HEIDENHAIN

QUADRA-CHEK 3000

Operating Instructions

Evaluation Unit

English (en)
02/2018

Contents

1

Fundamentals

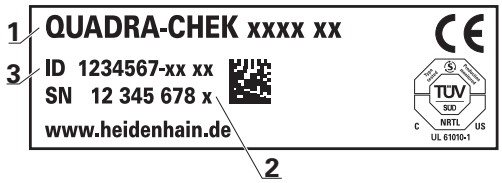
1.1 Overview

This chapter contains information about the product and these instructions.

1.2 Information on the product

Product designation	Part number	Firmware version	Index
QUADRA-CHEK 3000	1089174-xx	826880.1.1.x	-/A

The ID label is provided on the back of the product.
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 434

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

If the part numbers and indexes 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

⚠ 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

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

Documentation	Description
Addendum	An addendum supplements or supersedes the corresponding contents of the Operating Instructions and, if applicable, of the Installation Instructions. If an addendum is included in the shipment, it has the highest priority for reading. All other contents of the documentation retain their validity.
Installation Instructions	The Installation Instructions contain all of the information and safety precautions needed for the proper mounting and installation of the product. The Installation Instructions are contained as an excerpt from the Operating Instructions in every delivery. The Installation Instructions have the second highest level of 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. The Operating Instructions are included on the supplied storage medium and can also be downloaded in the download area from **www.heidenhain.de**. The Operating Instructions must be read before the unit is put into service. The Operating Instructions have the third highest level of priority for reading.
Documentation of connected measuring devices and other peripherals	These documents are not included in delivery. They are shipped with the respective measuring devices and peripheral devices.

Would you like to see any changes made, 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

The 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 given or resold to any other party, the following documents must be passed on to the new owner:

- Addendum (if supplied)
- Installation Instructions
- Operating Instructions

1.5 About these instructions

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

1.5.1 Document category

Operating Instructions

These instructions are the **Operating Instructions** for the product.

The Operating Instructions

- are oriented to the product life cycle
- contain all information and safety precautions needed for the proper operation of the product according to its intended use

1.5.2 Target groups for the instructions

These instructions must be read and observed by every person who performs any of the following tasks:

- Mounting
- Installation
- Commissioning and configuration
- Operation
- Programming
- Service, cleaning and maintenance
- Troubleshooting
- Removal and disposal

1.5.3 Target groups according to user types

The target groups of these instructions refer to the various user types of the product and their authorizations.
The product features the following user types:

OEM user

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 create **Setup** 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 user

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 user

The **Operator** user is permitted to use the basic functions of the product.
An **Operator**-type user cannot create additional users, but is allowed to edit various operator-specific settings, such as his name or the language. A user of the **Operator** group can be logged in automatically as soon as the product is switched on.

1.5.4 Contents of the chapters

The table below shows:

- from which chapters these instructions are derived from
- which information the chapters of the instructions contain
- to which target groups the chapters of the instructions mainly apply

Section	Contents	Target group		
	This chapter contains information about…	**OEM**	**Setup**	**Operator**
1 "Fundamentals"	■ … this product ■ … these instructions	✓	✓	✓
2 "Safety"	… Safety regulations and safety measures ■ for mounting the product ■ for installing the product ■ for operating the product	✓	✓	✓
3 "Transport and storage"	■ … transporting the product ■ … storing the product ■ … items supplied with the product ■ … accessories for the product	✓	✓	
4 "Mounting"	… correct mounting of the product	✓	✓	
5 "Installation"	… correct installation of the product	✓	✓	
6 "Basic operation"	■ … the operating elements of the product user interface ■ … the user interface of the product ■ … basic functions of the product	✓	✓	✓
7 "Commissioning"	… commissioning the product	✓		
8 "Setup"	… correct setup of the product		✓	
9 "Quick Start"	… an example of a typical measuring sequence: ■ Aligning the measured object ■ Measuring features ■ Creating a measuring report			✓
10 "Measuring"	■ … Geometry types ■ … the acquisition of measuring points ■ … performing a measurement ■ … the definition and construction of features			✓
11 "Measurement evaluation"	■ … the evaluation of measurements ■ … the determination of tolerances			✓
12 "Programming"	… the creation, processing and use of measuring programs		✓	✓

Section	Contents	Target group		
	This chapter contains information about…	**OEM**	**Setup**	**Operator**
13 "Measurement reports"	■ … the creation, modification and management of templates for measuring reports ■ … the creation of measuring reports		✓	✓
14 "File management"	… the functions of the "File management" menu	✓	✓	✓
15 "Settings"	… setting options and associated setting parameters for the product	✓	✓	✓
16 "Service and maintenance"	… general maintenance work on the product	✓	✓	✓
17 "What to do if …"	■ … causes of faults or malfunctions of the product ■ … corrective actions for faults or malfunctions of the product	✓	✓	✓
18 "Removal and disposal"	■ … disassembly and disposal of the product ■ … environment protection specifications	✓	✓	✓
19 "Specifications"	■ … the technical data of the product ■ … product dimensions and mating dimensions (drawings)	✓	✓	✓
20 "Index"	This chapter enables accessing the content of these instructions according to specific topics.	✓	✓	✓

1.5.5 Notes in this documentation

Safety precautions

Precautionary statements warn of hazards in handling the product and provide information on their prevention. Precautionary statements are classified by hazard severity and 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, such as property damage**.

Informational notes

Informational notes ensure reliable and efficient operation of the product. Informational notes are divided into the following groups:

The information symbol indicates a **tip**.

A tip provides 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.

1.5.6 Symbols and fonts used for marking text

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

Depiction	Meaning
▶ ... > ...	Identifies an action and the result of this action Example: ▶ Tap **OK** > The message is closed
■ ... ■ ...	Identifies an item of a list Example: ■ TTL interface ■ EnDat interface ■ ...
Bold	Identifies menus, displays and buttons Example: ▶ Tap **Shut down** > The operating system shuts down ▶ Turn the power switch off

2

Safety

2.1 Overview

This chapter provides important safety information needed for the proper operation of the unit.

2.2 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.

2.3 Intended use

The products of the QUADRA-CHEK 3000 series are advanced digital evaluation electronics for the measurement of 2-D features in metrology applications. The products are used primarily on measuring machines, video measuring machines and profile projectors.

The products of this 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 in which the contamination caused by humidity, dirt, oil and lubricants complies with the requirements of the specifications

The products support the use 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.

2.4 Improper use

In particular, the products of the QUADRA-CHEK 3000 series must not be used in the following applications:

- Use and storage outside the operating conditions specified in "Specifications"
- Outdoor use
- Use in potentially explosive atmospheres
- Use of the products of the QUADRA-CHEK 3000 series as part of a safety function

2.5 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 are specified in detail as follows with regard to their qualifications and tasks.

Operator

The operator uses and operates the product within the framework specified for the intended use. He is informed by the operating company about the special tasks and the potential hazards resulting from incorrect behavior.

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.

2.6 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

2.7 General safety precautions

	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 there is no documentation at hand, 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.

2.7.1 Symbols in the instructions

The following safety symbols are used in this document:

Symbol	Meaning
	identifies information that warns of personal injury
	identifies electrostatic sensitive devices (ESD)
	identifies use of an ESD armband for personnel grounding

2.7.2 Symbols on the product

The following symbols are used to identify the product:

Symbol	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.

2.7.3 Electrical safety precautions

⚠ WARNING

Hazard of contact with live parts when opening the unit.

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

⚠ 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

NOTICE

Damage to internal parts of the product!

If you open the product, the warranty and the guarantee will be void.

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

3

Transport and storage

3.1 Overview

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

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

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

3.3.1 Items supplied

The following items are included in delivery:

Name	Description
Addendum (optional)	Supplements or supersedes the contents of the Operating Instructions and, if applicable, of the Installation Instructions.
2-D demo part	Demonstration part for 2-D application examples
Operating Instructions	PDF issue of the Operating Instructions on a memory medium in the currently available languages
Product	Evaluation Unit QUADRA-CHEK 3000
Installation Instructions	Printed issue of the Installation Instructions in the currently available languages

3.3.2 Accessories

> Software options need to be enabled on the product via a license key. Before you can use the associated hardware components, you need to enable the respective software option.
>
> **Further information:** "Enabling the Software options", Page 130

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

Accessories	Name	Description	Part number
For operation			
	QUADRA-CHEK 3000 OED Trial software option	Automatic point measurement via optical edge detection, time-limited test version (60 days) **Product requirement:** Index A or higher	1089229-58
	QUADRA-CHEK 3000 OED software option	Automatic point measurement via optical edge detection **Product requirement:** Index A or higher	1089229-08
	2-D demo part	Demonstration part for 2-D application examples	681047-02
	QUADRA-CHEK 3000 AEI1 Trial software option	Enabling of an additional encoder input, test version for a limited time (60 days)	1089229-51
	QUADRA-CHEK 3000 VED software option	Automatic point measurement via video edge detection; display and archiving of live images; light control	1089229-02
	QUADRA-CHEK 3000 AEI1 software option	Enabling of an additional encoder input	1089229-01
	QUADRA-CHEK 3000 VED Trial software option	Automatic point measurement via video edge detection, display and archiving of live images; light control; test version for a limited time (60 days)	1089229-52
	Calibration standard	Calibration standard for calibrating video measuring machines, measuring microscopes, and profile projectors; can be traced back to national or international standards	681047-01
For installation			

Acces-sories	Name	Description	Part number
	Adapter connector for TTL	Conversion of the pin layout from HEIDENHAIN TTL to RSF TTL and Renishaw TTL	1089210-01
	Cables	For information on connecting cables, see "Cables and Connectors for HEIDENHAIN Products" brochure.	---
	Power cable	Power cable with European plug (type F), length: 3 m	223775-01
	Adapter connector for light control	Conversion of the pin layout for light control (without zoom) from QUADRA-CHEK 3000 (X103) to assignment for ND 1300 QUADRA-CHEK (light)	1089212-01
	USB connecting cable	USB connecting cable for connector type A to type B	354770-xx
For mounting			
	Multi-Pos holder	Holder for fastening the device on an arm, continuously tiltable within an angle of 90°, fixing hole pattern 100 mm x 100 mm	1089230-04
	Multi-Pos stand	Stand for continuously variable tilting within an angle of 90°, fixing hole pattern 100 mm x 100 mm	1089230-03
	Duo-Pos stand	Stand for rigid mounting, inclination angle 20° or 45°, fixing hole pattern 100 mm x 100 mm	1089230-02
For QUADRA-CHEK 3000 OED software option			
	Holder	Transparent holder for accepting a fiber-optic cable with right-angle end	681050-xx
	Fiber-optic cable	Fiber-optic cable with one right-angle end and an SMA connector (subminiature A)	681049-xx
	Connection for fiber-optic cable	Fiber-optic cable with two SMA connectors (subminiature A)	681049-xx

Recommended cameras

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	Interface	Resolution
AB00795	UI-1240LE-C-HQ QUADRA-CHEK APPROVED	USB 2.0	1.31 megapixels
AB00796	UI-1240LE-M-GL QUADRA-CHEK APPROVED	USB 2.0	1.31 megapixels
AB00799	UI-1250LE-C-HQ QUADRA-CHEK APPROVED	USB 2.0	1.92 megapixels
AB00800	UI-1250LE-M-GL QUADRA-CHEK APPROVED	USB 2.0	1.92 megapixels
AB00797	UI-1240SE-C-HQ QUADRA-CHEK APPROVED	USB 2.0	1.31 megapixels
AB00798	UI-1240SE-M-GL QUADRA-CHEK APPROVED	USB 2.0	1.31 megapixels
AB00801	UI-1250SE-C-HQ QUADRA-CHEK APPROVED	USB 2.0	1.92 megapixels
AB00802	UI-1250SE-M-GL QUADRA-CHEK APPROVED	USB 2.0	1.92 megapixels
AB00870	UI-5240SE-C-HQ Rev.2 QUADRA-CHEK APPROVED	GigE	1.31 megapixels
AB00871	UI-5240SE-M-HQ Rev.2 QUADRA-CHEK APPROVED	GigE	1.31 megapixels
AB00877	UI-5240CP-M-GL QUADRA-CHEK APPROVED	GigE	1.31 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

If damage occurred during 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 the product

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

- Re-attach all mounting parts and dust protection caps to the product as received from the factory, or repackage them in the original packaging as received from the factory
- Repackage the product in such a way that
  - it is protected from impact and vibration during transit
  - 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 32
- Enclose all the documentation that was included in the original packaging
  Further information: "Storage and distribution of the documentation", Page 18

If the product is returned for repair to the Service Department:
- 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
  Further information: "Specifications", Page 511
- Inspect the product for damage after any transport or longer storage times

4

Mounting

4.1 Overview

This chapter describes the mounting of the product. It contains instructions about how to correctly mount the product on stands or holders.

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

4.2 Assembly of the device

General mounting information

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

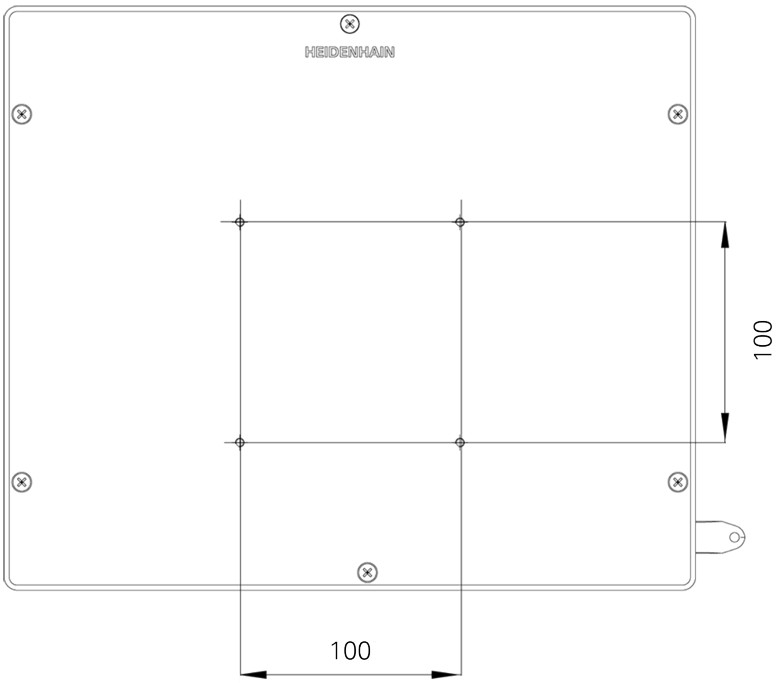


Figure 1: Dimensions of the rear panel

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
- Allen key, size 2.5 (Duo-Pos stand)
- Material for mounting on supporting surface

The unit must be mounted to a stand or a holder to ensure the correct and intended use 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.

- Mount the stand with the supplied M4 x 8 ISO 7380 hex screws to the lower VESA 100 tapped holes on the rear panel of the product

> Comply with the permissible tightening torque of 2.6 Nm

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

or

- Attach self-adhesive rubber pads to the underside of the stand
- Route the cable from behind through the two supports of the stand and then through the lateral openings to the connections

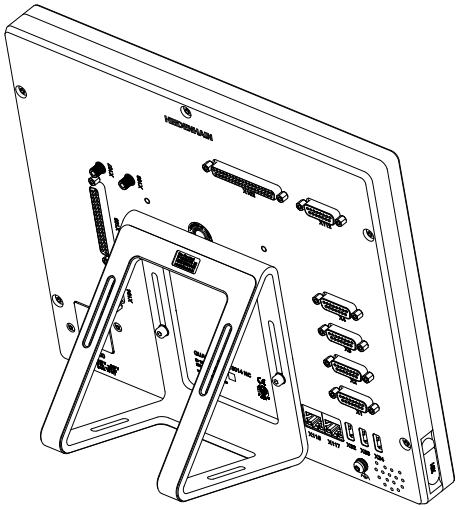


Figure 2: Product mounted on Duo-Pos stand

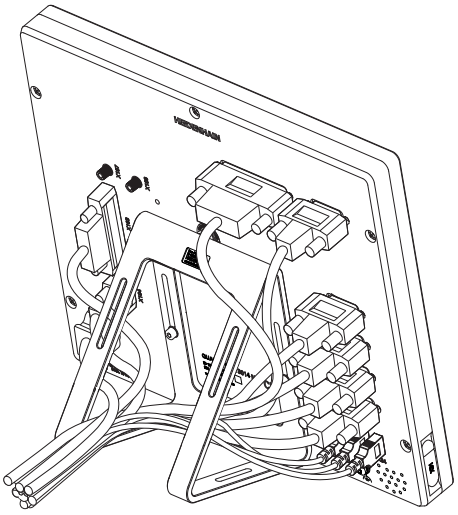


Figure 3: Cable routing on Duo-Pos stand

Further information: "Product dimensions with Duo-Pos stand", Page 515

4.2.2 Mounting on Multi-Pos stand

- Mount the stand with the supplied M4 x 8 ISO 14581 (black) countersunk head screws to the VESA 100 tapped holes on the rear panel of the product

> Comply with the permissible tightening torque of 2.6 Nm

- Using two M5 screws, you can also optionally screw the stand to a supporting surface from the bottom
- Set the desired tilt angle within the 90° tilt range
- To fix the stand: Tighten the T25 screw

> Comply with the tightening torque for screw T25
> - Recommended tightening torque: 5.0 Nm
> - Maximum permissible tightening torque: 15.0 Nm

- Route the cable from behind through the two supports of the stand and then through the lateral openings to the connections

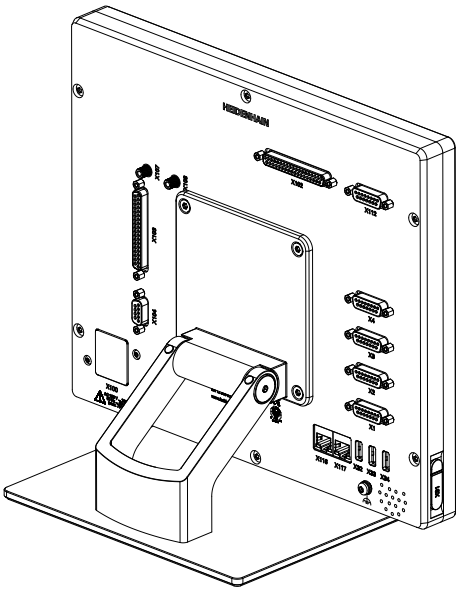


Figure 4: Product mounted on Multi-Pos stand

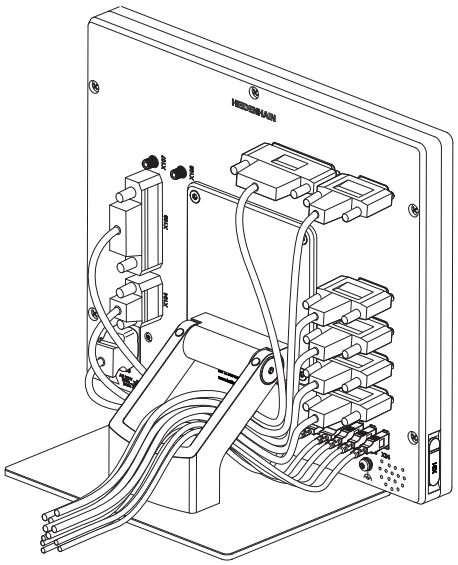


Figure 5: Cable routing on Multi-Pos stand

Further information: "Product dimensions with Multi-Pos stand", Page 515

4.2.3 Mounting on Multi-Pos holder

- Mount the holder with the supplied M4 x 8 ISO 14581 (black) countersunk head screws to the VESA 100 tapped holes on the rear panel of the product

> Comply with the permissible tightening torque of 2.6 Nm

- Mount the holder with the supplied M8 screw, the washers, the handle and the M8 hexagon nut to an arm
- Set the desired tilt angle within the 90° tilt range
- To fix the holder: Tighten the T25 screw

> Comply with the tightening torque for screw T25
> - Recommended tightening torque: 5.0 Nm
> - Maximum permissible tightening torque: 15.0 Nm

- Route the cable from behind through the two supports of the holder and then through the lateral openings to the connections

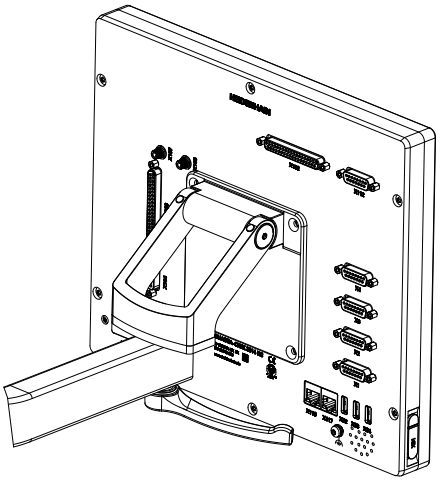


Figure 6: Product mounted on Multi-Pos holder

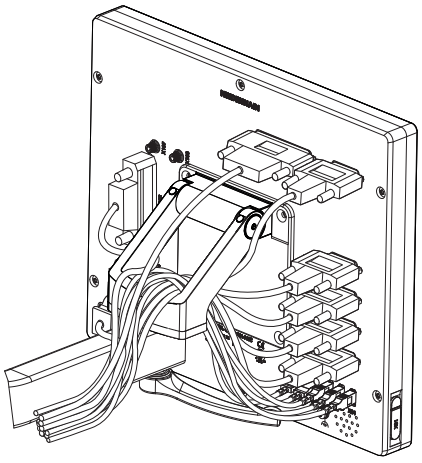


Figure 7: Cable routing on Multi-Pos holder

Further information: "Product dimensions with Multi-Pos holder", Page 516

5

Installation

5.1 Overview

This chapter describes the installation of the product. It contains information about the product's connections and instructions about how to correctly connect the peripheral devices.

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

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

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

NOTICE

Damage to the product due to incorrect wiring!

The incorrect wiring of inputs or outputs can cause damage to the unit or to peripheral devices.

- Keep the pin layouts and specifications of the unit in mind.
- Assign only pins or wires that will be used

Further information: "Specifications", Page 511

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!

If no dust protection caps are fitted to unused connections, 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 without dust protection caps

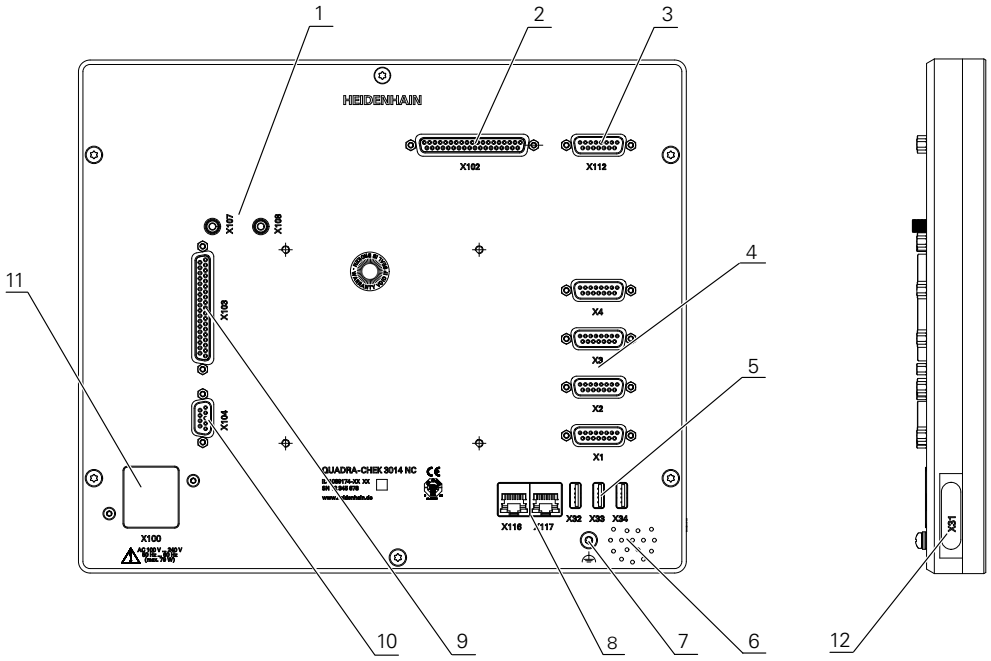


Figure 8: Rear panel

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 withTTL interface

5 USB connections

X32: USB 2.0 Hi-Speed connection (Type A) for digital cameras, printers, input devices or USB mass storage devices

X33 to X34: USB 2.0 Hi-Speed connection (Type A) for printers, input devices or USB mass storage devices

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 fiber-optic cable from the light source
X108: input for fiber-optic cable 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; 3 analog inputs, 10 outputs)

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

Left side panel

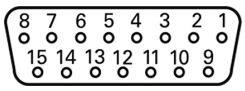
12 **X31** (below protective cover): USB 2.0 Hi-Speed connection (Type A) for printers, input devices or USB mass storage devices

5.4 Connecting encoders

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", Page 38
- Connect the encoder cables tightly to the respective connections
  Further information: "Product overview", Page 46
- If the cable connectors include mounting screws, do not overtighten them

Pin layout of X1, X2, X3, X4

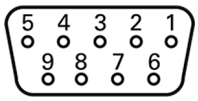
1 V_{PP}



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, X22, X23, X24

TTL



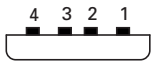
1	2	3	4	5	6	7	8	9
/	U_{a1}	$\overline{U_{a1}}$	U_{a2}	$\overline{U_{a2}}$	0 V	U_p	$\overline{U_{a0}}$	U_{a0}

5.5 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 38
- Connect the camera to the USB Type A port X32. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", Page 46

Pin layout of X32

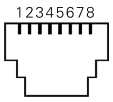


1	2	3	4
DC 5 V	Data (–)	Data (+)	GND

Connecting an Ethernet digital camera

- Remove and save the dust protection caps
- Route the cables based on the mounting variant
  Further information: "Assembly of the device", Page 38
- Connect the camera to the Ethernet port X117 using a standard CAT.5 cable. The cable connector must engage firmly in the port
  Further information: "Product overview", Page 46

Pin layout of X117



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

5.6 Connecting an optical edge detector

- Remove and save the dust protection caps
- Route the fiber-optic cable depending on the mounting variant
  Further information: "Assembly of the device", Page 38

> - Adhere to the manufacturer's specifications regarding the maximum bend radius of the fiber-optic cable

- Connect the fiber-optic cable of the light source (reference) to connection X107
- Connect the fiber-optic cable from the projection screen to connection X108

Further information: "Product overview", Page 46

Pin layout of X107, X108

1
In

5.7 Wiring switching inputs and outputs

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

Example: Safety Extra Low Voltage (SELV) exceeded

Further information: "Personnel qualification", Page 27

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.

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant

Further information: "Assembly of the device", Page 38

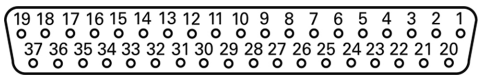
- Connect the connecting cables of the peripherals tightly to their connectors

Further information: "Product overview", Page 46

- If the cable connectors include mounting screws, do not overtighten them

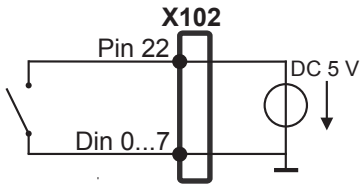
The digital or analog inputs and outputs must be assigned in the device settings of the respective switching function.

Pin layout of X102

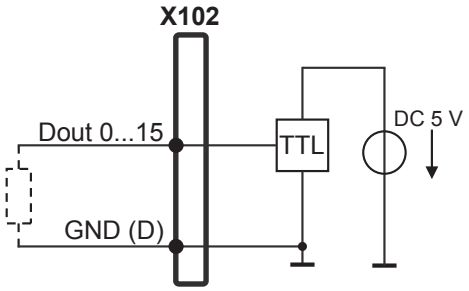


1	2	3	4	5	6	7	8
GND	Din 1	Din 3	Din 4	Din 6	GND	Dout 0	Dout 2
9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Dout 4	GND	Dout 6	Dout 8	Dout 10	GND	Dout 12	Dout 14
17	**18**	**19**	**20**	**21**	**22**	**23**	**24**
/	/	GND	Din 0	Din 2	5 V DC	Din 5	Din 7
25	**26**	**27**	**28**	**29**	**30**	**31**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

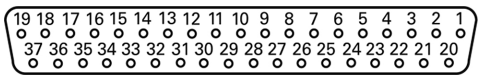
Digital inputs:



Digital outputs:



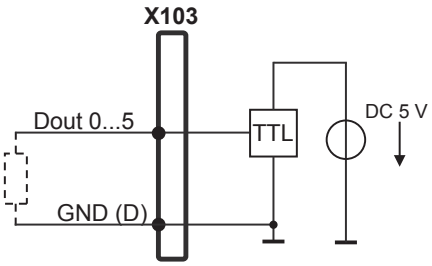
Pin layout of X103



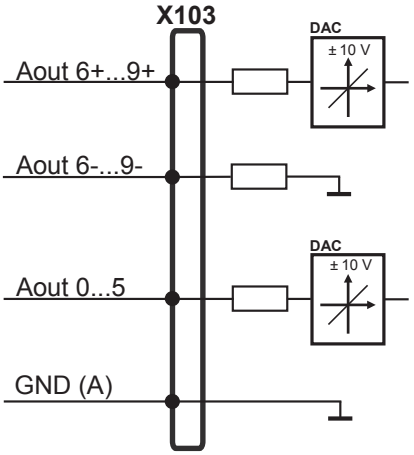
1	2	3	4	5	6	7	8
GND (D)	Din 1	Din 3	DC 5V (A)[1)]	Ain 1	GND (A)	Dout 0	Dout 2
9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Dout 4	GND (D)	Aout 0	Aout 2	Aout 4	GND (A)	Aout 6+	Aout 7+
17	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Aout 8+	Aout 9+	GND (A)	Din 0	Din 2	DC 5 V (D)	Ain 0	Ain 2
25	**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–			

1) Index ≥ A

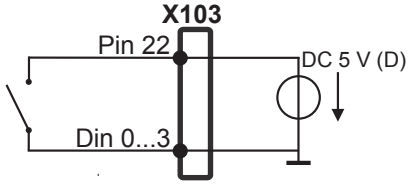
Digital outputs:



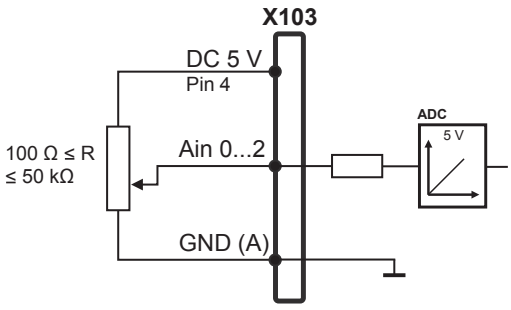
Analog outputs:



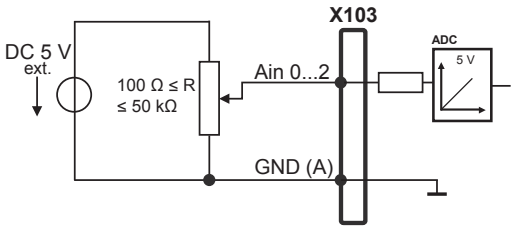
Digital inputs:



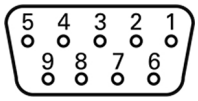
Analog inputs (Index ≥ A):



Analog inputs DC 5 V ext.:



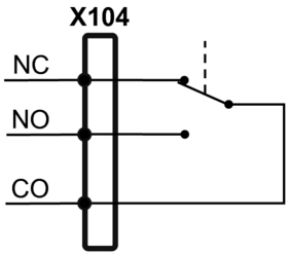
Pin layout of X104



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

Relay outputs:

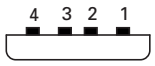


5.8 Connecting a printer

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 38
- Connect the USB printer to one of the Type A USB connections X31, X32, X33, X34. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", Page 46

Pin layout of X31, X32, X33, X34

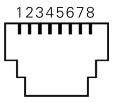


1	2	3	4
DC 5 V	Data (–)	Data (+)	GND

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 38
- 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 46

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 barcode scanner

The following barcode scanners can be connected to the product:
- COGNEX DataMan 8600 (with serial module for USB)

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", Page 38
- Connect the barcode scanner to one of the USB Type A ports X31, X32, X33, X34. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", Page 46

Pin layout X31, X32, X33, X34

1	2	3	4
DC 5 V	Data (–)	Data (+)	GND

5.10 Connecting input devices

- Remove and save the dust protection caps
- Route the cables depending on the mounting variant
  Further information: "Assembly of the device", Page 38
- Connect the USB mouse or USB keyboard to one of the USB Type A ports X31, X32, X33, X34. Make sure the USB cable connector is fully inserted
  Further information: "Product overview", Page 46

Pin layout X31, X32, X33, X34

1	2	3	4
DC 5 V	Data (–)	Data (+)	GND

5.11 Connecting a network peripheral

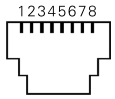
- Remove and save the dust protection caps
- Route the cables depending on the mounting variant

Further information: "Assembly of the device", Page 38

- 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 46

Pin layout of X116



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

5.12 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 due to wrong power cable!

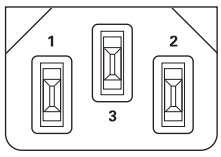
Use of a power cable that does not meet the requirements of the mounting location may cause a fire hazard.

- 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 46

Pin layout X100



1	2	3
L/N	N/L	⏚

6

Basic operation

6.1 Overview

This chapter describes the user interface, operating elements and basic functions of the QUADRA-CHEK 3000.

6.2 Using the touchscreen and input devices

6.2.1 Touchscreen and input devices

The operating elements in the product's user interface are operated via a touchscreen or a connected mouse (USB).

To enter data, you can use the screen keyboard of the touchscreen or a connected keyboard (USB).

NOTICE

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

Humidity or water can impair the proper functioning of the touchscreen.

- Protect the touchscreen from humidity or contact with water

  Further information: "Product data", Page 512

6.2.2 Gestures and mouse actions

To activate, switch, or move the operating elements of the user interface, you can use the touchscreen of the unit or a mouse. Gestures are used to operate the touchscreen and the mouse.

The gestures for operating the touchscreen may differ from the gestures for operating the mouse.

If the gestures for operating the touchscreen differ from those for operating the mouse, then these instructions describe both operating options as alternative actions.

The alternative actions for operating the touchscreen or the mouse are identified by the following symbols:

Operation using the touchscreen

Operation using the mouse

The following overview describes the different gestures for operating the touchscreen and the mouse:

Tapping	
	means touching the screen briefly with your finger tip
	means pressing the left mouse button once

The actions initiated by tapping include

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

Holding	
	means touching the screen and holding your finger(s) on it for a few seconds
	means pressing the left mouse button once and holding it down

The actions initiated by holding include

- Quickly change the values in input fields with plus and minus buttons

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
	means pressing the left mouse button once and holding it down while moving the mouse when at least the starting point of the motion is defined

The actions initiated by dragging include

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

Two-finger drag	
	means moving two fingers in parallel over the touchscreen when at least the starting point of motion is defined
	means pressing the right mouse button once and holding it down while moving the mouse when at least the starting point of the motion is defined

Two-finger dragging initiates the following action:

- In the **Measure** menu, move the image section within the field of view of a camera in the workspace
  Further information: "Moving an image section", Page 89

6.3 General operating elements and functions

The operating elements described below are available for configuration and operating the product via the touchscreen or input devices.

6.3.1 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.

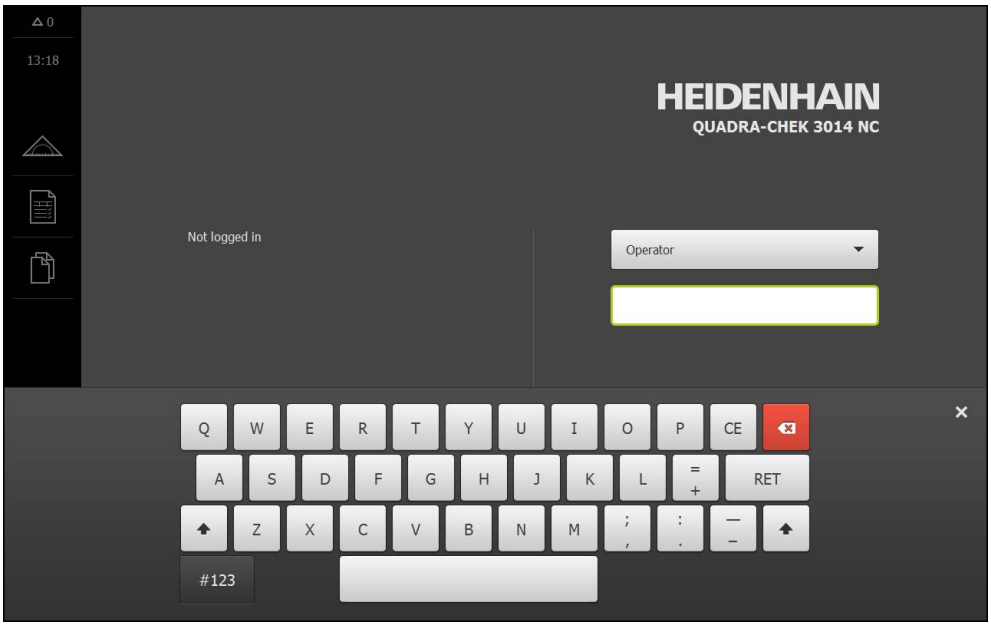


Figure 9: Screen keyboard

- ▶ 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 in this case
- ▶ 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

Slide switch

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

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

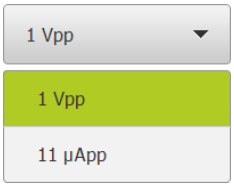
Slider

With the slider, you can continuously adjust values.

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

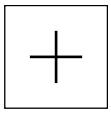
Undo

With this button, you can undo the last action.

Processes that have already been concluded cannot be undone.

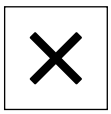
- ▶ Tap **Undo**
- > The last action is undone

Add



- ▶ 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

Back

- ▶ Tap **Back** to return to the higher level in the menu structure

6.4 QUADRA-CHEK 3000 – switch-on and switch-off

6.4.1 Switching on QUADRA-CHEK 3000

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 125

- ▶ 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 and the last user who logged in was of the **Operator** type, the user interface opens with the **Measure** menu
- > If automatic user login is not active, the **User login** menu is displayed
  Further information: "User login and logout", Page 70

6.4.2 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

6.4.3 Switching off QUADRA-CHEK 3000

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 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: **You can switch off the device now.**
- Turn the QUADRA-CHEK 3000 off at the power switch

6.5 User login and logout

In the **User login** menu, you can log in and out of the product as a user.

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.

> The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

6.5.1 User login

- Tap **User login** in the main menu
- In the drop-down list, select the **OEM** user
- Tap the **Password** input field
- Enter the user's password

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

- Confirm entry with **RET**

- Tap **Log in**

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

6.5.2 User logout

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

- Tap **Log out**

> The user is logged out

> All functions of the main menu are inactive, except for **Switch off**

> The product can only be used again after a user has logged in

6.6 Setting the language

The default language for the user interface is English. You can switch the user interface to the desired 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 the **Language** drop-down list
- Select the flag for the desired language in the **Language** drop-down list
- > The user interface is displayed in the selected language

6.7 Performing a reference mark search after startup

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

Further information: "Reference marks (Encoder)", Page 485

If the reference mark search is active on the product, then a wizard will ask you to traverse the reference marks of the axes.

- After logging in, follow the instructions of the wizard
- > upon successful completion of the reference mark search, the color of the reference symbol changes

Further information: "Activating the reference mark search", Page 136

6.8 User interface

6.8.1 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.

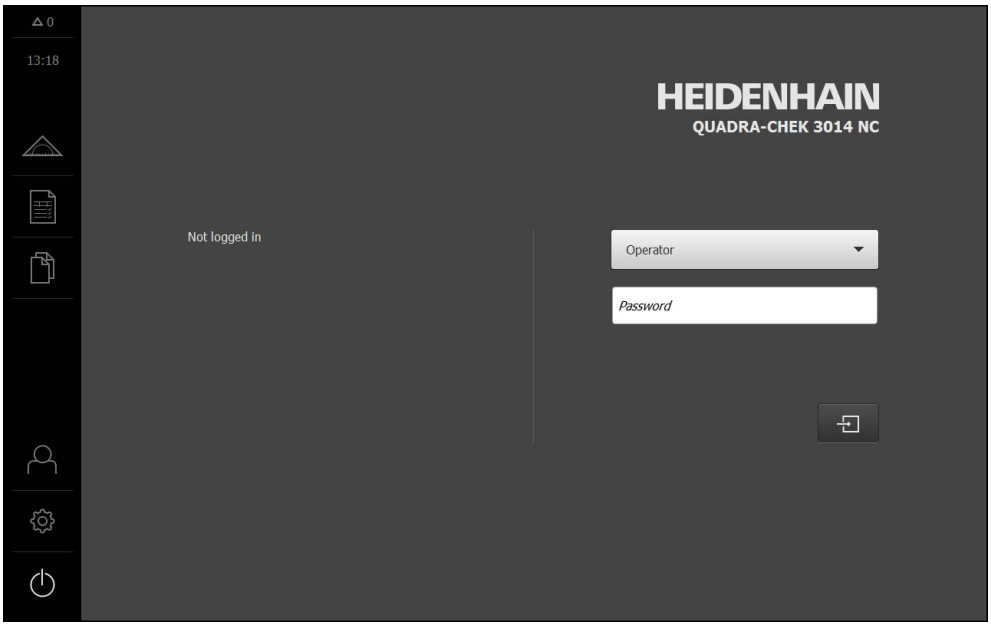


Figure 10: User interface in factory default setting of the device

User interface after startup

If automatic user login is active and the last user who logged in was of the **Operator** type, the **Measure** menu with the workspace and the Inspector is displayed after the product has started up.

Further information: "Measure menu", Page 75

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

Further information: "User login menu", Page 84

6.8.2 Main menu of the user interface

User interface with QUADRA-CHEK 3000 VED software option

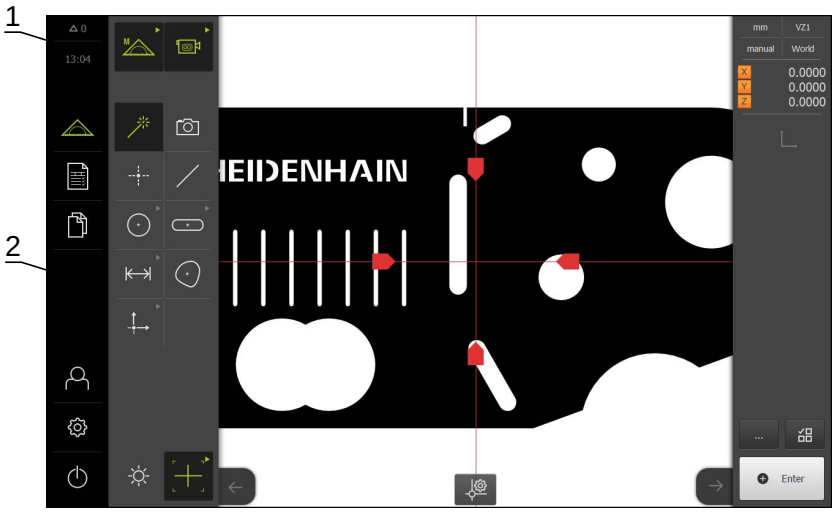


Figure 11: User interface with QUADRA-CHEK 3000 VED software option

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** Display of an overview of all messages as well as the number of messages that have not been closed **Further information:** "Messages", Page 121
	**Measure** Manual measurement, construction or definition of features by using measuring programs and predefined geometries **Further information:** "Measure menu", Page 75
	**Measurement report** Creation and management of measurement reports by using templates **Further information:** "Measurement report menu", Page 81
	**File management** Management of the files that are available on the product **Further information:** "File management menu", Page 83
	**User login** Login and logout of the user **Further information:** "User login menu", Page 84

Operating element	Function
	**Settings** Settings of the product, such as setting up users, configuring sensors or updating the firmware **Further information:** "Settings menu", Page 85
	**Switch-off** Shutdown of the operating system or activation of energy-saving mode **Further information:** "Switch off menu", Page 86

6.8.3 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

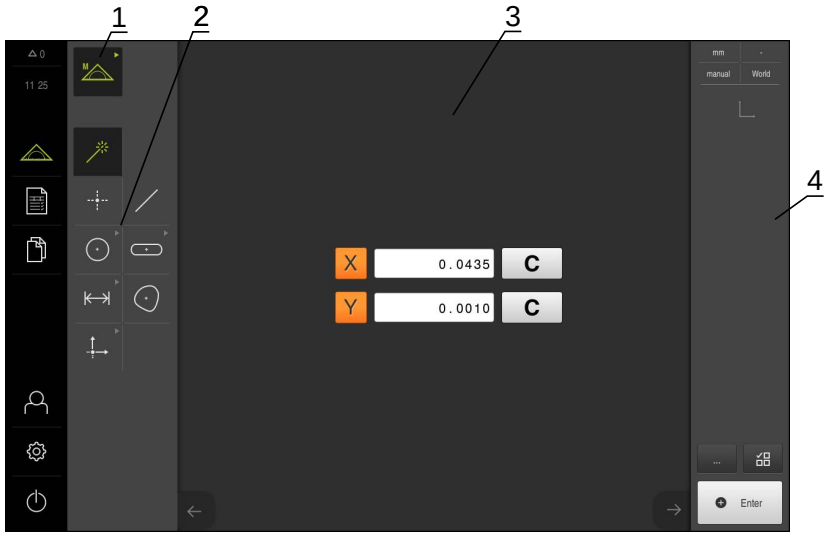


Figure 12: **Measure** menu without software option

1 The function palette provides functions for manual measuring 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 view (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

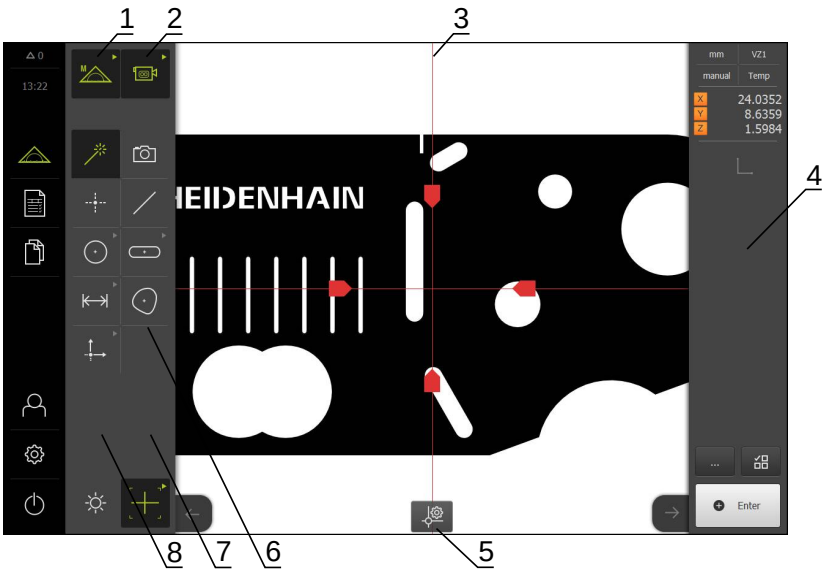


Figure 13: **Measure** menu with **QUADRA-CHEK 3000 VED software option**

1 The function palette includes the functions for manual measuring 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 contains the quick access menu, the position preview, the features preview, and the feature list or the 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 VED software option is active.

Measure menu with QUADRA-CHEK 3000 OED software option

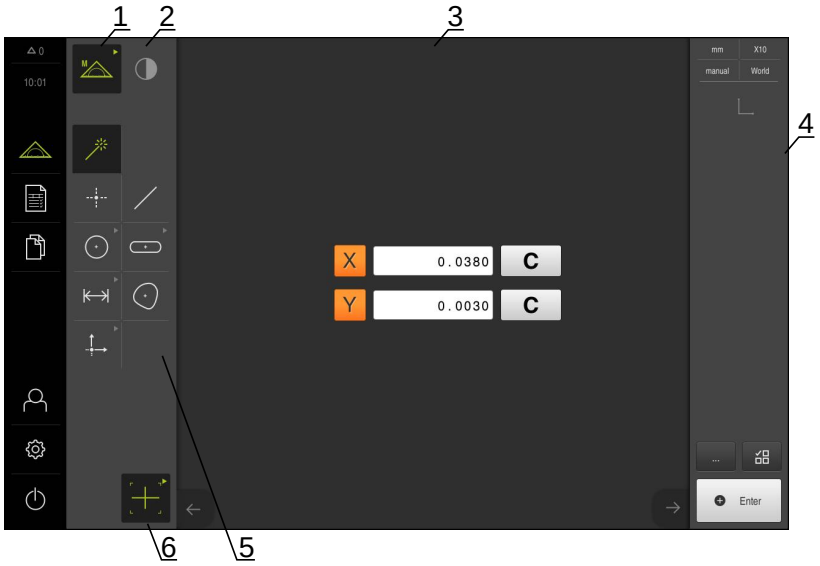


Figure 14: **Measure** menu with QUADRA-CHEK 3000 OED software option

1 The function palette includes the functions for manual measuring and defining. The selected function is displayed as an active operating element.
2 The sensor palette contains the optional sensors (e.g., OED). It is only visible if the software option is active.
3 The workspace displays, among other things, the position display or the input area for constructing and defining elements.
4 The Inspector contains the quick access menu, the position preview, the features preview, and the feature list or the program step list. The feature list contains the features that have been measured, constructed or defined.
5 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.
6 The tool palette provides the measuring tools required for conducting the selected measurement.

Operating elements of the function palette

Manual measuring	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)	Optical edge detection (OED)
	

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

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 available only if the VED sensor is active.

Operating elements of the VED 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 if video edge detection is activated and e.g. if the live image is in the workspace.

Crosshair	Single edge	Circle
		

Buffer	Contour	DXF template
		

Operating elements of the OED tool palette

The operating elements of the tool palette are only available if a software option is active. They are only displayed in the manual measuring function if optical edge detection is activated.

Crosshair	OED	Auto OED
		

6.8.4 Measurement report menu

Activation

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

Short description

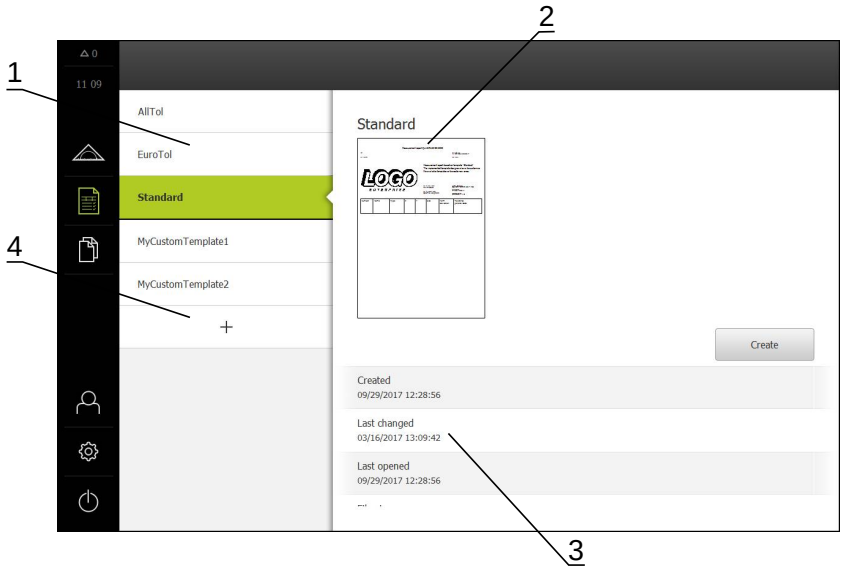


Figure 15: **Measurement report** menu

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

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 reports", Page 399

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.

6.8.5 File management menu

Activation

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

Short description

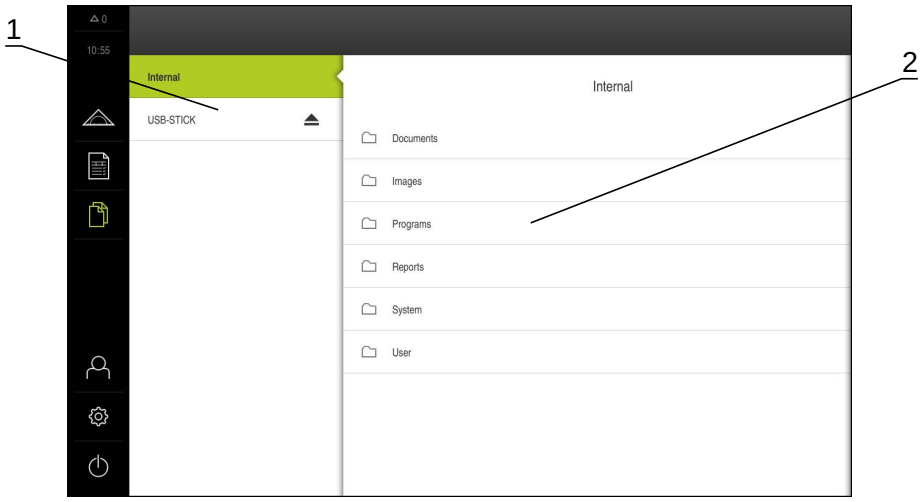


Figure 16: **File management** menu

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.

Any connected USB mass storage devices (FAT32 format) or available network drives are displayed in the list of storage locations. The USB mass storage devices and the network drives are displayed with their names or drive designations.

Further information: "File management", Page 421

6.8.6 User login menu

Activation

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

> The user interface for user login and logout is displayed

Short description

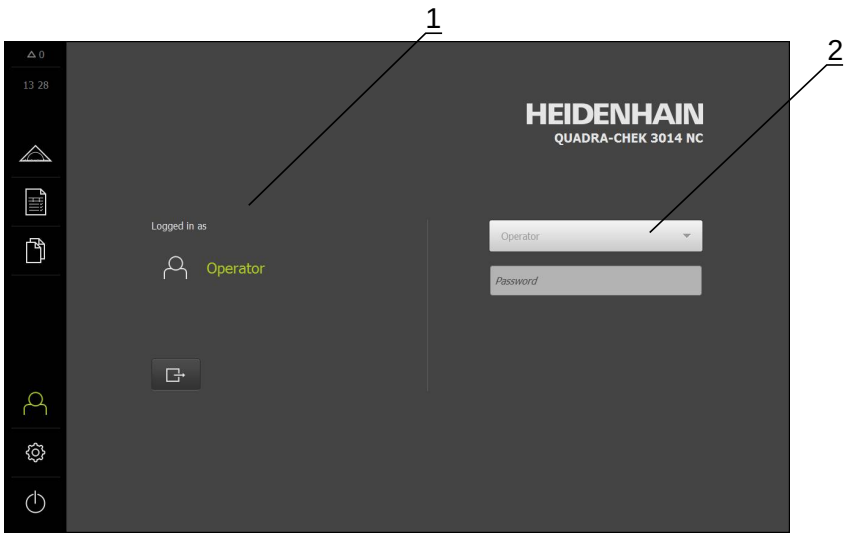


Figure 17: **User login** menu

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 70

6.8.7 Settings menu

Activation

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

Short description

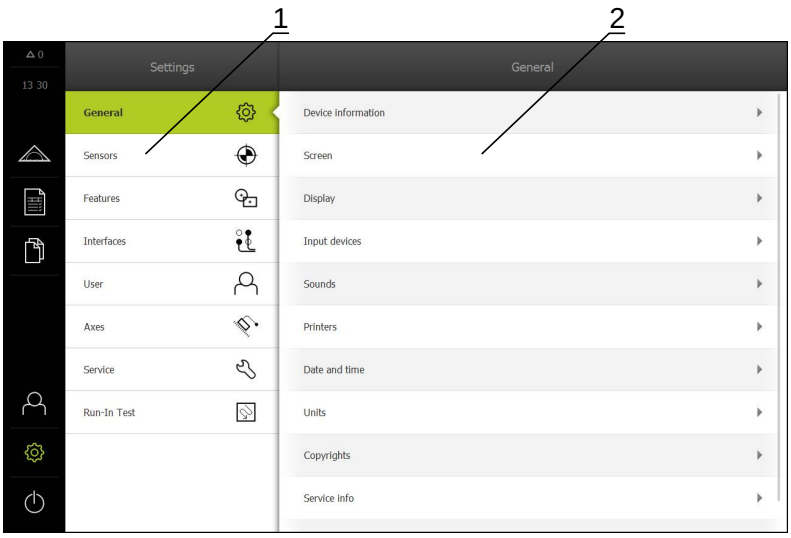


Figure 18: **Settings** menu

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 431

The product provides various authorization levels that grant the user full or restricted access to management and operation functionality.

6.8.8 Switch off menu

Activation

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

Short description

The **Switch off** menu provides the following options:

Operating element	Function
	**Shut down** Shuts down the operating system
	**Energy saving mode** Switches the screen off and puts the operating system into energy-saving mode
	**Cleaning mode** Switches the screen off; the operating system continues unchanged

Further information: "QUADRA-CHEK 3000 – switch-on and switch-off", Page 68

Further information: "Display reinigen", Page 495

6.9 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

6.9.1 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**

6.9.2 Operating elements in the workspace

The operating elements of the manual measuring function if an optical sensor is active

Measuring tool settings	Edge detection modes
	

Operating elements of the manual measuring function for modifying the features view

Display annotations	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.

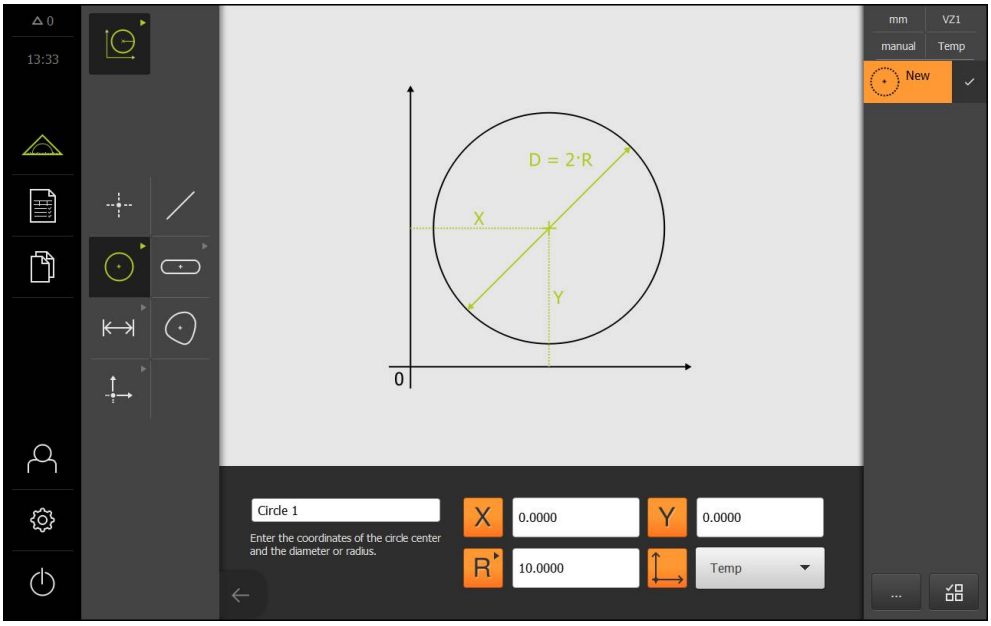


Figure 19: Operating elements of the definition function for the geometry circle

6.9.3 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.

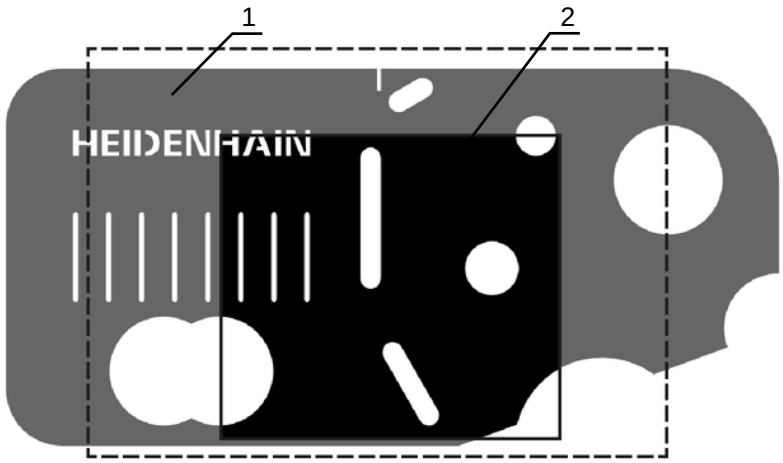


Figure 20: Field of view of the camera and detail of the live image

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
- ▶ In the workspace, drag the image section with the right mouse button to the desired position

> The image section is moved within the camera's field of view

6.10 Working in the features view

The features view is only available in the **measuring** function. In the features view, you can select and deselect features. You can construct a new feature from the selected features. You can add annotations to one or more features.

In the **Measure** menu:

- ▶ Call the features view: Tap the **Features preview** in the Inspector
- > The features view is displayed in the workspace
- > The current content of the workspace switches to the Inspector
- ▶ Deselect or select features: Tap the features in succession
- > The selected features are highlighted in green
- > The current selection is suggested as new feature in the feature list
- ▶ Confirm the addition of the new geometry: Tap **Finish** in the new feature

6.10.1 Editing annotations

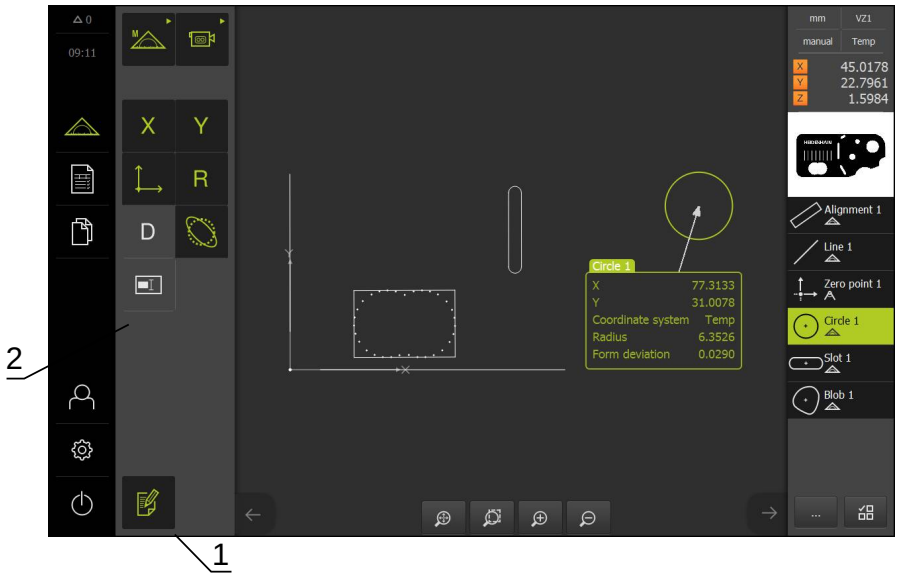


Figure 21: Feature with annotations in the features view

1 The **Edit annotations** operating element
2 Operating elements for adding annotations to one or more features

The operating elements for adding annotations are displayed if the edit mode for annotations is activated and if at least one feature is selected in the feature list. The available operating elements depend on the geometry type of the selected feature.

Edit annotations
 Operating element activates the edit mode for annotations

Coordinate value X	Coordinate value Y	Coordinate system	Radius	Diameter
				
Angle	**Starting angle**	**End angle**	**Length**	**Width**
				
Surface	**Circumference**	**Form deviation**	**Note**	
				

6.11 Using the Inspector

The Inspector is only available in the Measure menu.

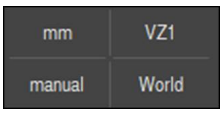
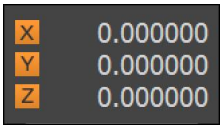
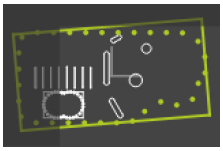
Activation

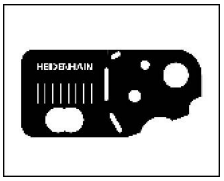
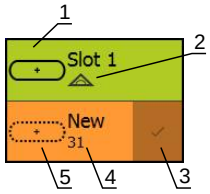
- ▶ Tap **Measure** in the main menu
- > The user interface for measuring, constructing and defining is displayed

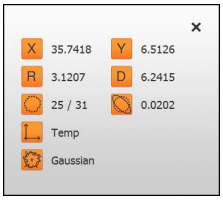
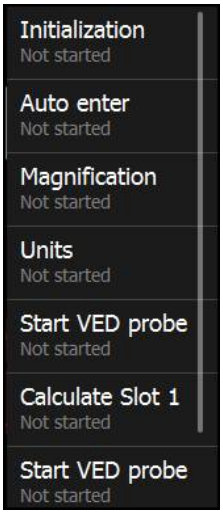
6.11.1 Operating elements of the Inspector

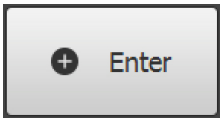
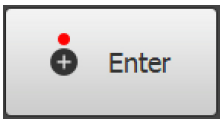
The Inspector contains the following areas and operating elements:

- 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 of measurement 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 225 ▶ 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
	**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

Operating element	Short description
	**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 **Symbol** / **Meaning**  Measured feature  Constructed feature  Defined 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 display the measured values and adjust the tolerances, drag a feature into the workspace > A detail view with the **Overview** and **Tolerance** tabs now opens in the workspace. **Further information:** "Measurement evaluation", Page 350 **Further information:** "Defining tolerances", Page 358 ▶ To select or deselect features, tap the features in succession > The selected features are highlighted in green ▶ To delete a feature, drag the feature to the right out of the Inspector

Operating element	Short description
	**Measurement result preview** After completion of a measurement process, the measurement result preview appears in the workspace and displays information about the measured feature. For every geometry type, it is possible to define which parameters are displayed in the measurement result preview. The respective geometry type determines which parameters are available. **Further information:** "Configuring the measurement result preview", Page 216
	**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 381
	**Miscellaneous functions** The miscellaneous functions contain the following functions: ■ Switching the display between feature list and program step list ■ Creating, saving, and opening a program ■ Calling the program control in the workspace ■ Opening and saving a coordinate system ■ Deleting selected features or all features from the feature list
	**Feature selection** Multiple selection of features of the same geometry type ▶ Tap **Feature selection** ▶ To select all of the features of a geometry type in the feature list, tap the desired geometry type. ▶ Confirm with **OK** > The selected features are highlighted in green

Operating element	Short description
	**Enter** If automatic measuring point acquisition is deactivated, then measuring points will be acquired manually. If automatic measuring point acquisition is active, then a red dot will be shown in the operating element. If automatic measuring point acquisition is active, then the measuring points will be acquired after the set timeout expires.
	

6.11.2 Adjusting settings in the quick access menu

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

- Coordinate system used
- Automatic generation of a coordinate system
- Selection of magnification
- 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**)
- Type of measuring point acquisition (**Auto enter**)
- Timeout for automatic measuring point acquisition (**Auto enter timeout in ms**)
- Display of contrast bar
- Orientation of contrast bar (**Horizontal** or **Vertical**)

Selecting the coordinate system

Depending on the measuring task, you can set the coordinate system used in the Inspector's quick access menu. As the standard value, the coordinate system of the measuring plate with the designation **World** is used. You can define a new coordinate system by defining a new zero point; this can be done automatically with the option **Create coordinate system automatically**.

- ▶ Tap the **Quick access menu** in the Inspector
- ▶ Select the desired **Coordinate system**
- ▶ Activate **Create coordinate system automatically** with the **ON/OFF** sliding switch

- ▶ 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 or OED optics in the quick access menu. The number of available magnification levels depends on the configuration of the measuring machine.

The optical magnification must match the magnification that is set in the product.

When measuring with an OED sensor/VED sensor: 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 optics
- If required, adjust the respective magnification and the focus of the optics
- Tap **Close** to close the quick access menu

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

When measuring with a VED sensor: 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 166

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**

Select the type of 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**

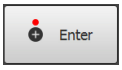
- Tap **Close** to close the quick access menu

> The positions are displayed in the **Position preview** according to the selected coordinate system

Setting 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** (150 ms to 10 000 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 manual or auto status is indicated in the **quick access menu**

Show contrast bar

If you show the **contrast bar** slider in the workspace, this enables stepless adjustment of the contrast threshold.

- Tap the **Quick access menu** in the Inspector
- Show the contrast bar with the **ON/OFF** sliding switch
- Select the desired orientation in the **Orientation of contrast bar** field

> **Horizontal**: The contrast bar is shown in the workspace with horizontal orientation

> **Vertical**: The contrast bar is shown in the workspace with vertical orientation

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

6.11.3 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 381

- 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, saving and opening a measuring program

With the miscellaneous functions of the Inspector, you can:

- Create a new measuring program
- Save acquired features as a measuring program
- Open a saved measuring program
- Show the program control

Further information: "Programming", Page 381

...

- ▶ 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
- > The miscellaneous functions are closed
- ▶ To save acquired features as a measuring program, tap **Save as**
- ▶ Select the storage location in the dialog, e.g. **Internal/Programs**
- ▶ Tap the input field
- ▶ Enter a name for the measuring program
- ▶ Confirm entry with **RET**
- ▶ Tap **Save as**
- > The measuring program is saved
- > The miscellaneous functions are closed

...

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ To open a measuring program, tap **Open**

> If you open a measuring program, then the current measuring program will be closed. Unsaved changes to the current measuring program are thereby lost.
>
> ▶ Save changes made to the current measuring program before opening a measuring program
>
> **Further information:** "Saving a measuring program", Page 272

- ▶ Confirm the note with **OK**
- > The **Internal/Programs** folder is now displayed
- ▶ Navigate to storage location of the measuring program
- ▶ Tap the name of the measuring program
- ▶ Tap **Select**
- > 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
- ▶ To display the program control in the workspace, tap **Control**
- > The program control is displayed

Saving and opening a coordinate system

With the miscellaneous functions of the Inspector, you can:

- Save the currently used coordinate system
- Open a saved coordinate system

Further information: "Changing the coordinate system", Page 280

- ▶ Defining and constructing a new reference feature
- > A new coordinate system with the designation **Temp** is created and preselected
- ▶ Drag the new reference feature to the detail view
- ▶ Enter a new name for the feature in the detail view

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ To save the current coordinate system, tap **Save as**
- ▶ Select the storage location in the dialog, e.g. **Internal/Programs**
- ▶ Tap the input field
- ▶ Enter a name for the coordinate system
- ▶ Confirm the entry with **RET**
- ▶ Tap **Save as**
- > The coordinate system is saved
- > The miscellaneous functions are closed

- ▶ Tap **Miscellaneous functions** in the Inspector
- ▶ To open a saved coordinate system, tap **Open**
- ▶ Select the storage location in the dialog, e.g. **Internal/Programs**
- ▶ Tap the desired file
- ▶ Confirm the entry with **Select**
- > The coordinate system is loaded and is active
- > 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**

> 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

6.12 Using measuring tools

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

In the case of a VED optical sensor, if the live image is in the workspace

In the case of an OED optical sensor, if the position display or the features view 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 applicable, tap the **live image preview**, **position preview** or **features view** (OED) in the Inspector

> The live image, position display, or the features view is displayed in the workspace.

- Tap **Tool palette**

> The measuring tools of the tool palette are displayed

6.12.1 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.

VED measuring tools

Symbol	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. on 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
	DXF template	■ Visual comparison of contours between template and measured object ■ No automatic acquisition of light-to-dark transitions ■ Manual and automatic orientation and positioning adjustable

Further information: "Using VED measuring tools", Page 108

OED measuring tools

Symbol	Measuring tool	Functions and characteristics
	Crosshair	■ Manual acquisition of single measuring points ■ No automatic acquisition of light-to-dark transitions
	OED	■ Active measuring tool ■ Acquisition of light-to-dark transitions ■ Buffering of a single measuring point (manual confirmation required) If the OED sensor traverses an edge, a measuring point is buffered in the clipboard. If the OED sensor traverses a further edge, the buffered measuring point is overwritten. By tapping **Enter**, the previously buffered measuring point is added to the feature calculation.
	Auto OED	■ Active measuring tool ■ Automatic acquisition of measuring points, e.g. on circles and circular arcs ■ Acquisition of light-to-dark transitions If the OED sensor traverses an edge, a measuring point is automatically acquired and added to the feature calculation.

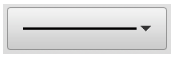
6.12.2 Setting the VED measuring tool

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 **Measuring tool settings** at the bottom of the workspace

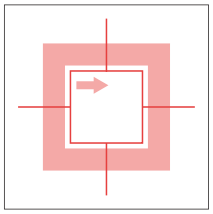
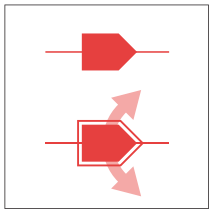
- > The **Measuring tool settings** dialog for the selected measuring tool opens
- > The available parameters depend on the selected measuring tool
- ▶ Adjust the parameter
- ▶ Tap **Close** to close the Settings dialog

- > The selected parameters are saved for the measuring tool

Operating element	Parameter	Function
	**Expanded 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 mode can be used for alignment and for fine positioning with motion reduction. **Buffer:** The search range is extended with the crosshairs. The expanded 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
	**Lock position**	The measuring tool is fixed at the center of the workspace. The object of measurement must be positioned manually in the search range.
	**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 mode.
	**Maximum number of points to be measured**	Function of the **Circle** and **Buffer** measuring tools

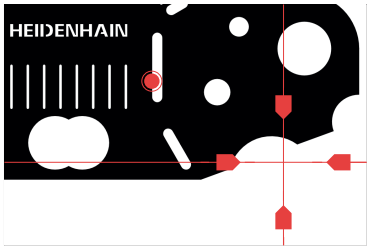
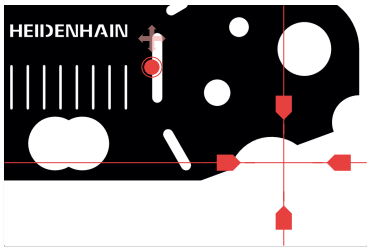
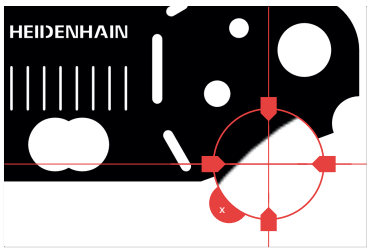
Operating element	Parameter	Function
		Maximum number of measuring points acquired with one entry (**Enter**).
	**Distance of points to be measured**	Function of the **Contour** measuring tool Distance between the measuring points that are captured with one entry (**Enter**).
	**Number of points to be 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 that are captured with one entry (**Enter**).
	**Selection of the DXF template**	Function of the **DXF template** measuring tool Selection of the DXF file compared with the object of measurement. The selected path is indicated via the selection button. The DXF file must contain no constructions consisting of splines.
	**Unit for DXF file**	Function of the **DXF template** measuring tool Setting of the unit of display for the **DXF template**. Millimeters and inches are available.
	**Align pattern**	Function of the **DXF template** measuring tool The template is aligned to the constructed zero point.
	**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. **Crosshair:** Size and position are reset **Single Edge:** Size and position are reset **Circle:** Size and position are reset **Buffer:** Size and position are reset **Contour:** Size and position are reset **DXF template:** Position is reset

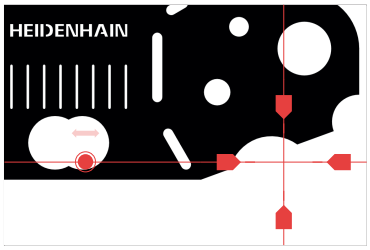
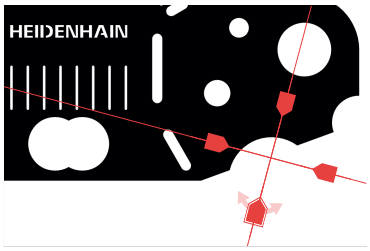
6.12.3 Using VED measuring tools

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.

Crosshairs

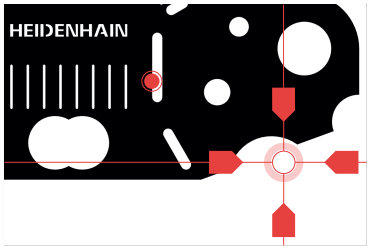
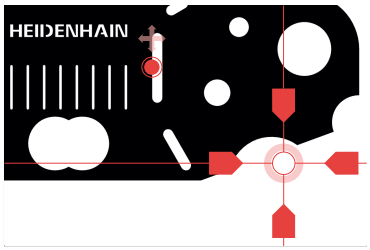
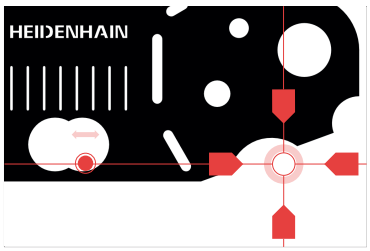
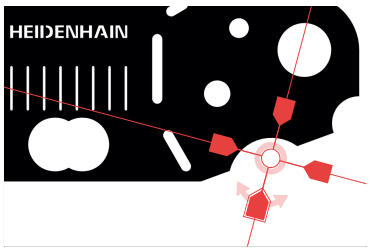
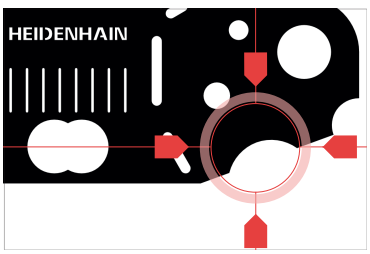
The measuring tool can only be displaced or moved if the **Lock position** option is not activated in the settings of the measuring tool.

Display	Activity
	**Relocating the crosshairs** ▶ Tap the desired position in the live image ▶ Double-click the desired position in the live image with the left mouse button > 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
	**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 ▶ Double-click the live image with the right mouse button ▶ 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.

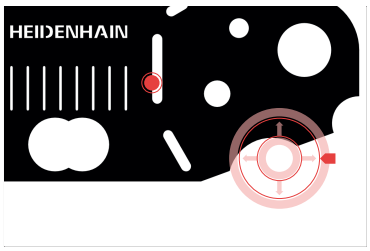
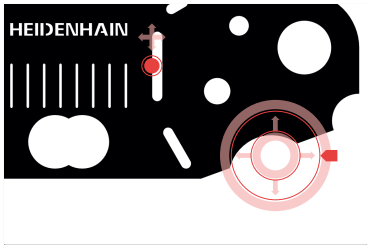
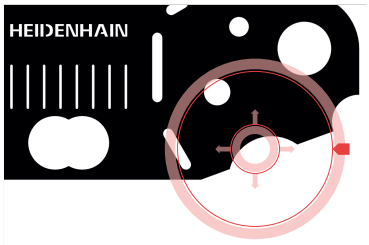
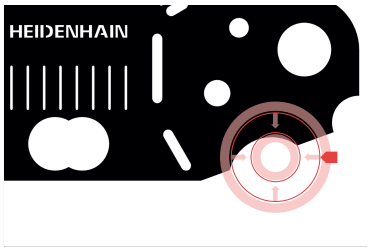
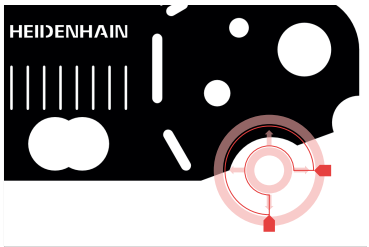
Display	Activity
	**Moving the crosshairs in an axis** ▶ Touch an axis of the crosshairs and drag the crosshairs along the axis to the desired position > The crosshairs move with motion reduction
	**Aligning the crosshairs** ▶ Touch a handle of the crosshairs and drag the crosshairs to the desired orientation

Single edge

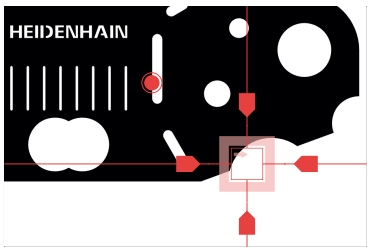
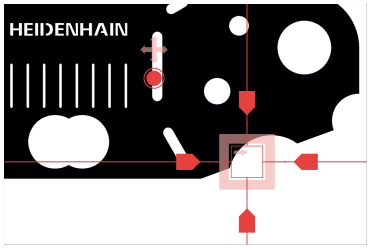
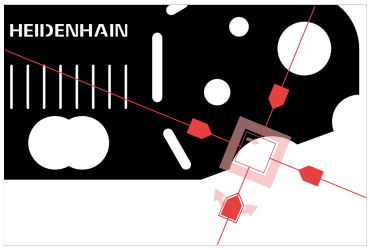
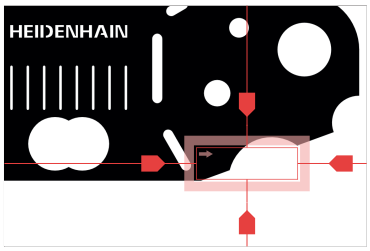
The measuring tool can only be displaced or moved if the **Lock position** option is not activated in the settings of the measuring tool.

Display	Activity
	**Relocating the single edge** ▶ Tap the desired position in the live image ▶ Double-click the desired position in the live image with the left mouse button > 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
	**Resizing the search range** ▶ Touch the edge of the search range and drag it to the desired size

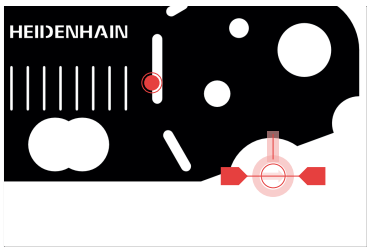
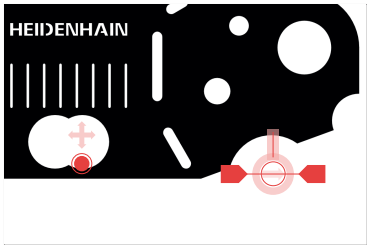
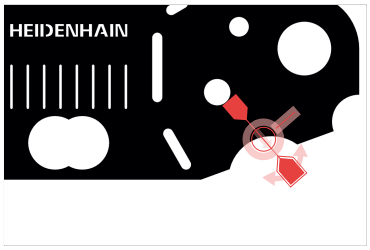
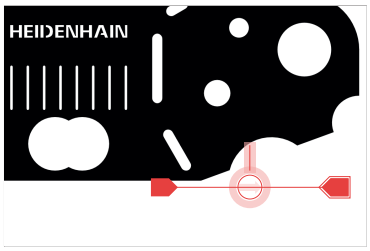
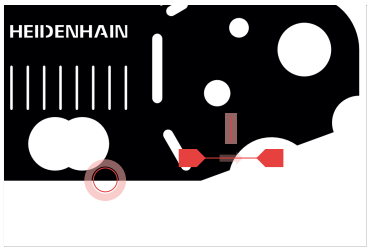
Circle

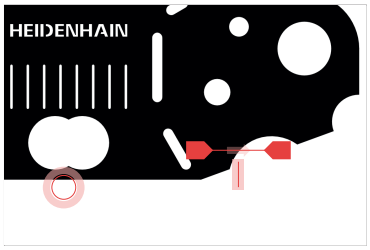
Display	Activity
	**Relocating the circle**  ▶ Tap the desired position in the live image  ▶ Double-click the desired position in the live image with the left mouse button > The circle jumps to the selected position
	**Shifting the circle** ▶ Touch a place in the live image and drag the circle to the 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 capture 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

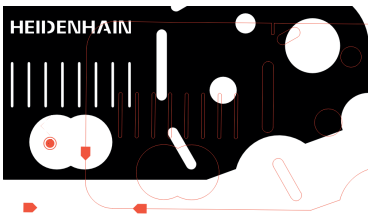
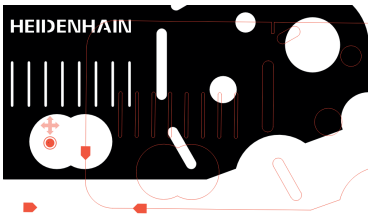
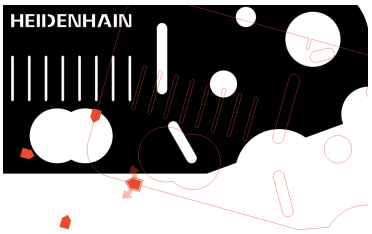
Display	Activity
	**Relocating the buffer**  ▶ Tap the desired position in the live image  ▶ Double-click the desired position in the live image with the left mouse button > The buffer jumps to the selected position
	**Shifting the buffer** ▶ Touch a place in the live image and drag the buffer to the 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  ▶ Double-click the desired position in the live image with the left mouse button > 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
	**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

Display	Activity
	**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

DXF template

Display	Activity
	**Displacing the template**  ▶ Tap the desired position in the live image  ▶ Double-click the desired position in the live image with the left mouse button > The template jumps to the selected position
	**Moving the template** ▶ Touch a place in the live image and drag the template to the desired position
	**Aligning the template** ▶ Touch a handle of the template and drag the template to the desired orientation

6.13 Adjusting the lighting

> The lighting palette is only available with active video edge detection. The selection and the range of functions depend on the device settings and the connected light unit.

You can connect three 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 above the measured object, with four segments that can be switched individually
- Laser pointer: Point light above the measured object that can be used as a positioning aid
- Coaxial light: Light source whose light is fed into the optical beam path from the side

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

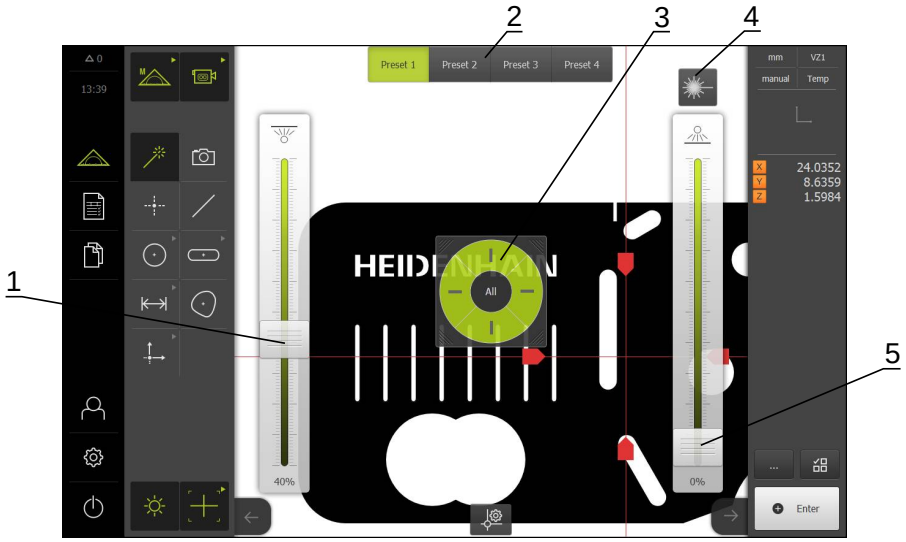
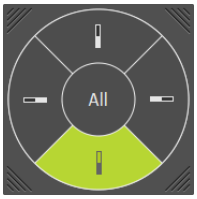


Figure 22: Operating elements of the **lighting palette**

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

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

Operating element	Short description
	**Preset** toggle switch for saving and recalling lighting settings. The active preset is displayed in green. Any changes will automatically be saved to the active preset.
	**Transmitted light** slider for setting the light intensity for the transmitted light.

Operating element	Short description
	**Segment switch** for selecting the reflected-light segments. To select all segments, use **All**. The selected segments are displayed in green. The function varies depending on the type of lighting selected: ■ **A transmitted light + 4 x AD reflected light**: Reflected-light segments are activated or deactivated by selecting them. The slider controls the light intensity for all reflected-light segments, regardless of the selection. ■ **A trans.light + 4 x A refl.light + D laser pointer**: The slider controls only the light intensity for the selected reflected-light segments. ⓘ If **All** is used to select all segments, the slider is reset to the minimum value. The light intensity can now simultaneously be controlled for all segments. ■ **AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time**: Reflected-light segments are activated or deactivated by selecting them. The slider controls the light intensity for all reflected-light segments, regardless of the selection.
	**Reflected light** slider for setting the light intensity for the reflected-light segments.
	**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.
	**Coaxial light** slider for setting the light intensity for the coaxial light.
	Camera exposure time **Camera exposure time** slider for setting the exposure time for the camera.

Further information: "Adjusting the lighting", Page 160

6.14 Modifying the contrast threshold

> The **Contrast bar** slider is only displayed if a VED sensor is activated and if an active VED measuring tool is selected.
>
> **Further information:** "Contrast settings", Page 455

The **Contrast bar** slider enables the contrast threshold to be continuously modified.

Figure 23: **Measure** menu with **Contrast bar** slider

1 Slider

Operating element	Short description
	**Contrast bar** slider for continuous modification of the contrast threshold If you change the position of the measuring tool the minimum and maximum contrast are redetermined. The determined contrast is shown in green if the slider is within the range. The determined contrast is shown in gray if the slider is outside the range. Measuring point acquisition is only possible if you position the slider in the green range.

Further information: "Adjusting the contrast settings", Page 165

6.15 Messages and audio feedback

6.15.1 Messages

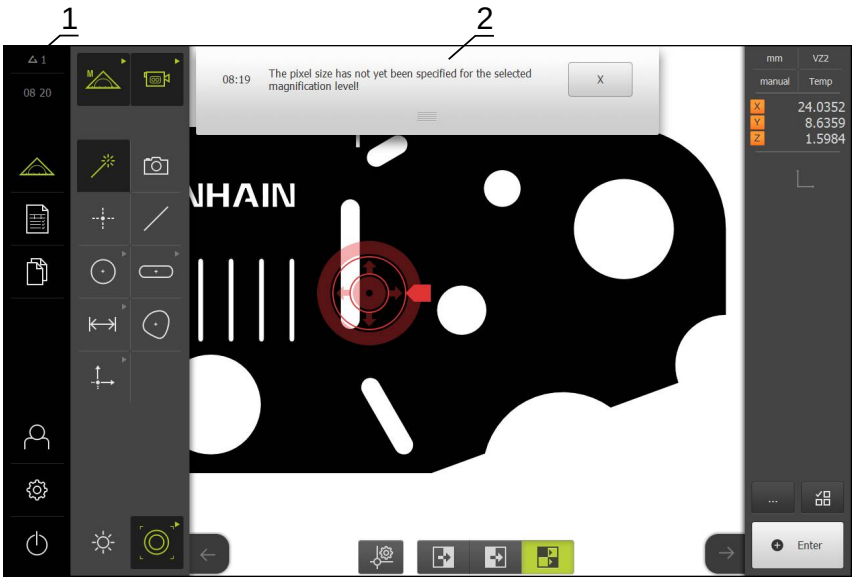


Figure 24: Display of messages in the workspace

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

6.15.2 Wizard

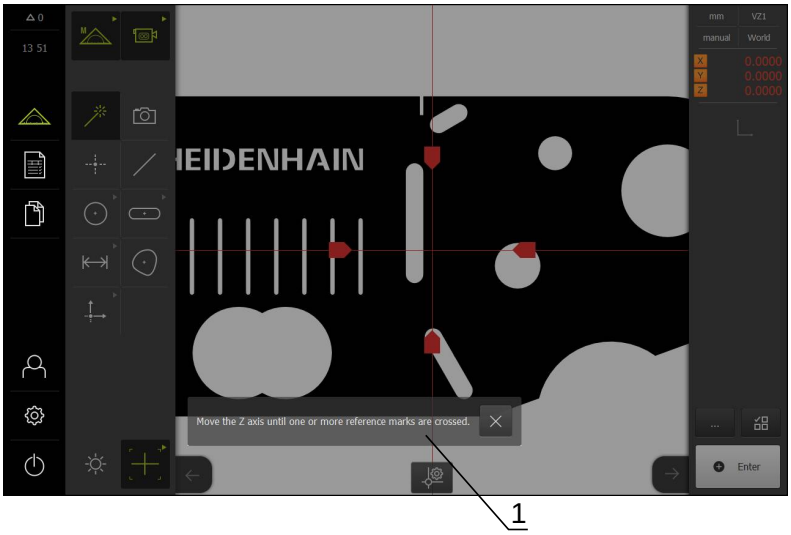


Figure 25: Messages of the wizard

1 Wizard (example)

The wizard assists you in performing work steps or teach-in processes, and in executing programs.

You can move the wizard in the workspace.

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

- To return to 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

6.15.3 Audio feedback

The product can 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 437

7

Commissioning

7.1 Overview

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

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

The settings can be reset to the factory defaults.

Further information: "Reset", Page 490

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

Further information: "Basic operation", Page 61

The following steps must be performed only by qualified personnel.

Further information: "Personnel qualification", Page 27

7.2 Logging in for commissioning

User login

To commission the unit, 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** user or **OEM** user for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

- Confirm entry with **RET**

- Tap **Log in**
- > The user is logged in
- > The unit now opens the **Measure** menu

> If "Reference mark search after unit start" is active, then all of the unit's functions will be disabled until the reference mark search is successfully completed.
>
> **Further information:** "Reference marks (Encoder)", Page 485

If the reference mark search is active on the product, a wizard will ask you to traverse the reference marks of the axes.

- After logging in, follow the instructions of the wizard
- > On successful completion of the reference mark search, the color of the reference symbol changes

Further information: "Activating the reference mark search", Page 136

The default language for the user interface is English. You can switch the user interface to the desired 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 the **Language** drop-down list
- Select the flag for the desired language in the **Language** drop-down list
- > The user interface is displayed in the selected language

Changing the password

You must change the password to prevent unauthorized configuration.
The password is confidential and must not be disclosed to any other person.

- Tap **Settings** in the main menu

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

7.3 Steps for commissioning

NOTICE

Loss of or damage to configuration data!

If the product is disconnected from the power source while it is on, the configuration data can be lost or corrupted.

- Back up the configuration data and keep the backup for recovery purposes

7.3.1 Basic settings

Setting the date and time

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Date and time**

> The set values are displayed in the following format: Year, month, day, hour, minute

- 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 440

Setting the units of measure

You can set various parameters to define the units of measure, rounding methods and decimal places.

- 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 set the rounding method, tap the corresponding drop-down list and select the rounding method
- To set the number of decimal places displayed, tap **-** or **+**

Further information: "Units", Page 440

Enabling the Software options

Additional **Software options** are enabled for the product via a **License key**.

On the overview page, you can check which **Software options** are enabled.
Further information: "Checking the Software options", Page 135

Requesting license key

You can request a license key by using the following procedure:

- 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 submit the displayed device information in order to request a license key for the product
- > The license key and the license file are generated and sent by e-mail

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 option, tap **Request trial options**
- Select the desired software option
- To select a QUADRA-CHEK 3000 AEI1 software option, select the number of additional encoder inputs using **-** and **+**
- To select the QUADRA-CHEK 3000 VED software option, tap the check mark
- To select the QUADRA-CHEK 3000 OED 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 entry with **RET**
- Tap **Save as**

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

- If the license key request is stored on the unit, move the file to a connected USB mass storage device (FAT32 format) or to the network drive
  Further information: "Moving a file", Page 425
- Contact a HEIDENHAIN service agency and submit the file you created in order to request a license key for the product

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

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 key from the provided license file into the product

- 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 **Select**
- 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 manually into the product

- 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 the 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

Reading the license key

- 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 **Select**
- 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 the 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

Checking the Software options

On the overview page, you can check which **Software options** are enabled for 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

7.3.2 Configuring the axes

Activating the reference mark search

The product uses the reference marks to reference the machine table to the machine. If the reference mark search has been activated, a wizard appears on startup of the product and asks the user to move the axes for the reference mark search.

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

The automatic reference mark search on startup of the product can be canceled depending on the configuration.

Further information: "Reference marks (Encoder)", Page 485

- Tap **Settings** in the main menu

- Tap **Axes**
- Open in the sequence
  - **General settings**
  - **Reference marks**
- Use the **ON/OFF** sliding switch to activate **Reference mark search after unit start**

> The reference marks 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 of the reference marks changes

Configuring axis parameters for encoders

Before you start measuring, you need to configure the parameters of the connected encoders for the individual axes.

The parameters of HEIDENHAIN encoders, which are typically connected to the unit, can be found in the overview of typical encoders.
Further information: "Overview of typical encoders", Page 139

> The configuration 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 name of 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
- 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 a linear encoder or an angle encoder is involved, enter the parameters for the **Signal period** or the **Line count** in the input field (see Page 139)
- Confirm entry with **RET**
- Tap **Reference marks**
- 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

  For encoders with TTL interface:
  - **Reverse coded**: Encoder has reverse-coded reference marks
  - **Reverse coded TTLx5**: Encoder has reverse-coded reference marks with integrated 5-fold interpolation
  - **Reverse coded TTLx10**: Encoder has reverse-coded reference marks with integrated 10-fold interpolation
- 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, then enter the parameter for the **Nominal increment** (see Page 140)
- Confirm entry with **RET**

- Tap **Reference point displacement**
- Use the **ON/OFF** sliding switch to activate or deactivate **Reference point displacement** (calculation of offset between the reference mark and the machine zero point)
- If it is activated, then enter the offset value for **Reference point displacement**
- Confirm the entry with **RET**
- As an alternative, you can tap **Apply** in **Current position for reference point shift** in order to apply the current position as the offset value
- Tap **Back** twice to return to the previous display

- In the **Analog filter frequency** drop-down list, select the frequency of the low-pass filter for suppressing high-frequency interference signals:
  - **33 kHz**: Interference frequencies above 33 kHz
  - **400 kHz**: Interference frequencies above 400 kHz
- Use the **ON/OFF** sliding switch to activate or deactivate the **Terminating resistor**

> The terminating resistor is deactivated automatically for incremental signals of the current signal type (11 µApp).

- 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 is in the counting direction of the encoder
  - **Negative**: The direction of traverse is opposite to the counting direction of the encoder

Further information: "Axes X, Y, Z", Page 481

Overview of typical encoders

The following overview lists the parameters of the HEIDENHAIN encoders that are typically connected to the product.

When connecting other encoders, refer to the encoder's documentation for the required parameters.

Linear encoders

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

Encoder series	Interface	Line count/ outputs signals per revolution	Reference mark	Nominal increment
RON 225	TTLx2	18 000	One	-
RON 285	1 V_{PP}	18000	One	-
RON 285C	1 V_{PP}	18000	Coded	20°
RON 785	1 V_{PP}	18000	One	-
RON 785C	1 V_{PP}	18000	Coded	20°
RON 786	1 V_{PP}	18000	One	-
RON 786C	1 V_{PP}	18000	Coded	20°
ROD 220	TTLx2	18 000	One	-
ROD 280	1 V_{PP}	18000	One	-
ROD 280C	1 V_{PP}	18000	Coded	20°

The formulae below enable you to calculate the nominal increment of the distance-coded reference marks with angle encoders:

Nominal increment = 360° ÷ number of reference marks × 2

Nominal increment = (360° × nominal increment in signal periods) ÷ line count

Performing error compensation

Mechanical influences such as guideway error, tilting in the end positions, mounting surface tolerances, or poor mounting (Abbe error) can cause measuring errors. With error compensation, the unit can automatically compensate for systematic measuring errors during measuring point acquisition. Through the comparison of nominal and actual values, one or more compensation factors can be defined and applied during subsequent measurements.

A distinction is made between the following methods:

Configuring error compensation for individual axes

- Linear error compensation (LEC): The compensation factor is calculated based on the specified length of a calibration standard (nominal length) and the actual distance traversed (actual length). The compensation factor is applied linearly to the entire measuring range.
- Segmented linear error compensation (SLEC): The axis is divided into multiple segments with the help of a maximum of 200 supporting points. A distinct compensation factor is defined and applied for every segment.

Configuring error compensation across axes

- Nonlinear error compensation (NLEC): By means of a maximum of a 99 supporting points, the measuring range is divided into a grid with multiple subareas. For every subarea, a distinct compensation factor is determined and applied.
- Squareness error compensation: The compensation factor is determined by comparing the nominal angle of the spatial axes with the measurement result. The compensation factor is applied to the entire measuring range.

NOTICE

Subsequent changes to the encoder settings can cause measuring errors

If encoder settings such as encoder input, encoder type, signal period, or reference marks are changed, then previously determined compensation factors may no longer apply.

- ▶ Reconfigure the error compensation if encoder settings are changed.

For all methods, the actual error curve must be exactly measured (e.g., with the help of a comparator measuring device or calibration standard.

Linear error compensation and segmented linear error compensation can no longer be combined with each other.

Configuring linear error compensation (LEC)

With linear error compensation (LEC) the product applies a compensation factor that is calculated from the specified length of a reference standard (nominal length) and the actual traverse path (actual length). The compensation factor is applied to the complete measuring range.

- Tap **Settings** in the main menu

- Tap **Axes**
- Select the axis
- Open in the sequence
  - **Error compensation**
  - **Linear error compensation (LEC)**
- Enter the length of the reference standard (nominal length)
- Confirm the entry with **RET**
- Enter the length of the actual traverse path determined by measure (actual length)
- Confirm the entry with **RET**
- Activate **Compensation** with the **ON/OFF** sliding switch

Further information: "Linear error compensation (LEC)", Page 486

Configuring segmented linear error compensation (SLEC)

For a segmented linear error compensation (SLEC), you divide the axis into short segments by defining up to 200 supporting points. 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.

- 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 desired **Number of supporting points** (max. 200)
- Enter the desired **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 measured compensation value into the **compensation value (D)** input field for each supporting point created
- Confirm the entry with **RET**

- Tap **Back** twice to return to the previous display
- Activate **Compensation** with the **ON/OFF** sliding switch
- > The error compensation for the axis is applied

Further information: "Segmented linear error compensation (SLEC)", Page 487

Adjusting an existing table of supporting points

After you have created a table of supporting points for the linear or segmented linear error compensation, you can adjust the table 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**

- Tap **Back** twice to return to the previous display
- Activate **Compensation** with the **ON/OFF** sliding switch
- > The adjusted error compensation for the axis is applied

Further information: "Segmented linear error compensation (SLEC)", Page 487

Nonlinear error compensation (NLEC)

For **Nonlinear error compensation (NLEC)** the measuring range is divided into a grid by defining up to 99 supporting points. For each of the identically-sized surface segments a specific compensation factor is determined by comparing nominal and actual values (the measured values).

The following options are available for measuring the nominal and actual values of the supporting points:

- Create the table of supporting points manually and enter actual values
- Create the table of supporting points manually and determine actual values in a teach sequence
- Read deviations of the calibration standard and enter actual values, determine these in a teach sequence or import the values (.txt)

  Import formats:
  - .txt format: contains actual values of the supporting points
  - Extended .txt format: contains deviations of the theoretical nominal value
- Import a table of supporting points with nominal and actual values (.xml)

  Import format
  - .xml format: corresponds to the standard export format of the product

If you read the deviations of a calibration standard or import a table of supporting points and the number or distances of the supporting points are different from the existing table of supporting points, a new table of supporting points is generated. The original table of supporting points is overwritten.

- ▶ Tap **Settings** in the main menu

- ▶ Open in the sequence
  - **Axes**
  - **General settings**
  - **Error compensation**
  - **Nonlinear error compensation (NLEC)**
- ▶ Deactivate **Compensation** with the **ON/OFF** sliding switch
- ▶ Enter the **Number of supporting points** for each axis
- ▶ Enter the **Spacing of the supporting points** for each axis
- ▶ To import existing calibration data, tap **Read deviations of calibration standard**
  Further information: "Measuring calibration data in .acf format", Page 147
- ▶ Navigate to the desired folder
- ▶ Tap the desired file (.acf)
- ▶ Tap **Select**
- > The calibration data of the calibration standard are read
- ▶ To import a table of supporting points, tap **Import table of supporting points**
  Further information: "Measuring the table of supporting points in .txt format", Page 148
- ▶ Navigate to the desired folder
- ▶ Tap the desired file (.xml or .txt)

- ▶ Tap **Select**
- > The table of supporting points is imported
- ▶ To manually adjust the table of supporting points, tap **Table of supporting points**
- ▶ Adjust the actual values of the axes
- ▶ The start the teach sequence, tap **Start**
- > The teach sequence is started and the wizard is displayed in the **Measure** menu
- ▶ Follow the instructions of the wizard
- > Values measured in the teach sequence are adopted as actual values in the table of supporting points
- > After the teach sequence is complete, the **Measure** menu continues to be displayed
- ▶ Recall the **Nonlinear error compensation (NLEC)** menu
- ▶ Activate **Compensation** with the **ON/OFF** sliding switch
- > The error compensation is applied from the next measurement

Further information: "Nonlinear error compensation (NLEC)", Page 480

Measuring calibration data in .acf format

The manufacturer of the calibration standard usually provides you with the calibration data and specifications about the deviations. To read the calibration data into the product you must measure these in .acf format.

- Open a new file in the text editor of your computer
- Save the file under a unique name and the file extension *.acf
- Measure the calibration data with tab stops separated according to the following schema

Schema of the calibration data in .acf format

Unit of measure	Directional axis
Spacing of supporting points on the X axis	Spacing of supporting points on the Y axis
Number of supporting points on the X axis	Number of supporting points on the Y axis
X value of the first supporting point	Y value of the first supporting point
X value of the second supporting point	Y value of the second supporting point
...	...
X value of the last supporting point	Y value of the last supporting point

Select either X or Y as the directional axis.

Example:

The example shows a grid with 5 x 5 supporting points with spacing of 25 mm on the X axis and 20 mm on the Y axis, oriented on the X axis.

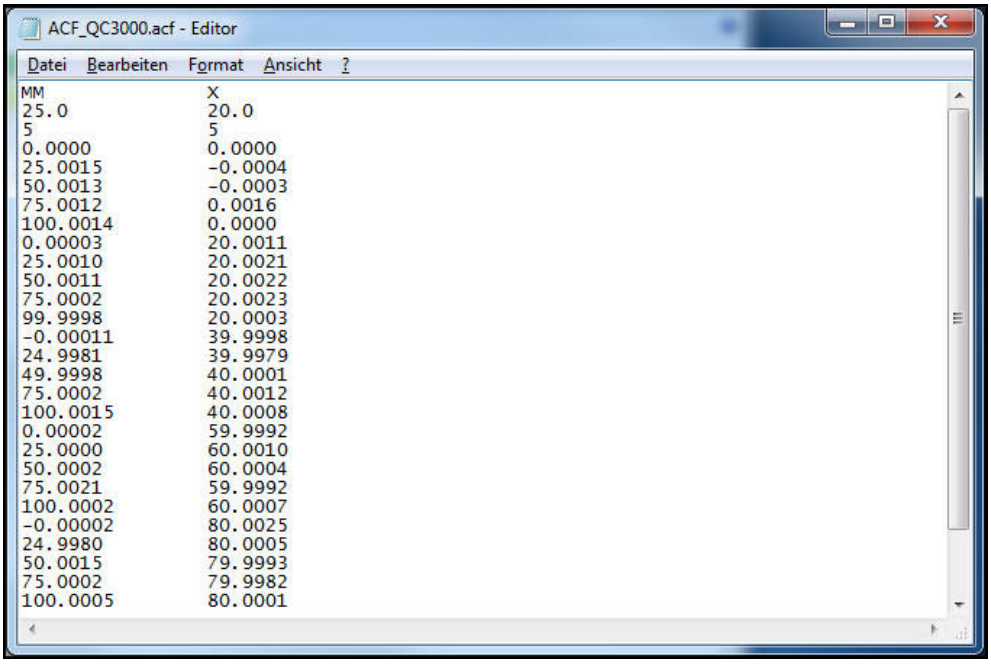


Figure 26: Example of calibration data in .acf format

Measuring the table of supporting points in .txt format

You can generate the import file for the table of supporting points in .txt format:

- Open a new file in the text editor of your computer
- Save the file under a unique name and the file extension *.txt
- Measure the data with tab stops separated according to the following schema

Data schema in .txt format

The .txt file contains the actual values of the supporting points (in X and Y) and must be constructed according to the following schema:

Unit of measure	Directional axis
Spacing of supporting points on the X axis	Spacing of supporting points on the Y axis
Number of supporting points on the X axis	Number of supporting points on the Y axis
X value of the first supporting point	Y value of the first supporting point
X value of the second supporting point	Y value of the second supporting point
...	...
X value of the last supporting point	Y value of the last supporting point

Select either X or Y as the directional axis.

Example:

The example shows a grid with 5 x 5 supporting points with spacing of 25 mm on the X axis and 20 mm on the Y axis, oriented on the X axis.

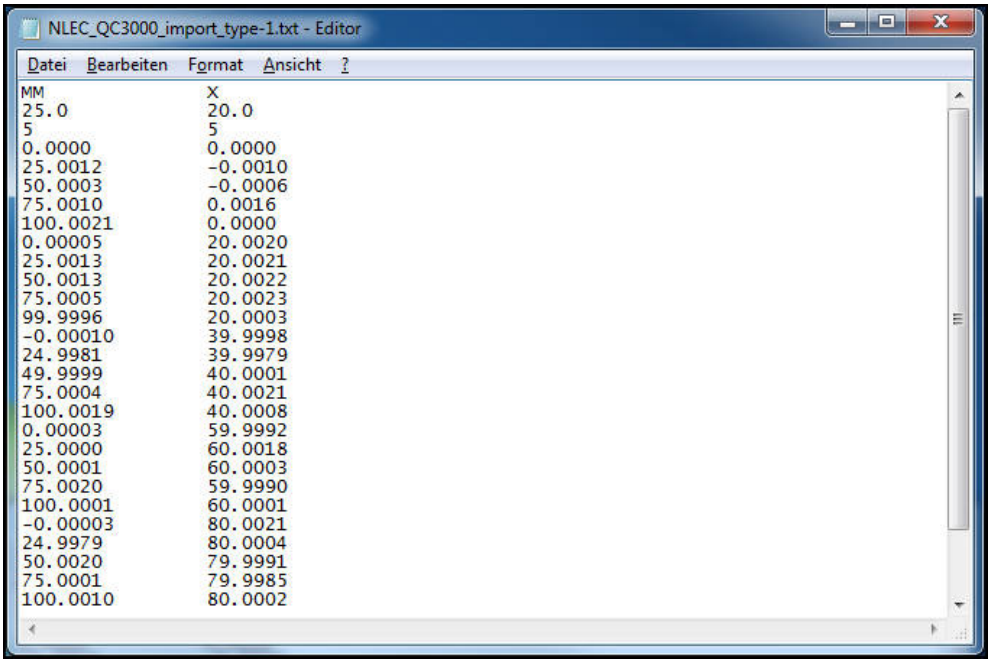


Figure 27: Example for .txt import format

Data schema in extended .txt format

The .txt file contains the deviations of the supporting points (in X and Y) from their nominal values and must be constructed according to the following schema:

NLEC Data File (required text)	
0.91 (required text)	
// Serial Number = xx-xxxx-xxxx-xxxx (comment, optional)	
mm (units of measure)	
ON (required text)	
Number of Grid Points (x, y): (required text)	
x (number of supporting points on the X axis)	**x** (number of supporting points on the Y axis)
Grid Block Size (x, y): (required text)	
x.x (spacing of supporting points on the Y axis)	**x.x** (spacing of supporting points on the X axis)
Offset: (required text)	
0	**0**
Station (x1, y1) (required text)	
x.xxxx (deviation of the first supporting point on the X axis)	**x.xxxx** (deviation of the first supporting point on the Y axis)
Station (x2, y1) (required text)	
x.xxxx (deviation of the second supporting point on the X axis)	**x.xxxx** (deviation of the second supporting point on the Y axis)
...	...

Example:

The example shows a grid with 5 x 5 supporting points with spacing of 25 mm on the X axis and 20 mm on the Y axis.

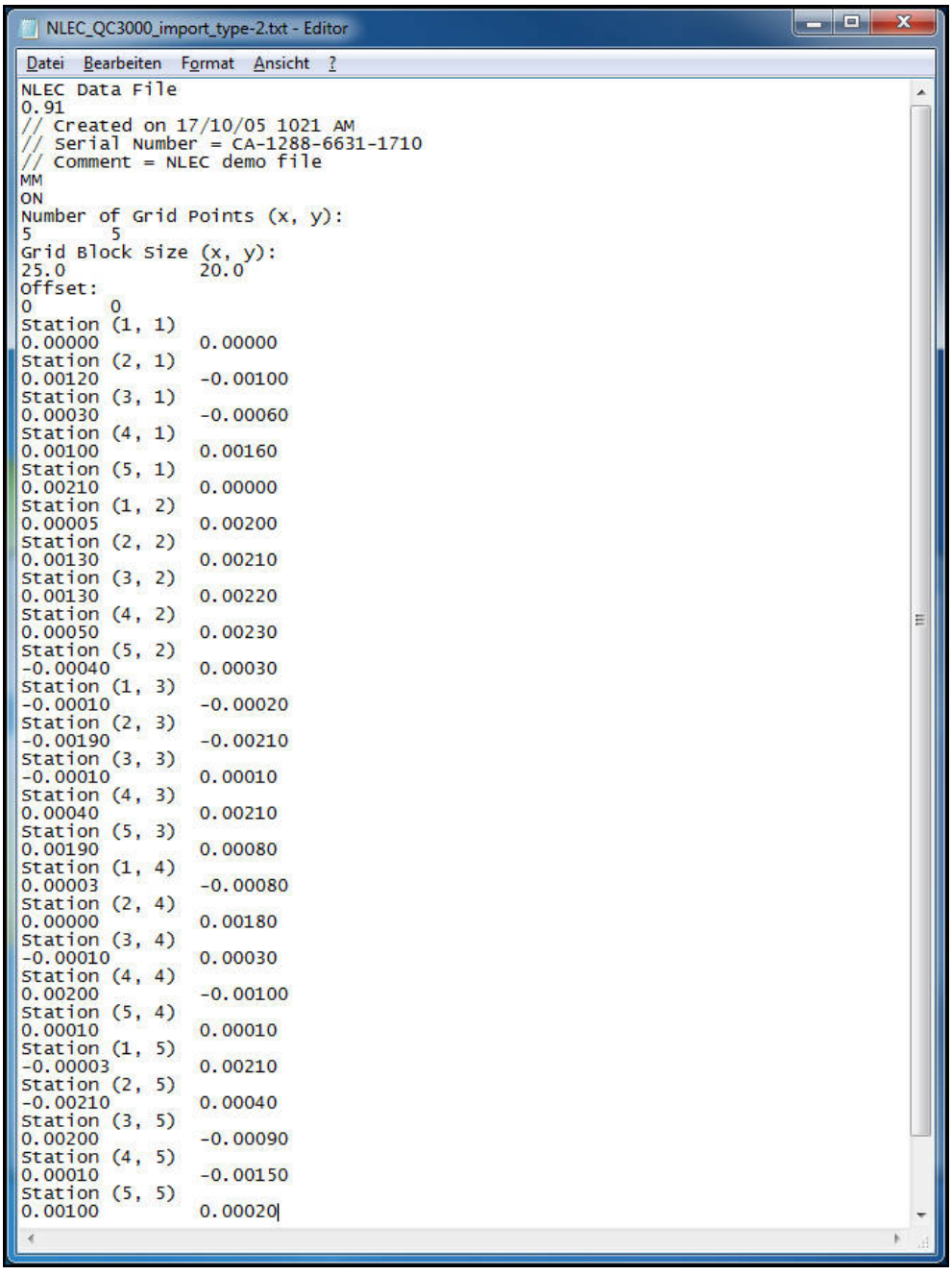


Figure 28: Example for extended .txt import format

Squareness error compensation (SEC)

Squareness error compensation (SEC) enables angular errors to be compensated during measuring point acquisition. The compensation factor is determined by comparing the deviation of the nominal angle of the spatial axes with the actual measurement result. The compensation factor is applied to the complete measuring range.

- Tap **Settings** in the main menu

- Open in the sequence
  - **Axes**
  - **General settings**
  - **Error compensation**
  - **Squareness error compensation (SEC)**

> The measured values (M) and nominal values (S) of the three spatial axes are displayed

- Enter the measured values of the reference standard (= nominal values)

> Squareness error compensation is applied from the next measurement

Further information: "Squareness error compensation (SEC)", Page 480

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 the 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 **Frame 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 444

Setting the 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 **ON/OFF**
- 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 **Frame 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 444

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 PNG and JPG file formats and with an image size of 1280 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 444

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 166

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

Modifying 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 the entry with **RET**
- Tap the **Acronym for quick access menu** input field
- Adapt the existing acronym
- Confirm the entry with **RET**
- > The magnification list shows the magnification together with the adapted information

Further information: "Magnifications", Page 447

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 the entry with **RET**
- Tap the **Acronym for quick access menu** input field
- Enter a meaningful acronym
- Confirm the 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 447

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

Adjusting 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 light 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**
- **AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time**

Further information: "Lighting", Page 448

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 448

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 448

Setting the lighting configuration AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time

- 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 **AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time**
- If necessary, tap **Activate** to activate an inactive lighting

> Use the **ON/OFF** sliding switch to activate or deactivate the individual types of lighting and camera exposure time in the specific menu.

- Tap **Transmitted light**
- Select the desired digital output in the **Digital output** drop-down list
- Select the desired analog output in the **Analog output** drop-down list

- Tap **Return**
- Tap **Reflected light**
- 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

> Depending on the light unit and configuration, you can also select a digital output for each segment.

- Tap **Return**
- Tap **Coaxial light**
- Select the desired digital output in the **Digital output** drop-down list
- Select the desired analog output in the **Analog output** drop-down list

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

Further information: "Lighting", Page 448

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 454

Adjusting the contrast settings

The contrast threshold defines the contrast value starting from which a light-to-dark transition is recognized as an edge. The higher the defined contrast threshold, the higher the contrast of the measured transition must be.

How the contrast threshold can be either set manually or adjusted automatically to the current light conditions by means of a teach sequence is described below.

Alternatively, you can also adjust the contrast threshold with the contrast bar in the **Measure** menu.
Further information: "Show contrast bar", Page 99 and Page 120

	The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- 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
  - **Automatic**: The edge is defined automatically
  - **First edge**: The first transition ≥ the contrast threshold is defined as the edge
  - **Strongest edge**: Strongest transition ≥ the contrast value is defined as the edge
- In the **Contrast threshold value for edge detection** field, enter the desired contrast threshold and do not superimpose the camera image (setting range: **0 ... 255**)

Or:

- Start the teach sequence: Tap **Start**

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

- 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

> The values in the **Contrast threshold value for edge detection**, **Minimum contrast** and **Maximum contrast** fields will be adjusted automatically, depending on the selected edge algorithm

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

- Tap **Close** to close the wizard

Further information: "Contrast settings", Page 455

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 the 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 457

Configuring parcentric and parfocal error compensation

Parcentric and parfocal error compensation adjust deviations caused by the mechanical settings of magnification and video focus. The parcentric error compensation adjusts deviations on the X and Y axes. The parfocal error compensation adjusts deviations on the Z axis. The error compensation can be configured via a teach sequence.

Before configuring and activating parcentric and parfocal error compensation, carry out the following configurations:

- Camera orientation
- Contrast settings
- Pixel sizes
- Error compensation of the axes (optional)

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Parcentric and parfocal error compensation**
- Tap **Magnification**
- Select the desired magnification
- 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

- Tap **Back** twice to return to the previous display
- Activate **Compensation** with the **ON/OFF** sliding switch

> The error compensation for the axis is applied

Further information: "Parcentric and parfocal error compensation", Page 458

Configuring the field of view compensation

The **Field of view compensation** adjusts deviations caused by the properties of the lens. The curvature means that rays of light are refracted more strongly at the edge of the lens—this may cause measuring error. The error compensation can be configured via a teach sequence. In the teach sequence a grid is measured from a defined number of measuring points (supporting points). This step is repeated for each available magnification. The compensation factor is determined from the deviations in the measurement results with each supporting point.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Video edge detection (VED)**
  - **Field of view compensation**
- Tap **Magnification**
- Select the desired magnification
- 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

- Tap **Back** twice to return to the previous display
- Activate **Compensation** with the **ON/OFF** sliding switch

> The error compensation for the axis is applied

Further information: "Field of view compensation", Page 459

7.3.4 Configuring OED sensors

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

Adjusting the contrast settings

The contrast settings define the contrast value starting from which a light-to-dark transition is recognized as an edge. Adjust the contrast settings to the actual light conditions via a teach sequence. As part of this process the wizard requests that you capture one point from each of the light and dark areas of the screen with the OED sensor.

	The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **Contrast settings**
- Start the teach sequence: 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
- With several magnifications, repeat the procedure for all available magnifications

Further information: "Contrast settings", Page 461

Configuring OED offset settings

The OED offset settings compensate the position error between the crosshair for measuring point acquisition and the OED sensor for edge measurement.
To configure the OED offset settings, carry out a teach sequence in which you measure a circle with two different measuring tools. The momentary offset of the OED sensor for the X and Y axes is calculated from the deviations of both circles and is then compensated with subsequent measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **OED offset settings**
- Tap **Magnification**
- Select the desired magnification
- Enter the permissible deviation of the circle diameter measured in the teach sequence into the **Tolerance of circle diameter** entry field
- Confirm the entry with **RET**
- Start the teach sequence: 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 and determine the OED offset settings for all available magnifications

Further information: "OED offset settings", Page 462

7.4 OEM area

In the **OEM area**, commissioning engineers can customize the product in various ways:

- **Documentation**: Adding the OEM documentation, e.g. service information
- **Startup screen**: Defining a startup screen with the OEM's company logo

7.4.1 Adding documentation

You can store and display the product's documentation right on the product.

> Only documents in the *.pdf file format can be added as a documentation. The product does not display documents provided in other file formats.

- 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 (FAT32 format) 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 **Select**
- > The file is copied to the **Service info** area on the product **Further information:** "Service info", Page 442
- Confirm the successful transfer with **OK**

Further information: "Documentation", Page 492

Safely removing a USB mass storage device

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

7.4.2 Adding a startup screen

You can define an OEM-specific startup screen, e.g. the company name or logo, which will be displayed when the product is switched on. An image file with the following properties needs to be stored on the product for this purpose:

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

Adding a startup screen

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **OEM area**
  - **Startup screen**
  - **Add startup screen**
- If required, connect a USB mass storage device (FAT32 format) 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 **Select**
- > The image is copied to the product and displayed as the startup screen the next time the product is started
- Confirm the successful transfer with **OK**

Safely removing a USB mass storage device

Safely removing a USB mass storage device

- Tap **File management** in the main menu
- Navigate to the list of storage locations
- Tap **Safely remove**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

7.4.3 Screenshots with ScreenshotClient

Informationen about ScreenshotClient

ScreenshotClient enables you to take screenshots from a computer of the active screen of the device. Before taking the screenshot, select the desired user interface language, as well as the file name and the location where you want to store the screenshots.

ScreenshotClient creates image files of the desired screen:

- In .PNG format
- With the configured name
- With the appropriate language code
- With the time information of year, month, day, hour, minute, and second

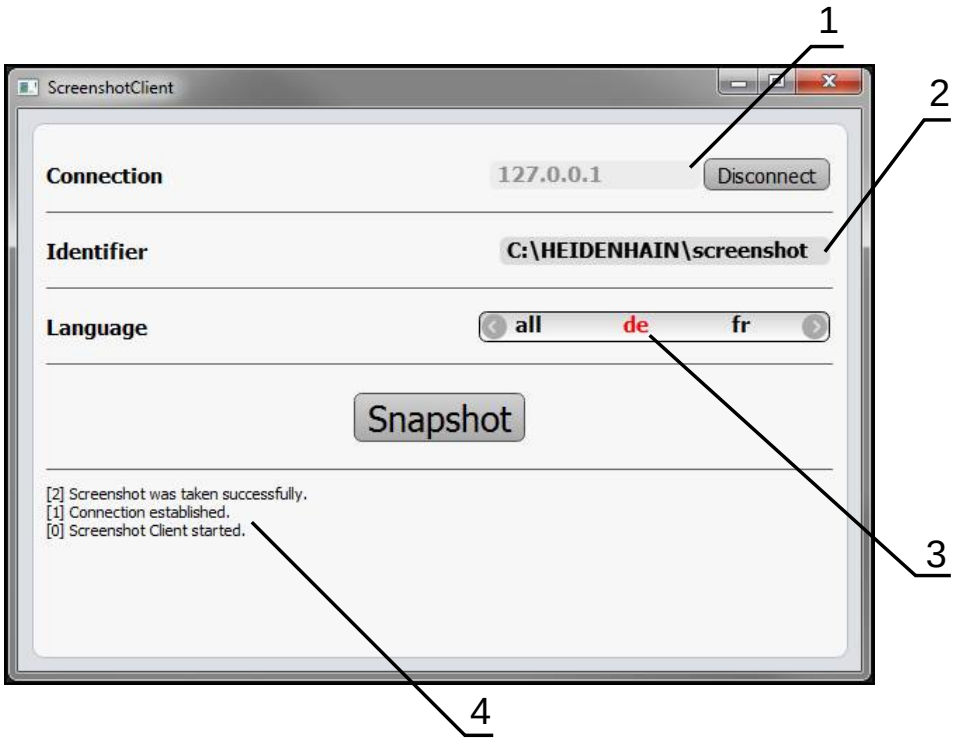


Figure 29: ScreenshotClient user interface

1 Connection status
2 File path and file name
3 Language selection
4 Status messages

The ScreenshotClient program is included in the standard installation of QUADRA-CHEK 3000 Demo. You can install the QUADRA-CHEK 3000 Demo software independently of the actual device on a computer in order to learn about the device's functions, or in order to test or present it.

System requirements

If you want to install QUADRA-CHEK 3000 Demo on a computer, the computer system must meet the following requirements:

- Microsoft Windows 7 or higher
- Screen resolution of at least 1280 × 800 recommended

Downloading the installation file

Before you can install the demo software on a computer, you need to download an installation file from the HEIDENHAIN Portal.

To download the installation file from the HEIDENHAIN Portal, you need access rights to the **Software** portal folder in the directory of the appropriate product.

If you do not have access rights to the Portal's **Software** folder, you can request the access rights from your HEIDENHAIN contact person.

- Download the latest version of QUADRA-CHEK 3000 Demo here: **www.heidenhain.de**
- Select the download folder of your browser
- Unpack the downloaded file with the extension **.zip** into a temporary storage folder

> The following files will be unpacked into the temporary storage folder:
  - Installation file with the extension **.exe**
  - File **DemoBackup.mcc**

Installing QUADRA-CHEK 3000 Demo under Microsoft Windows

- Select the temporary storage folder into which you unpacked the downloaded file with the **.zip** extension
  Further information: "Downloading the installation file", Page 175
- Run the installation file with the extension **.exe**

> The installation wizard is opened:

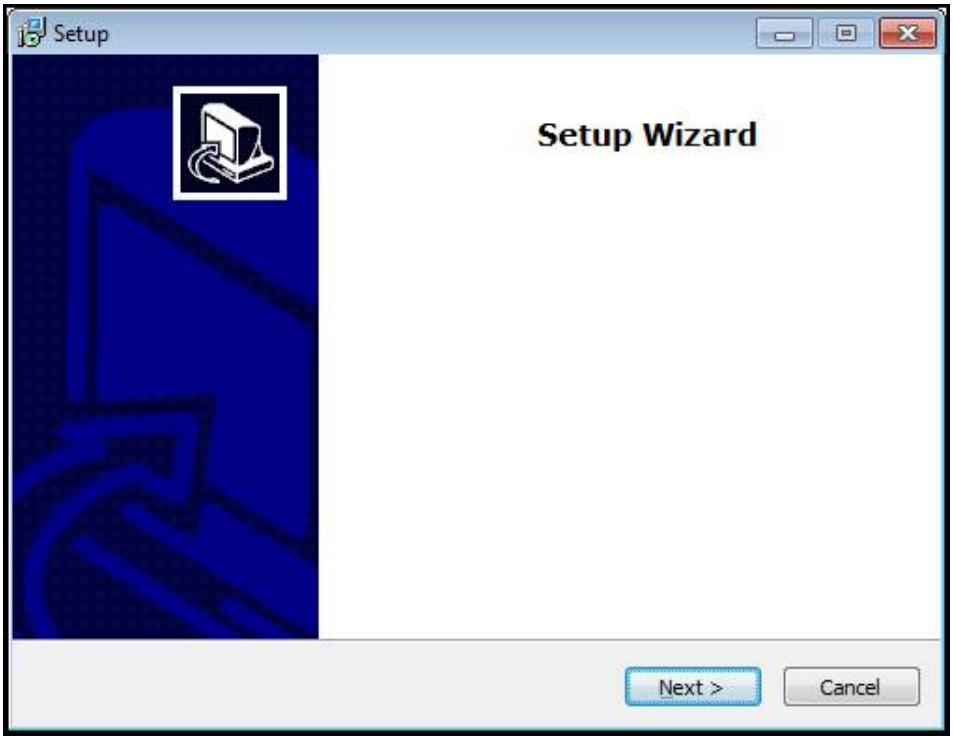


Figure 30: **Installation wizard**

- Tap **Next**
- In the **License Agreement** installation step, accept the terms of the license
- Tap **Next**

> In the **Select Destination Location** installation step, the installation wizard suggests a storage location. We recommend retaining the suggested storage location.

- In the **Select Destination Location** installation step, select the storage location to which you want to save QUADRA-CHEK 3000 Demo
- Tap **Next**
- In the **Select Components** installation step:
  - Select the type of installation
  - Activate or deactivate the option **Screenshot Utility**

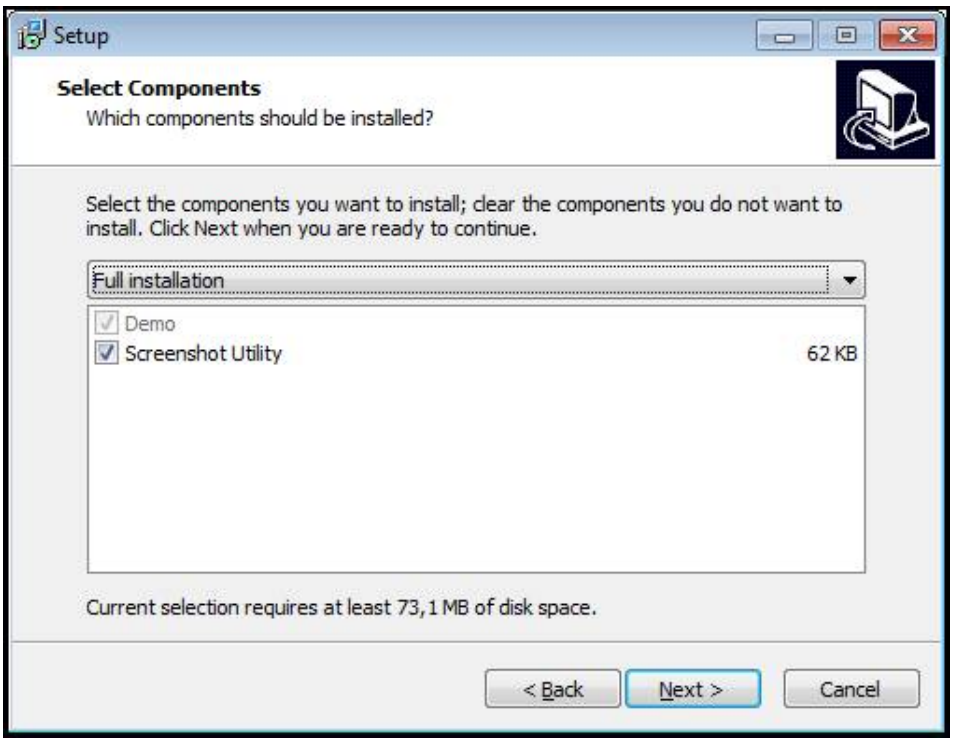


Figure 31: Installation wizard with the selected options **Demo Software** and **Screenshot Utility**

- Tap **Next**
- In the **Select Start Menu Folder** installation step, select the storage location at which you want to create the start menu folder
- Tap **Next**
- In the **Select Additional Tasks** installation step, select or deselect **Desktop icon**
- Tap **Next**
- Tap **Install**

> Installation starts—the status of installation is shown in the progress bar

- After installation has been completed successfully, use **Finish** to close the installation wizard

> The program has been successfully installed on your computer

Activating remote access for screenshots

To connect ScreenshotClient with the product via the computer you need to activate **Remote access for screenshots** on the product.

- Tap **Settings** in the main menu

- Tap **Service**
- Tap **OEM area**
- Activate **Remote access for screenshots** with the **ON/OFF** sliding switch

Further information: "OEM area", Page 491

Starting ScreenshotClient

Prerequisite: The network must be configured on the device.

Further information: "Configuring the network", Page 193

> Turn the device on before you establish the connection with ScreenshotClient. Otherwise ScreenshotClient will show the status message **Connection close.** when trying to connect.

- Select in succession in Microsoft Windows:
  - **Start**
  - **All programs**
  - **HEIDENHAIN**
  - **QUADRA-CHEK 3000 Demo**
  - **ScreenshotClient**

> ScreenshotClient is started:

Figure 32: ScreenshotClient has been started (not connected yet)

- Enter the **IPv4 address** of the interface in the **Connection** input field.
  Further information: "Network", Page 472
- Tap **Connect**

> The connection to the device is established

> The status message is updated

> The **Identifier** and **Language** input fields become active

Configuring ScreenshotClient for taking screenshots

Once you have started ScreenshotClient, you can make the following configurations:

- Location at which screenshots are stored, and what the file names are
- User interface language in which the screenshots are created

Configuring the storage location and file name for screenshots

By default, ScreenshotClient saves screenshots to the following storage location:

C:\HEIDENHAIN\[product designation]\ProductsMGE5\[product code]\sources\[file name]

You can define a different storage location, if necessary.

- Tap the **Identifier** input field
- In the **Identifier** input field, enter the path to the storage location and the name for the screenshots

Use the following syntax to enter the path and file name for screenshots:

[drive]:\[folder]\[file name]

> ScreenshotClient will save all screenshots to the storage location entered

Configuring the user interface language of screenshots

The **Language** input field shows all user interface languages of the device that are available. Once you have selected a language code, ScreenshotClient will take screenshots in the corresponding language.

The user interface language you are using on the device does not have any effect on the screenshots. Screenshots are always created in the language that you have selected in ScreenshotClient.

Screenshots in the desired user interface language

In order to create screenshots of the device in a specific user interface language

- Use the arrow keys to select the desired language code in the **Language** input field
- > The selected language code is shown in red
- > ScreenshotClient creates the screenshots in the desired user interface language

Screenshots of all available user interface languages

To create screenshots in all available user interface languages

- Use the arrow keys to select **all** in the **Language** input field
- > The **all** language code is shown in red
- > ScreenshotClient creates the screenshots in all available user interface languages

Creating screenshots

- On the device, perform the desired action and move to the screen of which you want to take a screenshot
- Switch to **ScreenshotClient**
- Tap **Snapshot**

> The screenshot is created and saved to the configured storage location

> The screenshot is saved in the format [file name]_[language code]_[YYYYMMDDhhmmss] (e.g. **screenshot_en_20170125114100**)

> The status message is updated:

Figure 33: ScreenshotClient after screenshot has been created successfully

Exiting ScreenshotClient

- Tap **Disconnect**

> The connection to the device is terminated

- Tap **Close**

> ScreenshotClient is exited

7.5 Back up settings

The settings 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

- Tap **Service**
- Open in the sequence
  - **Back up and restore**
  - **Back up settings**

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 (FAT32 format) 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 the entry with **RET**
- Tap **Save as**
- Tap **OK** to confirm the successful backup of the configuration
- > The configuration file was backed up

Further information: "Back up and restore", Page 489

Safely removing a USB mass storage device

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

- Tap **Safely remove**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

7.6 Back up user files

The user files of the product can be backed up as a file to make it available after a reset to the factory default state or for installation on multiple products.

Performing back up

The user files can be backed up as a ZIP file on a USB mass storage device or connected network drive.

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **Back up and restore**
  - **Back up user files**
- Tap **Save as ZIP**
- If required, connect a USB mass storage device (FAT32 format) to a USB port of the product
- Select the folder to which you want to copy the ZIP file
- Specify a name for the ZIP file, e.g. "<yyyy-mm-dd>_config"
- Confirm the entry with **RET**
- Tap **Save as**
- Tap **OK** to confirm successful backup of the user files

> The user files were backed-up.

Further information: "Back up and restore", Page 489

Safely removing a USB mass storage device

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

- Tap **Safely remove**

> The message **The storage medium can be removed now.** appears

- Disconnect the USB mass storage device

8

Setup

8.1 Overview

This chapter contains all the information necessary for setting up the product.

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

Make sure that you have read and understood the "Basic Operation" chapter before performing the activities described below.
Further information: "Basic operation", Page 61

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

8.2 Logging in for setup

User login

To set up the unit, 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** in the input field
- Enter the password "setup"

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

- Confirm entry with **RET**

- Tap **Log in**

> If "Reference mark search after unit start" is active, then all of the unit's functions will be disabled until the reference mark search is successfully completed.
>
> **Further information:** "Reference marks (Encoder)", Page 485

If the reference mark search is active on the product, a wizard will ask you to traverse the reference marks of the axes.

- After logging in, follow the instructions of the wizard

> On successful completion of the reference mark search, the color of the reference symbol changes

Further information: "Activating the reference mark search", Page 136

Changing the password

You must change the password to prevent unauthorized configuration.

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

- Tap **Settings** in the main menu

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

8.3 Individual setup steps

8.3.1 Basic settings

The commissioning engineer (**OEM**) may have already carried out several basic settings.

Setting the date and time

- Tap **Settings** in the main menu

- Tap **General**
- Tap **Date and time**
- > The set values are displayed in the following format: Year, month, day, hour, minute
- 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 440

Setting the units of measure

You can set various parameters to define the units of measure, rounding methods and decimal places.

- 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 set the rounding method, tap the corresponding drop-down list and select the rounding method
- To set the number of decimal places displayed, tap **-** or **+**

Further information: "Units", Page 440

Entering and configuring users

The following user types, which have different rights, are defined in the product's factory default settings:

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

Creating a user and password

You can create new **Operator**-type users. You can use any characters for the user ID and the password. These entries are case-sensitive.

Requirement: A user of **OEM** or **Setup**-type is logged in.

> It is not possible to create new **OEM** or **Setup**-type users.

- 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 the entry with **RET**
- Tap the **Name** input field
- Enter the name of the new user
- Confirm the entry with **RET**
- Tap the **Password** input field
- Enter the new password and repeat it
- Confirm the entry with **RET**

> You can show the contents of the 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 is created with the basic data. The user can then further edit the data himself later

Configuring the user

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

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

If automatic user login is active for one or more users, the last user who logged in is automatically logged in when the product is switched on. Neither the user ID nor the password needs to be entered.

- ▶ 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 the 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

Deleting users

You can remove **Operator**-type users that are no longer needed.

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

Requirement: A user of **OEM** or **Setup**-type is logged in.

- 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

Adding the Operating Instructions

The product provides the possibility to upload the corresponding Operating Instructions in the desired language. You can copy the Operating Instructions from the supplied USB mass storage device to the product.

The most recent version of the Operating Instructions is also available at **www.heidenhain.de**.

Requirement: The 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 (FAT32 format) 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 **Select**

> 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 and displayed on the product

Configuring the network

Network settings

The configuration of the network settings is identical for both network connections.

Contact your network administrator for the correct network settings for configuring the product.

Requirement: The unit is connected to a network.

Further information: "Connecting a network peripheral", Page 59

- 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** using the **ON/OFF** sliding switch
- > If DHCP is active, the network settings are obtained automatically as soon as the IP address is assigned
- If DHCP 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, then enter the **IPv6 address**, **IPv6 subnet prefix length** and **IPv6 standard gateway**
- Confirm the entires with **RET**
- Enter the **Preferred DNS server** and, if required, the **Alternative DNS server**
- Confirm the entires with **RET**
- > The configuration of the network connection is applied

Further information: "Network", Page 472

Network drive

You will need the following data for configuring the network drive:

- **Name**
- **Server IP address or host name**
- **Shared folder**
- **User name**
- **Password**
- **Network drive options**

	Contact your network administrator for the correct network settings for configuring the product.

Requirement: The product is connected to a network and a network drive is available.

Further information: "Connecting a network peripheral", Page 59

- 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**
  - Select **Authentication** for encrypting the password in the network
  - Configure the **Mount options**
- Tap **Mount**
- The connection to the network drive is established

Further information: "Network drive", Page 473

Configuring the printer

The product can print measurement reports and stored PDF files with a printer connected via USB or the network. The product supports several printer models from various manufacturers. See the product area at **www.heidenhain.de** for a complete list of supported printers.

If this list contains the used printer, the appropriate driver is available on the product and you can directly configure the printer. If this is not the case, you will need a printer-specific PPD file.

Further information: "Finding PPD files", Page 200

Adding a USB printer

Requirement: A USB printer is connected to the product.

Further information: "Connecting a printer", Page 57

- 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 the desired printer
- Tap **Located printers** once again
- > The available printer information, e.g. name and description, is displayed
- If required, enter a name for the printer into the **Name** input field

> The text must not contain slashes ("/"), hash characters ("#") or spaces.

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

> If the appropriate driver is not listed, a suitable PPD file must be copied to the product.
>
> **Further information:** "Finding PPD files", Page 200

- > 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
- Depending on the type of printer, select further values such as type of paper or duplex print
- Tap **Properties**

> The entered values are saved as defaults

> The printer is added and can be used

Use the CUPS web interface to configure the enhanced settings of the connected printer. You can also use this web interface if the printer information fails over the product.

Further information: "Using CUPS", Page 201

Further information: "Printers", Page 437

Adding a network printer

Requirement: A network printer or network is connected to the product.

Further information: "Connecting a printer", Page 57

Further information: "Connecting a network peripheral", Page 59

- 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 the desired printer
- Tap **Located printers** once again

> The available printer information, e.g. name and description, is displayed

- If required, enter a name for the printer into the **Name** input field

> The text must not contain slashes ("/"), hash characters ("#") or spaces.

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

> If the appropriate driver is not listed, a suitable PPD file must be copied to the product.
>
> **Further information:** "Finding PPD files", Page 200

> 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
- Depending on the type of printer, select further values such as type of paper or duplex print
- Tap **Properties**

> The entered values are saved as defaults

> The printer is added and can be used

Use the CUPS web interface to configure the enhanced settings of the connected printer. You can also use this web interface if the printer information fails over the product.

Further information: "Using CUPS", Page 201

Further information: "Printers", Page 437

Unsupported printers

To set up an unsupported printer, the product needs a "PPD" file containing information about the printer properties and drivers

> The product only supports drivers made available by Gutenprint (gutenprint.sourceforge.net).

Alternatively, you can select a similar printer from the list of supported printers. The scope of functionality may be limited but general printing should be possible.

Finding PPD files

Locate the required PPD file as follows:

- Search for the printer manufacturer and printer model at www.openprinting.org/printers
- Download the appropriate PPD file

or

- Search for a Linux driver for the printer model on the website of the printer manufacturer
- Download the appropriate PPD file

Using PPD files

When configuring an unsupported printer, during the driver selection step you need to copy the located PPD file to the product:

- Tap **Select the driver**
- In the **Select the manufacturer** dialog 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 downloaded PPD file
- Select the PPD file
- Tap **Select**
- > The PPD file is copied to the product
- Tap **Continue**
- > The PPD file is loaded and the driver is activated
- Tap **Close** in the message

Enhanced printer settings

Using CUPS

For printer control the product uses the Common Unix Printing System (CUPS). In the network, CUPS enables connected printers to be set up and managed using a web interface. These functions depend on whether the product uses a USB printer or network printer.

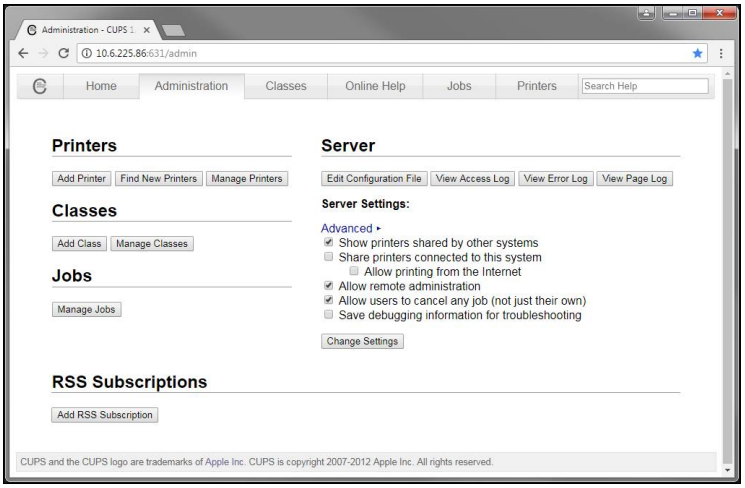
The CUPS web interface enables you to configure the enhanced settings of the printer connected to the product. You can also use this web interface if printer setup via the product fails.

Requirement: The product is connected to a network.

Further information: "Connecting a network peripheral", Page 59

- Tap **Settings** in the main menu

- Tap **Interfaces**
- Tap **Network**
- Tap the **X116** interface
- Specify and write down the IP address of the product from **IPv4 address**
- On a computer in the network, call the web interface of CUPS via the following URL:
  http://[IP address of the product]:631
  (e.g. http://10.6.225.86:631)
- In the web interface, click on the **Administration** tab and select the desired action



See the **Online Help** tab for detailed information about the CUPS web interface.

Modifying the resolution and paper size for a printer

- 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 entered values are saved as defaults

Depending on the type of printer, select further values such as type of paper or duplex print under **Properties**

Further information: "Printers", Page 437

Removing a printer

- 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

Configuring operation with a mouse or touchscreen

The product can be operated either via the touchscreen or a connected (USB) mouse. If the product is in its factory default setting, touching the touchscreen deactivates the mouse. Alternatively, you can set that the product is operated either only via the mouse or only via the touchscreen.

Requirement: A USB mouse is connected to the product.

Further information: "Connecting input devices", Page 58

You can modify the touch sensitivity of the touch screen to enable operation under special conditions (e.g. operating with gloves).

- Tap **Settings** in the main menu

- Tap **Input devices**
- Select the desired option in the **Touchscreen sensitivity** drop-down list
- Select the desired option in the **Mouse substitute for multitouch gestures** drop-down list

Further information: "Input devices", Page 436

Configuring the USB keyboard

The factory default language for the keyboard assignment is English. You can switch the keyboard assignment to the desired language.

Requirement: A USB keyboard is connected to the product.

Further information: "Connecting input devices", Page 58

- Tap **Settings** in the main menu

- Tap **Input devices**
- Select the flag for the desired language in the **USB keyboard layout** drop-down list

> The keyboard assignment corresponds to the selected language

Further information: "Input devices", Page 436

Configuring the barcode scanner

You can transfer a defined number of characters from a barcode to a text field using a barcode scanner connected via USB. This enables you to load e.g. parts numbers or order numbers to a measurement report.

Requirement: A barcode scanner is connected to the product.

Further information: "Connecting a barcode scanner", Page 58

- Tap **Settings** in the main menu

- Tap **Interfaces**
- Tap **Barcode scanner**
- Activate the barcode scanner with the **ON/OFF** sliding switch
- In the **Filter setting 1** field, define how many characters are truncated at the start of the barcode
- In the **Filter setting 2** field, define how many characters of the barcode are transferred to the text field
- Tap the **Test area** text field
- Scanning the test code
- > All characters of the scanned test code appear in the **Raw data of test code** segment
- > The filtered test code appears in the **User data of test code** segment in accordance with the specifications in the **Filter setting 1** and **Filter setting 2** fields
- > The utilization data of the test code appear in the **Test area** input field
- > Analogous to this, you can also transfer the utilization data to any text field

Further information: "Barcode scanner", Page 474

8.3.2 Configuring VED sensors

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 contrast threshold defines the contrast value starting from which a light-to-dark transition is recognized as an edge. The higher the defined contrast threshold, the higher the contrast of the measured transition must be.

How the contrast threshold can be either set manually or adjusted automatically to the current light conditions by means of a teach sequence is described below.

Alternatively, you can also adjust the contrast threshold with the contrast bar in the **Measure** menu.
Further information: "Show contrast bar", Page 99 and Page 120

	The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- 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
  - **Automatic**: The edge is defined automatically
  - **First edge**: The first transition ≥ the contrast threshold is defined as the edge
  - **Strongest edge**: Strongest transition ≥ the contrast value is defined as the edge
- In the **Contrast threshold value for edge detection** field, enter the desired contrast threshold and do not superimpose the camera image (setting range: **0 ... 255**)

Or:

- Start the teach sequence: Tap **Start**

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

- 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

> The values in the **Contrast threshold value for edge detection**, **Minimum contrast** and **Maximum contrast** fields will be adjusted automatically, depending on the selected edge algorithm

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

- Tap **Close** to close the wizard

Further information: "Contrast settings", Page 455

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 the 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 457

8.3.3 Configuring OED sensors

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

Adjusting the contrast settings

The contrast settings define the contrast value starting from which a light-to-dark transition is recognized as an edge. Adjust the contrast settings to the actual light conditions via a teach sequence. As part of this process the wizard requests that you capture one point from each of the light and dark areas of the screen with the OED sensor.

	The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **Contrast settings**
- Start the teach sequence: 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
- With several magnifications, repeat the procedure for all available magnifications

Further information: "Contrast settings", Page 461

Configuring OED offset settings

The OED offset settings compensate the position error between the crosshair for measuring point acquisition and the OED sensor for edge measurement.
To configure the OED offset settings, carry out a teach sequence in which you measure a circle with two different measuring tools. The momentary offset of the OED sensor for the X and Y axes is calculated from the deviations of both circles and is then compensated with subsequent measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **OED offset settings**
- Tap **Magnification**
- Select the desired magnification
- Enter the permissible deviation of the circle diameter measured in the teach sequence into the **Tolerance of circle diameter** entry field
- Confirm the entry with **RET**
- Start the teach sequence: 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 and determine the OED offset settings for all available magnifications

Further information: "OED offset settings", Page 462

8.3.4 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.

Modifying 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 (features)", Page 463

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 measuring points** input field, specify the minimum percentage of measuring points that must be used for the measurement

Further information: "Measuring point filter", Page 465

Measure Magic

Measure Magic automatically determines the geometry type during measurement.

> The geometry type assigned to a new feature depends on the Measure Magic settings. The measurement result must correspond to the defined criteria.

- Tap **Settings** in the main menu

- Tap **Features**
- Tap **Measure Magic**
- To define up to which form deviation a feature type is automatically detected, enter the desired value in the **Maximum form deviation ratio** input field

> Calculate the **Maximum form deviation ratio** with the following formula:
>
> $$Form\ deviation\ ratio_{max} = \frac{form\ error}{feature\ size}$$
>
> The feature size with a **Circle** or **Arc** is the diameter. With an **Ellipse**, **Slot**, **Rectangle** or **Line**, it is the length.

- 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 469

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: "Geometry types", Page 470

Configuring the measurement result preview

The measurement result preview is displayed in the workspace after a measurement process is concluded and shows information about the measured feature. For each geometry type it can be defined which parameters are displayed in the measurement result preview. Which parameters are available depends on the specific geometry type.

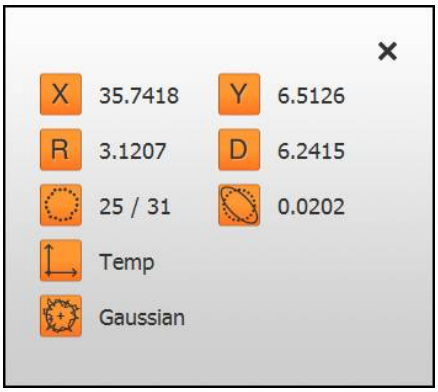


Figure 34: **Measurement result preview** for a circle

- Tap **Settings** in the main menu

- Tap **Features**
- Tap **General settings**
- If required, activate the measurement result preview with the **ON/OFF** sliding switch

- Tap **Return**
- Tap the desired **Geometry type**
- Tap **Measurement result preview**
- Activate the desired parameter with the **ON/OFF** sliding switch

The **Number of measuring points**, **Coordinate system** and **Fitting algorithm** parameters are always displayed in the measurement result preview and cannot be deactivated.

Further information: "General settings (features)", Page 463
Further information: "Geometry types", Page 470

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

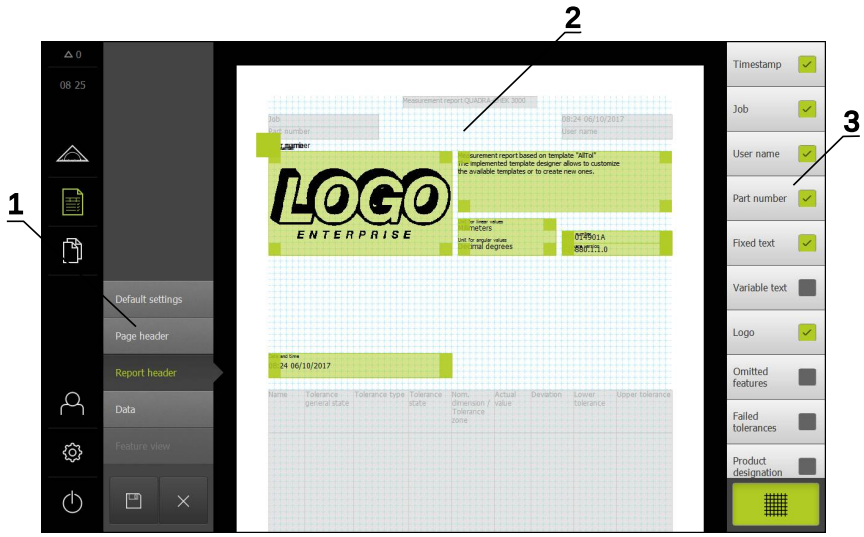


Figure 35: Template editor for measurement reports

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 reports", Page 399

Creating a measuring program

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

Figure 36: Displays and controls of measuring programs

1 Program 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 381

8.4 Back up settings

The settings 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

- Tap **Service**
- Open in the sequence
  - **Back up and restore**
  - **Back up settings**

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 (FAT32 format) 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 the entry with **RET**
- Tap **Save as**
- Tap **OK** to confirm the successful backup of the configuration
- > The configuration file was backed up

Further information: "Back up and restore", Page 489

Safely removing a USB mass storage device

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

- Tap **Safely remove**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

8.5 Back up user files

The user files of the product can be backed up as a file to make it available after a reset to the factory default state or for installation on multiple products.

Performing back up

The user files can be backed up as a ZIP file on a USB mass storage device or connected network drive.

- Tap **Settings** in the main menu

- Tap **Service**
- Open in the sequence
  - **Back up and restore**
  - **Back up user files**
- Tap **Save as ZIP**
- If required, connect a USB mass storage device (FAT32 format) to a USB port of the product
- Select the folder to which you want to copy the ZIP file
- Specify a name for the ZIP file, e.g. "<yyyy-mm-dd>_config"
- Confirm the entry with **RET**
- Tap **Save as**
- Tap **OK** to confirm successful backup of the user files

> The user files were backed-up.

Further information: "Back up and restore", Page 489

Safely removing a USB mass storage device

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

- Tap **Safely remove**

> The message **The storage medium can be removed now.** appears

- Disconnect the USB mass storage device

9

Quick Start

9.1 Overview

In this chapter an example is used to describe the steps of a typical measuring sequence. 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 "Measuring" chapter and to the following 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.

Make sure that you have read and understood the "Basic operation" chapter before carrying out the actions described below.

Further information: "Basic operation", Page 61

9.2 Logging in for Quick Start

User login

For Quick Start, the **Operator** user must log in.

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

> If the password does not match the default password, ask a **Setup** user or **OEM** user for the assigned password.
>
> If the password is no longer known, contact a HEIDENHAIN service agency.

- Confirm entry with **RET**

- Tap **Log in**

9.3 Conducting a measurement

This section describes the typical steps for conducting a measurement.

9.3.1 Preparing a 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

Conducting the reference mark search

With the help of reference marks, the unit can assign axis positions of the encoder to the machine.

If no reference marks for the encoder are provided by a defined coordinate system, you need to perform a reference mark search before you start measuring.

> If "Reference mark search after unit start" is active, then all of the unit's functions will be disabled until the reference mark search is successfully completed.
>
> **Further information:** "Reference marks (Encoder)", Page 485

If the reference mark search is active on the product, a wizard will ask you to traverse the reference marks of the axes.

- ▶ After logging in, follow the instructions of the wizard
- > On successful completion of the reference mark search, the color of the reference symbol changes

Further information: "Activating the reference mark search", Page 136

Starting the reference mark search manually

> A manual reference mark search can be performed only by the **Setup** and **OEM** user types.

If the reference mark search was not performed on startup, you can start it manually later.

- ▶ 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

Calibrating a 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

Adjusting 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

Adjusting the contrast settings

The contrast threshold defines the contrast value starting from which a light-to-dark transition is recognized as an edge. The higher the defined contrast threshold, the higher the contrast of the measured transition must be.

How the contrast threshold can be either set manually or adjusted automatically to the current light conditions by means of a teach sequence is described below.

Alternatively, you can also adjust the contrast threshold with the contrast bar in the **Measure** menu.
Further information: "Show contrast bar", Page 99 and Page 120

The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- ▶ 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
  - **Automatic**: The edge is defined automatically
  - **First edge**: The first transition ≥ the contrast threshold is defined as the edge
  - **Strongest edge**: Strongest transition ≥ the contrast value is defined as the edge
- In the **Contrast threshold value for edge detection** field, enter the desired contrast threshold and do not superimpose the camera image (setting range: **0 ... 255**)

Or:

- Start the teach sequence: Tap **Start**

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

- 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

> The values in the **Contrast threshold value for edge detection**, **Minimum contrast** and **Maximum contrast** fields will be adjusted automatically, depending on the selected edge algorithm

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

- Tap **Close** to close the wizard

Further information: "Contrast settings", Page 455

Calibrating an OED sensor

Selecting the sensor

- ▶ Tap **Manual measuring**
- > If only the OED sensor is enabled, then it is automatically activated

- ▶ If more than one sensor is enabled, then tap **OED sensor** in the sensor palette
- > The position display is now shown in the workspace
- ▶ Focus the optics of the measuring machine such that the sharpest edge possible is shown on the projection screen of the measuring machine
- ▶ Adjust the lighting of the measuring machine such that the highest amount of contrast possible is shown on the projection screen of the measuring machine

Adjusting the contrast settings

The contrast settings define the contrast value starting from which a light-to-dark transition is recognized as an edge. Adjust the contrast settings to the actual light conditions via a teach sequence. As part of this process the wizard requests that you capture one point from each of the light and dark areas of the screen with the OED sensor.

	The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- ▶ Tap **Settings** in the main menu

- ▶ Tap **Sensors**
- ▶ Open in the sequence
  - **Optical edge detection (OED)**
  - **Contrast settings**
- ▶ Start the teach sequence: 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
- ▶ With several magnifications, repeat the procedure for all available magnifications

Further information: "Contrast settings", Page 461

Configuring OED offset settings

The OED offset settings compensate the position error between the crosshair for measuring point acquisition and the OED sensor for edge measurement.
To configure the OED offset settings, carry out a teach sequence in which you measure a circle with two different measuring tools. The momentary offset of the OED sensor for the X and Y axes is calculated from the deviations of both circles and is then compensated with subsequent measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **OED offset settings**
- Tap **Magnification**
- Select the desired magnification
- Enter the permissible deviation of the circle diameter measured in the teach sequence into the **Tolerance of circle diameter** entry field
- Confirm the entry with **RET**
- Start the teach sequence: 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 and determine the OED offset settings for all available magnifications

Further information: "OED offset settings", Page 462

9.3.2 Measuring without a sensor

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: "Measuring", Page 275

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.

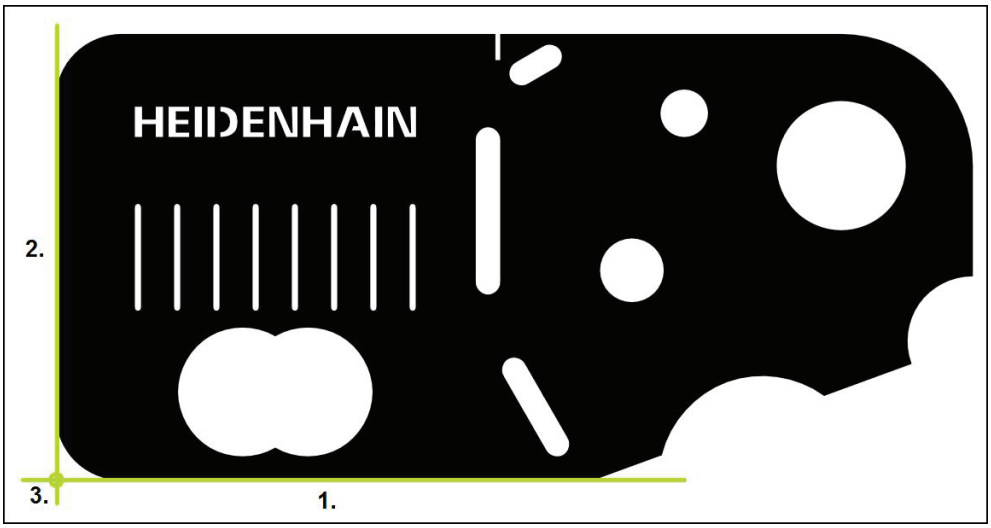


Figure 37: Example of aligning a 2-D demo part

Measured objects are usually aligned in the following steps:

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

> When using the **Manual measuring** function, you can move the image section.

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 line. In this way you increase the accuracy.

- Tap **Finish** in the new feature

> The alignment is displayed in the feature list

> The measurement result preview is now displayed

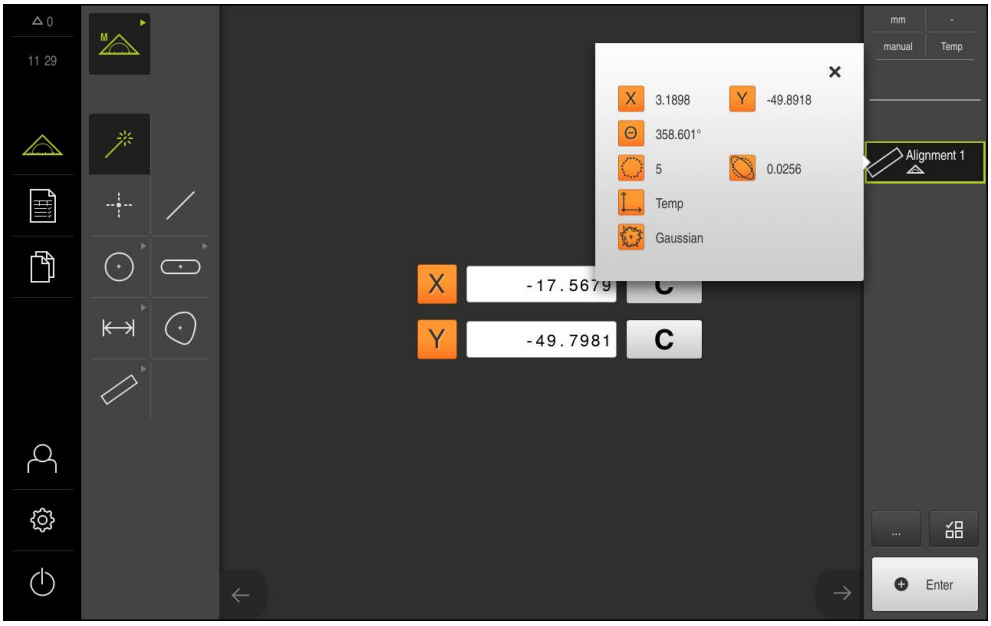


Figure 38: Alignment displayed in the feature list

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 straight line is displayed in the feature list

> The measurement result preview for the new feature is now displayed

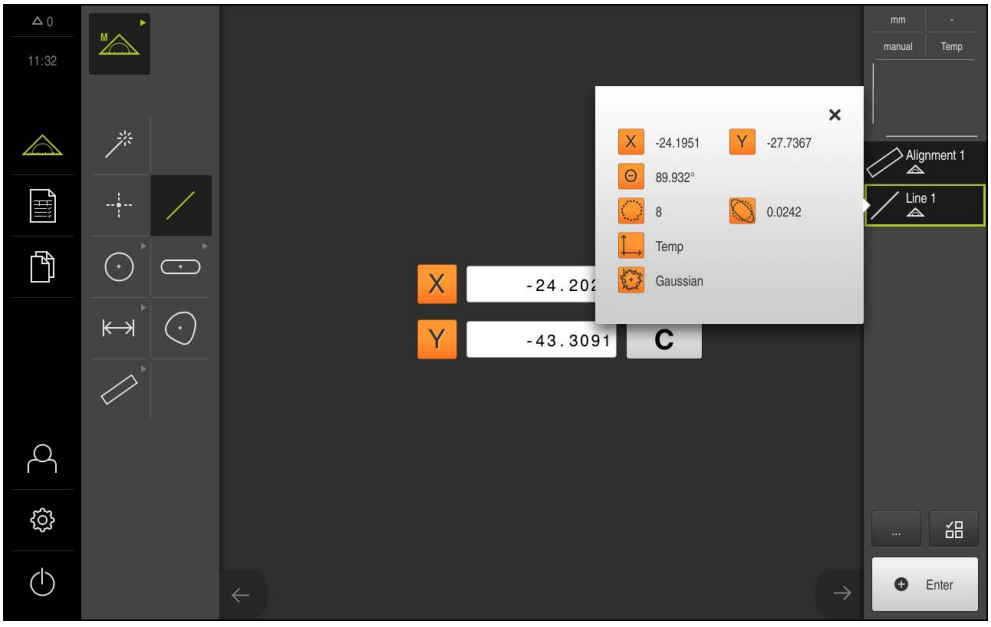


Figure 39: Straight line displayed in the feature list

Constructing the zero point

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

- ▶ 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
- > A new feature with the selected geometry is displayed

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

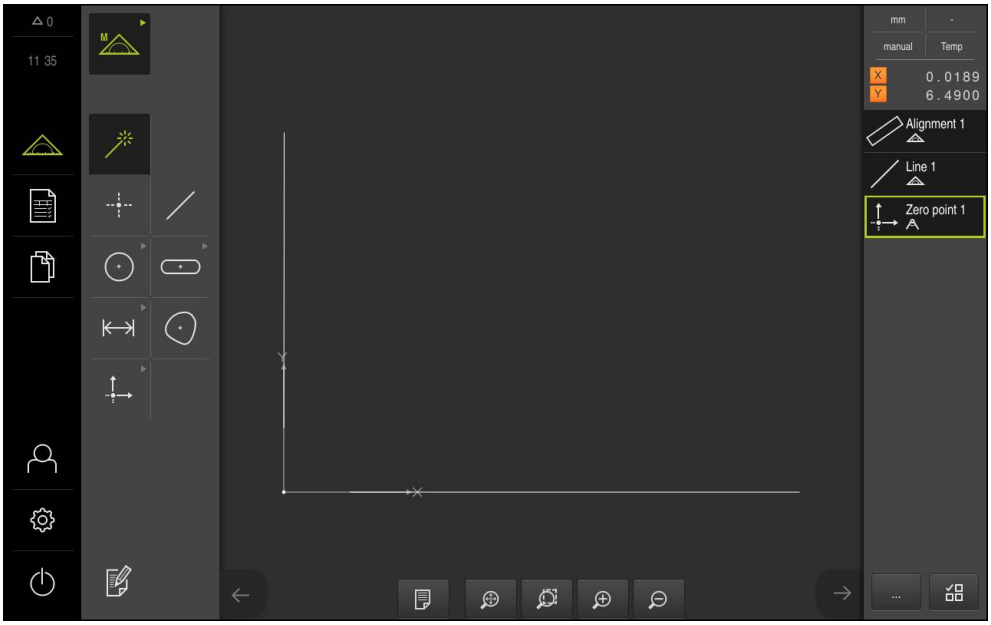


Figure 40: A coordinate system is now shown in the workspace

Measuring features

To measure features, you can use the geometries of the geometry palette or Measure Magic.

> If you use Measure Magic, the type of geometry is automatically determined from the captured measuring points. The type of geometry that is assigned to the new feature can be changed after the measurement.

Further information: "Measuring with Measure Magic", Page 308
Further information: "Overview of geometry types", Page 277

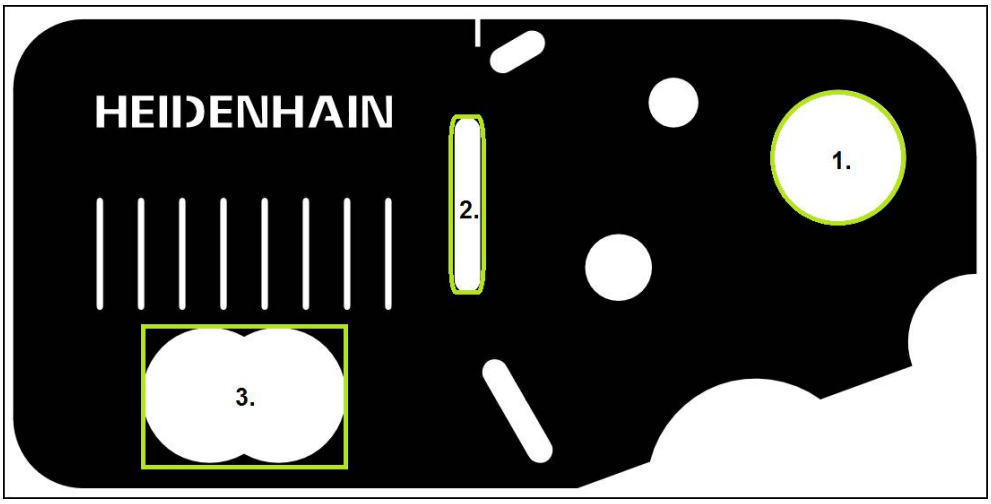


Figure 41: Examples of measuring a 2-D demo part

The section below describes measuring the following 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 **Measure Magic** in the geometry palette

or

- 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 result preview is now displayed
> The measurement is complete

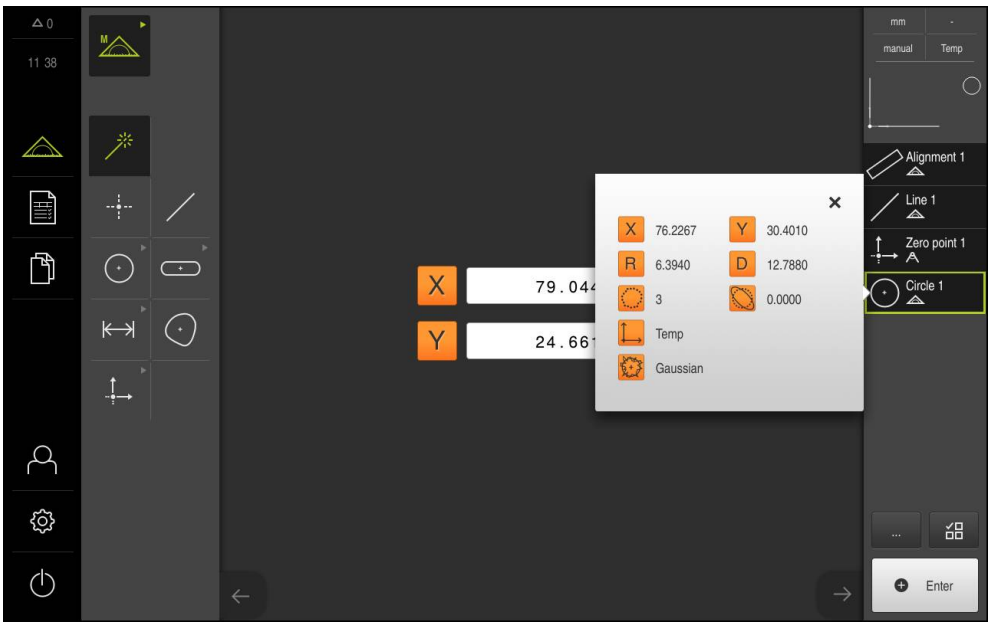


Figure 42: The circle is displayed in the features preview

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 Measure Magic in the geometry palette

or

- 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 result preview is now displayed
- The measurement is complete

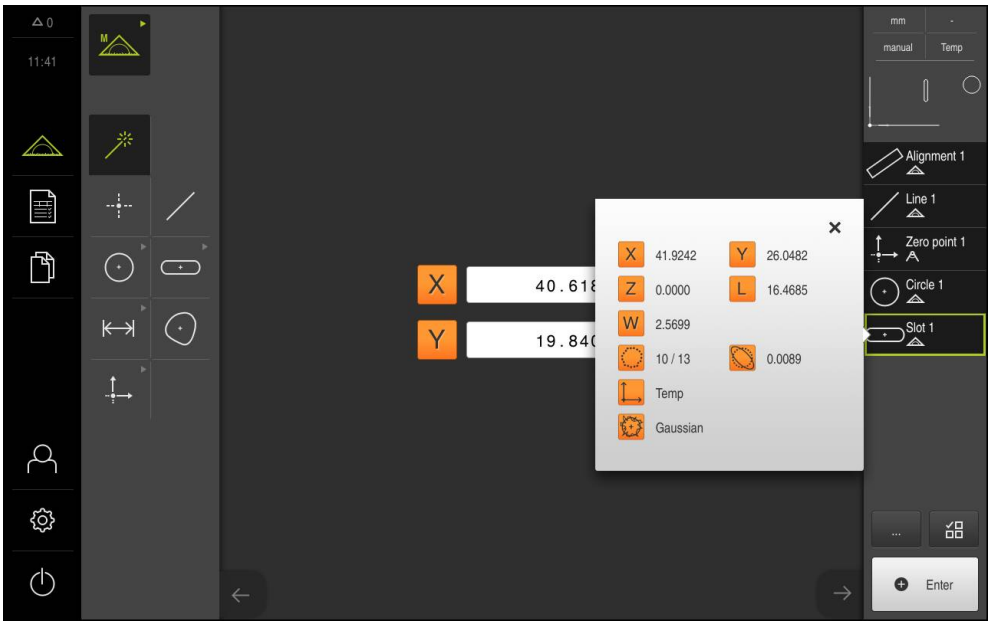


Figure 43: The slot is displayed in the features preview

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 result preview is now displayed
- > The measurement is complete

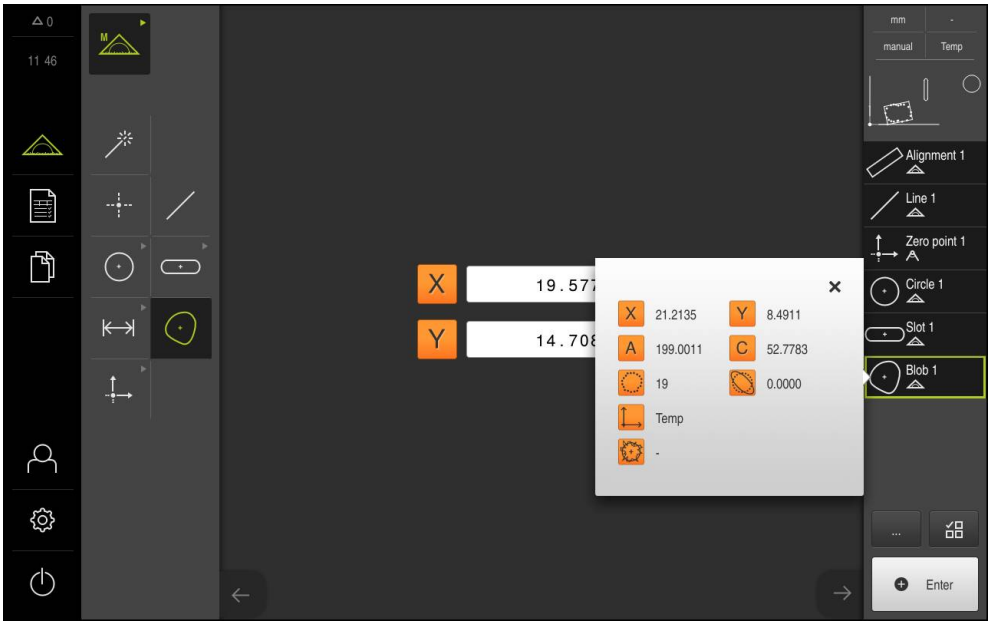


Figure 44: The blob is displayed in the features preview

9.3.3 Measuring with a VED sensor

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

Further information: "Measuring tools", Page 103

> 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 depiction of the supplied 2-D demo part.
>
> Application-specific adjustments during commissioning or setup can lead to deviating depictions.
>
> It is possible for the OEM user or the Setup user to switch to the virtual camera at any time. By this means, the depicted examples can be reproduced.

Further information: "Measuring", Page 275

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.

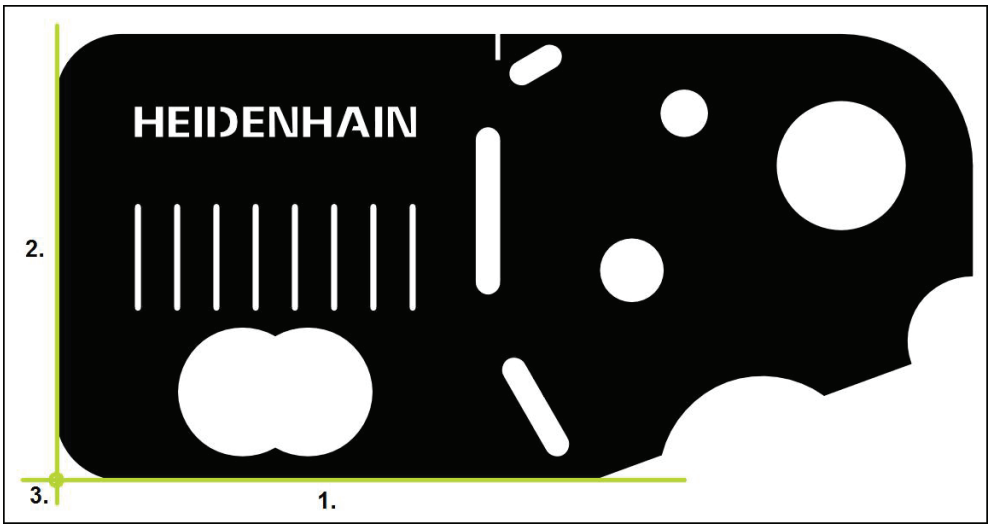


Figure 45: Example of aligning a 2-D demo part

Measured objects are usually aligned in the following steps:

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

> When using the **Manual measuring** function, you can move the image section.

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

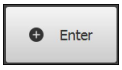
> The workspace shows the camera's live image

- 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

> The measurement result preview is now displayed

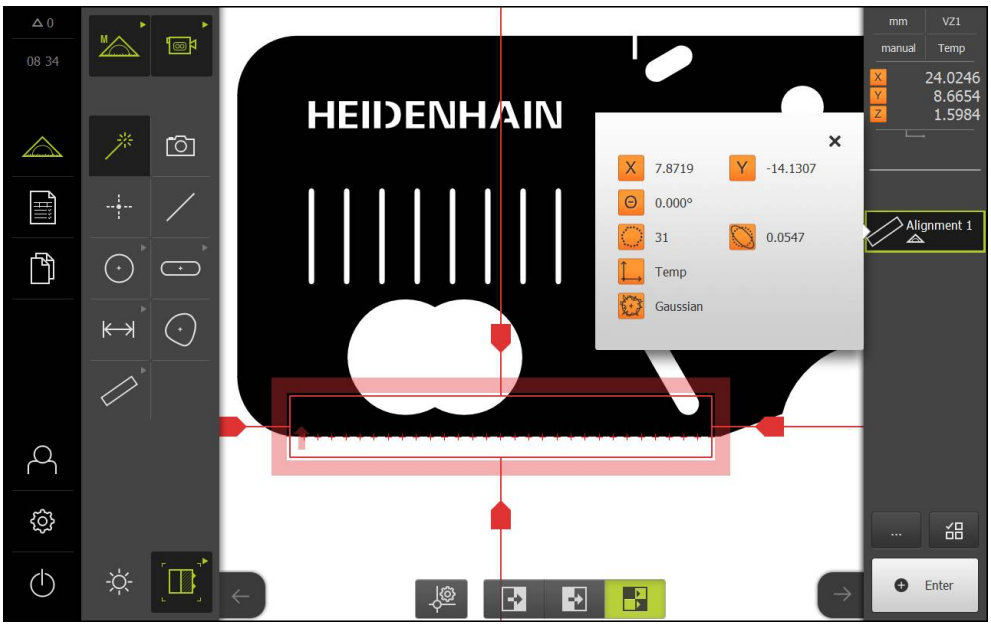


Figure 46: The alignment is displayed in the feature list of the Inspector

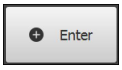
Measuring a straight line

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
- > The measurement result preview is now displayed

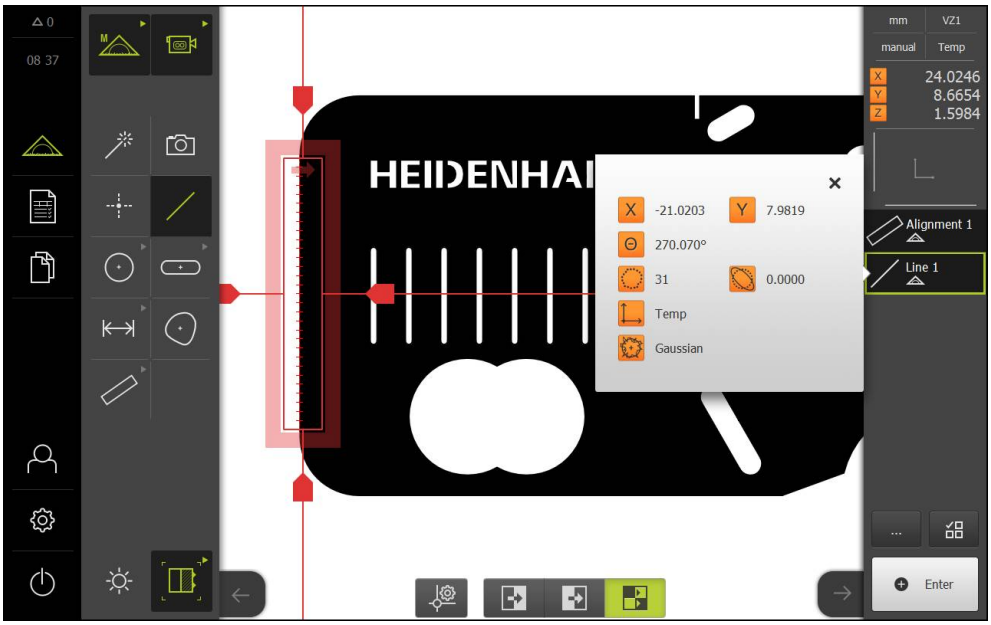


Figure 47: The straight line is displayed in the feature list of the Inspector

Constructing the zero point

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

- ▶ 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
- > A new feature with the selected geometry is displayed

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

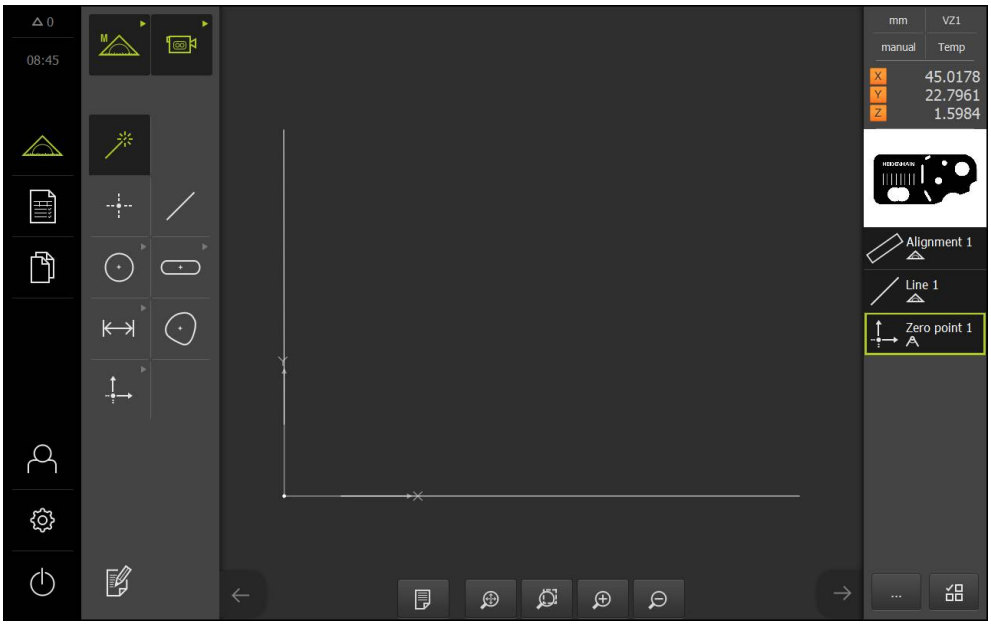


Figure 48: The coordinate system is shown in the workspace

Measuring features

To measure features, you can use the geometries of the geometry palette or Measure Magic.

> If you use Measure Magic, the type of geometry is automatically determined from the captured measuring points. The type of geometry that is assigned to the new feature can be changed after the measurement.

Further information: "Measuring with Measure Magic", Page 308
Further information: "Overview of geometry types", Page 277

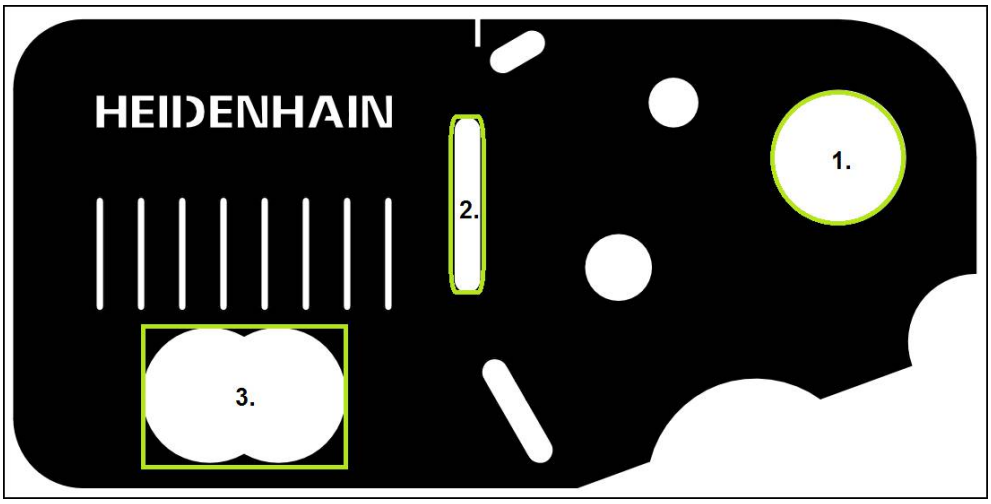


Figure 49: Examples of measuring a 2-D demo part

The section below describes measuring the following features:

1 Circle
2 Slot
3 Blob

> When using the **Manual measuring** function, you can move the image section.
>
> **Further information:** "Moving an image section", Page 89

Measuring a circle

A minimum of three measuring points is required to measure a circle. To acquire the measuring points, you can use the **Circle** measuring tool, for example. 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
- Position the measured object within the live image

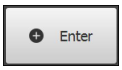
- Select **Measure Magic** in the geometry palette

or

- Select **Circle** in the geometry palette

- Select **Circle** in the tool palette
- Position the measuring tool on 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
- > Multiple measuring points are captured along the edge
- > A new feature is displayed in the feature list of the Inspector

- Tap **Finish** in the new feature
- > A new feature is calculated from the captured measuring points and the selected geometry
- > The measured circle is displayed in the features preview
- > The measurement result preview is now displayed

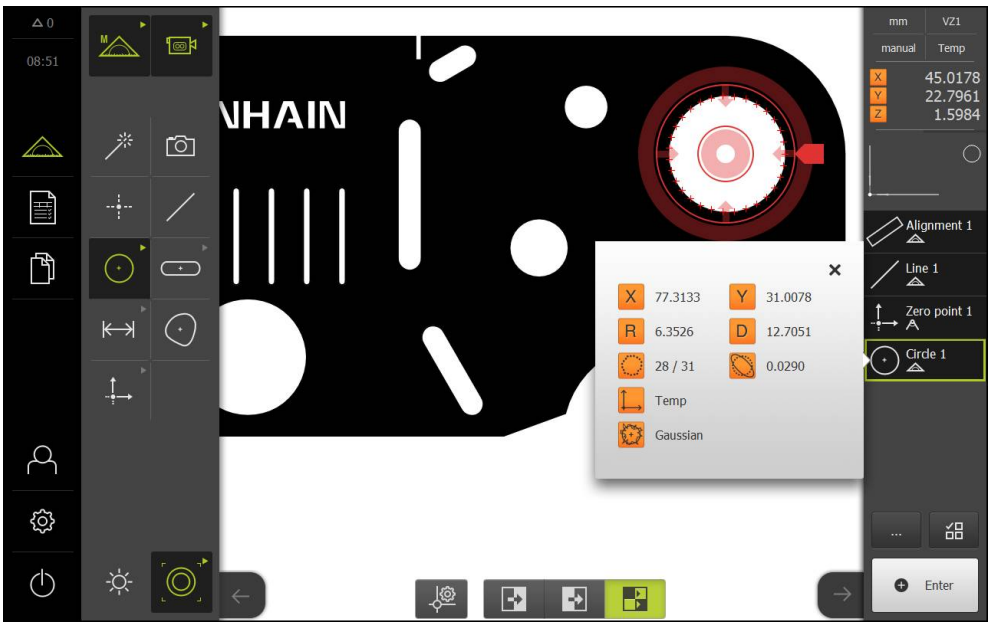


Figure 50: The circle is displayed in the features preview

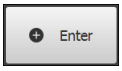
Measuring a slot

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

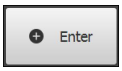
- Select **Single edge** in the tool palette
- Position the search range of the measuring tool on the contour of the slot
- Resize the search range

- 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

> 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
- > A new feature is calculated from the captured measuring points and the selected geometry
- > The measured slot is displayed in the features preview
- > The measurement result preview is now displayed

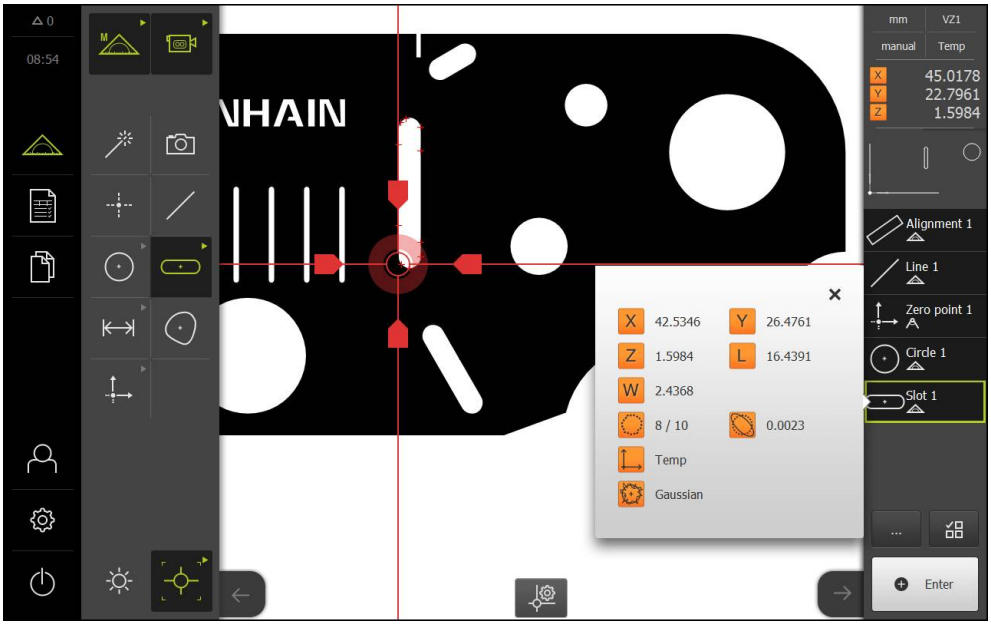


Figure 51: The slot is displayed in the features preview

Measuring a blob

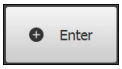
A minimum of three measuring points is required to measure a blob. To capture the measuring points, you can use e.g. the **Contour** measuring tool. Multiple measuring points are automatically distributed along the entire contour according to the specified settings.

- Select **Blob** in the geometry palette

- Select **Contour** in the tool palette
- Position the measuring tool at any desired location on 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 result preview is now displayed

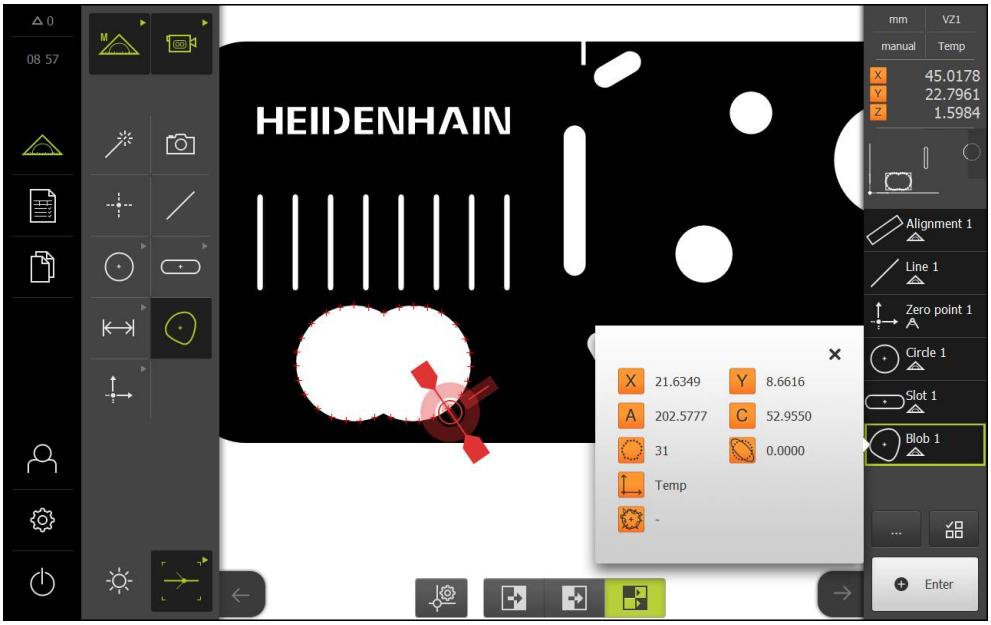


Figure 52: The blob is displayed in the features preview

9.3.4 Measuring with an OED sensor

For the measurement of edges and contours with the QUADRA-CHEK 3000 OED software option, various measuring tools are available to you for the acquisition of measuring points.

Further information: "Measuring tools", Page 103

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

Further information: "Measuring", Page 275

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.

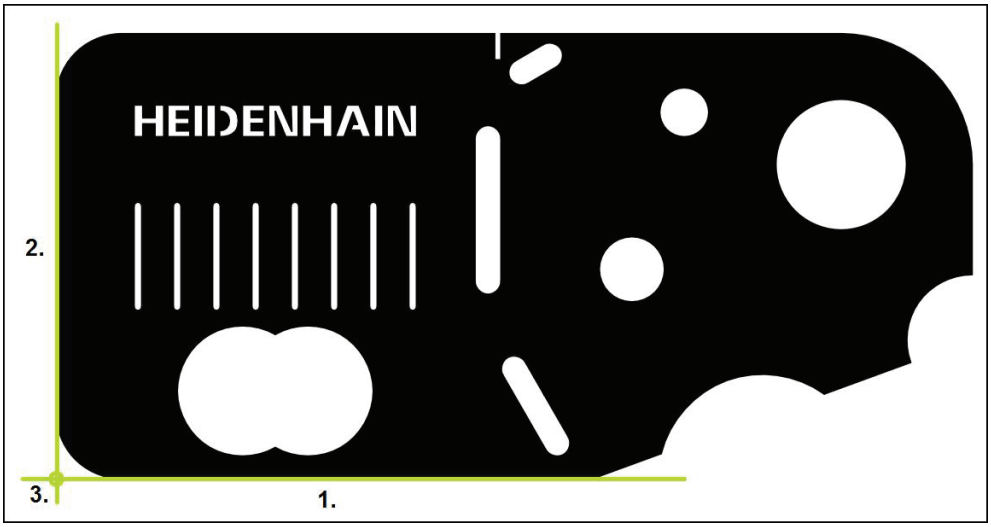


Figure 53: Example of aligning a 2-D demo part

Measured objects are usually aligned in the following steps:

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

> When using the **Manual measuring** function, you can move the image section.

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, then select **OED sensor** in the sensor palette

> The geometry palette and the OED measuring tools are now displayed

> The workspace now shows the position display

- In the quick access menu, select the magnification that is set on the measuring machine

- Select **Alignment** in the geometry palette

- Select **Auto OED** in the tool palette
- Cross over the reference edge multiple times with the OED sensor

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

> A new measuring point is added for each pass over the reference edge

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

- Tap **Finish** in the new feature

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

> The measurement result preview is now displayed

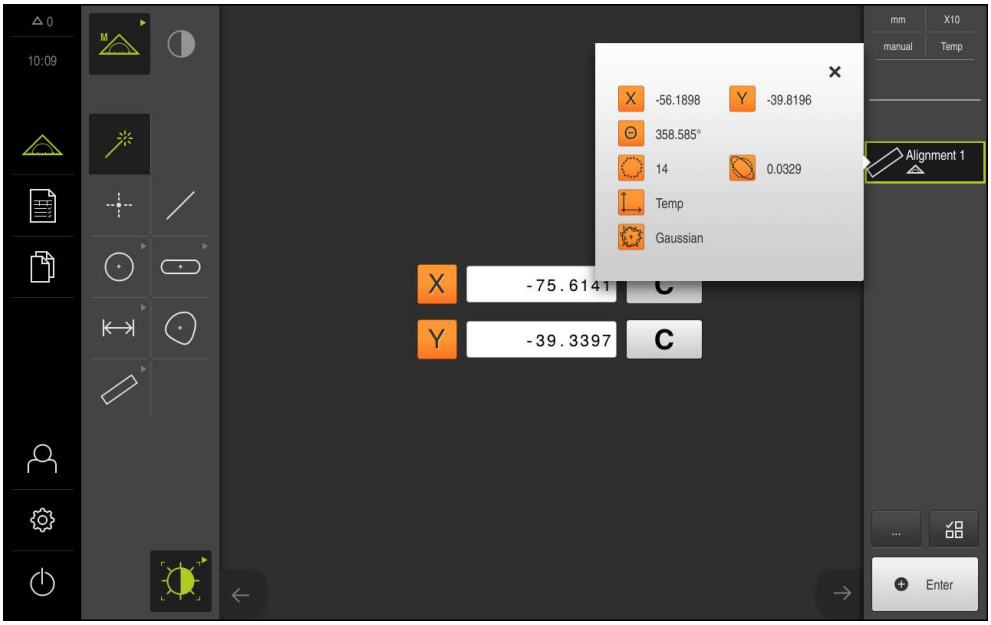


Figure 54: The alignment is displayed in the feature list of the Inspector

Measuring a straight line

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

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

- ▶ Select **Auto OED** in the tool palette
- ▶ Cross over the reference edge multiple times with the OED sensor
- > A new feature is displayed in the feature list of the Inspector
- > A new measuring point is added for each pass over the reference edge

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

- ▶ Tap **Finish** in the new feature
- > The line is displayed in the feature list of the Inspector
- > The measurement result preview is now displayed

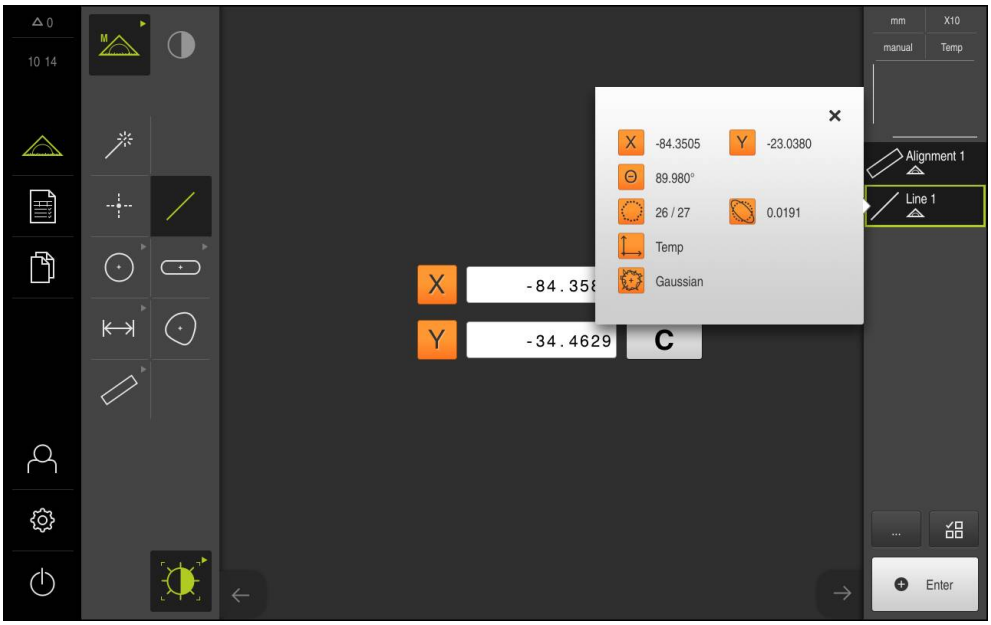


Figure 55: The line will be shown in the feature list of the Inspector

Constructing the zero point

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

- ▶ 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
- > A new feature with the selected geometry is displayed

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

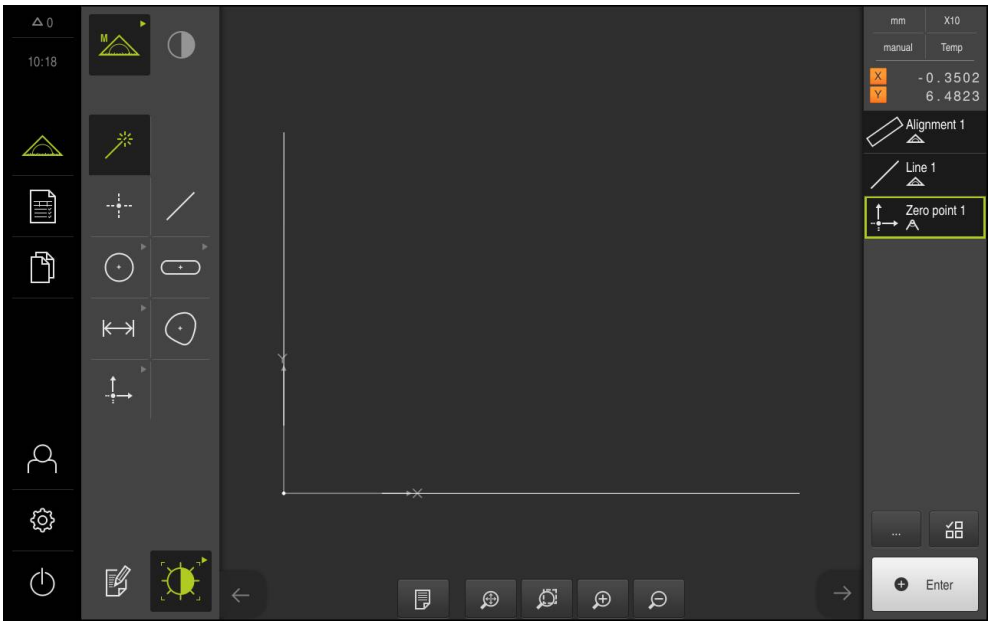


Figure 56: The coordinate system is shown in the workspace

Measuring features

To measure features, you can use the geometries of the geometry palette or Measure Magic.

> If you use Measure Magic, the type of geometry is automatically determined from the captured measuring points. The type of geometry that is assigned to the new feature can be changed after the measurement.

Further information: "Measuring with Measure Magic", Page 308
Further information: "Overview of geometry types", Page 277

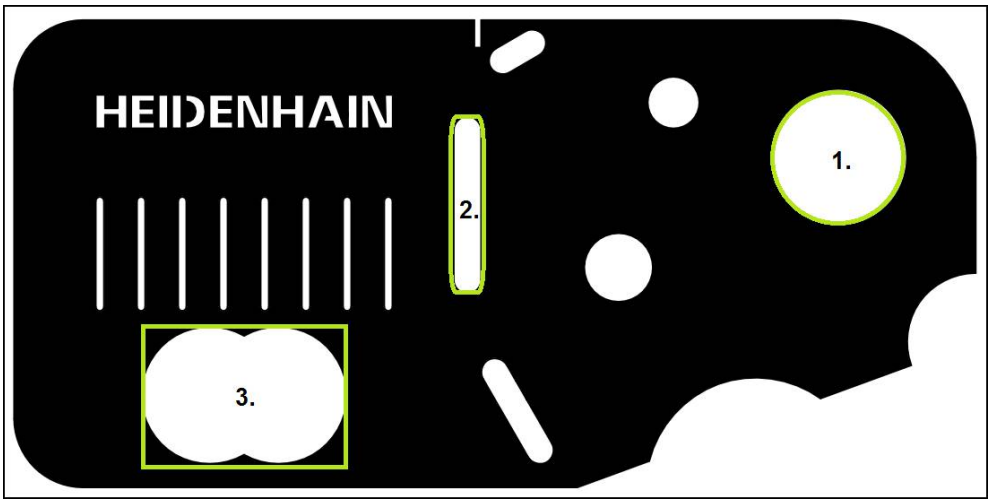


Figure 57: Examples of measuring a 2-D demo part

The section below describes measuring the following features:

1 Circle
2 Slot
3 Blob

Measuring a circle

A minimum of three measuring points is required to measure a circle. For measuring point acquisition, you can use the **OED** measuring tool, for example.

- Tap **Measure** in the main menu

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

- If more than one optical sensor is active, select **OED sensor** in the sensor palette

> The geometry palette and the OED measuring tools are displayed

> The workspace now shows the position display

- In the quick access menu, select the magnification that is set on the measuring machine

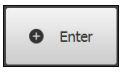
- Select **Measure Magic** in the geometry palette

or

- Select **Circle** in the geometry palette

- Select **OED** in the tool palette
- Cross over the edge of the circle with the OED sensor multiple times

> The unit records the measuring point in the clipboard



- To confirm the measuring point acquisition, tap **Enter** in the Inspector

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

> **i** A new measuring point is recorded every time you cross over an edge of the feature to be measured using the OED sensor. The clipboard is updated with the newly recorded measuring point. If you tap **Enter** in the Inspector, then only the most recently acquired measuring point is confirmed.

- To acquire more than one measuring point along the edge, repeat the process

- Tap **Finish** in the new feature

> A new feature is calculated from the captured measuring points and the selected geometry

> The measured circle is displayed in the features preview

> The measurement result preview is now displayed

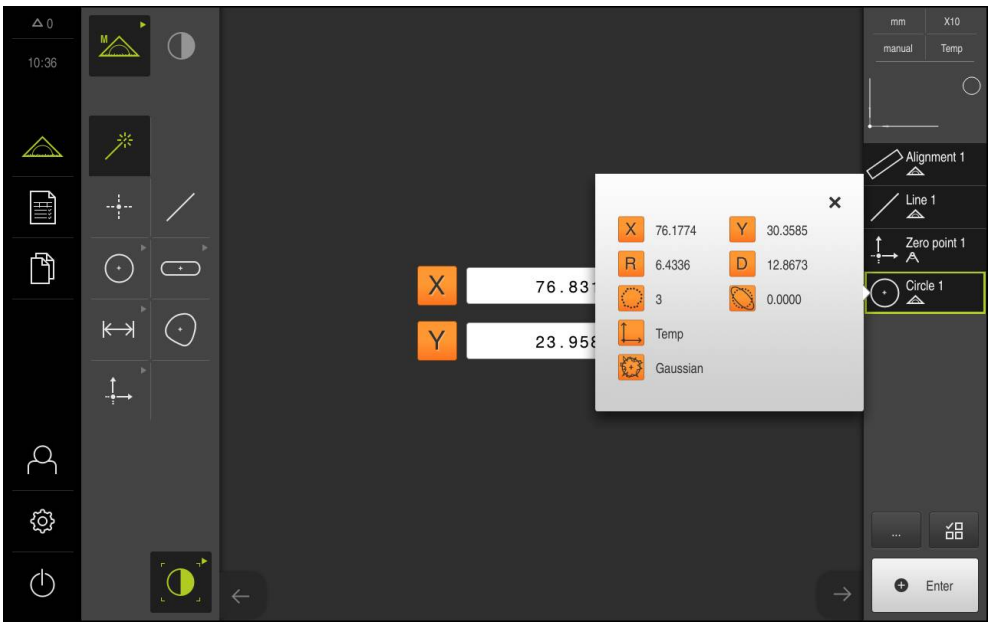


Figure 58: The circle is displayed in the features preview

Measuring a slot

A minimum of five measuring points is required in order to measure a slot. For measuring point acquisition, you can use the **Auto OED** measuring tool, for example. 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 **Auto OED** in the tool palette
- Cross over the edge of the slot multiple times with the OED sensor

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

> A new measuring point is added for each pass over the reference edge

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

- Tap **Finish** in the new feature

> A new feature is calculated from the captured measuring points and the selected geometry

> The measured slot is displayed in the features preview

> The measurement result preview is now displayed

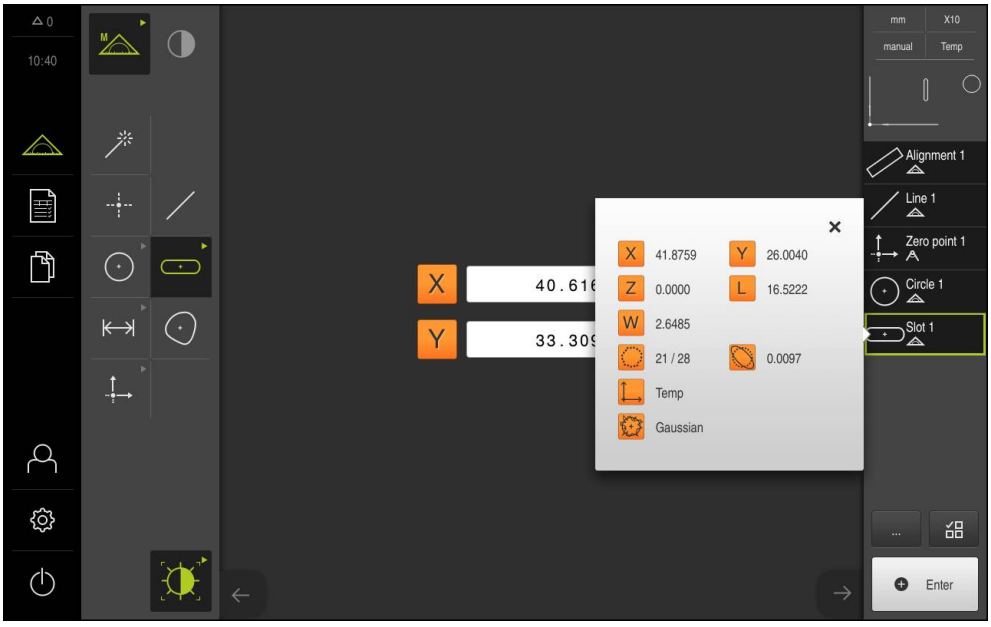


Figure 59: The slot is displayed in the features preview

Measuring a blob

A minimum of three measuring points is required to measure a blob. For measuring point acquisition, you can use the**Auto OED** measuring tool, for example. Multiple measuring points are automatically distributed along the entire contour according to the specified settings.

- Select **Blob** in the geometry palette

- Select **Auto OED** in the tool palette
- Cross over the edge of the blob multiple times with the OED sensor

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

> A new measuring point is added for each pass over the reference edge

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

- Tap **Finish** in the new feature

> The unit calculates a new feature from the captured measuring points and the selected geometry

> The measured blob is displayed in the features preview

> The measurement result preview is now displayed

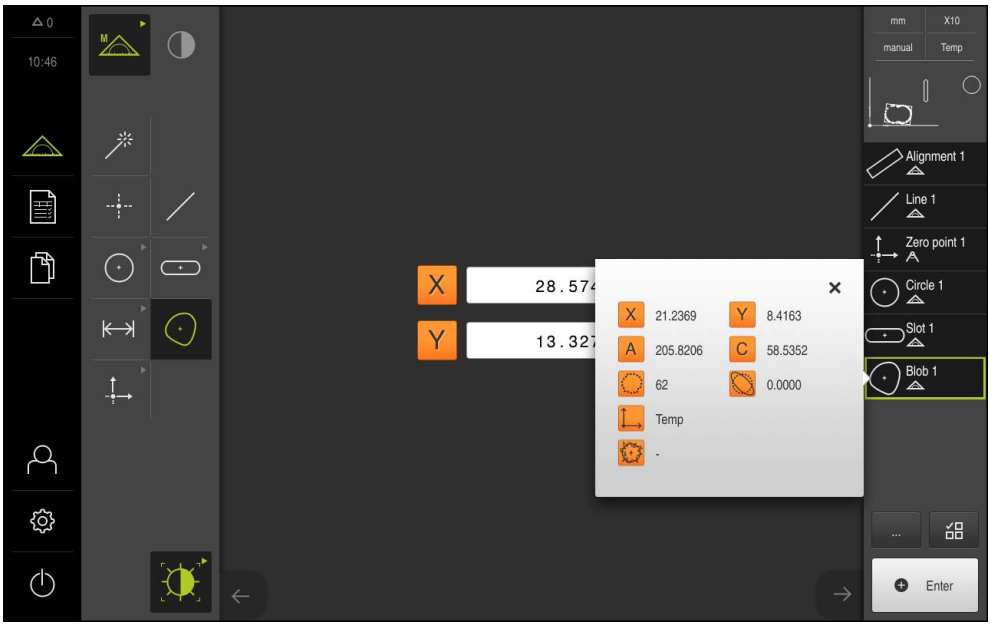


Figure 60: The blob is displayed in the features preview

9.3.5 Deleting features

If the measurement of a feature fails, one or more features can be deleted from the feature list.

	Reference features, such as a zero point, alignment, or reference plane, cannot be deleted as long as other features are referenced to them.

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

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

9.3.6 Displaying and editing the measurement results

You can edit the measured features immediately after capturing the measuring points. Drag individual features into the workspace and edit them in the **Details** dialog.

Short description

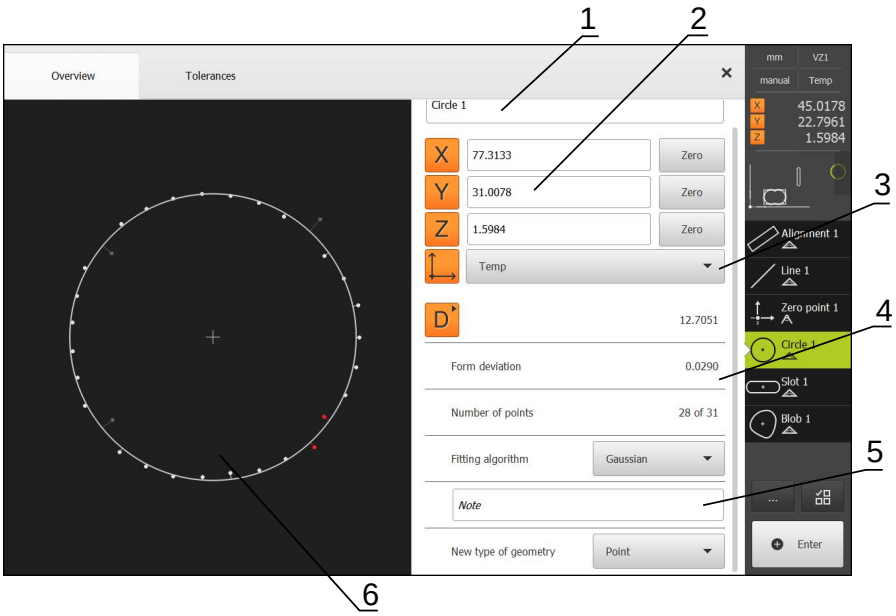


Figure 61: **Details** dialog with **Overview** tab

1 Name of the feature
2 Axis positions of the center point
3 Coordinate system
4 Feature properties and parameters
5 **Note** text field
6 View of the measuring points and the form

In the **Overview** tab of the **Details** dialog, you will find the following information and settings:

- The name of the feature
- The axis positions of the center point
- The coordinate system to which the coordinate values of the feature are referenced
- Feature parameters, depending on the type of geometry

  For the **Circle** geometry type, you can switch between **Radius** and **Diameter** by means of a button.
- 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)
- The **Note** text field, in which annotations can be entered and then displayed as annotations in the features view
- 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 new 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 353

- ▶ Drag a feature (e.g., the **Circle**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The fitting algorithm used is shown in the **Fitting algorithm** drop-down list
- ▶ In the **Fitting algorithm** drop-down list, select the **Min. circumscribed** fitting algorithm
- > The feature is displayed according to the selected fitting algorithm

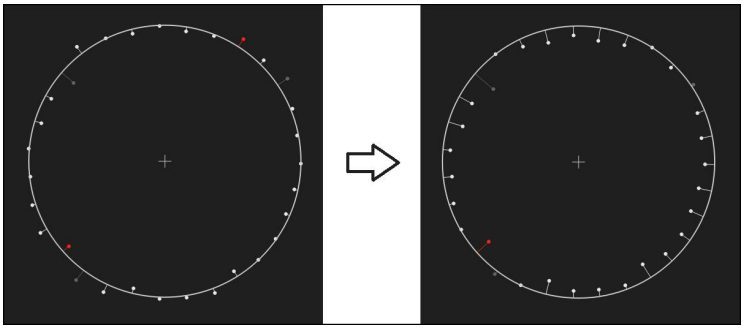


Figure 62: Feature with the new **Fitting algorithm**

- ▶ 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 **Details** dialog.

- ▶ Drag a feature (e.g., the **Slot**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The geometry type of the feature is displayed
- ▶ In the **New type of geometry** drop-down list, select the **Point** type of geometry, for example

> The **2-D profile** geometry type is currently not yet supported.

- > The feature is displayed in the new form

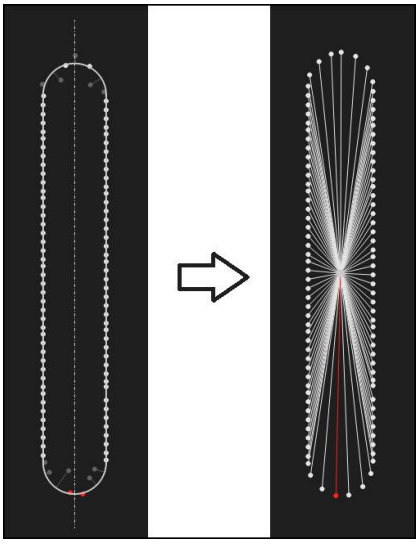


Figure 63: Type of geometry changed from **Slot** to **Point**

- ▶ Tap **Close** to close the dialog

Adjusting Tolerances

On the **Tolerances** tab, you can adjust the tolerances for a measured feature. The tolerances are grouped.

Figure 64: **Details** dialog with **Tolerances** tab

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

In the **Tolerances** tab, you can define the geometrical tolerancing of a feature. The tolerances are grouped.

- ▶ Drag a feature (e.g., the **Circle**) 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
- ▶ Tap the size tolerance **X**

- > An overview of the selected size tolerance appears

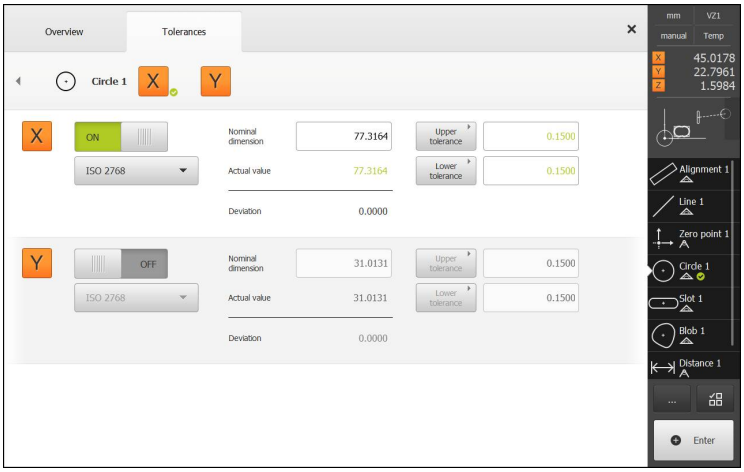


Figure 65: Overview of **Size tolerance** with activated size tolerance **X**

- ▶ Activate tolerancing of the measured value with the **ON/OFF** slide switch
- > The selection and input fields become active
- ▶ Tap the **Nominal dimension** input field and enter the value
- ▶ Confirm entry with **RET**
- ▶ Tap the **Upper tolerance** input field and enter the value
- ▶ Confirm entry with **RET**
- ▶ Tap the **Lower tolerance** input field and enter the value
- ▶ Confirm entry with **RET**
- > 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 **Back**

- > The **Tolerances** tab is displayed
- > Symbols are used to display the result of the tolerance check on the **Tolerances** tab and, after closing the dialog, in the feature list

	Activated tolerances are maintained
	One or more activated tolerances are exceeded

Further information: "Defining tolerances", Page 358

Adding annotations

In the features view, you can add annotations to each feature (for example, measurement information or informational texts).

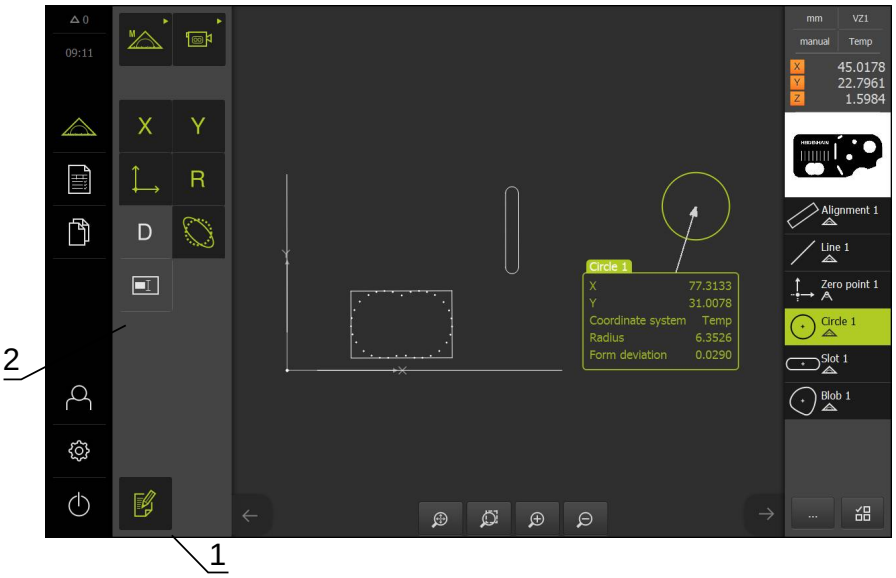


Figure 66: Feature with annotations in the features view

1 The **Edit annotations** operating element
2 Operating elements for adding annotations to one or more features

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

- ▶ Select **Manual measuring**
- ▶ If applicable, tap **Features preview** in the Inspector
- > The features preview is now displayed in the workspace

- ▶ Tap **Edit annotations**
- ▶ Select one or more features in the feature list
- > The operating elements for adding annotations are now displayed
  Further information: "Editing annotations", Page 91
- ▶ To add annotations to the selected features, tap the corresponding operating element
- > The annotations are now displayed in the workspace
- ▶ To place annotations in a different position, drag the annotations in the workspace to the desired location
- ▶ To leave the editing mode, tap **Edit annotations** again

If you select multiple features with different geometry types, then only those operating elements are displayed that are available for all objects. If an annotation has already been added to a portion of the selected features, then the associated operating element is depicted in dashed lines

Example: Adding a text annotation

- ▶ Drag a feature (e.g., a **Circle**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ In the **Note** input field, enter the text that is to be shown in the features view
- ▶ In the **Details** dialog, tap **Close**

- ▶ Tap **Edit annotations**
- ▶ In the feature list, select the feature for which the annotation has been entered
- > The operating elements for adding annotations are now shown

- ▶ Tap **Note**
- > The text is now displayed as an annotation in the workspace

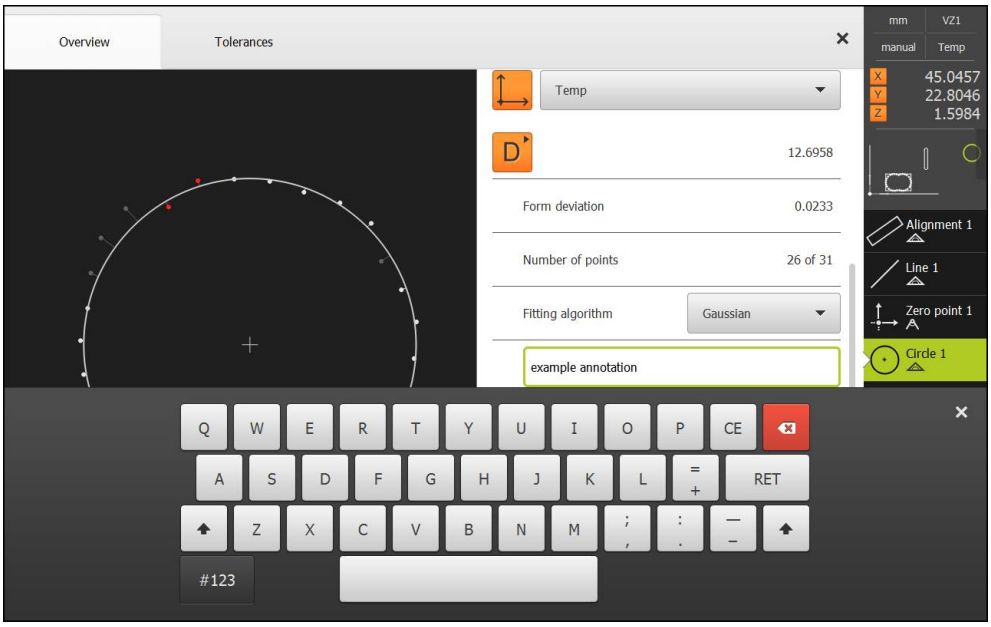


Figure 67: Text annotation in the input field

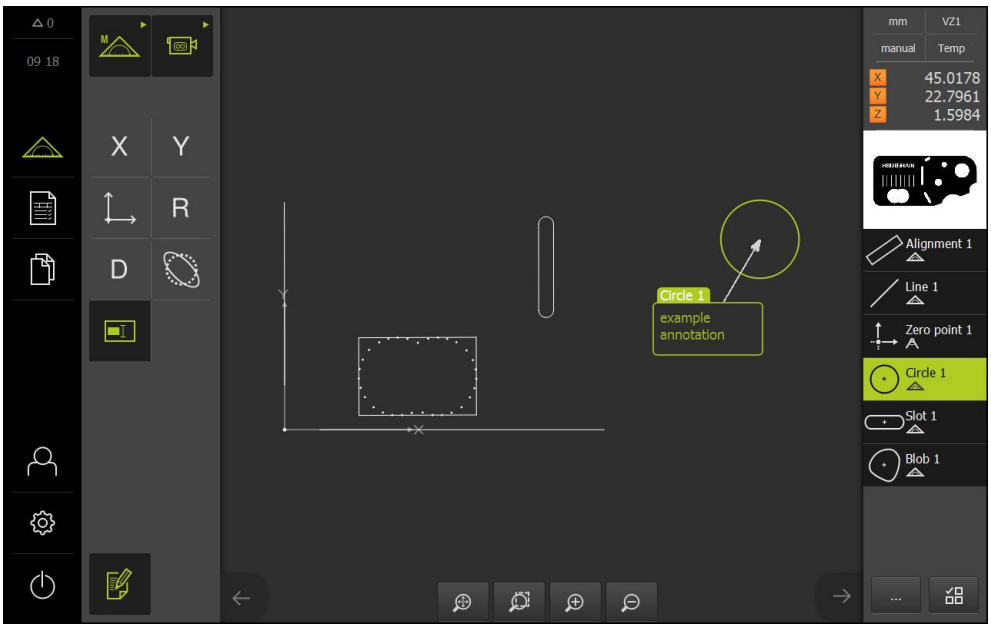


Figure 68: Text annotation in the features view

9.3.7 Creating a measurement report

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

You can create a measurement report in four steps:

- "Selecting the template and features"
- "Entering information on the measuring task"
- "Selecting document settings"
- "Exporting a measurement report"

Selecting the template and features

- ▶ Tap **Measurement report** in the main menu
- > The user interface for editing the measurement reports appears
- ▶ Select the **Standard** template
- > 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 270

- ▶ 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

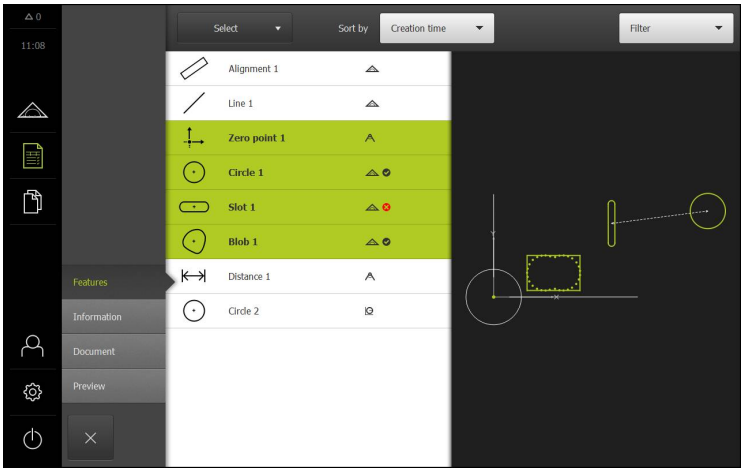


Figure 69: Measurement report menu with feature list and preview

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 of measurement for linear measurement values, select the desired unit of measurement 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 of measurement for angular values, select the desired unit of measurement in the **Unit for angular values** drop-down list
  - **Decimal degrees**: Display in degrees
  - **Radian**: Display in radians
  - **Deg-Min-Sec**: Display in degrees, minutes, and seconds
- 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

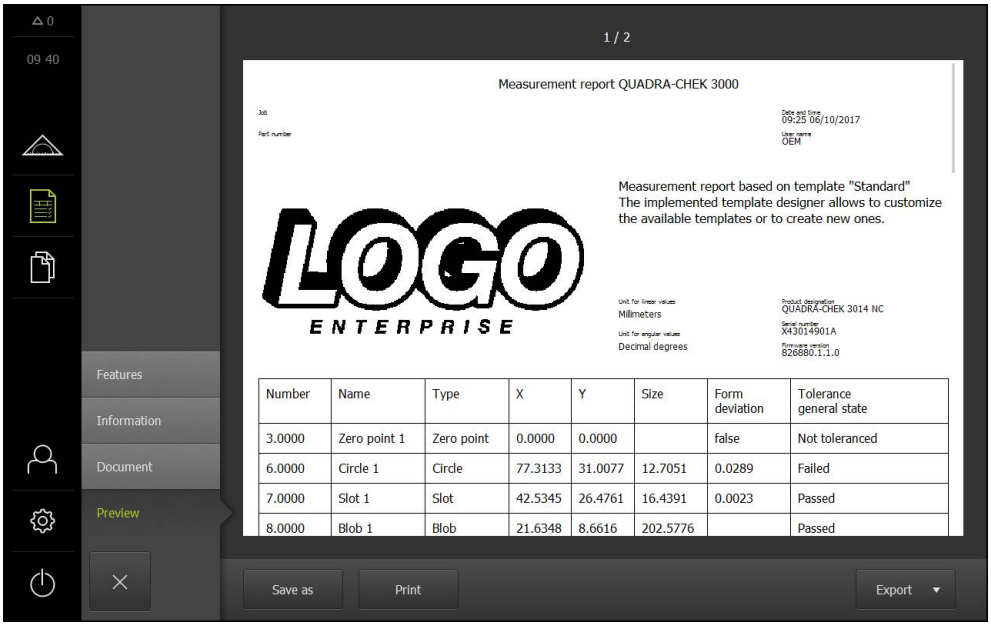


Figure 70: Preview of the measurement report

Saving a measurement report

Measurement reports are saved in the XMR data format.

- 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 **Save as**
- > The measurement report is saved

> Files saved in XMR data format can be displayed and newly created at a later point in time.
>
> **Further information:** "Protokoll erzeugen", Page 392
> Page 427

Printing a measurement report

- Tap **Print**
- > The measurement report is output to the specified printer
  Further information: "Configuring the printer", Page 195

Exporting a measurement report

Measurement reports can be exported as PDF or CSV files.

- 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 **Save as**
- > The measurement report is exported in the selected format and stored in the storage location

Canceling a 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 424

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 shown.
	Is not	Only features of the non-selected geometry type are shown.
Size	**Equal**	Only features of the specified size are shown.
	Greater than	Only features that are larger than the specified size are shown.
	Less than	Only features that are smaller than the specified size are shown.
Tolerance	**Is**	Only features that fulfill the selected characteristic are shown: ■ **Passed** ■ **Failed** ■ **Inactive**
	Is not	Only features that do not fulfill the selected characteristic are shown.
Selection	**Is**	Only the selected features are shown.
	Is not	Only the non-selected features are shown.

9.3.8 Creating and managing 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. The work steps of a measuring program are referred to as program steps.

Measuring programs can include the following program steps:

- Adapting the settings of the measuring program: Initialization, Auto enter, units
- Changing the reference system
- Adjusting the magnification
- Controlling the lighting
- Measuring point acquisition: Start the measuring tool
- Creating and evaluating a feature: Calculation, construction, definition
- Deleting features and 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.

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**
- Tap the input field, and enter a name for the measuring program
- Confirm entry with **RET**
- Tap **Save as**

> The measuring program is saved

> The name of the measuring program is displayed in 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

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

Opening and starting a measuring program from the miscellaneous functions

If you open a measuring program, then the current measuring program will be closed. Unsaved changes to the current measuring program are thereby lost.

- Save changes made to the current measuring program before opening a measuring program

Further information: "Saving a measuring program", Page 272

- Tap **Miscellaneous functions** in the Inspector
- In the Miscellaneous functions dialog, tap **Open**
- Confirm the note with **OK**
- > The **Internal/Programs** folder is now displayed
- Navigate to storage location of the measuring program
- Tap the name of the measuring program
- Tap **Select**
- > 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

10

Measuring

10.1 Overview

This chapter contains an overview of the predefined geometry types and describes how to prepare a measurement, acquire measuring points, and conduct the actual measurement. You will also learn how you can construct new features out of measured, constructed, or defined features.

Make sure that you have read and understood the "Basic operation" chapter before carrying out the actions described below.

Further information: "Basic operation", Page 61

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: "Geometry types", Page 470

Geometry	Name	Properties	Number of measuring points
	**Measure Magic**	Automatically determines the geometry type	≥ 1
	**Point**	Sets any measuring 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 or the maximum distance in the case of multiple 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 coordinate system

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

10.3 Acquiring 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 acquired measuring points (point cloud) in the coordinate system, the product can determine and evaluate the feature. Depending on the measuring task, you can change the coordinate system in use by defining a new zero point.
Further information: "Changing the coordinate system", Page 280

The product optionally provides various ways to acquire measuring points:

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

10.3.1 Changing the coordinate system

Depending on the measuring task, you can change the coordinate system in use. By default, the unit uses the coordinate system of the measuring plate with the designation **World**.

If you would like to create a new coordinate system, you must first define a new zero point. The coordinate system generated by this means is created with the designation **Temp**. This coordinate system is overwritten every time a new zero point is defined.

After you have renamed the current **Temp** coordinate system in the **Details** dialog, you can save it and use it again.

Further information: "Saving and opening a coordinate system", Page 102

- Select **Zero point** in the geometry palette
- From features, construct a new zero point in the Inspector or in the features view

or

- Tap the new zero point, and tap **Enter** in the Inspector

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

- Tap **Finish** in the new feature

> The zero point is now created

> A new coordinate system with the designation **Temp** is created. If a coordinate system with the designation **Temp** already exists, then the already existing coordinate system **Temp** is overwritten

- Drag the zero point out of the feature list into the workspace

> The **Details** dialog appears with the **Overview** tab selected

- Tap the **input field** with the name **Temp**
- Enter the new name for the zero point
- Confirm entry with **RET**

> The new coordinate system is displayed in the quick access menu

With the option **Create coordinate system automatically**, a new coordinate system is automatically generated for each definition of a reference feature.
Further information: "Coordinate systems", Page 464

10.3.2 Acquiring measuring points without using a sensor

If measuring points are acquired without using a sensor, then it is necessary that the operator on the connected measuring machine (e.g., measuring microscope, profile projector) be able to move to the desired position on the measured object (e.g., by using crosshairs). If this position has been reached, then measuring point acquisition is triggered either manually by the operator or automatically by the unit, 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.

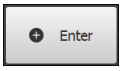
The measuring point acquisition procedure without a sensor is identical for all geometries and is explained below using the **Circle** geometry

Acquiring 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

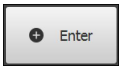
- Select **Circle** in the geometry palette
- On the measuring machine, move to the desired position on the measured object
> If automatic measuring point acquisition is active, the measuring point is captured automatically
Further information: "Setting automatic measuring point acquisition", Page 99



- 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

	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
> If **Number of measuring points Fixed** is set in the features settings, then measuring point acquisition is completed automatically

> If **Number of measuring points Free** is set in the features settings, then a check mark is displayed next to the feature in the feature list upon completion of the measurement

- Tap **Finish** to complete the measuring point acquisition
> The acquired feature is displayed in the feature list and the features preview
> The measurement result preview is now displayed

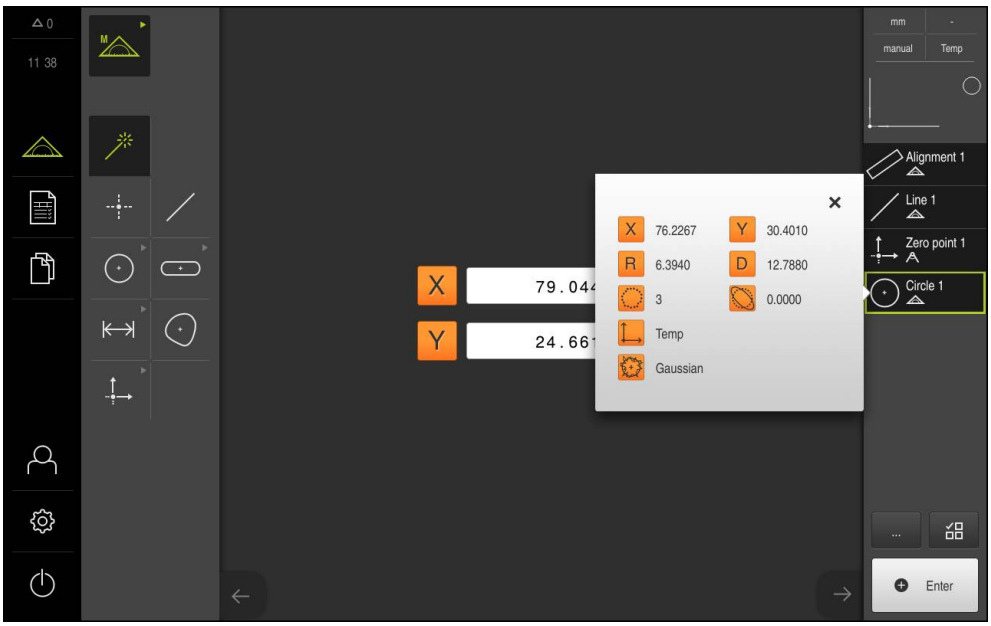


Figure 71: The feature is displayed in the feature list and features preview

10.3.3 Acquiring measuring points using 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

Optical sensors are particularly well suited for use in the following cases:

- For the measurement of small features
- When there is a large number of measuring points (particularly when measuring with active VED measuring tools)
- For short measuring times
- For non-rigid measuring objects

Acquiring measuring points with a VED sensor

If the QUADRA-CHEK 3000 VED software option is activated, then the unit supports the use of a VED sensor (optical sensor). A VED sensor is a USB camera or network camera connected to the product.

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 in order 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.

In addition to the **Crosshair** VED measuring tool, the unit also offers active VED measuring tools such as **Active Crosshair** or **Circle**.

When acquiring 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. Measuring point acquisition is initiated by the operator or automatically by the unit, depending on the configuration.

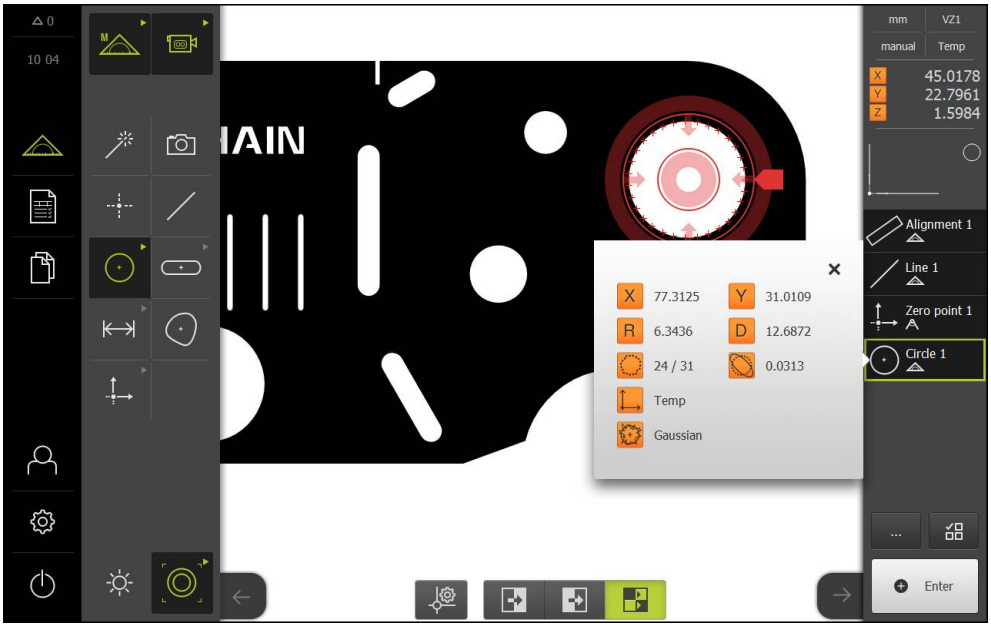


Figure 72: **Circle** VED measuring tool with captured measuring points

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 277

The procedure for acquiring measuring points using a VED sensor is identical for all geometries and is described below using the example of a **Circle** geometry.

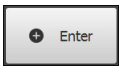
Acquiring measuring points with the “Crosshair” VED measuring tool

- 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

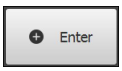
- Select **Crosshair** in the tool palette
- Position the measuring tool in the live image by tapping or dragging
- > If automatic measuring point acquisition is active, the measuring point is captured automatically
  Further information: "Setting automatic measuring point acquisition", Page 99



- 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

> 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
- > If **Number of measuring points Fixed** is set in the features settings, then measuring point acquisition is completed automatically

- > If **Number of measuring points Free** is set in the features settings, then a check mark is displayed next to the feature in the feature list upon completion of the measurement

- Tap **Finish** to complete the measuring point acquisition
- > The acquired feature is displayed in the feature list and the features preview
- > The measurement result preview is now displayed

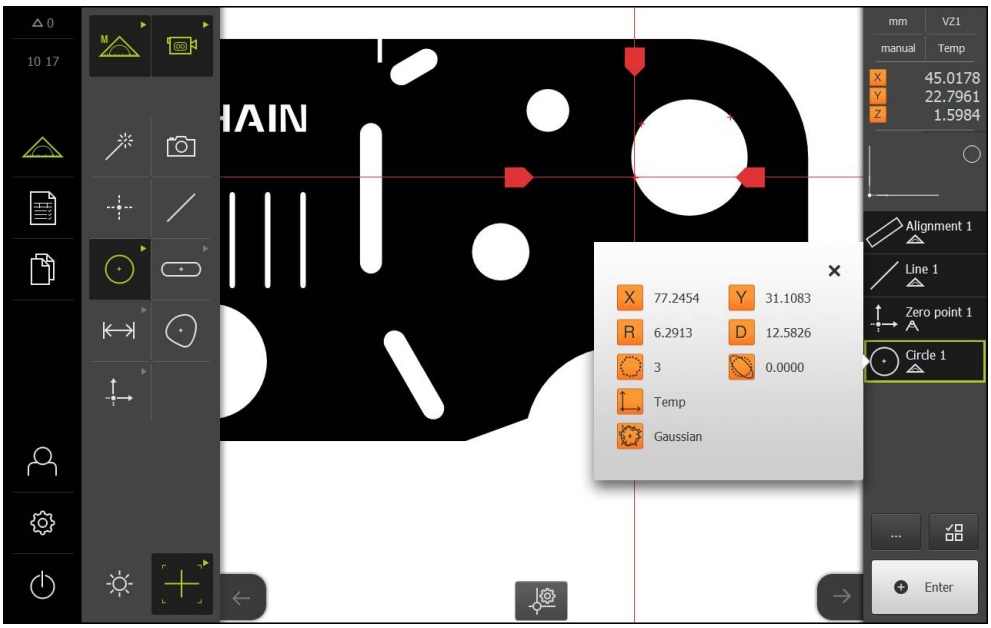


Figure 73: Measuring point acquisition with a **Crosshair** VED measuring tool

Measuring point acquisition with an active VED measuring tool

The active VED measuring tools vary in terms of their use and area of application. The measuring point acquisition is the same for all active VED measuring tools.

Further information: "Measuring tools", Page 103

- Tap **Measure** in the main menu

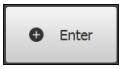
- Select **Manual measuring** in the function palette

- 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 on 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, then the measuring points are captured automatically
Further information: "Setting automatic measuring point acquisition", Page 99

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



- Tap **Enter** in the Inspector
- Repeat the last two steps for the third measuring point
> If **Number of measuring points Fixed** is set in the features settings, then measuring point acquisition is completed automatically

> If **Number of measuring points Free** is set in the features settings, then a check mark is displayed next to the feature in the feature list upon completion of the measurement

- Tap **Finish** to complete the measuring point acquisition
> The acquired feature is displayed in the feature list and the features preview
> The measurement result preview is now displayed

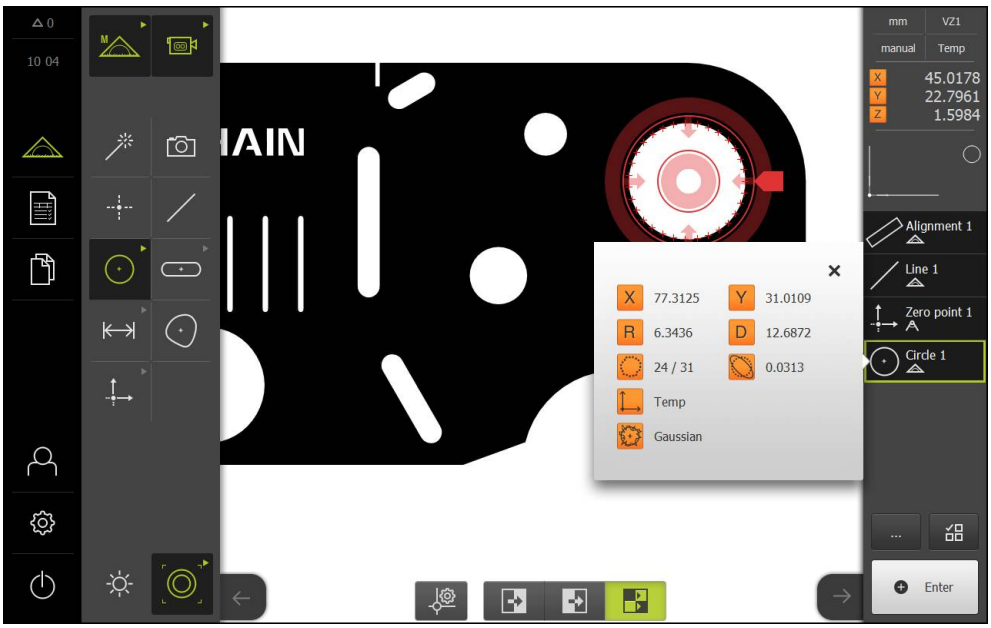


Figure 74: Acquiring measuring points with an active VED measuring tool

Acquiring measuring points with an OED sensor

If the QUADRA-CHEK 3000 OED software option is activated on the unit, then the unit supports the use of an OED sensor (optical sensor) An OED sensor is a fiber optic cable that is connected to the unit and that transfers information about light intensity from the screen of the measuring machine to the unit.

When measuring points are acquired with an OED sensor, the position display or features view is shown in the workspace. Measuring point acquisition is performed with OED measuring tools.

The operator positions the OED sensor at the desired edge by moving the measuring plate.

In addition to the **Crosshair** OED measuring tool, the unit also offers the active **OED** or **Auto OED** measuring tools.

When acquiring measuring points with the **Crosshair** tool, the operator specifies the measuring point by manually positioning the crosshairs in the projection screen of the measuring machine.

Active OED measuring tools enable the objective acquisition of measuring points. This is because, based on a contrast analysis, the unit recognizes a light-to-dark transition as an edge. Depending on the configuration and the selected OED measuring tool, measuring point acquisition is triggered by the operator or automatically by the unit.

The unit acquires the coordinates for the measuring point based on the axis positions and the position of the OED sensor in relation to the crosshairs (offset between crosshairs and OED sensor). The unit 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 277

The measuring point acquisition procedure with an OED sensor is identical for all geometries and is described below using the example of a **Circle** geometry.

Measuring point acquisition using the crosshair OED measuring tool

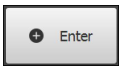
- ▶ Tap **Measure** in the main menu
- > The axis position is displayed in the workspace

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

- ▶ If more than one optical sensor is active, then select the **OED sensor** in the sensor palette
- > The geometry palette and the OED measuring tools are now displayed
- ▶ If needed, tap **Position preview** in the Inspector
- > The workspace now shows the position display
- ▶ In the quick access menu, select the magnification that is set on the measuring machine

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

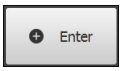
- ▶ Select **Crosshair** in the tool palette
- ▶ Position the crosshairs on the projection screen to the edge of the circle
- > If automatic measuring point acquisition is active, then the measuring point is acquired automatically
  Further information: "Setting automatic measuring point acquisition", Page 99



- ▶ 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

> 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
- > If **Number of measuring points Fixed** is set in the features settings, then measuring point acquisition is completed automatically

- > If **Number of measuring points Free** is set in the features settings, then a check mark is displayed next to the feature in the feature list upon completion of the measurement

- ▶ Tap **Finish** to complete the measuring point acquisition
- > The acquired feature is displayed in the feature list and the features preview
- > The measurement result preview is now displayed

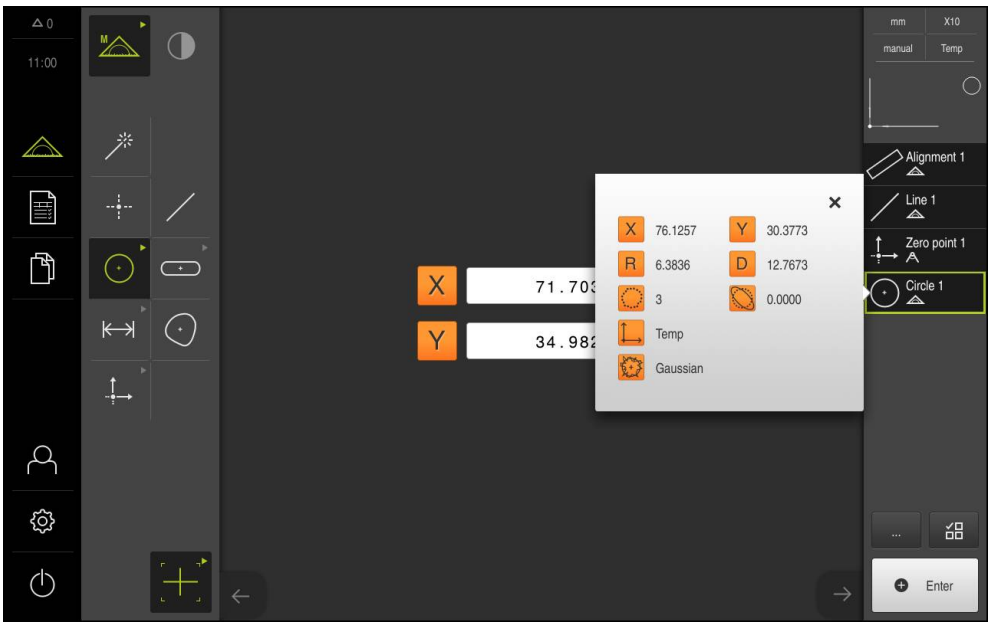


Figure 75: Measuring point acquisition using the **Crosshair** OED measuring tool

Measuring point acquisition using an active OED measuring tool

The active OED measuring tools vary in their areas of application and in how they are operated.

Further information: "Measuring tools", Page 103

- Tap **Measure** in the main menu

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

- If more than one optical sensor is active, then select **OED sensor** in the sensor palette

> The geometry palette and the OED measuring tools are now displayed

- If needed, tap **Position preview** in the Inspector

> The workspace now shows the position display

- 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. **, Auto OED**)
- With the OED sensor, cross over the edge of the circle

> The measuring point is acquired automatically

> 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

- Cross over the edge of the circle multiple times until an adequate number of measuring points have been acquired
- A new measuring point is added to the feature every time the edge is crossed over.

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

> If **Number of measuring points Free** is set in the features settings, then a check mark is displayed next to the feature in the feature list upon completion of the measurement

- Tap **Finish** to complete the measuring point acquisition

> The acquired feature is displayed in the feature list and the features preview

> The measurement result preview is now displayed

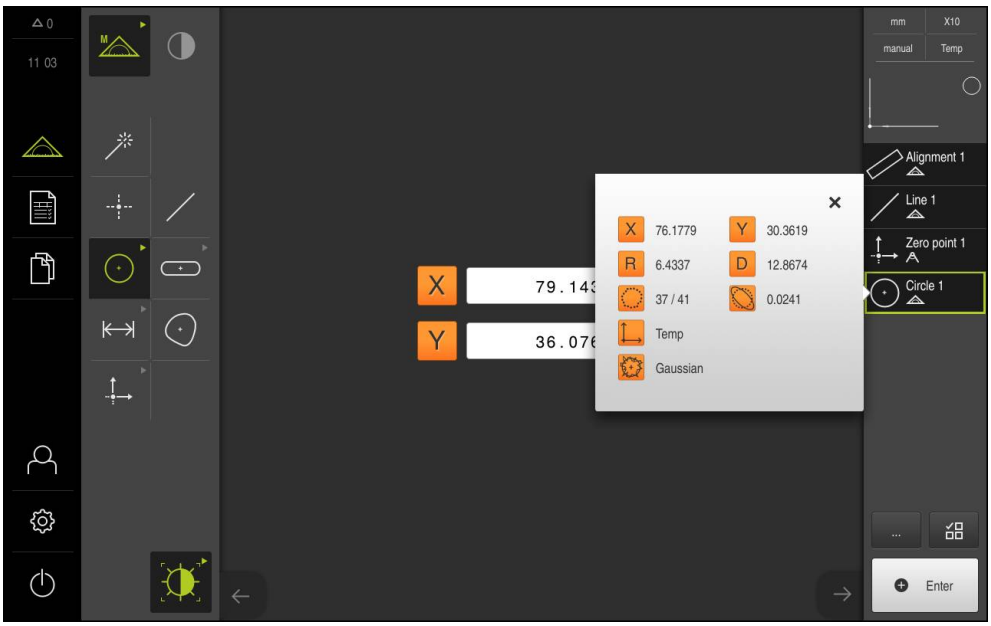


Figure 76: Measuring point acquisition with an active OED measuring tool

10.4 Conducting a measurement

The procedure for measuring features is basically the same for all geometries and is independent of the type of measuring point acquisition. The measurements below are shown using an example with the activated QUADRA-CHEK 3000 VED software option.

10.4.1 Preparing a 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

Conducting the reference mark search

With the help of reference marks, the unit can assign axis positions of the encoder to the machine.

If no reference marks for the encoder are provided by a defined coordinate system, you need to perform a reference mark search before you start measuring.

> If "Reference mark search after unit start" is active, then all of the unit's functions will be disabled until the reference mark search is successfully completed.
>
> **Further information:** "Reference marks (Encoder)", Page 485

If the reference mark search is active on the product, a wizard will ask you to traverse the reference marks of the axes.

- ▶ After logging in, follow the instructions of the wizard
- > On successful completion of the reference mark search, the color of the reference symbol changes

Further information: "Activating the reference mark search", Page 136

Starting the reference mark search manually

> A manual reference mark search can be performed only by the **Setup** and **OEM** user types.

If the reference mark search was not performed on startup, you can start it manually later.

- ▶ 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

Calibrating a 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

Adjusting 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

Adjusting the contrast settings

The contrast threshold defines the contrast value starting from which a light-to-dark transition is recognized as an edge. The higher the defined contrast threshold, the higher the contrast of the measured transition must be.

How the contrast threshold can be either set manually or adjusted automatically to the current light conditions by means of a teach sequence is described below.

Alternatively, you can also adjust the contrast threshold with the contrast bar in the **Measure** menu.
Further information: "Show contrast bar", Page 99 and Page 120

The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- ▶ 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
  - **Automatic**: The edge is defined automatically
  - **First edge**: The first transition ≥ the contrast threshold is defined as the edge
  - **Strongest edge**: Strongest transition ≥ the contrast value is defined as the edge
- In the **Contrast threshold value for edge detection** field, enter the desired contrast threshold and do not superimpose the camera image (setting range: **0 ... 255**)

Or:

- Start the teach sequence: Tap **Start**

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

- 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

> The values in the **Contrast threshold value for edge detection**, **Minimum contrast** and **Maximum contrast** fields will be adjusted automatically, depending on the selected edge algorithm

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

- Tap **Close** to close the wizard

Further information: "Contrast settings", Page 455

Calibrating an OED sensor

Selecting the sensor

- ▶ Tap **Manual measuring**
- > If only the OED sensor is enabled, then it is automatically activated

- ▶ If more than one sensor is enabled, then tap **OED sensor** in the sensor palette
- > The position display is now shown in the workspace
- ▶ Focus the optics of the measuring machine such that the sharpest edge possible is shown on the projection screen of the measuring machine
- ▶ Adjust the lighting of the measuring machine such that the highest amount of contrast possible is shown on the projection screen of the measuring machine

Adjusting the contrast settings

The contrast settings define the contrast value starting from which a light-to-dark transition is recognized as an edge. Adjust the contrast settings to the actual light conditions via a teach sequence. As part of this process the wizard requests that you capture one point from each of the light and dark areas of the screen with the OED sensor.

The light conditions in the room affect the measurement result. Re-adjust the contrast settings if there is a change in the light conditions.

- ▶ Tap **Settings** in the main menu

- ▶ Tap **Sensors**
- ▶ Open in the sequence
  - **Optical edge detection (OED)**
  - **Contrast settings**
- ▶ Start the teach sequence: 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
- ▶ With several magnifications, repeat the procedure for all available magnifications

Further information: "Contrast settings", Page 461

Configuring OED offset settings

The OED offset settings compensate the position error between the crosshair for measuring point acquisition and the OED sensor for edge measurement.
To configure the OED offset settings, carry out a teach sequence in which you measure a circle with two different measuring tools. The momentary offset of the OED sensor for the X and Y axes is calculated from the deviations of both circles and is then compensated with subsequent measurements.

- Tap **Settings** in the main menu

- Tap **Sensors**
- Open in the sequence
  - **Optical edge detection (OED)**
  - **OED offset settings**
- Tap **Magnification**
- Select the desired magnification
- Enter the permissible deviation of the circle diameter measured in the teach sequence into the **Tolerance of circle diameter** entry field
- Confirm the entry with **RET**
- Start the teach sequence: 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 and determine the OED offset settings for all available magnifications

Further information: "OED offset settings", Page 462

10.4.2 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.

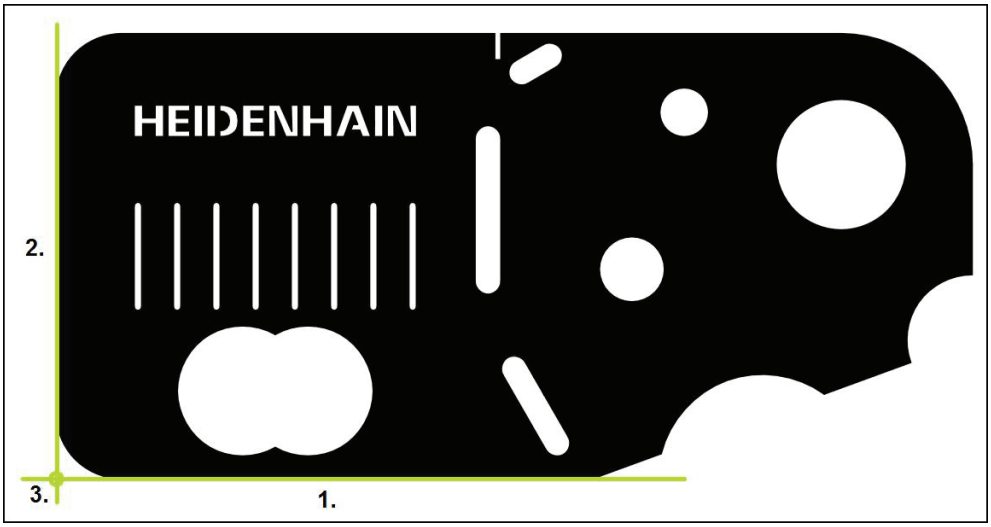


Figure 77: Example of aligning a 2-D demo part

Measured objects are usually aligned in the following steps:

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

When using the **Manual measuring** function, you can move the image section.

Measuring the alignment

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

- Tap **Measure** in the main menu

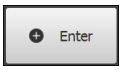
- Select **Manual measuring** in the function palette

- 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
- > The measurement result preview is now displayed

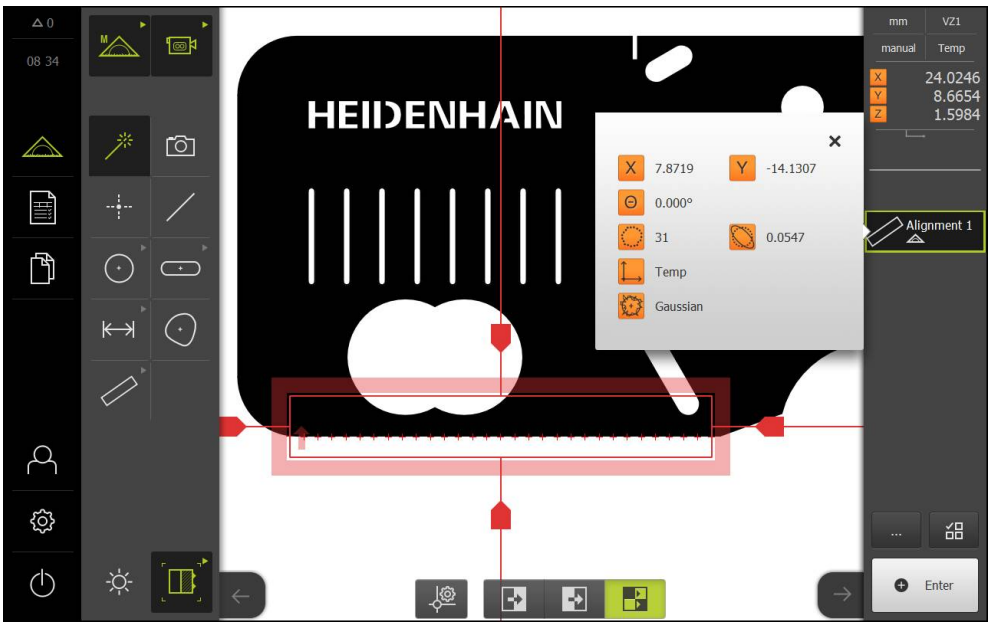


Figure 78: The alignment is displayed in the feature list of the Inspector

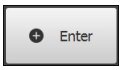
Measuring a straight line

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

> **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
- > The measurement result preview is now displayed

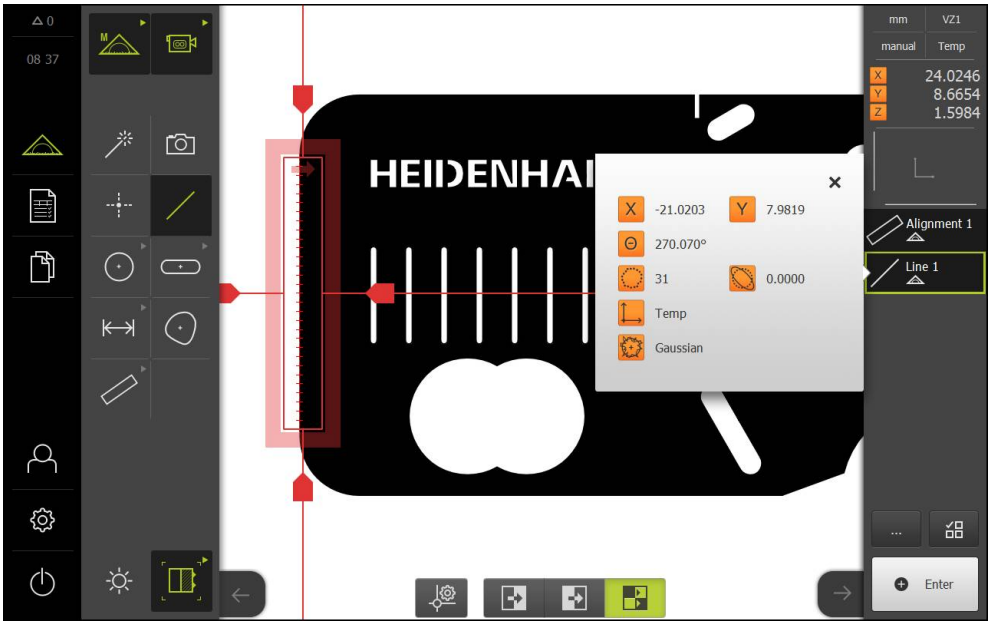


Figure 79: The straight line is displayed in the feature list of the Inspector

Constructing the zero point

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

- ▶ 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
- > A new feature with the selected geometry is displayed

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

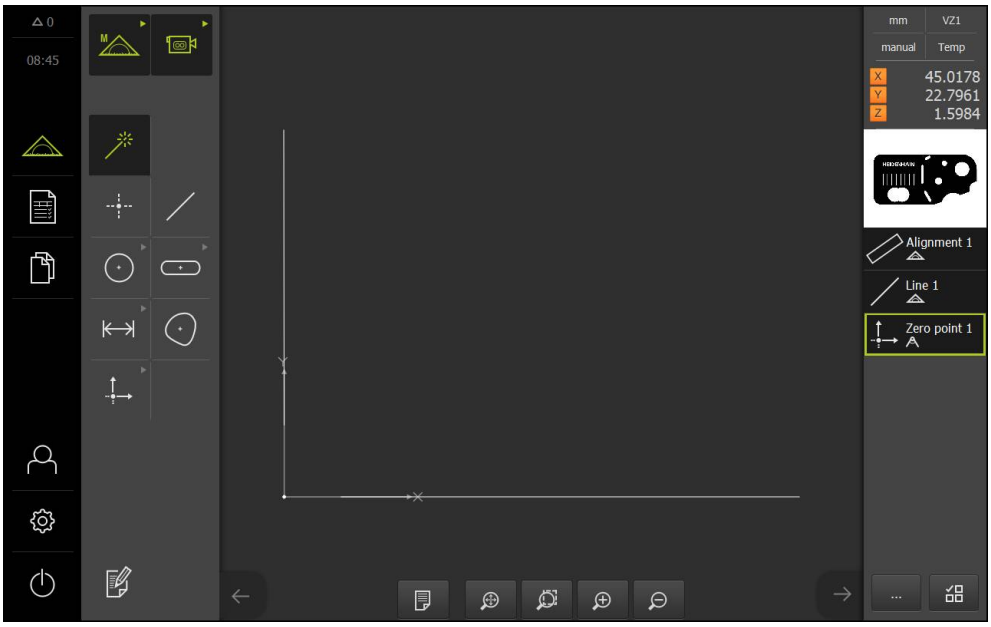


Figure 80: The coordinate system is shown in the workspace

10.4.3 Measuring features

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: "Acquiring measuring points", Page 279

> 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**
- If needed, increase the size of the workspace by hiding the main menu or the Inspector
- Position the measured object such that it is located in the workspace
- Activate or deactivate automatic measuring point acquisition
  Further information: "Setting automatic measuring point acquisition", Page 99

- Select the **Measure Magic** geometry in the geometry palette

Or

- Select the **Circle** geometry in the geometry palette

- Select the **Circle** measuring tool
- Position the measuring tool above the circle to be measured
- Capture measuring points

- Conclude the measuring point acquisition: Tap **Finish** in the new feature

> The measured feature is displayed in the feature list

> The measurement result preview is now displayed
> The feature can be evaluated
Further information: "Measurement evaluation", Page 349

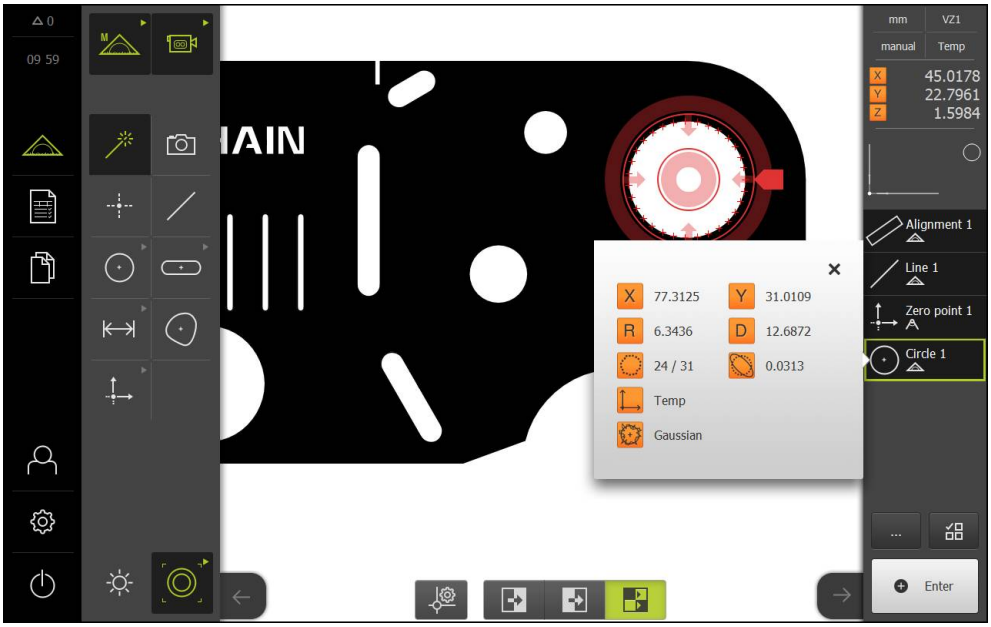


Figure 81: The measured feature is displayed in the feature list

10.4.4 Measuring with Measure Magic

When you work with Measure Magic, the geometry type is determined automatically based on the acquired measuring points. The type of geometry that is assigned to the new feature can be changed after the measurement.

> The geometry type assigned to a new feature depends on the Measure Magic settings. The measurement result must correspond to the defined criteria.

The steps described in this section are the same for each measuring process. These steps are carried out using the arc geometry as an example.

Measuring an arc

To measure an arc, at least three measuring points are needed. The central angle is determined by the two measuring points at the furthest ends.

- Tap **Measure** in the main menu

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

- Select **Measure Magic** in the geometry palette
- The measuring object is positioned such that the measured object is located in the workspace

- Select the **Circle** measuring tool
- Position the measuring tool on 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
- Position the handles such that the arc lies within the search area.
- Select the edge detection mode at the bottom of the workspace
- Tap **Enter** in the Inspector

> In accordance with the settings, multiple measuring points are automatically acquired 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 **Arc** is shown in the features preview

> The measurement result preview is now displayed

> The measurement is complete

- Convert the feature if the automatically determined geometry does not match
  Further information: "Converting a feature", Page 260

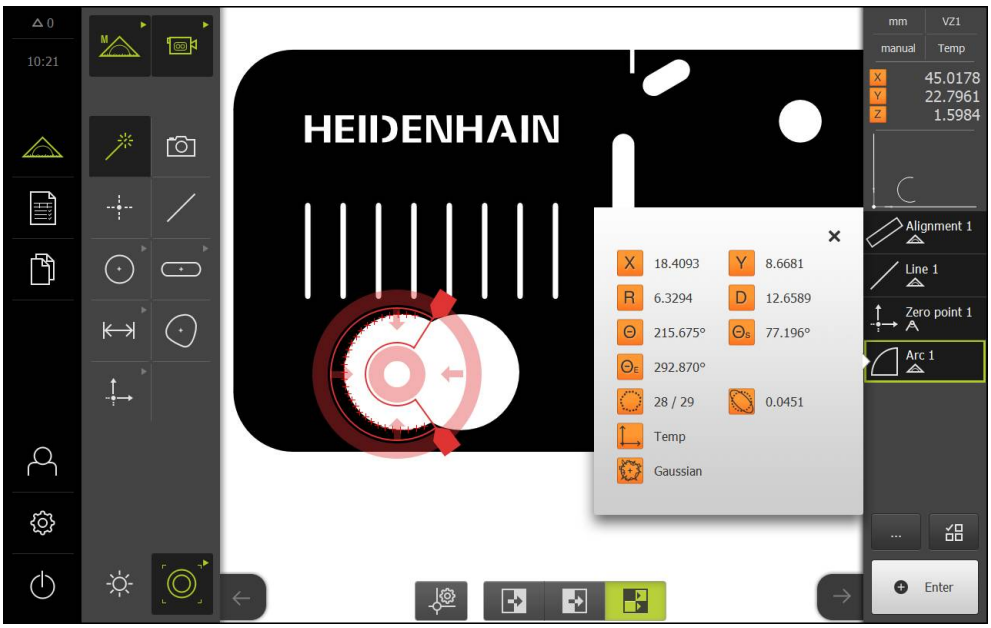


Figure 82: The measured arc is displayed in the feature list

If the geometry is not automatically recognized, then check the Measure Magic settings and the mathematically required minimum number of measuring points for the geometry type in question.

Further information: "Features", Page 215
Further information: "Overview of geometry types", Page 277

10.5 Constructing features

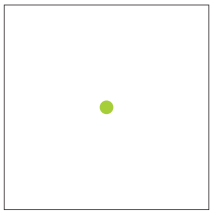
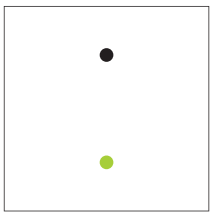
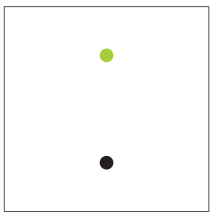
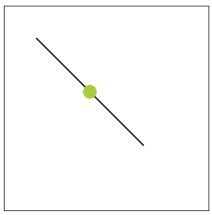
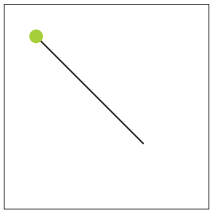
You can construct new features from measured, constructed or defined features. This is done by deriving new features from the existing features, e.g. by moving or copying.

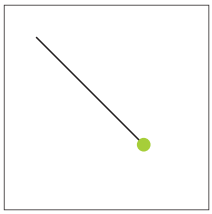
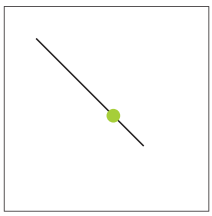
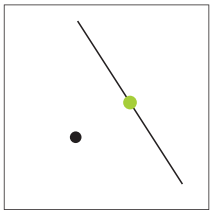
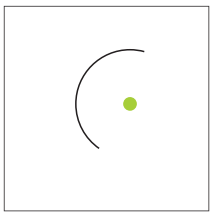
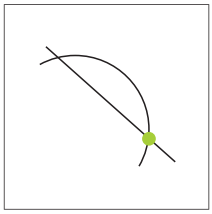
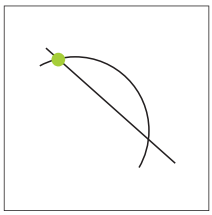
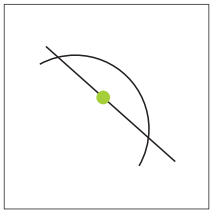
10.5.1 Overview of construction types

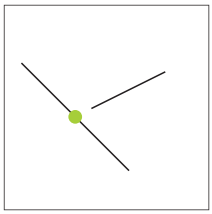
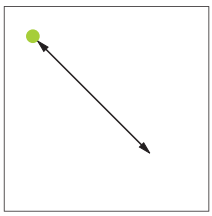
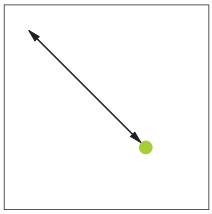
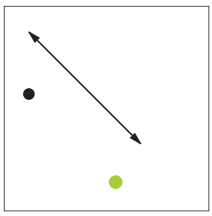
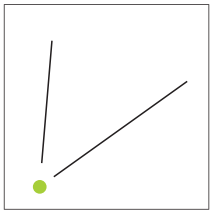
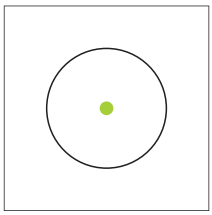
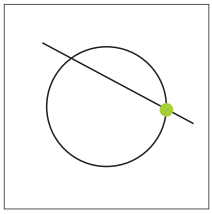
Existing features used for construction are referred to as parent features. Parent features can be measured, constructed or defined features.

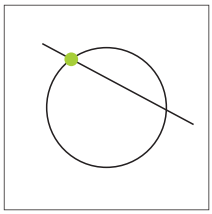
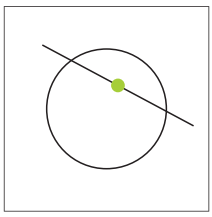
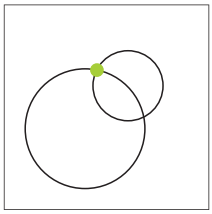
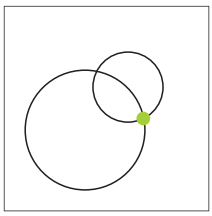
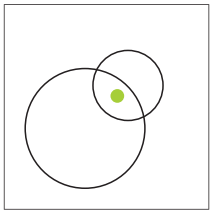
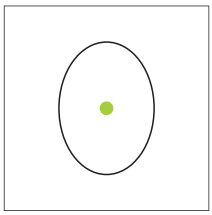
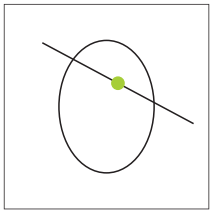
The overview shows the parent features and construction types that can be used for constructing a feature.

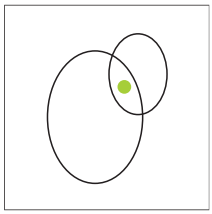
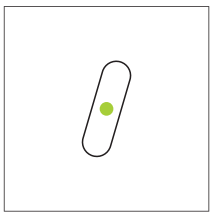
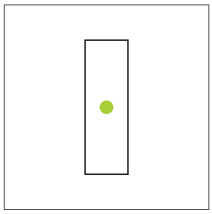
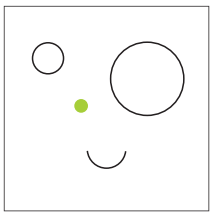
Point / Zero point

Parent feature	Construction type	Display
Point	**Copy**	
Point	**Min. Y point**	
Point	**Max. Y point**	
Line	**Center**	
Line	**End point 1**	

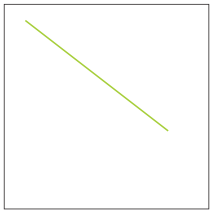
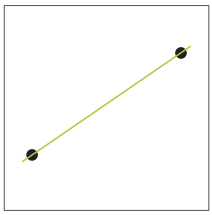
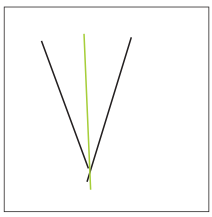
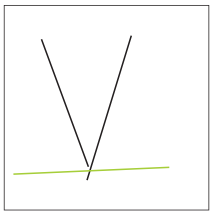
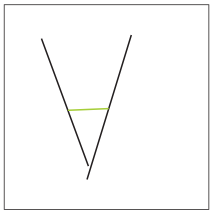
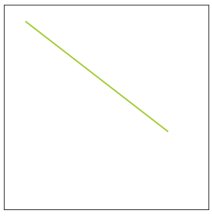
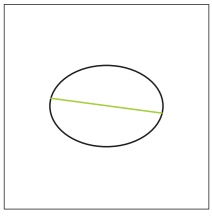
Parent feature	Construction type	Display
Line	**End point 2**	
Line	**Point of origin**	
Point and **Line**	**Perpendclr. pnt.**	
Arc	**Center**	
Arc and **Line**	**Intersection 1**	
Arc and **Line**	**Intersection 2**	
Arc and **Line**	**Perpendclr. pnt.**	

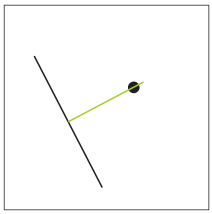
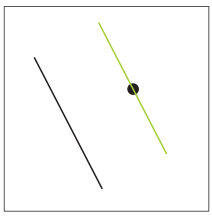
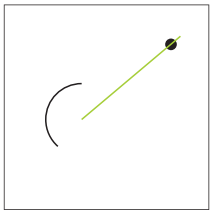
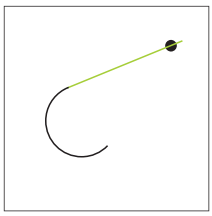
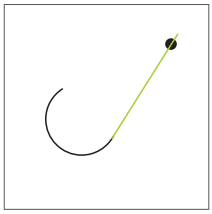
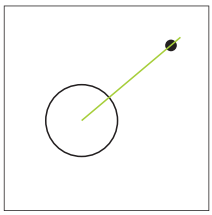
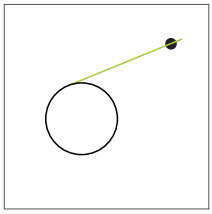
Parent feature	Construction type	Display
2x **Line**	**Intersection**	
Distance	**End point 1**	
Distance	**End point 2**	
Point and **Distance**	**Shift**	
Angle	**Vertex**	
Circle	**Center**	
Circle and **Line**	**Intersection 1**	

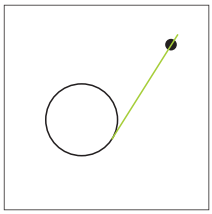
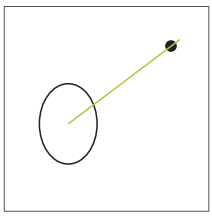
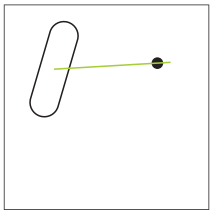
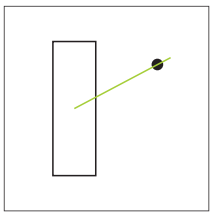
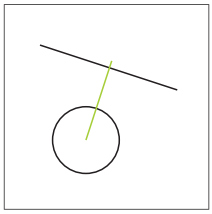
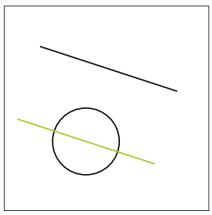
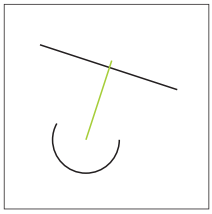
Parent feature	Construction type	Display
Circle and **Line**	**Intersection 2**	
Circle and **Line**	**Perpendclr. pnt.**	
2x **Circle**	**Intersection 1**	
2x **Circle**	**Intersection 2**	
2x **Circle**	**Center**	
Ellipse	**Center**	
Ellipse and **Line**	**Perpendclr. pnt.**	

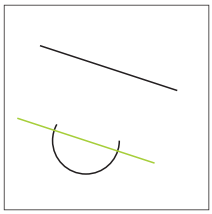
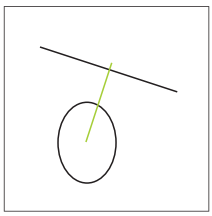
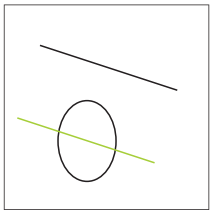
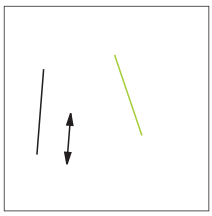
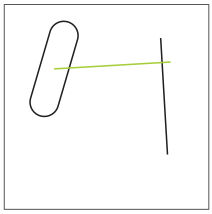
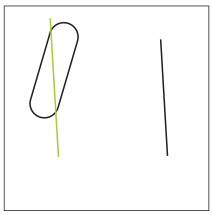
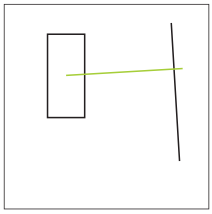
Parent feature	Construction type	Display
2x **Ellipse**	**Center**	
Slot	**Center**	
Rectangle	**Center**	
Multiple features	**Average** from any number and combination of the center points of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

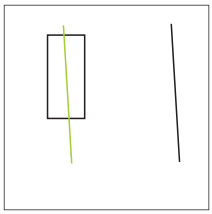
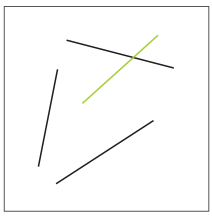
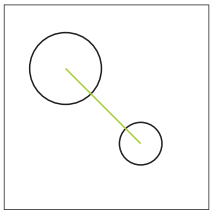
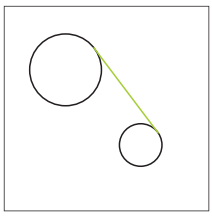
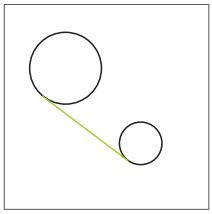
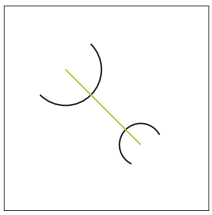
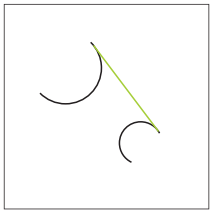
Line / Alignment

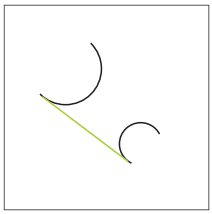
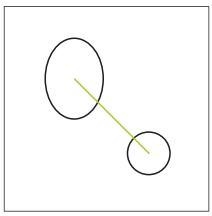
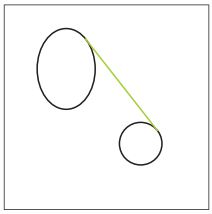
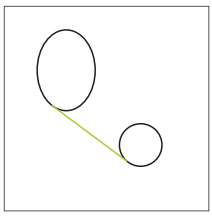
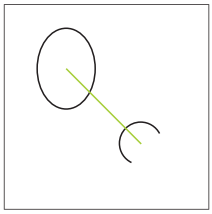
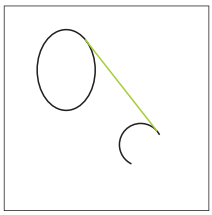
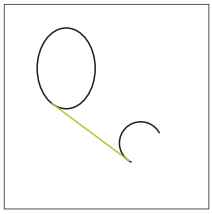
Parent feature	Construction type	Display
Line	**Copy**	
2x **Point**	**Center**	
2x **Line**	**Centerline 1**	
2x **Line**	**Centerline 2**	
2x **Line**	**Gauge line** (the length must be specified)	
Distance	**Centerline**	
Ellipse	**Semimajor axis**	

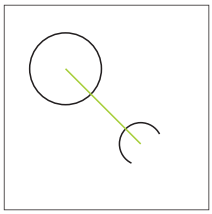
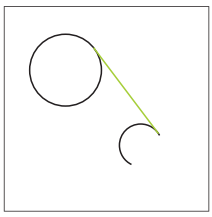
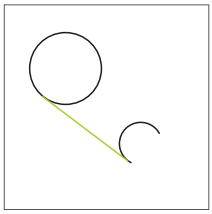
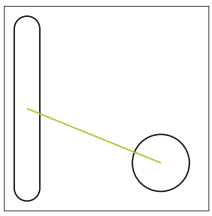
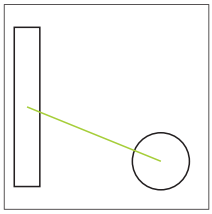
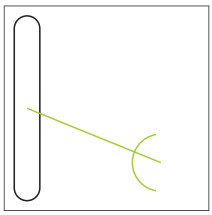
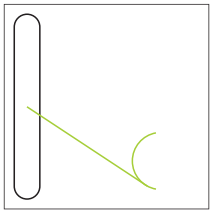
Parent feature	Construction type	Display
Point and **Line**	**Vertical**	
Point and **Line**	**Parallel**	
Point and **Arc**	**Center**	
Point and **Arc**	**Tangent 1**	
Point and **Arc**	**Tangent 2**	
Point and **Circle**	**Center**	
Point and **Circle**	**Tangent 1**	

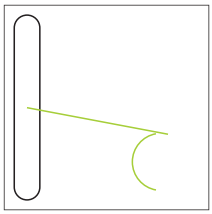
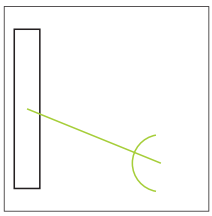
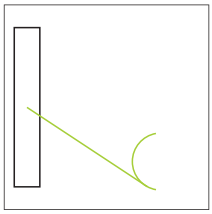
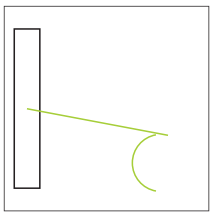
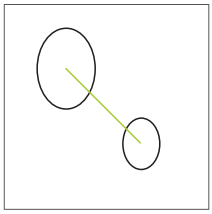
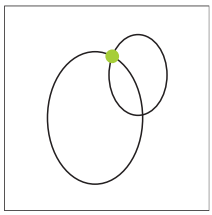
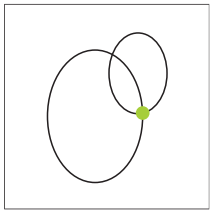
Parent feature	Construction type	Display
Point and **Circle**	**Tangent 2**	
Point and **Ellipse**	**Center**	
Point and **Slot**	**Center**	
Point and **Rectangle**	**Center**	
Line and **Circle**	**Vertical**	
Line and **Circle**	**Parallel**	
Line and **Arc**	**Vertical**	

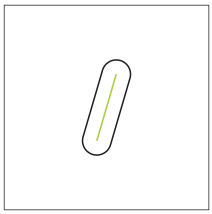
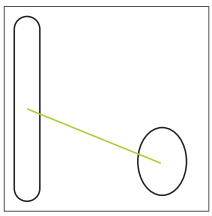
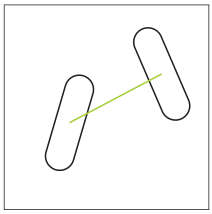
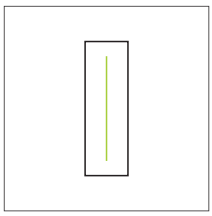
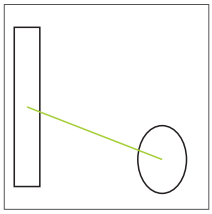
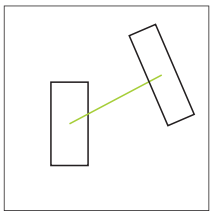
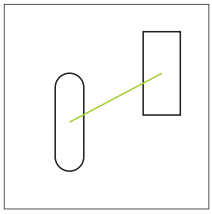
Parent feature	Construction type	Display
Line and **Arc**	**Parallel**	
Line and **Ellipse**	**Vertical**	
Line and **Ellipse**	**Parallel**	
Line and **Distance**	**Shift**	
Line and **Slot**	**Vertical**	
Line and **Slot**	**Parallel**	
Line and **Rectangle**	**Vertical**	

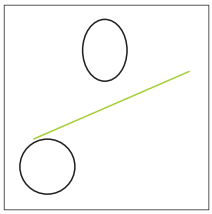
Parent feature	Construction type	Display
Line and **Rectangle**	**Parallel**	
Line and **Angle**	**Rotation**	
2x **Circle**	**Center**	
2x **Circle**	**Tangent 1**	
2x **Circle**	**Tangent 2**	
2x **Arc**	**Center**	
2x **Arc**	**Tangent 1**	

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**	

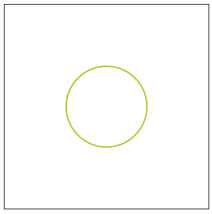
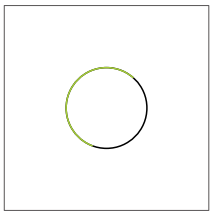
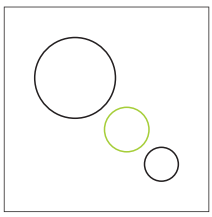
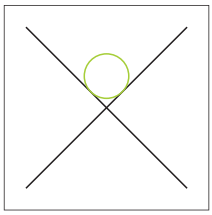
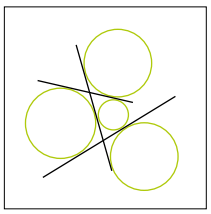
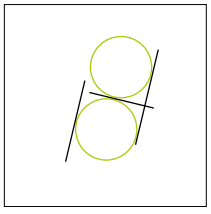
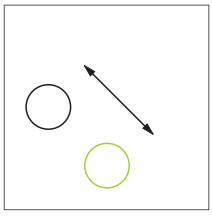
Parent feature	Construction type	Display
Circle and **Arc**	**Center**	
Circle and **Arc**	**Tangent 1**	
Circle and **Arc**	**Tangent 2**	
Circle and **Slot**	**Center**	
Circle and **Rectangle**	**Center**	
Arc and **Slot**	**Center**	
Arc and **Slot**	**Tangent 1**	

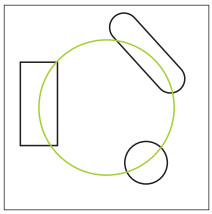
Parent feature	Construction type	Display
Arc and **Slot**	**Tangent 2**	
Arc and **Rectangle**	**Center**	
Arc and **Rectangle**	**Tangent 1**	
Arc and **Rectangle**	**Tangent 2**	
2x **Ellipse**	**Center**	
2x **Ellipse**	**Intersection 1**	
2x **Ellipse**	**Intersection 2**	

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**	

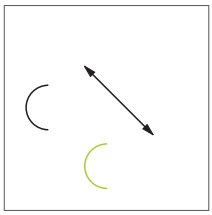
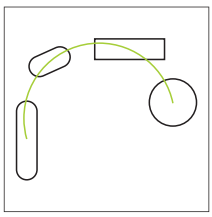
Parent feature	Construction type	Display
Multiple features	**Line** or **Alignment** from the center points of at least two features in any combination of: ■ **Point** ■ **Slot** ■ **Circle** ■ **Arc** ■ **Ellipse**	

Circle

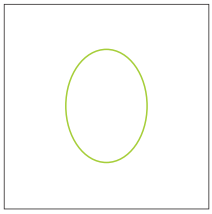
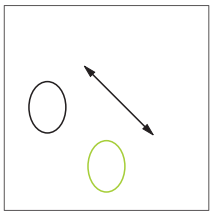
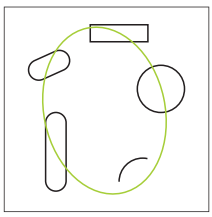
Parent feature	Construction type	Display
Circle	**Copy**	
Arc	**Copy** (circle superimposed on arc)	
2x **Circle**	**Average**	
2x **Line**	**Gauge circle**	
3x **Line**	**Circle 1**, **Circle 2**, **Circle 3**, **Circle 4**	
3x **Line**	**Circle 1**, **Circle 5**	
Circle and **Distance**	**Shift**	

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**	

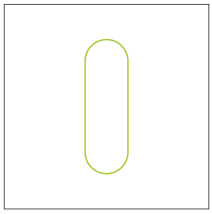
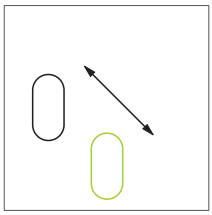
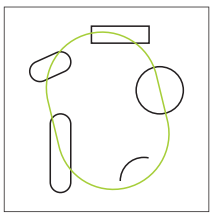
Arc

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**	

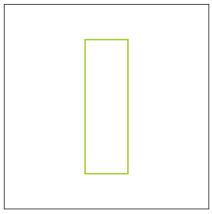
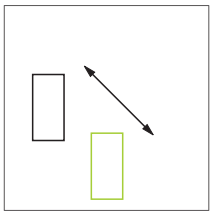
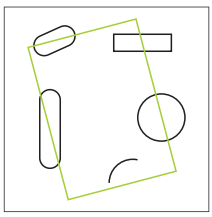
Ellipse

Parent feature	Construction type	Display
Ellipse	**Copy**	
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**	

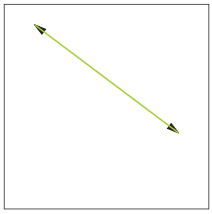
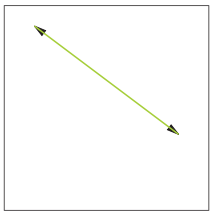
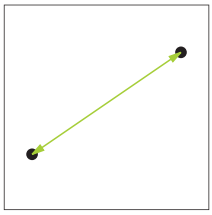
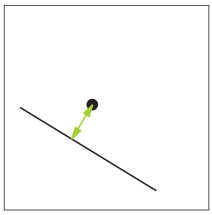
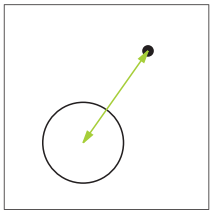
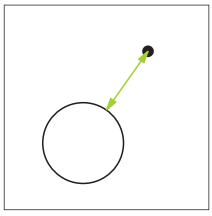
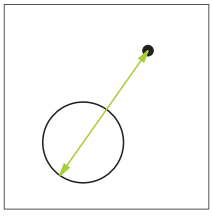
Slot

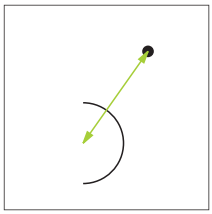
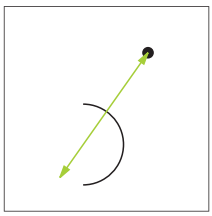
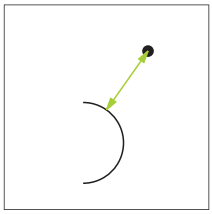
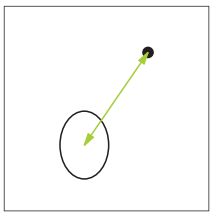
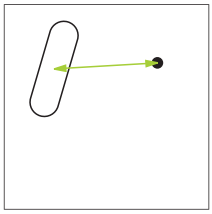
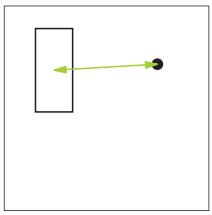
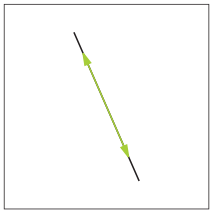
Parent feature	Construction type	Display
Slot	**Copy**	
Slot and **Distance**	**Shift**	
Multiple features	**Slot** from the center points of at least five features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

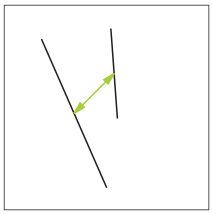
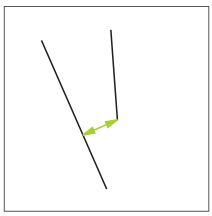
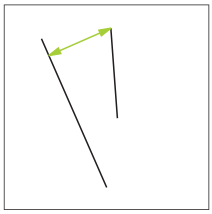
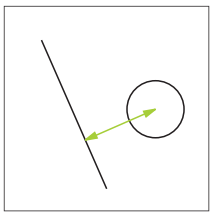
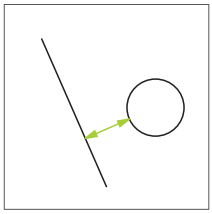
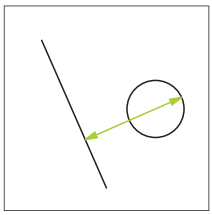
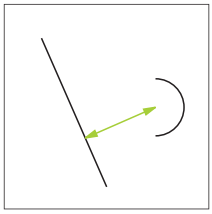
Rectangle

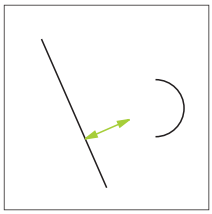
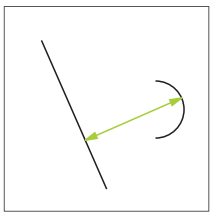
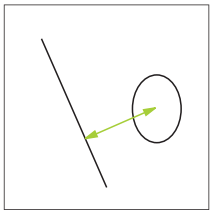
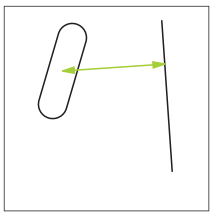
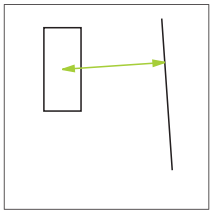
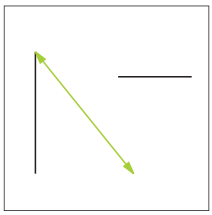
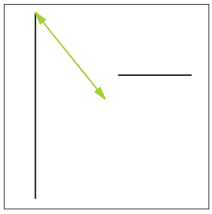
Parent feature	Construction type	Display
Rectangle	**Copy**	
Rectangle and **Distance**	**Shift**	
Multiple features	**Rectangle** from the center points of at least five features in any combination of: ■ **Point** ■ **Slot** ■ **Rectangle** ■ **Circle** ■ **Arc** ■ **Ellipse**	

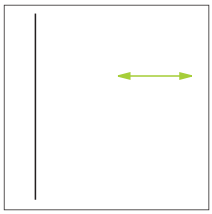
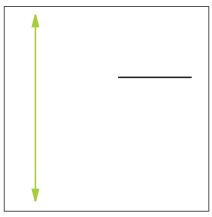
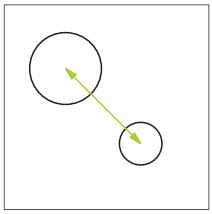
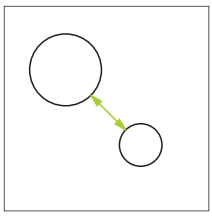
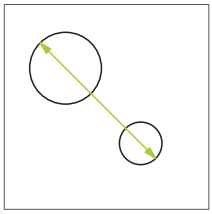
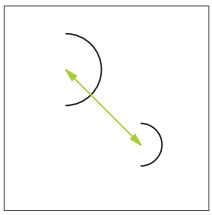
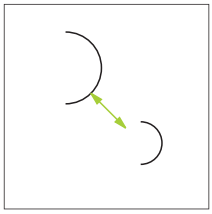
Distance

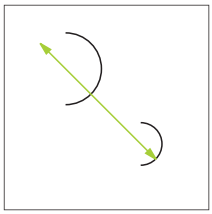
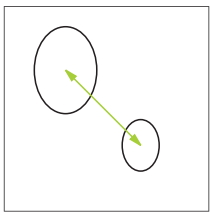
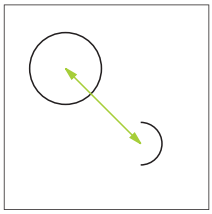
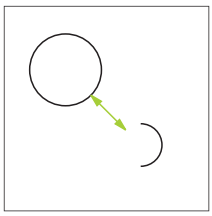
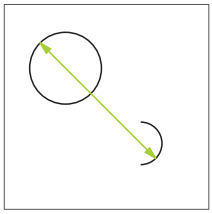
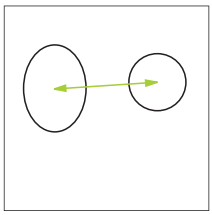
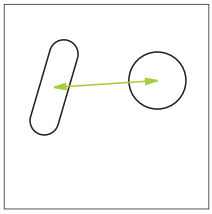
Parent feature	Construction type	Display
Distance	**Copy**	
Distance	**Direction change**	
2x **Point**	**Center**	
Point and **Line**	**Center**	
Point and **Circle**	**Center**	
Point and **Circle**	**Minimum**	
Point and **Circle**	**Maximum**	

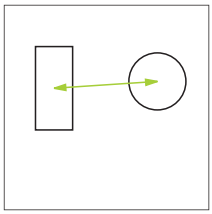
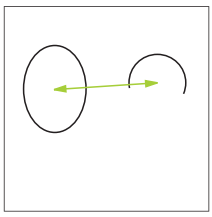
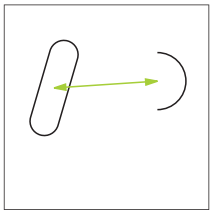
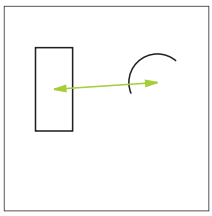
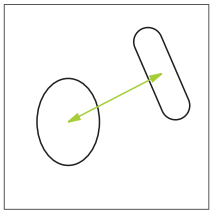
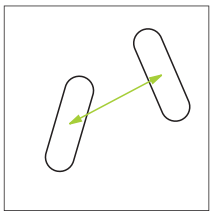
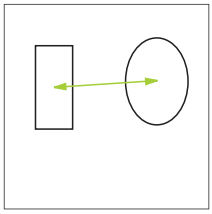
Parent feature	Construction type	Display
Point and **Arc**	**Center**	
Point and **Arc**	**Minimum**	
Point and **Arc**	**Maximum**	
Point and **Ellipse**	**Center**	
Point and **Slot**	**Center**	
Point and **Rectangle**	**Center**	
Line	**Length**	

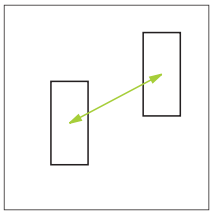
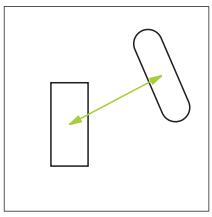
Parent feature	Construction type	Display
2x **Line**	**Center**	
2x **Line**	**Minimum**	
2x **Line**	**Maximum**	
Line and **Circle**	**Center**	
Line and **Circle**	**Minimum**	
Line and **Circle**	**Maximum**	
Line and **Arc**	**Center**	

Parent feature	Construction type	Display
Line and **Arc**	**Minimum**	
Line and **Arc**	**Maximum**	
Line and **Ellipse**	**Center**	
Line and **Slot**	**Center**	
Line and **Rectangle**	**Center**	
2x **Distance**	**Sum**	
2x **Distance**	**Average**	

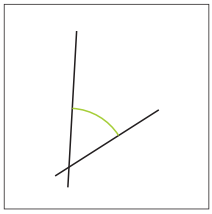
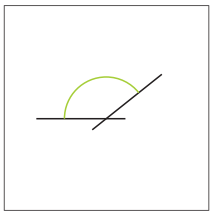
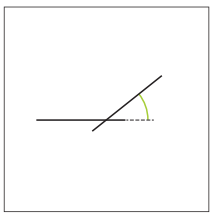
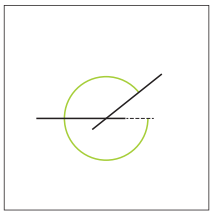
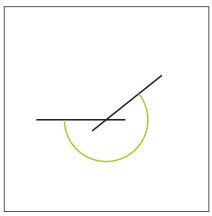
Parent feature	Construction type	Display
2x **Distance**	**Minimum**	
2x **Distance**	**Maximum**	
2x **Circle**	**Center**	
2x **Circle**	**Minimum**	
2x **Circle**	**Maximum**	
2x **Arc**	**Center**	
2x **Arc**	**Minimum**	

Parent feature	Construction type	Display
2x **Arc**	**Maximum**	
2x **Ellipse**	**Center**	
Circle and **Arc**	**Center**	
Circle and **Arc**	**Minimum**	
Circle and **Arc**	**Maximum**	
Circle and **Ellipse**	**Center**	
Circle and **Slot**	**Center**	

Parent feature	Construction type	Display
Circle and **Rectangle**	**Center**	
Arc and **Ellipse**	**Center**	
Arc and **Slot**	**Center**	
Arc and **Rectangle**	**Center**	
Slot and **Ellipse**	**Center**	
2x **Slot**	**Center**	
Rectangle and **Ellipse**	**Center**	

Parent feature	Construction type	Display
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 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

> If **Measure Magic** is selected in the geometry plane, then no new feature will be suggested in the feature list.
>
> - Select the desired geometry type

- Tap **Finish** in the new feature

> If you cannot finish a feature, then you must check the construction for the use of permissible parent features.

- > The constructed feature is displayed in the workspace and the feature list

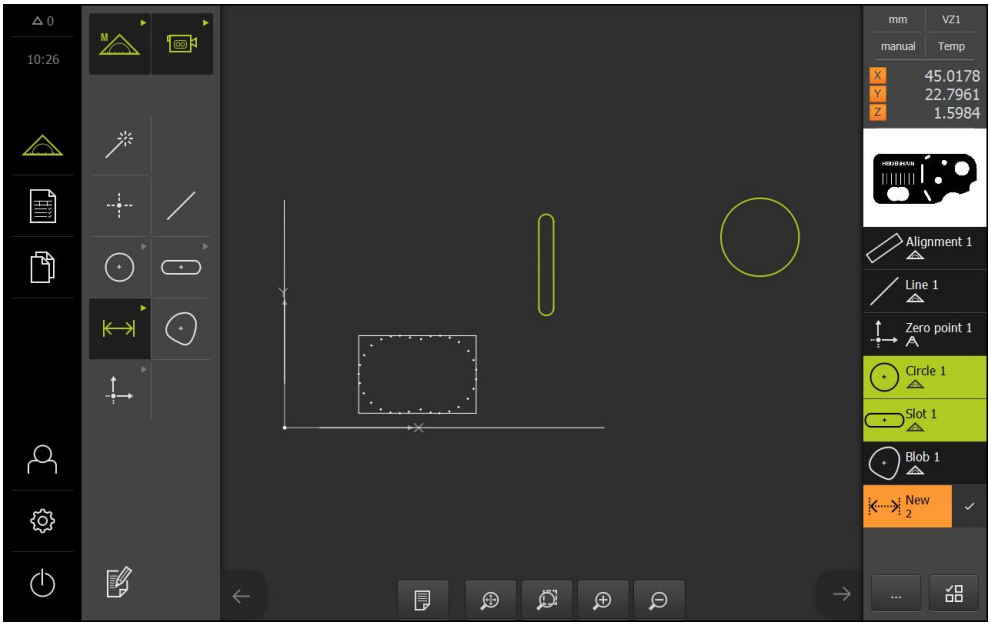


Figure 83: The constructed feature is suggested in the feature list

10.5.3 Modifying a constructed feature

The constructed features can be altered after being constructed. 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 311

- > 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.

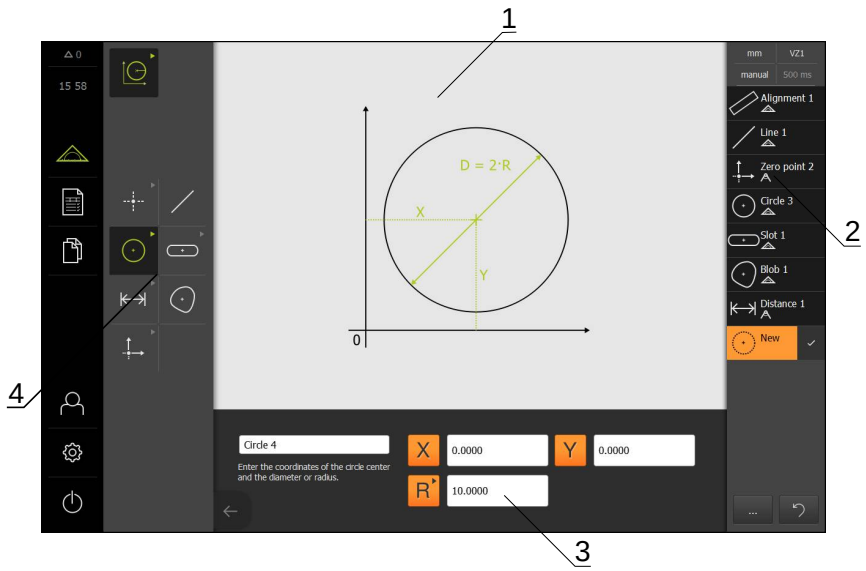
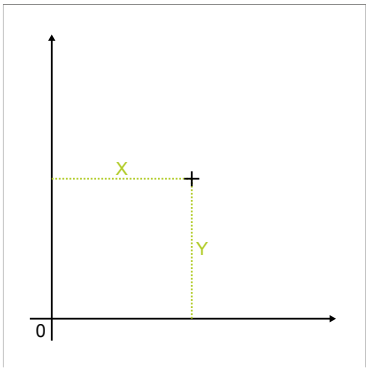
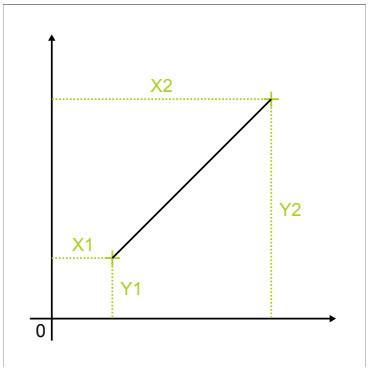
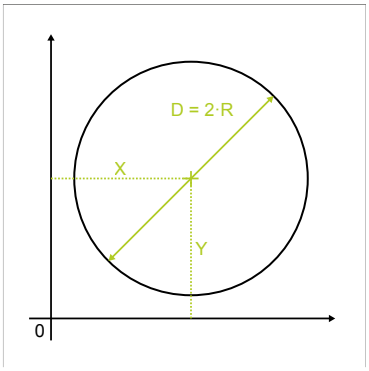
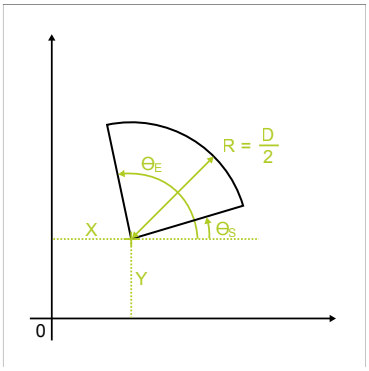


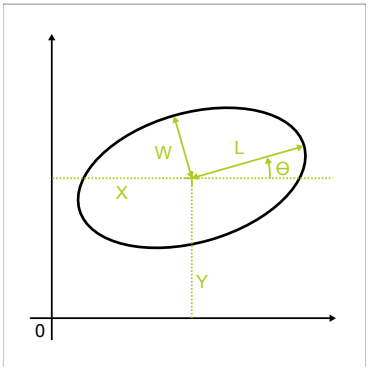
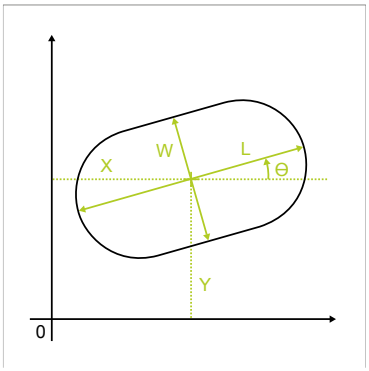
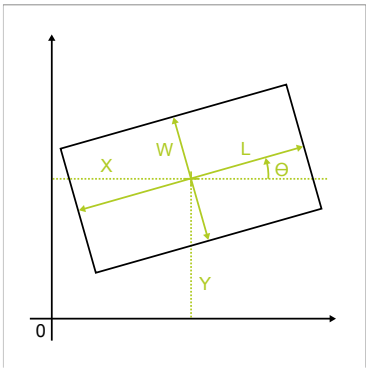
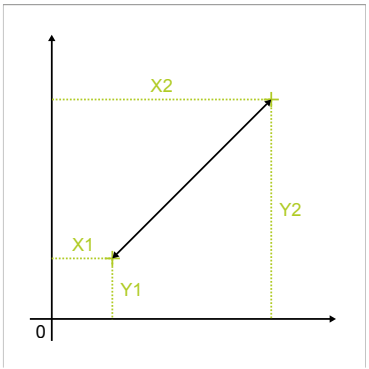
Figure 84: The **Define** function with **circle** geometry

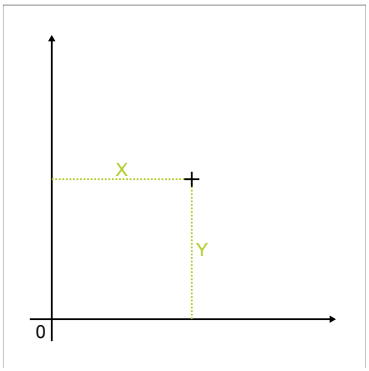
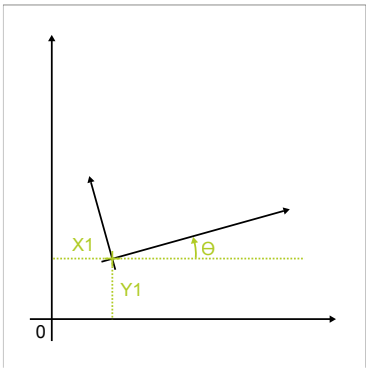
1 Display of the geometry
2 Feature list in the Inspector
3 Input fields for the geometry parameters
4 Geometry palette

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
	**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 344

> 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 entries with **RET**

- Tap **Finish** in the new feature

> The defined feature is displayed in the feature list

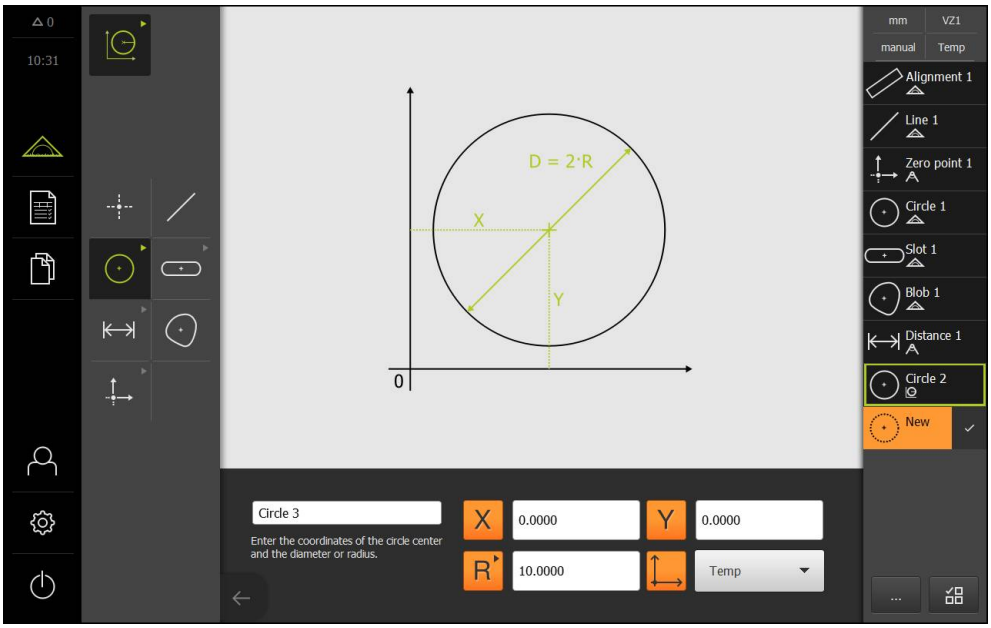


Figure 85: A defined feature is shown in the feature list

11

Measurement evaluation

11.1 Overview

This chapter describes how you can evaluate measurements and specify tolerances.

Measurement evaluation and tolerancing are carried out based on features that have been 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 221

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

Further information: "Basic operation", Page 61

11.2 Measurement evaluation

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

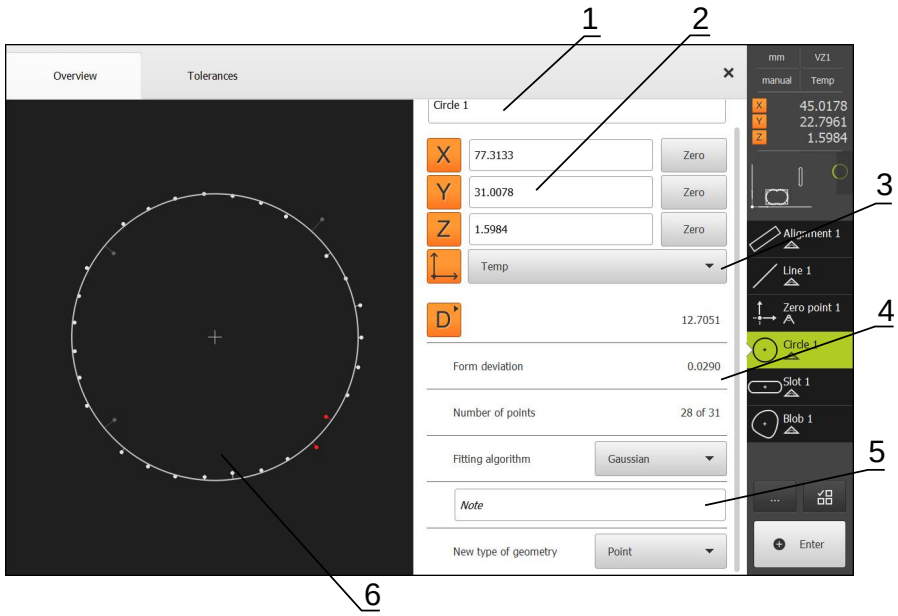


Figure 86: **Details** dialog with **Overview** tab

1 Name of the feature
2 Axis positions of the center point
3 Coordinate system
4 Feature properties and parameters
5 **Note** text field
6 View of the measuring points and the form

In the **Overview** tab of the **Details** dialog, you will find the following information and settings:

- The name of the feature
- The axis positions of the center point
- The coordinate system to which the coordinate values of the feature are referenced
- Feature parameters, depending on the type of geometry

  For the **Circle** geometry type, you can switch between **Radius** and **Diameter** by means of a button.
- 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)
- The **Note** text field, in which annotations can be entered and then displayed as annotations in the features view
- List of geometry types to which the feature can be converted

Depiction of the measuring points and the form

Figure 87: 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 for the calculated form are depicted as lines (symbolic representation)

11.2.1 Fitting algorithm

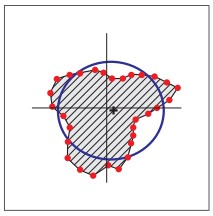
Short description

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:

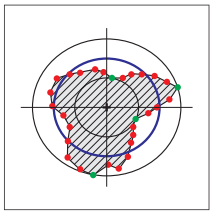


Gaussian

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.

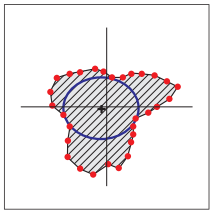


Minimum zone

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.

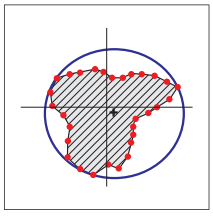
The algorithm is suitable for measuring form error.



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 new name for the feature
- ▶ Confirm entry with **RET**
- > The new name is displayed in the feature list
- ▶ Tap **Close** to close the dialog

Adapting the coordinate system

- ▶ Drag the feature from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab
- ▶ Select the desired coordinate system in the **Coordinate system** drop-down list.
- > The new coordinate system now applies
- > The displayed position values are now shown in relation to the selected coordinate system
- ▶ 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 353

- ▶ Drag a feature (e.g., the **Circle**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The fitting algorithm used is shown in the **Fitting algorithm** drop-down list
- ▶ In the **Fitting algorithm** drop-down list, select the **Min. circumscribed** fitting algorithm
- > The feature is displayed according to the selected fitting algorithm

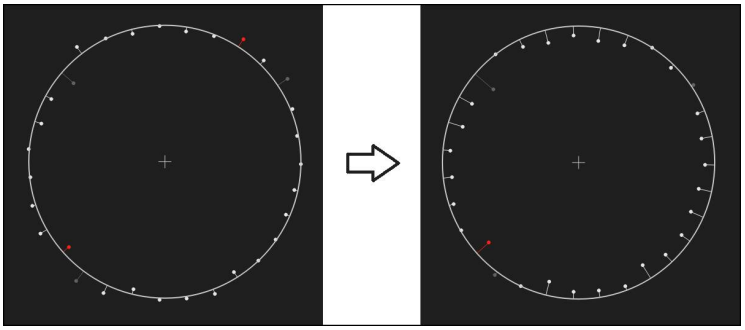


Figure 88: Feature with the new **Fitting algorithm**

- ▶ 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 **Details** dialog.

- ▶ Drag a feature (e.g., the **Slot**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- > The geometry type of the feature is displayed
- ▶ In the **New type of geometry** drop-down list, select the **Point** type of geometry, for example

> The **2-D profile** geometry type is currently not yet supported.

- > The feature is displayed in the new form

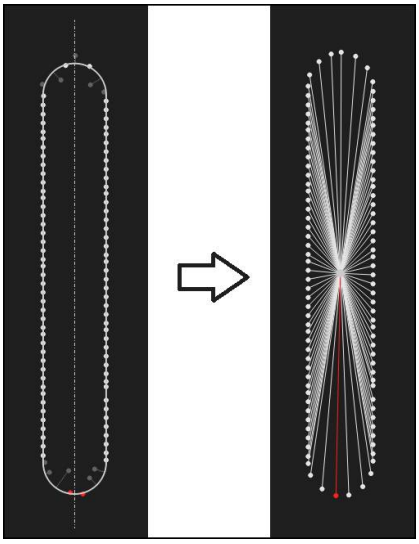


Figure 89: Type of geometry changed from **Slot** to **Point**

- ▶ Tap **Close** to close the dialog

11.3 Defining tolerances

This section describes which tolerances are available on the unit and how tolerances can be configured and activated. The activation and configuration of tolerances will be performed using the measured and constructed features in the "Quick Start" chapter as examples.

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
- ▶ Tap the **Tolerances** tab
- > The tab for tolerancing the selected feature is displayed

Short description

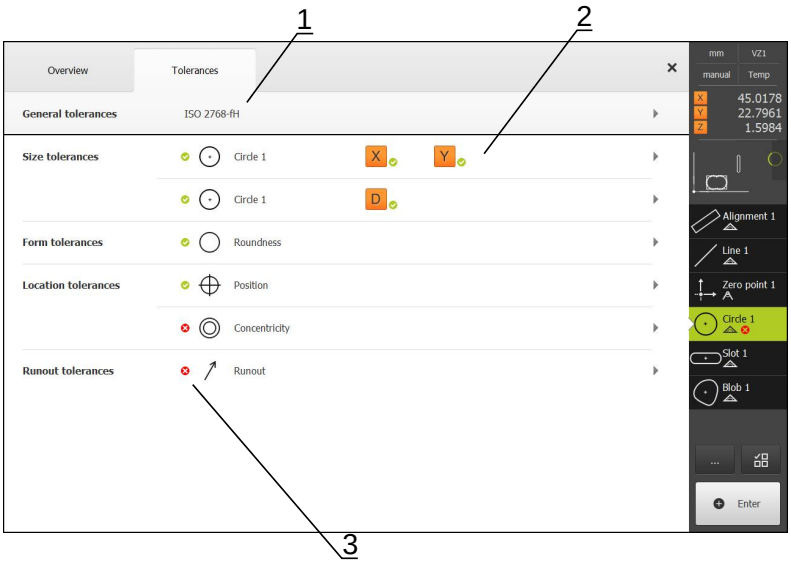


Figure 90: **Details** dialog with **Tolerances** tab

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.

Depending on the feature, you can define the following tolerances:

- Size tolerances (e.g., diameter, width, length, and angle of the 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 for each feature. To define tolerances for a feature, tolerance values can be entered manually, or standard values can be taken over from general tolerances (e.g., the ISO 2768 standard).

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

Display of toleranced features

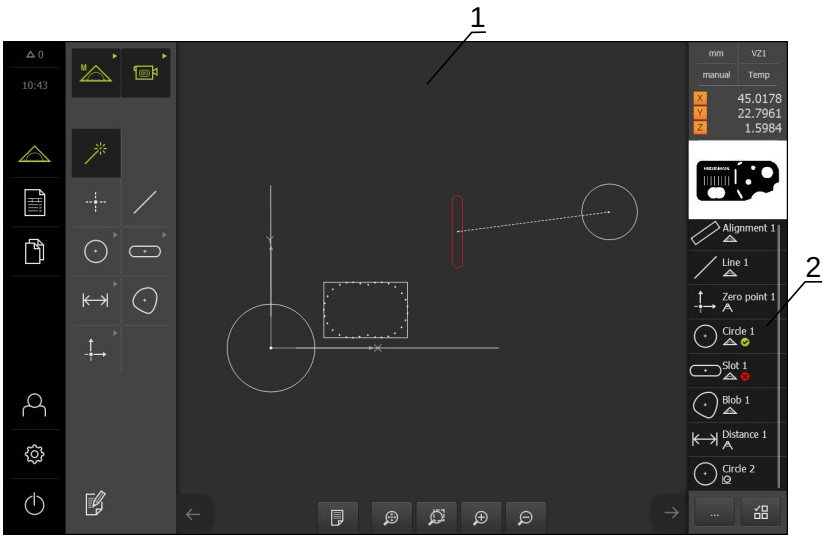


Figure 91: Toleranced features in the features view and feature list

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 at least one of its tolerance limits has been exceeded. These features are not permitted to be selected, because selected elements are displayed in green independently of the tolerance check.

The results of the tolerance check are indicated by symbols in the feature list and in the **Tolerances** tab.

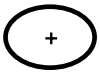
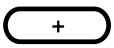
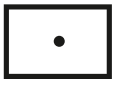
Symbol	Meaning
	The activated tolerances of the feature are met.
	One or more activated tolerances of the feature are exceeded.

The symbol does not appear until all of the required fields have been populated and the tolerance check was able to be conducted.

Example: During the configuration of the concentricity tolerance, the reference feature must be selected so that the tolerance check can be conducted.

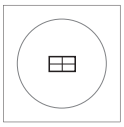
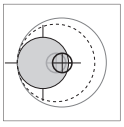
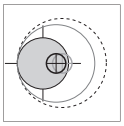
11.3.1 Overview of tolerances

The following overview shows the tolerances that can be defined for a feature.

Feature	Size	Form	Location	Direction	Runout
Point		-		-	-
Line				 	-
Circle			 	-	
Arc			 	-	
Ellipse		-		-	-
Slot		-		-	-
Rectangle		-		-	-
Distance		-	-	-	-

Feature	Size	Form	Location	Direction	Runout
Angle		-	-	-	-
Blob		-		-	-

Overview of position tolerance types

Symbol	Display	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 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

General tolerances contain standard values that can be taken over for the tolerancing of measured features. The unit provides a selection of standard values for the ISO 2768 standard or for the decimal place tolerance, for example.

The following overview shows which general tolerances are available for a specific tolerance.

Overview of general tolerances

Tolerances	General tolerances
Size	ISO 2768, decimal place tolerance, ISO 286 (only for the diameter and radius parameters of the circle and arc feature types)
Form	ISO 2768
Location	None
Direction	ISO 2768
Runout	ISO 2768

Taking over the standard values for a feature requires the following steps:

- For features overall: Selection of the desired general tolerance (default setting: ISO 2768 standard)
- For an individual feature: Activation of a tolerance (e.g., form tolerance) with the preselected general tolerance

If you activate a tolerance with standard values, then the standard values for this tolerance can be subsequently overwritten.

If you do not select a general tolerance, then tolerance values can only be entered manually.

If general tolerances are changed for features overall, then these changes take effect for all existing and new elements. For activated tolerances, the new values are automatically taken over.

Exception: If a tolerance value for a feature has been manually entered or changed, then the existing tolerance value is retained.

Selecting and modifying a general tolerance

- ▶ Drag any 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**

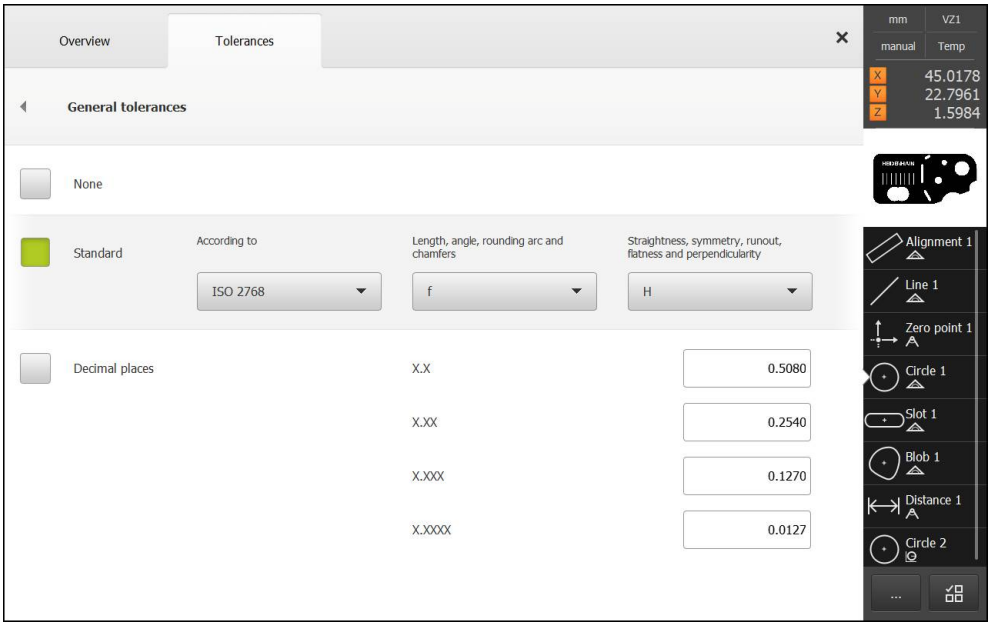


Figure 92: **General tolerances** menu in the **Details** dialog

Standard: General tolerance according to ISO 2768

The standard values of the ISO 2768 standard are taken over as the tolerance values. All of the tolerance classes of the standard are available for selection on the unit. The standard values cannot be changed for features overall.

- ▶ To select the general tolerances, tap the checkbox in front of **Standard**

- > The checkbox is now shown in green
- ▶ Select the desired standard in the **According to** 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 in the **Tolerances** tab
- > The general tolerance is preselected as soon as a tolerance is activated

	The ISO 2768 standard does not provide any standard values for location tolerances.

Decimal place tolerance

The tolerance value is determined by the number of decimal places. Depending on how many decimal places you select in the measurement evaluation, a corresponding standard value is applied.

Standard values of the unit:

Decimal places	Tolerance value (mm)
0.1	+/- 0.5080
0.01	+/- 0.2540
0.001	+/- 0.1270
0.0001	+/- 0.0127

The standard values of the unit can be modified for features overall.

- ▶ To perform tolerancing based on decimal places, tap on the checkbox in front of **Decimal places**

- > The checkbox is now shown in green
- ▶ Tap an input field
- ▶ Enter a value for the tolerance limit
- ▶ Confirm the entry with **RET**
- ▶ Repeat the last three steps for additional decimal places
- ▶ Tap **General tolerances**
- > The decimal place tolerance is shown in the **Tolerances** tab
- > The general tolerance is preselected as soon as a tolerance is activated.

Decimal place tolerancing is only available for size tolerances For all other tolerances, tolerance values can only be entered manually.

No general tolerance

Tolerance values can only be entered manually

- ▶ To deactivate the general tolerances, tap on the checkbox in front of **None**

- > The checkbox is now shown in green
- ▶ Tap **General tolerances**
- > No general tolerance is displayed in the **Tolerances** tab
- > For the activation of a tolerance, a tolerance value must be entered manually

11.3.3 Setting size tolerances on a feature

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
- Surface area (A) and circumference (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.

> For the Diameter (D) and Radius (R) parameters of the circle and arc feature types, the fit tolerance table of the ISO 286 standard can be selected as an alternative.

- ▶ 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 selection and input fields become active

Activating a tolerance (ISO 2768 standard)

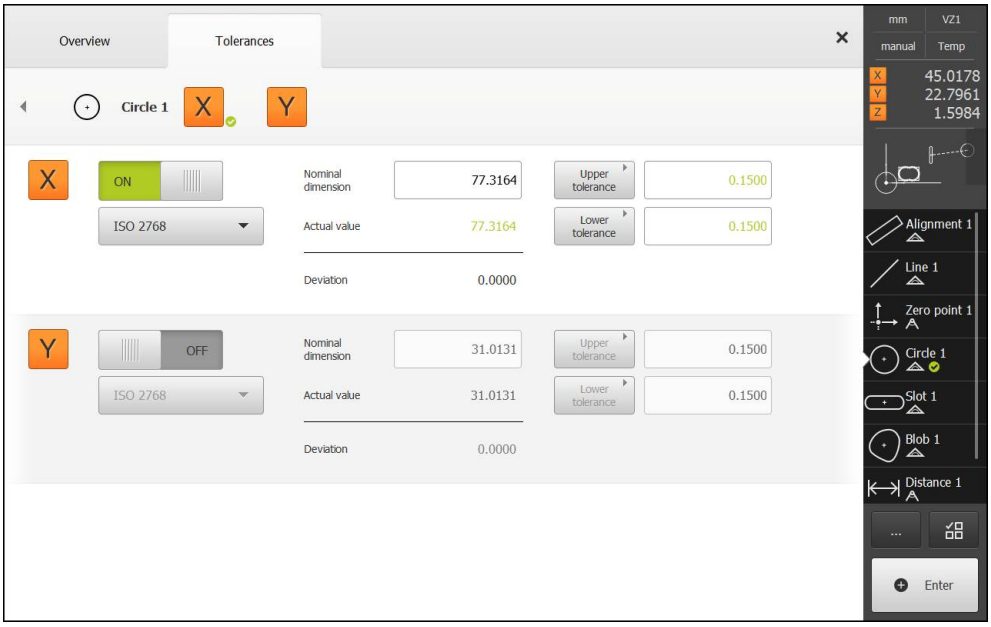


Figure 93: **Size tolerances** overview with activated **ISO 2768** tolerance for **X**

> 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 selected general tolerance.

- To switch between the **Upper tolerance** and **Upper limit** input fields, tap **Upper tolerance** or **Upper limit**

> If the actual value is within the tolerance, then the actual value and the tolerance values are shown in green.

> If the actual value is outside of the tolerance, then the actual value and the exceeded tolerance values are shown in red

- Tap the **tab**

> The **Tolerances** tab is displayed

> The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

Activating a tolerance (Decimal places)

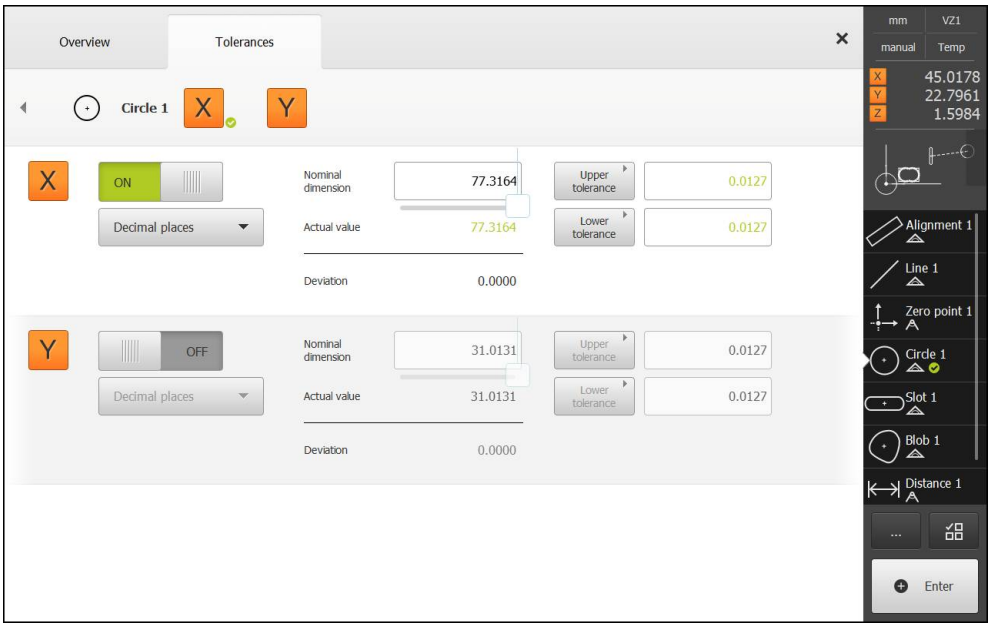


Figure 94: **Size tolerances** overview with activated **Decimal places** tolerance for **X**

> 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 selected general tolerance.

- To switch between the **Upper tolerance** and **Upper limit** input fields, tap **Upper tolerance** or **Upper limit**

> If the actual value is within the tolerance, then the actual value and the tolerance limits are shown in green

> If the actual value is outside of the tolerance, then the actual value and the exceeded tolerance limit are shown in red

- Tap **Back**

> The **Tolerances** tab is displayed

> The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

Setting the tolerance limits manually

Tolerance values can be entered manually for all tolerances. If a general tolerance is selected, then the tolerance values can be subsequently overwritten. A manually entered value applies only to the opened 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
- > If the actual value is within the tolerance, then the actual value and the tolerance values are show in green
- > If the actual value is outside of the tolerance, then the actual value and the exceeded tolerance value are shown in red
- > If a general tolerance has been preselected, then the selection in the drop-down list switches to **Manual**
- ▶ Tap **Back**
- > The **Tolerances** tab is displayed
- > The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

If general tolerances are changed for features overall, then these changes do not take effect for manually entered tolerance values. Manually entered tolerance values are retained.

If the fit tolerance table of the ISO 286 standard is selected, then changes made to general tolerances for features overall do not have an effect on this tolerance value. The tolerance value from the ISO 286 standard is retained.

11.3.4 Setting form tolerances on a feature

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 selection and input fields become active

Activating a tolerance (ISO 2768 standard)

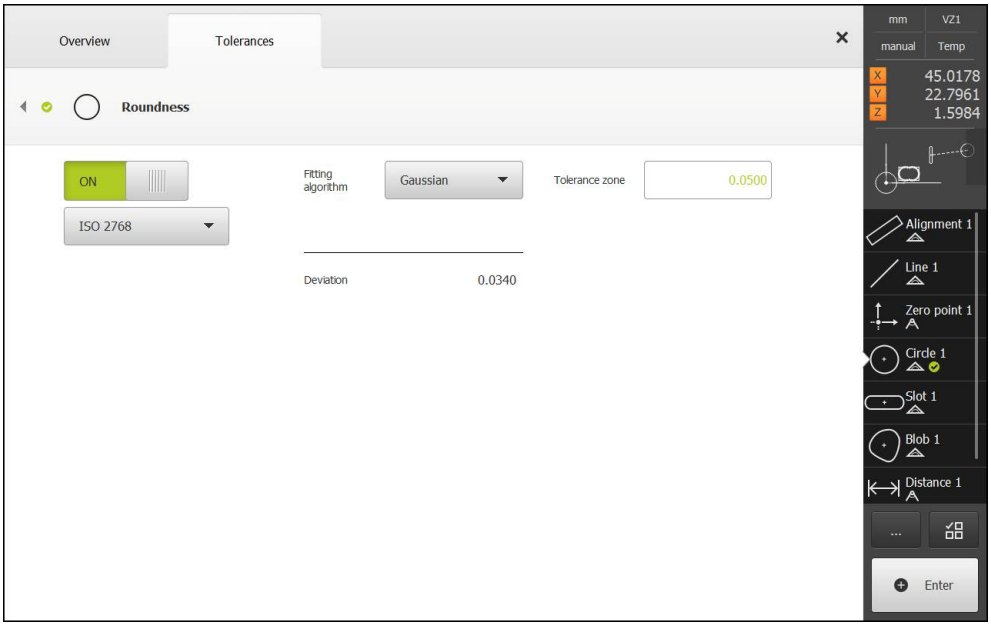


Figure 95: **Form tolerances** overview with activated **Roundness** tolerance as per **ISO 2768**

> The fitting algorithm is activated

> The tolerance zone of the selected general tolerance is displayed

	The tolerance zone is taken over from the provided table of the selected general tolerance.

> The deviation from the ideal form is displayed

▶ Select the desired fitting algorithm

> The deviation is now updated

> 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 **Back**

> The **Tolerances** tab is displayed

> The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

Setting the tolerance zone manually

The tolerance zone can be entered manually. If a general tolerance is selected, then the value of the tolerance zone can be subsequently overwritten. The manually entered value applies only to the opened 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
- > If a general tolerance has been selected, then the selection in the drop-down list switches to **Manual**
- ▶ Tap **Back**
- > The **Tolerances** tab is displayed
- > The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

11.3.5 Setting location tolerances for a feature

You can define the location tolerances for the following geometry parameters of a feature:

- Position for point, , line, circle, arc, ellipse, slot, rectangle, and blob
- Concentricity for circle and arc

The procedure for setting location tolerances is identical for all features. The following describes the procedure for setting a position tolerance for a circle with a 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 now displayed
  Further information: "Overview of tolerances", Page 361

- ▶ Activate tolerancing of the measured value with the **ON/OFF** sliding switch
- > The selection and input fields become active

Setting the tolerance zone manually

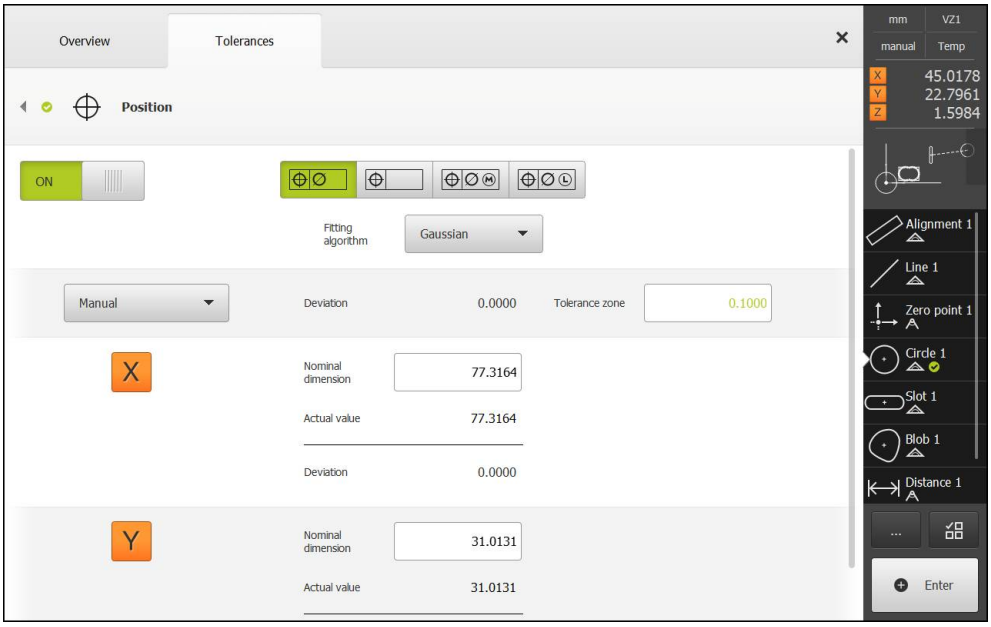


Figure 96: **Location tolerances** overview with activated **Position** tolerance

- ▶ 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 entered nominal values
- > The deviation is now updated
- > 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 **Back**
- > The **Tolerances** tab is displayed
- > The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

11.3.6 Setting runout and directional tolerances for a feature

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 selection and input fields become active

Activating a tolerance (ISO 2768 standard)

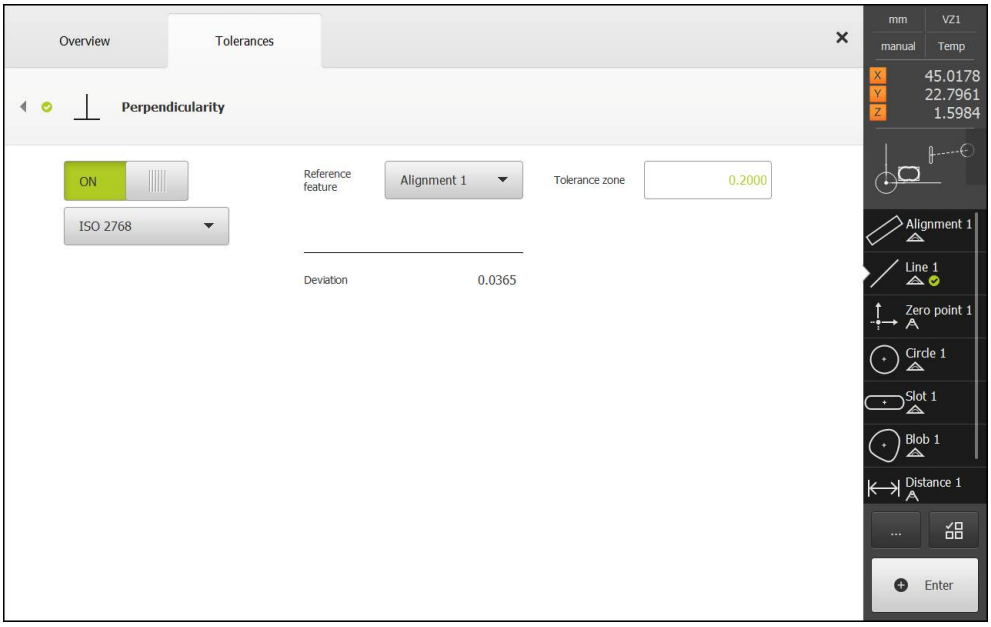


Figure 97: **Directional tolerances** overview with activated **Perpendicularity** tolerance as per **ISO 2768**

- ▶ Select the **Alignment** feature in the **Reference feature** drop-down list
- > The deviation is displayed
- > The tolerance zone is displayed

> The tolerance zone is taken over from the provided table of the selected general tolerance.

- > 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 **Back**
- > The **Tolerances** tab is displayed
- > The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed 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 **Back** tab is now displayed
- > The results of the tolerance check are shown in the **Tolerances** tab and, after the dialog has been closed, are displayed in the feature list

11.4 Adding annotations

In the features view, you can add annotations to each feature (for example, measurement information or informational texts).

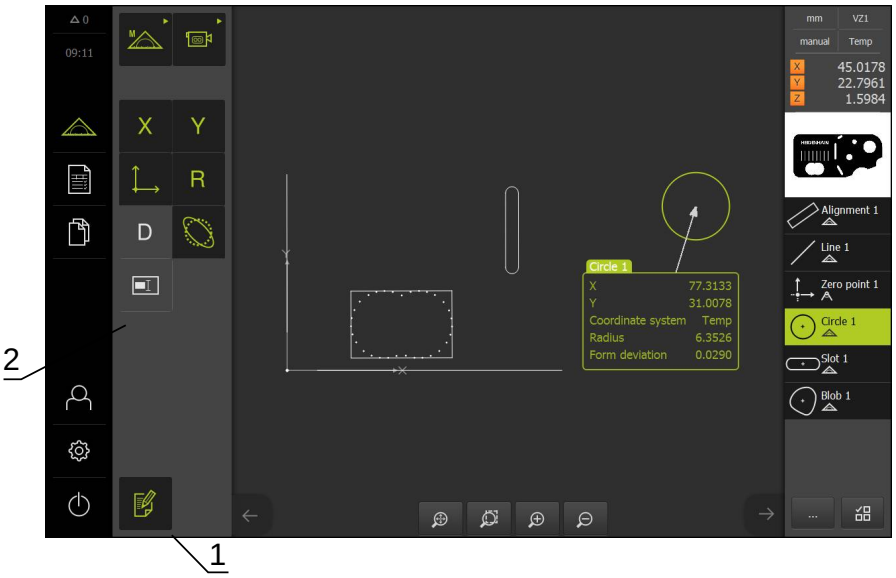


Figure 98: Feature with annotations in the features view

1 The **Edit annotations** operating element
2 Operating elements for adding annotations to one or more features

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

- ▶ Select **Manual measuring**
- ▶ If applicable, tap **Features preview** in the Inspector
- > The features preview is now displayed in the workspace

- ▶ Tap **Edit annotations**
- ▶ Select one or more features in the feature list
- > The operating elements for adding annotations are now displayed
  Further information: "Editing annotations", Page 91
- ▶ To add annotations to the selected features, tap the corresponding operating element
- > The annotations are now displayed in the workspace
- ▶ To place annotations in a different position, drag the annotations in the workspace to the desired location
- ▶ To leave the editing mode, tap **Edit annotations** again

If you select multiple features with different geometry types, then only those operating elements are displayed that are available for all objects. If an annotation has already been added to a portion of the selected features, then the associated operating element is depicted in dashed lines

Example: Adding a text annotation

- ▶ Drag a feature (e.g., a **Circle**) from the feature list into the workspace
- > The **Details** dialog appears with the **Overview** tab selected
- ▶ In the **Note** input field, enter the text that is to be shown in the features view
- ▶ In the **Details** dialog, tap **Close**

- ▶ Tap **Edit annotations**
- ▶ In the feature list, select the feature for which the annotation has been entered
- > The operating elements for adding annotations are now shown

- ▶ Tap **Note**
- > The text is now displayed as an annotation in the workspace

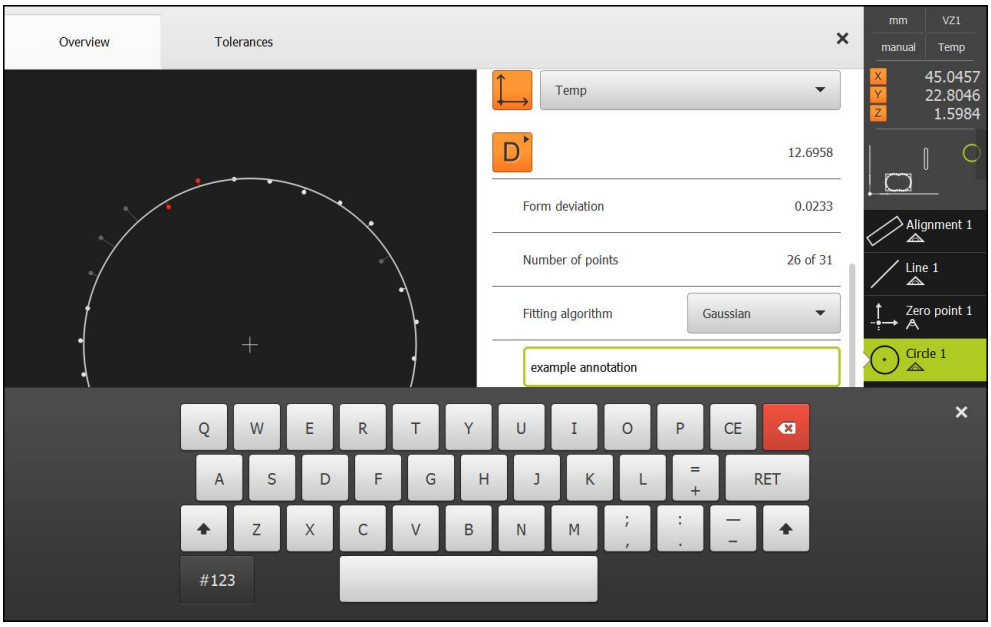


Figure 99: Text annotation in the input field

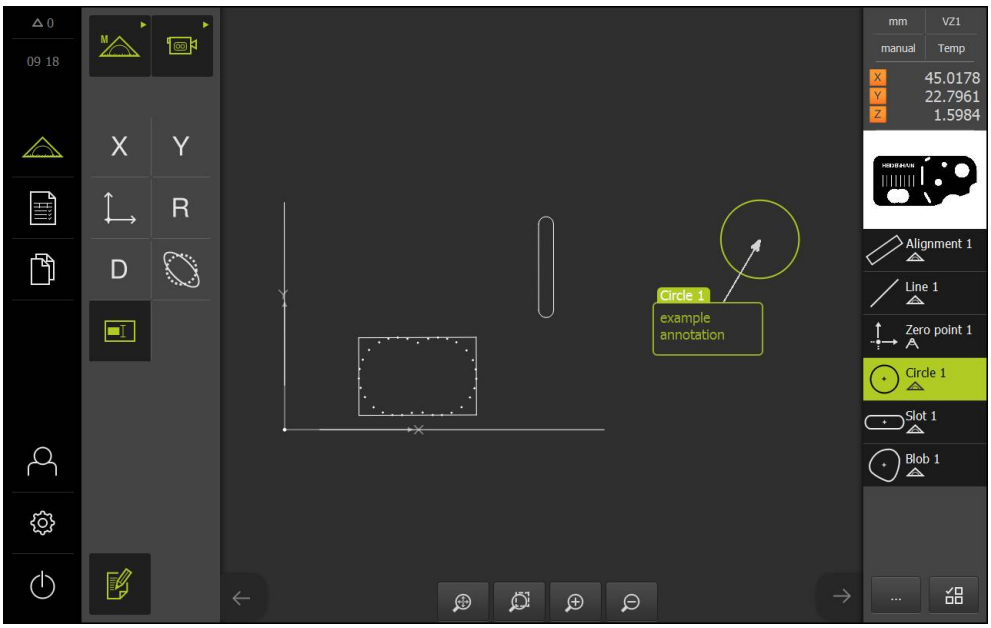


Figure 100: Text annotation in the features view

12

Programming

12.1 Overview

This chapter describes how you can create and edit measuring programs and how you can use them for recurring measuring tasks.

Make sure that you have read and understood the "Basic operation" chapter before carrying out the actions described below.

Further information: "Basic operation", Page 61

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. The work steps of a measuring program are referred to as program steps.

Measuring programs can include the following program steps:

- Adapting the settings of the measuring program: Initialization, Auto enter, units
- Changing the reference system
- Adjusting the magnification
- Controlling the lighting
- Measuring point acquisition: Start the measuring tool
- Creating and evaluating a feature: Calculation, construction, definition
- Deleting features and 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**

Figure 101: Display and operating elements of measuring programs

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

12.2 Using the program control

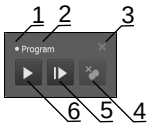
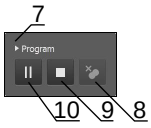
You can control the execution of an active measuring program directly in the workspace.

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., align measured object, acquire and evaluate features, generate measurement report)

> All program steps are displayed in the program step list

- Saving a measuring program

Further information: "Saving a measuring program", Page 272

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**
- Tap the input field, and enter a name for the measuring program
- Confirm entry with **RET**
- Tap **Save as**

> The measuring program is saved

> The name of the measuring program is displayed in 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

12.6 Opening and starting a measuring program from the miscellaneous functions

If you open a measuring program, then the current measuring program will be closed. Unsaved changes to the current measuring program are thereby lost.

- Save changes made to the current measuring program before opening a measuring program

Further information: "Saving a measuring program", Page 272

- Tap **Miscellaneous functions** in the Inspector
- In the Miscellaneous functions dialog, tap **Open**
- Confirm the note with **OK**
- > The **Internal/Programs** folder is now displayed
- Navigate to storage location of the measuring program
- Tap the name of the measuring program
- Tap **Select**
- > 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

12.7 Editing a measuring program

You can edit the program steps of a measuring program in a program step list that has just been recorded or saved You thus have the option, for example, of adding the measurement of an additional feature, or correcting lighting or references, or of adapting a measuring program to new part specifications without having to re-record it. Individual program steps can be deleted.

It is recommended that you create a backup copy of the measuring program before deleting program steps. Program steps can no longer be restored once they have been deleted.

Further information: "Copying a file", Page 425

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

12.7.1 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 is to be inserted
- ▶ Execute the new work step
- > The work step is added to the program step list as a new program step

> To apply changes in a measuring program, you must save the measuring program again.
> **Further information:** "Saving a measuring program", Page 272

12.7.2 Adjusting program steps

You can later modify recorded program steps (e.g., in order to correct measuring program settings, lighting, or tolerances).

Modifying a program step

- ▶ Drag the program step to the left into the workspace
- > The settings are displayed
- ▶ Change the settings
- ▶ Tap **Finish** in the program step
- > The settings are applied

> If you tap **Finish**, then the changes made to the program step take effect and cannot be reset.

> To apply changes in a measuring program, you must save the measuring program again.
> **Further information:** "Saving a measuring program", Page 272

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

Initialization

The **Initialization** program step contains settings for the execution of the measuring program. You can adjust these settings. The **Initialization** program step cannot be deleted.

Parameters	Settings
Fixturing Indicates whether there is a fixture for aligning the measured object. If there is a fixture, then parts can be placed in the same position. The alignment does not have to be remeasured	■ **None**: There is no fixture. The alignment of the measured object must be remeasured for every measurement ■ **Permanent**: There is a permanent fixture. The alignment of the measured object is taken over from the measuring program ■ **Temporary**: There is a temporary fixture. The alignment of the measured object must be remeasured at the beginning of every measurement series. For all further measurements, the alignment of the measured object is taken over from the measuring program Default setting: **Permanent**
Number of program runs Defines how many times the program will automatically run in a row	Setting range: **1** to **10000000** Default setting: **1**
Clear the feature list Defines whether features from the feature list are deleted prior to every measuring program execution	■ **Yes**: The feature list will be emptied automatically ■ **No**: Existing features in the feature list will be retained Default setting: **Yes**
Mode of the guidance assistant Defines whether the measuring tool will navigate to the edge automatically as soon as the next measuring point arrives in the workspace	■ **Snap in**: The measuring tool will move to the edge automatically as soon as the edge arrives in the workspace ■ **Centering**: The measuring tool remains in the center of the workspace. The operator must approach the desired position manually Default setting: **Snap in**
Coordinate system Defines whether a previously saved coordinate system is used for position measurement	■ **Yes**: A saved coordinate system will be used ■ **No**: The **World** standard coordinate system will be used Default setting: **No**
Path of coordinate system file	Storage location of the coordinate system file
Create report Defines whether a measurement report is generated and saved automatically	■ **Yes** ■ **No** Default setting: **No** **Further information:** "Protokoll erzeugen", Page 392

Further information: "Modifying a program step", Page 390

Create report

- ▶ Select the option **Yes** in the **Create report** drop-down list
- > The **Report based on** and **Path of report file** input fields now appear
- ▶ Tap **Report based on** in the input field
- ▶ In the dialog, select a measurement report that was generated with the desired characteristics and features
- ▶ Confirm with **Select**
- ▶ Tap **Path of report file** in the input field
- ▶ Select the desired storage location in the dialog
- ▶ Tap in the input field
- ▶ Enter a file name under which the measurement report should be automatically saved

> Measurement reports with the identical name will be overwritten If you want to keep the existing measurement reports, then assign a new file name prior to every execution of the measuring program.

- ▶ Input with RET
- ▶ Confirm with **Save as**
- > The measurement report will be generated and saved after successful execution of the measuring program

Auto enter

The **Auto enter** program step applies settings for measuring point acquisition.

Parameters	Settings
Auto enter Activates automatic measuring point acquisition	■ **ON**: Automatic measuring point acquisition is activated ■ **OFF**: Automatic measuring point acquisition is deactivated Default setting: **OFF**
Auto enter timeout in ms Defines how long a measuring tool must stand still at a position until a measuring point is automatically acquired	Setting range: **150** to **10000** Default setting: **500**

Magnification

The **Magnification** program step defines the magnification settings for the subsequent program run.

Bear in mind that this program step has an effect on the subsequent program steps. If you change settings or insert the program step into an existing measuring program, then the subsequent features must be remeasured. By doing so, you can avoid measuring errors.

Units

The **Units** program step defines units and coordinate systems for the entire measuring program.

Parameters	Settings
Unit for linear values	■ **Millimeters** ■ **Inch** Default setting: **Millimeters**
Unit for angular values	■ **Radian** ■ **Decimal degrees** ■ **Deg-Min-Sec** Default setting: **Decimal degrees**
Type of coordinate system	■ **Cartesian** ■ **Polar** Default setting: **Cartesian**

Further information: "Modifying a program step", Page 390

Lighting

The **Lighting** program step defines the lighting settings for the subsequent program run.
Modifying the program step:

- ▶ Drag the program step for setting the lighting to the left into the workspace
- > The lighting settings are displayed
- ▶ Change the lighting manually or switch manually between presets
  Further information: "Adjusting the lighting", Page 117
- ▶ Tap **Finish** in the program step
- > The lighting settings are applied

> Bear in mind that this program step has an effect on the subsequent program steps. If you change settings or insert the program step into an existing measuring program, then the subsequent features must be remeasured. By doing so, you can avoid measuring errors.

Program steps for measuring point acquisition

The **Start VED** or **Start OED** program steps execute measuring point acquisition with the selected measuring tool and the defined settings.

Adjusting measuring tools:

- ▶ 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 **Measuring tool settings** at the lower edge of the workspace
- ▶ Change the settings of the measuring tool
  Further information: "Setting the VED measuring tool", Page 106
- ▶ Tap **Close** to close the settings of the measuring tool
- ▶ Tap **Finish** in the program step
- > The settings for the measuring tool are applied

Program steps for creating a feature

Depending on whether a feature is to be calculated, constructed, or defined, a corresponding program step will be inserted during the recording of the measuring program:

- **Calculate** calculates a feature from the acquired measuring points with the parameters that have been set (e.g., fitting algorithm and tolerances)
- **Construct** constructs a feature with the parameters that have been set
- **Define** defines a feature with the parameters that have been set

Modifying a program step:

- ▶ 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 355

- ▶ In the **Tolerances** tab, adjust the tolerancing of the feature

Further information: "Defining tolerances", Page 358

- ▶ Tap **Close** to close the dialog
- > The settings and tolerances are saved for the feature

For the measurement and calculation of a feature, the **Start VED** / **Start OED** and **Calculate** program steps must follow in sequence. If one or both of the program steps are missing, then the measuring program cannot be executed.

Modify datum

With the **Modify datum** program step, the axis references can be changed. This program step is generated when you overwrite the indicated position of an axis. This program step cannot be configured.

Bear in mind that this program step has an effect on the subsequent program steps. If you change settings or insert the program step into an existing measuring program, then the subsequent features must be remeasured. By doing so, you can avoid measuring errors.

Delete

With the **Delete** program step, you can, before completion of the measuring program, delete auxiliary features that should not be incorporated into the measurement evaluation. This program step is generated when you delete a feature from the feature list. This program step cannot be configured

12.7.3 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

To apply changes in a measuring program, you must save the measuring program again.

Further information: "Saving a measuring program", Page 272

12.7.4 Setting and removing 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 reports

13.1 Overview

This chapter describes how to create, modify, manage, and generate templates for measurement reports.

Make sure that you have read and understood the "Basic operation" chapter before carrying out the actions described below.

Further information: "Basic operation", Page 61

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 407

Activation

- Tap **Measurement report** in the main menu

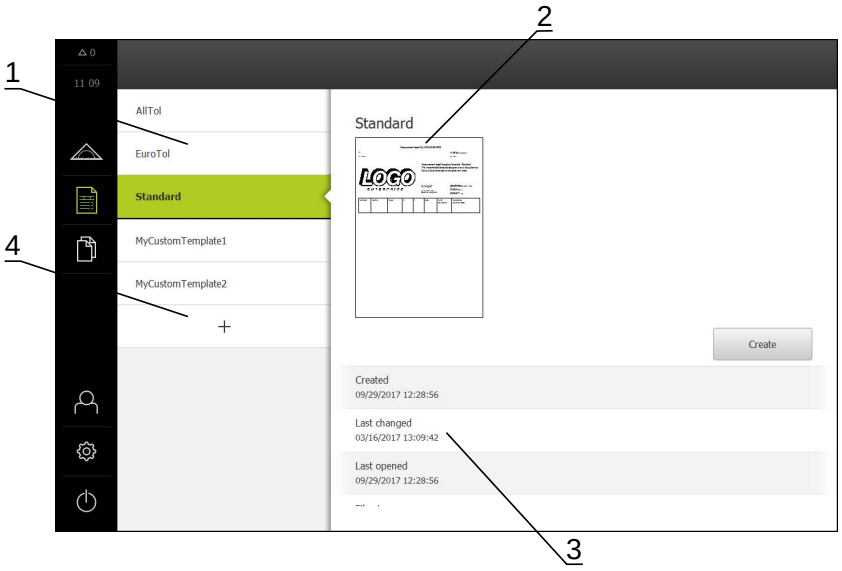


Figure 102: Measurement report menu

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 407

- To duplicate the template, tap **Save as**

> The **Save as** dialog appears

- Select storage location (e.g. **Internal/Reports**
- Enter a name for the template
- Confirm entry with **RET**
- Confirm copying with **Save as**

> The copy of the template is saved

Editing a template

- Tap **Edit file**

> The editor opens

Further information: "Creating and editing a template", Page 407

Renaming a template

- Tap **Rename file**
- Change the file name in the dialog
- Confirm 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 output the measurement as a measurement report. In this way, you can save and print the measurement results.

You can create a measurement report in four steps:

- "Selecting the template and features"
- "Entering information on the measuring task"
- "Selecting document settings"
- "Exporting a measurement report"

13.3.1 Selecting the template and features

- ▶ Tap **Measurement report** in the main menu
- > The user interface for editing the measurement reports appears
- ▶ Select the **Standard** template
- > 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 270

- ▶ 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

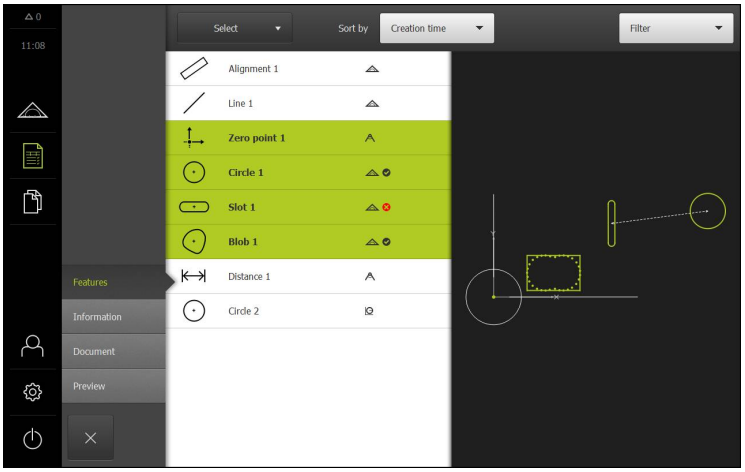


Figure 103: Measurement report menu with feature list and preview

13.3.2 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**

13.3.3 Selecting document settings

- Tap the **Document** menu
- To adjust the unit of measurement for linear measurement values, select the desired unit of measurement 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 of measurement for angular values, select the desired unit of measurement in the **Unit for angular values** drop-down list
  - **Decimal degrees**: Display in degrees
  - **Radian**: Display in radians
  - **Deg-Min-Sec**: Display in degrees, minutes, and seconds
- 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

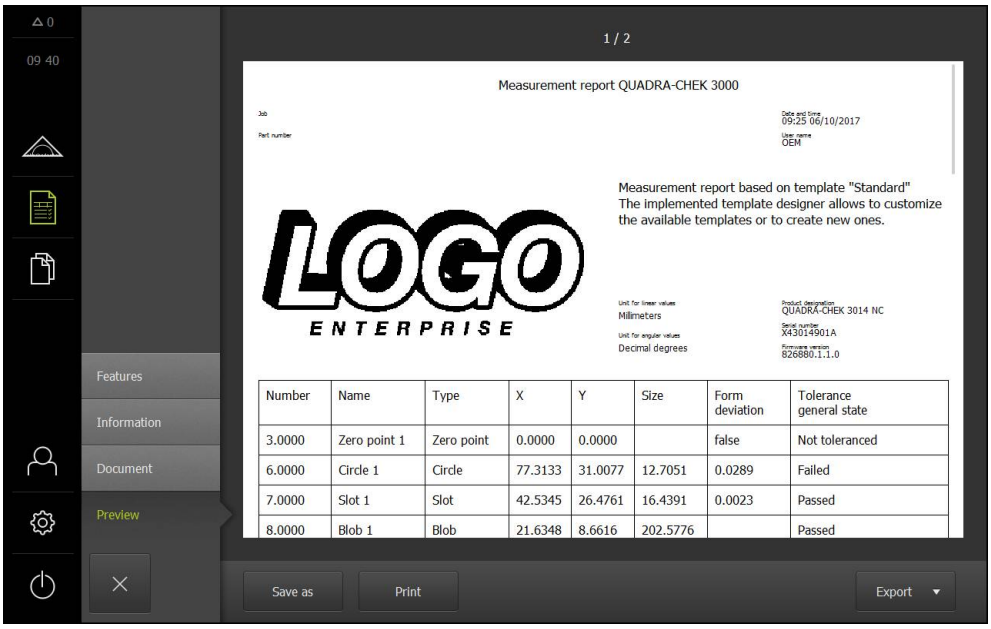


Figure 104: Preview of the measurement report

13.3.4 Saving a measurement report

Measurement reports are saved in the XMR data format.

- 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 **Save as**

> The measurement report is saved

> Files saved in XMR data format can be displayed and newly created at a later point in time.
>
> **Further information:** "Protokoll erzeugen", Page 392
> Page 427

13.3.5 Printing a measurement report

- Tap **Print**

> The measurement report is output to the specified printer
> **Further information:** "Configuring the printer", Page 195

13.3.6 Exporting a measurement report

Measurement reports can be exported as PDF or CSV files.

- 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 **Save as**

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

13.3.7 Canceling a 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 424

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 shown.
	Is not	Only features of the non-selected geometry type are shown.
Size	**Equal**	Only features of the specified size are shown.
	Greater than	Only features that are larger than the specified size are shown.
	Less than	Only features that are smaller than the specified size are shown.
Tolerance	**Is**	Only features that fulfill the selected characteristic are shown: ■ **Passed** ■ **Failed** ■ **Inactive**
	Is not	Only features that do not fulfill the selected characteristic are shown.
Selection	**Is**	Only the selected features are shown.
	Is not	Only the non-selected features are shown.

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

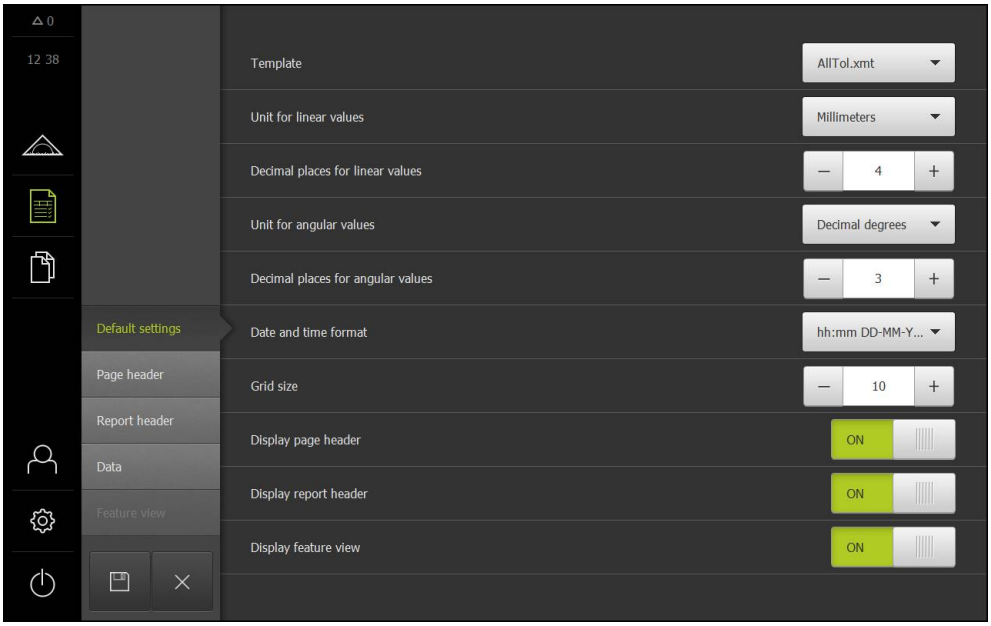


Figure 105: Editor for measurement report templates

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 of measurement 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 of measurement 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 **+**

> The grid for the auxiliary lines can be set between 5 and 50. 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.

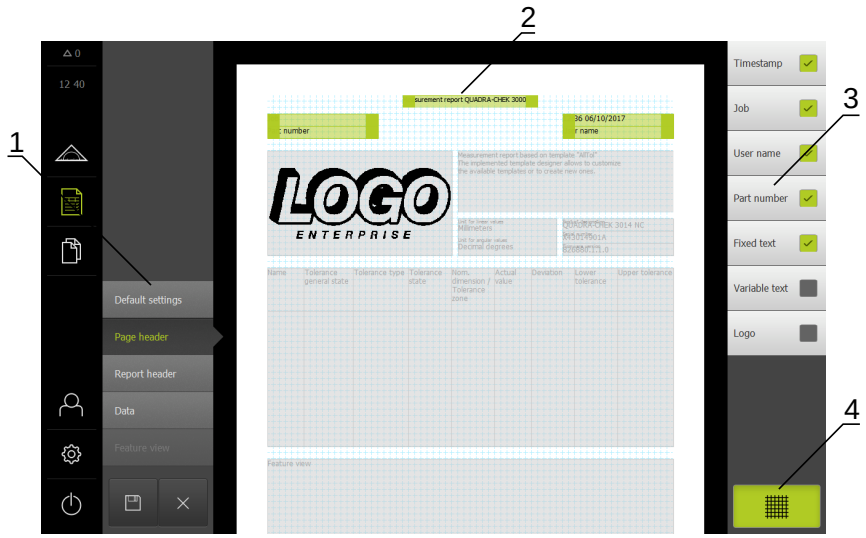


Figure 106: The page header of a measurement report template

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.

Inserting 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 insert 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 adjust the size of the form field using the square handles at the corner of the 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 in the template according to your own preferences.

- ▶ 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.

Figure 107: Report header of a measurement report template

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.

Inserting 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 insert 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 **Select** 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 adjust the size of the form field using the square handles at the corner of the 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 in the template according to your own preferences.

- ▶ 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 data for a measurement report

▶ Tap **Data**

Figure 108: The data table of a measurement report template

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 insert 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.
Coordinate system	The coordinate system that is used for the feature 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 algorithms used on the feature or on the activated tolerances are inserted.
No. of points / parent features	For measured features, the number of measuring points is inserted. For constructed features, the number of parent features 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 symbol for the process with which the feature has been generated is inserted (measuring, constructing, or defining).

Form field	Meaning and application
Tolerance general state	The overall status of all of the tolerances that have been inserted into the feature are inserted (e.g., **Passed**, if all of the individual tolerances are good).
Tolerance type	The tolerance types applied to the feature are inserted.
Tolerance state	The states of the tolerances applied to the feature are inserted.
Nom. dimension / Tolerance zone	The nominal dimension or the value of the tolerance zone of a tolerance applying to a 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 a template

The templates are saved in the XMT data format.

- ▶ To save the template, tap **Save as**
- > The **Save as** dialog appears
- ▶ Select the storage location (e. g., **Internal/Reports**
- ▶ Enter a name for the template
- ▶ Confirm entry with **RET**
- ▶ Tap **Save as**
- > 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 a template", Page 419

- ▶ 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 **File management** menu and its functions.

Make sure that you have read and understood the "Basic operation" chapter before carrying out the actions described below.

Further information: "Basic operation", Page 61

Short description

The **File management** menu shows an overview of the files stored in the product's memory.

Activation

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

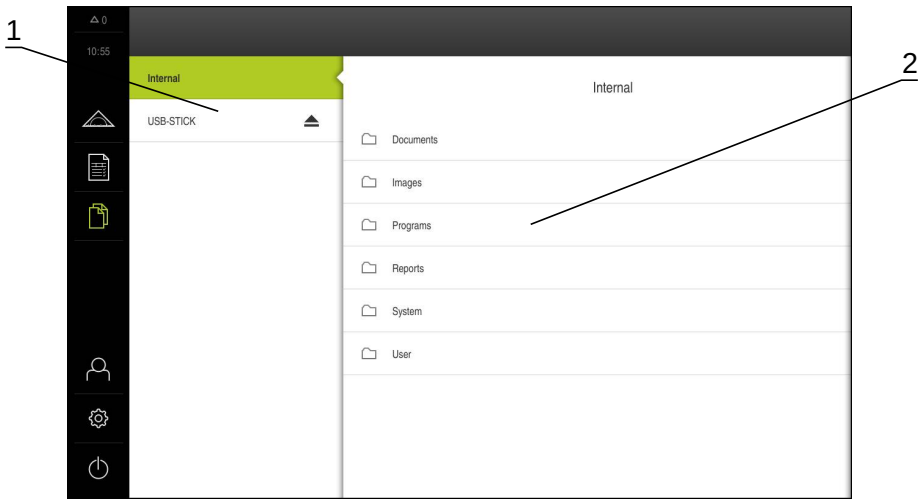


Figure 109: **File management** menu

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

14.2 File types

In the **File management** menu you can edit the following file types:

Type	Use	Manage	View	Open	Print
*.xmp	Measuring programs	✓	✓	✓	–
*.xmr	Measurement reports	✓	✓	–	–
*.xmt	Measurement report templates	✓	–	–	–
*.mcc	Configuration files	✓	–	–	–
*.dro	Firmware files	✓	–	–	–
*.svg, *.ppm	Image files	✓	–	–	–
*.jpg, *.png, *.bmp	Image files	✓	✓	–	–
*.csv	Text files	✓	–	–	–
*.txt, *.log, *.xml	Text files	✓	✓	–	–
*.pdf	PDF files	✓	✓	–	✓

14.3 Managing folders and files

Folder structure

In the **File management** menu, the files in the **Internal** storage location are saved in the following folders:

Folders	Application
Documents	Document files with instructions and service addresses
Images	Images of measured objects as reference material
Programs	Stored programs
Reports	Stored measurement reports and measurement report templates
System	Audio files and system files
User	User data

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 new folder
- ▶ Confirm 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 **Select**
- > 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 **Select**
- > The folder is copied

If you copy a folder to the folder it is stored in, the suffix "_1" is appended to the name of the copied folder.

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 name for the new 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 **Select**
- > 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 **Select**
- > The file is copied

If you copy a file to the folder it is stored in, the suffix "_1" is appended to the name of the copied file.

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 name for the new 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 permanently deleted and cannot be recovered. 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

14.4 Opening and viewing files

Viewing files

- Tap **File management** in the main menu
- Navigate to the storage location of the desired file
- Tap the file

> A preview image (only for PDF and image files) as well as information about the file are displayed

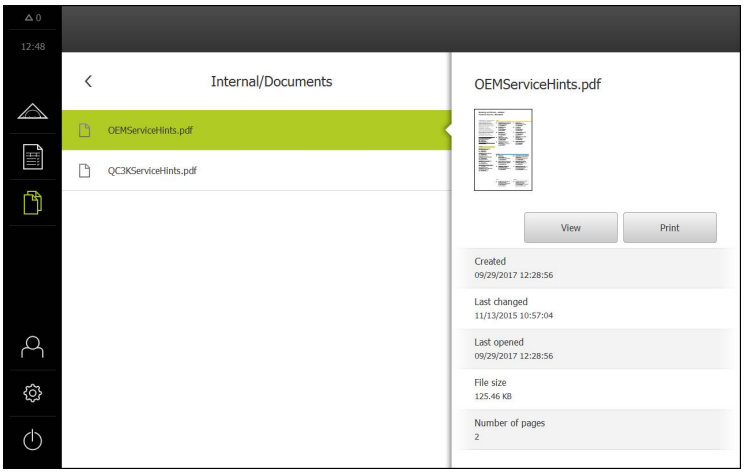


Figure 110: **File management** menu with preview image and file information

- Tap **View**

> The file contents are displayed

- Tap **Close** to close the view

> In this view, you can print PDF files on the printer configured in the product 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

Opening and recreating the measurement report

Measurement reports saved as *.xmr file type can be viewed or regenerated. A new measurement report uses the template, the template settings and the selected features for recreating.

- 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 recreate the measurement report, tap **Recreate report**
- Select the storage location in the dialog, e.g. **Internal/Reports**
- Enter the name of the new measurement report
- Confirm the entry with **RET**
- Tap **Save as**

> The new measurement report is created based on the existing measurement report

> The new measurement report is saved

14.5 Exporting files

You can export files to an external USB mass storage device (FAT32-Format) or to the network drive. You can either copy or move the files:

- If you copy files, duplicates of the files will remain stored in the product
- If you move files, the files will be 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 **Select**
- > 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**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

14.6 Importing files

You can import files from a USB mass storage device (FAT32-Format) or a network drive into the product. You can either copy or move the files:

- If you copy files, duplicates of the files will remain on the USB mass storage device or the network drive
- If you move files, the files will be deleted from the USB mass storage device or the network drive

- Tap **File management** in the main menu
- On the USB mass storage device or network drive, navigate to the file you want to import
- 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 save the file
- Tap **Select**

> The file is stored 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**

> The message **The storage medium can be removed now.** appears

- Disconnect the USB mass storage device

15

Settings

15.1 Overview

This chapter describes the setting options and the associated settings parameters for the product.

The basic setting options and settings parameters for commissioning and product setup are outlined in the respective chapters:

Further information: "Commissioning", Page 125

Further information: "Setup", Page 183

Short description

Depending on the type of user that is logged in to the product, settings and settings 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 settings parameter, the setting or settings parameter is grayed out and cannot be opened or edited.

Depending on the software options that have been activated on the product, various settings and settings parameters are available in the Settings menu.

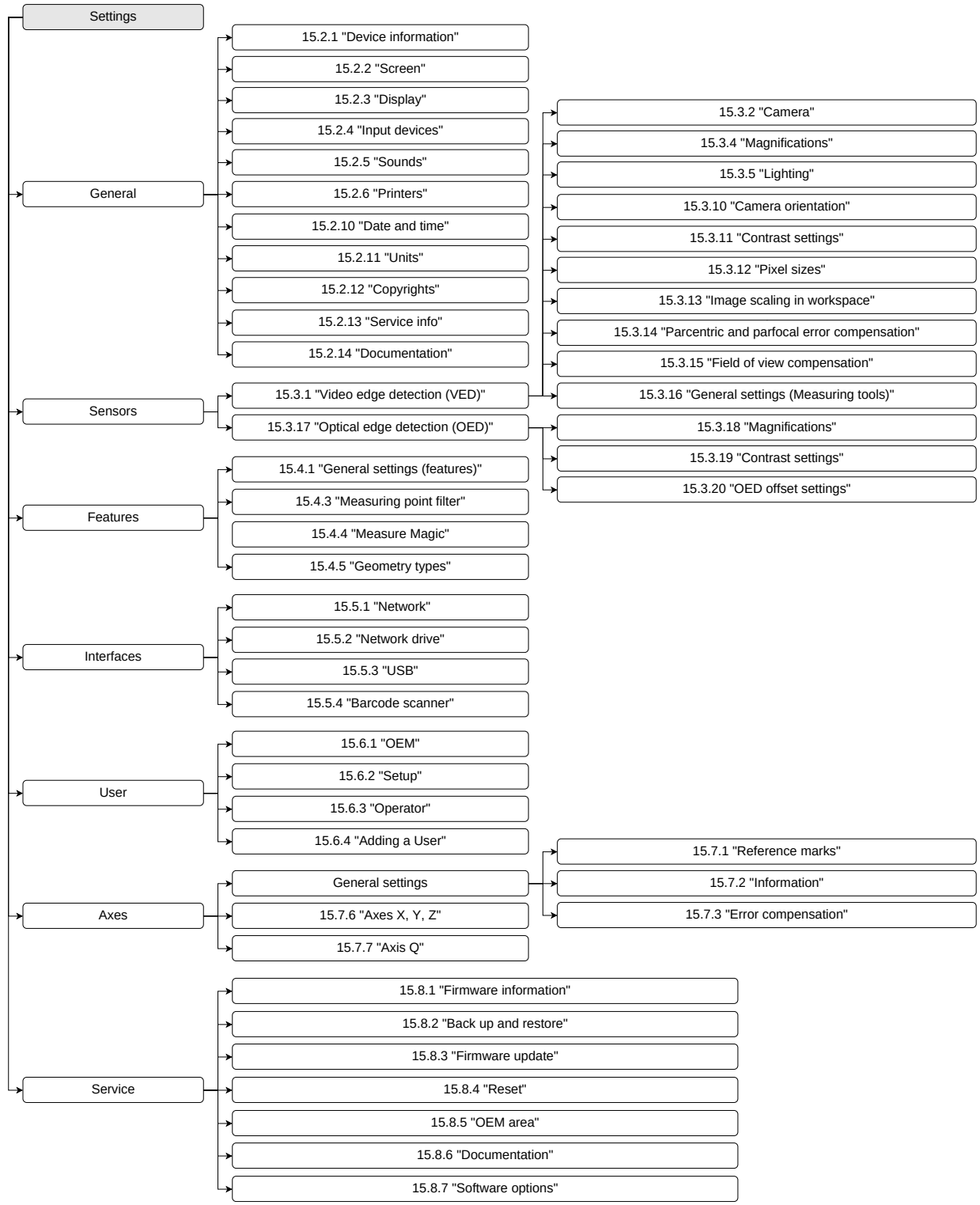
For example, if the QUADRA-CHEK 3000 VED software option is not active on the product, the settings parameters required for this software option are not displayed on the product.

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

15.1.1 Overview of the Settings menu



15.2 General

This chapter describes settings for configuring the operation and display and for setting up printers.

15.2.1 Device information

Path: **Settings ► General ► 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

15.2.2 Screen

Path: **Settings ► General ► Screen**

Parameter	Explanation
Brightness	Brightness of the screen ■ Setting range: **1 % ... 100 %** ■ Default setting: **90 %**
Energy-save-mode timeout	Time until energy-save mode is activated ■ Setting range: **0 min ... 120 min** If the value is set to 0, the energy-save mode is deactivated ■ Default setting: **30** minutes
Quit the energy saving mode	Required actions to reactivate the screen ■ **Tap and drag**: Touch the touchscreen and drag the arrow upwards from the lower edge ■ **Tap**: Touch the touchscreen ■ **Tap or axis movement**: Touch the touchscreen or move the axis ■ Default setting: **Tap and drag**

15.2.3 Display

Path: **Settings ▶ General ▶ 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. Settings: ■ **Small** ■ **Medium** ■ **Large** ■ Default setting: **Small**

15.2.4 Input devices

Path: **Settings ▶ General ▶ Input devices**

Parameter	Explanation
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)**
Mouse substitute for multitouch gestures	Specifies whether mouse operation should replace operation using the touchscreen (multitouch) Settings: ■ **Auto (until first multitouch)**: Touching the touchscreen causes mouse deactivation ■ **On (no multitouch)**: Operation only possible with the mouse, the touchscreen is deactivated ■ **Off (only multitouch)**: Operation only possible with the touchscreen, the mouse is deactivated ■ Default setting: **Auto (until first multitouch)**
USB keyboard layout	If a USB keyboard is connected: ■ Language selection of the keyboard assignment

15.2.5 Sounds

Path: **Settings ► General ► 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**

15.2.6 Printers

Path: **Settings ► General ► Printers**

Parameters	Explanation
Default printer	List of printers configured on the product
Properties	Settings of the selected default printer
Add printer	Adds a **USB printer** or **Network printer**
Remove printer	Removes a **USB printer** or **Network printer** connected to the product

15.2.7 Properties

Path: **Settings ► General ► Printers ► Properties**

Parameters	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
Feed tray	Specification of the paper feeder ■ The setting range and default setting depend on the printer type
Type of paper	Designation of the paper type ■ The setting range and default setting depend on the printer type
Duplex printing	Options for duplex printing ■ The setting range and default setting depend on the printer type
Color/Black and white	Specification of the printing mode ■ The setting range and default setting depend on the printer type

15.2.8 Add printer

Path: **Settings ▶ General ▶ Printers ▶ Add printer**

The following parameters are available for **USB printer** and **Network printer**.

Parameters	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 ("/"), hash characters ("#") 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

15.2.9 Remove printer

Path: **Settings ▶ General ▶ Printers ▶ Remove printer**

Parameters	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

15.2.10 Date and time

Path: **Settings ► General ► 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")

15.2.11 Units

Path: **Settings ► General ► 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 ■ **Round to 0 and 5**: Decimal places ≤ 24 or ≥ 75 are rounded to 0, decimal places ≥ 25 or ≤ 74 are rounded to 5 ■ 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**

Parameter	Explanation
Unit for angular values	Unit for angular values Settings: ■ **Radian**: angles in radian (rad) ■ **Decimal degrees**: angles in degrees (°) with decimal places ■ **Deg-Min-Sec**: angles in degrees (°), minutes ['] and seconds ["] ■ Default setting: **Decimal degrees**
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 ■ **Round to 0 and 5**: Decimal places ≤ 24 or ≥ 75 are rounded to 0, decimal places ≥ 25 or ≤ 74 are rounded to 5 ■ 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**

15.2.12 Copyrights

Path: **Settings ► General ► Copyrights**

Parameter	Meaning and function
Open source software	Display of the licenses of the software used

15.2.13 Service info

Path: **Settings ► General ► 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 **Further information:** "Adding documentation", Page 171

15.2.14 Documentation

Path: **Settings ► General ► Documentation**

Parameter	Meaning and function
Operating Instructions	Display of the operating instructions stored on the product ■ Default: no document; the document in the desired language can be added **Further information:** "Documentation", Page 492

15.3 Sensors

This chapter describes settings for configuring the sensors.

Depending on the software options 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 (sensor for video edge detection). A VED sensor is a USB camera or network camera connected to the product. **Further information:** "Video edge detection (VED)", Page 444
QUADRA-CHEK 3000 OED software option	**Optical edge detection (OED)**: The product supports the use of an OED sensor (sensor for optical edge detection). An OED sensor is a fiber-optic cable connected to the product, enabling changes in contrast to be detected on the shield of a profile projector. **Further information:** "Optical edge detection (OED)", Page 460

15.3.1 Video edge detection (VED)

Path: **Settings ► Sensors ► Video edge detection (VED)**

Parameter	Explanation
Camera	List of selectable virtual cameras and cameras connected to the product
Magnifications	Definition of the magnifications available on the measuring machine
Lighting	Configuration of the lighting in accordance with the lighting variant used
Camera orientation	Compensation of camera orientation
Contrast settings	Edge algorithm and contrast threshold for defining from when a light-to-dark transition is recognized as an edge
Pixel sizes	Pixel size of the live image compared to the actual size of the object of measurement
Image scaling in workspace	Scaling of the live image by a defined factor in the workspace
Parcentric and parfocal error compensation	Adjusts deviations caused by the mechanical setting of the magnifications
Field of view compensation	Adjusts deviations caused by the properties of the lens
Measuring tools	Configuration of the measuring tools

15.3.2 Camera

Path: **Settings ► Sensors ► Video edge detection (VED) ► Camera**

The **Camera** menu lists the virtual cameras as well as the camera 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.

15.3.3 Virtual camera or hardware camera

Path: **Settings ► Sensors ► Video edge detection (VED) ► Camera ► Camera designation**

> 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
Frames per second	Shows the number of camera images per second
Frames (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**
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 of the 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: ■ **None**: Image is not mirrored ■ **Horizontal**: Image is mirrored horizontally ■ **Vertical**: Image is mirrored vertically ■ **Horizontal and vertical**: Image is mirrored horizontally and vertically ■ Default setting: **None**
Pixel clock (MHz)	Rate at which the image data are read from the camera sensor ■ Setting range: Depending on connected camera
Frame rate	Number of single images acquired per second ■ Setting range: Depending on connected camera

Parameter	Explanation
	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 **Frame 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
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
Deactivate camera	Deactivates the camera and live image

15.3.4 Magnifications

Path: **Settings ► Sensors ► Video edge detection (VED) ► Magnification**

If an optical sensor is active you can configure one or more magnifications. For each optical magnification available on the measuring machine, a **Magnification** must be set up on the product. During measurement the optical magnification must match the magnification set 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**
+	Adding a new magnification

15.3.5 Lighting

Path: **Settings ► Sensors ► Video edge detection (VED) ► 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

15.3.6 General settings (Lighting)

Path: **Settings ► Sensors ► Video edge detection (VED) ► Lighting ► 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**

15.3.7 A transmitted light + 4 x AD reflected light

Path: **Settings ► Sensors ► Video edge detection (VED) ► Lighting ► 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 according to pin layout Default value: **Not connected**
Analog output for reflected light	
Digital output for front segment	Assignment of the digital outputs for reflected-light segments according to pin layout Default value: **Not connected**
Digital output for rear segment	
Digital output for left segment	
Digital output for right segment	

15.3.8 A trans.light + 4 x A refl.light + D laser pointer

Path: **Settings ► Sensors ► Video edge detection (VED) ► Lighting ► A trans.light + 4 x A refl.light + D laser pointer**

Parameter	Explanation
Analog output for transmitted light	Assignment of the analog outputs for reflected-light segments and transmitted light according to pin layout Default value: **Not connected**
Analog output for front segment	
Analog output for rear segment	
Analog output for left segment	
Analog output for right segment	
Digital output for laser pointer	Assignment of the digital outputs for laser pointer according to pin layout Default value: **Not connected**

15.3.9 AD trans.light + 4 x AD refl.light + AD coaxial light + exposure time

Path: **Settings ► Sensors ► Video edge detection (VED) ► Lighting ► 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 according to pin layout Default value: **Not connected**
Analog output	Assignment of the analog output for the lighting according to pin layout 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 % in the control range, starting from which the light is activated or deactivated ■ 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 according to pin layout 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 according to pin layout 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 % in the control range, starting from which the light is activated or deactivated ■ 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 according to pin layout Default value: **Not connected**
Analog output	Assignment of the analog output for the lighting according to pin layout 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 % in the control range, starting from which the light is activated or deactivated ■ 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

15.3.10 Camera orientation

Path: **Settings ► Sensors ► Video edge detection (VED) ► 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**

15.3.11 Contrast settings

Path: **Settings ► Sensors ► Video edge detection (VED) ► Contrast settings**

Parameter	Explanation
Contrast bar	Displays the **Contrast bar** slider in the workspace for continuously adjusting the contrast threshold Settings: ■ **ON**: Contrast bar is displayed ■ **OFF**: Contrast bar is not displayed ■ Default value: **OFF** **Further information:** "Modifying the contrast threshold", Page 120
All users can alter the contrast threshold value	Defines which users can adjust the contrast threshold via the contrast bar. If there is no permission the contrast bar is displayed but cannot be adjusted Settings: ■ **ON**: All users can adjust the contrast threshold via the contrast bar ■ **OFF**: Only **OEM**-type or **Setup**-type users can adjust the contrast threshold via the contrast bar ■ Default value: **ON**
Orientation of contrast bar	Defines how the contrast bar is displayed in the workspace Settings: ■ **Vertical**: Contrast bar oriented vertically ■ **Horizontal**: Contrast bar oriented horizontally ■ Default value: **Horizontal**
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 contrast threshold is determined automatically during each measurement. The edge calculation is implemented with the edge algorithm **First edge** ■ Default value: **First edge**
Maximum contrast	Display of the maximum contrast determined in the teach sequence. The search range of the VED measuring tool in the live image is evaluated
Minimum contrast	Display of the minimum contrast determined in the teach sequence. The search range of the VED measuring tool in the live image is evaluated
Contrast threshold value for edge detection	Threshold value for the contrast starting from which a transition is recognized as an edge

Parameter	Explanation
	■ Setting range: **0 … 255** ■ Default value: **0**
Teach sequence	Teach sequence for determining the contrast threshold value for edge detection

15.3.12 Pixel sizes

Path: **Settings ► Sensors ► Video edge detection (VED) ► Pixel sizes**

Parameter	Explanation
Magnification	List of available magnifications **Further information:** "Magnifications", Page 447
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	Determined system pixel size Setting range ■ **Millimeters**: **0.00001 mm ... 5 mm** ■ **Inch**: **0.0000004" ... 0.2"** Default value: ■ **Millimeters**: **1.0000** ■ **Inch**: **0.0393700787**
Teach sequence	Teach sequence for determining the **Pixel size** for the selected **Magnification**

15.3.13 Image scaling in workspace

Path: **Settings ► Sensors ► Video edge detection (VED) ► Image scaling in workspace**

Parameter	Explanation
Scaling	Activation of image scaling in the workspace: The camera image in the workspace is reduced by the scaling factor ■ Settings: **ON** or **OFF** ■ Default setting: **OFF**
Scaling factor	Factor by which the camera image is reduced in the workspace ■ Setting range: **0.00001 ... 1.00000** ■ Default value: **1.00000**

15.3.14 Parcentric and parfocal error compensation

Path: **Settings ► Sensors ► Video edge detection (VED) ► Parcentric and parfocal error compensation**

Parcentric and parfocal error compensation adjusts position deviations caused by errors in a lens with magnification settings. The parcentric error compensation adjusts deviations on the X and Y axes. The parfocal error compensation adjusts deviations on the Z axis.

Parameter	Explanation
Compensation	Mechanical factors of influence are compensated with the adjustment of magnifications Settings: ■ **ON**: Compensation is active ■ **OFF**: Compensation is not active ■ Default value: **OFF**
Reference magnification	Selection of reference magnification **Further information:** "Magnifications", Page 447
Magnification offsets	Display of the deviations per axis determined in the teach sequence for each available magnification
Teach sequence	Teach sequence for determining the compensation factor for all available magnifications

15.3.15 Field of view compensation

Path: **Settings ► Sensors ► Video edge detection (VED) ► Field of view compensation**

The **Field of view compensation** adjusts deviations caused by the properties of the lens (lens curvature).

Parameter	Explanation
Compensation	Field of view compensations are adjusted Settings: ■ **ON**: Compensation is active ■ **OFF**: Compensation is not active ■ Default value: **OFF**
Magnification	List of available magnifications **Further information:** "Magnifications", Page 447
Number of supporting points	Number of measuring points for error compensation on both axes (X and Y) of the encoder ■ Setting range: **3 ... 11** (X and Y) ■ Default value: **5** (X and Y)
Table of supporting points	Opens the table of supporting points for manual editing
Teach sequence	The teach sequence for determining the compensation values is started

15.3.16 General settings (Measuring tools)

Path: **Settings ► Sensors ► Video edge detection (VED) ► Measuring tools ► General settings**

Parameter	Explanation
All users can alter measuring tool settings	Determines for which users the **Measuring tool settings** operating element is visible in the workspace, via which the measuring tool settings can be modified Settings: ■ **ON**: All users can see the operating element ■ **OFF**: Only **OEM**-type or **Setup**-type users can see the operating element ■ Default value: **ON** **Further information:** "Operating elements in the workspace", Page 88

15.3.17 Optical edge detection (OED)

Path: **Settings ► Sensors ► Optical edge detection (OED)**

Parameter	Explanation
Magnifications	Definition of the magnifications available on the measuring machine
Contrast settings	Defines from when a light-to-dark transition is recognized as an edge
OED offset settings	Defines which offset between the crosshairs and OED sensor must be calculated in with point acquisition

15.3.18 Magnifications

Path: **Settings ► Sensors ► Optical edge detection (OED) ► Magnification**

If an optical sensor is active you can configure one or more magnifications. For each optical magnification available on the measuring machine, a **Magnification** must be set up on the product. During measurement the optical magnification must match the magnification set on the product.

Parameter	Explanation
Magnifications Default magnification: **Zoom 1**	Definition of the respective magnifications ■ Entry for **Description** and **Acronym for quick access menu**: at least one character ■ Default setting: **Zoom 1** and **Z1**
	Adding a new magnification

15.3.19 Contrast settings

Path: **Settings ► Sensors ► Optical edge detection (OED) ► Contrast settings**

Parameter	Explanation
Intensity	Display of the measured light intensity of reference (R) and shield (S) ■ Setting range: **0 ... 4095**
Target intensity	Target light intensity of reference (R) and shield (S) ■ Setting range: **0 ... 4095**
Settling time	Measurement duration for detecting the light intensity values for reference (R) and shield (S) ■ Setting range: **0 ms ... 300 ms**
Gain	Gain for reference (R) and shield (S) ■ Setting range: **0 ... 255**
Threshold	Switching threshold ■ Setting range: **0 ... 1023** ■ Default value: Mean value between the light value (target intensity) and dark value (measured value in the dark range)
Threshold settling time	Delay time during modification of the threshold value ■ Setting range: **0 ms ... 300 ms**
Teach sequence	Teach sequence for determining the optimum contrast settings for edge detection

15.3.20 OED offset settings

Path: **Settings ► Sensors ► Optical edge detection (OED) ► OED offset settings**

Parameter	Explanation
Current offset	Display of the position error determined in the teach sequence between the OED sensor and crosshairs for both X and Y axes.
Magnification	List of available magnifications **Further information:** "Magnifications", Page 447
Tolerance of circle diameter	Permissible deviation between the two circle diameters measured in the teach sequence ■ Setting range: **0.001 ... 1.000** ■ Default setting: **0.200** An error message is output if the diameter of the circles measured in the teach sequence exceeds the specified tolerance.
Teach sequence	Teach sequence for determining the offset between the crosshairs and OED sensor

15.4 Features

This chapter describes settings for configuring the measuring point acquisition.

15.4.1 General settings (features)

Path: **Settings ► Features ► 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**
Measurement result preview	A window is displayed with detailed information about the measured feature ■ Settings: **ON** or **OFF** ■ Default setting: **ON** **Further information:** "Operating elements of the Inspector", Page 93 The parameters displayed in the measurement result preview can be defined individually for each geometry type **Further information:** "Geometry types", Page 470
Coordinate systems	Configuration of the coordinate systems

15.4.2 Coordinate systems

Path: **Settings ► Features ► General settings ► Coordinate systems**

Parameter	Explanation
Create coordinate system automatically	Defines whether a new coordinate system is created upon each definition of a datum. The naming convention **COS[x]** is used and the value **[x]** is sequentially incremented (COS1, COS2, ...). The option can also be activated in the quick access menu. ■ Settings: **ON** or **OFF** ■ Default setting: **OFF**

15.4.3 Measuring point filter

Path: **Settings ► Features ► Measuring point filter**

Information about the measuring point filter

The measuring point filter enables automatic filtering and prevents contamination on the object of measurement or encoder optic from distorting the measurement result.

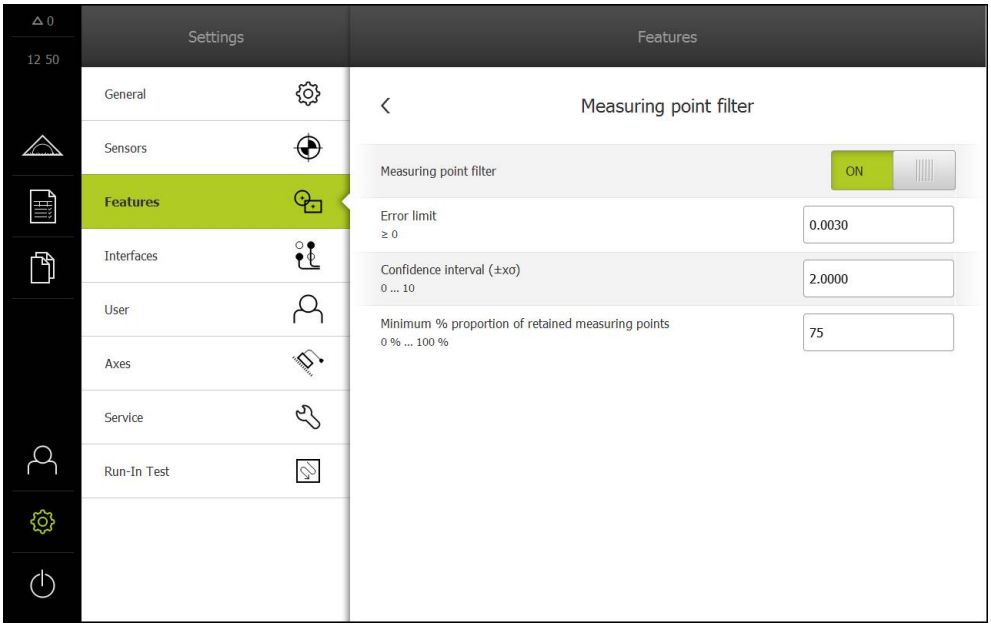


Figure 111: Settings of the measurement point filter

The measurement point filter identifies runaway values in the measuring point cloud based on the following filter criteria:

- **Error limit**
- **Confidence interval (±xσ)**
- **Minimum % proportion of retained measuring points**

Filtered-out measuring points are not included in the calculation of a feature.

The measuring point filter can be used for the following feature types:

- Line segment
- Circle
- Arc
- Ellipse
- Slot
- Rectangle

Error limit filter

The **Error limit** filter specifies the maximum permitted deviation per measuring point.

Deviation = orthogonal distance to the feature

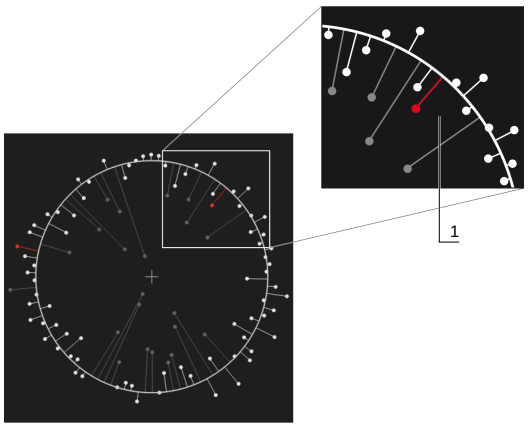


Figure 112: Schematic representation of the form with point cloud and deviations

1 Maximum permissible deviation

Confidence interval (±xσ) filter

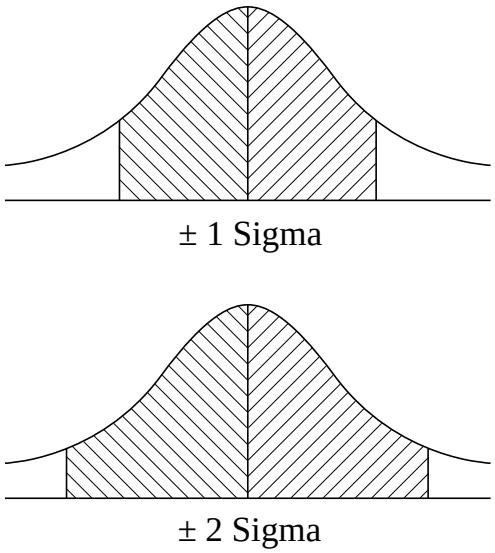


Figure 113: Schematic representation of the confidence interval

Normal distribution is assumed with dispersion of the deviations. The mean value corresponds to the average of all deviations.

The **Confidence interval (±xσ)** filter limits a range that must flow into the calculation. The limits of the confidence interval correspond to the standard deviation (Sigma) multiplied by the Sigma factor:

Confidence interval = Sigma factor * Sigma

Entering the Sigma factor into the **Confidence interval (±xσ)** field influences the width of the confidence interval.

Example: If you select Sigma factor 2, the confidence interval includes almost 95 % of all values.

Filter Minimum % proportion of retained measuring points

To rule out that the measuring result is no longer representative, the majority of measuring points should be kept. The **Minimum % proportion of retained measuring points** filter enables you to define the percentage of all measuring points that must flow into the calculation.

Filter procedure: least-square-best-fit procedure in accordance with Gauß

Runaway values are determined according to the least-square-best-fit procedure and filtered out:

1. Feature is calculated from all measuring points. The Gauß compensation is applied independently of the compensation process you selected for the feature
2. Measuring point with the greatest deviation is checked with filter criteria:
   - Deviation is greater than the value in the **Error limit** field
   - Deviation is outside the confidence interval—if the point is filtered out, **Minimum % proportion of retained measuring points** is not fallen below
   - If the deviation fulfills all criteria the point is filtered out
3. The feature and confidence interval are recalculated (Gauß compensation) based on the remaining points
4. The process is repeated for each point, always based on the greatest deviation
5. The process stops as soon as a deviation falls below the **Error limit**, or is inside the confidence interval, or as soon as **Minimum % proportion of retained measuring points** is fallen below
6. The previously checked point is kept
7. The feature is recalculated with the compensation process you selected for the feature. No more points are filtered out

Bar chart display

Display	Explanation	
	**White**	The measuring point is taken into account in the calculation. Deviation is less than the error limit and is inside the confidence interval.
	Red	The measuring point is taken into account in the calculation. Deviation is greater than the error limit or is outside the confidence interval.
	Gray	The measuring point was filtered out and is not taken into account in the calculation.

The measuring point filter always uses the Gauß compensation independently of the selected compensation process. Observe that runaway values are determined differently according to the compensation process—this may lead to different results.

Further information: "Fitting algorithm", Page 353

Settings of the measurement point filter

Parameter	Explanation
Measuring point filter	Automatic identification of runaway values in the measuring point cloud under consideration of the following filter criteria ■ Settings: **ON** or **OFF** ■ Default setting: **ON**
Error limit	Filter precondition Input of the maximum permitted deviation per measuring point from the calculated feature ■ Setting range: **≥ 0** (**Millimeters** or **Inch**) ■ Default setting: **0.0030 mm or 0.0001181"**
Confidence interval (±xσ)	Filter precondition Input of the Sigma factor for calculating the confidence interval ■ Setting range: **0 ... 10** ■ Default value: **2.0000**
Minimum % proportion of retained measuring points	Filter precondition Input of the minimum amount of all measuring points needed for calculating the feature ■ Setting range: **0 % ... 100 %** ■ Default value: **75 %**

15.4.4 Measure Magic

Path: **Settings ► Features ► Measure Magic**

Parameter	Explanation
Maximum form deviation ratio	Maximum permissible ratio of form error to main dimension for recognizing a feature ■ Setting range: **≥ 0** ■ Default value: **0.0500**
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: **0.0010**
Minimum numeric ellipse eccentricity	Ratio of the two reference axes for recognizing an ellipse ■ Setting range: **≥ 0** ■ Default value: **0.5000**

15.4.5 Geometry types

Path: **Settings ► Features ► point, line...**

Parameter	Explanation
Minimum number of points for a measurement	Minimum number of points to be acquired for measuring the specific feature **Further information:** "Overview of the minimum number of points for a measurement", Page 470
Measurement result preview	List of parameters that can be displayed in the measurement result preview for the specific feature ■ Settings for each parameter: **ON** or **OFF** ■ Default setting: **ON** (exception: **Display of coordinate value Z**) **Further information:** "Overview of parameters in the measurement result preview", Page 471

Overview of the minimum number of points for a measurement

Geometry type	Settings
Point	■ Setting range: **1 ... 100** ■ Default setting: **1**
Even	■ 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**

Overview of parameters in the measurement result preview

For each geometry type it can be defined which parameters are displayed in the measurement result preview. Which parameters are available depends on the specific geometry type.

The measurement result preview can contain the following parameters:

Parameter	Explanation
X	**Display of coordinate value X** Default setting: **ON**
Y	**Display of coordinate value Y** Default setting: **ON**
Z	**Display of coordinate value Z** Default setting: **OFF**
	Display of form deviation Default setting: **ON**
Θ	**Display of angle** Default setting: **ON**
R	**Display of radius** Default setting: **ON**
D	**Display of diameter** Default setting: **ON**
Θ_S	**Display of start angle** Default setting: **ON**
Θ_E	**Display of end angle** Default setting: **ON**
L	**Display of length** Default setting: **ON**
W	**Display of width** Default setting: **ON**
A	**Display of area** Default setting: **ON**
C	**Display of circumference** Default setting: **ON**
	Number of measuring points (measuring points for calculating the feature / acquired measuring points) Cannot be configured, is displayed by default
	Coordinate system Cannot be configured, is displayed by default
	Fitting algorithm Cannot be configured, is displayed by default

15.5 Interfaces

This chapter describes settings for configuring networks and network drives.

15.5.1 Network

Path: **Settings ► Interfaces ► Network ► 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

15.5.2 Network drive

Path: **Settings ► Interfaces ► 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	Configuration of the **Authentication** for encrypting the password in the network Settings: ■ **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** Configuration of the **Mount options** Settings: ■ Default value: **nounix,noserverino**

15.5.3 USB

Path: **Settings ► Interfaces ► USB**

Parameter	Explanation
Automatically detect attached USB mass storage devices	Automatic recognition of a USB mass storage device ■ Settings: **ON** or **OFF** ■ Default setting: **ON**

15.5.4 Barcode scanner

Path: **Settings ► Interfaces ► Barcode scanner**

Parameter	Explanation
Device	Activation of the barcode scanner ■ Settings: **ON** or **OFF** ■ Default setting: **OFF**
Filter setting 1	Number of characters truncated at the start of the code ■ Setting range: **0 ... 100** ■ Default setting: **21** The first 21 characters of the code are truncated
Filter setting 2	Number of output characters ■ Setting range: **0 ... 100** ■ Default setting: **10** A total of ten characters of the code are output; the trailing characters are truncated
Raw data of test code	Display of all characters of the scanned test code (unfiltered)
User data of test code	Display of filtered characters of the scanned test code according to **Filter setting 1** and **Filter setting 2**
Test area	Text field and test code, enabling settings of the barcode scanner to be checked

15.6 User

This chapter describes settings for configuring users and user groups.

15.6.1 OEM

Path: **Settings ► User ► 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 create **Setup** 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.

Parameters	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 ■ Default value: **oem**	**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	–

15.6.2 Setup

Path: **Settings ► User ► 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.

Parameters	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 ■ Default value: **setup**	**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	–

15.6.3 Operator

Path: **Settings ► User ► Operator**

The **Operator** user is permitted to use the basic functions of the product.
An **Operator**-type user cannot create additional users, but is allowed to edit various operator-specific settings, such as his name or the language. A user of the **Operator** group can be logged in automatically as soon as the product is switched on.

Parameters	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 ■ Default value: **operator**	**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**

15.6.4 Adding a User

Path: **Settings ► User ► +**

Parameter	Explanation
	Adds a new user of the type **Operator** **Further information:** "Entering and configuring users", Page 188 It is not possible to add further **OEM** and **Setup**-type users.

15.7 Axes

This chapter describes settings for configuring the axes and assigned devices.

15.7.1 Reference marks

Path: **Settings ► Axes ► General settings ► Reference marks**

Parameters	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 prompt for a mandatory reference mark search is displayed after startup of the product ■ Default value: **ON**
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 **OEM** or **Setup**-user types ■ Default value: **OFF**
Reference mark search	**Start** starts the reference mark search and opens the workspace
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**

15.7.2 Information

Path: **Settings ► Axes ► General settings ► Information**

Parameters	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

15.7.3 Error compensation

Path: **Settings ► Axes ► General settings ► 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

15.7.4 Nonlinear error compensation (NLEC)

Path: **Settings ► Axes ► General settings ► Error compensation ► 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: **1.00000 mm** (**X** and **Y**)
Read deviations of calibration standard	A file containing the deviations of the calibration standard is read
Import table of supporting points	A file containing the position indications of the supporting points is read An xml file is read: including the deviations of the calibration standard
Export table of supporting points	A file containing the position indications of the supporting points and the deviations of the calibration standard is saved
Table of supporting points	Opens the table of supporting points for manual editing
Teach sequence	The teach sequence for determining the compensation values is started

15.7.5 Squareness error compensation (SEC)

Path: **Settings ► Axes ► General settings ► Error compensation ► 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**

15.7.6 Axes X, Y, Z

Path: **Settings ► Axes ► X** or **Y** or **Z**

Parameters	Explanation
Axis name	Definition of the axis name displayed in the position preview Settings: ■ **Not defined** ■ **X** ■ **Y** ■ **Z** Default setting: **X**, **Y**, **Z**
Encoder	Configuration of the connected encoder **Further information:** "Encoder", Page 483
Error compensation	Configuration of the linear error compensation **LEC** or segmented linear error compensation **SLEC** **Further information:** "Linear error compensation (LEC)", Page 486 **Further information:** "Segmented linear error compensation (SLEC)", Page 487

15.7.7 Axis Q

Path: **Settings ► Axes ► Q**

Parameter	Explanation
Axis name	Definition of the axis name displayed in the position preview Settings: ■ **Not defined** ■ **Q** Default setting: **Q**
Encoder	Configuration of the connected encoder **Further information:** "Encoder", Page 483
Error compensation	Configuration of the linear error compensation **LEC** or segmented linear error compensation **SLEC** **Further information:** "Linear error compensation (LEC)", Page 486 **Further information:** "Segmented linear error compensation (SLEC)", Page 487

The Q axis is the manual rotary axis of the measuring plate and is used for angle measurement. If the Q axis is configured in the product, its position can be read in the position display or position preview.

The Q axis values are not processed by the product and do not flow into the measurement and the calculation of features. For this reason the values are not displayed in the features view and cannot be output in the measurement report.

15.7.8 Encoder

Path: **Settings ► Axes ► X** or **Y** or **Z** or **Q ► Encoder**

Encoder configuration for axis

Parameters	Explanation
Encoder input	Assignment of the encoder input to the axis of the product Settings: ■ **Not connected** ■ **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 for the encoder variant with **1 Vpp** encoder signal. The parameter cannot be edited for the encoder 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 encoder variant)
Encoder model	Connected encoder model Settings: ■ **Linear encoder**: linear axis ■ **Angle encoder**: rotary axis ■ Default value: Depending on the connected encoder
Signal period	For linear encoders: length of a signal period ■ Setting range: **0.001 µm ... 1000000.000 µm** ■ Default value: **20.000**
Line count	For angle encoders: number of lines ■ Setting range: **1 ... 1000000** ■ Default value: **1000**
Reference marks	Configuration of the **Reference marks** **Further information:** "Reference marks (Encoder)", Page 485
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: **400 kHz**

Parameters	Explanation
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** ℹ A warning or error message is displayed if one of the limit values for error monitoring is exceeded. The limit values depend on the signal of the connected encoder: ■ Signal **1 Vpp**, setting **Amplitude** ■ Warning with voltage ≤ 0.45 V ■ Error message with voltage ≤ 0.18 V or ≥ 1.34 V ■ Signal **1 Vpp**, setting **Frequency** ■ Error message with frequency ≥ 400 kHz ■ Signal **11 µApp**, setting **Amplitude** ■ Warning with current ≤ 5.76 µA ■ Error message with current ≤ 2.32 µA or ≥ 17.27 µA ■ Signal **11 µApp**, setting **Frequency** ■ Error message with frequency ≥ 150 kHz ■ Signal **TTL**, setting **Frequency** ■ Error message with frequency ≥ 5 MHz
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**

15.7.9 Reference marks (Encoder)

Path: **Settings ► Axes ► X** or **Y** or **Z** or **Q ► Encoder ► Reference marks**

> The following parameters depend on the type of encoder connected and the setting of the reference marks.
> **Further information:** "Encoder", Page 483

Parameters	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 For encoders with TTL interface: ■ **Reverse coded**: The encoder has inverse-coded reference marks ■ **Reverse coded TTLx5**: The encoder has inverse-coded reference marks with integrated 5-fold interpolation ■ **Reverse coded TTLx10**: The encoder has inverse-coded reference marks with integrated 10-fold interpolation ■ Default value: **One**
Maximum traverse path	For linear encoders with coded reference marks: maximum traverse path for determining the absolute position ■ Setting range: **0.1 mm ... 10000.0 mm** ■ Default value: **20.0**
Nominal increment	For angle encoders with coded reference marks: maximum nominal increment for determining the absolute position ■ Setting range: **> 0° ... 360°** ■ Default value: **10.0**
Inversion of reference mark pulses	Specifies whether the reference mark pulses are evaluated in inverted form Settings ■ **ON**: Reference pulses are evaluated in inverted form ■ **OFF**: Reference pulses are not evaluated in inverted form ■ Default value: **OFF**
Reference point displacement	Configuration of the offset between the reference mark and the zero point **Further information:** "Reference point displacement", Page 486

15.7.10 Reference point displacement

Path: **Settings ► Axes ► X** or **Y** or **Z** or **Q ► Encoder ► Reference marks ► Reference point displacement**

Parameters	Explanation
Reference point displacement	Activation of offset calculation between reference mark and datum of the machine ■ Setting range: **ON** or **OFF** ■ Default value: **OFF**
Reference point displacement	Manual input of the offset (in mm or degrees according to the selected encoder type) between reference mark and datum Default value: **0.00000**
Current position for reference point shift	Capture of the current position as offset (in mm or degrees according to the selected encoder type) between reference mark and datum

15.7.11 Linear error compensation (LEC)

Path: **Settings ► Axes ► X** or **Y** or **Z** or **Q ► Error compensation ► Linear error compensation (LEC)**

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** If **Compensation** is active, the **Nominal length** and **Actual length** cannot be edited or generated.
Nominal length	Input field for nominal value in mm
Actual length	Input field for actual value in mm

15.7.12 Segmented linear error compensation (SLEC)

Path: **Settings ► Axes ►** **X** or **Y** or **Z** or **Q ► Error compensation ► Segmented linear error compensation (SLEC)**

Parameters	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** When **Compensation** is active, the **Table of supporting points** cannot be edited or created.
Table of supporting points	Opens the table of supporting points for manual editing
Create table of supporting points	The menu for creating a new **Table of supporting points** is opened **Further information:** "Create table of supporting points", Page 487

15.7.13 Create table of supporting points

Path: **Settings ► Axes ►** **X** or **Y** or **Z** or **Q ► Error compensation ► Segmented linear error compensation (SLEC) ► Create table of supporting points**

Parameters	Explanation
Number of supporting points	Number of supporting points on the mechanical axis of the machine ■ Setting range: **2 ... 200** ■ Default value: **2**
Spacing of the supporting points	Spacing of the supporting points on the mechanical axis of the machine ■ Default value: **100.00000**
Start point	The start point defines the position starting from which the compensation is applied to the axis ■ Default value: **0.00000**
Create	Creates a new table of supporting points based on the entries

15.8 Service

This chapter describes settings for product configuration, for maintaining the firmware and for enabling software options.

15.8.1 Firmware information

Path: **Settings ► Service ► 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
C Library Version	Version number of the C library
Compiler Version	Version number of the compiler
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
Kernel	Version number of the Linux kernel
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
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

Parameter	Explanation
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
lightcontrolRuntime.xml	Version number of the runtime environment parameters of the lighting
metrology.xml	Metrology parameters
network.xml	Version number of the network parameters
os.xml	Version number of the operating system 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 number of the VED parameters
GI Patch Level	Patch level of the golden image (GI)

15.8.2 Back up and restore

Path: **Settings ► Service ► Back up and restore**

The settings or user filesof 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.

Parameters	Explanation
Restore settings	Restoring of the backed up settings **Further information:** "Restore settings", Page 499
Back up settings	Backing up of settings of the product **Further information:** "Back up settings", Page 181
Back up user files	Backing up of user files of the product **Further information:** "Back up user files", Page 182

15.8.3 Firmware update

Path: **Settings ► Service ► 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.

Prior to the firmware update, you must comply with the release notes for the respective software version and the information they contain regarding reverse compatibility.

In order to be on the safe the side, the current settings must be backed up if the unit’s firmware is going to be updated.

Further information: "Updating the firmware", Page 497

15.8.4 Reset

Path: **Settings ► Service ► Reset**

You can reset the settings of the product to the factory default settings or shipping condition if required. Software options are deactivated and subsequently need to be reactivated with the available license key.

Parameter	Explanation
Reset all settings	The settings are reset to factory default settings **Further information:** "Reset all settings", Page 500
Reset to shipping conditions	The settings are reset to factory default settings and the user files are deleted from the memory range of the product **Further information:** "Reset to shipping conditions", Page 501

15.8.5 OEM area

Path: **Settings ► Service ► OEM area**

Parameters	Explanation
Documentation	Addition of OEM documentation, e.g. service information **Further information:** "Adding documentation", Page 171
Startup screen	Customization of the startup screen, e.g. with the OEM's company logo **Further information:** "Adding a startup screen", Page 172
Remote access for screenshots	Permit network connection with the ScreenshotClient program, enabling ScreenshotClient to take screenshots of the product from a computer Settings: ■ **ON**: Remote access is possible ■ **OFF**: Remote access is not possible ■ Default value: **OFF** When the product is shut down, **Remote access for screenshots** is automatically deactivated.

15.8.6 Documentation

Path: **Settings ► Service ► 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**.

Parameters	Explanation
Add Operating Instructions	Adding the Operating Instructions in the desired language

15.8.7 Software options

Path: **Settings ► Service ► Software options**

Software options need to be enabled on the product via a license key. Before you can use the associated hardware components, you need to enable the respective software option.

Further information: "Enabling the Software options", Page 130

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 license key", Page 131
Request trial options	Creation of a license key request that can be submitted to a HEIDENHAIN service agency **Further information:** "Requesting license key", Page 131
Activate options	Activation of the software options via license key or license file **Further information:** "Activating a license key", Page 133
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.

The following steps must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

This chapter contains a description of maintenance work for the product only. Any maintenance work on peripheral devices is not described in this chapter.
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

Cleaning the housing

- Use only a cloth dampened with water and a mild detergent for cleaning the exterior surfaces

Cleaning the display

Activate cleaning mode to clean the display. This switches the unit to an inactive state without interrupting the power supply. The screen is switched off in this state.

- ▶ Tap **Switch off** in the main menu to activate the energy-saving mode.

- ▶ Tap **Cleaning mode**
- > The screen switches off
- ▶ Use a lint-free cloth and a commercially available glass cleaner to clean the display

- ▶ To deactivate the cleaning 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

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 repair or operate the device if it is 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 27

Maintenance step	Interval	Corrective action
▶ All labels and symbols provided on the product must be checked 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: "Mounting", Page 37

Further information: "Installation", Page 43

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 28

16.5 Updating the firmware

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.

Prior to the firmware update, you must comply with the release notes for the respective software version and the information they contain regarding reverse compatibility.

In order to be on the safe the side, the current settings must be backed up if the unit’s firmware is going to be updated.

Requirement

- The new firmware is available as a *.dro file
- To update the firmware over the USB port, the current firmware must be stored on a USB mass storage device (FAT32 format)
- To update the firmware via the network interface, the current firmware must be available in a folder on the network drive

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 (FAT32 format) 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 **Select** 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**
> The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

16.6 Restore settings

Backed-up settings can be restored to the product. The current configuration of the product is replaced in the process.

Software options that were active when the settings were backed up must be activated before restoring the settings.

A restore can be necessary in the following cases:

- During commissioning, the settings are set on a product and transferred to all identical products
  Further information: "Steps for commissioning", Page 129
- After a reset, the settings are copied back to the product
  Further information: "Reset all settings", Page 500

- Tap **Settings** in the main menu
- Open in the sequence
  - **Service**
  - **Back up and restore**
  - **Restore settings**
- Tap **Complete restoration**
- If required, connect a USB mass storage device (FAT32 format) to a USB port of the product
- Navigate to the folder containing the backup file
- Select the backup file
- Tap **Select**
- 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**
- > The message **The storage medium can be removed now.** appears
- Disconnect the USB mass storage device

16.7 Reset all settings

You can reset the settings of the product to the factory defaults if required. The 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**
  - **Reset all settings**
- Enter password
- Confirm the entry with **RET**
- To show the password in plain text, activate **Show password**
- Tap **OK** to confirm the action
- 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

16.8 Reset to shipping conditions

You can reset the settings of the product to the factory defaults and delete the user files from its memory range. The 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**
  - **Reset to shipping conditions**
- Enter password
- Confirm the entry with **RET**
- To show the password in plain text, activate **Show password**
- Tap **OK** to confirm the action
- Tap **OK** to confirm the reset
- Tap **OK** to confirm shutdown of the product

> The product is shut down

> All settings are reset and the user files are deleted

> To restart the product, switch it off and then back on

17

What to do if ...

17.1 Overview

This chapter describes the causes of faults or malfunctions of the product and the appropriate 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 61

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 a Recovery System that displays short instructions on the screen.

With restoration, the Recovery System overwrites the damaged firmware with a new firmware previously saved to a USB mass storage device. During this procedure the settings of the product are deleted.

17.2.1 Restoring the firmware

- ▶ On a computer, create the folder "heidenhain" on a USB mass storage device (FAT32 format).
- ▶ In the "heidenhain" folder, create the folder "update"
- ▶ Copy the new firmware to the "update" folder
- ▶ Switch off the product
- ▶ Connect a USB mass storage device to a USB port of 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

17.2.2 Restore settings

Reinstalling the firmware resets the product to the factory defaults. As a result the settings are deleted, including error correction values and activated software options. Not affected by this are user files (measurement reports and measuring programs) saved in the memory or files maintained after reinstalling of the firmware.

To restore the settings you must either reset these or restore previously backed up settings on the product.

> Software options that were active when the settings were backed up must be activated before restoring the settings.

- Enabling software options

Further information: "Enabling the Software options", Page 130

- Restoring settings

Further information: "Restore settings", Page 499

17.3 Malfunctions

If faults or malfunctions that are not listed in the "Troubleshooting" table below occur during operation, refer to the machine tool builder's documentation or contact a HEIDENHAIN service agency.

17.4 Troubleshooting

The following troubleshooting steps must be performed only by the personnel indicated in the table.

Further information: "Personnel qualification", Page 27

Fault	Cause of fault	Correction of fault	Personnel
The 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 unit starts up	Firmware 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
Axes do not count despite movement of the encoder	Incorrect connection of the encoder	▶ Correct the connection ▶ Contact the encoder manufacturer's service agency	Qualified personnel
Axis values are red, and the functions are blocked	The encoder has not been referenced	▶ Conduct a reference mark search Page 225	Operator
Axes are miscounting	Incorrect settings of the encoder	▶ Check the encoder settings Page 137	Qualified personnel
The lighting does not work	Defective connection	▶ Check the cable	Electrical specialist
	Incorrect settings of the inputs and outputs	▶ Check input and output settings Page 160	Qualified personnel
Camera image is not displayed	Wrong camera model connected	▶ Check the camera model	Qualified personnel
	Incorrect camera settings	▶ Check the camera settings Page 153	Qualified personnel
	Defective connection	▶ Check the cable and for correct connection to X32 / X117	Qualified personnel
The camera image flickers.	Incorrect pixel format selected for the camera	▶ Set the pixel format in the camera settings Page 444	Qualified personnel
Connection to the network is not possible	Defective connection	▶ Check the cable and the correct connection to X116	Qualified personnel

Fault	Cause of fault	Correction of fault	Personnel
	Incorrect settings of the network	▶ Check the network settings Page 193	Qualified personnel
The connected USB mass storage device is not detected	Defective USB connection	▶ Check the correct position of the USB mass storage device in the port ▶ Use another USB port	Qualified personnel
	The type or formatting of the USB mass storage device is not supported	▶ Use another USB mass storage device ▶ Format USB mass storage device with FAT32	Qualified personnel
The unit starts in recovery mode (text only mode)	Firmware 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 Page 188 ▶ To reset the OEM password, contact the HEIDENHAIN service agency	Qualified personnel

18

Removal and disposal

18.1 Overview

This chapter contains information and environmental protection specifications that must be observed for correct disassembly and disposal of the product.

18.2 Removal

Removal of the product must be performed only by qualified personnel.
Further information: "Personnel qualification", Page 27

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.

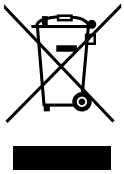
Removing the product

To remove the product, follow the installation and mounting steps in the reverse order.

Further information: "Installation", Page 43

Further information: "Mounting", Page 37

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 Overview

This chapter contains an overview of the product data and drawings with the product dimensions and mating dimensions.

19.2 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	2 (2 additional inputs can be enabled optionally via software option)
Encoder interfaces	■ 11µA: max. current 300 mA, max. input frequency 150 kHz ■ 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
Touch probe connection	■ DC 5 V or DC 12 V supply voltage ■ 5 V or floating switching output ■ Max. cable length with HEIDENHAIN cable 30 m
Camera connection	USB 2.0 Hi-Speed (Type A), max. current 500 mA, Ethernet 1 Gbit (RJ45)
Connection for optical edge detector	2 F-SMA sockets (screw thread designation 1/4-36 UNS-2A)
Digital inputs	TTL DC 0 V ... +5 V
Digital outputs	TTL DC 0 V ... +5 V Maximum load 1 kΩ

Electrical data	
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 DC 0 V ... +5 V Resistance 100 Ω ≤ R ≤ 50 kΩ
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	■ 4 USB 2.0 Hi-Speed (Type A), maximum current 500 mA per USB connection ■ 1 Ethernet 10/100 Mbit/1 Gbit (RJ45)

Environment	
Operating temperature	0 °C ... +45 °C
Storage temperature	-20 °C ... +70 °C
Relative air humidity	10 % ... 80 % r.H., non-condensing
Altitude	≤ 2000 m

General information	
Directives	■ EMC Directive 2014/30/EU ■ Low Voltage Directive 2014/35/EU ■ RoHS Directive 2011/65/EU
Pollution degree	2
Protection EN 60529	■ Front panel and side panels: IP 65 ■ Rear panel: IP 40
Mass	■ 3.5 kg ■ With Duo-Pos stand: 3.8 kg ■ With Multi-Pos stand: 4.5 kg ■ With Multi-Pos holder: 4.1 kg

19.3 Product dimensions and mating dimensions

All dimensions in the drawings are in millimeters.

All dimensions in the drawings are in millimeters.

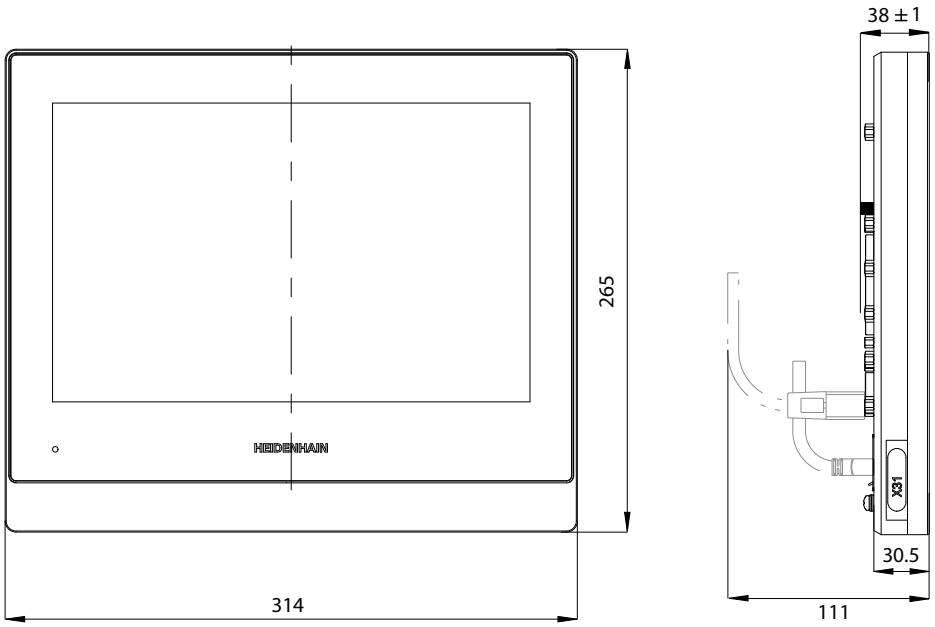


Figure 114: Dimensions of housing

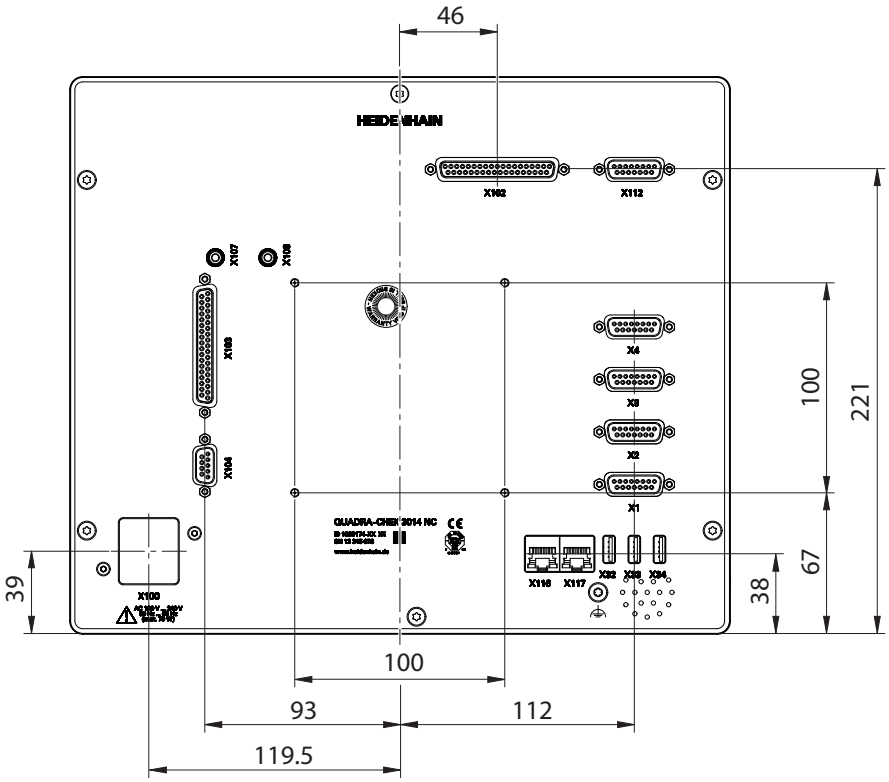


Figure 115: Dimensions of rear panel of the product

19.3.1 Product dimensions with Duo-Pos stand

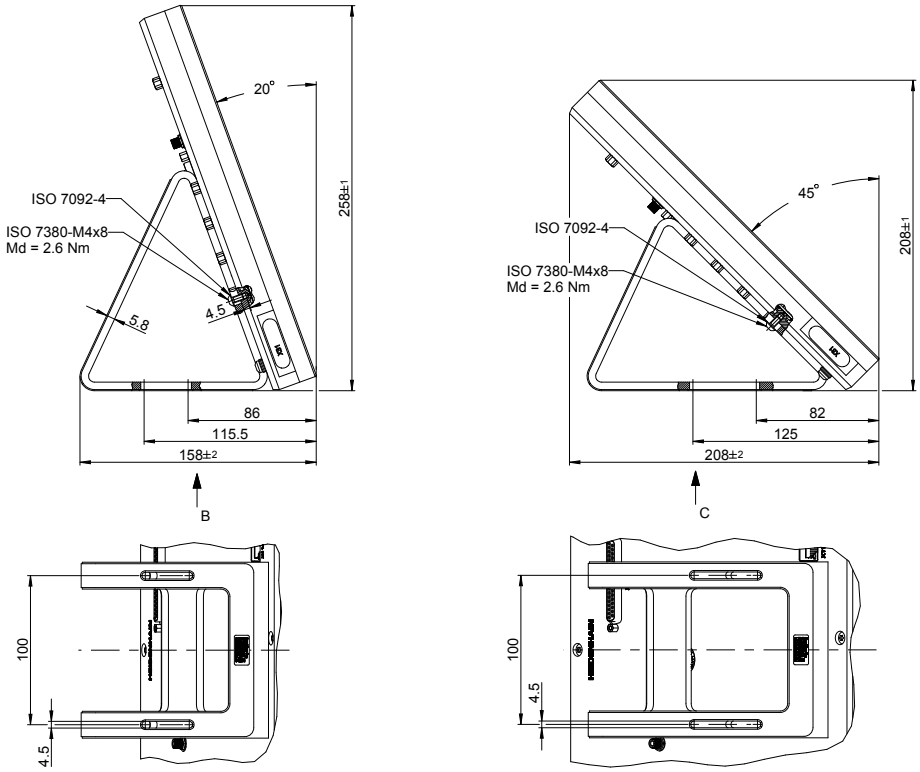


Figure 116: Product dimensions with Duo-Pos stand

19.3.2 Product dimensions with Multi-Pos stand

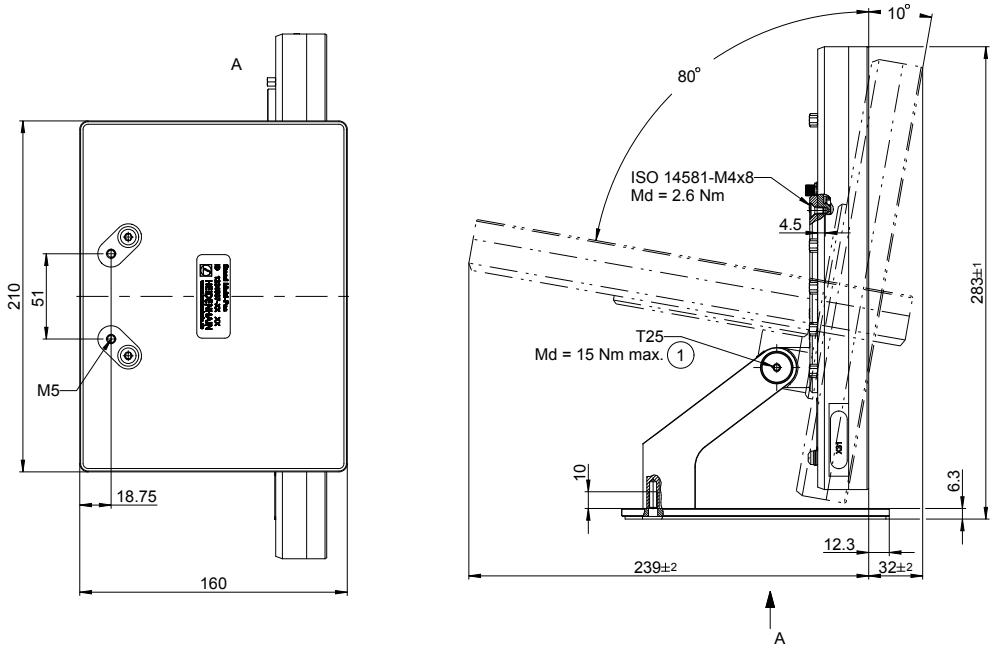


Figure 117: Product dimensions with Multi-Pos stand

19.3.3 Product dimensions with Multi-Pos holder

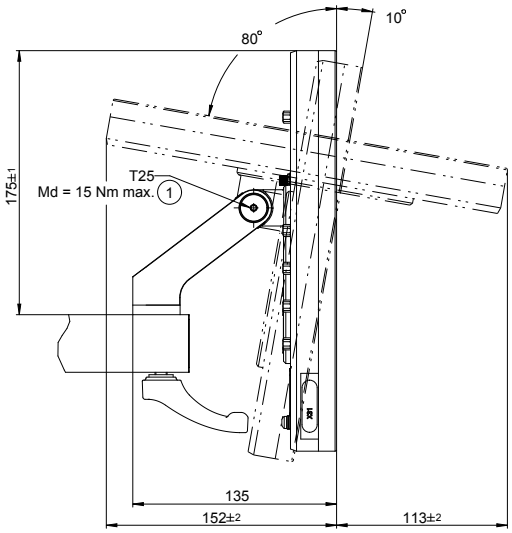


Figure 118: Product dimensions with Multi-Pos holder

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