MMZ M

Coordinate measuring machine

Operating Instructions

(Translation of the original operating instructions)

ZEISS

Read before commencement!

– Please read these operating instructions before using the ZEISS product.

– For your own safety, always keep all relevant accompanying documents ready to hand.

This manual is subject to change, and the ZEISS product described as well as the components therein are subject to technical modifications.

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MMZ M
Operating Instructions
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Preface

Information about this document

The MMZ M coordinate measuring machine (CMM) is described in these operating instructions. These operating instructions apply to all types of the MMZ M series.

These operating instructions address operators and users of the coordinate measuring machine.

Configuration of safety instructions

Safety instructions indicate a personal health hazard. We distinguish three different levels: Danger, warning and caution. All three safety instructions are marked with the same warning symbol. The designation of the safety instruction is shown beside the symbol. The safety instructions used are described below.

Configuration of a safety instruction

A safety instruction may have the following components:

- Warning symbol and designation of the safety instruction (signal word): Danger, warning or caution.
- Source and cause of the danger
- Consequences for the user due to non-observance of the safety instruction
- Required measures to be taken by the user to avoid possible consequences
- A measure may cause an intermediate result.
- At the end of all measures, a final result may be caused.

Personal health hazard

⚠ DANGER

A »danger« indicates an imminent risk to life and limb.
Non-observance of this safety instruction when the described risk occurs causes death or serious injuries.
Example: Electric shock due to high electric voltage.

⚠ WARNING

A »warning« indicates a possible risk to life and limb.
Non-observance of this safety instruction when the described risk occurs may cause death or serious injuries.
Example: Risk of severe crushing of the body caused by heavy loads.

⚠ CAUTION

A »caution« indicates a personal health hazard.
Non-observance of this safety instruction when the described risk occurs may cause slight to moderate injuries.
Example: Risk of minor crushing of the limbs caused by small loads.

Risk of material damage

If there is no personal health hazard, but the CMM or components may get damaged, this is pointed out by the following notice.

This symbol refers to possible damage to the CMM.
Non-observance of this safety instruction when the event occurs may cause damage to the CMM or one of its components.
Example: Collision of the ram with a workpiece.

Markup elements

Text may be displayed differently in this document. Examples and the meaning of the representation type are described below:

Example	Meaning
not	Words to be emphasized are represented in *italics*. The italic print is sometimes used to mark a subheading, e.g. *Examples:*
Main switch	Any reference to control elements in the text is highlighted typographically.
Tolerance field	Designation of parts of software windows.
Cancel	Marking of buttons
RETURN	Keys of the keyboard are represented as small capitals.
"InstallShield Wizard completed"	Software messages
File → Open	Representation of menu items
`Code`	Source code
...\CALYPSO\protocol\protform	File and directories
CALYPSO	Product name
ZEISS	Company name
CAUTION! The measuring table must be clean.	Safety instructions embedded in the text.
Note: Pay attention to the correct orientation of the qualification marks.	Note embedded in the text.
[1]	Representation of position numbers in texts

1 Introduction

This chapter contains:

General specifications 1-2
Warranty 1-5

General specifications

Scope of delivery

The standard version of the MMZ M coordinate measuring machine comprises the following components:

- Coordinate measuring machine (CMM)
- Control unit
- Control console (standard version)
- Computer with peripheral devices
- Software, e.g. CALYPSO
- Documents
- Probing system
- Master stylus
- Reference sphere - for qualifying styli
- Temperature sensor – for measuring the workpiece temperature

Information on the properties of the materials used

Treated surfaces

Due to the treatment process, treated surfaces may show irregularities in color. These irregularities do not constitute a defect authorizing a complaint. The promised measuring accuracy of the coordinate measuring machine will not be affected by the irregularities.

CE marking

EC declaration of conformity as defined by EC Machinery Directive 2006/42/EC Appendix II No. 1A

We hereby declare that, due to its design and construction, the version of the machine named below which we placed on the market complies with the requirements set out in EC Directive 2006/42/EC and in the additional EC directives listed below.

If modifications are made to the machinery without our prior approval, this declaration will no longer be valid.

Designation of the machine:	Coordinate measuring machine
CMM type:	MMZ M
Additional EU directives:	– EMC Directive (2014/30/EU) – RoHS Directive (2011/65/EU)
Applied harmonized standards, in particular:	– EN 60204-1 – EN 61326-1 Table 2, Class A – EN 61010-1 – EN ISO 12100 – EN 63000

The product bears the CE marking on its type plate.

Standards and regulations

The CMM has been designed, manufactured and tested according to the following standards and regulations:

Regulations

– DGUV regulation 3:

  Accident prevention regulations - electrical systems and equipment

Standards

– EN (IEC) 61010-1:

  Safety requirements for electrical equipment for measurement, control and laboratory use

– GB 4793.1

  Safety requirements for electrical equipment for measurement, control and laboratory use

– EN (IEC) 60204-1:

  Safety of machinery. Electrical equipment of machines

– EN ISO 12100:

  Safety of machinery. General principles for design. Risk assessment and minimization

– EN (IEC) 61326-1:

  EMC - Interference immunity; table 2, interference emission, Class A

– GB 4824

  Industrial, scientific and medical (ISM) radio frequency equipment - Electromagnetic disturbance characteristics - Limits and methods

– EN (IEC) 60825-1:

  Safety of laser devices

– CAN/CSA-C22.2 No 61010-1-12:

  Safety requirements for Electrical Equipment for measurement, control and laboratory use.

– UL 61010-1 3rd Ed.:

  Standard for Electrical Equipment for Laboratory use.

– EN (IEC) 62471:

  Photobiological safety of lamps and lamp systems.

Separate document

Components for which separate documents are available are referred to in these operating instructions.

The following documents are delivered with each CMM:

– BP26SE control console

– Sensors (information on probing systems)

Optional :

– LineScan

Documentation on data medium

The above documents and others are also contained on the supplied data medium.

Warranty

Notes

- The specifications and statements in the German operating instructions are prevalent and binding for translations into other languages.
- All rights pertaining to changes in the coordinate measuring machine and its options, the software packages and the pertaining documents reserved.
- All rights reserved, especially in cases of granting a patent or registering a utility model.

The warranty *does not* cover the following:

- incidentals
- wearing parts.

Exclusion of warranty

The manufacturer cannot be held liable.....

- for actions contrary to the instructions given in this manual,
- for actions contrary to the instructions given in the separate »Installation site requirements« brochure,
- in case of alteration of the coordinate measuring machine version delivered by us,
- if maintenance work is not carried out by personnel specially trained at ZEISS,
- if measures for care are not taken by the operator or user according to the specified measures,
- if no original spare parts are used for maintenance and repair work,
- if the necessary maintenance work and measures for care are not carried out according to the technical documentation.

Any information regarding maintenance work and measures for care, incidentals and wearing parts is specified in separate publications.

2 Safety

This chapter contains:

Intended use 2-2
Safe operation of the CMM 2-6
Safety on the CMM 2-13
Checking the safety devices 2-22

Intended use

Warranty

The coordinate measuring machine (CMM) may be used only for its intended purpose. The operator is liable for any damage incurred during any reasonably foreseeable misuse.

CMM

The CMM can be used to determine the geometric sizes of workpieces. The workpieces may be made of metal or plastic. Geometric sizes are width, length, height as well as the diameter and depth of bores, for example. The position of bores is calculated from the measuring data. Furthermore, the form of workpieces can be determined by means of a special software.

NOTE

The CMM may be used only for determining geometric parameters of workpieces. The CMM must not be used for any purposes other than those listed below.

Only workpieces and objects required for measurement may be placed on the measuring plate.

Functions of the CMM:

- Workpiece probing in six directions (±X, ±Y, ±Z).

  The CMM can be moved in the axes X, Y and Z. Probing is performed by means of a probing system. For measurement, the workpieces must be fastened on measuring plate or devices.
- The measuring plate and devices have the following functions:
  - Holding and securing one or more workpieces
  - Holding and securing qualification tools
  - Holding and securing a changer rack (optional)
  - Holding and securing a rotary table (optional)
  - Fastening of the workpieces, installation of changer racks, qualification tools and rotary table by use of the threaded holes provided in the measuring plate.
- Moving workpieces by means of the rotary table.

Reasonably foreseeable misuse

NOTE

The coordinate measuring machine (CMM) may be used only for its intended purpose. The user is liable for any damage caused by reasonably foreseeable misuse.

The CMM must not be used for purposes contrary to the intended use.

Examples of reasonably foreseeable misuse:

- No objects, for example workpieces, may be moved with the movable CMM components.
- The Z axis of the CMM must not be used as drilling or lifting device.
- The CMM must not be used to measure living objects or parts of the body.

Probing system

The probing system is a high-tech product which may be used only for its intended purpose.

CMM probing systems are designed to determine the coordinates of a workpiece. This is usually achieved via probing, during which the workpiece is probed by a stylus tip. The probing system comprises several components such as the probe holder, probe and stylus.

Probe holder

An articulating head serves as probe holder. The articulating head is fastened to the ram, either rigidly or by means of an adapter. The probe can be moved to nearly any position using an articulating head.

Probe

A probe is mounted on the ram by means of an adapter. In combination with probe holders, the probe is screwed to an adapter plate of the probe holder. The stylus system is inserted below the probe. The probe and stylus system must be handled carefully.

Functions of the contact probe:

- Holding the stylus system.
- Exact positioning of the stylus system.
- Detecting the stylus system deflection and transmitting the signal to the computer.

  The computer calculates the coordinates of the probed point.

Stylus system

The stylus system consists of several components: Adapter plate, stylus and stylus system components. One or more styli can be mounted on a stylus system. The stylus tip is located at the end of the stylus.

Functions of the stylus system:

- The adapter plate holds and positions the stylus system exactly in the probe.
- Workpiece probing is carried out by the stylus tip.

Reasonably foreseeable misuse

The probe, the probe carrier and the stylus system must not be used for purposes other than their proper use.

Examples:

- The probe must not be used as a support.
- The stylus system must not be used as a lever arm, e.g. to loosen a ring bolt.
- The stylus system must not be used as a hammer.

Changer rack

The changer rack is used for automatic change of stylus systems. This changer rack must not be used for other purposes.

Rotary table

The rotary table is a high-tech product which may be used only for its intended purpose.

Workpieces can be positioned in any angular position by means of rotary tables. This allows high-precision angular and radial measurements.

Rotationally symmetrical objects

Measurement of rotationally symmetrical objects is a special application of rotary tables: e.g. gears, turning parts, camshafts. Rotary tables also facilitate the measurement of prismatic parts.

Functions of the rotary table:

- Holding the workpiece
- Positioning the workpiece
- Probing with rotary table
- Scanning with rotary table

Reasonably foreseeable misuse

Rotary tables must not be used for purposes contrary to the intended use.

Examples of reasonably foreseeable misuse:

- The rotary table must not be used as storage surface.
- The rotary table is not to be sat upon.

Safe operation of the CMM

Operator requirements

The operator must ensure the following:

- The installation site requirements must be met.
- The operator has been properly instructed regarding handling and operation of the CMM.
- The operator has received the operating instructions for working with the CMM. The operating instructions should be suitable for all local operating conditions and should be available in the language spoken by the operating personnel.

  The operating instructions must always be available within easy reach of the CMM.
- The operator must know and follow the safety instructions.
- Only competent spcialists may perform maintenance work and work on electrical equipment.

Defining a competent specialist

A competent specialist is a person who reliably performs the required work and who is able to recognize and avoid possible risks.

Performing a task is subject to the following conditions:

- The competent specialist has been authorized by the person responsible for the safety of the coordinate measuring machine to perform the required tasks.
- The competent specialist must have relevant training and experience.
- The competent specialist must have been instructed in the use of the corresponding CMM.
- The competent specialist must be familiar with the relevant standards, regulations, accident prevention regulations and present operating conditions.

Work to be carried out by a competent specialist

- CMM installation.
- Maintenance work on the CMM.
- Work on the electrical equipment, for example controller.
- Preparation of the measurement: Workpiece setting, creation of measurement plans and automatic measuring runs.

Requirements for safe use

Reading the documentation

Proper use of the CMM is essential for safe measuring operations. It is assumed that you are familiar with the documents included in the delivery package. Read the CMM documents.

Requirements

In order to ensure safe operation of the coordinate measuring machine (CMM), certain requirements must be met.

1 Ensure that the operating instructions for the CMM and the optional equipment are always available at the CMM.

2 Follow the generally recognized accident prevention regulations and safety instructions.

3 The CMM may only be used outside explosion-proof areas.

4 The CMM may only be used indoors.

5 Comply with the ambient conditions.

6 Wear clothing suitable for the work.

7 Do not exceed the maximum permissible workpiece weight.

8 Ensure sufficient illumination when operating the CMM.

9 Operate the CMM only with the protective devices provided for that purpose.

Do not remove any covers, protective equipment, or warning signs.

10 Do not conduct routes through the working area.

11 Delimit the working area.

12 Carry out a visual check before start-up.

13 Use only power cords and connectors that are in perfect condition.

14 Insert the power connectors only in sockets equipped with a perfect protective ground connection.

15 Clean the measuring plate and the workpiece.

16 Clamp the workpiece onto the measuring plate.

17 Do not exceed the measuring volume.

18 Keep the control console within reach in order to be able to press the *EMERGENCY STOP button* in cases of emergency.

19 Perform a homing run.

20 Read the notes regarding the end of the measuring operation.

No warranty claims

The CMM manufacturer cannot be held liable for any damage caused by unauthorized interventions in the measuring system. In case of unauthorized manipulations, all warranty claims against the CMM manufacturer and suppliers as well as the validity of the EC declaration of conformity are void.

Safety instructions

NOTE

The »Safety« chapter contains a section with the basic safety instructions. Where necessary, further safety instructions are mentioned in these operating instructions.

- Read and follow all safety instructions.

Requirements for automatic measuring runs

The following must be observed for automatic measurement runs:

– Only authorized persons may work with the CMM.

– Access to the CMM by unauthorized persons must be prevented by appropriate measures.

– The set-up man must instruct the operator as to the operating position of the CMM.

– The control console must be placed outside the danger zone of the CMM.

  The control console must be equipped with a sufficiently long connecting cable to ensure that the CMM can be operated from all sides if necessary.

  You are even more flexible if you use the wireless control console. **NOTICE! The wireless control console must be inserted in the docking station during automatic measuring runs.**

– Existing safety devices must be used.

– It must be ensured that all persons are located outside of the demarcated area.

– If the constant presence of the operator during batch measurement cannot be guaranteed, the relevant safety regulations for unattended operation must be observed.

Basic safety instructions

Electric voltage

⚠ WARNING

Danger to life due to electric shock resulting from contact with electrical lines and components.

Cardiac arrest, burns, and death.

✓ Any work on the controller must be carried out only by a certified electrician. The cover of the controller may only be removed when the CMM is out of operation. The following measures need to be taken for this:

- Turn off the drives and the controller.
- Turn off the main switch on the controller and secure it against being turned on again unintentionally.

  Warning: some components in the controller cabinet remain live even when the main switch is turned off. These places are marked with warning signs. If necessary, completely disconnect the controller from the power supply.
- If you do not have a permanent connection, pull the power plug as well.

Travel movements

There is a risk of injuries during all travel movements of the CMM. The speed of the travel movements and the travel direction are irrelevant. Travel movements take place in the three CMM axes X, Y, Z and during rotation of a rotary table. Sharp-edged workpieces increase the risk.

⚠ WARNING

Risk of injury due to axis movements at high speed and during rotation of the rotary table axis.

Crushing and severing body parts.

Risk to the eyes caused by the styli. Styli can hurt the eyes during travel movements if you approach your head close to the workpiece during probing.

- Keep a safe distance to moving parts during manual operation.
- Ensure that nobody is at risk during manual operation of the machine.
- Keep a safe distance away from the CMM during automatic measurement runs.

Automatic measurement run

During an automatic measurement run, the CMM travels at the maximum speed in all three axes. There is an increased danger to people and the CMM.

⚠ WARNING

Risk of injury in case of collision due to faulty automatic measurement run.

Crushing and severing body parts.
Damage to CMM and workpiece.

- Test the automatic measurement run at reduced travel speed.
- Keep the control console within reach in order to be able to press the EMERGENCY STOP button in cases of emergency.

⚠ CAUTION

Risk of injury due to movements at high speed.

Crushing and severing body parts.

- Make sure that you start the right automatic measurement run.
- Keep a safe distance to all moving parts of the CMM.
- Restrict the working area of the CMM by means of a light barrier.

Risk of tripping or stumbling

⚠ CAUTION

Risk of injury due to tripping over exposed cables or accessories.

Falling and concussion injuries on head and body.

✓ Cables and accessories must not become a tripping or stumbling hazard.

- Run the cables through cable ducts.
- Install accessories securely at the predefined locations.

Home position

After start-up, travel movements may only be carried out to a limited extent using the joysticks located on the control console. Cause: No end positions of the axes have been defined yet. Possible consequences: Danger to personnel and damage to the CMM.

⚠ CAUTION

Risk of injury if the travel movement exceeds the end positions.

Crushing and severing body parts.
Damage to the CMM.

✓ Before performing unlimited travel movements, the end positions must have been defined.

- After start-up, first perform a homing run.

After this, travel movements can be performed without restrictions using the joysticks.

Suitable clothing

Certain work on the CMM presents a risk of injury caused by unsuitable clothing. This applies particularly to the loading of the measuring plate and the workpiece set-up on the measuring plate.

⚠ CAUTION

Risk of injury caused by heavy, sharp-edged workpieces.

Tearing of fingers and crushing of feet.

- Wear safety shoes.
- Wear safety gloves.

General precautions

Delimiting the work area

The work area around the CMM must be delimited by means of a light barrier.

Do not modify the CMM

If the delivered version of the CMM is modified, safe operation of the CMM is no longer guaranteed.

– Do not make any alterations to the CMM.

Maintenance work

Any modification and maintenance work on the CMM may only be carried out by ZEISS service engineers or trained personnel authorized by ZEISS.

Sufficient illumination

Sufficient illumination is required for safe operation of the CMM.

– Ensure sufficient illumination before starting the CMM.

Visual check

A visual check must be carried out before switching the CMM on. The CMM may be switched on only if it is in perfect condition.

– Make sure that the CMM is in perfect condition.

Work on the CMM

Make sure that no travel movements are possible when working on the CMM.

– Switch the drives off before proceeding with the following work:
  – Preparing the workpiece and the probing system
  – Care and cleaning

Protective circuit

The function of the protective circuit must be checked regularly during measurement operation in order to guarantee safe operation of the CMM.

– Check the function of the protective circuit every 3 months.

  If the protective circuit is not functioning properly, the CMM must be taken out of operation until the protective circuit has been checked by a ZEISS service engineer.

Protection of the eyes

Styli can hurt the eyes during travel movements if you approach your head close to the workpiece during probing.

– Keep a safe distance away from the styli.

– Wear safety goggles.

Safety on the CMM

Safety symbols on the CMM

The following symbols are attached to the CMM and/or the control unit.

	Danger symbol for electric voltage: This symbol indicates a risk to life and limb.
	Danger symbol: This symbol indicates a danger to people and the CMM as well as to its components.
	Danger symbol for risk of crushing: The symbol indicates a risk of injury.

NOTE

Any work on the control must be carried out only by an electrical engineer.

Safety devices

Overview

The coordinate measuring machine (CMM) is equipped with safety devices. Some devices are standard devices, others are optional.

The standard safety devices include:

- EMERGENCY STOP button on the control console and control cabinet
- Shearing force limitation (hardware) and drive monitoring (software).
- Fall brake of the ram
- Collision protection for ram, probe and stylus system
- Light barrier

NOTE

For a safe operation of the CMM, all safety devices must be functional.

Collision protection

The CMM is equipped with a multi-collision protection which should prevent the endangerment to people or damage to workpieces and machine components. The following protection features are only applicable for the set-up mode, i.e. for a maximum speed of 90 mm/s.

NOTE

The maximum speed is generally reached during automatic runs, and the collision protection cannot be guaranteed in all cases. For this reason, special care is required.

Component	Function
Ram	A light curtain is provided around the ram as collision protection. If the light beams are interrupted, the drives will be switched off.
Probe	The probe receptacle is provided with a joint that deflects when a certain force is exceeded. The drives are switched off.
Stylus system with adapter plate	For VAST: the probe's deflection is 5 mm at maximum speed. After a collision, the drives are stopped but not switched off.
Stylus	After a collision, the drives are stopped but not switched off.
Axis movements	Drive monitoring. When a limit value is exceeded, the drives are switched off.

EMERGENCY STOP buttons

EMERGENCY STOP buttons are located on the controller cabinet and on the control console. The drives can be stopped immediately in cases of emergency. To do so, press the button. The button engages. The drives are switched off.

The button must be unlocked to switch the drives on again.

– Unlock the button by turning it.

  Then the button automatically releases and unlocks.

NOTE

The *EMERGENCY STOP button* should only be pressed in cases of emergency. A separate key is for switching the drives off is provided on the BP26SE control console.

If you want to switch the drives off during daily operation, you should use the key shown here. The LED above the key indicates whether the drives are on or off.

Collision protection of the ram

The CMM ram is equipped with collision protection. In the case of an unintentional collision, it should prevent personal injury or damage to the CMM. The collision protection must be activated with a switch. The collision protection is effective in all operation modes.

Safety instructions

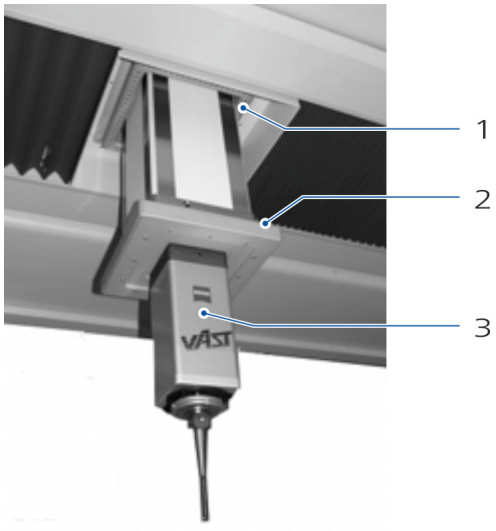
⚠ CAUTION

Risk of injury due to disabled collision protection.
If collision protection is disabled, personal injury may occur and the CMM could be damaged.

- Enable collision protection before starting the measuring operation.

Components and functioning

The collision protection system uses a light curtain. The sender of the light beams is located above the probe, the receiver on the X-carriage. If the light beam is interrupted, the drives will be switched off.



1 Receiver on X-carriage
2 Emitter at the lower end of the ram
3 Probe

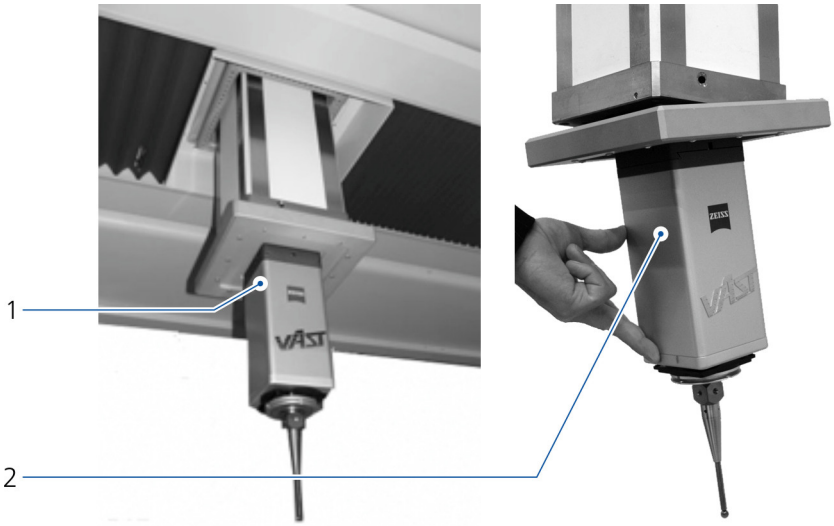
When the light beam between emitter and receiver is interrupted by a workpiece or another obstacle, the drives are switched off. All travel movements stop.

NOTE

The operator's controls for the collision protection are located in the control cabinet. ➤ *See [⇨ 3-13]*

Collision protection of the probe

The probe receptacle is equipped with a protective device to protect persons and the CMM in case of collision. The collision protection is effective both in the set-up mode and during automatic measuring runs.



1 Probe without deflection
2 Probe with deflection

The protective device is a joint holding the probe receptacle in a defined position by means of spring tension.

If a collision occurs, the probe is deflected, thus immediately stopping all travel movements. Once the CMM has been moved out of the collision state, the probe returns to its initial position.

NOTE

Styli should be requalified after a collision with the probe.

Fall brake of the ram

In case of a fault, the drives will be switched off automatically. The fall brake ensures that the ram does not fall off afterwards. The fall brake is active in all operating modes and effective in the entire speed range.

NOTE

If the fall brake is triggered, i.e. if the Z movement is blocked on the CMM, the fault must be eliminated by specially trained personnel only.

Light barrier

Features of the light barrier

Different beam lengths

The light barrier is available with two different beam lengths:

– 0.5 m - 18 m

– 15 m - 70 m

Effectiveness

The light barrier is only effective in the AUTO operating mode. If the operating mode switch is set to the MAN or 0 position, the light barrier will not be effective.

Operating mode indication

The signal tower has three lamps used to indicate the operational states:

Color	Meaning
green	The light barrier is active and not interrupted. The CMM moves at the speed defined in the measurement plan.
white	The light barrier is not active. The MAN or 0 operating mode has been selected.
Blue	EMERGENCY STOP has been triggered.

Functions of the light barrier

The light barrier may have two functions: *EMERGENCY STOP* and *REDUCTION*. The required light barrier function must be set by a ZEISS service engineer during the start-up of the light barrier. It is *not* possible to switch between the two functions.

Option 1: EMERGENCY STOP function

An EMERGENCY STOP is activated when the light barrier is interrupted. The drives are switched off and all travel movements are stopped. The current measurement plan is interrupted and may need to be restarted later if necessary.

Restarting

As soon as the light beam is no longer interrupted, the light barrier is active again.

– Switch on the drives.

Option 2: REDUCTION function

The *safe speed* option is activated if the light barrier is interrupted. After that, the CMM travels at the same speed as in the MAN operating mode. This means the execution of the measurement plan is continued at reduced speed.

Returning to normal speed

As soon as the CMM is outside the danger area, you can switch back to normal speed using the switch on the signal tower. Then the CMM moves at the speed according to the values defined in the measurement plan.

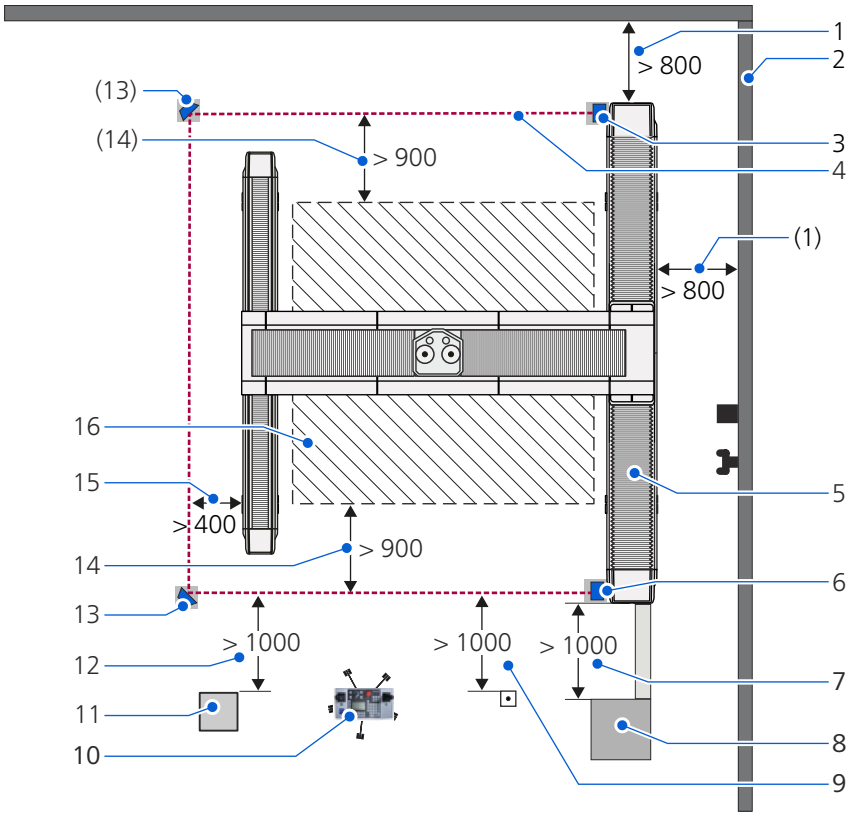
Setting up the light barrier

To ensure that the light barrier serves as a safety device, it must be installed correctly. This includes the correct configuration and alignment. In addition, the individual columns must be screwed to the floor to ensure that their position cannot be changed. When installing the light barriers, make sure that the distance between the light beam and the danger zone is at least 900 mm.

Position of control elements

All control elements must be located outside the blocked danger zone. This applies to the control elements on the controller cabinet, control console, and signal tower for the light barrier. Also ensure that the control elements cannot be reached from inside the blocked danger zone.

Ensure that users can view the entire danger zone from the location of the signal tower for the light barrier.



Examples of blocking off a danger zone

1 Distance between CMM and wall, minimum 800 mm
2 Wall
3 Light barrier receiver
4 Laser beam
5 CMM, top view
6 Light barrier transmitter
7 Distance between controller cabinet and CMM, minimum 1000 mm
8 Controller cabinet
9 Distance between compressed air connection and laser beam, minimum 1000 mm
10 Control console
11 Signal tower
12 Distance between signal tower and laser beam, minimum 1000 mm
13 Deflecting mirror
14 Distance between measuring range and laser beam, minimum 900 mm
15 Distance between CMM and laser beam, minimum 400 mm
16 Measuring range

NOTE

Ensure that the control elements cannot be reached from inside the blocked danger zone.

- Install the controller cabinet and the signal tower outside the danger zone (see drawing).

Activating the light barrier

The AUTO operating mode is required for operation of the light barrier. The white lamp must not light up. It it is on, the MAN or 0 operating mode is active.

– Set the AUTO operating mode.

The light barrier is activated by means of the key-operated switch located on the signal tower.

NOTE

Do not leave the signal tower unattended while the key is inserted in order prevent the light barrier from being deactivated by unauthorized persons during the execution of the measurement run.

- Withdraw the key and keep it with you.

Intensity check

When activating the light barrier, an automatic intensity check is carried out. If the beam path between the emitter and the detector is not interrupted, the green lamp on the signal tower for the light barrier is on. You can then switch the CMM drives on.

If the LED does not light up, determine the reasons for that.

Possible causes:

– Incorrect alignment of the emitter, detector or reflecting mirror.

– Dirt accumulation on the emitter, detector or reflecting mirror.

– Distance between emitter and detector is too large.

Interruption of the beam path

If the beam path of the light barrier is interrupted, an EMERGENCY STOP is activated or the travel speed is reduced. The option applied depends on the setting. ➢ *See [⇨ 2-17]*

Checking the safety devices

What you should know!

Safety devices must be checked regularly. Some safety devices must be checked at least once every three months, for others a check once a year is necessary. A distinction is made between a check by the operator and a check by a specialist.

NOTE

When the function of the safety device cannot be guaranteed, the CMM must not be operated. Inform a ZEISS service engineer.

Check by the operator

Checking the collision protection

The CMM is equipped with safety devices for the ram and the probe. Both safety devices must be checked at regular intervals.

Collision protection function

When the travel movement is hindered by a collision with the ram or the probe and triggers the collision protection function, the drives must automatically switch off.

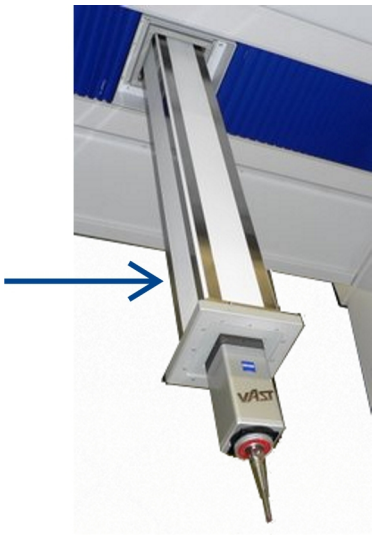
NOTE

The function of the protective device must be checked regularly in order to guarantee safe operation of the CMM. Check the protection device function at every start-up.

In automatic measuring mode with maximum travel speed, the CMM's working area must be delimited using additional measures. For more information, please refer to the »Installation site requirements«.

Checking the ram collision protection

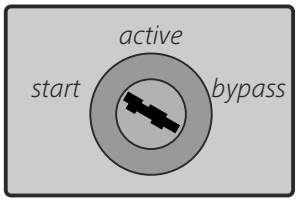
It is recommended that the collision protection function is checked daily. A check should be carried out when the machine is at rest.



Performance check of the ram protection

1 Move the bridge to the front until you can touch the ram with your hand.

2 Activate the collision protection device.



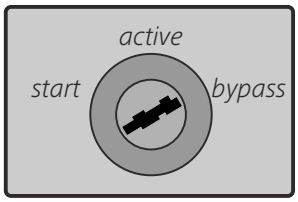
- Turn the key-operated switch to «start» and hold until the corresponding indicator lamp lights up.

3 Switch on the drives.

4 When the CMM is stopped, put your hand in the light curtain in front of the ram. See above illustration.

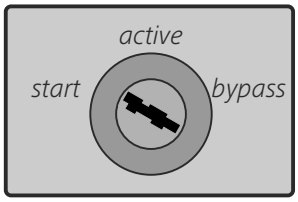
This must switch off the drives.

5 Reactivate the collision protection device.



- Briefly (for about one second) turn the key-operated switch to «bypass».

This is necessary to reset the protective device into the initial status.



- Turn the key-operated switch to «start» and hold until the corresponding indicator lamp lights up.

The CMM is ready for operation again. You can reactivate the drives.

Checking collision protection of the probe

It is recommended checking the collision protection function *monthly*. A check should be carried out when the machine is at rest.

Performance check of the probe protection

1 Move the bridge to the front until you can touch the probe with your hand.

2 Switch the drives on.

3 When the CMM is stopped, press against the probe from the side. See above illustration.

This must switch off the drives.

Checking the protective circuit

The CMM is equipped with a protective circuit that monitors the drive forces during bridge movement in the X and Y axes. The thrust force monitoring is effective in the set-up mode.

If the travel movement in the X or Y axis is hindered by a collision and the thrust forces exceed a value of approx.150 N, the drives must switch off automatically.

⚠ CAUTION

Impaired safety if the safety device has not been tested.

Failure of the protective circuit may cause injuries, such as crushing of parts of the body.

The function of the protective circuit must be checked regularly in order to guarantee safe operation of the CMM.

- Check the function of the protective circuit *every 3 months*.

Y axis

Components can become damaged as a result of incorrect operation.

The probe, ram and the left column could be damaged.

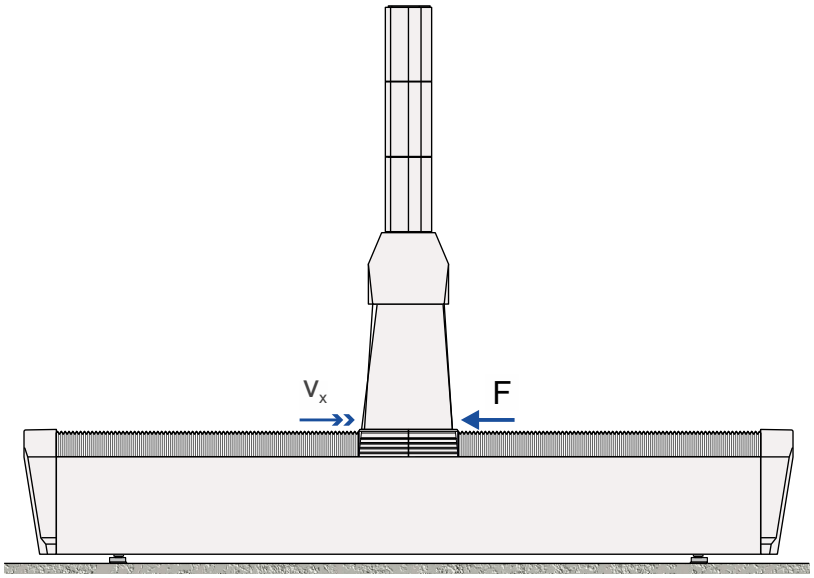
✓ You may only push against the right column of the bridge.

- Do *not* push against the probe and do *not* push against the left-hand column of the bridge.

1 Set «MAN» operating mode.

2 Move the control console to the *drive side* for Y axis travel.

The drive is located on the *right* side of the CMM.



v_y: Ram speed in the Y axis

F: Force which must be exerted manually against the right bridge column.

3 Move the bridge in the Y axis.

- While the bridge is traveling, try to stop its movement by pushing against the right bridge column with one hand.

Under normal circumstances, the force of your hand should suffice to stop movement. If the movement cannot be stopped in this way, the protective circuit must be checked immediately by a ZEISS service engineer.

NOTE

If you can stop the travel movements, you will need to reactivate the drives. See control elements.

Check by a specialist

No-contact protective devices

Once a year

No-contact protective devices such as the light barrier must be checked once a year by a specialist.

3 Description

This chapter contains:

Identification of a CMM 3-2
Design of the CMM 3-3
Components and functions 3-4
Control and operation 3-10
Probing system 3-18

Identification of a CMM

Coordinate measuring machines (CMMs) are identified by the size of their measuring range. The range is specified in the X, Y, and Z axes.

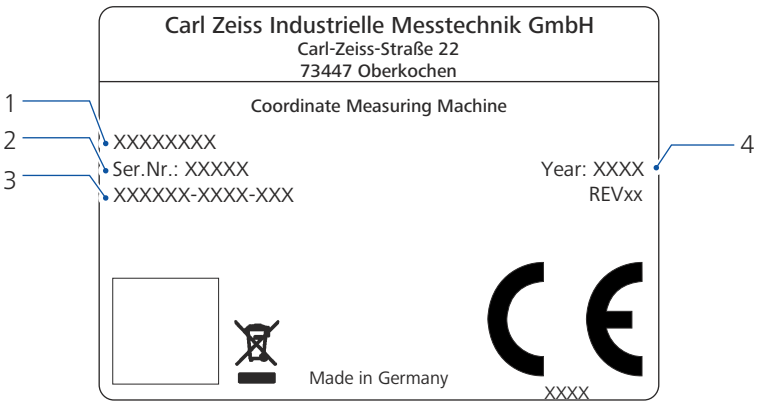
Examples of labeling:

Model: 20/30/16

Identifier	Measuring range
20	X: 2000 mm
30	Y: 3000 mm
16	Z: 1600 mm

Type plate

The identification of your CMM is given on the type plate. The type plate is located on the drive side of the CMM.

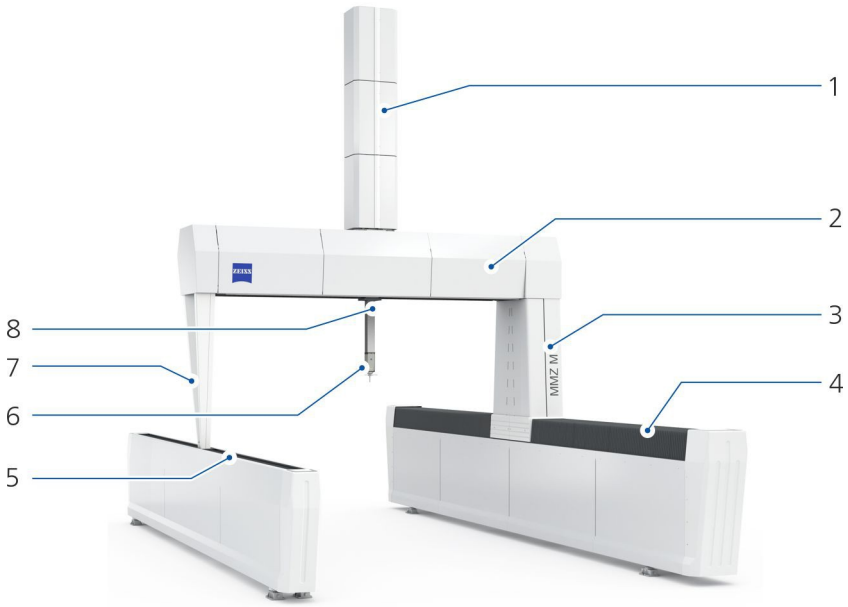


Type plate on the CMM

1 Series and identification of the CMM
2 Serial number
3 CMM number
4 Year of manufacture

Design of the CMM

A CMM of the MMZ M series is shown below.



1 Ram cover
2 Cover of the X-bridge and the X-carriage
3 Driving column
4 Y guideway for driving column (with bellows cover)
5 Y guideway for supporting column (with bellows cover)
6 Probe with stylus system
7 Supporting column
8 Ram

Damage to the CMM due to improper application of force to the probe or the ram.
The ram can only be moved by motor. By applying force to the probe or the ram, either manually or otherwise, the CMM may be damaged.

Components and functions

Bridge

The MMZ M is a *bridge* coordinate measuring machine. The bridge is composed of an X-bridge and two columns. The X-carriage in which the ram is guided moves along the X-bridge. The bridge travels in the Y axis.

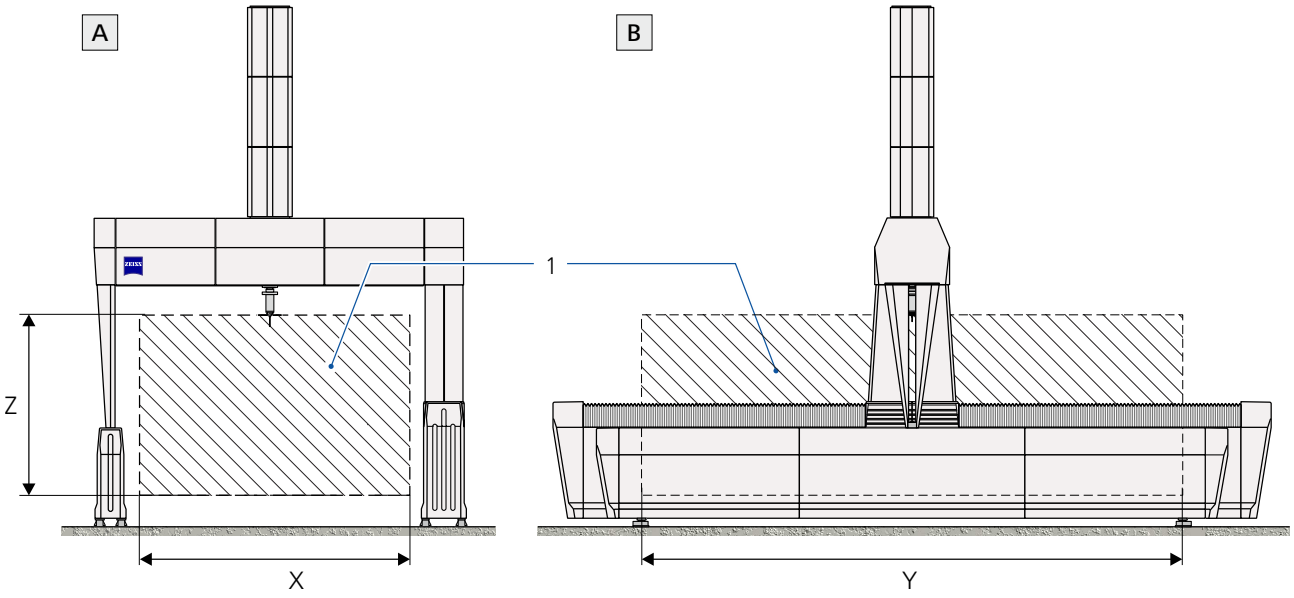
1 X-carriage, below the cover
2 X-bridge, below the cover
3 Driving column
4 Supporting column

Version and measuring range

The MMZ M may be equipped with measuring plates or clamping plates. Different plate surface options are possible, e.g. T-slots or thread grids.

Measuring range

The measuring area is the space in which workpieces can be probed. The size of the measuring range depends on the size of the CMM.



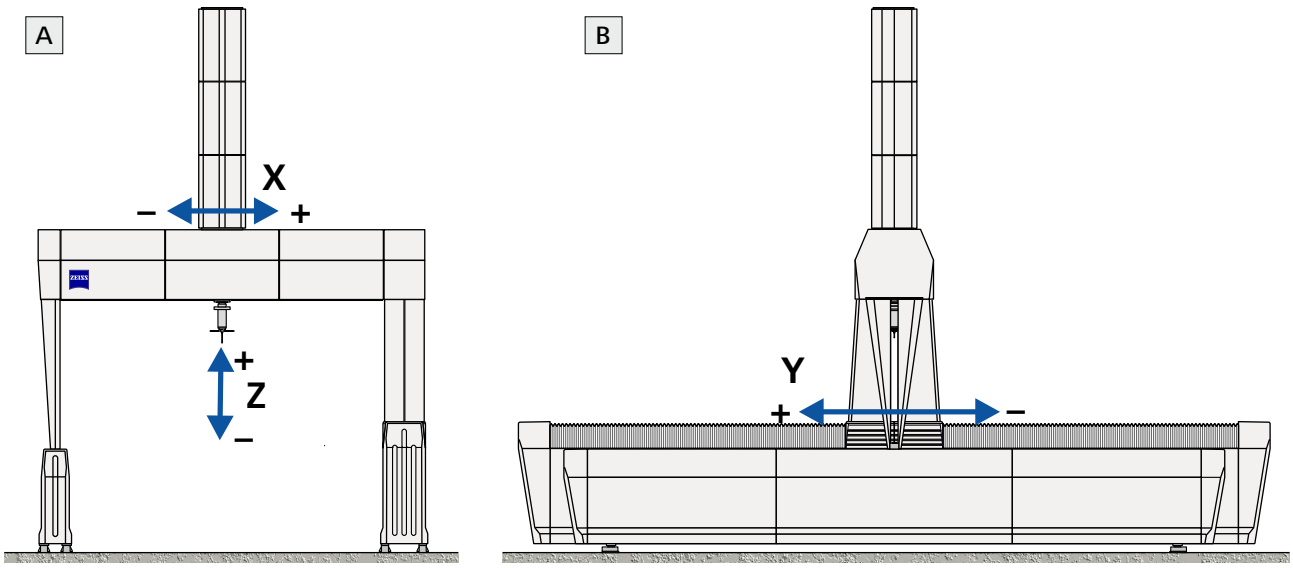
A Front view
B Left view
1 Measuring range

Coordinate axes

Moving in three axes is possible with the coordinate measuring machine: X, Y, Z.

Travel directions

The illustration shows the possible *travel directions* of the bridge.



A Front view
B View from the left

X axis (X-bridge)

The X-bridge is mounted on columns and supports the X-carriage. The X-carriage is guided along the X-bridge and can be moved *back and forth* to enable probing in the X axis.

Y axis (Y columns))

The driving column and the supporting column support the X-bridge, moving the entire bridge on a linear guideway in the Y axis.

Z axis (Ram)

The ram is guided in the Z bearing cage. It can be moved in the *vertical* direction and is used to probe in the Z axis. The probing system is located at the bottom of the ram.

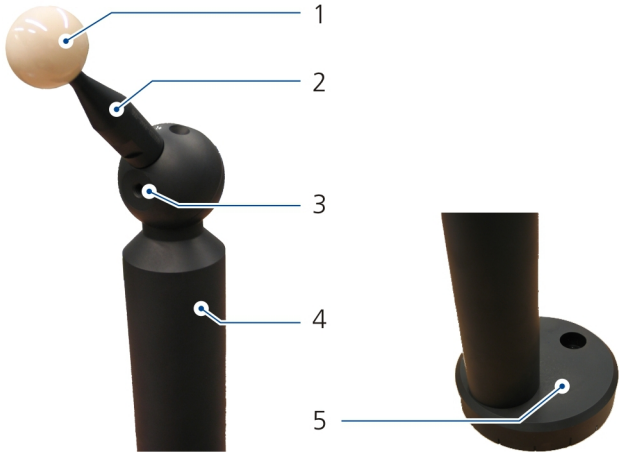
Reference standard

A high-precision sphere is used as the reference standard. The sphere is made of ceramic and has a diameter of 30 mm. The sphere is attached to a reference sphere holder.

Note: The reference standard is supplied in a separate case. Read and follow the information provided in the supplied operating instructions.

Reference sphere with shaft

The shaft of the reference sphere can be screwed in at different positions of the reference sphere holder. It is possible to mount more than one reference sphere onto the reference sphere holder.



RSH reference sphere holder

1 Reference sphere
2 Reference sphere shaft
3 Adjustable hemisphere holding the reference sphere shaft

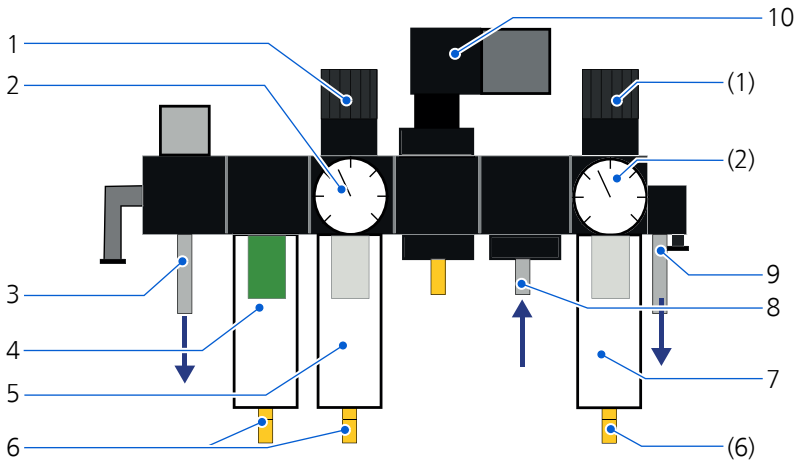
4 Reference sphere holder
5 Base with through hole for fastening

The CMM is equipped with the RSH 514 reference sphere holder.

Service unit and oil pump

Service unit for compressed air supply

Compressed air is required for active vibration damping and for the RDS articulating system. The service unit is located on the left side of the controller cabinet.



1 Pressure regulator
2 Pressure gauge
3 Compressed air line for the RDS articulating system
4 Super-fine filter
5 Fine filter
6 Screw for water draining
7 Fine filter (air damping)
8 Compressed air connection
9 Compressed air line for active air damping of the CMM
10 Solenoid valve

When the controller is switched on, the compressed air supply is released for the CMM via a pneumatic valve. When the controller is switched off, the compressed air supply is automatically cut off.

NOTE

The filters are equipped with a water separator. If water has accumulated in the water separator, it can be drained using the screw on the bottom of the filter.

Oil pump

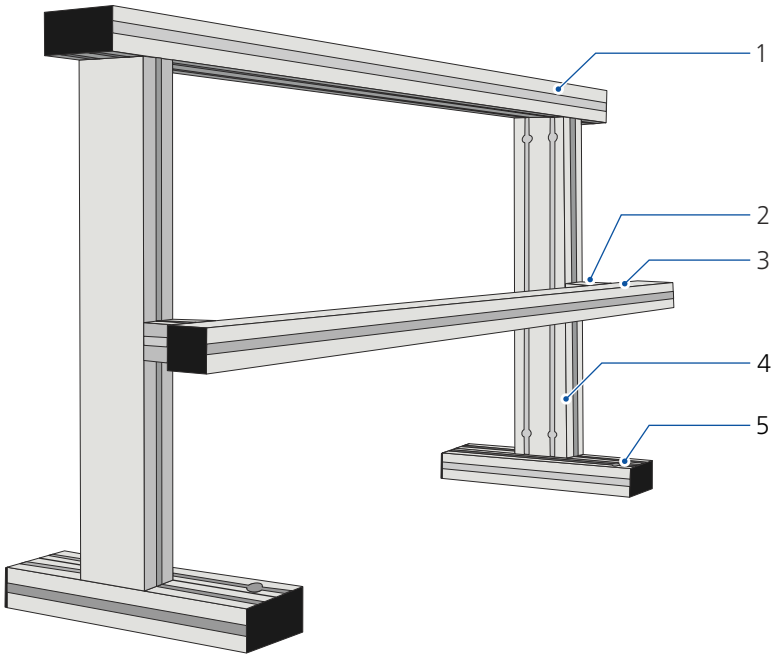
The oil pump is used for automatic lubrication of CMM guideways and bearings. The oil pump is located on the left side of the controller cabinet.

Impairment of function.
Any work on the oil pump may only be carried out by a ZEISS service engineer.

MSR changer rack

The changer rack comes standard with two tiers: a fixed-height horizontal frame profile rail and a height-adjustable profile rail. A possible third profile rail is optional. The profile rails are mounted on the frame support.

The unit is preassembled. The height of the changer rack depends on the CMM.



1 Frame profile rail
2 Spacer for mounting profile rail; height-adjustable
3 Profile rail
4 Frame support (leg)
5 Foot profile; consisting of mounting and guide profiles

NOTE

For more information, please refer to the separate operating instructions for changer racks.

Control and operation

Control cabinet

32 bit / C99

The control unit is located in a separate control cabinet. This CMM is equipped with a 32-bit control unit. This control unit has the designation C99.

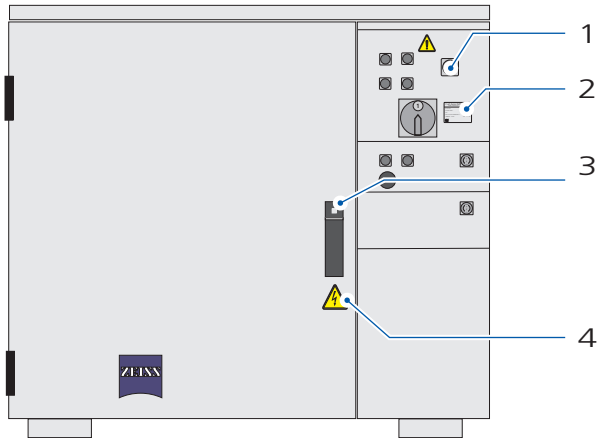
NOTE

ZEISS USB sticks (backup or boot sticks) may only be used for ZEISS control units and computers by ZEISS service technicians. We do not assume any warranty and liability for damage due to other use.

MCC 800

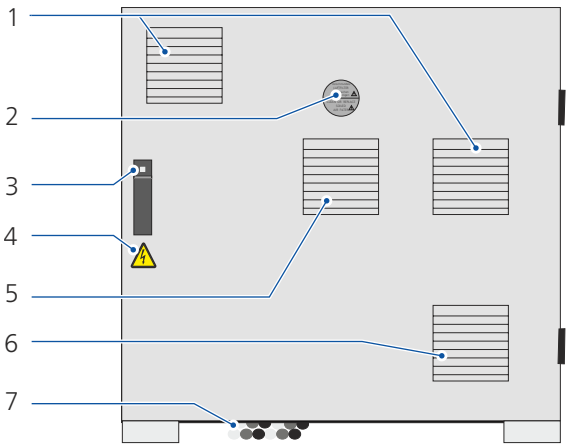
IP54

The housing of the control cabinet has protection class IP54.



MCC 800 control cabinet; front

1 Operator's controls
2 Type plate for control cabinet
3 Door latch
4 Warning symbol for electric voltage: The control cabinet may be opened only by a skilled electrician.



MCC 800 control cabinet; rear

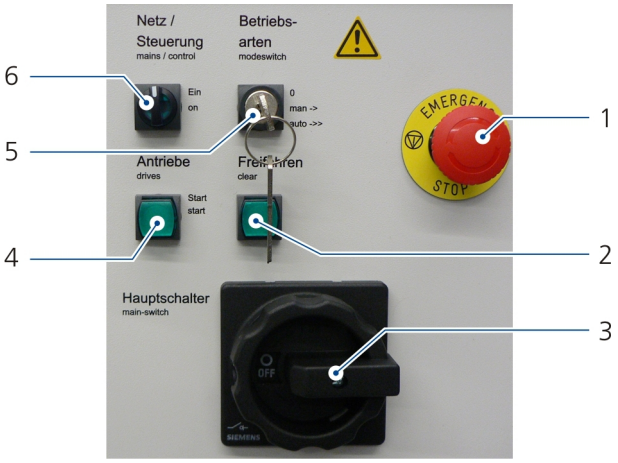
1 Air filter
2 Adhesive label indicating replacement or cleaning of the filter mats
3 Door latch
4 Warning symbol for electric voltage: The control cabinet may be opened only by a skilled electrician.
5 Fan and air filter; air outlet
6 Fan and air filter; air intake
7 Power supply of the control cabinet and cables leading to the CMM

NOTE

If the MCC 800 is climate-controlled, the air-conditioning unit is located on the rear side of the control cabinet.

Control elements on the controller cabinet

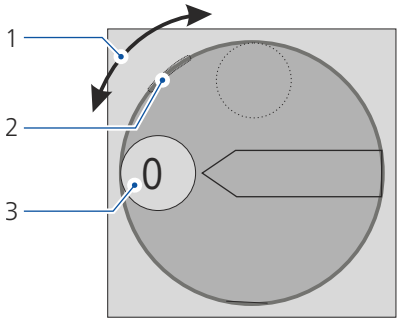
Control elements for CMM operation



1 EMERGENCY STOP button; push-and-turn switch
2 Button for clearing the axes

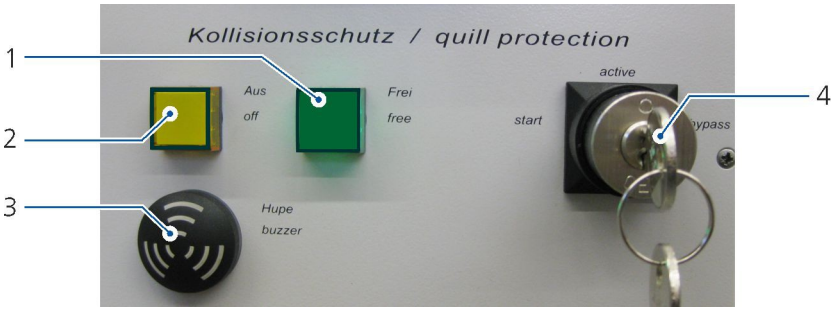
3 Main switch for power supply
4 Push-button for drives; with indicator lamp
5 Key-operated switch for operating mode selection
6 Rotary switch for controller; with indicator lamp

Functions of the control elements

Control element		Function
Main switch for power supply		When the main switch is turned to «1 ON», the power supply is connected.  1 Direction of rotation for switching on and off; 0=Off, 1=On 2 Detent opening; in the «0» position, the switch can be protected against unauthorized switching-on of the unit. 3 «0» position; power supply is off.
Rotary switch for the controller		If the switch is in the «ON» position, the controller is switched on. The integrated indictor lamp lights up to confirm this.
Push button for drives		When the drives are switched on, the integrated indicator lamp lights up to confirm this.
Key-operated switch for operating mode selection		The key-operated switch is used to determine the operating mode in which the measurements are to be carried out. – 0: No travel movement possible. – MAN: Manual mode – MAN operating mode. – AUTO: Automatic mode – AUTO operating mode.

Control element		Function
EMERGENCY STOP button		The *push-and-turn button* can be pressed to stop all travel movements in cases of emergency. It engages when pressed. All drives are switched off. The *EMERGENCY STOP* button must be released before reactivating the drives. Release the button by turning it clockwise. After that, the drives can be switched on again. For further information ➤ *See [⇨ 2-14]*
Push button for clearing		A limit switch is activated when the CMM moves to the end position. The drives are switched off. The *push button* is used to move the CMM back to into the measuring range.

Control elements for collision protection of the ram



1 Indicator lamp for collision protection
2 Indicator lamp for bypassing the collision protection
3 Acoustic signal for bypassing the collising protection.
4 Key-operated switch for collision protection functions

Functions assigned to the switch positions:

start: Activation of the collision protection.
The *key-operated switch* does not remain in this position, but returns to the «active» position.

active: Normal operating position.
A pilot lamp signals that the collision protection is active.

bypass:	Bypass collision protection (interruption of the light beams). For moving the CMM clear after a collision. The yellow indicator lamp is lit, and a signal tone is heard. **NOTICE! When moving the CMM in the wrong direction, it can be seriously damaged.** Make sure to move the joystick on the control console in the right direction. Also ensure that the operating position has been properly set on the control console.

Key-operated switch for coupling

If a loading device is used, the controllers of the loading device and the CMM are coupled to each other. In some cases, decoupling is necessary to allow moving the CMM manually. The key-operated switch labeled *service mode* is used for decoupling of the two controllers.

Functions assigned to the switch positions:

0 The controllers of the CMM and of the loading device are coupled to each other.

1 Coupling between CMM and loading device is disabled; the CMM can be moved

NOTE

The switch remains in position «1». After moving the CMM, turn the switch back to «0».

Operation

BP26SE control console

Standard

The CMM comes standard with the following control console.

BP26SE control console

1 Keypad
2 EMERGENCY STOP button
3 Joystick for the X and Y axes. The joystick is equipped with a push-button for setting intermediate positions.
4 Indicator for joystick lock
5 Display
6 Joystick for the Z axis and the rotary table (optional).The joystick is equipped with a push-button to the rotary table (if available)
7 Rotary knob for setting the travel speed

NOTE

Separate operating instructions are available for the control console. The standard version and the optional wireless control console are described in the operating instructions.

Option

Optionally, the CMM can be operated using the BP26SE REMOTE wireless control console.

Movable operating station

Optionally, a movable operating station is available. The operating station is height-adjustable and has room for the control console, a screen, keyboard and mouse.

Operation of the joysticks

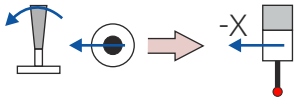
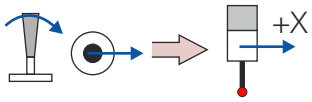
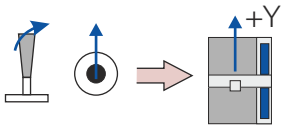
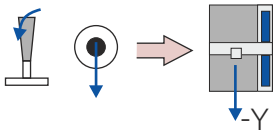
The joysticks are required for travel control. This applies to manual and automatic probing. Prior to automatic probing, manual probing is required to program the automatic measurement run.

Right joystick

The *right* joystick is used to move the stylus system in the X and Y axes.

Operating position

The travel movements in X and Y depend on the operating position. By default, travel movements using the joysticks are set for operation from the front. In the following examples, it is assumed that you operate the CMM from the front.

Direction		Action	Movement of the joystick, ram and probe
X axis	-X	– Push the joystick to the *left*. The ram moves to the left.	
	+X	– Push the joystick to the *right*. The ram moves to the right.	
Y axis	+Y	– Push the joystick to the *rear*. The probe moves away from the operator.	
	-Y	– Pull the joystick to the *front*. The probe moves towards the operator.	

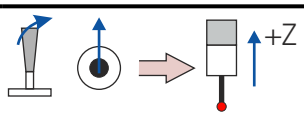
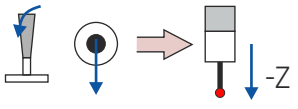
NOTE

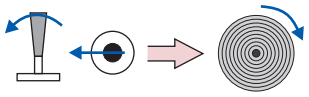
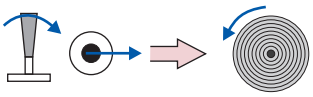
You may reverse the movement direction of the joysticks. This is advisable when operating the control console and performing probing from behind the CMM.

To reverse the movement direction of the joystick, you need to press a button on the control console. See operating instructions for the control console.

Left joystick

The *left* joystick is used to move the ram in the Z axis. When using a rotary table, the rotary table can also be turned.

Direction		Action	Movement of the joystick, ram, and rotary table
Z direction	+Z	– Push the joystick to the *rear*. The ram moves upwards.	
	-Z	– Pull the joystick to the *front*. The ram moves downwards.	

Direction	Action	Movement of the joystick, ram, and rotary table
Rotation direction of the rotary table (optional)	1. Press the button on the joystick and keep it pressed. 2. Push the joystick to the *left*. The rotary table turns clockwise.	
	1. Press the button on the joystick and keep it pressed. 2. Push the joystick to the *right*. The rotary table turns counterclockwise.	

NOTE

If the joysticks are not activated within a certain period of time, they will be locked. The locking must be removed before it will be possible again to carry out travel movements using the joysticks.

More information can be found in a separate publication. See operating instructions for the control console.

Probing system

Types of probing systems

The MMZ M can be equipped with different probing systems.

Probing system	
VAST XT gold or VAST gold or VAST XTR gold	Standard
RDS with VAST XXT	Option
RDS with the optical probe LineScan	Option

The individual probing systems are explained briefly below. You will find further information in separate operating instructions for sensor systems, such as the instructions for contact probing systems.

Contact probing systems

The individual probing systems are explained briefly below. You will find further information in the separate operating instructions for contact probing systems.

VAST active measuring probes:

	VAST XT gold	VAST gold	VAST XTR gold
			
Application	Universal	Universal	Universal
Measuring principle	Measuring	Measuring	Measuring

Combination of the RDS articulating system (probe holder) and one probe:

RDS articulating system with VAST XXT

NOTE

The RDS articulating system can be replaced with a VAST probe using an adapter.

ZEISS probes with RDS:

RDS / ...	
Probe	VAST XXT

RDS / ...

Application: Universal
Measuring principle: Measuring

Optical probing systems

The optical probe can be used in combination with the articulating probe holder.

Optical probes in combination with RDS:

	LineScan
	
Application	– Profile measurement

You will find further information in the separate operating instructions for optical probing systems.

4 Technical data

This chapter contains:

CMM 4-2

CMM

Note

The table below lists a selection of technical specifications. For more data, please refer to the »Installation site requirements«.

General data

Dimensions		
Width / length / height	[mm]	Depending on the model
Measuring range		
X / Y / Z	[mm]	Depending on the model
Weight		
CMM	[kg]	Depending on the model, see »Installation Instructions«
Workpiece	[kg]	Depending on the model
Sound pressure level of the CMM	[dBA]	< 70

Characteristic values of the coordinate measuring machine

Category	Characteristic value
Overvoltage category	III
Degree of pollution	2
Protection class	I

Electrical data

Electrical data of MCC 800:

Line voltage	100/110/115/120/125/230/240 VAC (±10 %)
Type of current	1/N/PE
Frequency	50 - 60 Hz (±3.5%)
Power consumption	
Maximum	3000 VA
Typical	550 W

Fuse	
230-240 V	C 16 A
100-125 V	25 A

Amount of heat generated

CMM	10,800 kJ/h
Data station and peripheral devices	3800 kJ/h

Compressed air

Certain requirements have to be met before connecting the compressed air in order not to impair the function of the CMM.

Requirements	
Pressure	6-10 bar
Air quality according to ISO 8573-1:2010 [6:4:4]	– Air purity with regard to particle concentration according to class 6 – Air purity with regard to pressure dew point according to class 4 – Air purity with regard to oil concentration according to class 4
Air consumption	
Weight counterbalancing of the ram (only for Z = 2000 mm)	80 Nl/min at 1 bar
Air consumption for RDS	8 Nl/min at 1 bar

Travel speed

Creep speed:	
	0 to 5 mm/s
Set-up mode: (MAN operating mode)	
	0 to 90 mm/s
Series measurement mode: (AUTO operating mode)	
Axis	max. 300 mm/s
Vector (3D)	max. 520 mm/s

Environmental conditions

The following conditions must be met to ensure proper operation of the coordinate measuring machine.

Operational readiness	
Ambient temperature	10-35°C
Measuring operation	
Relative humidity	40% - 70% (without condensation)
Room temperature	18-22°C
Height above mean sea level	100 - 125 V: max. 3000 m 230 - 240 V: max. 2000 m

NOTE

Please see the separate specifications brochure for information about permissible temperature variations.

Reference temperature

Temperature at which the promised measuring accuracy is guaranteed when the conditions are met.

The following conditions must be met:

– Temperature for measuring operation must be constant for at least 48 hours.

– Temperature variations must not exceed certain values. Limit values: 2 K/d and 1 K/h.

Example of a reference temperature for measurement of 20°C:

Temperature	Change	Status	Action
Per day			
18.1-20.0°C	1.9 K	OK	
20.0-22.0°C	2.0 K	OK	
17.9-20.0°C	2.1 K	Not OK	Wait for 48 hours until the new temperature set is constant.
Per hour			
20.9-20.0°C	0.9 K	OK	
20.0-21.0°C	1.0 K	OK	
18.9-20.0°C	1.1 K	Not OK	Wait for 48 hours until the new temperature set is constant.

5 Transport and installation

This chapter contains:

Notes 5-2
Transport 5-3
Installation 5-4

Notes

Separate document

NOTE

You already received the document »Installation site requirements« before delivery of the coordinate measuring machine. This document informs you about all measures to be taken for transport and installation. In the following, we will refer to some of the most important points contained in this document.

Transport

To be observed on delivery

The coordinate measuring machine comes disassembled on shipping pallets. The individual parts are wrapped in insulated packaging. For overseas transport, the individual parts are packed in shipping crates.

Requirements on the forklift

A forklift with sufficient carrying capacity has to be used for transport. The forklift must be suitable for the weight of the individual shipping containers. In order to avoid tilting of the load, the forks must reach completely underneath the transport pallet or the shipping containers. In addition to that, the spacing between the fork arms must be variable. You will find the weight and dimensions of the individual parts in the »Installation site requirements« document.

NOTE

The packaging or shipping containers must not be damaged. The packaging may only be removed at the installation site by a ZEISS service engineer.

Ambient temperature +5 °C to +40 °C

The transport pallets or shipping containers must be stored in a covered area until the machine is installed. The ambient temperature at the storage area must be between +5°C and +40°C.

Transport conditions

The transport route from the storage area to the installation site must be selected carefully. It might be necessary to prepare it to meet the requirements.

Prerequisites for transport

Observe the following for transport:

- Weight: Is the bearing capacity of the floor along the transport routes suitable for the weight of the shipping containers and the forklift?
- Dimensions: Are the height and width of the doorways and transport routes sufficient for the shipping containers and the forklift?
- Forklift: Does the forklift comply with the requirements?

Installation

Choosing the installation site

The installation site has to meet certain requirements. The following questions should be clarified:

- Is the room height sufficient?
- Is there enough space available?
- Is the floor suitable for the weight of the CMM and the forklift?
- How strong are the floor vibrations at the installation site?

  Disturbing floor vibrations may be caused, for example, by machines in adjacent rooms or buildings.
- Does the installation site comply with all the ambient conditions required for perfect operation of the CMM?
- Is the installation site free from coarse dirt particles such as casting sand and metal chips?
- Have the requirements for the compressed air supply been met?
- Are there problems with the power supply?

For more information, please refer to the »Installation site requirements«.

Carrying out vibration analysis

A vibration analysis must be carried out in any case. The result of the analysis must be made available to ZEISS for planning purposes. An additional foundation may be necessary.

NOTE

ZEISS can carry out a vibration analysis for you. Please contact us if you need our support.

Installation requirements

The following preparations have to be made prior to the installation of the CMM by a ZEISS service engineer:

1. Ensure the flatness of the installation surface according to the installation instructions.
2. Installation of the power supply.
3. Installation of the compressed air supply.
4. Adapt the CMM to room temperature.

You will find the data required for preparation in the »Installation site requirements«.

Temperature control

When installing the CMM, the temperature of all CMM parts must be stabilized to a minimum temperature of 10°C.

At least two days in advance

– Store all parts of the CMM in a place having an ambient temperature of at least 10°C for at least two days prior to installation.

6

Start-up

This chapter contains:

Preparations for start-up 6-2

Starting the CMM 6-5

Mounting / changing the probe 6-8

Preparing the stylus system 6-12

Setting up the workpiece 6-13

Start-up checklist 6-17

Preparations for start-up

Before you start!

What you should know!

The preparation includes activities that are not necessary to be carried out on a daily or weekly basis. One exception to this is the visual check. The visual check should be part of your daily measuring operation routine.

Initial start-up by a service engineer

Initial start-up is carried out by a ZEISS service engineer. However, you must familiarize yourself with the preparations required for start-up as well as know and follow the corresponding safety instructions.

Connecting the power supply

The electrical power supply must be close to the installation site to allow connecting the power supply to the CMM. The corresponding measures must be taken before installing the CMM. See electrical data.

NOTE

For more information on the electrical power supply, please refer to the »Installation site requirements« brochure.

Connecting the compressed air supply

The compressed air supply system needs to be close to the CMM to enable its connection to the CMM supply line. The corresponding measures must be taken before installing the CMM.

– Comply with the requirements for compressed air supply. ➢ *See [⇨ 4-3]*

NOTE

For more information on the connection of the compressed air supply, please refer to the »Installation site requirements« document.

Adjusting the pressure

The pressure is adjusted individually by a ZEISS service engineer during the initial start-up. After this, the pressure must not be readjusted.

If the required pressure is not indicated, proceed as follows:

1 Identify the cause of the decrease or increase in pressure.

2 Call a ZEISS service engineer if you cannot find or eliminate the cause.

Setting up the changer rack

Instructions for setting up a changer rack are provided in a separate document. See operating instructions for changer racks.

Visual check and check list

The visual check must be part of the routine work to be carried out during the daily measuring operation. Before switching the CMM on, make sure by means of a visual check that the measuring system components do not show any visible damage.

In case of damage, …

Start-up of the CMM is not allowed in case of damage to the CMM.

1 In this case, protect the CMM against switching on.
   - Switch off the *main switch* and lock it with a padlock.
   - Turn the *key-operated switch* for the operating mode to the «OFF» position and withdraw the key.

2 Inform the ZEISS service division.

Housing covers

The CMM may only be operated if all covers are mounted on the CMM and all doors are closed.

– Mount all housing covers before taking further measures.

Cable for power supply

The cable must be in perfect condition. It must not be bent nor damaged.

– Ensure that no heavy objects are lying on the cable.

Compressed air supply

The compressed air lines and connections must be in perfect condition. The compressed air line must not be damaged or bent. Furthermore, no heavy objects may lie on the line. Check whether the following points apply:

– Make sure that the hoses are in perfect condition.

– Ensure that no heavy objects are lying on the hose.

– Make sure that it is connected correctly to the supply line and the CMM.

Changer rack

– Has the changer rack been installed correctly?

– Is a stylus system change possible without collision?

Starting the CMM

Safety measures and notes

Visual inspection

NOTE

A visual check must be carried out before turning on the CMM. The CMM may be turned on only if it is in proper working order.

- Make sure that the CMM is in proper working order.

AUTO operating mode

NOTE

When starting a measurement run in the AUTO mode, make sure that no one is in the danger zone of the CMM.

- Check to ensure that no one is in the danger zone of the CMM.

NOTE

The AUTO operating mode only be set if the measurement run has been tested in the manual mode beforehand. This is to prevent collisions at high travel speeds.

NOTE

During automatic measurement runs, the key should be removed and stored in a safe place to prevent the setting from being changed accidentally.

NOTE

In the AUTO operating mode, the CMM moves at the maximum possible speed. The maximum speed can be reduced.

Examples of reduced maximum speed:

– The control knob for the speed setting on the control console is turned back.

– The default speed in the measuring software is reduced.

– The light barrier or light curtain has been interrupted.

Measuring software

NOTE

The probe must be connected to the ram before starting the measuring software.

CMM starting sequence

Proceed in the following order when switching the controller on:

1 Connect the power supply; switch it on with the main switch. **[1]**

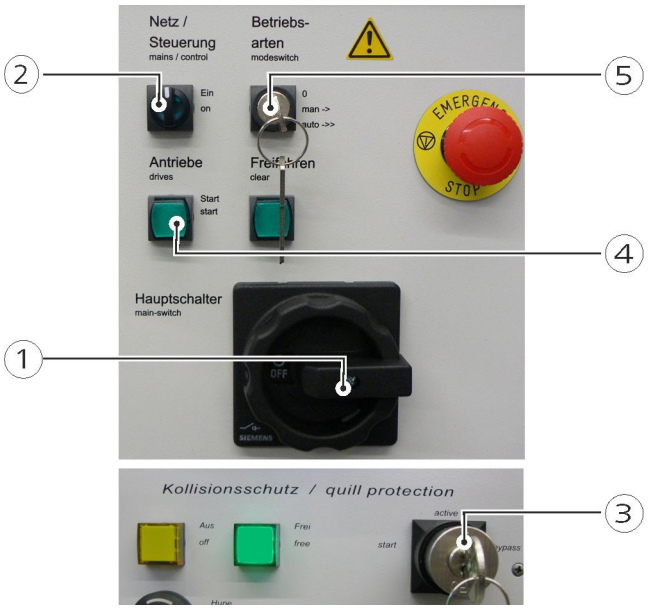
2 Switch the controller on. **[2]**

3 Activate the ram protection. **[3]**

4 Turn the drives on. **[4]**

5 Select the operating mode. **[5]**

6 Switch the computer on and start the measuring software.



Start-up sequence

Connecting the power supply (1)

– Turn the main switch clockwise to position «1».

The power supply for all electronic components of the CMM is switched on.

Switching on the controller (2)

1 Turn the rotary switch to the «ON» position.

The indicator lamp of the switch lights up. The controller is on.

2 Wait for approx. 30 s before switching the drives on.

This is necessary because the internal computer of the controller requires a certain amount of time to start. The starting process must be completed before the drives are switched on. The LEDs on the control console flash during the starting process.

Activating the ram protection (3)

– Turn the key-operated switch to the «Start» position.

  The indicator lamp of the switch then lights up in green. The ram collision protection is active.

  The key-operated switch does not remain in this position. The key-operated switch returns to the «active» position.

Switching on the drives (4)

– Press the push button.

  The indicator lamp of the switch then lights up. The drives are on.

Selecting the operating mode (5)

The operating mode can also be set later.

– Turn the key-operated switch to the required position.

  MAN: manual mode - set-up mode. The travel speed is limited in all three axes.

  You must set this operating mode for ...:

  – Joystick-controlled probing
  – Programming measurement runs
  – Testing measurement runs

  AUTO: automatic mode - AUTO operating mode. The CMM travels at maximum speed in all axes.

  You can set this operating mode for ...:

  – Workpiece measurement in a tested measurement run.

Switching the computer on

1 Switch on the computer and peripheral devices such as the printer.

2 Boot the computer; start the operating system.

3 Start the measuring software.

Mounting / changing the probe

What you should know!

NOTE

This chapter is only relevant if the CMM is prepared for a manual probe change. In the »active« version, a VAST gold probe can be replaced with an RDS articulating head.

After a probe change, measuring software adjustments may be necessary.

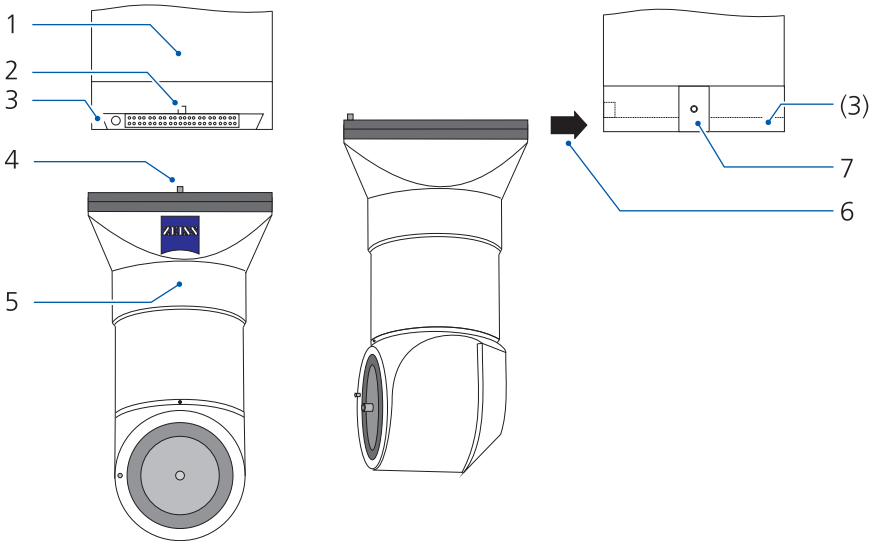
– Please also read the corresponding chapters in the operating instructions for the measuring software.

Fastening the probe holder and the probe

How to fasten the RDS articulating system and a VAST probe to the ram is described below.

Fastening the RDS

The articulating system is slid onto the dovetail guide of the ram and secured with a screw.



1 Ram
2 Groove for pin
3 Dovetail guide on the ram
4 Pin
5 RDS articulating system

6 Direction in which the articulating probe holder is inserted into the dovetail guide.

7 Hexagon socket screw, width across flats: 2.5 mm

1 Move the ram to a position from which the articulating system can be attached to the ram.

Use the joysticks on the control console to move the CMM in all axes.

2 Switch the drives off.

3 Slide the articulating system up to the stop into the dovetail guide on the ram.

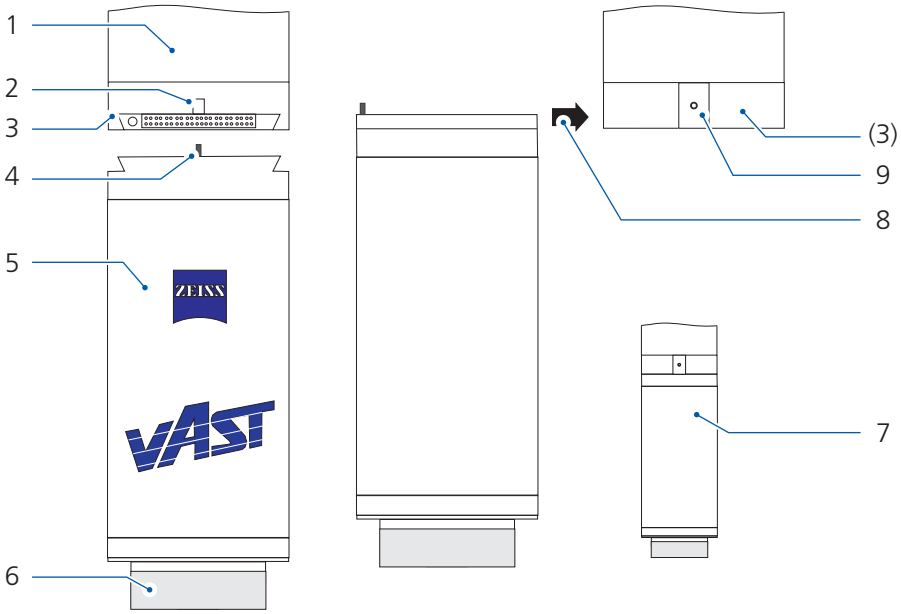
4 The adapter must be flush with the ram.

5 Secure the articulating system by tightening the hexagon socket screw to a torque of 2.2 Nm.

6 Reactivate the drives.

Fastening the VAST

Slide the probe onto the dovetail guide of the ram. The probe must always be secured with a screw.



1 Ram

2 Groove for pin

3 Dovetail guide on the ram

4 Pin

5 Probe

6 Cover of the adapter plate receptacle

7 Ram and probe after mounting
8 Direction in which the probe is inserted into the dovetail guide
9 Hexagon socket screw, width across flats: 2.5 mm

1 Move the ram to a position from which the probe can be attached to the ram.

Use the joysticks on the control console to move the CMM in all axes.

2 Switch the drives off.

3 Slide the probe onto the dovetail guide of the ram up to the stop.

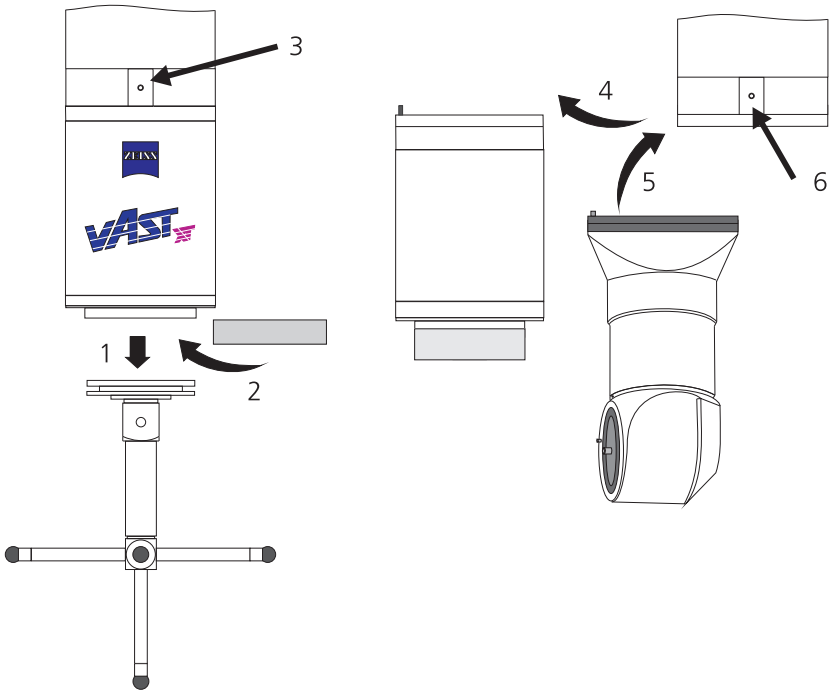
4 Secure the probe by tightening the hexagon socket screw to a torque of 2.2 Nm.

5 Reactivate the drives.

Replacing a probe with an articulating system

The VAST XT and VAST probing systems can be replaced with another probing system, such as the RDS/XXT probing system, for example, if the CMM is equipped accordingly.

The following description applies to the VAST XT, VAST, and RDS probes.



1 Switch the drives off.

2 Remove the stylus system, store the stylus system in a safe place **[1]**.

3 Cover the adapter plate receptacle **[2]**.

4 Loosen the screw; width across flats: 2.5 mm **[3]**.

The screw is located on the right-hand side of the ram.

5 Remove the VAST XT or VAST probe from the dovetail guide of the ram **[4]**.

6 Slide the RDS articulating system onto the dovetail guide (*without* RDS adapter plate) – **[5]**.

7 Tighten the screw to 2.2 Nm **[6]**.

8 Reactivate the drives.

The new probing system is automatically recognized. However, it must be initialized in the measuring software. Then the styli of the stylus system must be qualified and the workpiece must be aligned again during the computer-controlled manual run. Please refer to the operating instructions for the measuring software.

Preparing the stylus system

For information on the stylus system, please refer to the separate brochure »Sensors«.

Automatic stylus system change

Notes on the automatic change: ➢ *See [⇨ 7-4]*.

Setting up the workpiece

Safety instructions

Switching the drives off

You are exposed to the danger area of the CMM when working on the measuring plate. With the drives on, unintentional travel movements can result in injuries.

⚠ CAUTION

Risk of injury due to unintentional travel movements within the danger zone.

Crushing and severing body parts. Risk to the eyes caused by the styli.

✓ Risk of injury due to unintentional travel movements must be excluded.

- Move the CMM to a safe position.
- Switch the drives off.
- If the workpiece is brought in the measuring area by means of a loading device, also SIPOS should be activated.

  SIPOS is an optional device which controls the travel movements of the CMM and the loading device.

Cleaning the measuring plate and workpiece

The measuring plate must be free from grease. Workpieces may slide and fall off of the measuring plate, thus representing a risk to persons and the CMM.

⚠ CAUTION

Risk of injury due to a workpiece sliding down as a result of a lubricating film on the measuring plate.

Crushing and severing body parts.

✓ Make sure that the measuring plate and the workpiece are free of lubricants before placing the workpiece on the plate.

- Clean the workpiece and the measuring plate before placing a workpiece on the measuring plate.
- Remove any greasy or oily substances from the measuring plate and the workpiece.

Fastening the workpiece on the measuring plate

Workpieces must always be clamped in order to prevent them from being moved, knocked over or falling down from the measuring plate. Any workpieces that have not been clamped endanger the personnel, the CMM and the workpiece.

⚠ CAUTION

Risk of injury if an unfastened workpiece falls down.
Crushing and severing body parts.

- Clamp the workpiece on the measuring plate before measuring the workpiece.

Precautionary measures

Certain safety measures have to be observed to avoid damage to the CMM and the measuring plate.

1. Do not exceed the permissible workpiece weight. See Technical specifications.
2. Carefully put the workpiece down on the measuring plate.
3. Never place the workpiece on the guideway.
   The function of the bearings could otherwise be adversely affected.
4. Lift and move heavy workpieces with a lifting device.
   - Approach the CMM slowly in order to avoid damage to the CMM.
   - Make sure that the workpiece or lifting device does not strike the CMM. Even light jolts may affect the functioning of the CMM.
   - Lower workpieces more than 15 kg in weight to the measuring plate at a maximum speed of 2 mm/s. The CMM may be damaged if the workpiece is set down hard.
5. Put the workpiece down vertically on the measuring plate.
6. Do not move the workpiece on the measuring plate.

The surface of the table could be scratched when sliding the workpiece, thus affecting measuring accuracy.

Damage caused by hard particles.
Any hard particles lying underneath the workpiece may lead to inaccurate measurements. Furthermore, the surface of the measuring plate and workpiece may become damaged.

✓ The workpieces must have full contact with the measuring plate.

- Clean the measuring plate before placing a workpiece or a clamping device on it.
- Always clamp the workpiece in such a way that it lies on the defined points of support (three-point support). This can be achieved, for example, by means of a clamping device.

Lowering the workpiece onto the measuring plate

Workpieces can be set down on the measuring plate either manually or by means of a lifting device.

SIPOS

Activate SIPOS when using a lifting device to set down workpieces on the measuring plate. SIPOS is an optional device which controls the travel movements of the CMM and the loading device.

Heavy workpieces

Heavy workpieces have a hard impact if they are lowered onto the measuring plate too quickly.

1 Lower heavy workpieces at a maximum speed of 2 mm/s.

2 First place the workpiece on elastic supports.

3 Then replace the elastic elements with rigid supports.

Metal blocks clamped by clamping devices can be used as rigid supports. Screw elements can be used alternatively. The screw fasteners must be screwed into the threaded holes in the measuring plate.

Positioning the workpiece

Position the workpiece so that all required measurements can be carried out without changing the workpiece position.

Measuring operation without collision

When using a changer rack, position the workpiece so that the measurement and the stylus system change can be carried out without collision.

– Position the workpiece such that no collision can occur during the measuring run.

Do not exceed the measuring volume

⚠ WARNING

Risk of injury due to exceeding of the measuring volume.
Crushing and cutting of body parts between the workpiece and supporting columns.

- Position the workpiece and clamping devices within the measuring volume.

Clamping the workpiece

Workpieces must always be clamped.

– Clamp all workpieces securely in place.

The reasons for this are:

– The workpieces cannot be knocked over inadvertently.

– The workpieces cannot be moved or knocked over by probing or collision.

When clamping, the maximum permissible torque for the screws used must be observed.

NOTE

Workpieces made of soft materials may be deformed by chucks, thus falsifying the results of the measurement.

- If necessary, use special chucks to avoid deforming of the workpieces.

Clamping equipment

Chucks must be screwed onto the measuring plate.

Metal, plastic, wood

Chucks are generally made of metallic materials. Chucks made of plastic or wood may also be used if necessary.

Start-up checklist

Switching the CMM on

- Has the CMM been switched on in the correct order? ➢ *See [⇨ 6-6]*
  - Power supply connected?
  - Control cabinet switched on?
  - Ram protection activated?
  - Drives switched on?
  - Operating mode selected?
  - Computer switched on?
  - Measuring software started?
  - Light barrier activated? ➢ *See [⇨ 2-20]*

Mounting the probe

- Has the probe been secured on the ram with a screw? Torque: 2,2 Nm. ➢ *See [⇨ 6-8]*

Stylus system assembly

- Have the criteria for the assembly been observed?

  See operating instructions »Sensors«.
- Have the limit values for the stylus system been observed?

  See operating instructions »Sensors«.

Clamping the workpiece

- Is the workpiece in the correct position? ➢ *See [⇨ 6-15]*
- Is it possible to measure all workpiece dimensions in one cycle?
- Is measurement possible without collision? A collision with the changer rack, for example.
- Has the workpiece been clamped properly?

7

Measuring operation

This chapter contains:

What you should know! 7-2

Safety during the measuring operation 7-5

Preparation for measuring operation 7-9

Probing the workpiece 7-20

Evaluation of the measuring results 7-23

Terminating the measuring operation 7-25

What you should know!

Measuring software

For the preparation work and the actual measurements, special software is required. Examples: CMM-OS (interface software) and CALYPSO (measuring software).

– Please read the corresponding chapters in the operating instructions for the measuring software before operating it.

Operating mode

A distinction is made between two operating modes: MAN and AUTO. The two operating modes differ from each other in their maximum possible travel speed in the CMM axes.

MAN operating mode (set-up mode)	– Travel movements are performed manually using the joysticks on the control console. – The maximum travel speed is limited to a certain value. The travel speed can be reduced by means of the control knob on the control console.
AUTO operating mode (batch measurement mode)	– Travel movements are performed in an automatic run. – The maximum travel speed can be reached.

The operating mode is set by means of the *key-operated switch* on the controller cabinet.

NOTE

The AUTO operating mode may only be selected for measurement runs tested previously.

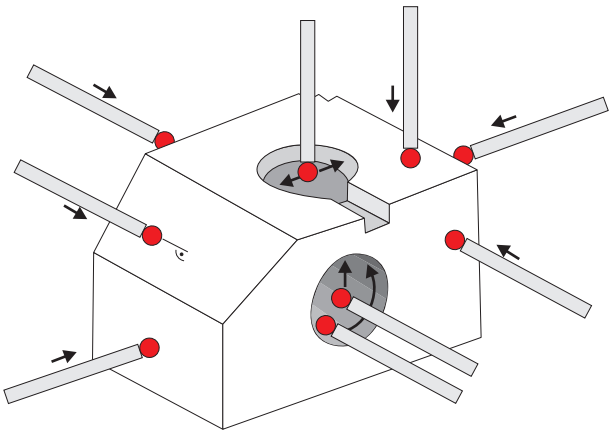
Coordinate systems

There are three coordinate axes corresponding to the travel movements: X, Y and Z. Together these axes form a machine coordinate system. Additional coordinate systems, e.g. a workpiece coordinate system, are required for exact calculation.

More information can be found in a separate brochure. See Operating instructions for the measuring software.

Probing and scanning

Workpieces may be probed from any directions. The illustration shows the possible probing directions and the scanning of a bore.



Using the measuring software, it is also possible to probe oblique surfaces perpendicular to the probing surface. See operating instructions for the measuring software.

NOTE

Clamp a workpiece before probing. Otherwise, the workpiece may be shifted by the probing. Correct measurement is not possible if the workpiece is shifted.

NOTE

In the ideal case, probings should be performed perpendicular to the probing surface.

Tips for effective operation

Changing the stylus systems automatically

If several stylus systems are required for workpiece measurement, you should note which stylus system you have assigned to which holder. If more stylus systems are required than can be accommodated by the changer rack, it is possible to mount additional changer racks.

Do not switch off the CMM if ...!

The start-up procedure involves a number of worksteps which take a while to perform. Furthermore, the CMM should have been in operation for a prolonged period before performing the first measurement. You can save time by leaving the CMM switched on.

In order to avoid that the measured values are influenced by switching on and off, the CMM should be switched off as seldom as possible. We recommend that you switch off the CMM only in the following cases:

– In case of longer shutdown, for example during the weekend

– Maintenance work.

Automatic stylus system change

A changer rack is required for automatic changing. Before it is possible to change a stylus system automatically, preparations have to be made first.

– Allocate a rack holder.

  A specific holder in the changer rack must be allocated to each stylus system. You should note which rack holder is allocated to which stylus system.

NOTE

The measuring software is required in order to carry out this procedure. Please refer to the operating instructions for the measuring software.

Safety during the measuring operation

Safety instructions

Ram collision protection

⚠ CAUTION

Risk of injury due to disabled collision protection.
If collision protection is disabled, personal injury may occur and the CMM could be damaged.

- Enable collision protection before starting the measuring operation.

Set-up work

Risk of injury due to travel movements at high speed. Therefore, any set-up work in the danger zone of the CMM may be carried out only if special precautionary measures have been taken.

⚠ CAUTION

Risk of injury due to travel movements in set-up mode.
Crushing and severing of body parts. Risk to the eyes caused by the styli.

- Set the MAN operating mode.
- Withdraw the key and keep it with you. Ensure that nobody can switch to the AUTO operating mode.
- Reduce the maximum travel speed either via the control knob on the control console or in the measuring software.
- Always keep the control console within reach in order to be able to press the *EMERGENCY STOP button* in case of emergency.

Performing a homing run

After start-up, travel movements may only be carried out to a limited extent using the joysticks located on the control console. Cause: No end positions of the axes have been defined yet. Possible consequences: Danger to personnel and damage to the CMM.

⚠ CAUTION

Risk of injury if the travel movement exceeds the end positions.

Crushing and severing of body parts. Risk to the eyes caused by the styli.

Damage to the CMM.

✓ Before performing unlimited travel movements, the end positions must have been defined.

- After start-up, home the machine first.

After this, travel movements can be performed without restrictions using the joysticks.

⚠ CAUTION

Risk of injury during homing as a result of an automatic sequence.

Crushing and severing of body parts. Risk to the eyes caused by the styli.

- Ensure that nobody is endangered by the travel movements.

Electromagnetic fields

⚠ CAUTION

Impairment of the function of electronic components due to electromagnetic fields.

The functioning of active implants may be impaired.

- Keep a minimum distance of 100 mm from the VAST probe or another magnetic sources such as magnetic clamping equipment.

Precautions

Automatic measurement runs

Collisions due to measurement runs that have not been tested
Damage to the CMM and workpiece.

- Test measurement runs at reduced travel speed before starting them at maximum speed.

  The travel speed can be reduced using the control knob on the control console or in the measuring software.

Magnetic effect

Magnetic effect of workpieces, clamping devices, and probes
Data loss, e.g. on diskettes and credit cards

- Keep data carriers away from magnetic materials.

Liquids

Faults due to liquids in electrical equipment
Impairment of the CMM function.

- Keep liquids away from the CMM to exclude unintentional penetration of liquids into the electrical equipment.

Radio signals

Interference caused by radio signals
Malfunctions of the CMM

- Do not use any cell phones or walkie-talkies within a radius of 3 m around the CMM.

Lateral styli

Collision of laterally projecting styli with the cover or the changer rack
Damage to the stylus

- Ensure that there is no risk of collision between the styli and parts of the CMM.

Faults due to vibrations and shocks

NOTE
Vibrations and shocks may impair the function of the CMM.

Possible causes of vibrations are for example:

- Heavy machine tools
- Transporters
- Presses

Measuring force for qualification

NOTE

Different qualification methods are available in the measuring software. For some qualification methods, the measuring force has to be considered. Please see the user guide for the measuring software.

Batch measurement mode

NOTE

If the constant presence of the operator during batch measurement cannot be guaranteed, the relevant safety regulations for unattended operation must be observed. Access to the CMM by unauthorized persons must be prevented by appropriate measures.

Observe the following regarding the batch measurement mode:

- Only authorized persons may work with the CMM.
- The set-up man must instruct the operator as to the operating position of the CMM.
- During automatic measurement runs, the control console must be placed outside the danger zone of the CMM.
- The control console must be equipped with a sufficiently long connecting cable to ensure that the CMM can be operated from all sides if necessary.

  You are even more flexible if you use the wireless control console. **NOTICE! The wireless control console must be inserted in the docking station during automatic measuring runs.**
- All existing safety equipment must be used. Make sure that no one is in the danger zone.
- For more information on the safety equipment, please refer to the separate “Installation site requirements” brochure.

Preparation for measuring operation

Prerequisites for a precise measuring run

The following preparations have to be made to ensure maximum accuracy when measuring with the CMM.

The CMM must be adapted to room temperature prior to the measuring run. Recommendation: The CMM should always remain on.

1 Switch the CMM on at least *30 minutes* before starting the measuring run.

The heat of the hand may influence the properties of probe holder and probe. The components should therefore be installed before starting the measurement.

2 Mount the probe to the CMM at least 15 minutes before starting the measuring run.

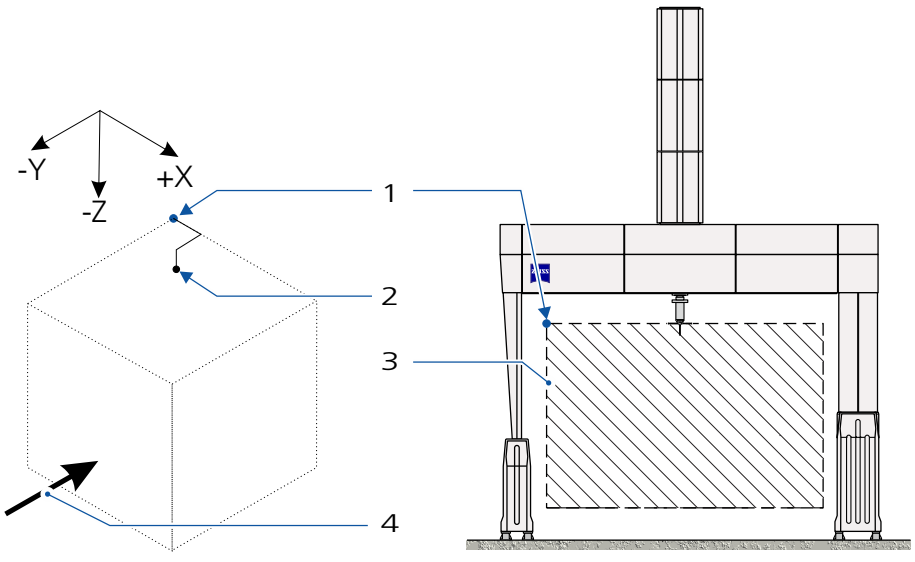
3 Always carry out a reference measurement after the reference point travel and qualify each stylus used for measurement.

4 Carry out temperature compensation. ➢ *See [▷ 7-17]*

Homing run

Home position

The home position corresponds to the origin of the machine coordinate system. It is located in the upper left corner of the measuring volume. The home position must be determined by a homing run *prior* to the measuring run.



1 Home position (= origin of the machine coordinate system)
2 Park position, signs of the coordinates: +X, -Y and -Z
3 Measuring volume
4 Front view

Performing a homing run

A homing run has to be performed after every start-up of the CMM in order to determine the home position. By determining the home position, the end positions of the CMM are determined, too.

Before starting the homing run, make sure that the probe is within the measuring volume. Otherwise, homing will not be possible.

Safety instructions

⚠ CAUTION

Risk of injury during homing as a result of an automatic sequence.

Crushing and severing of body parts. Risk to the eyes caused by the styli.

- Ensure that nobody is endangered by the travel movements.

NOTE

The home position cannot be approached with laterally projecting styli.

- Remove the stylus system from the probe if styli project too far.

NOTE

The homing run is performed automatically. The probe moves first in all axes up to 60 mm away from the home position, then in the Z axis up to the mechanical end position and then in the X and Y axes. If a rotary table is available, the rotary table homing run will be performed afterwards.

Make sure that the homing run can be carried out without any collisions.

- Move the probe to a position from where the homing run can be performed automatically.

NOTE

If the stylus system installed on the RDS articulating system has been swiveled to the side, the stylus system may collide with CMM parts during the homing run. Additionally, there is a risk of collision in the measuring range, for example with the workpiece.

- To avoid collisions, move the RDS to the 0°/0° position.

Starting the automatic run

The homing run is started by the measuring software. Please refer to the operating instructions for the measuring software.

Park position

After homing, the probe moves to the park position. The park position coordinates are defined in the measuring software. The coordinates must be inside the measuring volume.

Example of a park position: X = 30, Y = -30, Z = -30.

NOTE

The position of the reference sphere has to be redetermined in the following cases after a homing run:

Case 1: Redetermination is necessary if a *stylus system* needs to be requalified. This is required, for example, after supplementing or replacing a stylus and after a collision.

Case 2: Redetermination is necessary if the position of the *changer rack* or holder has changed.

Stylus system qualification

What you should know!

Why is qualification necessary?

By means of qualification, the stylus vector and diameter are determined. This data is required to determine the coordinates of the probed point.

The reference measurement has to be carried out before determining the stylus vector.

In which cases is qualification necessary?

Qualification is necessary in the following cases:

- After a collision
- When the ambient temperature varies considerably and if the stylus system consists of components having different expansion coefficients.
- When inserting a new stylus into the stylus system.
- When mounting a new probe.

What should be observed during qualification?

Take the following steps during qualification:

– Perform a reference measurement; use a master stylus.
– Select the stylus to be qualified.

NOTE

Usually, the qualification process is carried out semi-automatically.
Please refer to the operating instructions for the measuring software.

Preparation

What is required for qualification?

The following is required for qualification:

– Reference sphere

  Usually, a high-precision ceramic sphere is used.

– Master stylus

  The master stylus must be used for the reference measurement. ➢ *See [⇨ 7-13]*

– Styli required for workpiece measurement.

Information about the master stylus:

Red dot

The master stylus has different features with regard to length and diameter of the stylus tip. The features depend on the probe used. Normally, the master stylus is marked with a red dot.

The properties of master styli for the various probes are listed as follows:

Probe	Master stylus		
	Threads	Length	Diameter of the stylus tip
	[mm]	[mm]	[mm]
VAST gold	M5	64	8
VAST XT gold	M5	64	8
VAST XTR gold	M5	64	8
VAST XXT TL1	M3	30	5
VAST XXT TL3	M3	30	5
VAST XXT TL4	M3	125	5

Requirements for proper qualification

Before starting qualification, make sure that the following prerequisites are met:

– The stylus is stable.
– All stylus system components are screwed together tightly.

– The limit values for assembly of the stylus system have been observed.
– The reference sphere, the stylus tips, and the adapter plate are clean and not damaged.
– Stylus system components have not been damaged.

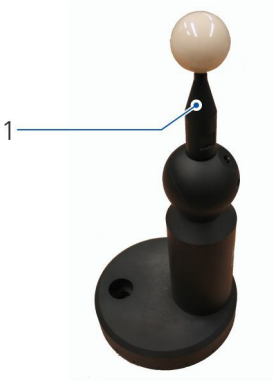
Fastening the reference sphere holder

Place the reference sphere holder on the measuring plate and screw it into a threaded hole in the measuring plate (max. torque 35 Nm).

NOTE

Select the position of the reference sphere holder so that the reference sphere can be probed with all styli.

If it is not possible to qualify certain styli, you may change the orientation of the reference sphere. Example:



1 Vertical orientation of the reference sphere

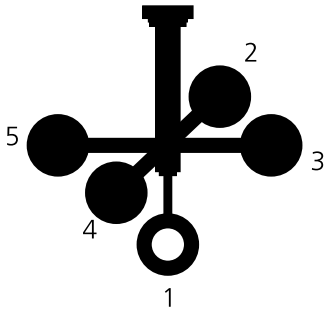
Performing a reference measurement

The position of the reference sphere must be determined before the stylus vector can be determined. Use the master stylus for this purpose. Proceed as follows:

1 Insert the master stylus.

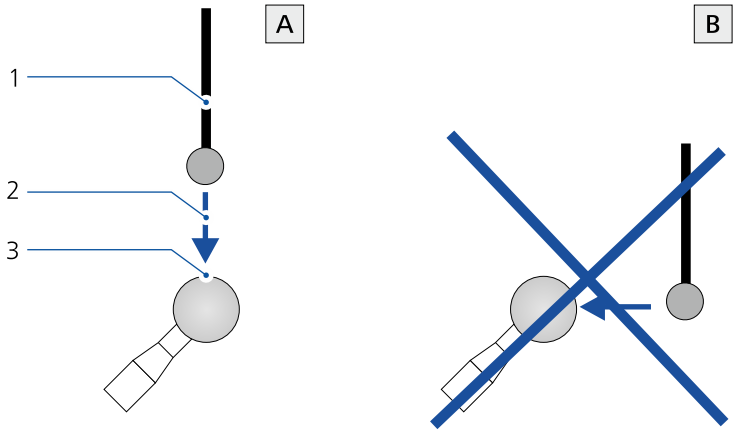
2 Open the menu for the reference measurement. Please see the user guide for the measuring software.

3 Select stylus 1 on the control console.



4 Probe the reference sphere in the Z axis.

The reference sphere is measured, determining its position.



A Correct
B Incorrect
1 Stylus shaft
2 Probing direction
3 Reference sphere; probing on the pole.

5 Remove the master stylus.

All styli can now be qualified.

Qualification procedure

After the reference measurement has been carried out, the stylus systems can be qualified.

NOTE

During qualification, the temperature effect should be taken into account.

- Prior to qualification, carry out temperature compensation.

NOTE

For measuring probing systems, a *Tensor qualification* should be performed. This is important because the measuring force causes a certain amount of stylus bending. Tensor qualification makes it possible to correct the bending for all subsequent probing operations.

Tensor qualification must be carried out *by means of vectors*. All axes can move.

NOTE

Different qualification methods are available depending on the application. Please refer to the operating instructions for the measuring software.

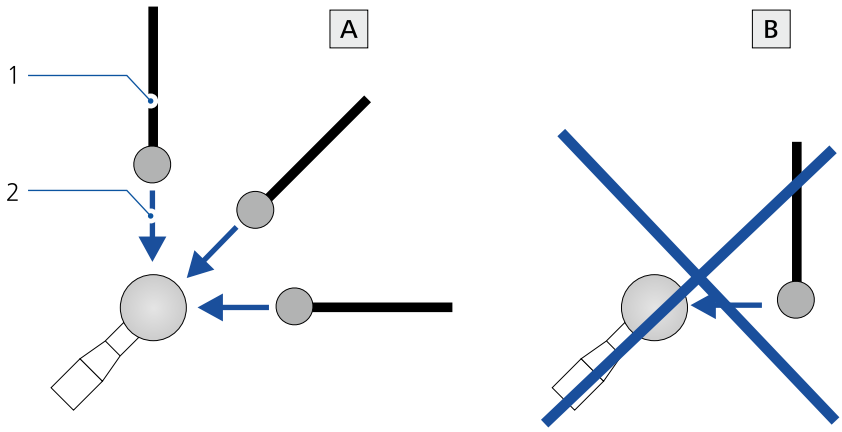
1 Install the stylus system.

2 The menu for the qualification appears in the measuring software. Please refer to the operating instructions for the measuring software.

3 On the control console, select the stylus you want to qualify.

4 Probe the reference sphere in the shaft direction of the stylus and measure its diameter.

The shaft of the reference sphere may not be probed during the qualification.



Probing directions during qualification

A Correct
B Wrong
1 Stylus shaft
2 Probing direction

5 Check the result.

The result is evaluated according to the standard deviation. There is no maximum standard deviation which applies to all applications. The toleranceable deviation depends on many factors: for example resolution and precision of the CMM, length and rigidity of the stylus shaft, quality of the stylus tip, cleanness of the environment. Normally, the standard deviation should be within a range of a few micrometers

If the result is not satisfactory, repeat the qualification or look for plausible causes. It may be necessary to decide whether or not to accept measuring inaccuracies.

Note: If measured values scatter despite good values for the standard deviation, or unexpected deviations occur, then you should check the stylus system and replace it if necessary.

6 Repeat steps 2 to 4 for all other styli of the stylus system.

7 Qualify additional stylus systems if necessary.

In this case, repeat steps 1 to 5.

NOTE

If high precision is required or in case of high temperature variations, the qualification procedure should be repeated regularly.

When the CMM has been in operation for several weeks without interruption and the same stylus systems are always required for measurement, the stylus systems should be qualified at least once a week. For requalification of already qualified styli, six probing points are sufficient.

Causes of large deviations

If large deviations occur during qualification, measuring inaccuracies will be caused during subsequent measuring operation. In order to avoid such inaccuracies, the mechanical design of the corresponding stylus system should be checked.

Sources of errors

The sources of malfunctions and errors which may lead to increased deviations are listed below.

- Stylus system configuration
- Stylus status
- Magnetic field
- Influence of temperature

Influence of temperature

The stylus is inserted manually and qualified immediately. Due to the heat of the hand, the temperature of the probe material and the material properties change as a result thereof. Minor differences in temperature already influence the material properties. The effect depends on the stylus system components. For the temperature effect to be as low as possible, wear gloves while handling the stylus system and insert it into the adapter plate receptacle

See also

- ➢ *Causes of scattering and measurement errors [⇨ 7-23]*

Temperature compensation

What is temperature compensation?

The measuring software calculates the workpiece geometry for the material properties at 20 °C. 20 °C is the reference temperature for length measurements according to DINENISO1. Since the actual temperature deviates from the 20 °C, the geometric data have to be corrected by a correction value.

Expansion coefficient

The correction value is calculated by the measuring software. However, the measuring software needs to know the temperature of the CMM and the workpiece. Furthermore, the expansion coefficient must be entered in the measuring software. See operating instructions for the measuring software.

We can differentiate between two cases:

Case 1:	No temperature sensor can be connected to the CMM. 1. Determine the temperature of the workpiece. 2. Enter the temperature of the workpiece and the expansion coefficient for the workpiece material in the measuring software. The measuring software calculates the correction value.
Case 2:	Connecting a temperature sensor to the CMM is possible. 1. Enter the expansion coefficient for the workpiece material in the measuring software. 2. Connect the temperature sensor. The measuring software calculates the correction value.

NOTE

The measured values are automatically transferred to the measuring software. The measuring software calculates the correction value.

All of the geometric data measured on the workpiece are corrected by the correction value with respect to the reference temperature of 20 °C. Workpieces can be measured accurately by means of the correction.

When should temperature compensation be carried out?

Temperature compensation can be carried out continuously. In the following cases, it is imperative to carry out a temperature compensation:

- After every start-up.
- As a test measurement:
  - If the ambient conditions change greatly during the day, you should carry out at least one test measurement per day.
  - You should also carry out test measurements when the CMM has been in operation for several weeks. In case of constant ambient conditions, one test measurement per week is sufficient. In case of varying ambient temperatures, test measurements should be carried out more frequently.

Connecting the temperature sensors

A temperature sensor is required for the temperature compensation. Two temperature sensors are included in the delivery.

The temperature sensor consists of a copper block, a long cable and a connector.

1 Copper block
2 Connector
3 Connection socket on CMM

1 Plug the connector into the connection sockets.

The connection sockets are located on the rear side of the CMM. Two sockets are available.

2 Place the copper blocks at two different locations in or on the workpiece to be measured.

Probing the workpiece

How to ensure correct measurement

NOTE

Regular inspection of the stylus systems is required to ensure correct workpiece measurement.

- If particles adhere to the stylus tip or a lubricating film has formed, the stylus tip must be cleaned.
- When the stylus has become damaged, it must be replaced.
- The adapter plate must likewise be free of impurities and must be cleaned, if necessary.

Probing procedure

What you should know!

The type of probing depends on the measuring job and the required number of measuring points. Position measurement requires only one or more discrete-point probing actions. Multipoint probing or scanning can be used when determining dimensions. Scanning must be used for form measurements.

NOTE

The following conditions must be fulfilled for probing: These conditions depend on the probing system. See brochure »Sensors«.

Probing conditions

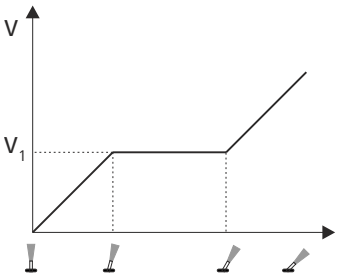
- Constant probing speed.
- Minimum distance to the contact point.

  A minimum distance is required to reach the probing speed. The minimum distance should be 2 to 4 mm. In case of smaller distances, the probing time increases.

Probing speed

Probing should be carried out at constant travel speed.

The travel speed depends on the deflection of the joystick. At the beginning and end of the deflection range, the travel speed is proportional to the amount of deflection. The travel speed between the beginning and the end is constant. This speed corresponds to the probing speed.



Probing speed as a function of the joystick deflection

v Travel speed

v_1 Probing speed; optimum travel speed during probing.

With full deflection of the joystick, the maximum possible travel speed is reached which can be reached in the MAN operating mode. The actual travel speed depends on the default value defined in the measuring software and the position of the control knob on the control console.

Proceed as follows:

1 Enter a default value of 100 % in the measuring software.

2 Adjust the travel speed using the control knob on the control console.

If the control knob is turned clockwise as far as possible, the maximum possible travel speed corresponds to the default value, e.g. 100 %, defined in the measuring software.

The control knob makes it possible to reduce the travel speed to zero. If the travel speed reaches a value of less than 10 % of the default value, this will be indicated on the control console. An LED on the standard control console lights up.

- If the probing speed is too high for certain probing operations, reduce the maximum possible travel speed.

NOTE

When probing oblique workpiece surfaces at an angle between 30° and 50°, the probing speed should be reduced.

Particularities of probing systems

For the various probing systems, certain points must be observed: For more information, please refer to the separate brochure »Sensors«.

Preventing measuring errors

Measuring errors may have several causes. Answer the following questions before starting the measurement:

Checklist for the prevention of measuring errors:

Questions	Yes / No
Are the probing surfaces of the workpiece clean and oil free?	
Is the workpiece secured against shifting?	
Are the structural criteria of the stylus system fulfilled?	
Are the stylus system and the stylus in perfect condition?	
Has the reference point travel been carried out?	
Has the reference measurement been carried out?	
Has the qualification been carried out correctly?	
When using a measuring probing system, has tensor qualification been performed?	
All styli qualified?	
Has the correct stylus been selected?	
Has the temperature compensation been carried out?	

Evaluation of the measuring results

Limit values for deviations

Standard deviation

The result is evaluated according to the standard deviation. There is no maximum standard deviation which applies to all applications. The tolerable deviation depends on many factors: for example resolution and precision of the CMM, length and rigidity of the stylus shaft, quality of the stylus tip, cleanness of the environment, surface and form of the workpiece.

It may be necessary to decide whether or not to tolerate measuring inaccuracies.

Causes of scattering and measurement errors

The sources of malfunctions and errors which may lead to increased deviations are listed below.

Source of error	Cause
Home position	– No reference measurement has been carried out.
Temperature compensation	– No temperature compensation performed. – Incorrect temperature compensation, for example a wrong material coefficient has been entered.
Status of the reference sphere and of the stylus system	– The setup of the reference sphere is not stable. – The reference sphere or stylus tip is soiled, oiled or damaged. – The stylus system components or adapter plate are/is damaged.
Reference sphere holder	– The bottom side of the reference sphere holder is damaged. – The tightening torque is too high or too low.
Stylus system configuration	– The structure of the stylus system is not stable. – The stylus system components are not screwed together firmly enough. – Admissible probe limiting values have not been observed. The stylus system is too long, too heavy or contains components which are not suitable.

Source of error	Cause
Workpiece condition	– The workpiece shows signs of deformation and roughness. – The workpiece is soiled. – The workpiece is covered with oil, for example drops of oil in the small bores. – The workpiece material is too soft.
Magnetic field	– A malfunction was caused by a magnetic field. Possible causes of a magnetic field: for example workpiece, clamping tool, stylus system extensions.
Qualification	– Different axis clamping set than for qualification. – Different measuring force set than for qualification (depending on the measuring method, with measuring probes)
Probing	– Probing has not been performed perpendicular to the probing surface.

Terminating the measuring operation

What you should know!

If you put the CMM out of operation, the following data will be lost:

– Home position

– Information about the current valid coordinate system

When starting the machine again, a homing run has to be carried out.

The desired workpiece coordinate system must be called again in the software.

Shutting down the CMM

After the CMM has been shut down, the probe remains in its last position. The probe's position coordinates are lost. To avoid malfunctions when the CMM is put back into operation, the measuring operation should be finished correctly.

– Proceed in the described order.

1 Move the probe to a safe position.

This position must be inside the measuring volume. Prepare for the next CMM start by positioning the probe close to the home position.

2 Move the probe holder to its initial position.

- Turn the articulating system to the 0°/0° position.

3 Close the measuring software.

4 Shut down the operating system.

5 Switch off the computer.

6 Switch off the drives using the key shown here.

The drives are have been switched off if the LED above the key is *not* lit.

7 Switch off the controller.

8 Switch off the power supply.

- Turn the main switch counterclockwise to the «0» position.

8 Errors and faults

This chapter contains:

Errors occurring prior to the measuring operation 8-2
Malfunctions during measuring operations..... 8-3
Special measures..... 8-5
Service features..... 8-8

Errors occurring prior to the measuring operation

If the CMM cannot be started, check whether the following errors can be excluded:

Errors	Cause	Measure	Check
The CMM cannot be started.	Wrong start-up sequence.	– Follow the specified order. – First, switch on the CMM and then the computer.	
Power Supply	The *main switch* is not on.	Connect power supply: – Turn the *main switch* to the «1» position.	Position «1» must be visible.
Controller	The controller is off.	Switch the control unit on: – Turn the *rotary switch* clockwise.	The indicator lamp in the rotary switch must be lit.
Drives	The drives are off.	Switch on the drives: – Push the *button* on the controller cabinet. There is a button on the BP26SE control console to turn on the drives.	The indicator lamp of the button must light up. In the BP26SE control console, the LED above the button is lit.
	The *EMERGENCY STOP button* on the control console is locked.	Unlock the button: – Slightly turn the *EMERGENCY STOP button*.	The button pops out a few millimeters.
	The *EMERGENCY STOP button* on the control console is locked.	Unlock the button: – Slightly turn the *EMERGENCY STOP button*.	The button pops out a few millimeters.
Pressure	The compressed air line is defective.	– Check the compressed air line and the connections.	Pressure gauges
	The compressed air line is not connected.	– Connect the compressed air line.	

1 If the above mentioned errors can be excluded, put the CMM out of operation and repeat the start-up procedure.

2 If measuring operation is still not possible, call a ZEISS service engineer or our support team. ➤ *See [⇨ 8-8]*

Malfunctions during measuring operations

The following table helps you identify and eliminate malfunctions that occur during measuring operations.

NOTE

A malfunction can have different causes. One or more measures may be necessary to eliminate a certain cause. If two measures are specified, this does not mean that you have to take both of them to fix the problem.

Malfunction	Cause	Action	Check
No travel movement possible.	The *EMERGENCY STOP* button on the control console or the controller cabinet is locked.	Unlock the *EMERGENCY STOP* button: – Turn the button slightly.	The button pops out a few millimeters.
	Collision, for example with the workpiece.	– Eliminate the cause of the collision. – Reactivate the drives. – Reinitialize the CMM if necessary.	
	«AUTO» operating mode set or *key-operated switch* in «0» position.	– Turn the *key-operated switch* to «MAN».	
	A CNC function has been activated and is not yet complete, e.g. a semi-automatic measurement run.	– Wait until the measurement run is finished.	
	The CMM is in the end position.	See	
	The pressure is too low.	– Increase the pressure in the supply line.	Pressure gauges
	The filter is clogged.	– Change the filter.	
Travel movement too slow.	The set travel speed is too low.	Increase the travel speed: – Turn the control knob on the control console clockwise.	

Malfunction	Cause	Action	Check
	The default value set in the measuring software is too low, for example 50 %.	– Set the default speed value in the measuring software to 100 %.	
	The SLOW function is active.	– Deactivate the SLOW function via the control console.	Display on the control console
	The «MAN» operating mode is set during an automatic run.	Set the «AUTO» operating mode: – Turn the *key-operated switch* to the «AUTO» position.	
Stylus system change	No holder has been assigned to the stylus system.	– Assign a holder to the stylus system.	
	The position of the changer rack or holder has changed.	– Reassign the holder.	
	Collision: missing intermediate positions.	– Reassign the holder and set intermediate positions.	
	Two stylus systems have been assigned to one holder.	– Reassign the holder.	

Special measures

After a collision

If the ram or the probe collides with an obstacle, the guideway and other components of the CMM may become damaged. In this case, perfect measuring operation is no longer guaranteed.

– If measurements are not possible after a collision, call a ZEISS service engineer or our support.

Notes

NOTE

After a collision, the stylus system has to be requalified and the workpiece position (w position) has to be determined again.

NOTE

If measurements are not possible after a collision, call a ZEISS service engineer or our support.

NOTE

After a collision, the stoplight switches to red in the stoplight window. You have to switch back the stoplight to green before continuing measurement. Please refer to the operating instructions for the measuring software.

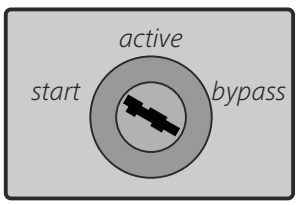
Collision between the probe and stylus

When the probe or stylus has collided with an obstacle and the drives have been switched off, proceed as follows:

1 Eliminate the cause of the collision.

2 Activate the collision protection.

- Turn the key-operated switch to «start» and hold until the corresponding indicator lamp lights up.



3 Reactivate the drives.

4 Check whether the stylus needs to be requalified.

NOTE

If the drives cannot be switched on, the CMM must be reinitialized. Please refer to the operating instructions for the measuring software.

Collision of the ram or the support column

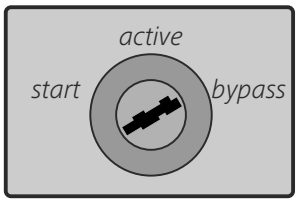
NOTE

If the ram or the probe collides with an obstacle, the guideway and other components of the CMM may become damaged. In this case, perfect measuring operation is no longer guaranteed.

If the ram or the support column runs into an obstacle, the drives switch off. After a collision, proceed as follows:

1 First of all, check if a probing action was registered due to the collision with the ram.

If a probing is indicated on the control console, this condition must first be deleted by moving the corresponding joystick.



2 Deactivate the collision protection by turning the key-operated switch to the «bypass» position.

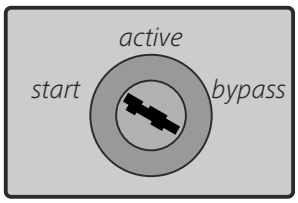
The indicator lamp for the deactivated collision protection is lit. In addition, a signal tone is heard.

3 Reactivate the drives.

If the drives cannot be switched on, the CMM must be reinitialized. For more information about the initialization procedure, please refer to the operating instructions for the measuring software.

4 Clear the CMM by means of the joystick.

5 Activate the collision protection.



- Turn the key-operated switch to «start» and hold until the corresponding indicator lamp lights up.

The drives switch off.

6 Reactivate the drives.

7 Restore the computer's normal state.

- Finish the automatic measuring run.

An automatic measuring run may not be carried out after a collision because it could result in another collision.

Collision during automatic stylus system change

A collision occurring during change may be caused by missing intermediate positions.

– Reallocate the holder to the stylus system and choose the intermediate positions so that changes can be carried out without collision.

CMM in end positions

A limit switch is activated when the CMM moves to the end position. The drives are switched off. In order to move the CMM again, the CMM must be cleared by instructed personnel.

Clearing the CMM

⚠ WARNING

Injuries can be caused when safety devices are disabled.
Crushing and severing body parts.

✓ Safety devices have been disabled.

- Clearing from the end position may only be performed by instructed personnel.

Damage to the CMM by manual movements.
The CMM can only be moved out of the end position by means of the joysticks. Never try to clear the CMM by sliding, pushing, or pulling CMM components.

- Move the CMM out of the end position by means of the joysticks on the control console.

1 Disable the safety devices.

2 Switch on the drives.

Check in which direction the CMM must be moved before operating the joysticks. The aim is to move the probe back into the measuring volume. You must not move the CMM away from the measuring volume.

3 Clear the CMM using the joysticks.

4 Reactivate the safety devices.

NOTE
After clearing, a homing run has to be carried out.

Service features

Support

If a malfunction cannot be eliminated and if it occurs again after a renewed start-up, call a ZEISS service engineer or our support in Oberkochen (Germany).

Telephone numbers for the support:

Within Germany:	0 73 64.20.6337
From abroad:	+49.73 64.20.6337

Teleservice

ZEISS offers fast and economical help in the form of online diagnostic tools. There are several options here.

Teleservice tools

- Online diagnosis of errors
- Online software update
- Online service
- Online training

If you are interested in this type of assistance, call our support team.

9

Maintenance and care

This chapter contains:

Maintenance..... 9-2
Lubrication..... 9-4
Care..... 9-5

Maintenance

Purpose of maintenance work

Maintenance work serves the following purposes:

- Safety during the measuring run
- Avoiding downtimes
- Measuring with the highest precision.

In order to guarantee these features in the long run, the CMM requires regular maintenance.

NOTE

Maintenance work must be carried out only by competent specialists. These persons must have received special training on the corresponding CMM qualifying them to carry out all necessary maintenance work.

Maintenance agreement

ZEISS offers maintenance agreements relieving you of any need to worry about maintenance.

NOTE

If you wish to subsequently conclude a maintenance agreement, call our support. ➤ *See [⇨ 8-8]*

Regarding maintenance work, a distinction is made between *Extensive maintenance* and *Little maintenance*.

Extensive maintenance:

- Performance of preventive maintenance actions on all components according to manufacturer specifications.
- Acquisition and correction of the geometry with laser and other measuring machines.
- Visual check of the data system.
- Test of the drives and motors in all axes.
- Calibration and recording of measuring results.
- Replacement of possible wear ana spare parts against invoice.

The scope includes the check of a combination of the probe and measuring software, for example VAST/CALYPSO. Further combinations will be billed separately on a T & M basis.

Little maintenance:

- Performance of preventive maintenance actions on all components according to manufacturer specifications.
- Check and correction of the geometry without laser measuring machine.
- Visual check of the data system.
- Test of the drives and motors in all axes.
- Calibration and recording of measuring results.

Maintenance intervals

The time intervals between two maintenance calls depend on the degree of utilization. Generally, maintenance should be carried out at least every 2000 operating hours.

NOTE

ZEISS recommends performing little and complete maintenance on an alternating basis: little maintenance in the first year and complete maintenance in the second year.

Components of maintenance work

Maintenance work includes inspection of the following:

Area	Examples
Safety devices (standard equipment)	For example drive monitoring; collision protection in the series measurement mode
Measuring system	For example functioning, precision
Control	For example operator's controls; control console
Drive unit	Motor and gear unit
Sensors	Probing system

NOTE

When concluding a maintenance agreement, you also must specify any optional equipment to be covered.

Lubrication

Some components of the CMM must be lubricated within the scope of maintenance work.

NOTE

Lubrication may only be carried out by competent specialists.

Components to be lubricated:

Component	Type of grease	Procedure
Drive spindles	**Klüber NBU 15**	3 - 4 strokes with the grease gun

Care

What you should know!

Although the CMM is robust and easy to care for, a certain degree of care is still required. The sensitive measuring system of the CMM requires a certain degree of cleanliness. Even the smallest dust particles on the stylus tip or the reference sphere may cause inaccurate measurements. Furthermore, the measuring plate requires daily care.

The measures for care also include the regular cleaning and checking of certain components.

Cleaning agent:

Medium	Purpose	Order number
Mild cleaning agent		
Contact 60	To pre-clean the contacts on adapter plates and the adapter plate receptacle of the probe carrier **NOTICE! Do not use for ball pairs in the adapter plate receptacle.**	000000-0118-669
Contact WL	For secondary cleaning of the contacts on adapter plates and the adapter plate receptacle of the probe carrier **NOTICE! Do not use for ball pairs in the adapter plate receptacle.**	000000-0118-666 (75 ml) 000000-0119-013 (200 ml)
Lint-free cloth, for example made of linen		
Vacuum cleaner		
Shellsol	Grease dissolving agent to clean the drive surfaces and the measuring plate	
Corrosion preventing agent **Rivolta T.R.S. Plus** (pump spray 300 ml)	To protect and clean the measuring plate	000000-0518-313
Solvent	To remove aluminum deposits from the stylus tip	

Safety instructions

⚠ WARNING

Risk of injury caused by travel movements.
Crushing and cutting of body parts.

✓ When carrying out care measures, make sure that no travel movements are performed.

- Switch the drives off in order to enable safe execution of the care measures.

⚠ CAUTION

Injuries can be caused by sharp edges.
Cutting or tearing of the skin.

- Be very careful and wear appropriate clothing, if required, e.g. gloves.

⚠ CAUTION

There is a risk of injury if filters are replaced under pressure.

- Switch off the compressed air before replacing the air filters.
- Disconnect the compressed-air supply from the power supply.
- Make sure to depressurize the line.

Measures of precaution

Contamination of components by compressed air.
The functioning of some sensitive components may become impaired by dust particles.

- Do *not use compressed air* for cleaning the CMM.

NOTE

Use *grease-dissolving* and *non-corroding* cleaning agents.

NOTE

Preventive care also includes making sure that all workpieces to be measured are clean. The workpieces must be free from machining residues (e.g. metal chips, oil) and dust.

- Clean the workpieces before placing them on the measuring plate.

Overview

The components requiring care are listed below. The specified time intervals apply only if all installation site requirements have been met.

Care measures:

Object	Interval	Type of care	
Measuring plate	Every week or more frequently	Vacuum cleaner, cleaning agent	➤ *See [⇨ 9-8]*
Grooves and boreholes	Weekly	Vacuum cleaner	➤ *See [⇨ 9-8]*
Stylus tips	At least every week	Depending on the degree of contamination: – Cleaning agent – Solvent for removing aluminum deposits	➤ *See [⇨ 9-9]*
Reference sphere	Weekly	Cleaning agent	➤ *See [⇨ 9-9]*
Adapter plate	As required	Fluff-free cloth; using a cleaning agent if required	➤ *See [⇨ 9-10]*
Probe	As required	Dry or damp cloth	➤ *See [⇨ 9-10]*
Changer rack	Monthly	– Vacuum cleaner – Use a cleaning agent if required	➤ *See [⇨ 9-10]*
Bellows cover	Monthly	Vacuum cleaner	➤ *See [⇨ 9-10]*
Control console	Monthly	Dry or damp cloth	➤ *See [⇨ 9-11]*
Housing covers	Monthly	Mild, normal cleaning agent	➤ *See [⇨ 9-11]*

Inspection measures:

Stylus system	At least every week	Fluff-free cloth; using a cleaning agent if required	➤ *See [⇨ 9-11]*
Filter mat to ventilate the controller cabinet	Every three months	– Clean by beating and vacuuming – Replace the filter if required	➤ *See [⇨ 9-11]*
Filters for compressed air	As required	Check	➤ *See [⇨ 9-12]*

Care measures

Measuring plate

The bearing surfaces of the workpiece or the clamping device and the measuring plate must be clean. Any particles lying underneath the bearing surface may lead to inaccurate measurements. Furthermore, the surface of the measuring plate and workpiece may become damaged.

Before placing a workpiece on the measuring plate, make sure that the measuring plate is clean.

⚠ CAUTION

Risk of injury when a workpiece falls down due to an oily substance.

Crushing of feet and abrasions on legs.

✓ The measuring plate and the workpiece must be *free from any lubricating film*.

- Remove any greasy or oily substances from the measuring plate and the workpiece.

⚠ CAUTION

When using anticorrosive agents, there is a risk of slipping.

- Do *not* treat measuring plates to be walked on with anticorrosive agents that leave a lubricating film on the measuring plate surface.

1. Remove large particles with a vacuum cleaner.
2. Then clean the measuring plate with a grease dissolving agent, such as Shellsol.
3. After that apply an anticorrosive agent to the measuring plate, making sure that it does not leave any grease film on the measuring plate surface, for example: Rivolta K.S.P. Apply the agent sparingly.

NOTE

Make sure that no cleaning agent residues remain on the measuring plate.

Grooves and boreholes

For fastening workpieces, changer racks, and qualification tools, there are grooves and boreholes on the measuring plate, which can be contaminated with dust.

– Clean the grooves and vacuum-clean possible contamination from the boreholes.

Stylus tips

Stylus tips may be contaminated, e. g. by dust particles. Furthermore, material rubbed off of the probed workpiece may accumulate on the stylus tip, especially during scanning.

NOTE

The styli must be handled carefully. If force is applied, the glued bond between the stylus tip and the stylus shaft may be dissolved and the stylus shaft may bend or even break.

Do not apply any force when cleaning.

NOTE

If the styli are not being used, store them in a safe place, ideally in the packaging intended for this purpose.

– Clean the stylus tips with a lint-free cloth.

– Use a cleaning agent if required.

  Make sure that the stylus tip is free from cleaning agent residues.

If material from the workpiece settles on the stylus tip, it can be removed with a suitable solvent.

Removing aluminum deposits

Aluminum deposits can be removed with a solvent. Make sure that the solvents do not act too long since the glued bond between the stylus tip and the stylus shaft may be affected. When cleaning, proceed as follows:

1. Wear rubber gloves and safety goggles.
2. Immerse a cloth (e.g. cotton cloth) in a solvent and clean the stylus tip with the cloth.
3. Then rinse the stylus tips immediately with water and dry them.

Reference sphere

The reference sphere must be clean and in perfect condition to ensure correct qualification.

– Clean the reference sphere with a lint-free cloth.

– Use a cleaning agent if required.

  Make sure that the reference sphere is free from cleaning agent residues.

Adapter plate and adapter plate receptacle

The adapter plate and the adapter plate receptacle must be protected against soiling.

1. First, clean the adapter plate and the adapter plate receptacle using **Kontakt 60**.
2. Then clean the adapter plate and adapter plate receptacle using **Kontakt WL**.
3. Dry the adapter plate and the adapter plate receptacle in order to prevent oxidation of the contacts. **NOTICE! Ensure that there are no cleaning agent residues. The function of the adapter plate and adapter plate receptacle may be impaired.**

NOTE

The adapter plate receptacle must be protected against soiling. Besides, adapter plates that are not required must be stored in a safe place.

- Always leave an adapter plate at the adapter plate receptacle.

Probes and probe holders

Wipe off the probes and probe holders with a dry or damp cloth.

– Store a probe or a probe holder in a dust-free and clean place, for example in a cabinet or drawer, whenever it is not in use.

LineScan

The laser beam outlet window on the probe must be free from dirt particles and smears.

– Clean the window using a dry, lint-free cloth or a brush.

Changer rack

Vacuum the changer rack and the holders and clean them with a mild cleaning agent.

– Remove all cleaning agent residues.

Bellows cover

Vacuum the movable cover and clean it with a damp cloth.

NOTE

The cover must not be removed.

Control console

The control console can be wiped with a damp cloth. A mild cleaning agent can be used here.

No humidity is allowed inside of the control console. For cleaning, use only a damp cloth cloth. The cloth may not be wet.

Housing covers

Vacuum the housing covers and clean them with a damp cloth.

NOTE

The covers must not be removed.

Inspection measures

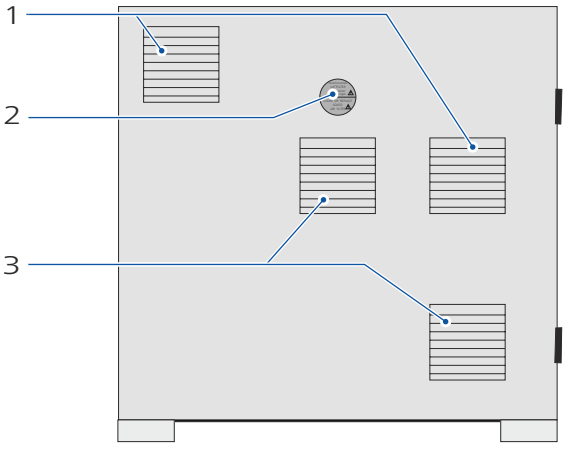
Checking the stylus system

Regular inspection of the stylus systems is required to ensure correct workpiece measurement.

1. Check the styli at regular intervals.
2. Remove any particles or grease film from stylus tips.
3. Replace any damaged styli.

Cleaning or replacing the filter mats of the MCC 800 controller cabinet

The interior of the controller cabinet is cooled by a fan attached to the rear side of the controller cabinet. The filter mats must be cleaned at least every three months.



MCC 800 controller cabinet; rear

1 Air filter

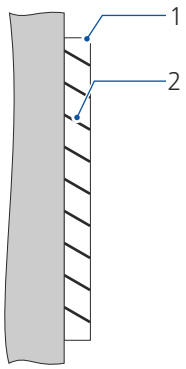
2 Adhesive label indicating replacement or cleaning of the filter mats
3 Air filters of the fans

1 Remove the air filter cover.

2 Clean or replace the filter mat.

The air filter lamella must lie deeper on the outside than on the inside. See illustration.

3 Place the cover on the air filter.

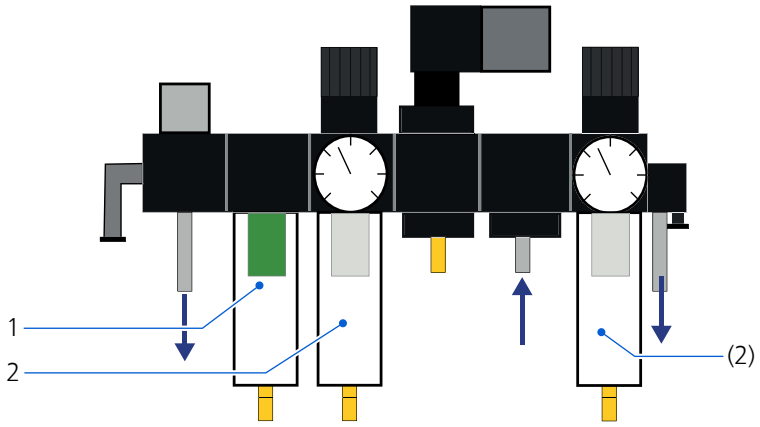


Alignment of the cover

1 Cover
2 Lamella of the cover

Checking the compressed air filters

The service unit is equipped with at least two filters. The CMM is usually equipped with a fine filter and an extra fine filter. The filters have to be checked regularly. The transparent filter caps make it possible to check the degree of soiling.



Service unit for compressed air supply

1 Fine filter with filter element
2 Extra fine filter with filter element

Filter replacement should take place every 2000 operating hours at the latest. If one of the filter elements significantly changes color before expiry of this interval, you should replace the filter elements. To order the filter elements, please call our support team or contact a ZEISS service engineer. Different filter elements are used in the filters.

Changing the filter

⚠ CAUTION

There is a risk of injury if the filter cap is removed under pressure.

- Shut off the pressure before starting work on the service unit.
- Disconnect the compressed air supply from the power supply.
- Make sure to depressurize the line.

1. Open the filter cap and remove it.
2. Clean the filter cap.
3. Replace the filter element.
4. Reattach the filter cap.

After replacing the filters, the compressed air can be switched on again.

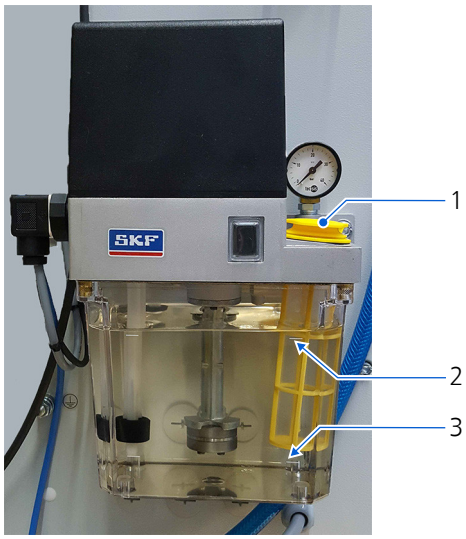
Checking the oil level of the oil pump

The oil level in the oil pump must be checked once a week. The oil pump is located on the left side of the controller cabinet.

Bearing damage due to insufficient lubrication.
Replacement of the bearings and other components.

✓ The oil reservoir must be filled up to the lower mark. **[3]**

- Fill in the specified oil into the filler hole until the upper mark is reached **[1.2]**



Oil pump with oil reservoir

1 Filler hole for oil
2 Upper mark for the maximum oil level
3 Lower mark for the minimum oil level

Designation of the oil:

Standard:	HLP DIN 51524-2
Manufacturer:	**Shell Tellus S2 MX 32**

10 Shutdown and disposal

This chapter contains:

Shutdown 10-2
Disposal 10-3

Shutdown

If you want to shut down the CMM for a longer period of time, the CMM must be disconnected from the power supply. We recommend storing the CMM in a dust-protected place.

1 Remove the power plug.

2 Cover the CMM using a tarpaulin, for example.

Disposal

Package

The regulations of the country in which the CMM is installed apply to the disposal of the packaging material.

CMM

General Information

Why is proper disposal necessary?

Proper disposal of the product serves to protect public health and the environment.

Resale

If you wish to resell the CMM or its peripherals, you must inform the buyer about his obligation to ensure proper disposal.

Labeling of electronic components

Some components of the CMM carry the symbol shown below. This symbol indicates that the component contains electronic component parts that must not be disposed of with general household waste.

Validity for EU 28 member states

Components labeled with this symbol must be disposed of correctly according to the WEEE directive 2012/19/EU or the respective country-specific legislation applicable within the EU 28 member states. This symbol is only applicable in the European Union.

Information about WEEE and RoHS

Category 9 (WEEE)

All ZEISS **IMT** products including goods such as **TSK** and **OEM** products sold by us and bearing the ZEISS logo are assigned to Category 9 of the Appendix of the WEEE directive.

All ZEISS **IMT** products comply with the RoHS directive unless they are subject to a specific exemption.

Hazardous materials according to RoHS:

Hazardous material	Chemical symbol
Lead	Pb
Mercury	Hg
Cadmium	Cd
Hexavalent chromium	Cr^{6+}
Polychlorinated biphenyls	PBB
Polybrominated diphenyl ethers	PBDE

Amounts of hazardous materials in CMM components:

CMM components	Hazardous materials					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
Controller	0	0	0	0	0	0
Cabling	0	0	0	0	0	0
Electromechanics	0	0	0	0	0	0
Mechanics	0	0	0	0	0	0
	If a hazardous material is not present or the quantity of the hazardous material is below the limit value, the hazardous material will have the value «0». The weight percentages of the hazardous materials are calculated for the entire system.					

NOTE

The table above is valid for coordinate measuring machines coming into the market since the year 2007.

Regulations

The CMM and peripherals can be returned to us for disposal. Of course, it is also possible to set up other regulations for disposal according to the German Electrical and Electronic Equipment Act (ElektroG). The return of the CMM takes place on the basis of the General Terms and Conditions.

For customers within the European Union:

– Please contact your dealer or supplier regarding the disposal of electrical and electronic devices.

Outside the European Union:

– Make sure to comply with the corresponding laws and other local regulations regarding the disposal of electrical and electronic devices.

Glossary

Term	Explanation
Bit	Abbreviation for »binary digit« (0 or 1)
ElektroG	German Electrical and Electronic Equipment Act, which implements the EU Directives WEEE and RoHS
GTC	Abbreviation for »General Terms and Conditions«
IP54	Code for a certain protection type (IP: Ingress Protection)
ISO	Acronym for »International Organization for Standardization«
LED	Acronym for »light-emitting diode«
MSL	Abbreviation for standard elevation zero (elevation of average sea level)
MSR	Acronym for »Multi Sensor Rack«
Nl	Abbreviation for »standard liter«; corresponds to the volume of a certain amount of gas at atmospheric pressure
Probe	Device that generates signals during probing
RDS	Abbreviation for »incremental articulating probe holder«
Reference standard	Measurement standards for the qualification of styli, e.g. sphere
RoHS	Abbreviation for »Restriction of the use of certain Hazardous Substances«; EU Directive on the restriction of the use of certain hazardous substance in electrical and electronic equipment
RSH	Acronym for »Reference Sphere Holder«
Stylus	a mechanical device consisting of a stylus tip and a shaft
Stylus system	Combination of stylus system components, containing at least one stylus and including an adapter plate for mounting on the probe
Stylus tip	physical element of different shapes which establishes contact to the workpiece. Examples: Sphere, cylinder, disk.
VAST	Abbreviation for »Variable Accuracy and Speed Probing Technology«
WEEE	Acronym for »Waste Electrical and Electronic Equipment«; EU Directive on Waste Electrical and Electronic Equipment

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