HEIDENHAIN

Evaluation Electronics

Evaluation Electronics

For Metrology Applications

For many metrology applications, ranging from simple measuring stations to complex inspection systems with multiple measuring points, HEIDENHAIN supports you with compatible evaluation electronics.

The functionality always orients itself to the specific application. Whether it is an SPC inspection station, a tool presetter, a profile projector, a measuring microscope, or a manual coordinate measuring machine, the **evaluation electronics from HEIDENHAIN for metrology applications** are the right choice for measurement tasks. There is even a CNC option for the automation of measurement tasks.

Digital readouts from HEIDENHAIN for manually operated machine tools optimally support the operator with field-proven cycles for milling, drilling, and turning. You can find these digital readouts on the Internet at www.heidenhain.de or in the brochure *Digital Readouts and Linear Encoders for Manually Operated Machine Tools*.

Evaluation electronics for 2-D and 3-D measuring tasks

Evaluation electronics for measuring and testing tasks

This brochure supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the brochure edition valid when the order is made.

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

Contents

Selection guide
2-D and 3-D measuring tasks

	Monitor	Axes		Functions
		Length	Angle	
QUADRA-CHEK 2000 Evaluation electronics for: • Profile projectors • Measuring microscopes • 2-D measuring machines	Color touchscreen	3 (XYZ) or (XYQ), one of which is a software option		• Acquisition of 2-D geometry features by measurement, design and definition of geometries • Measuring point acquisition via crosshairs • Creation of measuring programs (teach-in) • Tolerance input and graphic display of measurement results • Creation and output of measurement reports • User management • Measure Magic: automatic recognition of geometries
QUADRA-CHEK 3000 Evaluation electronics for: • Profile projectors • Measuring microscopes • 2-D measuring machines • Video measuring machines	Color touchscreen	4 (XYZQ) (2 of which are software options)		• Acquisition of 2-D geometry features by measurement, design and definition of geometries • Measuring point acquisition via crosshairs • Creation of measuring programs (teach-in) • Tolerance input and graphic display of measurement results • Creation and output of measurement reports • User management • Measure Magic: automatic recognition of geometries
IK 5000 QUADRA-CHEK Evaluation unit as the universal PC package solution for • Profile projectors • Measuring microscopes • Video measuring machines • Coordinate measuring machines	PC screen	3 (XYZ) 3 (XYZ) 3 (XYZ) 3 (XYZ) 2 (XY) 3 (XYZ) 3 (XYZ) 3 (XYZ)	1 (Q) – 1 (Q) 1 (Q) 1 (Q) 1 (Q) 1 (Q) 1 (Q)	• Measurement of 2-D and 3-D features (depending on the version) • Point measurement with crosshairs • Programming of features and parts • Graphic display of measurement results • Entry of tolerances • Import of CAD drawings for direct comparison • 3-D profiling (option; only with touch probe)

Options/Additional functions	Model	Page
• Additional encoder input • Optical edge detection	QC 2013	8
	QC 2023	
	QC 2093	

QUADRA-CHEK 2000

Options/Additional functions	Model	Page
• Additional encoder input • Video edge detection • Optical edge detection	QC 3014 NC	12
	QC 3024 NC	

QUADRA-CHEK 3000

Options/Additional functions	Model	Page
–	IK 5294	16
3-D; touch probe	IK 5293	
Optical edge finder	IK 5394-EG	
3-D; zoom and light control; video evaluation; touch probe	IK 5394-3D	
CNC; optical edge finder	IK 5493	
CNC; video evaluation; zoom and light control; autofocus	IK 5494-2D	
CNC; 3-D; video evaluation; touch probe; zoom and light control; autofocus	IK 5494-3D	
CNC; 3-D; video evaluation; touch probe TP 200; zoom and light control; autofocus	IK 5594	

IK 5000 QUADRA-CHEK

Selection guide
Measuring and testing tasks

	Monitor	Axes		Functions
		Length	Angle	
ND 200 Evaluation unit for • Measurement equipment • Adjustment and inspection equipment • SPC inspection stations	Monochrome	1 (adjustable)		–
	Color	Up to 2 (adjustable)		Metrological and statistical functions (sorting and tolerance checking, measurement series, SPC)
ND 1100 QUADRA-CHEK Evaluation electronics for • Positioning equipment • Measuring fixtures	Monochrome	2 (adjustable)		Measurement series with min./max. value storage
		3 (adjustable)		
ND 2100G GAGE-CHEK Evaluation electronics for • Multipoint inspection apparatuses • SPC inspection stations	Color	4 (adjustable)		• Programming of up to 100 parts • Graphic display of measurement results • Sorting and tolerance checking using tolerance and warning limits • Measurement series with min./max. value storage • Entry of formulas and combinations • Functions for statistical process control (SPC)
		8 (adjustable)		
MSE 1000 Modular evaluation electronics for • Multipoint inspection apparatuses • SPC inspection stations	PC screen	Up to 250 (adjustable)		• Modular design • Configurable as desired • Various interfaces • Fast communication with higher-level computer system • Universal outputs
EIB 700 Evaluation electronics for • Testing stations • Multipoint inspection apparatuses • Mobile data acquisition	PC screen	4 (adjustable)		• Precise position measurement up to 50 kHz updating rate • Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for approx. 250 000 measured values per channel • Connection over standard Ethernet interface to higher-level computer systems
IK 220 Evaluation electronics for installation in computer systems with PCI interface for Measuring and testing stations	PC screen	2 (adjustable)		• Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for 8192 measured values per channel

Options/Additional functions	Model	Page
–	**ND 280**	*Digital Readouts* **brochure** [1]
Second encoder for sum/difference display, temperature compensation	**ND 287**	**20**
Touch probes	**ND 1102**	**22**
	ND 1103	
–	**ND 2104 G**	**24**
	ND 2108 G	

Options/Additional functions	Model	Page
–	**MSE 1000**	**26**
Mounting bracket for 19-inch systems	**EIB 741** **EIB 742**	**30**
Assemblies for encoder outputs and external inputs/outputs	**IK 220**	**32**

[1] *Digital Readouts and Linear Encoders for Manually Operated Machine Tools*

ND 287

ND 1100 QUADRA-CHEK

ND 2100 G GAGE-CHEK

MSE 1000

EIB 741

IK 220

7

QUADRA-CHEK 2000
– Evaluation unit for easy and reliable 2-D measurement

The QUADRA-CHEK 2000 evaluation unit is well suited for mounting on measuring machines, profile projectors, and measuring microscopes with up to three axes. You can measure two-dimensional contour features quickly, simply and precisely using innovative measuring tools.

Design
Thanks to its industrial design, the QUADRA-CHEK 2000 is ideal for applications both in the measuring room and in a harsh production environment. Its flat aluminum housing with integrated power pack and fanless passive cooling is extremely sturdy and tolerant to negative influences. The intuitive touchscreen made of specially hardened glass supports multi-touch gesture control and can be operated with gloves.

Functions
Predefined geometries (e.g., point, line, circle, slot and rectangle) are available for the measurement of two-dimensional features. The "Measure Magic" function makes measurement especially easy. This function uses the acquired measuring points to automatically select the appropriate geometry. In addition to the measuring functions, you can also use functions for construction and definition—for example, in order to create relationships (distances, angles) between two or more contour features.

You can save your results in a measurement report individually formatted as a PDF or CSV file, or you can print them out from a connected printer. The measuring program can automatically record repetitive parts and then execute them again.
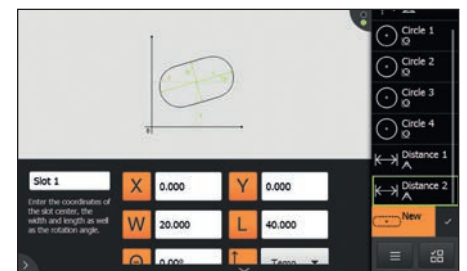
Software options
The QUADRA-CHEK 2000's range of functions can be adapted to specific requirements via software options. You can enable the software options by entering a license key. Please contact HEIDENHAIN for more information.

Intuitive display
The high-resolution, 7-inch color flat-panel display presents all necessary information in a quickly understandable and clearly structured format. The screen content is context sensitive, showing only the functions available in the actual operating situation. The self-explanatory operating controls provide intuitive user guidance.

	QUADRA-CHEK 2013	QUADRA-CHEK 2023	QUADRA-CHEK 2093
Axes	3 (XYZ) or (XYQ), one of which can be enabled as a software option		
Encoder interface Input frequency	$\sim$ 1 V$_{PP}$/$\leq$ 400 kHz	$\sqcap\!\sqcup$TTL/$\leq$ 5 MHz	2 $\times$ $\sim$ 1 V$_{PP}$/$\leq$ 400 kHz 1 $\times$ $\sqcap\!\sqcup$TTL/$\leq$ 5 MHz
Subdivision factor	4096-fold (at 1 V$_{PP}$)		
Display step	Adjustable, max. 8 digits Linear axes XYZ: to 0.00001 mm; angular axis Q: to 0.00001° (00° 00′ 00.1″)		
Display	7" color wide screen (15:9 multi-touch screen); resolution: WVGA 800 x 480 pixels for dialogs, inputs, position values, and graphics functions		
Functions	• Acquisition of 2-D geometry features by measurement, design and definition of geometries • Measuring point acquisition via crosshairs • Creation of measuring programs (teach-in) • Tolerance input and graphic display of measurement results • Creation and output of measurement reports • User management • Measure Magic: automatic recognition of geometries		
Additional encoder input (AEI1 software option)	One additional encoder input		
Optical edge detection (OED software option)	Automatic measuring point acquisition via optical edge detection		
Error compensation	• Linear (LEC) and segmented linear (SLEC) using up to 200 points • Squareness calibration; matrix compensation (NLEC) using up to 99 x 99 points		
Data interface	1x Ethernet 100 Mbit/1 Gbit (RJ45); 1x USB 2.0 Hi-Speed (Type A)		
Other connections	Foot switch for two functions		
Accessories	Multi-Pos and Duo-Pos stand, Multi-Pos holder, power cable, calibration standard, 2-D demo part, adapter connector (HEIDENHAIN TTL pin layout to RSF and Renishaw TTL), foot switch, holder, fiber-optic cable, adapter connector (HEIDENHAIN 11 µA$_{SS}$ pin layout conversion)		
Power connection	AC 100 V to 240 V (±10 %), 50 Hz to 60 Hz (±5 %), $\leq$ 38 W		
Operating temperature	0 °C to +45 °C (storage temperature –20 °C to +70 °C)		
Protection EN 60529	IP 65, back panel IP 40		
Mounting	Multi-Pos or Duo-Pos stand; Multi-Pos holder; mounting systems with 50 mm x 50 mm hole pattern		
Mass	Unit: $\approx$ 1.3 kg Unit with Duo-Pos stand: $\approx$ 1.5 kg Unit with Multi-Pos stand: $\approx$ 2.0 kg Unit with Multi-Pos holder: $\approx$ 1.7 kg		

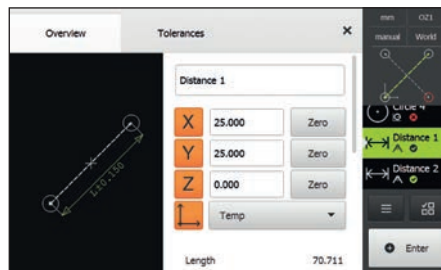# QUADRA-CHEK 2000
– Functions

Measuring point acquisition

The QUADRA-CHEK 2000 allows you to acquire measuring points on flat 2-D contours either manually with crosshairs or automatically, depending on the option installed. A particular advantage is the unit's integrated measuring point acquisition via optical edge detection (OED software option)

Optical edge detection

The OED software option provides you with various tools for detecting edges and defining measuring points. You can acquire measuring points either manually or automatically. Using optical edge detection (OED), you can traverse any edge of a contour, and the currently active tool will detect the actual measuring point on its own. This objective measuring point acquisition permits a high degree of repeatability, allowing you to work quickly and with very low measurement uncertainty.

Functional features view

The QUADRA-CHEK 2000 offers you a comprehensive graphic features view. In this view, you can use previously measured geometries to design new geometry features.

Of course, you can also enlarge or reduce this view as well as zoom into features, allowing you to keep a good overview of all the measured geometry features. The features view also makes it possible to add annotations to each feature (e.g., measurement information or informational texts).

Generating geometry features

The QUADRA-CHEK offers several possibilities for determining geometries:
- Measuring geometry features
- Constructing features from previously measured features (e.g., distance between two circle centers; angle between lines.)
- Defining unmeasurable geometry features

You can also run your created geometry features through a tolerance check.
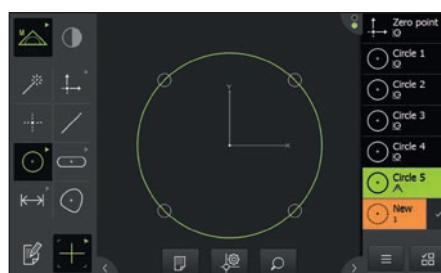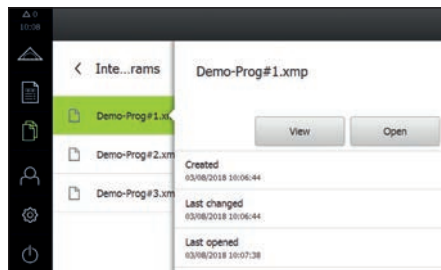
Tolerancing

With the tolerance-adapting function, you can define geometric tolerances for measured or constructed features. Dimensional, positional and form tolerances can be specified depending on the selected feature. You can also use general tolerancing as per ISO 2768 or decimal tolerancing.
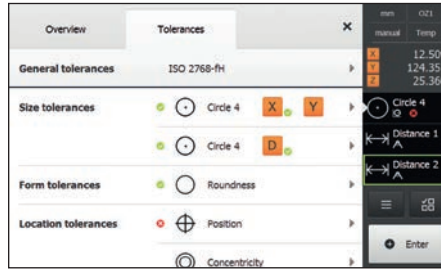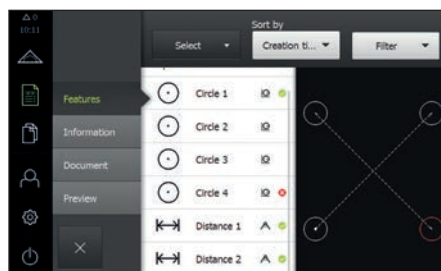
Creating a measuring program

For difficult or repetitive measuring tasks, you can automatically record all of the working steps as a measuring program. The QUADRA-CHEK 2000 learns the presets, sequence of measurements, tolerances, and data-output commands. When the program is run, the QUADRA-CHEK visually leads you to the features to be probed. The program view always provides you with an optimum overview of the process.
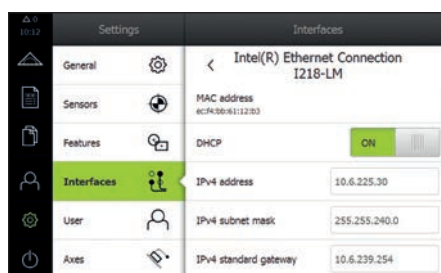
Creating measurement reports

Directly after the measurement, the integrated measurement report function lets you create a report containing the measurement and tolerance results along with other information. Using the demo software, you can also create customized measurement report templates and import them into the unit via the file management. To make a customized template, you either select a standard template and alter it as you see fit, or you can create entirely new templates. You can then save the created reports in the QUADRA-CHEK unit using the report file format, or as a PDF or CSV file. Alternatively, you can print reports from a connected printer.
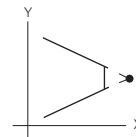
Data interfaces

You can use the data interfaces to output reports as well as to read and transmit settings and measuring programs. The Ethernet interface enables communication with a PC. You can also connect printers or memory media to the USB port. Network drives and printers can be connected via Ethernet as well. A list of possible printers is available on the Internet at www.heidenhain.de
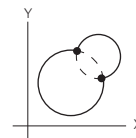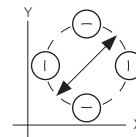
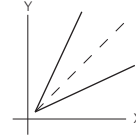**Examples of design capabilities:**

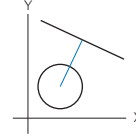Intersection of two lines
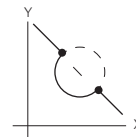
Intersection of line and circle
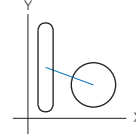
Intersection of two circles
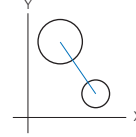
Bolt hole circle formed from three or more circles
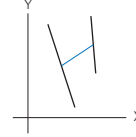
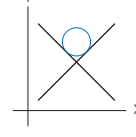Bisector of two lines

Line constructed from line and circle

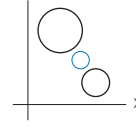Line constructed from circle and oblong hole

Distance constructed from two circles

Distance constructed from two lines

Circle constructed from two lines

Circle constructed from two circles

QUADRA-CHEK 3000
– The evaluation electronics for intuitive 2-D measurement

The QUADRA-CHEK 3000 evaluation unit is well suited for mounting on measuring machines, profile projectors, measuring microscopes and video testing machines with up to four axes. You can measure two-dimensional contour features quickly, simply and precisely using innovative measuring tools.

Design
Thanks to its industrial design, the QUADRA-CHEK 3000 is ideal for applications both in the measuring room and in a harsh production environment. Its low-profile aluminum housing with integrated power pack and fanless passive cooling is extremely sturdy and tolerant to negative influences. The large touchscreen, made of specially hardened glass, supports multi-touch gesture control and can be operated with gloves.

Functions
Predefined geometries (e.g., point, line, circle, slot and rectangle) are available for the measurement of two-dimensional features. The "Measure Magic" function makes measurement especially easy. This function uses the acquired measuring points to automatically select the appropriate geometry. In addition to the measuring functions, you can also use functions for construction and definition—for example, in order to create relationships (distances, angles) between two or more contour features.

You can save your results in a measurement report individually formatted as a PDF or CSV file, or you can print them out from a connected printer. The measuring program can automatically record repetitive parts and then execute them again.

Software options
The QUADRA-CHEK 3000's performance range can be adapted through software options to specific requirements. You can enable the software options by entering a license key. Please contact HEIDENHAIN for more information.

Intuitive display
The high-resolution, 12.1-inch color flat-panel display presents all necessary information in a quickly understandable and clearly structured format. The screen content is context sensitive, showing only the functions available in the actual operating situation. The self-explanatory operating controls provide intuitive user guidance.
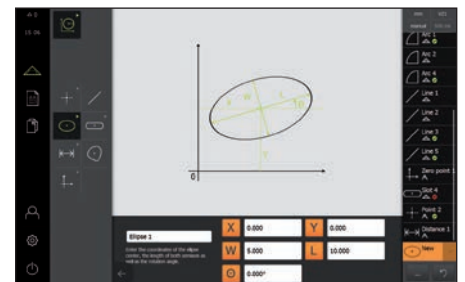
	QUADRA-CHEK 3014 NC	QUADRA-CHEK 3024 NC
Axes	4 (XYZQ), of which two axes can be enabled as software options	
Encoder interface Input frequency	$\sim$ 1 V_{PP} $\leq$ 400 kHz	$\sqcap\sqcup$ TTL $\leq$ 5 MHz
Subdivision factor	4096-fold (at 1 V_{PP})	
Display step	Adjustable, max. 8 digits Linear axes XYZ: to 0.00001 mm; angular axis Q: to 0.00001° (00° 00' 00.1")	
Display	12.1" color flat-panel display (16:10, touchscreen); resolution: WXGA 1280 x 800 pixels, for position values, dialogs and inputs, graphics functions, and video display (VED software option)	
Functions	• Acquisition of 2-D geometry features through measurement, construction, and definition • Measuring point acquisition via crosshairs • Creation of measuring programs (teach-in) • Tolerance input and graphic display of measurement results • Creation and output of measurement reports • User management • Measure Magic: automatic recognition of geometries	
Additional encoder input (AEI1 software option)	One additional encoder input	
Video edge finding (VED software option)	• Automatic measuring point acquisition via video edge detection and programmable light control • Display, archiving and output of live images	
Optical edge detection (OED software option)	Automatic measuring point acquisition via optical edge detection	
Error compensation	• Linear (LEC) and segmented linear (SLEC) via up to 200 points • Squareness calibration; matrix compensation (NLEC) over up to 99 x 99 points	
Data interface	1x Ethernet 100 MB/1 Gbit (RJ45); 3x USB 2.0 Hi-Speed (Type A)	
Other connections	• Camera connection[1] (USB 2.0 Hi-Speed (Type A), Ethernet 1 Gbit (RJ45)) • Light control for up to 6 light sources	
Accessories	Multi-Pos and Duo-Pos stand, Multi-Pos holder, power cable, measuring standard, 2-D demo part, adapter connector	
Power connector	AC 100 V to 240 V ($\pm$10 %), 50 Hz to 60 Hz ($\pm$5 %), $\leq$ 79 W	
Operating temperature	0 °C to +45 °C (storage temperature –20 °C to +70 °C)	
Protection EN 60529	IP 65, back panel IP 40	
Mounting	Multi-Pos or Duo-Pos stand, Multi-Pos holder, fastening systems compatible to VESA MIS-D 100	
Mass	Unit: $\approx$ 3.5 kg; unit with Multi-Pos holder: $\approx$ 4.1 kg; Unit with Duo-Pos stand: $\approx$ 3.8 kg; unit with Multi-Pos stand: $\approx$ 4.5 kg	

[1] Supported camera manufacturer: IDS Imaging Development Systems GmbH; camera resolution: $\leq$ 2.0 megapixel, list of released cameras on the Internet at www.heidenhain.de

QUADRA-CHEK 3000
– Functions

Measuring point acquisition

The QUADRA-CHEK 3000 allows you to acquire points on flat 2-D contours either manually with crosshairs or automatically, depending on the option installed. The integrated measuring point acquisition over video edge detection (VED software option) is particularly helpful. Here the video image is displayed in real-time. The evaluation electronics even assume complete control of the illumination.


Optical edge detection

The OED option allows you to use a range of tools for edge detection and for the definition of measuring points. You can acquire measuring points either manually or automatically. Using optical edge detection (OED), you can traverse any edge of a contour, and the currently active tool will detect the actual measuring point on its own.


Video edge detection

The VED option provides you with multiple tools for edge detection and for specifying measuring points. You can acquire the points manually or automatically. With VED automatic measuring point acquisition, all you need to do is to roughly approach the position, and the active tool will then detect the actual edge on its own. This method of objective measuring point acquisition permits a high degree of repeatability, making it possible for you to work quickly, reliably and effortlessly while at the same time maintaining a low degree of measurement uncertainty.
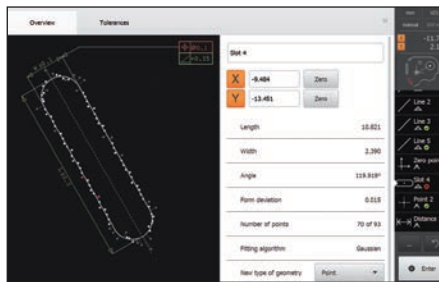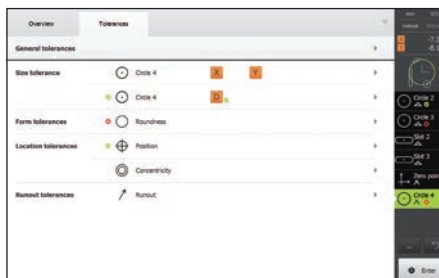

Functional features view

The QUADRA-CHEK 3000 offers you a comprehensive graphic features view. In this view, you can use previously measured geometries to design new geometry features.

You can also certainly enlarge and reduce this view, as well as zoom into features, in order to keep a good overview of all the measured geometry features. The features view also makes it possible to add annotations to each feature (e.g., measurement information or informational texts).
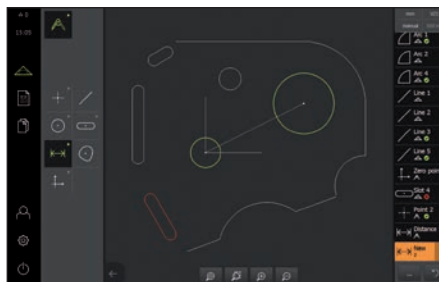
Tolerancing

With the tolerance-adapting function, you can define geometric tolerances for measured or constructed features. Dimensional, positional and form tolerances can be specified depending on the selected feature. You can also use general tolerancing as per ISO 2768 or decimal tolerancing.
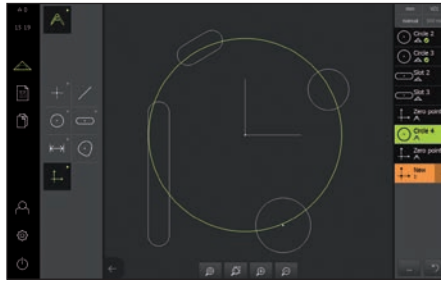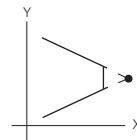
Generating geometry features

The QUADRA-CHEK offers several possibilities for determining geometries:

- Measuring geometry features
- Constructing features from previously measured features (e.g., distance between two circle centers; angle between lines.)
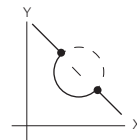- Defining unmeasurable geometry features

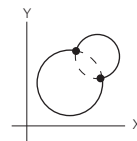You can also run your created geometry features through a tolerance check.

Creating a measuring program

For difficult or repetitive measuring tasks, you can automatically record all of the work steps as a measuring program. The QUADRA-CHEK 3000 learns the presets, sequence of measurements, tolerances, and data-output commands. When the program is run, the QUADRA-CHEK 3000 visually leads you to the features to be probed. The program view always provides you with an optimum overview of the process.
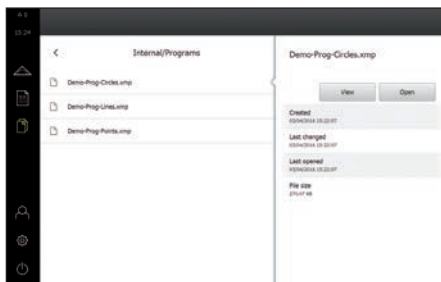
Creating measurement reports

With the integrated measurement report function, you can automatically create a report immediately after the measurement. The report contains measurement and tolerance results as well as other information. With the template designer you can create individually configured reports. You select a standard template and adapt it to meet your needs, or you can create entirely new templates.

Measurement reports can be saved in the QUADRA-CHEK 3000 using the .pdf, .csv, and measurement report file formats or can be printed out from a peripheral printer or network printer.

Data interfaces

You can use the data interfaces to output measurement reports as well as to import and export settings and measuring programs. The Ethernet interface enables communication with a PC. You can also connect printers or memory media to the USB port. Network drives and printers can be connected via Ethernet as well. A list of possible printers is available on the Internet at www.heidenhain.de
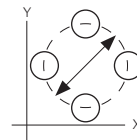
Examples of design capabilities:
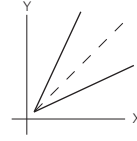
Intersection of two lines
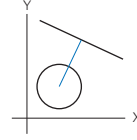
Intersection of line and circle
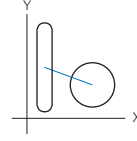
Intersection of two circles

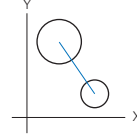Bolt hole circle formed from three or more circles
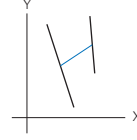
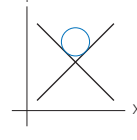Bisector of two lines

Line constructed from line and circle
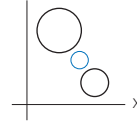
Line constructed from circle and oblong hole

Distance constructed from two circles

Distance constructed from two lines

Circle constructed from two lines

Circle constructed from two circles
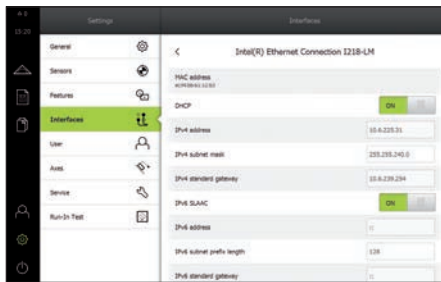
IK 5000 QUADRA-CHEK
– The universal PC package solution for measuring machines

The IK 5000 QUADRA-CHEK—the universal PC package solution for 2-D and 3-D measuring tasks—is well suited for both original equipment and retrofitting. It is available in versions for three or four axes, and the optional expansions make it ready for all coordinate measuring technology applications and for video measuring microscopes. You can use it to measure two- and three-dimensional geometries and their relationships.

Implementation
The IK 5000 QUADRA-CHEK consists of the IK 5000 slot card for the PC as well as the additional necessary slot covers and the corresponding PC software. Once it is installed on your PC, you will have a powerful measuring station.

System requirements
The following is necessary for running QUADRA-CHEK (values for 3-D profiling option in italics):
- PC ≥ Dual-Core Pentium: 2.66 GHz (*Quad-CorePentium: 2.8 GHz*)
- Operating systems: Windows Vista, 7, 8, and 10 (32-bit/64-bit)
- RAM ≥ 1GB (*2 GB*)
- Hard disk with at least 500 MB (*1 GB*) of free memory
- One PCIe slot and one, two, or three additional empty slots (depending on the version)
- Screen resolution: At least 1024 x 768 pixels
- Windows administrator rights for installation, setup, and updating

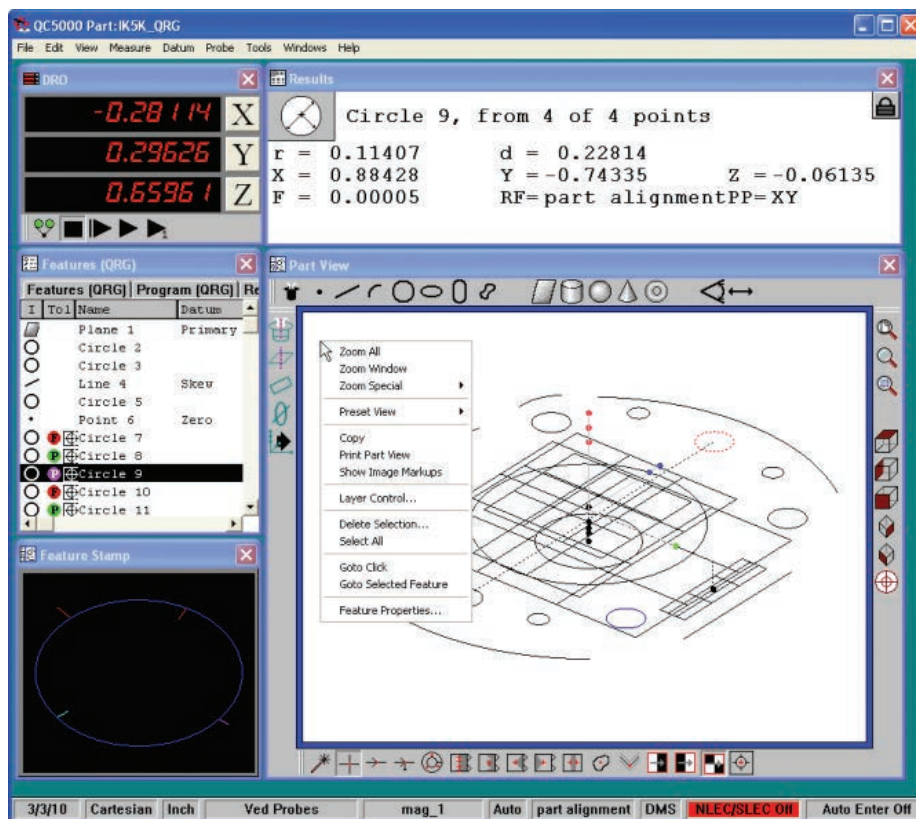### Configuration
Various versions of the IK 5000 are available. Please see the configuration table for the model designations and various functions supported.

User interface
The IK 5000 QUADRA-CHEK screen shows various configurable windows and tool fields for clear and simple operation.

The **Part View** window shows the measured features with the accepted measuring points. You can also define relationships here.

In the **Live View** (only for versions with video evaluation) you can see a real-time display of the video image.

The **Template** window lists all measured features, relationships, and constructed features together with their values and tolerances in tables.

The feature currently being measured is shown in the **Feature Stamp** window. The **Results** window contains all of the corresponding information.

The **DRO** window shows you the current measuring position.

	IK 5294	IK 5293	IK 5394		IK 5493	IK 5494		IK 5594
Axes	**4** XYZQ	**3** XYZ	**4** XYZQ	**4** XYZQ	**3** XYQ	**4** XYZQ	**4** XYZQ	**3** XYZQ
2-D geometries	●	●	●	●	●	●	●	●
3-D geometries	–	●	–	●	–	–	●	●
Optical edge detector	–	–	●	–	●	–	–	–
Video evaluation	–	–	–	●	–	●	●	●
Zoom and light control	–	–	–	●	–	●	●	●
Autofocus	–	–	–	–	–	●	●	●
Touch probes	–	Simple/Universal	–	●	–	–	Simple	High-End (TP 200)
3-D profiling	–	Optional	–	Optional	–	–	Optional	Optional
CNC function	–	–	–	–	–	●	●	●	●

	IK 5000
Axes[1]	3 (XYQ), 3 (XYZ) or 4 (XYZQ)
Encoder inputs* Input frequency	$\sim$ 1 V$_{PP}$ or $\sqcap\sqcup$ TTL (other interfaces upon request) $\sim$ *1 V$_{PP}$:* differential ≤ 1.5 MHz; $\sqcap\sqcup$ *TTL:* differential ≤ 3 MHz; single-ended ≤ 2.5 MHz
Subdivision factor	Up to 100-fold, selectable via dip switch; default setting: 50-fold (only for 1 V$_{PP}$)
Display step[2]	Adjustable, max. 7 digits *Linear axes XYZ:* 1 mm to 0.0001 mm; *angular axis Q:* 1° to 0.0001° (00° 00′ 01″)
Display	Via a PC screen
Functions	• Measurement of two-dimensional features (2-D) • Measurement of three-dimensional features (3-D)[1] • Measuring point acquisition using crosshairs • Programming of features and parts • Measure Magic: automatic recognition of geometries • Graphic display of measurement results • Entry of tolerances
Edge detector[1]	• Automatic point measurement via optical edge detector
Video[1]	• Automatic point measurement via video edge detection • Manual autofocus • Display of live images • Archiving and output of live images • Zoom and light control, programmable (with the *Light/Zoom* versions) • Video connection for digital USB camera (with the *Video* versions) • Light control for six light sources and zoom control (for version with *Video* and *Light/Zoom*)
CNC[1]	• Automation of measurement tasks • Axis control (for XYZQ) for servo and stepper motors • Autofocus via stepper-motor control (Z axis) • CNC outputs and inputs for joystick
3-D profiling[1] (option)	• Importing of CAD models • Probing of tested object and comparison with the CAD model • Flexible output of measurement results
Error compensation	• Linear, and segmented linear over any number of points • Squareness calibration • Matrix compensation over any number of points
Other connections	• Foot switch for two functions
Accessories	Foot switch, fiber-optic cable, holder for FO cable, calibration standard, demo part, distribution cable
PC interface	PCIe
Operating temperature	0 °C to 55 °C; (storage temperature –30 °C to 70 °C)
Dimensions	241 mm x 126 mm x 22 mm

* Please select when ordering [1] See the configuration table for possible combinations
[2] Depends on the signal period of the connected encoder as well as the subdivision factor

IK 5000 QUADRA-CHEK
– Functions

Its innovative operator guidance provides self-explanatory information about the various functions, and it supports you as early as setup of the coordinate system (aligning the part and specifying the datum).

Depending on the version, the following predefined features are available for measurement:
2-D measurement: point, line, circle, slot, rectangle
3-D measurement: plane, cylinder, cone, sphere
The "Measure Magic" function makes measurement especially easy by selecting the feature that best matches the distribution of acquired measuring points.

The IK 5000 QUADRA-CHEK enables you to define your own contour features (e.g., a circle exactly defined by its position and dimensions). In addition, you can establish relationships (distances, angles) between features.

Measuring programs that you create yourself or record automatically simplify the work needed for repeated parts. The evaluation electronics graphically take you to the next measuring position during program run.

Depending on the version, the IK 5000 QUADRA-CHEK probes the points of plane contours (2-D) either automatically or manually via crosshairs, optical edge detection, or a video camera.

For 3-D contours such as planes, cylinders, cones, and spheres you can measure points using a triggering touch probe. If a triggering touch probe is used, then the values are transferred automatically. In the case of rigid probing elements, a key must be pressed.

The measured features can be clearly displayed either in three dimensions or in one of the three projection planes.

Multi-sensor scanning

Along with the usual method for measuring point acquisition, the IK 5494 and IK 5594 versions permit multi-sensor scanning; in addition to the video camera, the measuring machine is also equipped with a touch probe. You can then use the touch probe to measure 3-D features on the object and enjoy the advantages of video evaluation for 2-D features. The integrated probe library manages the various measurement tools for you, whether they be optical, video, laser or touch-probe systems.
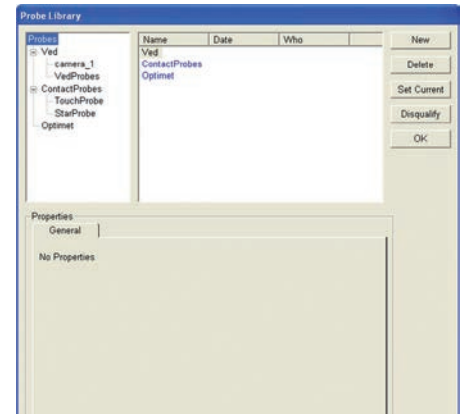

Constructed features

QUADRA-CHEK gives you several possibilities for determining dimensions:
- Measuring the features
- Calculating features (e.g., center of a measured circle)
- Relating features to one another (e.g., distance between two circle centers; angle between lines.)

However, you can also construct new features from existing features and from relationships. The properties of these constructed features can then be seen directly in the parts view.
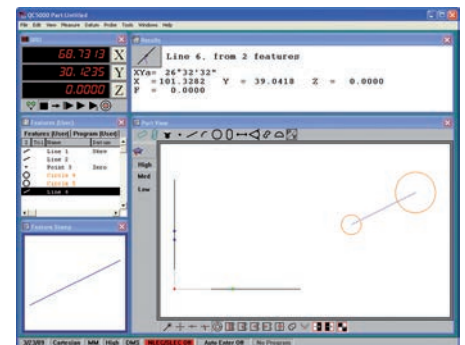
Data management

The integrated data-report generator for customized forms, databases, and tolerance checks is used to archive, export, and import data in numerous formats. You can use the integrated calculation tables for complex, non-standard calculations.
All you need to do is to send your customized reports to a printer or make the data available to other users in a database.
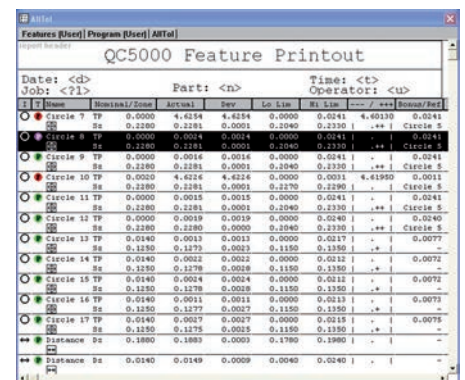
Functional part view window

QUADRA-CHEK provides you with a comprehensive, graphical part view window. You can choose between a 3-D view, or a projection in the XY, YZ or ZX planes. Additionally, you can magnify, reduce, zoom, shift or rotate the views. You can define tolerances and designed features in any view. The "pass/fail" color coding makes it easy to determine whether the part matches the specifications.
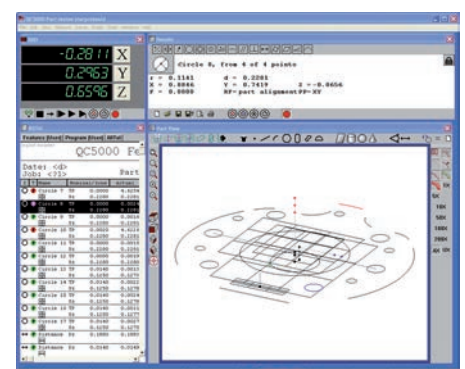
Programming of parts

Difficult and repetitive measuring tasks can be simplified with the aid of a program that you either create yourself or record automatically during measurement of the first part. The QUADRA-CHEK learns the reference points, the sequence of measurements, tolerances, and data-output commands and then visually guides you to the features to be probed during program execution. The program view also provides you with an optimum overview of the process.

Integrated image processing

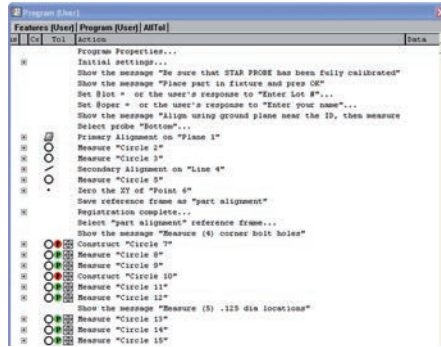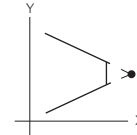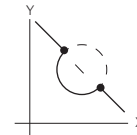In the versions with video functionality, the integrated image editing feature is particularly useful because it displays and saves the video image in real time. QUADRA-CHEK can even assume complete control of the illumination and the motor zoom. A digital USB camera can be connected.
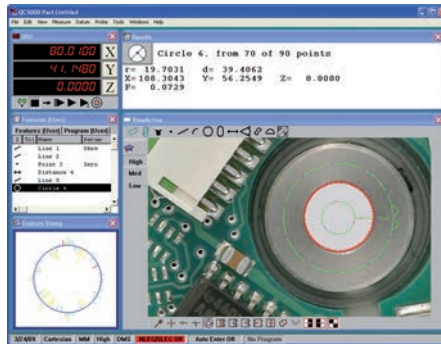
In order to quickly and directly compare the actual status and nominal status, you can import the parts drawing in DXF or IGES format and place it over the video image.

Axis positioning

The CNC versions of the IK 5000 QUADRA-CHEK work as full-fledged controls, directly controlling the positioning of the X, Y, Z and Q axes. Servo motors or stepper motors can be connected. Amplifiers with two or three axes for stepping motors are available as accessories.
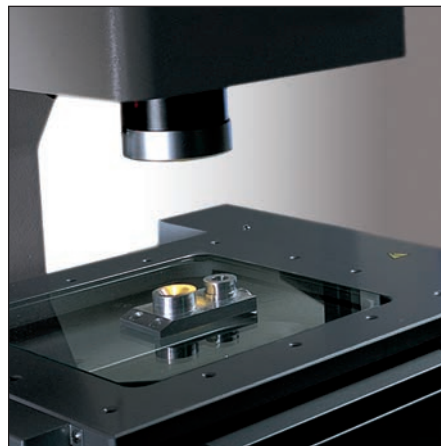
Automating

Programs running in combination with the CNC function of the IK 5000 QUADRA-CHEK run automatically. This minimizes the effects of subjective assessments and increases data throughput noticeably. By automating series of measurements and complex procedures, you spare yourself the strain of performing repetitive measuring tasks.

3-D profiling

The 3-D profiling option simplifies the measurement and evaluation of 3-D contours on multi-sensor and tactile measuring machines as follows: you import the CAD model, measure the real part, and then use the 3-D profiling function to compare the measured points with the CAD model. The measurement results are displayed graphically and can be managed in the usual manner. They can also be transferred to other quality systems.

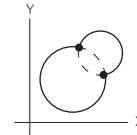**Examples of design capabilities:**
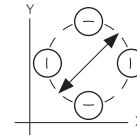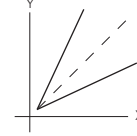
2-D possibilities

Intersection of two lines

Intersection of line and circle

Intersection of two circles

Bolt hole circle formed from three or more circles

Bisector of two lines
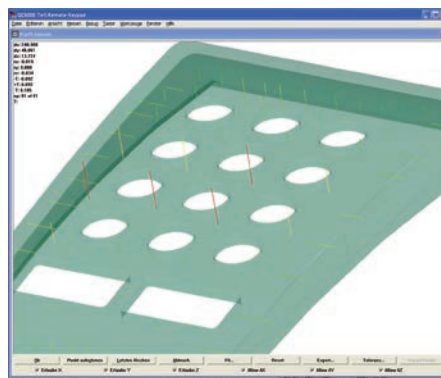
3-D possibilities
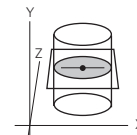
Intersection of cylinder and surface
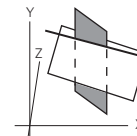
Plane from plane and 3-D line

Taper angle
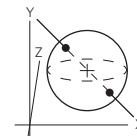
Intersection of sphere and line

ND 287
– The evaluation unit for measuring and testing stations

Thanks to its wide range of functions, the ND 287 evaluation unit for a single axis is predestined for measuring and inspection stations, but is also intended for simple positioning tasks. The universal encoder input permits connection of all incremental encoders with 11 µA$_{PP}$ and 1 V$_{PP}$ signals and absolute encoders with the EnDat 2.2 interface from HEIDENHAIN.

Execution
The ND 287 features a sturdy aluminum die-cast housing. A graphic TFT monitor displays the measured values, the status and the soft-key row. The splash-proof, full-travel keyboard is made to handle the shop floor.

Functions
The **ND 287** features numerous functions for measuring and processing individual positions; for example, sorting and tolerance check mode, minimum/maximum value storage, and measurement series storage. These data make it possible to calculate mean values and standard deviations and display them in histograms or control charts. Thanks to its modular design, the ND 287 permits connection of a second encoder for sum/difference measurement or of an analog sensor (e.g., for temperature compensation). For simple measurement and positioning tasks, there is the **ND 280** (see the *Digital Readouts and Linear Encoders for Manually Operated Machine Tools* brochure).

Data interfaces
The ND 287 has serial interfaces for measured value transfer to a PC or printer, for input/output of parameters and compensation value lists, and for diagnostics:
- USB
- RS-232-C/V.24
- Ethernet 100BaseT (option)

The measured value transfer can be started at the ND keyboard via an external command, via the RS-232-C/V.24 software command CTRL B, or by an adjustable internal clock.

Sorting and tolerance checking
With the sorting function of the ND 287, workpieces can be inspected for dimensional accuracy and divided into classes. The result is indicated in the status display in color or with symbols; in addition, a corresponding signal is available at the switching outputs.
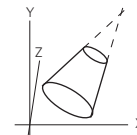
Display freeze
In order to read the display reliably despite rapidly changing values, you can use an external signal to freeze the display. The true position value is counted internally.

Combination with a second encoder
A second encoder or a sensor can be connected to the ND 287 through an optional **encoder module** or **analog module** input assembly. The data from two encoders can be combined through mathematical operands. The result and the two measured values are saved. This permits further areas of application, such as the sum/difference display of two encoders or temperature compensation through a temperature sensor.

Recording and evaluating series of measurements
The ND 287 provides a measured-value memory for recording series of measurements. The measurement value as well as the minimum, maximum or difference can be displayed during the serial measurements. In addition, the displayed value can be checked for compliance with tolerances by means of the sorting function. The saved measured values are evaluated and represented in the following ways:
- Statistical view (mean value x, standard deviation s, and range r)
- Diagram (graphical display of the measured values with minimum/ maximum and mean values as well as tolerance limits)
- Measured value overview as a table

Statistical Process Control (SPC)
For SPC, the ND 287 saves up to 1000 measured values in nonvolatile FIFO memory. They are evaluated with the following functions:
- Statistical view of measured values in the FIFO memory
- Measured value overview as a table
- Diagram of the last 30 measured values
- Histogram in ten classes with probability density function and process capability indexes cp and cpk.
- Control charts for mean value x, standard deviation s, and range r
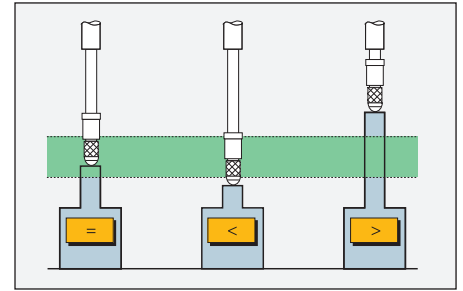
Sorting and tolerance checking
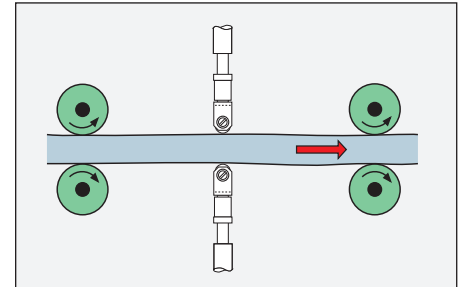
Sum measurement

Measured value acquisition

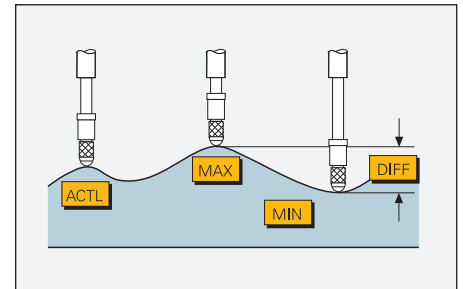|	ND 287
Axes	1; option: second input through encoder module
Encoder inputs Input frequency	$\sim$ 1 V$_{PP}$, $\sim$ 11 µA$_{PP}$ or EnDat[1] (automatic interface detection) $\sim$ *1 V$_{PP}$:* ≤ 500 kHz; $\sim$ *11 µA$_{PP}$:* ≤ 100 kHz
Subdivision factor	4096-fold
Display step[2]	Adjustable, max. 9 digits *Linear axis:* 0.5 µm to 0.002 µm; *angular axis:* 0.5° to 0.00001° (00° 00′ 00.1″)
Analog input	Option: ±10 V through analog module; resolution 5 mV
Display	Color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys
Functions	• REF reference-mark evaluation for distance-coded or single reference marks • Two reference marks and distance-to-go mode • Remote operation via serial interface • Sorting and tolerance checking • Measurement series with min./max. value storage • Storage of measured values (max. 10 000) • Functions for statistical process control (SPC) • Graphic depiction of distribution/histogram • Sum/difference display (with 2nd encoder module) • Thermal compensation (with analog module)
Axis-error compensation	*Linear axis:* linear, and segmented linear axis over up to 200 points *Angular axis:* segmented linear with 180 compensation points (every 2°)
Data interface	RS-232-C/V.24; USB (Type B); option: Ethernet 100BaseT, via Ethernet module
Switching outputs For tasks in automation	• Zero crossover; trigger points 1 and 2 • Sorting signals "<" and ">" • Error
Switching inputs For tasks in automation	• Zero reset, preset • Cross over reference point and ignore reference signals • Measured value output or display freeze • Start measurement series • Minimum/maximum/difference display • Gating of the two encoder inputs • Sum or difference display • Display measured value 1 or measured value 2
Accessories	Mounting adapter, encoder module, analog module, Ethernet module
Power connection	AC 100 V to 240 V (–15 % to +10 %), 48 Hz to 62 Hz; 30 W
Operating temperature	0 °C to 50 °C; (storage temperature –40 °C to 85 °C)
Protection EN 60529	IP 40, front panel IP 54
Mass	≈ 2.5 kg

[1] Purely serial; no evaluation of incremental signals
[2] Depends on the signal period of the connected encoder (display step ≈ signal periods/4096)

ND 1100 QUADRA-CHEK
– The evaluation unit for simple positioning tasks

The ND 1100 QUADRA-CHEK evaluation units can support up to four axes. They are primarily suited to positioning tasks on positioning equipment and measuring fixtures, as well as to retrofitting on measuring machines for the acquisition and forwarding of data to a PC.

Execution
The ND 1100 QUADRA-CHEK evaluation electronics have a monochrome flat-panel screen for displayed values, dialogs, inputs and soft keys. The robust, die-cast aluminum enclosure meets the demands of metrology and production control.

Functions
The intuitive placement of the function keys and soft keys permits innovative operator guidance, which supports you when using the diverse functions.

Along with the usual functions of evaluation electronics, such as zeroing and setting of reference values, the ND 1100 QUADRA-CHEKs have numerous other useful functions:
- Each axis can be configured for linear or angular display
- Minimum/maximum value storage
- Simple switching between counting directions
- Continuous data output via internal clock, or upon probing

Data interfaces
You use the data interfaces to output measured points as well as to save settings and compensation values. The ND 1100 has an RS-232-C/V.24 serial interface for communication with a PC. You can connect printers or memory media directly to the USB port.

A list of possible printers is available on the Internet at *www.heidenhain.de*

Display format
Depending on the type of encoder that is connected, you can define linear or angular display individually for each axis.

Minimum/maximum value storage
The ND 1100 is capable of minimum/maximum value storage in any selectable axis. The largest and smallest measured values of a measurement series as well as their difference are stored and can be output via the data interface. This function is particularly advantageous during concentricity testing.

Touch-probe connection
The ND 1100 units feature a connection for touch probes (e.g., from HEIDENHAIN or Renishaw). The evaluation unit automatically reads the current position value during probing, and also takes the radius of the stylus into account.
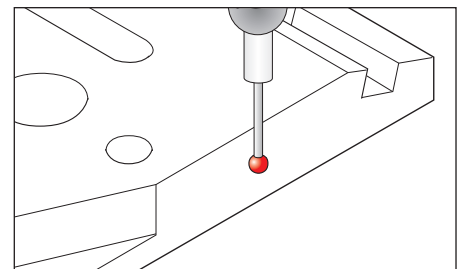
Output format of measured values
Since its universal output formats are used by various manufacturers of measuring machines, the ND 1100 can easily be retrofitted as a data logger to manually operated measuring machines. The measured values are recorded by the ND and then relayed to a connected PC for further processing.

	ND 1102	ND 1103
Axes	2	3
Encoder inputs* Input frequency	$\sim$ 1 V_{PP} or $\sqcap\!\sqcup$ TTL (other interfaces upon request) $\sim$ *1 V_{PP}: ≤ 275 kHz; $\sqcap\!\sqcup$ TTL: ≤ 3 MHz*	
Subdivision factor	10-fold (only at 1 V_{PP})	
Display step[1]	Adjustable, max. 7 digits *Linear axis:* 1 mm to 0.0001 mm *Angular axis:* 1° to 0.0001° (00° 00' 01")	
Display	5.7" monochrome flat-panel display for position values, dialogs and inputs, and soft keys	
Functions	• Measurement series with recording of min./max. value • Difference between minimum and maximum (range) • Scaling factor	
Error compensation	• Linear, and segmented linear over up to 300 points • Squareness calibration	
Data interface	• RS-232-C/V.24 • USB (type A)	
Touch-probe connection*	HEIDENHAIN or Renishaw touch probe	
Other connections	Foot switch for two functions, or remote keypad	
Accessories	Foot switch, remote keypad, protective cover, tilting base, mounting adapter	
Power connection	AC 100 V to 240 V (–15 % to +10 %), 47 Hz to 63 Hz, ≤ 100 W	
Operating temperature	0 °C to 45 °C; (storage temperature –20 °C to 70 °C)	
Protection EN 60529	IP 00, front panel IP 40	
Mounting*	Tilting base or mounting base	
Mass	*ND with tilting base:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg	

* Please select when ordering
[1] Depends on the signal period of the connected encoder as well as the subdivision factor

ND 2100 G GAGE-CHEK
– The evaluation unit for multipoint inspection apparatuses

The ND 2100 G GAGE-CHEKs are versatile metrology displays for measuring and inspection tasks in manufacturing and quality assurance. With inputs for up to eight encoders, they are predestined for multipoint measurements from simple pass/fail detection up to complex SPC evaluation.

Execution
The ND 2100 G evaluation units have a robust, die-cast aluminum enclosure and a keyboard suited to their environment. A large, graphic color screen displays the measured values, the soft-key row and other information.

Functions
The inputs can be assigned and combined as desired with mathematical, trigonometric or statistical formulas. This makes it possible to measure even complex dimensions such as thickness, flatness, volume and more. The results are displayed numerically or graphically as a color bar graph or a dial, or are archived for statistical process control (SPC). The GAGE-CHEK can be configured for basic or advanced applications. Soft keys and hot keys can be adapted as required. The minimum/maximum function of the ND 2100 G evaluation unit monitors and stores the highest and lowest measured or calculated value. Warning and tolerance limits can be assigned to each display value, and results outside of the tolerance are marked with a different color. An acoustic alarm sounds simultaneously. Tolerance values, SPC parameters and custom formulas are stored for individual parts. GAGE-CHEK can thus manage up to 100 parts with up to 16 visible and 16 invisible measurands. The rapid acquisition of measurement data enables the monitoring of dynamic events, such as the eccentricity of a rotating shaft.

Data interfaces
The GAGE-CHEK features various interfaces for communicating with parent systems:
- RS-232-C/V.24 for PCs and for remote operation of the GAGE-CHEK
- USB

A list of possible printers is available on the Internet at *www.heidenhain.de*

DRO view
The display values appear in large, easy-to-read numbers. Values outside the tolerance are color-coded, immediately notifying you of errors.
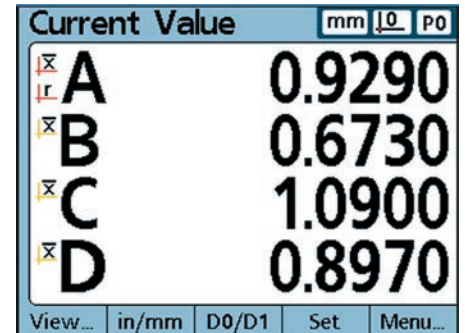
Bar diagram
You can select to have the values shown as a color-enhanced vertical or horizontal bar graph. The defined warning limits and tolerance limits provide instant feedback. If these limits are exceeded, the color of a bar changes from green to yellow or red, thereby alerting you to critical dimensions.
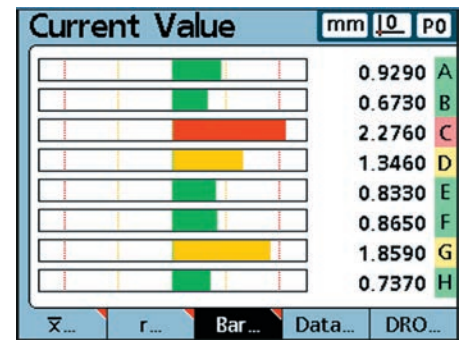
SPC and data storage
GAGE-CHEK includes integrated SPC functions such as mean value charts (X bar) and range charts (R). Min, max, sigma, cp and cpk are also calculated, and are clearly displayed as a graph or histogram. Historical raw data can be saved in a tabular numeric display. Each dimension and all data are time and date stamped.
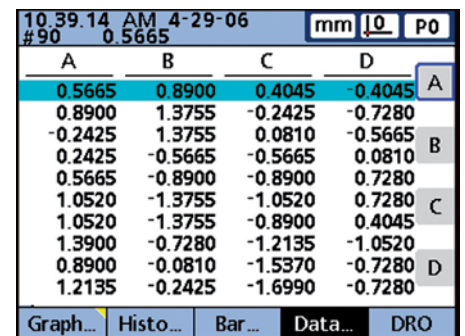
Formulas and combinations
You can use mathematical and trigonometric formulas, as well as logical conditions, to combine individual measured values or measurement sequences with each other, and so create complex calculations. This can be used, for example, to calculate and display the circumference of a turned part, the volume of a cube, or the angle between two cams, as well as to assign tolerance limits to these values.

	ND 2104 G	ND 2108 G
Axes	4	8
Encoder inputs* Input frequency	$\sim$ 1 V$_{PP}$ $\sqcap\sqcup$ TTL or EnDat 2.2 (other interfaces upon request) $\sim$ *1 V$_{PP}$: ≤ 275 kHz;* $\sqcap\sqcup$ *TTL: ≤ 3 MHz*	
Subdivision factor	10-fold (only at 1 V$_{PP}$)	
Display step[1]	Adjustable, max. 7 digits *Linear axis:* 1 mm to 0.00001 mm *Angular axis:* 1° bis 0,0001° (00° 00′ 01″)	
Display	5.7″ color flat-panel display for position values, dialogs and inputs, graphic functions and soft keys	
Functions	• Part programming for up to 100 parts • Graphic display of measurement results • Sorting and tolerance checking using tolerance and warning limits, with display as a bar graph • Measurement series with min./max. value storage • Mathematical and trigonometric formulas • Functions for statistical process control (SPC) • Graphic display of measurement results and distribution • Data storage of values and formulas • Convenient diagnostics of the connected encoders (only EnDat 2.2)	
Error compensation	• Linear, and segmented linear over up to 60 points	
Data interface	• RS-232-C/V.24 • USB (type A)	
Switching inputs	5 TTL inputs (freely definable)	
Switching outputs	12 TTL outputs (freely definable)	
	2 relay outputs	
Other connections	Foot switch for two functions, keypad	
Accessories	Foot switch, remote keypad, protective cover, tilting base, mounting adapter	
Power connection	AC 100 V to 240 V (–15 % to +10 %), 47 Hz to 63 Hz; ≤ 100 W	
Operating temperature	0 °C to 45 °C; (storage temperature –20 °C to 70 °C)	
Protection EN 60529	IP40	
Mounting*	Tilting base or mounting base	
Mass	*ND with stand:* ≈ 4.8 kg; *ND with mounting adapter:* ≈ 2 kg	

* Please select when ordering
[1] Depends on the signal period of the connected encoder as well as the subdivision factor

MSE 1000
– The modular evaluation unit for multipoint inspection apparatuses

With its modular design, the MSE 1000 modular evaluation unit is intended specifically for multipoint inspection apparatuses and shop-floor metrology. At the same time, such measuring apparatuses—which can be designed as stations for statistical process control (SPC)—also perform statistical evaluation of the measured values and thus permit qualified process control. They can be equipped with a large number of differing measuring devices.

The MSE is especially attractive for these areas of application for the following reasons:
- Flexibility for adaptation to differing conditions of operations
- A variety of interfaces for connection of numerous measuring devices
- Fast communication with higher-level computer systems over Ethernet
- Outputs for controlling sorting switches, warning lamps, PLC, etc.
- Output of measurement results for documentation and further processing

Design
The MSE 1000 consists of individual modules with various interfaces. They permit connection of incremental, absolute and analog measurands, the output of switch signals, and communication over diverse interfaces. The basic configuration of the MSE 1000 consists of a power module and a basic module. It can be expanded by further modules as needed. Users can configure up to 250 axes or channels to meet their specific needs.

Functions
The functions of the MSE 1000 are defined by the PC software used.

MSEsetup
This software package is available for download at www.heidenhain.de. It handles the basic functions of the MSE 1000:
- Configuration (modules, encoder inputs, data transmission)
- Diagnostics
- Data transfer to the PC
- Writing of measured values to an Excel table

MSElibrary
This program library (DLL) for Windows operating systems is needed if the MSE 1000 is to be operated through a customer-specific software application. The Ethernet driver provides functions that permit communication between the MSE 1000 and a PC.

The interfaces in C/C++ make application development possible using Visual Studio C/C++, Visual Basic, and Delphi. Also available as a LabView virtual instrument (VI).

MSElibrary is also available for download at *www.heidenhain.de*.
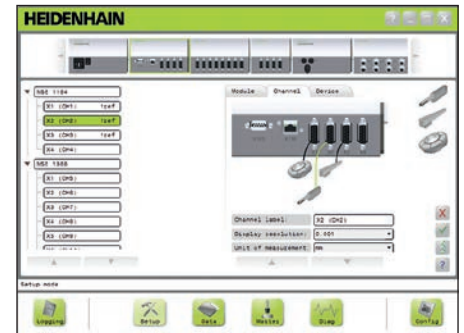
Configuration of the channels

Data acquisition
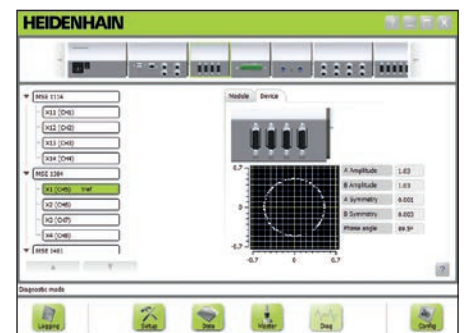
Diagnostics for 1 V$_{PP}$ signals

Functional reserve for EnDat units

	MSE 1000
Measuring channels/axes	Up to 250
Data transfer rate	20 to 100 measured values per second for all axes; depends on the configuration
Data transfer	Standard Ethernet, IEEE 802.3
Addressing	Fixed IP address or DHCP
External latch inputs	2 (e.g., for foot switch)
Software	**MSEsetup:** graphic-supported configuration of the system, diagnosis of the encoders, loading of measured data to Excel
	MSElibrary: library (DLL) for integration into the customer's software under Windows
Voltage supply*	AC 100 V to 240 V (±10 %), 50 Hz to 60 Hz (±2 %), ≤ 108 W DC 24 V (±10 %), ≤ 72 W
Operating temperature	0 °C to 45 °C; (storage temperature -20 °C to 70 °C)
Degree of protection*	IP40 or IP65
Mounting	On top hat rail, on a mounting stand, or in electrical cabinets (designed specifically for 19-inch cabinet)
Accessories	Mounting stand, foot switch, connecting cable

* Please select when ordering

MSE 1000
– Modules

Modules		Description	Interface	Connections	Width a	Power consumption[1]	Model
Required	**Basic**	Basic unit with complete functionality • Ethernet 10/100 for connection to the PC • Encoder inputs • 2 latch inputs ⊓⊔TTL	4 encoders EnDat 2.2	M12, 8-pin, female	159 mm	3.5 W	MSE 1114
			4 encoders ∿ 1 V$_{PP}$	D-sub, 15-pin, female		3.8 W	MSE 1184
			4 encoders ⊓⊔TTL	D-sub, 9-pin, female		2.7 W	MSE 1124
	Power supply	Supply unit Output power 50 W	AC 100 V to 240 V	Power plug (IP40)	159 mm	–	MSE 1201
				PG cable gland[3] (IP65)			
		Supply unit Output power 70 W	DC 24 V	M8, 3-pin, female			MSE 1202
Optional	**EnDat**	Axis module with bidirectional encoder interface (purely serial)	4 encoders EnDat 2.2	M12, 8-pin, female	106 mm	3.3 W	MSE 1314
			8 encoders EnDat 2.2		159 mm	4.4 W	MSE 1318
	Sinusoidal	Axis module for incremental encoders	4 encoders ∿ 1 V$_{PP}$	D-sub, 15-pin, female	106 mm	3.5 W	MSE 1384
			8 encoders ∿ 1 V$_{PP}$		159 mm	5.0 W	MSE 1388
	Square wave	Axis module for incremental encoders	4 encoders ⊓⊔TTL	D-sub, 9-pin, female	106 mm	2.4 W	MSE 1324
			8 encoders ⊓⊔TTL		159 mm	2.5 W	MSE 1328
	Analog	Axis module for analog inputs	2 inputs, ±10 V or 4 to 20 mA	D-sub, 9-pin, female	106 mm	3.2 W	MSE 1332
	HBT	Axis module for the connection of inductive position encoders	8 inputs, half-bridge, Tesa and Solartron compatible	Lumberg, 5-pin, female	159 mm	4.6 W	MSE 1358
	LVDT		8 inputs, full bridge, Mahr or Marposs compatible				
	I/O	Floating inputs/outputs	4 relay outputs 4 TTL switching inputs	Terminal block (IP40)	106 mm	6.1 W[2]	MSE 1401
				M8, 3-pin, female[4] (IP65)			
	Compressed air	Air switch for activation of pneumatic length gauges	1 input 1 output Compressed air	Plug-in connections for 4 mm tube	106 mm	3.7 W[2]	MSE 1501

Modules providing connection to further encoders and interfaces are planned.
[1] Power consumption of the module. Connected encoders must be considered additionally; see the example calculation
[2] With outputs under load
[3] Three-meter power cable with PG gland included in delivery
[4] Three mating connectors included in delivery

Example calculation of power consumption

The power supply module (MSE 1201, MSE 1202) provides the electrical power for further modules and encoders. If the power provided does not suffice for operating the desired system configuration, a further power supply module must be used.

The power consumption is specified for each module (see table). The power consumption of the connected HEIDENHAIN encoders can be calculated from the brochure data (supply voltage x current consumption). For all other consumers (e.g., inductive and analog sensors), the connected load must be known. The sum power of all consumers must not exceed the rated power of the power supply module(s). The following example illustrates this calculation.

Components to be supplied

Encoders: 8 x ACANTO AT 1217, 12 x SPECTO ST 1288, 2 x LS 388 C, 2 x temperature sensors 20 V/100 mA
Modules: 1 x basic module MSE 1114, 1 x axis module MSE 1314, 2 x axis modules MSE 1388, 1 x compressed air module MSE 1501, 1 x axis module MSE 1332

Power calculation

	Data from brochure or calculated				Total power consumption (example)
	Operating voltage	Current consumption	Power consumption/ unit	No. of units	
ACANTO AT 1217	5 V	150 mA	0.75 W	8	6 W
SPECTO ST 1288	5 V	90 mA	0.45 W	12	5.4 W
LS 388 C	5 V	100 mA	0.5 W	2	1 W
Thermistor	20 V	100 mA	2 W	2	4 W
MSE 1114	–	–	3.5 W	1	3.5 W
MSE 1314	–	–	3.3 W	1	3.3 W
MSE 1388	–	–	5 W	2	10 W
MSE 1501	–	–	3.7 W	1	3.7 W
MSE 1332	–	–	3.2 W	1	3.2 W
Total:					40.1 W

This power consumption can be met by **one** MSE 1201 (50 W) or MSE 1202 (70 W) power supply module.

29
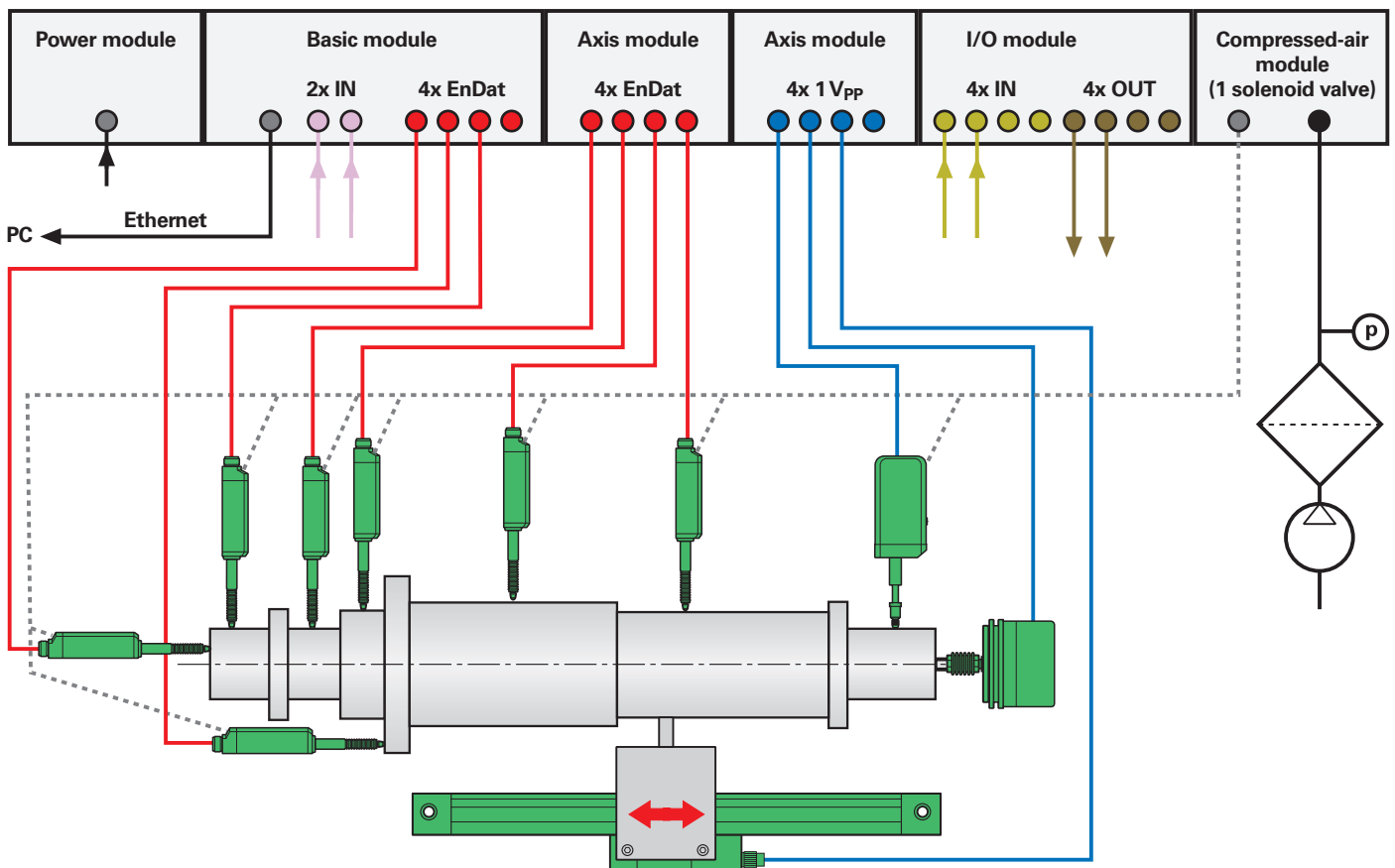
EIB 700
– The evaluation unit with measured-value memory

The EIB 700 evaluation electronics feature connections for four axes. They are especially well suited for precise position measurement in inspection stations and multipoint inspection apparatuses as well as for mobile data acquisition, such as in machine calibration.

The EIB 700 series is ideal for applications requiring high-resolution encoder signals and fast measured-value acquisition. Ethernet transmission also enables you to use switches or hubs for connecting more than one EIB. It is also possible to use WLAN transmission, for example.

Execution
The EIB 700 features a bench-top housing. With an accessory mounting bracket it can also be easily built into a 19-inch housing. It is designed for the following voltage supplies:
EIB 741: AC 100 V to 240 V
EIB 742: DC 24 V

Functions
For **measured-value generation**, the EIB 700 subdivides the incremental signal periods up to 4096-fold. The deviations within one signal period are reduced by the automatic adjustment of the sinusoidal incremental signals.

The integrated **measured-value memory** enables the EIB 700 series to save typically 250 000 measured values per axis. Internal or external triggers can be used for axis-specific storage of the measured values.

The **interval counter** permits position-dependent triggering in connection with an incremental encoder on axis 1. In addition, the signals of axis 1 are interpolated and forwarded to a position counter. Triggering pulses are generated either at a certain position or equidistantly in adjustable intervals. They begin after an adjustable start position has been traversed and continue in both counting directions. The trigger pulses can be used for triggering further EIB internal axes or also over a trigger output.

Data interface
A standard Ethernet interface using TCP/IP or UDP communication is available for **data output**. This permits direct connection to a PC, laptop or industrial PC. The type of measured-value transfer can be selected through the operating mode (transfer of individual values, block transfer, or transfer upon software request).

Driver software for Windows, Linux and LabVIEW, as well as example programs, and the EIB application software are included in delivery for the purpose of **processing the measured values** on the PC. The driver software enables customers to easily program their own applications. In addition, example programs demonstrate the capabilities of the EIB 700 series. The EIB application software is for commissioning and for demonstrating the capabilities of the EIB 700 series. This software is made available as source code and can serve as a platform for the development of one's own applications.

Operating Modes	Soft Real-Time	Recording	Streaming	Polling
Properties	Immediate transmission of measured values when the trigger event occurs	Storage of measured values in the EIB's internal measured-value memory	Buffering and block transfer of measured values	Software request from customer application
Selectable trigger sources	All internal and external sources			By software command
Trigger rate	≤ 10 kHz (access time to position values < 100 μs)	≤ 50 kHz	≤ 50 kHz Max. 1 200 000 bytes/s	Depends on the application
Typical applications	Closed loop control	Very high recording rate Offline analysis of data	High recording rate in combination with high recording depth	Quasi-static measured value recording

Specifications	EIB 741 EIB 742		
Encoder inputs	D-sub connections, 15-pin, female (X11 to X14), for four encoders		
Interface (switchable)	$\sim$ 1 V$_{PP}$ ($\sim$ 11 µA$_{PP}$ upon request)	EnDat 2.1	EnDat 2.2
Voltage supply for encoders	DC 5.12 V ±0.15 V; max. 450 mA per channel Overcurrent protection (automatic switch-off, resettable) at 550 mA		
Input frequency	≤ 500 kHz	–	–
Subdivision factor	4096-fold	–	–
Signal adjustment	Automatic adjustment of offset, phase and amplitude	–	–
Cable length[1]	≤ 150 m	≤ 150 m	≤ 100 m
Data register for meas. values	48 bits (only 44 bits are used)		
Interval counter	Derived from axis 1 (only 1 V$_{PP}$)[4], Interpolation factor can be set from 1-fold to 100-fold Can be used as trigger source or additional counting axis	–	–
Measured-value memory	Typically 250 000 position values per channel		

Measured-value trigger[2]	Storage of the measured values of the four axes alternatively through external or internal trigger.
	External: • Signal via trigger input
	            • Software command (over Ethernet)
	Internal: • Timer and interval counter
	           • Reference pulse of the respective axis (from axis 1 also possible for other axes)		

Trigger input[3]	D-sub connection, 9-pin, male; differential inputs as per RS-485 (terminating resistors can be activated)		
Trigger output[3]	D-sub connection, 9-pin, female, 4 differential inputs as per RS-485		
Access to measured values	Depends on the selected operating mode (see separate table)		
Software	• Driver software for Windows, Linux and LabVIEW • Program examples • EIB application software		
Data interface[5]	Ethernet as per IEEE 802.3 (10/100/1000 Mbit/s)		
Network address	Automatic assignment through Dynamic Host Configuration Protocol (DHCP) or manual assignment		
Dimensions	≈ 213 mm x 152 mm x 42 mm		
Operating temperature	0 °C to 45 °C; (storage temperature 0 °C to 70 °C)		
Power supply	**EIB 741:** AC 100 V to 240 V (±10 %), 50 Hz to 60 Hz (±2 %), power consumption up to 30 W **EIB 742:** DC 24 V (-15 %/+20 %), max. 2 A		

[1] The supply voltage range of the encoder must be maintained; specified cable length applies when HEIDENHAIN cables are used.
[2] Various trigger sources can be assigned to the individual axes.
[3] Can also be used as logical input or output; [4] Maximum input frequency for referencing: 70 kHz
[5] The quality of the data cable between EIB and PC must be adapted to the transmission rate and cable length.

IK 220
– The evaluation electronics as PC solution

The IK 220 evaluation unit is a PC counter card for two axes. It is inserted directly into a vacant PCI slot in the computer. The IK 220 is ideal for applications in which the measured-values are to be evaluated directly in the PC.

Design
Two HEIDENHAIN encoders with sinusoidal current signal ($\sim$ 11 µA$_{PP}$), sinusoidal voltage signal ($\sim$ 1 V$_{PP}$), EnDat 2.1 or SSI interface can be connected to the IK 220. External latch inputs/outputs and the output of ($\sim$ 11 µA$_{PP}$) measured value signals can be implemented by using additional slot covers (accessory).
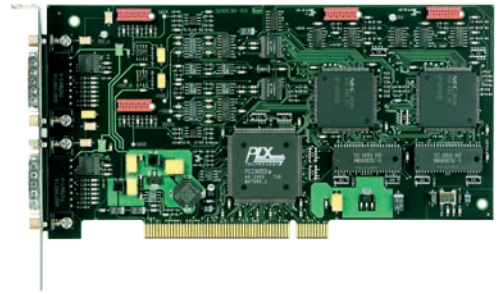
Functions
The IK 220 subdivides the periods of sinusoidal encoder signals up to 4096-fold for measured-value generation. They are called and stored either by using external latch inputs or by software.

The IK 220 features an integrated **measured value memory**. A total of up to 8192 measured values can be stored in the buffer and downloaded in a single block.

The **measured values are further processed** in the PC through programs created by the operator. Examples of such programs and driver software for Windows 2000/XP/Vista/7 (32/64 bit) are supplied with the card to demonstrate the PC counter card's capabilities.

Basic Circuit Diagram

	IK 220			
Encoder inputs	D-sub connections, 15-pin, male (X1 and X2), for two encoders			
Input signals (switchable)	$\sim$ 1 V$_{PP}$	$\sim$ 11 µA$_{PP}$	EnDat 2.1	SSI
Input frequency	≤ 500 kHz	≤ 33 kHz	–	
Cable length[1]	≤ 60 m		≤ 10 m	
Adjustment of encoder signals	Offset, phase and amplitude are adjusted through software			
Signal subdivision	4096-fold			
Data register for measured values	48 bits; only 44 bits are used for the measured value			
Internal memory	For 8192 position values			
Measured-value trigger	Alternatively through • External latch signals (over separate IK assembly for external inputs/outputs) • Software command • Timer • Traversing the reference marks			

Access time to measured values	• *Without adjustment, without compensation run:*
	  ≤ 100 µs
	• *With adjustment, without compensation run:*
	  ≤ 110 µs
	• *With adjustment, with compensation run:*
	  ≤ 160 µs
			Depends on the encoder	

Interface	PCI bus (plug and play) Local Bus Specification Rev. 2.1			
Driver software and demonstration program	For Windows 2000/XP/Vista/7 (32- and 64-bit) in VISUAL C++, VISUAL BASIC and BORLAND DELPHI			
Encoder outputs	$\sim$ 11 µA$_{PP}$ Over PCB connector on the IK (10-pin, female) Fitting cable assembly with PC-slot cover available as option			
Power consumption	≈ 4 W, without encoders			
Dimensions	190 mm x 100 mm			
Operating temperature	0 °C to 55 °C; (storage temperature –30 °C to 70 °C)			

[1] With HEIDENHAIN cable; larger cable lengths upon request

Mounting
Mounting the ND 200

ND 200 series
The ND 200 series digital readouts were conceived as bench-top units. They can easily be stacked, with recesses on the top preventing the stacked units from moving out of place.

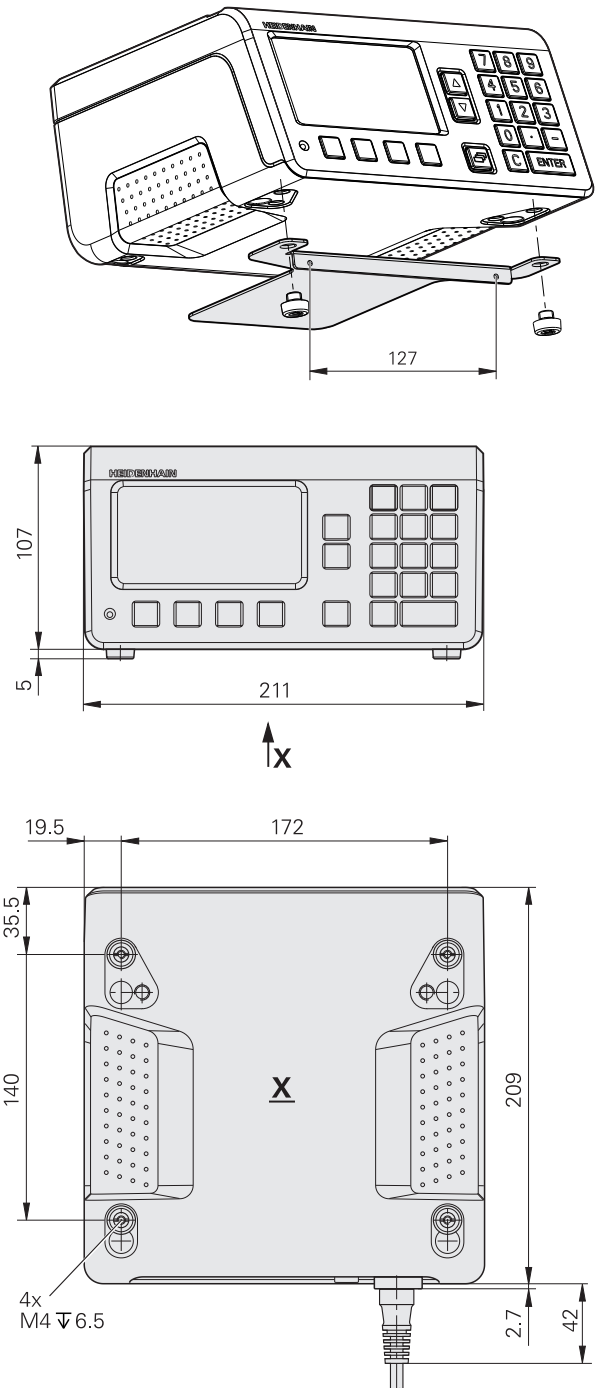You can secure the ND 28x from below by using M4 screws on a base plate.

Two ND 28x readouts fit next to each other in a 19″ housing. A mounting adapter is available as an accessory for mounting in a 19″ housing.

Accessories
Mounting adapter for 19″ housing
ID 654020-01

ND 287

127

107

5

211

X

19.5

172

35.5

140

X

209

4x
M4 ▼ 6.5

2.7

42

Mounting the MSE 1000

The MSE 1000 modules are easily mounted on a standard rail in a cabinet or on a mounting stand (accessory). The individual modules are plugged onto each other and fixed together with a lock. This also connects the internal bus and the power supply. The module widths are selected so that the MSE 1000 is also suitable for a 19″ housing.

	a
Size 1	53 mm
Size 2	106 mm
Size 3	159 mm

mm
Tolerancing ISO 8015
ISO 2768 - m H
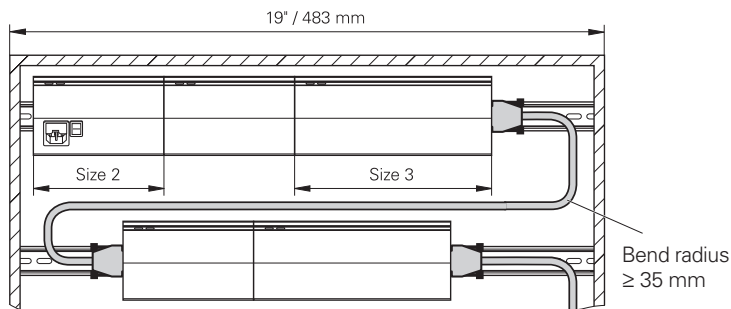≤ 6 mm: ±0.2 mm
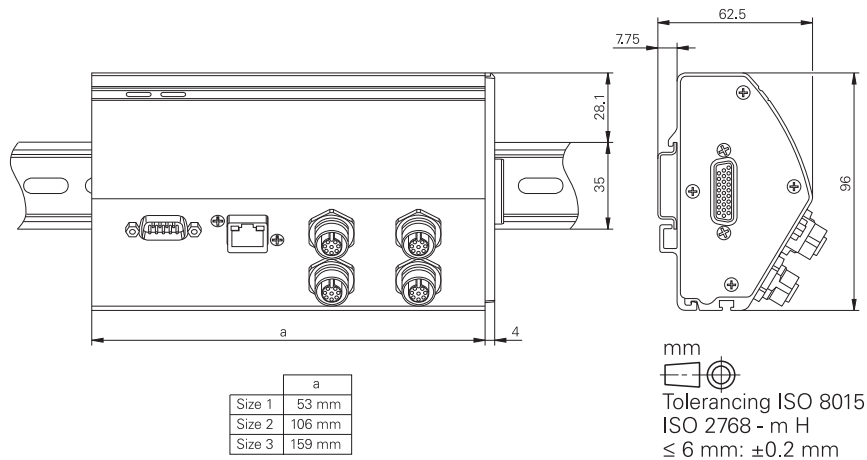
Accessories
Mounting stand
For mounting the MSE on a (table) surface. Two mounting brackets are connected together by two standard top hat rails. Two rows of modules or one MSE can be connected to it, and a cable channel can be fastened.
ID 850752-01
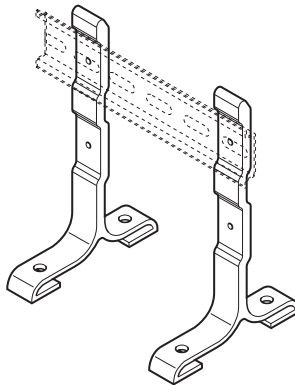
Connecting cables
For connecting two or more MSE rows (e.g., for mounting in an electrical cabinet).
ID 850753-xx

Mounting the ND 1000/ND 2000
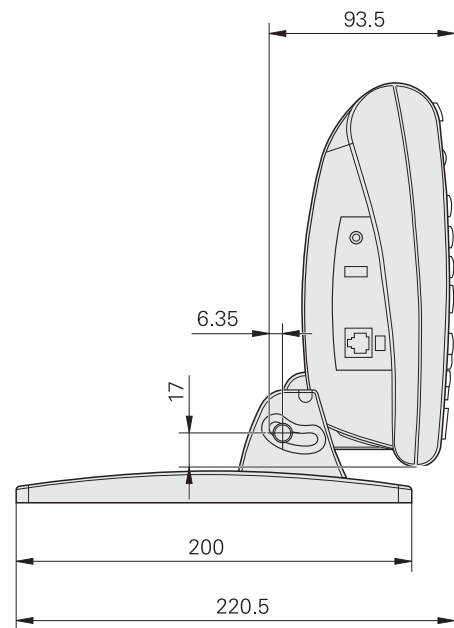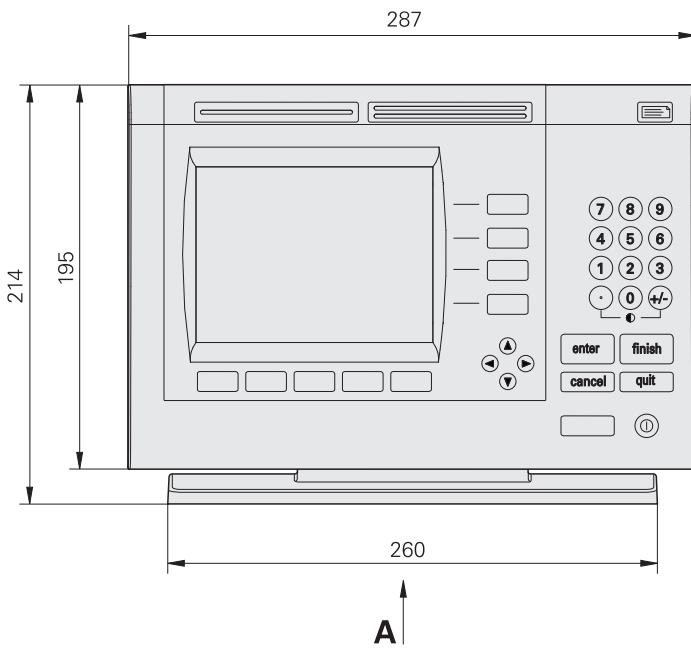
The ND 1000 and ND 2000 are shipped with either a tilting base or a mounting base.

Tilting base

The readout can be used as a tabletop unit when placed on the tilting base. The readout can then be tilted forward or backward by up to 20° for the best reading angle. The tilting base can be attached with M5 screws.

ID 382892-02
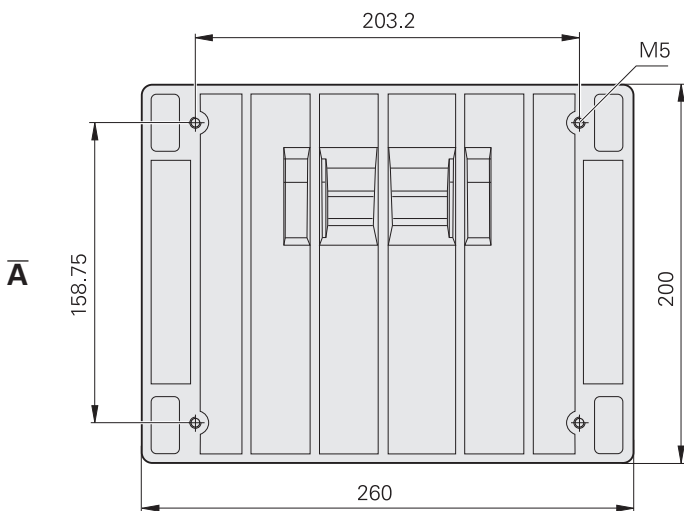
mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm

Mounting adapter
The mounting adapter is used to attach the ND 1000 or ND 2000 to a mounting arm or directly to the machine. It also enables the user to tilt the readout.

ID 682419-01

Mounting adapter
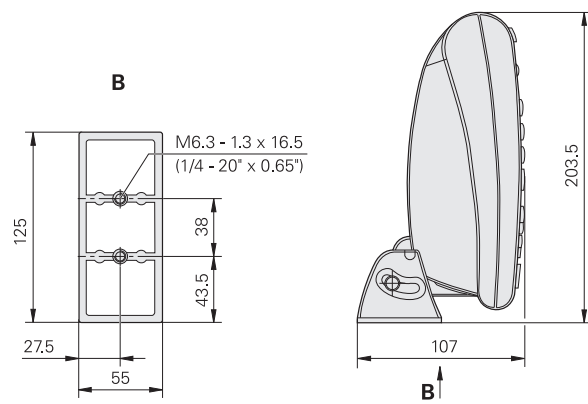
Accessories
Protective cover
Protective covers are available as accessories for protecting the keyboard and screen of the ND 1000/ND 2000 from becoming soiled. The display can still be easily read through the transparent protective covers. They fit themselves optimally to the front of the unit, without impairing the ease of operation.

ND 11xx (1/2 axes)   ID 681051-02
ND 11xx (3/4 axes)   ID 681051-03
ND 21xx

Mounting the QUADRA-CHEK 2000

The QUDARA-CHEK 2000 can be mounted flexibly at various angles by means of the Multi-Pos or Duo-Pos stand. For mounting on the machine, the Multi-Pos holder as well as mounting systems with a hole pattern of 50 mm x 50 mm are suitable.

Multi-Pos base
For mounting and fastening to a surface, continuously tiltable within an angle of 90°

ID 1089230-07

**QUADRA-CHEK 2000
with Multi-Pos base**

ISO 14581-M4x8
M_d = 2.6 Nm

A
2:1

4.5

113

40.7±1

10°

80°

4.5

185±1

A

T25
M_d = 15 Nm max.
①

6.6

10

15.25

1 = Recommended tightening torque: M_d = 6.8 Nm

200

169

HEIDENHAIN

X

X

130

18.75

51

M5

170

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

Duo-Pos base

For setup and mounting on a surface in two positions (20° or 45° tilt)

ID 1089230-06

B
4:1

ISO 7092-4

ISO 7380-M4x8
M_d = 2.6 Nm

4.5

20°

168±1

80

100

132±2

Y

C
4:1

ISO 7092-4

ISO 7380-M4x8
M_d = 2.6 Nm

4.5

45°

150±1

70

99

150±2

Z

50

4.5

Multi-Pos holder

For mounting to an arm, continuously tiltable within an angle of 90°

ID 1089230-08

10°

80°

186±1

T25
M_d = 15 Nm max.
①

133

1 = Recommended tightening
torque: M_d = 6.8 Nm
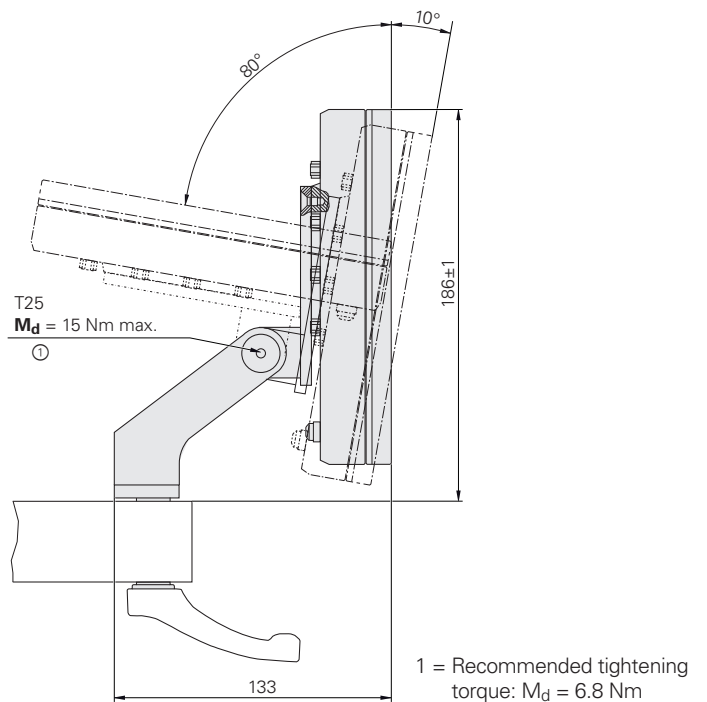
Mounting the QUADRA-CHEK 3000

The QUDARA-CHEK 3000 can be mounted flexibly with the Multi-Pos or Duo-Pos base at various tilting angles. The Multi-Pos holder or other fastening systems compatible with VESA MIS-D 100 are suitable for fastening it to a machine.
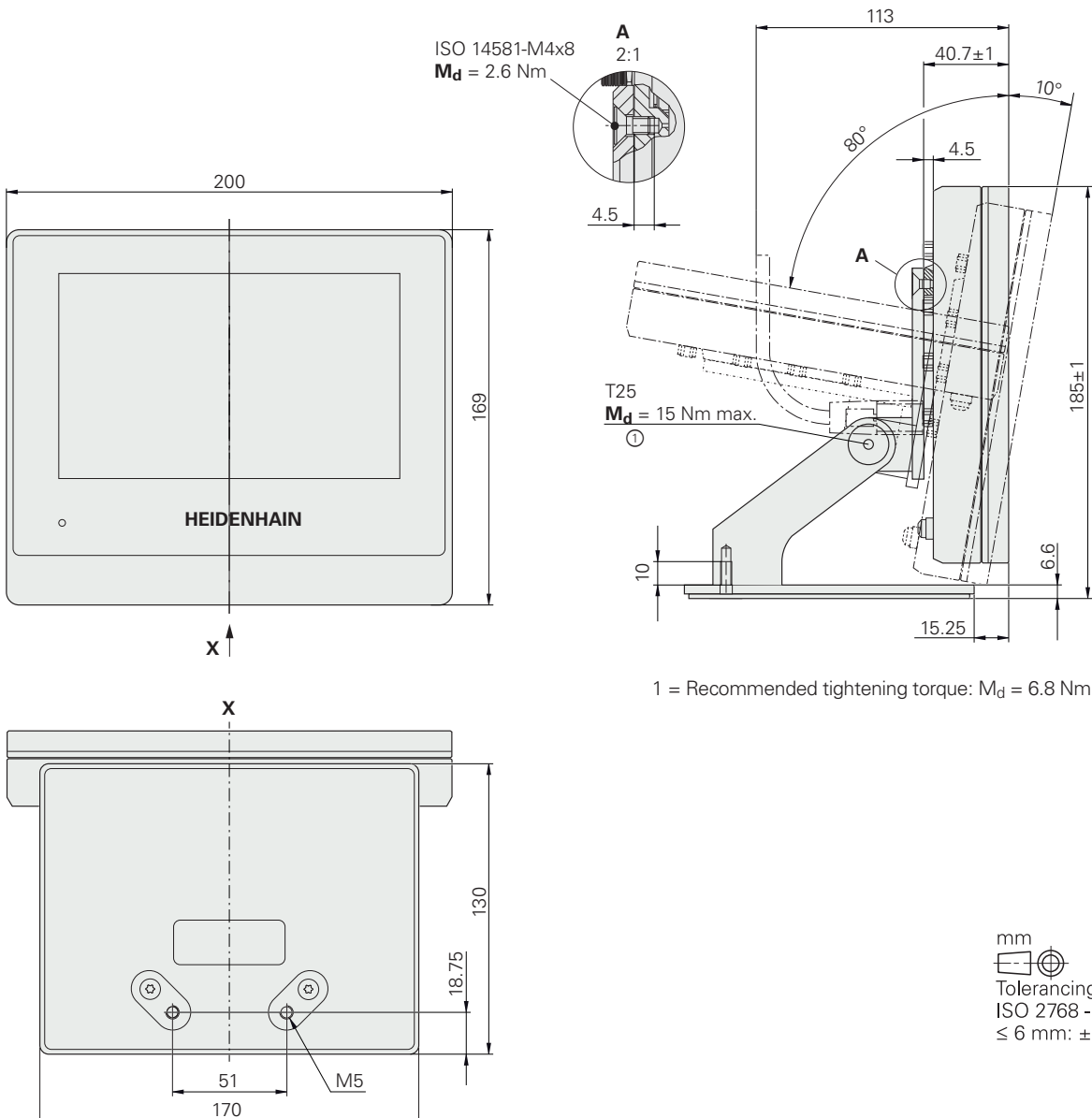
Multi-Pos base
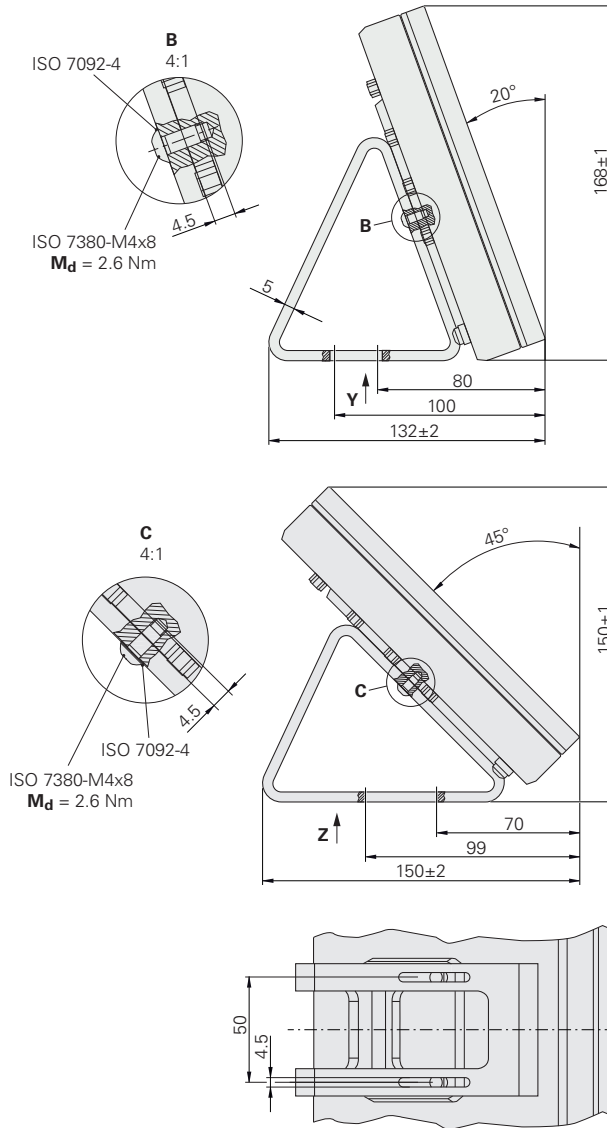For mounting and fastening to a surface, continuously tiltable within an angle of 90°

ID 1089230-03

**QUADRA-CHEK 3000
with Multi-Pos base**

ISO 14581 – M4 × 8
M_d = 2.6 Nm

A
4:1

4.5

314

265

X

X

160

51

M5

18.75

210

111

38±1

30.5

10°

80°

A

T25
M_d = 15 Nm max.
①

10

283±1

6.3

12.3

239±2

32±2

1 = Recommended tightening torque: M_d = 6.8 Nm

mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm
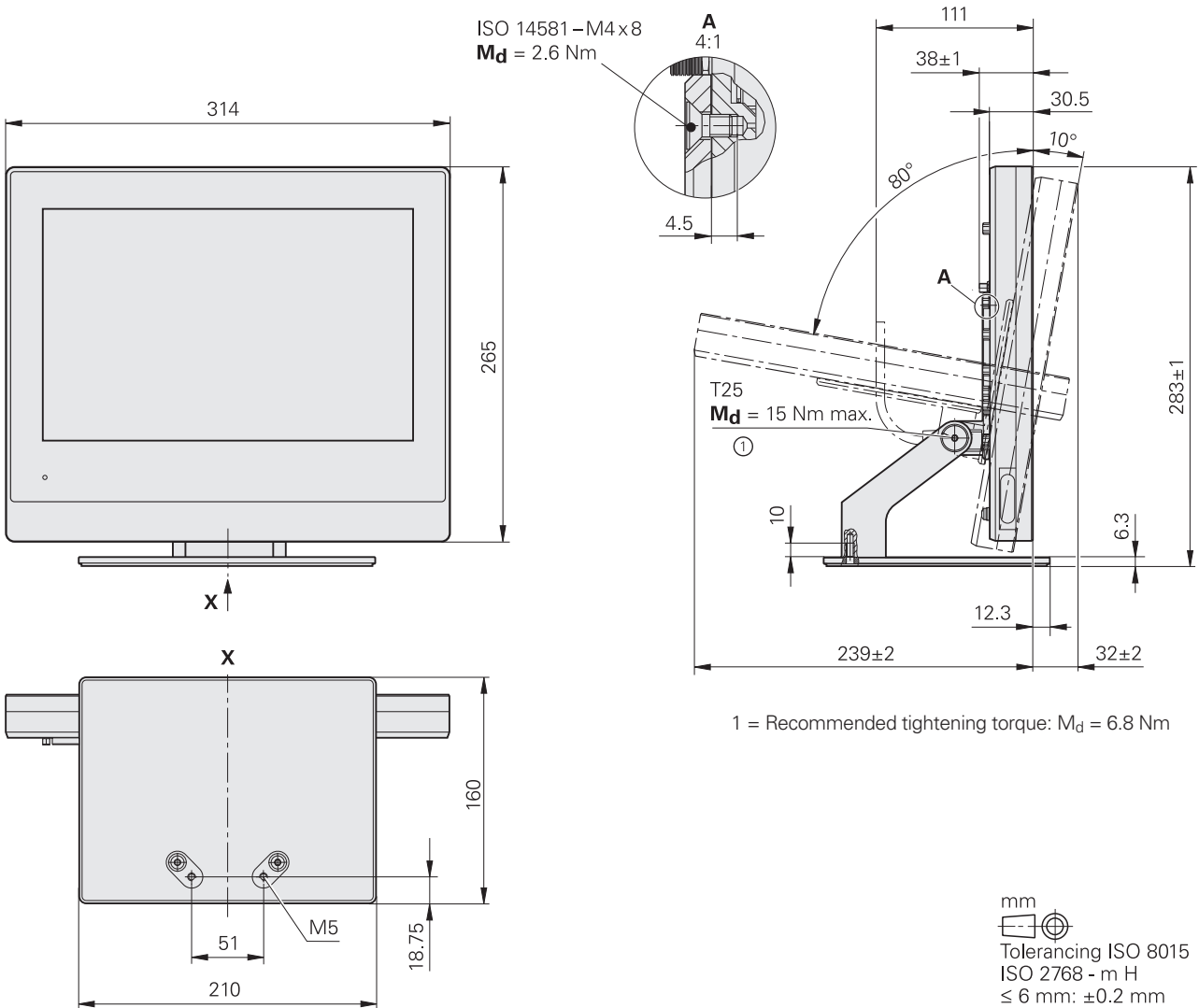
Duo-Pos base

For setup and fastening on a surface in two positions (20° or 45° tilt)

ID 1089230-02

B
4:1

ISO 7092−4

ISO 7380−M4×8
M_d = 2.6 Nm

4.5

20°

258±1

B

5.8

Y

86

115.5

158±2

C
4:1

ISO 7092−4

ISO 7380−M4×8
M_d = 2.6 Nm

4.5

45°

208±1

C

Z

82

125

208±2

Y/Z

100

4.5
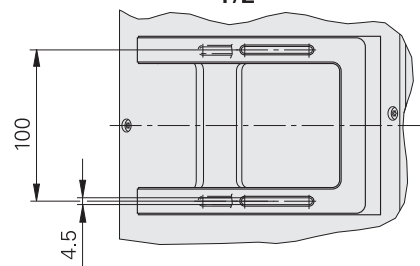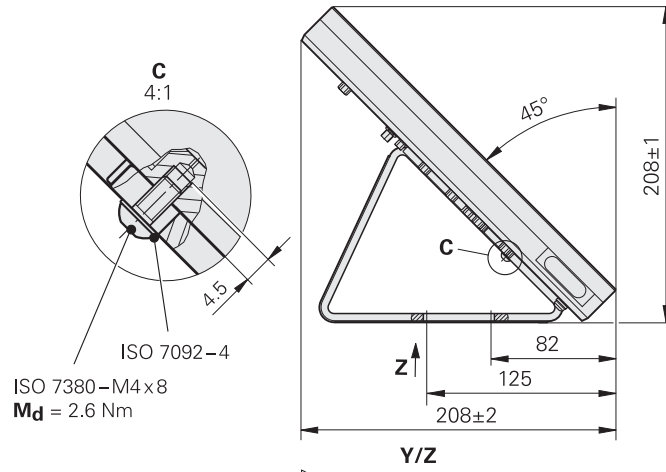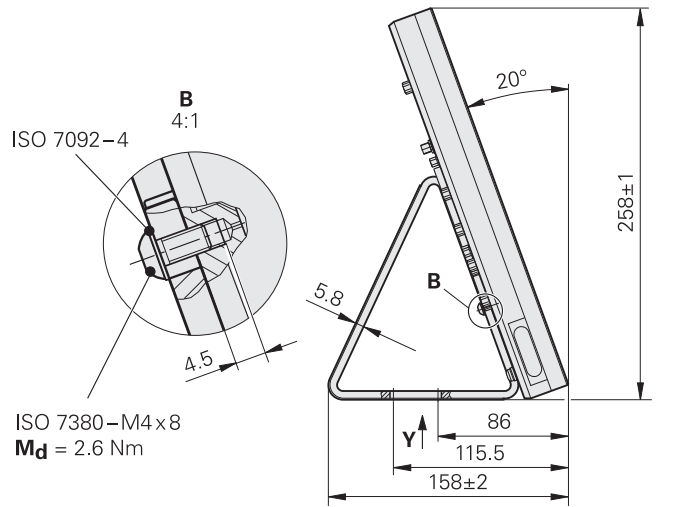
Multi-Pos holder

For fastening to an arm, continuously tiltable within an angle of 90°

ID 1089230-04

80°

10°

175±1

T25
M_d = 15 Nm max.
①

135

152±2

113±2
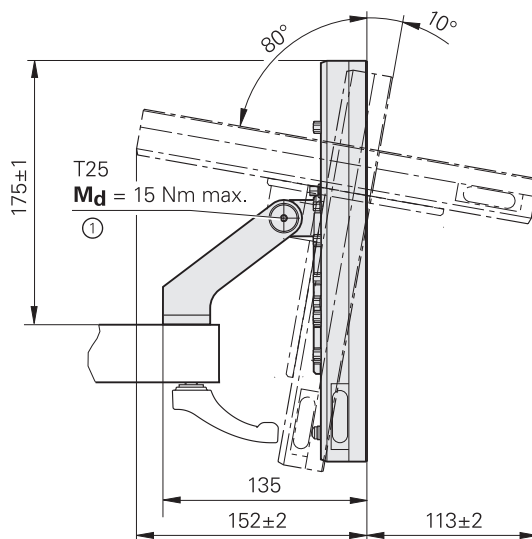
1 = Recommended tightening torque: M_d = 6.8 Nm

Mounting the EIB 700

The EIB 700s were conceived as bench-top units. They must be installed in a well-ventilated area. The operating orientation is specified.

You can secure the EIB 700 from below by using M4 screws on a base plate. Two EIB 700 units fit next to each other in a 19″ housing. They occupy one height unit. A mounting bracket is available as an accessory.

Accessories
Mounting bracket
For installation of two EIB 74x in a 19-inch housing
ID 671144-01

*) Max. thread engagement: 4 mm

EIB 741:
View X

Fan

EIB 742:
View X

Fan

mm
Tolerancing ISO 8015
ISO 2768 - m H
≤ 6 mm: ±0.2 mm
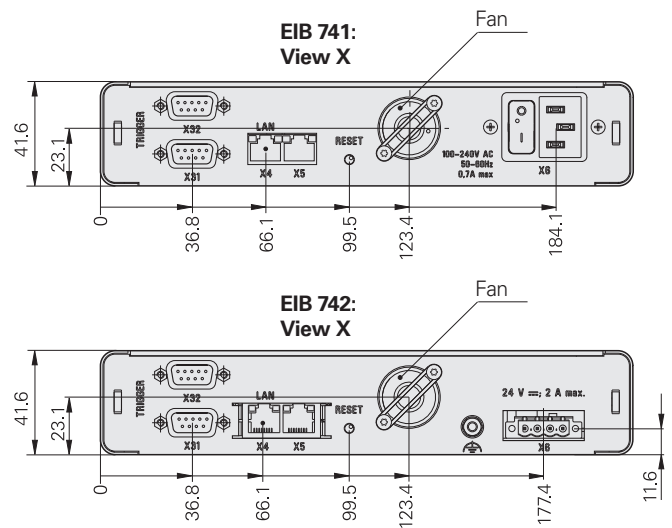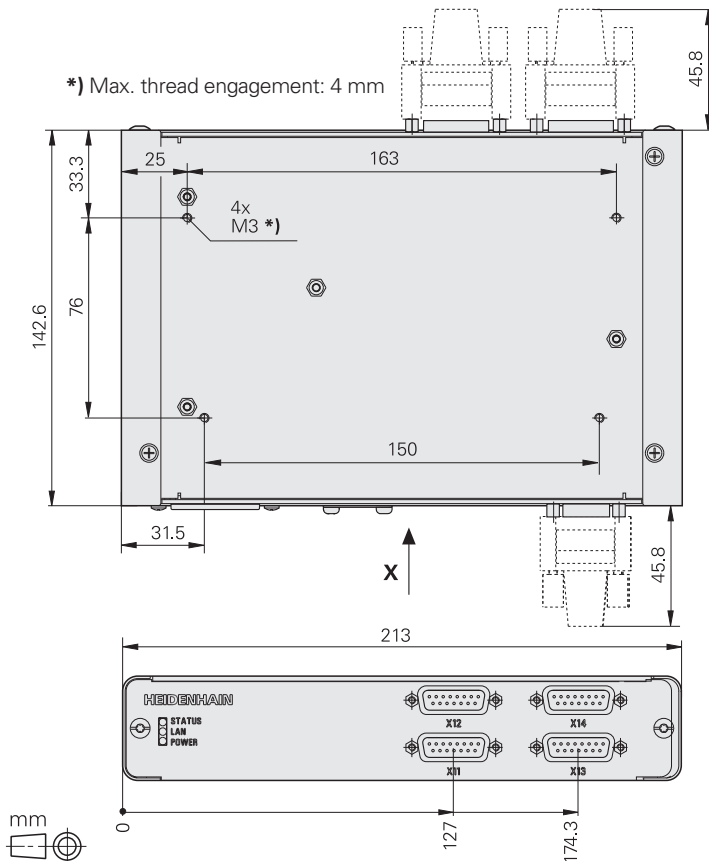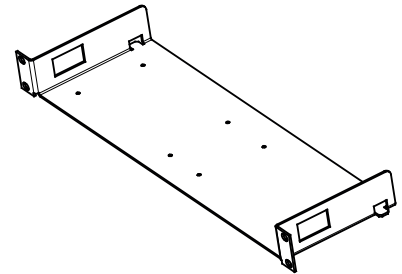
Optional accessories
Adapter connectors and calibration/demo parts

HEIDENHAIN offers various calibration parts as accessories for calibrating the optical and tactile edge detection systems.

Calibration standard
For the calibration of video measuring machines, measuring microscopes, and profile projectors. It can be traced back to national or international standards.
ID 681047-01

2-D demo part
The 2-D demo part is included with the QUADRA-CHECK 2000, QUADRA-CHEK 3000, and IK 5000. The application examples in the User's Manuals are based on this part. It can be reordered if a replacement is necessary.
ID 681047-02

3-D demo part (accessory)
Demo part for touch-probe applications. The examples in the user's manuals for the IK 5000 are based on this part.
ID 681048-01

3-D demo part for multi-sensor scanning (accessory)
Demo part for combined touch-probe applications and video edge detection. It is used for the examples in the IK 5000 User's Manual.
ID 681048-02

Adapter connectors for the QUADRA-CHECK 2000 and 3000
For conversion of the pin layout from HEIDENHAIN TTL to RSF and Renishaw TTL.
ID 1089210-01

For connection of HEIDENHAIN 11 μA_{PP} pin layout to HEIDENHAIN 11 μA_{PP}
ID 1089213-01

For connection of HEIDENHAIN 1 V_{PP} pin layout to HEIDENHAIN 1 V_{PP}
ID 1089214-01

For conversion of HEIDENHAIN 1 V_{PP} pin layout to Mitutoyo 2 V_{PP}
ID 1089216-01

Adapter connector for the QUADRA-CHEK 3000
For conversion of the pin layout for light control (without zoom) from QUADRA-CHEK 3000 (X103) to assignment for the ND 1300 QUADRA-CHEK (light)
ID 1089212-01

Calibration standard

2-D demo part

3-D demo part

3-D demo part for multi-sensor scanning

Adapter connector for TTL

Adapter connector 11 μA_{PP}, 1 V_{PP}, 2 V_{PP}

Adapter connector for light control

43

External control elements

The evaluation electronics and the PC package can be operated easily and intuitively. Nevertheless, remote operability may also be useful and convenient in some situations. The following components are available for remote operation:

Foot switch (accessory)
Cable length: 2.4 m

For ND with RJ45 connector
with two freely assignable keys
ID 681041-01

For IK 5000 with 3-pin DIN connector
with two freely assignable keys
ID 681041-02

For MSE 1000 with 9-pin D-sub connector
with two keys
ID 681041-03

For QUADRA-CHEK 2000
with 15-pin D-sub connector
with two keys
ID 681041-04

Keypad (accessory)
For remote operation of the evaluation unit; features a numeric keypad with "enter" and "finish" keys; cable length: 4.5 m; with RJ45 connector.

ID 681043-01

Joystick (accessory)
For remote operation and sensitive traversing of axes for ND 1300 and IK 5000. With 15-pin D-sub connector.

Without trackball   ID 681044-02
With trackball   ID 681044-01
With trackball and
Z-focus fine adjustment ID 681044-05

Foot switch

Keypad

Joystick without trackball

Joystick with trackball and Z-focus fine adjustment

Optical edge detector

Optical edge detector*

Two fiber-optic cables are necessary for edge detection with the optical edge detector. One fiber-optic cable is attached to the projection screen with a transparent holder. The second cable is attached near the transmitted light source so that the fibers point toward the light source. The following accessory components are required.

* Only required for the OED software option

Fiber-optic cable (accessory)
With one right-angle end and an SMA connector (subminiature A) for ND or IK.
Bend radius ≥ 25 mm
Temperature ≤ 100 °C
Lengths 2 m, 3 m, 5 m

ID 681049-xx

Holder (accessory)
With a hole for accepting the right-angle end of fiber-optic cables. Transparent design so that it can be attached to the projection screen.
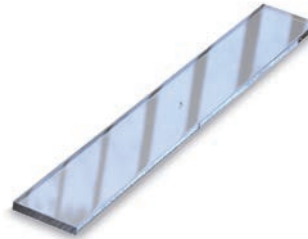Lengths: 350 mm, 600 mm, 760 mm

ID 681050-xx

Fiber-optic cable connection (accessory)
Two SMA (subminiature A) connectors for connecting an integrated edge detector.
Bend radius ≥ 25 mm
Temperature ≤ 100 °C
Lengths 2 m, 3 m, 5 m

ID 681049-xx

Fiber-optic cable

Holder

Fiber-optic cable connection

Interfaces
Evaluation electronics with integrated display

The evaluation electronics feature interfaces for encoders, for communication and for external components.

	ND 1102 ND 1103	QC 2000	ND 2104 G ND 2108 G	ND 287	QC 3014 NC QC 3024 NC
Encoders					
1 V$_{PP}$/11 µA$_{PP}$	●/–	●	●/–	●/●	●
TTL	●	●	●	–	●
EnDat 2.2.[1]	–	–	●	●	–
Touch probes	●[2]	–	–	–	–
Video	–	–	–	–	SW option[3]
Fiber-optic cable	–	SW option	–	–	SW option
Sensor ±10 V	–	–	–	Option	–
Data					
USB	Type A	Type A	Type A	Type B	Type A
RS-232-C/V.24	●	–	●	●	–
Ethernet	–	●	–	Option	●
Light control	–	–	–	–	SW option
Zoom	–	–	–	–	–
CNC outputs	–	–	–	–	–
Foot switch	●	●	●	–	–
Operating pad	●	–	●	–	–
Switching outputs	–	1 TTL	12 TTL	6 TTL	–
Switching inputs	–	4 TTL	5 TTL	12 TTL	–

● = Available
– = Not available
[1] Purely serial, no evaluation of incremental signals
[2] HEIDENHAIN or Renishaw touch probe
[3] Cameras from IDS Imaging Developing Systems GmbH with resolutions of up to 2 megapixels

Optional assemblies for the ND 287

Various input and output assemblies are available for the evaluation electronics

Second encoder input (option)
The ND 287 evaluation unit can be equipped with an optional second encoder input.

Encoder module
Input assembly for second encoder with 1 V_{PP} 11 μA_{PP} or EnDat 2.2 interface
ID 654017-01

Analog input (option)
Through an optional input assembly, the ND 287 digital readout can be equipped with an additional analog input for connecting a sensor. The input voltage range is interpolated 4096-fold; for a sensor with ±10 V, the resolution is therefore 5 mV. The analog module provides 5 V DC, 12 V DC and 24 V DC as the power supply for the sensor.

The 5 V DC (B) and 12/24 V DC (A) are galvanically isolated. They must not be used at the same time. A 9-pin D-sub connector is required as mating connector.

Analog module
Input assembly for ±10 V analog sensor
ID 654018-01
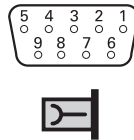
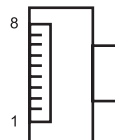| Pin	Assignment
1	−12 V (A)/85 mA
2	0 V (A)
3	0 V (A)
4	+12 V (A)/85 mA
5	Shield
6	0 V (B)
7	0 V (B)
8	Sensor (B) ±10 V max.
9	+5 V (B)/400 mA

Ethernet (option)
The ND 287 evaluation unit can be equipped with an optional Ethernet module.

Ethernet module
ID 654019-01

This module is provided with an Ethernet 100BaseT interface with RJ45 connector (female, 8-pin). This enables you to connect the ND 287 directly to your company's intranet or, with a crossover cable, to a PC.

Pin	Assignment
1	TX+
2	TX−
3	REC+
4	Do not assign
5	Do not assign
6	REC−
7	Do not assign
8	Do not assign
Housing	External shield

IK 5000 evaluation unit

The IK 5000 uses D-sub connectors. Depending on the version, further connections are made through one, two, or three additional slot covers. Please order the adapter cables necessary between the individual components separately.

		IK 5293		IK 5294	IK 5394		IK 5493	IK 5494		IK 5594
	Slots[1]	*2*	*2*	*2*	*3*	*4*	*3*	*4*	*4*	
	Position									
Encoders for X, Y, Z	*IK*	1 V_{PP} or TTL								
CNC outputs	*IK*	–		–	–	–	●	●	●	●
Foot switch	*IK*	●	●	●	●	●	●	●	●	●
Fiber-optic cable	*Slot L*	–	–	–	●[2]	–	●[2]	–	–	–
Touch probe[3]	*Slot 1*	Simple	Universal	–	–	Simple	–	–	Simple	High-End (TP 200)
Light control	*Slot 1*	–	–	–	–	●	–	●	●	●
Encoder for Q	*Slot 2*	–	–	1 V_{PP} or TTL						
Zoom	*Slot 3*	–	–	–	–	●	–	●	●	●
Video	*PC*	–	–	–	–	USB camera, Ethernet camera[4]	–	USB camera, Ethernet camera[4]	USB camera, Ethernet camera[4]	USB camera, Ethernet camera[4]

● = Available; – = Not available
[1] Including IK; [2] Connected directly to the IK PCB, special slot cover with cable guide included in delivery
[3] HEIDENHAIN or Renishaw touch probe; [4] Connected to the Ethernet port of the PC

Adapter cables			**1 V_{PP}**	**TTL**
Complete with D-sub connector (female), 15-pin (1 V_{PP}) or 9-pin (TTL), and 3-pin mini-DIN connector (female) For connecting the **XYZ encoders** and the **foot switch** to the IK 5000				
	For 3 axes XYZ and foot switch		540550-40	540550-10
	For 2 axes XY and foot switch		540540-24	540540-05
Complete with D-sub connector (female), 15-pin (1 V_{PP}) or 9-pin (TTL) For connecting the **Q encoder** to the IK 5000			540541-24	540541-05

MSE 1000 evaluation electronics

The modules of the MSE 1000 evaluation unit feature D-sub connectors or M12 plug connectors for connecting encoders and for external operation.

	MSE 1114	MSE 1124	MSE 1184	MSE 131x	MSE 132x	MSE 1332	MSE 1358	MSE 138x
Encoders							–	
1 V_{PP}	–	–	4	–	–	–	–	4 or 8
TTL	–	4	–	–	4 or 8	–	–	–
EnDat 2.2	4	–	–	4 or 8	–	–	–	–
Analog ±10 V	–	–	–	–	–	2[1]	–	–
Analog 4 mA to 20 mA	–	–	–	–	–	2[1]	–	–
LVDT or HBT[2]	–	–	–	–	–	–	8	–
Foot switch	●	●	●	–	–	–	–	–

[1] Selectable
[2] Please note when ordering

	MSE 1401	MSE 1501
Switching input	4 TTL	–
Switching output	4 relays	–
Compressed air	–	●

EIB 700, IK 220 evaluation units

The EIB 700 and IK 220 evaluation units feature D-sub connectors for connecting encoders and for external operation.

With the IK 220, the encoder signals can be sent out over an additional slot cover. They are available as 11 µA current signals for further processing in evaluation electronics or as EXE pulse-shaping electronics. A further slot cover contains the connections for the external inputs/outputs (e.g., for storing the measured values).

	EIB 700	IK 220
Encoder inputs		
1 V_{PP}	$4^{1)}$	$2^{1)}$
11 μA_{PP}	$4^{1)}$ Upon request	$2^{1)}$
EnDat 2.1	$4^{1)}$	$2^{1)}$
EnDat 2.2	$4^{1)}$	–
SSI	–	$2^{1)}$
Encoder outputs		
11 μA_{PP}	–	2 (optional assembly)
Trigger input	4	2 (optional assembly)
Trigger output	4	2 (optional assembly)
PLC inputs/outputs	$4/4^{2)}$	2/–

[1] Selectable   [2] Can alternatively be used as a trigger or logical input or output

Accessories
External inputs/outputs for the IK 220
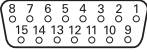Slot cover with two 9-pin D-sub connections (male)
ID 340253-01

Output assembly for IK 220
Slot cover with two 9-pin D-sub connections (male) for forwarding the encoder signals (11 μA_{PP}) to the subsequent electronics.
ID 340252-01
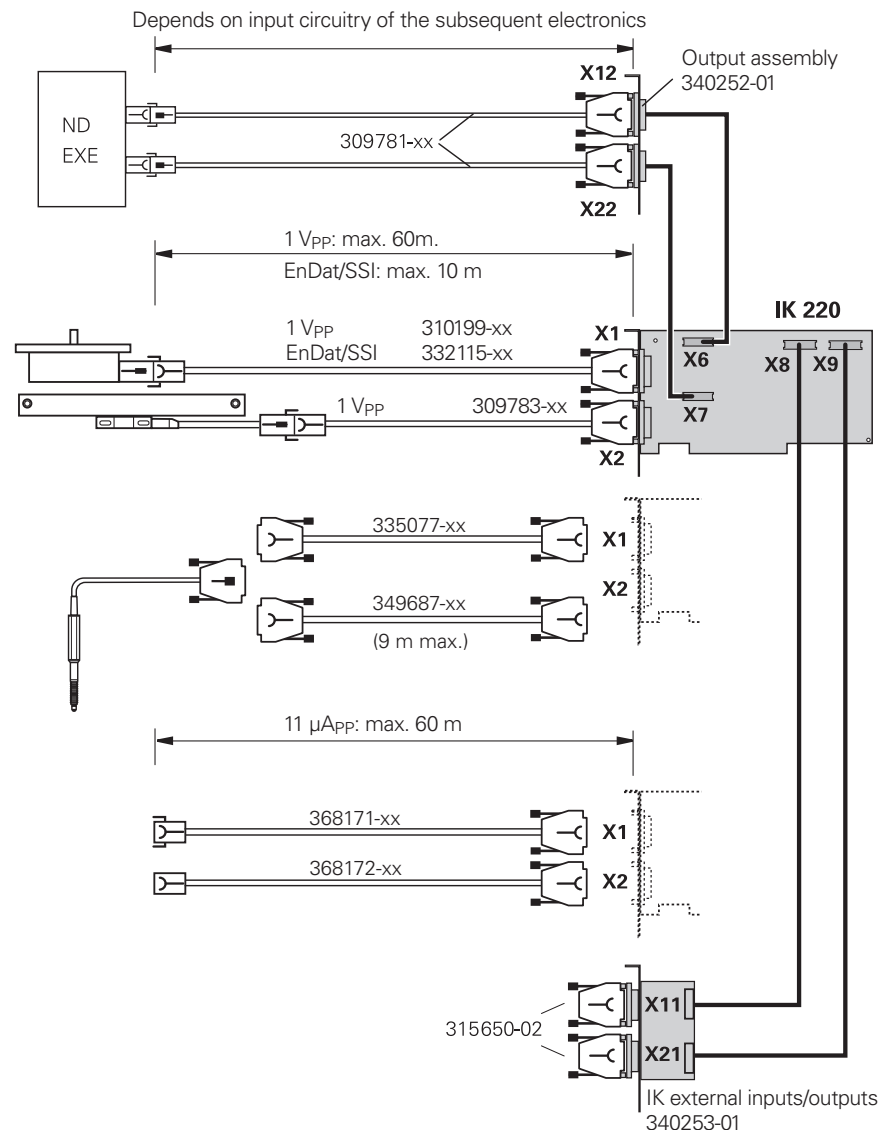
Encoder inputs

The evaluation units feature interfaces for connecting HEIDENHAIN encoders. Other interfaces are available upon request. A distribution cable is necessary in order to attach the encoders to the IK 5000.
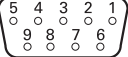
Pin layout ∿ 1 V$_{PP}$

15-pin D-sub flange socket (female)

	Power supply voltage				Incremental signals						Others
	4	12	2	10	1	9	3	11	14	7	5/6/8/13/15
∿ 1 V$_{PP}$	U$_P$	Sensor U$_P$	0 V	Sensor 0 V	A+	A−	B+	B−	R+	R−	/

Cable shield connected to housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Pin layout ⊓⊔ TTL

9-pin D-sub flange socket (female)

	Power supply voltage		Incremental signals						Others
	7	6	2	3	4	5	9	8	1
⊓⊔ TTL	U$_P$	0 V	U$_{a1}$	$\overline{U_{a1}}$	U$_{a2}$	$\overline{U_{a2}}$	U$_{a0}$	$\overline{U_{a0}}$	/

Cable shield connected to housing; **U$_P$** = Power supply voltage
Vacant pins or wires must not be used!

Pin layout of ND 2100 G and MSE 1000 EnDat
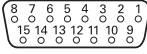
8-pin flange socket, M12

	Voltage supply				Serial data transfer			
	8	2	5	1	3	4	7	6
	U$_P$	Sensor U$_P$	0 V	Sensor 0 V	DATA	$\overline{DATA}$	CLOCK	$\overline{CLOCK}$

Cable shield connected to housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line
Vacant pins or wires must not be used!

Pin layout of series ND 200 $\sim$ 1 V$_{PP}$/$\sim$ 11 µA$_{PP}$/EnDat

15-pin D-sub flange socket (female)

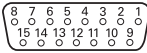|	Power supply voltage					Incremental signals						Serial data transfer			
	4	**12**	**2**	**10**	**6**	**1**	**9**	**3**	**11**	**14**	**7**	**5**	**13**	**8**	**15**
$\sim$ 1 V$_{PP}$	U$_P$	Sensor U$_P$	0 V	Sensor 0 V	/	A+	A–	B+	B–	R+	R–	/	/	/	/
$\sim$ 11 µA$_{PP}$					Internal shield	I$_{1+}$	I$_{1-}$	I$_{2+}$	I$_{2-}$	I$_{0+}$	I$_{0-}$	/	/	/	/
EnDat						/	/	/	/	/	/	DATA	$\overline{DATA}$	CLOCK	$\overline{CLOCK}$

Shield on housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line
Vacant pins or wires must not be used!

Pin layout of EIB 700 series $\sim$ 1 V$_{PP}$

15-pin D-sub flange socket (female)

	Power supply voltage				Incremental signals						Others		
	4	**12**	**2**	**10**	**1**	**9**	**3**	**11**	**14**	**7**	**8**	**6**	**5/13/15**
$\sim$ 1 V$_{PP}$	U$_P$	Sensor U$_P$	0 V	Sensor 0 V	A+	A–	B+	B–	R+	R–	L1/H[1]	L2/L[1]	/

Shield on housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line
Vacant pins or wires must not be used!
[1] Pins for homing or limit signals if these are supported by the encoder

Pin layout of EIB 700 series, EnDat

15-pin D-sub flange socket (female)

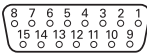|	Power supply voltage					Incremental signals[1]				Serial data transfer				Others
	4	**12**	**2**	**10**	**6**	**1**	**9**	**3**	**11**	**5**	**13**	**8**	**15**	**7/14**
EnDat	U$_P$	Sensor U$_P$	0 V	Sensor 0 V	Internal shield	A+	A–	B+	B–	DATA	$\overline{DATA}$	CLOCK	$\overline{CLOCK}$	/

Shield on housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line
Vacant pins or wires must not be used!
[1] For encoders with the ordering designations EnDat01 and EnDat02

Pin layout of IK 220

15-pin D-sub flange socket (male)														

	Power supply					Incremental signals						Serial data transfer			
▬	1	9	2	11	13	3	4	6	7	10	12	5	8	14	15
11 µA$_{PP}$	U$_P$ 5 V	Sensor 5 V	U$_N$ 0 V	Sensor 0 V	Internal shield	I$_1$ +	I$_1$ –	I$_2$ +	I$_2$ –	I$_0$ +	I$_0$ –	/	/	/	/
1 V$_{PP}$						A+	A–	B+	B–	R+	R–	/	/	/	/
EnDat SSI						A+	A–	B+	B–	/	/	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$

Shield on connector housing
Vacant pins or wires must not be used!

Pin layout of MSE 1000, analog

Mating connector: **9-pin D-sub flange socket (female)**									

	Power supply 1			Power supply 2		Shield		Analog signal		
▷	1	4	3	9	6	5	Housing	8	2	7
	– 12 V	+ 12 V	0 V	5 V	0 V	Shield	Chassis ground	U$_A$	I$_A$	$\overline{I_A}$

U$_A$: analog voltage signal –10 V to +10 V;   **I$_A$:** analog current signal 4 mA to 20 mA
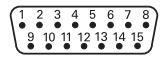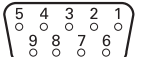
Cable shield connected to housing; **U$_P$** = Power supply voltage
Sensor: the sensor line is connected in the encoder with the corresponding power line
Vacant pins or wires must not be used!

Switching inputs/outputs on the ND 287

Switching inputs

The ND 287 evaluation unit features many inputs for external operation and outputs for switching functions.

The input can be addressed via a pulse or closed contact.

Exception: the switching inputs for transmitting measured values over the data interface are separate for contact and pulse.

The switching input E is active when a LOW signal U_L is applied (contact or pulse to 0 V).

Signal level

– $0.5\,V \leq U_L \leq 0.9\,V$ with $I_L \leq 6$ mA
  $3.9\,V \leq U_H \leq 15.0\,V$
$t_{min} \geq 30$ ms

Zero reset/preset

Each axis can be set by an external signal to the display value zero or to a value stored in a parameter (SET).

External control of measurement series Switching the display between MIN, MAX or DIFF

With a continuously applied LOW signal at the corresponding switching input, you activate the external control of measurement series. Starting a measurement series and switching to the MIN/MAX/DIFF display are controlled externally over additional switching inputs.

Ignoring reference mark signals

(reference pulse lock)
When the input is active, the readout ignores all reference mark signals. A typical application is linear measurement over a rotary encoder and lead screw.

Activating or deactivating REF mode

After switch-on or a power interruption, the digital readout can be switched externally to REF mode. The next signal then deactivates REF mode (switchover function).

Display with axis coupling

As an option, the ND 287 can have two encoder inputs. Using switching inputs, you can switch the display to individual measured values, sum, difference or any logical operation.

	ND 287
12 switching inputs	Reset, clear error message
	Set datum
	Ext. control of measurement series or display of X1[1]
	Start measurement series or display of f (X1, X2)[1]
	Display minimum MIN or display of X2[1]
	Display maximum MAX or display of X1 + X2[1]
	Display difference DIFF or display of X1 – X2[1]
	Measured value output (pulse)
	Measured value output (contact)
	Ignore reference mark signals (input X1)
	Ignore reference mark signals (input X2)
	Activating or deactivating REF mode
6 switching outputs	Display value is zero
	Measured value switching limit A1
	Measured value ≤ switching limit A2
	Measured value > upper sorting limit
	Measured value < lower sorting limit
	Error

[1] Also selectable by parameter
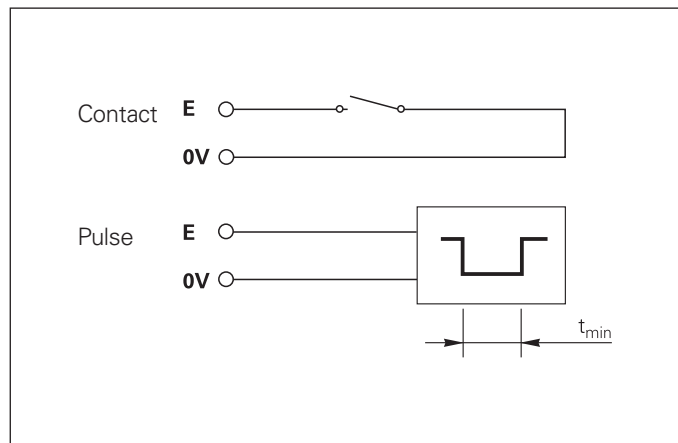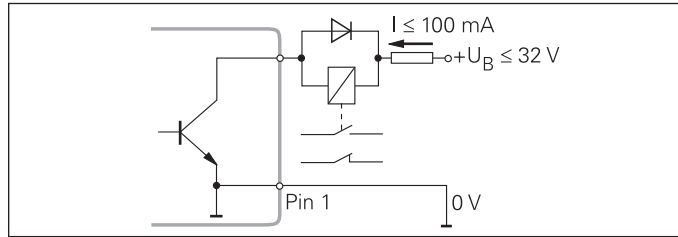
Switching outputs

The ND 287 features open-collector outputs that switch to 0 V (= active LOW).
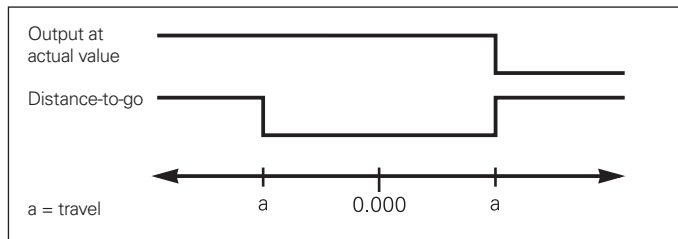
Delay of signal output:

$t_V \leq 20$ ms

Signal level

$U_L \leq 0.4$ V   with $I_L \leq 100$ mA
$U_H \leq 32$ V   with $I_H \leq 10$ µA

Trigger points (in actual value mode)
When the measured value reaches trigger points defined by parameters, the corresponding output becomes active. Up to two trigger points can be defined.

Switch-off ranges (distance-to-go mode)
In the distance-to-go mode the trigger points function as switch-off ranges. They are located symmetrically around the display value 0.
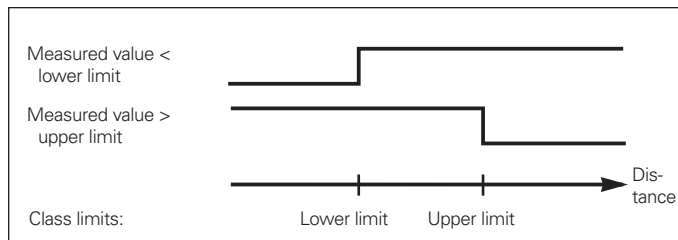
Sorting limits
When the measured value exceeds the limits defined via parameters, the corresponding outputs become active.

Trigger signal for error
The ND 200 series readouts constantly monitor the measuring signals, the input frequency, the data output, etc., for errors, and report errors as they occur with error messages. If errors occur that may distort the measurement or corrupt the data, the readout activates a switching output. This feature allows the monitoring of automated processes.
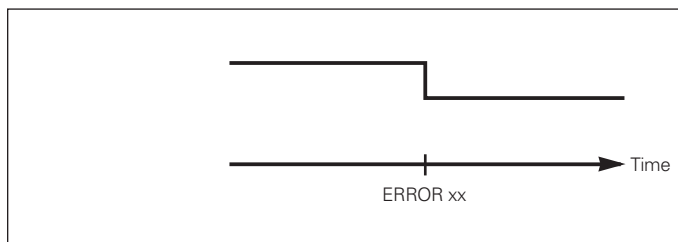
Zero crossover
At the display value "zero," the corresponding output becomes active. The minimum signal duration is 180 ms.
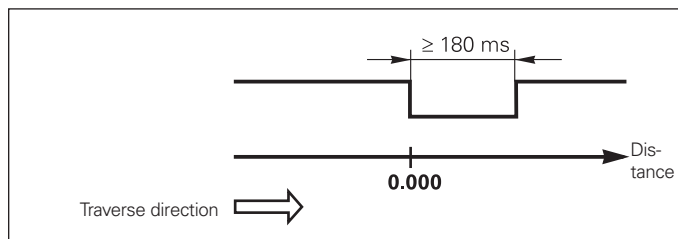
MSE 1000 inputs/outputs

Relay outputs

Specifications
$U_L \leq$ DC/AC 30 V
$I_L \leq 0.05$ A
$t_D \leq 25$ ms

Switching inputs

The switching inputs are active when a HIGH signal (contact or pulse) is present. They are isolated and can be supplied externally or internally.

Specifications
$0\,V \leq U_L \leq 1.5\,V$
$4.5\,V \leq U_H \leq 26\,V$
$I_L \leq 25$ mA
$t_{min} \geq 100$ ms

Switching inputs for internal power supply

Switching inputs for external power supply
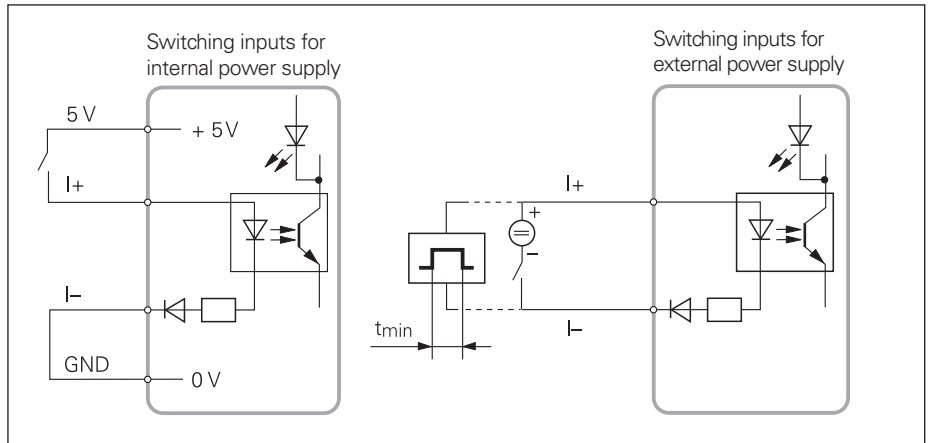
Relay outputs and switching inputs are integrated into the MSE 1401 input/output module, which is available in two versions.
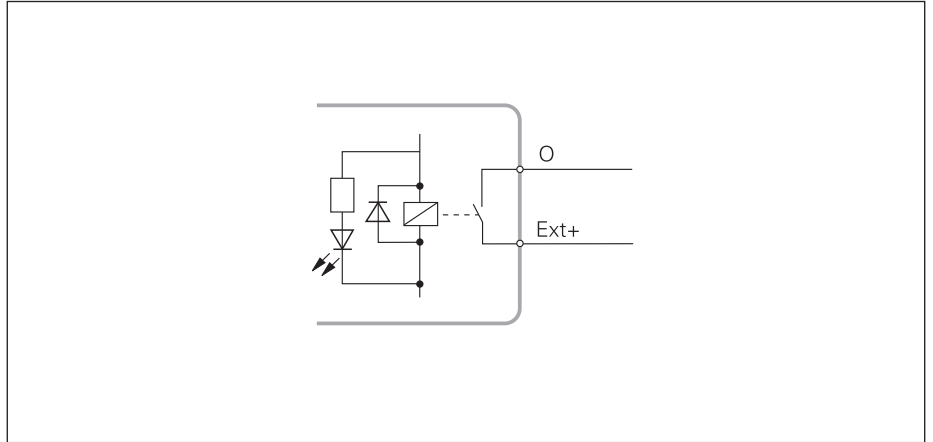
IP40 protection   Electrical connections as terminals
IP65 protection   Electrical connections as individual M8 connecting elements

IP 40 terminal block

X101		
1	5 V	DC 5 V [1]
2	Ext+	COMMON OUT [2]
3	GND	0 V [1]
1	O4	Output 4
2	O3	Output 3
3	O2	Output 2
4	O1	Output 1
5	I4	Input 4+
6		Input 4-
7	I3	Input 3+
8		Input 3-
9	I2	Input 2+
10		Input 2-
11	I1	Input 1+
12		Input 1-

X102

[1] For switching inputs: power supply (for the use of internal power)
[2] For relay outputs: common connection
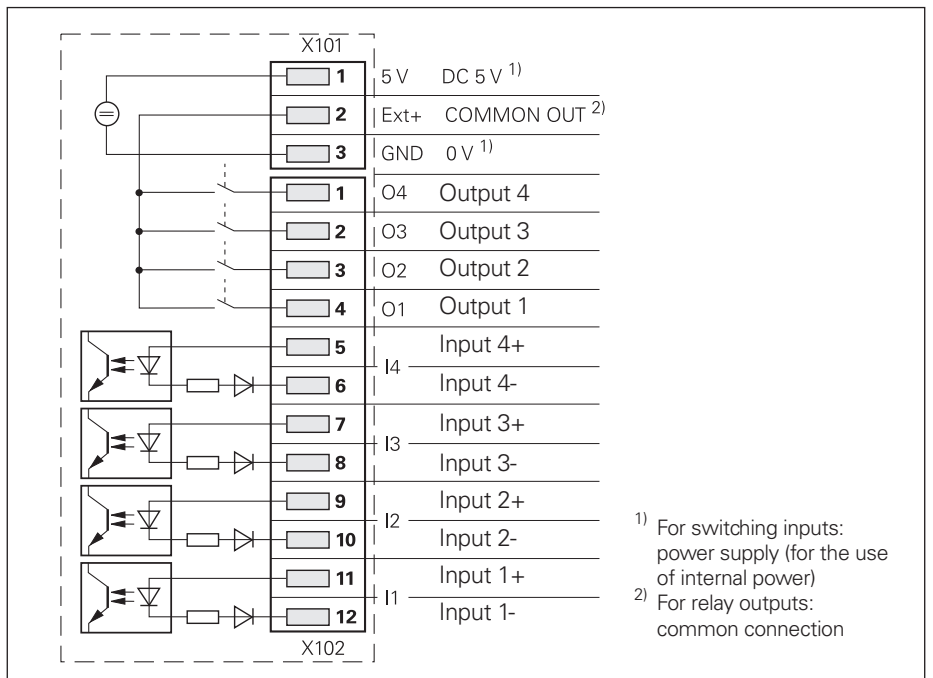
IP 65 relay outputs
Mating connector for MSE 1401 (IP65)
M8 coupling (male) 3-pin
ID 1071953-01

PIN	Assignment	
1	O	Output
3	Vacant	
4	Vacant	

IP 65 relay inputs
Mating connector for MSE 1401 (IP65)
M8 coupling (male) 3-pin
ID 1071953-01

PIN	Assignment	
1	I+	Entrance
4	I–	
3	Vacant	

IP 65 power supply
Mating connector for MSE 1202 and MSE 1401 (IP65)
M8 connector (female), 3-pin
ID 1071955-01
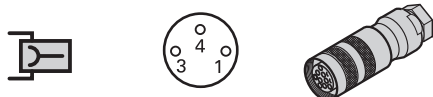
PIN	Assignment	
1	DC 5 V	*For switching inputs:* power supply (for the use of internal power)
4	0 V	
3	COMMON OUT	*For relay outputs:* Common connection

Supply unit

The MSE 1202 power-supply module with 24 V DC has an M8 connection

Mating connector
M8 connector (female), 3-pin

PIN	Assignment	
1	24 V DC	Voltage supply
3	0 V	
4	Vacant	

Software
QUADRA-CHEK Wedge

QUADRA-CHEK Wedge software
For communication between the
ND 280, 287/ND 1000/ND 2000 and PC
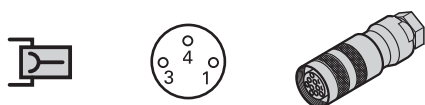ID 709141-01

The QUADRA-CHEK Wedge software
simplifies communication between an
ND 280, 287/ND 1000/ND 2000 and a
Windows-based PC. The measured values
are transmitted from the evaluation unit to
the PC via a RS-232-C connection and are
written directly to an Excel table, where
the data can be edited, saved, and printed.
A suitable RS-232-C cable* is included with
QUADRA-CHEK Wedge (cable length: 3 m).
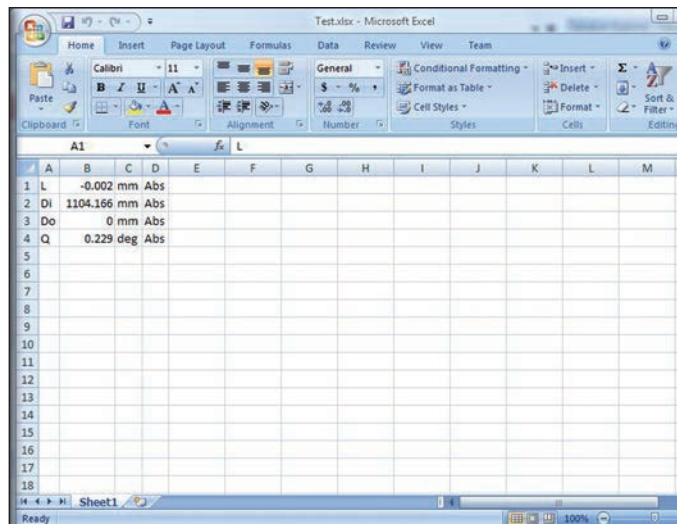
* Cable not suitable for ND 28x; cable for
  ND 28x can be ordered separately under
  ID 366964-03

System requirements
- Windows XP, Vista, 7, 8, or 10 (32-bit/64-bit)
- Internet Explorer 6.0 or higher
- Excel 2003 or later
- Windows user rights: Administrator
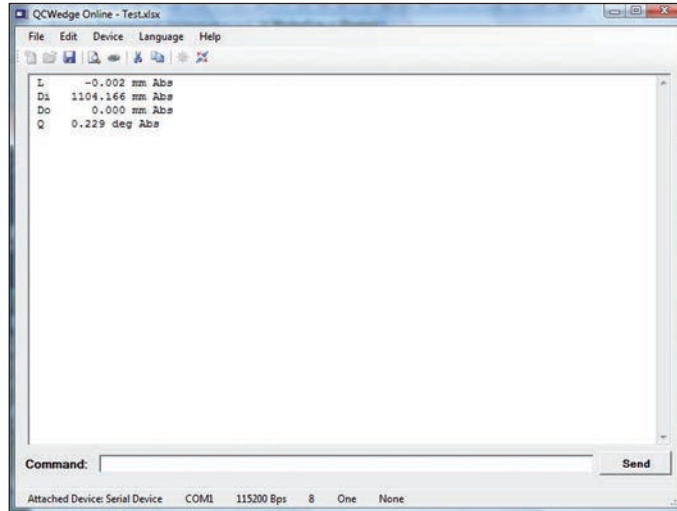
The values acquired by the evaluation electronics are transmitted to the PC ...

... and can be saved in an Excel table.

EIB 700 application software

The EIB application software covers two applications:

Commissioning and demonstration of the EIB 700
- Easy configuration of settings required for operation of the EIB 700 (e.g., input interface, data packets, operating mode, trigger settings).
- Management of one or more EIB 700 units.
- Simple representation of the positions transmitted by the EIB 700.
- Settings can be saved so that different application projects can be managed.

The user's guide provides more information.

Platform for customer applications

The EIB application software is made available in the source code. With this application as a basis, customers can rapidly implement their own applications. The application software was programmed using C++/CLI and Windows Forms in Visual Studio 2008. This programming environment is widely used in technical application programming but does not necessarily provide state-of-the-art operating techniques like those in Windows 10, for example. However, the customer can adapt the program to other graphic user interfaces.
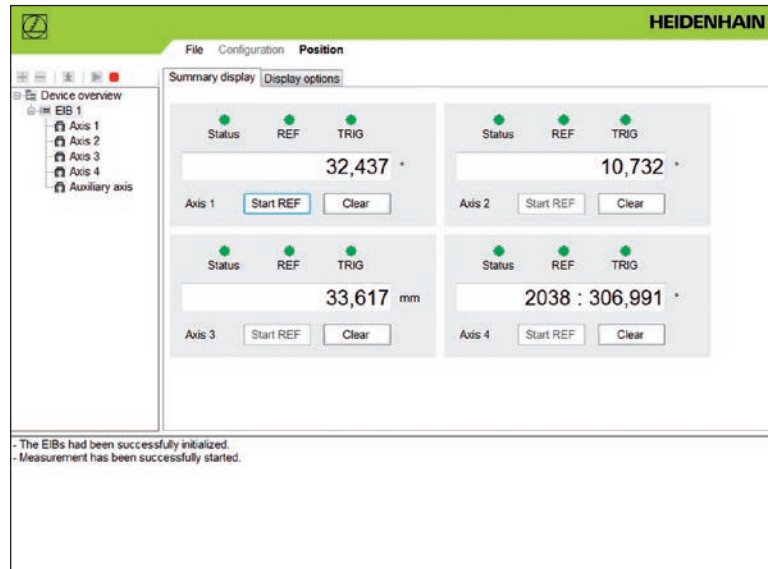
HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH
Dr.-Johannes-Heidenhain-Straße 5
83301 Traunreut, Germany
☎ +49 8669 31-0
FAX +49 8669 32-5061
E-mail: info@heidenhain.de

www.heidenhain.de

DE **HEIDENHAIN Vertrieb Deutschland**
83301 Traunreut, Deutschland
☎ 08669 31-3132
FAX 08669 32-3132
E-Mail: hd@heidenhain.de

HEIDENHAIN Technisches Büro Nord
12681 Berlin, Deutschland
☎ 030 54705-240

HEIDENHAIN Technisches Büro Mitte
07751 Jena, Deutschland
☎ 03641 4728-250

HEIDENHAIN Technisches Büro West
44379 Dortmund, Deutschland
☎ 0231 618083-0

HEIDENHAIN Technisches Büro Südwest
70771 Leinfelden-Echterdingen, Deutschland
☎ 0711 993395-0

HEIDENHAIN Technisches Büro Südost
83301 Traunreut, Deutschland
☎ 08669 31-1345

AR **NAKASE SRL.**
B1653AOX Villa Ballester, Argentina
www.heidenhain.com.ar

AT **HEIDENHAIN Techn. Büro Österreich**
83301 Traunreut, Germany
www.heidenhain.de

AU **FCR MOTION TECHNOLOGY PTY LTD**
Laverton North Victoria 3026, Australia
E-mail: sales@fcrmotion.com

BE **HEIDENHAIN NV/SA**
1760 Roosdaal, Belgium
www.heidenhain.be

BG **ESD Bulgaria Ltd.**
Sofia 1172, Bulgaria
www.esd.bg

BR **HEIDENHAIN Brasil Ltda.**
04763-070 – São Paulo – SP, Brazil
www.heidenhain.com.br

BY **GERTNER Service GmbH**
220026 Minsk, Belarus
www.heidenhain.by

CA **HEIDENHAIN CORPORATION**
Mississauga, OntarioL5T2N2, Canada
www.heidenhain.com

CH **HEIDENHAIN (SCHWEIZ) AG**
8603 Schwerzenbach, Switzerland
www.heidenhain.ch

CN **DR. JOHANNES HEIDENHAIN (CHINA) Co., Ltd.**
Beijing 101312, China
www.heidenhain.com.cn

CZ **HEIDENHAIN s.r.o.**
102 00 Praha 10, Czech Republic
www.heidenhain.cz

DK **TP TEKNIK A/S**
2670 Greve, Denmark
www.tp-gruppen.dk

ES **FARRESA ELECTRONICA S.A.**
08028 Barcelona, Spain
www.farresa.es

FI **HEIDENHAIN Scandinavia AB**
01740 Vantaa, Finland
www.heidenhain.fi

FR **HEIDENHAIN FRANCE sarl**
92310 Sèvres, France
www.heidenhain.fr

GB **HEIDENHAIN (G.B.) Limited**
Burgess Hill RH15 9RD, United Kingdom
www.heidenhain.co.uk

GR **MB Milionis Vassilis**
17341 Athens, Greece
www.heidenhain.gr

HK **HEIDENHAIN LTD**
Kowloon, Hong Kong
E-mail: sales@heidenhain.com.hk

HR Croatia → **SL**

HU **HEIDENHAIN Kereskedelmi Képviselet**
1239 Budapest, Hungary
www.heidenhain.hu

ID **PT Servitama Era Toolsindo**
Jakarta 13930, Indonesia
E-mail: ptset@group.gts.co.id

IL **NEUMO VARGUS MARKETING LTD.**
Holon, 58859, Israel
E-mail: neumo@neumo-vargus.co.il

IN **HEIDENHAIN Optics & Electronics India Private Limited**
Chetpet, Chennai 600 031, India
www.heidenhain.in

IT **HEIDENHAIN ITALIANA S.r.l.**
20128 Milano, Italy
www.heidenhain.it

JP **HEIDENHAIN K.K.**
Tokyo 102-0083, Japan
www.heidenhain.co.jp

KR **HEIDENHAIN Korea LTD.**
Gasan-Dong, Seoul, Korea 153-782
www.heidenhain.co.kr

MX **HEIDENHAIN CORPORATION MEXICO**
20290 Aguascalientes, AGS., Mexico
E-mail: info@heidenhain.com

MY **ISOSERVE SDN. BHD.**
43200 Balakong, Selangor
E-mail: sales@isoserve.com.my

NL **HEIDENHAIN NEDERLAND B.V.**
6716 BM Ede, Netherlands
www.heidenhain.nl

NO **HEIDENHAIN Scandinavia AB**
7300 Orkanger, Norway
www.heidenhain.no

NZ **Llama ENGINEERING Ltd**
5012 Wellington, New Zealand
E-mail: info@llamaengineering.co.nz

PH **MACHINEBANKS' CORPORATION**
Quezon City, Philippines 1113
E-mail: info@machinebanks.com

PL **APS**
02-384 Warszawa, Poland
www.heidenhain.pl

PT **FARRESA ELECTRÓNICA, LDA.**
4470 - 177 Maia, Portugal
www.farresa.pt

RO **HEIDENHAIN Reprezentanţă Romania**
Braşov, 500407, Romania
www.heidenhain.ro

RS Serbia → **BG**

RU **OOO HEIDENHAIN**
115172 Moscow, Russia
www.heidenhain.ru

SE **HEIDENHAIN Scandinavia AB**
12739 Skärholmen, Sweden
www.heidenhain.se

SG **HEIDENHAIN PACIFIC PTE LTD**
Singapore 408593
www.heidenhain.com.sg

SK **KOPRETINA TN s.r.o.**
91101 Trencin, Slovakia
www.kopretina.sk

SL **NAVO d.o.o.**
2000 Maribor, Slovenia
www.heidenhain.si

TH **HEIDENHAIN (THAILAND) LTD**
Bangkok 10250, Thailand
www.heidenhain.co.th

TR **T&M Mühendislik San. ve Tic. LTD. ŞTİ.**
34775 Y. Dudullu –
Ümraniye-Istanbul, Turkey
www.heidenhain.com.tr

TW **HEIDENHAIN Co., Ltd.**
Taichung 40768, Taiwan R.O.C.
www.heidenhain.com.tw

UA **Gertner Service GmbH Büro Kiev**
02094 Kiev, Ukraine
www.heidenhain.ua

US **HEIDENHAIN CORPORATION**
Schaumburg, IL 60173-5337, USA
www.heidenhain.com

VE **Maquinaria Diekmann S.A.**
Caracas, 1040-A, Venezuela
E-mail: purchase@diekmann.com.ve

VN **AMS Co. Ltd**
HCM City, Vietnam
E-mail: davidgoh@amsvn.com

ZA **MAFEMA SALES SERVICES C.C.**
Midrand 1685, South Africa
www.heidenhain.co.za