ... 95%
• Transport	5 ... 95%
• Operation	5 ... 95%
Ambient temperature	
• Storage	-20 ... +60 °C (-4 ... +140 °F)
• Transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	0 ... 50 °C (+32 ... +122 °F)
Dimensions	
• Width	205 mm (8.07 in)
• Height	95 mm (3.74 in)
• Depth	50 mm (1.97 in)
Weight, approx.	0.2 kg (0.44 lb)

Selection and Ordering Data

Designation	Order No.
MCPA module for MCP 802D sl connection and with ± 10 V interface for an analog spindle	6FC5312-0DA01-0AA0

Overview



The PP 72/48 I/O module is connected to PROFIBUS DP and provides 72 digital inputs and 48 digital outputs. The 3 plug-in connectors for the inputs and outputs are 50-pole terminal posts for connecting ribbon cables. Terminal strip converters can be used or the direct connection of distribution boards, for example, is possible.

Benefits

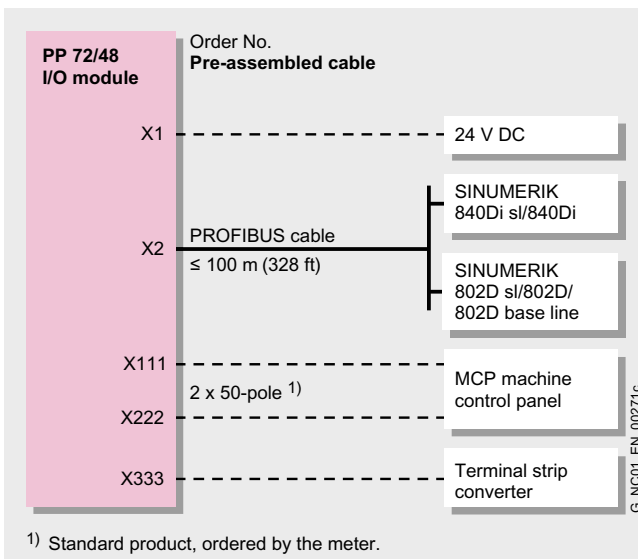
- Connection via PROFIBUS DP
- 3 post links with 24 digital inputs and 16 digital outputs each with 24 V DC, 0.25 A
- With mounting plate for easy mounting
- Integral 24 V DC power supply with electrical isolation between inputs and outputs and PROFIBUS

Integration

The PP 72/48 I/O module can be used for the following CNC controls:

- SINUMERIK 802D base line/802D/802D sl
- SINUMERIK 840Di/840Di sl

A power supply (+24 V DC) is required for the module and the digital outputs.



Connection overview for PP 72/48

Maximum permissible cable lengths (e.g. ≤ 25 m/82 ft) must be observed. Function faults can occur if longer cables are used.

Technical specifications

Order No.	6FC5611-0CA01-0AA0
Product name	SINUMERIK PP 72/48 I/O module
Input voltage	24 V DC
Power consumption, max.	11 W
Degree of protection to EN 60529 (IEC 60529)	IP00
Humidity classification in accordance with DIN EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).
Relative humidity	
• Storage	5 ... 95%
• Transport	5 ... 95%
• Operation	5 ... 95%
Ambient temperature	
• Storage	-20 ... +60 °C (-4 ... +140 °F)
• Transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	0 ... 50 °C (+32 ... +122 °F)
Dimensions	
• Width	325 mm (12.8 in)
• Height	194 mm (7.64 in)
• Depth	35 mm (1.38 in)
Weight, approx.	1.2 kg (2.65 lb)

Selection and Ordering Data

Designation	Order No.
PP 72/48 I/O module for 72 digital inputs and 48 digital outputs	6FC5611-0CA01-0AA0
Accessories	
Terminal strip converter 50-pole	6EP5406-5AA00
Cable set comprising: 6 m (20 ft) ribbon cable, 50-pole 8 insulation displacement connectors, 50-pole	6EP5306-5BG00
PROFIBUS cable	6XV1830-0EH10
PROFIBUS connectors	6ES7972-0BA41-0XA0

CNC control

I/Os

ADI 4 (Analog Drive Interface for 4 axes)

Overview



The ADI 4 (Analog Drive Interface for 4 axes) can be used to operate up to 4 drives with analog setpoint interface.

Benefits

- Connection via PROFIBUS DP to motion control functionality (isochronous mode)
- 4 inputs for incremental encoder (TTL signals) or optionally 4 inputs¹⁾ for absolute encoder (SSI)
- 4 analog outputs ± 10 V for the setpoint
- 4 relay contacts for drive enable axes 1 to 4
- 10 digital outputs²⁾ (4 general, 6 drive-specific)
- 10 digital drive-specific inputs²⁾
- Onboard status display on 4 diagnostics LEDs

To supply the module and digital outputs with power, an external voltage source (+24 V DC) is needed.

Integration

The ADI 4 interface module can be used with the following control:

- SINUMERIK 802D sl

Two ADI 4 modules can be connected to the SINUMERIK 802D sl, permitting analog control of all its axes.

Encoder connection

With SINUMERIK 802D sl (in accordance with the existing number of axes), the two following configurations are available as standard for each ADI 4:

- 4 x TTL signal inputs with S/R³⁾
 - 3 x 2500, 1 x 1024
 - 1 x 9000, 1 x 18000, 1 x 1024, 1 x 2500
- or
- 3 x 2048, 1 x 1024
- 1 x 9000, 1 x 18000, 1 x 1024, 1 x 2048

Other configurations can be implemented on request.

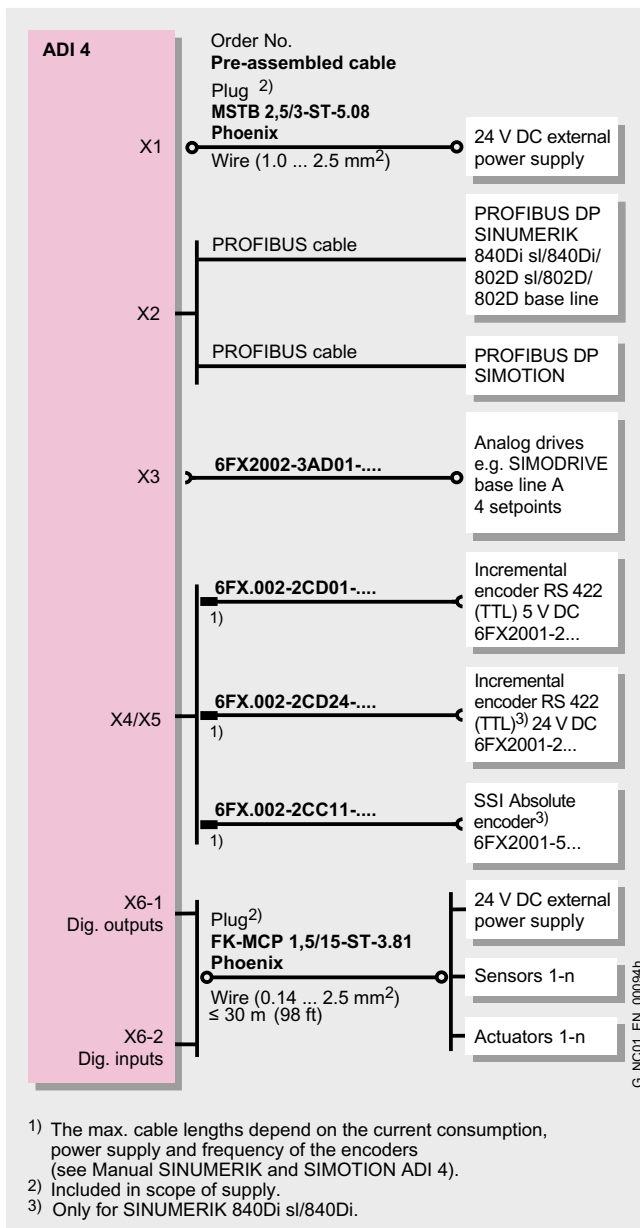
¹⁾ Cannot be used with SINUMERIK 802D sl.

²⁾ Only 9 can be used with SINUMERIK 802D sl.

³⁾ S/R = Signals/Revolution.

ADI 4 (Analog Drive Interface for 4 axes)

Integration (continued)



Connection overview for ADI 4

Maximum permissible cable lengths (e.g. ≤ 25 m (82 ft)) must be observed. Function faults can occur if longer cables are used.

Technical specifications

Order No.	6FC5211-0BA01-0AA2
Product name	SINUMERIK Analog Drive Interface for 4 axes (ADI 4)
Input voltage	24 V DC
Power consumption, max.	30.2 W
Input/output interfaces	4 outputs ±10 V setpoint
Degree of protection to EN 60529 (IEC 60529)	IP20
Humidity classification in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (+32 °F).
Relative humidity	<ul style="list-style-type: none"> • Storage 5 ... 95% • Transport 5 ... 95% • Operation 5 ... 95%
Ambient temperature	<ul style="list-style-type: none"> • Storage -20 ... +55 °C (-4 ... +131 °F) • Transport -40 ... +70 °C (-40 ... +158 °F) • Operation 0 ... 55 °C (+32 ... +131 °F)
Dimensions	<ul style="list-style-type: none"> • Width 48.5 mm (1.91 in) • Height 325 mm (12.80 in) • Depth 154.4 mm (6.08 in)
Weight, approx.	1.5 kg (3.31 lb)

Selection and Ordering Data

Designation	Order No.
ADI 4 Analog Drive Interface for 4 axes	6FC5211-0BA01-0AA2

CNC control

Ordering example

SINUMERIK 802D sl

You wish to order the equipment for a simple turning machine with 2 servo axes X and Z, and 1 spindle for a belt drive plus additional encoders:

- SINUMERIK 802D sl
- SINAMICS S120
- Motors
- Cables

Designation	Quantity	Order No.
SINUMERIK CNC control		
SINUMERIK 802D sl PCU T/M pro	1	6FC5370-0AA00-3AA0
SINUMERIK 802D sl, full CNC keyboard vertical format	1	6FC5303-0DT12-1AA0
SINUMERIK 802D sl MCP 802D sl machine control panel	1	6FC5303-0AF30-1AA0
SINUMERIK 802D sl MCPA module	1	6FC5312-0DA01-0AA0
PP 72/48 I/O module; 72 24 V inputs, 48 24 V outputs, 0.25 A	2	6FC5611-0CA01-0AA0
Repair service contract 0-4 measuring circuits, country groups 1-3	1	6FC8506-2RX01-0AA0
SINAMICS S120 Drive system		
SINAMICS Active Line Module; 16 kW; internal air cooling including DRIVE-CLiQ cable	1	6SL3130-7TE21-6AA0
SINAMICS Single Motor Module; 30 A, internal air cooling including DRIVE-CLiQ cable	1	6SL3120-1TE23-0AA1
SINAMICS Double Motor Module; 5 A/5 A, internal air cooling including DRIVE-CLiQ cable	1	6SL3120-2TE15-0AA0
SINAMICS Sensor Module SMC30	1	6SL3055-0AA00-5CA0
HF reactor, 16 kW (if a SINAMICS line filter is not required)	1	6SN1111-0AA00-0BA1
HF reactor, 16 kW together with a SINAMICS 16 kW line filter	1	6SL3000-0FE21-6AA0
SINAMICS DRIVE-CLiQ cable; IP20/IP20 Length: 0.60 m (23.62 in)	1	6SL3060-4AU00-0AA0
PROFIBUS DP bus cable 2-core	5	6XV1830-0EH10
Warning notices	4	6SL3166-3AB00-0AA0
Motors		
1FK7 Compact servomotor, 6.0 Nm, 3000 rpm; with DRIVE-CLiQ interface	2	1FK7060-5AF71-1DG0
1PH7 spindle motor, 9 kW, with DRIVE-CLiQ interface	1	1PH7107-2QF02-0CA0
Cables		
Power cable MOTION-CONNECT 800 for 1FK7 motors	2	6FX8002-5CG01-1AH0
Signal cable MOTION-CONNECT 800 for 1FK7 motors	3	6FX8002-2DC10-1AH0
Accessories		
SITOP POWER module, 24 V DC/10 A	1	6EP1434-2BA00
Connector for PROFIBUS up to 12 Mbit/s, without PG socket	3	6ES7972-0BA41-0XA0
Shaft encoder with TTL; 1024 pulses	1	6FX2001-2CB02
Spring disk coupling 6/6 mm	1	6FX2001-7KF10
Clamp straps for rotary encoder	3	6FX2001-7KP01

Appendix

Siemens Contacts Worldwide

Overview



At

<http://www.siemens.com/automation/partner>

you can find details of Siemens contact partners worldwide responsible for particular technologies.

You can obtain in most cases a contact partner for

- Technical Support,
- Spare parts/repairs,
- Service,
- Training,
- Sales or
- Consultation/engineering.

You start by selecting a

- Country,
- Product or
- Sector.

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.



Appendix

A&D Online Services

Information and Ordering in the Internet and on CD-ROM

A&D in the WWW



A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

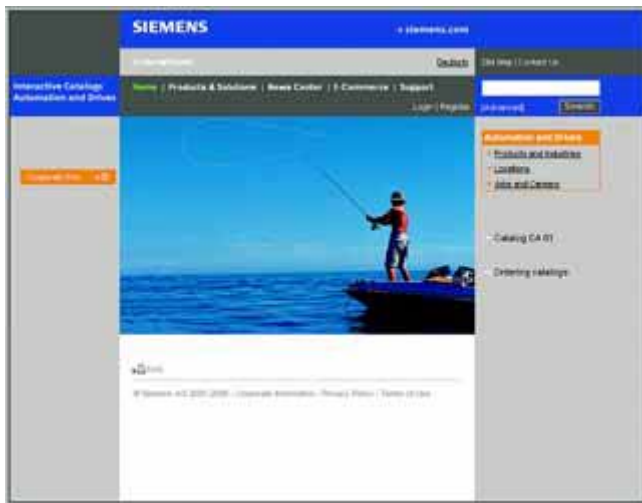
The Siemens Automation and Drives Group (A&D) has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

Under the address

<http://www.siemens.com/automation>

you will find everything you need to know about products, systems and services.

Product Selection Using the Offline Mall of Automation and Drives



Detailed information together with convenient interactive functions:

The Offline Mall CA 01 covers more than 80,000 products and thus provides a full summary of the Siemens Automation and Drives product base.

Here you will find everything that you need to solve tasks in the fields of automation, switchgear, installation and drives. All information is linked into a user interface which is easy to work with and intuitive.

After selecting the product of your choice you can order at the press of a button, by fax or by online link.

Information on the Offline Mall CA 01 can be found in the Internet under

<http://www.siemens.com/automation/ca01>

or on CD-ROM or DVD.

Easy Shopping with the A&D Mall



The A&D Mall is the virtual department store of Siemens AG in the Internet. Here you have access to a huge range of products presented in electronic catalogs in an informative and attractive way.

Data transfer via EDIFACT allows the whole procedure from selection through ordering to tracking of the order to be carried out online via the Internet.

Numerous functions are available to support you.

For example, powerful search functions make it easy to find the required products, which can be immediately checked for availability. Customer-specific discounts and preparation of quotes can be carried out online as well as order tracking and tracing.

Please visit the A&D Mall on the Internet under:

<http://www.siemens.com/automation/mall>

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Conversion tables

Rotary inertia

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	1.42×10^{-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

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	7.061×10^7
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

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

Mass

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

Power

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

Rotation

A \ B	RPM	rad/sec.	degrees/sec.
RPM	1	0.105	6.0
rad/sec.	9.55	1	57.30
degrees/sec.	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 $\frac{5}{9}$		multiply by $\frac{9}{5}$ and add 32	

Force

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}	890.7	1	0.00001
N	0.22481	3.5967	N.A.	100.000	1

To convert from A to B, multiply by entry in table.

Appendix

Metal surcharges

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 (<http://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 (<http://www.kabelverband.de>)
- 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.

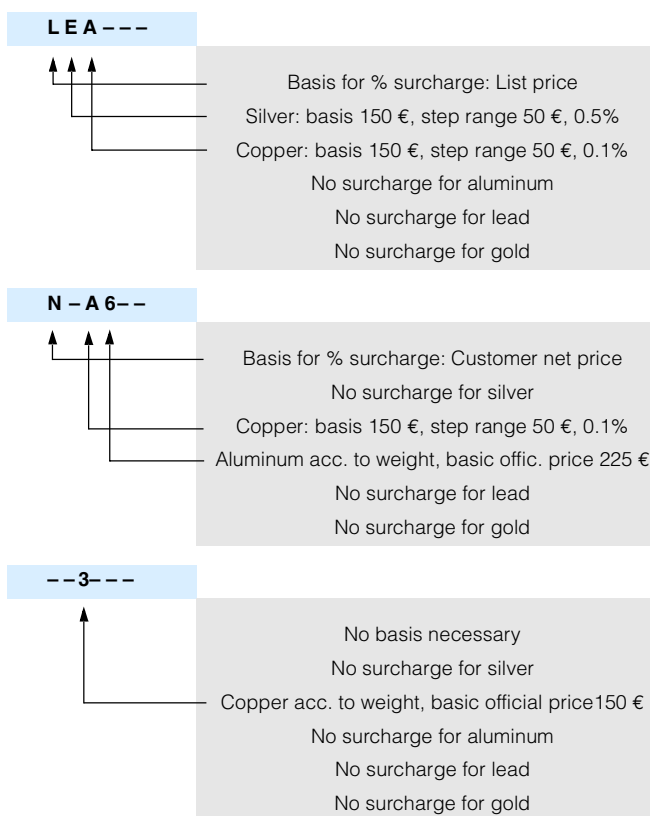
The basic official price can be found in the table below using the number (2 to 9) of the respective digit of the metal factor. The raw material weight can be found in the respective product descriptions.

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



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Appendix

Metal surcharges

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
G	150	50	0.7	1.4	2.1	2.8	0.7
H	150	50	1.2	2.4	3.6	4.8	1.2
I	150	50	1.6	3.2	4.8	6.4	1.6
J	150	50	1.8	3.6	5.4	7.2	1.8
K	150	50	2.0	3.5	5.0	6.5	1.5
L	150	50	2.2	4.4	6.6	8.8	2.2
M	150	50	2.5	5.0	7.5	10.0	2.5
			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
Q	175	50	0.3	0.6	0.9	1.2	0.3
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
T	225	50	0.5	1.0	1.5	2.0	0.5
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
			126 € – 150 €	151 € – 175 €	176 € – 200 €	201 € – 225 €	
X	125	25	1.9	3.8	5.7	7.6	1.9
			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						
3	150						
4	175						
5	200	Calculation based on raw material weight					
6	225						
7	300						
8	400						
9	555						
Misc.							
–	No metal surcharge						

Appendix

Terms and Conditions of Sale and Delivery Export regulations

Terms and Conditions of Sale and Delivery

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The sales tax (value added tax) is not included in the prices. It shall be debited separately at the respective rate according to the applicable legal regulations.

Prices are subject to change without prior notice. We will debit the prices valid at the time of delivery.

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. These surcharges will be determined based on the official price and the metal factor of the respective product.

The surcharge will be calculated on the basis of the official price on the day prior to receipt of the order or prior to the release order.

The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used. The metal factor, provided it is relevant, is included with the price information of the respective products. An exact explanation of the metal factor can be found on the page entitled “Metal surcharges”.

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