HEIDENHAIN

QUADRA-CHEK 3000

Operating Instructions

Evaluation Electronics

English (en)
6/2016

Contents

1

Fundamentals

1.1 About these instructions

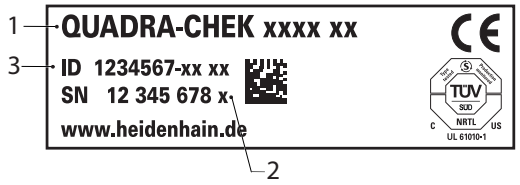
These instructions provide all the information and safety precautions needed for the safe operation of the product.

1.2 Information on the product

Product designation	Part number	Firmware version	Index
QUADRA-CHEK 30x4	1089174-xx	826880.1.0.x	

The ID label is provided on the rear panel of the unit.

Example:



1 Product designation
2 Index
3 Part number

Validity of the documentation

Before using the documentation and the product, you need to verify that the documentation matches the product.

- Compare the part number and the index indicated in the documentation with the corresponding data given on the ID label of the product
- Compare the firmware version given in the documentation with the firmware version of the product

Further information: "Device information", page 313

> If the part numbers and indexes as well as the firmware versions match, the documentation is valid

If the part numbers and indexes as well as the firmware versions do not match so that the documentation is not valid, you will find the current documentation for the product at www.heidenhain.de.

1.3 Notes on reading the documentation

The table below lists the components of the documentation in the order of priority for reading.

⚠ WARNING

Fatal accidents, personal injury or property damage caused by non-compliance with the documentation!

Failure to comply with the documentation may result in fatal accidents, personal injury or property damage.

- Read the documentation carefully from beginning to end
- Keep the documentation for future reference

Documentation	Description
Addendum	An addendum supplements or supersedes the corresponding contents of the Operating Instructions and, if applicable, of the Installation Instructions. If this document is included in delivery, read it first before you proceed. All other contents of the documentation retain their validity.
Installation Instructions	The Installation Instructions contain all the information and safety precautions needed for the proper mounting and installation of the product. They are an excerpt from the Operating Instructions and are included in every delivery. This document has the second highest priority for reading.
Operating Instructions	The Operating Instructions contain all the information and safety precautions needed for the proper operation of the product according to its intended use. This document has the third highest priority for reading. This documentation is included on the supplied storage medium and can be downloaded from the download area at **www.heidenhain.de**. The Operating Instructions must be printed prior to commissioning the product.
Documentation of connected measuring devices and other peripherals	These documents are not included in delivery. They are shipped with the respective measuring devices and peripherals.

Would you like any changes, or have you found any errors?

We are continuously striving to improve our documentation for you. Please help us by sending your requests to the following e-mail address:

userdoc@heidenhain.de

1.4 Storage and distribution of the documentation

These instructions must be kept in the immediate vicinity of the workplace and must be available to all personnel at all times. The operating company must inform the personnel where these instructions are kept. If the instructions have become illegible, the operating company must obtain a new copy from the manufacturer.

If the product is handed over or sold to a third party, the following documents must be given to the new owner:

- Addendum, if supplied
- Installation Instructions
- Operating Instructions

1.5 Target group for the instructions

The Operating Instructions must be read and observed by every person who performs any of the following tasks:

- Mounting
- Installation
- Commissioning
- Setup, programming and operation
- Service, cleaning and maintenance
- Troubleshooting
- Removal
- Disposal

1.6 Notes in this documentation

Safety precautions

Comply with all safety precautions indicated in these Operating Instructions and in your machine tool builder's documentation!

Precautionary statements warn of hazards in handling the product and provide information on their prevention. They are classified according to the severity of the danger, and are divided into the following groups:

⚠ DANGER

Danger indicates hazards for persons. If you do not follow the avoidance instructions, the hazard will **result in death or severe injury.**

⚠ WARNING

Warning indicates hazards for persons. If you do not follow the avoidance instructions, the hazard **could result in death or serious injury.**

⚠ CAUTION

Caution indicates hazards for persons. If you do not follow the avoidance instructions, the hazard **could result in minor or moderate injury.**

NOTICE

Notice indicates danger to material or data. If you do not follow the avoidance instructions, the hazard **could result in things other than personal injury, like property damage**.

Informational notes
Observe the informational notes provided in these instructions to ensure reliable and efficient operation of the product.
In these instructions, you will find the following informational notes:

The information symbol indicates a **tip**.
A tip provides important additional or supplementary information.

The gear symbol indicates that the function described **depends on the machine,** e.g.

- Your machine must feature a certain software or hardware option
- The behavior of the functions depends on the configurable machine settings

The book symbol represents a **cross reference** to external documentation, e.g. the documentation of your machine tool builder or other supplier.

1.7 Symbols and fonts used for marking text

In these instructions the following symbols and fonts are used for marking text:

Format	Meaning
▶ ...	identifies an action and the result of this action
> ...	Example: ▶ Tap **Finish** in the feature > The measured contour is shown in green
■ ...	identifies an item of a list
■ ...	Example:
Bold	identifies menus, tabs and buttons as well as geometry features, functions and parameters. Example: ▶ Select **Manual measuring** ▶ Select **Circle**

2

Safety

2.1 General safety precautions

General accepted safety precautions, in particular the applicable precautions relating to the handling of live electrical equipment, must be followed when operating the system. Failure to observe these safety precautions may result in personal injury or damage to the product.

It is understood that safety rules within individual companies vary. If a conflict exists between the material contained in these instructions and the rules of a company using this system, the more stringent rules take precedence.

2.2 Intended use

The products of the QUADRA-CHEK 3000 series are advanced digital evaluation electronics for the measurement of 2-D and 3-D features in metrological applications. The products are used primarily on measuring machines, profile projectors and video measuring machines. With the QUADRA-CHEK 3000 NC1 software option, measuring tasks can be automated completely.

The products of the QUADRA-CHEK 3000 series

- must only be used in commercial applications and in an industrial environment
- must be mounted on a suitable stand or holder to ensure the correct and intended operation of the product
- are intended for indoor use in an environment that is free from humidity, dirt, oil and lubricants (see Specifications)

The products of the QUADRA-CHEK 3000 series support the use of a wide variety of peripheral devices from different manufacturers. HEIDENHAIN cannot make any statements on the intended use of these devices. The information on their intended use, which is provided in the associated documentations, must be observed.

2.3 Improper use

When the products are used with the QUADRA-CHEK 3000 NC1 software option for automated measuring tasks, it must be ensured that no hazard to persons can result. If any such hazard exists, appropriate measures must be taken by the operating company.

In particular, the following applications are not permitted:

- Use and storage outside the specifications
- Outdoor use
- Use in potentially explosive atmospheres
- Use of the products of the QUADRA-CHEK 3000 series as part of a safety function

2.4 Personnel qualification

The personnel for mounting, installation, operation, service, maintenance and removal must be appropriately qualified for this work and must have obtained sufficient information from the documentation supplied with the product and with the connected peripherals.

The personnel required for the individual activities to be performed on the product are indicated in the respective sections of these instructions.

The personnel groups that are responsible for mounting, installation, operation, maintenance and removal have different qualifications and tasks, which are specified as follows.

Operator
The operator uses and operates the product within the framework specified for the intended use. The user is informed by the operating company about the special tasks and about the potential risks involved with improper handling.

Qualified personnel
The qualified personnel are trained by the operating company to perform advanced operation and parameterization. The qualified personnel have the required technical training, knowledge and experience and know the applicable regulations, and are thus capable of performing the assigned work regarding the application concerned and of proactively identifying and avoiding potential risks.

Electrical specialist
The electrical specialist has the required technical training, knowledge and experience and knows the applicable standards and regulations, and is thus capable of performing work on electrical systems and of proactively identifying and avoiding potential risks. Electrical specialists have been specially trained for the environment they work in.

Electrical specialists must comply with the provisions of the applicable legal regulations on accident prevention.

2.5 Obligations of the operating company

The operating company owns or leases the product and the peripherals. It is responsible that the intended use is complied with at all times.

The operating company must:

- Assign the different tasks to be performed on the product to appropriate, qualified and authorized personnel
- Verifiably train the personnel in the authorizations and tasks
- Provide all materials and means necessary in order for the personnel to complete the assigned tasks
- Ensure that the product is operated only when in perfect technical condition
- Ensure that the product is protected from unauthorized use

2.6 General safety precautions

NOTICE

Damage to the operating system!

Disconnecting the power source while the product is on can damage the operating system of the product.

- Use the **Switch-off** menu on the touchscreen to shut down the product.
- Do not disconnect the power source while the product is on.
- Do not turn the power switch off until the product has shut down.

NOTICE

Loss of or damage to configuration data!

- Back up the configuration data for restoration purposes.

Further information: "Backing up and restoring the configuration", page 346

The safety of any system incorporating the use of this product is the responsibility of the assembler or installer of the system.

The product supports the use of a wide variety of peripheral devices from different manufacturers. HEIDENHAIN cannot make any statements on the specific safety precautions to be taken for these devices. The safety precautions provided in the respective documentations must be observed. If no such information has been supplied, it must be obtained from the manufacturers concerned.

The specific safety precautions required for the individual activities to be performed on the product are indicated in the respective sections of these instructions.

2.6.1 Symbols in the Operating Instructions

The following safety symbols are used in this document:

Symbol	Meaning
	identifies information that warns of personal injury
	identifies electrostatic sensitive devices (ESD)
	ESD wristband for personal grounding

2.6.2 Symbols on the product

The following symbols are used to identify the product:

Symbol on the product	Meaning
	Observe the safety precautions regarding electricity and power connection before you connect the product.
	Functional ground connection as per IEC/EN 60204-1. Observe the information on installation.
	Product seal. Breaking or removing the product seal will result in forfeiture of warranty and guarantee.

2.6.3 Electrical safety instructions

⚠ WARNING

Hazard of contact with live parts when opening the product.

This may result in electric shock, burns or death.

- Never open the housing
- Only the manufacturer is permitted to access the inside of the product

NOTICE

Damage to internal parts of the product!

Opening the product will result in forfeiture of warranty and guarantee.

- Never open the housing
- Only the product manufacturer is permitted to access the inside of the product

⚠ WARNING

Hazard of dangerous amount of electricity passing through the human body upon direct or indirect contact with live electrical parts.

This may result in electric shock, burns or death.

- Work on the electrical system and live electrical components is to be performed only by trained specialists
- For power connection and all interface connections, use only cables and connectors that comply with applicable standards
- Have the manufacturer exchange defective electrical components immediately
- Regularly inspect all connected cables and all connections on the product. Defects, such as loose connections or scorched cables, must be removed immediately

3

Transport and storage

3.1 Overview

This chapter contains all the information necessary for the transportation and storage of the product and provides an overview of all the items supplied and the available accessories of the product.

3.2 Unpacking

- Open the top lid of the box
- Remove the packaging materials
- Unpack the contents
- Check the delivery for completeness
- Check the delivery for damage

3.3 Items supplied and accessories

Items supplied
The following items are included in the shipment:

- Device
- Installation Instructions
- Storage medium with Operating Instructions
- Addendum (optional)
  Further information: "Notes on reading the documentation", page 13
- 2-D demo part

Accessories
The following accessories are optionally available and can be ordered from HEIDENHAIN:

Accessories	Part number
Duo-Pos stand For rigid mounting, inclination angle 20° or 45°	1089230-02
Multi-Pos stand For steplessly variable tilting within an angle of 90°	1089230-03
Multi-Pos holder For fastening on an arm, continuously tiltable within an angle of 90°	1089230-04
USB connecting cable Connector Type A to Type B	354770-xx
Calibration standard	681047-01
2-D demo part	681047-02
Adapter connector HEIDENHAIN TTL to RSF TTL and RENISHAW TTL	1089210-01

The software options listed below are not enabled in the standard firmware of the product. Whether the below hardware accessories can be used depends on the software option. The accessories indicated for the software options can only be used in conjunction with the enabled software option.

Accessories	Part number
QUADRA-CHEK 3000 VED software option ■ Display, evaluation and archiving of live images from digital cameras ■ Manual or automatic acquisition of measuring points via video edge detection ■ Programmable control of lighting	1089229-02
QUADRA-CHEK 3000 AF software option	1089229-03
QUADRA-CHEK 3000 Z software option	1089229-04
QUADRA-CHEK 3000 OED software option	1089229-08
Fiber-optic cable With right-angle end	681049-xx
Fiber-optic connection Two SMA connectors	681049-xx
Holder With a hole for accepting the right-angle end of fiber-optic cables	681050-xx
QUADRA-CHEK 3000 TP software option	1089229-09
3-D demo part	681048-01
3-D demo part for multi-sensor scanning	681048-02
Adapter cable for touch-probe connection, DIN 5-pin female, for connection of Renishaw touch probes	1095709-xx
TS 248 touch probe	Cable outlet: Axial: 683110-xx Radial: 683112-xx
KT 130 edge finder	283273-xx
QUADRA-CHEK 3000 AEI1 software option ■ Enabling of an additional encoder input	1089229-01
QUADRA-CHEK 3000 NC1 software option	1089229-07

1) Only in conjunction with **QUADRA-CHEK 3000 VED software option**
2) Only in conjunction with **QUADRA-CHEK 3000 OED software option**
3) Only in conjunction with **QUADRA-CHEK 3000 TP software option**

The product supports only cameras from camera manufacturer IDS Imaging Development Systems GmbH.
The product supports only cameras with a maximum resolution of 2.0 megapixels.

For connection, HEIDENHAIN recommends the use of USB connecting cables from the manufacturer IDS Imaging Development Systems GmbH.

HEIDENHAIN recommends the following cameras from IDS Imaging Development Systems GmbH:

Part no.:	Model designation:	Resolution:
AB00795	UI-1240LE-C-HQ	1.31 megapixels
AB00796	UI-1240LE-M-GL	1.31 megapixels
AB00799	UI-1250LE-C-HQ	1.92 megapixels
AB00800	UI-1250LE-M-GL	1.92 megapixels
AB00797	UI-1240SE-C-HQ	1.31 megapixels
AB00798	UI-1240SE-M-GL	1.31 megapixels
AB00801	UI-1250SE-C-HQ	1.92 megapixels
AB00802	UI-1250SE-M-GL	1.92 megapixels

3.4 In case of damage in transit

- Have the shipping agent confirm the damage
- Keep the packaging materials for inspection
- Notify the sender of the damage
- Contact the distributor or machine manufacturer for replacement parts

In case of damage in transit:

- Keep the packaging materials for inspection
- Contact HEIDENHAIN or the machine manufacturer

This applies also if damage occurred to requested replacement parts during transit.

3.5 Repackaging and storage

Repackage and store the product carefully in accordance with the conditions stated below.

Repackaging

Repackaging should correspond to the original packaging as closely as possible.

- Attach all mounting parts and dust protection caps to the product or repackage them in the same way they were originally shipped from the factory.
- Repackage the product such that it is protected from impact and vibration during transit
- Repackage the product such that it is protected from the ingress of dust or humidity
- Place all accessories that were included in the shipment in the original packaging
  Further information: "Items supplied and accessories", page 24
- Include the Addendum (if it was included in the items supplied), the Installation Instructions and the Operating Instructions
  Further information: "Storage and distribution of the documentation", page 14

If you return the product for repair to a service agency:

- Ship the product without accessories, without measuring devices and without peripherals

Storage of the product

- Package the product as described above
- Observe the specified ambient conditions
- Inspect the product for damage after any transport or longer storage times

4

Mounting

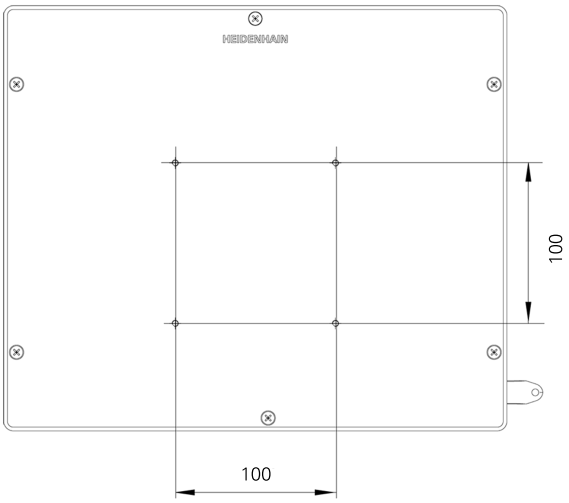
4.1 Overview

This chapter contains all the information necessary for mounting the product.

The following steps are only to be performed by qualified personnel.
Further information: "Personnel qualification", page 19

4.2 Assembly of the device

General mounting information
The receptacle for the mounting variants is provided on the rear panel. The connection is compatible with VESA standard 100 mm x 100 mm.



The material for attachment of the mounting variants on the device is included in delivery.

You will also need the following:

- Torx T20 screwdriver
- Torx T25 screwdriver
- Hex key, width A/F 2.5 (Duo-Pos stand)
- Material for mounting on supporting surface

The product must be mounted on a stand or holder to ensure the correct and intended operation of the product.

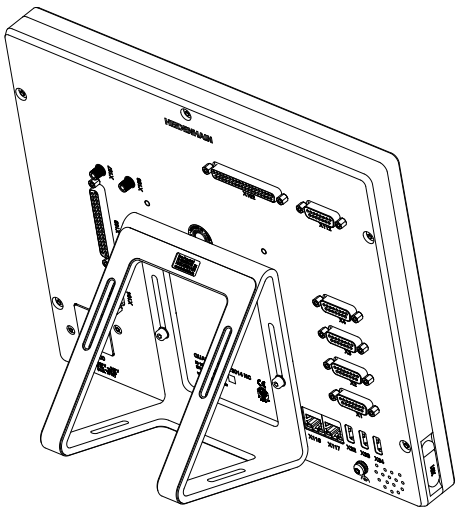
4.2.1 Mounting on Duo-Pos stand

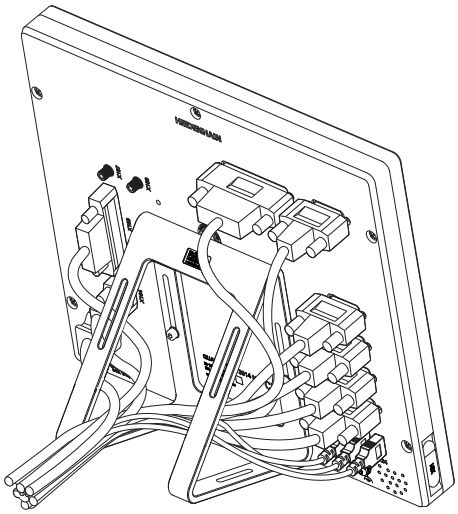
You can attach the Duo-Pos stand to the product at a 20° or 45° angle.

Use the two supplied M4 x 8 ISO 7380 hexagon socket screws to attach the stand to the lower threaded holes on the rear panel. The permissible tightening torque is 2.5 Nm.

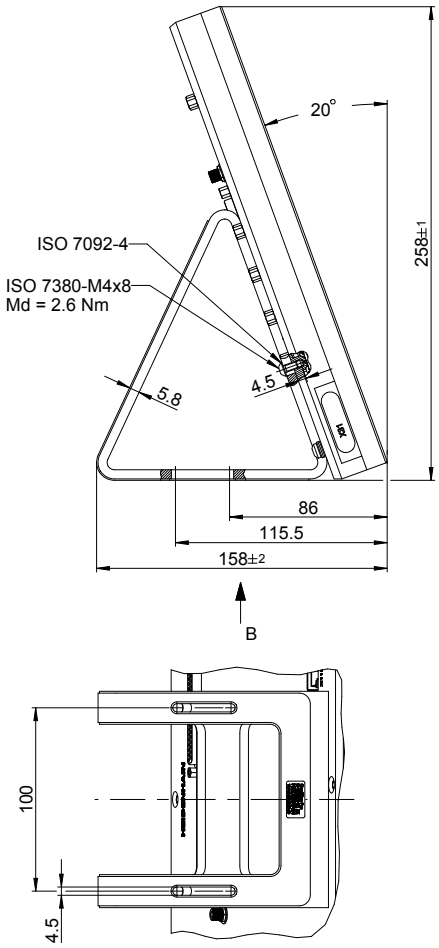
Using the mounting slots (width = 4.5 mm), you can screw the stand to a supporting surface.

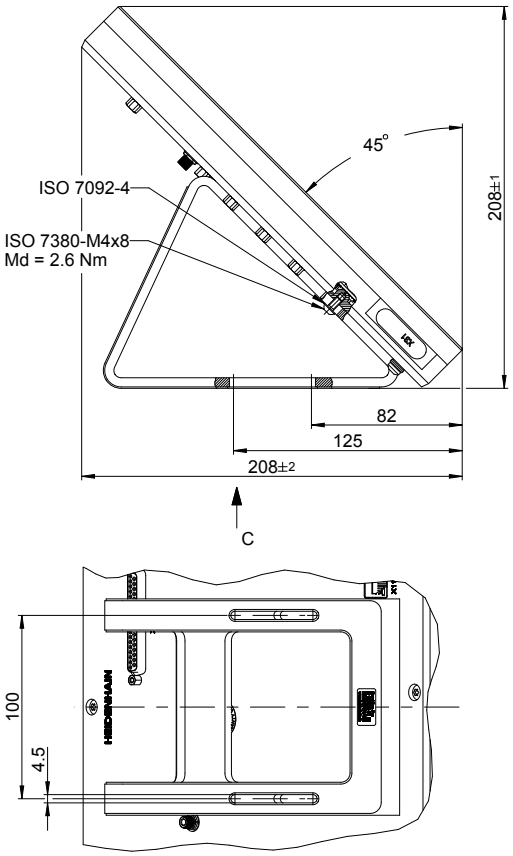
The cables are routed together through the two supports of the stand from behind and then through the lateral openings to the connections.





Dimensions of the Duo-Pos stand





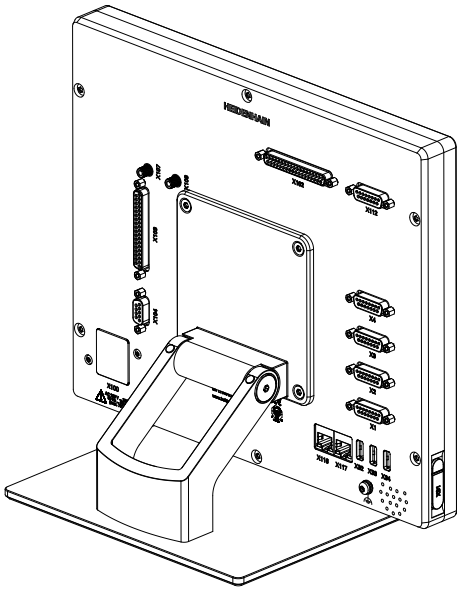
4.2.2 Mounting on Multi-Pos stand

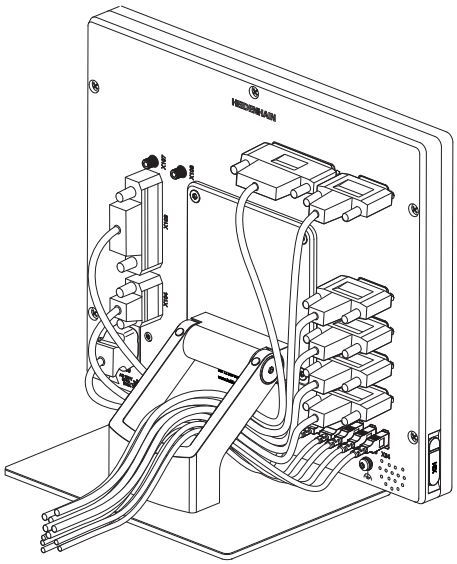
Use the four supplied M4 x 8 ISO 14581 (black) countersunk screws for attachment to the threaded holes on the rear panel. The permissible tightening torque is 2.5 Nm.

Using two M5 screws, you can screw the stand to a supporting surface from the bottom.

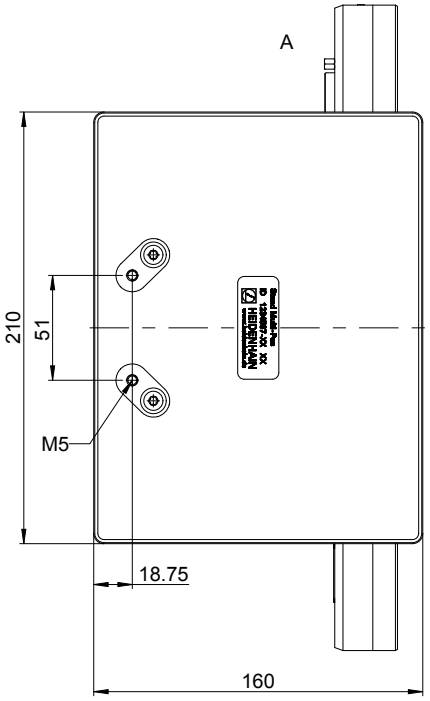
You can tilt the stand to any angle within the 90° tilt range. The recommended tightening torque for the T25 screw is 5.0 Nm. The maximum permissible tightening torque for the T25 screw is 15.0 Nm.

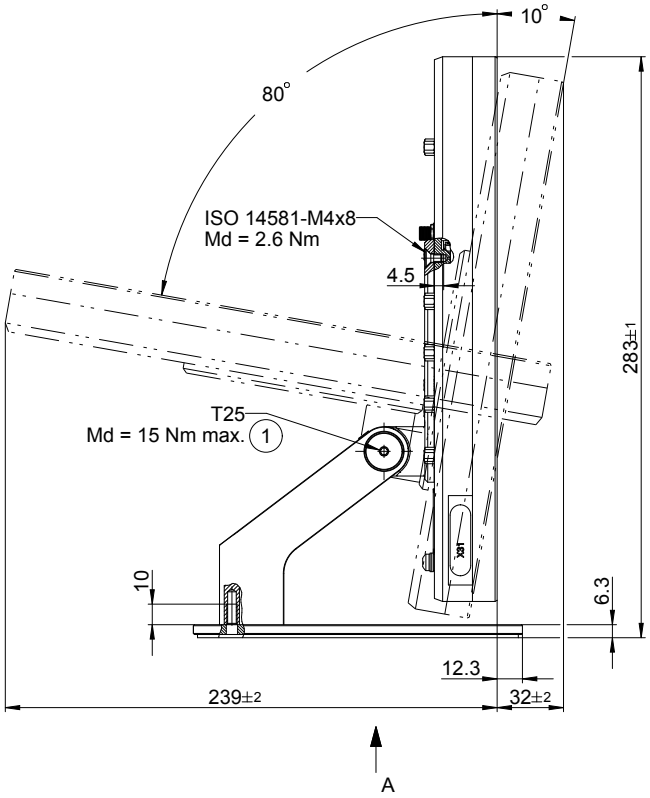
The cables are routed together through the opening in the stand from behind and then laterally below the joint to the connections.





Dimensions of the Multi-Pos stand



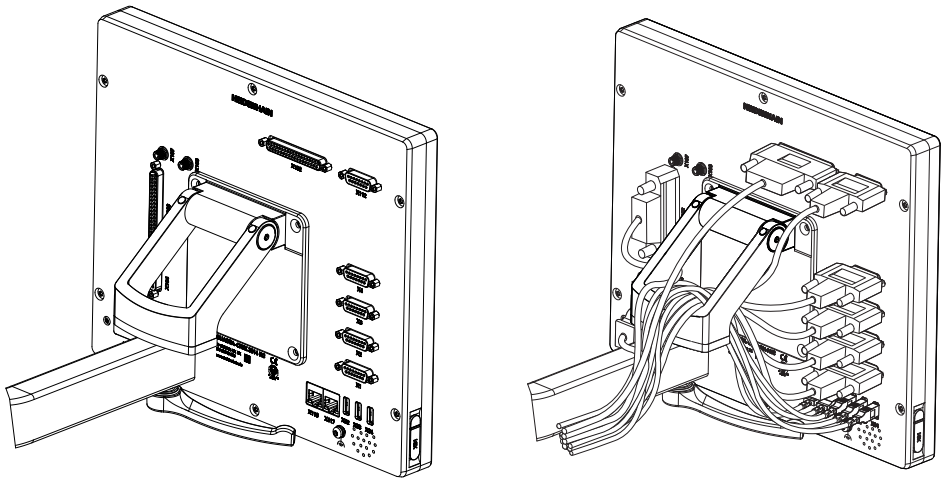


4.2.3 Mounting on Multi-Pos holder

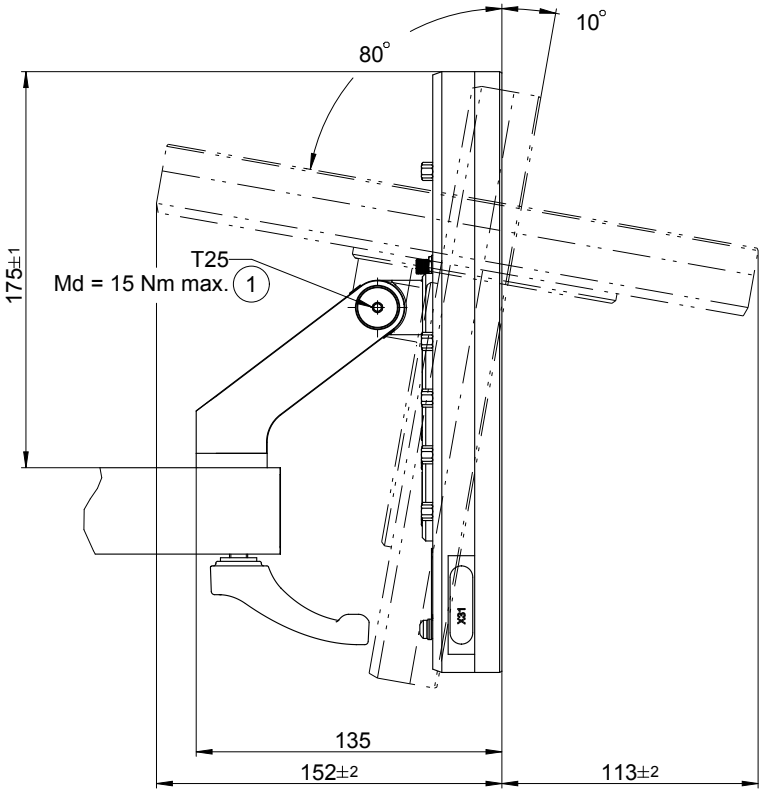
Use the four supplied M4 x 8 ISO 14581 (black) countersunk screws for attachment to the threaded holes on the rear panel. The permissible tightening torque is 2.5 Nm.

You can tilt the holder to any angle within the 90° tilt range. The recommended tightening torque for the T25 screw is 5.0 Nm. The maximum permissible tightening torque for the T25 screw is 15.0 Nm.

The cables are routed together through the opening in the holder from behind and then laterally to the connections.



Dimensions of the Multi-Pos holder



5

Installation

5.1 Overview

This chapter contains all the information necessary for installing the product.

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", page 19

5.2 General information

NOTICE

Interference from sources of high electromagnetic emission!

Peripheral devices, such as frequency inverters or servo drives, may cause interference.

To increase the noise immunity to electromagnetic influences:

- Use the optional functional ground connection as per IEC/EN 60204-1
- Use only USB peripherals with continuous shielding, e.g. by metalized film and metal braiding or a metal housing. The degree of coverage provided by the braiding must be 85 % or higher. The shield must be connected around the entire circumference of the connectors (360° connection).

NOTICE

Engaging and disengaging connecting elements!

Risk of damage to internal components.

- Do not engage or disengage any connecting elements while the unit is under power

NOTICE

Electrostatic discharge (ESD)!

This product contains electrostatic sensitive components that can be destroyed by electrostatic discharge (ESD).

- It is essential to observe the safety precautions for handling ESD-sensitive components
- Never touch connector pins without ensuring proper grounding
- Wear a grounded ESD wristband when handling product connections

5.3 Product overview

The connections on the rear panel of the device are protected by dust protection caps from contamination and damage.

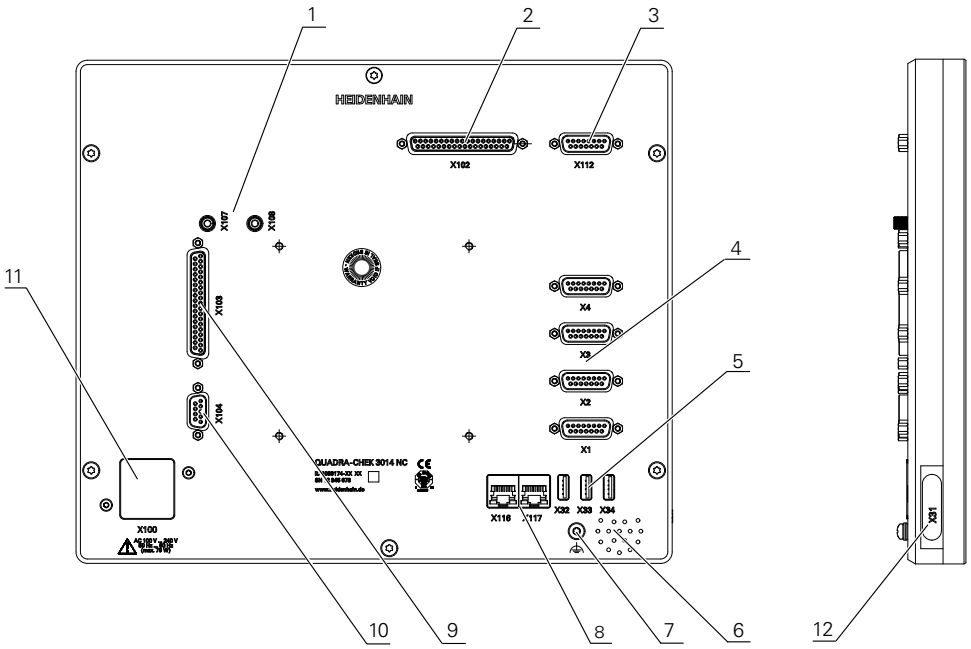
NOTICE

Contamination or damage may result if the dust protection caps are missing!

This may impair the proper functioning of the contacts or destroy them.

- Remove dust protection caps only when connecting measuring devices or peripherals
- If you remove a measuring device or peripheral, re-attach the dust protection cap to the connection

The type of connections for encoders may vary depending on the product version.



Rear panel

Connections that are independent of software options:

4 D-sub connections for encoders, 2 inputs enabled by default, another 2 inputs can be enabled optionally

X1 to X4: Device variant with 15-pin D-sub connections for encoders with 1 V_{pp} interface

X21 to X24: Device variant with 9-pin D-sub connections for encoders with a TTL interface

5 USB ports, Hi-Speed USB 2.0 (Type A)

X32: Connection for digital camera, printer or USB mass storage device

X33 to X34: Connection for printer or USB mass storage device

6 Speaker

7 Functional ground connection as per IEC/EN 60204-1

8 RJ45 Ethernet connections

X116: Connection for communication and data exchange with subsequent systems or PC

11 **X100**: Power switch and power connection

Connections that depend on software options:

1 Connections for optical edge detector for point measurement

X107: Reference input for optical waveguide from the light source

X108: Input for optical waveguide from the projection screen

2 **X102**: 37-pin D-sub connection for digital TTL interface (8 inputs, 16 outputs)

3 **X112**: 15-pin D-sub connection for touch probes (e.g. HEIDENHAIN touch probe)

8 RJ45 Ethernet connections

X117: Connection for digital camera

9 **X103**: 37-pin D-sub connection for digital or analog interface (TTL 4 inputs, 6 outputs; analog 3 inputs, 10 outputs)

10 **X104**: 9-pin D-sub connection for universal relay interface (2x relay changeover contacts)

Left side panel

12 **X31** (below protective cover):
Hi-Speed USB 2.0 port (Type A) for printer or USB mass storage device

5.4 Connecting encoders

The type of connections for encoders may vary depending on the product version.

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant.
  Further information: "Assembly of the device", page 30
- Connect the encoder cables tightly to the respective connections.
  Further information: "Product overview", page 39
- If the cable connectors include mounting screws, do not overtighten them

NOTICE

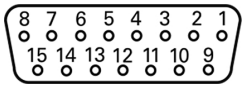
Incorrect pin assignment!

This may cause product malfunctions or damage to the product.

- Only assign pins or wires that are used

Pin layout of X1–X4

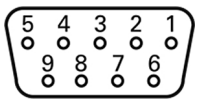
1 V_{PP}



1	2	3	4	5	6	7	8
A+	0 V	B+	U_P	/	/	R-	/
9	**10**	**11**	**12**	**13**	**14**	**15**	
A-	Sensor 0 V	B-	Sensor U_P	/	R+	/	

Pin layout of X21–X24

TTL



1	2	3	4	5	6	7	8	9
/	U_{a1}	$\overline{U_{a1}}$	U_{a2}	$\overline{U_{a2}}$	0 V	U_p	$\overline{U_{a0}}$	U_{a0}

5.5 Wiring of switching inputs and outputs

⚠ WARNING

Hazard when using switching inputs for safety functions!

If switching inputs for mechanical limit switches are used for safety functions, severe injury or death can result.

- Do not use the switching inputs for mechanical limit switches for safety functions

NOTICE

Damage to the product due to incorrect wiring!

Incorrect wiring of switching inputs or switching outputs can cause damage to the product or peripheral devices.

- Comply with the specifications of the product
  Further information: "Specifications", page 365

The encoder fulfills the requirements of standard IEC 61010-1 only if the power to the peripheral devices is supplied from a secondary circuit with current limitation as per IEC 61010-1 3rd Ed., Section 9.4 or with power limitation as per IEC 60950-1 2nd Ed., Section 2.5 or from a Class 2 secondary circuit as specified in UL1310.

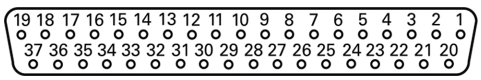
In place of IEC 61010-1 3rd Ed., Section 9.4, the corresponding sections of standards DIN EN 61010-1, EN 61010-1, UL 61010-1 and CAN/CSA-C22.2 No. 61010-1 and, in place of IEC 60950-1 2nd Ed., Section 2.5, the corresponding sections of standards DIN EN 60950-1, EN 60950-1, UL 60950-1, CAN/CSA-C22.2 No. 60950-1 can be applied.

Depending on the peripherals to be connected, the connection work may need to be performed by an electrical specialist.

Example: Safety Extra Low Voltage (SELV) exceeded.

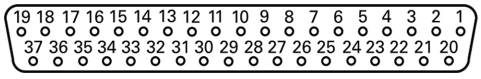
Pin layout of X102, X103

X102



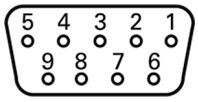
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
GND	Din 1	Din 3	Din 4	Din 6	GND	Dout 0	Dout 2
9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Dout 4	GND	Dout 6	Dout 8	Dout 10	GND	Dout 12	Dout 14
17	**18**	**19**	**20**	**21**	**22**	**23**	**24**
/	/	GND	Din 0	Din 2	DC 5 V	Din 5	Din 7
25	**26**	**27**	**28**	**29**	**30**	**31**	**32**
GND	Dout 1	Dout 3	Dout 5	GND	Dout 7	Dout 9	Dout 11
33	**34**	**35**	**36**	**37**			
GND	Dout 13	Dout 15	/	/			

X103



1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
GND (D)	Din 1	Din 3	/	Ain 1	GND (A)	Dout 0	Dout 2
9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Dout 4	GND (D)	Aout 0	Aout 2	Aout 4	GND (A)	Aout 6+	Aout 7+
17	**18**	**19**	**20**	**21**	**22**	**23**	**24**
8+	Aout 9+	GND (A)	Din 0	Din 2	DC 5 V (D)	Ain 0	Ain 2
25	**26**	**27**	**28**	**29**	**30**	**31**	**32**
GND (A)	Dout 1	Dout 3	Dout 5	GND (D)	Aout 1	Aout 3	Aout 5
33	**34**	**35**	**36**	**37**			
GND (A)	Aout 6–	Aout 7–	Aout 8–	Aout 9–			

Pin layout of X104



1	2	3	4	5	6	7	8	9
R-0 NO	R-0 NC	/	R-1 NO	R-1 NC	R-0 CO	/	/	R-1 CO

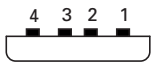
CO – Change Over
NO – Normally Open
NC – Normally Closed

5.6 Connecting a digital camera

Connecting a USB digital camera

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", page 30
- Connect the camera to the USB Type A port X32. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", page 39

Pin layout of X32

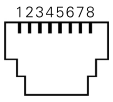


1	2	3	4
5 V DC	Data (–)	Data (+)	GND

Connecting an Ethernet digital camera

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", page 30
- Connect the camera to the Ethernet port X117 using a standard CAT.5 cable. The cable connector must firmly engage in the port
  Further information: "Product overview", page 39

Pin layout of X117



1	2	3	4	5	6	7	8
D1+ (TX+)	D1– (TX–)	D2+ (RX+)	D3+	D3–	D2– (RX–)	D4+	D4–

5.7 Connecting an optical edge detector

- Remove and save the dust protection cap
- Route the optical waveguides depending on the mounting variant
  Further information: "Assembly of the device", page 30

> - Adhere to the manufacturer's specifications regarding the maximum bend radius of the optical waveguides

- Connect the optical waveguide of the light source (reference) to connection X107
- Connect the optical waveguide from the projection screen to connection X108

Further information: "Product overview", page 39

Pin layout of X107 and X108

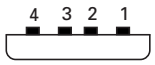
1
In

5.8 Connecting printers

Connecting a USB printer

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", page 30
- Connect the USB printer to one of the USB Type A ports X31–X34. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", page 39

Pin layout of X31–X34

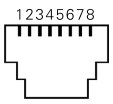


1	2	3	4
5 V DC	Data (–)	Data (+)	GND

Connecting an Ethernet printer

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", page 30
- Connect the Ethernet printer to the Ethernet port X116 using a standard CAT.5 cable. The cable connector must firmly engage in the port
  Further information: "Product overview", page 39

Pin layout of X116



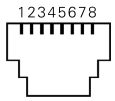
1	2	3	4	5	6	7	8
D1+ (TX+)	D1– (TX–)	D2+ (RX+)	D3+	D3–	D2– (RX–)	D4+	D4–

5.9 Connecting a network peripheral

Connecting a network peripheral

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", page 30
- Connect the network peripheral to the Ethernet port X116 using a standard CAT.5 cable. The cable connector must firmly engage in the port
  Further information: "Product overview", page 39

Pin layout of X116



1	2	3	4	5	6	7	8
D1+ (TX+)	D1– (TX–)	D2+ (RX+)	D3+	D3–	D2– (RX–)	D4+	D4–

5.10 Connecting the line voltage

⚠WARNING

Risk of electric shock!

Improper grounding of electrical devices may result in serious personal injury or death by electric shock.

- Always use 3-wire power cables
- Make sure the ground wire is correctly connected to the ground of the building's electrical installations

⚠WARNING

Fire hazard from the use of power cables that do not meet the national requirements of the respective country in which the product is mounted.

Improper grounding of electrical devices may result in serious personal injury or death by electric shock.

- Use only a power cable that meets at least the national requirements of the respective country in which the product is mounted.

- Use a power cable that meets the requirements to connect the power connection to a 3-wire grounded power outlet
  Further information: "Product overview", page 39

6

Basic operation

6.1 Overview

The product is operated using the touch-sensitive screen (touchscreen) only.

This chapter describes the following functions and operating elements of the product:

- Touchscreen and gestures
- User interface
- General operating elements and functions
- Adjusting the lighting
- Working in the workspace
- Using the Inspector
- Using measuring tools
- Switch-on/Switch-off
- User login and logout
- Messages and audio feedback

6.2 Touchscreen and gestures

6.2.1 Touchscreen

The product is operated solely via the operating elements of the touchscreen. The operating elements can be activated, switched or moved by using different gestures. Data is entered using the touchscreen keyboard.

NOTICE

Malfunctions of the touchscreen caused by humidity or contact with water!

- Protect the touchscreen from humidity or contact with water
  Further information: "Product data", page 366

6.2.2 Gestures

Tap

Tapping means touching the screen briefly with your finger tip.

The actions initiated by tapping the touchscreen include:

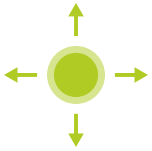
- Select menus, features or parameters
- Enter characters with the screen keyboard
- Close dialogs
- Relocate a measuring tool in the workspace
- Display and hide the main menu in the **Measure** menu
- Display and hide the Inspector in the **Measure** menu

Long press
Long press means touching the screen and holding your finger(s) on it for a few seconds.

A long press on a measuring tool in the **Measure** menu in the workspace initiates the following action:

- Open the zoom function in the workspace when measuring with the **Crosshair** measuring tool

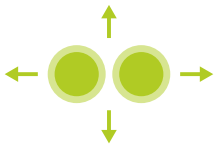
Drag
Dragging is a combination of long-press and then swipe, moving a finger over the touchscreen when at least the starting point of motion is defined.



The actions initiated by dragging an operating element include:

- Open the **Details** dialog in the Inspector
- Position the measuring tools
- Scroll lists and texts

Two-finger drag
Dragging with two fingers means moving two fingers in parallel over the touchscreen when at least the starting point of motion is defined.



Two-finger dragging in the **Measure** menu in the workspace initiates the following action:

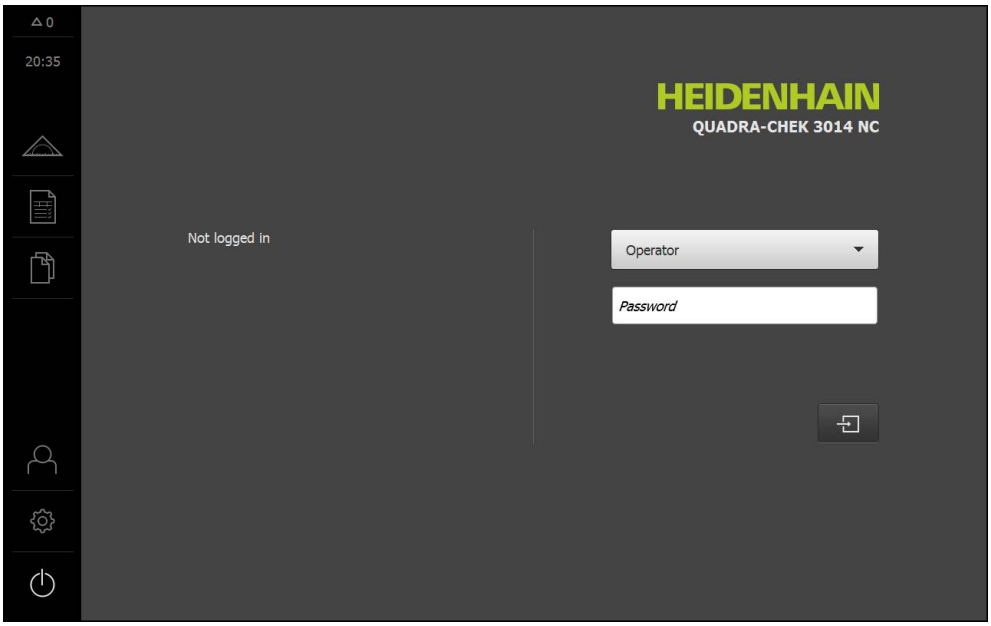
- Move the image section within the field of view of a camera in the workspace
  Further information: "Moving an image section", page 76

6.3 User interface

6.3.1 User interface after switch-on

Factory default user interface
The illustration shows the user interface the way it looks when you switch on the product for the first time.

This user interface will also be displayed after resetting the product to the factory defaults.



In the **User login** menu, you can log in and out of the product as a user. The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

Further information: "User permissions", page 335

User login

- In the drop-down list, select the user you want to log in
- Tap the **Password** input field
- Enter the user's password
  Further information: "Factory default settings", page 312

> If a password other than the default password has been assigned to the user, ask a **Setup** or **OEM** user for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

- Confirm the entry with **RET**

- Tap **Log in**

> The user is logged in and the **Measure** menu is displayed.

> If "Reference mark search after unit start" is active, all functions of the product will be disabled until the reference mark search is successfully completed.
>
> **Further information:** "Activating the reference mark search", page 112

Performing the reference mark search after startup

- After logging in, follow the instructions of the wizard

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting the language

The default language for the user interface is English. The language can be set individually for each user.

- Tap **Settings** in the main menu.

- Tap **User**

> The logged-in user is indicated by a check mark

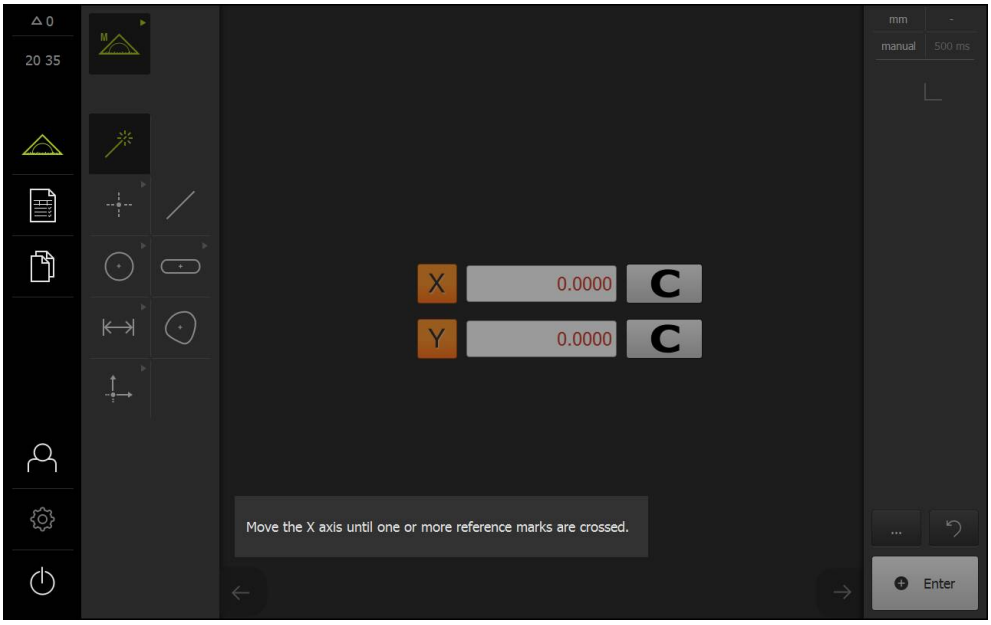
- Select the logged-in user

> The language selected for the user is indicated by a national flag in a drop-down list

- Select the flag for the desired language in the **Language** drop-down list

> The user interface immediately switches to the selected language

User interface without software options activated



If automatic user login is active, the **Measure** menu with the workspace and the Inspector is displayed after the product is started.

Further information: "Measure menu", page 64

If automatic user login is not active, the product displays the **User login** menu.

Further information: "User login menu", page 72

If "Reference mark search after unit start" is active, all functions of the product will be disabled until the reference mark search is successfully completed.

Further information: "Activating the reference mark search", page 112

Performing the reference mark search after startup

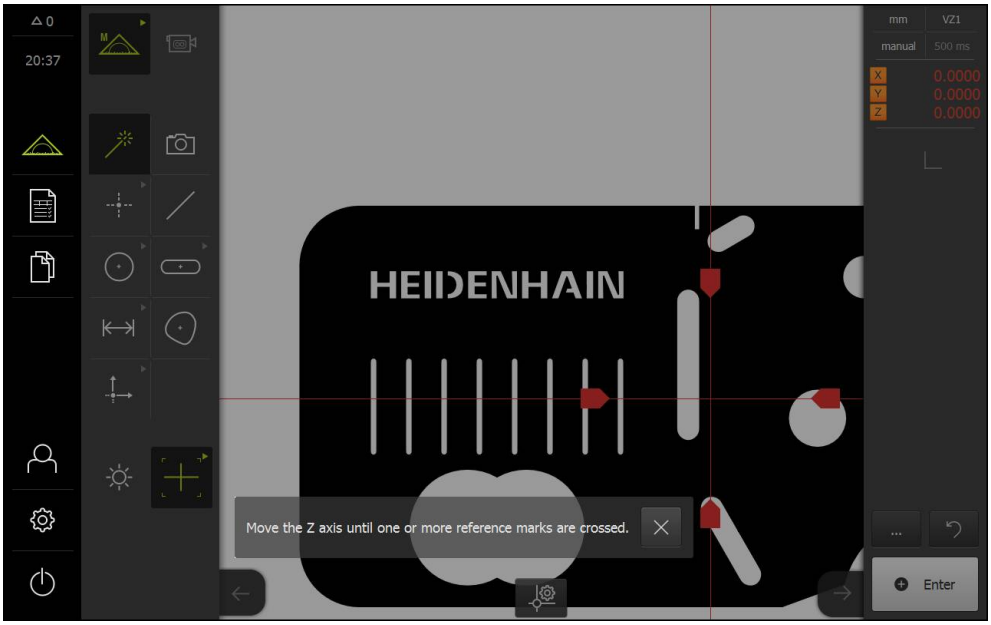
- ▶ After logging in, follow the instructions of the wizard
- > On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting the language

- Tap **Settings** in the main menu.

- Tap **User**
- The logged-in user is indicated by a check mark
- Select the logged-in user
- The language selected for the user is indicated by a national flag in a drop-down list
- Select the flag for the desired language in the **Language** drop-down list
- The user interface immediately switches to the selected language

User interface with QUADRA-CHEK 3000 VED software option



If automatic user login is active, the **Measure** menu with the activated software option, the workspace and the Inspector is displayed after the product is started.

Further information: "Measure menu", page 64

If automatic user login is not active, the product displays the **User login** menu.

Further information: "User login menu", page 72

If the QUADRA-CHEK 3000 VED software option was activated without connecting a camera, the virtual camera is used. The Operating Instructions show only the virtual camera.

For information on activating the software option, please refer to the Commissioning chapter.

Further information: "Enabling software options", page 108

If "Reference mark search after unit start" is active, all functions of the product will be disabled until the reference mark search is successfully completed.

Further information: "Activating the reference mark search", page 112

Performing the reference mark search after startup

- ▶ After logging in, follow the instructions of the wizard
- > On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting the language

- ▶ Tap **Settings** in the main menu.

- ▶ Tap **User**
- > The logged-in user is indicated by a check mark
- ▶ Select the logged-in user
- > The language selected for the user is indicated by a national flag in a drop-down list
- ▶ Select the flag for the desired language in the **Language** drop-down list
- > The user interface immediately switches to the selected language

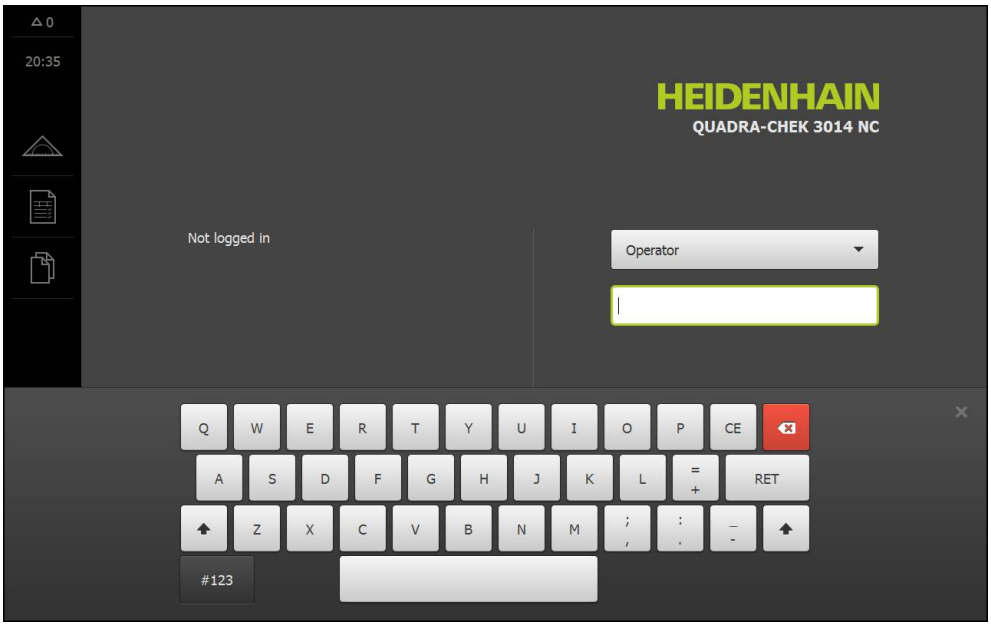
6.3.2 General operating elements and functions

The following operating elements are available for setting and operating the product via the touchscreen:

- Screen keyboard
- Input fields
- Toggle switch
- Sliding switch
- Slider
- Drop-down list
- Screen buttons

Screen keyboard

With the screen keyboard, you can enter text into the input fields of the user interface. The displayed screen keyboard is either numeric or alphanumeric, depending on the input field.



Example of using the screen keyboard

▶ To enter values, tap an input field
> The input field is highlighted
> The screen keyboard is displayed
▶ Enter text or numbers
> In some input fields, a green check mark indicates that the entry is correct
> If the entry is incomplete or incorrect, a red exclamation mark is displayed. The entry cannot be concluded
▶ To apply the values, confirm the entry with **RET**
> The values are displayed
> The screen keyboard disappears

Input fields with plus and minus buttons

To adjust a numerical value, use the "+" (plus) and "–" (minus) buttons to the left and right of the numerical value.

- ▶ Tap **+** or **-** until the desired value is displayed
- ▶ Long-press **+** or **-** to scroll through the values more quickly
- > The selected value is displayed

Toggle switch

Use the toggle switch to switch between functions.

- ▶ Tap the desired function
- > The active function is shown in green
- > The inactive function is shown in light gray

Sliding switch

With the sliding switch, you activate or deactivate a function.

- ▶ Drag the sliding switch to the desired position or tap the sliding switch
- > The function is activated or deactivated

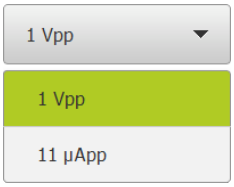
Slider

With the slider, you can continuously adjust a value.

- ▶ Drag the slider to the desired position
- > The selected value is displayed graphically or in percent

Drop-down list

Buttons that open drop-down lists are indicated by a triangle pointing down.



- ▶ Tap the button
- > The list opens
- > The active entry is highlighted in green
- ▶ Tap the desired entry
- > The selected entry is applied

Undo
With this button, you can undo the last action.
Processes that have already been concluded cannot be undone.

- ▶ Tap **Undo**
- > The last action is undone

Add
The button is displayed in different ways:

- Dark on light background
- Light on dark background

- ▶ To add a feature, tap **Add**
- > The new feature is added

Close

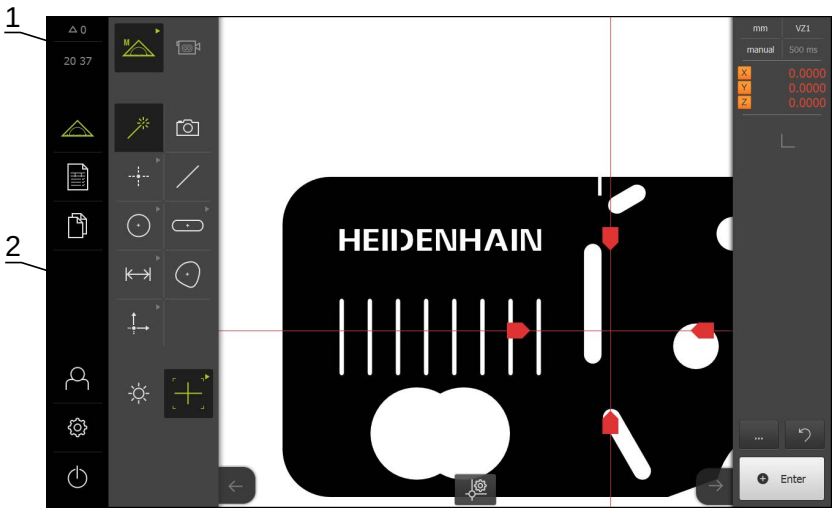
- ▶ Tap **Close** to close a dialog

Confirm

- ▶ Tap **Confirm** to conclude an activity

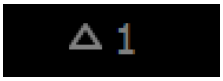
6.3.3 Main menu of the user interface

User interface with QUADRA-CHEK 3000 VED software option



1 Message display area, displays the time and the number of unclosed messages
2 Main menu with operating elements for controlling and configuring the product

Operating elements of the main menu
The main menu is displayed independently of activated software options.

Operating element	Function
	**Message** Opens an overview of all messages and shows the number of messages that have not been closed **Further information:** "Messages", page 100
	**Measure** Manual measurement, construction or definition of features by using measuring programs and predefined geometries **Further information:** "Measure menu", page 64
	**Measurement report** Creation and management of measurement reports by using templates **Further information:** "Measurement report menu", page 68
	**File management** Management of the files that are available in the product These include: • Measuring programs • Templates for measurement reports • Measurement reports • Documentation **Further information:** "File management menu", page 70

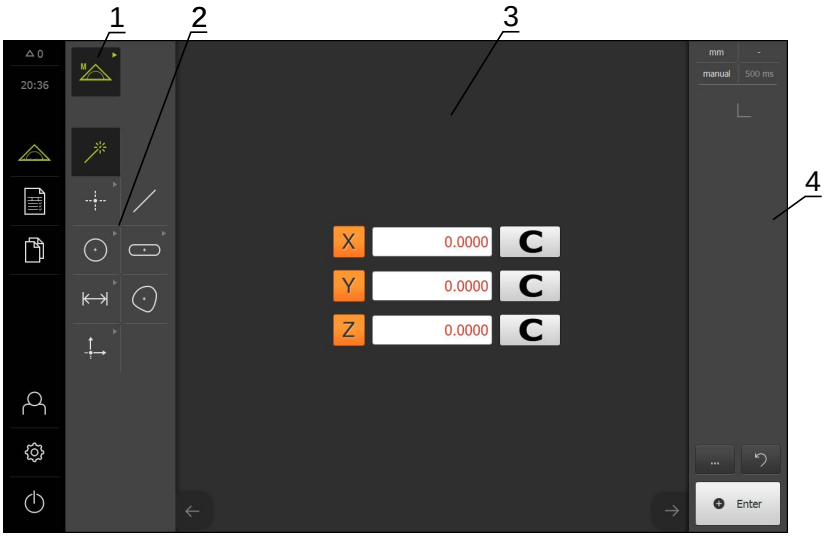
Operating element	Function
	**User login** Login and logout of users **Further information:** "User login menu", page 72
	**Settings** Settings of the product, such as setting up users, configuring sensors or updating the firmware **Further information:** "Settings menu", page 73
	**Switch off** Activation of energy-saving mode or shutdown of the operating system **Further information:** "Switch off menu", page 74

6.3.4 Measure menu

Activation

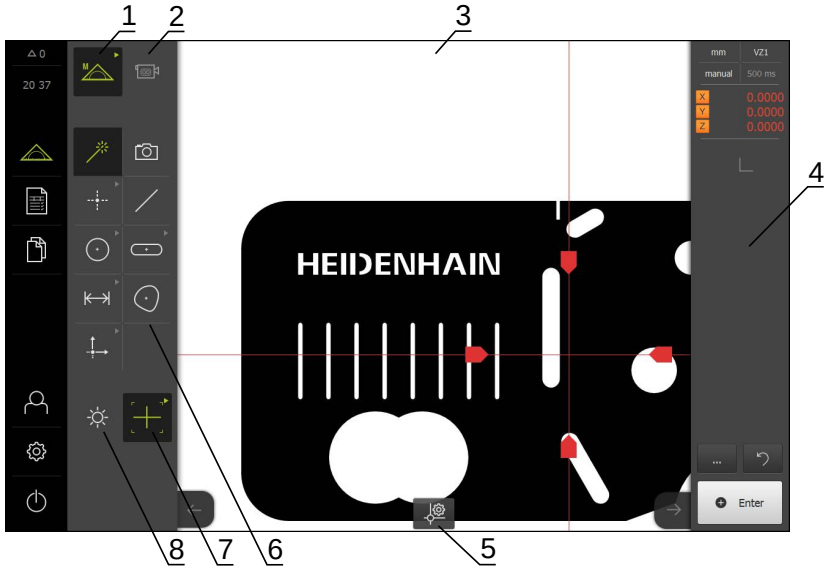
- ▶ Tap **Measure** in the main menu
- > The user interface for manual measuring, constructing and defining is displayed

Measure menu without software option



1 The function palette provides functions for manual measuring, constructing and defining. The selected function is displayed as an active operating element.
2 The geometry palette provides all geometries for manual measuring, constructing and defining. Some geometries are combined into geometry groups. The selected geometry is displayed as an active feature. The geometries available on the geometry palette depend on the selected function.
3 The workspace displays, for example, the current position of the measuring plate or the features preview (graphical representation of the features).
4 The Inspector provides the quick access menu, the position preview or features preview, and the feature list or program step list. The feature list contains the features that have been measured, constructed or defined.

Measure menu with QUADRA-CHEK 3000 VED software option



1 The function palette provides functions for manual measuring, constructing and defining. The selected function is displayed as an active operating element.
2 The sensor palette provides the optional sensors, e.g. VED. It is only visible if the software option is active.
3 The workspace displays, for example, the live image or the input area for constructing and defining features.
4 The Inspector provides the quick access menu, the position preview, the features preview, and the feature list or program step list. The feature list contains the features that have been measured, constructed or defined.
5 The workspace displays tool-dependent and sensor-dependent settings and control elements.
6 The geometry palette provides all geometries for manual measuring, constructing and defining. Some geometries are combined into geometry groups. The selected geometry is displayed as an active feature. The geometries available on the geometry palette depend on the selected function.
7 The tool palette provides the measuring tools required for conducting the selected measurement. The tool palette is only visible if the live image from the VED sensor is displayed in the workspace.
8 The lighting palette is only displayed if the optical sensor is active.

Operating elements of the function palette

Manual measuring	Constructing	Defining
		

Operating elements of the sensor palette

The operating elements of the sensor palette are only available if software options are active. If one software option is active, the software option is displayed. If multiple software options are active, you can choose between the options.

Video edge detection (VED)


Operating elements of the geometry palette

Measure Magic


Snapshot	
	The **Snapshot** operating element is only available if the QUADRA-CHEK 3000 VED software option is active.

Point	Height point	
		The **Height point** operating element is only available if the Z axis is active.

Line


Circle	Arc	Ellipse
		

Slot	Rectangle
	

Distance	Angle
	

Blob


Zero point	Alignment	Reference plane	
			The **Reference plane** operating element is only available if the Z axis is active.

Lighting palette	
	The **lighting palette** is only available if an optical sensor is active.

Operating elements of the tool palette

The operating elements of the tool palette are only available if a software option is active. They are displayed only in the manual measuring function, e.g. if the live image is in the workspace.

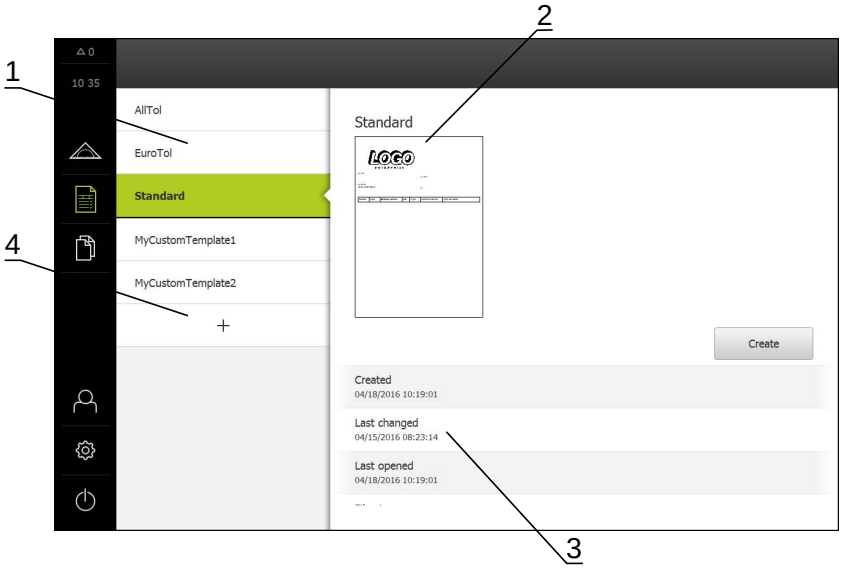
Crosshair	Single edge	Circle	Buffer	Contour
				

6.3.5 Measurement report menu

Activation

- ▶ Tap **Measurement report** in the main menu
- > The user interface for displaying and creating the measurement reports appears

Short description



1 List of default templates
2 Preview of the selected template
3 Display of information on the selected template
4 List of custom templates

In the **Measurement report** menu, you can select existing report templates and create custom templates. A list of the created templates is shown in the column on the left. A preview of the selected template is displayed in the column on the right.

Further information: "Measurement report", page 283

Displaying operating elements

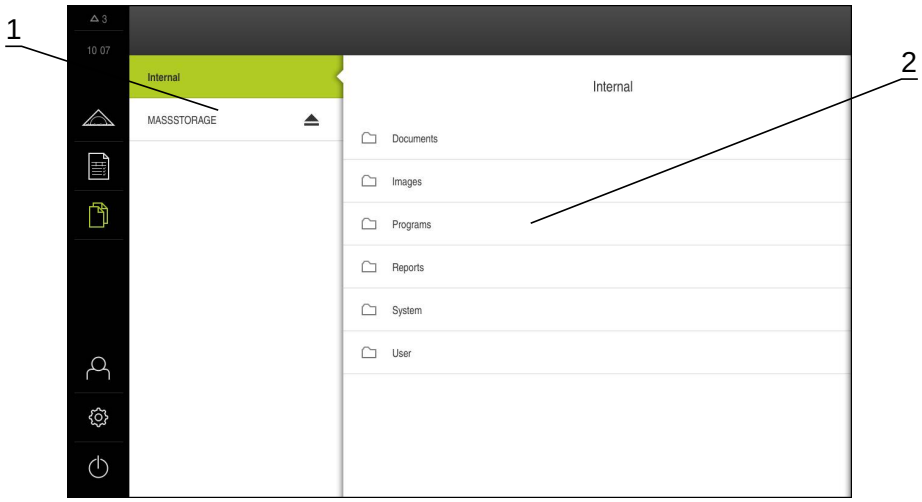
Operating element	Short description
	**Copy template** Opens a dialog for copying the selected template. After editing the properties, you can save a copy of the template under a new name and edit the copy.
	**Edit template** Activates the edit mode for a custom template. Default templates cannot be edited.
	**Rename template** Opens a dialog for renaming the template. Default templates cannot be renamed.
	**Delete selection** Opens a dialog for deleting the custom template. Default templates cannot be deleted.

6.3.6 File management menu

Activation

- ▶ Tap **File management** in the main menu
- > The user interface for managing the stored files is displayed

Short description



1 List of available storage locations
2 List of folders in the selected storage location

The **File management** menu shows an overview of the files stored in the product's memory. If USB mass storage devices or network drives are connected, they are displayed in the list of storage locations.

The connected USB mass storage devices and network drives are displayed with their names or drive designations.

The files in the **Internal** storage location are saved in folders:

- **Documents**: Documents with instructions and service addresses
- **Images**: Images of measured objects as reference material
- **Programs**: Stored measuring programs
- **Reports**: Stored measurement reports and measurement report templates
- **System**: Audio files and system logs
- **User**: User data

Displaying and opening files

- Tap a folder to open it
- Tap a file to display its properties

Further information: "Displaying and opening files", page 307

Displaying operating elements

- To display the operating elements, drag the icon of the folder or file to the right

> The operating elements are displayed

Operating element	Short description
	**Create a new folder** Adds a new folder to the selected folder
	**Move folder** Opens a dialog for moving the folder
	**Copy folder** Opens a dialog for copying the folder
	**Rename folder** Opens a dialog for renaming the folder
	**Move file** Opens a dialog for moving the file
	**Copy file** Opens a dialog for copying the file
	**Rename file** Opens a dialog for renaming the file
	**Delete selection** Opens a dialog for deleting the file or folder

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- Disconnect the USB mass storage device

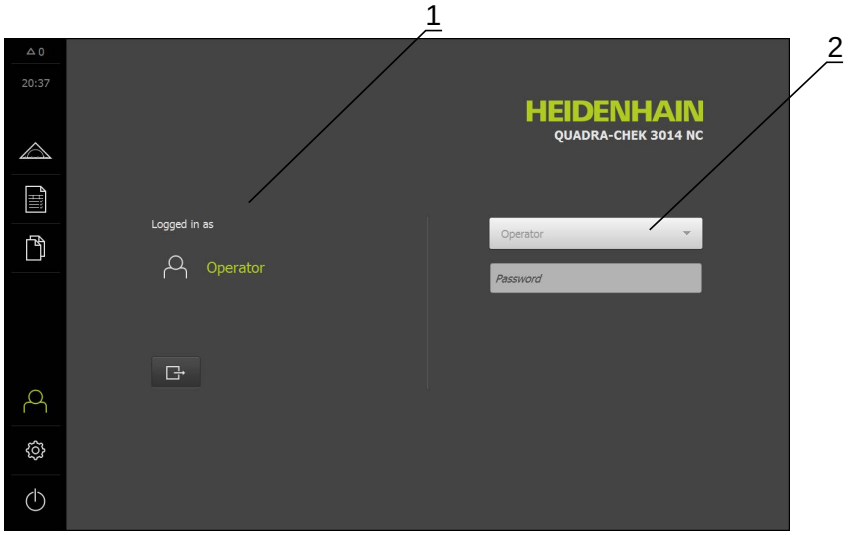
6.3.7 User login menu

Activation

- Tap **User login** in the main menu

> The user interface for user login and logout is displayed

Short description



1 Display of the logged-in user
2 User login

The **User login** menu shows the logged-in user in the column on the left. The login of a new user is displayed in the column on the right.

To log in another user, the logged-in user must log out.

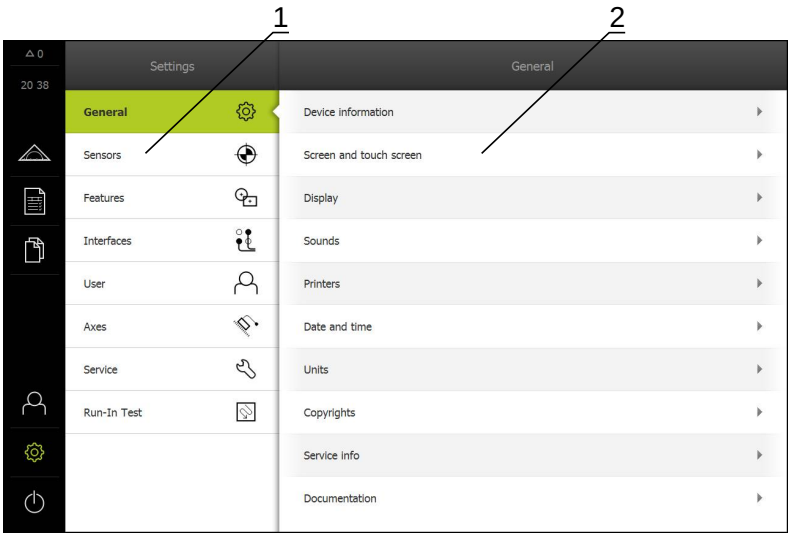
Further information: "User login and logout", page 98

6.3.8 Settings menu

Activation

- ▶ Tap **Settings** in the main menu
- > The user interface for the product settings is displayed

Short description



1 List of setting options
2 List of setting parameters

The **Settings** menu shows all options for configuring the product. With the setting parameters, you can adapt the product to on-site requirements.

Further information: "Settings", page 311

6.3.9 Switch off menu

Activation

- Tap **Switch off** in the main menu
- > The operating elements for shutting down the operating system and for activating the energy-saving mode are displayed

Short description
The **Switch off** menu provides the following two options:

Operating element	Function
	**Shut down** Shuts down the operating system of the product.
	**Energy saving mode** The screen is switched off.

Further information: "Switch-on/Switch-off", page 96

6.4 Working in the workspace

The workspace is only available in the Measure menu.

Activation

- Tap **Measure** in the main menu
- > The user interface for manual measuring, constructing and defining is displayed

6.4.1 Adjusting the display of the workspace

In the Measure menu, you can increase the workspace by hiding the main menu or the Inspector.

Hiding or displaying the main menu

- Tap the tab
- > The main menu is hidden
- > The arrow changes direction
- To display the main menu, tap the tab

Hiding or displaying the Inspector
The Inspector can only be hidden when using the Manual measuring function.

- Tap the tab
- > The Inspector is hidden
- > The arrow changes direction
- To display the Inspector, tap the tab

6.4.2 Operating elements in the workspace

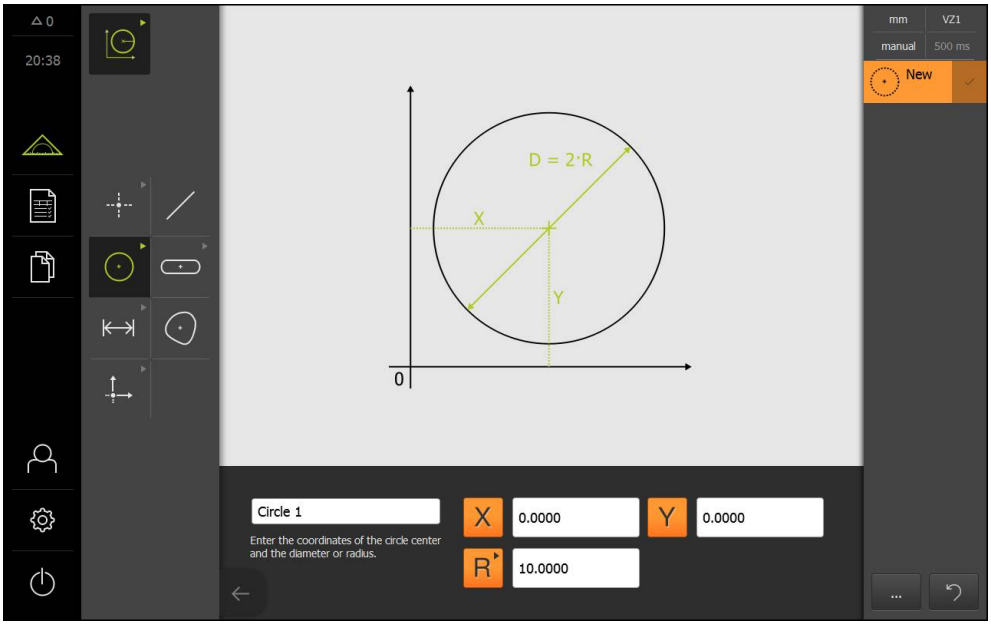
Operating elements of the manual measuring function
The operating elements in the workspace are only available if an optical sensor is active.

Settings	Edge detection modes
	

Operating elements of the construction function
The workspace provides operating elements for adjusting the features view.

Zoom to all	Zoom to selection	Magnify graphic	Reduce graphic
			

Operating elements of the definition function
Depending on the selected geometry, the input fields required for definition are displayed in the workspace.

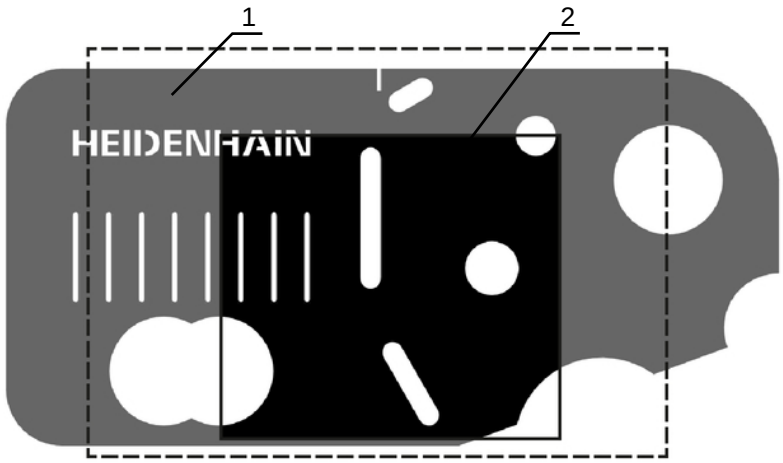


Example: Input fields in the workspace for Circle geometry

6.4.3 Moving an image section

> The live image can only be moved if the QUADRA-CHEK 3000 VED software option is active and the Manual measuring function is selected.

The live image can be moved within the field of view because the field of view of the camera image is larger than the image section in the workspace.



1 Field of view of the camera
2 Image section (live image)

- ▶ In the workspace, drag the image section with two fingers to the desired position
- > The image section is moved within the camera's field of view

6.5 Using the Inspector

The Inspector is only available in the Measure menu.

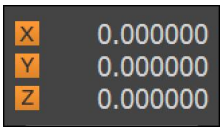
Activation

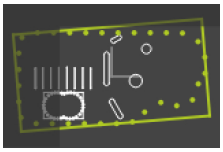
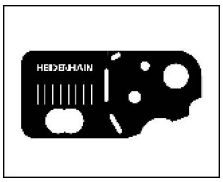
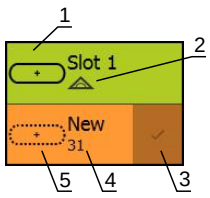
- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining is displayed

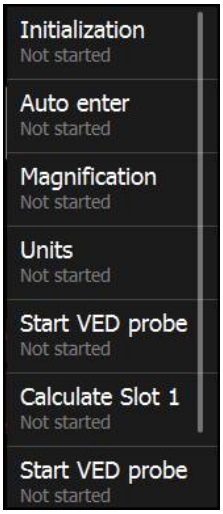
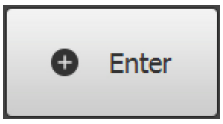
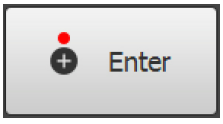
6.5.1 Operating elements of the Inspector

The Inspector comprises the following areas and operating elements:

- Quick access menu
- Position preview (only available in the manual measuring function)
- Features preview (only available in the manual measuring function and the definition function)
- Live image preview (only available in the manual measuring function and if the QUADRA-CHEK 3000 VED software option is active)
- Feature list or program step list
- Miscellaneous functions
- Undo (only available in the manual measuring function)
- Enter (only available in the manual measuring function)

Operating element	Short description
	**Quick access menu** The quick access menu displays the current settings for manual measuring, constructing and defining: ■ Unit for linear values (millimeters or inches) ■ Selected magnification ■ Type of measuring point acquisition (automatic or manual) ■ Timeout for automatic measuring point acquisition ▶ To adjust the settings of the quick access menu, tap the quick access menu
	**Position preview** The position preview is only available in the manual measuring function. The current axis positions are displayed. If no reference mark search has been performed, the axis positions are displayed in red. **Further information:** "Conducting the reference mark search", page 203 ▶ To display the position preview in the workspace, tap the position preview > The position preview is displayed in the workspace > The current content of the workspace switches to the Inspector

Operating element	Short description
	**Features preview** The features preview is only available in the measuring function. The features preview displays a reduced view of the measured, constructed and defined features. The current image section of the live image is highlighted. ▶ To display the features preview in the workspace, tap **Features preview** > The features preview is displayed in the workspace > The current content of the workspace switches to the Inspector
	**Live image preview** The live image preview is only available in the manual measuring function. The live image preview displays a reduced view of the live image. The live image preview is shown if the position preview or the features preview is displayed in the workspace. ▶ To display the live image preview in the workspace, tap **Live image preview** > The live image preview is displayed in the workspace > The current content of the workspace switches to the Inspector
	**Feature list** The feature list contains a list of all features that have been measured, constructed or defined. The feature list provides the following information: ■ **1:** Measured feature with symbol, name and consecutive number ■ **2:** Function that was used for creating the feature ■ **3:** Concludes the measuring point acquisition ■ **4:** Number of measuring points that have been acquired ■ **5:** Newly acquired feature with symbol Each feature contains details on the measurement results as well as selectable tolerances. ▶ To adjust the tolerances and display the measured values, drag a feature into the workspace ▶ To delete a feature, drag the feature to the right out of the Inspector

Operating element	Short description
	**Program step list** The program step list shows all actions that occur during the measurement. It is displayed instead of the feature list in the Inspector. The program steps can be combined and saved as measuring programs. **Further information:** "Programming", page 271
	**Miscellaneous functions** The miscellaneous functions comprise the following functions: ■ Switching the display between feature list and program step list ■ Creating and saving a program ■ Calling the program control in the workspace ■ Deleting selected features or all features from the feature list
 	**Enter** If automatic measuring point acquisition is deactivated, the measuring points are acquired manually. If automatic measuring point acquisition is active, a red dot is shown in the operating element. If automatic measuring point acquisition is active, the measuring points are acquired after the set timeout expires.

6.5.2 Adjusting settings in the quick access menu

With the quick access menu, you can adjust the following settings:

- Unit for linear values (**Millimeters** or **Inch**)
- Unit for angular values (**Radian**, **Decimal degrees** or **Deg-Min-Sec**)
- Type of coordinate system (**Cartesian** or **Polar**)
- Magnification
- Type of measuring point acquisition (**Auto enter**)
- Timeout for automatic measuring point acquisition (**Auto enter timeout in ms**)

Setting the units of measure

Before you start measuring, you need to set the desired units of measure in the Inspector's quick access menu.

- ▶ Tap the **Quick access menu** in the Inspector
- ▶ Select the desired **Unit for linear values**
- ▶ Select the desired **Unit for angular values**

- ▶ Tap **Close** to close the quick access menu
- > The selected units are displayed in the **Quick access menu**

Selecting the coordinate system

Depending on the measuring task, you can set the type of coordinate system in the Inspector's quick access menu.

- ▶ Tap the **Quick access menu** in the Inspector
- ▶ Select the desired **Type of coordinate system**

- ▶ Tap **Close** to close the quick access menu
- > The positions are displayed in the **Position preview** according to the selected coordinate system

Setting the magnification

If an optical sensor is active, you can take the optical magnification of the measured object (e.g. due to camera optics) into account. To do this, select the magnification that corresponds to the camera optics in the quick access menu. The number of available magnification levels depends on the configuration of the measuring machine.

> The magnification of the camera optics must match the magnification that is set in the product. To ensure that the live image is focused in the workspace, adjust the working distance between the measured object and the camera, if required.

- Tap the **Quick access menu** in the Inspector
- Select the desired magnification so that it corresponds to the camera optics
- If required, adjust the respective magnification and the focus of the camera optics

- Tap **Close** to close the quick access menu

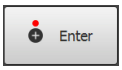
> The selected magnification is displayed in the **Quick access menu**

> If the selected magnification has not yet been set, the pixel size of the sensor must be determined in the **Settings** menu.
>
> **Further information:** "Determining the pixel sizes", page 129

Setting automatic measuring point acquisition

You can acquire measuring points automatically or manually one at a time. The automatic acquisition (auto enter) function automatically enters the measuring points as soon as the measuring tool has remained at a standstill above the measuring point for a short period of time. You can activate or deactivate this function, and set the standstill time ("timeout").

- Tap the **Quick access menu** in the Inspector
- Activate or deactivate **Auto enter**



> When **Auto enter** is active, a red dot is shown in the **Enter** button

- Set the **Auto enter timeout in ms**

> As soon as the measuring tool has remained at a standstill above a measuring point for longer than the selected period of time, the measuring tool automatically enters one or more measuring points

- Tap **Close** to close the quick access menu

> The selected timeout period is displayed in the **Quick access menu**

6.5.3 Adjusting miscellaneous functions of the Inspector

Switching between feature list and program step list
The feature list shows the acquired features whereas the program step list shows the program steps of the measuring program.

Further information: "Programming", page 271

- Tap **Miscellaneous functions** in the Inspector
- Select the **Feature list** or **Program step list** display
> Activating the program step list also activates the display of the program control in the workspace

- Tap **Close** to close the miscellaneous functions

Creating or saving a measuring program
With the miscellaneous functions of the Inspector, you can create a new measuring program or save acquired features as a measuring program.

Further information: "Programming", page 271

- Tap **Miscellaneous functions** in the Inspector
- To create a new measuring program, tap **New**
- Tap **OK** in the dialog
> A new measuring program is created and the miscellaneous functions are closed
- To save acquired features as a measuring program, tap **Save as**
- Tap the input field in the dialog and enter a name for the measuring program
- Confirm the entry with **RET**
- Tap **OK**
> The measuring program is saved
> The miscellaneous functions are closed

Deleting features
With the miscellaneous functions of the Inspector, you can delete multiple features simultaneously.

- Select the features in the feature list

- Tap **Miscellaneous functions** in the Inspector
- To delete the selected features from the feature list, tap **Delete selection**
- To delete all features from the feature list, tap **Delete all**

> The reference features, such as zero point, alignment and reference plane, cannot be deleted as long as other features are referenced to them.

- Tap **Close** to close the miscellaneous functions

6.6 Using measuring tools

> The operating elements of the tool palette are only available if an optical sensor is active. They are only displayed in the manual measuring function if the live image is in the workspace.

Activation

- Tap **Measure** in the main menu
> The user interface for measuring, constructing and defining is displayed

- Select **Manual measuring**
- If required, tap **Live image preview** in the Inspector
> The live image is shown in the workspace
- Tap **Tool palette**
> The measuring tools of the tool palette are displayed

6.6.1 Measuring tools

Depending on the optical sensor, various measuring tools are available for acquiring the measuring points. The measuring tools can be operated by gestures in the workspace.

Further information: "Using VED measuring tools", page 87

VED measuring tools

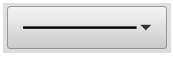
Icon	Measuring tool	Functions and characteristics
	Crosshair	■ Manual acquisition of single measuring points ■ No automatic acquisition of light-to-dark transitions ■ Zoom function available for pixel-precise positioning ■ Alignment and position adjustable
	Single edge	■ Active measuring tool ■ Automatic acquisition of single measuring points ■ Acquisition of light-to-dark transitions ■ Size of search range adjustable ■ Alignment and position adjustable
	Circle	■ Active measuring tool ■ Acquisition of multiple measuring points e.g. at circles and circular arcs ■ Acquisition of light-to-dark transitions ■ Size of search range adjustable ■ Scan direction adjustable ■ Search range angle adjustable ■ Position adjustable
	Buffer	■ Active measuring tool ■ Automatic acquisition of multiple measuring points at edges ■ Acquisition of light-to-dark transitions ■ Size of search range adjustable ■ Alignment and position adjustable
	Contour	■ Active measuring tool ■ Automatic acquisition of multiple measuring points at contours ■ Acquisition of light-to-dark transitions ■ Independent positioning of the start and end points of the search range ■ Size of search range adjustable ■ Scan direction adjustable ■ Alignment and position adjustable

6.6.2 Setting the VED measuring tool

You can set all functions separately for each measuring tool. The product will save your entries when you exit the dialog.

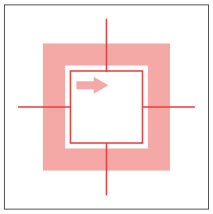
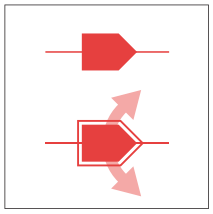
- ▶ Select the desired measuring tool in the **Tool palette**
- ▶ Tap **Settings** at the bottom of the workspace
- > The **Settings** dialog for the selected measuring tool opens
- > The available parameters depend on the selected measuring tool
- ▶ Set the parameters

- ▶ Tap **Close** to close the Settings dialog
- > The selected parameters are saved for the measuring tool

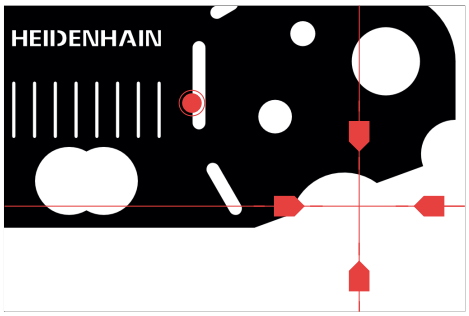
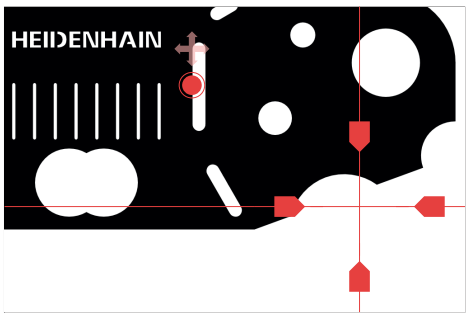
Operating element	Parameter	Function
	**Expanded tool mode**	Expansion of Crosshair, Single Edge and Buffer **Crosshair:** The lines of the crosshairs are extended to the edge of the workspace. The extensions can be used for alignment and for fine positioning with motion reduction. **Single edge:** The search range is extended with the crosshairs. The expanded tool mode can be used for alignment and for fine positioning with motion reduction. **Buffer:** The search range is extended with the crosshairs. The expanded tool mode can be used for alignment.
	**Edge detection modes**	Modes of automatic measuring point acquisition The active mode determines the acquisition direction for the light-to-dark transition at an edge (dark → light; light → dark; dark or light → light or dark).
	**Color**	Color of the measuring tool
	**Line type**	Line type of the measuring tool
	**Motion reduction in zoom**	Function of the **Crosshair** measuring tool Motion reduction of the zoom function at a ratio of 1:10 or 1:5. Selecting 1:1 deactivates the motion reduction. The motion reduction applies to the movement of the zoom function in the live image. The motion reduction in zoom is independent of the motion reduction of the expanded tool mode.
	**Maximum number of points to be measured**	Function of the **Circle** and **Buffer** measuring tools Maximum number of measuring points acquired with one entry (**Enter**).
	**Distance of points to be measured**	Function of the **Contour** measuring tool Distance between the measuring points that are acquired with one entry (**Enter**).

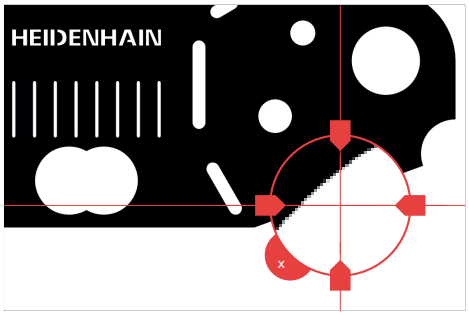
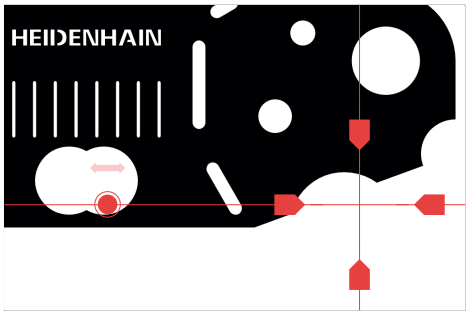
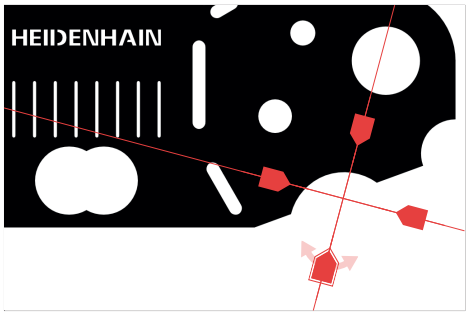
Operating element	Parameter	Function
	**Number of points to be measured**	Function of the **Contour** measuring tool **Number of points to be measured** is only taken into account if the **Distance of points to be measured** parameter is set to "**0**". Number of measuring points acquired with one entry (**Enter**).
	**Tool size and position**	Resets the measuring tool to the default size, default alignment and default position The default position is at the center of the camera's field of view.

6.6.3 Using VED measuring tools

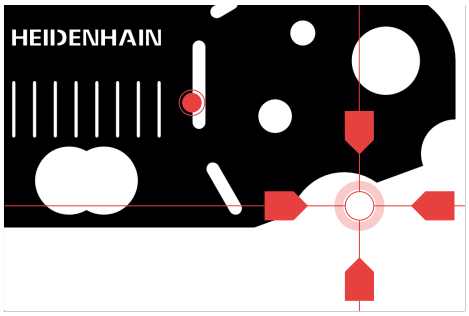
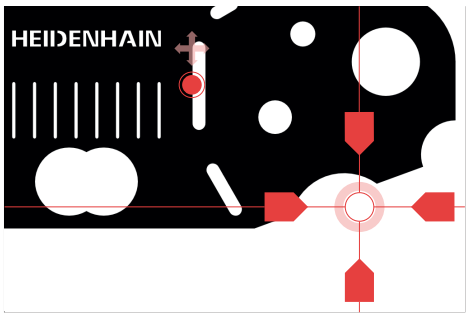
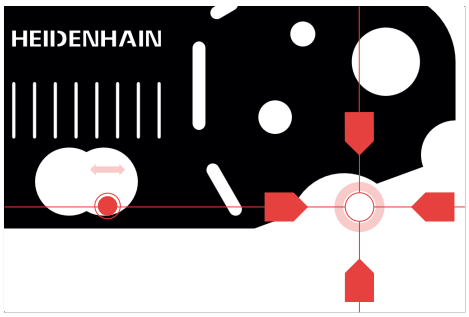
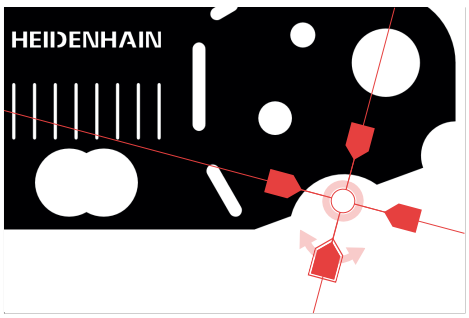
Display	Meaning
	**Search range** The **Single edge**, **Circle** and **Buffer** measuring tools have an edge that indicates the search range of the tool. The edge of the **Contour** measuring tool indicates the end point of measuring point acquisition. The scan direction of the search range is indicated by an arrow.
	**Handles** The handles are located on the edge or the axes of the measuring tools. Active handles are shown with an outline around the handle. The direction of motion of the active handle is indicated by arrows next to the handle.

Crosshair

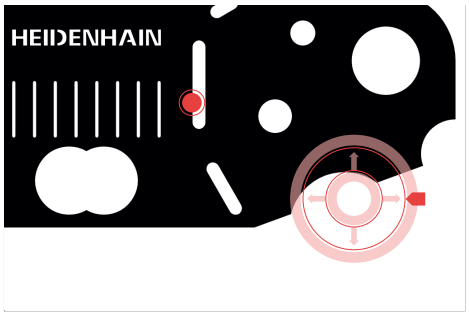
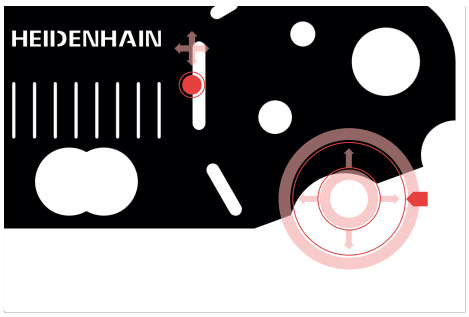
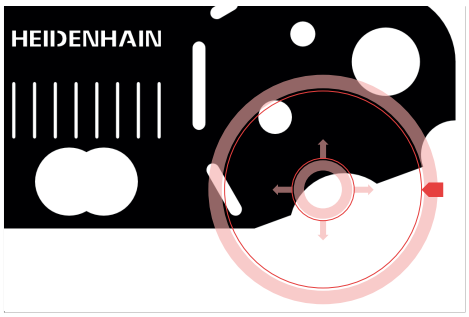
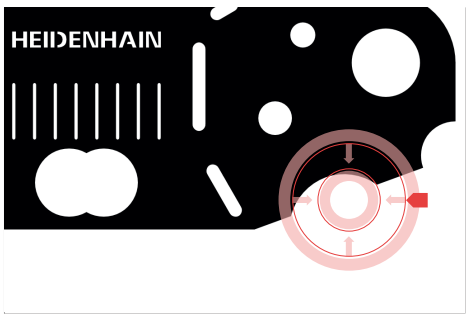
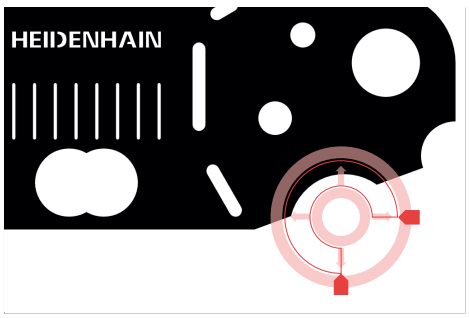
Display	Activity
	**Relocating the crosshairs** ▶ Tap the desired position in the live image > The crosshairs jump to the selected position
	**Shifting the crosshairs** ▶ Touch a place in the live image and drag the crosshairs to the desired position

Display	Activity
	**Zooming** To precisely position the measuring tool, you can use the zoom function to magnify the immediate vicinity of the crosshairs. ▶ Long-press the crosshairs or their vicinity ▶ Drag the magnifying glass with the crosshairs to the desired position > The crosshairs move with motion reduction ▶ To exit the zoom function, tap **X** on the edge of the magnifying glass You can change the motion reduction of the zoom function in the settings of the measuring tool.
	**Moving the crosshairs in an axis** ▶ Touch an axis of the crosshairs and drag the crosshairs along the axis to the desired position > The crosshairs move with motion reduction
	**Aligning the crosshairs** ▶ Touch a handle of the crosshairs and drag the crosshairs to the desired orientation

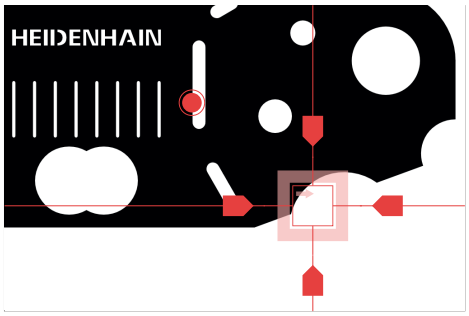
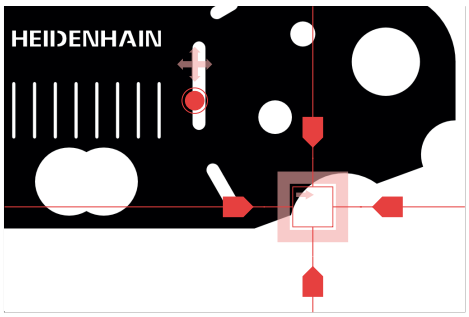
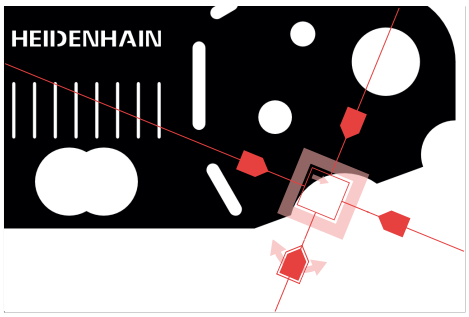
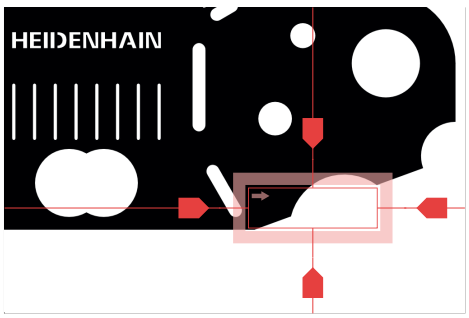
Single edge

Display	Activity
	**Relocating the single edge** ▶ Tap the desired position in the live image > The single edge jumps to the selected position
	**Shifting the single edge** ▶ Touch a place in the live image and drag the single edge to the desired position
	**Moving the single edge in an axis** ▶ Touch an axis of the single edge and drag the single edge along the axis to the desired position > The single edge moves with motion reduction
	**Aligning the single edge** ▶ Touch a handle of the single edge and drag the single edge to the desired orientation

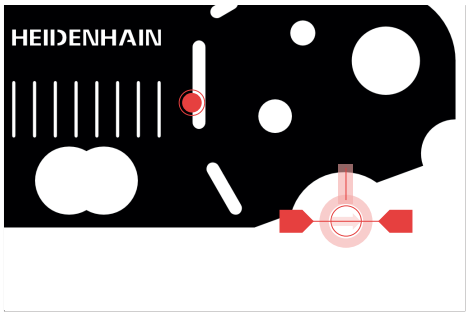
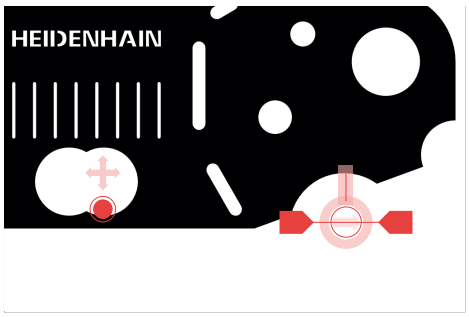
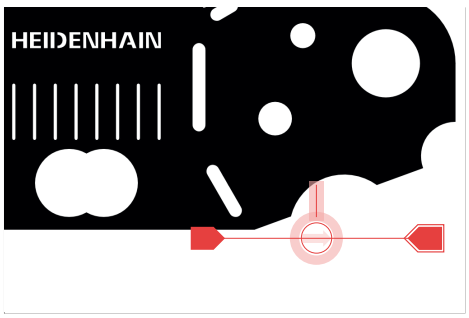
Circle

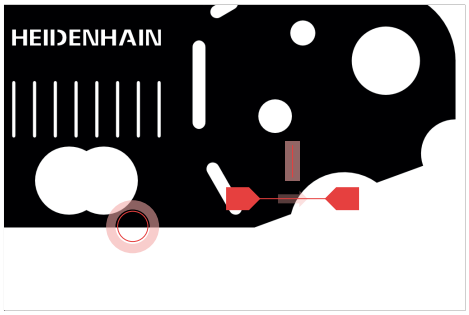
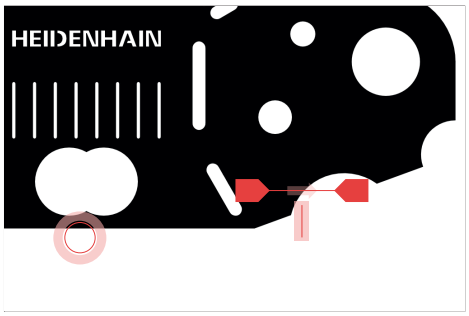
Display	Activity
	**Relocating the circle** ▶ Tap the desired position in the live image > The circle jumps to the selected position
	**Shifting the circle** ▶ Touch a place in the live image and drag the circle to the desired position
	**Resizing the search range** ▶ Touch the outer edge of the search range and drag it to the desired size > The size of the inner edge changes proportionally ▶ Touch the inner edge of the search range and drag it to the desired size
	**Reversing the scan direction of the search range** ▶ Touch the inner edge of the search range and drag it over the outer edge > The arrows indicate the changed scan direction
	**Adjusting the search range angle** To limit the search range, you can adjust the search range angle. This makes it possible, for example, to acquire measuring points on circular arcs. ▶ Touch the handle of the circle and drag the handle along the outer edge > The search range is inside the circular arc delimited by the handles

Buffer

Display	Activity
	**Relocating the buffer** ▶ Tap the desired position in the live image > The buffer jumps to the selected position
	**Shifting the buffer** ▶ Touch a place in the live image and drag the buffer to the desired position
	**Aligning the buffer** ▶ Touch a handle of the buffer and drag the buffer to the desired orientation
	**Resizing the search range** ▶ Touch the edge of the search range and drag it to the desired size > The search range is changed along the axis at an equal distance from the center

Contour

Display	Activity
	**Relocating the contour** ▶ Tap the desired position in the live image > The contour jumps to the selected position
	**Shifting the contour** ▶ Touch a place in the live image and drag the contour to the desired position
	**Aligning the contour** ▶ Touch a handle of the contour and drag the contour to the desired orientation
	**Resizing the contour** ▶ Touch a handle of the contour and drag the contour to the desired size > The contour is changed along the axis at an equal distance from the center

Display	Activity
	**Separating start point and end point** To measure a contour, you can separate the start point and the end point of measuring point acquisition. The measuring points are acquired between the contour and the edge of the circle, depending on the search direction. ▶ Touch the search range (circle) and drag it to the desired position > The position of the contour remains unchanged
	**Adjusting the search direction** The indicator at the contour shows the search direction along the measured object for the acquisition of measuring points. The measuring points are acquired between the contour as the start point and the circle as the end point. ▶ Touch the indicator at the contour and drag the indicator to the other side of the contour > The search direction of the measuring point acquisition is changed

6.7 Adjusting the lighting

The lighting palette is only available if an optical sensor is active. The selection and the range of functions depend on the device settings and the connected light unit.

You can connect two different light sources and one laser pointer to the product and adjust them separately.

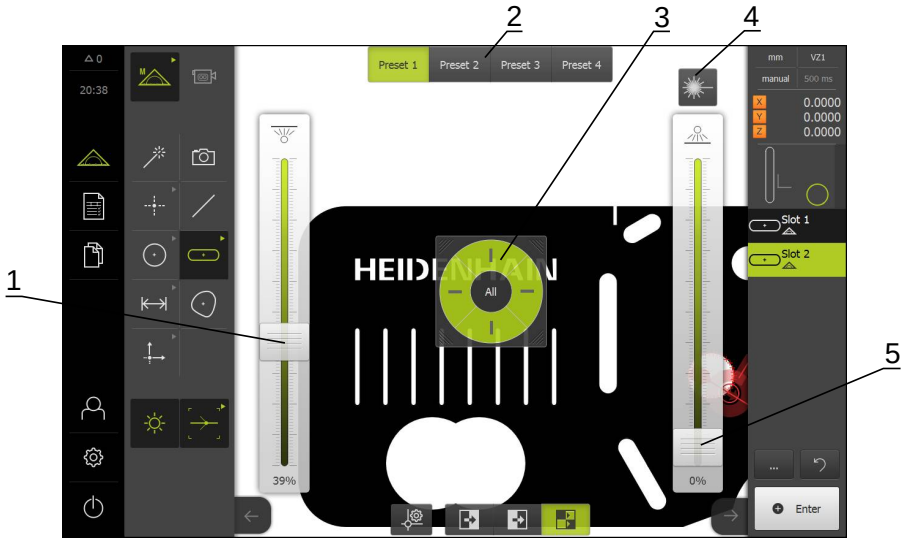
- Transmitted light: Light source below the measured object (backlight)
- Reflected light: Light source with four segments that can be switched individually
- Laser pointer: Point light above the measured object that can be used as a positioning aid

Displaying the lighting palette

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining is displayed

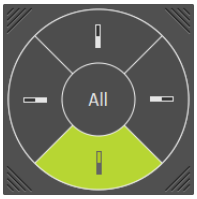
- ▶ Select **Manual measuring**
- ▶ If required, tap **Live image preview** in the Inspector
- > The live image is shown in the workspace

- ▶ Tap **Lighting palette**
- > The operating elements of the lighting palette are displayed



1 Slider for transmitted light
2 Preset operating elements
3 Segment switch for reflected light
4 Laser pointer
5 Slider for the reflected-light segments

Set the lighting according to the properties of the measured object.

Operating element	Short description
	**Transmitted light** slider for setting the light intensity for the transmitted light.
	**Preset** toggle switch for selecting and saving the desired preset settings. The active preset is displayed in green.
	**Laser pointer** operating element for switching a connected laser pointer on and off. When the laser pointer is on, the operating element is displayed in green.
	**Reflected light** slider for setting the light intensity for the reflected-light segments.
	**Segment switch** for selecting the active reflected-light segments. To activate all segments, select **All**. Active segments are displayed in green.

Further information: "Setting the lighting", page 124

6.8 Switch-on/Switch-off

6.8.1 Switch-on

> Before using the product, you need to perform the commissioning and setup steps. Depending on the purpose of use, you may have to configure additional setup parameters.
>
> **Further information:** "Commissioning", page 103

- ▶ Turn the power switch on
  The power switch is on the rear side of the unit
- > The unit powers up. This can take a moment
- > If automatic user login is active, the user interface is displayed in the **Measure** menu
  Further information: "Measure menu", page 64
- > If automatic user login is not active, the **User login** menu is displayed
  Further information: "User login and logout", page 98

6.8.2 Activating and deactivating the energy-saving mode

If you will not be using the unit for a while, you should activate the energy-saving mode. This switches the unit to an inactive state without interrupting the power supply. The screen is switched off in this state.

Activating energy-saving mode

- ▶ Tap **Switch off** in the main menu

- ▶ Tap **Energy-saving mode**
- > The screen switches off

Deactivating energy-saving mode

- ▶ Tap anywhere on the touchscreen
- > An arrow appears at the bottom of the screen
- ▶ Drag the **Arrow** up
- > The screen is switched on and shows the user interface last displayed

6.8.3 Switch-off

NOTICE

Damage to the operating system!

Disconnecting the power source while the product is on can damage the operating system of the product.

- Use the **Switch-off** menu on the touchscreen to shut down the product.
- Do not disconnect the power source while the product is on.
- Do not turn the power switch off until the product has shut down.

- Tap **Switch off** in the main menu

- Tap **Shut down**
- > The operating system shuts down
- Wait until the following message appears on the screen: **To restart the device, switch it off and then back on.**
- Turn the power switch off

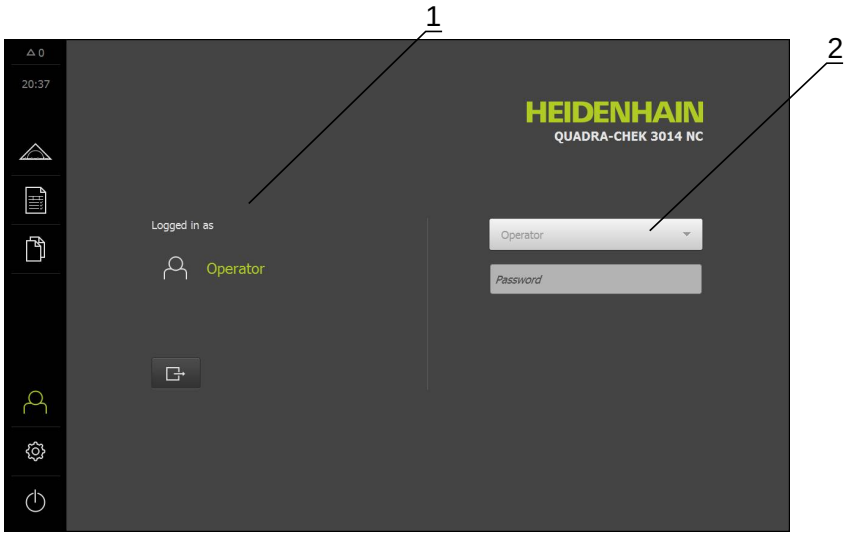
6.9 User login and logout

In the **User login** menu, you can log in and out of the product as a user. The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

Further information: "User permissions", page 335

Activation

- Tap **User login** in the main menu



1 Display of the logged-in user
2 User login

Only one user can be logged in to the product at a time. The logged-in user is displayed.

Before a new user can log in, the logged-in user has to log out.

User logout

- Tap **Log out**
- > The user is logged out
- > The functions of the main menu are inactive, except for **Switch off**
- > The product can only be operated again after a user has logged in

User login

- In the drop-down list, select the user you want to log in
- Tap the **Password** input field
- Enter the user's password
  Further information: "Factory default settings", page 312

> If a password other than the default password has been assigned to the user, ask a **Setup** or **OEM** user for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

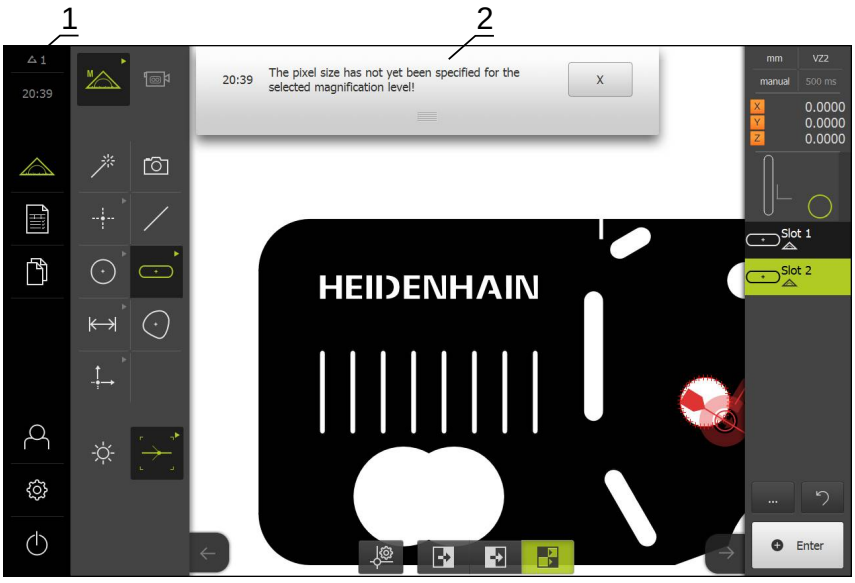
- Confirm the entry with **RET**

- Tap **Log in**

> The user is logged in and the **Measure** menu is displayed.

6.10 Messages and audio feedback

6.10.1 Messages



1 Message display area, displays the time and the number of unclosed messages
2 Message list

The messages that appear at the top of the workspace are generated as a result of e.g. operator errors, uncompleted processes, or successfully completed measuring programs.

The messages are displayed on occurrence of the message cause or when you tap the **Messages** display area at the top left of the screen.

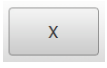
Viewing messages

- ▶ Tap **Messages**
- > The message list opens

Resizing the display area

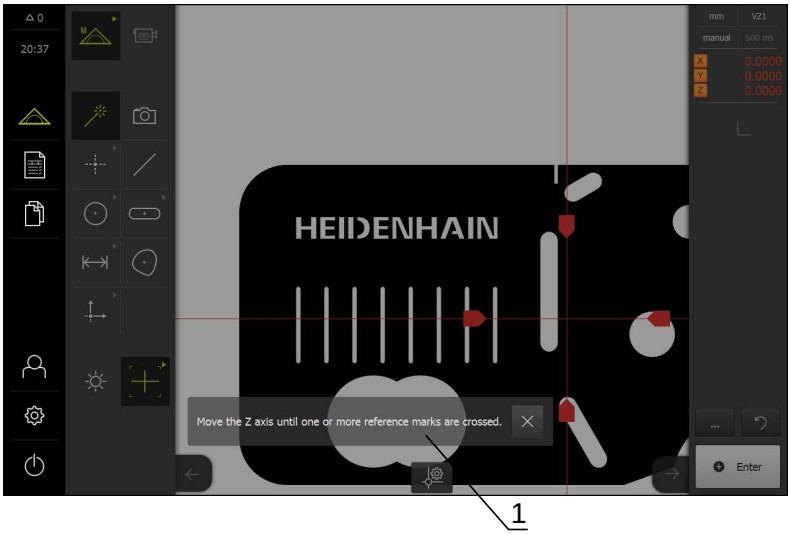
- ▶ To resize the message display area, drag the **handle** up or down
- ▶ To close the display area, drag the **handle** up out of the screen
- > The number of unclosed messages is indicated in **Messages**

Closing messages



- ▶ Tap **Close** to close a message
- > The message disappears

6.10.2 Wizard



1 Wizard (example)

The wizard supports the user when performing teach-in processes or handling procedures, and when executing measuring programs.

You can move the wizard in the workspace.

The operating elements provided by the wizard depend on the work step or process.

- To undo the last work step or repeat the process, tap **Undo**

- To confirm the displayed work step, tap **Confirm**

> The wizard proceeds to the next step or concludes the process

- Tap **Close** to close the wizard

6.10.3 Audio feedback

The product can also provide audio feedback to indicate user actions, completed processes or malfunctions.

The available sounds are grouped into categories. The sounds differ within a category.

You can define the audio feedback settings in the **Settings** menu.

Further information: "Sounds", page 314

7

Commissioning

7.1 Overview

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

The following steps must be performed only by qualified personnel.

Further information: "Personnel qualification", page 19

During commissioning, the machine manufacturer's commissioning engineer (**OEM**) configures the product for use in the specific measuring machine.

The settings can be reset to the factory defaults.

Further information: "Resetting to the factory defaults", page 350

Backing up the configuration

To back up the settings, you can back up the configuration data after commissioning or setup. These configuration data can be reused for equivalent products.

Before the backed-up configuration data can be restored to a product, the software options that were active during the backup must be activated on the respective product.

Further information: "Backing up and restoring the configuration", page 346

7.2 Logging in for commissioning

In the **User login** menu, you can log in and out of the product as a user. The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

Login
To commission the product, the **OEM** user must log in.

- Tap **User login** in the main menu
- If required, log out the user who is currently logged in
- Select the **OEM** user
- Tap the **Password** input field
- Enter the password 'oem'

> If a password other than the default password has been assigned to the user, ask a **Setup** or **OEM** user for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

- Tap **Log in**

> The user is logged in and the **Measure** menu is displayed.

Performing the reference mark search after startup

- After logging in, follow the instructions of the wizard

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting the language

The default language for the user interface is English. The language can be set individually for each user.

- Tap **Settings** in the main menu.

- Tap **User**
- > The logged-in user is indicated by a check mark
- Select the logged-in user
- > The language selected for the user is indicated by a national flag in a drop-down list
- Select the flag for the desired language in the **Language** drop-down list
- > The user interface immediately switches to the selected language

Changing the password

The password must be changed to prevent unauthorized configuration.

The password is confidential and must not be disclosed to any other person.

- Tap **Settings** in the main menu

- Select **User**
- > The logged-in user is indicated by a check mark
- Select the logged-in user
- Tap **Password**
- Enter the current password
- Confirm the entry with **RET**
- Enter the new password and repeat it
- Confirm the entries with **RET**
- Tap **OK**
- Close the message with **OK**
- > The new password is available the next time the user logs in

7.3 Commissioning steps

The steps for commissioning the product should be performed in the sequence in which they are described in the following sections.

Sec. 7.3.1: **Basic settings**	▶	**Sec. 7.3.2:** **Configuring the axes**	▶	**Sec. 7.3.3:** **Configuring VED sensors**
Setting the date and time Setting the units of measure Entering and configuring users and passwords Enabling software options		Activating the reference mark search Setting axis parameters Configuring axis error compensation		Setting the camera Setting the magnification Setting the lighting Setting the camera orientation Adjusting the contrast settings Determining the pixel sizes

NOTICE

Loss of or damage to configuration data!

- Back up the configuration data for restoration purposes and keep the backup safe.
  Further information: "Backing up and restoring the configuration", page 346

7.3.1 Basic settings

Sec. 7.3.1: **Basic settings**	▶	Sec. 7.3.2: Configuring the axes	▶	Sec. 7.3.3: Configuring VED sensors

Setting the date and time

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Date and time**
- To set the date and time in the middle line, drag the columns up or down
- Tap **Set** to confirm
- Select the desired format in the **Date format** list:
  - MM-DD-YYYY: Display as month, day, year
  - DD-MM-YYYY: Display as day, month, year
  - YYYY-MM-DD: Display as year, month, day

  Further information: "Date and time", page 316

Setting the units of measure

The product provides various parameters for setting the units of measure, decimal places and rounding methods.

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Units**
- To set a unit of measure, tap the corresponding drop-down list and select the unit
- To reduce or increase the number of decimal places displayed, tap **-** or **+**
  Further information: "Units", page 316

Enabling software options

Additional software options are enabled in the product via a license key.

Overview of software options

The overview page shows you which software options are enabled in the product.

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **Software options**
  - **Overview**

> A list of enabled software options is displayed

Requesting a license key

You can request a license key by

- Reading out device information for the license key request
- Creating a license key request

Reading out device information for the license key request

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Device information**

> An overview of the device information appears

> The product name, part number, serial number and firmware version are displayed

- Contact a HEIDENHAIN service agency and request a license key for the product

> The license key and the license file are generated and sent to you by e-mail

> You can read the license key from the provided license file into the product or enter it manually

Creating a license key request

- Tap **Settings** in the main menu

- Tap **Service**
- Tap **Software options**
- To request a software option that is available for a fee, tap **Request options**
- To request a free trial version, tap **Request trial options**
- To select a QUADRA-CHEK 3000 AEI1 software option, use **-** and **+** to specify the number of additional encoder inputs
- To select the QUADRA-CHEK 3000 VED software option, tap the check mark

- To deselect an entry, tap the check mark for the respective software option

- Tap **Creating a request**
- In the dialog, select the storage location in which you want to save the license key request
- Enter a suitable file name
- Confirm the entry with **RET**
- Tap **OK**

> The license key request is created and saved in the selected folder

- If the license key request is stored in the product, move the file to a connected USB mass storage device or the network drive
  Further information: "Moving a file", page 306
- Contact a HEIDENHAIN service agency and request a license key for the product

> The license key and the license file are generated and sent to you by e-mail

> You can read the license key from the provided license file into the product or enter it manually

Activating a license key

You can activate a license key by

- Reading the license key from the provided license file into the product
- Entering the license key manually into the product

Reading the license file

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **Software options**
  - **Activate options**
- Tap **Read license file**
- Select the license file in the file system, on the USB mass storage device or on the network drive
- Confirm your selection with **OK**
- Tap **OK**

> The license key is activated

- Tap **OK**

> You may need to restart the product, depending on the software option

- Confirm the restart with **OK**

> The activated software option is available

Entering the license key

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **Software options**
  - **Activate options**
- Enter the license key into the **License key** input field
- Confirm entry with **RET**
- Tap **OK**

> The license key is activated

- Tap **OK**

> You may need to restart the product, depending on the software option

- Confirm the restart with **OK**

> The activated software option is available

7.3.2 Configuring the axes

Sec. 7.3.1: Basic settings	▶	**Sec. 7.3.2: Configuring the axes**	▶	Sec. 7.3.3: Configuring VED sensors

Activating the reference mark search

The reference mark search must be performed to ensure that the relationship between the axis positions and the measuring plate is reproducible.

Requirement: The encoders installed in the measuring machine have reference marks that have been configured in the axis parameters.

If the reference mark search has been activated, a wizard appears on startup of the product and asks the user to move the axes of the encoder.

The reference mark search performed on startup of the product can only be canceled if an **OEM** or **Setup** user is logged in. Users of the **Operator** type cannot cancel the reference mark search.

- Tap **Settings** in the main menu

- Tap **Axes**
- Open in the sequence
  - **General settings**
  - **Reference marks**
- Set the sliding switch to **ON**

> The reference marks of the encoder must be traversed every time the product is started

> The functions of the product will only be available after the reference mark search has been completed

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Further information: "Axes", page 337

Starting the reference mark search

- Tap **Settings** in the main menu
- Open in the sequence
  - **Axes**
  - **General settings**
  - **Reference marks**
- Tap **Start**

> Existing reference marks are cleared

> The display color of the axis position changes from white to red

- Follow the instructions of the wizard

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting axis parameters

Linear encoders

The following overview provides examples of HEIDENHAIN linear encoders that can be connected to the product.

Encoder series	Interface	Signal period	Reference mark	Maximum traverse path
LS 328C	TTL	20 µm	Coded / 1000	20 mm
AK LIDA 27	TTL	20 µm	One	-
		4 µm		
		2 µm		
AK LIDA 47	TTL	4 µm	One	-
		4 µm	Coded / 1000*)	20 mm
		2 µm	One	-
		2 µm	Coded / 1000*)	20 mm
LS 388C	1 V_{PP}	20 µm	Coded / 1000	20 mm
AK LIDA 28	1 V_{PP}	200 µm	One	-
AK LIDA 48	1 V_{PP}	20 µm	One	-
AK LIF 48	1 V_{PP}	4 µm	One	-

*) "Coded / 1000" only in conjunction with the LIDA 4x3C scale

Angle encoders

The following overview provides examples of HEIDENHAIN angle encoders that can be connected to the product.

Encoder series	Interface	Line count/ outputs signals per revolution	Reference mark	Nominal increment
RON 225	TTLx2	18 000	One	-
RON 285	1 V_{PP}	18 000	One	-
RON 285C	1 V_{PP}	18 000	Coded / 1000	20°
RON 785	1 V_{PP}	18 000	One	-
RON 785C	1 V_{PP}	18 000	Coded / 1000	20°
RON 786	1 V_{PP}	18 000	One	-
RON 786C	1 V_{PP}	18 000	Coded / 1000	20°
ROD 220	TTLx2	18 000	One	-
ROD 280	1 V_{PP}	18 000	One	-
ROD 280C	1 V_{PP}	18 000	Coded / 1000	20°

Adjusting the encoder

The adjustment procedure is the same for each axis. The following section describes only the configuration of the X axis.

- Tap **Settings** in the main menu

- Tap **Axes**
- Tap **X**
- Select the axis in the **Axis name** drop-down list
- Tap **Encoder**
- Specify the connection (X1 - X4) for the respective encoder in the **Encoder input** drop-down list
- If required, select the type of incremental signal in the **Incremental signal** drop-down list:
  - **1 Vpp**: Sinusoidal voltage signal
  - **11 µApp**: Sinusoidal current signal
- Select the encoder model in the **Encoder model** drop-down list:
  - **Linear encoder**: Linear axis
  - **Angle encoder**: Rotary axis
- Depending on whether you will be using a linear encoder or an angle encoder, enter the appropriate value in the **Signal period** or **Line count** input field
- Confirm entry with **RET**
- Select the reference mark in the **Reference mark** drop-down list:
  - **None**: There is no reference mark
  - **One**: The encoder has one reference mark
  - **Coded**: The encoder has distance-coded reference marks
- If the linear encoder has coded reference marks, enter the **Maximum traverse path**
- Confirm entry with **RET**
- If the angle encoder has coded reference marks, enter the **Nominal increment**
- Confirm entry with **RET**
- In the **Analog filter frequency** drop-down list, select the frequency of the low-pass filter for suppressing high-frequency interference signals:
  - **33 kHz**: Suppression of interference frequencies above 33 kHz
  - **400 kHz**: Suppression of interference frequencies above 400 kHz
- Activate or deactivate the **Terminating resistor**

> The terminating resistor is deactivated automatically for incremental signals of the current signal type (11 μA_{PP}).

- Select the type of error monitoring in the **Error monitor** drop-down list:
  - **Off**: Error monitoring not active
  - **Amplitude**: Error monitoring of signal amplitude
  - **Frequency**: Error monitoring of signal frequency
  - **Frequency & amplitude**: Error monitoring of signal amplitude and signal frequency
- Select the desired counting direction in the **Counting direction** drop-down list:
  - **Positive**: The direction of traverse corresponds to the counting direction of the encoder
  - **Negative**: The direction of traverse does not correspond to the counting direction of the encoder

Further information: "Axis settings", page 341

Configuring error compensation in the axis

The axes of a measuring machine are subject to mechanical influences, such as guideway errors, tilting in the end positions, tolerances of the bearing surface or poor mounting (Abbe error). To compensate these influences, the products provide the possibility to perform not only linear error compensation (LEC) over the entire measuring range, but also segmented linear error compensation (SLEC). In this way, even nonlinear error curves can be compensated down to a comparatively small residual error. For both methods, the actual error curve of the entire axis must be exactly measured with a comparator system or calibration standard over the path whose error is to be compensated.

> The linear error compensation (LEC) or segmented linear error compensation (SLEC) is performed for each linear axis. The procedure is the same for each axis.

Configuring linear error compensation
To perform linear error compensation (LEC), you enter two supporting points to define the axis as a single segment covering the entire measuring range. The deviation between the segment length and the actual distance traversed in the segment determines the compensation value that compensates the mechanical influences acting on the axis. The compensation value is calculated by subtracting the actual distance traversed from the segment length.

	For linear error compensation (LEC), use the segmented linear error compensation (SLEC) function to enter two supporting points that define the axis as a single segment covering the entire measuring range. In this way, linear compensation of the axis is performed over the entire segment.

- Tap **Settings** in the main menu

- Tap **Axes**
- Select the axis
- Open in the sequence
  - **Error compensation**
  - **Segmented linear error compensation (SLEC)**
- Deactivate **Compensation** with the **ON/OFF** sliding switch

- Tap **Create table of supporting points**
- Tap **+** or **-** to set the **Number of supporting points**
- Enter the **Spacing of the supporting points**
- Confirm the entry with **RET**
- Enter the **Start point**
- Confirm the entry with **RET**
- Tap **Create** to create the table of supporting points
> The table of supporting points is created
> The table lists the **supporting point positions (P)** and the **compensation values (D)** of the individual segments
- Enter the compensation value (D) **"0.0"** for supporting point **0**
- Confirm the entry with **RET**
- Enter the determined **compensation value (D)** for supporting point **1**
- Confirm the entry with **RET**
- To switch to **Segmented linear error compensation (SLEC)**, tap **Table of supporting points**
- Tap **Create table of supporting points**
- Activate **Compensation** with the **ON/OFF** sliding switch
> The linear error compensation for the axis is applied

Further information: "Segmented linear error compensation (SLEC)", page 343

Configuring segmented linear error compensation
To perform segmented linear error compensation, you can enter up to 200 supporting points to divide the axis into segments of any desired length. The deviations between the actual distance traversed and the segment length in the individual segments determine the compensation values that compensate the mechanical influences acting on the axis. The compensation value is calculated by subtracting the actual distance traversed from the segment length.

- Tap **Settings** in the main menu

- Tap **Axes**
- Select the axis
- Open in the sequence
  - **Error compensation**
  - **Segmented linear error compensation (SLEC)**
- Deactivate **Compensation** with the **ON/OFF** sliding switch

- Tap **Create table of supporting points**
- Tap **+** or **-** to set the **Number of supporting points**
- Enter the **Spacing of the supporting points**
- Confirm entry with **RET**
- Enter the **Start point**
- Confirm entry with **RET**
- Tap **Create** to create the table of supporting points
> The table of supporting points is created
> The table lists the **supporting point positions (P)** and the **compensation values (D)** of the individual segments
- Enter the compensation value (D) **"0.0"** for supporting point **0**
- Confirm entry with **RET**
- Enter the determined compensation value into the **compensation value (D)** input field for each supporting point
- Confirm each entry with **RET**
- To switch to **Segmented linear error compensation (SLEC)**, tap **Table of supporting points**
- Tap **Create table of supporting points**
- Activate **Compensation** with the **ON/OFF** sliding switch
> The linear error compensation for the axis is applied

Further information: "Segmented linear error compensation (SLEC)", page 343

Editing the existing Table of supporting points
Once the supporting point table for linear or segmented linear error compensation has been created, it can be edited as needed.

- Tap **Settings** in the main menu

- Tap **Axes**
- Select the axis
- Open in the sequence
  - **Error compensation**
  - **Segmented linear error compensation (SLEC)**
- Deactivate **Compensation** with the **ON/OFF** sliding switch
- Tap **Table of supporting points**
- > The table lists the **supporting point positions (P)** and the **compensation values (D)** of the individual segments
- Adjust the **compensation value (D)** for the supporting points
- Confirm the entries with **RET**
- To switch to **Segmented linear error compensation (SLEC)**, tap **Table of supporting points**
- Activate **Compensation** with the **ON/OFF** sliding switch
- > The adjusted linear error compensation for the axis is applied

Further information: "Segmented linear error compensation (SLEC)", page 343

7.3.3 Configuring VED sensors

Sec. 7.3.1: Basic settings ▶ Sec. 7.3.2: Configuring the axes ▶ **Sec. 7.3.3: Configuring VED sensors**

If the QUADRA-CHEK 3000 VED software option is active, the VED sensor must be configured. This section describes the configuration procedure.

Setting the camera

The product supports the use of a connected camera. Connecting more than one camera can lead to faulty settings and incorrect measurement results.

If no camera is detected, the product will switch to the virtual camera. In this case, the live image will show the 2-D demo part.

Setting a USB camera

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Camera**

> The list of available cameras is displayed

> USB cameras are indicated by **(USB)** at the end of their name

- Tap the USB camera you want to use
- Tap **Activate** first, if necessary, to activate an inactive camera

> The camera is activated

> The first lines show the camera data

- Select the desired pixel format in the **Pixel format** drop-down list
- Tap **-** or **+** to set the **Pixel clock (MHz)**
- Tap **-** or **+** to set the **Image rate**
- Tap **-** or **+** to set the **Detail: Width**
- Tap **-** or **+** to set the **Detail: Height**
- Tap **-** or **+** to set the **Detail: X position**
- Tap **-** or **+** to set the **Detail: Y position**
- Drag the **slider** to the desired position to adjust the **Master gain**
- Drag the **slider** to the desired position to adjust the **Red gain**
- Drag the **slider** to the desired position to adjust the **Green gain**
- Drag the **slider** to the desired position to adjust the **Blue gain**
- Tap **-** or **+** to set the **Exposure time (µs)**

> The new camera settings are applied

Further information: "Camera", page 318

Setting an Ethernet camera

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Camera**

> The list of available cameras is displayed

> Ethernet cameras are indicated by **(GigE)** at the end of their name

- Tap the Ethernet camera you want to use
- Tap **Activate** first, if necessary, to activate an inactive camera

> The camera is activated

> The first lines show the camera data

- Select the desired pixel format in the **Pixel format** drop-down list
- Tap **Network settings**

> The **Network settings** dialog appears

- Depending on the network environment, activate or deactivate **DHCP** with the **ON/OFF** sliding switch
- In the dialog, enter the **IPv4 address** and **IPv4 subnet mask** you want to use
- Confirm each entry with **RET**
- Save the settings in the dialog with **OK**

> The dialog is closed

- Tap **-** or **+** to set the **Pixel clock (MHz)**
- Tap **-** or **+** to set the **Image rate**
- Tap **-** or **+** to set the **Detail: Width**
- Tap **-** or **+** to set the **Detail: Height**
- Tap **-** or **+** to set the **Detail: X position**
- Tap **-** or **+** to set the **Detail: Y position**
- Drag the **slider** to the desired position to adjust the **Master gain**
- Drag the **slider** to the desired position to adjust the **Red gain**
- Drag the **slider** to the desired position to adjust the **Green gain**
- Drag the **slider** to the desired position to adjust the **Blue gain**
- Tap **-** or **+** to set the **Exposure time (µs)**

> The new camera settings are applied

Further information: "Camera", page 318

Activating the virtual camera
To try out examples described in these instructions, you can activate a virtual camera. When you use the virtual camera, an image of the 2-D demo part is displayed in the live image.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Camera**

> The list of available cameras is displayed

- Tap the virtual camera you want to use
- Tap **Activate** first, if necessary, to activate an inactive camera

> The camera is activated

Replacing the live image of the virtual camera
When you use a virtual camera, an image is displayed in the workspace. You can replace this image with an image of your choice, provided that a geometry in that image is known and can be used for determining the pixel size.

Only images in the PNG and JPG file formats and with an image size of 1280 px x 1024 px can be displayed.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Camera**

> The list of available cameras is displayed

- Tap the virtual camera you want to use
- Tap **Activate** first, if necessary, to activate an inactive camera
- To select the source for the image displayed in the workspace, tap **Image directory**
- Select the folder and confirm with **OK**

> The image stored in the selected folder is displayed in the workspace

Further information: "Camera", page 318

Setting the magnification

For camera systems with adjustable optical magnifications, the pixel size must be determined for each magnification. This ensures the correct size ratio between the live image and the measured object during a measurement. Before the pixel sizes can be determined for the magnifications, the magnifications provided by the measuring machine need to be entered into the product.

Further information: "Determining the pixel sizes", page 129

The number of magnifications depends on the measuring machine connected to the product.

Adjusting the magnification

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Magnifications**
- Set a magnification in the camera system, e.g. 1.0
- Tap **VED Zoom 1**, for example
- Tap the **Description** input field
- Adapt the existing description
- Confirm entry with **RET**
- Tap the **Acronym for quick access menu** input field
- Adapt the existing acronym
- Confirm entry with **RET**
- > The magnification list shows the magnification together with the adapted information

Further information: "Magnifications", page 320

Adding a magnification

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Magnifications**
- Set a magnification in the camera system, e.g. 2.0

- Tap **Add**
- Tap the **Description** input field
- Enter a description for the magnification you have set
- Confirm entry with **RET**
- Tap the **Acronym for quick access menu** input field
- Enter a meaningful acronym
- Confirm entry with **RET**
- > The acronym is needed for selecting the magnification in the quick access menu of the Inspector
- Tap **Add**
- > The new magnification appears in the magnification list

Further information: "Magnifications", page 320

Removing magnifications

Magnifications that are no longer needed can be removed from the list.

Only inactive magnifications can be removed.

- Tap **Measure** in the main menu
- Tap the **quick access menu** in the Inspector
- Select a magnification that is not to be deleted

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Magnifications**
- > The active magnification is indicated by a check mark
- Tap the inactive magnification that you want to remove
- Tap **Remove**
- To confirm the removal, tap **Remove** in the dialog
- > The magnification is removed from the magnification list

Setting the lighting

Linking the lighting to the magnification

The light intensity that reaches the VED sensor, e.g. through the camera optics, decreases with increasing magnification. To compensate the reduced brightness, you can link the lighting to the magnification.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Lighting**
- Tap **General settings**
- To activate or deactivate the link between the lighting and the magnification, drag the **ON/OFF** sliding switch to the desired setting

> When the link is active, the lighting settings are saved for the respective magnification

> When the link is not active, you need to manually adjust the lighting if you change the magnification

Lighting configurations
The range of lighting functions depends on the lighting unit of the connected measuring machine.

The product supports the following configurations:

- **A transmitted light + 4 x AD reflected light**
- **A trans.light + 4 x A refl.light + D laser pointer**

Further information: "Lighting", page 321

Setting the lighting configuration A transmitted light + 4 x AD reflected light

- ▶ Tap **Settings** in the main menu

- ▶ Tap **Sensors**
- ▶ Open in the sequence
  - **Video edge detection (VED)**
  - **Lighting**
- > The list of available lighting configurations is displayed
- ▶ Tap **A transmitted light + 4 x AD reflected light**
- ▶ If necessary, tap **Activate** to activate an inactive lighting
- ▶ Select the desired analog output in the **Analog output for transmitted light** drop-down list
- ▶ Select the desired analog output in the **Analog output for reflected light** drop-down list
- ▶ Select the desired digital output in the **Digital output for front segment** drop-down list
- ▶ Select the desired digital output in the **Digital output for rear segment** drop-down list
- ▶ Select the desired digital output in the **Digital output for left segment** drop-down list
- ▶ Select the desired digital output in the **Digital output for right segment** drop-down list
- > The lighting can now be adjusted with the **lighting palette**.

Further information: "Lighting", page 321

Setting the lighting configuration A trans.light + 4 x A refl.light + D laser pointer

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Lighting**

> The list of available lighting configurations is displayed

- Tap **A trans.light + 4 x A refl.light + D laser pointer**
- If necessary, tap **Activate** to activate an inactive lighting
- Select the desired analog output in the **Analog output for transmitted light** drop-down list
- Select the desired analog output in the **Analog output for front segment** drop-down list
- Select the desired analog output in the **Analog output for rear segment** drop-down list
- Select the desired analog output in the **Analog output for left segment** drop-down list
- Select the desired analog output in the **Analog output for right segment** drop-down list
- Select the desired digital output in the **Digital output for laser pointer** drop-down list

> The lighting can now be adjusted with the **lighting palette**.

Further information: "Lighting", page 321

Setting the camera orientation

A slight skew of the camera relative to the measuring plate of the measuring machine can be compensated to a small extent by using the camera orientation function.

	If the skew cannot be compensated by the product, a mechanical alignment needs to be performed.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Camera orientation**
- Tap **Start**

> The teach sequence is started

> The wizard is displayed in the **Measure** menu

- Follow the instructions of the wizard

> The successful measurement of the camera skew is displayed

- Tap **Confirm** to confirm the measured camera skew

> The measured value is displayed in **Camera skew**

> The value can be adjusted by direct entry

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

Further information: "Camera orientation", page 327

Adjusting the contrast settings

The currently selected contrast threshold of the product may need to be adjusted to varying brightness conditions of the surroundings, e.g. changes in daylight. The contrast threshold defines the contrast value starting from which the product will recognize a light-to-dark transition as a transition.

A change in brightness could result in light-to-dark transitions—and therefore edges—being detected earlier or later, thus falsifying the measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Contrast settings**
- Select the **Edge algorithm** for the edge detection
- Tap **Start**

> The teach sequence is started and the **Measure** menu is displayed

- Follow the instructions of the wizard

- Select the **lighting palette**
- Adjust the sliders to achieve the highest possible contrast at the edge

- Tap **Confirm** in the wizard to confirm the positioning of the measuring tool and the lighting settings

> The teach sequence is complete

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

Further information: "Contrast settings", page 328

Determining the pixel sizes

When measuring with a VED sensor, the measurement is performed in the live image on the product. To ensure that the size of the live image matches that of the measured object, the pixel size must be determined for each magnification.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Pixel sizes**
- Tap **Magnification**
- Select the desired magnification
- In **Calibration standard diameter**, enter the diameter of the desired circle, which is specified in the calibration chart supplied with the calibration standard
- Confirm entry with **RET**
- Tap **Start**

> The teach sequence is started and the wizard is displayed in the **Measure** menu

- Follow the instructions of the wizard

- Tap **Confirm** to confirm that you have completed the wizard's instructions

> The teach sequence is complete

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

- Repeat the procedure to determine the pixel sizes for all available magnifications

Further information: "Pixel sizes", page 329

7.4 OEM area

The OEM area enables commissioning engineers to install custom information in the product:

- **Documentation**: OEM documentation, e.g. service information
- **Opening screen**: Adjustment of the startup screen, e.g. to display the OEM's company logo

7.4.1 Adding the OEM documentation

> Only documents in PDF format can be added. Other documents are not displayed.

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **OEM area**
  - **Documentation**
  - **Add OEM service info**
- If required, connect a USB mass storage device to a USB port of the product
- To navigate to the desired file, tap the location where the file is stored

> If you have accidentally tapped the wrong folder, you can return to the previous folder. Tap the file name that is displayed above the list.

- Navigate to the folder containing the file
- Tap the file name
- Tap **OK**
- > The document is copied to the product and displayed in the service information area
- Confirm the successful transfer with **OK**

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

7.4.2 Adjusting the startup screen

The product can display a custom startup screen, e.g. the company name or logo. The corresponding image needs to be stored on the product for this purpose.

Requirements

- File format: PNG or JPG
- Resolution: 96 ppi
- Image format: 16:10
  Images in other formats will be scaled proportionally
- Image size: Max. 1280 x 800 px

Inserting a startup screen

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **OEM area**
  - **Opening screen**
  - **Select the startup screen**
- If required, connect a USB mass storage device to a USB port of the product
- To navigate to the desired file, tap the location where the file is stored

> If you have accidentally tapped the wrong folder, you can return to the previous folder. Tap the file name that is displayed above the list.

- Navigate to the folder containing the file
- Tap the file name
- Tap **OK**

> The image is copied to the product and displayed the next time the product is started

- Confirm the successful transfer with **OK**

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

8

Setup

8.1 Overview

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.
Further information: "Basic operation", page 51

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", page 19

During setup, the setup engineer (**Setup**) configures the product for use with the measuring machine in the respective measurement applications. This includes setting up operators, defining measurement report templates, and creating measuring programs.

Backing up the configuration
To back up the settings, you can back up the configuration data after commissioning or setup. These configuration data can be reused for equivalent products.

Before the backed-up configuration data can be restored to a product, the software options that were active during the backup must be activated on the respective product.

Further information: "Backing up and restoring the configuration", page 346

8.2 Logging in for setup

In the **User login** menu, you can log in and out of the product as a user. The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

Login
To set up the product, the **Setup** user must log in.

- Tap **User login** in the main menu
- If required, log out the user who is currently logged in
- Select the **Setup** user
- Tap the **Password** input field and enter 'setup' as the password

> If a password other than the default password has been assigned to the **Setup** user, ask the machine manufacturer (**OEM**) for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

- Confirm entry with **RET**

- Tap **Log in**

Performing the reference mark search after startup

- After logging in, follow the instructions of the wizard

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Setting the language
The default language for the user interface is English. The language can be set individually for each user.

- Tap **Settings** in the main menu.

- Tap **User**

> The logged-in user is indicated by a check mark

- Select the logged-in user

> The language selected for the user is indicated by a national flag in a drop-down list

- Select the flag for the desired language in the **Language** drop-down list

> The user interface immediately switches to the selected language

Changing the password

The password must be changed to prevent unauthorized configuration.

The password is confidential and must not be disclosed to any other person.

- Tap **Settings** in the main menu

- Select **User**
- > The logged-in user is indicated by a check mark
- Select the logged-in user
- Tap **Password**
- Enter the current password
- Confirm the entry with **RET**
- Enter the new password and repeat it
- Confirm the entries with **RET**
- Tap **OK**
- Close the message with **OK**
- > The new password is available the next time the user logs in

8.3 Setup steps

The steps for setting up the product should be performed in the sequence in which they are described in the following sections.

Sec. 8.3.1: **Basic settings**	**Sec. 8.3.2:** **Configuring sensors**	**Sec. 8.3.3:** **Setting the measuring application**
Setting the date and time Setting the units of measure Entering and configuring users and passwords Configuring the network Setting up a printer	Adjusting the contrast settings Determining the pixel sizes	Configuring the measuring point acquisition Creating a template for measurement reports Creating a measuring program

8.3.1 Basic settings

Sec. 8.3.1: **Basic settings**	Sec. 8.3.2: Configuring sensors	Sec. 8.3.3: Setting the measuring application

Setting the date and time

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Date and time**
- To set the date and time in the middle line, drag the columns up or down
- Tap **Set** to confirm
- Select the desired format in the **Date format** list:
  - MM-DD-YYYY: Display as month, day, year
  - DD-MM-YYYY: Display as day, month, year
  - YYYY-MM-DD: Display as year, month, day

Further information: "Date and time", page 316

Setting the units of measure

The product provides various parameters for setting the units of measure, decimal places and rounding methods.

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Units**
- To set a unit of measure, tap the corresponding drop-down list and select the unit
- To reduce or increase the number of decimal places displayed, tap **-** or **+**
  Further information: "Units", page 316

Entering and configuring users

The product defaults to three users with different rights:

- **OEM**
- **Setup**
- **Operator**

Further information: "User", page 335

Entering users and passwords
Requirement: OEM or **Setup** user is logged in.

You can use any characters for the user ID and the password. These entries are case-sensitive.

- Tap **Settings** in the main menu

- Tap **User**

- Tap **Add**
- Tap the **User ID** input field

> The **User ID** is displayed for user selection, e.g. at the login prompt.
>
> The **User ID** cannot be changed later.

- Enter the user ID
- Confirm entry with **RET**
- Tap the **Name** input field
- Enter the name of the new user
- Confirm entry with **RET**
- Tap the **Password** input field
- Enter any password
- Confirm entry with **RET**
- Re-enter the password in the **Repeat password** input field
- Confirm entry with **RET**

> You can show the contents of the two password fields in plain text and hide them again:
>
> - Use the **ON/OFF** sliding switch to show or hide the contents

- Tap **OK**

> A message appears

- Close the message with **OK**

> The user account is created with the basic data; the user can then further adjust the account settings

Configuring the user
After creating a new **Operator**-type user account, you can add or edit the following user data:

- Name
- First name
- Department
- Password
- Language
- Auto login

> If auto login is active for one or more users, the last user who logged in is automatically logged in to the product on power-up without entering the user ID and password.

- ▶ Tap **Settings** in the main menu

- ▶ Tap **User**
- ▶ Select the user
- ▶ Tap the input field whose contents you want to edit: **Name**, **First name**, **Department**
- ▶ Edit the contents and confirm your changes with **RET**
- ▶ To change the password, tap **Password**
- > The **Change password** dialog appears
- ▶ When changing the password of the logged-in user, enter the current password
- ▶ Confirm entry with **RET**
- ▶ Enter the new password and repeat it
- ▶ Confirm the entries with **RET**
- ▶ Tap **OK**
- > A message appears
- ▶ Close the message with **OK**
- ▶ To change the language, select the flag for the desired language in the **Language** drop-down list
- ▶ To activate or deactivate **Auto login**, use the **ON/OFF** sliding switch

Further information: "User", page 335

Entering and configuring new users
New users and their authorization settings are entered during setup of the product.
Further information: "Entering and configuring users", page 138

Deleting users
You can remove **Operator**-type users that are no longer needed.
Requirement: OEM or **Setup** user is logged in.

OEM-type and **Setup**-type users cannot be deleted.

- Tap **Settings** in the main menu

- Tap **User**
- Tap the user you want to delete
- Tap **Remove user account**
- Enter the password of the authorized user (**OEM** or **Setup**)
- Tap **OK**

> The user is deleted

Configuring the network

For the network setting details, contact your network administrator.

> The configuration of the network settings is the same for all network connections.

- Tap **Settings** in the main menu

- Tap **Interfaces**
- Tap **Network**
- Tap the desired interface (**X116** or **X117**)

> The MAC address is detected automatically

- Depending on the network environment, activate or deactivate **DHCP** with the **ON/OFF** sliding switch

> If DHCP is active, the network settings are obtained automatically as soon as the IP address is assigned

- If the DHCP protocol is not active, enter the **IPv4 address**, **IPv4 subnet mask** and **IPv4 standard gateway**
- Confirm the entries with **RET**
- Depending on the network environment, activate or deactivate **IPv6 SLAAC** with the **ON/OFF** sliding switch

> If IPv6 SLAAC is active, the network settings are obtained automatically as soon as the IP address is assigned

- If IPv6 SLAAC is not active, enter the **IPv6 address**, **IPv6 subnet prefix length** and **IPv6 standard gateway**
- Confirm the entries with **RET**
- Enter the **Preferred DNS server** and, if required, the **Alternative DNS server**
- Confirm the entries with **RET**

> The configuration of the network connection is applied

Further information: "Network", page 333

Configuring the network drive
For the network drive details, such as IP address or host name of the server, shared folders, etc., contact your network administrator.

- Tap **Settings** in the main menu

- Tap **Interfaces**
- Tap **Network drive**
- Enter the network drive details
- Confirm the entries with **RET**
- Use the **ON/OFF** sliding switch to activate or deactivate **Show password**
- If required, select **Network drive options**
- Tap **Mount**
- The connection to the network drive is established

Further information: "Network drive", page 334

Setting up a printer

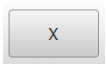
Requirement: A printer is connected.
Further information: "Connecting printers", page 48

Adding a USB printer

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Printers**

> If no default printer has been set up yet, a message appears



- Tap "Close" in the message

- Open in the sequence
  - **Add printer**
  - **USB printer**

> Connected USB printers are detected automatically

- Tap **Located printers**

> The list of detected printers is displayed

> If only one printer is connected, the printer is selected automatically

- Select a printer
- Tap **Located printers** once again
- Enter a name for the printer into the **Name** input field

> The name of the printer must not contain slashes ("/"), number signs ("#") or spaces

- Confirm entry with **RET**
- Enter an optional description for the printer into the **Description** input field, e.g. "Color printer"
- Confirm entry with **RET**
- Enter an optional location into the **Location** input field, e.g. "Office"
- Confirm entry with **RET**
- Enter the connection parameters into the **Connection** input field, if they have not been entered automatically
- Confirm entry with **RET**
- Tap **Select the driver**

i	The printer can only be activated with the assigned driver.

- Select the appropriate driver for the printer

> If the appropriate driver is not listed, it needs to be copied to the product

i	The printer manufacturer usually provides the appropriate driver.

- To copy a custom driver to the product, tap **Select PPD file**
- Tap **Select file**
- To navigate to the desired PPD file, tap the **location** where the file is stored
- Navigate to the folder containing the PPD file
- Select PPD file
- Tap **OK**

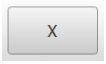
> The PPD file is copied to the product

> You can only use drivers that are supported by Linux. Drivers for other operating systems are not recognized.

- Tap **Continue**

> The driver is activated

- Tap **Close** in the message



- Tap **Set standard values**
- Tap **Resolution** to set the printer resolution
- Select the desired resolution
- Tap **Resolution** once again
- Tap **Paper size** to set the paper size
- Select the desired paper size

> The resolution and the paper size are saved as defaults

> The printer is added and can be used

Further information: "Printers", page 315

Adding a network printer

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Printers**
- Open in the sequence
  - **Add printer**
  - **Network printer**

> Printers available on the network are detected automatically

- Tap **Located printers**

> The list of detected printers is displayed

> If only one printer is connected, the printer is selected automatically

- Select a printer
- Tap **Located printers** once again
- Enter a name for the printer into the **Name** input field

> The name of the printer must not contain slashes ("/"), number signs ("#") or spaces

- Confirm entry with **RET**
- Enter an optional description for the printer into the **Description** input field, e.g. "Color printer"
- Confirm entry with **RET**
- Enter an optional location into the **Location** input field, e.g. "Office"
- Confirm entry with **RET**
- Enter the connection parameters into the **Connection** input field, if they have not been entered automatically
- Confirm entry with **RET**
- Tap **Select the driver**

The printer can only be activated with the assigned driver.

- Select the appropriate driver for the printer

> If the appropriate driver is not listed, it needs to be copied to the product

> The printer manufacturer usually provides the appropriate driver.

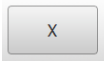
- To copy a custom driver to the product, tap **Select PPD file**
- Tap **Select file**
- To navigate to the desired PPD file, tap the **location** where the file is stored
- Navigate to the folder containing the PPD file
- Select PPD file
- Tap **OK**

> The PPD file is copied to the product

> You can only use drivers that are supported by Linux. Drivers for other operating systems are not recognized.

- Tap **Continue**

> The driver is activated



- Tap **Close** in the message
- Tap **Set standard values**
- Tap **Resolution** to set the printer resolution
- Select the desired resolution
- Tap **Resolution** once again
- Tap **Paper size** to set the paper size
- Select the desired paper size

> The resolution and the paper size are saved as defaults

> The printer is added and can be used

Further information: "Printers", page 315

Setting the resolution and paper size

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Printers**
- If multiple default printers have been set up for the product, select the desired printer in the **Default printer** drop-down list
- Tap **Properties**
- Tap **Resolution** to set the printer resolution
- > The resolutions provided by the driver are displayed
- Select the resolution
- Tap **Resolution** once again
- Tap **Paper size** to set the paper size
- > The paper sizes provided by the driver are displayed
- Select the paper size
- > The resolution and the paper size are saved as defaults

Further information: "Printers", page 315

Removing a printer

You can remove printers you no longer need. Once removed, they are no longer available for printing measurement reports or PDF files.

- Tap **Settings** in the main menu

- Tap **General**
- Open in the sequence
  - **Printers**
  - **Remove printer**
- In the **Printers** drop-down list, select the printer you no longer need
- > The model, location and connection of the printer are displayed
- Tap **Remove**
- Confirm with **OK**
- The printer is removed from the list and can no longer be used

8.3.2 Configuring sensors

Sec. 8.3.1: Basic settings	**Sec. 8.3.2: Configuring sensors**	Sec. 8.3.3: Setting the measuring application

If the QUADRA-CHEK 3000 VED software option is active, the sensors must be configured. This section describes the configuration procedure.

Adjusting the contrast settings

The currently selected contrast threshold of the product may need to be adjusted to varying brightness conditions of the surroundings, e.g. changes in daylight. The contrast threshold defines the contrast value starting from which the product will recognize a light-to-dark transition as a transition.

A change in brightness could result in light-to-dark transitions—and therefore edges—being detected earlier or later, thus falsifying the measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Contrast settings**
- Select the **Edge algorithm** for the edge detection
- Tap **Start**
- > The teach sequence is started and the **Measure** menu is displayed
- Follow the instructions of the wizard

- Select the **lighting palette**
- Adjust the sliders to achieve the highest possible contrast at the edge

- Tap **Confirm** in the wizard to confirm the positioning of the measuring tool and the lighting settings
- > The teach sequence is complete

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

Further information: "Contrast settings", page 328

Determining the pixel sizes

When measuring with a VED sensor, the measurement is performed in the live image on the product. To ensure that the size of the live image matches that of the measured object, the pixel size must be determined for each magnification.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Pixel sizes**
- Tap **Magnification**
- Select the desired magnification
- In **Calibration standard diameter**, enter the diameter of the desired circle, which is specified in the calibration chart supplied with the calibration standard
- Confirm entry with **RET**
- Tap **Start**

> The teach sequence is started and the wizard is displayed in the **Measure** menu

- Follow the instructions of the wizard

- Tap **Confirm** to confirm that you have completed the wizard's instructions

> The teach sequence is complete

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

- Repeat the procedure to determine the pixel sizes for all available magnifications

Further information: "Pixel sizes", page 329

8.3.3 Setting the measuring application

Sec. 8.3.1: Basic settings	▶	Sec. 8.3.2: Configuring sensors	▶	**Sec. 8.3.3: Setting the measuring application**

Configuring the measuring point acquisition

To measure the features, you can e.g. adjust the required minimum number of measuring points or the settings for the measuring point filter.

Adjusting the General settings

- Tap **Settings** in the main menu

- Tap **Features**
- Tap **General settings**
- To set the measuring point acquisition to a fixed or free number of measuring points, select the desired option in the **Number of measuring points** drop-down list:
  - **Fixed**: Measuring point acquisition is concluded automatically as soon as the specified minimum number of measuring points for the geometry is reached
  - **Free**: The user can capture as many additional measuring points as desired after reaching the required minimum number of measuring points. When the minimum number of points for the geometry has been reached, the measuring point acquisition can be concluded manually
- To display the distances between the measuring points as absolute or direction-dependent values, select the desired option in the **Distances** drop-down list:
  - **Signed**: The distance between the measuring points is displayed depending on the measuring direction
  - **Absolute**: The distance between the measuring points is displayed independently of the measuring direction

Further information: "General settings", page 330

Measuring point filter
During a measurement, you can filter out measuring points that are outside the defined criteria.

- Tap **Settings** in the main menu

- Tap **Features**
- Tap **Measuring point filter**
- To activate or deactivate the filter during measuring point acquisition, drag the **ON/OFF** sliding switch to the desired setting
- In the **Error limit** input field, specify the tolerance of the measuring point filter
- In the **Confidence interval (±xσ)** input field, specify the number of measuring points allowed outside the error limit
- In the **Minimum % proportion of retained points** input field, specify the minimum percentage of measuring points that must be used for the measurement

Further information: "Measuring point filter", page 330

Measure Magic

- Tap **Settings** in the main menu

- Tap **Features**
- Tap **Measure Magic**
- To define the maximum ratio of form error to main dimension, enter the desired value into the **Maximum form error ratio** input field
  - The maximum form error ratio is calculated from the form error divided by the feature size. It specifies the value below which a feature is correctly recognized
- To define the minimum angle for the detection of a circular arc, enter the desired value into the **Minimum angle for an arc** input field
- To define the maximum angle for the detection of a circle segment, enter the desired value into the **Maximum angle for an arc** input field
- To define the minimum length for the detection of a line, enter the desired value into the **Minimum line length** input field
- To define the ratio of linear eccentricity to the semimajor axis of an ellipse, enter the desired value into the **Minimum numeric ellipse eccentricity** input field
  - The numerical eccentricity describes the deviation of an ellipse from the circular shape; the greater the value, the greater the deviation
  - A value of 0 represents a circle; a value of 1 results in an ellipse flattened into a line

Further information: "Measure Magic", page 331

Features

- Tap **Settings** in the main menu

- Tap **Features**
- Tap the desired feature, e.g. **Circle**
- To reduce or increase the minimum number of measuring points required, tap **-** or **+**

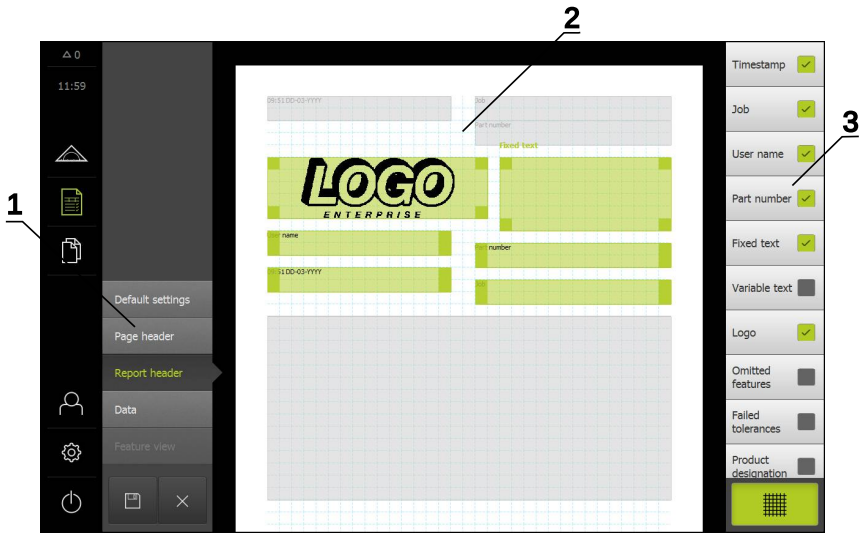
It is not possible to use fewer than the mathematically required minimum number of points for the geometries.

Further information: "Geometries", page 332

Creating a template for measurement reports

In the **Measurement report** main menu, you can create detailed reports for your measuring tasks. You can document one or more measured features in a measurement report. The measurement reports can be printed, exported and saved.
Using the integrated editor, you can create custom report templates and adapt them as needed.

Creating a template with the editor



1 The different sections of the template can be edited in the editor menu.
2 The form fields for the template are adjustable.
3 The list shows the form fields that can be inserted into the selected section of the template.

A description of how to create the templates is provided in the Measurement Report chapter.

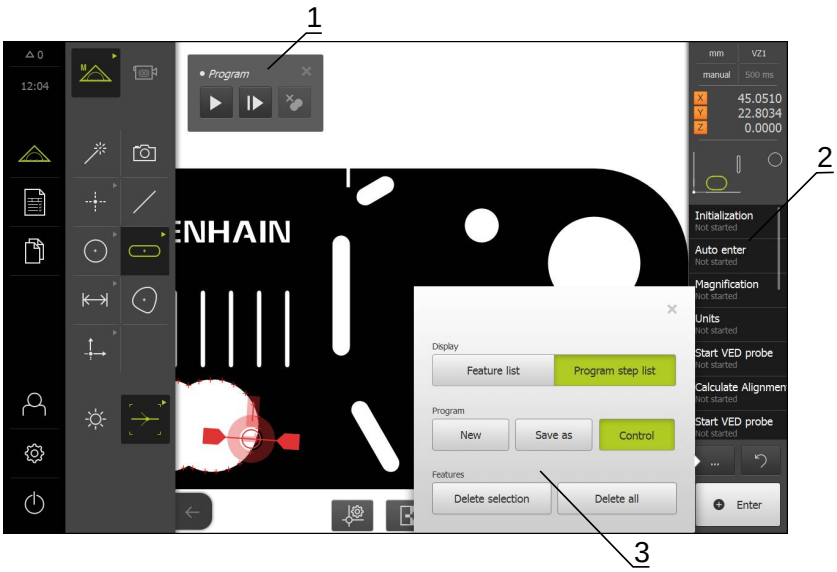
Further information: "Measurement report", page 283

Creating a measuring program

The product can record and save the steps of a measuring process, and run them sequentially as a batch process. This batch processing is referred to as the "measuring program".

In a measuring program, you can thus combine multiple work steps, such as measuring point acquisition and tolerancing, into a single process. This simplifies and standardizes the measuring process.

You can create measuring programs for the measurements with the measuring machine and store them on the product.



1 Control with operating elements
2 Program step list
3 Miscellaneous functions

A description of how to create the measuring programs is provided in the Programming chapter.

Further information: "Programming", page 271

9

Quick Start

9.1 Overview

The Quick Start chapter describes the steps of a general measuring sequence on the product. The steps range e.g. from aligning the measured object and measuring the features through to creating the measurement report. For a detailed description of the individual activities, please refer to the **Measurement** chapter and subsequent chapters.

Depending on the configuration of the product and the enabled software options, you can capture measuring points without or with a sensor. The product identifies the captured measuring points as features and displays them.

Requirement: Commissioning and setup have been completed.

9.2 Conducting a measurement

This section describes the typical steps for conducting a measurement. The description provides an overview and, thus, additional steps may be necessary depending on the measuring machine or the respective measuring application.

Sec. 9.2.1: **Preparing a measurement**	**Sec. 9.2.2:** **Measuring without a sensor**	**Sec. 9.2.3:** **Measuring with a VED sensor**	**Sec. 9.2.4:** **Evaluating and documenting the measurement**
■ Preparing the measured object and measuring machine ■ Conducting the reference mark search ■ Adjusting the sensors	■ Aligning the measured object ■ Measuring the features	■ Aligning the measured object ■ Measuring the features	■ Displaying and editing the measurement results ■ Outputting measurement reports ■ Using measuring programs

9.2.1 Preparing a measurement

Sec. 9.2.1: **Preparing a measurement** ▶ Sec. 9.2.2: Measuring without a sensor ▶ Sec. 9.2.3: Measuring with a VED sensor ▶ Sec. 9.2.4: Evaluating and documenting the measurement

Cleaning the measured object and the measuring machine
Contamination, e.g. from chips, dust and oil residues, leads to incorrect measurement results. The measured object, the holder for the measured object, and the sensor must be clean before you start measuring.

- Clean the measured object, the holder for the measured object, and the sensors with appropriate cleaning products

Stabilizing the temperature of the measured object
The objects to be measured should be stored at the measuring machine for an appropriate amount of time to allow the objects to adjust to the ambient temperature. Since the dimensions of the measured objects vary with temperature changes, the temperature of the measured objects must be stabilized.

This ensures the reproducibility of the measurement. The reference temperature is usually 20 °C.

- Stabilize the temperature of the measured objects for an appropriate amount time

Reducing environmental influences
Environmental influences, such as incident light, ground vibration or air humidity, can affect the measuring machine, the sensors or the measured objects, and thus falsify the measurement results. Certain influences, such as incident light, also have a negative effect on the measurement uncertainty.

- Eliminate or avoid environmental influences as far as possible

Fixing the measured object in place
The measured object must be fixed in place on the measuring plate or in an appropriate holder, depending on its size.

- Position the measured object in the center of the measuring range
- Use e.g. modeling clay to fix small measured objects in position
- Use fixtures to fix large measured objects in position
- Make sure that the measured object is fastened neither too loosely nor too tightly

9.2.2 Measuring without a sensor

Sec. 9.2.1: Preparing a measurement ▶ **Sec. 9.2.2: Measuring without a sensor** ▶ Sec. 9.2.3: Measuring with a VED sensor ▶ Sec. 9.2.4: Evaluating and documenting the measurement

On products without optical sensors, only geometries and no measuring tools are available. For alignment and measuring point acquisition, you can use an external screen with crosshairs, for example. The workspace of the user interface displays the position of the measuring plate.

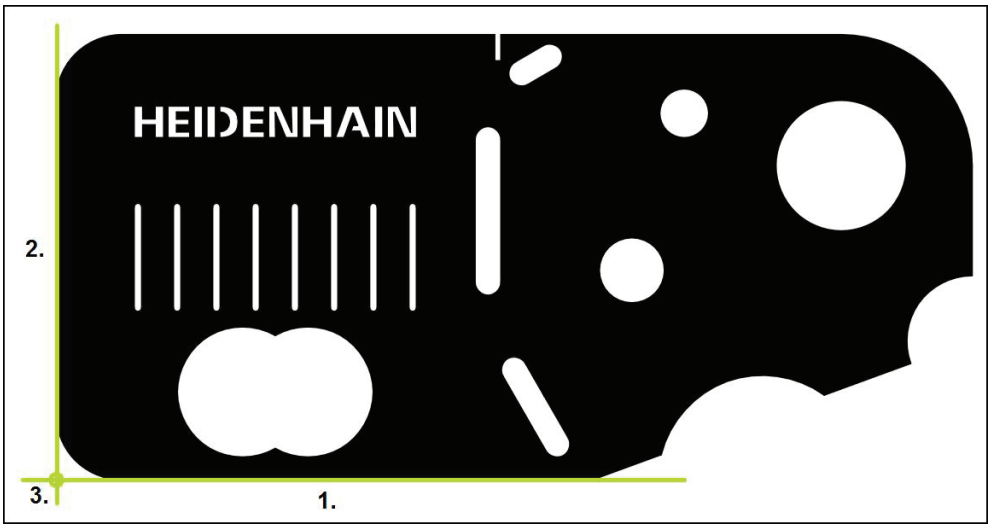
The measurements illustrated here are described in detail in the Measurement chapter.

Further information: "Measure menu without software option", page 64

Aligning the measured object

Before you can evaluate the measuring points, you need to align the measured object. During this process, the coordinate system of the measured object (workpiece coordinate system) is determined, which is specified in the technical drawing.

This makes it possible to compare the measured values with the data in the technical drawing and assess them.



Measured objects are usually aligned in three steps:

1 Measuring the alignment
2 Measuring a straight line
3 Constructing the zero point

Measuring the alignment
Define the reference edge for the alignment according to the technical drawing.

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette
> The workspace with the axis positions is displayed.

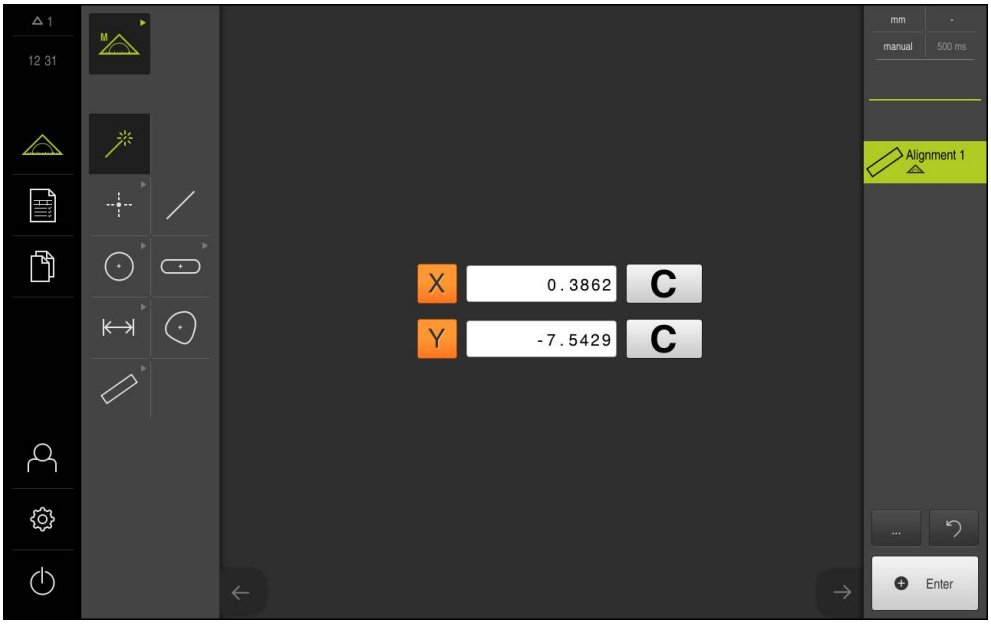
- Select **Alignment** in the geometry palette
- Position the first measuring point on the reference edge
- Tap **Enter** in the Inspector
> A new feature is displayed in the feature list of the Inspector

> Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- Position the second measuring point on the reference edge
- Tap **Enter** in the Inspector

> Depending on the configuration of the measuring point acquisition, you can also capture additional measuring points for the alignment. In this way you increase the accuracy of the alignment.

- Tap **Finish** in the new feature
> The alignment is displayed in the feature list of the Inspector



Measuring a straight line

For the second reference edge, you can measure a straight line, for example.

- Select **Line** in the geometry palette
- Position the first measuring point on the reference edge
- Tap **Enter** in the Inspector

> A new feature is displayed in the feature list of the Inspector

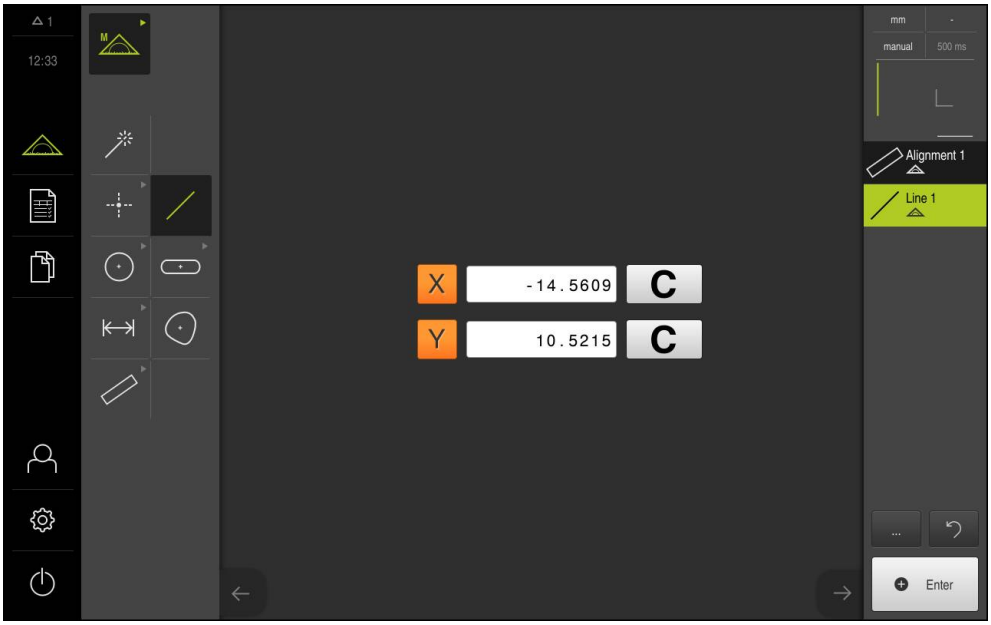
> Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- Position the second measuring point on the reference edge
- Tap **Enter** in the Inspector

> Depending on the configuration of the measuring point acquisition, you can also capture additional measuring points for the line. In this way you increase the accuracy.

- Tap **Finish** in the new feature

> The line is displayed in the feature list of the Inspector

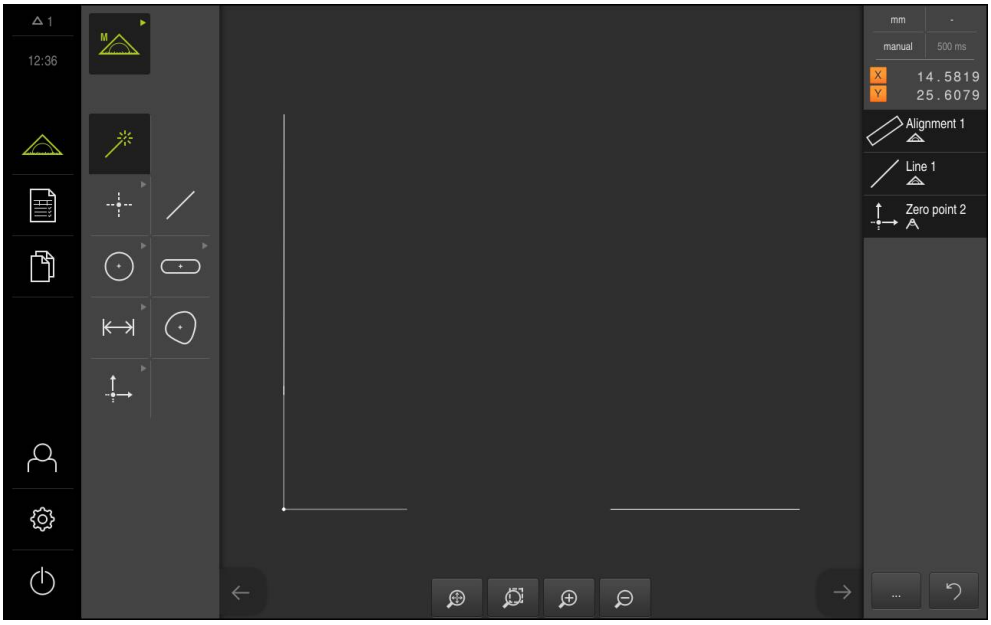


Constructing the zero point
The zero point is constructed of the point of intersection between the alignment and the straight line.

- ▶ Select **Construct** in the function palette
- > A new feature is displayed in the feature list of the Inspector

- ▶ Select **Zero point** in the geometry palette
- ▶ Select the **Alignment** and **Line** features in the Inspector or in the features view
- > The selected features are displayed in green

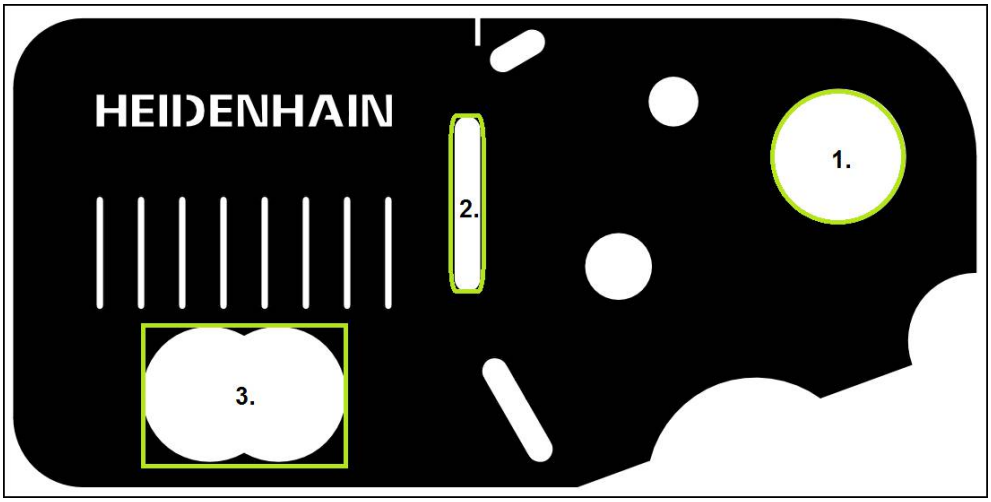
- ▶ Tap **Finish** in the new feature
- > The zero point is created
- > The workpiece coordinate system for the measured object has been determined
- ▶ Select **Manual measuring** in the function palette
- ▶ Tap **Features preview**
- > The coordinate system is shown in the workspace



Measuring the features

To measure features, you can use the geometries of the geometry palette or Measure Magic. Measure Magic is able to automatically recognize the geometry to be measured.

Further information: "Overview of geometry types", page 191



This section provides examples describing how to measure three different features:

1 Circle
2 Slot
3 Blob

Measuring a circle

A minimum of three measuring points is required to measure a circle.

- Tap **Measure** in the main menu

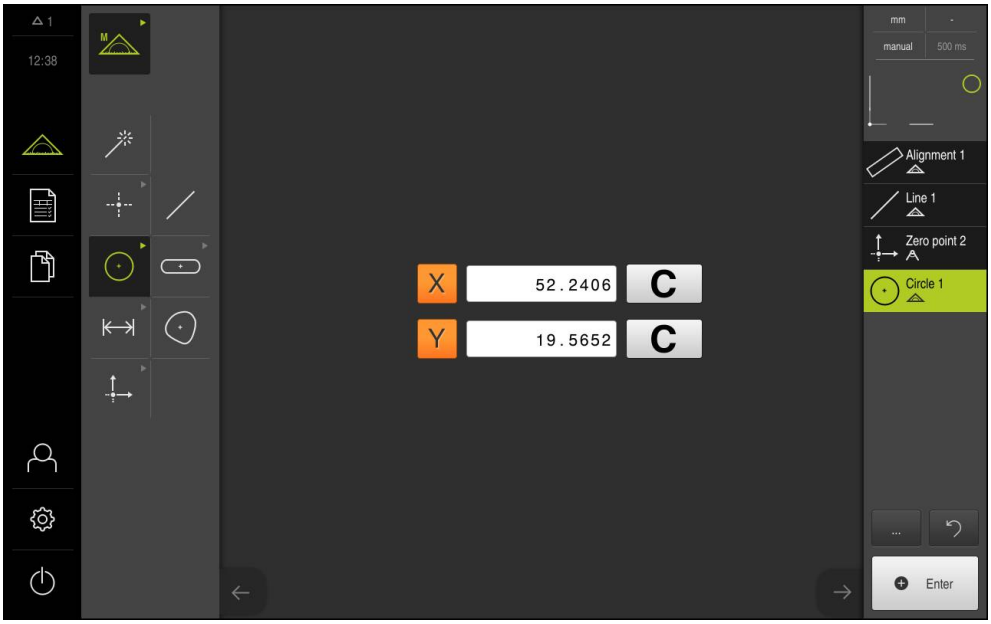
- Select **Manual measuring** in the function palette
> The workspace with the axis positions is displayed

- Select **Circle** in the geometry palette
- Position the first measuring point on the circular contour
- Tap **Enter** in the Inspector
> A new feature is displayed in the feature list
- Position the second measuring point on the circular contour

Distribute the measuring points as evenly as possible along the contour of the feature.

- Tap **Enter** in the Inspector
- Repeat the last two steps for the third measuring point

- Tap **Finish** in the new feature
> The product calculates a new feature from the captured measuring points and the selected geometry
> The measured circle is displayed in the features preview
> The measurement is complete



Measuring a slot

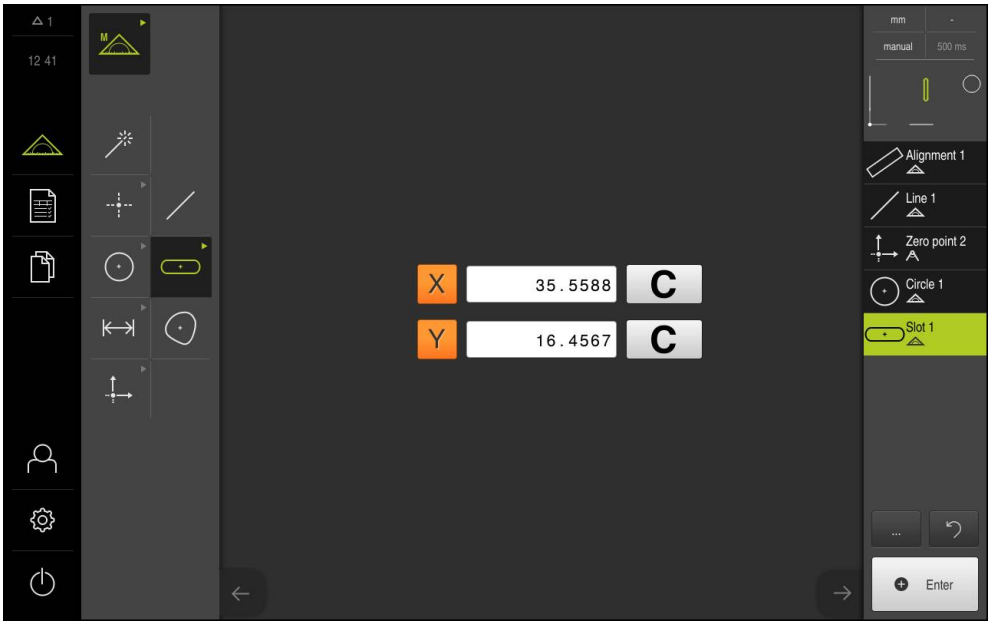
A minimum of five measuring points is required to measure a slot. Place at least two measuring points on the first long side, one measuring point on the second long side, and one measuring point on each arc of the slot. You can capture the points in any sequence.

- Select **Slot** in the geometry palette
- Position the first measuring point on the contour of the slot
- Tap **Enter** in the Inspector
- > A new feature is displayed in the feature list of the Inspector
- Position the second measuring point on the contour of the slot

> Distribute the measuring points along the entire length of the first side, as far as possible.

- Tap **Enter** in the Inspector
- Repeat the last two steps for each of the remaining contour points

- Tap **Finish** in the new feature
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The measured slot is displayed in the features preview
- > The measurement is complete



Measuring a blob

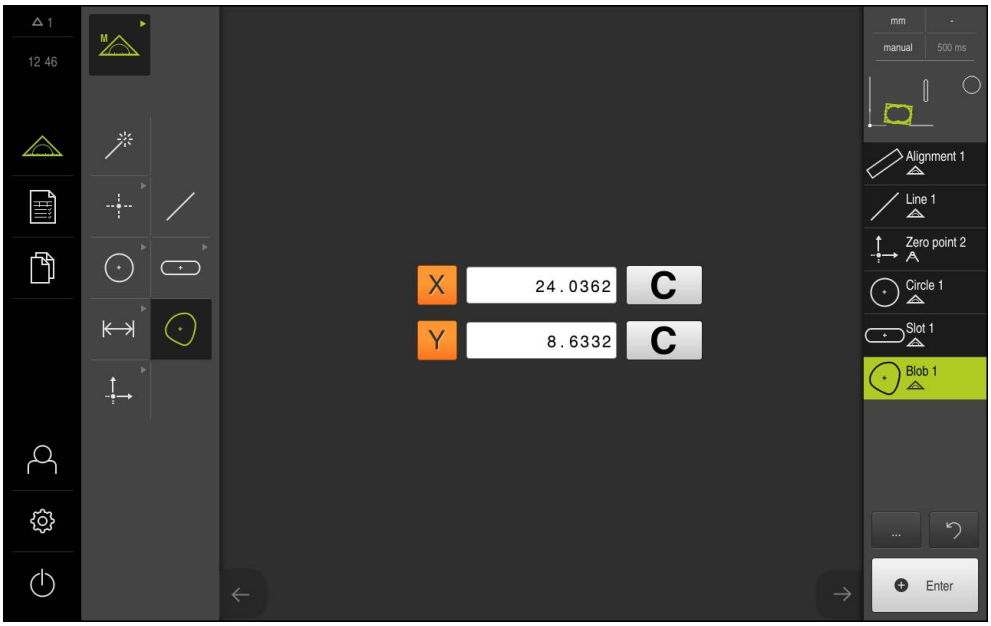
A minimum of three measuring points is required to measure a blob. Capture a sufficient number of measuring points to enable the product to determine the contour and calculate the center of mass.

- Select **Blob** in the geometry palette
- Position the first measuring point on the contour
- Tap **Enter** in the Inspector
- > A new feature is displayed in the feature list of the Inspector
- Position the second measuring point on the contour

> Distribute the measuring points as evenly as possible along the contour of the feature.

- Tap **Enter** in the Inspector
- Repeat the last two steps for each of the remaining contour points

- Tap **Finish** in the new feature
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The measured blob is displayed in the features preview
- > The measurement is complete



9.2.3 Measuring with a VED sensor

Sec. 9.2.1: Preparing a measurement	▶	Sec. 9.2.2: Measuring without a sensor	▶	**Sec. 9.2.3: Measuring with a VED sensor**	▶	Sec. 9.2.4: Evaluating and documenting the measurement

For measuring edges and contours with the QUADRA-CHEK 3000 VED software option, various measuring tools are available for the acquisition of measuring points in the live image.

Further information: "Measuring tools", page 84

The measurements illustrated here are described in detail in the Measurement chapter.

For the measurements described in this section, a virtual camera (Virtual Camera (GigE)) will be used with the representation of the supplied 2-D demo part.

Application-specific adaptations during commissioning or setup can lead to differing representations.

OEM or **Setup** users can switch to the virtual camera at any time in order to try out the examples shown.

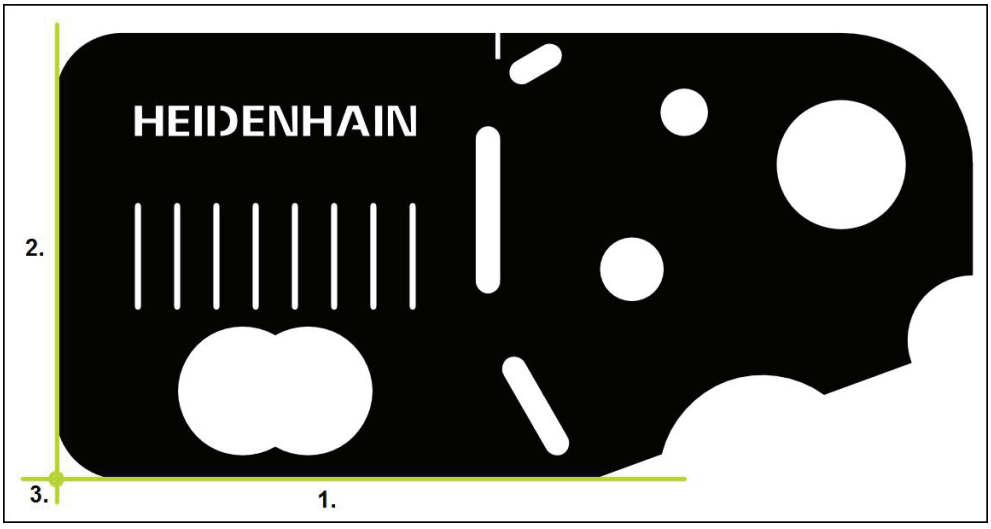
Further information: "Measure menu with QUADRA-CHEK 3000 VED software option", page 65

Aligning the measured object

Sec. : **Aligning the measured object**	▶	Sec. : Measuring the features

Before you can evaluate the measuring points, you need to align the measured object. During this process, the coordinate system of the measured object (workpiece coordinate system) is determined, which is specified in the technical drawing.

This makes it possible to compare the measured values with the data in the technical drawing and assess them.



Measured objects are usually aligned in three steps:

1 Measuring the alignment
2 Measuring a straight line
3 Constructing the zero point

Measuring the alignment

Define the reference edge for the alignment according to the technical drawing.

- ▶ Tap **Measure** in the main menu

- ▶ Select **Manual measuring** in the function palette

- ▶ If more than one optical sensor is active, select **VED sensor** in the sensor palette
- > The geometry palette and the VED measuring tools are displayed
- > The workspace shows the camera's live image
- ▶ In the quick access menu, select the magnification that is set on the measuring machine

- ▶ Select **Alignment** in the geometry palette

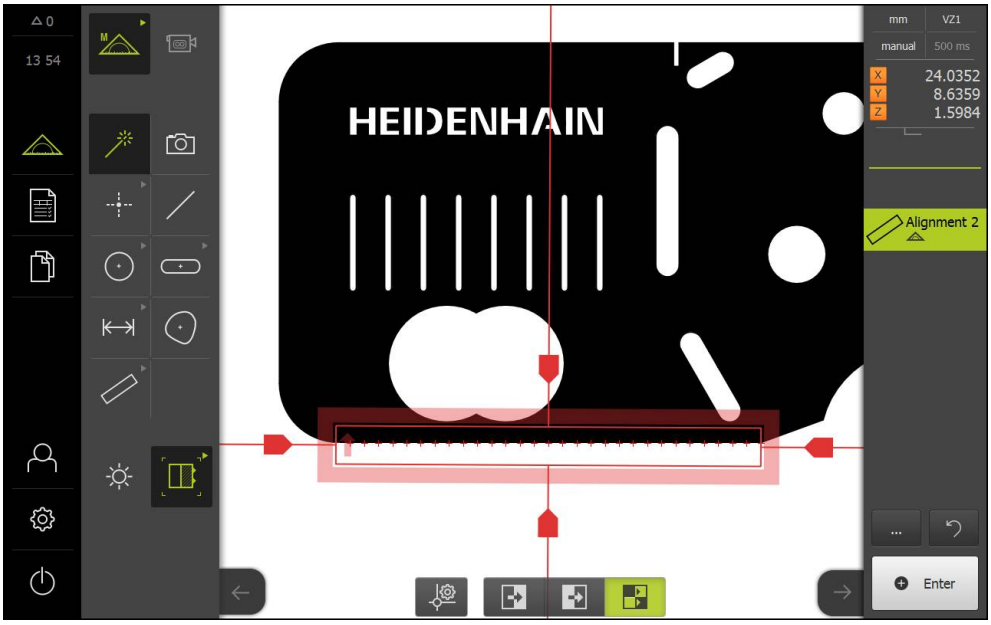
- Select **Buffer** in the tool palette
- Position the measuring tool above the reference edge
- Expand the measuring tool so that the edge area enclosed in the search range is as large as possible
- Rotate the measuring tool so that the scan direction corresponds to the desired scan direction

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > Multiple measuring points are captured along the edge
- > A new feature is displayed in the feature list of the Inspector

> Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- If the edge is interrupted or not fully displayed in the workspace, reposition the measuring tool and capture more measuring points

- Tap **Finish** in the new feature
- > The alignment is displayed in the feature list of the Inspector



Measuring a straight line

For the second reference edge, you can measure a straight line with the **Buffer** measuring tool, for example.

- Select **Line** in the geometry palette

- Select **Buffer** in the tool palette
- Position the measuring tool above the reference edge
- Expand the measuring tool so that the edge area enclosed in the search range is as large as possible
- Rotate the measuring tool so that the scan direction corresponds to the desired scan direction

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector

> Multiple measuring points are captured along the edge

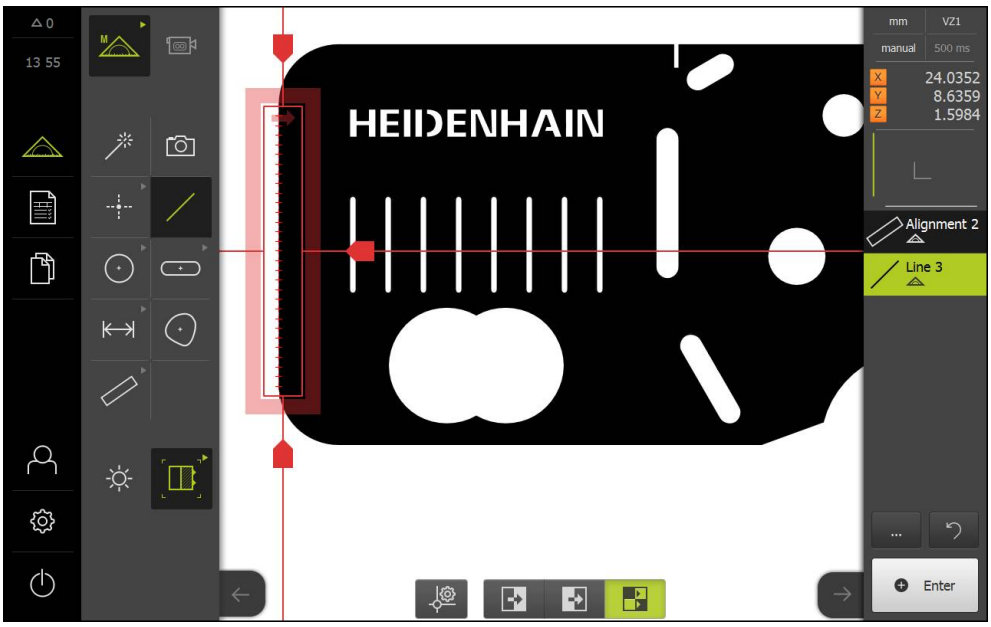
> A new feature is displayed in the feature list of the Inspector

> **i** Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- If the edge is interrupted or not fully displayed in the workspace, reposition the measuring tool and capture more measuring points

- Tap **Finish** in the new feature

> The line is displayed in the feature list of the Inspector

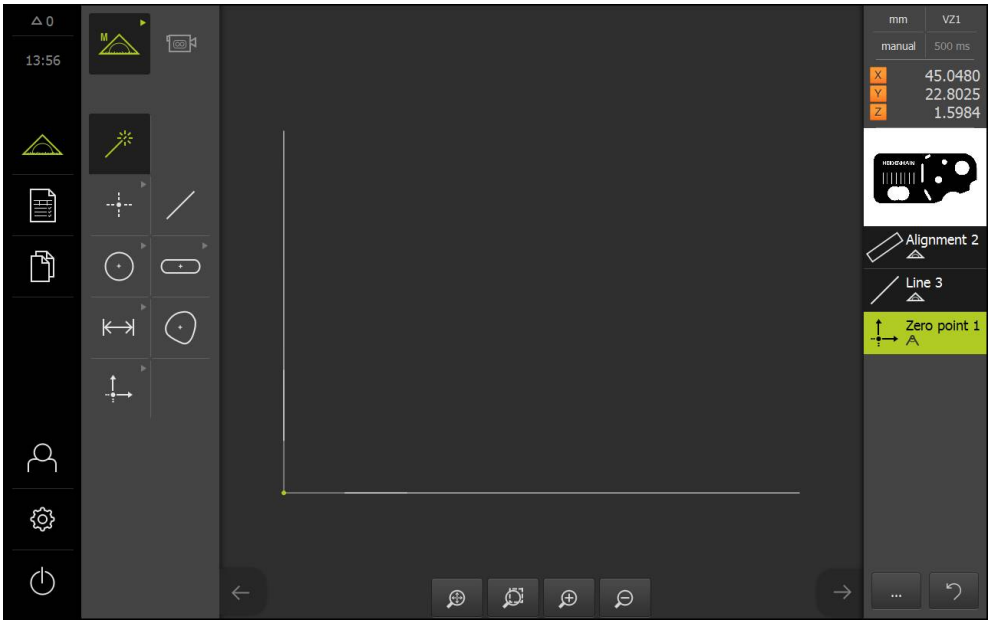


Constructing the zero point
The zero point is constructed of the point of intersection between the alignment and the straight line.

- ▶ Select **Construct** in the function palette
- > A new feature is displayed in the feature list of the Inspector

- ▶ Select **Zero point** in the geometry palette
- ▶ Select the **Alignment** and **Line** features in the Inspector or in the features view
- > The selected features are displayed in green

- ▶ Tap **Finish** in the new feature
- > The zero point is created
- > The workpiece coordinate system for the measured object has been determined
- ▶ Select **Manual measuring** in the function palette
- ▶ Tap **Features preview**
- > The coordinate system is shown in the workspace

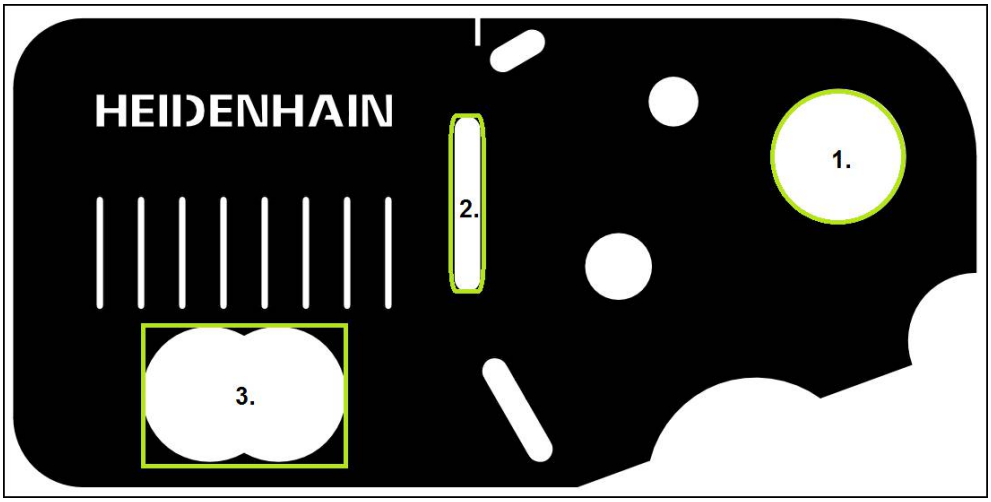


Coordinate system of the measured object

Measuring the features

To measure features, you can use the geometries of the geometry palette or Measure Magic. Measure Magic is able to automatically recognize the geometry to be measured.

Further information: "Overview of geometry types", page 191



This section provides examples describing how to measure three different features:

1 Circle
2 Slot
3 Blob

Measuring a circle

A minimum of three measuring points is required to measure a circle. To capture the measuring points, you can use e.g. the **Circle** measuring tool. Multiple measuring points are automatically distributed along the entire contour according to the specified settings.

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette

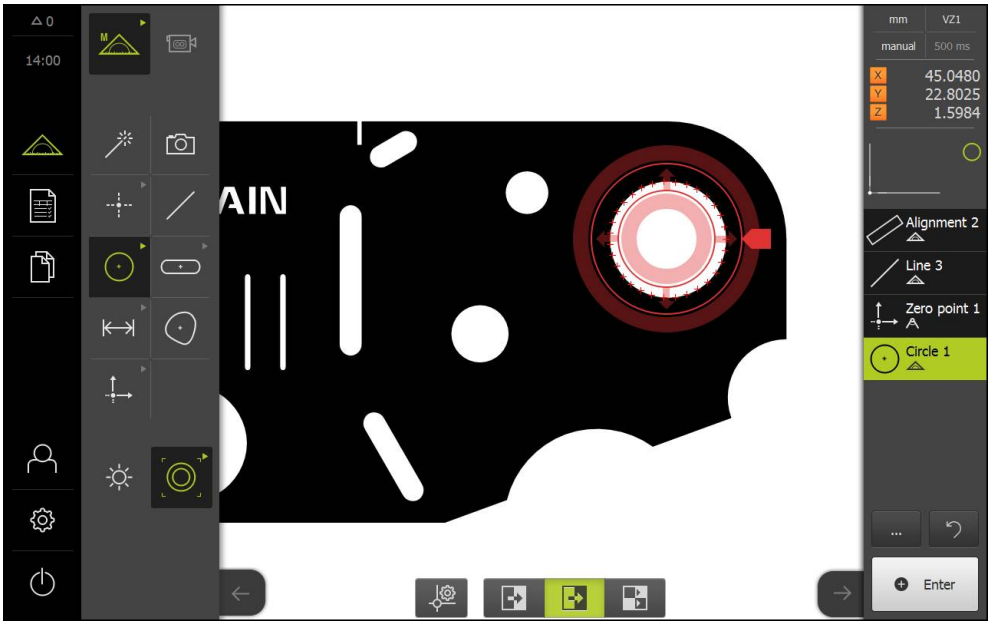
- If more than one optical sensor is active, select **VED sensor** in the sensor palette
- > The geometry palette and the VED measuring tools are displayed
- Tap **Live image preview** in the Inspector
- > The workspace shows the camera's live image
- In the quick access menu, select the magnification that is set on the measuring machine

- Select **Circle** in the geometry palette
- Position the measured object in the live image by moving the measuring plate

- Select **Circle** in the tool palette
- Position the measuring tool above the contour
- Resize the two rings of the measuring tool so that the contour is fully enclosed within the search range between the inner and outer rings

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > The measuring points are captured along the contour
- > A new feature is displayed in the feature list

- Tap **Finish** in the new feature
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The measured circle is displayed in the features preview
- > The measurement is complete



Measuring a slot

A minimum of five measuring points is required to measure a slot. To capture the measuring points, you can use e.g. the **Single edge** measuring tool. Place at least two measuring points on the first long side and one measuring point on the second long side, and at least one measuring point on each arc of the slot. You can capture the points in any sequence.

- Select **Slot** in the geometry palette

- Select **Single edge** in the tool palette
- Position the search range of the measuring tool on the contour of the slot
- Resize the search range

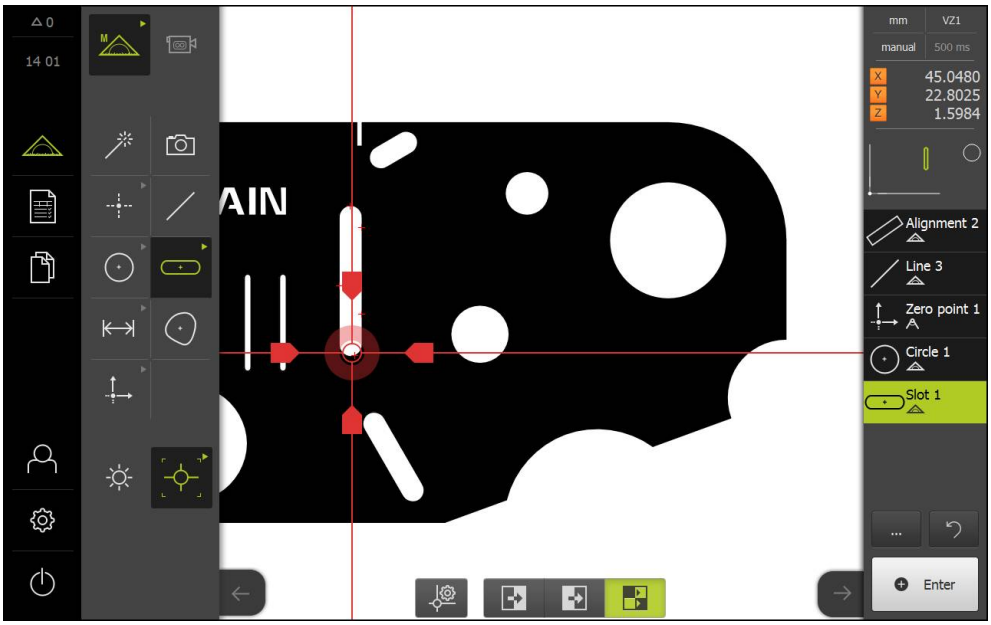
- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > A new feature is displayed in the feature list

- Position the measuring tool on the contour of the slot to capture the second measuring point

> **i** Distribute the measuring points along the entire length of the first side, as far as possible.

- Tap **Enter**
- Repeat the last two steps for the remaining three contour points

- Tap **Finish** in the new feature
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The measured slot is displayed in the features preview
- > The measurement is complete



Measuring a blob

A minimum of three measuring points is required to measure a blob. To capture the measuring points, you can use e.g. the **Contour** measuring tool. Multiple measuring points are automatically distributed along the entire contour according to the specified settings.

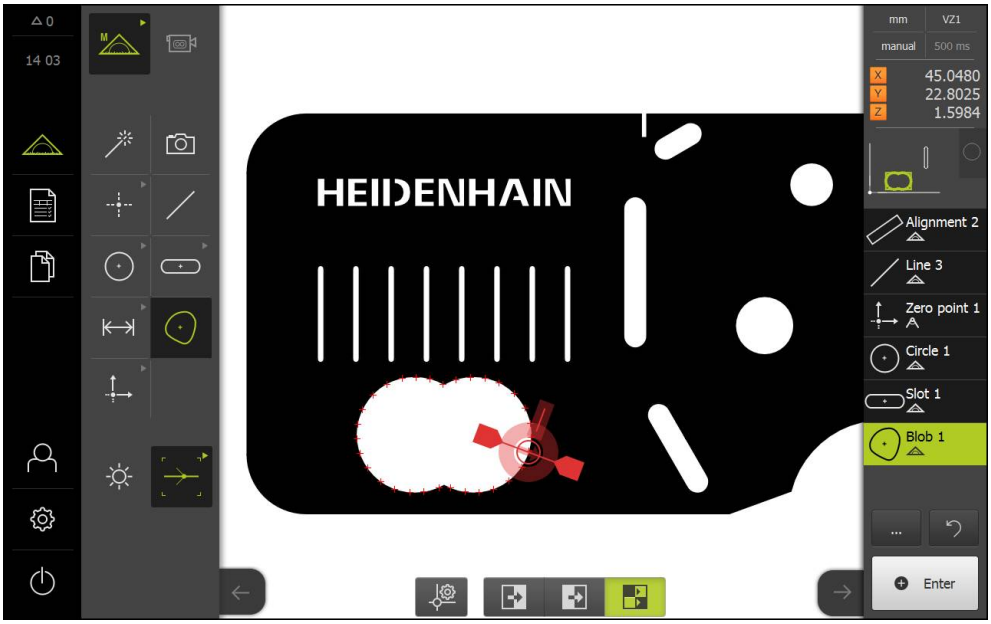
- Select **Blob** in the geometry palette

- Select **Contour** in the tool palette
- Position the measuring tool at any desired location above the contour
- Resize the search range to enclose only one edge

> Make sure that there are no other edges or contours within the search range of the measuring tool.

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > The measuring points are captured along the edge until the start point is reached again
- > A new feature is displayed in the feature list

- Tap **Finish** in the new feature
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The measured blob is displayed in the features preview
- > The measurement is complete



9.2.4 Evaluating and documenting the measurement

Sec. 9.2.1: Preparing a measurement	▶	Sec. 9.2.2: Measuring without a sensor	▶	Sec. 9.2.3: Measuring with a VED sensor	▶	**Sec. 9.2.4: Evaluating and documenting the measurement**

Displaying and editing the measurement results

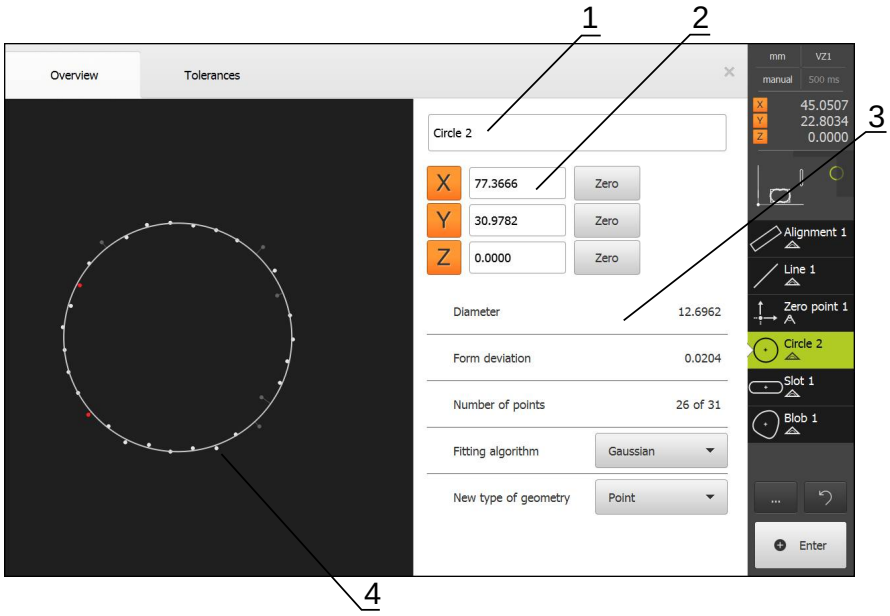
You can edit the measured features immediately after capturing the measuring points.

Further information: "Measurement evaluation", page 245

Activation

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining appears
- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected

Short description



1 Name of the feature
2 Axis positions of the center point
3 Feature properties and parameters
4 Features view of the measuring points and the form

The Overview shows the following details about the feature:

- Name of the feature
- Axis positions of the center point
- Feature parameters, depending on the type of geometry
- Number of measuring points used for calculating the feature
- Fitting algorithm used for calculating the feature (depending on the geometry and the number of measuring points)
- List of geometry types to which the feature can be converted

Renaming a feature

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ Tap the **input field** containing the current name
- ▶ Enter a name for the feature
- ▶ Confirm entry with **RET**
- > The new name is displayed in the feature list
- ▶ Tap **Close** to close the dialog

Adjusting the fitting algorithm

You can adjust the fitting algorithm depending on the measured feature. The geometry is basically calculated using the Gaussian fitting algorithm.

Further information: "Fitting algorithm", page 248

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The fitting algorithm used is displayed
- ▶ Select the desired fitting algorithm in the **Fitting algorithm** drop-down list
- > The feature is displayed according to the selected fitting algorithm
  Further information: "Display of measuring points and form", page 247
- ▶ Tap **Close** to close the dialog

Converting a feature

The feature can be converted to a different type of geometry. The list of possible geometry types is provided as a drop-down list in the features view.

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The geometry type of the feature is displayed
- ▶ Select the desired geometry type in the **New type of geometry** drop-down list
- > The feature is displayed in the new form
  Further information: "Display of measuring points and form", page 247
- ▶ Tap **Close** to close the dialog

Adjusting tolerances

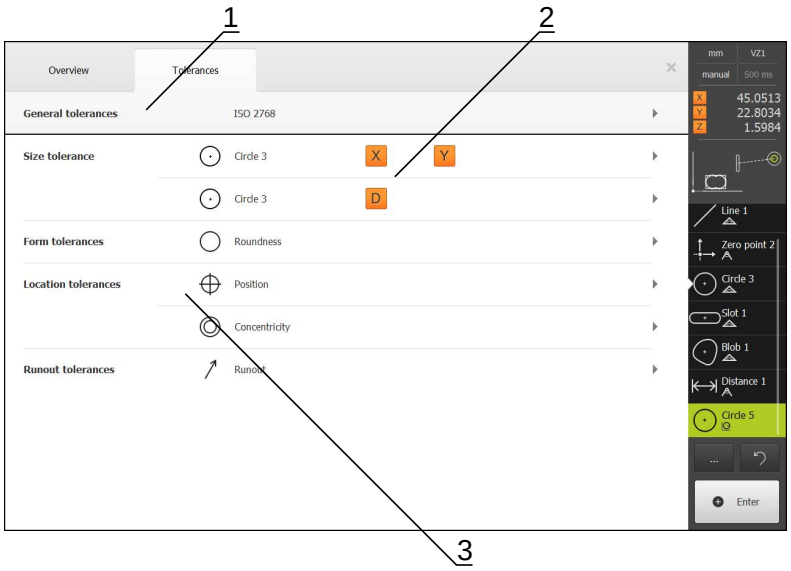
To set tolerances for the measured geometry, enter the tolerance values on the **Tolerances** tab.

Further information: "Defining tolerances", page 252

Activation

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining appears
- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed

Short description



1 Display of general tolerance
2 List of tolerances, depending on feature
3 Status of the tolerance: active and within the tolerance or active and outside the tolerance

On the **Tolerances** tab, you can define the geometrical tolerancing of a measured or constructed feature. The tolerances are grouped.

> Tolerances cannot be applied to reference features, such as zero point, alignment and reference plane.

Depending on the feature, you can define the following tolerance types:

- General tolerances, e.g. application of the ISO 2768 standard
- Size tolerances, e.g. diameter, width, length and angle of reference axis
- Form tolerances, e.g. roundness
- Location tolerances, e.g. position, concentricity
- Directional tolerances, e.g. angularity, parallelism, perpendicularity
- Runout tolerances

The tolerances can be activated or deactivated.

Further information: "Tolerancing the features", page 258

Outputting measurement reports

You can output the measurement as a measurement report. In this way, you can save and print the measurement results.

Further information: "Measurement report", page 283

You can create a measurement report in five steps:

- Selecting a template
- Selecting features
- Entering information on the measuring task
- Selecting document settings
- Saving, printing or exporting the measurement report

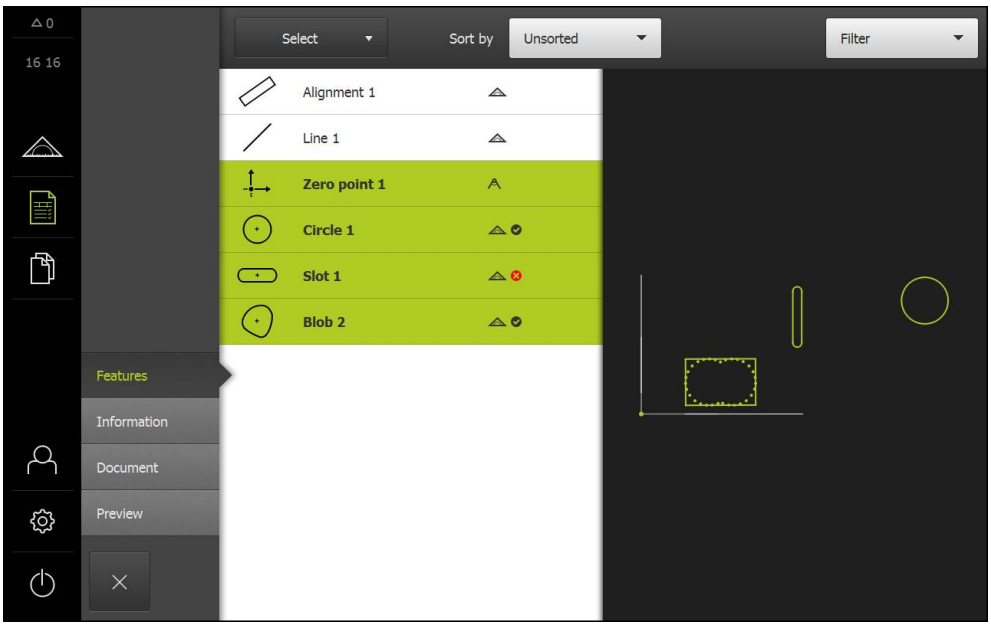
Requirement

- The measurement and the measurement evaluation are complete

Activation

- Tap **Measurement report** in the main menu
- > The user interface for editing the measurement reports appears
- Select a template, e.g. **Standard**
- > The preview of the selected template is displayed
- Tap **Create** to create the measurement report
- > The **Features** menu appears with a list of all features that have been measured, constructed and defined

- Tap a feature to add it to the measurement report
- > Selected features are displayed in green in the list and in the features preview
- To add all features to the measurement report, tap **Select all** in the **Select** drop-down list
- > All features in the list and in the features preview are activated and displayed in green

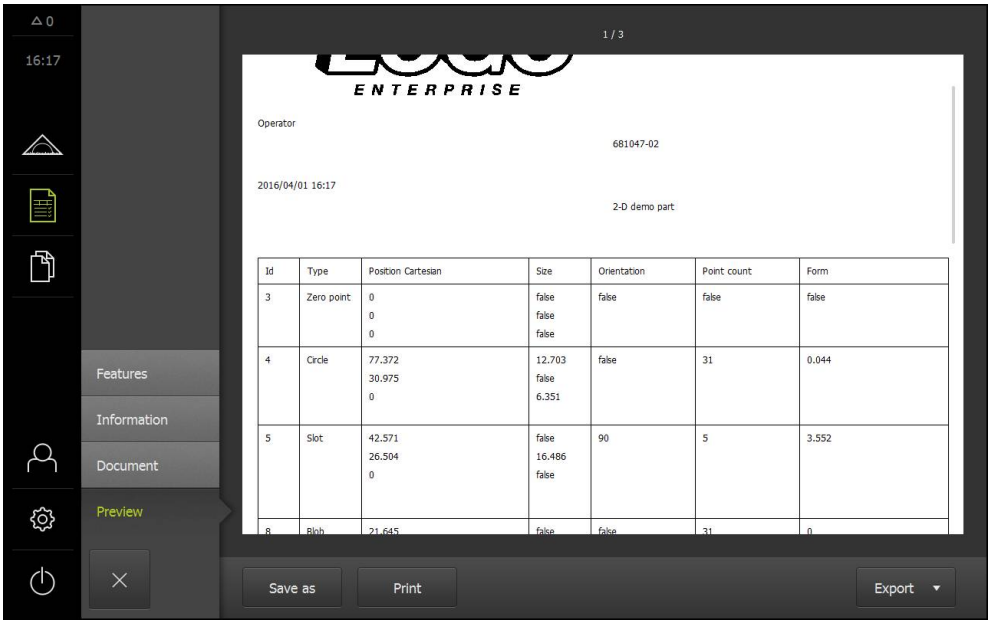


- Tap the **Information** menu
- To adjust the date and time in the measurement report, select the **Set automatically** or **Set manually** function in the **Timestamp** drop-down list
  - **Set manually**: When creating the report, the manually set date and time are entered
  - **Set automatically**: When creating the report, the current system date and time are entered
- Select an existing user in the **User name** drop-down list
- If you want another user to be displayed in the measurement report, select **Other user**
- Enter the name of the user into the input field
- Confirm entry with **RET**
- Enter the number of the measurement job into the **Job** input field
- Confirm entry with **RET**
- Enter the part number of the measured object into the **Part number** input field
- Confirm entry with **RET**

Entering information about the document

- Tap the **Document** menu
- To adjust the unit for linear measurement values, select the desired unit in the **Unit for linear values** drop-down list
  - **Millimeters**: Display in millimeters
  - **Inch**: Display in inches
- To reduce or increase the number of displayed **Decimal places for linear values**, tap **-** or **+**
- To adjust the unit for angular values, select the desired unit in the **Unit for angular values** drop-down list
  - **Decimal degrees**: Display in degrees
  - **Radian**: Display as radian measure
- To adjust the format for the date and time, select the desired format in the **Date and time format** drop-down list
  - **hh:mm DD-MM-YYYY**: Time and date
  - **hh:mm YYYY-MM-DD**: Time and date
  - **YYYY-MM-DD hh:mm**: Date and time
- Tap the **Preview** menu

> The preview of the measurement report is displayed



Saving the measurement report
Measurement reports are saved in the XMR data format. Files saved in XMR data format can be displayed and newly created at a later point in time.

- Tap **Save as**
- Select the storage location in the dialog, e.g. **Internal/Reports**
- Enter a name for the measurement report
- Confirm entry with **RET**
- Tap **OK**

> The measurement report is saved

Printing the measurement report

- Tap **Print**

> The measurement report is output to the specified printer
> **Further information:** "Setting up a printer", page 143

Exporting the measurement report
Measurement reports can be exported as PDF or CSV files. Exported measurement reports cannot be newly created.

- Select the desired export format in the **Export** drop-down list
  - **Export as PDF**: The measurement report is saved as a printable PDF. The values are no longer editable
  - **Export as CSV**: The values in the measurement report are separated by semicolons. The values can be edited using spreadsheet software
- Select the storage location in the dialog, e.g. **Internal/Reports**
- Enter a name for the measurement report
- Confirm entry with **RET**
- Tap **OK**

> The measurement report is exported in the selected format and stored in the storage location

Canceling the measurement report or closing it after saving

- Tap **Close**
- Close the message with **OK**
- The measurement report is closed

In the **File management** main menu, you can open and edit saved reports.
Further information: "Managing folders and files", page 305

Creating and using measuring programs

The product can record and save the steps of a measuring process, and run them sequentially as a batch process. This batch processing is referred to as the "measuring program".

In a measuring program, you can thus combine multiple work steps, such as measuring point acquisition and tolerancing, into a single process. This simplifies and standardizes the measuring process.

Measuring programs can include the following work steps:

- Alignment of the measured object
- Measuring point acquisition
- Construction and definition
- Measurement evaluation
- Tolerancing

The work steps of a measuring program are referred to as program steps. The program steps are displayed in the program step list in the Inspector.

> Regardless of whether the feature list or the program step list is the current view in the Inspector, the product always records every measuring process or work step as a program step. The operator can switch the view between the feature list and the program step list at any time.

Further information: "Programming", page 271

Saving a measuring program

To be able to run a measuring process repeatedly, you need to save the executed work steps as a measuring program.

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette

- Tap **Miscellaneous functions** in the Inspector
- In the Miscellaneous functions dialog, tap **Save as**
- Select the storage location in the dialog, e.g. **Internal/Programs**
- Enter a name for the measuring program
- Confirm entry with **RET**
- Tap **OK**

> The measuring program is saved

> The name of the measuring program is displayed on the program control

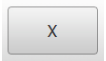
Starting a measuring program

The measuring program that is currently being recorded or executed can be started directly with the program control. Program steps requiring user intervention are supported by a wizard. User intervention may be required under the following conditions, for example:

- The measuring points are outside the live image (only if the QUADRA-CHEK 3000 VED software option and the VED sensor are both active)
- The settings of the camera optics must be adjusted, e.g. magnification of the camera
- The measured object must be positioned manually using the axes of the measuring plate

	The user interface is locked while a program is running. Only the operating elements of the program control and **Enter** can be used.

- ▶ Tap **Run** on the program control
- > The program steps are executed
- > Program steps that are currently being executed or require user intervention are highlighted
- > When user intervention is required, the measuring program stops
- ▶ Perform the required user intervention
- > The execution of the program steps is resumed until the next user intervention is required or the end of the program is reached
- > The successful completion of the measuring program is displayed



- ▶ Tap **Close** in the message
- > The features are displayed in the features preview

Further information: "Starting a measuring program", page 276

10

Measurement

10.1 Overview

This chapter describes the following functions:

- Overview of geometry types
- Capturing measuring points
- Conducting a measurement
- Constructing features
- Defining features

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

Requirement: Commissioning and setup have been completed.

Short description

In the **Measure** menu you measure, construct or define all the features needed for the acquisition of a measured object. This section discusses the different possibilities of measuring point acquisition and describes the basic steps for conducting a measurement. Features are measured by manually capturing measuring points and using predefined geometries.

You can optionally use optical sensors and various measuring tools to capture measuring points.

10.2 Overview of geometry types

The product provides predefined geometries that you can use for measuring, constructing and defining. Which geometry you choose depends on the measuring task.

The selected geometry specifies the type of geometry that is determined from the captured measuring points.

> The number of measuring points to be captured can be adjusted in the settings of the product.
>
> It is not possible to use fewer than the mathematically required minimum number of points for the geometries.

Further information: "Geometries", page 332

Geometry	Name	Properties	Number of measuring points
	**Measure Magic**	Automatically recognizes the geometry to be measured	≥ 1
	**Point**	Sets any measuring point	≥ 1
	**Height point**	Sets a height point	≥ 1
	**Line**	Determines a line	≥ 2
	**Circle**	Determines a circle	≥ 3
	**Arc**	Determines a circle segment The opening angle is defined by the outermost measuring points	≥ 3
	**Ellipse**	Determines an ellipse The position and length of the reference axis are defined by the measuring points that are farthest apart	≥ 5
	**Slot**	Determines a slot The position and length of the reference axis are defined by the measuring points that are farthest apart	≥ 5
	**Rectangle**	Determines a rectangular feature with straight sides The position and length of the reference axis are defined by the measuring points that are farthest apart	≥ 5

Geometry	Name	Properties	Number of measuring points
	**Distance**	Determines the distance between two measuring points	2
	**Angle**	Determines two straight lines that intersect at any angle The angle is determined from the point of intersection of the two sides, and the position of each side The measuring points need to be captured for the first side and then for the second side	≥ 4
	**Blob**	Determines the center of mass of the area formed by all measuring points	≥ 3

Geometries for determining the reference system

Geometry	Name	Property	Number of measuring points
	**Zero point**	Sets the zero point of the reference system for a measured object	≥ 1
	**Alignment**	Determines the alignment of the X axis of the reference system for a measured object	≥ 2
	**Reference plane**	Determines the inclination of the reference plane for a measured object	≥ 3

10.3 Capturing measuring points

When you measure an object, the existing geometries are determined based on features. To determine a feature, you need to capture measuring points for the feature.

A measuring point is a point in the coordinate system whose position is defined by the coordinates. Based on the positions of the captured measuring points (point cloud) in the coordinate system, the product can determine and evaluate the feature. The product optionally provides various ways to capture measuring points:

- Without a sensor, e.g. by using crosshairs on the measuring microscope or profile projector
- With a sensor, e.g. in the form of a camera on the measuring machine

10.3.1 Capturing measuring points without a sensor

If measuring points are captured without using a sensor, the operator on the connected measuring machine (e.g. measuring microscope, profile projector) must be able to move to the desired position on the measured object, e.g. by using crosshairs. On reaching this position, the measuring point acquisition is initiated either manually by the operator or automatically by the product, depending on the configuration.

For the measuring point, the product captures the current axis positions that are displayed in the workspace or position preview. The coordinates of this measuring point thus result from the current position of the measuring plate. Based on the captured measuring points, the product determines the feature according to the selected geometry and displays it in the feature list in the Inspector.

The number of measuring points that need to be captured for a feature depends on the configuration of the selected geometry.

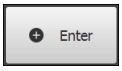
The procedure for capturing measuring points without a sensor is basically the same for all geometries and is described below using the "Circle" geometry as an example.

Capturing measuring points without a sensor

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette
> The workspace with the axis positions is displayed

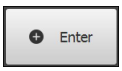
- Select **Circle** in the geometry palette
- On the measuring machine, move to the desired position on the measured object
> If automatic measuring point acquisition is active, the measuring point is captured automatically
Further information: "Setting automatic measuring point acquisition", page 81



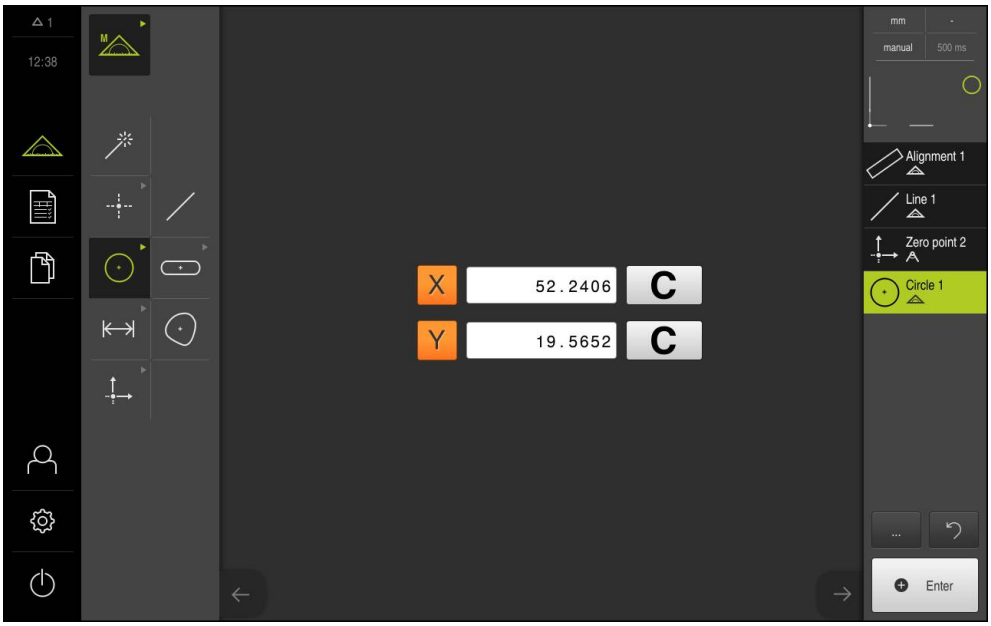
- If automatic measuring point acquisition is not active, tap **Enter** in the Inspector

> A new feature appears in the feature list of the Inspector. The symbol of the feature corresponds to the selected geometry
> The number of captured measuring points is shown next to the symbol
- Position the second measuring point on the circular contour

i	Distribute the measuring points as evenly as possible along the contour of the feature.



- Tap **Enter** in the Inspector
- Repeat the last two steps for the third measuring point
- > As soon as a sufficient number of measuring points have been captured for the feature, a check mark appears next to the feature in the feature list
- Tap **Finish** to conclude the measuring point acquisition
- > The acquired feature is displayed in the feature list and the features preview



10.3.2 Capturing measuring points with a sensor

When capturing measuring points with a sensor, various sensor types are available in the metrology sector. A distinction is made between tactile and optical sensors. Which of two is used depends on the measuring task.

When selecting the appropriate sensor, the following criteria need to be considered:

- Properties of the measured object (e.g. surface structure, compliance)
- Size and arrangement of the features to be measured (e.g. accessibility, form)
- Required measuring accuracy
- Economic efficiency and available measuring time

If the QUADRA-CHEK 3000 VED software option is activated on the product, the product supports the use of a VED sensor (optical sensor). A VED sensor is a USB camera or network camera connected to the product.

Optical sensors are particularly well suited for use in the following cases:

- Small features to be measured
- Large number of measuring points
- Short measuring times
- Compliant objects to be measured

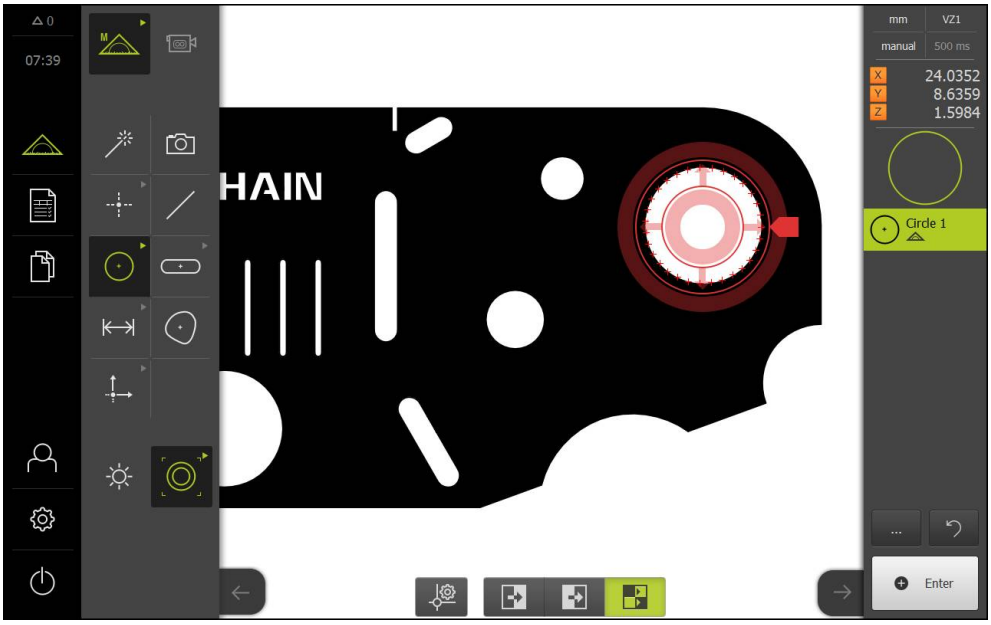
When capturing measuring points with a VED sensor, the live image from the connected camera is displayed in the workspace. The measuring points are captured in the live image by using VED measuring tools.

For this purpose, the measuring plate is traversed to position the measured object in such a way that the live image shows the feature to be measured on the object. The operator positions a VED measuring tool above the measured object in the live image.

The product provides the **Crosshair** VED tool as well as active VED measuring tools such as **Single edge** or **Circle**.

When capturing measuring points with the **Crosshair** tool, the operator specifies the measuring point by manually positioning the measuring tool in the live image.

Active VED measuring tools allow an objective acquisition of measuring points because the product detects a light-to-dark transition within a defined search range of the measuring tools by evaluating the contrast. The measuring point acquisition is initiated by the operator or automatically by the product, depending on the configuration.



Circle VED measuring tool with captured measuring points

Based on the position of the VED measuring tool in the live image and the axis positions, the product acquires the coordinates for the measuring point. The product determines the feature from the captured measuring points according to the selected geometry. The new feature is shown in the feature list of the Inspector. The number of measuring points that need to be captured for a feature depend on the configuration of the selected geometry.

Further information: "Overview of geometry types", page 191

	The procedure for capturing measuring points with a sensor is basically the same for all geometries and is thus described below by way of an example geometry.

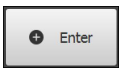
Capturing measuring points with the 'Crosshair' VED measuring tool

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette

- Select **Circle** in the geometry palette
- Position the measured object in the live image by moving the measuring plate

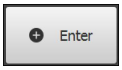
- Select **Crosshair** in the tool palette
- Position the measuring tool in the live image by tapping or dragging
- > If automatic measuring point acquisition is active, the measuring point is captured automatically
  Further information: "Setting automatic measuring point acquisition", page 81



- If automatic measuring point acquisition is not active, tap **Enter** in the Inspector

- > A new feature appears in the feature list of the Inspector. The symbol of the feature corresponds to the selected geometry
- > The number of captured measuring points is shown next to the symbol
- Position the second measuring point on the contour of the slot

> Distribute the measuring points as evenly as possible along the contour of the feature.

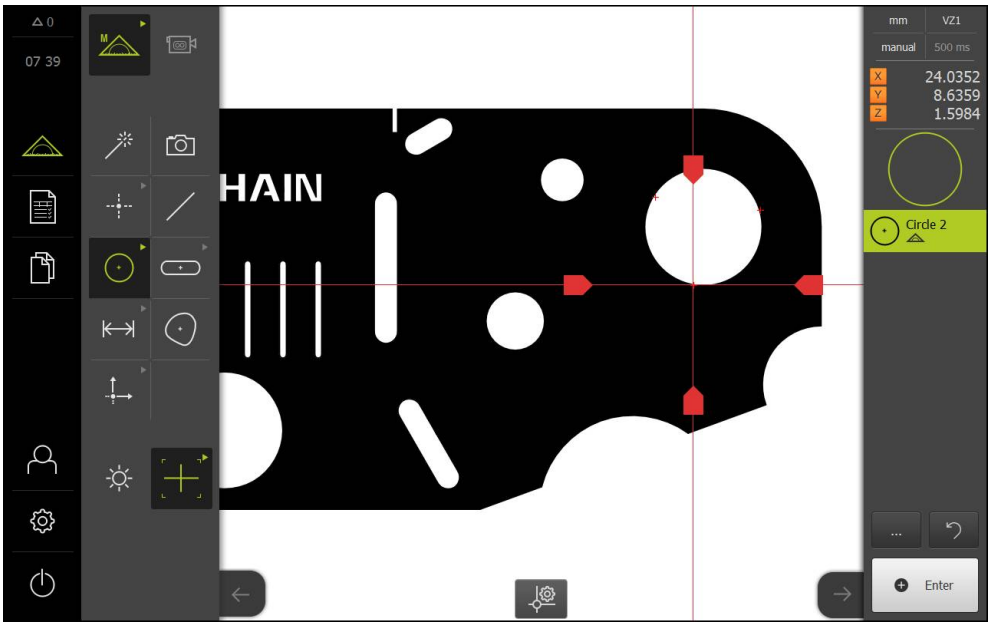


- Tap **Enter** in the Inspector
- Repeat the last two steps for the third measuring point

- > As soon as a sufficient number of measuring points have been captured for the feature, a check mark appears next to the feature in the feature list

- Tap **Finish** to conclude the measuring point acquisition

> The acquired feature is displayed in the feature list and the features preview



Capturing measuring points with an active VED measuring tool
The active VED measuring tools vary in use and area of application. The measuring point acquisition is the same for all active VED measuring tools.

Further information: "Measuring tools", page 84

- Tap **Measure** in the main menu

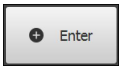
- Select **Manual measuring** in the function palette

- If more than one optical sensor is active, select **VED sensor** in the sensor palette
> The geometry palette and the VED measuring tools are displayed
- Tap **Live image preview** in the Inspector
> The workspace shows the camera's live image
- In the quick access menu, select the magnification that is set on the measuring machine

- Select **Circle** in the geometry palette

- Select the appropriate measuring tool in the tool palette, e.g. **Circle**
- Position the measuring tool above the contour
- Resize the two rings of the measuring tool so that the contour is fully enclosed within the search range between the inner and outer rings
> If automatic measuring point acquisition is active, the measuring points are captured automatically
Further information: "Setting automatic measuring point acquisition", page 81

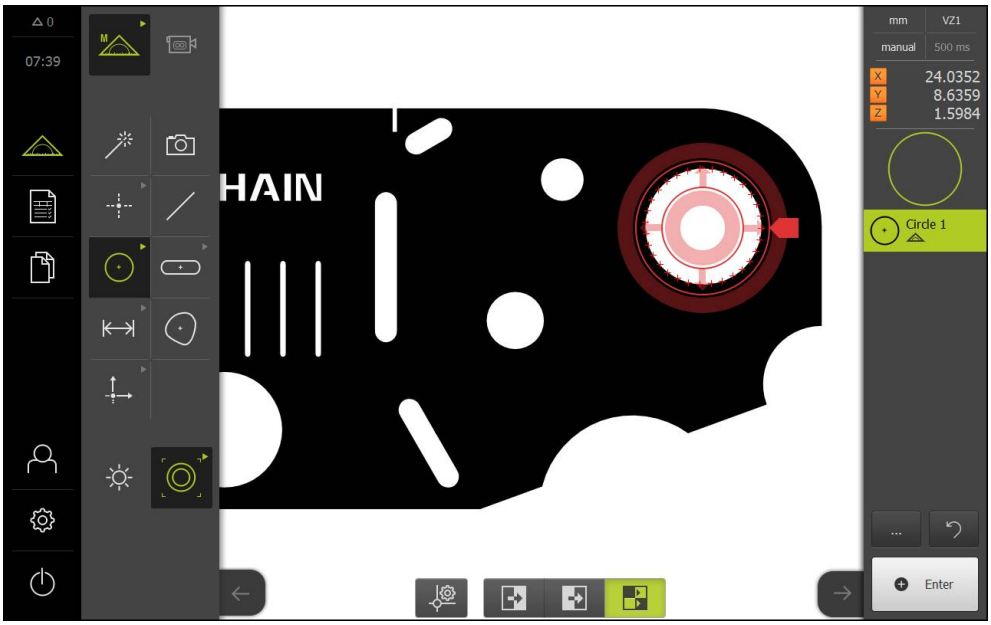
- Select the edge detection mode at the bottom of the workspace
> A new feature is displayed in the feature list



- If automatic measuring point acquisition is not active, tap **Enter** in the Inspector
> The measuring points are captured along the contour

> If the number of measuring points is set to "Free" in the feature settings, a new feature with a check mark is shown in the feature list of the Inspector
Further information: "Adjusting the General settings", page 151
> The number of captured measuring points is shown next to the symbol

- ▶ Tap **Finish** to conclude the measuring point acquisition
- > The product calculates a new feature from the captured measuring points and the selected geometry
- > The acquired feature is displayed in the feature list and the features preview



10.4 Conducting a measurement

To measure features on an object, various steps are required, including the following:

Sec. 10.4.1: Preparing a measurement	Sec. 10.4.2: Aligning the measured object	Sec. 10.4.3: Measuring a feature
■ Preparing the measured object and measuring machine ■ Conducting the reference mark search ■ Adjusting the sensors	■ Measuring the alignment ■ Measuring a straight line ■ Constructing the zero point	■ Selecting the geometry ■ Capturing measuring points

The procedure for measuring features is basically the same for all geometries and independent of the type of measuring point acquisition. In the measurement examples illustrated below, the QUADRA-CHEK 3000 VED software option is active.

10.4.1 Preparing a measurement

Sec. 10.4.1: Preparing a measurement	Sec. 10.4.2: Aligning the measured object	Sec. 10.4.3: Measuring a feature

Cleaning the measured object and the measuring machine

Contamination, e.g. from chips, dust and oil residues, leads to incorrect measurement results. The measured object, the holder for the measured object, and the sensor must be clean before you start measuring.

- Clean the measured object, the holder for the measured object, and the sensors with appropriate cleaning products

Stabilizing the temperature of the measured object

The objects to be measured should be stored at the measuring machine for an appropriate amount of time to allow the objects to adjust to the ambient temperature. Since the dimensions of the measured objects vary with temperature changes, the temperature of the measured objects must be stabilized.

This ensures the reproducibility of the measurement. The reference temperature is usually 20 °C.

- Stabilize the temperature of the measured objects for an appropriate amount time

Reducing environmental influences
Environmental influences, such as incident light, ground vibration or air humidity, can affect the measuring machine, the sensors or the measured objects, and thus falsify the measurement results. Certain influences, such as incident light, also have a negative effect on the measurement uncertainty.

- Eliminate or avoid environmental influences as far as possible

Fixing the measured object in place
The measured object must be fixed in place on the measuring plate or in an appropriate holder, depending on its size.

- Position the measured object in the center of the measuring range
- Use e.g. modeling clay to fix small measured objects in position
- Use fixtures to fix large measured objects in position
- Make sure that the measured object is fastened neither too loosely nor too tightly

Conducting the reference mark search

The reference mark search must be performed to ensure that the relationship between the axis positions and the measuring plate is reproducible.

If the reference mark search is active on the product, the reference marks of the axes must be traversed after startup. All functions in the main menu will only be available after the reference mark search has been successfully completed.

Further information: "Activating the reference mark search", page 112

Performing the reference mark search after startup

- After logging in, follow the instructions of the wizard

> On successful completion of the reference mark search, the display color of the axis position changes from red to white

Starting the reference mark search manually
If the reference mark search was not performed on startup, it can be started manually later.

Further information: "Starting the reference mark search", page 112

Adjusting the VED sensor

Selecting the sensor

- ▶ Tap **Manual measuring**
- > If only the VED sensor is enabled, the VED sensor is activated automatically

- ▶ If more than one sensor is enabled, tap **VED sensor** in the sensor palette
- > The image section from the VED sensor is displayed in the workspace
- ▶ Position the VED measuring tool above a high-contrast edge of the measured object
- ▶ Focus the optics of the measuring machine until the displayed edge is as sharp as possible

Setting the lighting

- ▶ Tap **Lighting palette**
- ▶ Use the sliders to adjust the lighting in the workspace so that the contrast at the object edge is as high as possible

Setting the contrast threshold

The currently selected contrast threshold of the product may need to be adjusted to varying brightness conditions of the surroundings, e.g. changes in daylight. The contrast threshold defines the contrast value starting from which the product will recognize a light-to-dark transition as a transition.

A change in brightness could result in light-to-dark transitions—and therefore edges—being detected earlier or later, thus falsifying the measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Contrast settings**
- Select the **Edge algorithm** for the edge detection
- Tap **Start**

> The teach sequence is started and the **Measure** menu is displayed

- Follow the instructions of the wizard

- Select the **lighting palette**
- Adjust the sliders to achieve the highest possible contrast at the edge

- Tap **Confirm** in the wizard to confirm the positioning of the measuring tool and the lighting settings

> The teach sequence is complete

- Tap **Undo** to repeat the teach sequence

- Tap **Close** to close the wizard

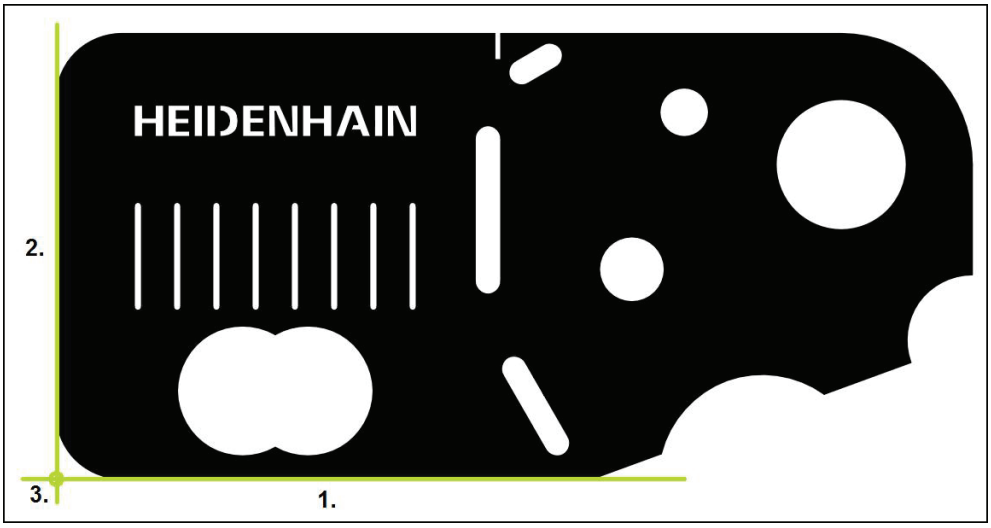
Further information: "Contrast settings", page 328

10.4.2 Aligning the measured object

Sec. 10.4.1: Preparing a measurement ▶ **Sec. 10.4.2: Aligning the measured object** ▶ Sec. 10.4.3: Measuring a feature

Before you can evaluate the measuring points, you need to align the measured object. During this process, the coordinate system of the measured object (workpiece coordinate system) is determined, which is specified in the technical drawing.

This makes it possible to compare the measured values with the data in the technical drawing and assess them.



Measured objects are usually aligned in three steps:

1 Measuring the alignment
2 Measuring a straight line
3 Constructing the zero point

Measuring the alignment

Define the reference edge for the alignment according to the technical drawing.

- Tap **Measure** in the main menu

- Select **Manual measuring** in the function palette

- If more than one optical sensor is active, select **VED sensor** in the sensor palette
- > The geometry palette and the VED measuring tools are displayed
- > The workspace shows the camera's live image
- In the quick access menu, select the magnification that is set on the measuring machine

- Select **Alignment** in the geometry palette

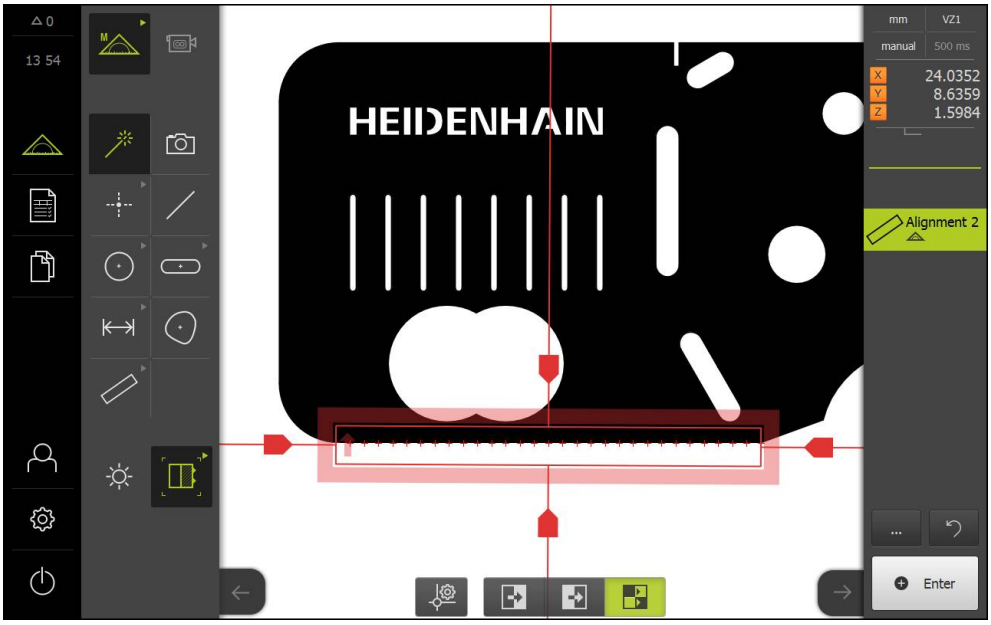
- Select **Buffer** in the tool palette
- Position the measuring tool above the reference edge
- Expand the measuring tool so that the edge area enclosed in the search range is as large as possible
- Rotate the measuring tool so that the scan direction corresponds to the desired scan direction

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > Multiple measuring points are captured along the edge
- > A new feature is displayed in the feature list of the Inspector

> Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- If the edge is interrupted or not fully displayed in the workspace, reposition the measuring tool and capture more measuring points

- Tap **Finish** in the new feature
- > The alignment is displayed in the feature list of the Inspector



Measuring a straight line

For the second reference edge, you can measure a straight line with the **Buffer** measuring tool, for example.

- Select **Line** in the geometry palette

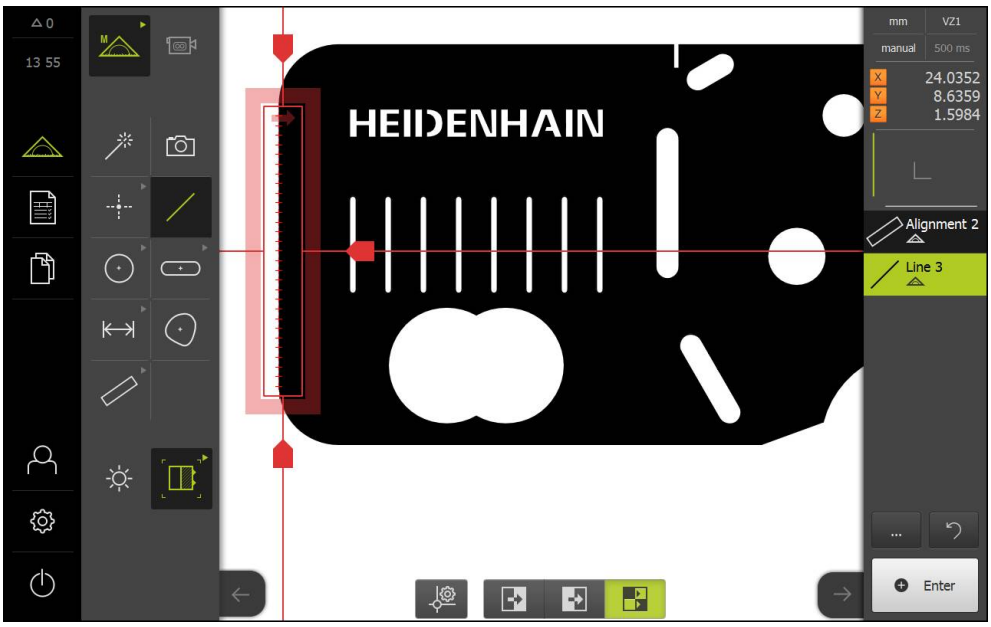
- Select **Buffer** in the tool palette
- Position the measuring tool above the reference edge
- Expand the measuring tool so that the edge area enclosed in the search range is as large as possible
- Rotate the measuring tool so that the scan direction corresponds to the desired scan direction

- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector
- > Multiple measuring points are captured along the edge
- > A new feature is displayed in the feature list of the Inspector

> **i** Distribute the measuring points along the entire length of the edge, as far as possible. This minimizes the angular error.

- If the edge is interrupted or not fully displayed in the workspace, reposition the measuring tool and capture more measuring points

- Tap **Finish** in the new feature
- > The line is displayed in the feature list of the Inspector

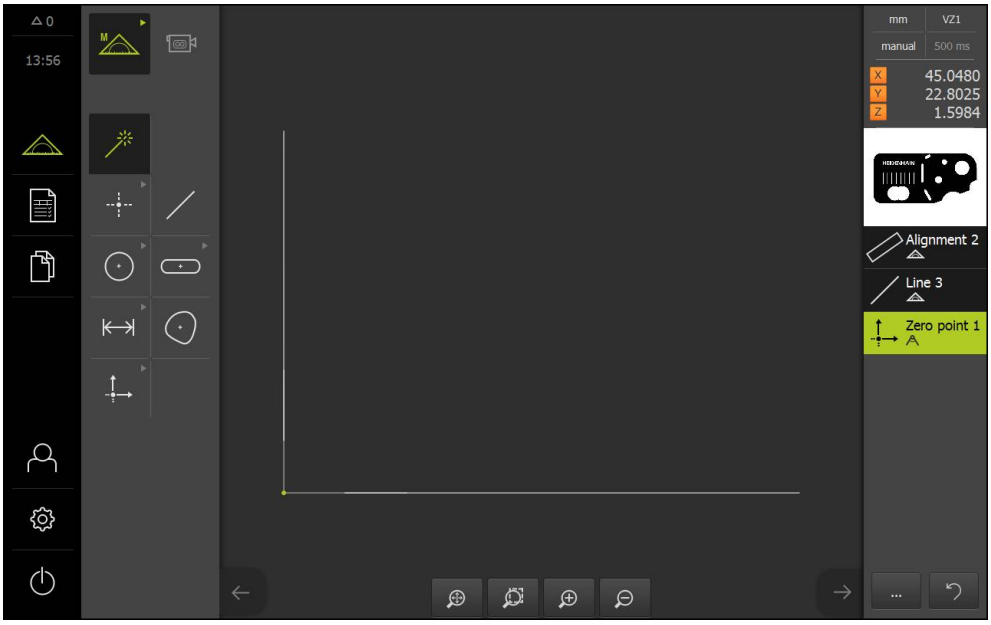


Constructing the zero point
The zero point is constructed of the point of intersection between the alignment and the straight line.

- ▶ Select **Construct** in the function palette
- > A new feature is displayed in the feature list of the Inspector

- ▶ Select **Zero point** in the geometry palette
- ▶ Select the **Alignment** and **Line** features in the Inspector or in the features view
- > The selected features are displayed in green

- ▶ Tap **Finish** in the new feature
- > The zero point is created
- > The workpiece coordinate system for the measured object has been determined
- ▶ Select **Manual measuring** in the function palette
- ▶ Tap **Features preview**
- > The coordinate system is shown in the workspace



Coordinate system of the measured object

10.4.3 Measuring a feature

Sec. 10.4.1: Preparing a measurement	▶	Sec. 10.4.2: Aligning the measured object	▶	**Sec. 10.4.3: Measuring a feature**

This section describes the typical steps required for conducting a measurement. The description provides an overview. Additional steps may be necessary depending on the measuring machine or the respective measuring application.

A measurement consists of the following steps:

- Selection of the appropriate geometry for the feature to be measured
- Measuring point acquisition using the selected geometry
  Further information: "Capturing measuring points", page 193

> The steps described in this section are the same for each measuring process. The steps are illustrated using the "Circle" geometry as an example.

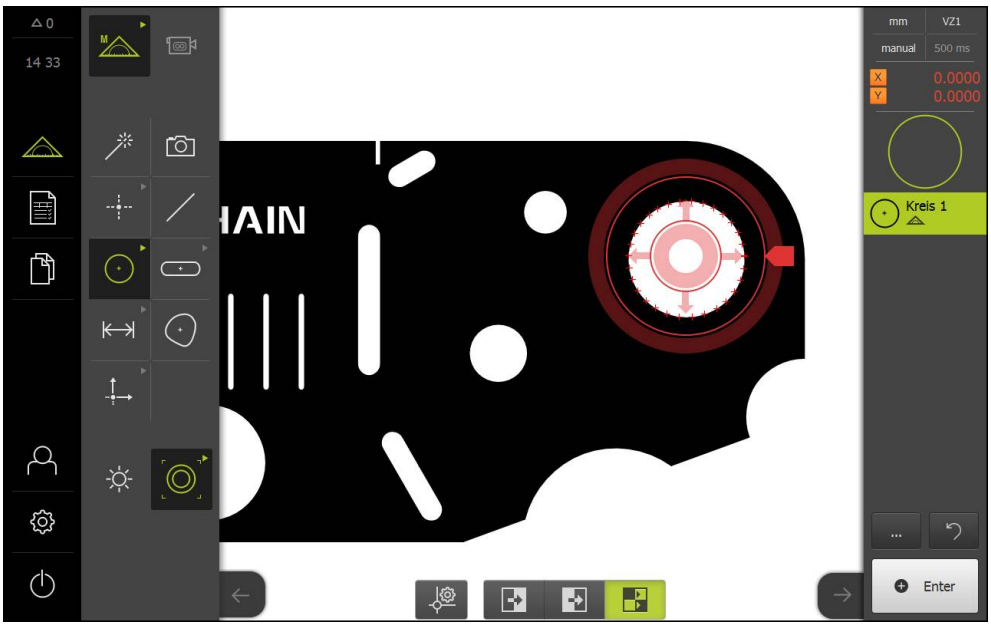
- Tap **Measure** in the main menu

- Select **Manual measuring**

- Select the **Circle** or **Measure Magic** geometry in the geometry palette
- If required, increase the workspace by hiding the main menu or the Inspector
- Move the measured object so that it is within the workspace
- Activate or deactivate automatic measuring point acquisition
  Further information: "Setting automatic measuring point acquisition", page 81

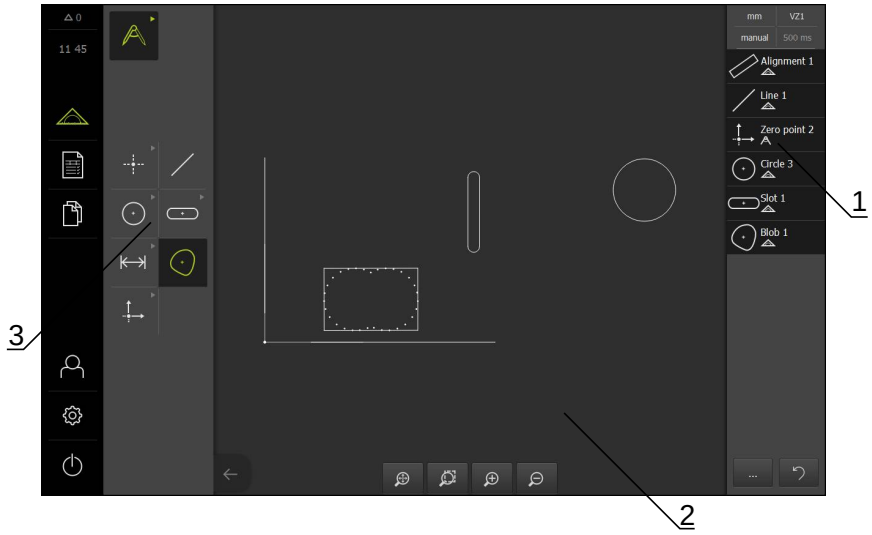
- Select the **Circle** measuring tool
- Position the measuring tool above the circle to be measured
- Capture measuring points

- ▶ Conclude the measuring point acquisition
- > The measured feature is displayed in the feature list
- > The feature can be evaluated
  Further information: "Measurement evaluation", page 245



10.5 Constructing features

You can construct new features from measured, constructed or defined features. This is done by deriving new features from the existing features, e.g. by moving or copying.



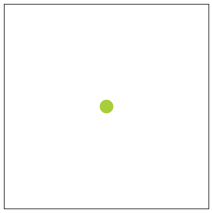
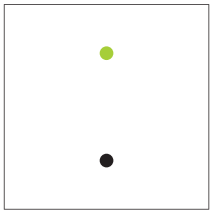
1 Feature list in the Inspector
2 Features view in the workspace
3 Geometry palette

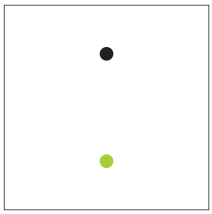
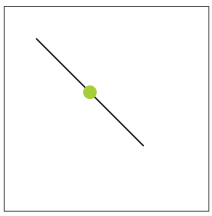
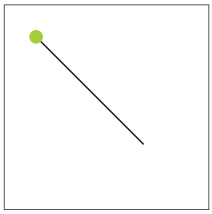
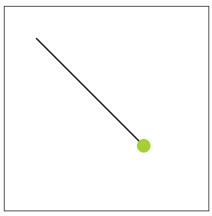
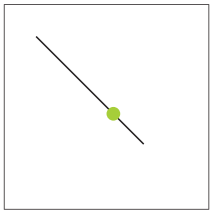
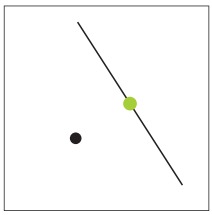
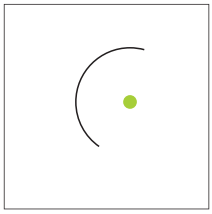
10.5.1 Overview of construction types

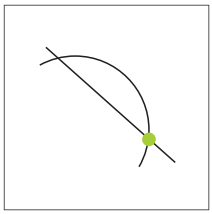
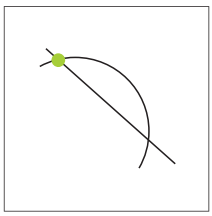
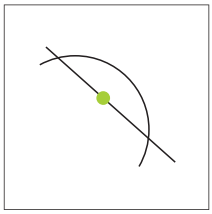
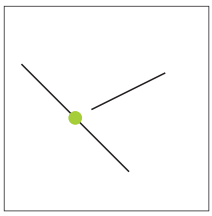
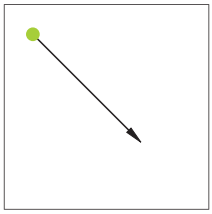
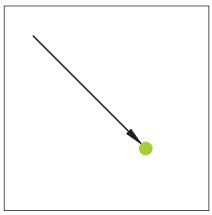
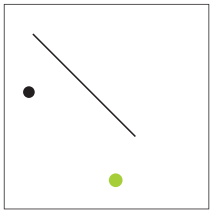
Existing features used for construction are referred to as parent features. Parent features can be measured, constructed or defined features.

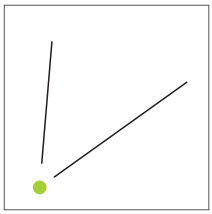
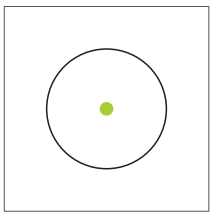
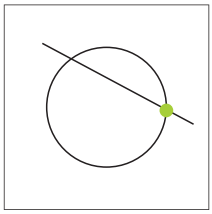
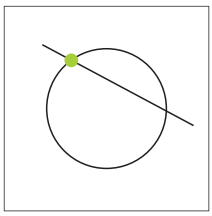
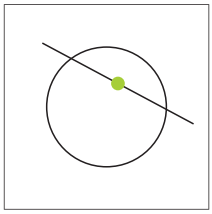
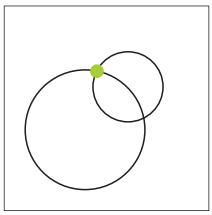
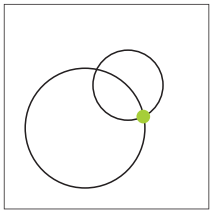
The overview shows the parent features and construction types that can be used for constructing a feature.

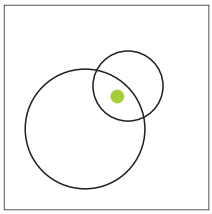
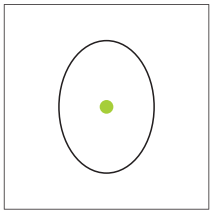
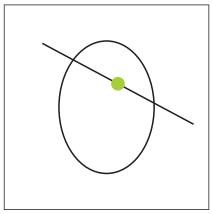
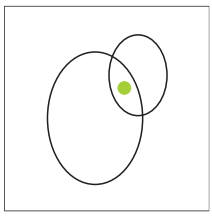
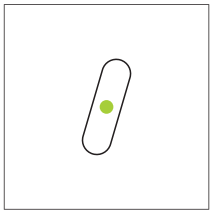
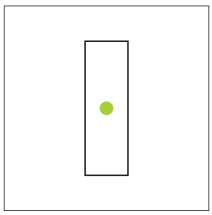
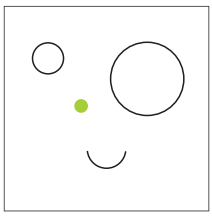
Point / Zero point

Parent feature	Construction type	Display
Point	**Copy**	
Point	**Max. Y point**	

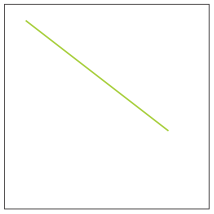
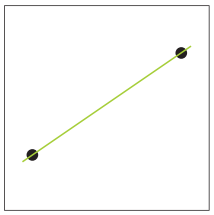
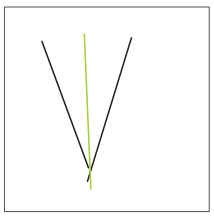
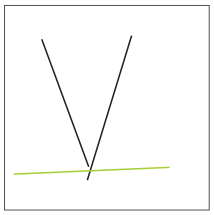
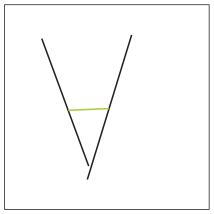
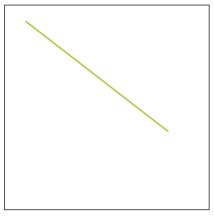
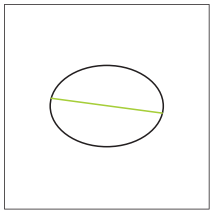
Parent feature	Construction type	Display
Point	**Min. Y point**	
Line	**Center**	
Line	**End point 1**	
Line	**End point 2**	
Line	**Point of origin**	
Point and **Line**	**Perpendclr. pnt.**	
Arc	**Center**	

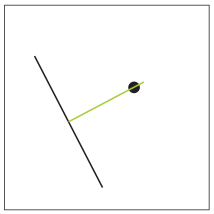
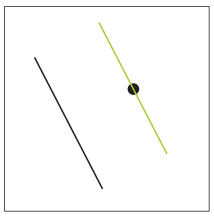
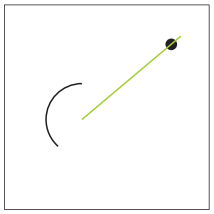
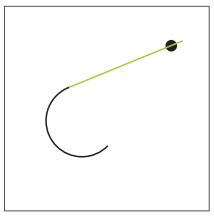
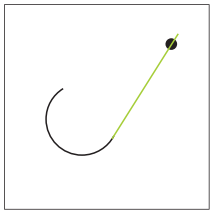
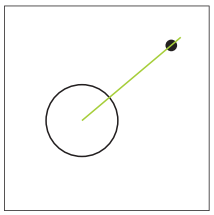
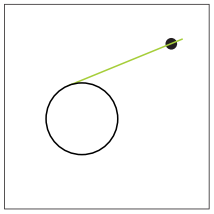
Parent feature	Construction type	Display
Arc and **Line**	**Intersection 1**	
Arc and **Line**	**Intersection 2**	
Arc and **Line**	**Perpendclr. pnt.**	
2x **Line**	**Intersection**	
Distance	**End point 1**	
Distance	**End point 2**	
Point and **Distance**	**Shift**	

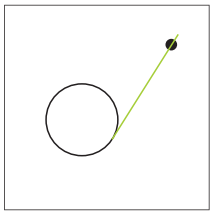
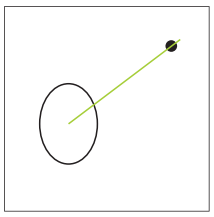
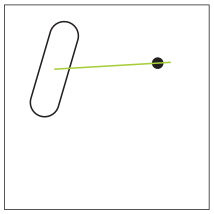
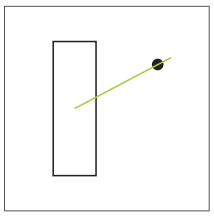
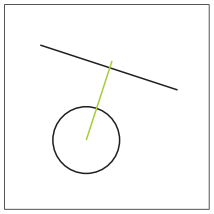
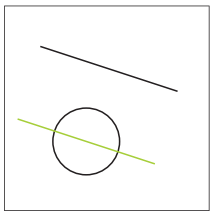
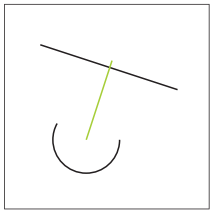
Parent feature	Construction type	Display
Angle	**Vertex**	
Circle	**Center**	
Circle and **Line**	**Intersection 1**	
Circle and **Line**	**Intersection 2**	
Circle and **Line**	**Perpendclr. pnt.**	
2x **Circle**	**Intersection 1**	
2x **Circle**	**Intersection 2**	

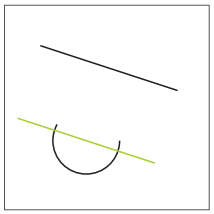
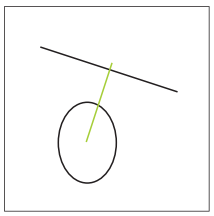
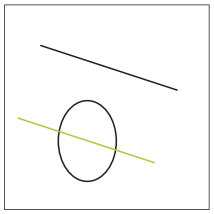
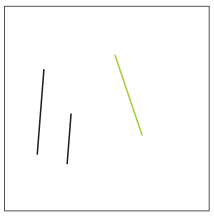
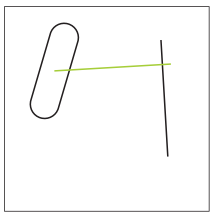
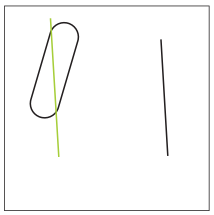
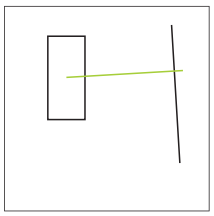
Parent feature	Construction type	Display
2x **Circle**	**Center**	
Ellipse	**Center**	
Ellipse and **Line**	**Perpendclr. pnt.**	
2x **Ellipse**	**Center**	
Slot	**Center**	
Rectangle	**Center**	
Multiple features	**Average** from any number and combination of the center points of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

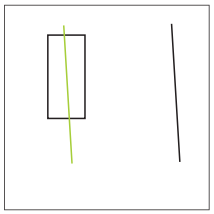
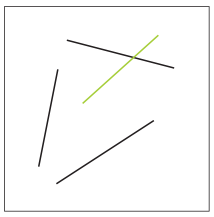
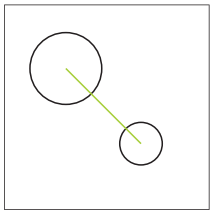
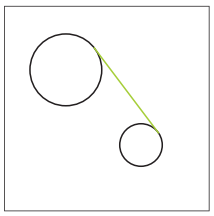
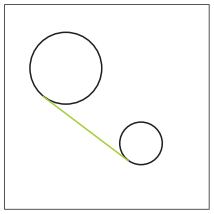
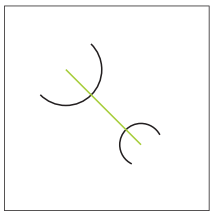
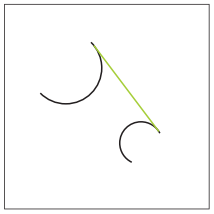
Line / Alignment

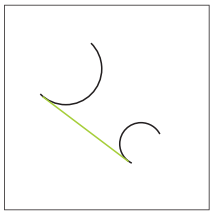
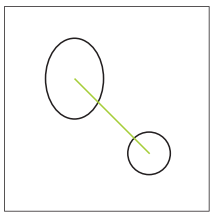
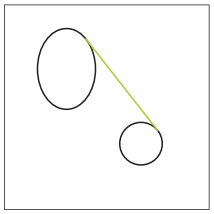
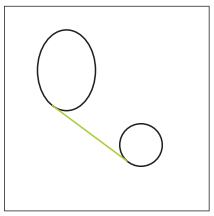
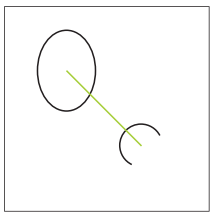
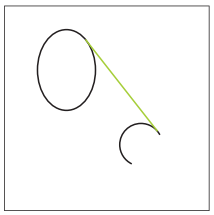
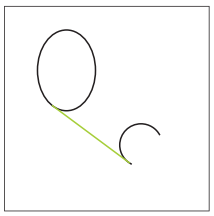
Parent feature	Construction type	Display
Line	**Copy**	
2x **Point**	**Center**	
2x **Line**	**Centerline 1**	
2x **Line**	**Centerline 2**	
2x **Line**	**Gauge line** (the length must be specified)	
Distance	**Centerline**	
Ellipse	**Semimajor axis**	

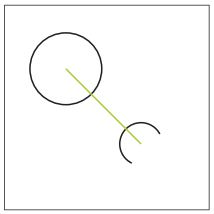
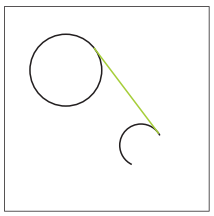
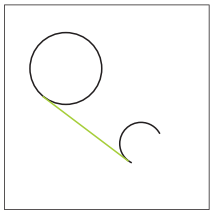
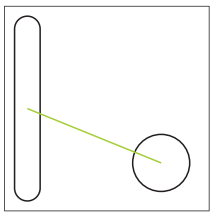
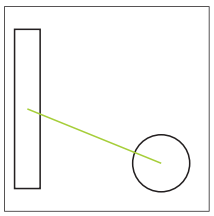
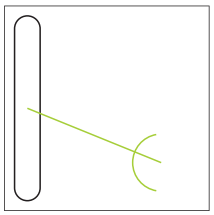
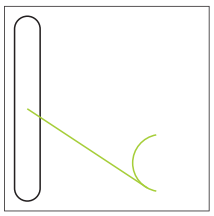
Parent feature	Construction type	Display
Point and **Line**	**Vertical**	
Point and **Line**	**Parallel**	
Point and **Arc**	**Center**	
Point and **Arc**	**Tangent 1**	
Point and **Arc**	**Tangent 2**	
Point and **Circle**	**Center**	
Point and **Circle**	**Tangent 1**	

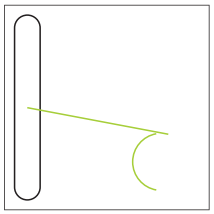
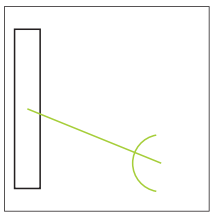
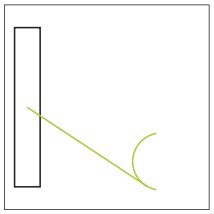
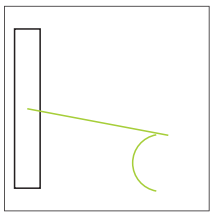
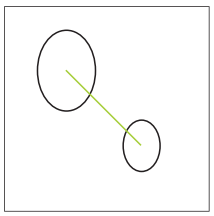
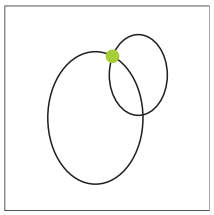
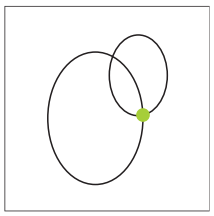
Parent feature	Construction type	Display
Point and **Circle**	**Tangent 2**	
Point and **Ellipse**	**Center**	
Point and **Slot**	**Center**	
Point and **Rectangle**	**Center**	
Line and **Circle**	**Vertical**	
Line and **Circle**	**Parallel**	
Line and **Arc**	**Vertical**	

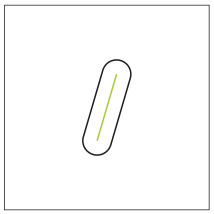
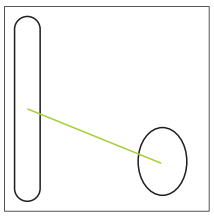
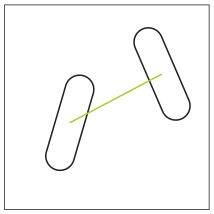
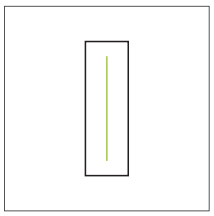
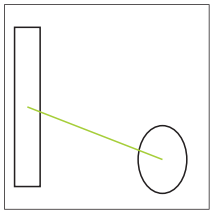
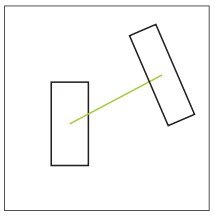
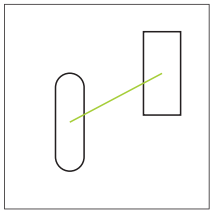
Parent feature	Construction type	Display
Line and **Arc**	**Parallel**	
Line and **Ellipse**	**Vertical**	
Line and **Ellipse**	**Parallel**	
Line and **Distance**	**Shift**	
Line and **Slot**	**Vertical**	
Line and **Slot**	**Parallel**	
Line and **Rectangle**	**Vertical**	

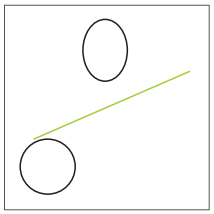
Parent feature	Construction type	Display
Line and **Rectangle**	**Parallel**	
Line and **Angle**	**Rotation**	
2x **Circle**	**Center**	
2x **Circle**	**Tangent 1**	
2x **Circle**	**Tangent 2**	
2x **Arc**	**Center**	
2x **Arc**	**Tangent 1**	

Parent feature	Construction type	Display
2x **Arc**	**Tangent 2**	
Circle and **Ellipse**	**Center**	
Circle and **Ellipse**	**Tangent 1**	
Circle and **Ellipse**	**Tangent 2**	
Arc and **Ellipse**	**Center**	
Arc and **Ellipse**	**Tangent 1**	
Arc and **Ellipse**	**Tangent 2**	

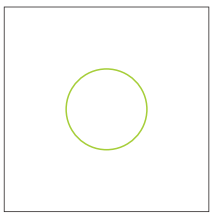
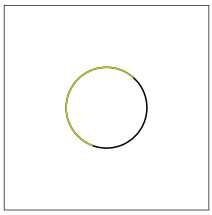
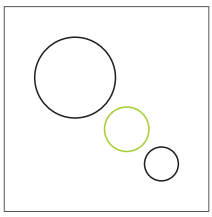
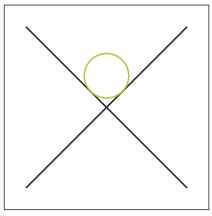
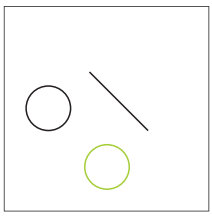
Parent feature	Construction type	Display
Circle and **Arc**	**Center**	
Circle and **Arc**	**Tangent 1**	
Circle and **Arc**	**Tangent 2**	
Circle and **Slot**	**Center**	
Circle and **Rectangle**	**Center**	
Arc and **Slot**	**Center**	
Arc and **Slot**	**Tangent 1**	

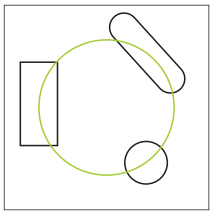
Parent feature	Construction type	Display
Arc and **Slot**	**Tangent 2**	
Arc and **Rectangle**	**Center**	
Arc and **Rectangle**	**Tangent 1**	
Arc and **Rectangle**	**Tangent 2**	
2x **Ellipse**	**Center**	
2x **Ellipse**	**Intersection 1**	
2x **Ellipse**	**Intersection 2**	

Parent feature	Construction type	Display
Slot	**Centerline**	
Slot and **Ellipse**	**Center**	
2x **Slot**	**Center**	
Rectangle	**Centerline**	
Rectangle and **Ellipse**	**Center**	
2x **Rectangle**	**Center**	
Slot and **Rectangle**	**Center**	

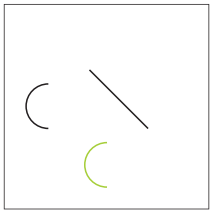
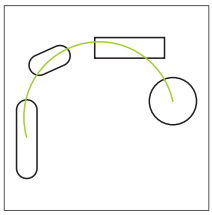
Parent feature	Construction type	Display
Multiple features	**Line** or **Alignment** from the center points of at least two features in any combination of: ■ **Point** ■ **Slot** ■ **Circle** ■ **Arc** ■ **Ellipse**	

Circle

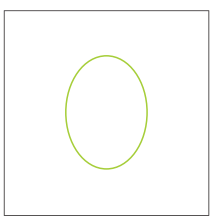
Parent feature	Construction type	Display
Circle	**Copy**	
Arc	**Copy** (circle superimposed on arc)	
2x **Circle**	**Average**	
2x **Line**	**Gauge circle**	
Circle and **Distance**	**Shift**	

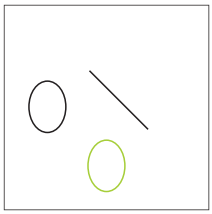
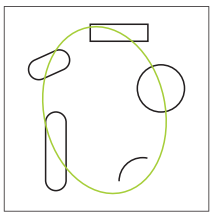
Parent feature	Construction type	Display
Multiple features	**Circle** from the center points of at least three features in any combination of: ■ **Point** ■ **Slot** ■ **Circle** ■ **Arc** ■ **Ellipse**	

Arc

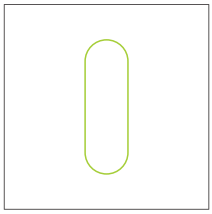
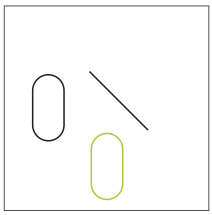
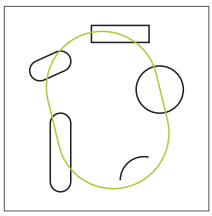
Parent feature	Construction type	Display
Arc	**Copy**	
Arc and **Distance**	**Shift**	
Multiple features	**Arc** from the center points of at least three features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

Ellipse

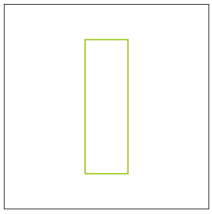
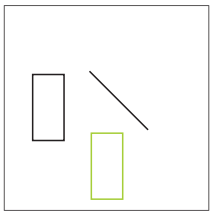
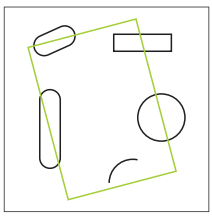
Parent feature	Construction type	Display
Ellipse	**Copy**	

Parent feature	Construction type	Display
Ellipse and **Distance**	**Shift**	
Multiple features	**Ellipse** from the center points of at least five features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

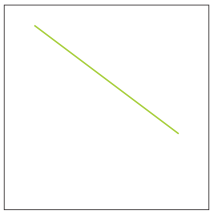
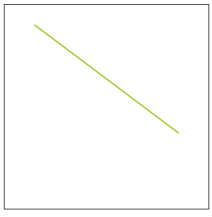
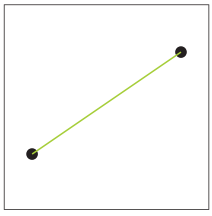
Slot

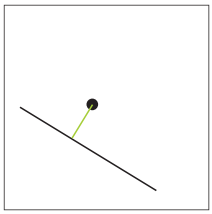
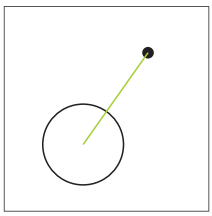
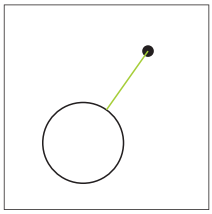
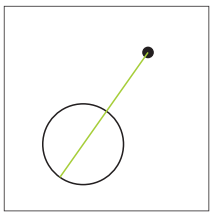
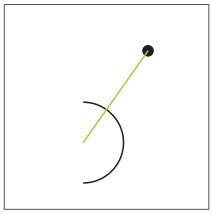
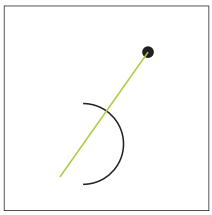
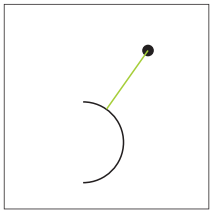
Parent feature	Construction type	Display
Slot	**Copy**	
Slot and **Distance**	**Shift**	
Multiple features	**Slot** from the center points of at least five features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

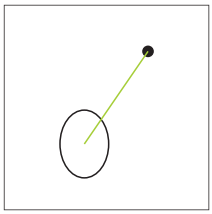
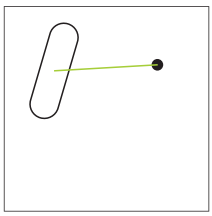
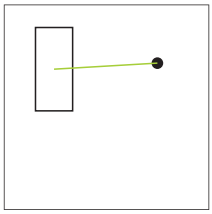
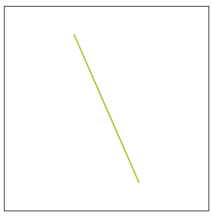
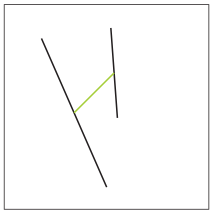
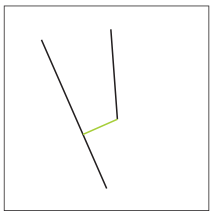
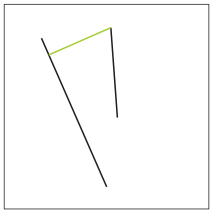
Rectangle

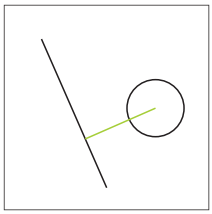
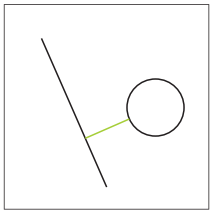
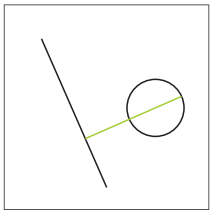
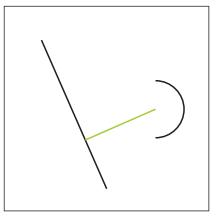
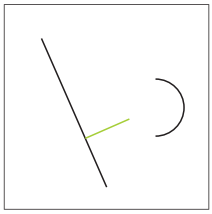
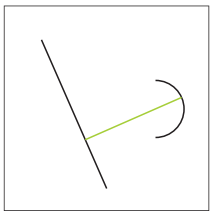
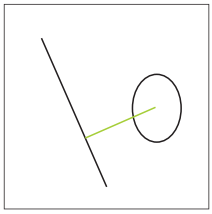
Parent feature	Construction type	Display
Rectangle	**Copy**	
Rectangle and **Distance**	**Shift**	
Multiple features	**Rectangle** from the center points of at least five features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

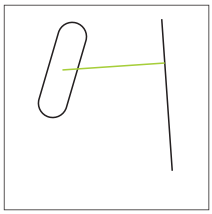
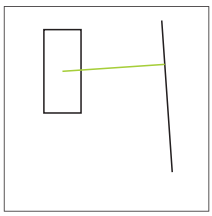
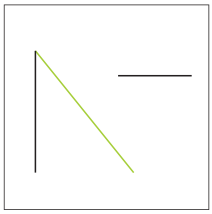
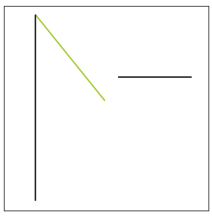
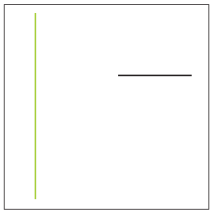
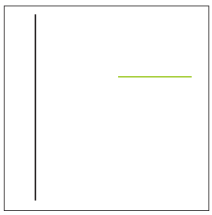
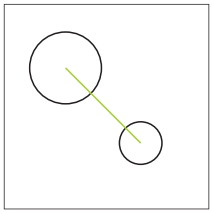
Distance

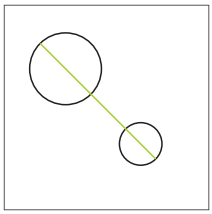
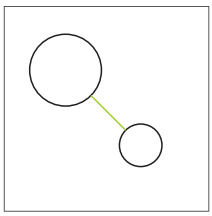
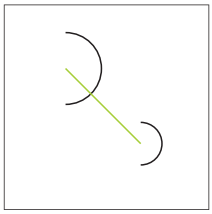
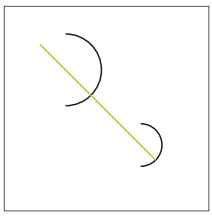
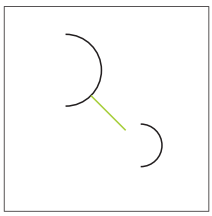
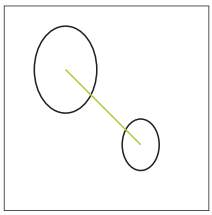
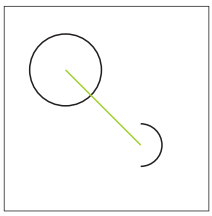
Parent feature	Construction type	Display
Distance	**Copy**	
Distance	**Direction change**	
2x **Point**	**Center**	

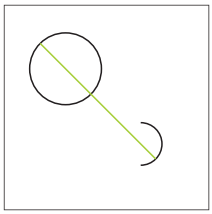
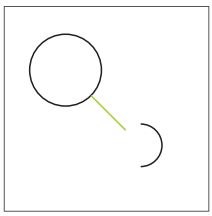
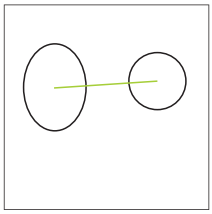
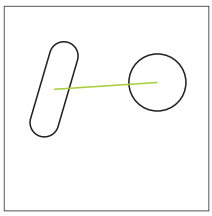
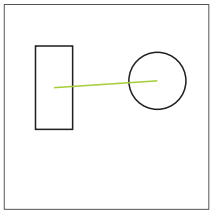
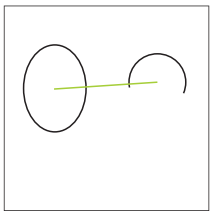
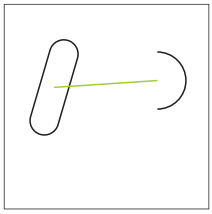
Parent feature	Construction type	Display
Point and **Line**	**Center**	
Point and **Circle**	**Center**	
Point and **Circle**	**Minimum**	
Point and **Circle**	**Maximum**	
Point and **Arc**	**Center**	
Point and **Arc**	**Minimum**	
Point and **Arc**	**Maximum**	

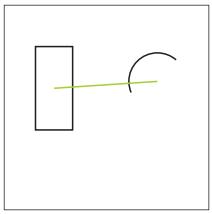
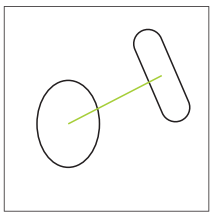
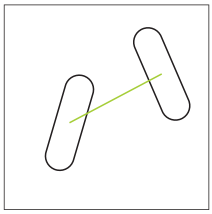
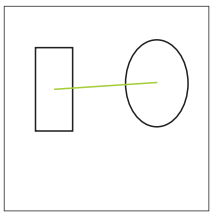
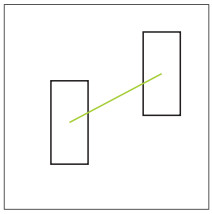
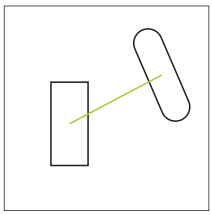
Parent feature	Construction type	Display
Point and **Ellipse**	**Center**	
Point and **Slot**	**Center**	
Point and **Rectangle**	**Center**	
Line	**Length**	
2x **Line**	**Center**	
2x **Line**	**Minimum**	
2x **Line**	**Maximum**	

Parent feature	Construction type	Display
Line and **Circle**	**Center**	
Line and **Circle**	**Minimum**	
Line and **Circle**	**Maximum**	
Line and **Arc**	**Center**	
Line and **Arc**	**Minimum**	
Line and **Arc**	**Maximum**	
Line and **Ellipse**	**Center**	

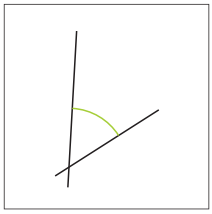
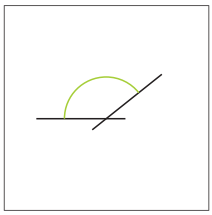
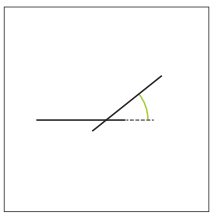
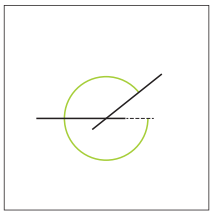
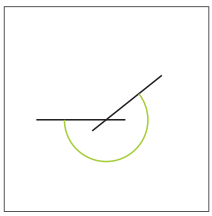
Parent feature	Construction type	Display
Line and **Slot**	**Center**	
Line and **Rectangle**	**Center**	
2x **Distance**	**Sum**	
2x **Distance**	**Average**	
2x **Distance**	**Maximum**	
2x **Distance**	**Minimum**	
2x **Circle**	**Center**	

Parent feature	Construction type	Display
2x **Circle**	**Maximum**	
2x **Circle**	**Minimum**	
2x **Arc**	**Center**	
2x **Arc**	**Maximum**	
2x **Arc**	**Minimum**	
2x **Ellipse**	**Center**	
Circle and **Arc**	**Center**	

Parent feature	Construction type	Display
Circle and **Arc**	**Maximum**	
Circle and **Arc**	**Minimum**	
Circle and **Ellipse**	**Center**	
Circle and **Slot**	**Center**	
Circle and **Rectangle**	**Center**	
Arc and **Ellipse**	**Center**	
Arc and **Slot**	**Center**	

Parent feature	Construction type	Display
Arc and **Rectangle**	**Center**	
Slot and **Ellipse**	**Center**	
2x **Slot**	**Center**	
Rectangle and **Ellipse**	**Center**	
2x **Rectangle**	**Center**	
Slot and **Rectangle**	**Center**	

Angle

Parent feature	Construction type	Display
Angle	**Copy**	
2x **Line**	**Interior angle**	
2x **Line**	**180° - angle**	
2x **Line**	**180° + angle**	
2x **Line**	**360° - angle**	

10.5.2 Constructing a feature

- Tap **Measure** in the main menu

- Select **Construct** in the function palette

- Select the desired geometry in the geometry palette, e.g. **Distance**
- Select the required parent features in the feature list

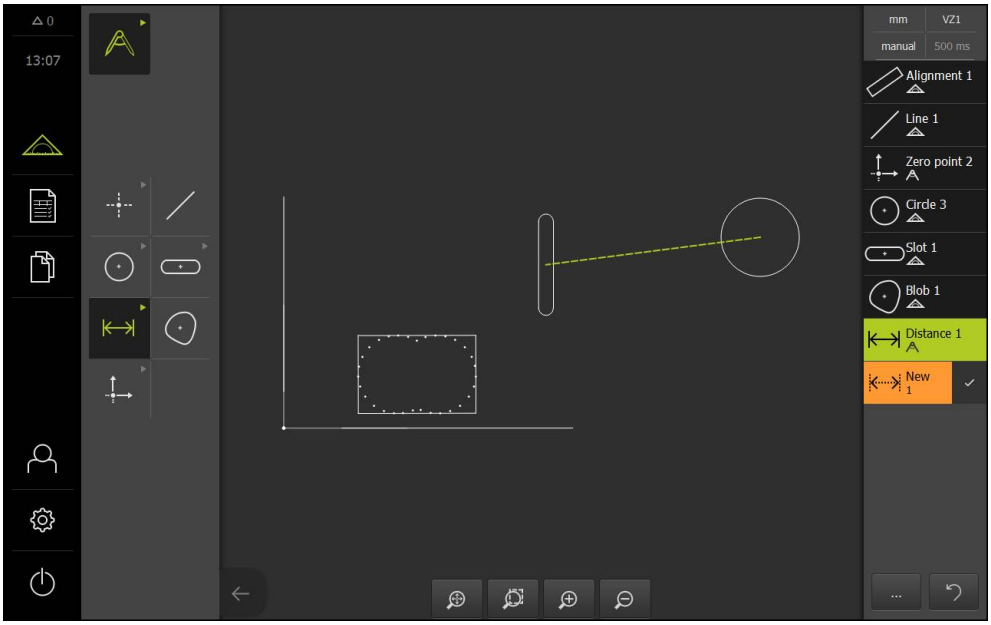
> The selected features are displayed in green

> A new feature with the selected geometry is displayed

- Tap **Finish** in the new feature

> If a feature cannot be concluded, the construction must be checked to ensure that the parent features used are permitted.

> The constructed feature is displayed in the workspace and the feature list



Editing a constructed feature

The constructed features can be edited immediately after construction. Depending on the geometry and the parent features, you can change the construction type of a constructed feature.

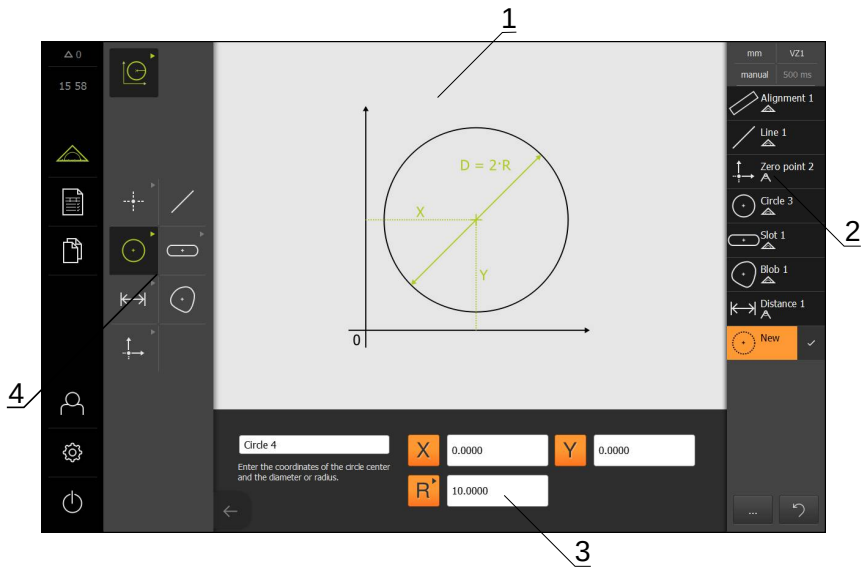
- ▶ Drag the constructed feature from the feature list into the workspace
- > The Details dialog appears with the **Overview** tab selected
- ▶ To rename the feature, tap the **input field** containing the current name
- ▶ Enter a name for the feature
- ▶ Confirm entry with **RET**
- > The new name is displayed in the feature list
- ▶ To change the construction type of the feature, select the type you want to use for the construction in the **Construction type** drop-down list

> The available construction types depend on the geometry and the parent features.
>
> **Further information:** "Overview of construction types", page 212

- > The new construction type is applied
- ▶ To change the geometry type, select the desired geometry type in the **New type of geometry** drop-down list
- > The feature is displayed in the new form
- ▶ Tap **Close** to close the dialog

10.6 Defining features

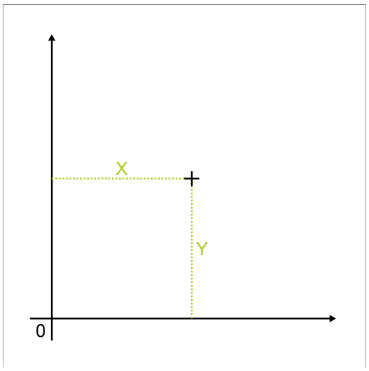
In some situations, it is necessary to define features. This may be the case, for example, if a reference used in the technical drawing cannot be established on the measured object by means of measurement or construction. Here you can define the reference on the basis of the coordinate system of the measured object.

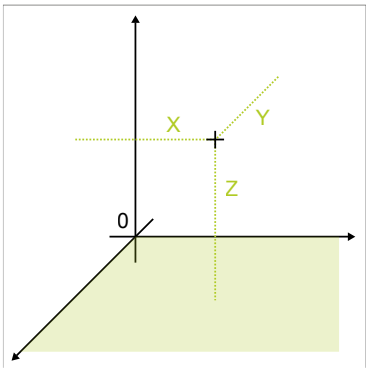
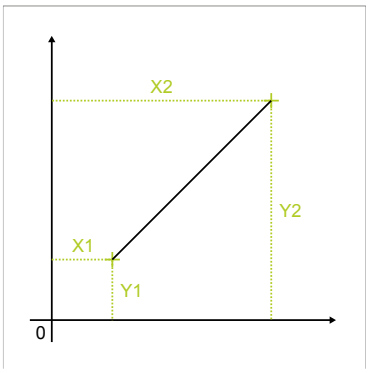
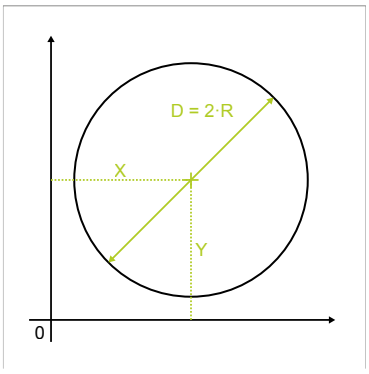
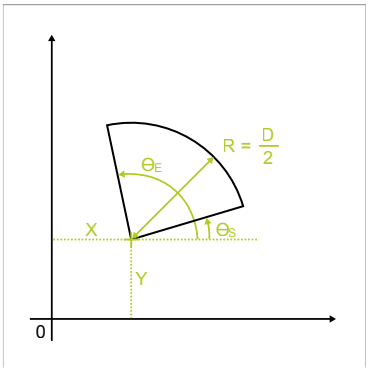


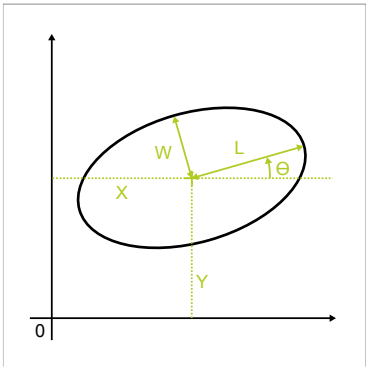
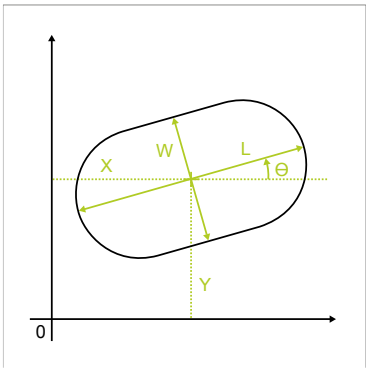
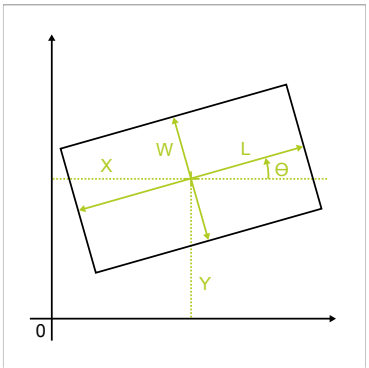
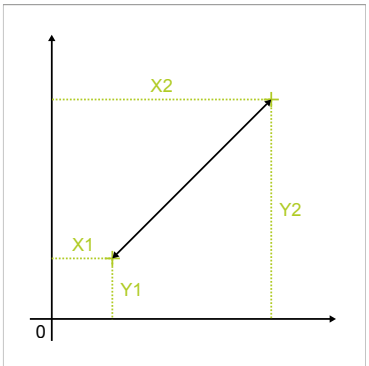
1 Display of the geometry
2 Feature list in the Inspector
3 Input fields for the geometry parameters
4 Geometry palette

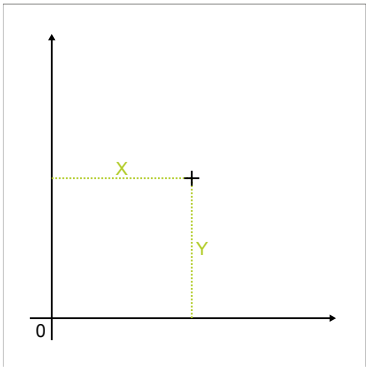
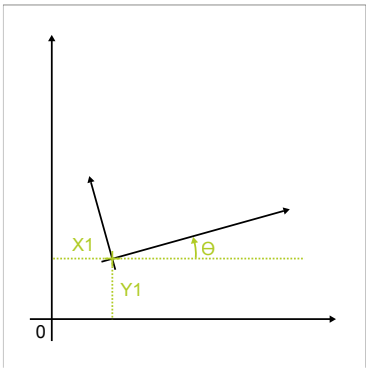
10.6.1 Overview of definable geometries

The overview shows the definable geometries and the required geometry parameters.

Display	Geometry parameters
	**Point** The feature is defined by the following values: ■ X: Position on the X axis ■ Y: Position on the Y axis

Display	Geometry parameters
	**Height point** The height point can only be defined if the Z axis is active. The feature is defined by the following values: ■ X: Position on the X axis ■ Y: Position on the Y axis ■ Z: Position on the Z axis
	**Line** The feature is defined by the following values: ■ X1: Position of the first point on the X axis ■ Y1: Position of the first point on the Y axis ■ X2: Position of the second point on the X axis ■ Y2: Position of the second point on the Y axis
	**Circle** The feature is defined by the following values: ■ X: Position of the center point on the X axis ■ Y: Position of the center point on the Y axis ■ D: Diameter of the circle ■ R: Radius of the circle ▶ To switch between diameter and radius, tap **D** or **R**
	**Arc** The feature is defined by the following values: ■ X: Position of the vertex on the X axis ■ Y: Position of the vertex on the Y axis ■ θ_S: Starting angle between the X axis and the first side ■ θ_E: End angle between the X axis and the second side enclosing the opening angle ■ D: Diameter of the arc ■ R: Radius of the arc ▶ To switch between diameter and radius, tap **D** or **R**

Display	Geometry parameters
	**Ellipse** The feature is defined by the following values: ■ X: Position of the center point on the X axis ■ Y: Position of the center point on the Y axis ■ W: Length of the minor axis ■ L: Length of the reference axis ■ θ: Angle between X axis and reference axis
	**Slot** The feature is defined by the following values: ■ X: Position of the center point on the X axis ■ Y: Position of the center point on the Y axis ■ W: Width of the slot ■ L: Length of the slot (reference axis) ■ θ: Angle between X axis and reference axis
	**Rectangle** The feature is defined by the following values: ■ X: Position of the center point on the X axis ■ Y: Position of the center point on the Y axis ■ W: Width of the rectangle ■ L: Length of the rectangle (reference axis) ■ θ: Angle between X axis and reference axis
	**Distance** The feature is defined by the following values: ■ X1: Position of the first point on the X axis ■ Y1: Position of the first point on the Y axis ■ X2: Position of the second point on the X axis ■ Y2: Position of the second point on the Y axis

Display	Geometry parameters
	**Zero point** The feature is defined by the following values: ■ X: Position on the X axis ■ Y: Position on the Y axis
	**Alignment** The feature is defined by the following values: ■ X: Position on the X axis ■ Y: Position on the Y axis ■ θ: Direction with angle between X axis and alignment

10.6.2 Defining a feature

- Tap **Measure** in the main menu

- Select **Define** in the function palette

- Select the desired geometry in the geometry palette

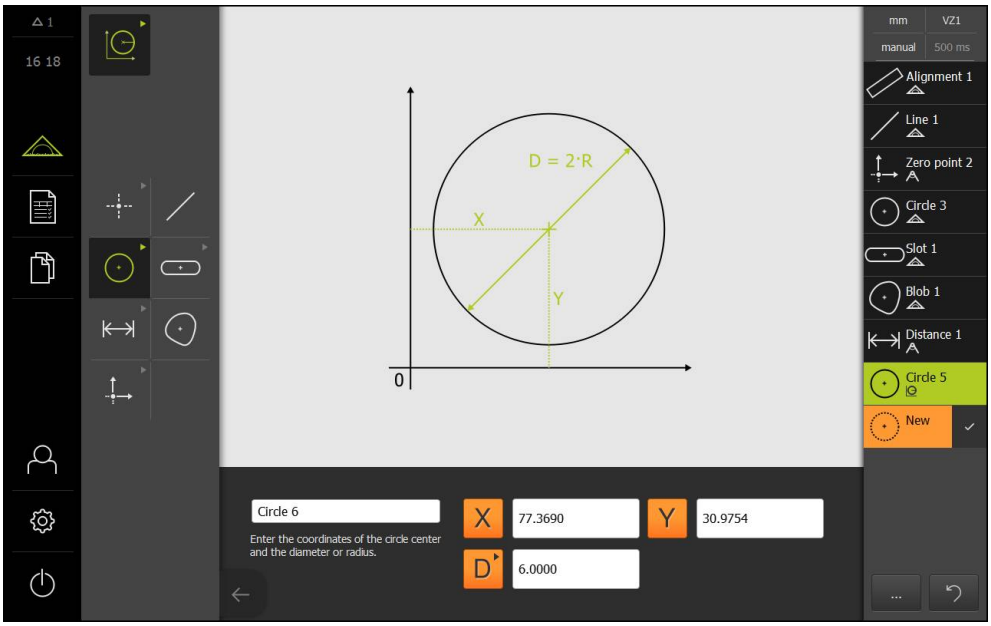
Further information: "Overview of definable geometries", page 240

> A new feature is added to the feature list and displayed in the workspace

- Enter a name for the feature
- Confirm entry with **RET**
- Enter the geometry parameters of the feature
- Confirm the entries with **RET**

- Tap **Finish** in the new feature

> The defined feature is displayed in the feature list



11

Measurement evaluation

11.1 Overview

This section describes the following functions:

- Evaluating a measurement
- Defining tolerances

> Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.
>
> **Further information:** "Basic operation", page 51

The measurement evaluation and tolerancing described in this chapter are performed using the features that were measured or constructed in the Quick Start chapter. The supplied 2-D demo part is used as an example for illustrating how to apply the tolerances.

Further information: "Quick Start", page 157

11.2 Evaluating a measurement

During a measurement, the product determines features from the captured measuring points. Depending on the number of measuring points captured, a fitting algorithm is used to calculate the appropriate substitute feature and display it as a feature in the feature list. The Gaussian fitting algorithm is used by default.

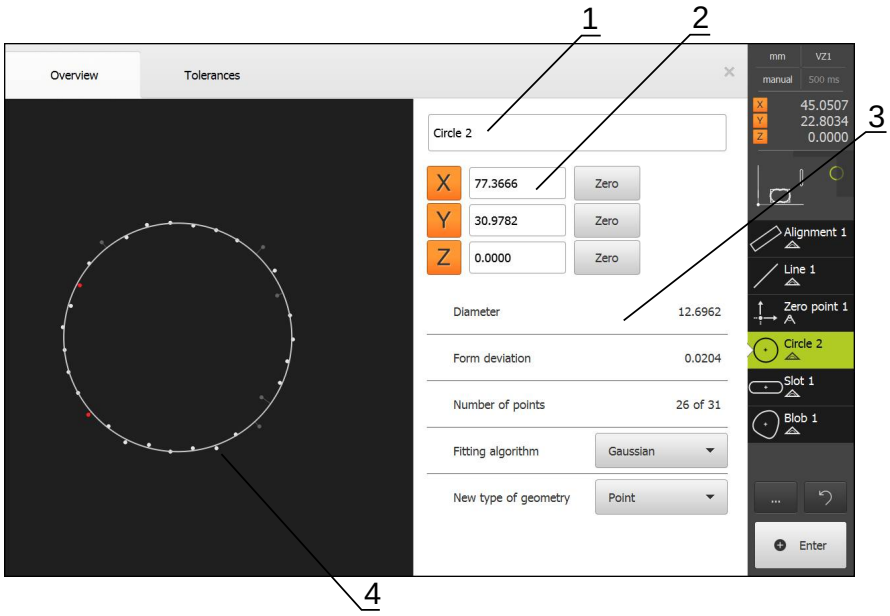
The following functions are available:

- Changing the fitting algorithm
- Converting the geometry type

Activation

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining appears
- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected

Short description



1 Name of the feature
2 Axis positions of the center point
3 Feature properties and parameters
4 Features view of the measuring points and the form

The Overview shows the following details about the feature:

- Name of the feature
- Axis positions of the center point
- Feature parameters, depending on the type of geometry
- Number of measuring points used for calculating the feature
- Fitting algorithm used for calculating the feature (depending on the geometry and the number of measuring points)
- List of geometry types to which the feature can be converted

Display of measuring points and form

- The measuring points with the greatest deviations within the fitting algorithm are displayed in red
- The measuring points that are not used for the fitting algorithm according to the measuring point filter settings are displayed in gray
- The measuring points used for the fitting algorithm are displayed in white
- The distances between the measuring points and the calculated form are displayed as lines

11.2.1 Fitting algorithm

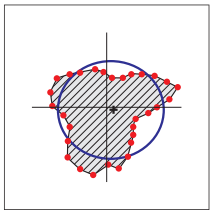
Short description

If the number of points captured during the measurement of a feature exceeds the mathematical minimum number of points, there are more points than necessary for determining the geometry. The geometry is thus overdetermined. Therefore, fitting algorithms are used to calculate the appropriate substitute feature.

The following fitting algorithms are available:

- Gaussian
- Minimum zone
- Max. inscribed
- Min. circumscribed

The fitting algorithms are described below, using a circle as an example:

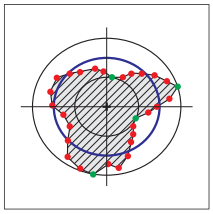


Gaussian

Fitting algorithm that calculates a substitute feature that is optimally centered between all measuring points.

The statistical mean of all captured measuring points is used for the calculation. All measuring points are weighted equally.

Gaussian is the default setting.

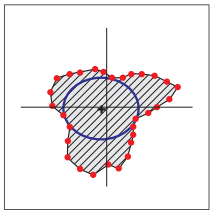


Minimum zone

Fitting algorithm that calculates a geometry from two reference circles. One circle lies on the two outermost measuring points. The other circle lies on the two innermost measuring points. The two circles have the same center.

The substitute feature is located halfway between the two circles.

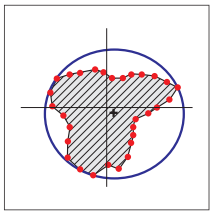
The algorithm is suitable for measuring form error.



Max. inscribed

Fitting algorithm that calculates a substitute feature that is located within all measuring points and, at the same time, is as large as possible.

The algorithm is suitable e.g. for measuring holes when checking mating sizes.



Min. circumscribed

Fitting algorithm that calculates a substitute feature that is located outside the measuring points and, at the same time, is as small as possible.

The algorithm is suitable e.g. for measuring pins or shafts when checking mating sizes.

The center of the minimum circumscribed circle does not coincide with the center of the maximum inscribed circle.

Overview
The following overview shows the possible fitting algorithms for the features.

Geometry	Fitting algorithm			
	Gaussian	**Minimum**	**Max. inscribed**	**Min. circum-scribed**
Point	X	-	-	-
Line	X	X	-	-
Circle	X	X	X	X
Arc	X	X	-	-
Ellipse	X	-	-	-
Slot	X	-	-	-
Rectangle	X	-	-	-
Distance	X	-	-	-
Angle	X	-	-	-
Blob	X	-	-	-
Zero point	X	-	-	-
Alignment	X	X	-	-
Reference plane	X	-	-	-

11.2.2 Evaluating a feature

Renaming a feature

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ Tap the **input field** containing the current name
- ▶ Enter a name for the feature
- ▶ Confirm entry with **RET**
- > The new name is displayed in the feature list
- ▶ Tap **Close** to close the dialog

Adjusting the fitting algorithm

You can adjust the fitting algorithm depending on the measured feature. The geometry is basically calculated using the Gaussian fitting algorithm.

Further information: "Fitting algorithm", page 248

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The fitting algorithm used is displayed
- ▶ Select the desired fitting algorithm in the **Fitting algorithm** drop-down list
- > The feature is displayed according to the selected fitting algorithm
  Further information: "Display of measuring points and form", page 247
- ▶ Tap **Close** to close the dialog

Converting a feature
The feature can be converted to a different type of geometry. The list of possible geometry types is provided as a drop-down list in the features view.

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The geometry type of the feature is displayed
- ▶ Select the desired geometry type in the **New type of geometry** drop-down list
- > The feature is displayed in the new form
  Further information: "Display of measuring points and form", page 247

- ▶ Tap **Close** to close the dialog

11.3 Defining tolerances

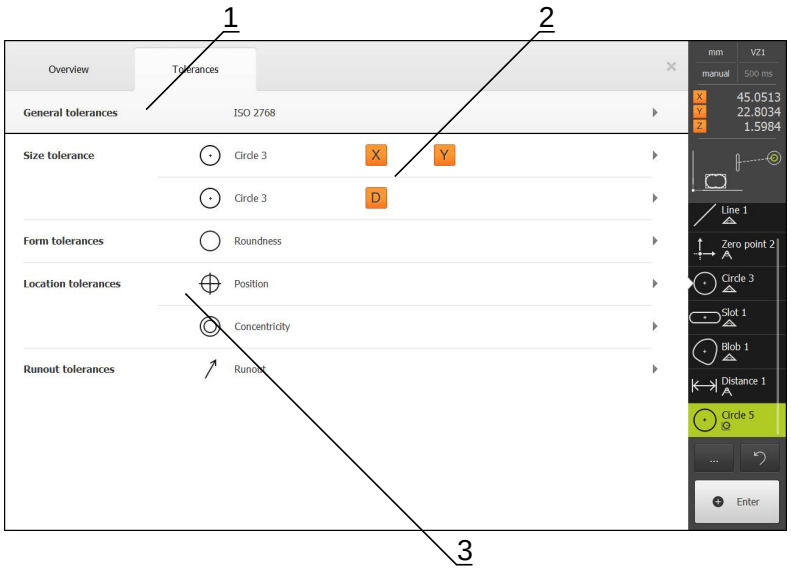
This section describes the following functions:

- Overview of tolerances
- Configuring general tolerances
- Tolerancing the features

Activation

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining appears
- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed

Short description



1 Display of general tolerance
2 List of tolerances, depending on feature
3 Status of the tolerance: active and within the tolerance or active and outside the tolerance

On the **Tolerances** tab, you can define the geometrical tolerancing of a measured or constructed feature. The tolerances are grouped.

> Tolerances cannot be applied to reference features, such as zero point, alignment and reference plane.

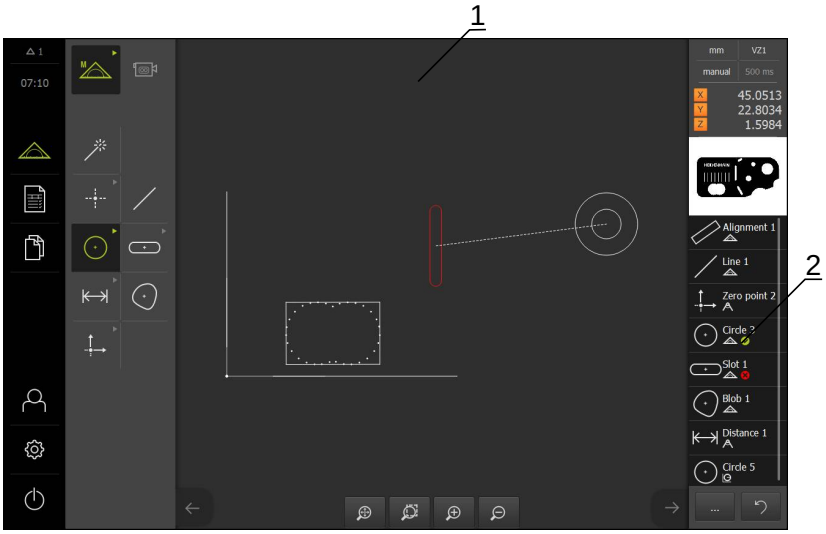
Depending on the feature, you can define the following tolerance types:

- General tolerances, e.g. application of the ISO 2768 standard
- Size tolerances, e.g. diameter, width, length and angle of reference axis
- Form tolerances, e.g. roundness
- Location tolerances, e.g. position, concentricity
- Directional tolerances, e.g. angularity, parallelism, perpendicularity
- Runout tolerances

The tolerances can be activated or deactivated.

Further information: "Tolerancing the features", page 258

Display of toleranced features



1 Feature (red) with one or more tolerance values exceeded
2 Feature list with toleranced features, indicated by the symbol

The features preview in the workspace displays a feature in red if one or more of its tolerance limits were exceeded.

The results of the tolerance test are indicated by symbols in the feature list and on the **Tolerances** tab.

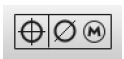
Symbol	Meaning
	The activated tolerances of the feature are met.
	One or more activated tolerances of the feature are exceeded.

11.3.1 Overview of tolerances

The following overview shows the tolerances that can be defined for a feature.

Feature	General	Size	Form	Location	Direction	Runout
Point, height point	ISO 2768		-		-	-
Line	ISO 2768				 	-
Circle	ISO 2768			 	-	
Arc	ISO 2768			 	-	
Ellipse	ISO 2768		-		-	-
Slot	ISO 2768		-		-	-
Rectangle	ISO 2768		-		-	-
Distance	ISO 2768		-	-	-	-
Angle	ISO 2768		-	-	-	-
Blob	ISO 2768		-		-	-

Overview of position tolerance types

Symbol	Tolerance type
	**Circular tolerance zone** A circular tolerance zone is set around the nominal dimension of the feature's position. The position of the center point defines the position of the feature. The center point of the feature must be within the tolerance zone.
	**Rectangular tolerance zone** A rectangular tolerance zone is set around the nominal dimension of the feature's position. The upper and lower tolerance limits define the tolerance zone. The center point of the feature must be within the tolerance zone.
	**Maximum material requirement (MMR)** The maximum material requirement allows tolerance compensation between the position tolerance and the size tolerance. The maximum material requirement is applied to features of the circle and arc types. It defines a tolerance for the feature with respect to a geometrically ideal counterpart to check the joinability of the workpiece.
	**Least material requirement (LMR)** The least material requirement defines the requirements for the minimum material thicknesses of a feature. It defines a tolerance for the feature with respect to a geometrically ideal counterpart that must be fully enclosed by the feature.

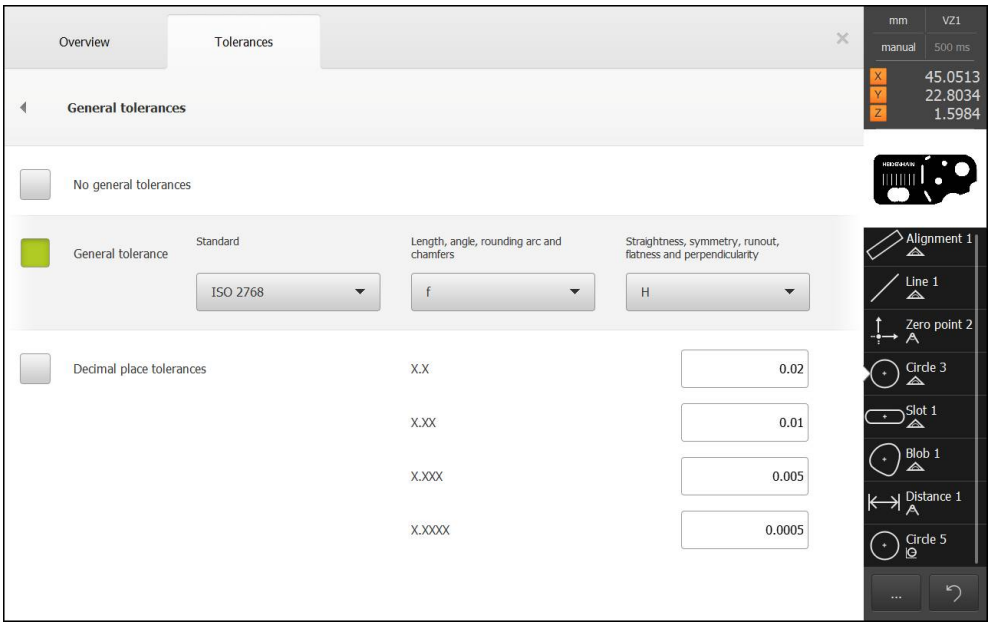
11.3.2 Configuring general tolerances

Tolerances can be assigned to the features in different ways. You can either manually define the tolerance limits for each value, e.g. size or position, or you can use general tolerances.

The general tolerances are defined globally. The general tolerances can be used in all features that can be toleranced. The general tolerances available on the product include, for example, ISO 2768 and decimal place tolerances.

Features to which a general tolerance is applied are automatically updated with respect to the tolerance limits whenever the setting of the general tolerance changes. Manually set tolerance limits are not updated automatically.

- ▶ Drag the feature from the feature list into the workspace
- > The **Overview** tab is displayed
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed
- ▶ Tap **General tolerances**



Selecting general tolerances

The tolerance tables defined in the ISO 2768 standard are stored on the product for all tolerance classes.

- ▶ Tap the checkbox next to **General tolerance** to activate the general tolerances

- > The active checkbox is highlighted in green
- ▶ Select the desired standard in the **Standard** drop-down list
- ▶ Select the desired tolerance class in the **Length, angle, rounding arc and chamfers** drop-down list
- ▶ Select the desired tolerance class in the **Straightness, symmetry, runout, flatness and perpendicularity** drop-down list
- ▶ Tap **General tolerances**
- > The selected general tolerance is displayed on the **Tolerances** tab

Defining the decimal place tolerance

You can define a separate tolerance for each decimal place.

- ▶ To perform decimal place tolerancing, tap the checkbox next to **Decimal place tolerances**

- > The active checkbox is highlighted in green
- ▶ Tap an input field
- ▶ Enter a value for the tolerance limit
- ▶ Confirm entry with **RET**
- ▶ Repeat the last three steps for the remaining decimal places
- ▶ Tap **General tolerances**
- > The **Decimal place tolerances** are displayed on the **Tolerances** tab

Deactivating general tolerances

- ▶ Tap the checkbox next to **No general tolerances** to deactivate the general tolerances

- > The active checkbox is highlighted in green
- ▶ Tap **General tolerances**
- > No general tolerance is displayed on the **Tolerances** tab

11.3.3 Tolerancing the features

The setting of tolerances is described using an example based on the features that were measured and constructed in the Quick Start chapter.

Setting size tolerances

You can define the size tolerances for the following geometry parameters of a feature:

- Axis positions (X, Y) of the center point
- Angle (θ) between the X axis of the coordinate system and the reference axis
- Width (W) and length (L) of slot and rectangle
- Length (L) of line and distance
- Largest dimension (A) and smallest dimension (C) of a blob
- Radius (R) of circle and arc
- Diameter (D) of circle and arc

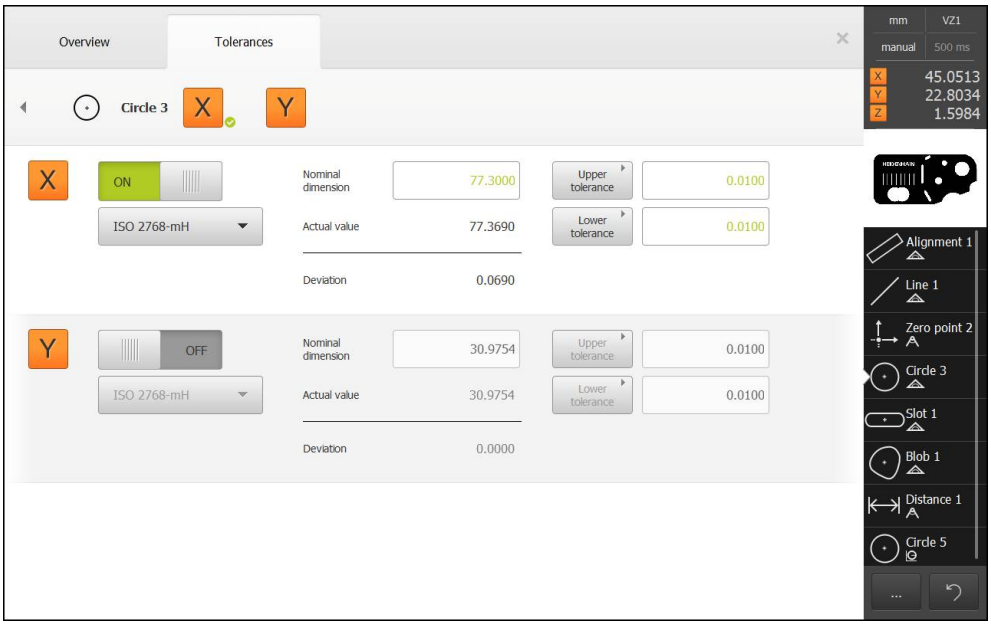
> The procedure for setting the size tolerances is the same for all features. The following description shows how to set the size tolerance for the axis position X of a circle.

- ▶ Drag the feature from the feature list into the workspace
- > The **Overview** tab is displayed
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed
- ▶ Tap the size tolerance **X**

- > An overview of the selected size tolerance appears
- ▶ Activate tolerancing of the measured value with the **ON/OFF** sliding switch

- > The drop-down list with the selected **General tolerance ISO 2768** or **Decimal place tolerances** is activated

Setting General tolerance ISO 2768



> The nominal and actual dimensions are displayed

▶ Tap the **Nominal dimension** input field to enter the nominal dimension

▶ Enter the desired value

▶ Confirm entry with **RET**

> The upper and lower tolerance or the upper and lower limit are displayed

> The tolerance limits are entered automatically based on the nominal dimension and the specified general tolerance.

▶ To switch between the **Upper tolerance** and **Upper limit** input fields, tap **Upper tolerance** or **Upper limit**

> The nominal value is shown in red if it is out of tolerance

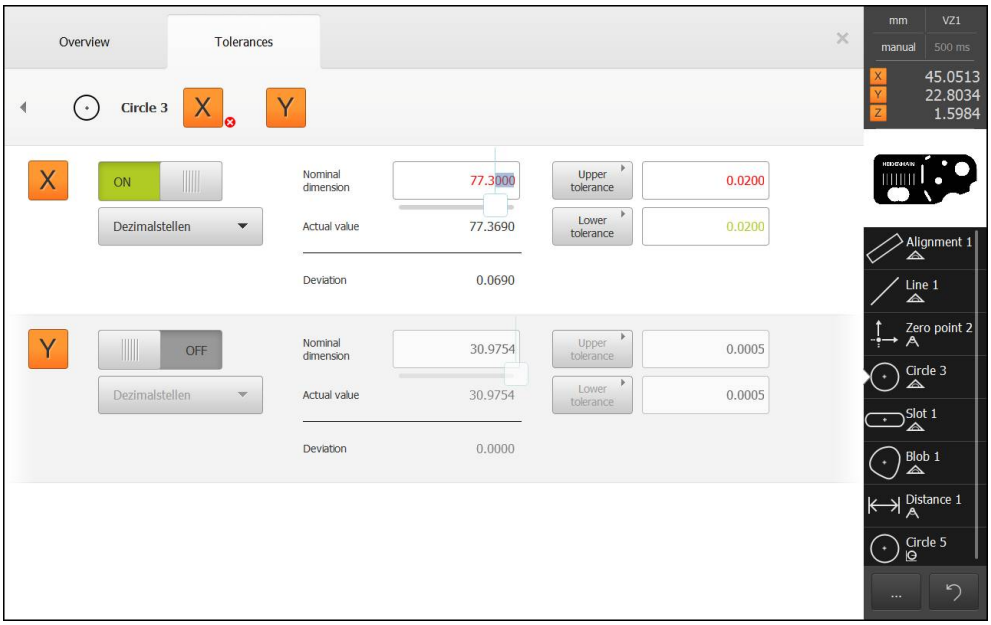
> The nominal value is shown in green if it is within tolerance

▶ Tap the **size tolerance**

> The **Tolerances** tab is displayed

> The result of the tolerance test is displayed on the tab and in the feature list

Setting General tolerance Decimal place tolerances



> The nominal and actual dimensions are displayed

- Tap the **Nominal dimension** input field to enter the nominal dimension
- Enter the desired value
- Confirm entry with **RET**
- Use the slider below **Nominal dimension** to set the tolerance limit (number of decimal places)

> The upper and lower tolerance limit values or the upper limit and lower limit are displayed

> The tolerance limits are entered automatically based on the nominal dimension and the specified general tolerance.

- To switch between the **Upper tolerance** and **Upper limit** input fields, tap **Upper tolerance** or **Upper limit**

> The nominal value is shown in red if it is out of tolerance

> The nominal value is shown in green if it is within tolerance

- Tap the **size tolerance**

> The **Tolerances** tab is displayed

> The result of the tolerance test is displayed on the tab and in the feature list

Setting the tolerance limits manually

The tolerance limits can be adjusted manually to differ from the general tolerance specified for the respective feature. The modified tolerance values apply only to the currently open feature.

- ▶ To switch between the **Upper tolerance** and **Upper limit** input fields, tap **Upper tolerance** or **Upper limit**
- ▶ Tap the **Upper tolerance** or **Upper limit** input field
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The adjusted tolerance value is applied
- ▶ Tap the **Lower tolerance** or **Lower limit** input field
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The adjusted tolerance value is applied
- > The value is shown in green if the deviation of the actual dimension is within the tolerance zone
- > The value is shown in red if the deviation of the actual dimension is outside the tolerance zone
- > The display in the drop-down list switches to **Manual** after the adjustment

- ▶ Tap the symbol for size tolerance
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

Setting form tolerances

You can define the form tolerances for the following geometry parameters of a feature:

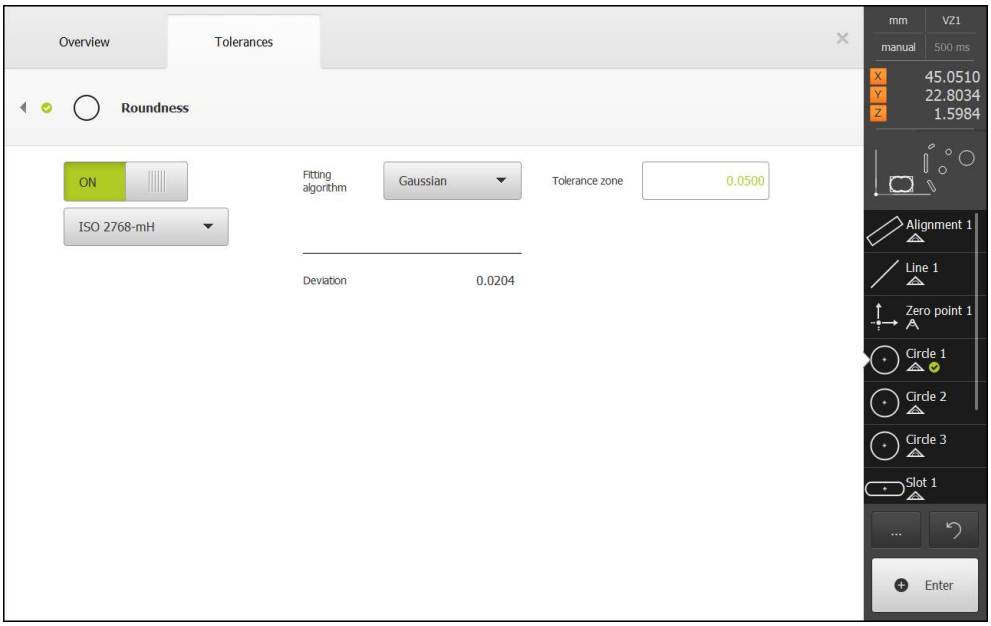
- Roundness for circles and arcs
- Straightness for lines

> The procedure for setting the form tolerances is the same for all features. The following description shows how to perform roundness tolerancing for a circle.

- ▶ Drag the feature from the feature list into the workspace
- > The **Overview** tab is displayed
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed
- ▶ Tap **Roundness**
- > An overview of the selected form tolerance appears
- ▶ Activate tolerancing of the measured value with the **ON/OFF** sliding switch

- > The drop-down list with the selected **General tolerance ISO 2768** or **Decimal place tolerances** is activated

Setting General tolerance ISO 2768



> The fitting algorithm is activated

> The tolerance zone of the selected general tolerance is displayed

	The tolerance zone is entered automatically based on the specified general tolerance.

> The deviation from the ideal form is displayed

▶ Select the desired fitting algorithm

> The value of the tolerance zone is shown in green if the deviation is within the tolerance zone

> The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone

▶ Tap **Roundness**

> The **Tolerances** tab is displayed

> The result of the tolerance test is displayed on the tab and in the feature list

Setting the tolerance zone manually
The tolerance zone can be adjusted manually to differ from the general tolerance specified for the respective feature. The modified tolerance value applies only to the currently open feature.

- ▶ Tap the **Tolerance zone** input field
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The adjusted tolerance value is applied
- > The value of the tolerance zone is shown in green if the deviation is within the tolerance zone
- > The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone
- > The display in the drop-down list switches to **Manual** after the adjustment

- ▶ Tap **Roundness**
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

Setting location tolerances

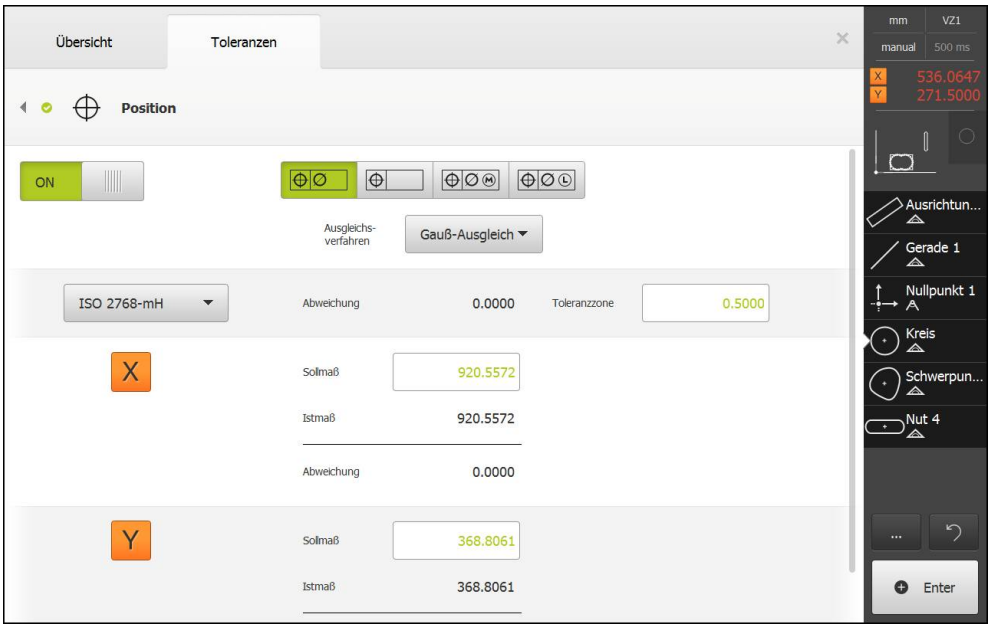
You can define the location tolerances for the following geometry parameters of a feature:

- Position for point, height point, line, circle, arc, ellipse, slot, rectangle and blob
- Concentricity for circle and arc

> The procedure for setting the position tolerances is the same for all features. The following description shows how to set a location tolerance for a circle with circular tolerance zone.

- ▶ Drag the feature from the feature list into the workspace
- > The **Overview** tab is displayed
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed
- ▶ Tap **Position**
- > An overview of the selected position tolerance appears
- > The selection of position tolerance types is displayed
  Further information: "Overview of position tolerance types", page 255
- ▶ Activate tolerancing of the measured value with the **ON/OFF** sliding switch
- > The drop-down list with the selected **General tolerance ISO 2768** or **Decimal place tolerances** is activated

Setting General tolerance ISO 2768



- ▶ Select the fitting algorithm for tolerancing in the **Fitting algorithm** drop-down list

- ▶ Tap **Circular tolerance zone**
- > The tolerance zone is displayed
- > The nominal and actual dimensions are displayed
- ▶ To enter the nominal dimension for **X**, tap the **Nominal dimension** input field
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- ▶ To enter the nominal dimension for **Y**, tap the **Nominal dimension** input field
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The tolerance zone is updated according to the specified nominal values

> The tolerance zone is entered automatically based on the nominal dimension and the specified general tolerance.

- > The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone
- > The value of the tolerance zone is shown in green if the deviation is within the tolerance zone

- ▶ Tap **Position**
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

Setting the tolerance zone manually
The tolerance zone can be adjusted manually to differ from the general tolerance specified for the respective feature. The modified tolerance value applies only to the currently open feature.

- ▶ Tap the **Tolerance zone** input field to manually adjust the tolerance zone
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The value of the tolerance zone is shown in green if the deviation is within the tolerance zone
- > The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone
- > The display in the drop-down list switches to **Manual** after the adjustment

- ▶ Tap **Position**
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

Setting the runout and directional tolerances

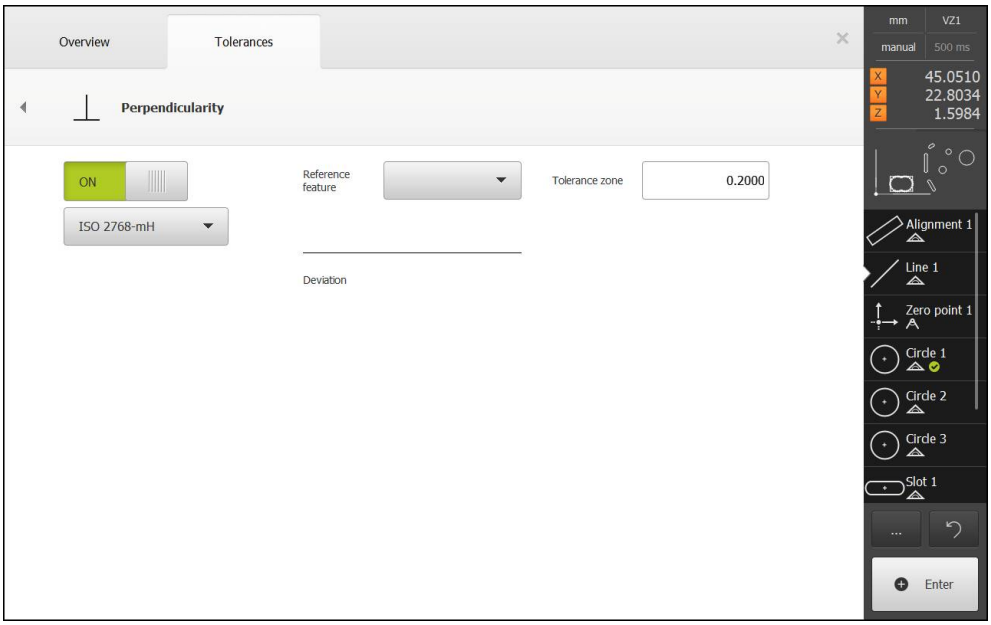
A reference feature is required for setting the runout and directional tolerances.

> Runout tolerances and directional tolerances (parallelism and perpendicularity) are set in the same way. The following section describes how to perform perpendicularity tolerancing for a straight line. The alignment is used as the reference object for tolerancing.

- ▶ Drag the feature from the feature list into the workspace
- > The **Overview** tab is displayed
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed
- ▶ Tap **Perpendicularity**
- > An overview of the perpendicularity tolerance appears

- ▶ Activate tolerancing of the measured value with the **ON/OFF** sliding switch
- > The drop-down list with the selected **General tolerance ISO 2768** or **Decimal place tolerances** is activated

Setting General tolerance ISO 2768



- ▶ Select the **Alignment** feature in the **Reference feature** drop-down list
- > The deviation is displayed
- > The tolerance zone is displayed

> The tolerance zone is entered automatically based on the specified general tolerance.

- > The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone
- > The value of the tolerance zone is shown in green if the deviation is within the tolerance zone

- ▶ Tap **Perpendicularity**
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

Setting the tolerance zone manually
The tolerance zone can be adjusted manually to differ from the general tolerance specified for the respective feature. The modified tolerance value applies only to the currently open feature.

- ▶ Tap the **Tolerance zone** input field to manually adjust the tolerance zone
- ▶ Enter the desired value
- ▶ Confirm entry with **RET**
- > The value of the tolerance zone is shown in green if the deviation is within the tolerance zone
- > The value of the tolerance zone is shown in red if the deviation is outside the tolerance zone
- > The display in the drop-down list switches to **Manual** after the adjustment

- ▶ Tap **Perpendicularity**
- > The **Tolerances** tab is displayed
- > The result of the tolerance test is displayed on the tab and in the feature list

12

Programming

12.1 Overview

This chapter describes how to create and edit measuring programs and how to use them for recurring measuring tasks. The following functions are described:

- Using the program control
- Recording a measuring program
- Saving a measuring program
- Starting a measuring program
- Editing a measuring program

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

Short description

The product can record and save the steps of a measuring process, and run them sequentially as a batch process. This batch processing is referred to as the "measuring program".

In a measuring program, you can thus combine multiple work steps, such as measuring point acquisition and tolerancing, into a single process. This simplifies and standardizes the measuring process.

Measuring programs can include the following work steps:

- Alignment of the measured object
- Measuring point acquisition
- Construction and definition
- Measurement evaluation
- Tolerancing

The work steps of a measuring program are referred to as program steps. The program steps are displayed in the program step list in the Inspector.

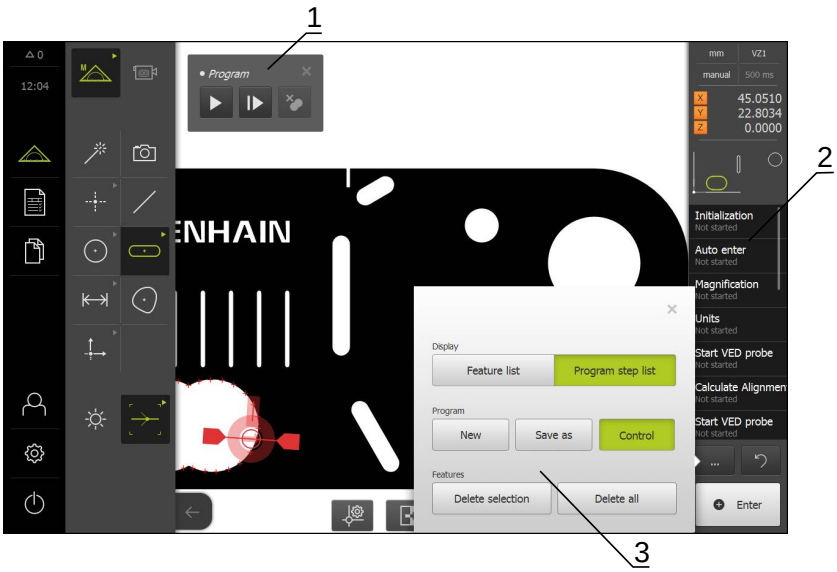
Regardless of whether the feature list or the program step list is the current view in the Inspector, the product always records every measuring process or work step as a program step. The operator can switch the view between the feature list and the program step list at any time.

Activation

- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining appears

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ Tap **Program step list** in the dialog
- > The program step list is displayed in the Inspector
- > The program control is displayed in the workspace

- ▶ In the Miscellaneous functions dialog, tap **Close**



1 Control with operating elements
2 Program step list
3 Miscellaneous functions

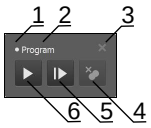
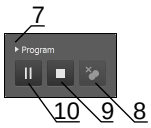
12.2 Using the program control

You can control the execution of an active measuring program directly in the workspace.

Calling the program control
If the program control is not displayed in the workspace, you can call the program control in the following way:

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ Tap **Control** in the dialog
- > The **program control** is displayed in the workspace
- ▶ To move the **program control** in the workspace, drag the **program control** to the desired location

Operating elements of the program control

Operating element	Short description
	Before the start of the measuring program, the program control shows the following information: ■ **1:** Status of the measuring program A dashed circle is displayed while a program step is being edited ■ **2:** Name of the measuring program, e.g. **Program** Unsaved measuring programs are displayed in italics ■ **3: Close** The program control is closed ■ **4: Remove breakpoints** Breakpoints that were set while editing a measuring program are cleared ■ **5: Single steps** The measuring program is run step by step ■ **6: Run** The measuring program is run
	After the start of the measuring program, the program control shows the following information: ■ **7:** Status of the measuring program Program steps are being executed ■ **8: Remove breakpoints** Breakpoints that were set while editing a measuring program are cleared ■ **9: Terminate** The measuring program is terminated ■ **10: Pause** The measuring program is paused

Closing the program control
If no measuring program is currently being executed or edited, you can close the program control.

- ▶ Tap **Close** to close the program control

12.3 Recording a measuring program

All work steps of a measuring process are recorded. The work steps are displayed as program steps in the program step list. You can use any work step for a measuring program.

To start recording a new measuring program, proceed as described below.

> Unsaved work steps are deleted before a new measuring program is recorded.

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ In the Miscellaneous functions dialog, tap **New**
- ▶ To delete existing program steps, confirm the message with **OK**
- > All features and program steps are deleted
- > An empty feature list or a new program step list appears, depending on the selection
- ▶ Perform the measuring process on the measured object, e.g. alignment of measured object, acquisition and evaluation of features
- > All program steps are displayed in the program step list

12.4 Saving a measuring program

To be able to run a measuring process repeatedly, you need to save the executed work steps as a measuring program.

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ In the Miscellaneous functions dialog, tap **Save as**
- ▶ Select the storage location in the dialog, e.g. **Internal/Programs**
- ▶ Enter a name for the measuring program
- ▶ Confirm entry with **RET**
- ▶ Tap **OK**
- > The measuring program is saved
- > The name of the measuring program is displayed on the program control

12.5 Starting a measuring program

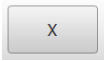
The measuring program that is currently being recorded or executed can be started directly with the program control. Program steps requiring user intervention are supported by a wizard. User intervention may be required under the following conditions, for example:

- The measuring points are outside the live image (only if the QUADRA-CHEK 3000 VED software option and the VED sensor are both active)
- The settings of the camera optics must be adjusted, e.g. magnification of the camera
- The measured object must be positioned manually using the axes of the measuring plate

Starting a measuring program

The user interface is locked while a program is running. Only the operating elements of the program control and **Enter** can be used.

- ▶ Tap **Run** on the program control
- > The program steps are executed
- > Program steps that are currently being executed or require user intervention are highlighted
- > When user intervention is required, the measuring program stops
- ▶ Perform the required user intervention
- > The execution of the program steps is resumed until the next user intervention is required or the end of the program is reached
- > The successful completion of the measuring program is displayed



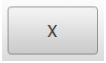
- ▶ Tap **Close** in the message
- > The features are displayed in the features preview

Starting a measuring program from the file manager

- ▶ Tap **File management** in the main menu
- > The user interface for managing the stored files and documents appears
- ▶ Navigate to the location where the program is stored, e.g. **Internal/Programs**
- ▶ Tap the name of the program
- > An overview of the program properties is displayed
- ▶ Tap **Open**
- > The user interface for measuring, constructing and defining appears
- > The program step list containing the program steps of the measuring program is displayed
- > The selected measuring program is displayed on the program control

The user interface is locked while a program is running. Only the operating elements of the program control and **Enter** can be used.

- ▶ Tap **Run** on the program control
- > The program steps are executed
- > Program steps that are currently being executed or require user intervention are highlighted
- > When user intervention is required, the measuring program stops
- ▶ Perform the required user intervention
- > The execution of the program steps is resumed until the next user intervention is required or the end of the program is reached
- > The successful completion of the measuring program is displayed



- ▶ Tap **Close** in the message
- > The features are displayed in the features preview

12.6 Editing a measuring program

In the program step list, you can edit the program steps of a measuring program that is currently being recorded or that has been saved.

Opening a measuring program

- ▶ Tap **File management** in the main menu
- > The user interface for managing the stored files and documents appears
- ▶ Navigate to the location where the program is stored, e.g. **Internal/Programs**
- ▶ Tap the name of the program
- > An overview of the program properties is displayed
- ▶ Tap **Open**
- > The user interface for measuring, constructing and defining appears
- > The program step list containing the program steps of the measuring program is displayed
- > The selected measuring program is displayed on the program control

12.6.1 Adding program steps

You can add work steps to an existing measuring program. To include the new work steps in the measuring program, you need to save the measuring program again.

- ▶ In the program step list, highlight the program step after which the new work step must be inserted
- ▶ Execute the new work step
- > The work step is added to the program step list as a new program step

If changes are made to a measuring program, the measuring program needs to be saved again.

Further information: "Saving a measuring program", page 275

12.6.2 Adjusting program steps

You can adjust the settings of every recorded program step.

The program steps of a measuring program belong to the following categories:

- Settings of the Inspector, e.g. unit of measure
- Measuring tools
- Lighting
- Features

The adjustments made to a program step become effective immediately after tapping Finish or Close.

To apply the changes to the measuring program, you need to save the measuring program again after you have made the adjustments.

Adjusting the settings

- ▶ Drag the program step to the left into the workspace
- > The settings are displayed
- ▶ Adjust the settings
- ▶ Tap **Finish** in the program step
- > The settings are applied

> If changes are made to a measuring program, the measuring program needs to be saved again.
>
> **Further information:** "Saving a measuring program", page 275

Adjusting the measuring tool

- ▶ Drag the program step of the measuring tool to the left into the workspace
- > The measuring tool is displayed
- ▶ Adjust the measuring tool, e.g. size and alignment
- ▶ Tap **Settings** at the bottom of the workspace
- ▶ Adjust the settings of the measuring tool

Further information: " Setting the VED measuring tool", page 85

- ▶ Tap **Close** to close the settings of the measuring tool
- ▶ Tap **Finish** in the program step
- > The settings for the measuring tool are applied

> If changes are made to a measuring program, the measuring program needs to be saved again.
>
> **Further information:** "Saving a measuring program", page 275

Adjusting the lighting

- ▶ Drag the program step for setting the lighting to the left into the workspace
- > The lighting settings are displayed
- ▶ Adjust the lighting

Further information: "Adjusting the lighting", page 94

- ▶ Tap **Finish** in the program step
- > The lighting settings are applied

If changes are made to a measuring program, the measuring program needs to be saved again.

Further information: "Saving a measuring program", page 275

Adjusting a feature

- ▶ Drag the program step of the feature to the left into the workspace
- > The **Overview** and **Tolerances** tabs are displayed
- ▶ On the **Overview** tab, adjust the settings of the feature

Further information: "Evaluating a feature", page 250

- ▶ On the **Tolerances** tab, adjust the tolerancing of the feature

Further information: "Defining tolerances", page 252

General tolerances are applied to all tolerances of the features unless they are overwritten manually or ISO 286 is applied.

- ▶ Tap **Close** to close the dialog
- > The settings and tolerances are saved for the feature

If changes are made to a measuring program, the measuring program needs to be saved again.

Further information: "Saving a measuring program", page 275

Deleting a program step

- ▶ Drag the program step to the right out of the program step list
- > The program step is deleted from the program step list

> If changes are made to a measuring program, the measuring program needs to be saved again.
>
> **Further information:** "Saving a measuring program", page 275

Closing a program step without applying adjustments

- ▶ Tap **Close** in the program step to close it without applying any adjustments you made
- > The changes made are discarded

12.6.3 Setting and clearing breakpoints

When creating or editing a measuring program, you can stop the program run at specified points. After being started, the measuring program stops at a breakpoint and needs to be resumed or terminated. A breakpoint can be set at any program step of the measuring program.

Breakpoints cannot be saved in the measuring program.

Setting a breakpoint

- ▶ Tap the program step
- > The program step is highlighted
- > The breakpoint is displayed at the program step

- ▶ Tap **Breakpoint**
- > A dot appears next to the name of the program step
- > The breakpoint is set

Removing a breakpoint

- ▶ Tap the program step containing the breakpoint
- > The program step is highlighted
- > The breakpoint is displayed at the program step

- ▶ Tap **Breakpoint**
- > The dot next to the name of the program step is removed
- > The breakpoint is cleared

Removing all breakpoints

- ▶ Tap **Remove breakpoints** on the program control
- > All breakpoints are removed

13

Measurement report

13.1 Overview

This chapter describes the following functions and activities:

- Managing templates for measurement reports
- Creating a measurement report
- Creating and editing templates for measurement reports

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

Short description

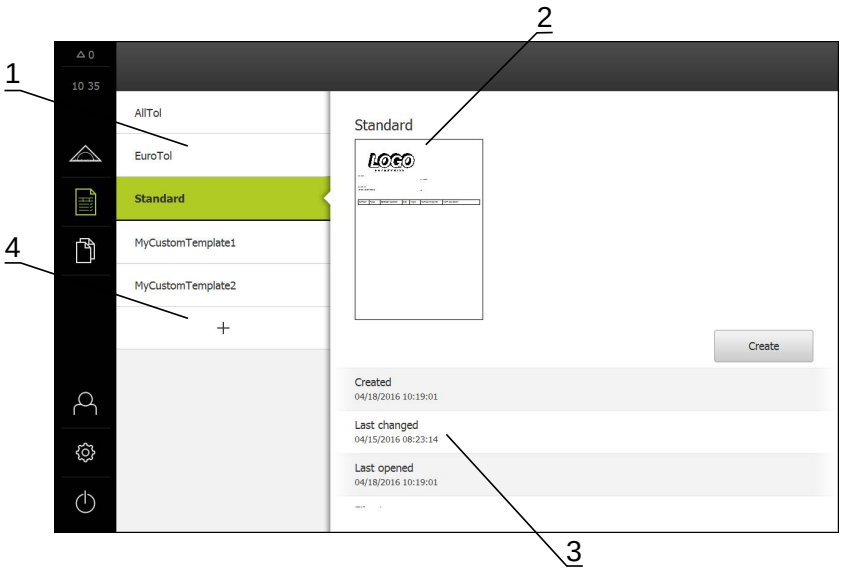
In the **Measurement report** main menu, you can create detailed reports for your measuring tasks. You can document one or more measured features in a measurement report. The measurement reports can be printed, exported and saved.

Using the integrated editor, you can create custom report templates and adapt them as needed.

Further information: "Creating and editing a template", page 291

Activation

- Tap **Measurement report** in the main menu



1 List of default templates
2 Preview of the selected template
3 Display of information on the selected template
4 List of custom templates

13.2 Managing templates for measurement reports

You can copy existing default templates, or edit, rename or delete custom templates.

Displaying operating elements

- Tap **Measurement report** in the main menu
- In the list, drag the name of the template to the right

> The operating elements for managing the templates are displayed

Copying a template

- Tap **Copy to**

> The editor opens

Further information: "Creating and editing a template", page 291

- To duplicate the template, tap **Save as**

> The **Save as** dialog appears

- Select a storage location, e.g. **Internal/Reports**
- Enter a name for the template
- Confirm the entry with **RET**
- Tap **OK** to confirm copying

> The copy of the template is saved

Editing a template

- Tap **Edit file**

> The editor opens

Further information: "Creating and editing a template", page 291

Renaming a template

- Tap **Rename file**
- Change the file name in the dialog
- Confirm the entry with **RET**
- Tap **OK**

Deleting a template

- Tap **Delete selection**
- Tap **Delete**

> The template for the measurement report is deleted

13.3 Creating a measurement report

You can create a measurement report in five steps:

- Selecting a template
- Selecting features
- Entering information on the measuring task
- Selecting document settings
- Saving, printing or exporting the measurement report

Requirement

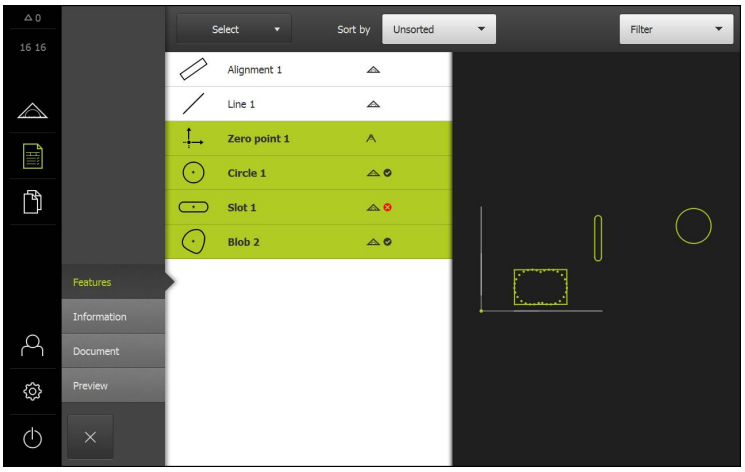
- The measurement and the measurement evaluation are complete

Selecting the template and features

- Tap **Measurement report** in the main menu
- > The user interface for editing the measurement reports appears
- Select a template, e.g. **Standard**
- > The preview of the selected template is displayed
- Tap **Create** to create the measurement report
- > The **Features** menu appears with a list of all features that have been measured, constructed and defined

> The feature list can be filtered by criteria.
> **Further information:** "Filtering features", page 290

- Tap a feature to add it to the measurement report
- > Selected features are displayed in green in the list and in the features preview
- To add all features to the measurement report, tap **Select all** in the **Select** drop-down list
- > All features in the list and in the features preview are activated and displayed in green



Entering information on the measuring task

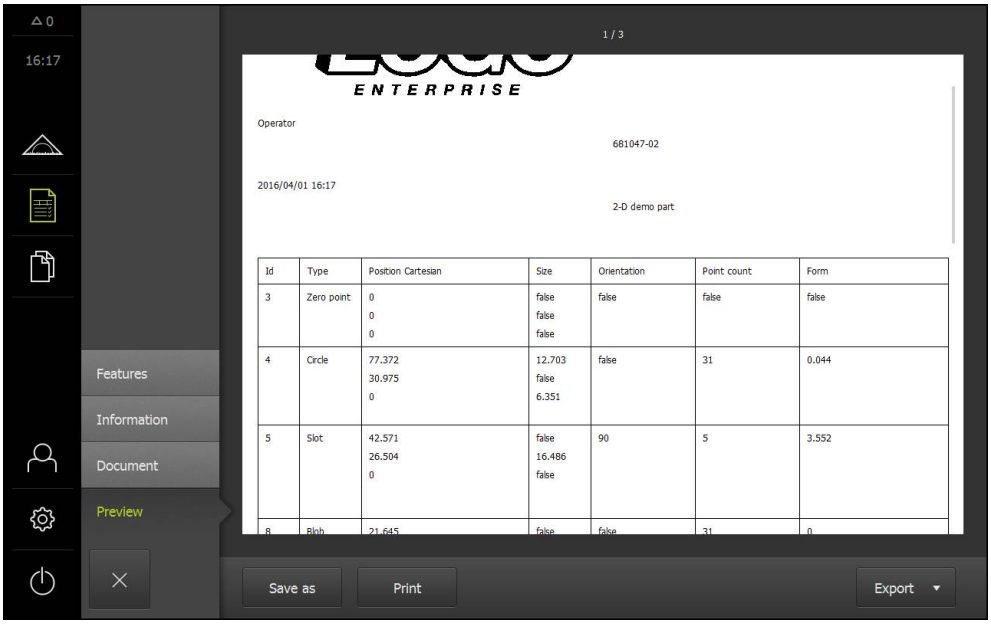
The information entered depends on the configuration of the template.

- Tap the **Information** menu
- To adjust the date and time in the measurement report, select the **Set automatically** or **Set manually** function in the **Timestamp** drop-down list
  - **Set manually**: When creating the report, the manually set date and time are entered
  - **Set automatically**: When creating the report, the current system date and time are entered
- Select an existing user in the **User name** drop-down list
- If you want another user to be displayed in the measurement report, select **Other user**
- Enter the name of the user into the input field
- Confirm entry with **RET**
- Enter the number of the measurement job into the **Job** input field
- Confirm entry with **RET**
- Enter the part number of the measured object into the **Part number** input field
- Confirm entry with **RET**

Selecting document settings

- Tap the **Document** menu
- To adjust the unit for linear measurement values, select the desired unit in the **Unit for linear values** drop-down list
  - **Millimeters**: Display in millimeters
  - **Inch**: Display in inches
- To reduce or increase the number of displayed **Decimal places for linear values**, tap **-** or **+**
- To adjust the unit for angular values, select the desired unit in the **Unit for angular values** drop-down list
  - **Decimal degrees**: Display in degrees
  - **Radian**: Display as radian measure
- To adjust the format for the date and time, select the desired format in the **Date and time format** drop-down list
  - **hh:mm DD-MM-YYYY**: Time and date
  - **hh:mm YYYY-MM-DD**: Time and date
  - **YYYY-MM-DD hh:mm**: Date and time
- Tap the **Preview** menu

> The preview of the measurement report is displayed



Saving the measurement report
Measurement reports are saved in the XMR data format. Files saved in XMR data format can be displayed and newly created at a later point in time.

- Tap **Save as**
- Select the storage location in the dialog, e.g. **Internal/Reports**
- Enter a name for the measurement report
- Confirm entry with **RET**
- Tap **OK**

> The measurement report is saved

Printing the measurement report

- Tap **Print**

> The measurement report is output to the specified printer
> **Further information:** "Setting up a printer", page 143

Exporting the measurement report
Measurement reports can be exported as PDF or CSV files. Exported measurement reports cannot be newly created.

- Select the desired export format in the **Export** drop-down list
  - **Export as PDF**: The measurement report is saved as a printable PDF. The values are no longer editable
  - **Export as CSV**: The values in the measurement report are separated by semicolons. The values can be edited using spreadsheet software
- Select the storage location in the dialog, e.g. **Internal/Reports**
- Enter a name for the measurement report
- Confirm entry with **RET**
- Tap **OK**

> The measurement report is exported in the selected format and stored in the storage location

Canceling the measurement report or closing it after saving

- Tap **Close**
- Close the message with **OK**
- The measurement report is closed

In the **File management** main menu, you can open and edit saved reports.
Further information: "Managing folders and files", page 305

Filtering features

You can filter the feature list in the **Features** menu by type, size, tolerance and selection. Only features meeting the filter criteria are displayed, e.g. only circles with a specific minimum diameter.

You can use any combination of filters.

- Select the desired filter criterion
- Specify the operator
- Select the function
- To deactivate a filter criterion, tap **Close** next to the filter

Filter	Operator	Function
Type	**Is**	Only features of the selected geometry type are displayed.
	Is not	Only features that are not of the selected geometry type are displayed.
Size	**Equal**	Only features of the specified size are displayed.
	Greater than	Only features that are larger than the specified size are displayed.
	Less than	Only features that are smaller than the specified size are displayed.
Tolerance	**Is**	Only features that meet the selected characteristic are displayed: ■ **Passed** ■ **Failed** ■ **Inactive**
	Is not	Only features that do not meet the selected characteristic are displayed.
Selection	**Is**	Only the selected features are displayed.
	Is not	Only the unselected features are displayed.

13.4 Creating and editing a template

With the editor, you can create or edit custom templates for the measurement reports. You can create a new template in six steps:

- Opening a new template with the editor
- Editing the default settings for the measurement report
- Configuring the page header
- Configuring the report header
- Defining the data for the measurement report
- Saving the template

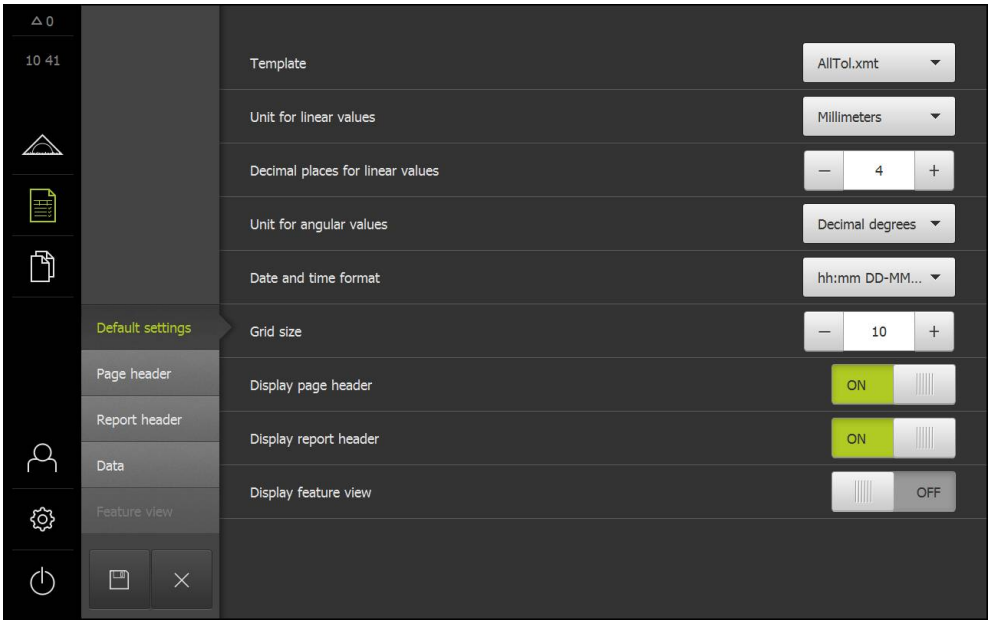
13.4.1 Opening a new template with the editor

A new template can be added or created from existing templates.

> Tap **Measurement report** in the main menu

- Tap **Add** to create a new template

> The **Default settings** for the template are displayed



13.4.2 Editing the default settings for the measurement report

- Select the default template you want to use as the basis in the **Template** drop-down list
- Select the desired unit in the **Unit for linear values** drop-down list
- To reduce or increase the number of displayed **Decimal places for linear values**, tap – or +
- Select the desired unit in the **Unit for angular values** drop-down list
- Select the desired format in the **Date and time format** drop-down list
- To reduce or increase the **Grid size**, tap **-** or **+**

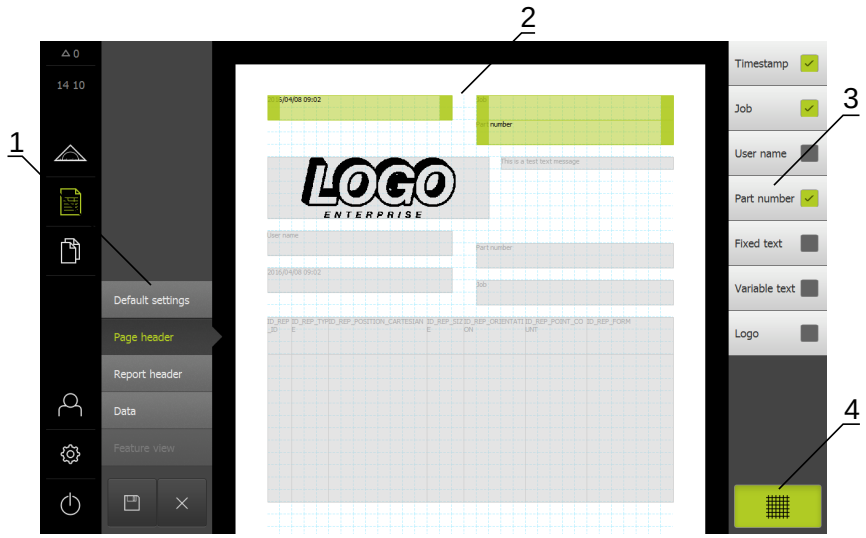
> A grid from 5 to 50 can be specified for the auxiliary lines. The auxiliary lines are displayed only in the editor. The smaller the spacing is between the auxiliary lines, the more precisely the fields and columns of the form can be positioned.

- To show the page header in the template, activate **Display page header** with the **ON/OFF** sliding switch
- To show the report header in the template, activate **Display report header** with the **ON/OFF** sliding switch

13.4.3 Configuring the page header

▶ Tap **Page header**

> The menu is only available if the **Display page header** setting is active in the **Default settings** menu.



1 The different sections of the template can be edited in the editor menu.
2 The form fields for the template are adjustable.
3 The list shows the form fields that can be inserted into the selected section of the template.
4 "Grid" operating element for displaying and hiding the auxiliary lines in the editor.

▶ Tap **Grid** to display or hide the grid of auxiliary lines

> The grid of auxiliary lines is always active. All fields of the form are automatically aligned with it.

Adding or removing form fields
The form fields listed below can be inserted into the page header of the measurement report. During the creation of the measurement report, the form fields are filled according to the entries made.

- ▶ To add or remove a form field, tap the **form field** in the list
- > Active form fields are indicated by a check mark
- > The form field is inserted into the template or removed from the template

Form field	Meaning and application
Timestamp	The date and time are inserted.
Job	The job is inserted.
User name	The user name is inserted.
Part number	The part number is inserted.
Fixed text	Fixed text is inserted into the template. ▶ Tap the **Fixed text** form field in the template > An input field opens ▶ Enter the desired text ▶ To close the input field, tap anywhere outside the input field
Variable text	Variable text is inserted. You can type the variable text into the template. When creating the measurement report, you can overwrite the text as needed.
Logo	A logo is inserted. ▶ Tap the **Logo** form field in the template > A dialog appears ▶ Select the desired logo in the storage location ▶ Tap **OK** to close the dialog > The logo is inserted into the template

Resizing a form field
You can resize a form field with the square handles at the corners of the form field.

- ▶ Tap **Grid** to use auxiliary lines for easy alignment
- ▶ Drag the square handle of the corresponding form field to the desired size
- > If form fields overlap, the affected area is highlighted in red
- > The change to the form field is applied

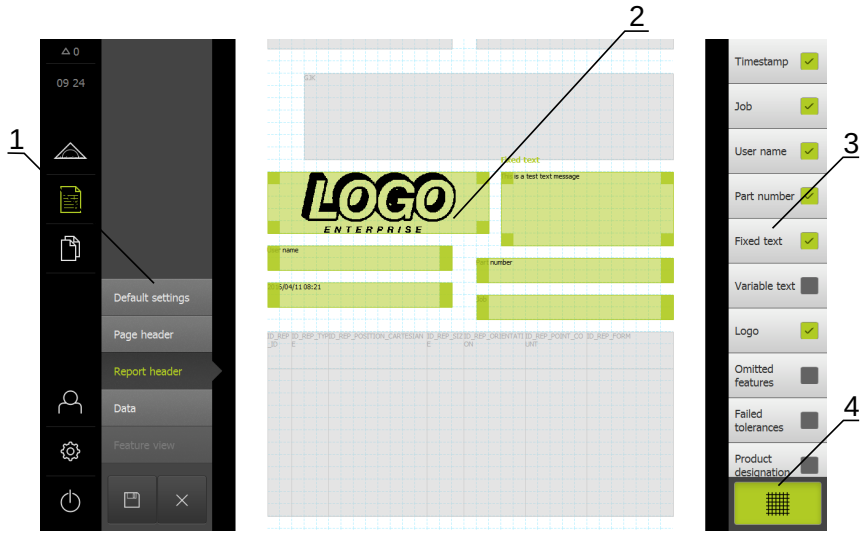
Positioning a form field
You can position the form fields any way you want in the template.

- ▶ Tap **Grid** to use auxiliary lines for easy alignment
- ▶ Drag the form field to the desired position in the template
- > If form fields overlap, the affected area is highlighted in red
- > The change to the form field is applied

13.4.4 Configuring the report header

- Tap **Report header**

> The menu is only available if the **Display report header** parameter is active in the **Default settings** menu.



1 The different sections of the template can be edited in the editor menu.
2 The form fields for the template are adjustable.
3 The list shows the form fields that can be inserted into the selected section of the template.
4 "Grid" operating element for displaying and hiding the auxiliary lines in the editor.

Adding or removing form fields
The form fields listed below can be inserted into the report header of the measurement report. During the creation of the measurement report, the form fields are filled according to the entries made.

- ▶ To add or remove a form field, tap the **form field** in the list
- > Active form fields are indicated by a check mark
- > The form field is inserted into the template or removed from the template

Form field	Meaning and application
Timestamp	The date and time are inserted.
Job	The job is inserted.
User name	The user name is inserted.
Part number	The part number is inserted.
Fixed text	Fixed text is inserted into the template. ▶ Tap the **Fixed text** form field in the template > An input field opens ▶ Enter text ▶ To close the input field, tap anywhere outside the input field
Variable text	Variable text is inserted. You can type the variable text into the template. When creating the measurement report, you can overwrite the text as needed.
Logo	A logo is inserted. ▶ Tap the **Logo** form field in the template > A dialog appears ▶ Select the desired logo in the storage location ▶ Tap **OK** to close the dialog > The logo is inserted into the template
Omitted features	The number of measured features that are not displayed in the measurement report is inserted.
Failed tolerances	The number of features that are out of tolerance is inserted.
Product designation	The product designation of the product is inserted.
Serial number	The serial number of the product is inserted.
Firmware version	The firmware version currently installed on the product is inserted.

Resizing a form field
You can resize a form field with the square handles at the corners of the form field.

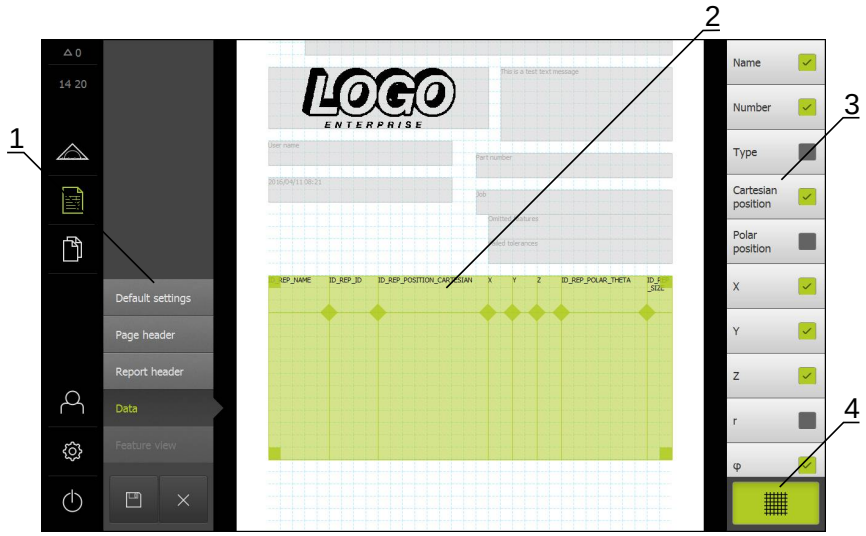
- ▶ Tap **Grid** to use auxiliary lines for easy alignment
- ▶ Drag the square handle of the corresponding form field to the desired size
- > If form fields overlap, the affected area is highlighted in red
- > The change to the form field is applied

Positioning a form field
You can position the form fields any way you want in the template.

- ▶ Tap **Grid** to use auxiliary lines for easy alignment
- ▶ Drag the form field to the desired position in the template
- > If form fields overlap, the affected area is highlighted in red
- > The change to the form field is applied

13.4.5 Defining the data for the measurement report

▶ Tap **Data**



1 The different sections of the template can be edited in the editor menu.
2 The data table in the template can be adjusted.
3 The list shows the form fields that can be inserted into the data table.
4 "Grid" operating element for displaying and hiding the auxiliary lines in the editor.

▶ Tap **Grid** to display or hide the grid of auxiliary lines

> The grid of auxiliary lines is always active. All fields of the form are automatically aligned with it.

Selecting the data for the measurement report
The form fields listed below can be inserted into the data table of the measurement report. During the creation of the measurement report, the data are filled in according to the entries made and depending on the measured features.

- ▶ To add or remove a form field, tap the **form field** in the list
- > Active form fields are indicated by a check mark
- > The form field is inserted as a column into the data table or removed from the data table.

Form field	Meaning and application
Name	The name of the feature is inserted.
Number	The number of the feature is inserted.
Type	The feature type is inserted.
Cartesian position	The position in Cartesian coordinates is inserted.
Polar position	The position in polar coordinates is inserted.
X	The X coordinate (Cartesian) is inserted.
Y	The Y coordinate (Cartesian) is inserted.
Z	The Z coordinate (Cartesian) is inserted.
r	The radial coordinate (polar) is inserted.
φ	The angular coordinate (polar) is inserted.
Size	The main dimension of the feature (e.g. the length of a straight line) is inserted.
Length	The length of the feature is inserted.
Width	The width of the feature is inserted.
Radius	The radius of the feature is inserted.
Diameter	The diameter of the feature is inserted.
Angle	The angle of the feature is inserted.
Fitting algorithm	The fitting algorithm applied to the feature is inserted.
Number of points	The number of points measured for the feature is inserted.
Form deviation	The maximum deviation from the calculated ideal form is inserted. ⓘ Applies only to features that have been measured using more than the mathematically required number of points.
Creation type	The feature type used for creating the feature is inserted.
Tolerance - general state	The overall status of all tolerances applied to the feature is inserted. For example, **Passed** if all individual tolerances are met.

Form field	Meaning and application
Tolerance type	The tolerance types applied to the feature are inserted.
Tolerance state	The states of the tolerances applied to the feature are inserted.
Nominal dimension	The nominal dimension of a tolerance applied to the feature is inserted.
Actual value	The actual dimension of a tolerance applied to the feature is inserted.
Deviation	The difference between nominal dimension and actual dimension is inserted.
Lower tolerance	The lower tolerance limit of a tolerance applied to the feature is inserted.
Upper tolerance	The upper tolerance of a tolerance applied to the feature is inserted.
Lower limit	The lower limit of a tolerance applied to the feature is inserted.
Upper limit	The upper limit of a tolerance applied to the feature is inserted.
Trend [-/+++]	The trend of the deviation is inserted. The tolerance zone is divided into seven segments. The result is assigned to the corresponding segment. The corresponding segment is shown as a trend: ■ Segment -3: **---** ■ Segment -2: **--** ■ Segment -1: **-** ■ Segment 0: **.** ■ Segment +1: **+** ■ Segment +2: **++** ■ Segment +3: **+++**
Reference, bonus	The reference feature of a tolerance applied to the feature is inserted. If a material requirement is being used, the existing tolerance bonus is inserted.

Adjusting the data table
You can resize the data table with the square handles at the corners of the data table. The sequence of form fields in the list determines how the columns are arranged in the table. To adjust the width of the columns in the data table, use the diamond-shaped handles.

- Tap **Grid** to use auxiliary lines for easy alignment
- Use the square handles to resize and position the data table as needed
- To rearrange the columns, long press the form field in the list and drag it to the desired position in the list
- Adjust the column width with the diamond-shaped handles
> Columns that are outside the print area are marked red
> The changes to the data table are applied

13.4.6 Saving the template

The templates are saved in the XMT data format.

- To save the template, tap **Save as**
> The **Save as** dialog appears
- Select a storage location, e.g. **Internal/Reports**
- Enter a name for the template
- Confirm entry with **RET**
- Tap **OK**
> The template is saved and can be used for measurement reports

13.4.7 Exiting or canceling the creation of a template

When creating or editing a template, you need to save the template before closing it. Otherwise, the editing process will be canceled and the changes will be discarded.

Further information: "Saving the template", page 302

- Tap **Close** to exit or cancel the creation of the template or measurement report
- Tap **OK** to close the message
> The editor is closed

14

File management

14.1 Overview

This chapter describes the functions provided in the "File management" menu.

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

Short description

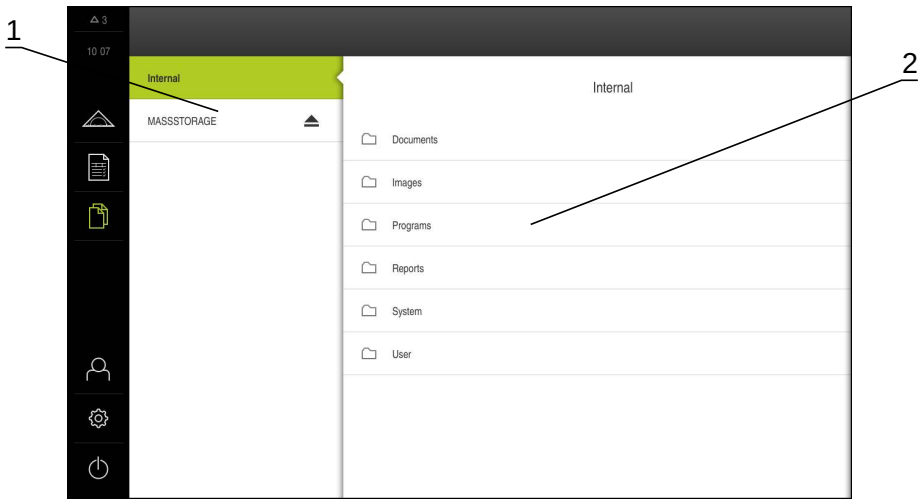
The files of the product are managed in the **File management** menu.

Overview of file types:

Type	Use
*.xmr	Measurement reports
*.xmt	Measurement report templates
*.xmp	Measuring programs
*.mcc	Configuration files
*.dro	Firmware files
*.jpg, *.png, *.bmp	Image files
*.txt, *.log, *.xml, *.csv	Text files
*.pdf	PDF files

Activation

- Tap **File management** in the main menu



1 List of available storage locations
2 List of folders in the selected storage location

14.2 Managing folders and files

Creating a new folder

- ▶ Touch the icon of the folder in which you want to create a new folder, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Create a new folder**
- ▶ Tap the input field in the dialog and enter a name for the folder
- ▶ Confirm the entry with **RET**
- ▶ Tap **OK**
- > A new folder is created

Moving a folder

- ▶ Touch the icon of the folder you want to move, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Move to**
- ▶ In the dialog, select the folder to which you want to move the folder
- ▶ Tap **OK**
- > The folder is moved

Copying a folder

- ▶ Touch the icon of the folder you want to copy, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Copy to**
- ▶ In the dialog, select the folder to which you want to copy the folder
- ▶ Tap **OK**
- > The folder is copied

Renaming a folder

- ▶ Touch the icon of the folder you want to rename, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Rename folder**
- ▶ Tap the input field in the dialog and enter a new name for the folder
- ▶ Confirm the entry with **RET**
- ▶ Tap **OK**
- > The folder is renamed

Moving a file

- ▶ Touch the icon of the file you want to move, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Move to**
- ▶ In the dialog, select the folder to which you want to move the file
- ▶ Tap **OK**
- > The file is moved

Copying a file

- ▶ Touch the icon of the file you want to copy, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Copy to**
- ▶ In the dialog, select the folder to which you want to copy the file
- ▶ Tap **OK**
- > The file is copied

Renaming a file

- ▶ Touch the icon of the file you want to rename, and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Rename file**
- ▶ Tap the input field in the dialog and enter a new name for the file
- ▶ Confirm the entry with **RET**
- ▶ Tap **OK**
- > The file is renamed

Deleting a folder or file

The folders and files you delete will be deleted irreversibly. If you delete a folder, all subfolders and files contained in that folder will also be deleted.

- ▶ Touch the icon of the folder or file you want to delete and drag it to the right
- > The operating elements are displayed

- ▶ Tap **Delete selection**
- ▶ Tap **Delete**
- > The folder or file is deleted

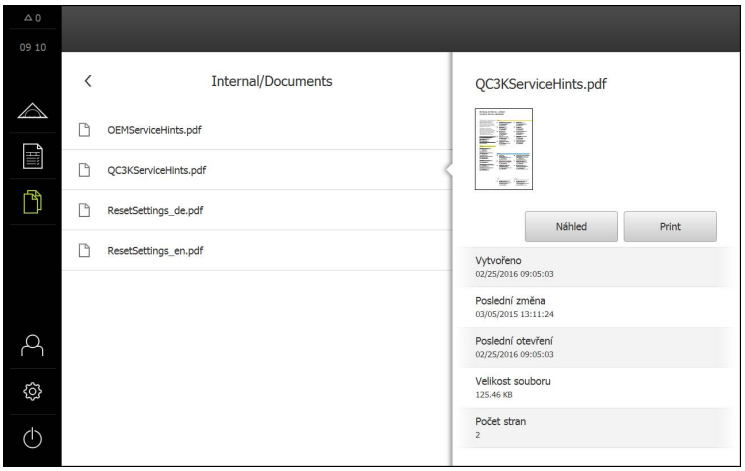
14.3 Displaying and opening files

You can view the following file types in the file manager and, if applicable, open them for editing:

Type	Use	View	Open
*.xmr	Measurement reports	✓	✓
*.xmt	Measurement report templates	✓	✓
*.xmp	Measuring programs	✓	✓
*.mcc	Configuration files	✓	–
*.dro	Firmware files	✓	–
*.jpg, *.png, *.bmp	Image files	✓	–
*.txt, *.log, *.xml, *.csv	Text files	✓	–
*.pdf	PDF files	✓	–

Viewing files

- Tap **File management** in the main menu
- Select the **Internal** storage location
- Tap the folder containing the file
- Tap the file
- A preview image (only with PDF and image files) as well as information about the file are displayed



- Tap **View**
- The file contents are displayed

- Tap **Close** to close the view

In this view, you can print files of the *.pdf type on the connected printer by tapping **Print**.

Opening measuring programs

Measuring programs saved as *.xmp file type can be viewed or opened for editing.

- Tap **File management** in the main menu
- Select the **Internal** storage location
- Tap the **Programs** folder
- Tap the desired file
- To display the measuring program, tap **View**
- To edit the measuring program, tap **Open**

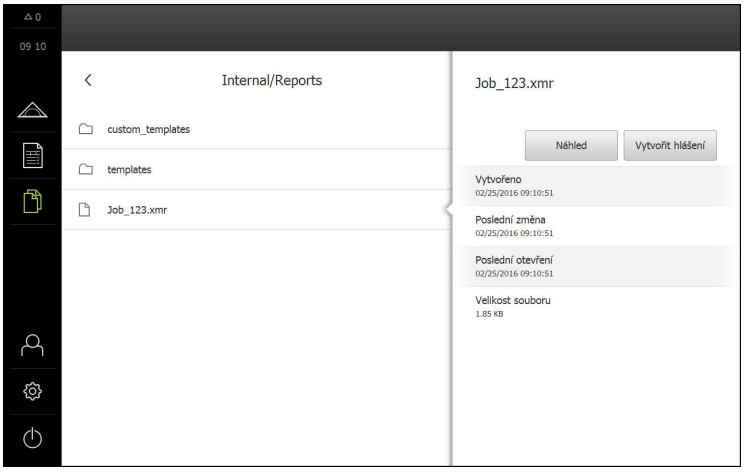
> The measuring program is opened in the Inspector

Further information: "Editing a measuring program", page 278

Opening a measurement report

Measurement reports saved as *.xmr file type can be viewed or opened for editing.

- Tap **File management** in the main menu
- Select the **Internal** storage location
- Tap the **Reports** folder
- Tap the desired file



- To display the measurement report, tap **View**
- To edit the measurement report, tap **Recreate report**

> The measurement report is opened in the preview of the editor

Further information: "Opening a new template with the editor", page 291

14.4 Exporting files

The data can be exported to an external USB mass storage device or to the network drive. The data can be either copied or moved:

- If they are copied, duplicates of the data remain in the product
- Moved data are deleted in the product

- Tap **File management** in the main menu
- In the **Internal** storage location, navigate to the file you want to export
- Drag the icon of the file to the right

> The operating elements are displayed

- To copy the file, tap **Copy file**

- To move the file, tap **Move file**
- In the dialog, select the storage location to which you want to export the file
- Tap **OK**

> The file is exported to the USB mass storage device or the network drive

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

15

Settings

15.1 Overview

Short description
This chapter describes the setting options and the associated adjustment parameters for the product.

The basic setting options and adjustment parameters for commissioning and setup are outlined in the respective chapters:

Further information: "Commissioning", page 103

Further information: "Setup", page 133

Depending on the type of user that is logged in to the product, settings and adjustment parameters can be edited and changed (edit permission).
If a user logged in to the product has no edit permission for a setting or an adjustment parameter, the setting or adjustment parameter is grayed out. The setting or adjustment parameter cannot be accessed or edited.

Further information: "User permissions", page 335

Function	Description
General	General settings and information
Sensors	Configuration of sensors and sensor-dependent functions
Features	Configuration of measuring point acquisition and features
Interfaces	Configuration of interfaces and network drives
User	Configuration of users
Axes	Configuration of connected encoders and error compensation
Service	Configuration of software options, service functions and information

Activation

- Tap **Settings** in the main menu

15.2 Factory default settings

If settings that were changed during commissioning or setup need to be reset to the factory defaults, you can look up the default setting for each adjustment parameter in the Settings chapter.

If all settings need to be reset to the factory defaults, you can restore the product to the factory default settings.

Further information: "Resetting to the factory defaults", page 350

15.3 General

15.3.1 Device information

The overview displays basic information about the software.

Parameter	Displays the information
Product designation	Product designation of the product
Part number	Part number of the product
Serial number	Serial number of the product
Firmware version	Version number of the firmware
Firmware built on	Firmware creation date
Last firmware update on	Date of most recent firmware update
Free memory space	Free memory space in the internal storage location **Internal**
Free working memory (RAM)	Free RAM on the system
Number of unit starts	Number of times the product was started up with the current firmware
Operating time	Operating time of the product with the current firmware

15.3.2 Screen and touch screen

Parameter	Explanation
Brightness	The brightness of the screen can be adjusted continuously ■ Setting range: **1 % ... 100 %** ■ Default setting: **70 %**
Touchscreen sensitivity	The sensitivity of the touchscreen can be adjusted in three levels. ■ **Low(contamination)**: Allows operating the touchscreen if it is dirty ■ **Normal(standard)**: Allows operating the touchscreen under normal conditions ■ **High(gloves)**: Allows operating the touchscreen while wearing gloves ■ Default setting: **Normal(standard)**
Energy-save-mode timeout	The time until energy-save mode is activated is adjustable. ■ Setting range: **0 min ... 120 min** If the value is set to 0, the energy-save mode is deactivated ■ Default setting: **30** minutes

15.3.3 Display

Parameter	Explanation
Size of the axis displays	The size in which the axis positions are displayed in the workspace can be adjusted in three levels. ■ **Small** ■ **Medium** ■ **Large** ■ Default setting: **Small**

15.3.4 Sounds

The available sounds are grouped into categories. The sounds differ within a category.

Parameter	Explanation
Speaker	Use of the built-in speaker on the rear panel of the product ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Speaker volume	Volume of the product's speaker ■ Setting range: **0 % ... 100 %** ■ Default setting: **50 %**
Measuring point acquired	Sound to be played after a measuring point was acquired When you select a setting, the associated sound is played ■ Settings: **Standard**, **Guitar**, **Robot**, **Outer space**, **No sound** ■ Default setting: **Standard**
Message and Error	Sound to be played when a message is displayed When you select a setting, the associated sound is played ■ Settings: **Standard**, **Guitar**, **Robot**, **Outer space**, **No sound** ■ Default setting: **Standard**
Measurement successful	Sound to be played when the measurement was successful When you select a setting, the associated sound is played ■ Settings: **Standard**, **Guitar**, **Robot**, **Outer space**, **No sound** ■ Default setting: **Standard**
Touch tone	Sound to be played when using a touch element When you select a setting, the associated sound is played ■ Settings: **Standard**, **Guitar**, **Robot**, **Outer space**, **No sound** ■ Default setting: **Standard**

15.3.5 Printers

Default printer

Parameter	Explanation
Default printer	List of printers set up on the product

Properties

Parameter	Explanation
Resolution	Print resolution in dpi ■ The setting range and default setting depend on the printer type
Paper size	Specification of paper size and dimensions ■ The setting range and default setting depend on the printer type

Add printer

The following parameters are available for **USB printer** and **Network printer**.

Parameter	Explanation
Located printers	Printers detected automatically on the (USB or network) port of the product
Name	Arbitrary printer name for easy identification ⓘ The text must not contain slashes ("/"), number signs ("#") or spaces.
Description	General printer description (optional, arbitrary)
Location	General location description (optional, arbitrary)
Connection	Type of printer connection
Select the driver	Selection of the appropriate driver for the printer

Remove printer

Parameter	Explanation
Printers	List of printers configured on the product
Type	Shows the type of the configured printer
Location	Shows the location of the configured printer
Connection	Shows the connection of the configured printer
Remove the selected printer	Deletes the configured printer from the product

15.3.6 Date and time

Parameter	Explanation
Date and time	Current date and time of the product ■ Settings: **Year**, **Month**, **Day**, **Hour**, **Minute** ■ Default setting: **Current system time**
Date format	Format in which the date is displayed Settings: ■ **MM-DD-YYYY**: Month, day, year ■ **DD-MM-YYYY**: Day, month, year ■ **YYYY-MM-DD**: Year, month, day ■ Default setting: **YYYY-MM-DD** (e.g. "2016-01-31")

15.3.7 Units

Parameter	Explanation
Unit for linear values	Unit of measure for linear values ■ Settings: **Millimeters** or **Inch** ■ Default setting: **Millimeters**
Rounding method for linear values	Rounding method for linear values Settings: ■ **Commercial**: Decimal places from 1 to 4 are rounded down, decimal places from 5 to 9 are rounded up ■ **Round off**: Decimal places from 1 to 9 are rounded down ■ **Round up**: Decimal places from 1 to 9 are rounded up ■ **Truncate**: Decimal places are truncated without rounding up or down ■ Default setting: **Commercial**
Decimal places for linear values	Number of decimal places for linear values Setting range: ■ **Millimeters**: **0 ... 5** ■ **Inch**: **0 ... 7** Default value: ■ **Millimeters**: **4** ■ **Inch**: **6**
Unit for angular values	Unit for angular values Settings: ■ **Radian**: Angle in radian (rad) ■ **Decimal degrees**: Angle in degrees (°) with decimal places ■ **Deg-Min-Sec**: Angle in degrees (°), minutes ['] and seconds ["] ■ Default setting: **Decimal degrees**

Parameter	Explanation
Rounding method for angular values	Rounding method for decimal angular values Settings: ■ **Commercial**: Decimal places from 1 to 4 are rounded down, decimal places from 5 to 9 are rounded up ■ **Round off**: Decimal places from 1 to 9 are rounded down ■ **Round up**: Decimal places from 1 to 9 are rounded up ■ **Truncate**: Decimal places are truncated without rounding up or down ■ Default setting: **Commercial**
Decimal places for angular values	Number of decimal places for angular values Setting range: ■ **Radian**: **0 ... 7** ■ **Decimal degrees**: **0 ... 5** ■ **Deg-Min-Sec**: **0 ... 2** Default value: ■ **Radian**: **5** ■ **Decimal degrees**: **3** ■ **Deg-Min-Sec**: **0**
Decimal separator	Separator for the display of values ■ Settings: **Point** or **Comma** ■ Default setting: **Point**

15.3.8 Copyrights

Parameter	Meaning and function
Open source software	Display of the licenses of the software used

15.3.9 Service info

Parameter	Meaning and function
HEIDENHAIN - Customer service	Display of a document containing HEIDENHAIN service addresses
OEM service info	Display of a document containing service information from the machine manufacturer Default: Document containing HEIDENHAIN service addresses

15.3.10 Documentation

Parameter	Meaning and function
Operating Instructions	Display of the operating instructions stored on the product Default: No document available, the desired language can be added

15.4 Sensors

Depending on the software options for sensors that have been activated on the product, various parameters are available for configuring the sensors.

Software option	Sensor
QUADRA-CHEK 3000 VED software option	**Video edge detection (VED)**: The product supports the use of a VED sensor (optical sensor). A VED sensor is a USB camera or network camera connected to the product. **Further information:** "Video edge detection (VED)", page 318

15.5 Video edge detection (VED)

15.5.1 Camera

The **Camera** menu lists the virtual cameras (**(GigE)** and **(USB)**) as well as the camera (**(GigE)** or **(USB)**) that is connected to the product.

The displayed information relates to the respective camera; the values specified by the respective manufacturer apply to the settings.

The available parameters and settings depend on the camera model connected and may differ from the list given below.

Parameter	Explanation
Camera	Shows the name of the camera
Serial number	Shows the serial number of the camera
Sensor resolution	Shows the resolution of the camera sensor
Images per second	Shows the number of camera images per second
Images (successful/faulty)	Shows the number of successful and faulty images taken since the last time the product was powered up
Pixel format	Displayable color range of the camera image Settings: ■ **8 Bit**: 256 colors ■ **16 Bit**: 65 536 colors ■ **24 Bit**: 16.78 million colors ■ **32 Bit**: 16.78 million colors with accelerated rendering
Image directory	Location in which the demo image is stored on the product (can only be set for virtual cameras) ■ Default setting: **Internal/System/Camera**Internal/System/Camera

Parameter	Explanation
Network settings	Network address and subnet mask of the network connection (can only be set for connected **(GigE)** camera) **DHCP** ■ Settings: **ON** or **OFF** ■ Default setting: **OFF** The camera must be in the same subnet as the product.
Mirroring image	Depending on the mechanical mounting of the camera, the image can be mirrored in the camera (can only be set for connected cameras) Settings: ■ **No**: Image is not mirrored ■ **Horizontally**: Image is mirrored horizontally ■ **Vertically**: Image is mirrored vertically ■ **Horizontally and vertically**: Image is mirrored horizontally and vertically ■ Default setting: **No**
Pixel clock (MHz)	Rate at which the image data are read from the camera sensor ■ Setting range: Depending on connected camera
Image rate	Number of single images acquired per second ■ Setting range: Depending on connected camera
For image evaluation, the field of view of the camera can be reduced to the relevant image section. This enables you to increase e.g. the **Image rate**, if required. The zero point for determining the size and position of the image section is located in the upper left corner of the camera's field of view. The width and height as well as the X and Y positions are set with respect to the zero point.	
Detail: Width	Width of the image section relevant to image evaluation ■ Setting range: Depending on connected camera
Detail: Height	Height of the image section relevant to image evaluation ■ Setting range: Depending on connected camera
Detail: X position	X position of the image section relevant to image evaluation ■ Setting range: Depending on connected camera
Detail: Y position	Y position of the image section relevant to image evaluation ■ Setting range: Depending on connected camera

Parameter	Explanation
Master gain	The camera sensor outputs a voltage in proportion to the amount of incident light. If you want to increase image brightness and contrast, you can use analog gain to increase this voltage before digitizing. The **Master gain** leads to an increase in the overall brightness of the resulting image and improves the contrast. Master gain for increasing brightness and contrast ■ Setting range: **1 % ... 100 %**
Red gain	Comparable with **Master gain**, **Red gain** can be used for setting the gain for this color value. **Red gain** for increasing brightness and contrast ■ Setting range: **1 % ... 100 %**
Green gain	Comparable with **Master gain**, **Green gain** can be used for setting the gain for this color value. **Green gain** for increasing brightness and contrast ■ Setting range: **1 % ... 100 %**
Blue gain	Comparable with **Master gain**, **Blue gain** can be used for setting the gain for this color value. **Blue gain** for increasing brightness and contrast ■ Setting range: **1 % ... 100 %**
Exposure time (µs)	Length of time during which the light for image acquisition can reach the sensor ■ Setting range: Depending on connected camera

15.5.2 Magnifications

For each optical magnification available on the measuring machine, a **Magnification** must be set up on the product.

Parameter	Explanation
Magnifications Default magnification: **VED Zoom 1**	Definition of the respective magnifications ■ Entry for **Description** and **Acronym for quick access menu**: At least one character ■ Default setting: **VED Zoom 1** and **VZ1**

15.5.3 Lighting

Parameter	Explanation
General settings	Global settings for lighting
A transmitted light + 4 x AD reflected light	Configuration of lighting using transmitted light and reflected light
A trans.light + 4 x A refl.light + D laser pointer	Configuration of lighting using transmitted light, reflected light and laser pointer
AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time	Configuration of lighting using transmitted light, reflected light, coaxial light and camera exposure time

General settings

Parameter	Explanation
Linking with magnifications	Setting of reflected light and transmitted light depending on the magnification Settings: ■ **ON**: When selecting a magnification, the last selected setting for this magnification is set for the lighting ■ **OFF**: When selecting a magnification, no changes are made to the lighting ■ Default setting: **OFF**

A transmitted light + 4 x AD reflected light

Parameter	Explanation
Analog output for transmitted light	Assignment of the analog outputs for reflected light and transmitted light
Analog output for reflected light	Settings of the analog outputs: ■ **Not connected** ■ **Aout 0 X103.11** ■ **Aout 1 X103.30** ■ **Aout 2 X103.12** ■ **Aout 3 X103.31** ■ **Aout 4 X103.13** ■ **Aout 5 X103.32** Default value: **Not connected**
Digital output for front segment	Assignment of the digital outputs for reflected-light segments
Digital output for rear segment	
Digital output for left segment	Settings of the digital outputs: ■ **Not connected** ■ **Dout 0 X103.7** ■ **Dout 1 X103.26** ■ **Dout 2 X103.8** ■ **Dout 3 X103.27** ■ **Dout 4 X103.9** ■ **Dout 5 X103.28** Default value: **Not connected**
Digital output for right segment	

A trans.light + 4 x A refl.light + D laser pointer

Parameter	Explanation
Analog output for transmitted light **Analog output for front segment** **Analog output for rear segment** **Analog output for left segment** **Analog output for right segment**	Assignment of the analog outputs for reflected-light segments and transmitted light Settings of the analog outputs: ■ **Not connected** ■ **Aout 0 X103.11** ■ **Aout 1 X103.30** ■ **Aout 2 X103.12** ■ **Aout 3 X103.31** ■ **Aout 4 X103.13** ■ **Aout 5 X103.32** Default value: **Not connected**
Digital output for laser pointer	Assignment of the digital output for the laser pointer Settings of the digital output: ■ **Not connected** ■ **Dout 0 X103.7** ■ **Dout 1 X103.26** ■ **Dout 2 X103.8** ■ **Dout 3 X103.27** ■ **Dout 4 X103.9** ■ **Dout 5 X103.28** Default value: **Not connected**

AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time

Parameter	Explanation
Transmitted light	Configuration of the transmitted light
Reflected light	Configuration of the reflected light
Coaxial light	Configuration of the coaxial light
Camera exposure time	Configuration of the camera's exposure time

Transmitted light

Parameter	Explanation
Function	Use of the transmitted light ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Digital output	Assignment of the digital output for the lighting Settings of the digital outputs: ■ **Not connected** ■ **Dout 0 X103.7** ■ **Dout 1 X103.26** ■ **Dout 2 X103.8** ■ **Dout 3 X103.27** ■ **Dout 4 X103.9** ■ **Dout 5 X103.28** Default value: **Not connected**
Analog output	Assignment of the analog output for the lighting Settings: ■ **Not connected** ■ **Aout 0 X103.11** ■ **Aout 1 X103.30** ■ **Aout 2 X103.12** ■ **Aout 3 X103.31** ■ **Aout 4 X103.13** ■ **Aout 5 X103.32** Default value: **Not connected**
Minimum selectable voltage	Minimum voltage that is output at the analog output ■ Setting range: **0 mV ... 9900 mV** ■ Default value: **0**
Maximum selectable voltage	Maximum voltage that is output at the analog output ■ Setting range: **100 mV ... 10000 mV** ■ Default value: **10000**
Slider threshold for "light off"	Threshold value for the slider in pixels from the initial position (0 %), starting from which the light is activated or deactivated via the digital output ■ Setting range: **0 ... 100** ■ Default value: **5**

Reflected light

Parameter	Explanation
Function	Use of the reflected light ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Digital output for front segment **Digital output for rear segment** **Digital output for left segment** **Digital output for right segment**	Assignment of the digital outputs for the reflected-light segments Settings of the digital outputs: ■ **Not connected** ■ **Dout 0 X103.7** ■ **Dout 1 X103.26** ■ **Dout 2 X103.8** ■ **Dout 3 X103.27** ■ **Dout 4 X103.9** ■ **Dout 5 X103.28** Default value: **Not connected**
Analog output for front segment **Analog output for rear segment** **Analog output for left segment** **Analog output for right segment**	Assignment of the analog outputs for the reflected-light segments Settings: ■ **Not connected** ■ **Aout 0 X103.11** ■ **Aout 1 X103.30** ■ **Aout 2 X103.12** ■ **Aout 3 X103.31** ■ **Aout 4 X103.13** ■ **Aout 5 X103.32** Default value: **Not connected**
Minimum selectable voltage	Minimum voltage that is output at the analog output ■ Setting range: **0 mV ... 9900 mV** ■ Default value: **0**
Maximum selectable voltage	Maximum voltage that is output at the analog output ■ Setting range: **100 mV ... 10000 mV** ■ Default value: **10000**
Slider threshold for "light off"	Threshold value for the slider in pixels from the initial position (0 %), starting from which the light is activated or deactivated via the digital output ■ Setting range: **0 ... 100** ■ Default value: **5**

Coaxial light

Parameter	Explanation
Function	Use of the coaxial light ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Digital output	Assignment of the digital output for the lighting Settings of the digital outputs: ■ **Not connected** ■ **Dout 0 X103.7** ■ **Dout 1 X103.26** ■ **Dout 2 X103.8** ■ **Dout 3 X103.27** ■ **Dout 4 X103.9** ■ **Dout 5 X103.28** Default value: **Not connected**
Analog output	Assignment of the analog output for the lighting Settings: ■ **Not connected** ■ **Aout 0 X103.11** ■ **Aout 1 X103.30** ■ **Aout 2 X103.12** ■ **Aout 3 X103.31** ■ **Aout 4 X103.13** ■ **Aout 5 X103.32** Default value: **Not connected**
Minimum selectable voltage	Minimum voltage that is output at the analog output ■ Setting range: **0 mV ... 9900 mV** ■ Default value: **0**
Maximum selectable voltage	Maximum voltage that is output at the analog output ■ Setting range: **100 mV ... 10000 mV** ■ Default value: **10000**
Slider threshold for "light off"	Threshold value for the slider in pixels from the initial position (0 %), starting from which the light is activated or deactivated via the digital output ■ Setting range: **0 ... 100** ■ Default value: **5**

Camera exposure time

Parameter	Explanation
Function	Use of the camera exposure time ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
	Minimum exposure time and **Maximum exposure time** define the setting range of the slider for the exposure time in the lighting.
Minimum exposure time	Minimum length of time during which the light for image acquisition can reach the sensor ■ Setting range: Depending on connected camera
Maximum exposure time	Maximum length of time during which the light for image acquisition can reach the sensor ■ Setting range: Depending on connected camera

15.5.4 Camera orientation

Parameter	Explanation
Camera skew	Compensation of the camera skew caused by the mechanical mounting ■ Setting range: **-5° ... +5°** ■ Default value: **0°**
Teach sequence	Teach sequence for determining the **Camera orientation**

15.5.5 Contrast settings

Parameter	Explanation
Edge algorithm	Contrast definition for edge detection Settings: ■ **First edge**: The first detected contrast transition that is equal to or greater than the contrast threshold value is defined as the edge ■ **Strongest edge**: The strongest contrast transition that is equal to or greater than the contrast threshold value is defined as the edge ■ **Automatic**: The edge is detected automatically ■ Default value: **Automatic**
Maximum contrast	Display of the maximum contrast determined in the live image
Minimum contrast	Display of the minimum contrast determined in the live image
Contrast threshold value for edge detection	Threshold value for the contrast starting from which a transition is recognized as an edge ■ Setting range: **0 ... 255** ■ Default value: **0**
Teach sequence	Teach sequence for determining the contrast threshold value for edge detection

15.5.6 Pixel sizes

Parameter	Explanation
Magnification	List of available magnifications (see "Magnifications", page 320)
Calibration standard diameter	Circle diameter specified in the calibration chart for the calibration standard Setting range ■ **Millimeters**: **0.00001 mm ... 50 mm** ■ **Inch**: **0.0000004" ... 2"** Default value: ■ **Millimeters**: **1.0000** ■ **Inch**: **0.039370**
Pixel size	Pixel size of the camera sensor Setting range ■ **Millimeters**: **0.00001 mm ... 5 mm** ■ **Inch**: **0.0000004" ... 0.2"** Default value: ■ **Millimeters**: **1.0000** ■ **Inch**: **0.039370**
Teach sequence	Teach sequence for determining the **Pixel size** for the selected **Magnification**

15.6 Features

15.6.1 General settings

Parameter	Explanation
Number of measuring points	Specifies whether the number of measuring points is fixed or freely selectable for each feature Settings: ■ **Free**: Number of measuring points is freely selectable ■ **Fixed**: Number of measuring points is fixed ■ Default setting: **Free**
Distances	Display of the measuring point distance Settings: ■ **Signed**: Distances are displayed with a positive or negative algebraic sign, depending on the relative direction ■ **Absolute**: Distances are displayed without an algebraic sign, independently of the relative direction ■ Default setting: **Signed**

15.6.2 Measuring point filter

Parameter	Explanation
Measuring point filter	Automatic compensation of the measuring point acquisition for detecting measuring points outside the normal distribution ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Error limit	Definition of the maximum permissible deviations of the measuring point filter ■ Setting range: **≥ 0** (**Millimeters** or **Inch**) ■ Default setting: **0.003 mm or 0.0001181"**
Confidence interval (±xσ)	Definition of the measuring point filter range ■ Setting range: **0 ... 10** ■ Default value: **2**
Minimum % proportion of retained points	Percentage of the measuring points that are used for the calculation of the feature ■ Setting range: **0 % ... 100 %** ■ Default value: **75 %**

15.6.3 Measure Magic

Parameter	Explanation
Maximum form error ratio	Maximum permissible ratio of form error to main dimension for recognizing a feature ■ Setting range: **≥0** ■ Default value: **0.050**
Minimum angle for an arc	Minimum angle for recognizing a circular arc ■ Setting range: **0° ... 360°** ■ Default setting: **15.000**
Maximum angle for an arc	Maximum angle for recognizing a circular arc ■ Setting range: **0° ... 360°** ■ Default setting: **195.000**
Minimum line length	Minimum length for recognizing a line ■ Setting range: **≥0** ■ Default value: **0.001**
Minimum numeric ellipse eccentricity	Ratio of the two reference axes for recognizing an ellipse ■ Setting range: **≥0** ■ Default value: **0.500**

15.6.4 Geometries

The overview shows the minimum number of points for measuring the individual features.

Parameter	Explanation
Point	■ Setting range: **1 ... 100** ■ Default setting: **1**
Line	■ Setting range: **2 ... 100** ■ Default setting: **2**
Circle	■ Setting range: **3 ... 100** ■ Default setting: **3**
Arc	■ Setting range: **3 ... 100** ■ Default setting: **3**
Ellipse	■ Setting range: **5 ... 100** ■ Default setting: **5**
Slot	■ Setting range: **5 ... 100** ■ Default setting: **5**
Rectangle	■ Setting range: **5 ... 100** ■ Default setting: **5**
Blob	■ Setting range: **3 ... 100** ■ Default setting: **3**
Reference plane	■ Setting range: **3 ... 100** ■ Default setting: **3**
Alignment	■ Setting range: **2 ... 100** ■ Default setting: **2**
Distance	■ Setting range: **2 ... 100** ■ Default setting: **2**
Angle	■ Setting range: **4 ... 100** ■ Default setting: **4**

15.7 Interfaces

15.7.1 Network

Parameter	Explanation
X116	Configuration of the interface **X116**
X117	Configuration of the interface **X117**

X116 or X117

> Contact your network administrator for the correct network settings for configuring the product.

Parameter	Explanation
MAC address	Unique hardware address of the network adapter
DHCP	Dynamically assigned network address of the product ■ Settings: **ON** or **OFF** ■ Default value: **ON**
IPv4 address	Network address consisting of four octets The network address is automatically assigned if DHCP is active, or it can be entered manually ■ Setting range: **0.0.0.0 ... 255.255.255.255**
IPv4 subnet mask	Identifier within the network, consisting of four octets The subnet mask is automatically assigned if DHCP is active, or it can be entered manually. ■ Setting range: **0.0.0.0 ... 255.255.255.255** ■ Default value: **0.0.0.0**
IPv4 standard gateway	Network address of the router connecting a network > The network address is automatically assigned if DHCP is active, or it can be entered manually ■ Setting range: **0.0.0.0 ... 255.255.255.255**
IPv6 SLAAC	Network address with extended namespace Only required if supported in the network ■ Settings: **ON** or **OFF** ■ Default value: **OFF**
IPv6 address	Automatically assigned if **IPv6 SLAAC** is active
IPv6 subnet prefix length	Subnet prefix in IPv6 networks
IPv6 standard gateway	Network address of the router connecting a network
Preferred DNS server	Primary server for mapping the IP address
Alternative DNS server	Optional server for mapping the IP address

15.7.2 Network drive

Contact your network administrator for the correct network settings for configuring the product.

Parameter	Explanation
Name	Folder name displayed in the file management Default value: **Share** (cannot be changed)
Server IP address or host name	Name or network address of the server
Shared folder	Name of the shared folder
User name	Name of the authorized user
Password	Password of the authorized user
Show password	Display of the password in plain text ■ Settings: **ON** or **OFF** ■ Default value: **OFF**
Network drive options	**Authentication** settings: Selection of the encryption for the password in the network ■ **None** ■ **Kerberos V5 authentication** ■ **Kerberos V5 authentication and packet signing** ■ **NTLM password hashing** ■ **NTLM password hashing with signing** ■ **NTLMv2 password hashing** ■ **NTLMv2 password hashing with signing** ■ Default value: **None** **Mount options** settings: ■ Default value: **nounix,noserverino**

15.8 User

15.8.1 User permissions

The product's operating system provides the following levels of permissions:

OEM
The **OEM** (Original Equipment Manufacturer) user has the highest level of permissions. This user is allowed to configure the product's hardware (e.g. connection of encoders and sensors). He can also create **Setup**-type and **Operator**-type users and configure the **Setup** and **Operator** users. The **OEM** user cannot be duplicated or deleted. This user cannot be logged in automatically.

Setup
The **Setup** user configures the product for use at the place of operation. This user can create **Operator**-type users. The **Setup** user cannot be duplicated or deleted. This user cannot be logged in automatically.

Operator
The **Operator** user is permitted to use the basic functions of the product.
An **Operator**-type user cannot create additional users and is allowed to change his name or the language, for example. A user of the **Operator** group can be logged in automatically as soon as the product is switched on.

15.8.2 User settings

Parameter	Explanation
OEM	Configuration of the default user **OEM**
Setup	Configuration of the default user **Setup**
Operator	Configuration of the default user **Operator**
+	Creation of a new user of the type **Operator** **Further information:** "Entering and configuring users", page 138

It is not possible to create additional **OEM**-type and **Setup**-type users.

15.8.3 User type OEM

Parameter	Explanation	Edit permission
Name	Name of the user ■ Default value: **OEM**	–
First name	First name of the user ■ Default value: –	–
Department	Department of the user ■ Default value: –	–
Group	Group of the user ■ Default value: **oem**	–
Password	Password of the user	**OEM**
Language	Language of the user	**OEM**
Auto login	On restart of the product: Automatic login of the last logged-in user ■ Default value: **OFF**	–
Remove user account	Removal of the user account	–

15.8.4 User type Setup

Parameter	Explanation	Edit permission
Name	Name of the user ■ Default value: **Setup**	–
First name	First name of the user ■ Default value: –	–
Department	Department of the user ■ Default value: –	–
Group	Group of the user ■ Default value: **setup**	–
Password	Password of the user	**Setup**, **OEM**
Language	Language of the user	**Setup**, **OEM**
Auto login	On restart of the product: Automatic login of the last logged-in user ■ Default value: **OFF**	–
Remove user account	Removal of the user account	–

15.8.5 User type Operator

Parameter	Explanation	Edit permission
Name	Name of the user ■ Default value: **Operator**	**Operator**, **Setup**, **OEM**
First name	First name of the user	**Operator**, **Setup**, **OEM**
Department	Department of the user ■ Default value: –	**Operator**, **Setup**, **OEM**
Group	Group of the user ■ Default value: **operator**	–
Password	Password of the user	**Operator**, **Setup**, **OEM**
Language	Language of the user	**Operator**, **Setup**, **OEM**
Auto login	On restart of the product: Automatic login of the last logged-in user ■ Settings: **ON** or **OFF** ■ Default value: **OFF**	**Operator**, **Setup**, **OEM**
Remove user account	Removal of the user account	**Setup**, **OEM**

15.9 Axes

Parameter	Explanation
General settings	Configuration of global functions for all axes
X	Configuration of the axes that are available on the product Default: **X** and **Y**
Y	

The number of axes may vary depending on the activation of the QUADRA-CHEK 3000 AEI1 software option.

15.9.1 General settings

Parameter	Explanation
Reference mark search	Configuration of reference mark search after unit start
Information	Display of the assignment of the encoder inputs, the analog and digital outputs as well as the analog and digital inputs to the axes
Error compensation	Configuration of error compensation using **NLEC** and **SEC**

Reference mark search

Parameter	Explanation
Reference mark search after unit start	Setting for the reference mark search after unit start Settings: ■ **ON**: The reference mark search must be performed after startup ■ **OFF**: No reference mark search is required after startup of the product ■ Default value: **ON**
Reference mark search status	Indicates whether the reference mark search was successful Display: ■ **Successful** ■ **Unsuccessful**
Stop of reference mark search	Indicates whether the reference mark search was canceled Display: ■ **Yes** ■ **No**
Reference mark search	**Start** starts the reference mark search and opens the workspace
All users can cancel reference mark search	Specifies whether the reference mark search can be canceled by all user types Settings ■ **ON**: The reference mark search can be canceled by any user type ■ **OFF**: The reference mark search can only be canceled by the **OEM** or **Setup** user type ■ Default value: **OFF**

Information

Parameter	Explanation
Assignment of the encoder inputs to the axes	Shows the assignment of the encoder inputs to the axes
Assignment of the analog outputs to the axes	Shows the assignment of the analog outputs to the axes
Assignment of the analog inputs to the axes	Shows the assignment of the analog inputs to the axes
Assignment of the digital outputs to the axes	Shows the assignment of the digital outputs to the axes
Assignment of the digital inputs to the axes	Shows the assignment of the digital inputs to the axes

Error compensation

Parameter	Explanation
Nonlinear error compensation (NLEC)	Mechanical influences on the axes of the machine are compensated
Squareness error compensation (SEC)	Mechanical influences on the squareness of the axes relative to each other are compensated

Nonlinear error compensation (NLEC)

Parameter	Explanation
Compensation	Mechanical influences on the axes of the machine are compensated Settings: ■ **ON**: Compensation is active ■ **OFF**: Compensation is not active ■ Default value: **OFF**
Number of supporting points	Number of measuring points for error compensation on both axes (**X** and **Y**) of the encoder ■ Setting range: **1 ... 99** (**X** and **Y**) ■ Default value: **2** (**X** and **Y**)
Spacing of the supporting points	Spacing of the compensation points on the axes (**X** and **Y**) ■ Setting range: **0.00001 mm ... 100.0 mm** (**X** and **Y**) ■ Default value: **0.00001 mm** (**X** and **Y**)
Read deviations of calibration standard	The file containing the deviations of the calibration standard is read
Table of supporting points	The overview of the table of supporting points is opened for manual editing
Teach sequence	The teach sequence for determining the compensation values is started

Squareness error compensation (SEC)

Parameter	Explanation
XY plane **XZ Plane** **YZ plane**	Mechanical influences on the squareness of the axes relative to each other are compensated ■ Setting range: **85° ... 95°** ■ Default value: **90**

15.9.2 Axis settings

Parameter	Explanation
Axis name	Definition of the axis name displayed in the position preview Settings: ■ **X** ■ **Y** ■ **Z** ■ **Q**
Encoder	Configuration of the connected encoder
Error compensation	Configuration of the segmented linear error compensation **SLEC**

Encoder

Parameter	Explanation
Encoder input	Assignment of the encoder input to the axis of the product Settings: ■ **X1** (**1 Vpp**) or **X21** (**TTL**) ■ **X2** (**1 Vpp**) or **X22** (**TTL**) ■ **X3** (**1 Vpp**) or **X22** (**TTL**) ■ **X4** (**1 Vpp**) or **X24** (**TTL**)
Incremental signal	The **Incremental signal** parameter can only be changed on the product variant with **1 Vpp** encoder signal. The parameter cannot be edited on the product variant with **TTL** encoder signal. Signal of the connected encoder Settings: ■ **1 Vpp**: Sinusoidal voltage signal ■ **11 µApp**: Sinusoidal current signal ■ Default value: **1 Vpp** or **TTL** (depending on the product variant)
Encoder model	Connected encoder model Settings: ■ **Linear encoder**: Linear axis ■ **Angle encoder**: Rotary axis ■ Default value: Depending on the connected encoder
Signal period	Length of a signal period on linear encoders ■ Setting range: **0.001 µm ... 1000000.000 µm** ■ Default value: **20.000**
Line count	Number of lines on angle encoders ■ Setting range: **1 ... 1000000** ■ Default value: **1000**

Parameter	Explanation
Reference mark	Definition of the type of reference mark Settings: ■ **None**: There is no reference mark ■ **One**: The encoder has one reference mark ■ **Coded**: The encoder has distance-coded reference marks ■ Default value: **One**
Analog filter frequency	Frequency value of the analog low-pass filter (not with TTL) Settings: ■ **33 kHz**: Suppression of interference frequencies above 33 kHz ■ **400 kHz**: Suppression of interference frequencies above 400 kHz ■ Default value: **33 kHz**
Terminating resistor	Dummy load to avoid reflections ■ Settings: **ON** or **OFF** ■ Default value: **ON**
Error monitor	Monitoring of signal errors Settings: ■ **Off**: Error monitoring not active ■ **Amplitude**: Error monitoring of signal amplitude ■ **Frequency**: Error monitoring of signal frequency ■ **Frequency & amplitude**: Error monitoring of signal amplitude and signal frequency ■ Default value: **Frequency & amplitude**
Counting direction	Signal detection during axis movement Settings: ■ **Positive**: The direction of traverse corresponds to the counting direction of the encoder ■ **Negative**: The direction of traverse does not correspond to the counting direction of the encoder ■ Default value: **Positive**

Segmented linear error compensation (SLEC)

Parameter	Explanation
Compensation	Mechanical influences on the axes of the machine are compensated Settings: ■ **ON**: Compensation is active ■ **OFF**: Compensation is not active ■ Default value: **OFF**
Table of supporting points	The overview of the table of supporting points is opened for manual editing
Create table of supporting points	The menu for creating a new **Table of supporting points** is opened

Create table of supporting points

Parameter	Explanation
Number of supporting points	Number of supporting points on the mechanical axis of the measuring machine For linear error compensation (LEC), use the segmented linear error compensation (SLEC) function to enter two supporting points that define the axis as a single segment covering the entire measuring range. In this way, linear compensation of the axis is performed over the entire segment. ■ Setting range: **2 ... 200** ■ Default value: **2**
Spacing of the supporting points	Spacing of the supporting points on the mechanical axis of the measuring machine
Start point	The start point defines the point starting from which the compensation is applied to the axis
Create	Creates a new table of supporting points based on the entries

15.10 Service

15.10.1 Firmware information

The following information on the individual software modules is displayed for service and maintenance.

Parameter	Explanation
Core version	Version number of the microkernel
Microblaze bootloader version	Version number of the Microblaze bootloader
Microblaze firmware version	Version number of the Microblaze firmware
Extension PCB bootloader version	Version number of the bootloader (expansion board)
Extension PCB firmware version	Version number of the firmware (expansion board)
Boot ID	ID number of the boot process
HW Revision	Revision number of the hardware
Touchscreen Controller version	Version number of the touchscreen controller
Qt build system	Version number of the Qt compilation software
Qt runtime libraries	Version number of the Qt runtime libraries
Login status	Information on the logged-in user
SystemInterface	Version number of the system interface module
BackendInterface	Version number of the backend interface module
GuiInterface	Version number of the user interface module
TextDataBank	Version number of the text database module
Optical edge detection	Version number of the optical edge detection module
CameraInterface	Version number of the camera interface module
Imageprocessing	Version number of the image processing module
Metrology	Version number of the metrology module
NetworkInterface	Version number of the network interface module
OSInterface	Version number of the operating system interface module
PrinterInterface	Version number of the printer interface module
Programming	Version number of the programming module
ReferenceSystem	Version number of the reference system module
VideoProbes	Version number of the video tools module
system.xml	Version number of the system parameters
io.xml	Version number of the parameters for inputs and outputs
info.xml	Version number of the information parameters
option.xml	Version number of the parameters of the software options
audio.xml	Version number of the audio parameters
camera.xml	Version number of the camera parameters
cameraRuntime.xml	Version number of the runtime environment parameters of the camera

Parameter	Explanation
lightcontrolRuntime.xml	Version number of the runtime environment parameters of the lighting
metrology.xml	Metrology parameters
network.xml	Version number of the network parameters
networkRuntime.xml	Version number of the runtime environment parameters of the network
os.xml	Version number of the operating system parameters
printer.xml	Version number of the printer parameters
probeRuntime.xml	Version number of the runtime parameters of the sensors
runtime.xml	Version number of the runtime parameters
serialPort.xml	Version number of the parameters of the serial interface
users.xml	Version number of the user parameters
ved.xml version	Version number of the VED parameters

15.10.2 Backing up and restoring the configuration

Backing up the configuration

The configuration of the product can be backed up as a file to make it available after a reset to the factory default settings or for installation on multiple products.

- Tap **Settings** in the main menu
- Open in the sequence
  - **Service**
  - **Backup and restore configuration**
  - **Backup configuration**

Performing a complete backup
During a complete backup of the configuration, all settings of the product are backed up.

- Tap **Complete backup**
- If required, connect a USB mass storage device to a USB port of the product
- Select the folder to which you want to copy the configuration data
- Specify a name for the configuration data, e.g. "<yyyy-mm-dd>_config"
- Confirm entry with **RET**
- Tap **OK**
- Confirm the successful backup of the configuration
- > The configuration file was backed up

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

Restoring the configuration

Backed-up configurations can be restored to the product. The current configuration of the product is replaced in the process.

> Software options that were active when the configuration was backed up must be activated before restoring the configuration.

A restore can be necessary in the following cases:

- During commissioning, the configuration data are set on a product and transferred to all identical products
  Further information: "Commissioning steps", page 107
- After a reset to the factory default settings, the configuration data are copied back to the product
  Further information: "Resetting to the factory defaults", page 350

- Tap **Settings** in the main menu
- Open in the sequence
  - **Service**
  - **Backup and restore configuration**
  - **Restore configuration**

Performing a complete restore

- Tap **Complete restoration**
- If required, connect a USB mass storage device to a USB port of the product
- Navigate to the folder containing the configuration data
- Select the configuration data
- Tap **OK**
- Confirm successful transfer with **OK**
- > The system is shut down
- To restart the product with the transferred configuration data, switch the product off and then back on

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- Disconnect the USB mass storage device

15.10.3 Firmware update

The firmware is the operating system of the product. You can import new versions of the firmware via the product's USB port or the network connection.

When updating the firmware of the product, the current configuration must be backed up for safety and security reasons.

The existing settings are not changed during a firmware update.

Requirement

- The new firmware is available as a *.dro file
- To update the firmware via the USB port, the current firmware must be stored on a USB mass storage device
- To update the firmware via the network interface, the current firmware must be available in a folder on the network

Starting a firmware update

- ▶ Tap **Settings** in the main menu
- ▶ Tap **Service**
- ▶ Open in the sequence
  - **Firmware update**
  - **Continue**
- > The service application is launched

Updating the firmware

The firmware can be updated from a USB mass storage device or via a network drive.

- Tap **Firmware update**
- Tap **Select**
- If required, connect a USB mass storage device to a USB port of the product
- Navigate to the folder containing the new firmware

> If you have accidentally tapped the wrong folder, you can return to the previous folder.
> - Tap the file name that is displayed above the list

- Select the firmware
- Tap **OK** to confirm the selection
- > The firmware version information is displayed
- Tap **OK** to close the dialog

> The firmware update cannot be canceled once the data transfer has started.

- Tap **Start** to start the update
- > The screen shows the progress of the update
- Tap **OK** to confirm successful update
- Tap **Finish** to terminate the service application
- > The service application is terminated
- > The main application is launched
- > If automatic user login is active, the user interface is displayed in the **Measure** menu
- > If automatic user login is not active, the **User login** menu is displayed

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- Disconnect the USB mass storage device

15.10.4 Resetting to the factory defaults

You can reset the settings of the product to the factory defaults, if required. Software options are deactivated and subsequently need to be reactivated with the available license key.

- Tap **Settings** in the main menu
- Tap **Service**
- Open in the sequence
  - **Reset to factory settings**
  - **Reset all settings**
- Enter password
- Confirm entry with **RET**
- To show the password in plain text, activate **Show password**
- Tap **OK** to confirm the reset
- Tap **OK** to confirm shutdown of the product

> The product is shut down
> All settings are reset
> To restart the product, switch it off and then back on

15.10.5 OEM area

The OEM area enables commissioning engineers to install custom information in the product:

- **Documentation**: OEM documentation, e.g. service information
- **Opening screen**: Adjustment of the startup screen, e.g. to display the OEM's company logo

Adding the OEM documentation

> Only documents in PDF format can be added. Other documents are not displayed.

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **OEM area**
  - **Documentation**
  - **Add OEM service info**
- If required, connect a USB mass storage device to a USB port of the product
- To navigate to the desired file, tap the location where the file is stored

> If you have accidentally tapped the wrong folder, you can return to the previous folder. Tap the file name that is displayed above the list.

- Navigate to the folder containing the file
- Tap the file name
- Tap **OK**
- > The document is copied to the product and displayed in the service information area
- Confirm the successful transfer with **OK**

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

Adjusting the startup screen

The product can display a custom startup screen, e.g. the company name or logo. The corresponding image needs to be stored on the product for this purpose.

Requirements

- File format: PNG or JPG
- Resolution: 96 ppi
- Image format: 16:10
  Images in other formats will be scaled proportionally
- Image size: Max. 1280 x 800 px

Inserting a startup screen

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **OEM area**
  - **Opening screen**
  - **Select the startup screen**
- If required, connect a USB mass storage device to a USB port of the product
- To navigate to the desired file, tap the location where the file is stored

> If you have accidentally tapped the wrong folder, you can return to the previous folder. Tap the file name that is displayed above the list.

- Navigate to the folder containing the file
- Tap the file name
- Tap **OK**
- > The image is copied to the product and displayed the next time the product is started
- Confirm the successful transfer with **OK**

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations

- Tap **Safely remove**
- Disconnect the USB mass storage device

15.10.6 Documentation

The product provides the possibility to upload the corresponding Operating Instructions in the desired language. The Operating Instructions can be copied from the supplied USB mass storage device to the product.

The latest version can be downloaded from the download area at www.heidenhain.de.

Requirement
The current Operating Instructions are available as a PDF file.

- Tap **Settings** in the main menu
- Tap **Service**
- Open in the sequence
  - **Documentation**
  - **Add Operating Instructions**
- If required, connect a USB mass storage device to a USB port of the product
- Navigate to the folder containing the new Operating Instructions

If you have accidentally tapped the wrong folder, you can return to the previous folder.

- Tap the file name that is displayed above the list

- Select file
- Tap **OK**
> The Operating Instructions are copied to the product
> Any existing Operating Instructions will be overwritten
- Confirm successful transfer with **OK**
> The Operating Instructions can be opened on the product

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- Disconnect the USB mass storage device

15.10.7 Software options

In the factory default setting, no software options are enabled on the product. To enable software options, the corresponding license keys must be installed.

Parameter	Explanation
Overview	Overview of all software options that are active on the product
Request options	Creation of a license key request that can be submitted to a HEIDENHAIN service agency **Further information:** "Requesting a license key", page 108
Request trial options	Creation of a license key request that can be submitted to a HEIDENHAIN service agency **Further information:** "Requesting a license key", page 108
Activate options	Activation of the software options via license key or license file **Further information:** "Activating a license key", page 111
Reset trial options	Reset of the trial options by entering a license key

16

Service and maintenance

16.1 Overview

This chapter describes the general maintenance work on the product:

- Cleaning
- Maintenance schedule
- Resuming operation

This chapter contains a description of maintenance work for the product only.
Further Information: Manufacturer's documentation for the respective peripheral devices

16.2 Cleaning

NOTICE

Cleaning with sharp-edged objects or aggressive cleaning agents

Improper cleaning will cause damage to the product.

- Never use abrasive or aggressive cleaners, and never use strong detergents or solvents
- Do not use sharp-edged objects to remove persistent contamination

- Use only a cloth dampened with water and a mild detergent for cleaning the exterior surfaces
- Use a lint-free cloth and a commercially available glass cleaner to clean the screen

16.3 Maintenance schedule

The product is largely maintenance-free.

NOTICE

Operating defective products

Operating defective products may result in serious consequential damage.

- Do not operate or repair the product if damaged
- Replace defective products immediately or contact a HEIDENHAIN service agency

The following steps are only to be performed by electrical specialists.
Further information: "Personnel qualification", page 19

Maintenance step	Interval	Corrective action
▶ Check all labels and symbols provided on the product for readability	Annually	▶ Contact HEIDENHAIN service agency
▶ Inspect electrical connections for damage and check their function	Annually	▶ Replace defective cables. Contact HEIDENHAIN service agency if required
▶ Check power cables for faulty insulation and weak points	Annually	▶ Replace power cables according to the specification

16.4 Resuming operation

When operation is resumed, e.g. when the product is reinstalled after repair or when it is remounted, the same measures and personnel requirements apply as for mounting and installing the product.

Further information: "Assembly of the device", page 30

Further information: "Installation", page 37

When connecting the peripheral devices (e.g. encoders), the operating company must ensure safe resumption of operation and assign authorized and appropriately qualified personnel to the task.

Further information: "Obligations of the operating company", page 19

17

What to do if ...

17.1 Overview

This chapter describes the causes of faults or malfunctions of the product and corrective actions.

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.

Further information: "Basic operation", page 51

17.2 System or power failure

Operating system data can be corrupted in the following cases:

- System or power failure
- Switching off the product without shutting down the operating system

If the firmware is damaged, the product starts the Recovery System. The firmware and the configuration are deleted.

Restoring the firmware

- ▶ Create the "heidenhain" folder in a USB mass storage device
- ▶ In the "heidenhain" folder, create the "update" folder
- ▶ Copy the current firmware to the "update" folder
- > The firmware will be restored to the product by using the USB mass storage device
- ▶ Switch off the product
- ▶ Connect the USB mass storage device to the product
- ▶ Switch on the product
- > The product starts the Recovery System
- > The USB mass storage device is detected automatically
- > The firmware is installed automatically
- ▶ Restart the product on completion of the installation
- > The product starts up with the factory defaults

Restoring the configuration

Installing the firmware resets the product to the factory defaults. If a backup of the configuration was made e.g. during setup, the backup file can be used for restoring the configuration. Before the backed-up configuration data can be restored to the product, the software options that were active when the backup was made must be activated in the product.

- ▶ Enable the software options

Further information: "Enabling software options", page 108

- ▶ Restore the configuration

Further information: "Backing up and restoring the configuration", page 346

17.3 Malfunctions

If faults or malfunctions that are not listed in the "Troubleshooting" table below occur during operation, a HEIDENHAIN service agency must be contacted.

17.4 Troubleshooting

The following troubleshooting steps must be performed only by the personnel indicated in the table below.

Further information: "Personnel qualification", page 19

Error	Error source	Correction of fault	Personnel
Status LED remains dark after switch-on.	There is no supply voltage	▶ Check the power cable	Electrical specialist
	The product does not function properly	▶ Contact a HEIDENHAIN service agency	Qualified personnel
A blue screen appears when the product starts up.	Software error during startup	▶ If this fault occurs for the first time, switch the product off and then on again ▶ If the fault recurs, contact a HEIDENHAIN service agency	Qualified personnel
After startup, the product does not recognize any entries made on the touchscreen.	Incorrect hardware initialization	▶ Switch the product off and then on again	Qualified personnel
The position display does not count the axis position even though the encoder is moving.	Incorrect connection of the encoder	▶ Correct the connection ▶ Contact the encoder manufacturer's service agency	Qualified personnel
The axis values are red and the functions are disabled.	The encoder has not been referenced	▶ Perform the reference mark search (see "Conducting the reference mark search", page 203)	Operator
The position display miscounts the axis position.	Incorrect settings of the encoder	▶ Check the encoder settings (see "Setting axis parameters", page 113)	Qualified personnel
The lighting does not work.	Defective connection	▶ Check the cable	Electrical specialist
	Incorrect settings of the inputs and outputs	▶ Check the settings for the inputs and outputs (see "Setting the lighting", page 124)	Qualified personnel
The camera image is not displayed.	Wrong camera model connected	▶ Check the camera model	Qualified personnel
	Incorrect settings of the camera	▶ Check the camera settings (see "Setting the camera", page 118)	Qualified personnel
	Defective connection	▶ Check the cable and the correct connection to X32 / X117	Qualified personnel

Error	Error source	Correction of fault	Personnel
The camera image flickers.	Incorrect pixel format selected for the camera	▶ Set the pixel format in the camera settings (see "Camera", page 318)	Qualified personnel
Connection to the network is not possible.	Defective connection	▶ Check the cable and the correct connection to X116	Qualified personnel
	Incorrect settings of the network	▶ Check the network settings (see "Configuring the network", page 142)	Qualified personnel
The connected USB mass storage device is not detected.	Defective connection	▶ Check the correct position of the USB mass storage device in the port ▶ Use another USB port (X31 to X34)	Qualified personnel
	The type or formatting of the USB mass storage device is not supported	▶ Use another USB mass storage device	Qualified personnel
The device starts up in recovery mode (text-only mode).	Software error during startup	▶ If this fault occurs for the first time, switch the product off and then on again ▶ If the fault recurs, contact a HEIDENHAIN service agency	Qualified personnel
User login is not possible.	Password does not exist	▶ As a user with a higher authorization level, reset the password (see "Entering and configuring users", page 138) ▶ To reset the OEM password, contact a HEIDENHAIN service agency	Qualified personnel

18

Removal and disposal

18.1 Overview

This chapter provides information about the removal and disposal of the product. This information includes requirements to be complied with in respect of environmental-protection laws.

18.2 Removal

Removal of the product must be performed only by qualified personnel.
Further information: "Personnel qualification", page 19

Depending on the connected peripherals, the removal may need to be performed by an electrical specialist.

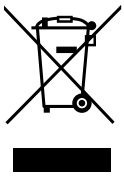
In addition, the same safety precautions that apply to the mounting and installation of the respective components must be taken.

Removing the product
To remove the product, follow the installation and mounting steps in the reverse order.

Further information: "Installation", page 37

Further information: "Mounting", page 29

18.3 Disposal



NOTICE

Incorrect disposal of the product!

Incorrect disposal of the product can cause environmental damage.

- Do not dispose of electrical waste and electronic components in domestic waste
- Forward the product to recycling in accordance with the applicable local disposal regulations

- If you have any questions about the disposal of the product, please contact a HEIDENHAIN service agency

19

Specifications

19.1 Product data

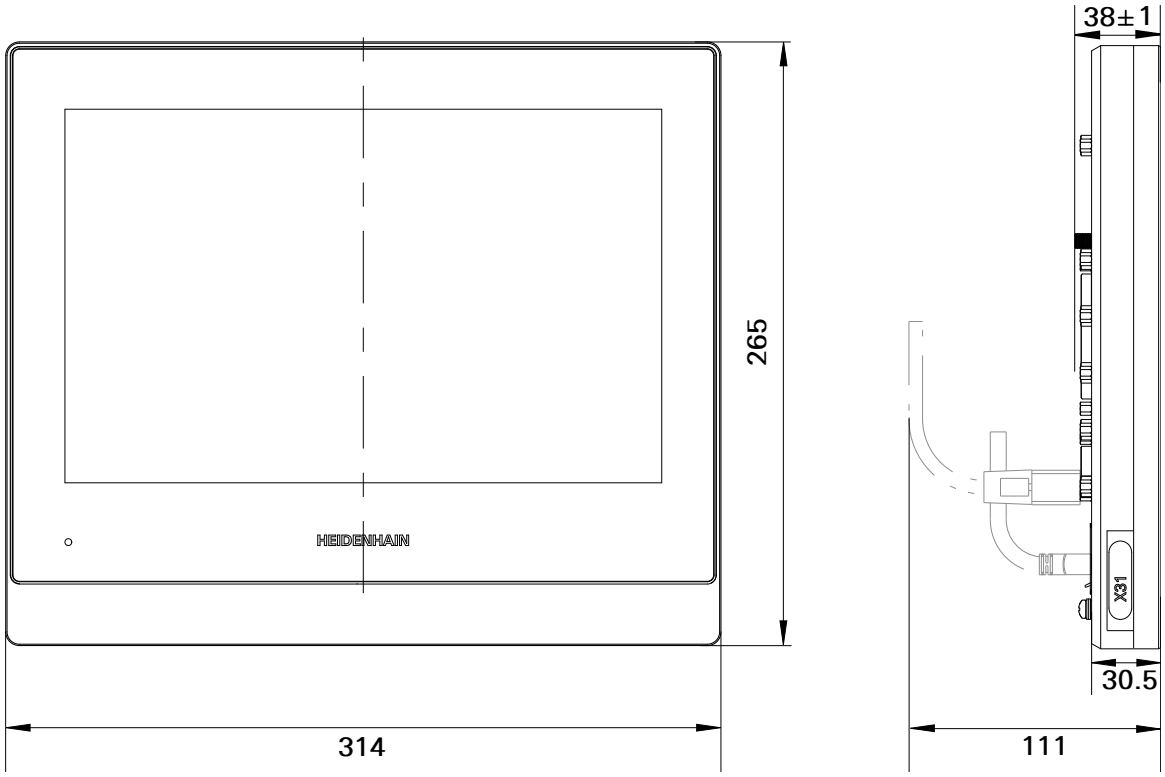
Device	
Housing	Aluminum milled housing
Housing dimensions	314 mm x 265 mm x 38 mm
Fastener system, mating dimensions	VESA MIS-D, 100 100 mm x 100 mm
Display	
Visual display unit	■ LCD widescreen (16:10) Color screen 30.7 cm (12.1") ■ 1280 x 800 pixels
Display step	Selectable, min. 0.00001 mm
User interface	User interface (GUI) with touchscreen
Electrical data	
Power supply	■ AC 100 V ... 240 V (±10 %) ■ 50 Hz ... 60 Hz (±5 %) ■ Input power max. 79 W
Overvoltage category	II
Number of encoder inputs	2x (2 additional inputs can be enabled optionally via software option)
Encoder interfaces	■ 1 V_{PP}: Max. current 300 mA, max. input frequency 400 kHz ■ TTL: Max. current 300 mA, max. input frequency 5 MHz
Interpolation at 1 V_{pp}	4096-fold
Camera connection	Hi-Speed USB 2.0 (Type A), max. current 500 mA, 1 Gigabit Ethernet (RJ45)
Connection for optical edge detector	Two F-SMA sockets (thread designation 1/4-36 UNS-2A)
Digital inputs	TTL 0 V to +5 V
Digital outputs	TTL 0 V to +5 V, maximum load 1 kΩ
Relay outputs	■ Max. switching voltage AC 30 V / DC 30 V ■ Max. switching current 0.5 A ■ Max. switching capacity 15 W ■ Max. continuous current 0.5 A
Analog inputs	Voltage range 0 V ... +5 V
Analog outputs	Voltage range DC –10 V ... +10 V Maximum load =1 kΩ
5 V voltage outputs	Voltage tolerance ±5 %, maximum current 100 mA
Data interface	■ Hi-Speed USB 2.0 (Type A), max. current 500 mA per USB port ■ 100 Mbit/1 Gbit Ethernet (RJ45)

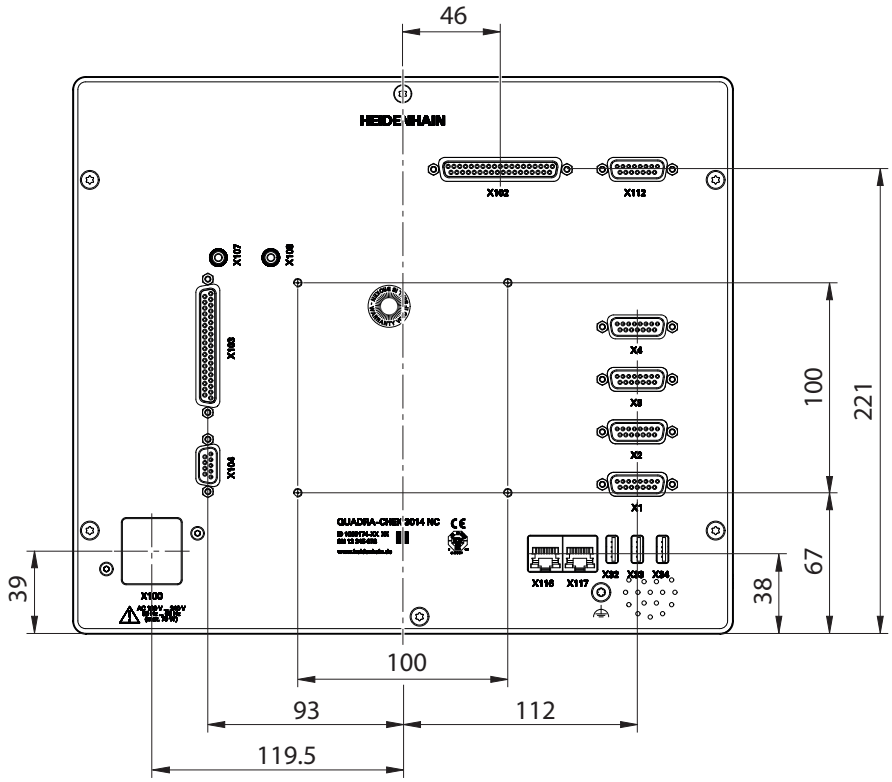
Ambient conditions	
Operating temperature	0 °C to +45 °C
Storage temperature	–20 °C to +70 °C
Relative air humidity	10 % to 80 % r.H., non-condensing
Altitude	≤ 2000 m

General information	
Directives	Until April 19, 2016: ■ EMC Directive 2004/108/EC ■ Low Voltage Directive 2006/95/EC As of April 20, 2016: ■ EMC Directive 2014/30/EU ■ Low Voltage Directive 2014/35/EU
Pollution degree	2
Protection EN 60529	■ Front panel and side panels: IP 65 ■ Rear panel: IP 40
Weight	■ 3.5 kg ■ With Duo-Pos stand 3.8 kg ■ With Multi-Pos stand: 4.5 kg ■ With Multi-Pos holder: 4.1 kg

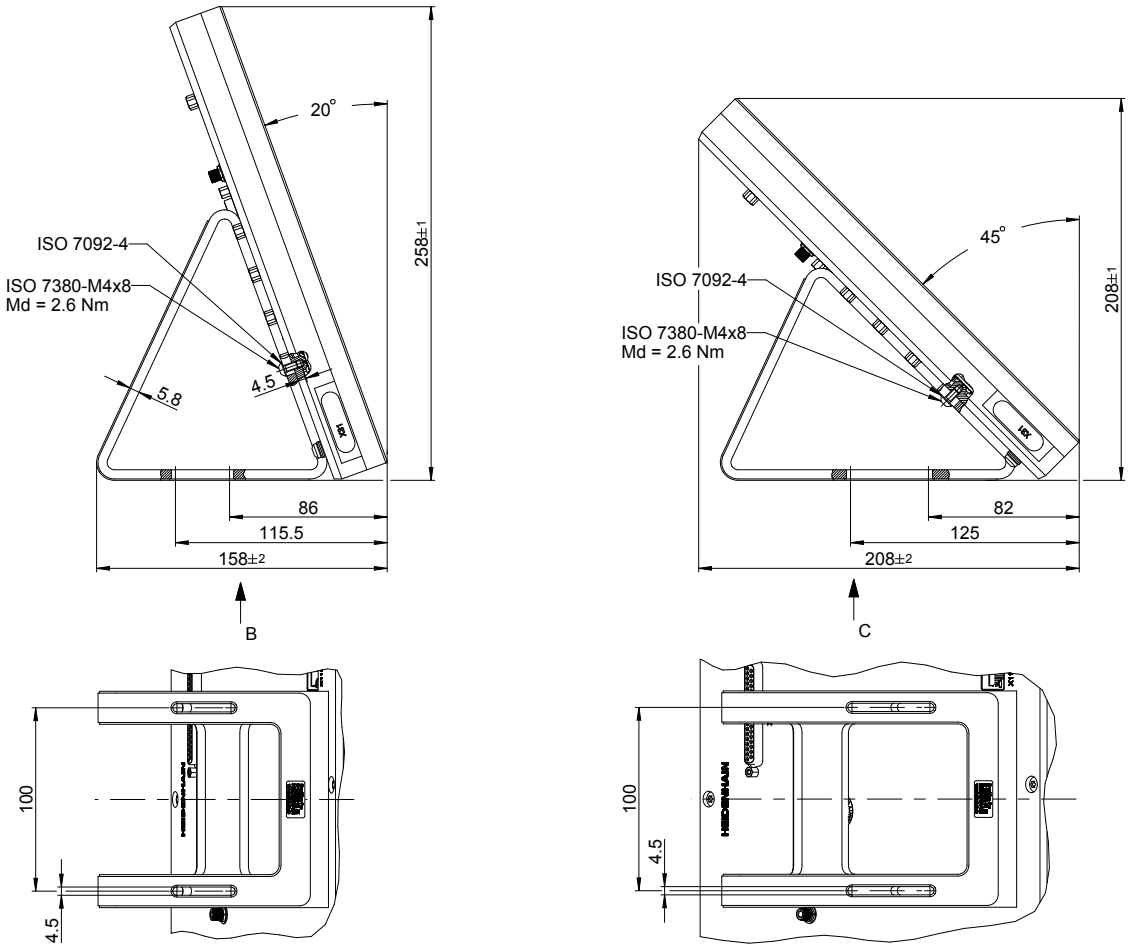
19.2 Product dimensions and mating dimensions

All dimensions in the drawings are in millimeters.

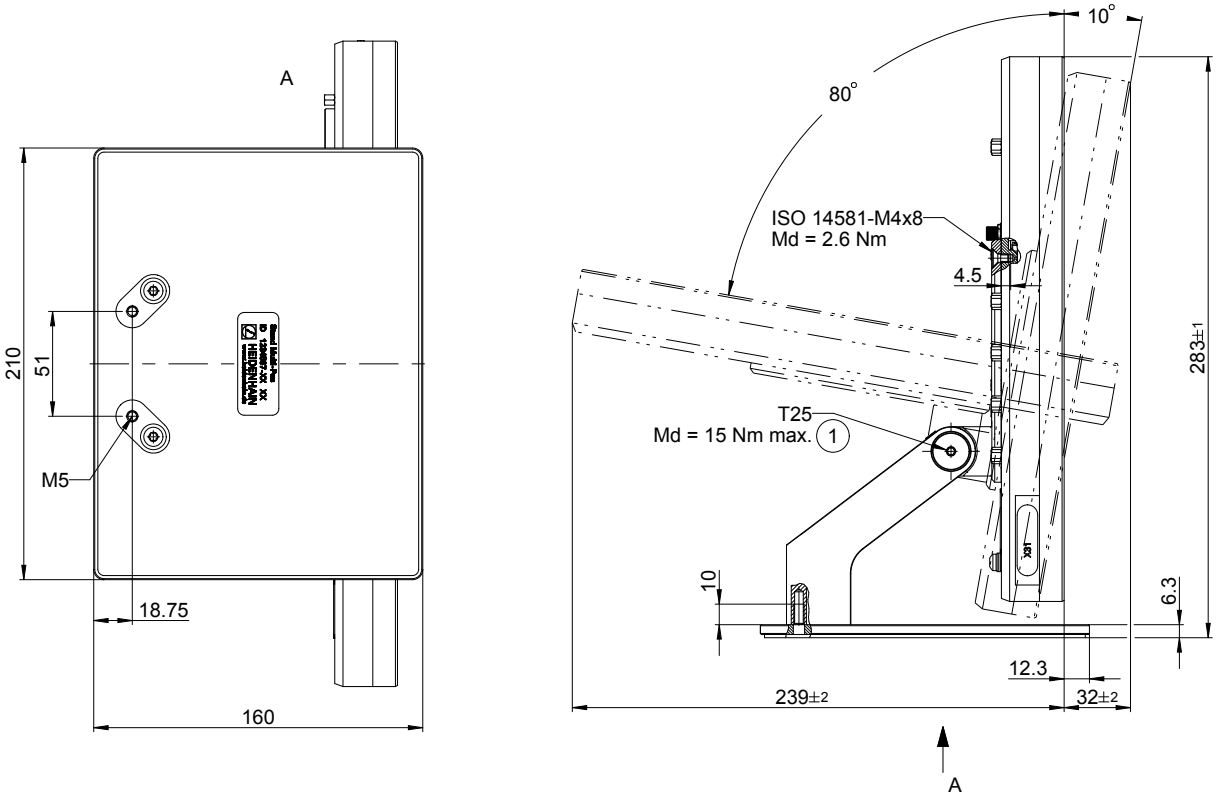




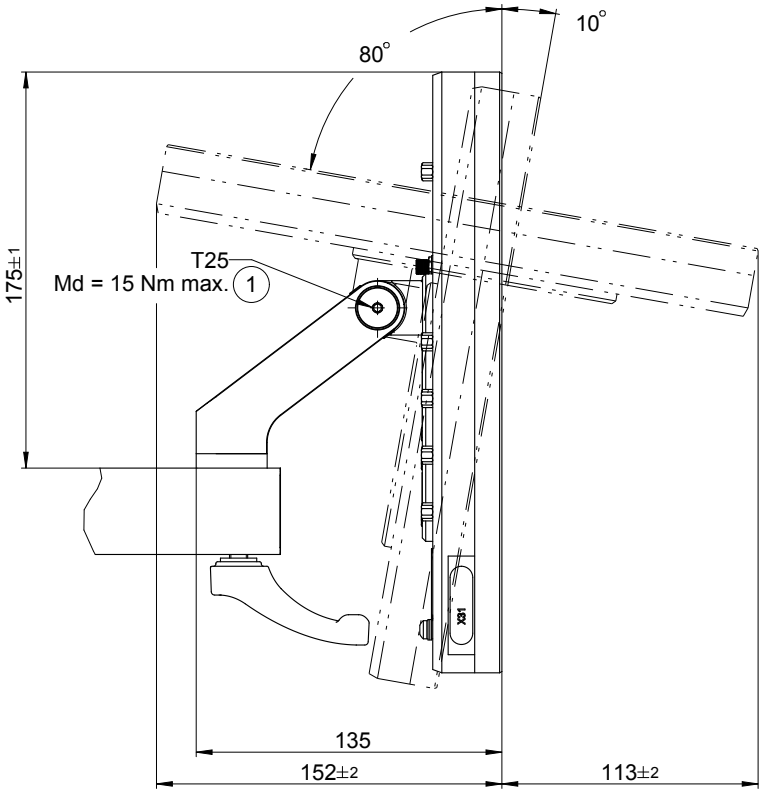
Product dimensions with Duo-Pos stand



Product dimensions with Multi-Pos stand



Product dimensions with Multi-Pos holder



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

Technical support FAX +49 8669 32-1000
Measuring systems ☎ +49 8669 31-3104
E-mail: service.ms-support@heidenhain.de
TNC support ☎ +49 8669 31-3101
E-mail: service.nc-support@heidenhain.de
NC programming ☎ +49 8669 31-3103
E-mail: service.nc-pgm@heidenhain.de
PLC programming ☎ +49 8669 31-3102
E-mail: service.plc@heidenhain.de
Lathe controls ☎ +49 8669 31-3105
E-mail: service.lathe-support@heidenhain.de

www.heidenhain.de

Translation of original document
1178796-20 · Ver00 · 6/2016 · H · Printed in Germany