HEIDENHAIN

CNC PILOT 640

The Contouring Control for Lathes and Turning-Milling Machines

Information for the Machine Tool Builder

April 2016

Contouring control with drive system from HEIDENHAIN
General information

CNC PILOT 640

- Contouring control for **lathes and turning-milling machines**
- Suitable for horizontal and vertical lathes as well as vertical boring and turning mills
- Up to 3 principal axes (X, Z and Y), B axis, closed-loop spindle and counter 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 counter spindle
- The position of a parallel secondary axis can be shown combined with its principal axis
- HEIDENHAIN inverter systems and motors recommended
- Uniformly digital with HSCI interface and EnDat interface
- TFT color flat-panel display, 19-inch or 15-inch
- Data medium: CFR CompactFlash memory card (CFast):
- 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), 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:

CNC PILOT 640 with NC software versions
688946-04 (export license required)
688947-04 (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.

Contents

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

Overview tables
Components

Control systems		19″ design	15″ design	Page
Main computer	*For operating panel*	**MC 7532** (integrated screen) or **MC 6542**	**MC 7420** (integrated screen) or **MC 6542**	16
	For electrical cabinet	**MC 6441** or **MC 6542**		
Memory medium		**CFR** memory card		18
NC software license		On **SIK component**		18
Screen		**BF 760** (integrated in MC 7532)	**BF 750** (integrated in MC 7420)	25
Operating panel		**TE 745T**	**TE 735T**	26
Machine operating panel		Integrated		
		PLB 6001 (HSCI adapter for OEM machine operating panel)		30
Controller unit	6 control loops	**CC 6106**		21
	8 control loops	**CC 6108**		21
	10 control loops	**CC 6110**		21
	12 control loops	**CC 6106 + CC 6106**		21
	14 control loops	**CC 6108 + CC 6106**		21
	16 control loops	**CC 6108 + CC 6108**		21
	18 control loops	**CC 6106 + CC 6106 + CC 6106** or **CC 6110 + CC 6108**		21
	20 control loops	**CC 6110 + CC 6110**		21
Voltage supply[*)]		**PSL 130 / PSL 135**		29
PLC inputs/ outputs[1)]	With HSCI interface	**PL 6000** consisting of PLB 62xx basic module (system PL) or PLB 61xx (extension PL) and I/O modules		27
		On UEC		22
Additional modules[1)]		**CMA-H** for analog axes/spindles in the HSCI system		31
		Module for PROFIBUS-DP		
		Module for PROFINET-IO		
Inverter systems		Compact inverters and modular inverters		*)
Inverters with integrated controller unit	4 control loops	**UEC 111**		22
	5 control loops	**UEC 112**		22
	6 control loops	**UEC 113**		
Connecting cables		✓		41

*) 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	CNC PILOT 640	Page
Electronic handwheels	• **HR 130** panel-mounted handwheel or • Up to three **HR 150** via HRA 110 handwheel adapter, or • **HR 510** portable handwheel	34
Workpiece touch probes	• **TS 260**[1] touch trigger probe with cable connection or • **TS 460**[1] 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	32
Tool touch probes	With cuboid probe contact as accessory • **TT 160** touch trigger probe or • **TT 460** touch trigger probe with radio or infrared transmission	33
USB hub	✓	64
Programming station	**DataPilot CP 640** Control software for PCs for programming, archiving, and training • Full version for single user or network license • Demo version (free of charge)	[2]
Industrial PC	**IPC 6641** – industrial PC for Windows	36
Snap-on keys	For the control For handwheels	39 37

[1] New generation of touch probes
[2] For more information, refer to the *Programming Station Lathe Controls* brochure.

Accessories / Software	CNC PILOT 640	Page
PLCdesign[1]	PLC development software	60
TNCremo[2]	Data transfer software	64
TNCremoPlus[2]	Data transfer software with "live" screen	64
ConfigDesign[1]	Software for configuring the machine parameters	58
TNCkeygen[1]	Software for enabling SIK options for a limited time, and for day-by-day access to the OEM area	18
TNCscope[1]	Software for data recording	59
DriveDiag[1]	Software for diagnosis of digital control loops	58
TNCopt[1]	Software for putting digital control loops into service	58
IOconfig[1]	Software for configuring PLC I/O and fieldbus components	28
TeleService[1]	Software for remote diagnostics, monitoring, and operation	59
RemoTools SDK[1]	Function library for developing customized applications for communication with HEIDENHAIN controls	65
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	CNC PILOT 640	Page
Axes[1)]		49
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 Counter spindle Driven tool	 51 52
Speed[2)]	Max. 60 000 rpm	51
Operating mode switchover	✓	51
Position-controlled spindle	✓	51
Spindle orientation	✓	51
Gear shifting	✓	51
NC program memory	1.8 GB	16
Input resolution and display step		49
Linear axes	X axis: 0.5 µm (diameter1 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		54
With following error	✓	
With feedforward	✓	
With jerk limiting	✓	49
Maximum feed rate	$\frac{60000\ \text{rpm}}{\text{No. of motor pole pairs}} \cdot \text{Screw pitch [mm]}$ at f_{PWM} = 5000 Hz	49
Constant surface speed	✓	
Input	mm/min or mm/revolution	

*) For further information, refer to the *CNC PILOT 640* (ID 895949-xx) brochure
1) As ordered
2) On motors with two pole pairs

Specifications	CNC PILOT 640		Page
Cycle times of main computer	**MC**		54
Block processing	1.5 ms		
Cycle times of controller unit	**CC/UEC**		54
Path interpolation	3 ms		54
Fine interpolation	*Single speed:* 0.2 ms *Double speed:* 0.1 ms (option 49)		
Position controller	*Single speed:* 0.2 ms *Double speed:* 0.1 ms (option 49)		
Speed controller	*Single speed:* 0.2 ms *Double speed:* 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 *CNC PILOT 640* (ID 895949-xx) brochure
1) As ordered
2) On motors with two pole pairs

Interfacing to the machine

Interfacing to the machine	CNC PILOT 640	Page
Error compensation	✓	57
Linear axis error	✓	57
Nonlinear axis error	✓	57
Backlash	✓	57
Hysteresis, reversal spikes	✓	57
Thermal expansion	✓	57
Integrated PLC	✓	60
Program format	Statement list	60
Program input at the control	✓	60
Program input by PC	✓	60
PLC memory	350 MB	60
PLC cycle time	9 ms to 30 ms (adjustable)	60
PLC inputs/outputs	A PLC system can consist of max. seven PLB 61xx and one TE 7x5T or one PLB 6001. A total maximum of 1000 inputs/outputs is supported.	27, 22
PLC inputs, DC 24 V	Via PL, UEC	27
PLC outputs, DC 24 V	Via PL, UEC	27
Analog inputs ± 10 V	Via PL	27
Inputs for PT 100 thermistors	Via PL	27
Analog outputs, ± 10 V	Via PL	27
PLC functions	✓	60
PLC soft keys	✓	60
PLC positioning	✓	60
PLC basic program	✓	61
Integration of applications		61
High-level language programming	Python programming language used in combination with the PLC (option 46)	61
User interfaces can be custom-designed	Inclusion of specific user interfaces from the machine tool builder (option 46)	61

Interfacing to the machine	CNC PILOT 640	Page
Commissioning and diagnostic aids		58
DriveDiag	Software for diagnosis of digital drive systems	58
TNCopt	Software for putting digital control loops into service	58
ConfigDesign	Software for creating the machine configuration	58
Integrated oscilloscope	✓	59
Trace function	✓	59
API DATA function	✓	59
Table function	✓	59
OLM (online monitor)	✓	58
Log	✓	59
TNCscope	✓	59
Bus diagnostics	✓	59
Data interfaces	✓	
Ethernet	2 x 1000BASE-T	63
USB	*Rear:* USB 3.0 *Front:* USB 2.0	63
RS-232-C	✓	63
Protocols		63
Standard data transfer	✓	63
Blockwise data transfer	✓	63
LSV2	✓	63

Encoder inputs		CC 6106	CC 6108	CC 6110	UEC 111	UMC 111	UEC 112	UEC 113	53
Position		6	8	10	4	-	5	6	53
	Incremental	1 V_{PP}							53
	Absolute	EnDat 2.2							53
Speed		6	8	10	4	4	5	6	53
	Incremental	1 V_{PP}							53
	Absolute	EnDat 2.2							53
Nominal-value outputs		CC 6106	CC 6108	CC 6110	UEC 111	UMC 111	UEC 112	UEC 113	53
PWM		6	8	10	-	-	-	-	20
Motor connections		-	-	-	4	4	5	6	20

User functions

User function	Standard	Option	CNC PILOT 640
Short description	✓		Basic version: X and Z axis, spindle
		0-6	Driven tool and auxiliary axes (U, V, W)
		55+0-6	C axis and driven tool
		70+0-6	Y axis
		54+0-6	B axis
		94+0-6	Parallel axes U, V, W (display function and compensation)
		132+0-6	Counter spindle
	✓		Digital current and shaft speed control
Operating modes			
Manual Operation	✓		Manual slide movement through axis-direction keys, intermediate switch or electronic handwheels
	✓		Graphic support for entering and running cycles without saving the machining steps in alternation with manual machine operation
		11	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			All are possible in single-block and full-sequence modes
	✓		DIN PLUS programs
		9	smart.Turn programs
		8	Cycle programs
Setup functions	✓		Workpiece datum setting
	✓		Definition of tool-change position
	✓		Definition of protection zone
	✓		Defining machine dimensions
	✓		Manual programs
	✓		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	CNC PILOT 640
Interactive Contour Programming (ICP)		8/9	Contour definition with linear and circular contour elements
		8/9	Immediate display of entered contour elements
		8/9	Calculation of missing coordinates, intersections, etc.
		8/9	Graphic display of all solutions for selection by the user if more than one solution is possible
		8/9	Chamfers, rounding arcs and undercuts available as form elements
		8/9	Input of form elements immediately during contour creation or by superimposition later
		8/9	Changes to existing contours can be programmed
		8/9	Machining attributes available for individual contour elements
		8/9+55	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
		9+70	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
		8/9+55+ 70+132	Programming of the rear face for full-surface machining with the C and Y axes
		8/9+42	DXF import: Import of contours for lathe and milling operations
smart.Turn programming		9	The basis is the "unit," which is the complete description of a machining block (geometry, technology and cycle data)
		9	Dialog boxes divided into overview and detail forms
		9	Fast navigation between the fillable forms and input groups via the "smart" keys
		9	Context-sensitive help graphics
		9	Start unit with global settings
		9	Transfer of global values from the start unit
		9	Transfer of cutting values from technology database
		9	Units for all turning and recessing operations for simple contours and ICP contours
		9+55/70	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
		9+55	Special units for activating/deactivating the C axis, subroutines and section repeats
		9+55/70	Verification graphics for blank and finished part and for C and Y axis contours
		9	Turret assignment and other setup information in the smart.Turn program
		9	Parallel programming
		9	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 chucking equipment – Automatic generation of work blocks for rechucking for turning with counter spindles – Automatic generation of work blocks for rear-face machining (with option 132)

User function	Standard	Option	CNC PILOT 640
DIN PLUS programming	✓		Programming in DIN 66025 format
	✓		Expanded command format (IF ... THEN ... ELSE ...)
	✓		Simplified geometry programming (calculation of missing data)
	✓		Powerful fixed cycles for area clearance, recessing, recess turning and thread machining
		55	Powerful fixed cycles for boring, drilling and milling with the C axis
		70	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
		131/132	– Spindle synchronization
		132	– Converting and mirroring
	✓		– Mechatronic tailstock
	✓		Programming with variables
		8/9	Contour description with ICP
	✓		Program verification graphics for workpiece blank and finished part
	✓		Turret assignment and other setup information in the DIN PLUS program
		9	Conversion of smart.Turn units into DIN PLUS command sequences
	✓		Parallel programming
	✓		Parallel simulation
Program verification graphics	✓		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)
		55	Side or face view, or 2-D view of cylindrical surface for verification of C-axis machining
	✓		Display of programmed contours
		54	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
		132	Simulation of mirrored contours for rear-face machining
	✓		Shifting and magnifying functions
	✓		Block scan in the simulation
B-axis machining		54	Machining with the B axis
	✓		Tilting the working plane
		54	Rotating the machining position of the tool
Eccentric machining		135	Cycles for eccentric turning and for the manufacture of oval and polygonal contours
		135	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
Load monitoring		151	Load monitoring for machining processes – Detection of tool wear and breakage – Display of workload values

User function	Standard	Option	CNC PILOT 640
Tool database	✓		For 250 tools
		10	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
		10	Tool monitoring with automatic tool change after expiration tool life
	✓		Management of multipoint tools (multiple inserts or reference points)
	✓		Support of quick-change systems
Technology database		8/9	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.
		8/9	Automatic determination of the machining modes from the cycle or the machining unit
		8/9	The cutting data are entered in the cycle or in the unit as default values.
		8/9	9 workpiece-material/tool-material combinations (144 entries)
		10	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 688946-688947-	ID	Comment	Page
0	Additional axis 1	01	ID 354540-01	Additional control loop 1	19
1	Additional axis 2	01	ID 353904-01	Additional control loop 2	19
2	Additional axis 3	01	ID 353905-01	Additional control loop 3	19
3	Additional axis 4	01	ID 367867-01	Additional control loop 4	19
4	Additional axis 5	01	ID 367868-01	Additional control loop 5	19
5	Additional axis 6	01	ID 370291-01	Additional control loop 6	19
6	Additional axis 7	01	ID 370292-01	Additional control loop 7	19
7	Additional axis 8	03	ID 370293-01	Additional control loop 8	19
8	Teach-in	01	ID 632226-01	**Cycle programming** • Contour description with ICP • Cycle programming • Technology database with 9 workpiece-material/tool-material combinations	
9	smart.Turn	01	ID 632227-01	**smart.Turn** • Contour description with ICP • Programming with smart.Turn • Technology database with 9 workpiece-material/tool-material combinations	
10	Tools and technology	01	ID 632228-01	**Tools and technology** • Tool database expanded to 999 entries • Technology database expanded to 62 workpiece-material/tool-material combinations • Tool life monitoring with exchange tools	
11	Thread recutting	01	ID 632229-01	**Thread** • Thread recutting • Handwheel superimposition during thread cutting	
17	Touch probe functions	01	ID 632230-01	**Tool measurement and workpiece measurement** • 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	65
24	Gantry axes	01	ID 634621-01	Gantry axes in master-slave torque control	50
42	DXF import	01	ID 632231-01	Loading DXF contours	
46	Python OEM process	01	ID 579650-01	Python application on the control	61
49	Double-speed axes	01	ID 632223-01	Short control-loop cycle times for direct drives	20
54	B-axis machining	01	ID 825742-01	**B axis:** Tilting the working plane, rotating the machining position of the tool	50
55	C-axis machining	01	ID 633944-01	**C-axis machining**	51
63	TURN PLUS	01	ID 825743-01	**TURN PLUS:** Automatic generation of smart.Turn programs	

Option number	Option	As of NC software 688946- 688947-	ID	Comment	Page
70	Y-axis machining	01	ID 661881-01	**Y-axis machining**	
77	4 additional axes	03	ID 634613-01	4 additional control loops	19
78	8 additional axes	03	ID 634614-01	8 additional control loops	19
94	Parallel axes	01	ID 679676-01	Support of parallel axes (U, V, W) Combined display of principal axes and secondary axes	
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)	52
132	Opposing spindle	01	ID 806275-01	**Counter spindle** (spindle synchronism, rear-face machining)	51
133	Remote desktop manager	04	ID 894423-01	Display and remote operation of external computer units (e.g. a Windows PC)	64
135	Synchronizing functions	03	ID 1085731-01	Expanded synchronization of axes and spindles	50
143	Load Adapt. Control Control	01	ID 800545-01	LAC: Load-dependent adaptation of control parameters	57
151	Load monitoring	03	ID 1111843-01	Monitoring of the tool load	56

HSCI control components
Main computer

Main computer

The **MC** main computers feature:
- Processor
- RAM memory
- HSCI interface to the CC 6xxx or UEC controller unit and to other control components
- HDL interface to the BF 7xx display unit (BF integrated with MC 7420 and MC 7532)
- USB 3.0 interface to the TE 7x5T operating panel

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

The following HSCI components are necessary for operation of the CNC PILOT 640:
- MC main computer
- Controller unit
- PLC I/O unit **PLB 62xx** (system PL; integrated in UEC)
- **TE 745T** or **TE 735T** operating panel with integrated machine operating panel

Interfaces

The standard MC main computers feature USB 3.0, RS-232-C and Ethernet interfaces for use by the end user. Connection to PROFINET-IO or PROFIBUS-DP is possible via an additional module.

Voltage supply

DC 24 V of power are supplied to the main computer and other HSCI components by the PSL 13x supply unit. For the entire HSCI system, this DC 24 V NC supply voltage is required to be safely separated voltage. It must not be connected to the DC 24 V supply voltage for PLC components (e. g. holding brakes). This DC 24 V NC is a supply voltage for electric circuits with basic insulation that must not be connected to each other or mixed with safely separated electric circuits.

Export version

Because the entire NC software is saved on the memory card (CFR), 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

Various versions of the MC main computer are available:

- For integration in the **operating panel**
  Together with the BF display unit, the MC 7420 (15") or MC 7532 (19") form a unit and is installed directly into the control panel
  The benefit: except for the power supply line, only one HSCI connecting cable to the electrical cabinet is necessary.
- For installation in the **electrical cabinet**
  The MC 6x41 is installed in the electrical cabinet. HSCI, USB and HDL cables to the operating panel are required as control lines
- For installation in the **operating panel or electrical cabinet**
  Because the CFR memory card is used as a storage medium, the MC 6542 can be universally integrated. HSCI, USB and HDL cables to the operating panel are required as control lines

The MC 6441 and MC 7420 main computers are supported as of NC software 68894x-02. The MC 6542 and MC 7532 main computers are supported as of NC software 68894x-03. These MC main computers cannot be run on earlier software versions.

MC 6x41

MC 6x41

MC 7420 with main computer installed on the back

	To be installed in	Memory medium	Processor	RAM memory	Power loss	Mass	
MC 7420	Operating panel	CFR	Intel Celeron 1047, 1.4 GHz, dual-core	2 GB	52 W	6.5 kg	ID 1066650-xx
MC 7532	Operating panel	CFR	Intel Core i7-3 1.7 GHz, dual-core	4 GB	75 W	7.5 kg	ID 1124449-xx
MC 6542	Operating panel or electrical cabinet	CFR	Intel Core i7-3 1.7 GHz, dual-core	4 GB	48 W	4.0 kg	ID 1081188-xx
MC 6441	Electrical cabinet	CFR	Intel Celeron 1047, 1.4 GHz, dual-core	2 GB	40 W	4.0 kg	ID 1054739-xx

Options

The capabilities of the CNC PILOT 640 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

The storage medium is a CFR (= CompactFlash Removable) compact flash memory card. 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 MCs described in **Main computer** section.

CFR CompactFlash

CFR CompactFlash 8 GB

Free capacity for NC programs	1.8 GB
Free capacity for PLC programs	350 MB
Export license required	ID 1075088-04
No export license required	ID 1075088-54

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.

SIK component

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)

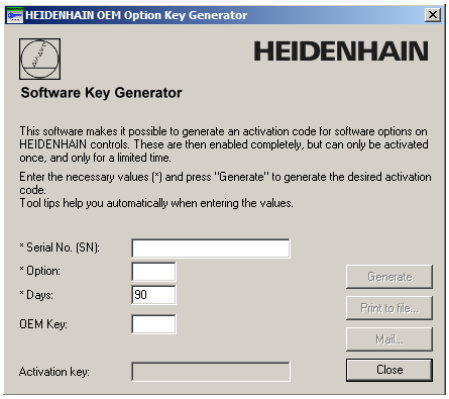
For commissioning the CNC PILOT 640, a general key can be used that will unlock all control loop options for a duration of 90 days. After this period, only those options with the correct keywords will be active. The general key is activated via a soft key.

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.



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	• smart.Turn (option 9)	ID 686002-01 *ID 686002-51*
	• Teach-In (option 8) • smart.Turn (option 9) • Thread recutting (option 11) • C-axis machining (option 55)	ID 686002-10 *ID 686002-60*
4	• smart.Turn (option 9) • C-axis machining (option 55)	ID 686002-03 *ID 686002-53*
5	• smart.Turn (option 9) • C-axis machining (option 55)	ID 686002-04 *ID 686002-54*
6	• smart.Turn (option 9) • C-axis machining (option 55) • Y-Axis Machining (option 70)	ID 686002-05 *ID 686002-55*

(*italics* = 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. A maximum of **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** are preferred for HSC spindles and axes that are difficult to control (Option 49). 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

At 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	
10 000 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
SPI expansion slots	2	4	4
Mass	4.1 kg	4.7 kg	4.8 kg
	ID 662636-xx	ID 662637-xx	ID 662638-xx

For more than 10 control loops, an HSCI line is used to combine the controller units. For example:

CC 6106 + CC 6106 for up to 12 control loops
CC 6106 + CC 6108 for up to 14 control loops **CC 6110 + CC 6108** for up to 18 control loops

Constraints:

- Max. 20 control loops for max. 20 drives (of which, max. 8 NC axes and max. 6 spindles can be activated
- Maximum of 4 controller motherboards are permissible in the HSCI system (CC 6106 contains one motherboard, CC 6108/CC 6110 each have two)

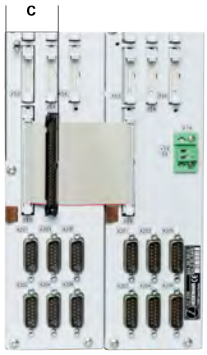
Ribbon cable for supply voltage

Additional ribbon cables are necessary if multiple CC 6xxx units are combined.

Combination	Length	Dimension c	
2 x CC 6108, or 2 x CC 6110, or CC 6108 and CC 6110	160 mm[1)]	26.5 mm	ID 325816-22
2 x CC 6106	110 mm	31.5 mm	ID 325816-24

[1)] In order to reduce the voltage drop, the long ribbon cable is led doubled.

With a combination of CC 6108 and/or CC 6110, the short ribbon cable included in delivery is not needed. They are only necessary for connecting sockets X69 A and X69 B if the CC units are used separately.



For more information about connecting a CC 6xxx to a supply unit via ribbon cables, see the *Inverter Systems* brochure.

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
- SPI interface

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 (of which 7 can be switched off)
  UEC 11x FS: 38 free inputs, 28 free outputs (of which 7 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
	10 000 Hz	3.0/6.0 A	4.6/9.2 A	12.2/18.3 A
Supply voltage		3AC 400 V (± 10 %); 50 Hz or 3AC 480 V (+6 %/–10 %); 60 Hz		
Rated power of DC link		**14 kW**		
Peak power[2] of DC link		18 kW / 25 kW		
Power loss at I_N		≈ 450 W		
DC-link voltage		DC 565 V		
Integral braking resistance[3]		2.1 kW / 27 kW		
Power pack for HSCI components		DC 24 V / 3.5 A		
Module width		150 mm		
Mass		≈ 14 kg		
UEC 111 **UEC 112** **UEC 113**		ID 1081002-xx ID 1081003-xx ID 828471-xx		

[1] Axis: 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 cycle duration of 10 minutes (S6-40 %)
2nd value: 4 s cyclic duration factor for cycle duration of 20 s

[3] 1st value: Continuous power
2nd value: Peak power (1.5 % cyclic duration factor for cycle duration of 120 s)

KTY adapter connector

The adapter connector makes it possible for applications with purely serial EnDat 2.2 encoders to connect an external KTY temperature sensor (e.g. of linear and torque motors) and lead it to the speed encoder input of the controller unit.

The adapter connector can also be used in conjunction with encoders with EnDat02 or 1 V_{PP} interface. The adapter connector is plugged directly onto the speed encoder input (X15 to X20) of the controller unit.

KTY adapter connector

KTY adapter connector ID 367770-xx
Mass ≈ 0.1 kg

Additional cables are required for the use of two or more adapter connectors on one controller unit because the connector for an external KTY temperature sensor does not permit two or more adapter connectors next to each other.

	Encoders with EnDat interface (EnDat2.1, EnDat2.2)	**Encoders with 1 V_{PP} interface**
1 m cable	ID 336377-01	ID 312533-01
3 m cable	ID 336377-03	ID 312533-03

19″ screen and keyboard

BF 760 color flat panel display

- Voltage supply: DC 24 V/≈ 65 W
- **19-inch**; 1280 x 1024 pixels
- HDL interface to the MC 6xxx
- 10 horizontal NC soft keys, 8 + 10 vertical soft keys for PLC
- Soft-key row switchover
- Selectable screen layout
- Operating mode switchover
- Integrated USB hub with six USB interfaces on the rear

BF 760 ID 732589-xx
Mass ≈ 7.8 kg

BF 760

TE 745T

- Suitable for MC 7532 and BF 760 (19″ design)
- Editing keys
- Operating mode keys
- Numeric keypad
- ASCII keyboard
- Spindle-speed, feed-rate and rapid-traverse override potentiometers
- Three holes for additional keys or keylock switches
- Touchpad and navigation keys
- Electronic handwheel
- USB interface to the MC main computer
- USB port with cover cap on front

Integrated machine operating panel with:

- Voltage supply: DC 24 V/≈ 4 W
- 36 exchangeable snap-on keys with status LEDs, of which 22 are not labeled, freely definable via PLC
- Operating elements include keys that are preassigned according to PLC basic program: Control voltage on[1]; NC start[1]; NC stop[1]; emergency stop; 6 axis keys; rapid traverse key; spindle start; spindle stop; spindle jog, spindle change key, feed rate stop
- Connection for HR handwheel (due to the internal connector layout, no additional handwheels can be connected)
- HSCI interface
- 7 free PLC inputs and 5 free PLC outputs

[1] Keys illuminated, addressable via PLC

TE 745T ID 801306-xx
Mass ≈ 4.5 kg

TE 745T

15″ screen and keyboard

BF 750 color flat-panel display

- Voltage supply: DC 24 V/≈ 50 W
- **15.1-inch**; 1024 x 768 pixels
- HDL interface to the MC 6xxx
- 8 horizontal soft keys, 6 vertical soft keys for PLC
- Soft-key row switchover
- Selectable screen layout
- Operating mode switchover
- USB port with cover cap on front
- Integrated USB hub with four USB interfaces on the rear

BF 750	ID 785080-xx
Mass	≈ 4 kg

BF 750

TE 735T

- Suitable for MC 7420 and BF 750 (15″ design)
- Editing keys
- Operating mode keys
- Numeric keypad
- ASCII keyboard
- Spindle-speed and feed-rate override potentiometer
- One hole for additional key or keylock switch
- Touchpad and navigation keys
- Electronic handwheel (in version with electronic handwheel)
- USB interface to the MC main computer

Integrated machine operating panel with:

- Voltage supply: DC 24 V/≈ 4 W
- 36 exchangeable snap-on keys with status LEDs, of which 22 are not labeled, freely definable via PLC
- Operating elements include keys that are preassigned according to PLC basic program: Control voltage on[1)]; NC start[1)]; NC stop[1)]; emergency stop; 6 axis keys; rapid traverse key; spindle start; spindle stop; spindle jog, spindle change key, feed rate stop
- Connection for HR handwheel (in version with integrated handwheel no additional handwheels can be connected)
- HSCI interface
- 7 free PLC inputs and 5 free PLC outputs

[1)] Keys illuminated, addressable via PLC

TE 735T	With integrated handwheel	ID 823058-xx
	Without handwheel; with connection for handwheel	ID 1034924-xx
Mass	≈ 3.0 kg	

TE 735T

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. Mounted on standard NS 35 rails (DIN 46 227 or EN 50 022)

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

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

System PL

- Required 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-xx
PLB 6206	for 6 I/O modules	ID 630054-xx
PLB 6208	For 8 I/O modules	ID 630055-xx

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-xx
PLB 6106	for 6 I/O modules	ID 630058-xx
PLB 6108	for 8 I/O modules	ID 630059-xx

Up to seven PLB 6xxx can be connected to the control.

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-xx
PLD-H 08-16-00	I/O module with 8 digital inputs and 16 digital outputs	ID 650891-xx
Total current	Outputs 0 to 7: ≤ 2 A per output (≤ 8 A simultaneously)	
Power output	Max. 200 W	
Mass	0.2 kg	
PLA-H 08-04-04	Analog module for PL 6xxx with • 8 analog inputs, ± 10 V • 4 analog outputs, ± 10 V • 4 analog inputs for PT 100 thermistors	ID 675572-xx
Mass	0.2 kg	

Empty housing For unused slots ID 383022-xx

IOconfig (accessory) PC software for configuring HSCI and fieldbus 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 DC 24 V NC power supply required for the HSCI components by EN 61 800-5-1. The NC supply voltage and the PLC supply voltage are separated from each other by basic insulation.

PSL 130

Supply voltage
- PSL 130 (L1, L2): AC 400 V ± 10 % 50 Hz
- PSL 135 (L1, L2): AC 400 V (360 V to 480 V), 50/60 Hz
- PSL 13x (DC-link voltage): DC 400 V to 750 V
- Power consumption ≤1000 W

Outputs
- NC: DC 24 V/≤ 20 A (double insulation from line power)
  DC 5 V/≤ 16 A (only for PSL 135) electrically connected with DC 24 V-NC
- PLC: DC 24 V/≤ 20 A (basic insulation from line power)
- Total: ≤ 32 A/750 W

The **PSL 130** serves as a DC 24 V power supply unit for supplying the HSCI components. It is not necessary in connection with the UEC if the total current consumption of the connected HSCI components does not exceed 3.5 A.

HSCI components		**Current consumption DC 24 V NC**
Main computer	MC 6441 MC 6542 MC 7420	1.7 A 2.0 A 2.5 A
Machine operating panel	PLB 6001	0.2 A (without handwheel)
Keyboard	TE 7x5 (MB integrated)	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
Screen	BF 750 BF 760	2.1 A 2.5 A
Handwheels	HR 510	0.05 A
Touch probes	See specifications of the touch probes	

The **PSL 135** has an additional DC 5 V output and is therefore suited for supplying the CC controller unit and the MC main computer. It might be necessary with multi-row layout

	Module width	**Degree of protection**	**Mass**	
PSL 130	50 mm	IP 20	2.1 kg	ID 575047-xx
PSL 135	50 mm	IP 20	2.5 kg	ID 627032-xx

The current UV(R) supply units also feature an integrated power supply that provides DC 24 V to HSCI components.

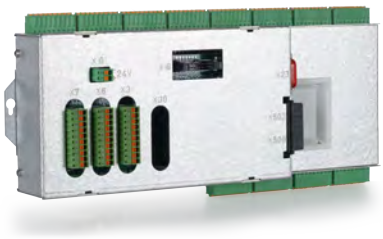
HSCI adapter for OEM machine operating panel

PLB 600x

The PLB 600x HSCI adapter is required in order to connect an OEM-specific machine operating panel to the CNC PILOT 640 The spindle-speed and feed-rate override potentiometers of the TE 7xx and the HR handwheel are also connected to these adapters.

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

PLB 6001	ID 668792-xx
Mass	≈ 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, 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-xx

CMA-H 04-04-00

Field bus systems

An expansion board can be used to provide the CNC PILOT 640 with a PROFIBUS or PROFINET interface at any time. This makes the connection to an appropriate fieldbus system as master possible.

PROFIBUS-DP module

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 to X121

PROFIBUS-DP additional module ID 828539-xx

PROFIBUS-DP module

PROFINET-IO module

The PROFINET module is integrated in the control system by using a slot in the MC. As of version 3.0, the interface is configured with IOconfig.

Additional module for PROFIBUS-DP
- Expansion board for the MC main computer
- RJ45 connection at X621 and X622

PROFINET-IO additional module ID 828541-xx

PROFINET-IO module

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 33for 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 transmission** for machines with automatic tool change (see page 33for 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 CNC PILOT 640 has standard routines. The CNC PILOT 640 automatically saves the results of measurement in a tool table. It is also possible to measure tool wear between two machining steps. The CNC PILOT 640 automatically compensates the tool dimensions for the subsequent operation.

With the triggering **TT touch probes**, the cuboid probe contact is deflected from its resting position by contact with the stationary or rotating tool and a trigger signal is transmitted to the CNC PILOT 640.

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 and infrared transmission (hybrid technology); common SE unit for TS 460 and TT 460; new 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

Support of electronic handwheels is standard on the CNC PILOT 640

- **HR 130** panel-mounted handwheel or
- Up to three **HR 150** panel-mounted handwheels via **HRA 110,** or
- **HR 510** portable handwheel

A handwheel or HRA handwheel adapter can be connected to the MB machine operating panel or the PLB 6001 adapter for HSCI.

HR 510

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 for 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 overview for HR 510 in *Snap-on keys for HR*).

	Keys	Without detent	With detent
HR 510	NC start/stop, spindle start (for basic PLC program)	ID 1119971-xx	ID 1120313-xx
	FCT A, FCT B, FCT C	–	ID 1099897-xx

Mass ≈ 0.6 kg

HR 510

Connecting cables

	For HR 510	
Connecting cable (spiral cable) to HR (3 m)	✓	ID 1117852-03
Connecting cable with metal armor	✓	ID 1117855-xx
Connecting cable without metal armor	✓	ID 1117853-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 41.

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
Mass	≈ 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
Mass	≈ 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 step switch (accessory) is evaluated over the PLC, for example to select the subdivision factor.

HRA 110		ID 261097-xx
Mass	≈ 1.5 kg	

HRA 110

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

Handwheel selection switch

Industrial PC

IPC 6641 for Windows

With the IPC 6641 industrial PC you can start and remotely operate Windows-based applications via the TNC's user interface. The user interface is displayed on the control screen. Option 133 is required.

Since Windows runs on the industrial PC, it does not influence the NC machining process. The IPC is connected to the NC main computer via Ethernet. No second screen is necessary, since the Windows applications are displayed on the TNC's screen via remote accesses.

In addition to the IPC 6641 industrial PC, a separately ordered hard disk is required for operation. The operating systems Windows 7, 8 or 10 can be installed on this empty data medium.

IPC 6641

IPC 6641		ID 1039543-xx
	To be installed in	Electrical cabinet
	Processor	Intel Core i7-3 2.1 GHz, quad-core
	RAM memory	4 GB
	Mass	4.0 kg
HDR hard disk		ID 1074770-51
	Empty data carrier for Windows operating system	
	Free capacity	≈ 160 GB

Snap-on keys for HR

Snap-on keys

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.

Overview for HR 410

Axis keys

Orange

A ID 330816-42	X ID 330816-24	U ID 330816-43	IV ID 330816-37
B ID 330816-26	Y ID 330816-36	V ID 330816-38	
C ID 330816-23	Z ID 330816-25	W ID 330816-45	

Gray

A– ID 330816-95	V+ ID 330816-69	ID 330816-0W	ID 330816-0R
A+ ID 330816-96	W– ID 330816-0G	ID 330816-0V	ID 330816-0D
B– ID 330816-97	W+ ID 330816-0H	ID 330816-0N	ID 330816-0E
B+ ID 330816-98	IV– ID 330816-71	ID 330816-0M	Z– ID 330816-65
C– ID 330816-99	IV+ ID 330816-72	Y– ID 330816-67	Z+ ID 330816-66
C+ ID 330816-0A	X– ID 330816-63	Y+ ID 330816-68	ID 330816-19
U– ID 330816-0B	X+ ID 330816-64	ID 330816-21	ID 330816-16
U+ ID 330816-0C	ID 330816-18	ID 330816-20	ID 330816-0L
V– ID 330816-70	ID 330816-17	ID 330816-0P	ID 330816-0K

Machine functions

SPEC FCT ID 330816-0X	FN 3 ID 330816-75	ID 330816-0T	ID 330816-86
SPEC FCT Black ID 330816-1Y	FN 4 ID 330816-76	ID 330816-81	ID 330816-87
FCT A Black ID 330816-30	FN 5 ID 330816-77	ID 330816-82	ID 330816-88
FCT B Black ID 330816-31	ID 330816-78	ID 330816-83	ID 330816-94
FCT C Black ID 330816-32	ID 330816-79	ID 330816-84	ID 330816-0U
FN 1 ID 330816-73	ID 330816-80	ID 330816-89	ID 330816-91
FN 2 ID 330816-74	ID 330816-0S	ID 330816-85	ID 330816-3L

Spindle functions

Red ID 330816-08	ID 330816-40	Red ID 330816-47	ID 330816-48
Green ID 330816-09	ID 330816-41	Green ID 330816-46	ID 385530-5X

Other keys

Black ID 330816-01	Red ID 330816-50	ID 330816-90	ID 330816-93
ID 330816-61	ID 330816-33	Black ID 330816-27	0 ID 330816-0Y
NC Green ID 330816-11	ID 330816-34	Black ID 330816-28	Black ID 330816-4M
NC Red ID 330816-12	ID 330816-35	Black ID 330816-29	ID 330816-3M
Green ID 330816-49	Green ID 330816-22	ID 330816-92	ID 330816-3N

Overview of HR 510

Axis keys

Orange

X	ID 1092562-05	Z	ID 1092562-07	B	ID 1092562-03	IV	ID 1092562-08
Y	ID 1092562-06	A	ID 1092562-02	C	ID 1092562-04	V	ID 1092562-09

Gray

X+	ID 1092562-28	Y–	ID 1092562-31	IV+	ID 1092562-24	V–	ID 1092562-27
X–	ID 1092562-29	Z+	ID 1092562-32	IV–	ID 1092562-25		
Y+	ID 1092562-30	Z–	ID 1092562-33	V+	ID 1092562-26		

Machine functions

FCT A	Black ID 1092562-14	FCT B	Black ID 1092562-15	FCT C	Black ID 1092562-16		

Spindle functions

	ID 1092562-18		ID 1092562-19		Green ID 1092562-22		Red ID 1092562-17

Other keys

	Black ID 1092562-01	NC	Green ID 1092562-23		ID 1092562-13		ID 1092562-35
	Green ID 1092562-20		ID 1092562-11		Black ID 1092562-10		
	Red ID 1092562-21		ID 1092562-12		ID 1092562-34		

Snap-on keys for control

Snap-on keys

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.

Overview of control keys

Keys
Orange

V	ID 679843-31	A	ID 679843-54	X	ID 679843-C8	U	ID 679843-D4
IV	ID 679843-32	W	ID 679843-55	B	ID 679843-C9		
Z	ID 679843-53	C	ID 679843-88	Y	ID 679843-D3		

Gray

X+	ID 679843-03	VI+	ID 679843-13	Y+	ID 679843-93	Z+	ID 679843-B9
X–	ID 679843-04	VI–	ID 679843-14	Y–	ID 679843-94	Z–	ID 679843-C1
Y+	ID 679843-05	Y–	ID 679843-43	B–	ID 679843-B1	X–	ID 679843-C2
Y–	ID 679843-06	Y+	ID 679843-44	B+	ID 679843-B2	X+	ID 679843-C3
Z+	ID 679843-07	C+	ID 679843-67	U–	ID 679843-B3	X+	ID 679843-C4
Z–	ID 679843-08	C–	ID 679843-68	U+	ID 679843-B4	X–	ID 679843-C5
IV+	ID 679843-09	A+	ID 679843-69	Y–	ID 679843-B5	X–	ID 679843-D9
IV–	ID 679843-10	A–	ID 679843-70	Y+	ID 679843-B6	X+	ID 679843-E1
V+	ID 679843-11	Z+	ID 679843-91	W–	ID 679843-B7		
V–	ID 679843-12	Z–	ID 679843-92	W+	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	FCT C	Black ID 679843-C7
	ID 679843-16		Green ID 679843-56	FCT A	Black ID 679843-95	SPEC FCT	ID 679843-D6
	ID 679843-22		Red ID 679843-57	FCT B	Black ID 679843-96		ID 679843-E3
	ID 679843-23		ID 679843-59		Black ID 679843-A1	FCT RC	ID 679843-E4
FN 1	ID 679843-24	–	ID 679843-60	FN 4	ID 679843-A2		ID 679843-E6
FN 2	ID 679843-25		ID 679843-61	FN 5	ID 679843-A3		ID 679843-E7
FN 3	ID 679843-26		ID 679843-62		ID 679843-A4		ID 679843-E8
	ID 679843-27	FCT	ID 679843-63		ID 679843-A5		
	ID 679843-28		ID 679843-64		ID 679843-A6		
	ID 679843-29		ID 679843-73		ID 679843-A9		

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		ID 679843-50		ID 679843-72		
	ID 679843-46		ID 679843-51		Red ID 679843-89		

Other keys

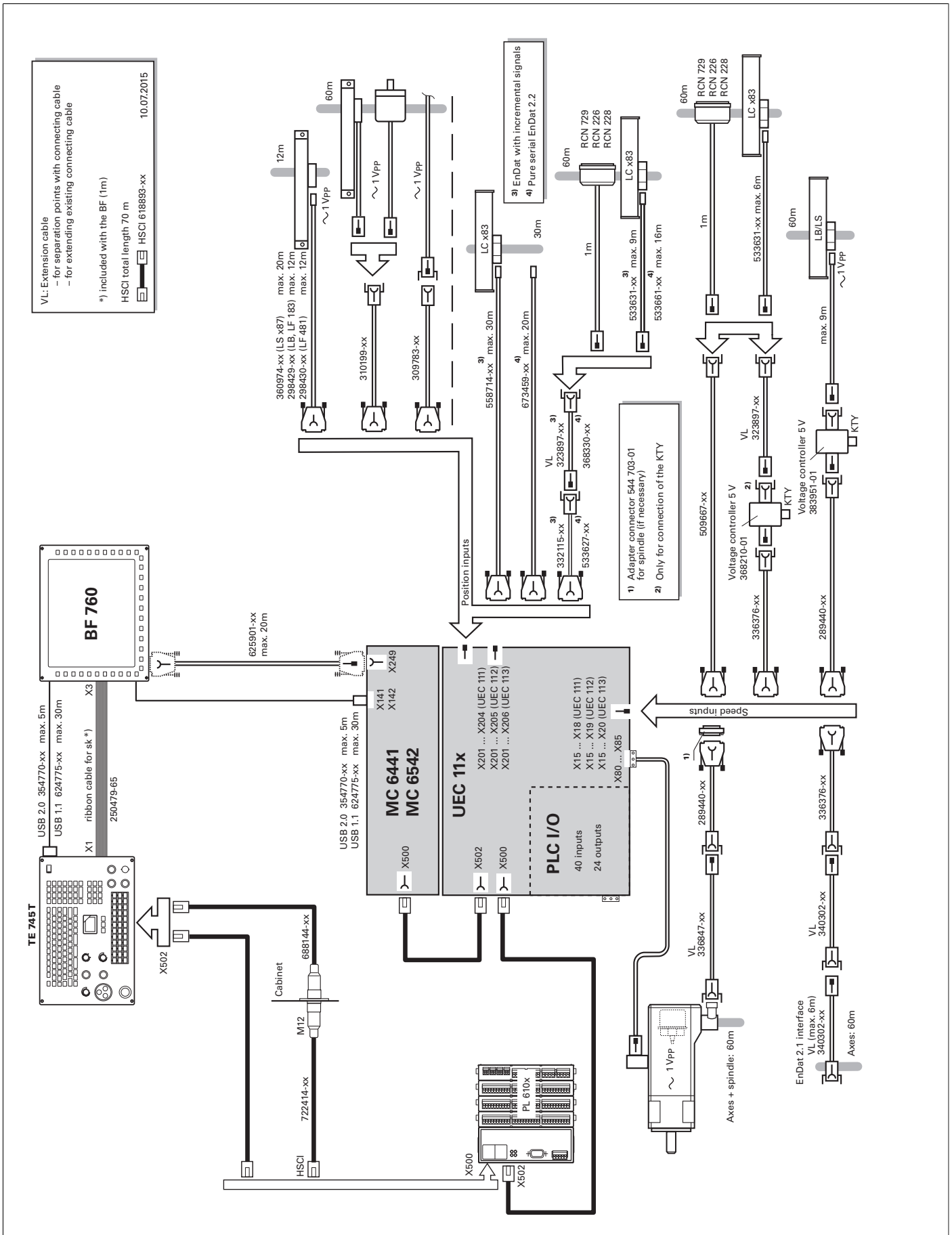
	ID 679843-15		ID 679843-39		ID 679843-97		Black ID 679843-E2
	ID 679843-17		ID 679843-41		ID 679843-98		ID 679843-E5
	ID 679843-33		ID 679843-42		ID 679843-A7		ID 679843-F2
	Black ID 679843-34		Red ID 679843-45		ID 679843-A8		ID 679843-F4
	Orange ID 679843-35		ID 679843-58		Black ID 679843-D1		ID 679843-F5
	ID 679843-36		ID 679843-66		Black ID 679843-D2		ID 679843-F6
	ID 679843-37		ID 679843-75		ID 679843-D5		
	ID 679843-38		Green ID 679843-90		Red ID 679843-D7		

Special keys

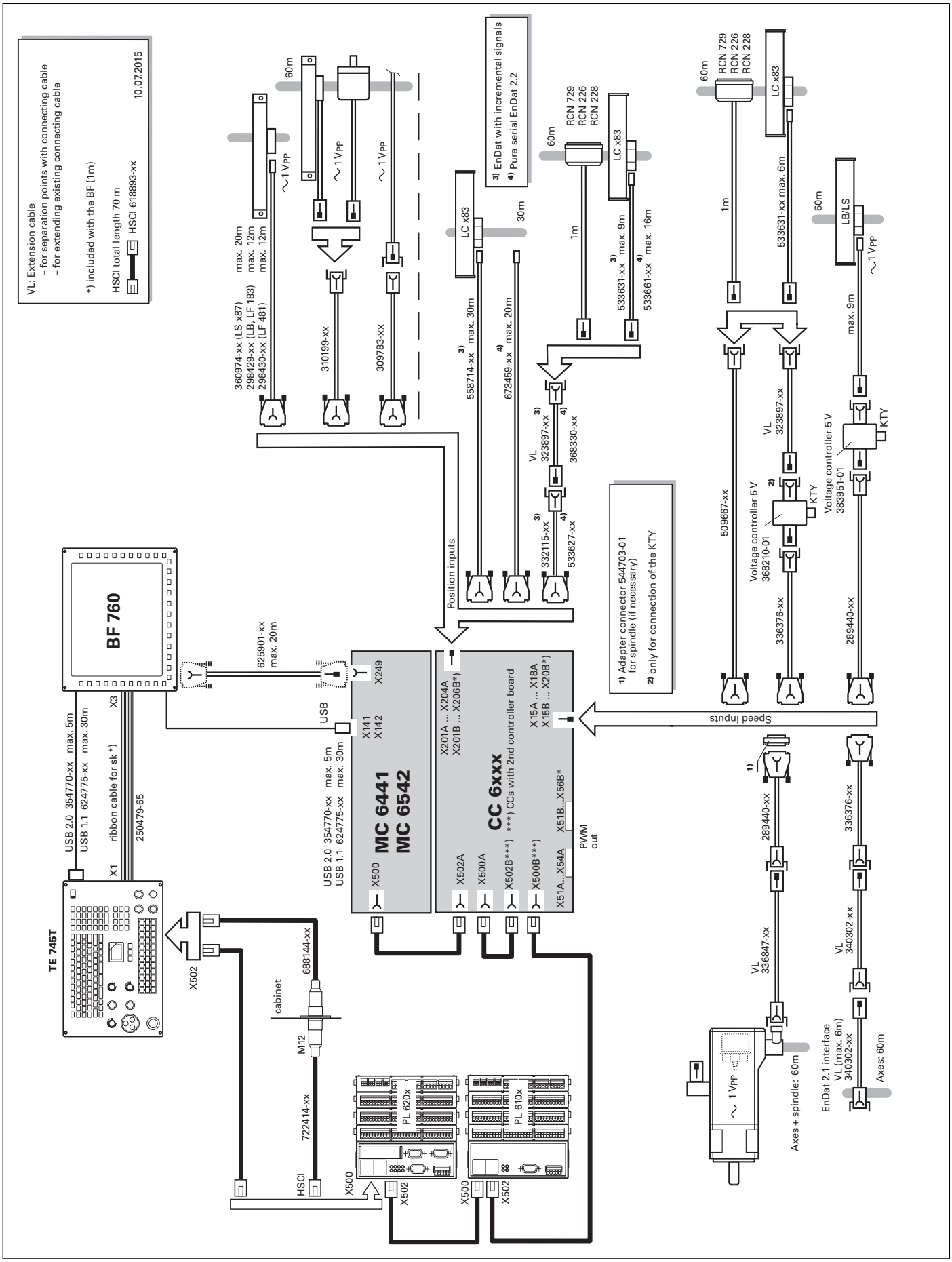
Snap-on keys with customized symbols for special applications can also be manufactured. The laser labeling differs optically from the labeling of the standard keys.

Cable overview

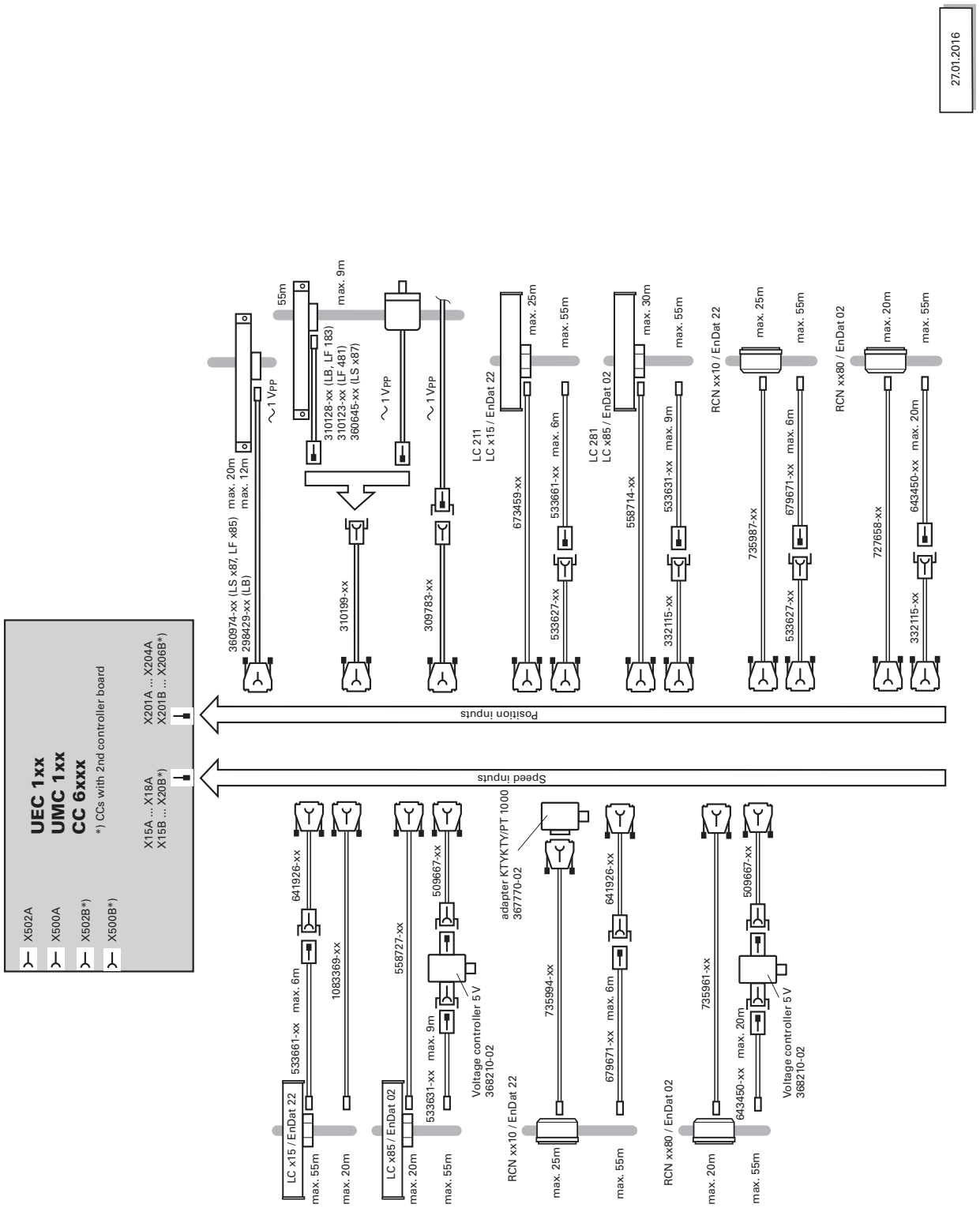
Control system with UEC



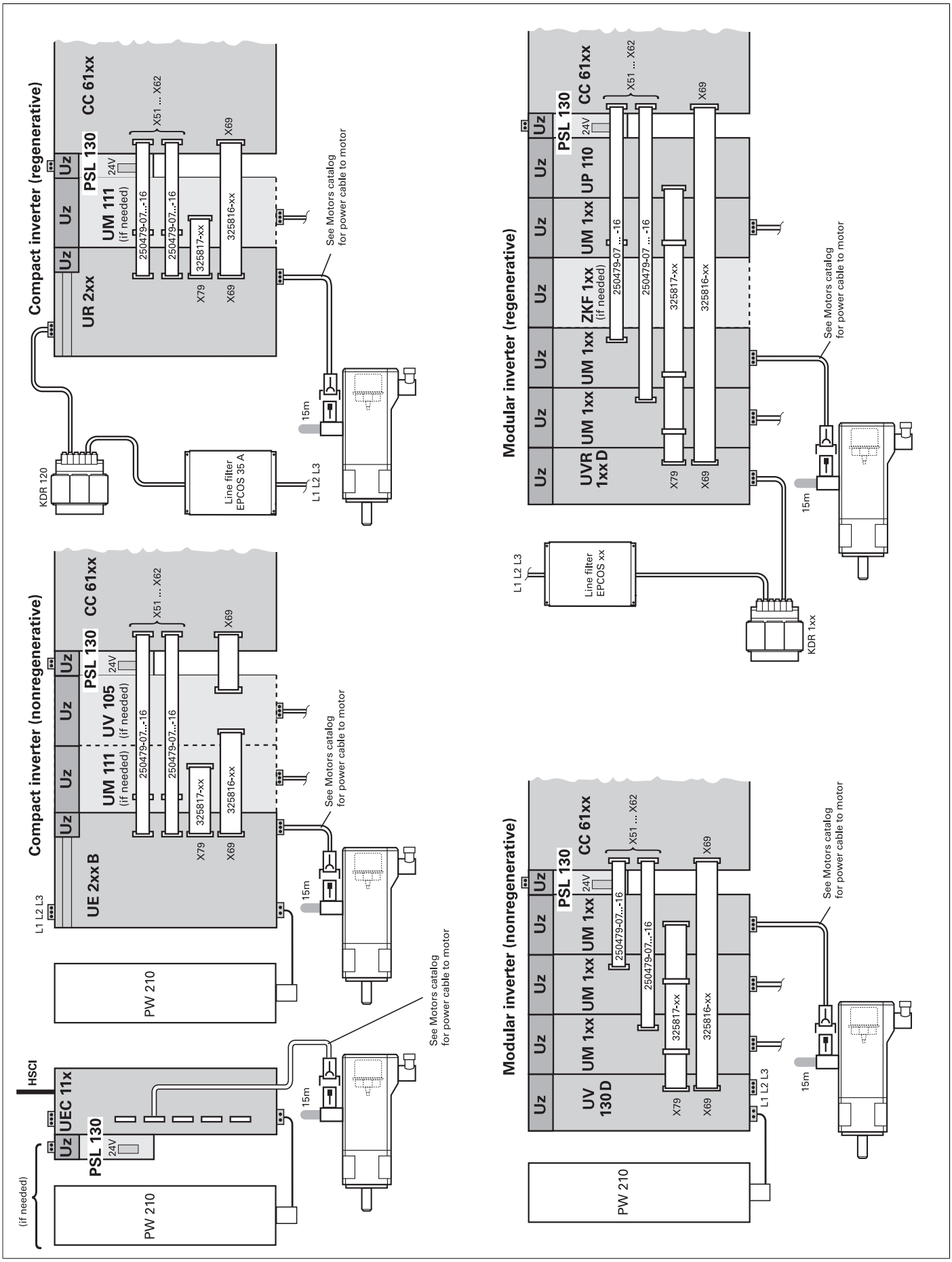
Control system with CC



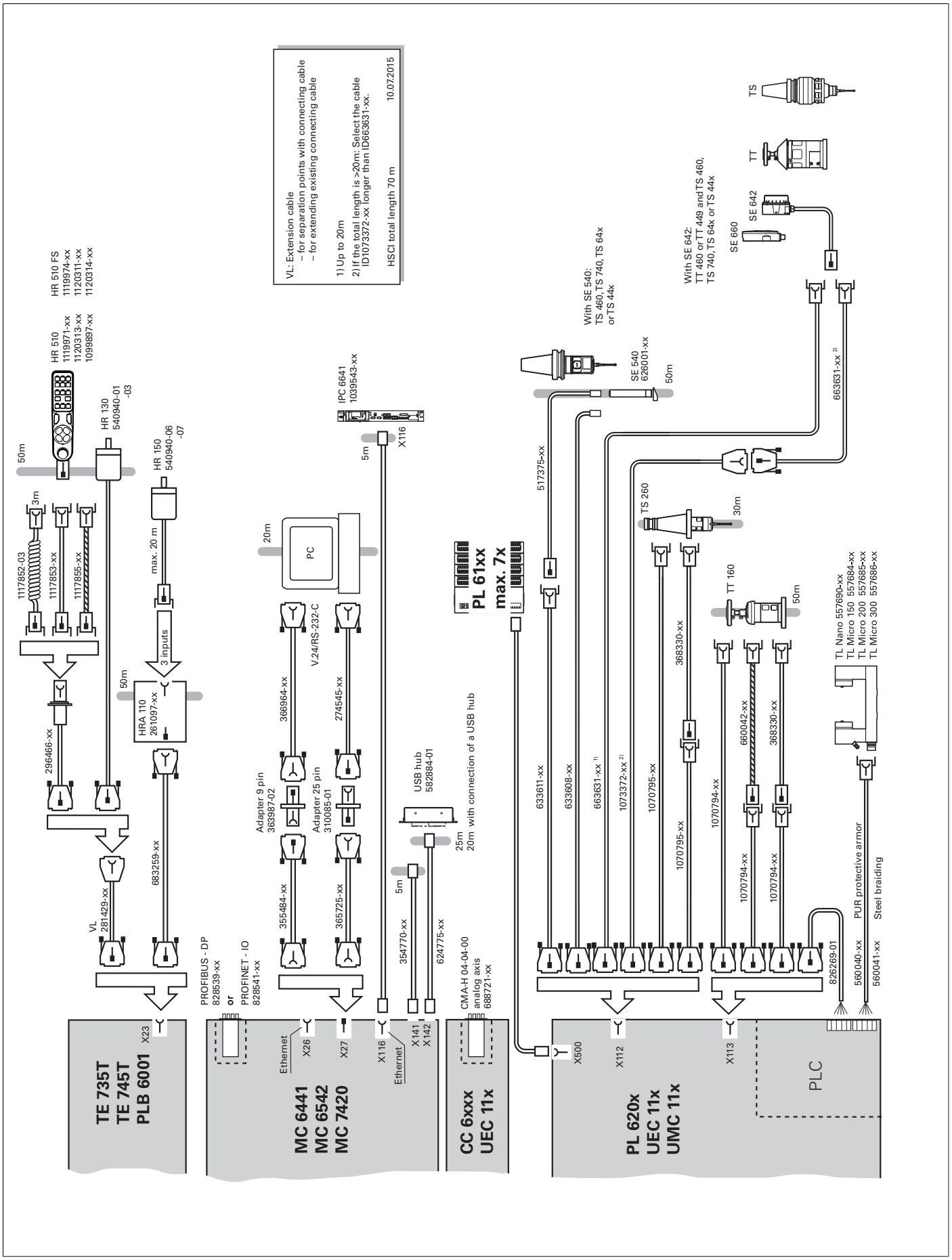
Encoders


27.01.2016
UEC 1xx
UMC 1xx
CC 6xxx
*) CCs with 2nd controller board
X502A
X500A
X502B*)
X500B*)
X15A ... X18A
X15B ... X20B*)
X201A ... X204A
X201B ... X206B*)
Position inputs
Speed inputs
360974-xx (LS x87, LF x85) max. 20m
298429-xx (LB) max. 12m
~ 1 VPP
55m
max. 9m
310128-xx (LB, LF 183)
310123-xx (LF 481)
360645-xx (LS x87)
310199-xx
309783-xx
LC 211
LC x15 / EnDat 22
673459-xx
max. 25m
533661-xx max. 6m
533627-xx
max. 55m
LC 281
LC x85 / EnDat 02
558714-xx
max. 30m
533631-xx max. 9m
332115-xx
RCN xx10 / EnDat 22
735987-xx
679671-xx max. 6m
RCN xx80 / EnDat 02
727658-xx
643450-xx max. 20m
641926-xx
1083369-xx
LC x15 / EnDat 22
558727-xx
509667-xx
533631-xx max. 9m
Voltage controller 5 V
368210-02
adapter KTYKTY/PT 1000
367770-02
735994-xx
679671-xx max. 6m
RCN xx10 / EnDat 22
735961-xx
643450-xx max. 20m
RCN xx80 / EnDat 02

Inverter system



Accessories



Technical description
Digital control design

Uniformly digital

In the HEIDENHAIN uniformly digital control solution, all components are connected over purely digital interfaces: the control components over **HSCI** (HEIDENHAIN Serial Controller Interface), the new HEIDENHAINreal-time protocol for Fast Ethernet and the encoders over **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. The outstanding characteristics of the uniform digital solution from HEIDENHAIN guarantee very high accuracy and surface definition together with high traversing speeds. 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. The connection between two HSCI components is also referred to as an HSCI segment. 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 a flexible and scalable control system (e.g. decentralized axis systems
- High noise immunity due to digital communication between components
- Hardware basis for implementing "functional safety"
- Simple wiring (commissioning, configuration)
- Inverters connected via proven PWM interface
- Large cable lengths in the entire system (HSCI segment up to max. 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 input/output modules, and an MB machine operating panel (e.g. 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.

Maximum cable length for HSCI:
- For one HSCI segment: 70 m
- For up to 12 HSCI slaves: 290 m (total of HSCI segments)
- For up to 13 HSCI slaves (maximum configuration): 180 m (total of HSCI segments)

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 controller 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 CNC PILOT 640 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 CNC PILOT 640 thanks to the **integrated browser**. The browser can be run in a **Sandbox** to increase data security.
- Plays **audio and video files** (ogg)
- You can open various **file formats** directly on the CNC PILOT 640 and also edit some of them with the appropriate editors:
  - Text files (txt, ini)
  - Graphic files (gif, bmp, jpg, png)
  - Tables (xls, csv)
  - Internet (html)
- Standardized **display format** for operating system dialogs
- Setting up a firewall for additional **data security**

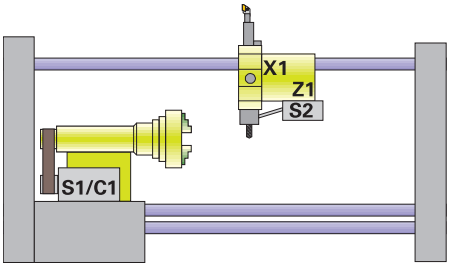
Axes

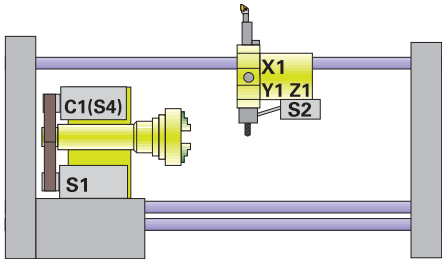
Overview

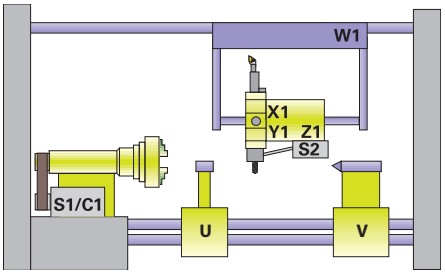
The CNC PILOT 640 is a contouring control for lathes with one spindle and a slide (X, Z and Y) for tool movement. For rear-face machining of the workpiece, an optional counter spindle can be operated in addition to the main spindle.

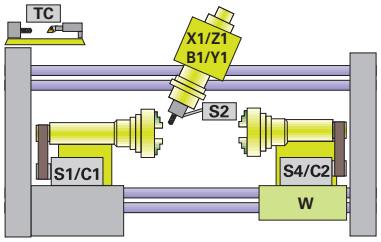
The control can offset the display of movements in the Z axis with those of its secondary axis W. Additional axes are available for positioning steady rests and the tailstock.

The CNC PILOT 640 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 Hz:

$$\frac{60000\ \text{rpm}}{\text{No. of motor pole pairs}} \cdot \text{Screw pitch [mm]}$$

Traverse range

–99 999.9999 to +99 999.9999 [mm]
The machine tool builder defines the traverse range. The user can set additional limits to the traverse range if he wishes to reduce the working space (software limit switch). A protection zone for the spindle (Z–) can also be specified.

Tool carriers

The CNC PILOT 640 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 counter spindles. The number of required tools and tool changes can thus be reduced.

Torque control (option 24)

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 counter spindle

Overview

For machines featuring a higher level of automation, you can position the spindle or counter spindle, or switch to C-axis operation.

Display and programming

Spindle speed:
- 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

- The CNC PILOT 640 monitors the actual speed.
- Speed limiting can be adjusted via parameter and in the feedrate/spindle/tool menu (TSF menu).

Spindle override

50 to 150 %

Maximum spindle speed

The maximum spindle speed is calculated as follows:

$$n_{max} = \frac{f_{PWM} \cdot 60000\ rpm}{NPP \cdot 5000\ Hz}$$

f_{PWM} = PWM frequency in Hz
NPP = Number of pole pairs

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, different parameter sets can be saved for closed-loop control (e.g. for wye or delta connections). 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 machining (option 55)

For milling, drilling and boring cycles, either the spindle or counter spindle is switched to C-axis operation, or a separate C-axis drive is activated.

Input resolution and display step: 0.001°

Opposing spindle (option 132)

The **Opposing Spindle** option is necessary in order to work with a counter spindle. The Spindle Synchronism option is included in the Opposing Spindle option.

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:
- Constant shaft speed: 1 to 99999 rpm
- Constant surface speed: 1 to 9999 m/min

Spindle speed limitation

- The CNC PILOT 640 monitors the actual speed.
- Speed limiting can be adjusted via parameter and in the feedrate/spindle/tool menu (TSF menu).

Spindle synchronism (option 131)

The **spindle synchronism** option is necessary for special operations with a driven tool (e.g. polygonal turning.) This option is included in the Opposing Spindle option.

Encoders

Overview

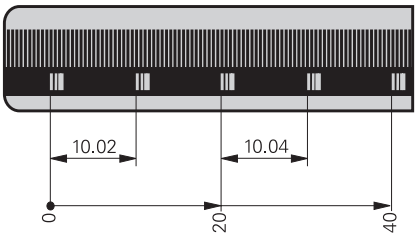
For speed and position control of the axes and spindle, HEIDENHAIN offers both incremental and absolute encoders.

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 by counting the 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 CNC PILOT 640 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.

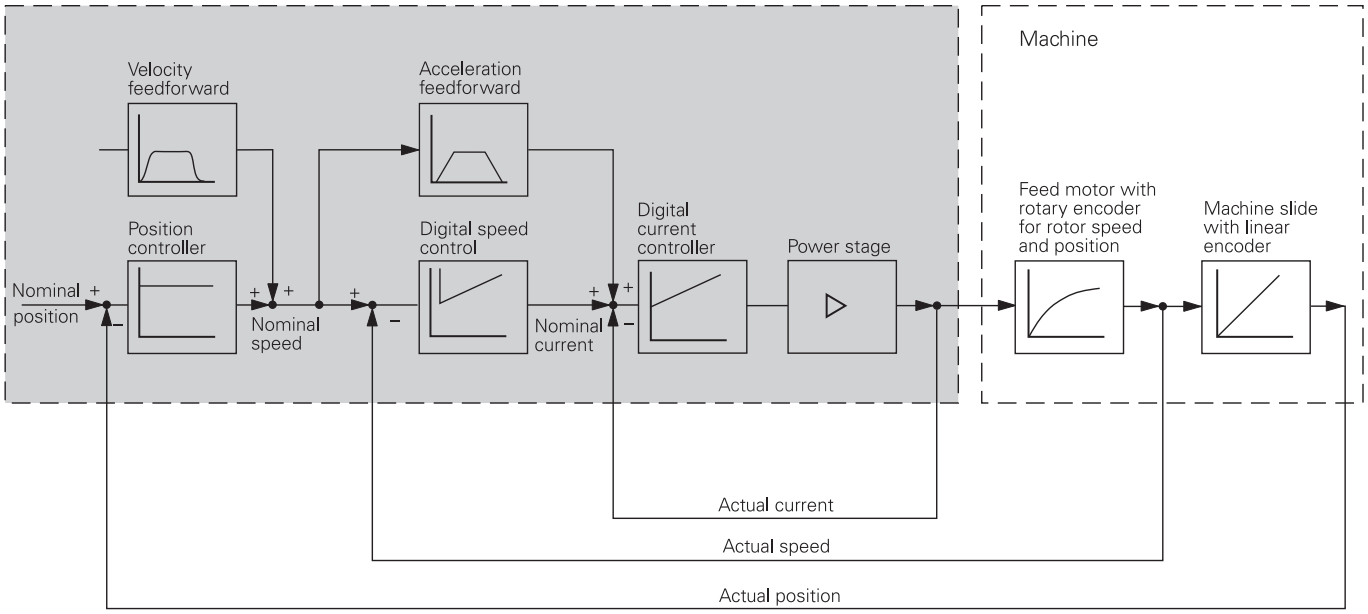
Channel inputs	**Signal level/ Interface[1)]**	**Input frequency[1)]**	
		Position	**Speed**
Incremental signals	~1 V_{PP}	33 kHz/350 kHz	350 kHz
Absolute position values Incremental signals	EnDat 2.2[2)]/02 ~1 V_{PP}	– 33 kHz/350 kHz	– 350 kHz
Absolute position values	EnDat 2.2[2)]/22	–	–

[1)] Switchable
[2)] Includes EnDat 2.1

Digital servo control

Integrated inverter

Position controllers, speed controllers, current controllers and inverters are integrated in the CNC PILOT 640. HEIDENHAIN synchronous or asynchronous motors are connected to the CNC PILOT 640.



Axis feedback control

The CNC PILOT 640 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 = velocity
k_v = position loop gain
s_a = 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

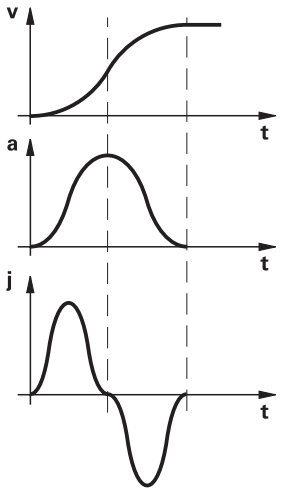
The derivative of acceleration is referred to as jerk. A linear change in acceleration causes a jerk step. Such motion sequences may cause the machine to oscillate.

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 CNC PILOT 640 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 following:
- Amplitude of the encoder signals
- Edge separation of the encoder signals
- Absolute position from 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
- EnDat alarm Error1→ EnDat status alarm register (0xEE)
- EnDat alarm Error2
- Edge speed of 5 µs
- Transmission of the absolute position value on the time grid

In the event 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 CNC PILOT 640 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.

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 CNC PILOT 640 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 CNC PILOT 640 immediately stops machining (cycle stop).

Meaningful error messages are issued if the limit values are exceeded. Furthermore, the CNC PILOT 640 can display the load values numerically and graphically in a separate window.

Error compensation

Overview

The CNC PILOT 640 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 CNC PILOT 640 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 CNC PILOT 640 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 CNC PILOT 640 can compensate for this problem condition.

Sliding friction

Sliding friction is compensated by the speed controller of the CNC PILOT 640.

Thermal expansion

To compensate thermal expansion, the machine's expansion behavior must be known.

The temperature can be recorded via thermistors connected to the analog inputs of the CNC PILOT 640. The PLC evaluates the temperature information and transfers the compensation value to the NC.

Load Adaptive Control (LAC) (option 143)

LAC (option 143) enables you to adapt controller parameters dynamically depending on the load or friction.

In order to optimize changed control behavior at differing loads, adaptive feedforward controls can exploit data on acceleration, holding torque, static friction and friction

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 CNC PILOT 640 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

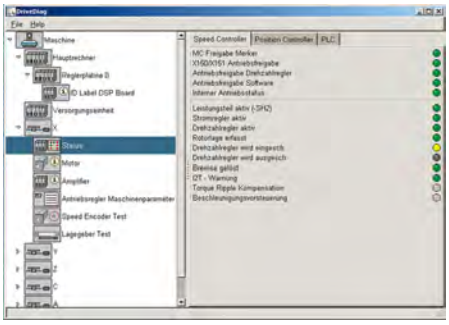
- Machine-parameter editor for the control; all support information; additional data and input limits are shown for each parameter
- Configuration of machine parameters
- Comparison of parameters from different controls
- Importing of service files: easy testing of machine parameters in the field
- Rule-based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

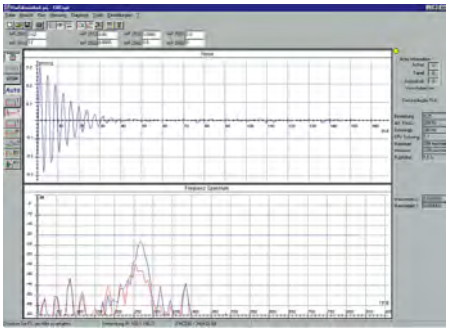
DriveDiag can be called directly from the control via the Diagnosis soft key. It is also available for downloading as PC software (accessory) from HESIS Web Including FileBase on the Internet. End users have read-access, whereas the code number for the machine tool builder gives access to comprehensive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



TNCopt (accessory)

PC software for commissioning digital control loops:Functions:

- Commissioning the current controller
- Commissioning the velocity controller (automatic)
- Optimization of sliding-friction compensation (automatic)
- Optimization of the reversal-spike compensation (automatic)
- Optimization of the k_V factor (automatic)
- Circular interpolation test, contour test



Online Monitor (OLM)

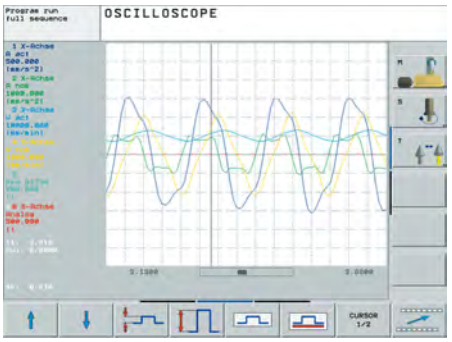
The online monitor is a component part of the CNC PILOT 640 and is called over a code number. It supports commissioning and diagnosis of control components by:

- 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 CNC PILOT 640 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:

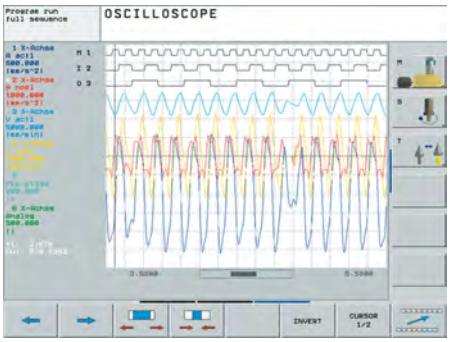
- Actual value and nominal value of the axis feed rate
- Contouring feed rate
- Nominal and actual position
- Following error of the position controller
- Content of PLC operands
- Encoder signal (0° – A) and (90° – B)
- Difference between position and speed encoder
- Nominal velocity value
- Integral-action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

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

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
- Support for 19" screens
- 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 with multifix
- Positioning of the tool turret with three-phase motor

Interfacing to the machine

Tool management

With integral PLC, the tool changer is moved either via proximity switch or as a controlled axis. Tool management including tool life monitoring and replacement tool monitoring is carried out by the CNC PILOT 640.

Tool calibration

Tools can be measured and checked using the **TT** tool touch probes (accessory). The control features standard cycles for automatic tool measurement. The control calculates the probing feed rate and the optimal spindle speed. The measured data is stored in a tool table.

Touch probe configuration

All touch-probe data can be configured conveniently through a table. All HEIDENHAIN touch probe systems are preconfigured and can be selected through a drop-down menu.

Magazine management

The magazine management provides several functions for various magazine types:

- Loading and unloading of tools in chain-type magazines
- Loading and unloading between magazine and spindle
- Support for manual tools in manual magazines
- Support for block search in tool magazines

Data transfer and communication
Data interfaces

Overview	The CNC PILOT 640 is connected to PCs, networks and other data storage devices via data interfaces.		
Ethernet	The CNC PILOT 640 can be interconnected via the Ethernet interface. For connection to the data net, the control features a 1000BASE-T (twisted pair Ethernet) connection. Maximum transmission distance: Unshielded 100 m Shielded 400 m		
Protocol	The CNC PILOT 640 communicates using the TCP/IP protocol.		
Network connection	• NFS file server • Windows networks (SMB)		
Data transfer speed	Approx. 400 to 800 Mbps (depending on file type and network utilization)		
RS-232-C/V24	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 CNC PILOT 640 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. For data backup, a so-called block check character (BCC) is used. This method improves data security.		
LSV2	Bidirectional transfer of commands and data as per DIN 66 019. The data is divided into telegrams (blocks) and transmitted.		
Adapter block	For connecting the interface to the electrical cabinet or operating panel.		
	RS-232-C adapter	9-pin 25-pin	ID 363987-xx ID 310085-xx
USB	The CNC PILOT 640 The TNC 640 features USB ports for the connection of standard USB devices, such as a mouse, drives, etc. On the back panel of the MC 7xxx there are 4 USB 3.0 ports. The MC 6xxx has four USB 3.0 ports. One of them is led to the BF or TE. More USB 2.0 ports are in the integrated USB hub on the rear of the BF. 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 Cable length 6 m to 30 m with integrated amplifier; USB 1.1.		ID 354770-xx 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 ID 582884-xx
Voltage supply: DC 24 V/max. 300 mA

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-xx

Software for data transfer

We recommend using HEIDENHAIN software to transfer files between the CNC PILOT 640 and a PC.

TNCremoPlus (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

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.

Additional functions:
- Query of DNC data (NC up time, Machine up time, Machine running time, Spindle running time, pending errors, data from the data servers, e.g. symbolic PLC operands)
- Targeted overwriting of tool tables (merge mode)

TNCremoPlus ID 340447-xx

Remote Desktop Manager (option 133)

Remote control and display of external computers over Ethernet connection (e.g. Windows-PC). The information is displayed on the control's screen.

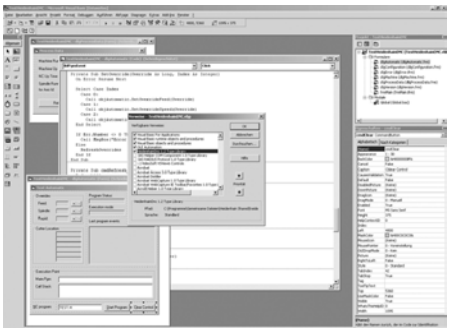
Remote desktop manager ID 894423-xx

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

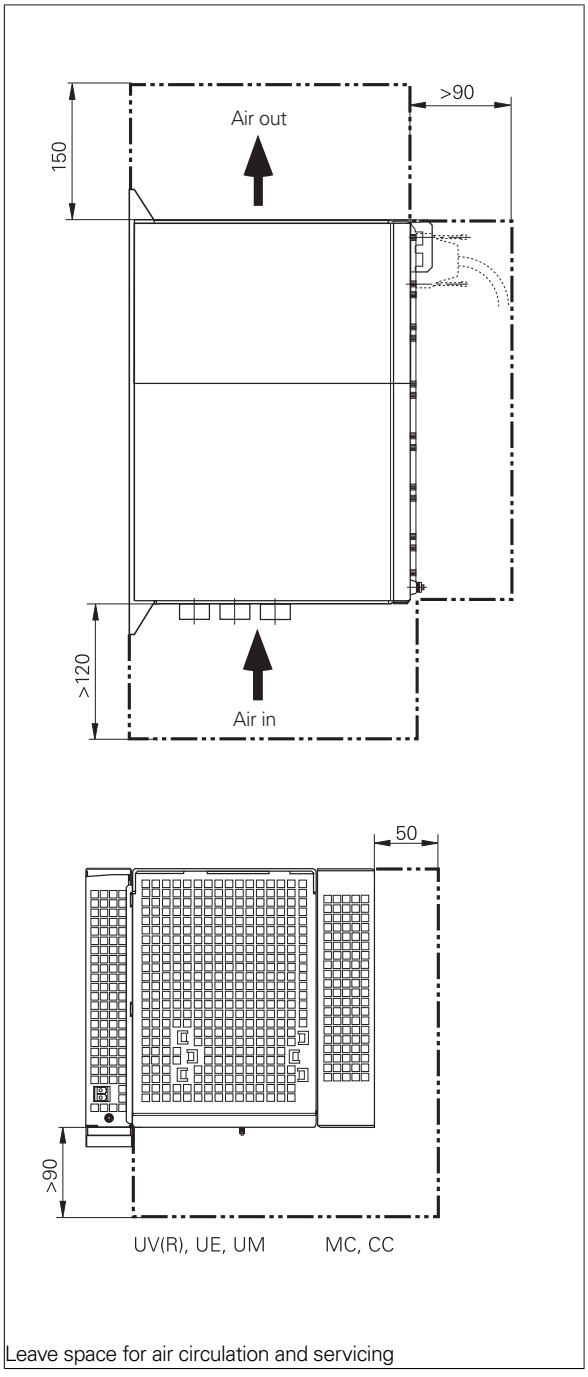
For more information, refer to the *HEIDENHAIN DNC* brochure.

Mounting information
Clearances and mounting

Proper minimum clearance

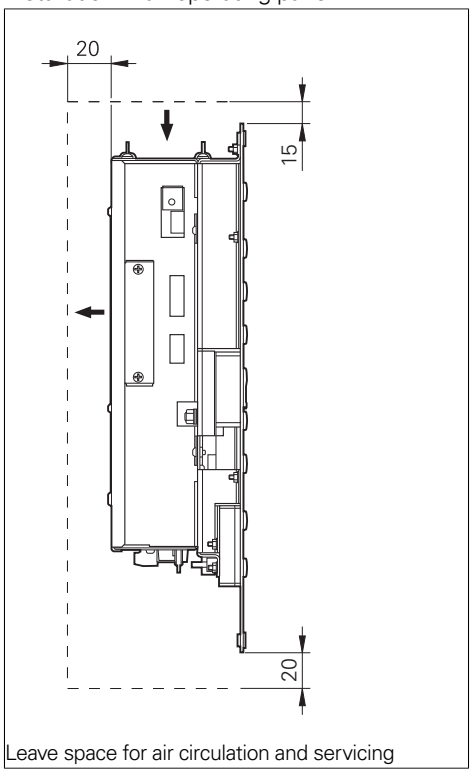
When mounting the control components, please observe proper minimum clearances, space requirements, length and position of the connecting cables.

Installation in an electrical cabinet



Leave space for air circulation and servicing

Installation in an operating panel



Leave space for air circulation and servicing

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 IP54 (dust protection and splash-proof protection):
- Display unit (installed)
- Keyboard unit (installed)
- Machine operating panel (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 IP54 (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 mm^2
- Use only genuine HEIDENHAIN cables and connecting elements

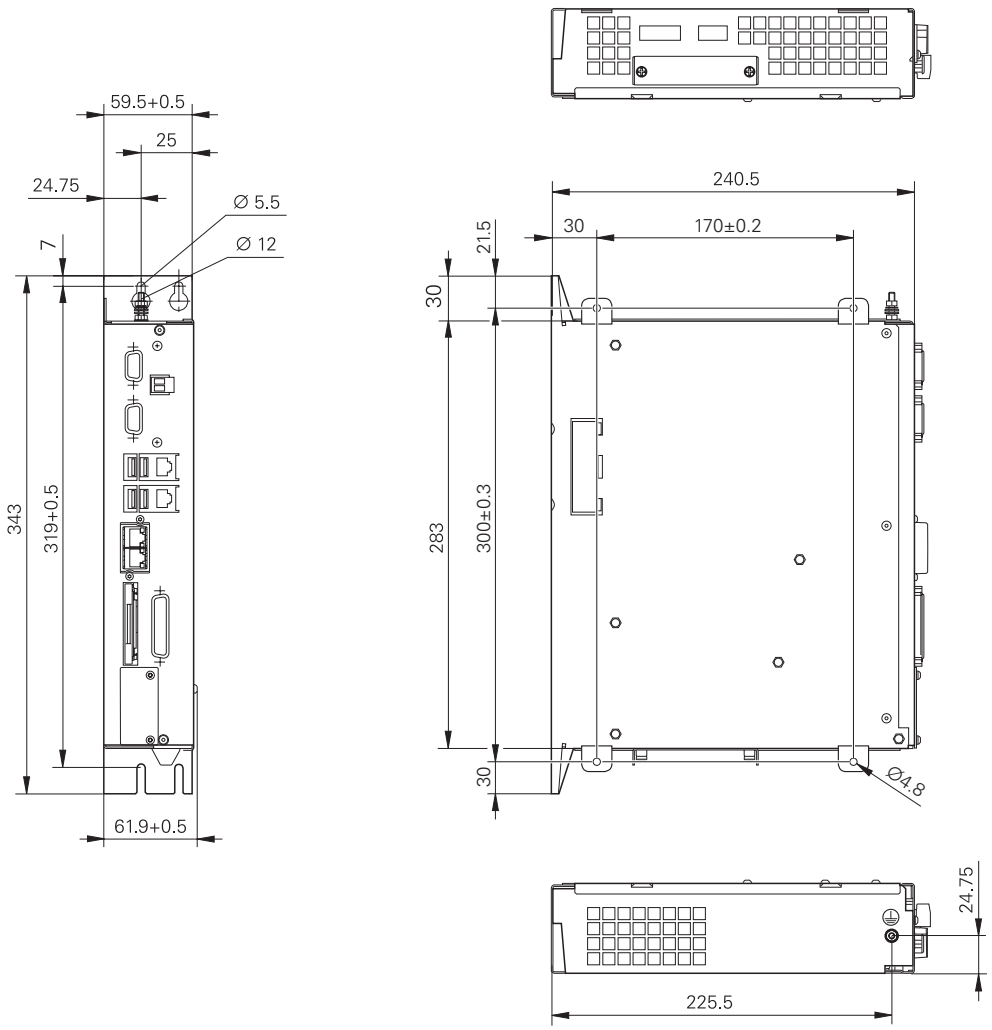
Overall dimensions

Main computer

MC 6542

mm

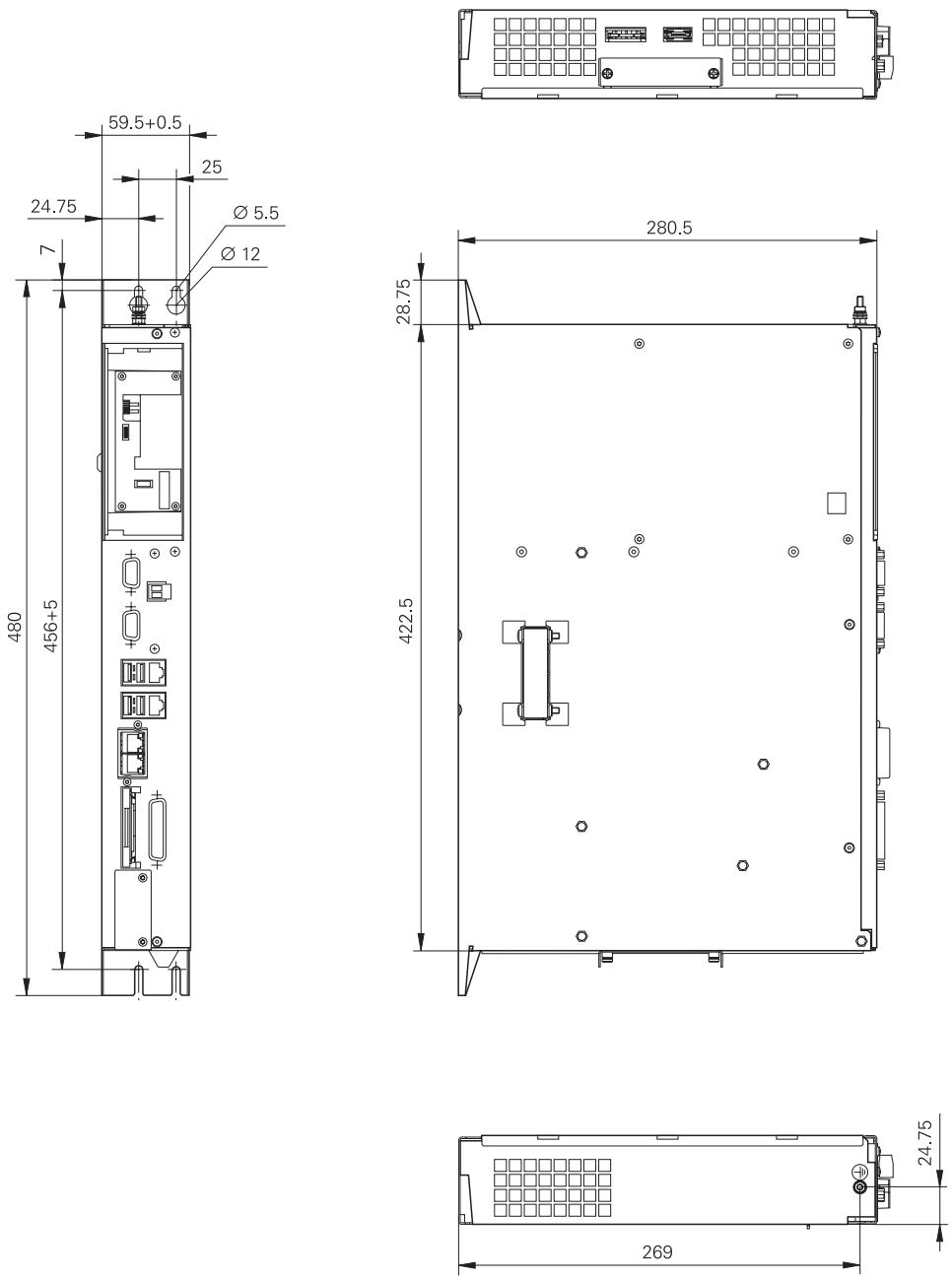
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



MC 6441, IPC 6641

mm

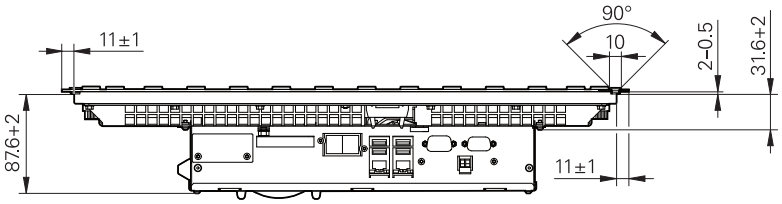
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

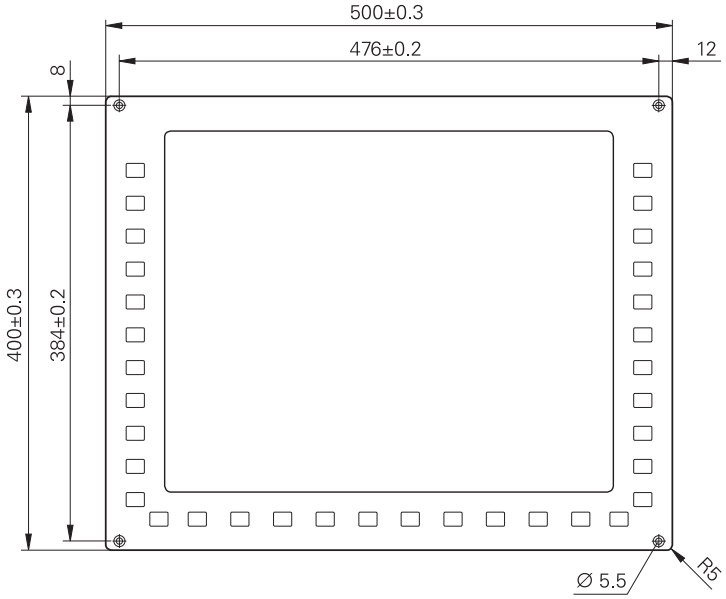


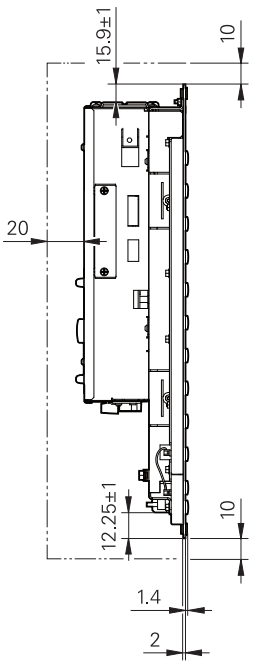
MC 7532

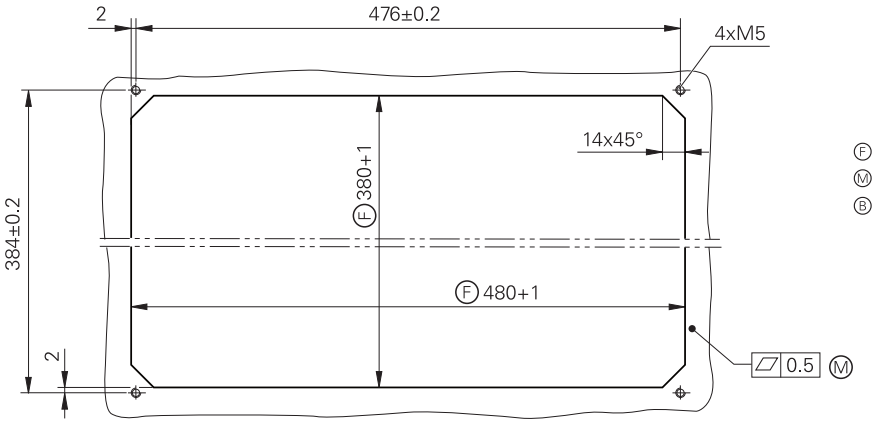
mm

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



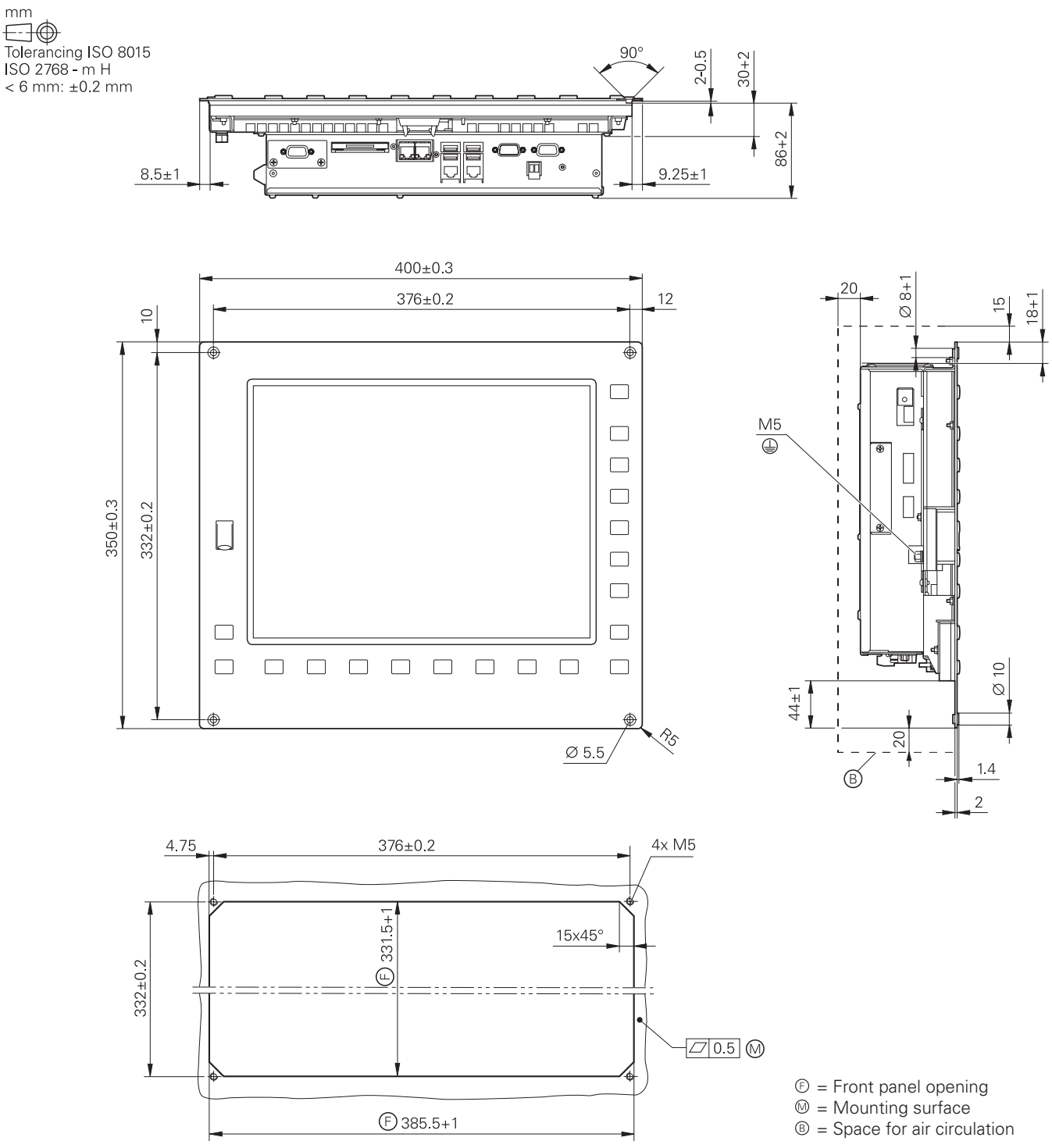






Ⓕ = Front panel opening
Ⓜ = Mounting surface
Ⓑ = Space for air circulation

MC 7420

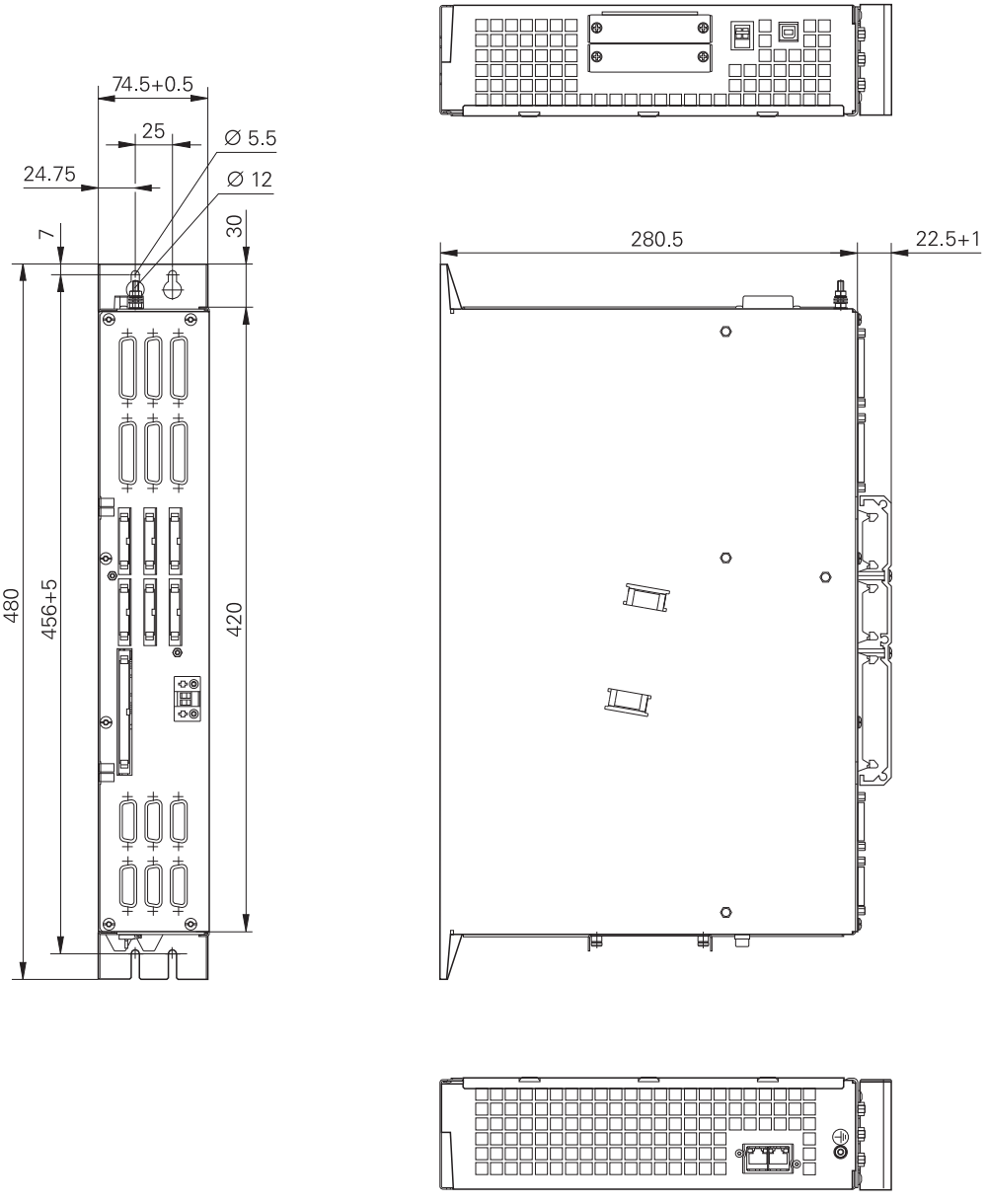

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm
90°
2-0.5
30+2
86+2
8.5±1
9.25±1
400±0.3
376±0.2
12
10
350±0.3
332±0.2
Ø 5.5
R5
20
Ø 8+1
15
18+1
M5
44±1
Ø 10
20
1.4
2
4.75
376±0.2
4x M5
332±0.2
Ⓕ 331.5+1
15x45°
0.5 Ⓜ
Ⓕ 385.5+1
Ⓕ = Front panel opening
Ⓜ = Mounting surface
Ⓑ = Space for air circulation

Controller unit

CC 6106

mm

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

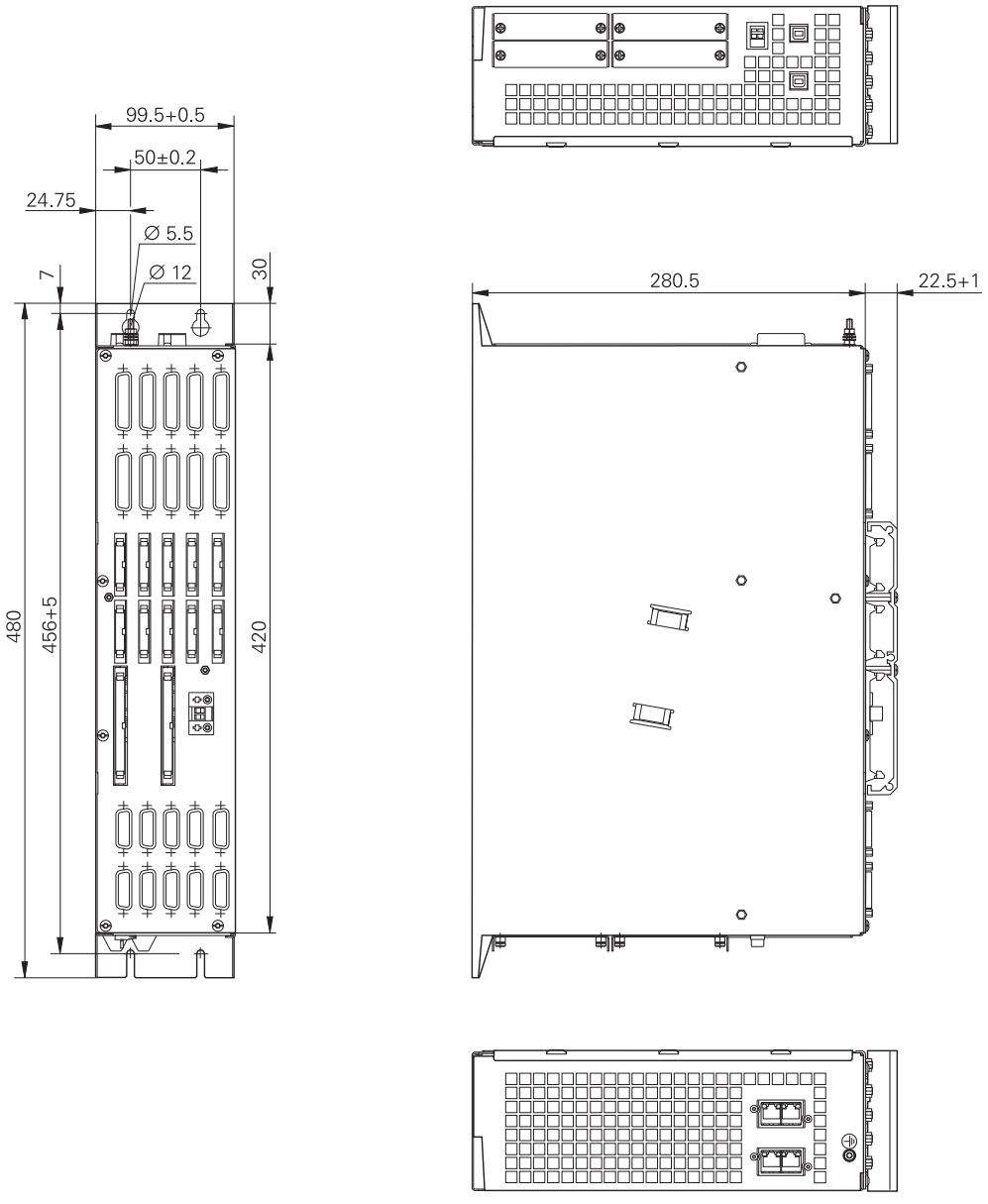


CC 6108, CC 6110

mm

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

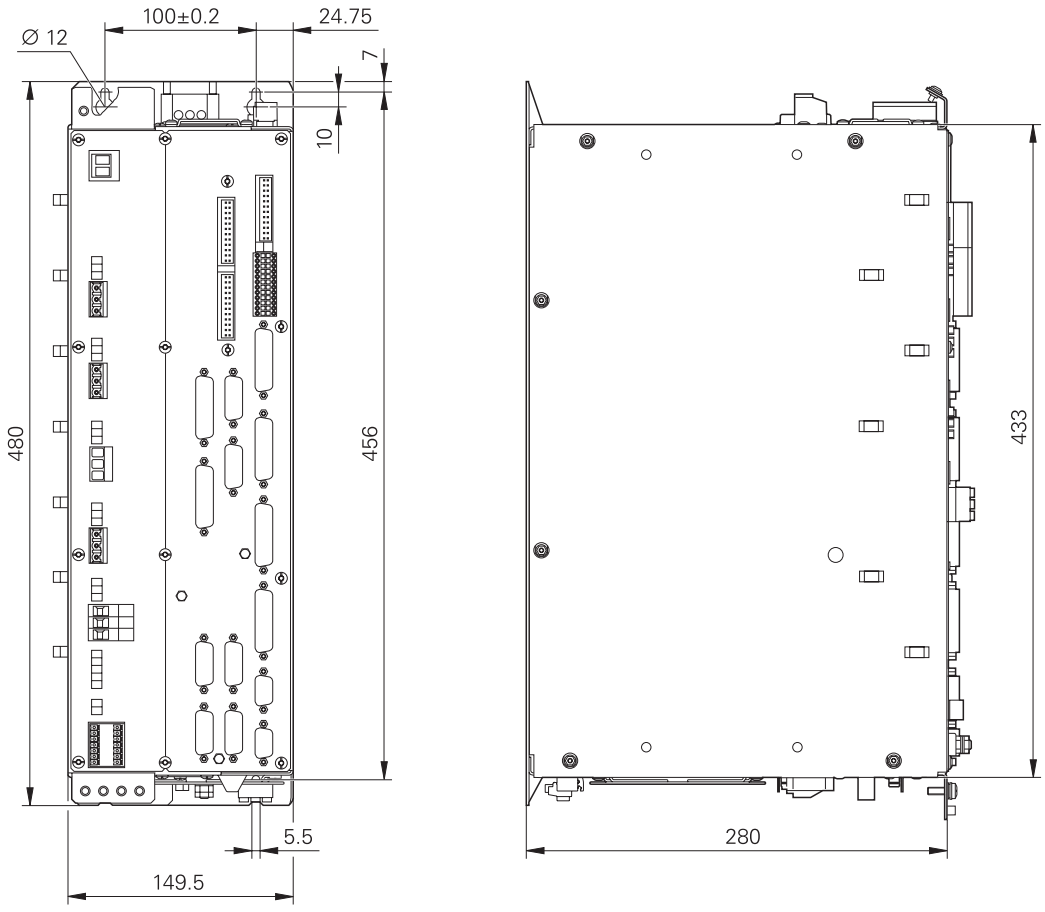
CC 6108: 8 control loops
CC 6110: 10 control loops



UEC 111, UEC 112, UEC 113

mm

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

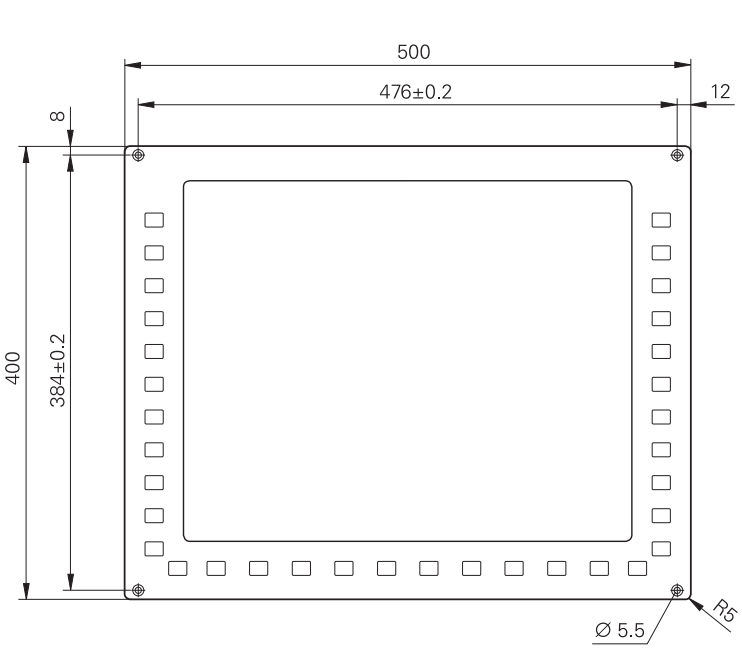


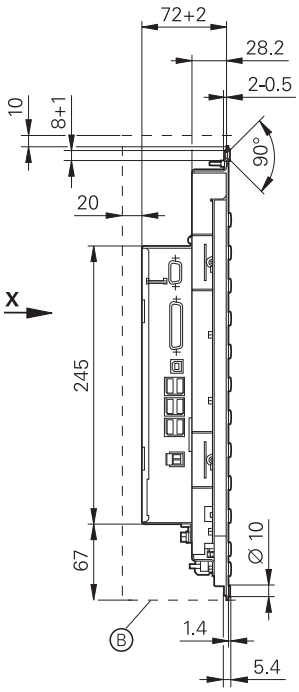
Screen and keyboard

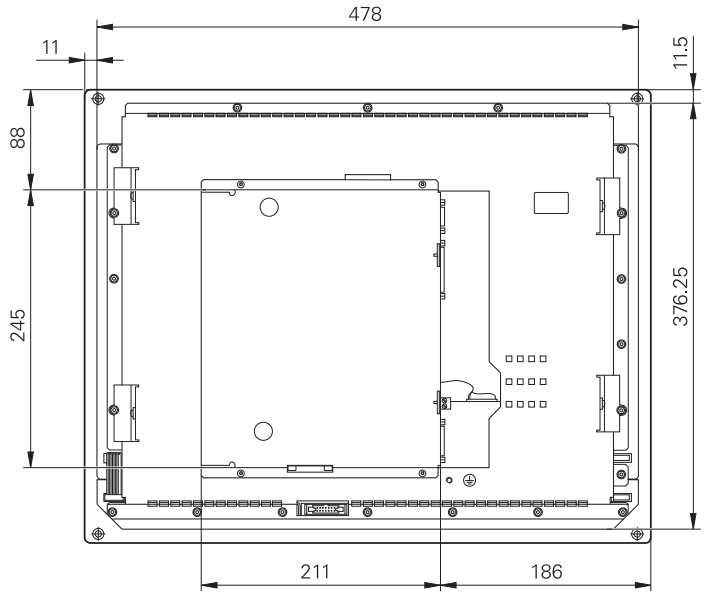
BF 760

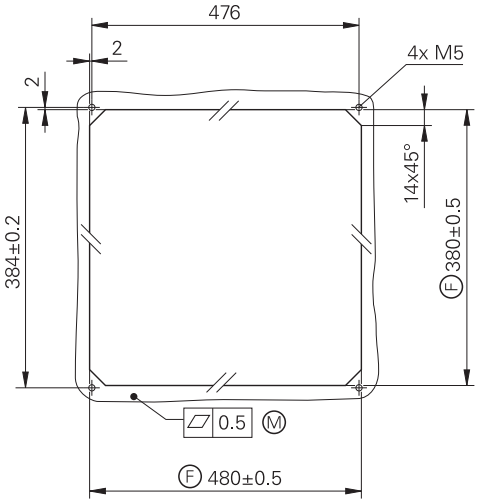
mm

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







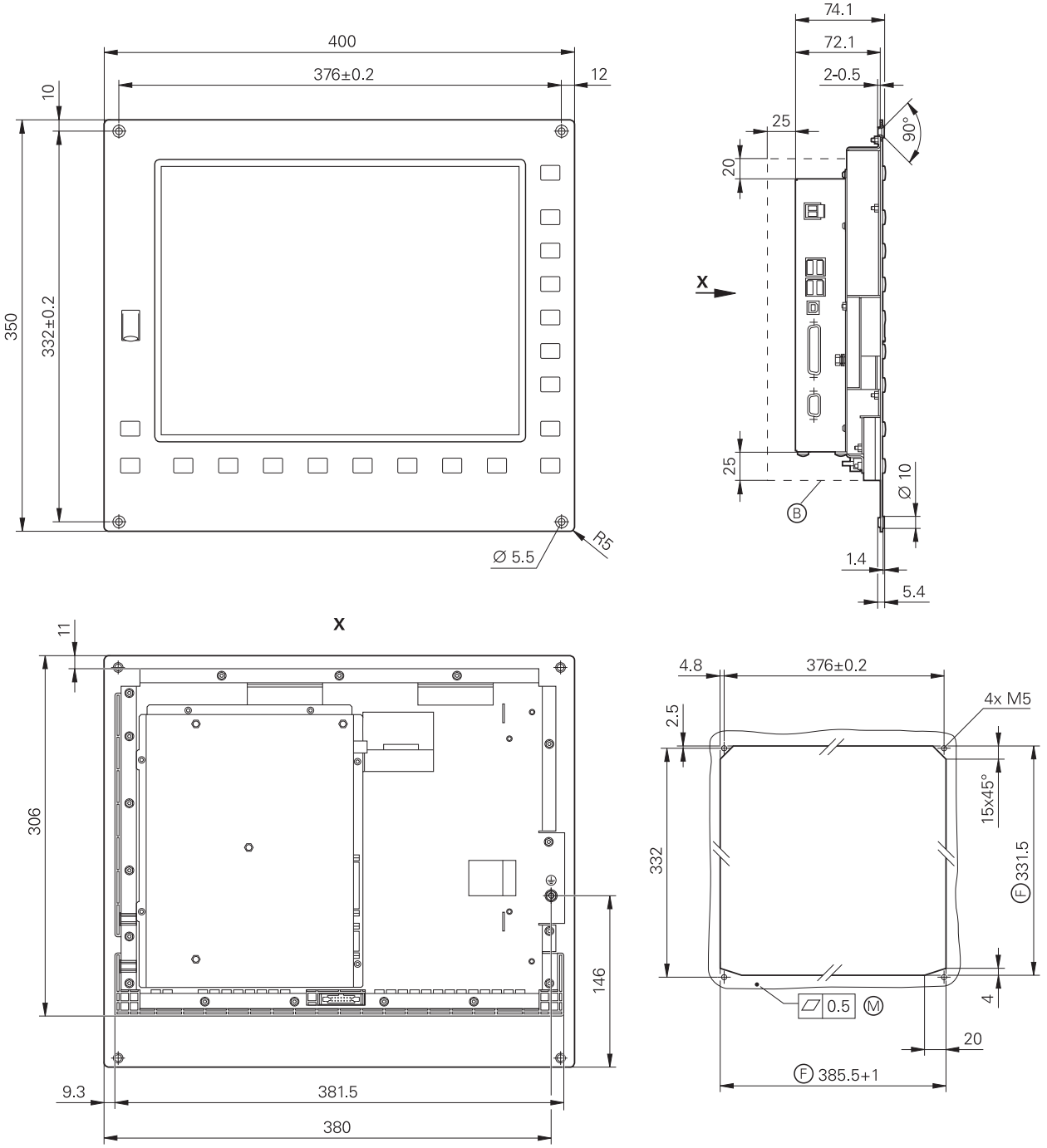


Ⓕ = Front panel opening
Ⓜ = Mounting surface
Ⓑ = Space for air circulation

BF 750

mm

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

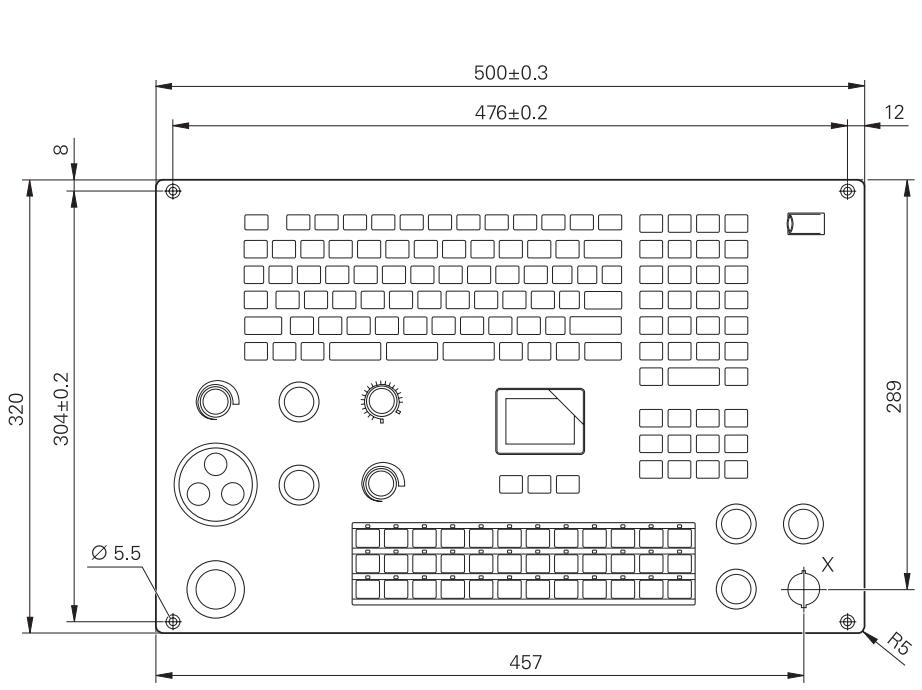


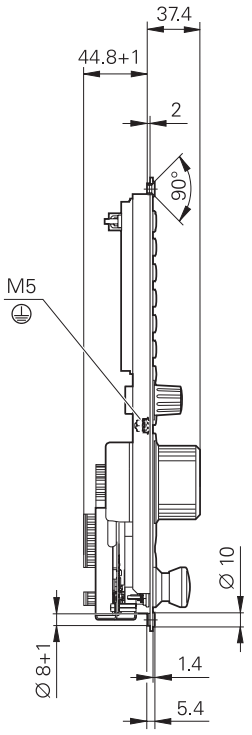
Ⓕ = Front panel opening
Ⓜ = Mounting surface
Ⓑ = Space for air circulation

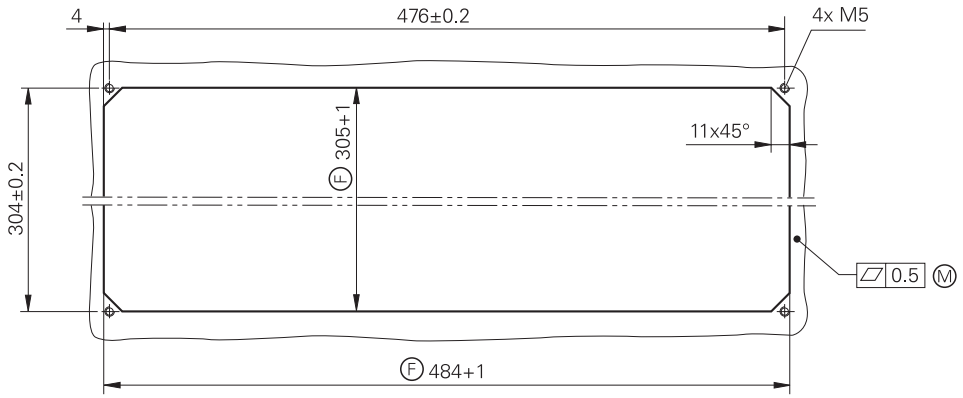
TE 745T

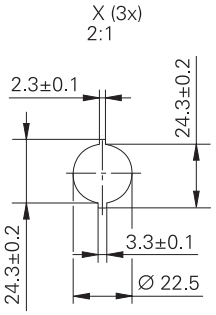
mm

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



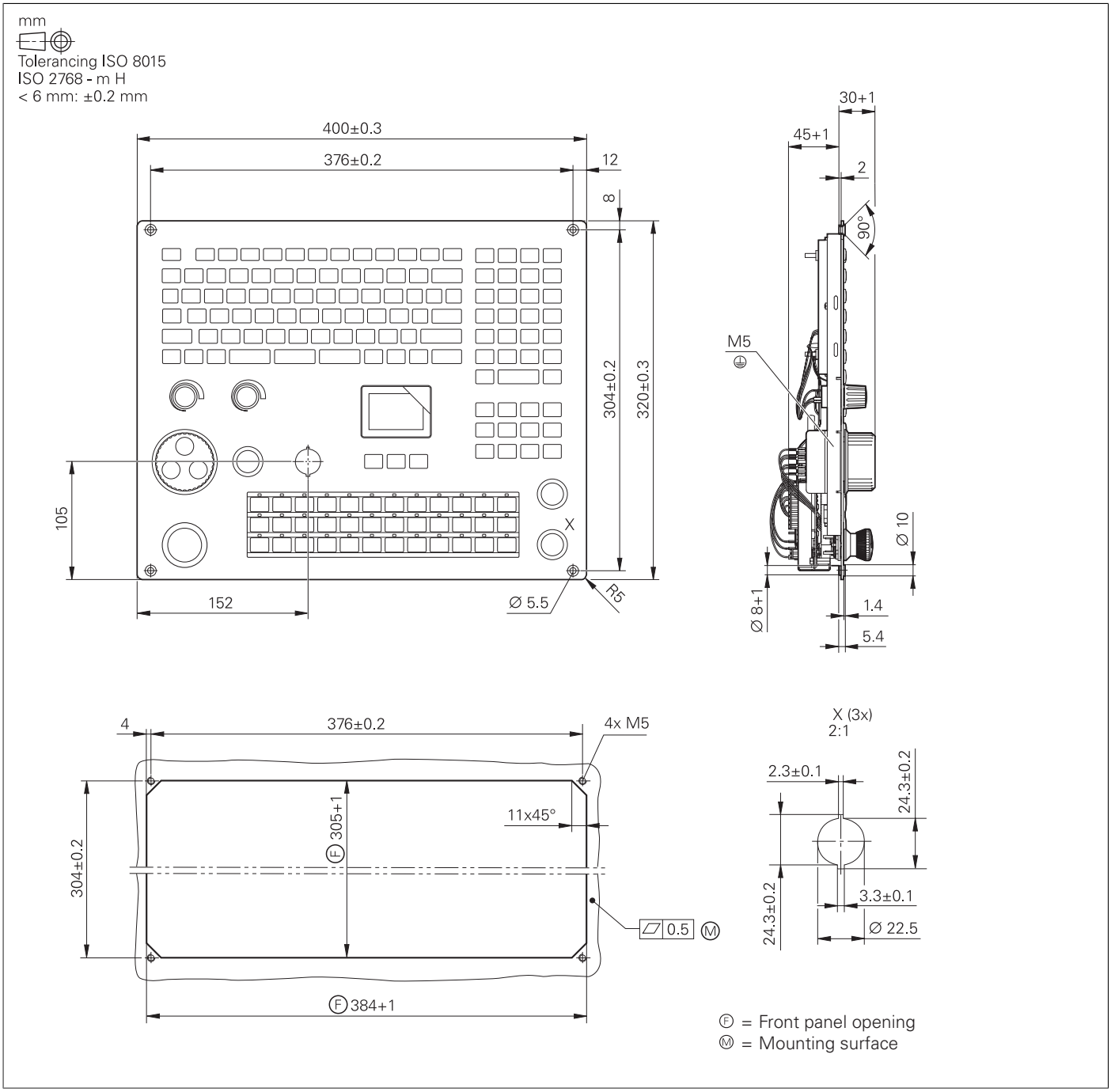




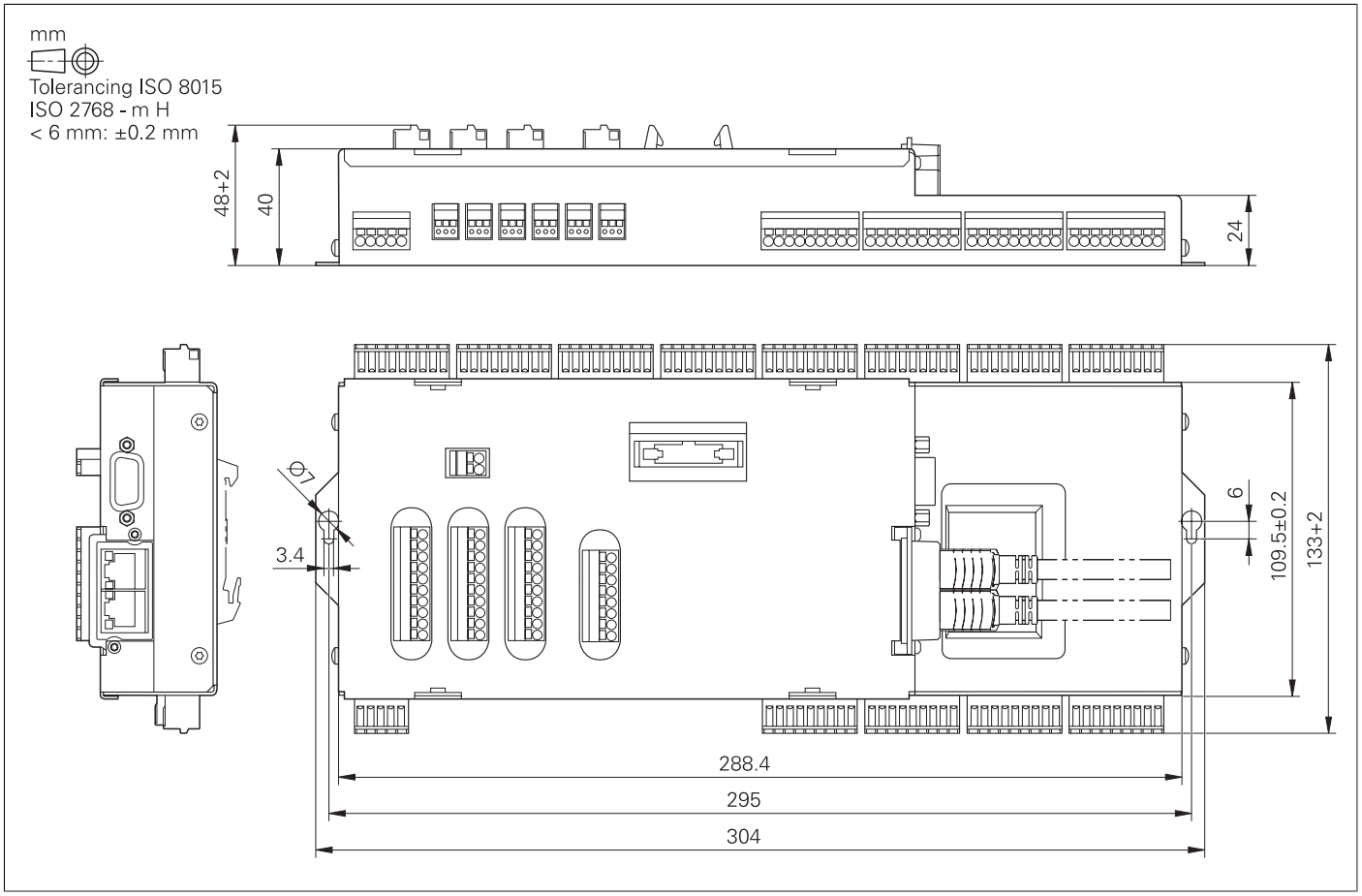


Ⓕ = Front panel opening
Ⓜ = Mounting surface

TE 735T

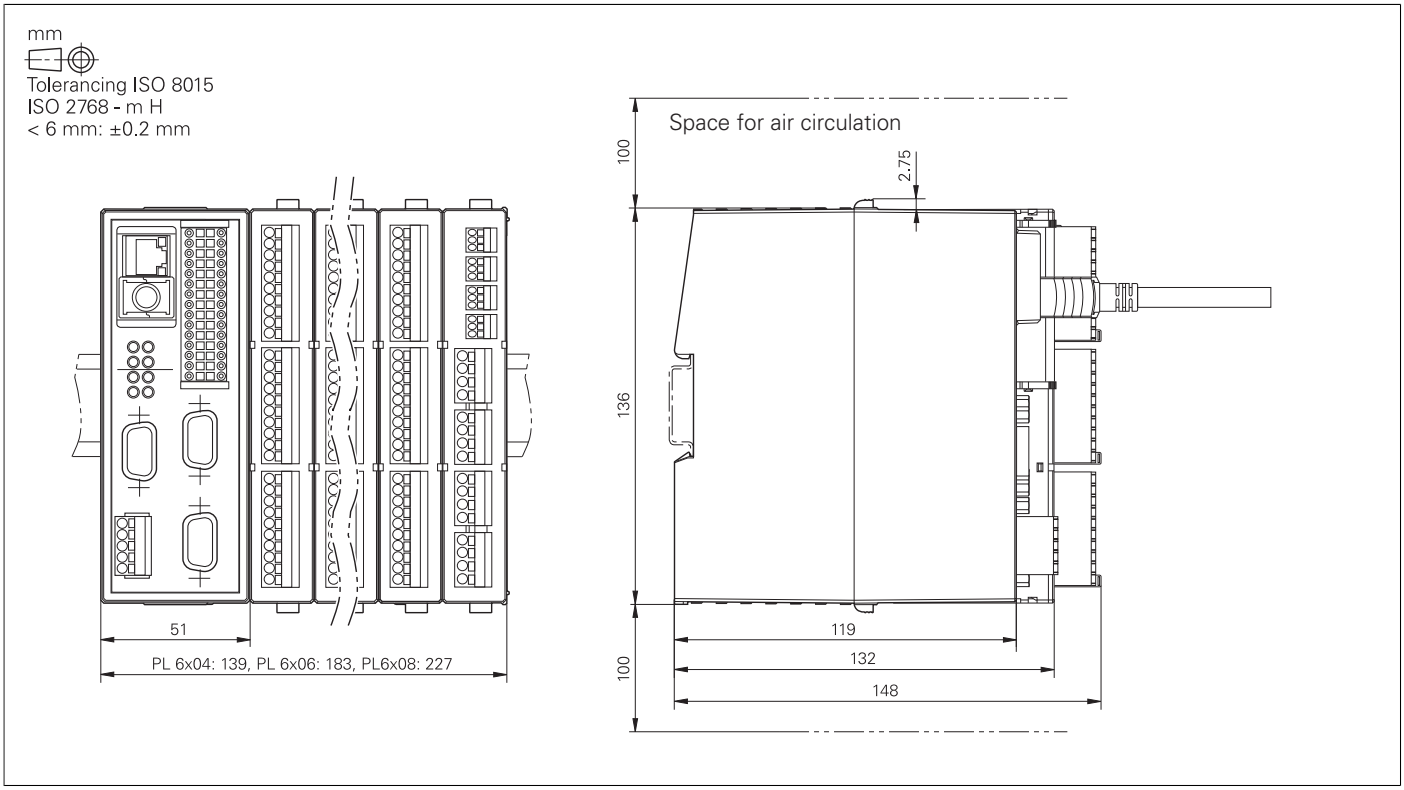

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm
400±0.3
376±0.2
12
8
304±0.2
320±0.3
105
152
Ø 5.5
R5
X
30+1
45+1
2
90°
M5
Ø 10
Ø 8+1
1.4
5.4
4
376±0.2
4x M5
304±0.2
305+1
11x45°
0.5
M
384+1
X (3x)
2:1
2.3±0.1
24.3±0.2
3.3±0.1
Ø 22.5
F = Front panel opening
M = Mounting surface

PLB 600x


mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm
48+2
40
24
Ø7
3.4
6
109.5±0.2
133+2
288.4
295
304

PLC inputs and outputs

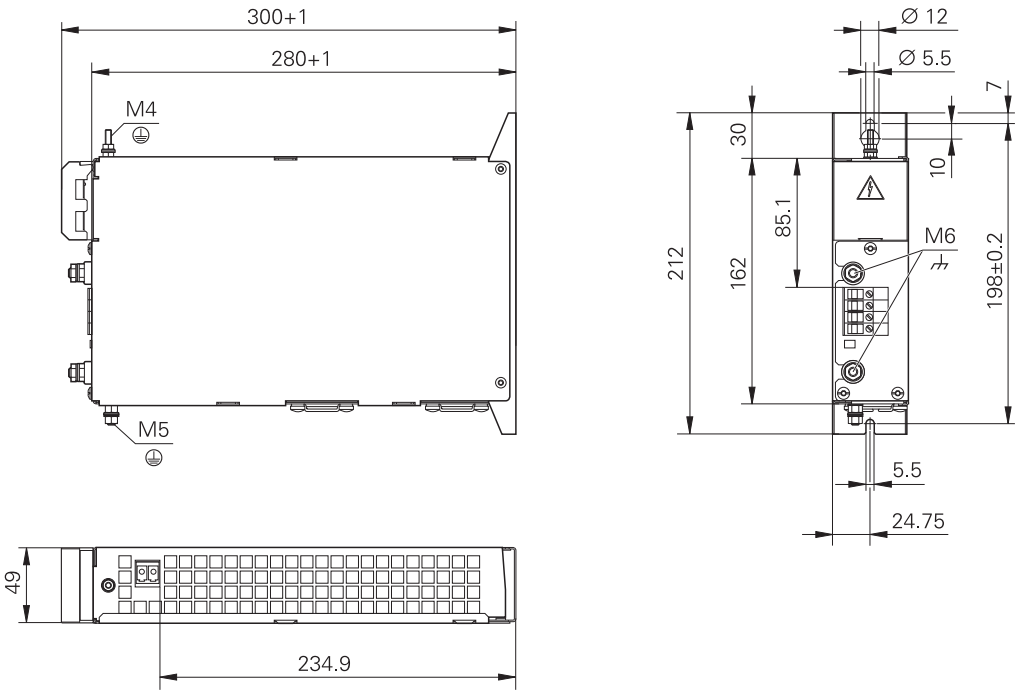
PL 6000 (PLB 62xx, PLB 61xx)



Power supply units

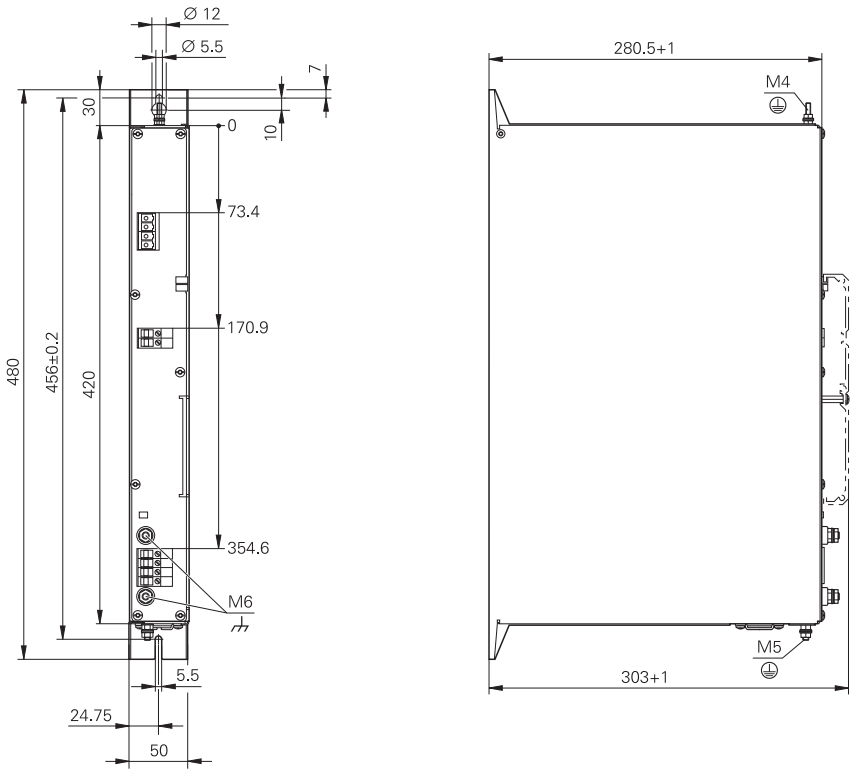
PSL 130

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



PSL 135

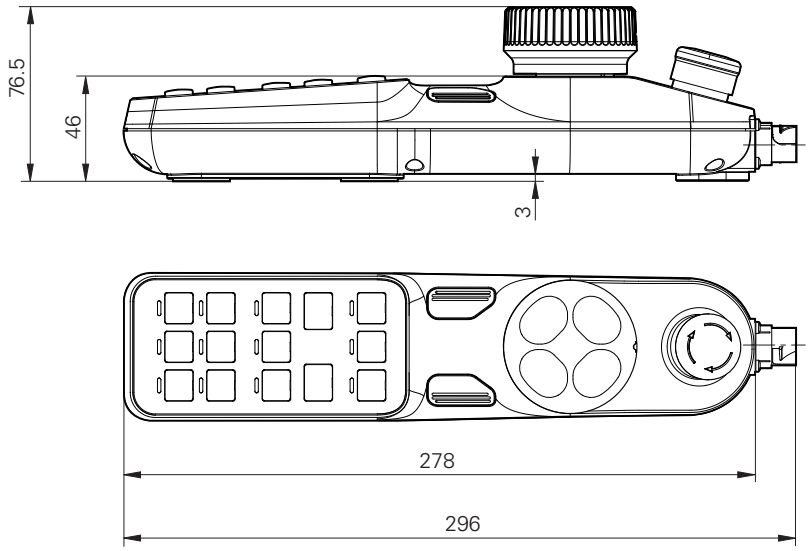
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Electronic handwheels

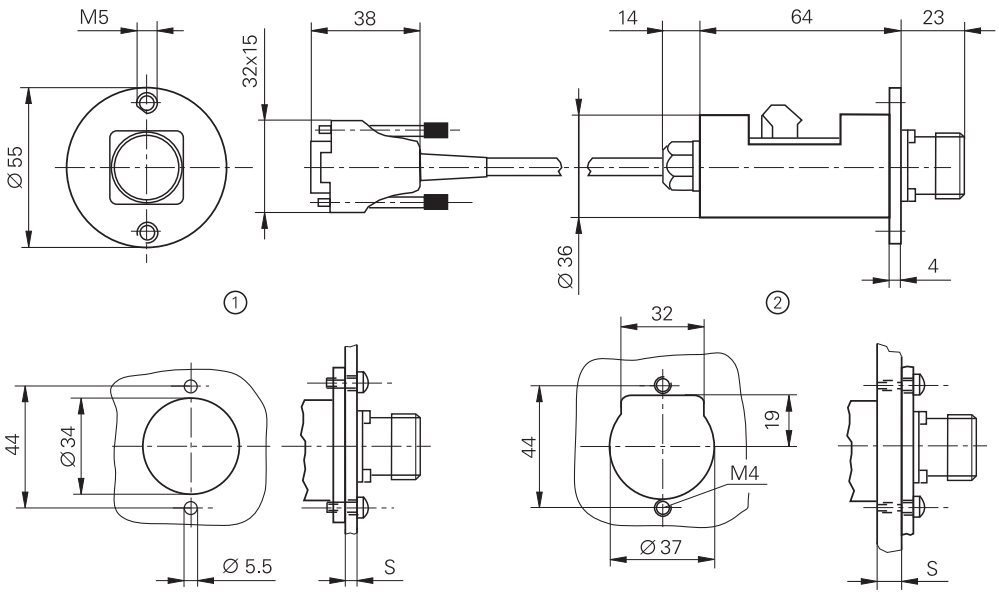
HR 510

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



Adapter cable for HR 510

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

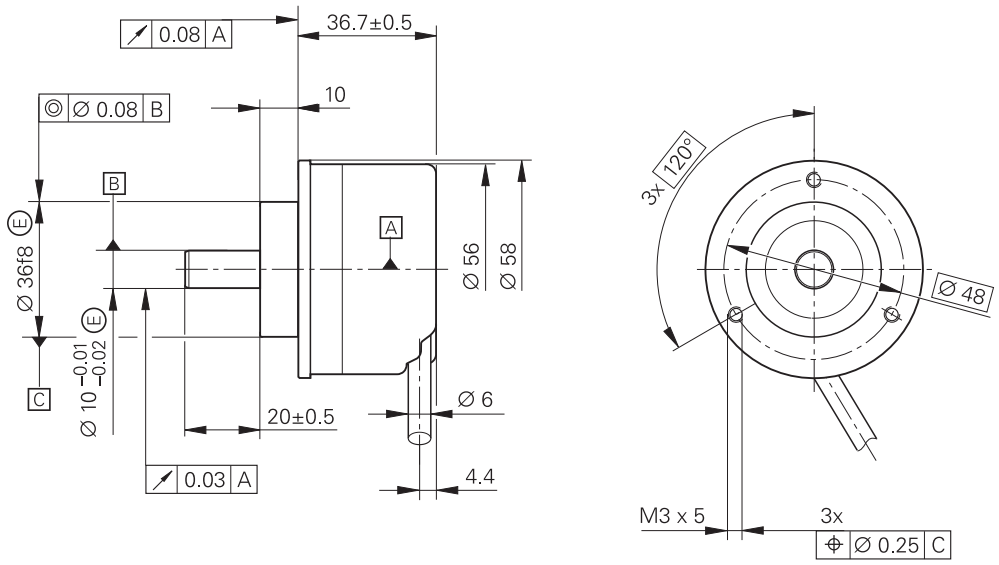


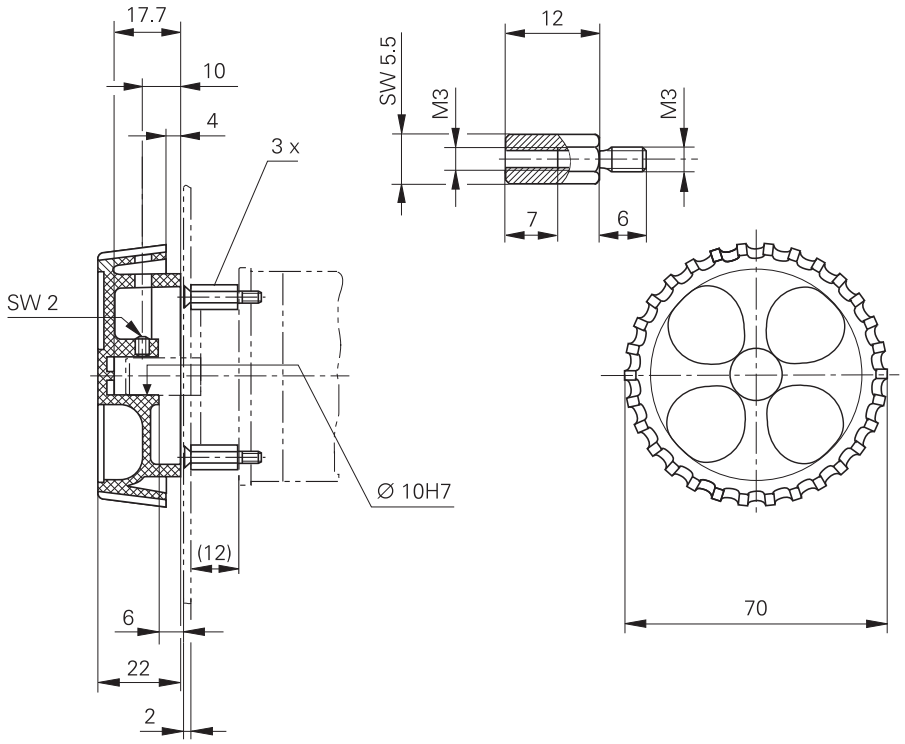
① Mounting opening for wall thickness up to S = 4
② Mounting opening for wall thickness from S = 4

HR 130, HR 150 with control knob

mm

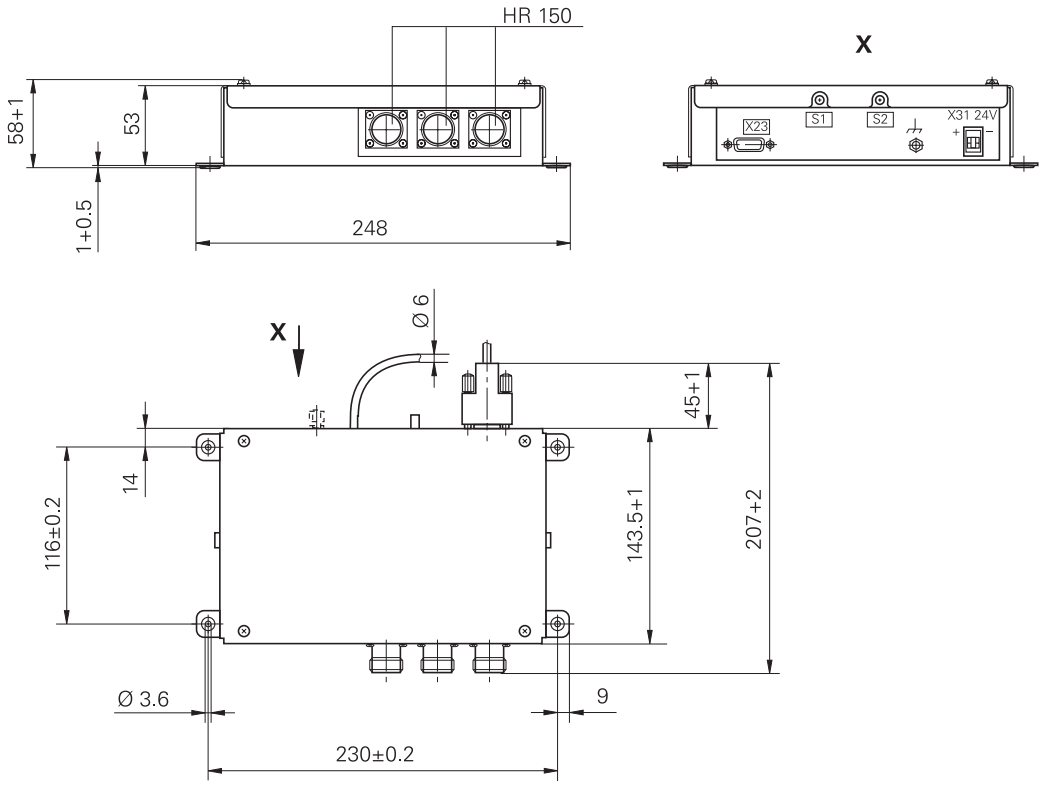
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm





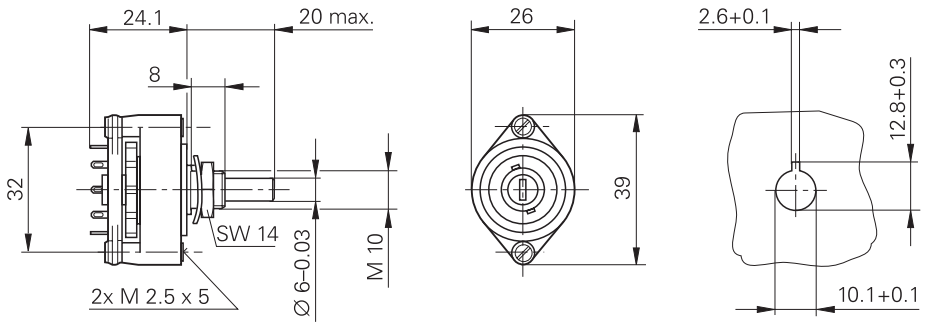
HRA 110

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



Handwheel selection switch

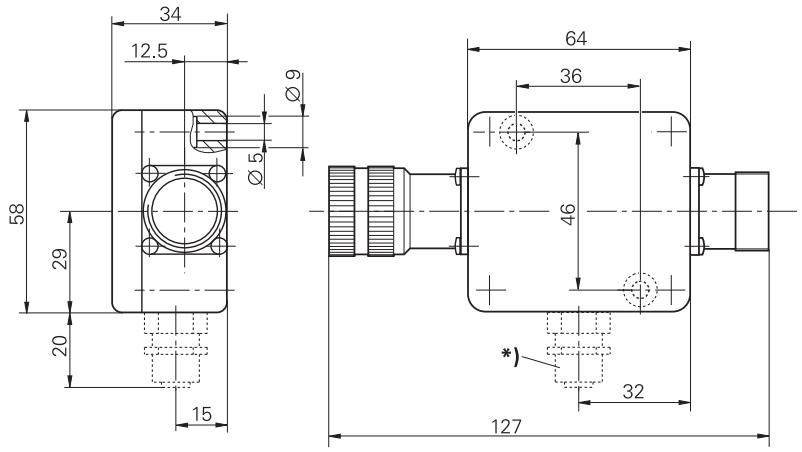
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Interface accessories

Line-drop compensator for encoders with EnDat interface

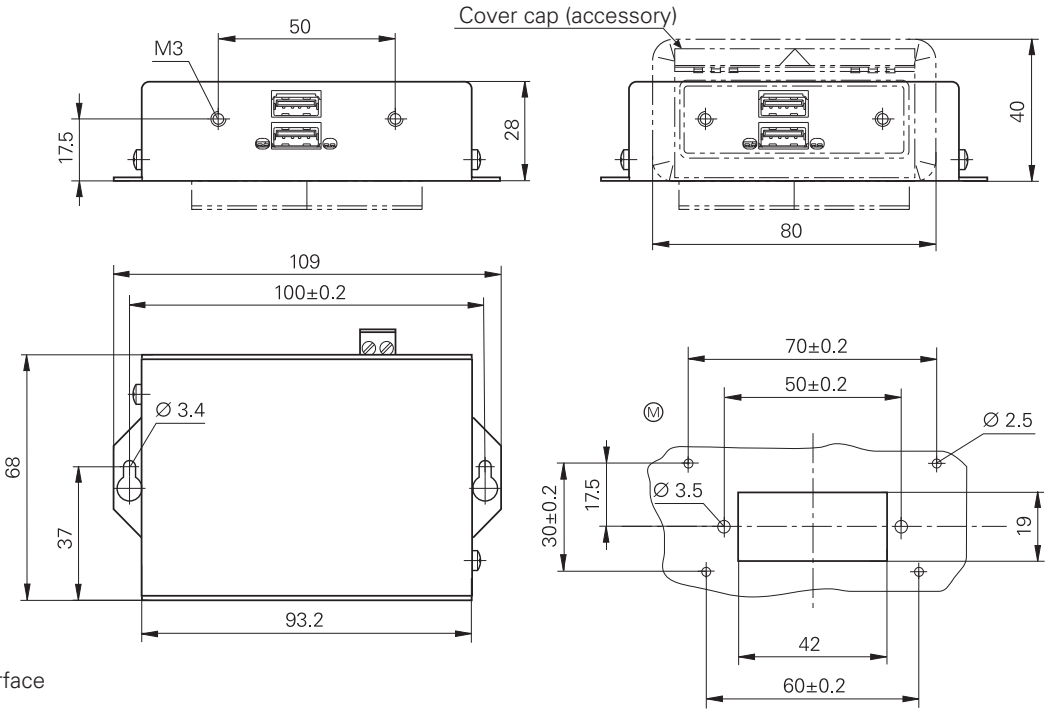
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



*) Connection to KTY

USB hub

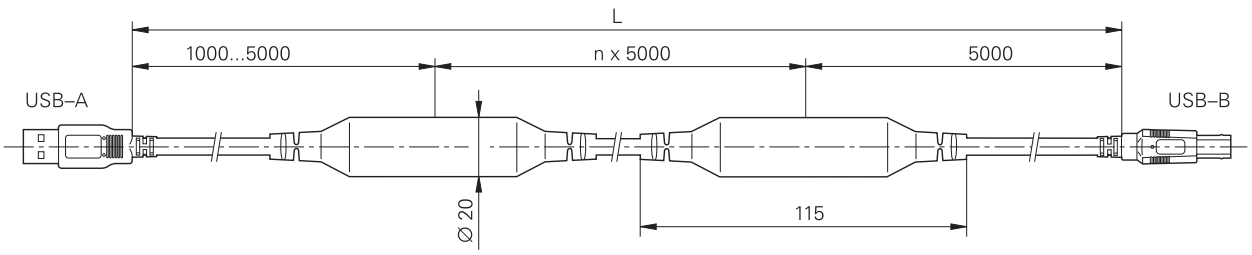
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Ⓜ = Mounting surface

USB extension cable with hubs

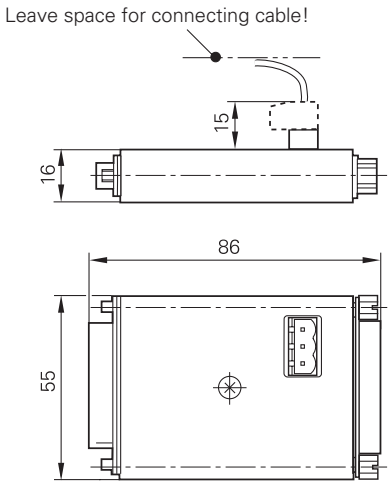
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



n = 0 ... 4
L = Ordering length

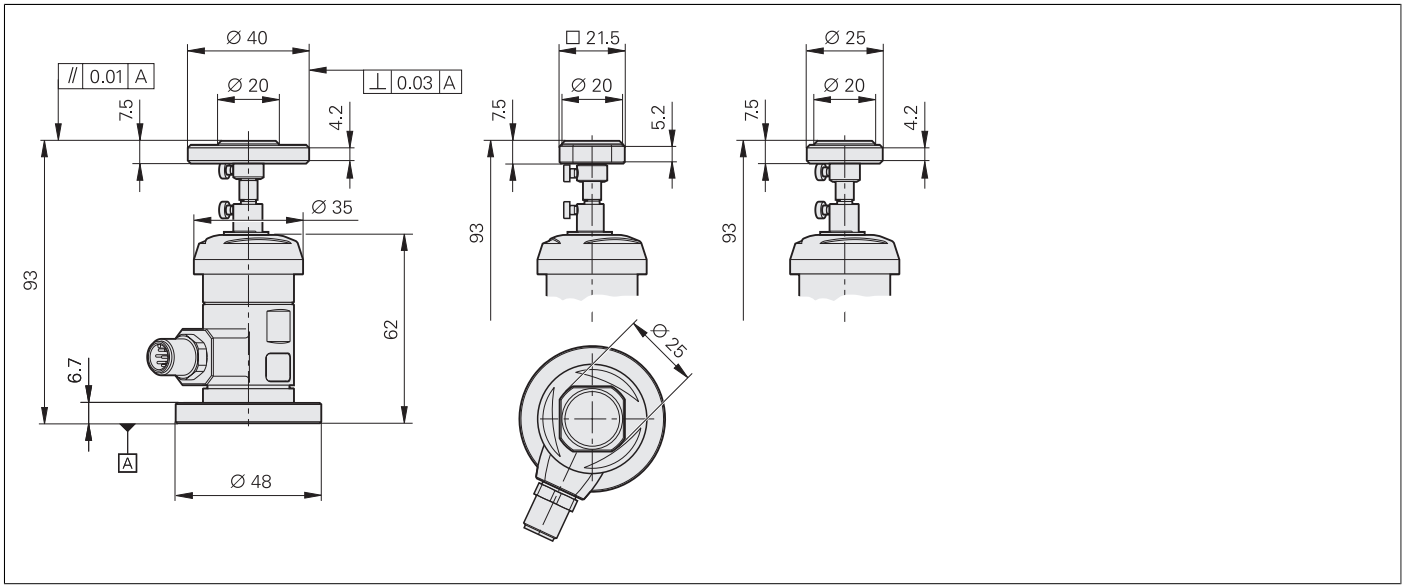
KTY adapter connector

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



Touch probe

TT 160 with cuboid probe contact



General information
Documentation

Technical documentation	• **CNC PILOT 640** Technical Manual	ID 1090006-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
	• **TT 460** Mounting Instructions	ID 808655-xx
User - documentation	**CNC PILOT 640**	
	• **CNC PILOT 640** User's Manual	ID 1079662-xx
	• **smart.Turn and DIN Programming** User's Manual	ID 1118606-xx
	Miscellaneous	
	• **TNCremo** User's Manual	As integrated help
	• **TNCremoPlus** User's Manual	As integrated help
	• **IOconfig** User's Manual	As integrated help
	• **PLCdesign** User's Manual	As integrated help
Other documentation	• **CNC PILOT 640** brochure	ID 895949-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:

- 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:
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www.heidenhain.de

Subject index

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www.farresa.es

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