Anton Paar

Instruction Manual and Safety Information

Calotest Industrial (CAT²i)
Calotest Compact (CAT²c)
Calotest Combo (CAT²combo)

Calotest / CAT²

Published and printed by Anton Paar

Find out more

www.anton-paar.com

Disclaimer

This document contains information that may affect your safety and your legal rights and obligations. Please read this document carefully as the failure to read and follow the instructions and warnings in this document may result in serious injury to yourself or others, damage to your Anton Paar product, or damage to other objects in the vicinity. This document does not purport to cover every detail or variation in the equipment, nor does it purport to provide for every possible contingency met in connection with safety, installation, operation, or maintenance.

Anton Paar shall not be liable for any damage, injury or legal liability arising directly or indirectly from the use of this document. For details on the warranty and liability of the Anton Paar GmbH and other companies of the Anton Paar Group please refer to the Terms and Conditions on our website (https://www.anton-paar.com/us-en/terms-and-conditions/).

This document may contain errors or omissions. If you find any such errors, or if you would like to add more information to this document, please contact us at the address below. Anton Paar assumes no responsibility for any errors or omissions in this document.

Changes, copyright, trademarks etc.

Address of the producer:
Anton Paar TriTec SA
Vernets 6
CH-2035 Corcelles / Switzerland
Tel: +41 (0) 32 552 16 00
Fax: +41 (0) 32 552 16 10
E-Mail: info.tritec@anton-paar.com
Web: www.anton-paar.com

Date: March 2026
Document number: G77IB001EN-I
Original instructions

Table of contents

1 Safety instructions

Read the documentation

- Read the documentation before using the product.
- Follow all hints and instructions in the documentation to ensure the correct use and safe functioning of the product.

1.1 General safety instructions

General

- The documentation is a part of the product. Keep it for the complete working life of the product and make it easily accessible to all persons involved with the product. If you receive any additions or revisions from Anton Paar, these must be treated as part of the documentation.

Liability

- This document does not claim to address all safety issues associated with the use of the product and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.
- Anton Paar only warrants the safe and proper functioning of the product if no modifications are made to mechanics, electronics, or software.
- Use the product only for the purpose described in the documentation. Anton Paar is not liable for damages caused by incorrect use of the product.
- The results delivered by the product depend on the correct function of the product and various other factors. We recommend that you have experts check the results (i.e., perform plausibility testing) before taking consequential actions based on the results.
- The proper function of the instrument's protective devices is only guaranteed when operated correctly within the specified scope of applications.

Cybersecurity

- The product must be installed in a physically restricted and access-controlled environment (e.g., non-public area, behind a firewall). Attacks requiring disassembly or hardware modification are out of scope.
- The user must use strong, unique passwords for each device and must keep them confidential, ensuring access is limited to authorized personnel only.
- The user must change or refresh passwords / PINs periodically.
- Security settings delivered by Anton Paar (e.g., authentication, PIN, encryption, logging) must remain enabled. Disabling or modifying them shifts responsibility and risk to the user and requires the customer to perform their own risk assessment.
- The user must configure the product in accordance with their company's recommended network and security policies.
- The user must regularly check for product updates and must install them (either independently or through Anton Paar processes).
- For software products, the customer must ensure proper access control to the host PC. The installer directory must be restricted to administrators.
- Security policies must ensure that users protect authenticators: keep them in their possession, do not share them, and report lost or compromised authenticators immediately. The user must not leave the product unlocked or unattended while authenticated.
- The product must operate only on a managed, regularly updated, and trusted operating system. It cannot protect against a compromised operating system.
- Only approved and conformant third-party components must be used. Secure implementation of connections to such components remains the responsibility of Anton Paar.
- The user must recognize that deviations from the Anton Paar–defined intended product use, environment, or documented security settings may introduce additional risks not covered by the provided security measures.

General precautions

- Observe and adhere to your national safety regulations regarding the handling of all substances associated with your measurements (e.g. use safety goggles, gloves, respiratory protection, etc.).
- Substances used must be labeled. The corresponding material safety data sheets must be observed and made available near the measuring setup.
- Check the wetted parts of the product for chemical resistance to all samples and cleaning liquids.
- Install the product so that you can easily separate it from the electrical supply (pull the power plug) at any time.

Installation

- The installation procedure shall only be carried out by authorized personnel who are familiar with the installation instructions.
- Never use the product outside the specified ambient conditions and specifications.
- Use only accessories, consumables, or spare parts supplied or approved by Anton Paar.

– Do not expose the product to direct sunlight for extended periods of time.

Using the product

– Ensure that all operators have been trained beforehand to use the product safely and correctly.
– Ensure that the product is sufficiently supervised during operation.
– In case of damage or malfunction, stop operating the product. Do not operate the product under conditions that could result in damage to goods or injuries or loss of life.
– If you suspect that spilled substances got into the product, disconnect the product from the electrical supply and have it checked for electrical safety by a service technician authorized by Anton Paar.

Operator's skills

– All personnel involved in the operation and/or maintenance of the product must be qualified or properly instructed in its use.
– Operators must be able to read and understand the instructions within the manual.
– It is the owner's responsibility that all operators are sufficiently trained in the correct and safe use of the product.
– Operators must be able to judge dangerous situations and take the right measures to prevent accidents, injury and damage.

Precautions for flammable samples and cleaning agents

– Keep potential sources of ignition, like sparks or open flames, at a safe distance from the product.
– Store only the minimum required amount of sample, cleaning liquids, and other hazardous materials near the product.
– Do not spill sample/cleaning liquids or leave their containers uncovered. Immediately remove spilled sample/cleaning liquids.
– Ensure that the setup location is sufficiently ventilated. The environment of the product must be kept free from flammable gases and vapors.
– Provide fire-extinguishing equipment.

Operation in areas with risk of explosion

– The product is **not** explosion-proof and therefore must not be operated in areas with risk of explosion.

Service and repairs

– Service and repair procedures may be carried out only by authorized persons or by Anton Paar.

Disposal

– Concerning the disposal of the product, observe the legal requirements in your country. Contact your Anton Paar representative for further questions.

1.2 Conventions of safety messages and typography

Conventions for safety messages

The following conventions for safety messages are used in this document:

WARNING

Description of risk

Warning indicates a hazardous situation which, if not avoided, **could** result in death or serious injury.

CAUTION

Description of risk

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

WARNING

Electricity

This sign calls attention to the **risk of electricity**. Do not proceed until the indicated conditions for averting this threat are fully understood and met.

CAUTION

Counter rotating rollers

This sign calls attention to the risk of injuries through rotating parts. Keep a safe distance as long as parts of the instrument are still in motion.

CAUTION

Sharp elements

This sign calls attention to the presence of a sharp element. Do not touch this element when it is rotating.

NOTICE

Description of risk

Notice indicates a situation which, if not avoided, could result in damage to property.

NOTE: *It gives general information or example.*

TIP: *Tip gives extra information about the situation at hand.*

Typographical conventions

The following typographical conventions are used in this instruction manual:

Convention	Description
Names for physical buttons *Labels for tabs, buttons etc. in the software*	The names and labels are written in *italic*.
Menu Level 1 > Menu Level 2	Menu paths are written in *italic*. The menu levels are connected using a closing angle bracket.

1.3 Special safety instructions

WARNING

Electricity – Protective earth

Any interruption of the protective earth (PE) ground conductor, inside and/or outside the instrument, or disconnection of the PE terminal, makes the instrument behavior potentially unstable and dangerous.

WARNING

Electricity – Power cord(s)

Only the delivered:

- instrument main power cord, for the 24 VDC power supply block,
- optional device power cords (separated for acquisition system, integrated for microscope),
- power multi-socket adapter, with its integrated power cord (only if both optional acquisition system and microscope are available),

shall be used, as it contains three conductors: L/N/PE.

A damaged power cord shall not be used.

CAUTION

Sharp elements – Shaft flanges

There is a risk of fingers being cut by the instrument shaft flanges, especially when the motorized shaft is rotating.
When the shaft is immobile, it can be cleaned using a cloth.

CAUTION

Substance hazard

The user should follow the safety sheet of any substance during its manipulation (e.g. isopropyl alcohol for cleaning) to avoid any risk of skin burn or respiratory trouble.

1.4 Safety signs on the instrument

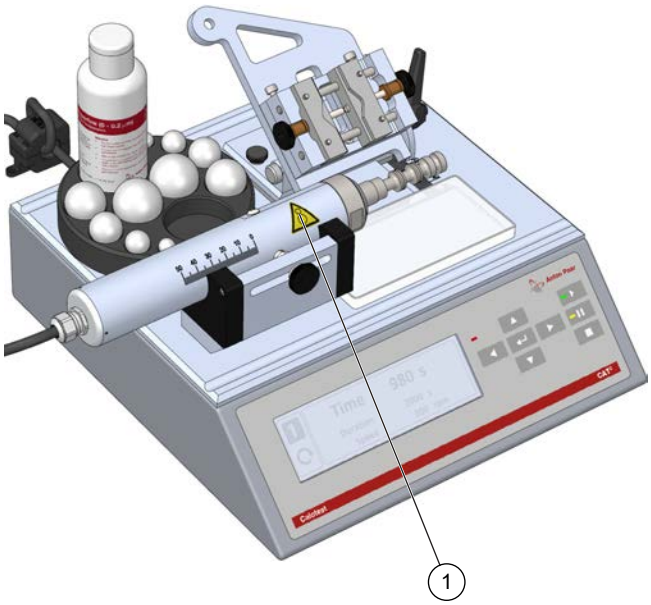

Fig. 1: *Position of warning sign on motorized shaft assembly of CAT²c*

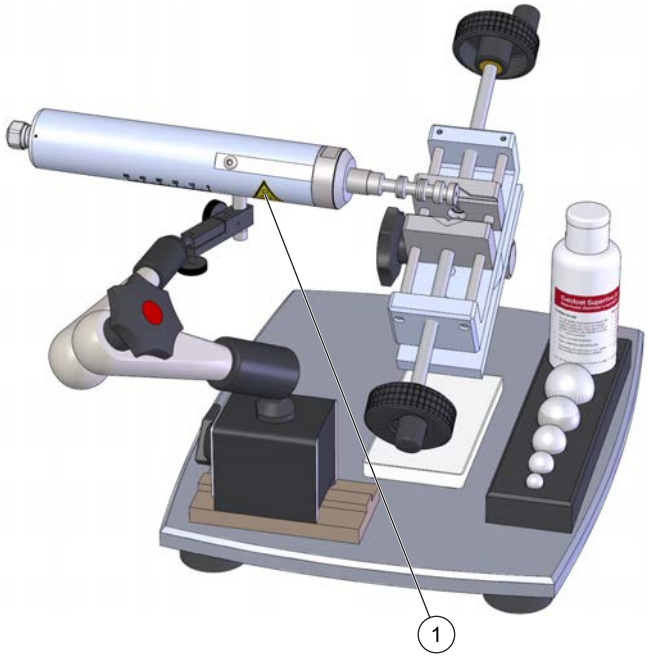

Fig. 2: *Position of warning sign on motorized shaft assembly of CAT²i*

1 CAUTION - Counter rotating rollers

CAUTION

Counter rotating rollers – Shaft

There is a risk of fingers being cut by the instrument motorized shaft flanges when the shaft rotates.

Avoid letting any external loose elements get caught in the rotating shaft.

NOTICE

It is imperative that the warning signs remain clearly legible.

2 Overview

2.1 About this document

In this document

- The images may differ from the actual product.
- Unless specified, CAT² means all Calotest models (CAT²c, CAT²i and CAT²combo).
- 'key(s)' refers to the control front panel unit key(s).

Table 1: Abbreviations

Abbr.	Designations
CAT²c	compact Calotest
CAT²i	industrial Calotest
CAT²combo	combo Calotest (compact & industrial)

2.2 Instrument description

The instrument is composed of the two following elements:

- **CAT²**, which includes the 4 following components:
  - control unit
  - motorized shaft
  - sample holder assembly(ies)
  - accessory holder
- **options/consumables**

2.3 Measuring principle

The CAT² developed by Anton Paar is an automatic instrument which enables a fast and reliable measurement of coating thickness.

The test consists of generating a calotte through the coating and down to the sublayer/substrate using a rotating ball in combination with a diamond slurry.

Then, the optional camera/microscope/Anton Paar *Video* software permits the user to do a complete analysis of the measurement results.

The CAT² is used either for quality control (QC) or product development.

The CAT² developed by Anton Paar is widely used for analyzing coatings with thicknesses of between 0.1 and 50 µm.

The simple ball-cratering method is a fast and accurate means of checking the thickness of any coating, whether a single or multi-layered stack.

Typical examples include CVD, PVD, plasma spray coatings, anodic oxidation layers, surfaces treated by ion sputtering or ion plating, chemical and galvanic deposits, polymers, paints and lacquers.

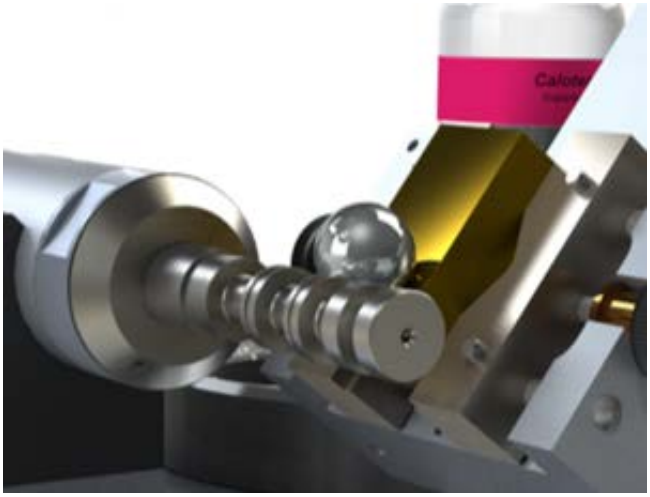

Fig. 3: *Measuring principle image*

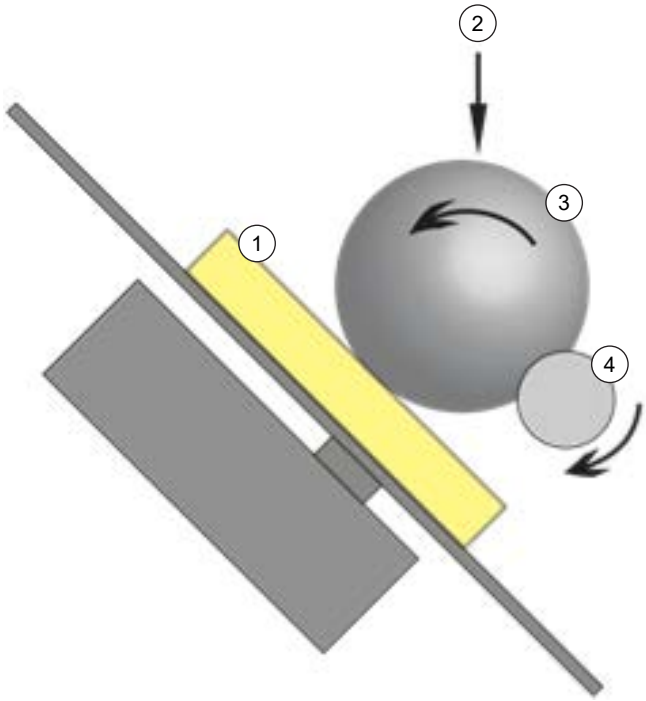

Fig. 4: *Measuring principle schematic*

1 Sample
2 Diamond slurry
3 Sphere
4 Driven shaft

2.4 Intended use of the instrument

The CAT² is intended for the measurement of the coating thickness of a wide range of different samples.

The CAT² may only be used in the way it is described in this document and other documentation provided by Anton Paar for this instrument and for its accessories and options.

2.5 Thickness calculation theory

All the theory of thickness calculation using a Calotest is based on the standard EN 1071-2.

2.5.1 Ball/plane model

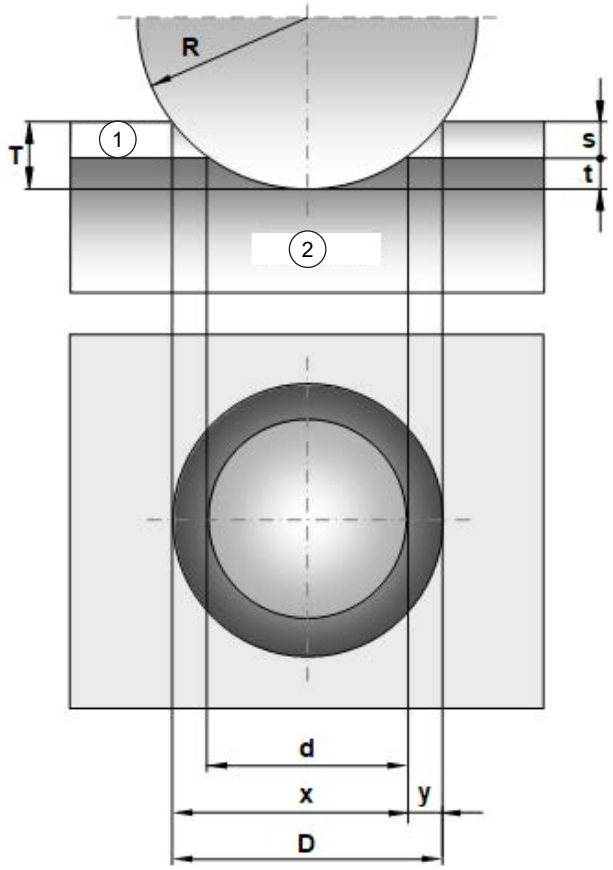

Fig. 5: *Schematic*

1 Coating
2 Substrate

(1)

$$s = T - t$$

(2)

$$T = R - \left(\frac{1}{2}\sqrt{4R^2 - D^2}\right)$$

(3)

$$t = R - \left(\frac{1}{2}\sqrt{4R^2 - d^2}\right)$$

s: thickness of the coating
T: total depth of penetration
t: depth of penetration in the substrate
R: ball radius
D: calotte diameter
d: calotte diameter in the substrate

The equation (1) becomes:

(4)

$$s = \frac{1}{2}\left(\sqrt{4R^2 - d^2}\right) - \sqrt{4R^2 - D^2}$$

For thin film, the penetration depth is small in comparison to the radius "R" of the ball. Therefore, the equation is simplified to:

$$s = \frac{D^2 - d^2}{8R}$$

Or, by substituting

$$D = x + y$$

and

$$d = x - y$$

$$s = \frac{xy}{2R}$$

2.5.2 Ball/cylinder model

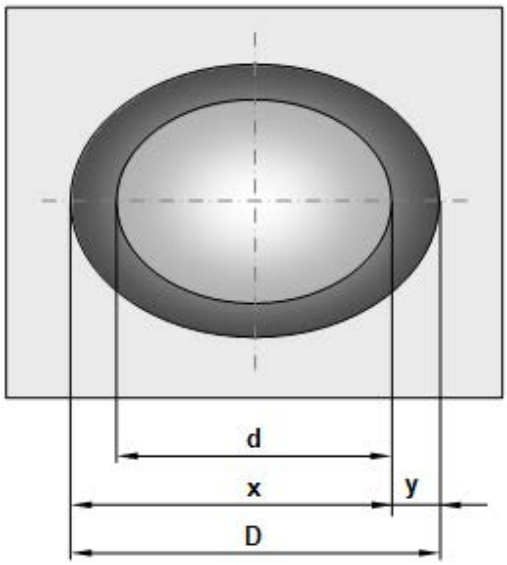

Fig. 6: *Schematic*

For the equations, the model is the same as for the ball/plane model (Section 2.5.1 [▶ 9]).

The only difference is that only the measurement of the largest diameter should be used to calculate the thickness of the coating.

In case the crater is in the concave area of a cylinder, the smallest diameter should be used to calculate the thickness of the coating.

2.5.3 Ball/ball model

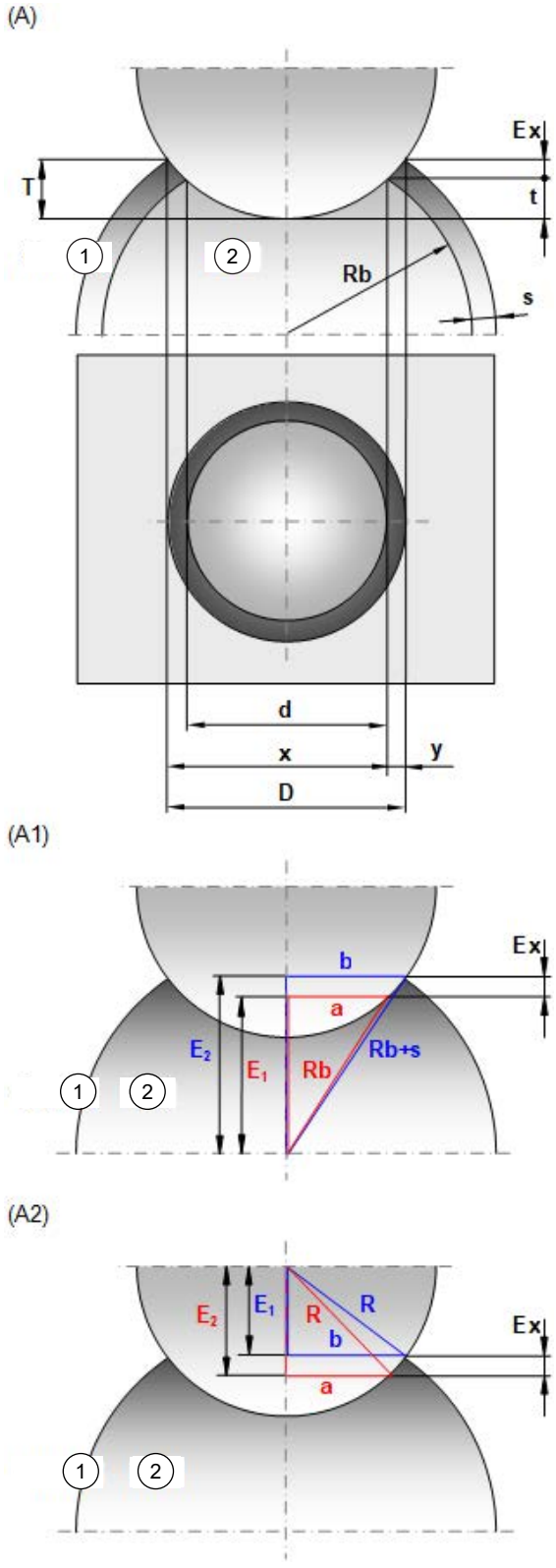

Fig. 7: *Schematic*

1 Coating
2 Ball

From (A1) drawing (Fig. 7 [▶ 10])

Red triangle:

$$Rb^2 = a^2 + {E_1}^2 \rightarrow E_1 = \sqrt{Rb^2 - a^2}$$

Blue triangle:

$$(Rb + s)^2 = b^2 + {E_2}^2 \rightarrow E_2 = \sqrt{(Rb + s)^2 - b^2}$$

(1)

$$Ex = E_2 - E_1 = \sqrt{(Rb + s)^2 - b^2} - \sqrt{Rb^2 - a^2}$$

From (A2) drawing (Fig. 7 [▶ 10])

Red triangle:

$$R^2 = a^2 + {E_2}^2 \rightarrow E_2 = \sqrt{R^2 - a^2}$$

Blue triangle:

$$R^2 = b^2 + {E_1}^2 \rightarrow E_1 = \sqrt{R^2 - b^2}$$

(2)

$$Ex = E_2 - E_1 = \sqrt{R^2 - a^2} - \sqrt{R^2 - b^2}$$

Equation (1) = (2)

$$\sqrt{(Rb + s)^2 - b^2} = \sqrt{Rb^2 - a^2} = \sqrt{R^2 - a^2} - \sqrt{R^2 - b^2}$$

$$\sqrt{(Rb + s)^2 - b^2} = \sqrt{R^2 - a^2} - \sqrt{R^2 - b^2} + \sqrt{Rb^2 - a^2}$$

$$(Rb + s)^2 = \left(\sqrt{R^2 - a^2} - \sqrt{R^2 - b^2} + \sqrt{Rb^2 - a^2}\right)^2 + b^2$$

(3)

$$s = \sqrt{\left(\sqrt{R^2 - a^2} - \sqrt{R^2 - b^2} + \sqrt{Rb^2 - a^2}\right)^2 + b^2} - Rb$$

Several approximations of the coating thickness, "s", can also be used assuming that "a"<<"R", "b"<<"R" and "s"<<"Rb":

(4)

$$s = \sqrt{R^2 - \frac{d^2}{4}} + \sqrt{Rb^2 - \frac{d^2}{4}} - \sqrt{R^2 - \frac{D^2}{4}} - \sqrt{Rb^2 - \frac{D^2}{4}}$$

AND

(5)

$$s = \frac{xy}{2}\left(\frac{1}{Rb} + \frac{1}{R}\right)$$

OR

$$s = \frac{D^2 - d^2}{8}\left(\frac{1}{Rb} + \frac{1}{R}\right)$$

2.6 Instrument views

2.6.1 CAT²c front

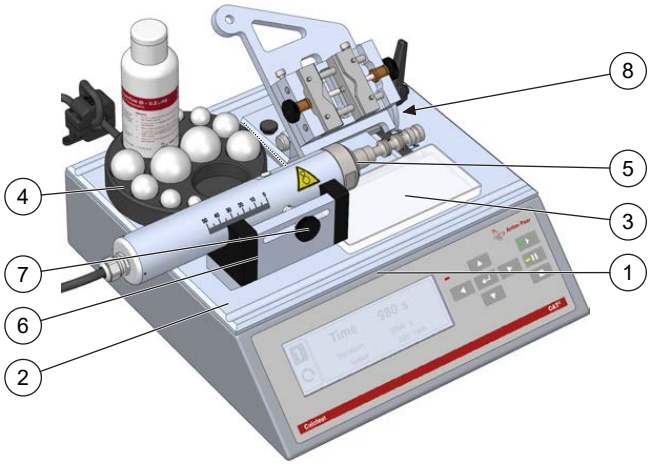

Fig. 8: *CAT²c front view*

1 *Control unit*
2 *Base plate*
3 *Slurry recuperation tray*
4 *Accessory holder*
5 *Motorized shaft*
6 *Shaft holder*
7 *Shaft locking hand screw*
8 *Sample holder assembly*

Motorized shaft assembly

Pos. 5 to 7
For lateral adjustment: Pos. 6, 7

Sample holder assembly

For details of pos. 8 refer to Section 2.6.2 [▶ 11]

2.6.2 CAT²c side

Sample holder assembly

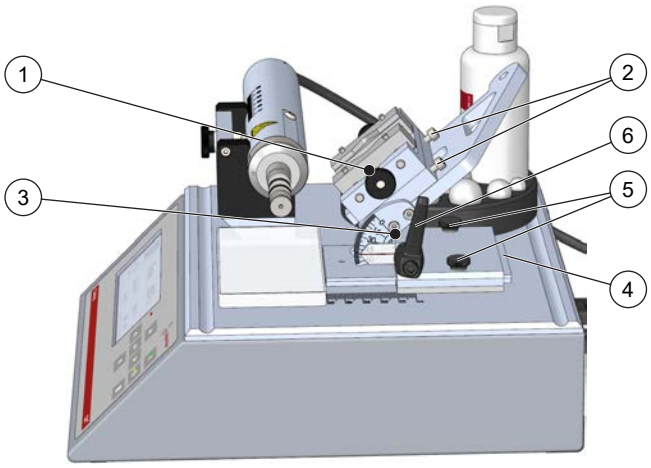

Fig. 9: *CAT²c sample holder assembly details – side view*

1 *Sample holder (mounted on its support with 2 hidden screws under clamping jaws)*
2 *Sample holder support locking screws*
3 *Sample holder table*
4 *Table support*
5 *Table locking hand screws*
6 *Table locking handle*

For translation adjustment: Pos. 5 (, 4)
For tilt adjustment: Pos. 6 (, 3)

2.6.3 CAT²i front

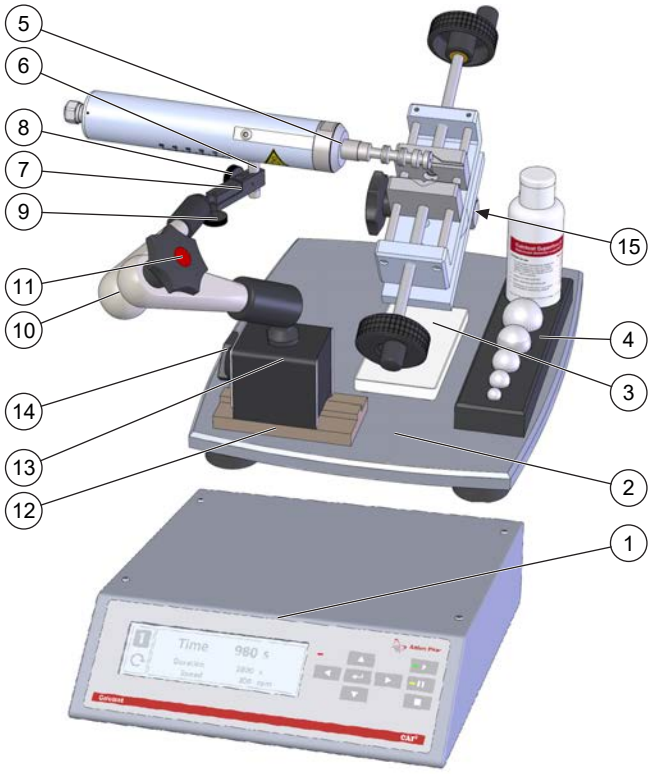

Fig. 10: *CAT²i front view*

1 *Control unit*
2 *Base plate*
3 *Slurry recuperation tray*
4 *Accessory holder*
5 *Motorized shaft*
6 *Shaft stud*
7 *Shaft holder*
8 *Shaft locking hand screw*
9 *Shaft holder hand screw*
10 *Hydraulic arm*
11 *Hydraulic arm locking knob*
12 *Magnetic foot support*
13 *Magnetic foot*
14 *Magnetic foot locking knob*
15 *Sample holder assembly*

Motorized shaft assembly

Pos. 5 to 14
For fine tilt (final) adjustment: Pos. 9
For three possible adjustments: Pos. 10, 11
For lateral adjustments: Pos. 12, 13, 14

Sample holder assembly

For details of pos. 15 refer to Section 2.6.4 [▸ 12]

2.6.4 CAT²i zoom

Sample holder assembly

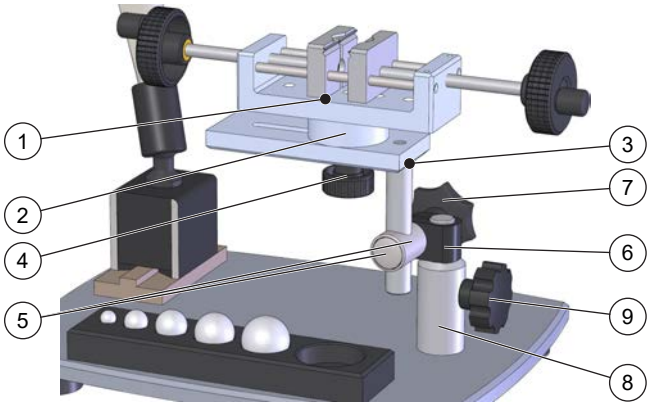

Fig. 11: *CAT²i sample holder assembly details – zoomed view*

1 *Sample holder*
2 *Spacer*
3 *Support plate with rod*
4 *Sample holder locking knob*
5 *Support plate rod connection parts*
6 *Post connection part*
7 *Support plate rod locking knob*
8 *Post*
9 *Post locking screw*

For rotation, translation adjustments: Pos. 2, 3, 4
For rotation, height, tilt adjustments: Pos. 5, 6, 7
Post assembly: Pos. 8, 9

2.6.5 Control unit front panel

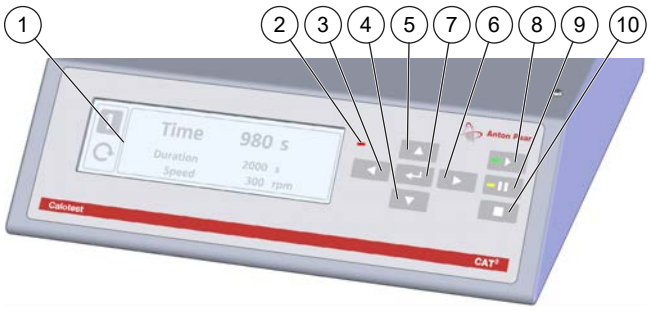

Fig. 12: *Control unit panel front view*

1 *LCD display*
2 *Key-press feedback red LED*
3 *'left directional' key*
4 *'down directional' key*
5 *'up directional' key*
6 *'right directional' key*
7 *'enter' key (OK, validation)*
8 *'start/validation' key, with green LED*
9 *'pause key', with yellow LED*
10 *'stop/cancellation' key*

2.6.6 Control unit rear panel

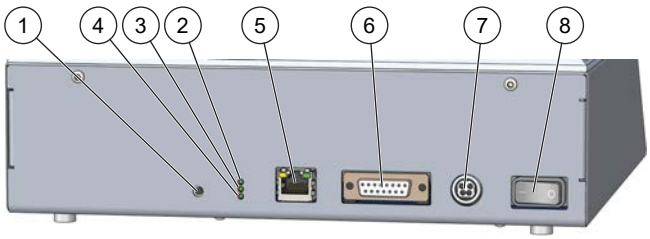

Fig. 13: *Control unit panel rear view*

1 Reset bouton
2 Status greeen LED: Reserved (service)
3 Status greeen LED: Heart beat
4 Status greeen LED: Power on
5 Reserved (service) RJ45 socket
6 Motor D-sub socket
7 24 VDC power supply MDJ-402 socket
8 Power on/off rocker switch

3 Supplied parts

The document at hand describes the most important features and functions. Find further information about the instrument on the enclosed USB stick.

The product was tested and packed carefully before shipment. However, damage may occur during transport.

- Keep the packaging material (box, foam piece, transport protection) for possible returns and further questions from the transport and insurance company.
- Check the delivery for completeness by comparing the supplied parts to those noted in the table(s) below.
- If a part is missing, contact your Anton Paar representative.
- If a part is damaged, contact the transport company and your Anton Paar representative.

Table 2: Supplied parts

	Qty.	Description	Part. No.
CAT²c	1	Standalone unit with integrated LCD display and controller. Including **universal sample holder (for sample width/Ø up to 32/35 mm)**, integrated accessory holder, two sets of stainless-steel balls Ø 10, 15, 20, 25.4, 30 mm, slurries: Super fine + high quality, plastic slurry collection tray	145182
OR			
CAT²i	1	Standalone unit with integrated LCD display and controller. Including **universal vice, stand and hydraulic arm, universal sample holder (for sample width/Ø up to 84/86 mm)**, integrated accessory holder, two sets of stainless-steel balls Ø 10, 15, 20, 25.4, 30 mm, slurries: Super fine + high quality, plastic slurry collection tray	145175
OR			
CAT²combo	1	Standalone unit with integrated LCD display and controller. Including **universal vice, stand and hydraulic arm, universal sample holder for CAT²c (for sample width/Ø up to 32/35 mm), universal sample holder for CAT²i (for sample width/Ø up to 84/86 mm)**, integrated accessory holder, two sets of stainless-steel balls Ø 10, 15, 20, 25.4, 30 mm, slurries: Super fine + high quality, plastic tray to catch excess slurry, plastic slurry collection tray	145166

Table 3: Main optional parts

	Qty.	Description	Part. No.
Only one of the 3 following options is possible:			
	1	USB video camera + Calotest software	168908
	1	Industrial inspection microscope (without acquisition system)	168112
	1	Industrial inspection microscope (with acquisition system)	169092
The following option is not possible for CAT²i:			
	1	Manual XY table	145298
Other options, accessories on demand			

Table 4: Consumables

	Qty.	Description	Part. No.
Balls Stainless steel AISI 420C	12	Ø 10	145485
	12	Ø 15	145486
	12	Ø 20	145487
	5	Ø 25.4	145494
	1	Ø 30	148685
	2	Sets of Ø 10, 15, 20, 25.4, 30 mm	145493
Other diameters for balls in stainless steel AISI 420 C on demand			
Slurries	1	Super fine: Bottle 100 ml, water-based diamond suspension, particles < 0.2 µm	144895
	1	High quality: Bottle 100 ml, water-based diamond suspension, particles 0.5 – 1 µm	144894

Table 5: Wear parts

	Qty.	Description	Part. No.
Replacement shafts	1	**Stainless steel** replacement shaft	163355
	OR		
	1	**Heavy-duty** (tungsten carbide WC) replacement shaft	144898

Table 6: Spare parts

	Qty.	Description	Part. No.
Motor with shaft and connector	1	Motor with **stainless steel** shaft, cable and connector	147783
	OR		
	1	Motor with **heavy duty** (tungsten carbide WC) shaft, cable and connector	158727

4 Installation

4.1 Installation requirements

Customer should provide:

– a desk min. 1200 x 600 mm to place the instrument (all models), without option,

OR

– a desk min. 1600 x 600 mm to place the instrument (all models) and optional microscope, keyboard and mouse of the optional acquisition system, that is generally placed on the ground under or next to the desk

– 1 wall power outlet: 100 - 120 VAC, 60 Hz, min. 7.1 A or 220 - 240 VAC, 50 Hz, min. 3.6 A to supply the instrument and optional devices: Acquisition system / microscope
(a multi-socket adapter is provided only if both optional acquisition system and microscope are available)

4.2 Environmental requirements

NOTICE

Risks of damage to the instrument / bad measurement results

To avoid the above described risks, the following requirements should be applied.

The setup location and surroundings should meet the requirements of a typical laboratory.

The dew point should be much lower than the ambient temperature to avoid condensation.

The instrument is not built to work with corrosive media in or near it.

Allow the equipment to reach ambient temperature before installation. This is very important if the equipment has been stored or transported at lower temperatures.

Place the product on a stable, flat lab desk that is free of vibrations.

To ensure temperature stability and trouble-free measurement never locate your product:

– next to a heating facility

– near an air conditioning, ventilation system or an open window
– in direct sunlight

Keep the product away from magnetic fields.

Find all technical data in Appendix A [▶ 32].

4.3 Installation

The instrument is commissioned/installed by Anton Paar representative.

Set up the instrument (Section 4.5 [▶ 16]) before operating it (Section 5 [▶ 20]). The remaining subsections may be useful or provide additional information.

4.4 Connecting the instrument

The cables were connected during the installation.

The users should not disconnect/connect any cables on the instrument. However, if necessary (relocation of the instrument…), refer to the following instructions.

NOTICE

Risk of damage to the electronics

Before unplugging/plugging any connectors, the instrument should be switched off [▶ 21].

The cables are disconnected first by reversing the following reconnection steps (mainly located on control unit rear panel). However, for step 3.a, the installation connection may remain in place, e.g. when relocating the unit.

Motor

1. Connect and lock (use the two hand screws) the plug of the motorized shaft cable to the motor D-Sub socket.

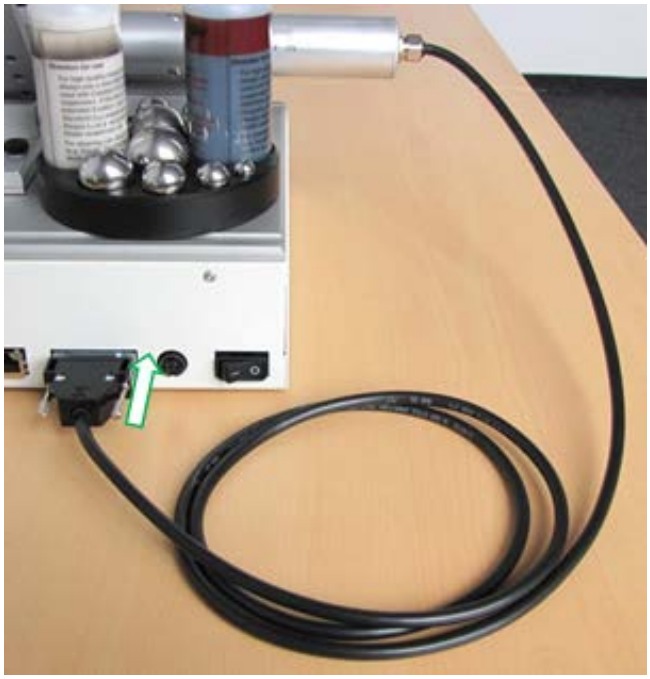

Fig. 14: *Connecting motor to rear panel*

Power supply DC side

With the correction orientation,

Fig. 15: *Power supply MDJ-402 plug zoom*

2. connect the MDJ-402 plug of the 24 V power supply cable to the MDJ-402 socket.

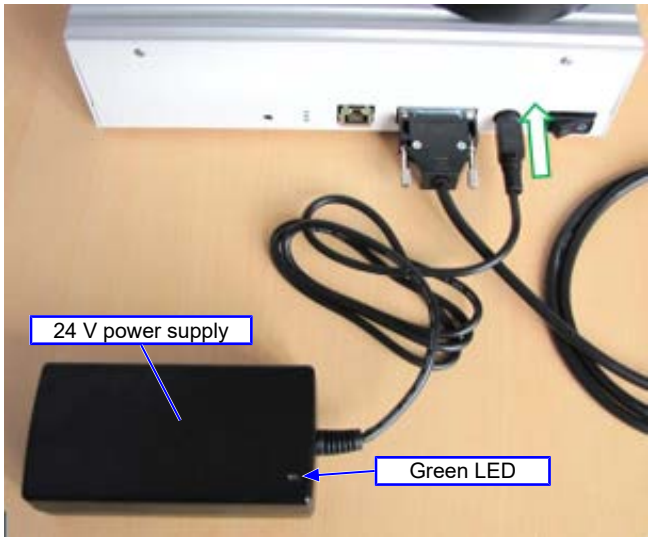

Fig. 16: *Connecting power supply to rear panel*

Power supply AC side

3. Connect the provided main power cord as follows:
   a. Connect the socket to the 24 VDC power supply plug.
   b. Connect the plug (adapted to the country) to the wall power outlet (110 - 240 VAC).

The power supply green LED should light.

Fig. 17: *Connecting main power cord to power supply and power outlet*

4.5 Setting up the instrument

4.5.1 CAT²c

Sample holder assembly mounting

Table mounting

1. Ensure that the two hand screws are loose enough to slide the adjustable sample holder table onto its support (located on base plate).
2. Tighten the two hand screws to lock the table position.
3. Tighten the handle to lock the table tilt.

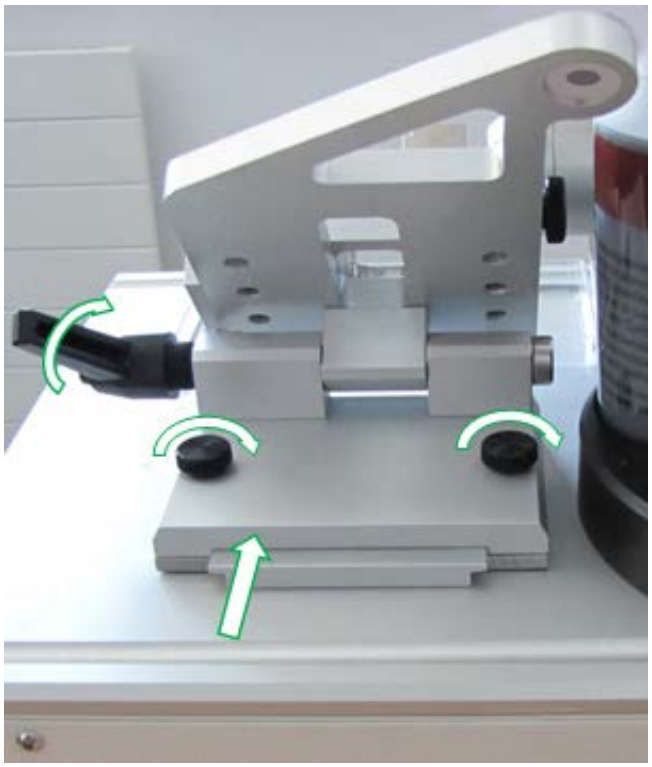

Fig. 18: *Mounting table on its support, on base plate*

4. If the handle extremity touches the top of the control unit before the handle has been fully tightened or loosened, pull the handle and rotate it to reposition it, allowing continuation of tightening or loosening.

Fig. 19: *Changing position of handle*

Sample holder mounting

Sample holder is assembled with its support below.

1. Ensure that the two sample holder support screws are loose enough to fully slide the two support underside openings onto the two table pegs (until table end stop).

Fig. 20: *Installing sample holder on table*

NOTICE

Risk of damage to the recuperation tray/base plate/sample holder

To prevent the sample holder from falling, hold it in place (against table) during the following instruction:

2. Tighten the two screws with a 3 mm Allen key to lock the sample holder/support on its table.

Fig. 21: *Securing the sample holder (keeping it pressed against table) for mounting it on table*

Motorized shaft mounting

1. Place the motorized shaft on its holder.
2. Insert the hand screw through the holder groove and in the motorized shaft housing tapped hole, and tighten this hand screw to lock the motorized shaft.

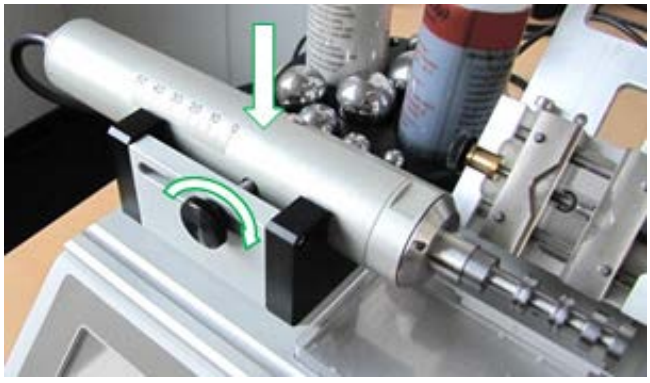

Fig. 22: *Mounting motorized shaft on holder*

Accessory holder installation

Place the accessory holder (there is a countersink below) over the locating pin (located on the base plate).

Fig. 23: *Installing accessory holder on base plate*

Optional manual XY stage

NOTICE

Risk of damage to the sample holder/slurry recuperation tray/base plate

When loosening the sample holder screws, retain the sample holder from falling.

1. Remove the sample holder from its table by performing the instructions explained in Sample holder mounting [▶ 16] in reverse order.

Fig. 24: *Removing sample holder from table*

Remove the sample holder from its support as follows.

2. Remove the jaws (refer to section 8.1) to have access to the two sample holder hidden screws.
3. Unscrew and remove the two screws with a 2.5 mm Allen key.

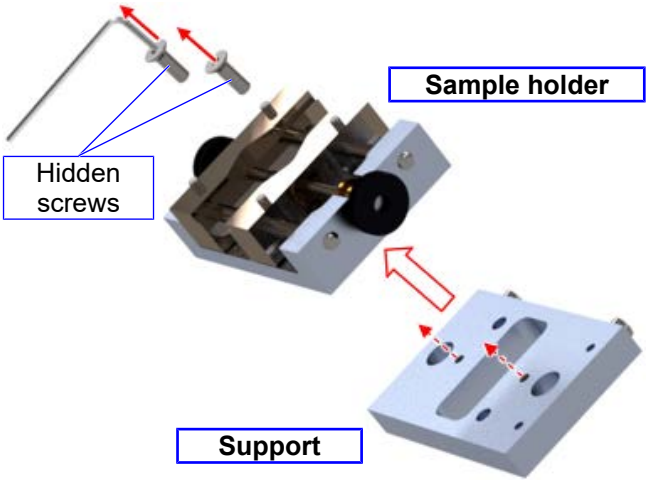

Fig. 25: *Removing sample holder from its support*

Still with the jaws dismounted, mount the sample holder on the optional manual XY stage as follows.

Respect the orientations shown on Fig. 26 [▶ 18]
→ The two sample holder jaw hand screws should be oriented on the left/right, for the following instruction.

4. Insert and tighten the two sample holder hidden screws with the 2.5 mm Allen key, in order to lock the sample holder on the stage.
5. Remount the sample holder jaws.

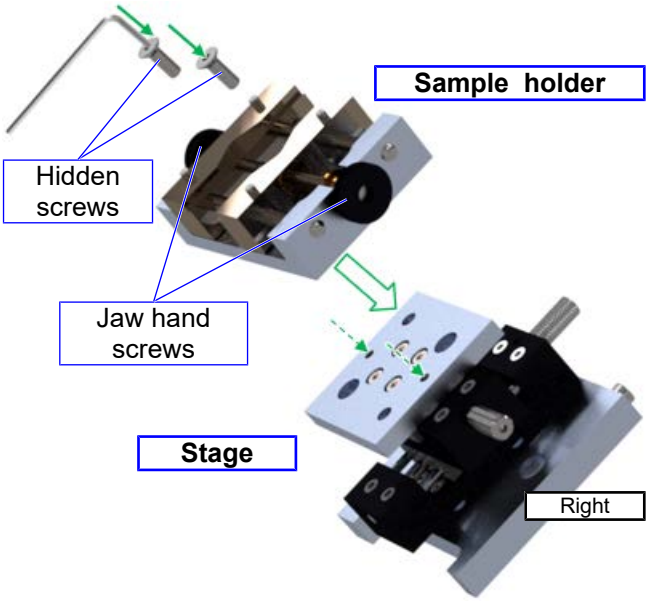

Fig. 26: *Mounting sample holder (without support) on optional XY stage*

6. Same as for the sample holder on its support, mount the optional manual XY stage (together with sample holder) on the table, as explained in Sample holder mounting [▶ 16].

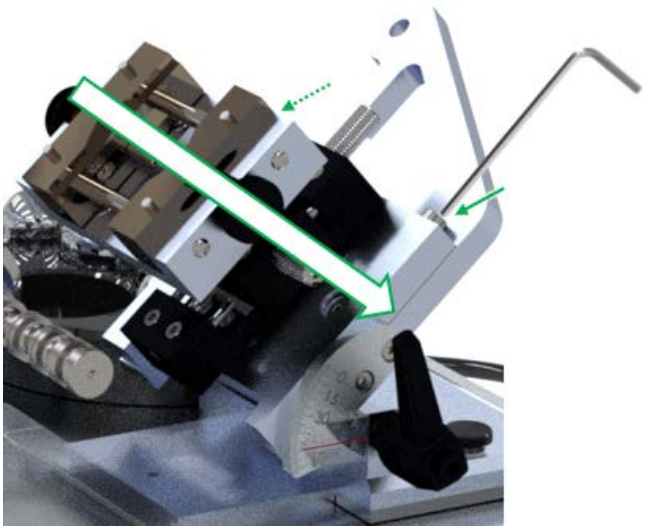

Fig. 27: *Mounting XY stage (together with sample holder) on table*

NOTE: *The stage has X and Y adjustable strokes of +/- 7 mm.*

4.5.2 CAT²i

Sample holder assembly mounting

Post and support plate with rod mounting

With the post locking knob partially unscrewed and facing the flat of the base plate pillar (refer to Fig. 28 [▶ 18]),

1. fully slide the post onto the pillar (until base plate end stop).
2. Tighten the knob to lock the post and prevent it from rotating.

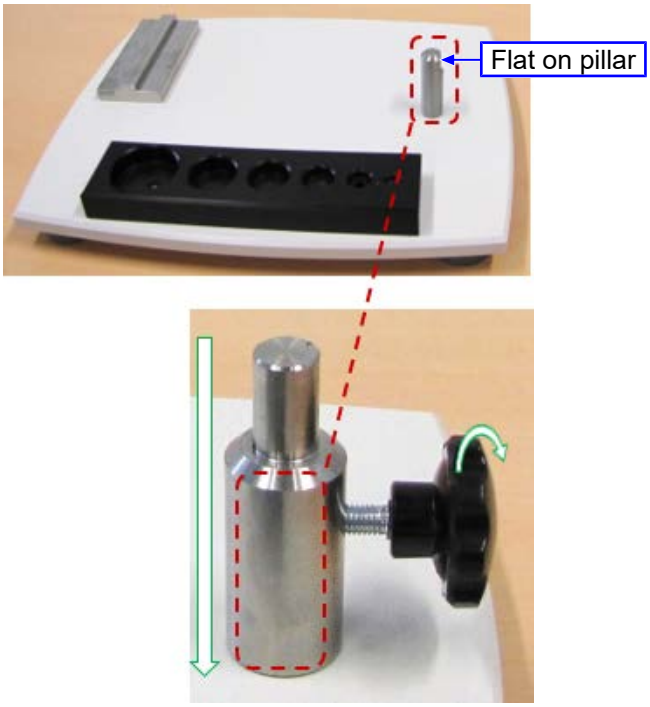

Fig. 28: *Mounting post onto pillar*

3. Slide the post connection part onto the top of the post, mounted together with the two connection parts of the support plate rod and locking knob (partially screwed but not tightened yet).

Fig. 29: *Mounting connection part together with two connection parts and knob for support plate rod*

4. Insert the rod of the support plate into its two dedicated connection parts.
5. Tighten the knob to lock the whole assembly.

Fig. 30: *Mounting rod of support plate into connection parts*

Sample holder mounting

1. Insert the locking knob through the support plate groove from the bottom and hold it in place.
2. Slide the spacer onto the knob screw until it touches the support plate.
3. Place one of the tapped holes below the sample holder onto the knob screw and tighten the knob to lock the sample holder together with the spacer.

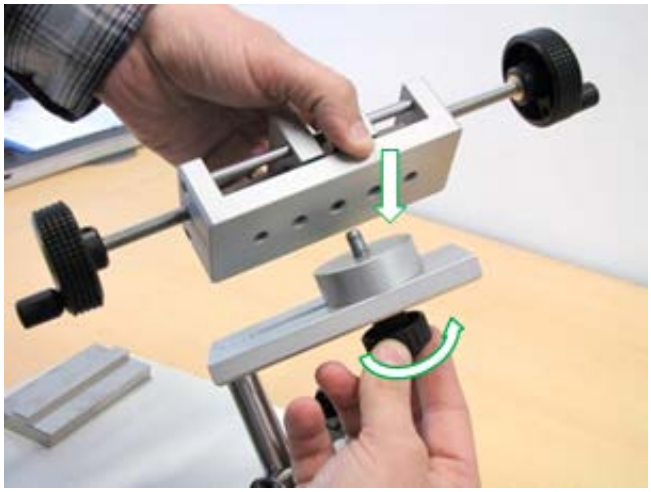

Fig. 31: *Mounting sample holder with spacer on support plate*

Motorized shaft assembly mounting

Magnetic foot and hydraulic arm mounting

Lock the magnetic foot on its support, located on the base plate, by switching the knob to *ON* position.

NOTE: *The magnetic foot locking knob position can be outside or inside the base plate.*

Fig. 32: *Mounting foot of hydraulic arm*

Motorized shaft mounting

1. Insert and hand tighten the threaded lower part of the hydraulic arm into the top of the magnetic foot.
2. Lock the hydraulic arm (three adjustments shown on the following image) using the knob to mount the motorized shaft without touching any surrounding parts.

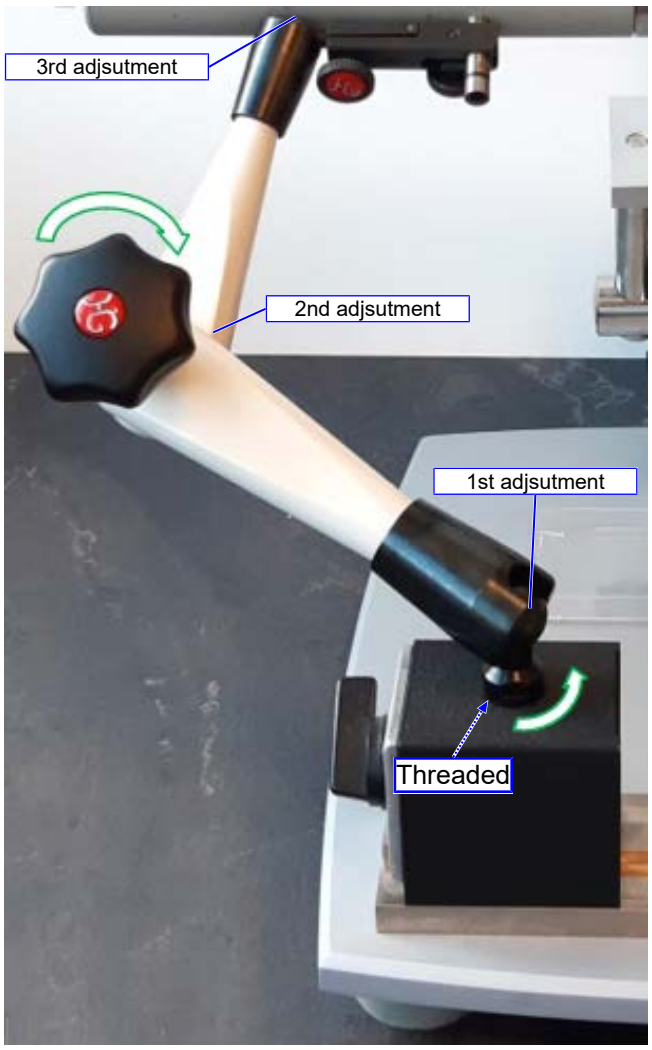

Fig. 33: *Mounting and blocking the hydraulic arm*

3. Insert the stud of the motorized shaft into its holder (extremity of the locked hydraulic arm) and tighten the hand screw to lock the motorized shaft.

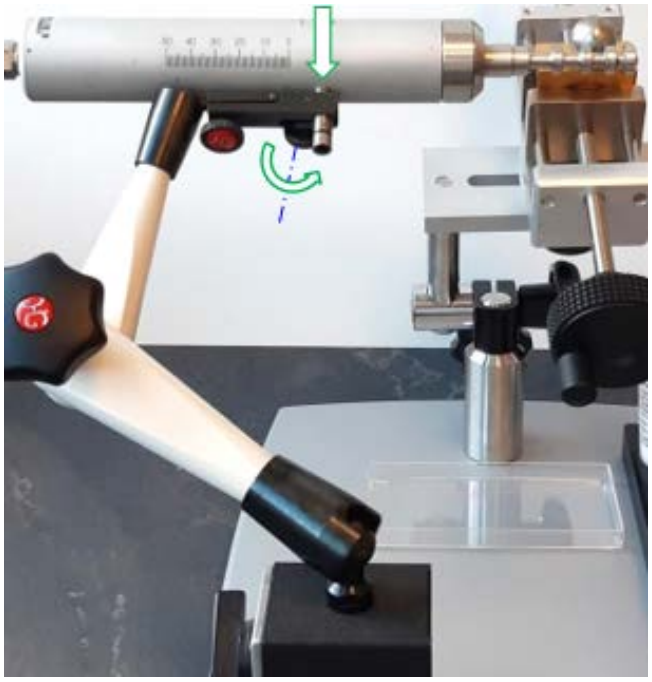

Fig. 34: *Mounting motorized shaft on hydraulic arm (using the stud)*

Accessory holder installation

Place the integrated accessory holder by superimposing the 2 hole underside over the two guiding pins on the base plate.

NOTE: *The accessory holder is symmetrical and can be positioned in both directions.*

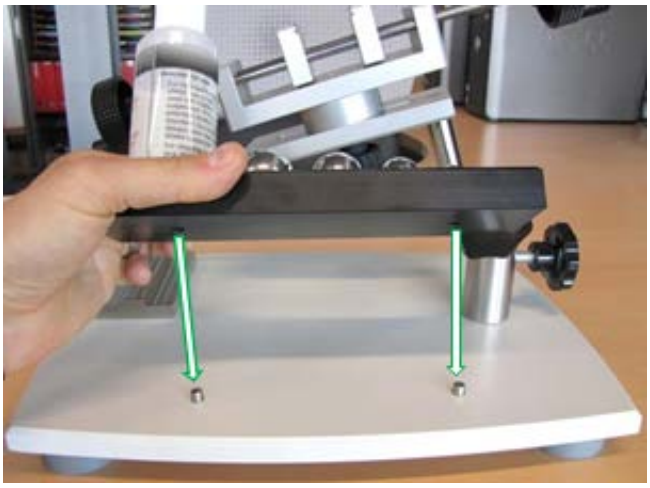

Fig. 35: *Installing accessory holder on base plate*

5 Operation

5.1 Switching on/off the instrument

Switching on

Press the control unit power rocker switch to – position:

Fig. 36: *Power rocker switch on rear panel to on position*

– On the control unit LCD display:
The boot screen on display appears for about 11 sec.

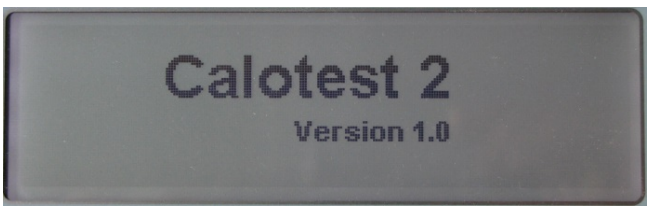

Fig. 37: *Boot screen on front panel display*

Then, the active measurement routine no. 1 appears.

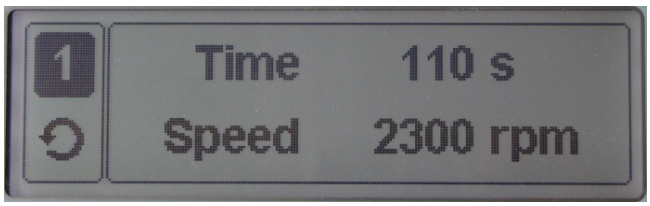

Fig. 38: *Initial active measurement no.1 on front panel display*

– The status of the 3 control unit green LEDs are as follows (from top to bottom):
  – Reserved (service): Off
  – Heart beat: Blinks
  – Power on: Lights

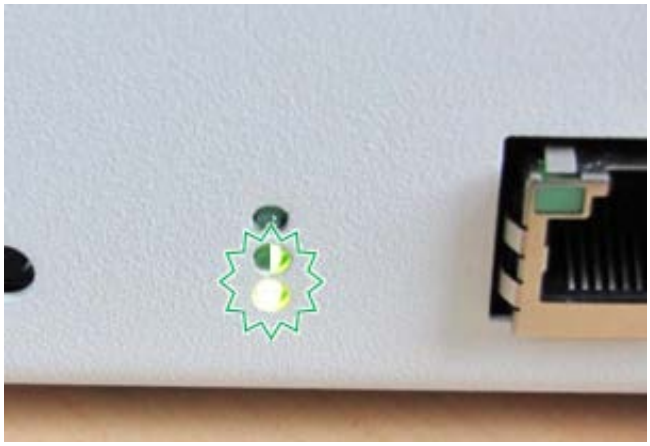

Fig. 39: *LEDs states on rear panel when instrument is switched on*

Switching off

Press the control unit power rocker switch to *O* position:

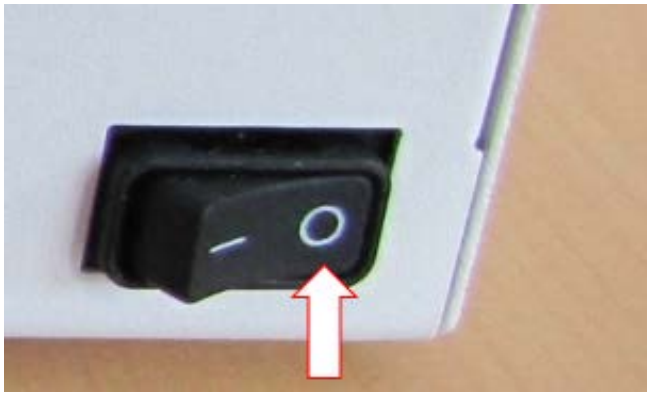

Fig. 40: *Power rocker switch on rear panel to off position*

– The control unit LCD display is off on front panel.
– The three control unit LEDs on rear panel are off.

6 Checking, adjusting and calibrating

6.1 Configuring the control unit measurement routines

10 preset measurement routines are available and shown on the control unit LCD display. The following parameters of each routine can be modified.

On display:

– Measurement *Time*: Min. 1 to max. 10000 sec
– Shaft *Speed*: Min. 10 to max. 3000 rpm
– Shaft *'rotation direction arrow'*: Clockwise or counterclockwise
– Selection(s) is highlighted in black.

When a control unit key is well pressed, the key-press feedback red LED lights.

Active measurement routine selection

Press *'up'* or *'right'* key to increase the routine number.

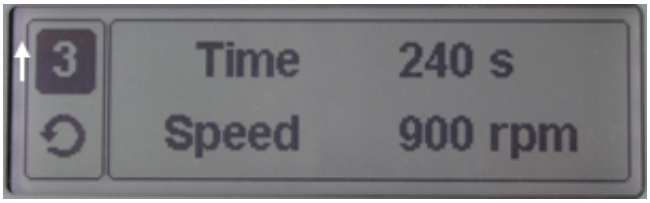

Fig. 41: *E.g. routine has been increased until no. 3, which is selected*

Press *'down'* or *'left'* key to decrease the routine number.

Fig. 42: *E.g. routine no.10 (max.) will be decrease*

Measurement routine parameter selection

For the following example, the routine no. *3* is selected.

Press *'enter'* key to the select one of the 3 parameters (by default *Time* is selected) of the current routine.

Fig. 43: *Time selection of routine 3*

Press *'up'* or *'right'* key to select in order: The *'rotation direction arrow'*, *Speed* or *Time*.

Press *'down'* or *'left'* key to select in order: The *Speed*, *'rotation direction arrow'* or *Time*.

Fig. 44: *'rotation direction arrow' selection of routine 3*

Fig. 45: *Speed selection of routine 3*

Fig. 46: *Time is selected with its preset value 240 s*

Selected parameter edition

Press *'enter'* key to modify the selected parameter (e.g. *Time* 240 s Fig. 46 [▶ 22]).

By default, a digit is selected.

Fig. 47: *E.g. Time digit 4 is selected*

Press *'left'* or *'right'* key (once or several times) to select another digit on the left or right side, respectively.

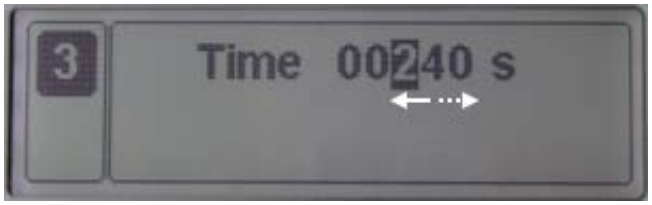

Fig. 48: *E.g. Time digit from 4 to 2 selection ('left' key pressed one time)*

Press *'up'* or *'down'* key (once or several time) to increase or decrease the selected digit value, repectively.

Fig. 49: *E.g. Time digit 2 increased to 3 ('up' key pressed one time)*

For *Speed* parameter modification, follow the same instructions as for the *Time* parameter modification.

Fig. 50: *E.g. Speed digit 9 is selected*

For *'rotation direction arrow'* parameter (direction from shaft extremity) selected, press *'enter'* key to change from counter-clockwise to clockwise.

TIP: *Counter-clockwise is recommend for standard measurements*

Fig. 51: *'rotation direction arrow' clockwise selection*

New parameter validation/cancellation

Press *'start/validation'* key to validate each new parameter value.

Fig. 52: *E.g. Time 140 s is validated (with initial Speed 900 rpm and 'rotation direction arrow' counter-clockwise) for routine no. 3*

Press *'stop/cancellation'* key to cancel each new parameter value and retrieve the previous (preset) one (Fig. 46 [▶ 22]).

New measurement routine validation/cancellation

Press *'start/validation'* key to validate each new routine with new parameter(s).

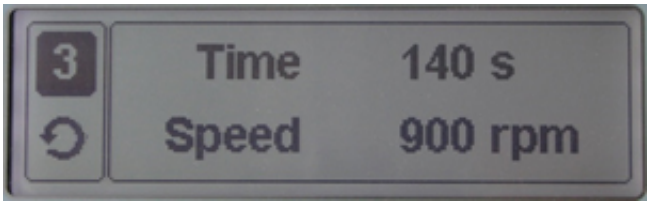

Fig. 53: *Validated routine (E.g. 3) = Active routine New*

Press *'stop/cancellation'* key to cancel each new routine with new parameter(s) and retrieve the previous preset one (Fig. 41 [▶ 21]).

Time, *Speed* and *'rotation direction arrow'* parameters are no longer highlighted in black.

7 Performing a measurement

7.1 Measurement routine

Select the desired active measurement routine

As instructed in Section 6.1 [▶ 21], select an active routine.

Fig. 54: *E.g. active routine no.3 is selected*

Start the measurement

Press *'start/validation'* key to start the selected active measurement routine - the key green LED lights:

- The motorized shaft runs at the defined speed (e.g. 900 rpm) and rotation direction (e.g. counter-clockwise).
- The elapsed time increases on the LCD display.

Fig. 55: *Time is increasing on display*

Pause the measurement

At any time, the measurement can be paused by pressing *'pause'* key - its yellow LED lights.

To continue the measurement, press *'start/validation'* key - its green LED lights.

End or stop the measurement

Wait until the end of the measurement, or press *'stop/cancellation'* key to abort the measurement (LCD display comes back to initial active routine Fig. 54 [▶ 23]).

7.2 Typical measurement set-up and running

7.2.1 CAT²c

1. Install the sample as flat as possible in the sample holder jaws and tighten the 2 jaw hand screws so that the sample remains firmly clamped.

NOTE: *The 2 jaw hand screws are inversed: To screw, turn counter-clockwise and to unscrew turn clockwise.*

2. Install the slurry recuperation tray on its dedicated location on the base plate.

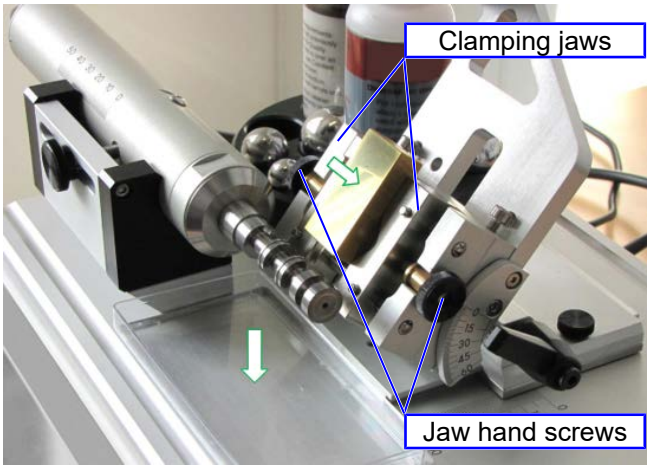

Fig. 56: *Installing sample and recuperation tray*

Referring to the table angle indicator,

Fig. 57: *Table angle indicator*

3. adjust the tilt position of the table with an angle between 10° and 30° using its locking handle. Smaller diameter balls require smaller angles.

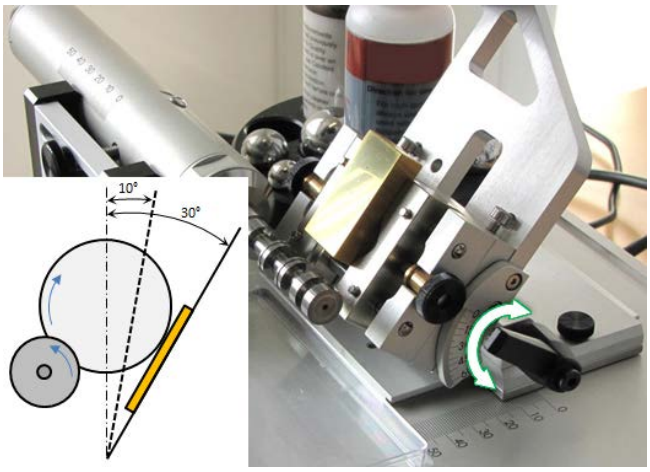

Fig. 58: *Adjusting table tilt*

4. Choose a ball → larger balls for thinner coatings.
5. Adjust and lock the shaft lateral position using its holder hand screw depending on the chosen ball (larger balls require larger flange spacing on the shaft).
6. Place the ball on the correct shaft position (the ball should touch the sample).

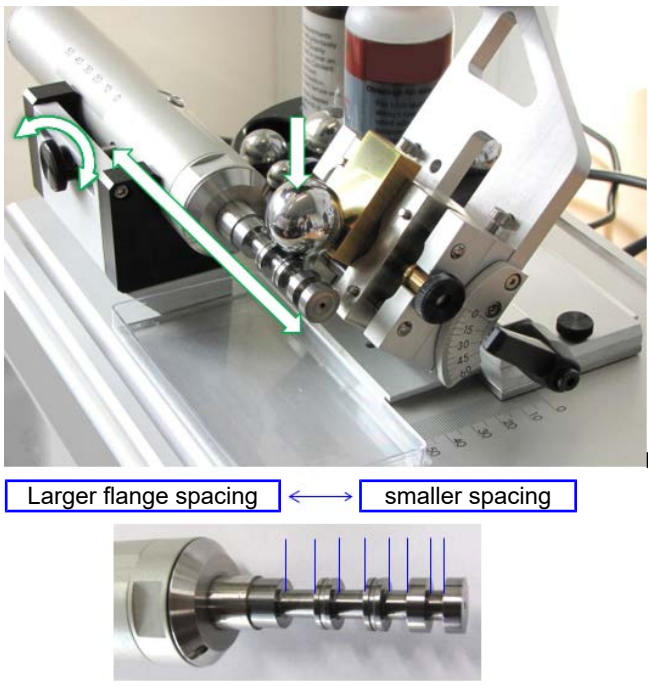

Fig. 59: *Adjusting lateral shaft position and placing the chosen ball on shaft*

7. Adjust the lateral position of the table using its 2 locking hand screws to fulfil with the following notice.

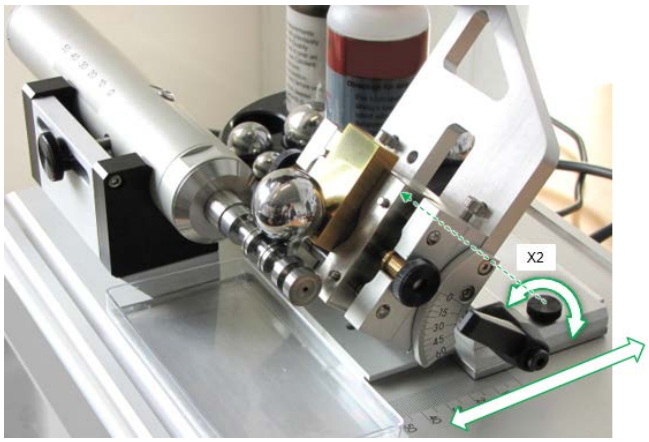

Fig. 60: *Adjusting table lateral position*

NOTICE

Risks of damage to the recuperation tray/baseplate or bad measurement results

- If the sample is too close to the shaft, the ball may fall from the shaft at the beginning of the measurement.
- If the sample is too far to the shaft, the ball may not turn during the measurement.

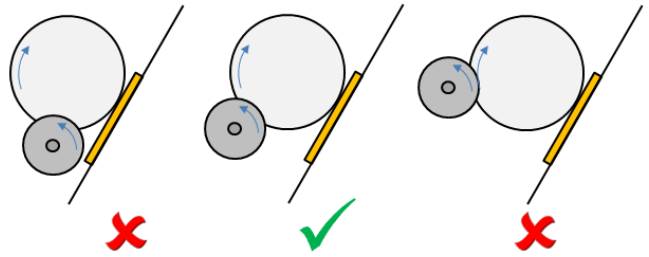

Fig. 61: *Left image: Bad – sample to close / Center image: Correct / Right image: Bad – sample to far*

8. As instructed in Section 6.1 [▸ 21], on the control unit panel, select an active routine and start the measurement to verify the adjustments:

⇨ the ball should turn.

If necessary, fine adjustments can be performed while the shaft is rotating – same manipulations as explained in steps 3. (tilt) and 5. (lateral)

9. Stop the shaft.
10. Shake the desired slurry bottle (e.g. high quality slurry).
11. Put 1 or 2 drops of the abrasive solution on top of the ball.

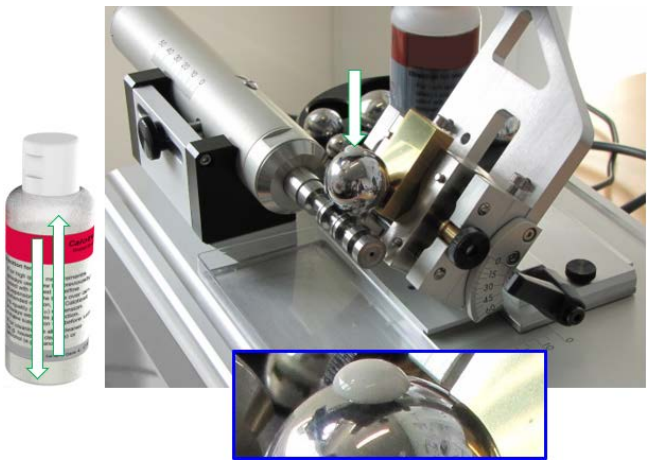

Fig. 62: *Shacked slurry drop(s) on top of ball*

12. As instructed in Section 6.1 [▸ 21], on the control unit panel, select an active routine and start the measurement.

Fig. 63: *Measurement is running, the ball is rotating on the sample with the slurry (excess slurry falls into the tray)*

At the end of the measurement:

13. Remove and clean the ball (Section 9.1 [▸ 27]).

Fig. 64: *Removing and cleaning the ball*

14. Clean the sample (Section 9.1 [▶ 27]).

Fig. 65: *Cleaning sample*

15. Remove the sample from the sample holder jaws.

If manual XY stage is mounted, the X and/or Y position(s) can be changed (Fig. 66 [▶ 25]) before starting a new measurement with the same setup:

16. After choosing the testing position, follow the previous detailed steps to perform a measurement.

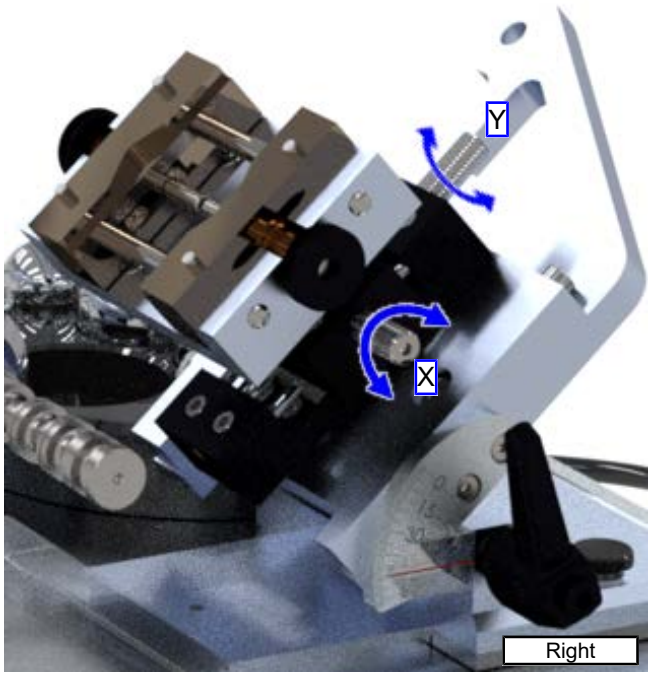

Fig. 66: *Moving X and/or Y axis/es of stage*

7.2.2 CAT²i

Refer to the same instructions as for the 16 steps of CAT²c (Section 7.2.1 [▶ 23]), **except** for certain steps that are different and others that are not applicable, as follows:

1. The screwing/unscrewing directions are not inversed for the 2 jaw screw knobs of the sample holder.

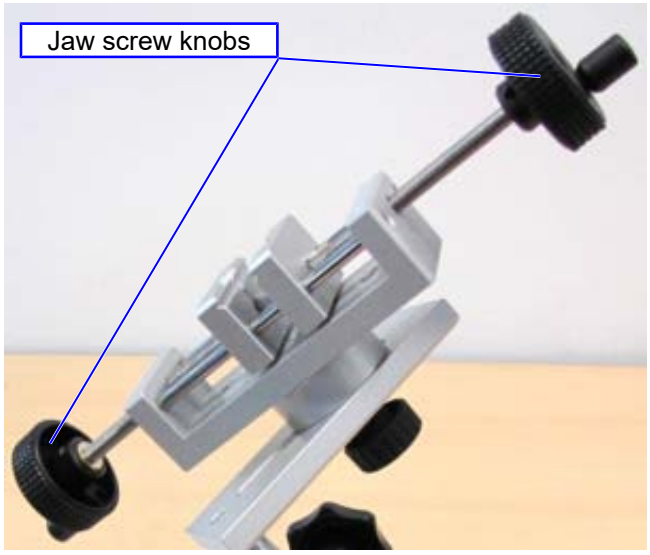

Fig. 67: *Install the sample (not shown) in sample holder jaws.*

2. There is no dedicated place for the slurry tray. Position it later, when the adjustments are done.

3. Pre/adjust and lock the sample holder assembly together with mounted sample, using the support rod & post connection locking knob and the sample holder locking knob (knurled).

Fig. 68: *Adjusting sample holder assembly*

4. Same as for CAT²c.

5. Making sure that:

   – The motorized shaft is horizontal – use the provided spirit level,

   – the sample is placed at a correct distance from the shaft - refer to the following Notice and Fig. 70 [▶ 26],
   adjust and lock the hydraulic arm using the three-adjustment knob, to ensure the contact ball/sample.

      a. If necessary, the magnetic foot can be laterally adjusted with its locking knob.

      b. For fine tilt adjustment, use the shaft holder hand screw.

Fig. 69: *Adjustment(s) of hydraulic arm / magnetic foot / tilt (of hydraulic arm extremity)*

NOTICE

Risks of damage to the baseplate or bad measurement results

– If the sample is too close to the shaft, the ball may fall from the shaft at the beginning of the measurement.

– If the sample is too far to the shaft, the ball may not turn during the measurement.

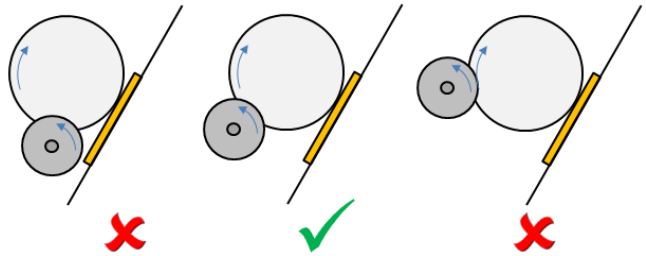

Fig. 70: *Left image: Bad – sample to close / Center image: Correct / Right image: Bad – sample to far*

6. Same as for CAT²c.

7. Not applicable for CAT²i.

8. Similar as for CAT²c, **exception:** For fine adjustments when the ball is rotating, perform same manipulations as explained in steps. 3. and 5. of this section, being careful of the following notice.

NOTICE

Risks of damage to the base plate/motorized shaft assembly

Be careful that the ball and motorized shaft assembly/sample holder assembly do not collapse when performing fine adjustments:

Retain in position the motorized shaft assembly, while loosening the three-adjustment knob of the hydraulic arm and before retightening it.

Retain in position the sample holder assembly, while loosening one of its knobs (three totally).

Now, place the slurry recuperation tray on the base plate under the sample/ball (Fig. 69 [▶ 26]).

9. to 15. Same as for CAT²c.

16. to 18. Not applicable for CAT²i.

8 Optional video measurement results

Refer to the ***Video software reference guide***, especially in sections ***Using the video software / Toolboxes / Calotest*** and ***/ Magnifier***, for software analysis details.

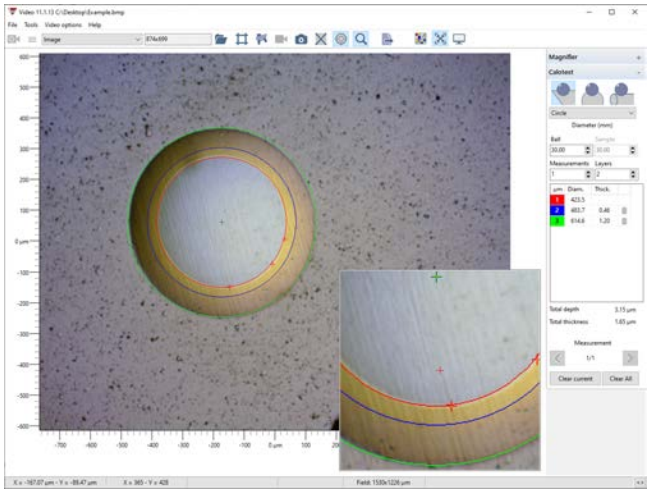

Fig. 71: *Calotest measurement with Video software (e.g. sample with 2 coating layers)*

9 Upkeep and cleaning

9.1 Cleaning

Dust cleaning

It is recommended to monthly clean the dust with a clean soft and dry cloth from:

- The control panel and top of the control unit
- The top of the motorized shaft housing and the sample holder table (CAT²c) / sample holder support plate (CAT²i)
- For CAT²i: The base frame and the hydraulic arm

Cleaning specific parts from slurry/dirt

NOTICE

Risk of damage to the instrument surfaces

Do not use chemical products. Only use water or soft solvents (alcohol...) on a soft cloth.

NOTICE

Risk of damage to the motorized shaft

The motorized shaft is not waterproof. Do not introduce slurry/dirt into the flange and shaft gaps.

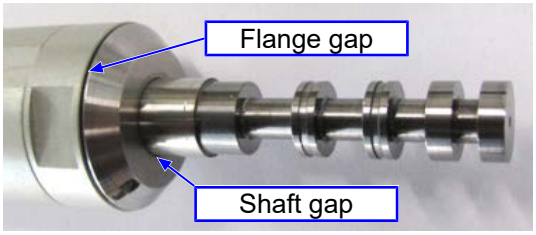

Fig. 72: *Motorized shaft*

Sample, ball, motorized shaft

After each measurement, clean the slurry/dirt from the sample, ball and shaft.

Sample holder, tray

Periodically or as necessary, clean the slurry/dirt from the sample holder and tray. It is recommended to well clean the guides of the sample holder jaws by dismounting them (Section 9.2 [▶ 27]).

9.2 Dismounting the sample holder clamping jaws

The sample holder clamping jaws are dismounted to clean the guides from slurry/dirt, or to install the optional manual XY stage only for CAT²c.

9.2.1 CAT²c

1. Remove the sample holder with its assembled support from the table by performing the instructions explained in Sample holder mounting [▶ 16] in reverse order (Section 4.5.1 [▶ 16]).
   Reminder: when loosening the screws, retain the sample holder assembly from falling.

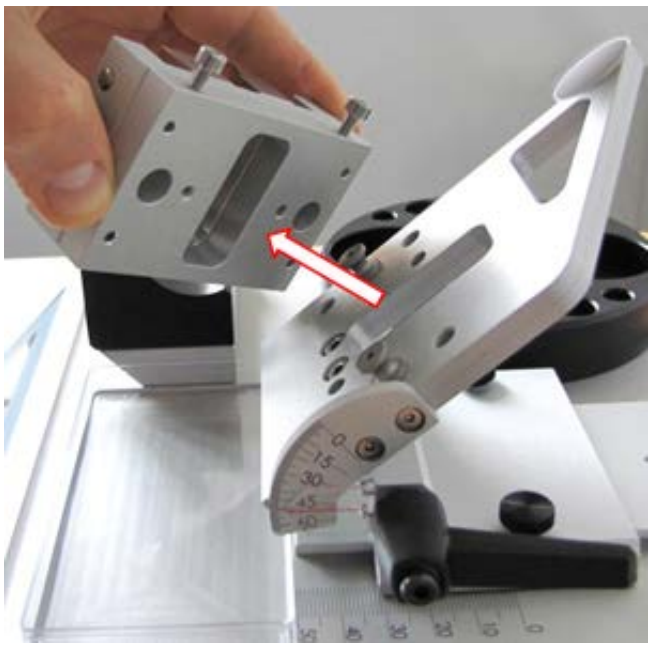

Fig. 73: *Dismounting sample holder with support from table*

2. Loosen the two small headless screws located on a side below the sample holder support, using a 0.89 mm Allen key. No need to remove the screws completely; loosen just enough to unlock the two jaw guides).

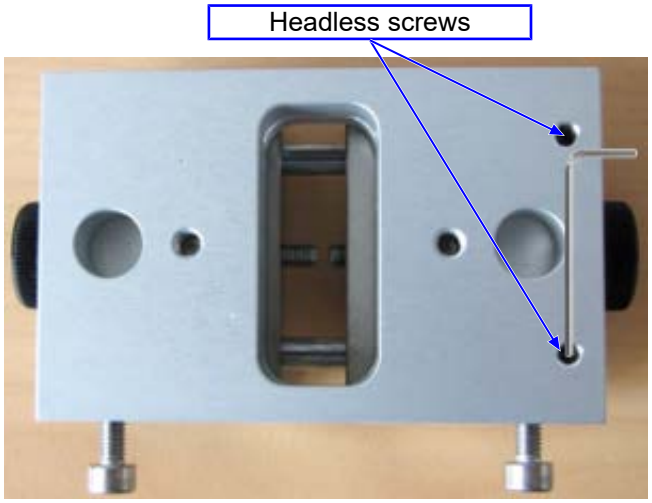

Fig. 74: *Loosening headless screws below sample holder support*

3. Push out the two guides to release the two jaws (an Allen key can be used to push out guides from the base side).

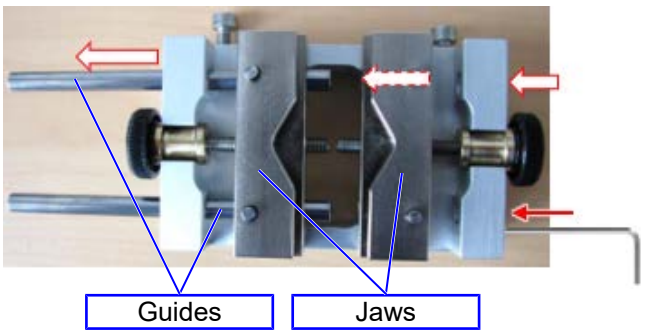

Fig. 75: *Pushing out both guides to release both jaws*

4. Pull upwards the jaws (together with their hand screws) to remove them from the sample holder base.

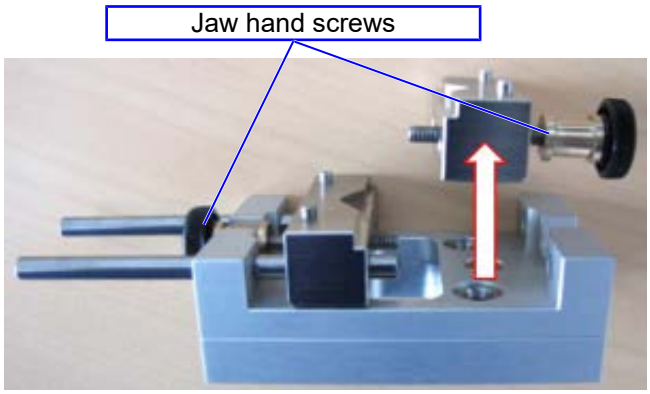

Fig. 76: *Removing both jaws together with hand screws from base*

5. Fully unscrew and remove each hand screw from the jaws.

Fig. 77: *Fully unscrewing hand screw from jaw*

To remount jaws, perform the previous instructions in reverse order and:

Make sure that the guides extend out from the base side by the same distance on both sides, before tightening the two guide screws.

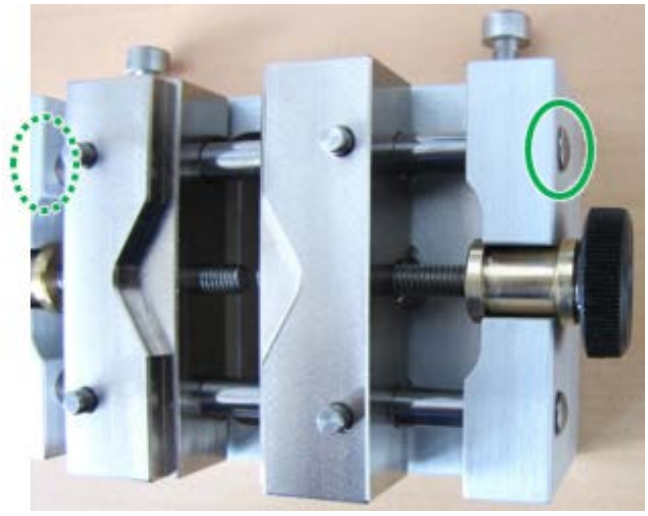

Fig. 78: *Both guides barely protrude from the base by the same distance*

NOTICE

Risk of damage to the sample holder

Do not over tighten the two small headless screws (0.89 mm) on the underside.

9.2.2 CAT²i

1. Remove the sample holder from the sample holder assembly by performing the instructions explained in Sample holder mounting [▸ 19] in reverse order (Section 4.5.2 [▸ 18]).

NOTICE

Risk of damage to the sample holder/assembly base plate

When unscrewing, retain the sample holder, spacer and locking knob from falling.

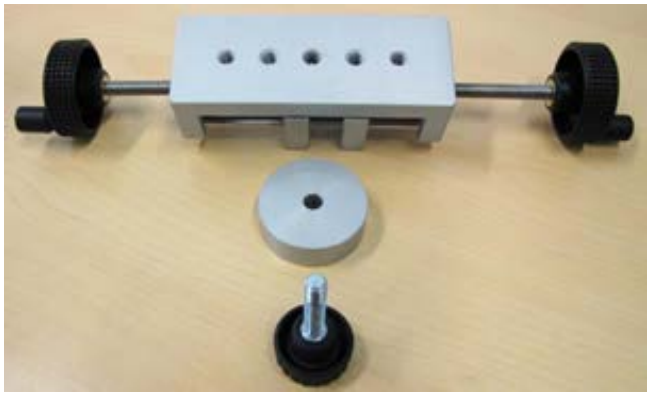

Fig. 79: *Sample holder dismounted*

2. Loosen the two small headless side screws with a 2 mm Allen key to unlock the two jaw guides (it is not necessary to remove these screws).

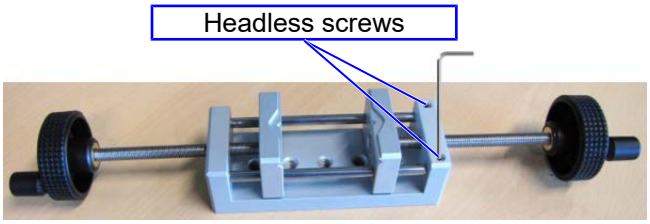

Fig. 80: *Loosening headless screws above sample holder*

3. Push out the two guides to release the two jaws (an Allen key can be used to push out guides from the base side).

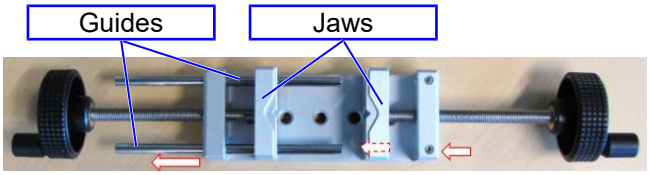

Fig. 81: *Pushing out guides to release jaws*

4. Retain each corresponding jaw screw knob to prevent it from turning and unscrew the two inside jaw screws with a 2 mm Allen key. Remove each screw together with washers and keep them at hand.

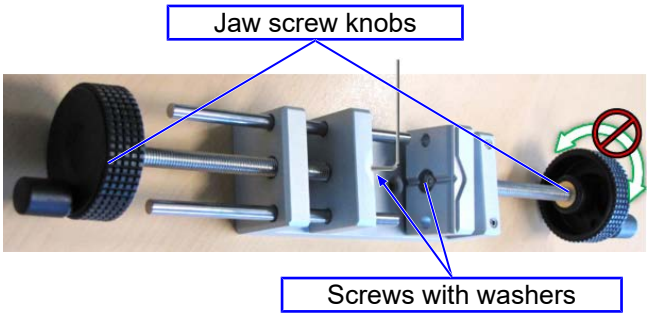

Fig. 82: *Unscrewing fully both screws with washers*

5. Withdraw both jaws from the sample holder screw knob to remove them.

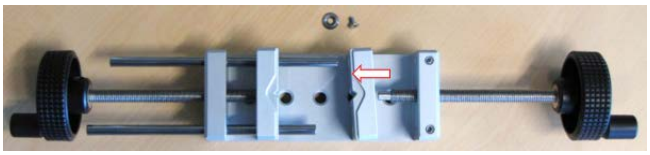

Fig. 83: *Withdrawing jaws from screw knobs*

To remount jaws, perform the previous instructions in reverse order and:

Make sure that the guides do not protrude from the base sides (but ensure same position on both left and right sides), before tightening the two guide screw.

Fig. 84: Both guides do not protrude from base

NOTICE

Risk of damage to the sample holder

Do not over tighten the two small headless screws (2 mm) on the side.

9.3 Worn balls

If the surface of the ball is no longer smooth, it is advised to change the ball.

9.4 Worn shaft replacement

In case of worn shaft flanges, the ball may jump on the shaft during measurement. A new shaft should be ordered and replaced as follows.

Only the following step concerned CAT²i

1. Insert a 4 mm Allen key inside the motorized shaft housing stud to unscrew and remove it.

Fig. 85: Stud removal

The following steps concerned all CAT² version

1. Insert a 1.27 mm Allen key through the motorized shaft housing opening and loosen the two coupling setscrews inside the housing (spaced of 120°), to free the coupling (on housing/motor side).

Fig. 86: Disconnection of the coupling from motor side

2. Unscrew the shaft with a 32 mm spanner on the dedicated location and remove the shaft together with the coupling from the motor (in housing).

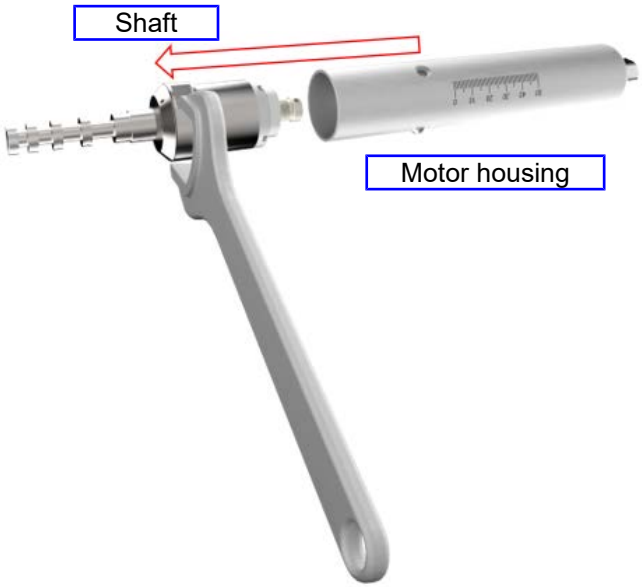

Fig. 87: Shaft with coupling removal

3. Insert a 1.27 mm Allen key and loosen the two coupling setscrews, spaced of 120°, to remove the coupling from the shaft.

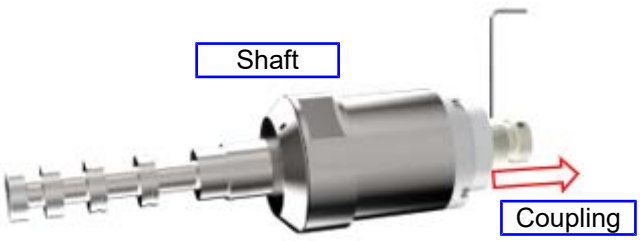

Fig. 88: Coupling removal from shaft

4. Replace the shaft and perform the previous operations in reverse order.
5. With the control unit, verify that there are no vibrations on the new shaft when the motorized shaft is rotating at the lowest speed (10 rpm) and at the highest speed (3000 rpm). No other calibration is necessary after this change.

The motor/tachometer replacement requires a new calibration and can be executed only by the manufacturer.

9.5 Storing and transporting the instrument

NOTICE

Risk of damage to the instrument

If the instrument should be transported for relocation, storage or packing (for return), carefully read the following sections in the chronological order.

9.5.1 Storing

The instrument can be stored at the place where it is operated. However, to avoid excess of dust (in case of long period of non-use):

– Cover all instrument devices, e.g. with protection cover(s)

OR

– place the instrument devices to a dry and dust free location, e.g. closed cabinet.

9.5.2 Cable disconnections

NOTICE

Risk of damage to electronics

Before transporting the instrument, the cables should be disconnected.

Before disconnecting any cables, the instrument should be switched off [▶ 21].

When the instrument is switched off, the cables should be disconnected from the CAT^2 control unit rear panel.

Refer to connecting the instrument in reverse order (Section 4.4 [▶ 15]).

9.5.3 Transporting

The CAT^2 should be carried as follows.

Carry each item by keeping it horizontal (especially with the accessory holder installed).

1. Carry by the control unit, preferably by the sides.

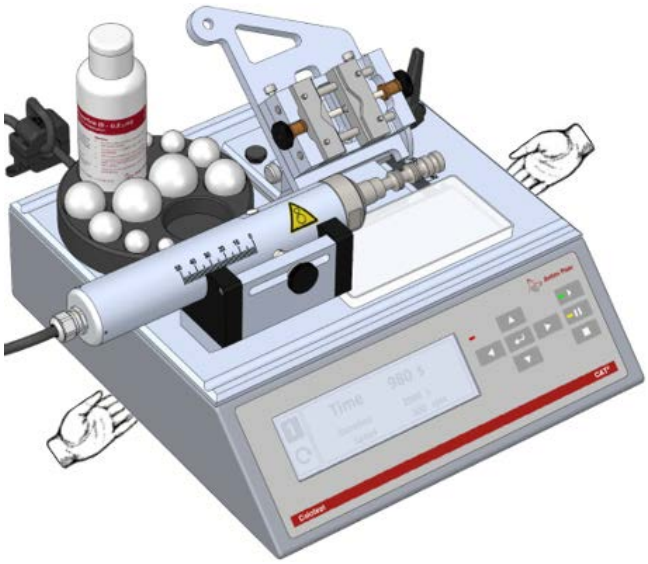

Fig. 89: *Carrying the CAT² by the control unit*

2. For CAT2i, carry by the base plate of the motorized shaft and sample holder assemblies, preferably by the narrowest sides.

Fig. 90: *Carrying the CAT²i by the base plate*

9.6 Packing the instrument for returns

If the instrument needs to be returned to the supplier, contact the local Anton Paar customer service in order to pack the instrument.

10 Maintenance and repair

10.1 Maintenance performed by an authorized Anton Paar representative

The product does not require a periodic maintenance by an authorized Anton Paar representative to retain warranty coverage.

To fulfill requirements of regulatory authorities e.g. FDA 21 CFR 211.67, PIC/S 023-2 (5.5), Anton Paar offers services for compliant preventive maintenance and requalification for qualified Anton Paar products in case of software update, repair, and location change.[1]

Following parts are generally excluded from the warranty (wear and tear parts)

- Replacement shaft
- Balls
- Slurries
- Slurry recuperation tray

All parts damaged in consequence of a fall or improper use of the instrument (e.g. wrong cleaning, misuse...) are excluded from warranty as well.

10.2 Repair performed by an authorized Anton Paar representative

In case your product needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your product needs to be returned, request an RMA (Return Material Authorization Number). It must not be sent without the RMA and the filled “Safety Declaration for Instrument Repairs”. Please make sure it is cleaned before return.
Do not return products that are contaminated by radioactive materials, infectious agents or other substances that cause health hazards.

TIP: *Find the contact data of your local Anton Paar representative on the Anton Paar website (https://www.anton-paar.com) under “Contact”.*

Appendix A Technical data

Table 7: Instrument specifications

Shaft speed	10–3000 rpm
Abrasion time range	1–10000 sec.
Nominal motor torque (max. continuous)	28 mNm
Typical thickness of coating measurement	0.1–50 µm
Measurement precision[a]	1–5 %

[a] *The measurement precision depends on the following points:*

- The surface quality (roughness) of the surface and/or the coating
- The contrast between the different surfaces
- The accuracy of the optical measurement system.

Table 8: Operating conditions and instrument data

Altitude	2000 m max.[a]		
Temperature	(23 ± 5) °C / Stability ±1 °C		
Humidity	(45 ± 10) % RH non-condensing		
Overvoltage	(II)		
Pollution degree	(2)		
Operation voltage Max. input current Frequency	100–240 VAC 1.4 A 50–60 Hz		
	CAT²c	**CAT²i**	**CAT²combo**
Dimensions [mm] Width x Depth x Height	**Controller/shaft** 350 max.[b] x 370 x 215 max.	**Controller** 169 x 301 x 367 **Shaft assembly** max. 400 x 365 x 270	**Controller/shaft** Same as CAT²c **Shaft assembly** Same as CAT²i
Weight [kg]	6	15	18

[a] *The instrument was not tested above this altitude.*

[b] *Includes rear motor connector and bending radius for cable (excluding connector = 296 mm).*

[1] For detailed information, please refer to general terms of delivery (GTD) on the Anton Paar website (https://www.anton-paar.com).

Appendix B F.A.Q.

Why is the ball not running?

Not enough axis/ball contact friction

If the ball does not turn it is because there is more contact friction between the sample/ball than the axis/ball. To try reversing this situation, tilt the sample more vertically (10 - 15°) and approach as much as possible the sample from the axis in order the ball weight applies more on the axis than on the sample.

Ball is too hard (i.e. Tungsten Carbide, WC)

If a WC ball is used on a WC axis, the ball may not turn. Given the hardness of WC, there is very little of elastic deformation, therefore the ball doesn't rub, it slips.

Appendix C Declaration of conformity

Docusign Envelope ID: B7A31779-8D51-4783-9124-12B6AD5C9944

EC Declaration of Conformity

(original)

The manufacturer **Anton Paar TriTec SA,** Vernets 6, 2035 Corcelles, Switzerland – Europe, hereby declares that the machinery described below:

Product designation:	**Standard industrial Calotest, Standard compact Calotest, Compact/industrial combo Calotest**
Model:	**CAT2i, CAT2c, CAT2combo**
Material number:	145175, 145182, 145166
Serial number:	.....

is in conformity with the relevant European Union harmonisation legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer.

Machinery Directive (2006/42/EC, OJ L 157/24 of 9.6.2006)

Applied harmonised standard:

- EN ISO 12100:2010

Safety objectives of the Low Voltage Directive (2014/35/EU, OJ L 96/357 of 29.3.2014)

Applied harmonised standard:

- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

Electromagnetic Compatibility (2014/30/EU, OJ L 96/79 of 29.3.2014)

Applied harmonised standard:

- EN 61326-1:2013

RoHS Directive (2011/65/EU, OJ L 174/88 of 1.7.2011)

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

The manufacturer compiles the technical file according to 2006/42/EC Annex II.

Place and date of issue: Corcelles, 6 October 2025

Signed by:
Phillip Tomé
56E3078837B2466...
Phillip Tomé
General Manager
Anton Paar TriTec

Signed by:
Bertrand Bellaton
2B9B79DACFC4456...
Bertrand Bellaton
Head of R&D
Anton Paar TriTec

European Economic Area contact: **Anton Paar GmbH,** Anton-Paar-Str. 20**,** 8054 Graz, Austria

G77IB001EN-I

www.anton-paar.com