



HEIDENHAIN



MANUALplus 620

The Contouring Control for CNC
and Cycle Lathes

**Information for the
Machine Tool Builder**

September 2014

Contouring control with drive system from HEIDENHAIN

General information

- MANUALplus 620**
- Contouring control for **CNC and cycle lathes**
 - Suitable for horizontal and vertical lathes
 - Up to 3 principal axes (X, Z and Y), B axis, closed-loop spindle and opposing spindle, C1/C2 axis and driven tools
 - 5-axis simultaneous machining (X, Z, Y, B, and C axes)
 - Up to 3 programmable auxiliary axes (U, V, W) for control of steady rest, tailstock and opposing spindle
 - The position of a parallel secondary axis can be shown combined with its principal axis
 - Compact design: Screen, keyboard and computer all in one unit
 - HEIDENHAIN inverter systems and motors recommended
 - Uniformly digital with HSCI interface and EnDat interface
 - 12.1-inch TFT color flat-panel display
 - Storage medium: CompactFlash memory card
 - Programming of turning, drilling and milling operations with smart.Turn, according to DIN or via cycles
 - TURN PLUS for automated smart.Turn program generation
 - ICP free contour programming for turning and milling contours
 - For simple tool holders (Multifix), tool turrets or magazines



System test Controls, motors and encoders from HEIDENHAIN are in most cases integrated as components in larger systems. In these cases, comprehensive tests of the complete system are required, irrespective of the specifications of the individual devices.

Expendable parts In particular the following parts in controls from HEIDENHAIN are subject to wear:

- Buffer battery
- Fan

Standards Standards (ISO, EN, etc.) apply only where explicitly stated in the catalog.

Note Microsoft, Windows, Windows Vista and Internet Explorer are registered trademarks of Microsoft Corporation.

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Validity The features and specifications described here apply for the following control and NC software versions:

MANUALplus with NC software versions
548430-03 (export license required)
548431-03 (no export license required)

This catalog supersedes all previous editions, which thereby become invalid. **Subject to change without notice.**

Requirements Some of these specifications require particular machine configurations. Please note also that, for some functions, a special PLC program must be created by the manufacturer.

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Please refer to the **page references** in the **tables** with the specifications.

Overview tables

Components

Control systems		MANUALplus 620	Page
Main computer		MC 7410T	16
Memory medium		CFR CompactFlash memory card	17
NC software license		On SIK component	17
Screen		12.1-inch color flat-panel display (integrated)	
Operating panel		Integrated	
Machine operating panel		MB 720T	22
		PLB 6001 (HSCI adapter for OEM machine operating panel)	27
Controller unit	6 control loops	CC 6106	20
	8 control loops	CC 6108	
	10 control loops	CC 6110	
Voltage supply¹⁾		PSL 130	26
PLC inputs/outputs¹⁾	With HSCI interface	PL 6000 consisting of PLB 62xx basic module (system PL) or PLB 61xx (expansion PL) and I/O modules	23
		On UEC	20
	With PROFIBUS-DP interface	PL 550 consisting of PLB 550 basic module and I/O modules	25
Additional modules¹⁾		CMA-H for analog axes/spindles in the HSCI system	28
		Module for PROFIBUS-DP	
Inverter systems		Compact inverters and modular inverters	*)
Inverters with integrated controller unit	4 control loops	UEC 111	20
	5 control loops	UEC 112	20
	6 control loops	UEC 113	20
Connecting cables		✓	36

*) For further information, refer to the *Inverter Systems for HEIDENHAIN Controls* brochure

¹⁾ May be necessary depending on the configuration

Please note: The MC main computer does not have any PLC inputs/outputs. Therefore one PL 6000 or one UEC is necessary for each control. They feature safety-relevant inputs/outputs as well as the connections for touch probes.

Accessories

Accessories	MANUALplus 620	Page
Electronic handwheels	<ul style="list-style-type: none"> • HR 180 panel-mounted handwheels for connection to position inputs, plus • HR 130 panel-mounted handwheel or • HR 410 portable handwheel 	31
Workpiece touch probes	<ul style="list-style-type: none"> • TS 260¹⁾ touch trigger probe with cable connection or • TS 460¹⁾ touch trigger probe with radio or infrared transmission or • TS 444 touch trigger probe with infrared transmission or • TS 642 touch trigger probe with infrared transmission or • TS 740 touch trigger probe with infrared transmission 	29
Tool touch probes	With cuboid probe contact as accessory <ul style="list-style-type: none"> • TT 160 touch trigger probe or • TT 460 touch trigger probe with radio or infrared transmission 	30
USB hub	✓	59
Programming station	DataPilot MP 620 Control software for PCs for programming, archiving, and training <ul style="list-style-type: none"> • Full version for single user or network license • Demo version (free of charge) 	2)
Snap-on keys	For the control For the handwheel	34 33

¹⁾ New generation of touch probes

²⁾ For more information, refer to the *Programming Station Lathe Controls* brochure.

Accessories / Software	MANUALplus 620	Page
PLCdesign ¹⁾	PLC development software	56
KinematicsDesign ¹⁾	Software for creating kinematics and initializing DCM	50
TNCremo ²⁾	Data transfer software	59
TNCremoPlus ²⁾	Data transfer software with “live” screen	59
TNCkeygen ¹⁾	Software for enabling SIK options for a limited time, and for day-by-day access to the OEM area	17
TNCscope ¹⁾	Software for data recording	54
TeleService ¹⁾	Software for remote diagnostics, monitoring, and operation	54
RemoTools SDK ¹⁾	Function library for developing customized applications for communication with HEIDENHAIN controls	60
TNCtest ¹⁾	Software for creation and execution of acceptance tests	-

¹⁾ Available to registered customers for downloading from the Internet

²⁾ Available to all customers (without registration) for downloading from the Internet

Specifications

Specifications	MANUALplus 620	Page
Axes¹⁾		43
Axes	Up to six closed-loop linear axes X, Z, U, V, W: Standard Y: Option	
B axis	Option	
C1/C2 axis	Option	
Synchronized axes	✓	
PLC axes	✓	
Spindles	Up to three closed-loop spindles: Main spindle Opposing spindle Driven tool	45 46
Speed ²⁾	Max. 60 000 min ⁻¹	45
Operating mode switchover	✓	45
Position-controlled spindle	✓	45
Spindle orientation	✓	45
Gear shifting	✓	45
NC program memory	1.8 GB	16
Input resolution and display step		43
Linear axes	X axis: 0.5 µm (diameter: 1 µm) U, V, W, Y, Z axis: 1 µm	
Rotary axes	B, C1/C2 axis: 0.001°	
Interpolation		
Straight line	In 2 axes (max. ±100 m); optional in 3 principal axes	*)
Circular	In 2 axes (radius max. 999 m); optional additional linear interpolation of the third axis	*)
C1/C2 axis	Interpolation of X and Z linear axes with the C1/C2 axis (option)	*)
B axis	5-axis interpolation between X, Z, Y, B, and C axes (option)	*)
Axis feedback control		48
With following error	✓	
With feedforward	✓	
With jerk limiting	✓	43
Maximum feed rate	$\frac{60000 \text{ min}^{-1}}{\text{No. of motor pole pairs}} \cdot \text{Screw pitch [mm]}$ at f _{PWM} = 5000 Hz	43
Constant surface speed	✓	
Input	mm/min or mm/revolution	

*) For further information, refer to the MANUALplus 620 (ID 634865-xx) catalog

1) As ordered

2) On motors with two pole pairs

Specifications	MANUALplus 620		Page
Cycle times of main computer	MC		48
Block processing	3 ms		
Cycle times of controller unit	CC/UEC		48
Path interpolation	3 ms		48
Fine interpolation	<i>Single speed:</i> 0.2 ms <i>Double speed:</i> 0.1 ms (option 49)		
Position controller	<i>Single speed:</i> 0.2 ms <i>Double speed:</i> 0.1 ms (option 49)		
Speed controller	<i>Single speed:</i> 0.2 ms <i>Double speed:</i> 0.1 ms (option 49)		
Current controller	f_{PWM} 3333 Hz 4000 Hz 5000 Hz 6666 Hz 8 000 Hz 10 000 Hz	T_{INT} 150 μs 125 μs 100 μs 75 μs with option 49 60 μs with option 49 50 μs with option 49	
Permissible temperature range	Operation: In electrical cabinet: 5 °C to 40 °C In operating panel: 0 °C to 50 °C Storage: –20 °C to 60 °C		

*) For further information, refer to the MANUALplus 620 (ID 634865-xx) catalog

1) As ordered

2) On motors with two pole pairs

Machine interfacing

Machine interfacing	MANUALplus 620	Page
Error compensation	✓	52
Linear axis error	✓	52
Nonlinear axis error	✓	52
Backlash	✓	52
Hysteresis, reversal spikes	✓	52
Thermal expansion	✓	52
Integrated PLC	✓	55
Program format	Statement list	55
Program input at the control	By external USB keyboard	55
Program input by PC	✓	55
PLC memory	350 MB	55
PLC cycle time	9 ms to 30 ms (adjustable)	55
PLC inputs/outputs¹⁾	A PLC system can consist of max. seven PLB 61xx and max. 2 MB 7xxT or one PLB 6001. A total maximum of 1000 inputs/outputs is supported.	23, 20
PLC inputs, 24 V DC ¹⁾	Via PL, UEC	23
PLC outputs, 24 V DC ¹⁾	Via PL, UEC	23
Analog inputs, ± 10 V	Via PL	23
Inputs for PT 100 thermistors	Via PL	23
Analog outputs, ± 10 V	Via PL	23
PLC functions	✓	55
PLC soft keys	✓	55
PLC positioning	✓	55
PLC basic program	✓	57
Integration of applications		56
High-level language programming	Python programming language used in combination with the PLC (option 46)	56
User interfaces can be custom-designed	Inclusion of specific user interfaces from the machine tool builder (option 46)	56

¹⁾ Further PLC inputs/outputs via PL 550 for connection to MC with PROFIBUS-DP additional module

Machine interfacing	MANUALplus 620	Page
Commissioning and diagnostic aids		53
DriveDiag	Software for diagnosis of digital drive systems	53
TNCOpt	Software for putting digital control loops into service	53
ConfigDesign	Software for creating the machine configuration	53
Integrated oscilloscope	✓	54
Trace function	✓	54
API DATA function	✓	54
Table function	✓	54
OnLine Monitor (OLM)	✓	53
Log	✓	54
TNCscope	✓	54
Bus diagnostics	✓	54
Data interfaces	✓	
Ethernet	2 x 1000BASE-T	58
USB	Rear: USB 3.0 Front: USB 2.0	58
RS-232-C	✓	58
Protocols		58
Standard data transfer	✓	58
Blockwise data transfer	✓	58
LSV2	✓	58

¹⁾ Further PLC inputs/outputs via PL 550 for connection to MC with PROFIBUS-DP additional module

Encoder inputs		CC 6106	CC 6108	CC 6110	UEC 111	UMC 111	UEC 112	UEC 113	47
Position		6	8	10	4	-	5	6	47
	Incremental	1 V _{PP}							47
	absolute	EnDat 2.2							47
Speed		6	8	10	4	4	5	6	47
	Incremental	1 V _{PP}							47
	absolute	EnDat 2.2							47
Nominal-value outputs		CC 6106	CC 6108	CC 6110	UEC 111	UMC 111	UEC 112	UEC 113	47
PWM		6	8	10	-	-	-	-	19
Motor connections		-	-	-	4	4	5	6	19

User functions

User function	Standard	Option	MANUALplus 620
Short description	✓	0-6 55+0-6 70+0-6 54+0-6 94+0-6 132+0-6	Basic version: X and Z axis, spindle Driven tool and auxiliary axes (U, V, W) C axis and driven tool Y axis B axis Parallel axes U, V, W (display function and compensation) Opposing spindle Digital current and shaft speed control
Operating modes			
Manual operation	✓		Manual slide movement through axis-direction keys, intermediate switch or electronic handwheels
	✓	11	Graphic support for entering and running cycles without saving the machining steps in alternation with manual machine operation Thread reworking (thread repair in a second workpiece setup)
Teach-in mode		8	Sequential linking of fixed cycles, where each cycle is run immediately after input, or is graphically simulated and subsequently saved
Program run	✓	9 8	All are possible in single-block and full-sequence modes DIN PLUS programs smart.Turn programs Cycle programs
Setup functions	✓		Workpiece datum setting
	✓		Definition of tool-change point
	✓		Definition of protection zone
	✓		Definition of machine dimensions
	✓		Manual programs
	✓	17	Tool measurement by touching the workpiece
		17	Tool measurement with a TT tool touch probe
		17	Tool measurement with an optical gauge
		17	Workpiece measurement with a TS workpiece touch probe
Programming			
Cycle Programming		8	Turning cycles for simple and complex contours, and contours described with ICP
		8	Contour-parallel turning cycles
		8	Recessing cycles for simple or complex contours, as well as contours defined with ICP
		8	Repetitions with recessing cycles
		8	Recess turning cycles for simple and complex contours, and contours described with ICP
		8	Undercut and parting cycles
		8	Engraving cycles
		8	Threading cycles for single or multi-start longitudinal, taper or API threads, threads with variable pitch
		8+55	Cycles for axial and radial drilling, pecking and tapping operations with the C axis
		8+55	Thread milling with the C axis
		8+55	Axial and radial milling cycles for slots, figures, single surfaces and polygons as well as for complex contours defined with ICP for machining with the C axis
		8+55	Helical slot milling (multi-start) with the C axis
		8+55	Deburring of ICP contours
		8+55	Linear and circular patterns for drilling, boring and milling operations with the C axis
		8	Context-sensitive help graphics
		8	Transfer of cutting values from technology database
		8	Use of DIN macros in cycle programs
		8+9	Conversion of cycle programs to smart.Turn programs

User function	Standard	Option	MANUALplus 620
Interactive contour programming (ICP)		8/9 8/9 8/9 8/9 8/9 8/9 8/9 8/9+55 9+70 8/9+55+70+132 8/9+42	Contour definition with linear and circular contour elements Immediate display of entered contour elements Calculation of missing coordinates, intersections, etc. Graphic display of all solutions for selection by the user if more than one solution is possible Chamfers, rounding arcs and undercuts available as form elements Input of form elements immediately during contour creation or by superimposition later Changes to existing contours can be programmed Machining attributes available for individual contour elements C-axis machining on face and lateral surface: – Description of individual holes and hole patterns (only in smart.Turn) – Description of figures and figure patterns for milling (only in smart.Turn) – Creation of freely definable milling contours Y-axis machining on the XY and ZY planes (only in smart.Turn): – Description of individual holes and hole patterns – Description of figures and figure patterns for milling – Creation of freely definable milling contours Programming of the rear face for full-surface machining with the C and Y axes DXF import: Import of contours for lathe and milling operations
smart.Turn programming		9 9 9 9 9 9 9 9+55/70 9+55 9+55/70 9 9 9	The basis is the unit, which is the complete description of a machining block (geometry, technology and cycle data) Dialog boxes divided into overview and detail forms Fast navigation between the fillable forms and input groups via the 'smart' keys Context-sensitive help graphics Start unit with global settings Transfer of global values from the start unit Transfer of cutting values from technology database Units for all turning and recessing operations for simple contours and ICP contours Units for boring, drilling and milling operations with the C or Y axis for simple holes, milling contours, and drilling and milling patterns, as well as those programmed with ICP Activating/deactivating special units for the C axis; subroutines and section repeats Verification graphics for blank and finished part and for C and Y axis contours Turret assignment and other setup information in the smart.Turn program Parallel programming Parallel simulation
TURN PLUS		63	Automatic smart.Turn program generation with – Automatic tool selection – Automatic turret assignment – Automatic calculation of cutting data – Automatic generation of machining sequence in all working planes, also for C-axis machining (with option 55) and Y-axis machining (with option 70) – Automatic cutting limitation through clamping devices – Automatic generation of work blocks for rechucking during full-surface machining – Automatic generation of work blocks for rear-face machining (with option 132)

User function	Standard	Option	MANUALplus 620
DIN PLUS programming	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	 55 70 131/132 132 8/9 9	Programming in DIN 66025 format Extended command format (IF ... THEN ... ELSE ...) Simplified geometry programming (calculation of missing data) Powerful fixed cycles for area clearance, recessing, recess turning and thread machining Powerful fixed cycles for boring, drilling and milling with the C axis Powerful fixed cycles for boring, drilling and milling with the Y axis Subprograms Technology functions for full-surface machining: – Moving to a fixed stop – Parting control – Spindle synchronization – Converting and mirroring – Mechatronic tailstock Programming with variables Contour description with ICP Program verification graphics for workpiece blank and finished part Turret assignment and other setup information in the DIN PLUS program Conversion of smart.Turn units into DIN PLUS command sequences Parallel programming Parallel simulation
Program verification graphics	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	 55 54 132	Graphic simulation of the cycle process, or of the cycle, smart.Turn or DIN PLUS program Display of the tool paths as pencil-trace or cutting-path graphics, special identification of the rapid traverse paths Machining simulation (2-D material-removal graphic) Side or face view, or 2-D view of cylindrical surface for verification of C-axis machining Display of programmed contours View of the tilted plane (B-axis machining) View of face and YZ plane for verification of Y-axis machining Three-dimensional display of the workpiece blank and finished part Simulation of mirrored contours for rear-face machining Shifting and magnifying functions Block scan in the simulation
B-axis machining	✓ ✓	54 54	Machining with the B axis Tilting the working plane Rotating the machining position of the tool
Eccentric machining		135 135	Cycles for eccentric turning and for the manufacture of oval and polygonal contours Superimpositioning of traverse movements of the X and Y axes synchronous to the rotational motion of the spindle
Machining time analysis	✓ ✓ ✓		Calculation of machining times and idle times Consideration of switching commands triggered by the CNC Representation of time per individual cycle or per tool change
Tool database	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	10 10	For 250 tools For 999 tools Tool description can be entered for every tool Automatic inspection of tool-tip position with respect to the contour Compensation of tool-tip position in the X/Y/Z plane High-precision correction via handwheel, capturing compensation values in the tool table Automatic tool-tip and cutter radius compensation Tool monitoring for lifetime of the insert (tool tip) or the number of workpieces produced Tool monitoring with automatic tool change after expiration tool life Management of multipoint tools (multiple inserts or reference points) Support of quick-change systems

User function	Standard	Option	MANUALplus 620
Technology database		8/9 8/9 8/9 8/9 10	Access to cutting data after definition of workpiece material, cutting material and machining mode. The CNC PILOT distinguishes between 16 machining modes. Each workpiece-material/tool-material combination includes the cutting speed, the main and secondary feed rates, and the infeed for the 16 machining modes. Automatic determination of the machining modes from the cycle or the machining unit Cutting data is entered in the cycle or in the unit as default values 9 workpiece-material/tool-material combinations (144 entries) 62 workpiece-material/tool-material combinations (992 entries)
Conversational languages	✓		English, German, Czech, French, Italian, Spanish, Portuguese, Dutch, Swedish, Danish, Finnish, Norwegian, Slovenian, Slovak, Polish, Hungarian, Russian (Cyrillic), Romanian, Turkish, Chinese (traditional and simplified), Korean

Options

Option number	Option	As of NC software 54843x-	ID	Remark	Page
0	Additional Axis 1	01	ID 354540-01	Additional control loop 1	18
1	Additional Axis 2	01	ID 353904-01	Additional control loop 2	18
2	Additional Axis 3	01	ID 353905-01	Additional control loop 3	18
3	Additional Axis 4	01	ID 367867-01	Additional control loop 4	18
4	Additional Axis 5	01	ID 367868-01	Additional control loop 5	18
5	Additional Axis 6	01	ID 370291-01	Additional control loop 6	18
6	Additional Axis 7	01	ID 370292-01	Additional control loop 7	18
7	Additional Axis 8	01	ID 370293-01	Additional control loop 8	18
8	Software option 1 Teach-in	01	ID 632226-01	Cycle programming <ul style="list-style-type: none"> • Contour description with ICP • Cycle programming • Technology database with 9 workpiece-material/tool-material combinations 	
9	Software option 2 smart.Turn	01	ID 632227-01	smart.Turn <ul style="list-style-type: none"> • Contour description with ICP • Programming with smart.Turn • Technology database with 9 workpiece-material/tool-material combinations 	
10	Software option 3 Tools and technology	01	ID 632228-01	Tools and technology <ul style="list-style-type: none"> • Tool database expanded to 999 entries • Technology database expanded to 62 workpiece-material/tool-material combinations • Tool life monitoring with exchange tools 	
11	Software option 4 Thread recutting	01	ID 632229-01	Thread <ul style="list-style-type: none"> • Thread recutting • Handwheel superimposition during thread cutting 	
17	Touch probe functions	01	ID 632230-01	Tool measurement and workpiece measurement <ul style="list-style-type: none"> • Determining tool-setting dimensions with a tool touch probe • Determining tool-setting dimensions with an optical gauge • Automatic workpiece measurement with a workpiece touch probe 	
18	HEIDENHAIN DNC	01	ID 526451-01	Communication with external PC applications over COM component	60
24	Gantry axes	01	ID 634621-01	Gantry axes in master-slave torque control	44
42	DXF import	01	ID 632231-01	Load and convert DXF contours	
46	Python OEM process	01	ID 579650-01	Python application on the TNC	56
49	Double-speed axis	01	ID 632223-01	Short control-loop cycle times for direct drives	19
54	B-axis machining	01	ID 825742-01	B axis: Tilting the working plane, rotating the machining position of the tool	44
55	C-axis machining	01	ID 633944-01	C-axis machining	45
63	TURN PLUS	01	ID 825743-01	TURN PLUS: Automatic generation of smart.Turn programs	
70	Y-axis machining	01	ID 661881-01	Y-axis machining	

Option number	Option	As of NC software 54843x-	ID	Remark	Page
94	Parallel axes	01	ID 679676-01	Support of parallel axes (U, V, W) Combined display of principal axes and secondary axes	
77	4 additional axes	03	ID 634613-01	4 additional control loops	18
78	8 additional axes	03	ID 634614-01	8 additional control loops	18
101 - 130	OEM option	01	ID 579651-01 to ID 579651-30	Options of the machine tool builder	
131	Spindle synchronism	01	ID 806270-01	Synchronization (of two or more spindles)	46
132	Opposing spindle	01	ID 806275-01	Opposing spindle (spindle synchronism, rear-face machining)	45
135	Synchronizing functions	03	ID 1085731-01	Expanded synchronization of axes and spindles	44
143	Load Adapt. Control	01	ID 800545-01	LAC: Load-dependent adaptation of control parameters	52
151	Load monitoring	03	ID 1111843-01	Monitoring of the tool load	51

HSCI control components

Main computer

Main computer

- The **MC 7410T** main computer consists of:
- Intel Celeron 1047 processor (1.4 GHz, dual-core)
 - 2 GB SDRAM main memory
 - MANUALplus operating panel with soft keys
 - 12.1-inch TFT color flat-panel display; resolution: 1024 x 768 pixels
 - HSCI interface to the controller unit and to other control components
 - USB port with cover cap on front
 - Further interfaces for use by the end user: Ethernet, USB 3.0, RS-232-C/V.24

- To be ordered separately, and installed in the main computer by the OEM:
- **CFR** memory card with the NC software
 - **SIK component** (System Identification Key) for enabling the control loops and software options

- The following HSCI components are necessary for operation of the MANUALplus 620:
- MC main computer
 - Controller unit
 - **PLB 62xx** PLC input/output unit (system PL; integrated in UEC)
 - **MB 720T** machine operating panel or **PLB 6001** HSCI adapter for connection of an OEM machine operating panel

Voltage supply 24 V DC of power are supplied to the main computer and other HSCI components by the PSL 13x supply unit. For the entire HSCI system, the 24 V DC NC supply voltage for the control components is required to be safely separated voltage (PELV). It must not be connected to the 24 V DC supply voltage for PLC components (e. g. holding brakes).

Export version Because the complete NC software is saved on the CFR memory medium, no export version is required for the main computer itself. Export versions are available only for the easily replaceable storage medium and the SIK component.

Versions The MC 7410T main computer is designed for direct installation in the operating panel. It combines the 12.1-inch screen and the control keyboard in one extremely compact unit.

	Keyboard	Power loss	Weight	
MC 7410T	Integrated	43 W	5.6 kg	ID 1034791-xx



MC 7410T

Options The capabilities of the MANUALplus 620 can also be adapted retroactively with options to meet new requirements. These options are described on page 14. They are enabled by entering keywords based on the SIK number, and are saved in the SIK component. Please indicate your SIK number when ordering new options.

Memory medium A CFR (= CompactFlash Removable) compact flash memory card is used as storage medium. It contains the NC software and is used to store NC and PLC programs. The storage medium is removable and must be ordered separately from the main computer.

Please note: These CFRs use the fast SATA protocol (CFast) for significantly shorter access times. They are not compatible with the previous CFRs and can be used only in conjunction with the MC 74xx main computers.

CFR CompactFlash 8 GB	
Free capacity for NC programs	1.8 GB
Free capacity for PLC programs	350 MB
Export license required	ID 1075055-01
No export license required	ID 1075055-51

SIK component The SIK component contains the **NC software license** for enabling control loops and software options. It gives the main computer an unambiguous ID code—the SIK number. The SIK component is ordered and shipped separately. It must be inserted in a special slot in the MC main computer.

The SIK component with the NC software license is available in various versions, depending on the enabled control loops and options. Further control loops can be enabled later by entering a keyword. HEIDENHAIN provides the keyword, which is based on the SIK number.

When ordering, please indicate the SIK number of your control. When the keywords are entered in the control, they are saved in the SIK component. This enables and activates the options. Should service become necessary, the SIK component must be inserted in the replacement control to enable all required options.

Master keyword (general key) There is a master keyword (general key) for putting the MANUALplus 620 into service that will unlock all options for a duration of 90 days. After this period, only those options with the correct keywords will be active. The general key is activated via a soft key.

TNCkeygen (accessory) TNCkeygen is a collection of PC software tools for generating time-limited enabling keys for HEIDENHAIN controls.

OEM Key Generator is used to generate enabling keys for software options by entering the SIK number, the option to be enabled, the duration and a manufacturer-specific password. The enabling period is limited to 10 to 90 days. Each option can only be enabled once. Option enabling is independent of the general key.

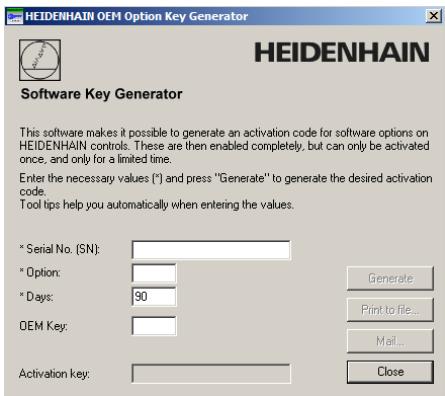
The **OEM daily key generator** generates an enabling key for the protected area of the machine tool builder. This grants the operator access to the area on the day the key was generated.



CFR CompactFlash



SIK component



NC software license and enabling of control loops

There are always three control loops enabled in the basic version. The controller unit must be designed for the corresponding number of activated control loops. Maximum numbers:

- UEC 111: 4 control loops
- UEC 112: 5 control loops
- CC 6106/UEC 113: 6 control loops
- CC 6108: 8 control loops
- CC 6110: 10 control loops

You can find the usual SIK combinations in the following table. Other versions are available upon request.

SIK with software license and enabling for		SIK
Control loops	Included options	
3	<ul style="list-style-type: none">• Teach-in (option 8)• smart.Turn (option 9)• Thread recutting (option 11)• C-axis machining (option 55)	ID 733 604-03 ID <i>733 604-53</i>
3	<ul style="list-style-type: none">• Teach-in (option 8)	ID 733 604-05 ID <i>733 604-55</i>
4	<ul style="list-style-type: none">• Additional axis 1 (option 0)• Teach-in (option 8)• C-axis machining (option 55)	ID 733 604-06 ID <i>733 604-56</i>

(Italics indicate export version)

Enabling further control loops

Further control loops can be enabled either as groups or individually. The combination of control-loop groups and individual control loops makes it possible to enable any number of control loops. Up to **20 control loops** are possible.

Control-loop groups	Option	
4 additional control loops	77	ID 634613-01
8 additional control loops	78	ID 634614-01

Individual control loops	Option	
1st additional control loop	0	ID 354540-01
2nd additional control loop	1	ID 353904-01
3rd additional control loop	2	ID 353905-01
4th additional control loop	3	ID 367867-01
5th additional control loop	4	ID 367868-01
6th additional control loop	5	ID 370291-01
7th additional control loop	6	ID 370292-01
8th additional control loop	7	ID 370293-01

Controller unit

Controller unit Due to the very short cycle times of the position, speed and current controllers, the controller units from HEIDENHAIN are equally suited for conventional drives, for direct drives (linear motors, torque motors) and for HSC spindles. They permit a high loop gain and short reaction times to changing machining forces, and so make the high contour accuracy and surface quality of the workpiece possible.

Single speed
Double speed

Single-speed control loops are usually sufficient for linear or torque motors and for conventional axes. **Double-speed control loops** (option 49) are preferred for HSC spindles and axes that are difficult to control. In the default setting, all axes are set to single speed. Each axis that is switched from single speed to double speed can reduce the number of available control loops by one. PWM frequencies greater than 5 kHz require double-speed control loops, for which option 49 must be enabled.

Cycle times	With f_{PWM}	Current controller	Speed controller		Position controller
			Single-speed	Double-speed	
	3333 Hz	150 μs	300 μs	150 μs	Same as speed controller
	4000 Hz	125 μs	250 μs	125 μs	
	5000 Hz	100 μs	200 μs	100 μs	
	6666 Hz ¹⁾	75 μs	150 μs	150 μs	
	8000 Hz ¹⁾	60 μs	125 μs	125 μs	
	10000 Hz ¹⁾	50 μs	100 μs	100 μs	

¹⁾ Possible only with option 49

Number of control loops The number of enabled control loops depends on the SIK (see *Main computer*), or on additionally enabled control loops, which can also be ordered as needed later.

- Versions
- Modular CC 61xx controller units with PWM interface to the inverters
 - Compact UEC/UMC inverters with integrated controller unit

Controller units, main computers and inverters operate in any desired combination.

CC 61xx

- The **CC 61xx** controller units feature:
- Position controller, speed controller, current controller
 - HSCI interfaces
 - PWM interfaces to the UM, UR, UE power modules
 - Interfaces to the speed and position encoders
 - Interfaces for power supply (via inverter)
 - SPI interfaces for expansion modules (e. g. CMA-H)



CC 6110

	CC 6106	CC 6108	CC 6110
Digital control loops	Max. 6 (single speed)	Max. 8 (single speed)	Max. 10 (single speed)
Speed inputs	6 x 1 V _{PP} or EnDat 2.2	8 x 1 V _{PP} or EnDat 2.2	10 x 1 V _{PP} or EnDat 2.2
Position inputs	6 x 1 V _{PP} or EnDat 2.2	8 x 1 V _{PP} or EnDat 2.2	10 x 1 V _{PP} or EnDat 2.2
PWM outputs	6	8	10
Weight	4.1 kg	4.7 kg	4.8 kg (10.6 lb)
	ID 662636-xx	ID 662637-xx	ID 662638-xx

UEC 11x

The UEC 11x compact inverters not only include the inverter, but also a controller with PLC inputs and outputs and an integrated braking resistor. They form a complete solution for machines with a limited number of axes and low power demands.

- Controllers
- Position controller, speed controller, current controller
 - HSCI interface
 - Interfaces to the speed and position encoders

- Inverters
- Power electronics
 - Connections for axis motors and spindle motor
 - Braking resistor
 - Connections for motor holding brakes
 - Additional DC-link connection on the front for connection of a PSL 130

- System PL
- Interfaces for one workpiece touch probe and one tool touch probe
 - Integrated PLC (expandable with PL 61xx)
 - UEC 11x: 38 free inputs, 23 free outputs (7 of which can be switched off)
 - UEC 11x FS: 38 free inputs, 28 free outputs (7 of which can be switched off), 8 free FS inputs, 8 free FS outputs
 - Configuration with IOconfig PC software



UEC 113

		UEC 111/UEC 112/UEC 113		
Controllers		4/5/6 digital control loops		
Speed inputs		4/5/6 x 1 V _{PP} or EnDat 2.2		
Position inputs		4/5/6 x 1 V _{PP} or EnDat 2.2		
Inverters		2/3/4 axes	1 axis	Spindle
Rated current I_N/maximum current I_{max}¹⁾ at a PWM frequency of	3333 Hz	6.0/12.0 A	9.0/18.0 A	24.0/36.0 A
	4000 Hz	5.5/11.0 A	8.3/16.5 A	22.0/33.0 A
	5000 Hz	5.0/10.0 A	7.5/15.0 A	20.0/30.0 A
	6666 Hz	4.2/8.4 A	6.3/12.6 A	16.8/25.2 A
	8000 Hz	3.6/7.3 A	5.5/11.0 A	14.6/21.9 A
	10000 Hz	3.0/6.0 A	4.6/9.2 A	12.2/18.3 A
Supply voltage		400 V 3 AC (± 10 %); 50 Hz or 480 V 3 AC (+6 %/-10 %); 60 Hz		
Rated power of DC link		14 kW		
Peak power²⁾ of DC link		18 kW / 25 kW		
Power loss at I_N		≈ 450 W		
DC-link voltage		565 V DC		
Integral braking resistance³⁾		2.1 kW / 27 kW		
Power pack for HSCI components		24 V DC / 3.5 A		
Module width		150 mm		
Weight		≈ 14 kg		
UEC 111		ID 1081002-xx		
UEC 112		ID 1081003-xx		
UEC 113		ID 828471-xx		

- ¹⁾ Axes: 0.2 s cyclic duration factor for duty cycle time of 10 s with 70 % rated current preload
Spindle: 10 s cyclic duration factor for duty cycle time of 60 s with 70 % rated current preload
- ²⁾ 1st value: 40 % cyclic duration factor for 10 minutes duty cycle time (S6-40 %)
2nd value: 4 s cyclic duration factor for 20 seconds duty cycle time
- ³⁾ 1st value: Continuous duty
2nd value: Peak power (1.5 % cyclic duration factor for 120 seconds duty cycle time)

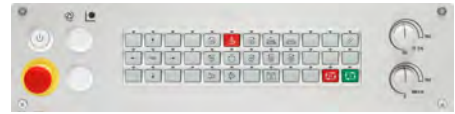
Machine operating panel

MB 720T

- Power supply: 24 V DC / ≈ 4 W
- 36 exchangeable snap-on keys, 16 of them are not labeled and freely definable via the PLC
- Operating elements: Keys pre-assigned by PLC basic program: Control voltage on¹⁾; NC start; NC stop; emergency stop; 4 axis keys; rapid traverse key; spindle right; spindle left; spindle stop; jog spindle to right; jog spindle to left; spindle positioning; clamp spindle; spindle switchover; chip removal; chip removal backwards; tool change at right; tool change at left; unlock door
- Spindle-speed and feed-rate override potentiometer
- Two holes for additional keys or keylock switches
- 7 free PLC inputs and 5 free PLC outputs

¹⁾ Keys illuminated, addressable via PLC

MB 720T ID 1043707-01
Weight ≈ 0.9 kg



MB 720T

PL 6000 PLC input/output systems with HSCI

PL 6000

The PLC inputs and outputs are available via external modular PL 6000 PLC input/output systems. They consist of a basic module and one or more input/output modules. A total maximum of 1000 inputs/outputs is supported. The PL 6000 units are connected to the MC main computer via the HSCI interface. The PL 6000 units are configured with the IOconfig PC software.



PLB 62xx

Basic modules

There are basic modules with **HSCI interface** available for 4, 6 or 8 I/O modules. They are mounted on standard NS 35 rails (DIN 46 227 or EN 50 022).

Supply voltage	24 V DC
Power consumption ¹⁾	≈ 48 W at 24 V DC NC
	≈ 21 W at 24 V DC PLC
Weight	0.36 kg (bare)

¹⁾ PLB 6xxx completely filled, incl. TS, TT. For more details regarding power supply for 24 V DC NC, see *Power supply for HSCI components*.

System PL

- Necessary once for each control system (except with UEC)
- Includes connections for TS and TT touch probes, as well as TL
- Safety-relevant inputs/outputs
- 12 free inputs, 7 free outputs

PLB 6204	for 4 I/O modules	ID 591832-03
PLB 6206	for 6 I/O modules	ID 630054-03
PLB 6208	for 8 I/O modules	ID 630055-03

Expansion PL

For connection to the system PL to increase the number of PLC inputs/outputs

PLB 6104	for 4 I/O modules	ID 591828-03
PLB 6106	for 6 I/O modules	ID 630058-03
PLB 6108	for 8 I/O modules	ID 630059-03

Up to seven PLB 6xxx can be connected to the control. The maximum cable length results from the maximum permissible length of the HSCI chain of 70 m.

I/O modules for HSCI

There are I/O modules with digital and analog inputs and outputs. For partially occupied basic modules, the unused slots must be occupied by an empty housing.

PLD-H 16-08-00	I/O module with 16 digital inputs and 8 digital outputs	ID 594243-02
PLD-H 08-16-00	I/O module with 8 digital inputs and 16 digital outputs	ID 650891-02
Total current	Outputs 0 to 7: ≤ 2 A per output (≤ 8 A simultaneously)	
Power output	Max. 200 W	
Weight	0.2 kg	
PLA-H 08-04-04	Analog module for PL 6xxx with <ul style="list-style-type: none">• 8 analog inputs, ± 10 V• 4 analog outputs, ± 10 V• 4 analog inputs for PT 100 thermistors	ID 675572-02
Weight	0.2 kg	

Empty housing

For unused slots ID 383022-01

IOconfig (accessory)

PC software for configuring HSCI and PROFIBUS components

PL 550 PLC input/output system for PROFIBUS-DP

PL 550

PLC inputs and outputs are also available via the external modular PL 550 PLC input/output system. It consists of a basic module and one or more I/O modules, and is connected to the MC main computer via the PROFIBUS-DP interface. The PLC I/O modules are configured with the PC software IOconfig. The additional module for PROFIBUS-DP (Page 28) must be installed in the MC before the PLB 550 is connected to the control.



PL 550

Basic module

Basic module with PROFIBUS-DP interface
The PLB 550 has slots for four I/O modules. It serves as a PROFIBUS slave. A total of 32 slaves can be connected to the MC with integrated PROFIBUS interface board (PROFIBUS single master). They are mounted on standard NS 35 rails (DIN 46 227 or EN 50 022).

PLB 550	ID 507872-01
Supply voltage	24 V DC
Power consumption	≈ 20 W
Weight	0.36 kg (bare)

I/O modules

The I/O modules consist of one module with digital inputs/outputs and one analog module. For partially occupied basic modules, the unused slots must be occupied by an empty housing.

PLD 16-8	ID 360916-11
I/O module for PL 5x0 with 16 digital inputs and 8 digital outputs.	
The max. power output per module is 200 W. A load of up to 2 A can be placed on each output. No more than four outputs may be loaded with 2 A at any given time.	
Weight	0.2 kg

PLA 4-4	ID 366423-01
Analog module for PL 5x0 with 4 analog inputs for PT 100 thermistors 4 analog inputs for ± 10 V	
Weight	0.2 kg

Empty housing

For unused slots	ID 383022-01
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IOconfig (accessory)

PC software for configuring HSCI and PROFIBUS components

Accessories

Power supply for HSCI components

PSL 13x

To power the HSCI components, HEIDENHAIN offers the PSL 13x power supply unit. Either line voltage and DC-link voltage or only line voltage is provided to the PSL 13x. The PSL 13x provides the safely separated 24 V DC NC power supply required for the HSCI components by EN 61800-5-1. The NC supply voltage and the PLC supply voltage are separated from each other by basic insulation.

Supply voltage	Line voltage 400 V AC \pm 10 % 50 Hz and DC-link voltage 400 V DC to 750 V DC Power consumption \leq 1000 W
Outputs	NC: 24 V DC / \leq 20 A (double insulation from line power) 5 V DC / \leq 16 A (only for PSL 135) electrically connected with 24 V DC NC PLC: 24 V DC / \leq 20 A (basic insulation from line power) Total: \leq 32 A / 750 W



PSL 130

The **PSL 130** serves as a 24 V DC power supply unit for supplying the HSCI components. If a UEC controller unit is used, then the PSL 130 is not necessary if the total current consumption of the connected HSCI components does not exceed 3.5 A.

HSCI components		Current consumption 24 V DC NC
Main computer	MC 7410T	1.8 A
Machine operating panel	PLB 6001 MB 720T	0.2 A (without handwheel) 0.2 A (without handwheel)
PLC inputs/outputs	PLB 62xx PLB 61xx PLD PLA	0.3 A (without touch probe) 0.2 A 0.05 A 0.1 A
Handwheels	HR 410	0.05 A
Touch probes	See specifications of the touch probes	

	Module width	Degree of protection	Weight	
PSL 130	50 mm	IP 20	2.1 kg	ID 575047-04

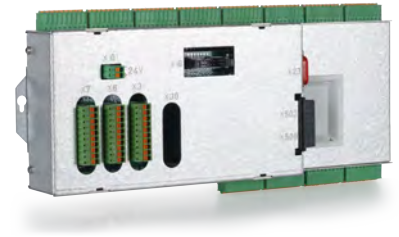
HSCI adapter for OEM machine operating panel

PLB 6001

The PLB 6001 HSCI adapter is required in order to connect an OEM-specific machine operating panel to the MANUALplus 620. The spindle-speed and feed-rate override potentiometers of the TE 7xx and the HR handwheel are also connected to this adapter.

- HSCI interface
- Connection for HR handwheel
- Inputs/outputs for keys/key illumination
 - Terminals for 72 inputs and 40 outputs
- Screw fastening or top-hat-rail mounting
- Configuration of the PLC inputs/outputs with the IOconfig computer software

PLB 6001	ID 668792-01
Weight	≈ 1.2 kg



PLB 6001

Additional modules

Overview

The additional modules are directly connected to the HSCI control system through a slot on the MC main computer.

Module for analog axes

Digital drive designs sometimes also require analog axes or spindles. The additional module CMA-H 04-04-00 (Controller Module Analog—HSCI) makes it possible to integrate analog servo drives in an HSCI system.

The CMA-H is connected to the HSCI control system through a slot on the underside of the CC or UEC. Every controller unit has slots for two boards. The CMA-H does not increase the total number of available axes: every analog axis used reduces the number of available digital control loops by one. Analog control loops also need to be enabled on the SIK. The analog control-loop outputs can only be accessed via the NC, and not via the PLC.

Additional module for analog axes/spindles

- Expansion board for CC 61xx or UEC controller units
- 4 analog outputs, ± 10 V for axes/spindle
- Spring-type plug-in terminals

CMA-H 04-04-00

ID 688721-01



CMA-H 04-04-00

Module for PROFIBUS-DP

An expansion board can be used to provide the MANUALplus 620 with a PROFIBUS interface at any time. This makes the connection to a PROFIBUS-DP field bus system possible.

The PROFIBUS module is integrated in the control system by using a slot in the MC. The interface is configured with IOconfig.

Additional module for PROFIBUS-DP

- Expansion board for the MC main computer
- Connection for D-sub connector (female) 9-pin

PROFIBUS-DP additional module

ID 828539-01



Module for PROFIBUS-DP

Touch probes

Overview

Touch probes for tool and workpiece measurement are connected via the system PL 62xx or the UEC/UMC. These touch probes generate a trigger signal that saves the current position value to the NC. For more information on the touch probes, ask for our brochure titled *Touch Probes*.

Workpiece measurement

The TS touch trigger probes have a stylus for probing workpieces. The HEIDENHAIN controls provide standard routines for datum setting and workpiece measurement and alignment. The touch probes are available with various taper shanks. Assorted styli are available as accessories.

Touch probes with **cable connection for signal transmission** for machines with manual tool change:

TS 260

New generation touch probe for NC machines



TS 260

Touch probe with **radio and infrared transmission** for machines with automatic tool change (see page 30 for the fitting transmitter/receiver unit):

TS 460

New generation touch probe with compact dimensions

- Hybrid technology: Signal transmission via radio and infrared signals
- Large transmission range and long operating time
- Mechanical collision protection and thermal decoupling



TS 460 with cylindrical shank

Touch probes with **infrared signal transmission** for machines with automatic tool change (see page 30 for the fitting transmitter/receiver unit):

TS 444

Compact dimensions, battery-free—power supply through integrated air turbine generator over central compressed air supply

TS 642

Activation via switch in taper shank

TS 740

High probing accuracy and reproducibility, low probing force

Tool measurement

The touch probes for tool measurement from HEIDENHAIN are suited for probing tools directly on the machine. The MANUALplus 620 has standard routines. The MANUALplus 620 automatically saves the results of measurement in a tool table. It is also possible to measure tool wear between two machining steps. The MANUALplus 620 compensates the changed tool dimensions automatically for subsequent machining.

With the triggering **TT touch probes**, the cuboid probe contact is deflected from its rest position upon contact with a stationary or rotating tool, sending a trigger signal to the MANUALplus 620 control.

TT 160 New generation touch probe; signal transmission to the control over connecting cable



TT 160 with a cuboid probe contact

TT 460 Next generation touch probe, hybrid technology: signal transmission via radio or infrared beam (see below for fitting transmitter/receiver unit)

Cuboid probe contact The TT tool touch probes include a disk-shaped probe contact. For use with lathes, it must be replaced by the cuboid probe contact.

Transceiver unit

The radio or infrared transmission is established between the TS or TT touch probe and the SE transceiver unit.

- SE 660** For radio or infrared transmission (hybrid technology); shared SE for TS 460 and TT 460; next generation
- SE 540** For infrared transmission; integration in the spindle head
- SE 642** For infrared transmission; shared SE for TS and TT

The following combinations are possible:

	SE 660	SE 540	SE 642
TS 444	-	Infrared	Infrared
TS 460	Radio/infrared	Infrared	Infrared
TS 642	-	Infrared	Infrared
TS 740	-	Infrared	Infrared
TT 460	Radio/infrared	Infrared	Infrared



SE 660

Electronic handwheels

Overview

The standard MANUALplus 620 supports the use of electronic handwheels.

- Up to two **HR 180** panel-mounted handwheels for connection to the position inputs
In addition, the MB machine operating panel or the PLB 6001 HSCI adapter can be connected with:
- **One HR 130** panel-mounted handwheel, or
- Up to three **HR 150** panel-mounted handwheels via **HRA 110**, or
- One **HR 410** portable handwheel

Any combination is possible. Cycle machines typically have two HR 180 and—depending on requirements—one HR 410 or—if too few position inputs are free—up to three HR 150 through the HRA 110 handwheel adapter. For CNC machines, usually only one HR 130 or HR 410 is used.

HR 410

Portable electronic handwheel with

- Keys for actual-position capture and the selection of 5 axes
- Keys for traverse direction and three preset feed rates
- Three keys with machine functions (see below)
- Emergency stop button and two permissive buttons (24 V)
- Magnetic holding pads

All keys are designed as snap-on keys and can be replaced by keys with other symbols (see *Snap-on keys*).

	Keys	W/o detent	With detent
HR 410	FCT A, FCT B, FCT C	ID 296469-53	–
	Spindle right/left/stop	ID 296469-54	–
	NC start/stop, spindle start (for PLC basic program)	ID 296469-55	ID 535220-05

Weight ≈ 1 kg



HR 410

Connecting cables

	For HR 410	
Connecting cable (spiral cable) to HR (3 m)	✓	ID 312879-01
Connecting cable with metal armor	✓	ID 296687-xx
Connecting cable without metal armor	✓	ID 296467-xx
Adapter cable for HR/HRA to MC	✓	ID 296466-xx
Extension cable to adapter cable	✓	ID 281429-xx
Dummy plug for standard handwheels	✓	ID 271958-03

See also *Cable overview* on Page 36.

HR 180

Panel-mounted handwheel with ergonomic control knob for connection to a position encoder input.

HR 180	With detent	ID 540940-08
Weight	≈ 0.7 kg	



HR 180

HR 130

Panel-mounted handwheel with ergonomic control knob.
It is attached to the MB 7x0 or the TE 7x5 either directly or via an extension cable.

HR 130	Without detent	ID 540940-03
	With detent	ID 540940-01
Weight	≈ 0.7 kg	



HR 130

HR 150

Panel-mounted handwheel with ergonomic control knob for connection to the **HRA 110** handwheel adapter.

HR 150	Without detent	ID 540940-07
	With detent	ID 540940-06
Weight	≈ 0.7 kg	



HR 150

HRA 110

Handwheel adapter for connection of up to three **HR 150** panel-mounted handwheels and two switches for axis selection and for selecting the subdivision factor. The first two handwheels are permanently assigned to axes 1 and 2. The third handwheel is assigned to the axes over a selection switch (accessory) or by machine parameters. The position of the second selection switch (accessory) is evaluated by the PLC, for example to set the proper interpolation.

HRA 110		ID 261097-04
Weight	≈ 1.5 kg	



HRA 110

Handwheel selection switch	With turning knob and cable	ID 270908-xx
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Handwheel selection switch




Snap-on keys for HR




Overview


The snap-on keys make it easy to replace the key symbols. In this way, the HR handwheel can be adapted to different requirements. The snap-on keys are available in packs of 5 keys.

Axis keys Orange










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



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




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Gray








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	ID 330816-0A
	ID 330816-0B
	ID 330816-0C
	ID 330816-70








	ID 330816-69
	ID 330816-0G
	ID 330816-0H
	ID 330816-71
	ID 330816-72
	ID 330816-63
	ID 330816-64
	ID 330816-18
	ID 330816-17








	ID 330816-0W
	ID 330816-0V
	ID 330816-0N
	ID 330816-0M
	ID 330816-67
	ID 330816-68
	ID 330816-21
	ID 330816-20
	ID 330816-0P






	ID 330816-0R
	ID 330816-0D
	ID 330816-0E
	ID 330816-65
	ID 330816-66
	ID 330816-19
	ID 330816-16
	ID 330816-0L
	ID 330816-0K

Machine functions



	ID 330816-0X
	Black ID 330816-1Y
	Black ID 330816-30
	Black ID 330816-31
	Black ID 330816-32
	ID 330816-73
	ID 330816-74



	ID 330816-75
	ID 330816-76
	ID 330816-77
	ID 330816-78
	ID 330816-79
	ID 330816-80
	ID 330816-0S



	ID 330816-0T
	ID 330816-81
	ID 330816-82
	ID 330816-83
	ID 330816-84
	ID 330816-89
	ID 330816-85



	ID 330816-86
	ID 330816-87
	ID 330816-88
	ID 330816-94
	ID 330816-0U
	ID 330816-91
	ID 330816-3L

Spindle functions






	Red ID 330816-08
	Green ID 330816-09






	ID 330816-40
	ID 330816-41






	Red ID 330816-47
	Green ID 330816-46






	ID 330816-48
	ID 385530-5X

Other keys

	Black ID 330816-01
	ID 330816-61
	Green ID 330816-11
	Red ID 330816-12
	Green ID 330816-49

	Red ID 330816-50
	ID 330816-33
	ID 330816-34
	ID 330816-13
	Green ID 330816-22












	ID 330816-90
	Black ID 330816-27
	Black ID 330816-28
	Black ID 330816-29
	ID 330816-92







































	ID 330816-93
	ID 330816-0Y
	Black ID 330816-4M
	ID 330816-3M
	ID 330816-3N


















































Snap-on keys for control

Overview



















The snap-on keys make it easy to replace the key symbols. In this way, the keyboard can be adapted to different requirements. The snap-on keys are available in packs of 5 keys.

Keys Orange		ID 679843-31		ID 679843-54		ID 679843-C8		ID 679843-D4
		ID 679843-32		ID 679843-55		ID 679843-C9		ID 679843-35
		ID 679843-53		ID 679843-88		ID 679843-D3		




























Gray		ID 679843-03		ID 679843-13		ID 679843-93		ID 679843-B9
		ID 679843-04		ID 679843-14		ID 679843-94		ID 679843-C1
		ID 679843-05		ID 679843-43		ID 679843-B1		ID 679843-C2
		ID 679843-06		ID 679843-44		ID 679843-B2		ID 679843-C3
		ID 679843-07		ID 679843-67		ID 679843-B3		ID 679843-C4
		ID 679843-08		ID 679843-68		ID 679843-B4		ID 679843-C5
		ID 679843-09		ID 679843-69		ID 679843-B5		ID 679843-D9
		ID 679843-10		ID 679843-70		ID 679843-B6		ID 679843-E1
		ID 679843-11		ID 679843-91		ID 679843-B7		
		ID 679843-12		ID 679843-92		ID 679843-B8		

Machine functions		ID 679843-01		ID 679843-30		ID 679843-74		ID 679843-C6	
		ID 679843-02		ID 679843-40		ID 679843-76		Black ID 679843-C7	
		ID 679843-16		Green ID 679843-56		Black ID 679843-95		ID 679843-D6	
		ID 679843-22		Red ID 679843-57		Black ID 679843-96		ID 679843-E3	
		ID 679843-23		+	ID 679843-59		Black ID 679843-A1		ID 679843-E4
		ID 679843-24		-	ID 679843-60		FN 4		ID 679843-E6
		ID 679843-25			ID 679843-61		FN 5		ID 679843-E7
		ID 679843-26			ID 679843-62				ID 679843-E8
		ID 679843-27		FCT	ID 679843-63				
		ID 679843-28			ID 679843-64				
		ID 679843-29			ID 679843-73				

Spindle functions

	ID 679843-18		ID 679843-47		Red ID 679843-52		ID 679843-99
	ID 679843-19		ID 679843-48		ID 679843-65		Green ID 679843-D8
	ID 679843-20		ID 679843-49		Green ID 679843-71		ID 679843-F3
	ID 679843-21		100% ID 679843-50		ID 679843-72		
	ID 679843-46		ID 679843-51		Red ID 679843-89		

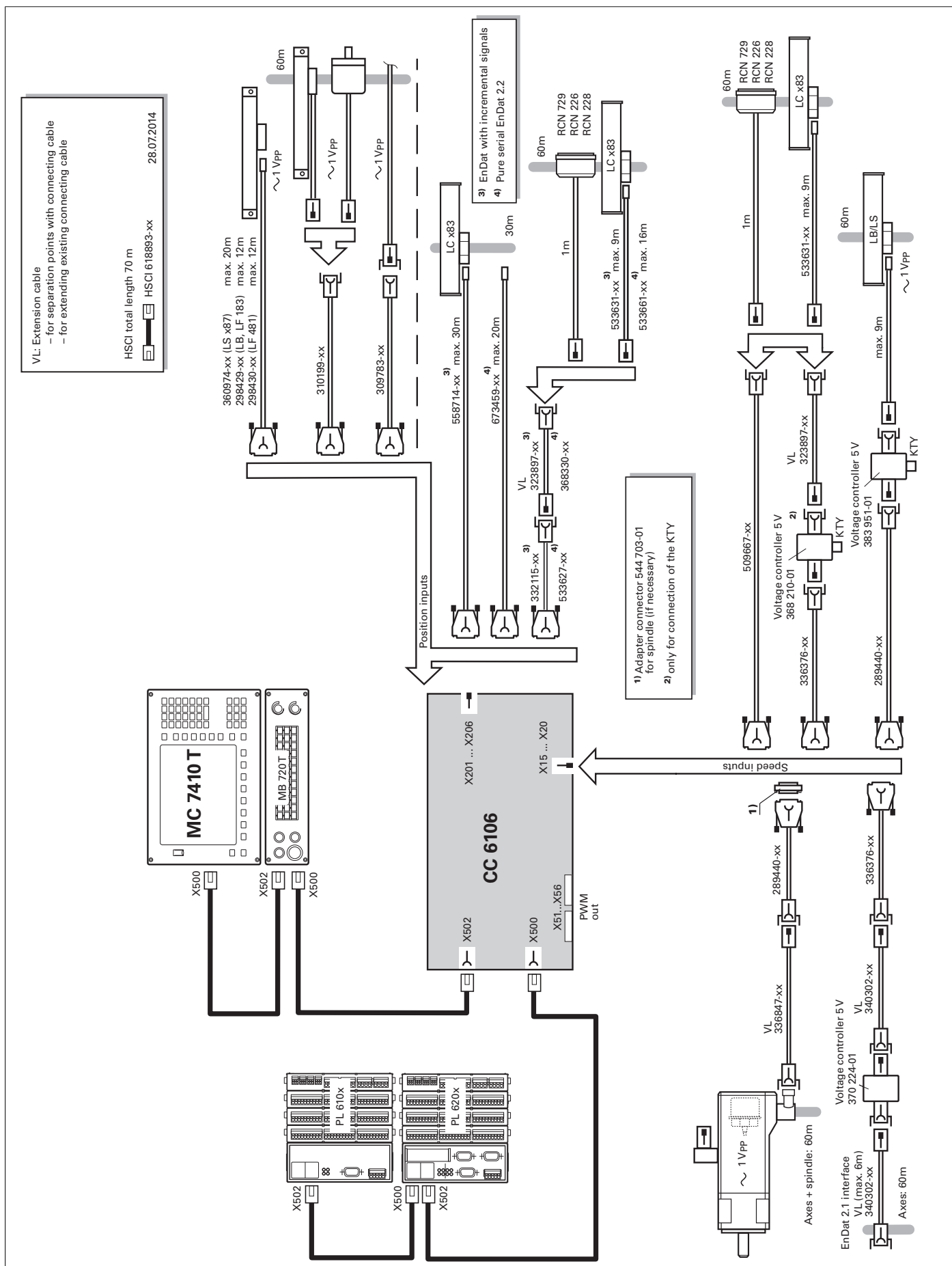
Other keys

	ID 679843-15		ID 679843-38		ID 679843-75		Black ID 679843-D2
	ID 679843-17		ID 679843-39		Green ID 679843-90		ID 679843-D5
	ID 679843-33		ID 679843-41		ID 679843-97		Red ID 679843-D7
	Black ID 679843-34		ID 679843-42		ID 679843-98		Black ID 679843-E2
	ID 679843-35		Red ID 679843-45		ID 679843-A7		ID 679843-E5
	ID 679843-36		ID 679843-58		ID 679843-A8		ID 679843-F2
	ID 679843-37		ID 679843-66		Black ID 679843-D1		

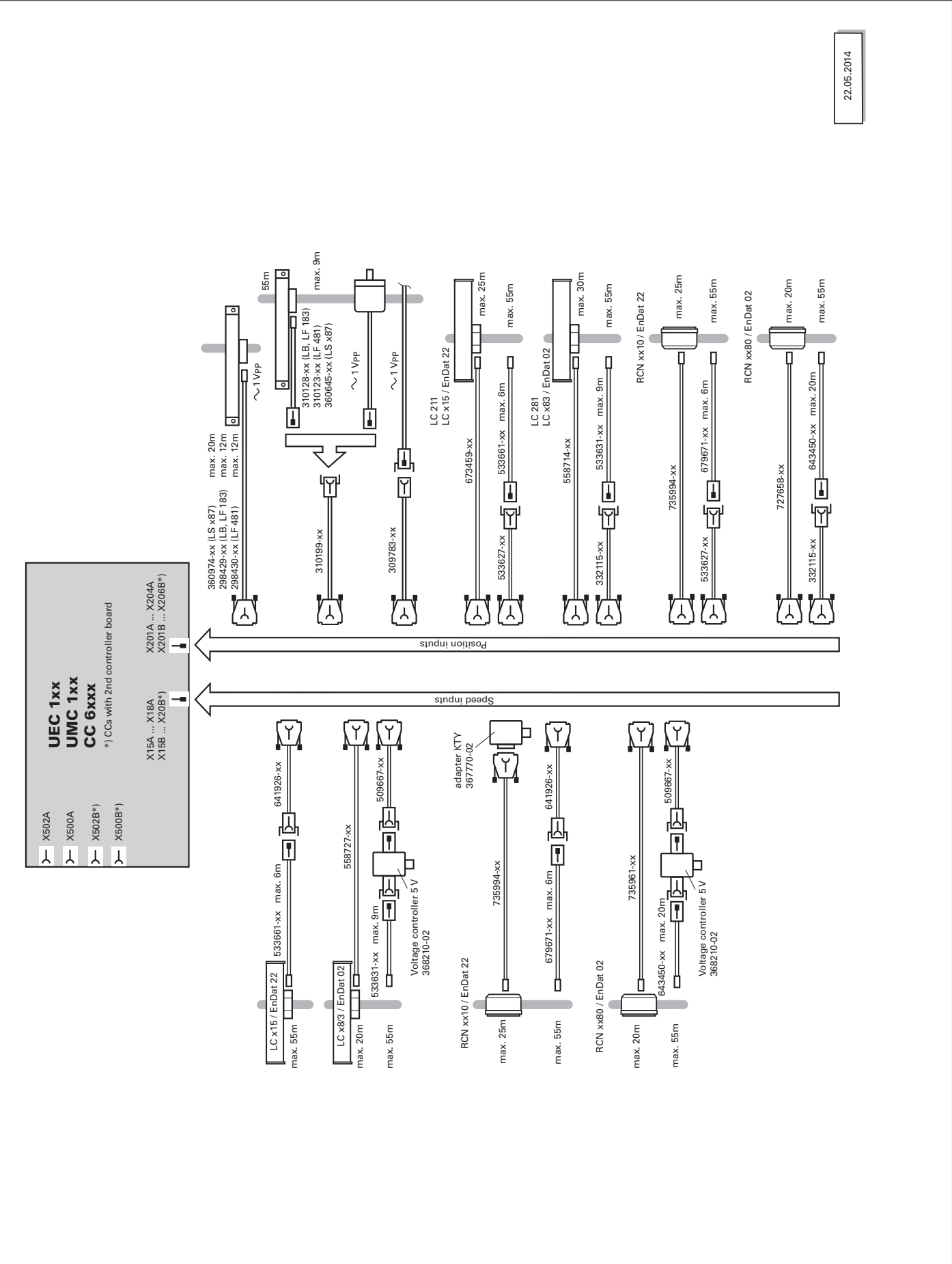
Control system with UEC



Control system with CC



Encoders



[illegible]

Technical description

Digital control design

Uniformly digital In the uniformly digital control design from HEIDENHAIN, all components are connected to each other via purely digital interfaces: The control components are connected via **HSCI** (HEIDENHAIN Serial Controller Interface), the new real-time protocol from HEIDENHAIN for Fast Ethernet, and the encoders are connected via **EnDat 2.2**, the bidirectional interface from HEIDENHAIN. This achieves a high degree of availability for the entire system. It can be diagnosed and is immune to noise—from the main computer to the encoder. These outstanding properties of the uniformly digital design from HEIDENHAIN guarantee not only very high accuracy and surface quality, but rapid traverse speeds as well. Please refer to the *Uniformly Digital* Technical Information sheet for more detailed information.

HSCI HSCI, the HEIDENHAIN Serial Controller Interface, connects the main computer, controller(s) and other control components. HSCI is based on 100BaseT Ethernet hardware. A special interface component developed by HEIDENHAIN makes short cycle times for data transfer possible.

- Main advantages of the control design with HSCI:**
- Hardware platform for flexible and scalable control system (e. g. local axis systems)
 - High noise immunity due to digital communication between components
 - Hardware basis for the implementation of “functional safety”
 - Simpler wiring (initial operation, configuration)
 - Inverters connected via proven PWM interface
 - Large cable lengths in the entire system (HSCI up to 70 m)
 - High number of possible control loops
 - High number of PLC inputs/outputs
 - Controller units can be installed elsewhere

CC or UEC controller units, up to nine PL 6000 PLC input/output modules, and machine operating panels (such as the MB 720 from HEIDENHAIN) can be connected to the serial HSCI bus of the MC main computer. The HR handwheel is connected directly to the machine operating panel. The combination of visual display unit and main computer is especially advantageous if the computer is housed in the operating panel. All that is required then is the power supply and an HSCI line to the controller in the electrical cabinet.

The maximum permissible number of individual HSCI participants is listed below.

HSCI components		Maximum number	
MC	HSCI master	1 in the system	
CC, UEC, UMC	HSCI slave	4 drive-control motherboards (distributed to CC, UEC, UMC as desired)	
MB, PLB 6001	HSCI slave	2 in the system	
PLB 61xx, PLB 62xx	HSCI slave	7 in the system	
HR	On MB or PLB 6001	1 in the system	
PLD-H-xx-xx FS	In PLB 6xxx FS	10 in the system	Total maximum of 1000 inputs/outputs
PLD-H-xx-xx, PLA-H-xx-xx	In PLB 6xxx	25 in the system	

Operating system

HEROS 5

The MANUALplus 620 runs HEROS 5 (HEIDENHAIN Real-time Operating System). This future-oriented operating system features powerful functions:

- Display of **PDF files**. Drawings, work instructions, etc. can be opened directly on the control.
- Direct Internet access from the MANUALplus 620 thanks to the **integrated browser**.
- You can open various **file formats** directly on the MANUALplus 620 and also edit some of them with the appropriate editors:
 - Text files (.txt, .ini)
 - Graphic files (.gif, .bmp, .jpg, .png)
 - Tables (.xls, .csv)
 - Internet files (.html)
- Standardized **display format** for operating system dialogs
- Setting up a firewall for additional **data security**

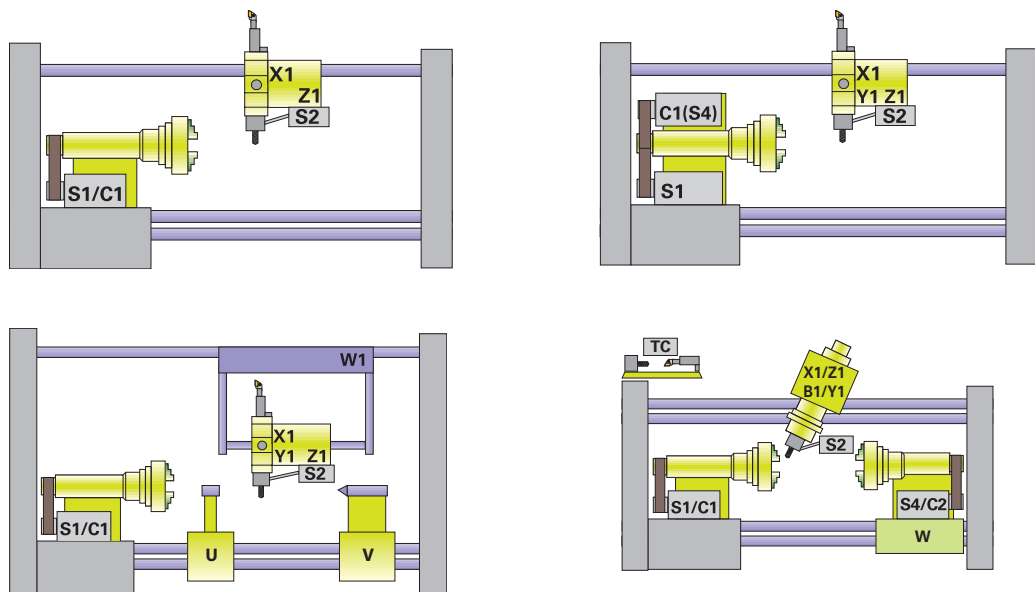
Axes

Overview

The MANUALplus 620 is a contouring control for lathes with one spindle and a slide (X, Z and Y) for tool movement. For rear-face machining of the workpiece, an optional opposing spindle can be operated in addition to the main spindle.

The control can offset the display of movements in the Z axis with those of its secondary axis W. Additional axes are available for positioning steady rests and the tailstock.

The MANUALplus 620 is suitable for various machine configurations, and supports **horizontal** as well as **vertical** lathes. Some examples of machine configurations:



Display and programming

Feed rate in

- mm/min
- mm/revolution
- Feed rate override: 0 % to 150 %
- Maximum feed rate at $f_{PWM} = 5000 \text{ Hz}$:

$$\frac{60000 \text{ min}^{-1}}{\text{No. of motor pole pairs}} \cdot \text{Screw pitch [mm]}$$

Traverse range

−99 999.9999 to +99 999.9999 [mm]

The machine tool builder defines the traverse range. It is also possible for the operator to limit the traverse range if he wishes to reduce the working space (with software limit switches). A protection zone for the spindle (Z−) can also be specified.

Tool carriers

The MANUALplus 620 supports quick change tool posts (Multifix), tool turrets and tool magazines. The tool carriers can be located in front of or behind the workpiece.

Synchronized axes (option 24)

Synchronized axes move in synchronism and are programmed with the same axis designation.

With HEIDENHAIN controls, parallel axis systems (gantry axes) such as on portal-type machines or tilting tables can be moved synchronously to each other through high-accuracy and dynamic position control.

With **gantry axes** more than one slave axis can be assigned to one master gantry axis. They may also be distributed to several controller units.

B axis (option 54)

With a B axis it is possible to drill, bore and mill in oblique planes. Programming, as usual, can be done in the main plane.

Moreover, by tilting the B axis and rotating the tool you can bring it into positions that enable you, for example, to use a single tool to machine in the longitudinal and transverse directions on the main and opposing spindles. The number of required tools and tool changes can thus be reduced.

Torque control

Torque control is used on machines with mechanically coupled motors for which

- a defined distribution of drive torque is desired,
- or
- parts of the controlled system show a backlash effect that can be eliminated by tensioning the servo drives (e.g. toothed racks).

Real-time coupling function (option 135)

The real-time coupling function (Synchronizing Functions) allows the cyclic calculation of a position offset for an axis from the actual and nominal values of any other axes in the system. This enables you to realize complex simultaneous movements of several NC or PLC axes. The mutual dependence of the axes is defined in mathematical formulas.

PLC axes

Axes can be controlled by the PLC. They are programmed through M functions or OEM cycles. The PLC axes are positioned independently of the NC axes and are therefore designated as asynchronous axes.

Spindle and opposing spindle

Overview	For machines featuring a higher level of automation, you can position the spindle or opposing spindle, or switch to C-axis operation.
Display and programming	<p>Spindle speed:</p> <ul style="list-style-type: none"> • Constant shaft speed: 1 to 99999 rpm • Constant surface speed: 1 to 9999 m/min
Spindle positioning	Input resolution and display step: 0.001°
Spindle speed limitation	<ul style="list-style-type: none"> • The MANUALplus 620 monitors the actual speed. • Speed limiting can be defined via parameters and in the feed rate/spindle/tool menu (TSF menu).
Spindle override	50 to 150 %
Maximum spindle speed	<p>The maximum spindle speed is calculated as follows:</p> $n_{\max} = \frac{f_{\text{PWM}} \cdot 60000 \text{ min}^{-1}}{\text{NPP} \cdot 5000 \text{ Hz}}$ <p> f_{PWM} = PWM frequency in Hz NPP = Number of pole pairs </p>
Gear ranges	A specific parameter set can be defined for each gear range. The gears are switched via the PLC. Up to 10 gear ranges are supported.
Operating mode switchover	For controlling the spindle (e.g. for wye/delta connection), different parameter sets can be stored. You can switch between the parameter sets in the PLC.
Position-controlled spindle	The position of the spindle is monitored by the control.
Encoder	HEIDENHAIN rotary encoder with sinusoidal voltage signals (1 V _{pp}) or EnDat interface.
C-axis operation (option 55)	<p>For milling, drilling and boring cycles, either the spindle or opposing spindle is switched to C-axis operation, or a separate C-axis drive is activated.</p> <p>Input resolution and display step: 0.001°</p>
Opposing spindle (option 132)	The option Opposing Spindle is necessary in order to work with an opposing spindle. The option Spindle Synchronism is included in the option Opposing Spindle.

Driven tool

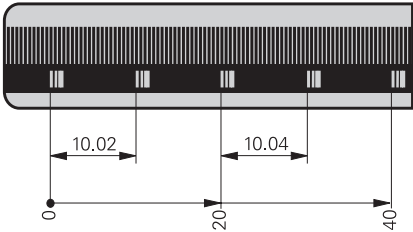
Overview	The driven tool is used for drilling and tapping holes as well as for milling in M19 or C-axis operation. Programs for the driven tool can be input in manual operation, via cycles with smart.Turn or in the DIN editor.
Display and programming	Speed of the driven tool: <ul style="list-style-type: none">• Constant shaft speed: 1 to 99999 rpm• Constant surface speed: 1 to 9999 m/min
Spindle speed limitation	<ul style="list-style-type: none">• The MANUALplus 620 monitors the actual speed.• Speed limiting can be defined via parameters and in the feed rate/spindle/tool menu (TSF menu).
Spindle Synchronism (option 131)	The option Spindle Synchronism is necessary for special operations with a driven tool (e.g. polygonal turning.) This option is included in the option Opposing Spindle.

Encoders

Overview For speed and position control of the axes and spindle, HEIDENHAIN offers both incremental and absolute encoders.

Incremental encoders Incremental encoders have as measuring standard a grating consisting of alternate lines and spaces. Relative movement between the scanning head and the scale causes output of sinusoidal scanning signals. The measured value is calculated from these signals.

Reference mark When the machine is switched on, the machine axes need to traverse a reference mark for an accurate reference to be established between measured value and machine position. For encoders with distance-coded reference marks, the maximum travel until automatic reference mark evaluation for linear encoders is only 20 mm or 80 mm, depending on the model, or 10° or 20° for angle encoders.



Evaluation of reference marks The routine for traversing the reference marks can also be started for specific axes via the PLC during operation (reactivation of parked axes).

Output signals Incremental encoders with sinusoidal output signals with ~ 1 V_{pp} levels are suitable for connection to HEIDENHAIN numerical controls.

Absolute encoders With absolute encoders, the position information is contained in several coded tracks. Thus, an absolute reference is available immediately after switch-on. Reference-mark traverse is not necessary. Additional incremental signals are output for highly dynamic control loops.

EnDat interface The MANUALplus 620 features the serial EnDat 2.2 interface (includes EnDat 2.1) for the connection of absolute encoders.

Note: The EnDat interface on HEIDENHAIN encoders differs in its pin assignment from the interface on Siemens motors with integrated absolute ECN/EQN rotary encoders. Special adapter cables are available.

Encoder inputs Incremental and absolute linear, angle or rotary encoders from HEIDENHAIN can be connected to all **position encoder** inputs of the controller unit.

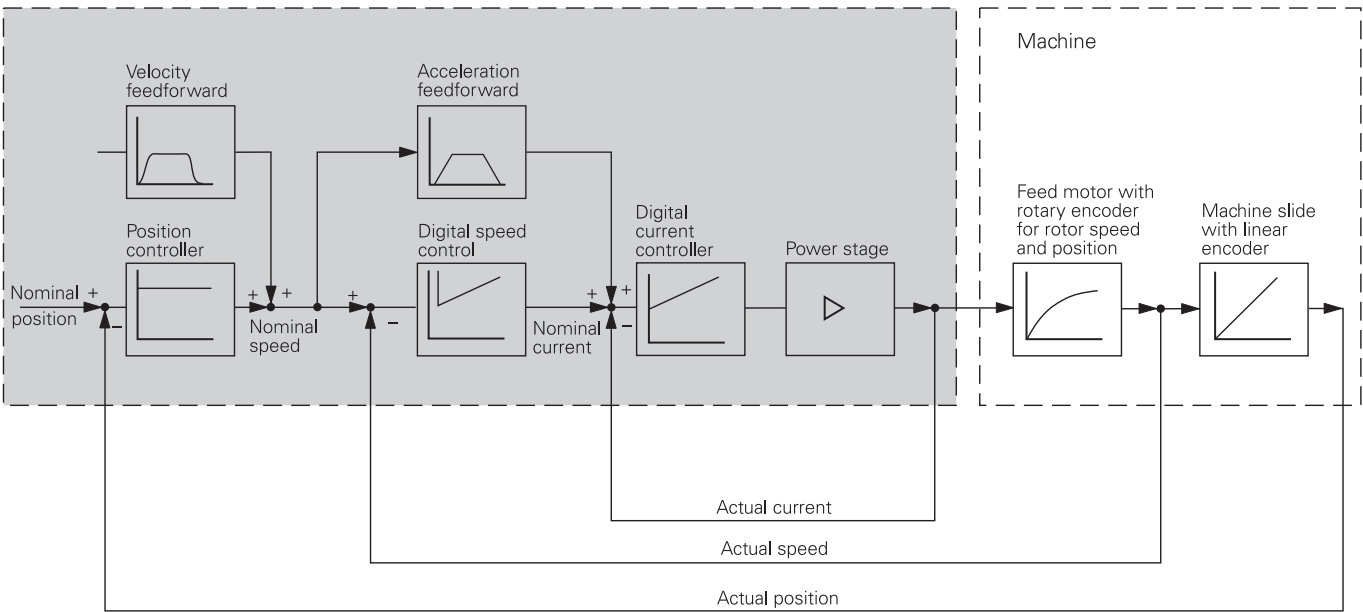
Incremental and absolute rotary encoders from HEIDENHAIN can be connected to all **speed encoder** inputs of the controller unit.

Channel inputs	Signal level/ Interface ¹⁾	Input frequency ¹⁾	
		Position	Speed
Incremental signals	~1 V _{pp}	33 kHz/350 kHz	350 kHz
Absolute position values	EnDat 2.2 ²⁾ /02	–	–
Incremental signals	~1 V _{pp}	33 kHz/350 kHz	350 kHz
Absolute position values	EnDat 2.2 ²⁾ /22	–	–

¹⁾ Switchable
²⁾ Includes EnDat 2.1

Digital servo control

Integrated inverter Position controllers, speed controllers, current controllers and inverters are integrated in the MANUALplus 620. HEIDENHAIN synchronous or asynchronous motors are connected to the MANUALplus 620.



Axis feedback control The MANUALplus 620 can be operated with following error or feedforward control.

Operation with following error The term “following error” denotes the distance between the momentary nominal position and the actual position of the axis. The velocity is calculated as follows:

$$v = k_v \cdot s_a$$

v
 k_v
 s_a

= velocity

= position loop gain

= following error

Operation with feedforward control Feedforward means that the speed and the acceleration are adjusted to fit the machine. Together with the values calculated from the following error, it forms the nominal value. This greatly reduces the following error (to within a few μm).

Compensation of torque ripples The torque of synchronous, torque and linear motors is subject to periodic oscillations, one cause of which can be permanent magnets. The amplitude of this torque ripple depends on the motor design, and under certain circumstances can have an effect on the workpiece surface. After the axes have been commissioned with the TNCopt software, the Torque Ripple Compensation (TRC) of the CC 61xx or UEC 11x can be used to compensate it.

Control loop cycle times The cycle time for **path interpolation** is defined as the time interval during which interpolation points on the path are calculated.

Double-speed control loops (option 49) Double-speed control loops permit higher PWM frequencies as well as shorter cycle times of the speed controller. This makes improved current control for spindles possible, and also higher control performance for linear and torque motors.

Jerk

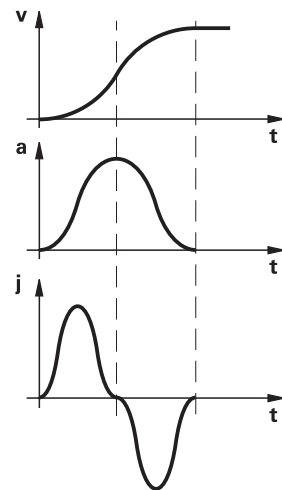
The derivative of acceleration is referred to as jerk. A linear change in acceleration causes a jerk step. Such motion sequences may cause the machine to oscillate.

Jerk limiting

To prevent machine oscillations, the jerk is limited to attain optimum path control.

Smoothed jerk

The jerk is smoothed by nominal position value filters. The MANUALplus 620 therefore mills smooth surfaces at the highest possible feed rate and yet keeps the contour accurate. The operator programs the permissible tolerance in a cycle. Special filters for HSC machining (HSC filters) can specifically suppress the natural frequencies of an individual machine. The desired accuracy and a very high surface quality are attained.



Monitoring functions

Description

During operation the control monitors the:

- Amplitude of the encoder signals
- Edge separation of the encoder signals
- Absolute position of encoders with distance-coded reference marks
- Current position (following error monitoring)
- Actual path traversed (movement monitoring)
- Position deviation at standstill
- Nominal speed value
- Checksum of safety-related functions
- Supply voltage
- Buffer battery voltage
- Operating temperature of the MC and CPU
- Run time of the PLC program
- Motor current and temperature
- Temperature of the power module
- DC-link voltage

With EnDat 2.2 encoders:

- the CRC checksum of the position value
- the EnDat alarm Error1 → EnDat status alarm register (0xEE)
- the EnDat alarm Error2
- the Edge speed of 5 µs
- the transmission of the absolute position value on the time grid

In the case of hazardous errors, an EMERGENCY STOP message is sent to the external electronics via the control-is-ready output, and the axes are brought to a stop. The correct connection of the MANUALplus 620 in the machine's EMERGENCY STOP loop is checked when the control system is switched on. In the event of an error, the control displays a message in plain language.

Context-sensitive help

The HELP and ERR keys provide the user with context-sensitive help. This means that in the event of an error message, the control displays information on the cause of the error and proposes solutions. The machine tool builder can also use this function for PLC error messages.

KinematicsDesign (accessory)

KinematicsDesign is a PC program for creating adaptable kinematic configurations. It supports:

- Complete kinematic configurations
- Transfer of configuration files between control and PC

Kinematics descriptions developed for the iTNC 530 can also be converted to kinematics descriptions for the TNC 640/620/320/128.

If KinematicsDesign is connected with a control online (operation is also possible with the programming station software), then machine movements can be simulated graphically along with axis traverse.

Possible display views include a wire model or a pure listing of the transformation chain. The TNC 640 and iTNC 530 can also depict the entire work envelope.

**Load monitoring
(option 151)**

Load monitoring (option 151) monitors the load that occurs during machining processes, in order to detect the wear or breakage of tools. By performing a reference operation for each machining step, the nominal load on the drives is determined. The actual drive load is then continuously compared to the nominal load. Up to four drives can be monitored per machining step. Two definable limit values lead to appropriate error reactions should a tool wear out or break.

Tool wear

If the load and/or the load integral exceed the limit value for tool wear, the MANUALplus 620 marks the current tool as worn out. With active tool life monitoring the tool will automatically be replaced by a defined replacement tool the next time it is called.

Tool breakage

If the load exceeds the limit value for tool breakage, the MANUALplus 620 immediately stops machining (cycle stop).

Meaningful error messages are issued if the limit values are exceeded. Furthermore, the MANUALplus 620 can display the load values numerically and graphically in a separate window.

Error compensation

Overview	The MANUALplus 620 automatically compensates mechanical errors on the machine.
Linear error	Linear error can be compensated over the entire travel range for each axis.
Nonlinear error	The MANUALplus 620 can compensate for ball-screw pitch errors and sag errors simultaneously. The compensation values are stored in a table.
Backlash	The play between table movement and rotary encoder movement on direction changes can be compensated in length measurements by spindle and rotary encoder. This backlash is outside the controlled system.
Hysteresis	The hysteresis between table movement and motor movement is also compensated in direct length measurements. In this case the hysteresis is within the controlled system.
Reversal spikes	In circular movements, reversal spikes can occur at quadrant transitions due to mechanical influences. The MANUALplus 620 can compensate for these reversal spikes.
Static friction	At very low feed rates, high static friction can cause the slide to stop and start repeatedly for short periods. This is commonly known as stick-slip. The MANUALplus 620 can compensate for this problem condition.
Sliding friction	Sliding friction is compensated by the speed controller of the MANUALplus 620.
Thermal expansion	<p>To compensate thermal expansion, the machine's expansion behavior must be known.</p> <p>The temperature can be recorded via thermistors connected to the analog inputs of the MANUALplus 620. The PLC evaluates the temperature information and transfers the compensation value to the NC.</p>
Load Adaptive Control (LAC) (option 143)	<p>LAC (option 143) enables you to adapt controller parameters dynamically depending on the load or friction.</p> <p>In order to optimize changed control behavior at differing loads, adaptive feedforward controls can exploit data on acceleration, holding torque, static friction and friction.</p>
Crossover Position Filter (CPF)	To increase the stability of the position control loop in systems with resonances, the position signal from the position encoder, which is filtered through a low-pass filter, is combined with the position signal from the motor speed encoder, which is filtered through a high-pass filter. This signal combination is made available to the position controller as actual position value. The possible position controller gain (k_v factor) is increased significantly by this. The filter separation frequency is set specifically for each axis via machine parameters. The CPF can be used only in dual-encoder systems, i.e. on drive motors with speed encoder and position encoder.

Commissioning and diagnostic aids

Overview

The MANUALplus 620 provides comprehensive internal commissioning and diagnostic aids. It also includes highly effective PC software for diagnosis, optimization and remote control.

ConfigDesign (accessory)

PC software for configuring the machine parameters

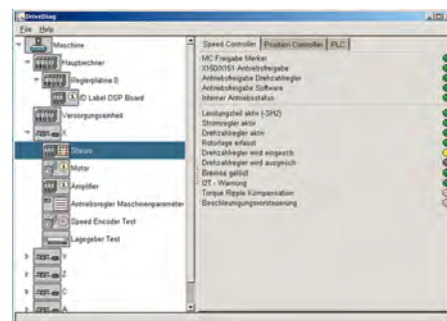
- Machine-parameter editor for the control; all support information; additional data and input limits are shown for each parameter
- Configuration of machine parameters
- Comparison of parameters from different controls
- Importing of service files: easy testing of machine parameters in the field
- Rule-based creation and management of machine configurations for multiple controls (together with PLCdesign)

DriveDiag

DriveDiag permits quick and easy troubleshooting of the drives. The following diagnostic functions are available:

- Reading and displaying the electronic ID labels of QSY motors with EQN 13xx or ECN 13xx as well as the inverter modules UVR 1xxD and UM 1xxD
- Displaying and evaluating the internal control conditions and the status signals of the inverter components
- Displaying the analog values available to the drive controller
- Automatic test for proper function of motors and inverters, of position encoders and speed encoders

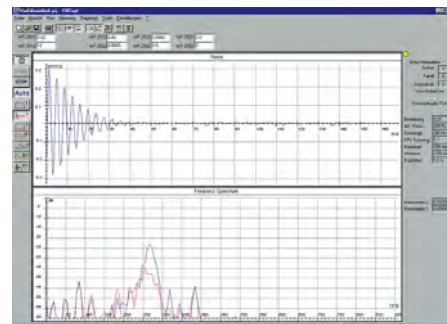
DriveDiag can be called directly from the control via the Diagnosis soft key. It is also available for downloading as PC software (accessory) from HESIS Web Including FileBase on the Internet. End users have read-access, whereas the code number for the machine tool builder gives access to comprehensive testing possibilities with DriveDiag.



TNCopt (accessory)

PC software for commissioning digital control loops

- Functions:
- Commissioning the current controller
 - (Automatic) commissioning of the speed controller
 - (Automatic) optimization of sliding-friction compensation
 - (Automatic) optimization of the reversal-spike compensation
 - (Automatic) optimization of k_v factor
 - Circular interpolation test, contour test



Requirements:

DriveDiag and TNCopt place the following demands on the PC:

- Windows 2000 / XP / Vista / 7 operating system
- At least 15 MB free memory on the hard disk
- Serial or Ethernet interface

Online Monitor (OLM)

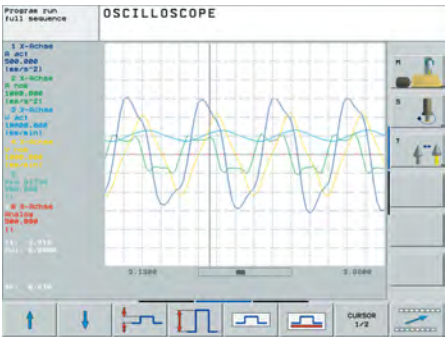
The online monitor is a component part of the MANUALplus 620 and is called over a code number. It supports commissioning and diagnosis of control components by:

- Display of control-internal variables for axes and channels
- Display of controller-internal variables (if a CC is present)
- Display of hardware signal states
- Various trace functions
- Activation of spindle commands
- Enabling control-internal debug outputs

Oscilloscope

The MANUALplus 620 features an integrated oscilloscope. Both X/t and X/Y graphs are possible. The following characteristic curves can be recorded and stored in six channels:

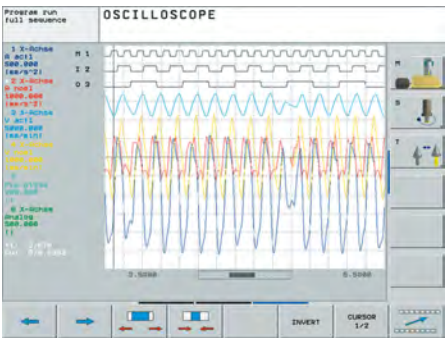
- Actual value and nominal value of the axis feed rate
- Contouring feed rate
- Nominal and actual position
- Following error of the position controller
- Content of PLC operands
- Encoder signal (0° – A) and (90° – B)
- Difference between position and speed encoder
- Nominal velocity value
- Integral-action component of the nominal current value
- Torque-determining nominal current value



Logic signals

Simultaneous graphic representation of the logic states of up to 16 operands (markers, words, inputs, outputs, counters, timers)

- Marker (M)
- Input (I)
- Output (O)
- Timers (T)
- Counter (C)
- IpoLogik (X)



TNCscope (accessory)

PC software for transferring the oscilloscope files to a PC. With TNCscope you can record and save up to 16 channels simultaneously.

API DATA

The API DATA function enables the control to display the states or contents of the symbolic API markers and API double words. This function requires that your PLC program use the symbolic memory interface.
Note: The API DATA function does not provide usable display values with the iTNC 530-compatible memory interface (API 1.0).

Table function

The current conditions of the markers, words, inputs, outputs, counters and timers are displayed in tables. The conditions can be changed through the keyboard.

Trace function

The current content of the operands and the accumulators is shown in the statement list in each line in hexadecimal or decimal code. The active lines of the statement list are marked.

Log

For the purposes of error diagnostics, all error messages and keystrokes are recorded in a log. The entries can be read using the **PLCdesign** or **TNCremo** software for PCs.

TeleService (accessory)

PC software for remote diagnostics, remote monitoring and remote operation of the control. For more information, please ask for the *Remote Diagnosis with TeleService* Technical Information sheet.

Bus diagnosis

In Diagnosis mode, the structure of the HSCI/PROFIBUS system as well as the details of the HSCI/PROFIBUS components can be displayed in a clearly laid out screen. For HSCI components this is possible even to the level of individual terminals.

Integrated PLC

Overview The PLC program is created by the machine manufacturer either at the control or with the PLC development software **PLCdesign** (accessory). Machine-specific functions are activated and monitored via the PLC inputs/outputs. The number of PLC inputs/outputs required depends on the complexity of the machine.

PLC inputs/outputs PLC inputs and outputs are available via the external PL 6000 PLC input/output systems or the UEC 11x. The PLC inputs/outputs and the PROFIBUS-DP-capable I/O system must be configured with the IOconfig PC software.

PLC programming	Format	Statement list
	Memory	350 MB
	Cycle time	9 ms to 30 ms (adjustable)
	Command set	<ul style="list-style-type: none">• Bit, byte and word commands• Logical operations• Arithmetic commands• Comparisons• Nested calculations (parentheses)• Jump commands• Subprograms• Stack operations• Submit programs• 952 timers• 48 counters• Comments• PLC modules• 100 strings

PLC soft keys The machine manufacturer can display his own PLC soft keys in the vertical soft-key row on the screen.

PLC positioning All closed-loop axes can be also positioned via the PLC. PLC positioning of the NC axes cannot be superimposed on NC positioning.

PLC axes Axes can be controlled by the PLC. They are programmed by M functions or OEM cycles. The PLC axes are positioned independently of the NC axes.

**PLCdesign
(accessory)**

PC software for PLC program development.
The PC program **PLCdesign** can be used for easy creation of PLC programs. Comprehensive examples of PLC programs are included.

- Functions:
- Easy-to-use text editor
 - Menu-guided operation
 - Programming of symbolic operands
 - Modular programming method
 - “Compiling” and “linking” of PLC source files
 - Operand commenting, creation of the documentation file
 - Comprehensive help system
 - Data transfer between the PC and control
 - Creation of PLC soft keys

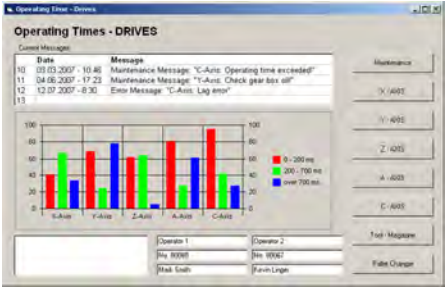
- PC requirements:
- Windows 2000 / XP / Vista / 7 / 8 operating system
 - At least 20 MB free memory on the hard disk
 - Serial interface; Ethernet interface recommended
 - Internet Explorer

**Python OEM
Process
(option 46)**

The Python OEM Process option is an effective tool for the machine tool builder to use an object-oriented high-level programming language in the control (PLC). Python is an easy-to-learn script language that supports the use of all necessary high-level language elements.

Python OEM Process can be universally used for machine functions and complex calculations, as well as to display special user interfaces. User-specific or machine-specific solutions can be efficiently implemented. Numerous libraries on the basis of Python and GTK are available, regardless of whether you want to create special algorithms for special functions, or separate solutions such as an interface for machine maintenance software.

The applications created can be included via the PLC in the familiar PLC windows, or they can be displayed in separate free windows that can be expanded to the control’s full screen size.



PLC basic program

The PLC basic program serves as a basis for adapting the control to the requirements of the respective machine. It can be downloaded from the Internet.

These essential functions are covered by the PLC basic program:

- Controlling all axes
- Clamped axes
- Homing the axes; reference end positions
- Positioning the axes after reference run
- Compensating the axis temperature
- Feed rate control
- Spindle control and orientation
- Spindle brake
- Gear switching via M functions
- C axis via main drive
- C axis with separate drive
- Vertical PLC soft-key row
- Displaying and managing PLC error messages
- Hydraulic control
- Hydraulic chuck
- Control of the coolant system (internal, external, air)
- M functions
- Lubrication
- Chip conveyor
- Operation of the second spindle alternately with the first
- S-coded spindle
- Touch probes
- PLC support for handwheels
- Control of doors
- Tool change for multifix tools
- Positioning of the tool turret with three-phase motor

Data transfer and communication

Data interfaces

Overview	The MANUALplus 620 is connected to PCs, networks and other data storage devices via data interfaces.		
Ethernet	The MANUALplus 620 can be interconnected via the Ethernet interface. The control features a 1000BaseT (Twisted Pair Ethernet) connection to the data network.		
	Maximum transmission distance: Unshielded 100 m Shielded 400 m		
Protocol	The MANUALplus 620 communicates using the TCP/IP protocol.		
Network connection	<ul style="list-style-type: none">• NFS file server• Windows networks (SMB)		
Data transfer rate	Approx. 400 to 800 Mbps (depending on file type and network utilization)		
RS-232-C	Data interface according to DIN 66 020 or EIA standard RS-232-C. Maximum transmission distance: 20 m		
Data transfer rate	115 200; 57 600; 38 400; 19 200; 9600; 4800; 2400; 1200; 600; 300; 150; 110 bps		
Protocols	The MANUALplus 620 can transfer data using various protocols.		
Standard data transfer	The data is transferred character by character. The number of data bits, stop bits, the handshake and character parity must be set by the user.		
Blockwise data transfer	The data is transferred blockwise. A block check character (BCC) is used to ensure data integrity. This method improves data security.		
LSV2	Bidirectional transfer of commands and data according to DIN 66 019. The data is divided into blocks and transferred.		
Adapter block	For connecting the interface to the electrical cabinet or operating panel.		
	RS-232-C adapter	9-pin	ID 363987-02
		25-pin	ID 310085-01
USB	The MANUALplus 620 features USB ports for the connection of standard USB devices, such as the mouse, drives, etc. There are four USB 3.0 ports on the rear of the MC 7xxx. One easily accessible USB 2.0 port is on the front of the unit. A cover cap protects it from contamination. The USB ports are rated for a maximum of 0.5 A.		
USB cables	Cable length up to 5 m	ID 354770-xx	
	Cable length 6 m to 30 m with integrated amplifier; USB 1.1.	ID 624775-xx	

USB hub

If you need further USB ports or if the supply current is not sufficient, a USB hub is required. The USB hub from HEIDENHAIN offers four free USB 2.0 ports.

USB hub

24 V DC power supply / max. 300 mA

ID 582884-02

**Cover**

The USB hub can be installed in the operating panel in such a way that two USB ports can be accessed from the outside. An optionally available cover cap can be used to protect the ports from contamination.

Cover

ID 508921-01

Software for data transfer

We recommend using HEIDENHAIN software to transfer files between the MANUALplus 620 and a PC.

TNCremo (accessory)

This PC software package helps the user to transfer data from the PC to the control. The software transfers data blockwise with block check characters (BCC).

Functions:

- Data transfer (also blockwise)
- Remote control (only serial)
- File management and data backup of the control
- Reading out the log
- Print-out of screen contents
- Text editor
- Managing more than one machine

Requirements:

- Windows 2000 / XP / Vista / 7 / 8 operating system
- At least 10 MB free hard-disk space
- Serial or Ethernet interface

TNCremoPlus (accessory)

In addition to the features you are already familiar with from TNCremo, TNCremoPlus can also transfer the current content of the control's screen to the PC (live screen). This makes it very simple to monitor the machine.

TNCremoPlus

ID 340447-xx

DNC applications

Overview

The development environments on Windows operating systems are particularly well suited as flexible platforms for application development in order to come to terms with the increasingly complex requirements of the machine's environment. The flexibility of the PC software and the large selection of ready-to-use software components and standard tools in the development environment enable you to develop PC applications of great use to your customers in a very short time, for example:

- Error reporting systems that, for example, send the customer a text message to his cell phone reporting problems on the currently running machining process
- Standard or customer-specific PC software that decidedly increases process security and equipment availability
- Software solutions controlling the processes of manufacturing systems
- Information exchange with job management software



HEIDENHAIN DNC (option 18)

The HEIDENHAIN DNC software interface is an attractive communication platform for this purpose. It provides all the data and configuration capabilities needed for these processes so that an external PC application can evaluate data from the control and, if required, influence the manufacturing process.

RemoTools SDK (accessory)

To enable you to use HEIDENHAIN DNC effectively, HEIDENHAIN offers the RemoTools SDK development package. It contains the COM components and the ActiveX control for integration of the DNC functions in development environments.

RemoTools SDK ID 340442-xx

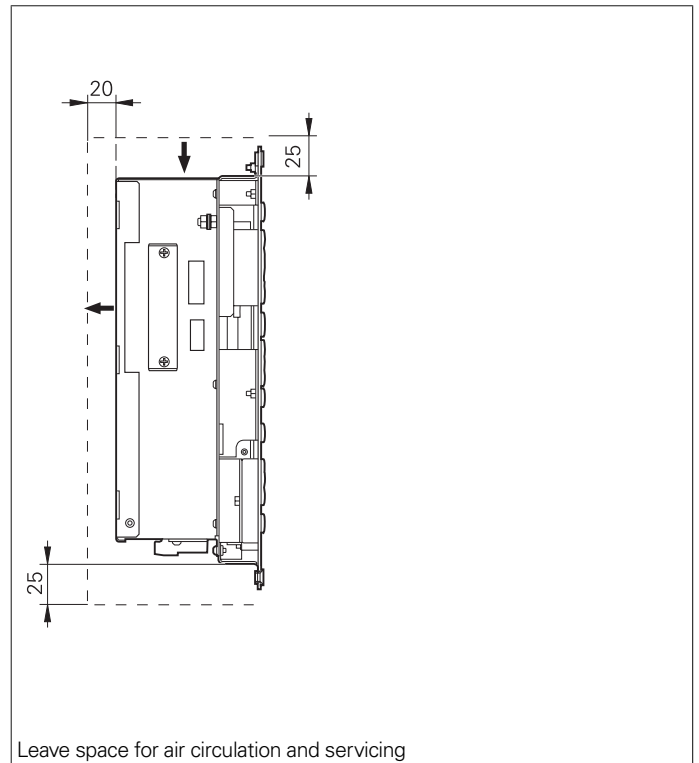
For more information, refer to the *HEIDENHAIN DNC* brochure.

Mounting information

Clearances and mounting

Proper minimum clearance

When mounting the control components, please observe proper minimum clearances, space requirements, length and position of the connecting cables.



Mounting and electrical installation

Keep the following in mind during mounting and electrical installation:

- National regulations for power installations
- Interference and noise immunity
- Operating conditions
- Mounting position

Degrees of protection

The following components fulfill the requirements for IP 54 (dust protection and splash-proof protection):

- MANUALplus 620 (when properly installed)
- Machine operating panel (when properly installed)
- Handwheel

All electric and electronic control components must be installed in an environment (e.g. electrical cabinet, housing) that fulfills the requirements of protection class IP 54 (dust and splash-proof protection) in order to fulfill the requirements of contamination level 2. All components of the OEM operating panel must also comply with protection class IP 54, just like the HEIDENHAIN operating panel components.

Electromagnetic compatibility

Protect your equipment from interference by observing the rules and recommendations specified in the Technical Manual.

Intended place of operation

This unit fulfills the requirements for EN 50370-1 and is intended for operation in industrially zoned areas.

Likely sources of interference

Interference is produced by capacitive and inductive coupling into electrical conductors or into device connections, caused by e.g.:

- Strong magnetic fields from transformers or electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Power lines and leads to the above equipment

Protective measures

- Keep a minimum distance of 20 cm from the MC, CC and its leads to devices that carry interference signals
- Keep a minimum distance of 10 cm from the MC, CC and its leads to cables that carry interference signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- Shielding according to EN 50 178
- Use equipotential bonding conductors with a cross section of 6 mm²
- Use only genuine HEIDENHAIN cables and connecting elements

Overall dimensions

Main computer

MC 7410T

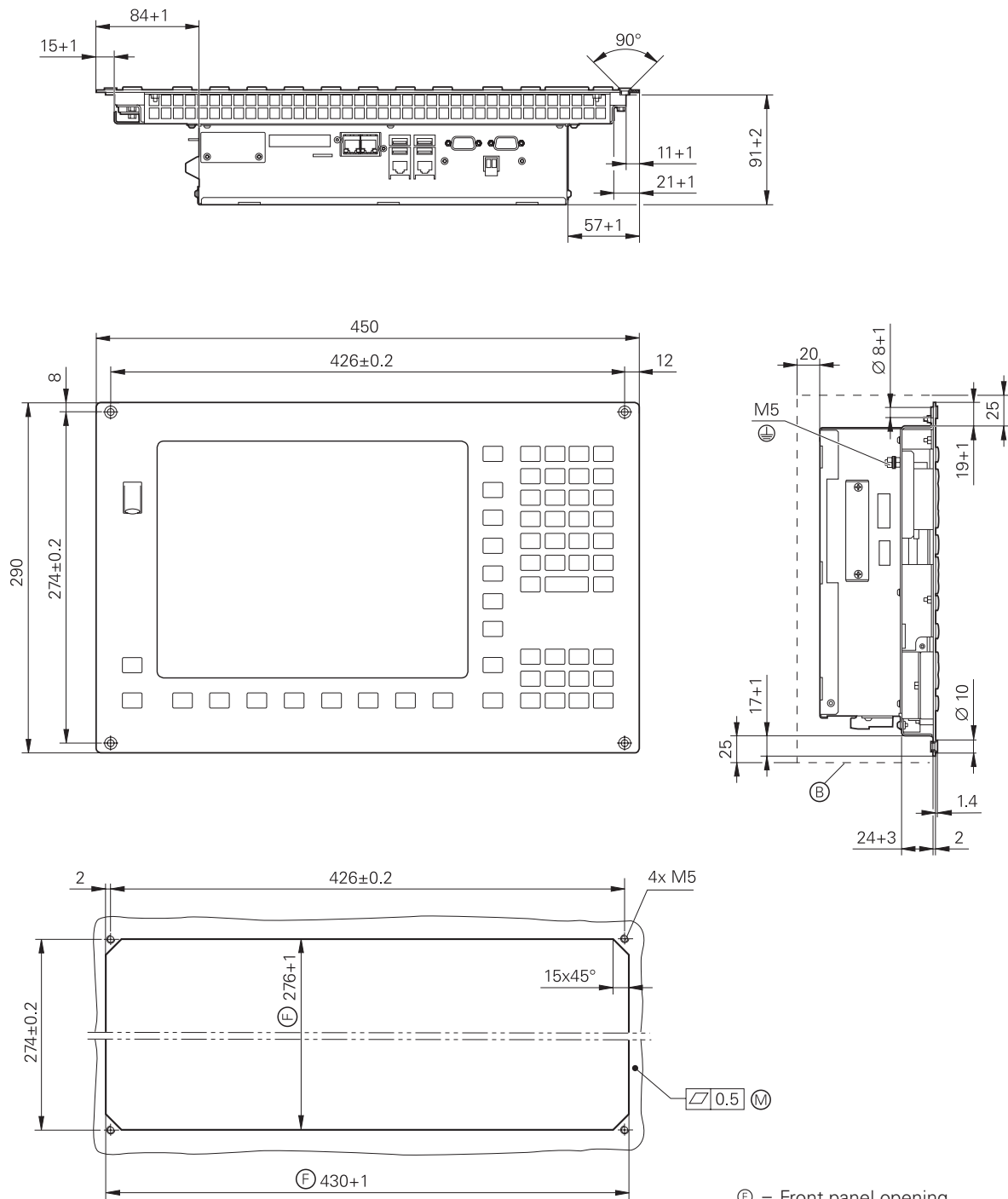
mm



Tolerancing ISO 8015

ISO 2768 - m H

< 6 mm: ± 0.2 mm

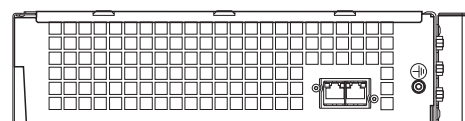
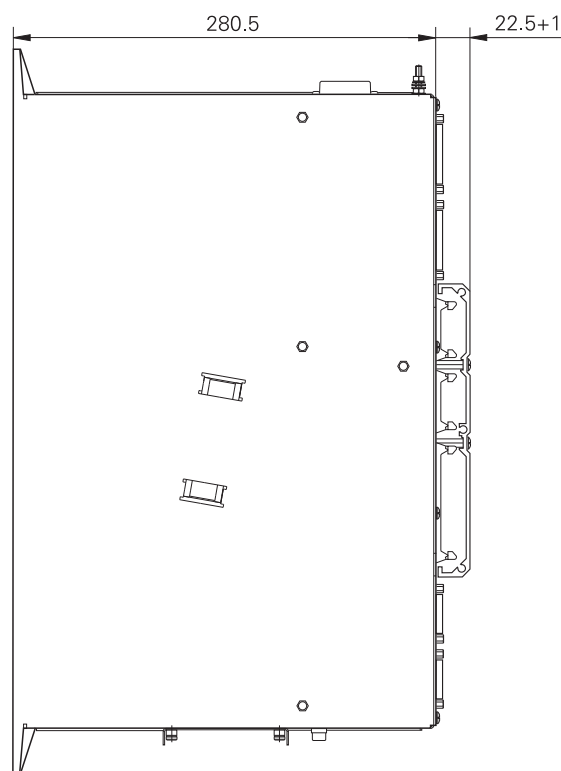
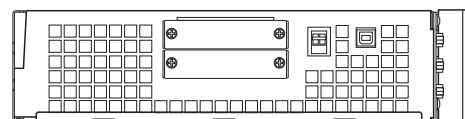
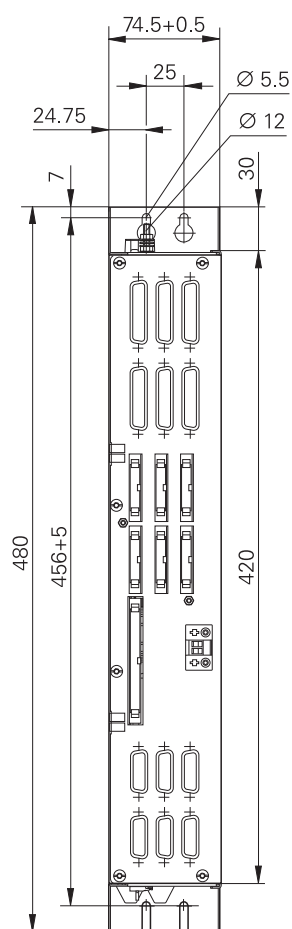


- ⓕ = Front panel opening
- (M) = Mounting surface
- Ⓟ = Space for air circulation

Controller unit

CC 6106

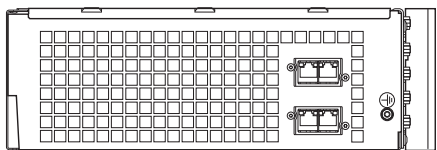
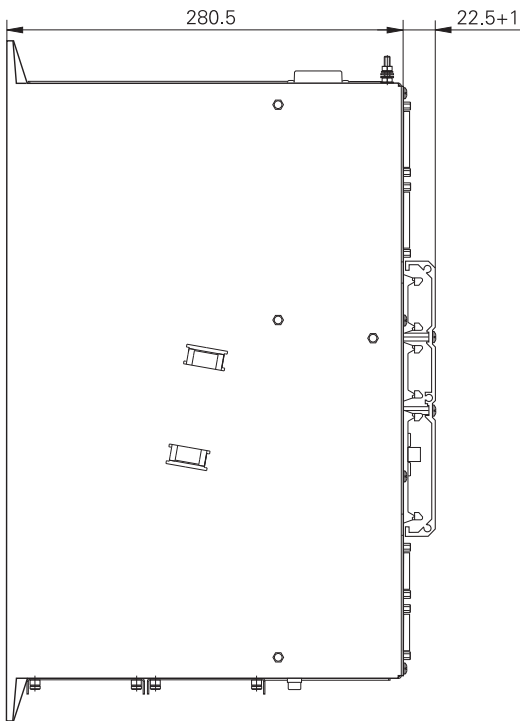
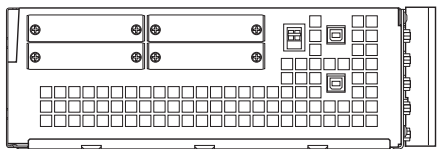
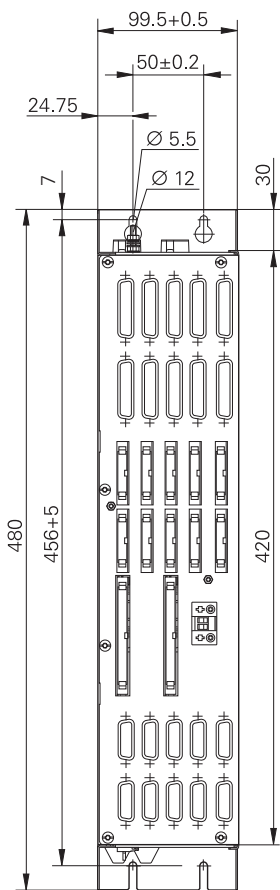
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ISO 2768 - m H
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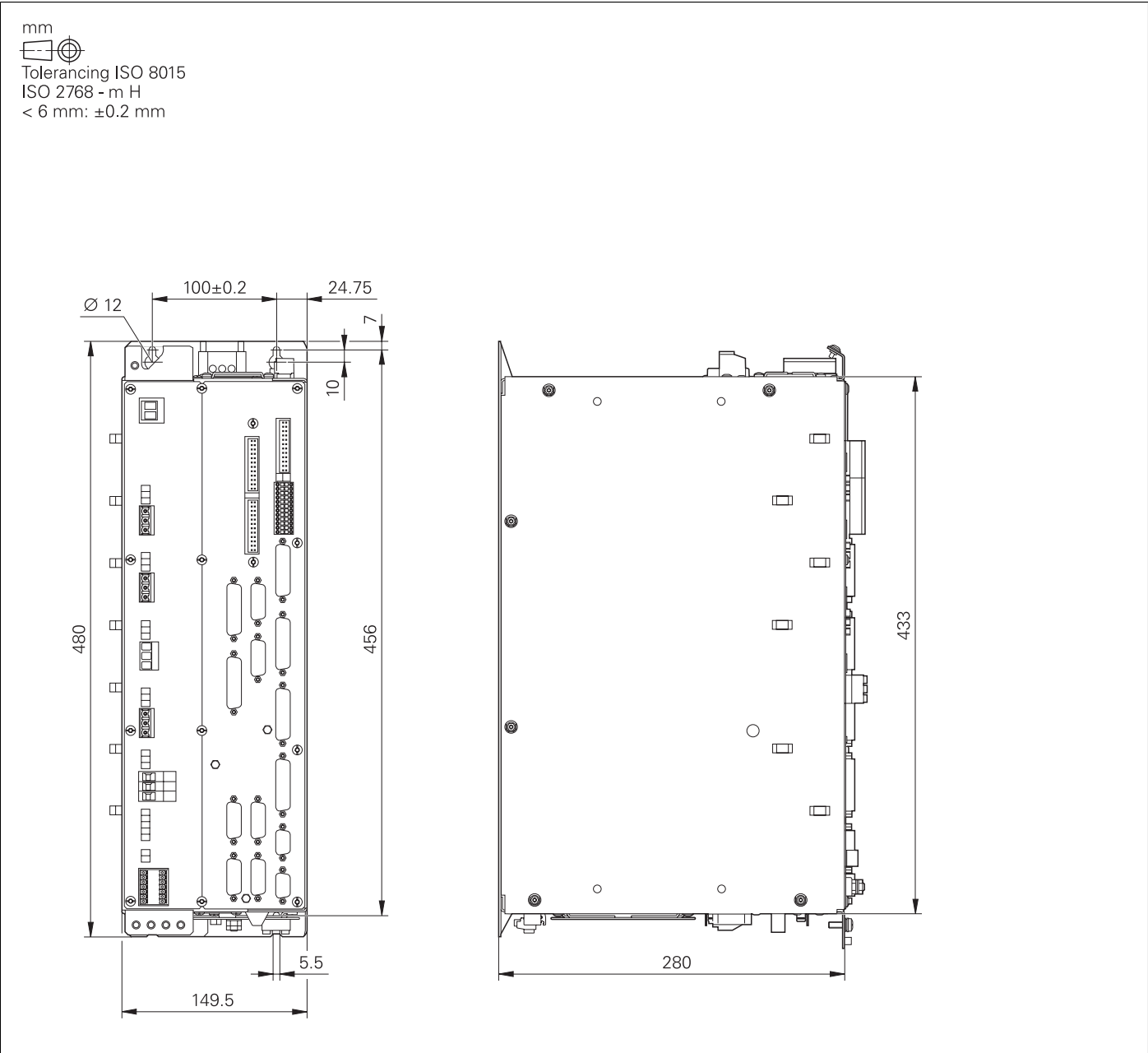
CC 6108, CC 6110

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Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ± 0.2 mm

CC 6108: 8 control loops
CC 6110: 10 control loops

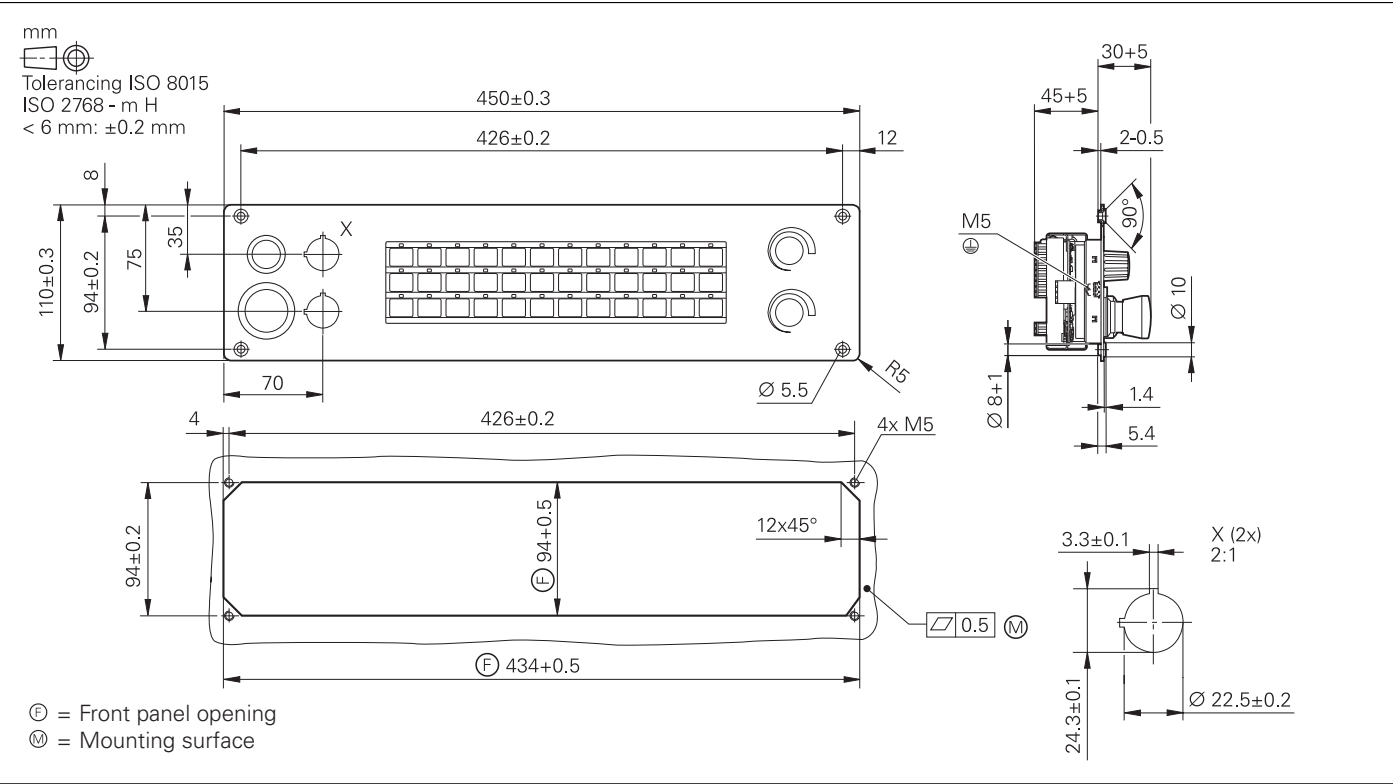


UEC 111, UEC 112, UEC 113

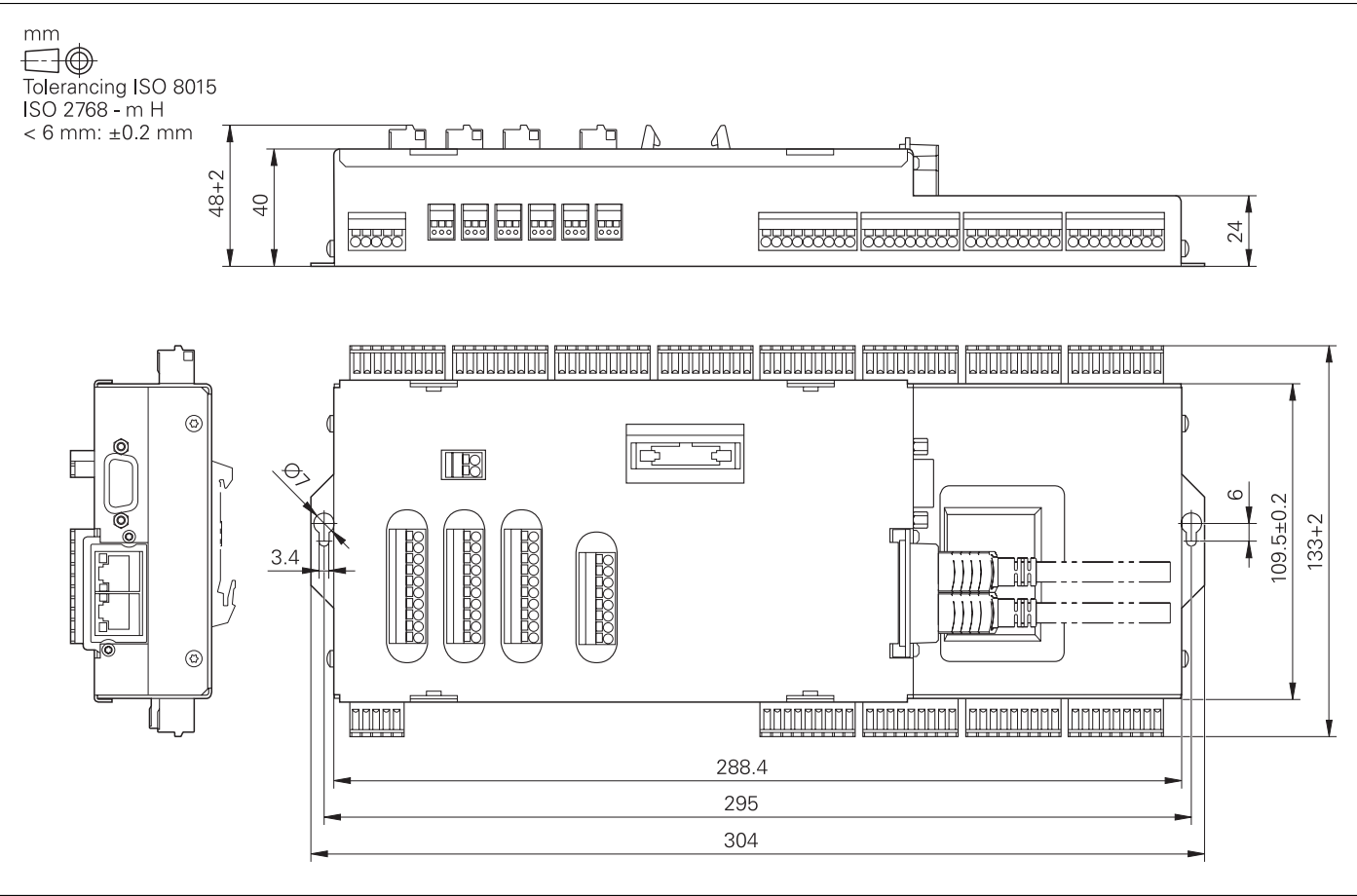


Keyboard and screen

MB 720T

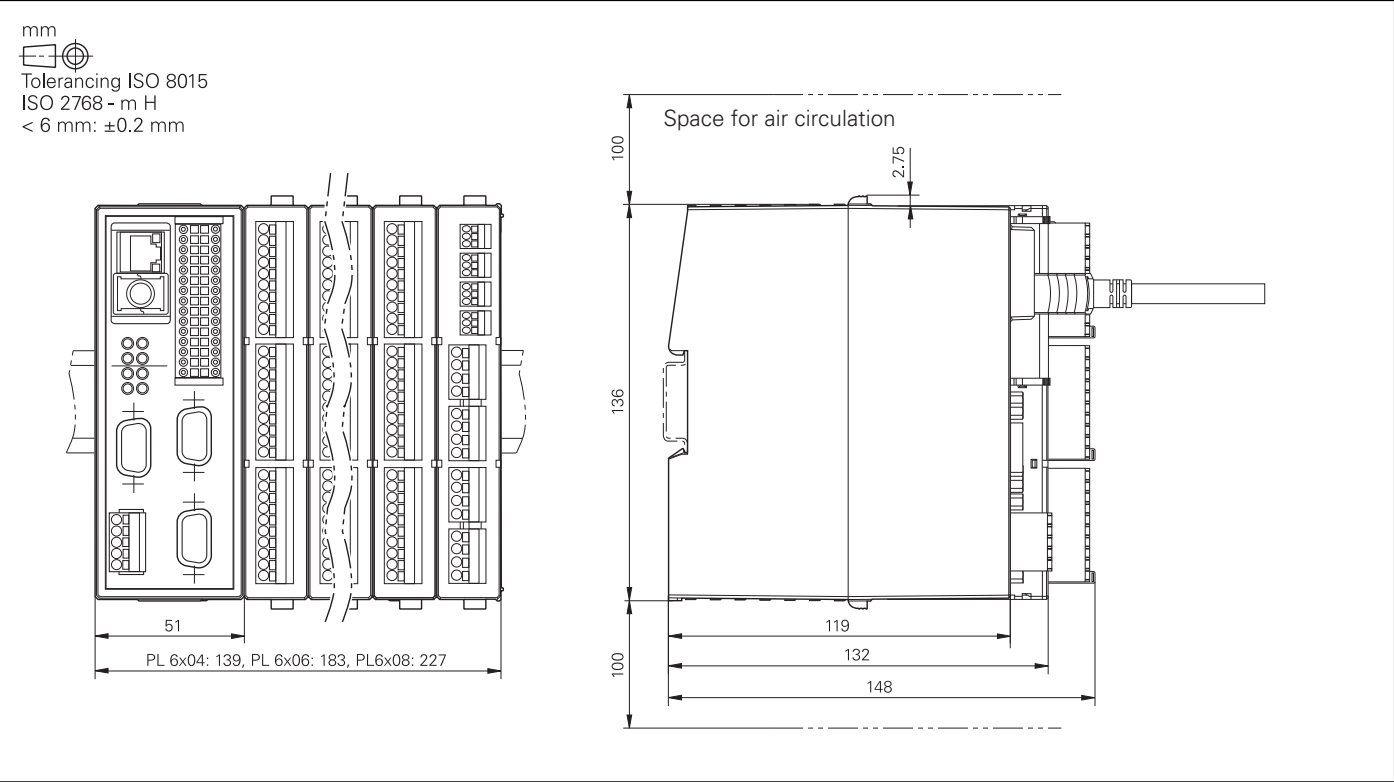


PLB 6001

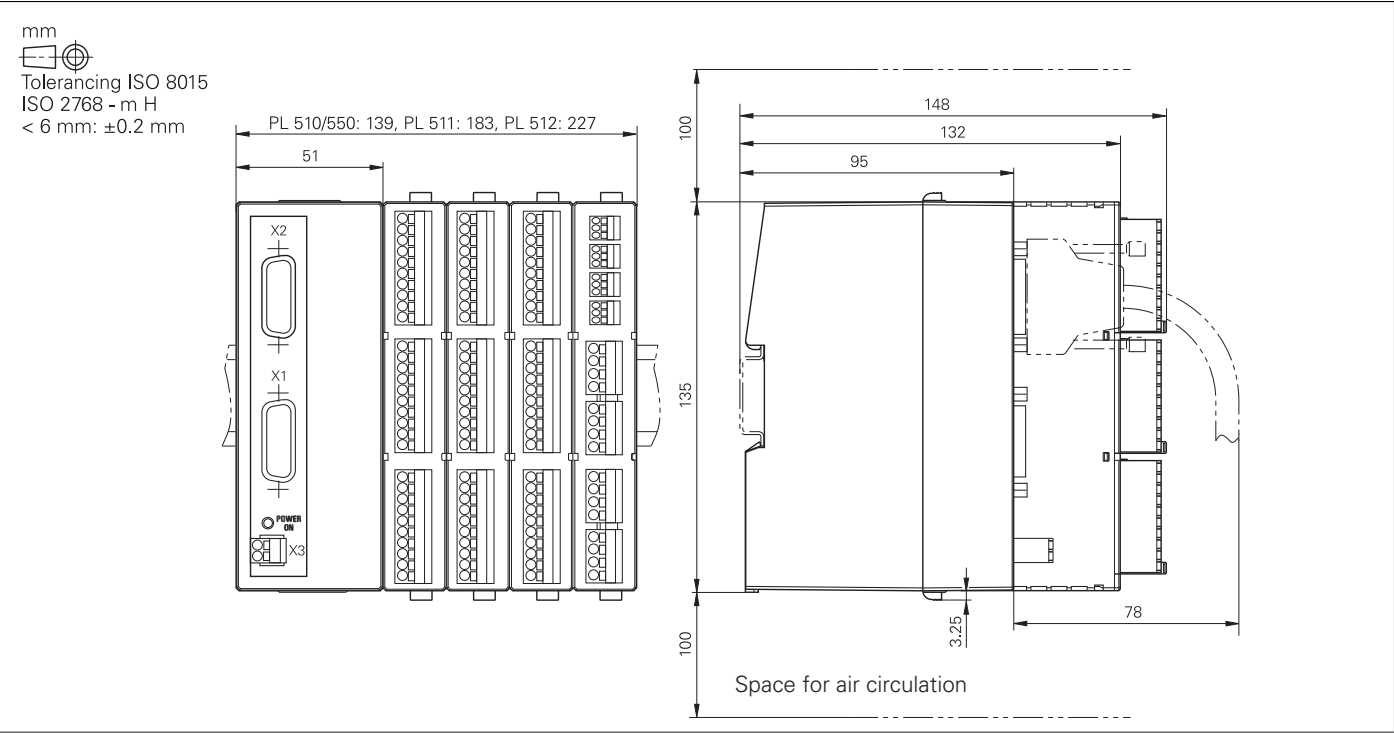


PLC inputs and outputs

PL 6000 (PLB 62xx, PLB 61xx)

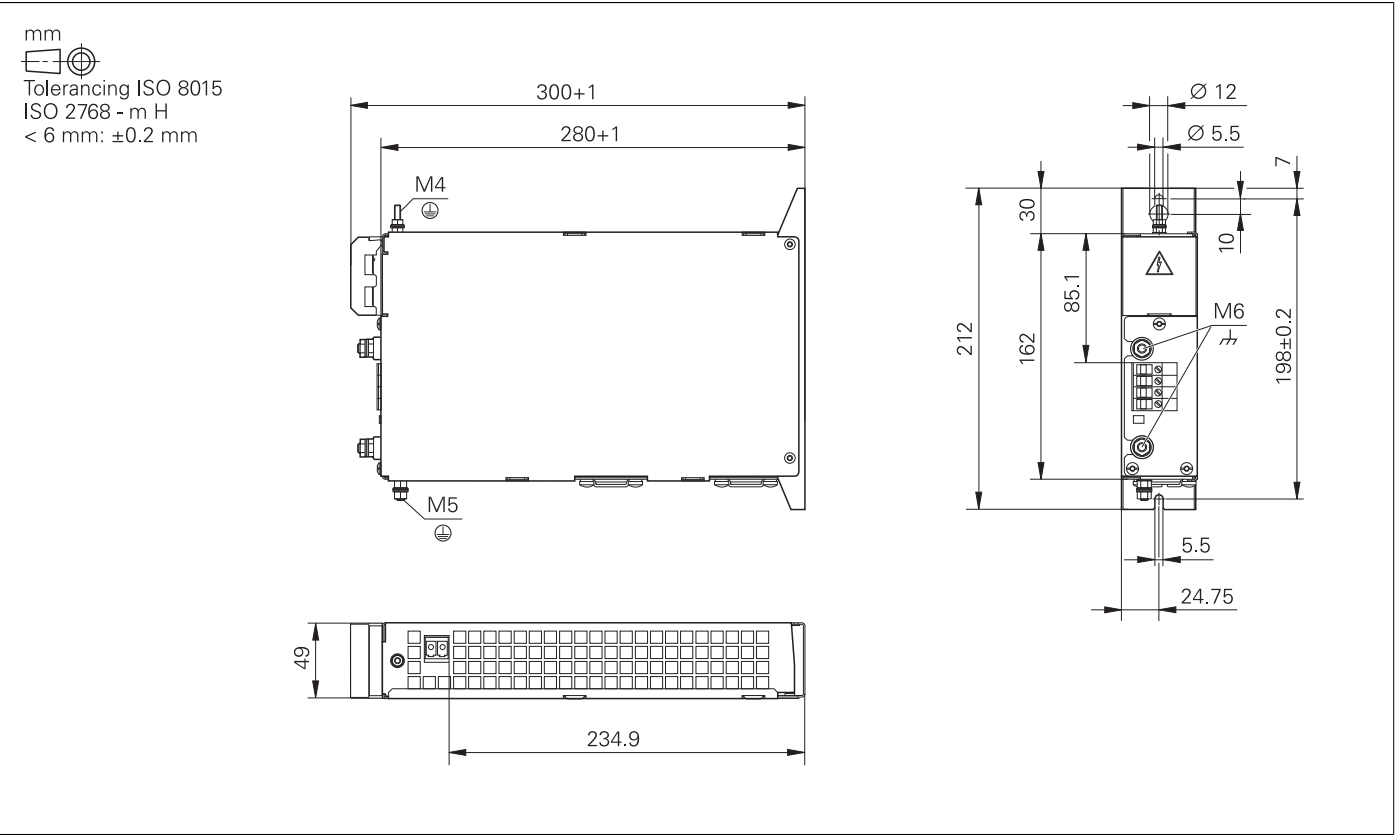


PL 550



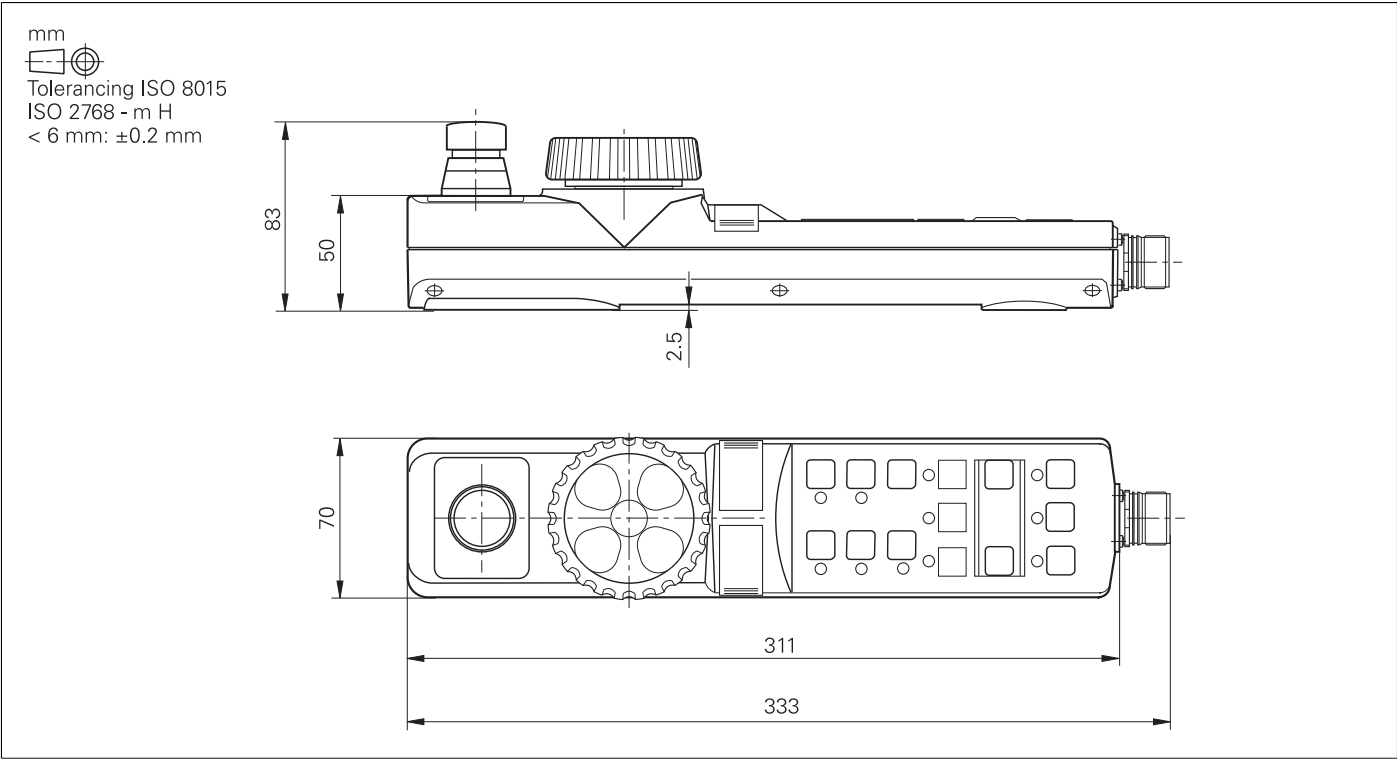
Power supply units

PSL 130

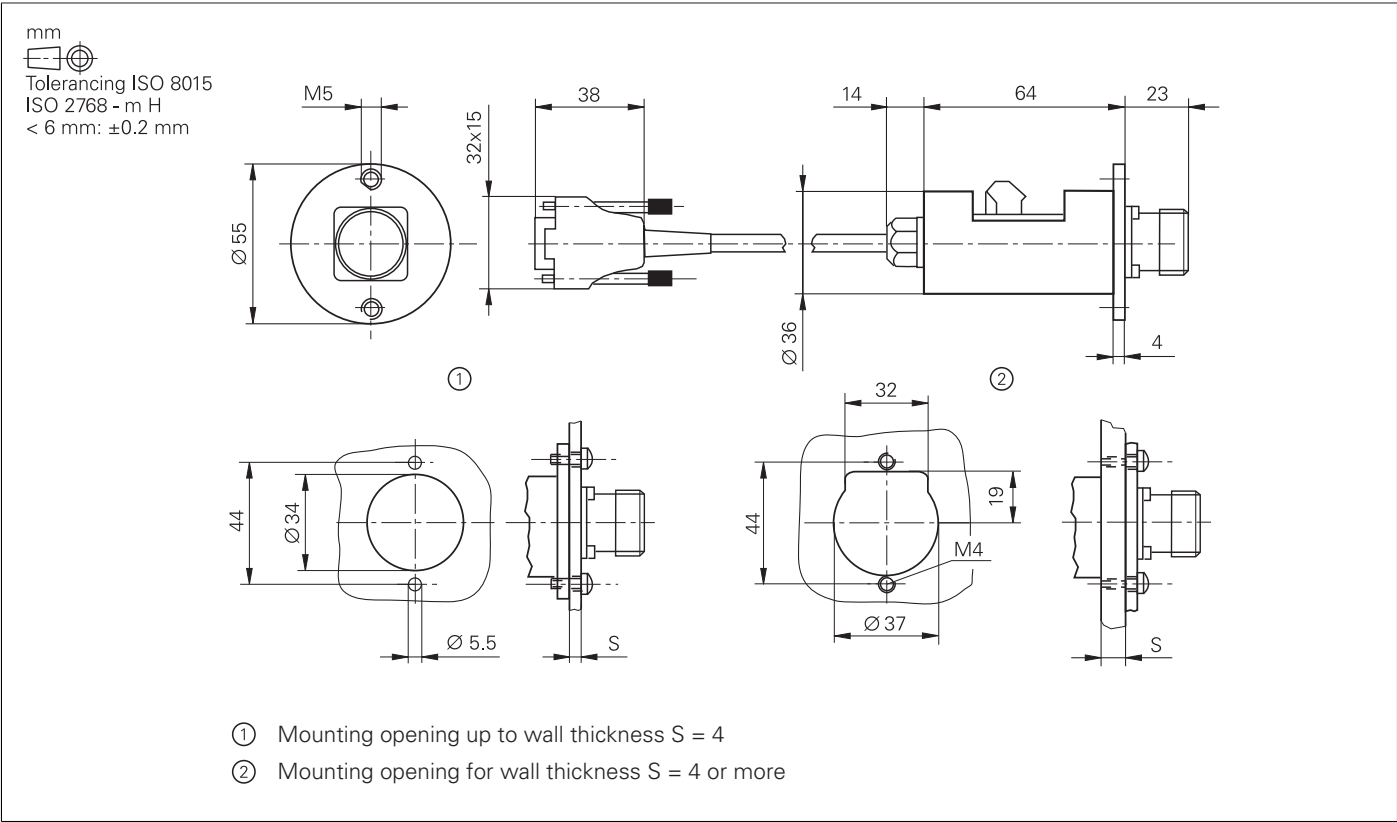


Electronic handwheels

HR 410

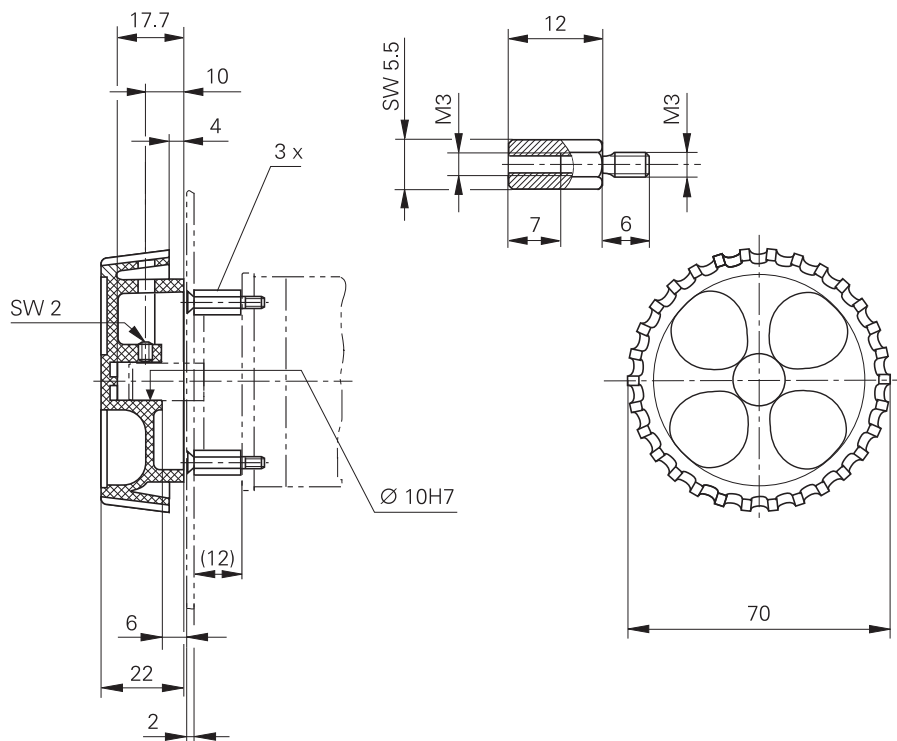
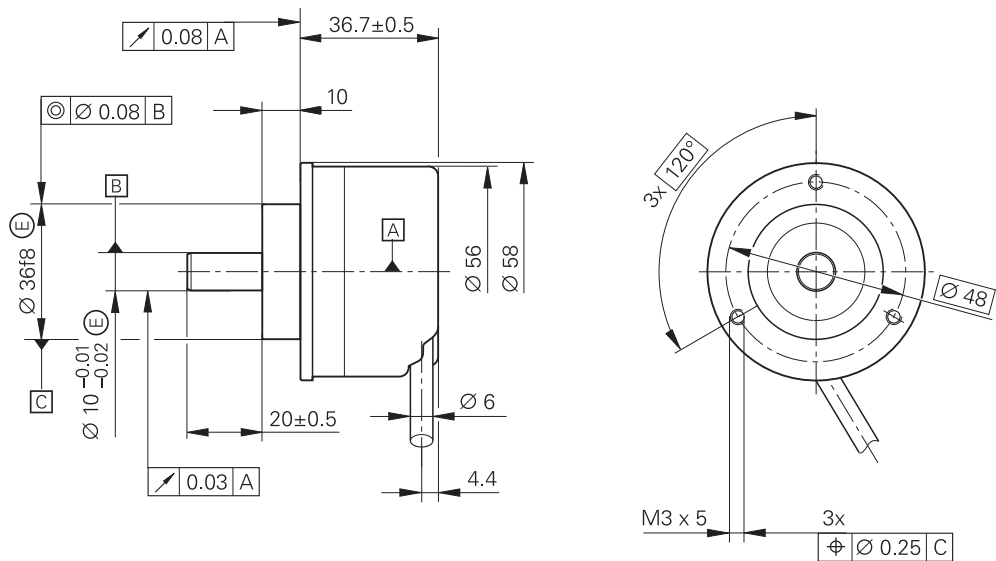


Adapter cable for HR 410 and HR 520

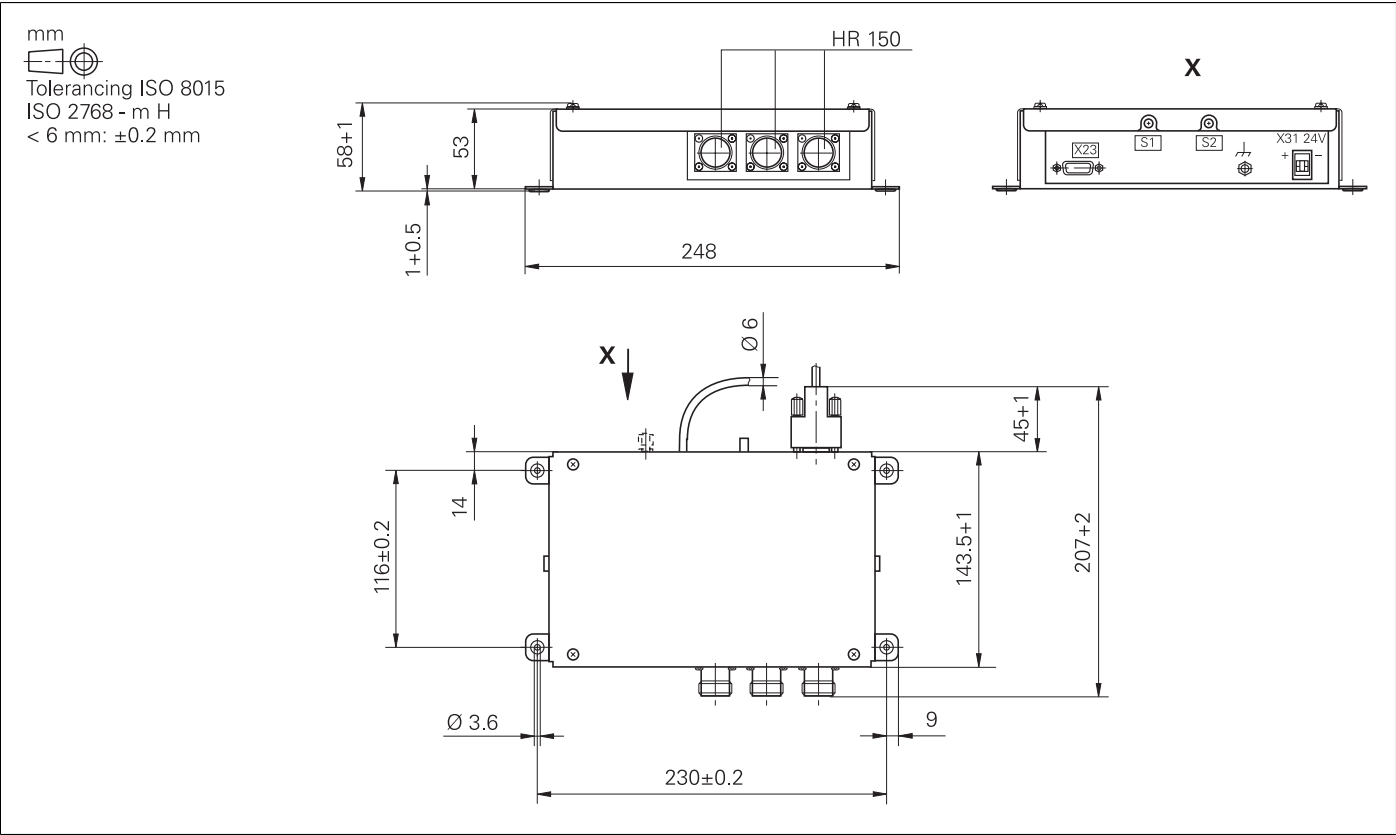


HR 130, HR 150, HR 180 with control knob

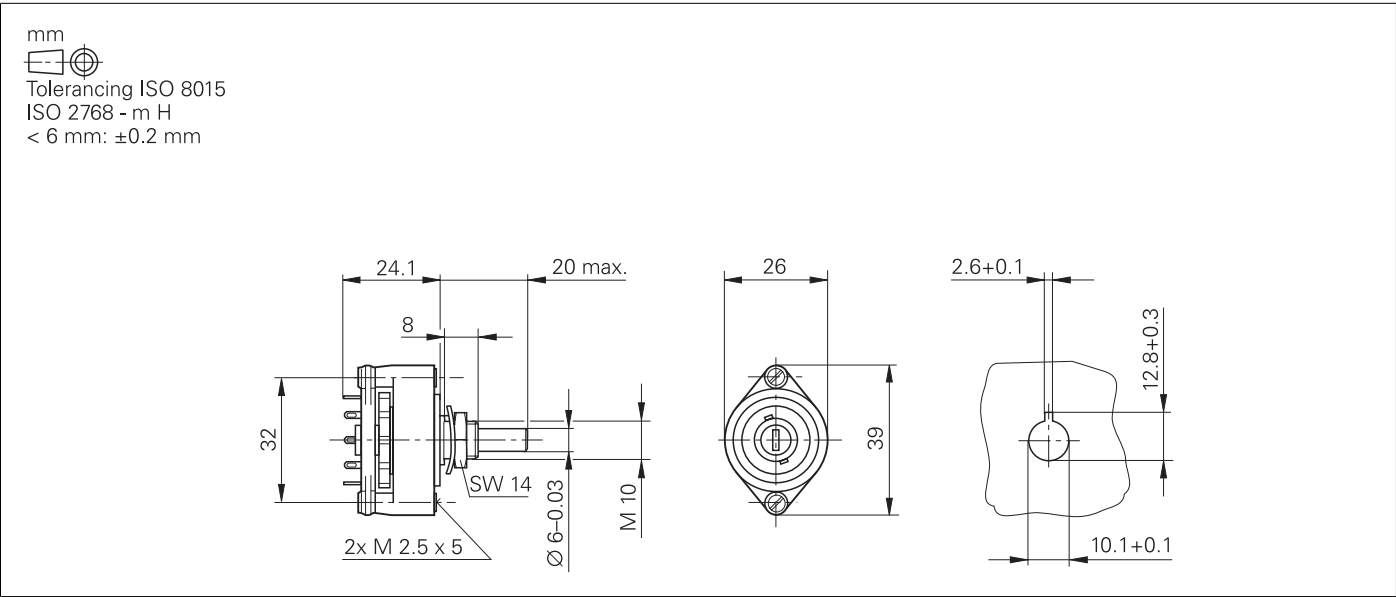
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Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



HRA 110

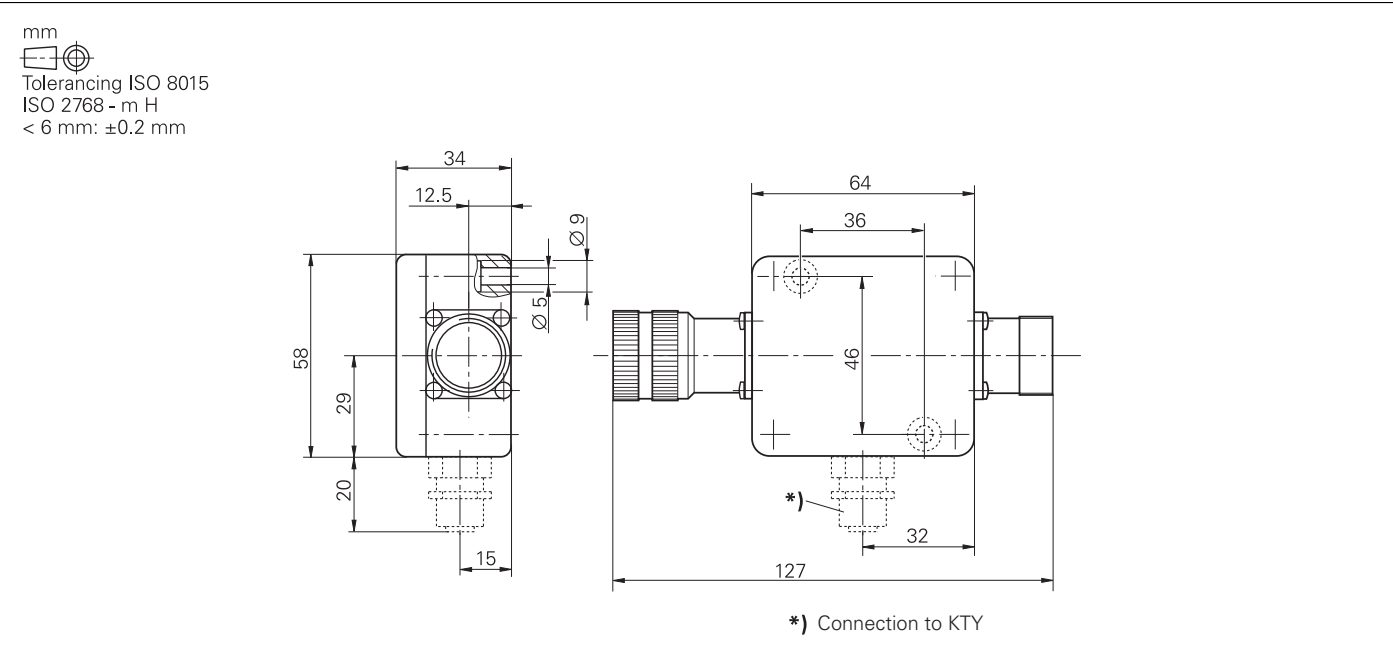


Handwheel selection switch

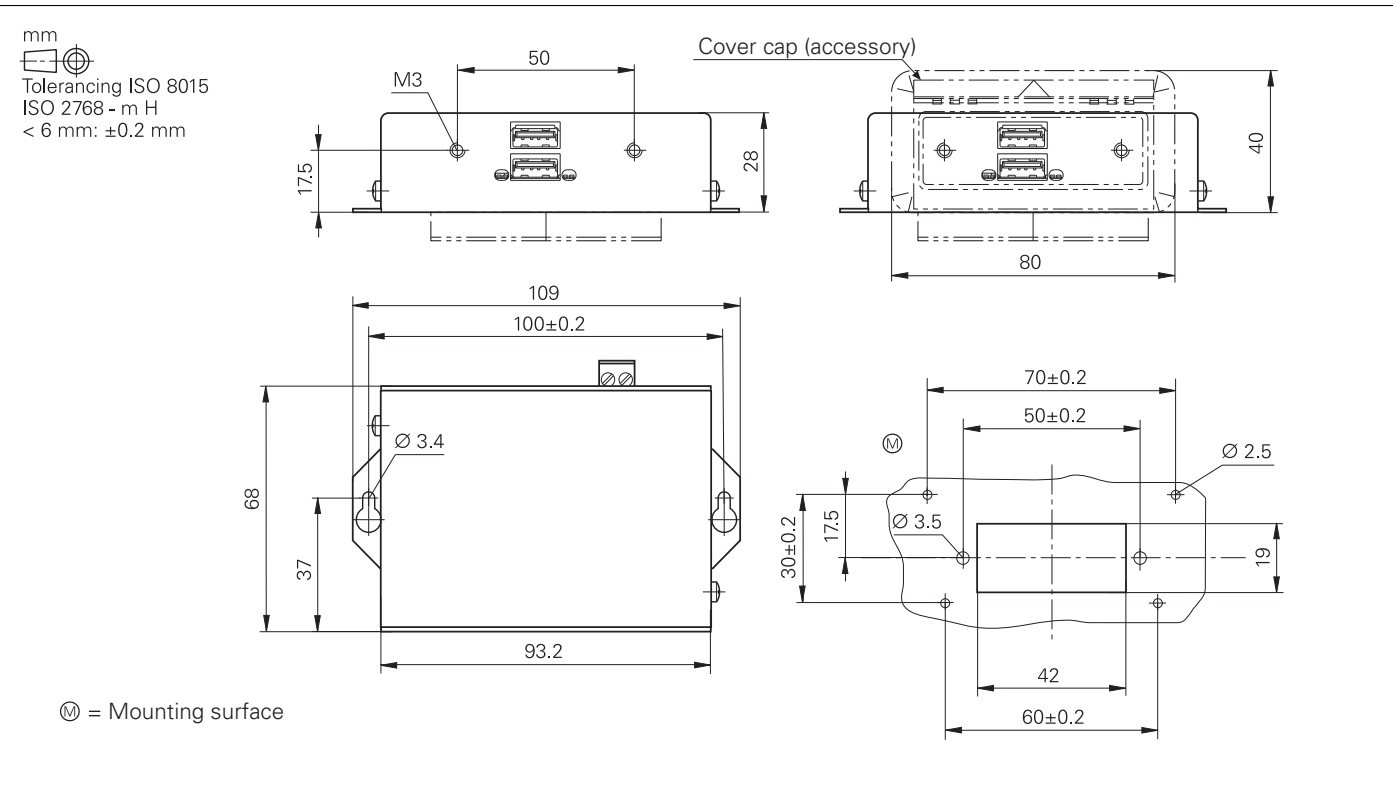


Interface accessories

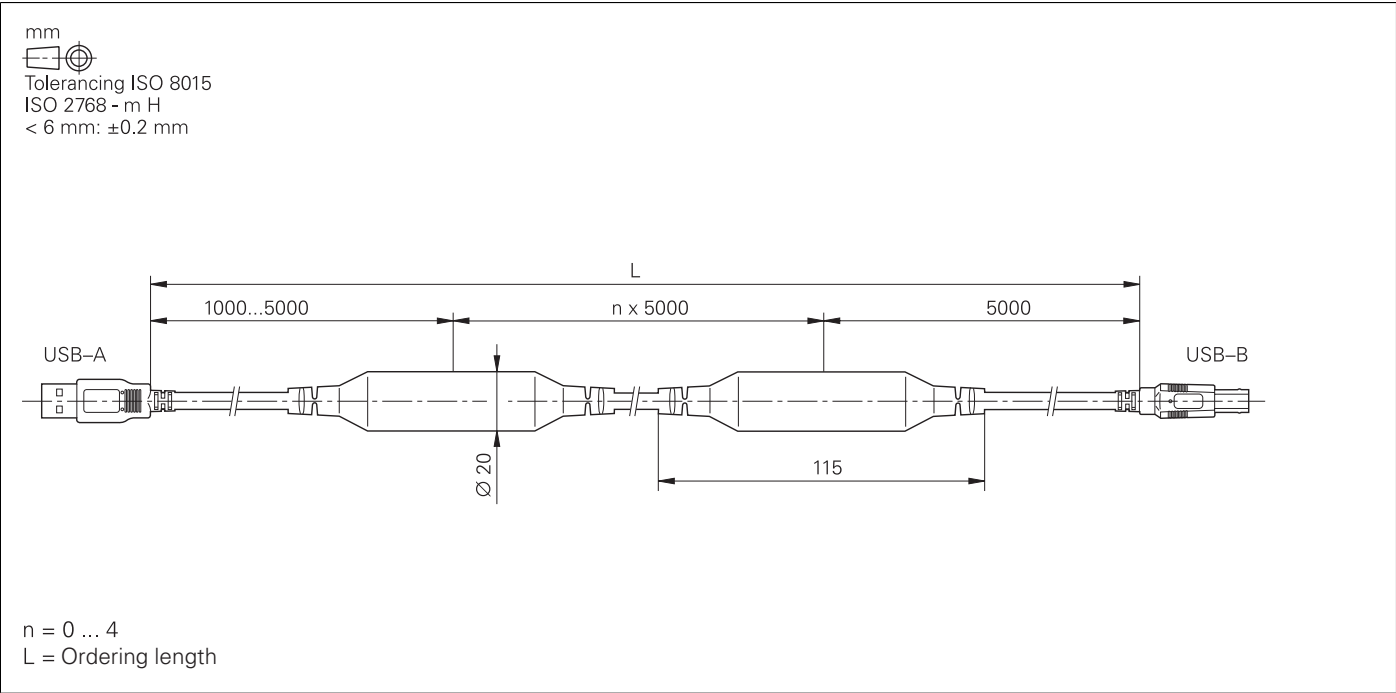
Line-drop compensator for encoders with EnDat interface



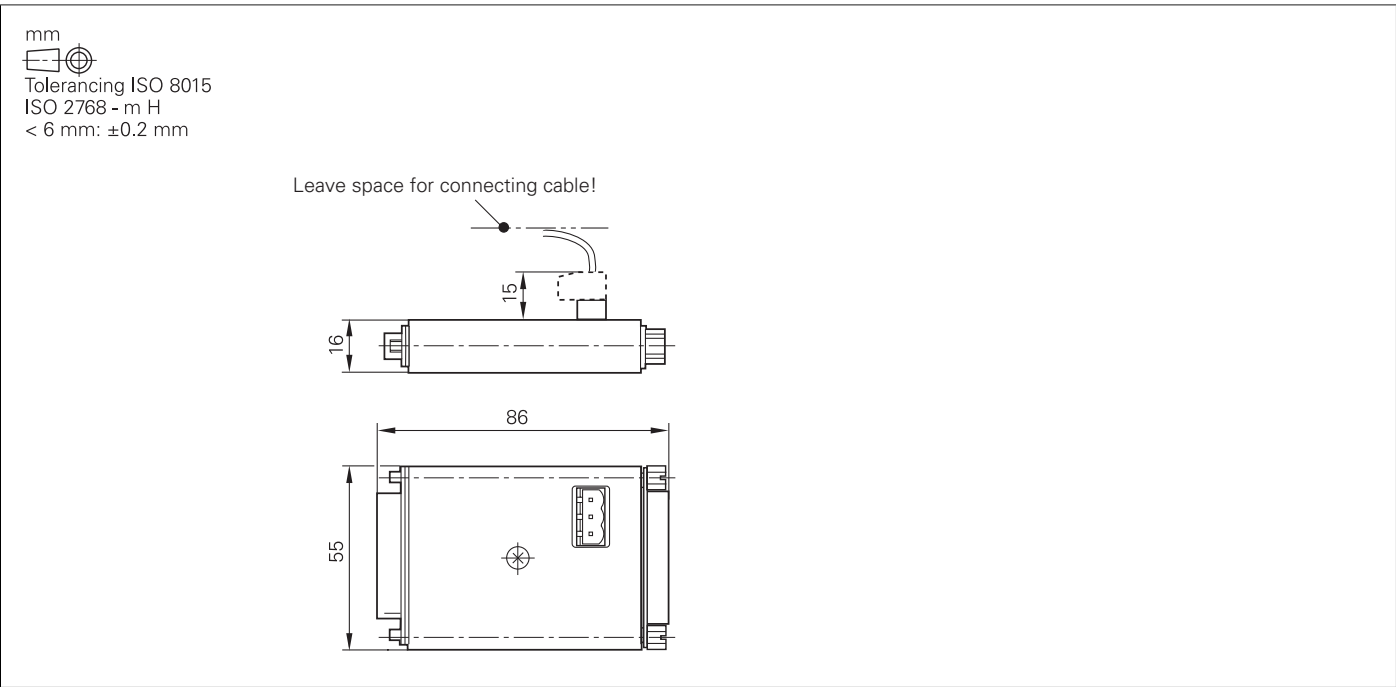
USB hub



USB extension cable with hubs

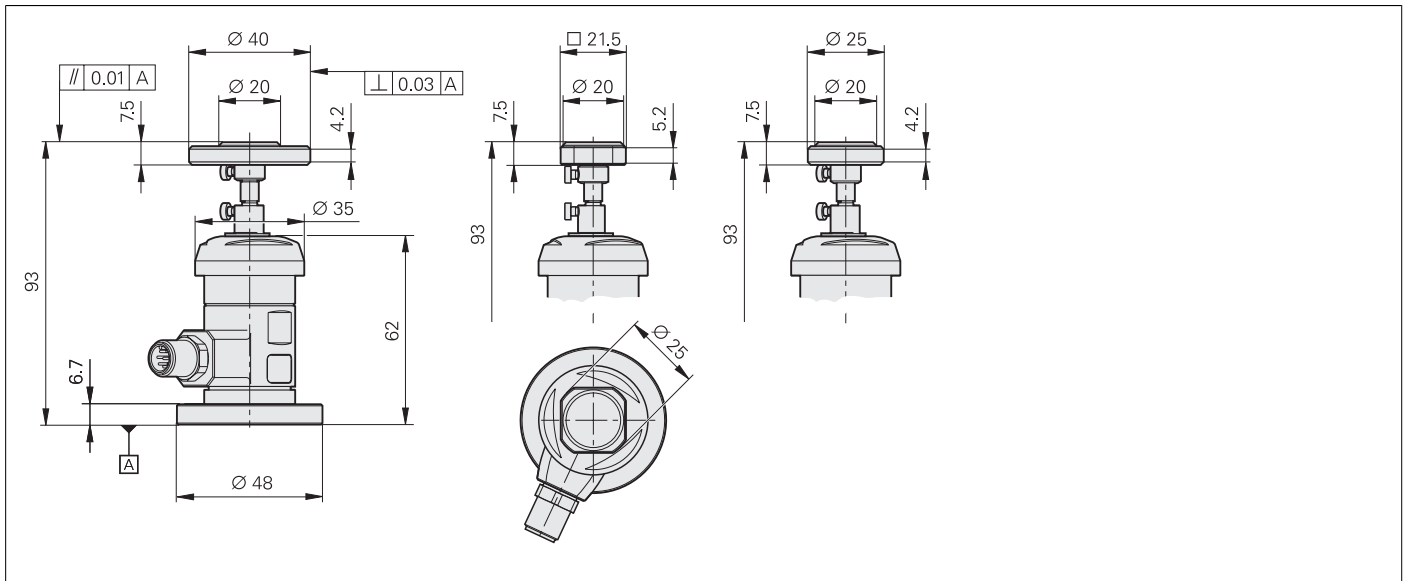


KTY adapter connector



Touch probe

TT 160 with a cuboid probe contact



General information

Documentation

Technical documentation	• MANUALplus 620 Technical Manual	ID 747323-xx
	• Inverter Systems and Motors Technical Manual	ID 208962-xx
	• TS 260 Mounting Instructions	ID 808652-9x
	• TS 460 Mounting Instructions	ID 808653-9x
	• TS 444 Mounting Instructions	ID 632757-9x
	• TS 642 Mounting Instructions	ID 666024-9x
	• TS 740 Mounting Instructions	ID 632761-9x
	• TT 160 Mounting Instructions	ID 808654-xx
User documentation	• TT 460 Mounting Instructions	ID 808655-xx
	MANUALplus 620	
	• MANUALplus 620 User's Manual	ID 1079948-xx
	• smart.Turn and DIN Programming User's Manual	ID 685556-xx
	Miscellaneous	
	• TNCremo User's Manual	As integrated help
	• TNCremoPlus User's Manual	As integrated help
	• PLCdesign User's Manual	As integrated help
	• CycleDesign User's Manual	As integrated help
	• KinematicsDesign User's Manual	As integrated help
Other documentation	• MANUALplus 620 brochure	ID 1082181-xx
	• Touch Probes brochure	ID 1113984-xx
	• Inverter Systems brochure	ID 622420-xx
	• Motors brochure	ID 208893-xx
	• HEIDENHAIN DNC brochure	ID 628968-xx
	• Remote Diagnosis with TeleService Product Overview	ID 348236-xx
	• Touch Probes CD-ROM	ID 344353-xx
	• CP 640, MP 620 Programming Station Demo Version CD-ROM	ID 737139-xx
	• Technical Information: Uniformly Digital	PDF

Service and training

Technical support	HEIDENHAIN offers the machine manufacturer technical support to optimize the adaptation of the TNC to the machine, including on-site support.
Replacement control system	In the event of a fault, HEIDENHAIN guarantees the rapid supply of a replacement control system (usually within 24 hours in Europe).
Hotline	Our service engineers are naturally at your disposal by telephone if you have any questions on the interfacing of the control or in the event of faults. TNC support +49 8669 31-3101 E-mail: service.nc-support@heidenhain.de PLC programming +49 8669 31-3102 E-mail: service.plc@heidenhain.de NC programming +49 8669 31-3103 E-mail: service.nc-pgm@heidenhain.de Measuring systems +49 8669 31-3104 E-mail: service.ms-support@heidenhain.de Lathe controls +49 8669 31-3105 E-mail: service.lathe-support@heidenhain.de
Machine calibration	On request, HEIDENHAIN engineers will calibrate your machine's geometry, e. g. with a KGM grid encoder.
Seminars	HEIDENHAIN provides technical customer training in the following subjects: <ul style="list-style-type: none">• NC programming• PLC programming• TNC optimization• TNC service• Encoder service• Special training for specific customers For more information on dates, registration, etc. call in Germany: +49 8669 31-2293 or 31-1695 +49 8669 31-1999 E-mail: mtt@heidenhain.de www.heidenhain.de

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