Reliable Connections

Oetiker fCAL 1
Calibration Measuring Unit

Instruction Manual

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1 Information about this document

1.1 Scope of application

This instruction manual is intended for the safe, proper and efficient use of the device and contains all relevant information on safety, design, function, installation, commissioning, operation, maintenance and disposal.

It is an integral part of the device and reflects the technical state of the art at the time of publication.

Please note the following instructions:

- Read the instruction manual carefully before using the device. Make sure that you are thoroughly familiar with all the individual parts, their properties and how they work.
- Follow all instructions in this instruction manual. They are a prerequisite to the long and reliable operation of the device.
- Observe all instructions marked with a warning symbol.

For reasons of better readability, the masculine form is used for personal names and personal nouns in this document. Corresponding terms apply to all genders in the interest of equal treatment. The abbreviated language form is for editorial reasons only and does not imply any judgment.

1.2 Storage of the instruction manual

This instruction manual is part of the scope of delivery. It must be kept close to the device and must be accessible at all times.

The operator must ensure that the target group [▸ 13] has read and understood it.

It must also be handed over if the device is resold.

1.3 Navigation within this document

Marginal column

The marginal column contains additional information (pictograms, functional illustrations, keywords). They either point out dangers or make it easier to understand and search within the manual.

Cross-references

Cross-references are highlighted in color. They refer to information in other chapters, e.g. Navigation within this document [▸ 6] or *Measure mode*.

1.4 Presentation conventions

This document contains various symbols and text markups.

Representation of buttons in the instruction manual

In the procedural instructions, the corresponding button or the relevant symbols/icons that must be pressed or selected are shown next to the text.

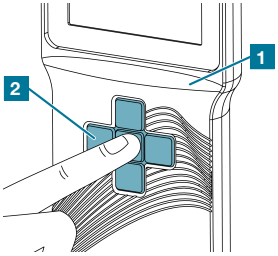
Symbols and text labels in the instructions

Symbol	Name	Function
–	List item (hyphen)	The hyphen indicates a list item.
▶	Action	The gray triangle indicates actions that must be performed in the specified order.
▶ ▷	Reaction	The white triangle indicates the reaction to an action.
Symbols, icons or text selections on the display (e.g. Measure)	Display selection reference	References to symbols, icons, or text selections on the display are shown in a display-like format.
1	Reference to image	Color-highlighted references indicate the position in the image.
Target group [▸ 13]	Cross-reference	Cross-references are used for navigation within the document. They refer to other chapters and are linked.
	User note	The light bulb indicates user notes and tips for efficient use of the device.

Graphics

Graphics provide information about the appearance and location of an assembly or function. The parts relevant to a work step are assigned an item number and are highlighted in color. The corresponding parts are indicated in the text by a parenthese, e. g.:

- ▶ Place the fCAL 1 Measuring Device (MD) 1 on a flat surface or hold firmly in your hand.
- ▶ Press and hold the middle button of the keypad 2 for 1.5 s.
  - ▷ fCAL 1 Measuring Device (MD) 1 switches on.



1.5 Revision information

All technical information, data and operating instructions contained in this instruction manual correspond to the state-of-the-art at the time of printing and are issued based on our previous experience and findings, according to the best of our knowledge.

We reserve the right to make technical changes within the scope of the further development of the components covered in this instruction manual. Therefore, no claims can be derived from the information, illustrations and descriptions in this instruction manual.

We expressly point out that only original spare parts and original accessories approved by Oetiker Schweiz AG may be used. This also applies analogously to components from other manufacturers.

2 Safety

2.1 General safety information

Every person working with the device must have read and understood this instruction manual and in particular the chapter on safety.

Risk is reduced by observing the safety instructions and complying with the instructed occupational safety measures.

NOTICE

Read the instruction manual and safety instructions before use.

2.2 Safety instructions

This instruction manual uses warning notices to alert you to potential personal injury and property damage.

- Always read and follow these warnings.
- Compliance with a warning symbol and warning word is mandatory.

The warning signs are divided into four levels: Danger, warning, caution, notice. They contain: Type and source of danger, severity of consequences and measures to avoid danger.

2.2.1 Personal hazards

⚠ DANGER

Danger

Signal word to indicate a high risk hazard that will result in immediate death or serious injury.

⚠ WARNING

Warning

Signal word indicating a hazard with medium risk, which could possibly result in death or serious injury.

⚠ CAUTION

Caution

Signal word to indicate a low-risk hazard that could possibly result in minor or moderate injury.

NOTICE

Notice

Signal word for a potentially harmful situation in which the device or an object in its vicinity may be damaged.

2.3 Symbols used

The following symbols are used in this instruction manual to indicate hazards, mandatory actions, prohibitions, and important information for the safe and proper use of the device.

Symbol	Meaning
	**WARNING** **General warning sign** Warns of a hazard. Always observe the associated safety information.
	**MANDATORY** **Read the instruction manual** Read the instruction manual and safety instructions before use.
	**MANDATORY** **General mandatory action sign** Mandatory action must be observed in accordance with supplementary information.
	**MANDATORY** **Wear eye protection** Wear eye protection when operating the device.
	**CAUTION** **DO NOT USE IN DAMP ROOMS!** DO NOT EXPOSE TO RAIN OR USE IN DAMP ROOMS.

Symbol	Meaning
	**Disposal with household waste prohibited** The device must not be disposed of with household waste. Dispose of the device through official collection points.
	**PROHIBITION** **Do not touch** Do not touch the marked parts.

2.4 General safety instructions

⚠ DANGER

Risk of personal injury

Failure to observe the personal dangers described in this instruction manual may result in personal injury.

- ▶ Read this instruction manual carefully before commissioning and operating the device.
- ▶ Observe the operating instructions.

2.5 Specific safety instructions

⚠ WARNING

Fire and explosion hazard

If rechargeable batteries are left in the device, there is an acute risk of fire or explosion in the event of damage or improper handling.

- ▶ Always remove the rechargeable batteries from the device before returning it.
- ▶ Do NOT include the rechargeable batteries with the return shipment.

NOTICE

Malfunctions

Operating the device outside the functions described in this instruction manual may damage the device.

- ▶ Read this instruction manual carefully before commissioning and operating the device.
- ▶ Observe the technical specifications under Technical data [▸ 18].

2.5.1 Noise level

The device does not generate any perceptible noise during operation and does not exceed any relevant sound pressure levels.

2.5.2 Ventilation

The device has no special ventilation requirements. No harmful gases, vapors or particles are generated during operation.

2.6 Safety-conscious operation

The fCAL 1 Calibration Measuring Unit (CMU) is intended exclusively for indoor use.

If the fCAL 1 Calibration Measuring Unit (CMU) is operated within its technical specifications and in compliance with the safety regulations, it does not pose any danger.

Oetiker accepts no liability for damage to property or personal injury caused by the incorrect interpretation of the measurement results.

All persons entrusted with the installation, commissioning, maintenance or repair of the device must have read and understood this instruction manual.

- – Before using thefCAL 1 Calibration Measuring Unit (CMU), check the device for visible damage and ensure that it is in perfect condition.
- – Report any defects immediately to your supervisor and stop using the device.
- – Error messages may only be acknowledged if the cause of the fault has been rectified and there is no further danger.

2.7 Modifications to the device

If the seal on the device is damaged or removed without authorization, any warranty provided by Oetiker shall be rendered null and void.

In particular, extending or modifying the cables and carrying out repairs are prohibited.

Modifications to the device are generally not permitted. However, if modifications are necessary, the following points must be observed:

- Do not make any modifications or additions or perform conversions on the device without the express permission of Oetiker.
- Do not make any changes to the system software without the express permission of Oetiker.
- All conversion measures require written confirmation from Oetiker.

2.8 Target audience

The operator is responsible for ensuring the required qualification of the personnel and their proper handling of the device. He must ensure that only competent and duly authorized personnel work on the device.

Competent persons are those who have sufficient knowledge, based on their technical training and experience, so as to be familiar with the commissioning and operation of the device. His qualifications should also enable him to assess the safe working condition of the device in accordance with the relevant occupational health and safety and accident prevention regulations and the generally recognized rules of technology and standards.

	Operator	Line Manager	Service technician (Oetiker)
Normal operation	X	X	X
Initial commissioning		X	X
Cleaning	X	X	X
Troubleshooting and fault correction		X	X
Maintenance, repairs, and servicing			X

Operator

The operator must have read and understood this instruction manual in his own language.

The operator:

- is familiar with the warnings and safety instructions in this document
- knows the relevant procedures described in this document
- has been trained accordingly
- has been trained by the responsible line manager

The operator may:

- operate the device, using its basic functions
- clean the device
- has been instructed on all operating issues (including risks)

Line manager

The line manager must have read and understood this instruction manual in his own language.

The line manager:

- possesses the knowledge described for the «Operator»
- trains the operator
- can interpret and rectify errors

The line manager may:

- operate the device
- carry out the initial commissioning
- apply settings
- train operators in handling the device
- make the instruction manual available

Service technician (Oetiker)

The service technician must have read and understood this instruction manual in his own language.

The service technician:

- possesses the knowledge described for the «Line Manager»
- can carry out simple service activities in accordance with the instruction manual

The service technician may:

- operate the device
- carry out the initial commissioning
- apply settings
- train operators in handling the device
- make the original instruction manual available
- carry out maintenance, servicing and repair work

2.9 Signs and labels on the fCAL 1 Calibration Measuring Unit (CMU)

Symbol	Meaning
	**Caution: leaking rechargeable batteries** Improper use of rechargeable batteries may cause leakage and damage the electronics of the device. ▶ Use the NiMH rechargeable battery type recommended in Battery powered fCAL 1 Measuring Device (MD) [▶ 19].

- ▶ Observe the safety signs and safety labels.
- ▶ Do not remove the safety signs and safety labels.
- ▶ Always keep the safety signs and safety labels in a legible condition.

3 Intended use

The fCAL 1 Calibration Measuring Unit (CMU) consisting of the fCAL 1 Measuring Device (MD) and a fCAL 1 Closing Force Sensor (CFS) has been developed according to the state-of-the-art and product-specific standards and is intended exclusively for checking the closing force and for interactive communication with pneumatic/hydraulic tools and other Oetiker tools.

The fCAL 1 Calibration Measuring Unit (CMU) is used in technical production facilities, in industry in the area of commissioning and for process monitoring and quality assurance. Any use beyond this description is considered «not as intended».

Areas of application

– Calibration of Oetiker tools according to the list Compatibility list of Oetiker products [▸ 17]

The fCAL 1 Measuring Device (MD) can be operated both wirelessly (in battery mode) and with a wired setup (via the USB-C cable).

The fCAL 1 Measuring Device (MD) can be used for force measurements in conjunction with a fCAL 1 Closing Force Sensor (CFS).

The display shows the current measured value and the mean values, which can then be sent to an Oetiker tool via an external interface or entered manually. In addition, the measured values can also be stored in the internal device memory and sent directly to a PC via the USB-C interface.

The fCAL 1 Calibration Measuring Unit (CMU) is not suitable for safety applications.

Examples of «Improper use»

– Force measurements on tools for which the fCAL 1 Calibration Measuring Unit (CMU) is not approved and/or that are not Oetiker products [▸ 17].
– Operating the fCAL 1 Calibration Measuring Unit (CMU) with a sensor not intended for this purpose.
– Operating the fCAL 1 Closing Force Sensor (CFS) with a measuring unit not intended for this purpose.
– Operating the fCAL 1 Calibration Measuring Unit (CMU) outside its measuring range.

Unintended use

The fCAL 1 Calibration Measuring Unit (CMU) corresponds to the state-of-the-art and is safe to operate. Residual dangers exist in the event of improper use and operation by untrained personnel (see Target audience [▸ 13]). The operator of the fCAL 1 Calibration Measuring Unit (CMU), not the manufacturer, is responsible for any personal injury or damage to property, resulting from improper use.

3.1 Compatibility list of Oetiker products

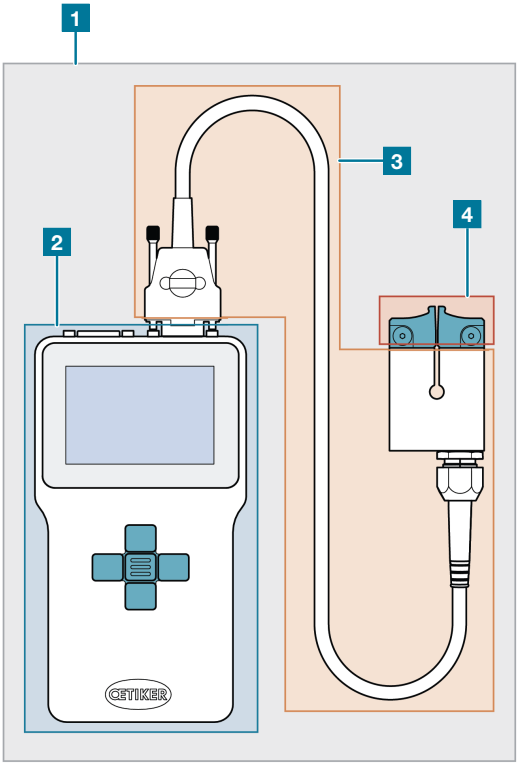
The fCAL 1 Calibration Measuring Unit (CMU) is compatible with the following Oetiker tools:

- «*EPC 01*» Electro-Pneumatic Controller
- «*FAST 3000*» Fastener Assembly Stationary Tool
- «*CP10 / CP20*» Cordless Clamp Pincer
- «*ELK 02*» Electronically Controlled Pneumatic Pincer
- «*ME Pincer*» Pneumatic Pincer
- «*HMK*» Manual Pincer with Force Control
- «*SMART*» Sensor Monitored Assembly Repair Tool

4 Technical data

4.1 Overall system fCAL 1 Calibration Measuring Unit (CMU)

The fCAL 1 Calibration Measuring Unit (CMU) consists of the fCAL 1 Measuring Device (MD) and the fCAL 1 Closing Force Sensor (CFS) including the fCAL 1 Closing Force Jaws (CFJ).



1 fCAL 1 Calibration Measuring Unit (CMU)
2 fCAL 1 Measuring Device (MD)
3 fCAL 1 Closing Force Sensor (CFS)
4 fCAL 1 Closing Force Jaws (CFJ)

4.2 Technical specifications

The following subsections provide a structured summary of the product-specific technical specifications of the complete fCAL1 system and its individual components.

4.2.1 Ambient conditions fCAL 1 Calibration Measuring Unit (CMU)

Parameter	Value
Display resolution	1 N
Working temperature range	10 °C to 40 °C
Altitude	Max. 2000 m a.s.l.
Pollution level	2 (according to EN 61010-1)
Overvoltage category	I (according to EN 61010-1)

4.2.2 USB powered fCAL 1 Measuring Device (MD)

Parameter	Value
Voltage	5 V ±0,25 V
Current / output	– 1500 mA / 7.5 W (operation & battery charging) – 200 mA / 1 W (operation & no battery charging)
USB PD protocol	– USB PD 3.0 standard, profile 1 (operation & battery charging) – No PD protocol (operation & no battery charging)
USB cable	– Any cable with USB-C to USB-C connections. USB-PD-compatible cable not required (operation & battery charging) – Any USB-C cable (operation & no battery charging)
Energy source	– Limited Power Source (LPS) classified power supply according to IEC 62368-1 (USB-C power supply with corresponding safety certification)

4.2.3 Battery powered fCAL 1 Measuring Device (MD)

Parameter	Value
Type	4 x AA NiMH rechargeable battery 1.2 V 2500 mAh

4.2.4 Ambient conditions fCAL 1 Closing Force Sensors (CFS)

fCAL 1 Closing Force Sensor 6 kN (CFS 06)

Parameter	Value
Sensor type	Strain gauge (DMS) sensor
Measuring range	200 - 6000 N
Calibrated range	1200 - 6000 N
Accuracy	Up to 2000 N: ± 11 N Above 2000 N: ± 26 N over the full measuring range
Max. Force	6720 N (112 %)
Working temperature range	10 °C to 40 °C
Altitude	Max. 2000 m a.s.l.
Pollution level	3 (according to EN 61010-1)
Overvoltage category	I (according to EN 61010-1)

fCAL 1 Closing Force Sensor 10 kN (CFS 10)

Parameter	Value
Sensor type	Strain gauge (DMS) sensor
Measuring range	200 – 10,000 N
Calibrated range	2000 – 10,000 N
Accuracy	± 45 N over the full measuring range
Max. Force without damage to the sensor	11,200 N (112 %)
Working temperature range	10 °C to 40 °C
Altitude	Max. 2000 m a.s.l.
Pollution level	3 (according to EN 61010-1)
Overvoltage category	I (according to EN 61010-1)

4.3 Operating mode

The fCAL 1 Measuring Device (MD) can be operated with 4x AA 1.2V NiMH rechargeable batteries or a USB-C power supply unit. Switching between battery and USB operation mode is automatic, with USB operation mode having priority.

USB operation mode without charging the batteries is possible at any time and there are no special requirements for the USB-C power supply unit. (see Charging the batteries [▶ 39]).

4.4 Interfaces

Type	Interface to	Type	Oetiker interface designation
Data communication	*EPC 01* (data)	RS-232	*X3*
Force measurement	fCAL 1 CFS	Analog	*X5*
PC communication	PC	USB-C	*USB-C* 

4.4.1 Data communication

X3 / RS-232 for EPC 01 Control Unit or other device

Communication parameters	Value
Baud rate [bit/s]	9600 bd
Data bits	8
Parity	even
Stoppbits	1
Protocol	None (text as readable ASCII characters)

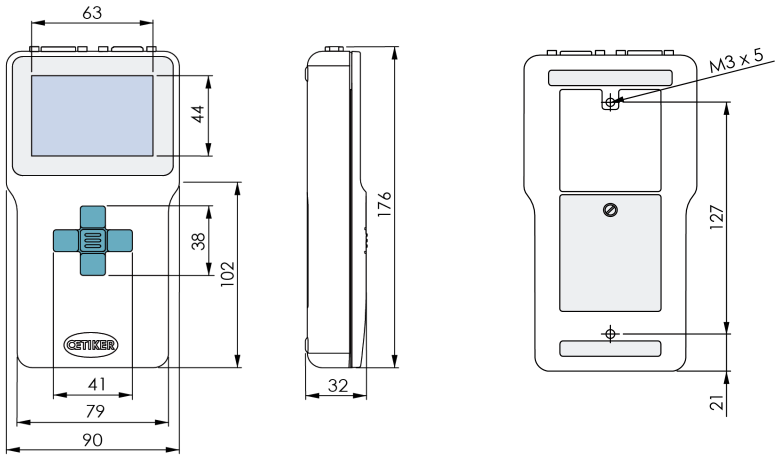
USB-C for PC

Communication parameters	Value
Baud rate [bit/s]	256'000
Data bits	8
Parity	odd
Stoppbits	1
New line at	LF

4.5 Dimensions, weight, materials

4.5.1 Dimensions fCAL 1 Measuring Device (MD) [mm]

Dimensional drawing	Hole pattern for wall mounting of the device



H x W x D	176 x 90 x 32

Dimension fCAL 1 Display

L x H	63 x 44

4.5.2 Weight fCAL 1 Measuring Device (MD) [g]

Housing incl. electronics without rechargeable batteries	280
Rechargeable batteries (4 pcs. approx. 20 g each)	80

4.5.3 Material fCAL 1 Measuring Device (MD)

Housing	PC / ABS, black
Keypad	Silicone, light blue

Non-slip rubber feet	Silicone, black

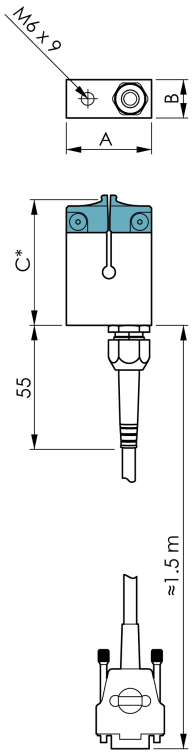
Material fCAL 1 Display

LCD Display	Tempered glass

4.5.4 Dimensions fCAL 1 Closing Force Sensor (CFS) [mm]

Dimensional drawing and variant-independent dimensions

The dimension for the force application plane, which is marked with an * in the dimensional drawing, remains unchanged for all jaw shapes and jaw sizes.



	CFS 06	CFS 10
A	40	48
B	18	22
C	59	66.5

fCAL 1 Closing Force Jaws (CFJ)

The dimensions of the Closing Force Jaws can vary depending on the type of clamp selected. For details on selecting the right Closing Force Jaws for your particular application, please refer to the technical data sheet for the respective clamp type.

Cable length	1.5 m, must NOT be extended or shortened!
Connection	SUB MIN D 9-pin plug
Thread	M6 for individual mounting fixture (see Positioning the fCAL 1 Closing Force Sensor (CFS) [▶ 44])

4.5.5 Weight fCAL 1 Closing Force Sensor (CFS) [g]

	CFS 06	CFS 10
Sensor without fCAL 1 Closing Force Jaws (CFJ)	300	525

4.5.6 Material fCAL 1 Closing Force Sensor (CFS)

CFS	Stainless steel

5 Design and function

5.1 Design of the fCAL 1 Measuring Device (MD)

1 Display
2 Keypad
3 Charging and communication port (USB-C)
4 X5 Interface fCAL 1 Closing Force Sensor (CFS)
5 X3 Interface EPC 01 / ELK 02 (RS232)
6 2x M3 Mounting thread for wall installation
7 Battery compartment

5.2 Operating concept

The described functions are available on the device and are explained in this instruction manual to provide a basic understanding of device operation.

Detailed operating instructions are described in the chapter «Operation [▶ 43]».

The functions for operating the device are provided via the central keypad.

These include switching the device on and off, confirming menu selections, and navigating within the menus.

The measured values are displayed on the backlit LCD display.

5.2.1 Switching on/off and confirming

The center button of the keypad is part of the central device operation system. It enables switching the device on and off as well as confirming menu selections.

A device restart can be forced by pressing and holding the middle keypad button (see Restarting the device [▶ 69]).

5.2.2 Vertical scrolling

Vertical scrolling is used for navigation within a selected menu or submenu.

Pressing and holding the up/down buttons enables accelerated scrolling (fast scrolling).

5.2.3 Horizontal menu navigation

Horizontal menu navigation is used to select menu items in the lower Display operating area [▶ 28] as well as to adjust values, for example tolerance values.

The left/right buttons are used to switch between menu items.

In addition, these buttons allow direct switching to the first or last menu selection within the vertical menu navigation.

5.3 Display areas

1 Display information area [▸ 27]
2 Display measurement area [▸ 28]
3 Display operating area [▸ 28]

5.3.1 Display information area

08:15 Time

Hold Measure mode

No sensor connected. Please connect sensor and try again.

Battery load

5.3.2 Display measurement area

Σ/6 Amount of closures

4383 N Mean force of all performed measurements

5 N Currently measured force

4351 N Measured value of the last closure

5.3.3 Display operating area

Depending on the submenu, different operating elements (symbols/icons) may appear in the operating area to those described here. The additional operating elements are described in detail in the corresponding chapters.

Back

Set zero

Send average measured value to connected Oetiker tool via X3 interface

Save measurement

Delete/reset measurement

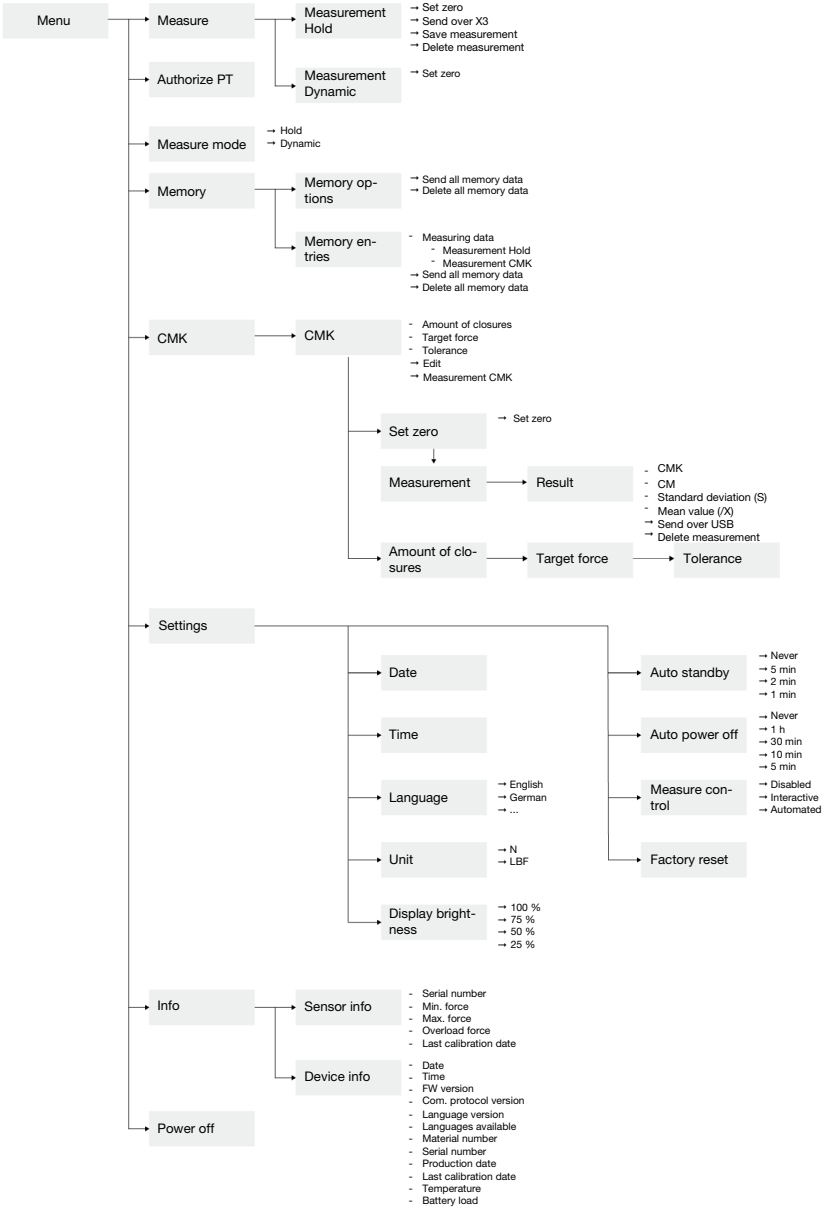
5.4 Device functions

When the fCAL 1 Measuring Device (MD) is switched on, the last used «Measure mode» (Hold / Dynamic) is displayed.

Using the central keypad, functions for navigating from the main menu to the lower menu levels are available (see Operating concept [▶ 26]).

5.4.1 Menu structure

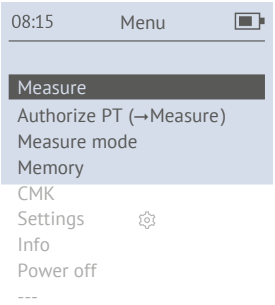
The complete graphical menu structure is illustrated in the following diagram:


Menu
Measure
Measurement Hold
→ Set zero
→ Send over X3
→ Save measurement
→ Delete measurement
Measurement Dynamic
→ Set zero
Authorize PT
Measure mode
→ Hold
→ Dynamic
Memory
Memory options
→ Send all memory data
→ Delete all memory data
Memory entries
- Measuring data
- Measurement Hold
- Measurement CMK
→ Send all memory data
→ Delete all memory data
CMK
CMK
- Amount of closures
- Target force
- Tolerance
→ Edit
→ Measurement CMK
Set zero
→ Set zero
Measurement
Result
- CMK
- CM
- Standard deviation (S)
- Mean value (/X)
→ Send over USB
→ Delete measurement
Amount of closures
Target force
Tolerance
Settings
Date
Time
Language
→ English
→ German
→ ...
Unit
→ N
→ LBF
Display brightness
→ 100 %
→ 75 %
→ 50 %
→ 25 %
Auto standby
→ Never
→ 5 min
→ 2 min
→ 1 min
Auto power off
→ Never
→ 1 h
→ 30 min
→ 10 min
→ 5 min
Measure control
→ Disabled
→ Interactive
→ Automated
Factory reset
Info
Sensor info
- Serial number
- Min. force
- Max. force
- Overload force
- Last calibration date
Device info
- Date
- Time
- FW version
- Com. protocol version
- Language version
- Languages available
- Material number
- Serial number
- Production date
- Last calibration date
- Temperature
- Battery load
Power off

5.4.2 Main menu

The main menu of the fCAL 1 Measuring Device (MD) provides the central device functions.

The following functions and menus are available via the main menu:



- Measure [▶ 31]
- Authorize Pincer Test (Authorize PT) [▶ 31] / Authorize PT (-> Measure)
- Measure mode [▶ 32]
- Memory [▶ 32]
- CMK [▶ 33]
- Settings [▶ 33]
- Info [▶ 36]
- Power off [▶ 36]

5.4.3 Measure

The «Measure» function is used to determine the force applied by an Oetiker tool, which is visualized on the fCAL 1 display.

For the «Measure» function, a selectable measuring mode Measure mode (Hold or Dynamic) is available.

In addition, the «Measure» function includes the option to reset the displayed measured value to «zero».

How to perform a measurement is described in the chapter Performing a measurement [▶ 45].

5.4.4 Authorize Pincer Test (Authorize PT)

The «Authorize Pincer Test» (Authorize PT) function is used to enable a connected Oetiker tool for performing a pincer test, provided that the defined authorization criteria are met.

The authorization ensures that only suitable and compatible Oetiker tools can be used for the pincer test.

How to perform a Pincer Test is described in the chapter «Performing the Pincer Test [▶ 46]».

5.4.5 Measure mode

The Measure mode determines how the force recorded by the fCAL 1 Closing Force Sensor (CFS) is displayed and processed.

The Measure mode can be set to «Hold» or «Dynamic».

By default, the Measure mode «Hold» is activated for measurements and calibrations.

Measure mode «Hold»

In Measure mode Hold, the measured force is displayed on the fCAL 1 display.
After releasing the jaws of the operated Oetiker tool, the determined measured value is displayed on the display and retained.

Measurement mode «Dynamic»

The Measure mode Dynamic is optionally used for measuring device self-testing.

The dynamically varying force applied to the fCAL 1 Closing Force Sensor (CFS) is displayed on the fCAL 1 Measuring Device (MD) and continuously adjusted.

The measured value displayed in Measure mode «Dynamic» is NOT suitable for calibration.

The selection of the measurement modes is described in the chapter Selecting the Measure mode [▶ 48].

5.4.6 Memory

The «Memory» function is used to store, manage, and retrieve measured values.

- Each measurement series can store up to 100 measured values.
- A total of 100 measurement series, each containing 100 measured values, can be stored.

Stored measurement values are saved together with Date and Time. The user can identify stored measurement series and measurement values based on this information.

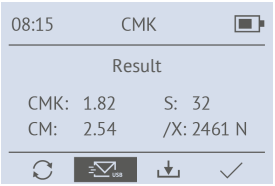
Information on setting the Date and Timeis provided in the Settings [▶ 33] chapter.

The description of how to operate the memory function is provided in the chapter Using memory [▶ 48].

5.4.7 CMK

The CMK value (machine capability index) indicates how well a machine can manufacture parts within specified tolerances.

The following values can be displayed on the fCAL 1 display:



- CMK: Information on the test definition in connection with the use of the fCAL 1 Calibration Measuring Unit (CMU) can be requested from the Oetiker Service Center (see Contact details [▶ 79]).
- S: Standard deviation
- CM: Analogous to the CMK value
- /X: Mean value of the measurements

The «CMK» function is used to determine the CMK value of the operated Oetiker tool.

The preferred presettings for the CMK measurement, such as Amount of closures, Target force and Tolerance, are part of the test definition.

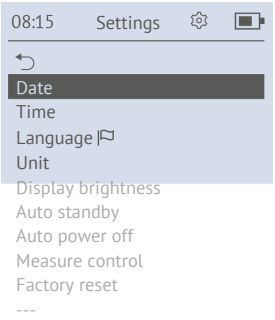
Operation for determining the CMK value is described in the Determining the CMK value [▶ 49] chapter.

5.4.8 Settings

In the Settings menu of the measuring device, individual settings such as Date, Time, Language, Unit, Display brightness, etc. can be configured

The setting parameters can be selected with the up/down or left/right buttons and confirmed with the middle keypad button.

How to adjust the settings is described in the «Adjusting settings [▶ 52]» chapter.



Date

To produce a timestamp for the recorded data, the system date must be set in the Date submenu. This setting is stored by an internal clock that is powered by an internal battery.

If its charge is low, the date can no longer be stored device-internally. In this case, the backup battery must be replaced by your local Oetiker Service Center [▶ 79].

Time

To produce a timestamp for the recorded data, the system date must be set in the Time submenu. This setting is stored by an internal clock that is powered by an internal battery.

If its charge is low, the time can no longer be stored device-internally. In this case, the backup battery must be replaced by your local Oetiker Service Center [▶ 79].

Language

When the fCAL 1 Measuring Device (MD) is first delivered, the start menu appears in English after switching on. The desired language can be set in the Language submenu.

Using the up/down keypad buttons, the available languages can be browsed and confirmed using the middle keypad button.

Available languages on the fCAL 1 Measuring Device (MD):

Chinese • German • English • French • Italian • Japanese • Korean • Dutch • Polish • Portuguese • Portuguese BR • Romanian • Swedish • Serbian • Slovakian • Slovenian • Spanish • Czech • Turkish • Hungarian

Unit

The desired unit of measurement is set in the submenu.

In the Unit submenu, the required unit of measurement is set. The displays of settings, tolerance limits, and calibration values are then shown in the selected unit.

Selectable units:

[N] (Newton) • [lbf] (Pound-force)

Display brightness

In the Display brightness submenu, different brightness levels can be set. Lower brightness values increase energy efficiency and therefore extend battery runtime.

Available brightness levels:

100% • 75% • 50% • 25%

Auto standby

In the Auto standby submenu, the time after which the device switches to standby mode can be set. In standby mode, the display backlight switches off, which increases battery runtime.

The device switches back on after the configured time if no action is detected (by pressing a button, performing a measurement, or USB communication). Any action resets the timer to the configured automatic standby time.

Selectable Auto standby times:

Never • 5 min • 2 min • 1 min

Auto power off

In the Auto power off submenu, you can set the time after which the device switches off automatically.

The device switches off after the configured time if no action is detected (by pressing a button, performing a measurement, or USB communication). Any action resets the timer to the configured automatic power-off time.

Selectable times for Auto power off:

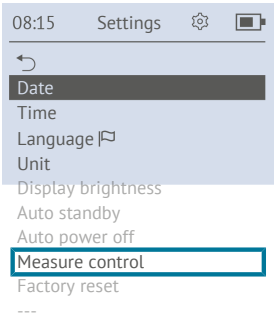
Never • 1 h • 30 min • 10 min • 5 min

Measure control

The «Measure control» function is available exclusively in combination with the Electro-Pneumatic Controller «*EPC 01*» from Oetiker.

This function increases the level of automation of the force calibration process when used with the Oetiker «*EPC 01*».

When «Measure control» is activated, steps that were previously performed manually on the fCAL 1 Measuring Device (MD) — such as transferring the measured force or deleting previous measurements — are performed automatically.



The Measure control function is available in the Settings submenu and supports the modes Disabled, Interactive, or Automated.

- Disabled: The Measure control function is disabled.
- Interactive: At the start of each Pincer Test with a compatible Oetiker closing tool, a confirmation screen with the selection options «Accept» or «Decline» is displayed on the fCAL1 Measuring Device (MD).
- Automated: The measurement starts immediately without a confirmation screen. In addition, the sensor is automatically set to «Zero» at the beginning of the Pincer Test.

The effects of the selected measurement control modes apply when performing the Pincer Test (see Performing the Pincer Test [▶ 46]).

Factory reset

By executing the submenu function Factory reset, the device is completely reset to its original factory settings. All user-specific data, settings, and stored data are IRREVERSIBLY deleted.

This submenu function is used to:

- Prepare the device for a new commissioning,
- Delete sensitive data before transferring or disposing of the device.

The procedure is described in the chapter Performing a factory reset [▶ 53].

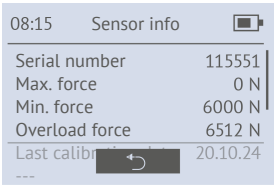
5.4.9 Info

In the Info menu, information about the fCAL 1 Measuring Device (MD) and the connected as well as about the connected fCAL 1 Closing Force Sensor (CFS) can be accessed.

The information is displayed by selecting the corresponding entry using the central keypad.

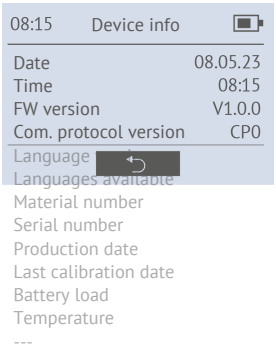
Sensor info

In the Sensor info submenu, the following information can be retrieved:



Device info

In the Device info submenu, the following information can be retrieved:



5.4.10 Power off

The fCAL 1 Measuring Device (MD) provides the following two options for switching off the device:

- Via the middle keypad button
- Via the corresponding Power off function in the main menu

When the fCAL1 Measuring Device (MD) is switched off, the measurement operation is terminated and the device is shut down in a controlled manner.

6 Commissioning

6.1 Scope of delivery

The scope of delivery must be checked for completeness and visible external damage.

– All components are delivered in the carrying case, provided their dimensions allow it.
– The scope of delivery may vary depending on the order; not all components must be included.
– Additionally, the following items may be included in the scope of delivery:

Designation	Item number / remarks	Quantity
fCAL 1 Measuring device	32100060	1
fCAL 1 Closing Force Sensor 6kN	32100028	1
Calibration set CFS 06-10-FC	32100038	1
Calibration set CFS 06-07-FC	32100040	1
Calibration set CFS 06-05-FC	32100042	1
Calibration set CFS 06-168-03-FC	32100044	1
Calibration set CFS 06-168-13-FC	32100045	1
Calibration set CFS 06-192-FC	32100047	1
Calibration set CFS 06-292-FC	32100055	1
Calibration set CFS 06-270	32100051	1
Calibration set CFS 06-268-FC	32100052	1
Calibration set CFS 06-298-FSC	32100054	1
fCAL 1 Closing Force Sensor 10 kN	32100078	1
Calibration set CFS 10-10-FC	32100087	1
Calibration set CFS 10-12.5FC	32100083	1
fCAL 1 Accessory Bundle	32100089	1
fCAL 1 L-Boxx 102 assembly	32100095	1
fCAL 1 L-Boxx mini assembly for MD	32100097	1
fCAL 1 L-Boxx mini assembly for CFS	32100098	1
Instruction manual fCAL 1 en	08906871	1

Designation	Item number / remarks	Quantity
Multilanguage Declaration of conformity fCAL 1	08906869	1

6.2 Unpacking

The fCAL 1 Calibration Measuring Unit (CMU) is properly packaged and delivered by Oetiker.

During transport, it is protected against weather influences and equipped with suitable packaging materials.

⚠ CAUTION

Caution during initial commissioning

Risk of injury and possible material damage due to damage to the device.

- ▶ Check the device for damage. If transport damage is suspected, contact your local Oetiker Service Center [▸ 79].
- ▶ Do not switch on the device if it shows signs of transport damage.
- ▶ Only operate the device within the technical specifications described in these operating instructions and for the purpose described.

6.3 Inserting the batteries

The rechargeable batteries must be inserted before operation.

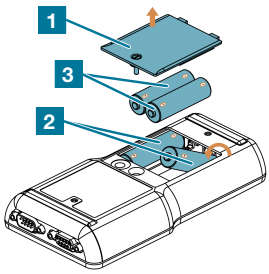
NOTICE

Caution in case of improper handling of rechargeable batteries

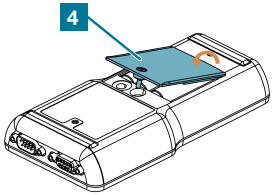
Damage to the measuring device due to improper handling of rechargeable batteries. Observe the following points when operating the device with AA rechargeable batteries:

- ▶ Insert the rechargeable batteries according to the battery arrangement diagram in the battery compartment.
- ▶ Always use a set of rechargeable batteries with the same charge level.
- ▶ Do not replace individual old empty rechargeable batteries with new ones.
- ▶ Always use rechargeable batteries from the same manufacturer and of the same type when replacing the batteries.
- ▶ Observe the rechargeable battery manufacturer's instructions.

- Open the battery compartment cover **1** with a slot screwdriver size 3.
- Insert the outer rechargeable batteries **2**.
- Insert the inner rechargeable batteries **3**.



- Slide the battery compartment cover **4** into position.
- Tighten the screw connection using a size 3 slotted screwdriver.



6.4 Charging the batteries

The fCAL 1 Measuring Device (MD) can be charged via the USB-C port with inserted NiMH rechargeable batteries (see Technical data [▸ 18]).

DANGER

Warning against fire hazard when operating with a non-certified USB-C power supply unit

The use of a non-certified power supply unit can lead to overheating and may pose a fire hazard.

- Ensure that the power source is a power supply classified as a «Limited Power Source» (LPS) in accordance with IEC 62368-1 (see Technical data [▸ 18]).
- Only use a USB-C power supply unit with the appropriate safety certification.

NOTICE

Risk of battery leakage

Leaking battery fluid can damage the device electronics and the batteries.

- Only use the recommended NiMH rechargeable battery type.
- Replace the rechargeable batteries periodically.

NOTICE

Inaccurate display of battery charge level values

Inaccurate battery charge level information and interruption of the battery charge learning process of the fCAL 1 Measuring Device (MD).

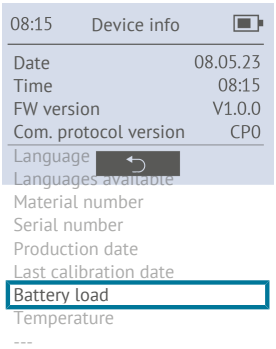
- ▶ Perform several complete charging and discharging cycles with a new set of rechargeable batteries before first commissioning.
- ▶ Repeat this procedure every time a new set of rechargeable batteries is inserted.

The fCAL 1 Measuring Device (MD) operates with four AA NiMH rechargeable batteries. To ensure accurate charge-level indication, the MD learns from the battery data; therefore, perform complete charge and discharge cycles using the same set of batteries. Removing the batteries while the device is powered via USB resets this learning process.

The battery symbol indicates the charge level in 25 % increments, while the device information screen displays it as a percentage. Accuracy may vary depending on the battery type and the current learning process.

- – Use always the same set of balanced batteries – do not exchange them individually.
- – Ensure ambient temperature stays below 35 °C for optimal charging performance and stable thermal conditions.
- – Avoid any movement or vibrations during the charging process.
- – Charge the rechargeable batteries only when the battery cover is assembled.
- – Replace the batteries when the operating time decreases noticeably.

The battery status of the fCAL 1 Measuring Device (MD) can be viewed via the symbol in the «Information area» (see Display information area [▶ 27]) or in the Device info submenu under «Battery load».



The corresponding symbol is shown on the display while the battery is charging.

Current battery level

Battery is charging

Battery fully charged

6.5 Switching on the device

NOTICE

Condensation on the fCAL 1 Measuring Device (MD) due to moisture ingress

Switching on a damp measuring device can lead to damage to the device and its electronic components.

- Dry the measuring device thoroughly.
- Before switching the measuring device on, ensure that no moisture remains in or on the housing.
- Stop using the measuring device immediately if it malfunctions.
- Contact your local Oetiker Service Center [▶ 79].

NOTICE

Damage to the Measuring Device (MD) after prolonged periods of non-use

Impairment of the measuring accuracy due to damage to the Measuring Device (MD) due to potential battery damage.

- Before using the fCAL 1 Measuring Device (MD) again, check whether one or more rechargeable batteries have leaked/are damaged.
- If the rechargeable batteries in the battery compartment are damaged, please stop using the fCAL 1 Measuring Device (MD).
- Contact your local Oetiker Service Center [▶ 79].

- Press and hold the middle keypad button for at least 1.5 s.
  - ▷ The device is switched on.

A device restart can be forced by pressing and holding the middle keypad button (see Restarting the device [▶ 69]).

6.6 Connecting

⚠ CAUTION

Caution when connecting products other than those specified in this instruction manual

Risk of injury and damage to the device if products other than those recommended by Oetiker are connected.

- ▶ Only use the fCAL 1 Calibration Measuring Unit (CMU) in combination with original Oetiker tools.
- ▶ Please refer to the compatibility list [▶ 17] of Oetiker products.

NOTICE

The fCAL 1 Closing Force Sensor (CFS) is not connected to fCAL 1 Measuring Device (MD)

Measurement is not possible.

- ▶ Connect the fCAL 1 Closing Force Sensor (CFS) to the fCAL 1 Measuring Device (MD) to carry out a measurement.

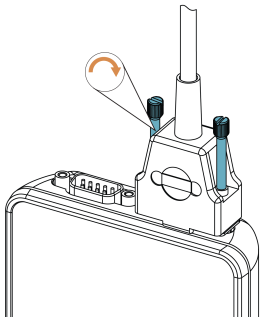
If the fCAL 1 Closing Force Sensor (CFS) is not connected to the fCAL 1 Measuring Device (MD), this is indicated by the corresponding symbol on the display.

NOTICE

Impaired measurement accuracy due to an improperly secured sensor

Measurement accuracy may be impaired if the fCAL 1 Closing Force Sensor (CFS) is not correctly secured to the fCAL 1 Measuring Device (MD).

- ▶ Tighten the screws of the CFS after inserting it.



7 Operation

The following sections explain the device's measurement functions based on the menu functions Measure [▶ 31], Authorize Pincer Test (Authorize PT) [▶ 31] and Measure mode [▶ 32] described in the chapter Design and function [▶ 25].

7.1 Closing force measurements with the fCAL 1 Closing Force Sensor (CFS)

⚠ DANGER

Risk of eye injury due to breakage of the fCAL 1 Closing Force Jaws (CFJ) during measurement.

Flying sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause serious eye injuries.

▶ Wear safety glasses when working with the fCAL 1 Measuring Device (MD).

⚠ WARNING

Warning against hand injuries due to contact with sharp-edged parts.

Broken off sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause cuts.

▶ Wear your personal protective equipment when working with the fCAL 1 Measuring Device (MD).

NOTICE

Warning against malfunctions

Operating the fCAL 1 Measuring Device (MD) and/or the fCAL 1 Closing Force Sensor (CFS) beyond its technical specifications can result in malfunctions.

▶ Observe the technical specifications under Technical data [▶ 18].

▶ Observe the technical specifications on the corresponding nameplate.

▶ Switch on the device (see Switching on the device [▶ 41]).

▶ Check the battery charge level before measuring. Charge the batteries if necessary (see Charging the batteries [▶ 39]).

▶ Connect the fCAL 1 Closing Force Sensor (CFS) to the fCAL 1 Measuring Device (MD).
Use the «*X5*» interface provided for this purpose (see Connecting [▶ 42])

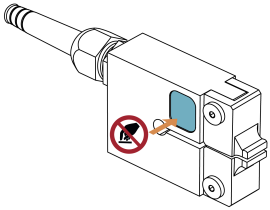
▶ Perform measurement (see Perform measurement [▶ 45]).

NOTICE

Warning against inaccurate measured values

Impairment of the measuring accuracy due to incorrect holding of the fCAL 1 Closing Force Sensor (CFS)

▶ When measuring, hold the sensor (CFS) in such a way that you are not touching the potting compound.



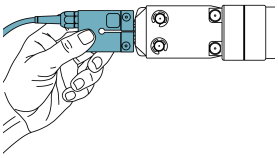
7.1.1 Positioning the fCAL 1 Closing Force Sensor (CFS)

The fCAL 1 Closing Force Sensor (CFS) can be held or mounted as described below:

Ensure that you do not expose yourself to any danger.

Manual

The fCAL 1 Closing Force Sensor (CFS) is held by hand between the pincer jaws of the Oetiker tool being operated.

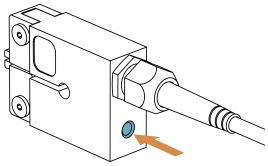


Insert the fCAL 1 Closing Force Jaws (CFJ) of the fCAL 1 Closing Force Sensor (CFS) flush into the pincer opening as such that:

- they are seated against the stop.
- they are centered within the pincer jaws.
- the sensor body is aligned parallel to the pincer head.

With an individual mounting fixture

If it is possible to fasten the fCAL 1 Closing Force Sensor (CFS) mechanically within the assembly chain of your system or installation, the M6 thread provided for this purpose can be used.



On the underside of the sensor (CFS) (next to the cable connection) there is an M6 thread into which a holder or bracket of your choice can be screwed to enable mounting on an individual mounting fixture or mounting mechanism.

7.2 Performing a measurement

⚠ DANGER

Risk of eye injury due to breakage of the fCAL 1 Closing Force Jaws (CFJ) during measurement.

Flying sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause serious eye injuries.

- ▶ Wear safety glasses when working with the fCAL 1 Measuring Device (MD).

⚠ WARNING

Warning against hand injuries due to contact with sharp-edged parts.

Broken off sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause cuts.

- ▶ Wear your personal protective equipment when working with the fCAL 1 Measuring Device (MD).

NOTICE

Warning against incorrect measurement

Incorrect measurement due to use outside the specified measuring or temperature range.

- ▶ Operate the fCAL 1 Measuring Device (MD) and the fCAL 1 Closing Force Sensor (CFS) within the specified measuring and temperature range.
- ▶ Observe the technical specifications under Technical data [▸ 18] in this instruction manual.

NOTICE

Warning against dropping

Damage to the device, the sensor and plug connections. This can affect the accuracy of the measured values.

- ▶ Place the device on a flat surface during operation or hold it firmly in your hand.
- ▶ Attach the device to the wall. Use the threaded sleeves on the back of the device.

NOTICE

Risk of damage to the fCAL 1 Closing Force Sensor (CFS)

Damage to the Closing Force Sensor due to improper holding or lifting.

- ▶ Always hold or lift the fCAL 1 Closing Force Sensor (CFS) by its body.

- ▶ Select the Measure [▶ 31] function in the main menu.
- ▶ Set the desired Measure mode [▶ 32].
- ▶ Zero the measured values on the display.
- ▶ Verify that the measurement value «0» is displayed.
- ▶ Perform the measurement.

NOTICE

Use of the fCAL 1 Closing Force Sensor (CFS) above its overload limit

Incorrect measurements and permanent damage to the sensor due to exceeding the overload limit.

- ▶ Check the measuring range of the fCAL 1 Closing Force Sensor (CFS) on its nameplate.
- ▶ Use the fCAL 1 Closing Force Sensor (CFS) within the measuring range specified on its nameplate.
- ▶ Send the fCAL 1 Closing Force Sensor (CFS) to an accredited body for recalibration if it exceeds 112% of the final value.

7.3 Performing the Pincer Test

⚠ DANGER

Risk of eye injury due to breakage of the fCAL 1 Closing Force Jaws (CFJ) during measurement.

Flying sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause serious eye injuries.

- ▶ Wear safety glasses when working with the fCAL 1 Measuring Device (MD).

⚠ WARNING

Warning against hand injuries due to contact with sharp-edged parts.

Broken off sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause cuts.

- ▶ Wear your personal protective equipment when working with the fCAL 1 Measuring Device (MD).

⚠ WARNING

Incorrect measurement due to incorrect pincer test preparations

Failure to follow the tool-specific instructions for the Oetiker tool being operated can result in incorrect measured values.

- ▶ The preparation of the pincer test is tool-specific and is determined by the Oetiker tool used.
- ▶ Follow the instructions in the respective instruction manual for the Oetiker tool being operated.

Prerequisites for performing the Pincer Test with «Measure control»

- ✓ The «Measure control» function is configured in the Settings menu (see Performing measurement with «Measure control» [▶ 47]).
- ▶ Select the «Authorize PT [▶ 31]» function.
- ▶ Further operation is dependent on the operated Oetiker tool.

Each Oetiker tool has an individual procedure for the pincer test. This procedure can be found in the corresponding instruction manual.

All Oetiker instruction manuals can be found and downloaded online at Oetiker | Downloads.

7.3.1 Performing measurement with «Measure control»

In the Settings menu, the Measure control function can be set to Deactivated, Interactive, or Automated (see Settings Measure control [▶ 33]).

Depending on the configuration of the Measure control function selected under Settings, the Pincer Test starts either only after user confirmation or automatically without a confirmation prompt.

Prerequisites for performing the measurement using the Measurement control

- ✓ The EPC 01 is configured in accordance with the instructions in the EPC 01 instruction manual.

✓ The X3 cable is connected between the EPC 01 and the fCAL 1 CMU.

✓ The fCAL 1 MD is in «Hold» measure mode.

▶ Start measurement.

All Oetiker instruction manuals can be found and downloaded online at Oetiker | Downloads.

7.4 Selecting the Measure mode

For calibrations, only the Measure mode «Hold» shall be used.

Setting measure mode «Hold»

– Select the Measure function in the main menu.
– Set the Measure mode to Hold.
– Verify that the Measure mode «Hold» is displayed on the display.
– Perform the measurement or calibration.

Setting measure mode «Dynamic»

Measured values from Measure mode «Dynamic» are not suitable for calibration.

– Select the Measure function in the main menu.
– Set the Measure mode to Dynamic.
– Observe the dynamically displayed measured values on the display.

7.5 Using memory

Opening the memory function

▶ Select the Memory function on the main display to open the memory submenu.

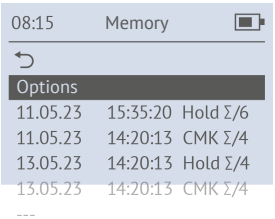
Set the Date and Time correctly before working with stored measurement values.

Information on setting the Date and Time is provided in the Settings [▶ 33] chapter.

Displaying stored measurement series

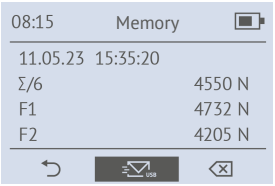
▶ Open the overview of stored measurement series using the submenu Options.

▷ The measurement series are displayed according to Date and Time.



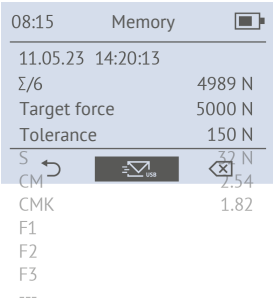
Selecting a measurement series and displaying measurement values

- ▶ Select the required measurement series.
- ▶ Navigate within the measurement series to display individual measurement values.



Sending stored data

- ▶ Select the measurement values or measurement series to be sent.
- ▶ Send the selected data using the provided Send function.



Deleting selected data

- ▶ Delete the selected data.
  - ▷ Selected data are PERMANENTLY deleted and the Memory is cleared.

7.6 Determining the CMK value

The fCAL 1 Calibration Measuring Unit (CMU) can be used to determine the CMK value of compatible Oetiker tools in accordance with the Compatibility list of Oetiker products [▶ 17].

All Oetiker instruction manuals can be found and downloaded online at Oetiker | Downloads.

⚠ DANGER

Risk of eye injury due to breakage of the fCAL 1 Closing Force Jaws (CFJ) during measurement.

Flying sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause serious eye injuries.

▶ Wear safety glasses when working with the fCAL 1 Measuring Device (MD).

⚠ WARNING

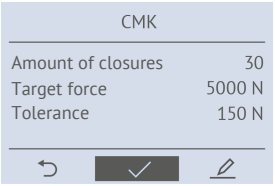
Warning against hand injuries due to contact with sharp-edged parts.

Broken off sharp parts or splinters from the fCAL 1 Closing Force Jaws (CFJ) can cause cuts.

▶ Wear your personal protective equipment when working with the fCAL 1 Measuring Device (MD).

▶ Select the CMK function in the main menu.

▷ All presettings that can be made in connection with a CMK measurement are displayed on the display.



▶ Check your presettings for Amount of closures, Target force and Tolerance.

▶ Edit the values as required using the operating panel.

▶ Follow the menu guidance.

▶ Adjust the presettings as required using the up/down buttons.

▶ Confirm your settings.

▷ After confirming the settings, the system returns to the CMK menu.

▶ Zero the value currently displayed on the display.

▶ Start the CMK measurement.

7.6.1 Transferring determined CMK values

Determined CMK values can be stored or transferred.

NOTICE

Warning against unintentional data loss

If the CMK results screen is exited using «Repeat» or «Back», you are taken directly to the corresponding submenu. All determined CMK data are lost.

- ▶ Save your data before exiting the CMK results screen via the save icon.
- ▶ Or send your data to a device connected via USB.

– The operated Oetiker tool provides the «Send over USB» function:

- ▶ Read and follow the instructions for data transmission via USB in the instruction manual of the operated Oetiker tool.

All Oetiker instruction manuals can be found and downloaded online at Oetiker | Downloads.

– The operated Oetiker tool does NOT provide the «Send over USB» function:

- ▶ Enter the values manually in the desired file format.

7.6.2 Using USB communication with the fCAL 1 Measuring Device (MD)

Forces output via the USB-C interface are specified in [N], even if the device is configured in [lbf].

The described USB commands are used to retrieve specific device information.

The USB commands are sent via a virtual COM-port connection to the USB-C interface of the fCAL 1 Measuring Device (MD) (see parameters Data communication [▶ 21]).

NOTICE

Impairment of measurement accuracy

Sending commands to the device via USB-C during a measurement can impair measurement accuracy.

- ▶ Do not communicate with the fCAL 1 Measuring Device (MD) via the USB-C interface during ameasurement.

USB function	Command	Description
Statistics	`statistics`	The «statistics» command retrieves the device statistics from the internal memory.

USB function	Command	Description
Log	`log`	The «log» command retrieves all saved logs from the internal memory.
Device info	`device info`	The «device info» command retrieves the environmental data for the device, the production data and some of the calibration data.
Sensor info	`sensor info`	The «sensor info» command retrieves the information stored in the closing force sensor memory.
Sensor IDs	`sensor ids`	The «sensor ids» command retrieves the IDs and connection data for the last ten sensors connected to the measuring device.
Firmware version	`fw version`	The «fw version» command retrieves the measuring device firmware version.
Firmware info	`fw info`	The «fw info» command retrieves the detailed firmware identification information.
Calibration data	`get calibration data`	The «get calibration data» command retrieves the calibration data for the measuring device (gain, offset, Vsource and last calibration date).
Production data	`get production data`	The «get production data» command retrieves the production data for the measuring device (material number, serial number and production date).

7.7 Adjusting settings

Individual device settings can be configured in the Settings menu.

NOTICE

No automatic time changeover

The fCAL 1 Measuring Device (MD) does not perform an automatic adjustment to daylight saving time.

- ▶ Set the time changeover between summer time and winter time manually.

- ▶ Select the Settings function in the main menu.

▶ Select the required setting parameter.

▶ Adjust the value using the up/down or left/right buttons.

▶ Confirm the setting using the middle keypad button.

7.8 Displaying information

In the «Info» submenu, device and sensor information is displayed.

▶ Select the Info function in the main menu.

▶ Select Sensor info or Device info.

▶ Scroll through the available information using the up/down buttons.

7.9 Switching off the device

The fCAL 1 Measuring Device (MD) can be switched off in two ways:

– By operating the central keypad:

▶ Press and hold the middle keypad button for at least 1.5 s.

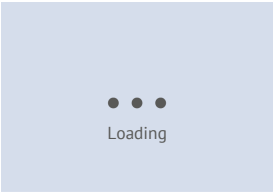
▷ The device is switched off.

– In the display menu «Switch off»:

▶ Select the Switch off function in the main menu.

▷ The device is switched off.

The «Loading»- screen appears if the device is busy performing a task and cannot process any further user input until the task has been completed.



As long as the «Loading» screen is displayed:

▶ Do not switch off the device.

▶ Leave the rechargeable batteries and/or the USB C cable plugged in.

7.10 Performing a factory reset

NOTICE

Irreversible process: complete data loss!

After executing the submenu function «Factory reset», data recovery is no longer possible.

▶ Back up important data stored on the device to an external storage location before executing the function.

- Select the Settings function in the main menu.
- Select the Factory reset function.
- Confirm the reset.

8 Maintenance

8.1 Maintenance schedule

⚠ DANGER

Any modification to the fCAL 1 Calibration Measuring Unit (CMU) without the consent of Oetiker is prohibited!

Oetiker accepts no liability for any damage caused if this requirement is not observed.

- ▶ Repairs should only be carried out by Oetiker specialists!

- ▶ Check the fCAL 1 Calibration Measuring Unit (CMU) at least once per shift for externally visible damage and proper function.

8.2 Cleaning

⚠ CAUTION

Water entering the device!

Damage to the device due to the ingress of moisture during operation.

- ▶ Do not immerse the fCAL 1 Calibration Measuring Unit (CMU) in water.
- ▶ Do not hold the fCAL 1 Calibration Measuring Unit (CMU) under running water.

8.2.1 Recommended cleaning agents

NOTICE

Damage to the device due to the use of incorrect cleaning agents

Damage to the device.

- ▶ Do not use any cleaning agents containing acids, alkalis or strong solvents!
- ▶ Wipe the device with a dry cloth.

8.3 Calibration

To maintain the high quality of this measuring instrument, Oetiker recommends that an annual calibration be performed through your nearest Oetiker Service Center [▶ 79].

- ▶ To do this, send the fCAL 1 Calibration Measuring Unit (CMU) to your nearest local Oetiker Service Center [▶ 79].

The fCAL 1 Measuring Device (MD) and the fCAL 1 Closing Force Sensor (CFS) can also be calibrated together as a set by an accredited laboratory. After this, the measuring device and the sensor may no longer be used separately unless they are recalibrated individually.

For more information, please contact your local Oetiker Service Center [▸ 79].

NOTICE

Data loss during calibration

Data retention cannot be guaranteed, as the device will be handed over to external parties for calibration.

- ▶ Ensure that the fCAL 1 Calibration Measuring Unit (CMU) or its individual components do not contain any sensitive data before calibration.

8.4 Inspection / Replacement of the fCAL 1 Closing Force Jaws (CFJ)

Inspection

- ▶ Perform a visual inspection (check for breakage).
- ▶ Check the closing force jaws for damage or excessive wear.

Replacement

NOTICE

Damage to the fCAL 1 Closing Force Sensor (CFS) and/or the fCAL 1 Measuring Device (MD) due to improper maintenance

Replacing the fCAL 1 Closing Force Jaws (CFJ) when the fCAL 1 Closing Force Sensor (CFS) is connected can damage the sensor and measuring device.

- ▶ Disconnect the fCAL 1 Closing Force Sensor (CFS) from the fCAL 1 Measuring Device (MD) before replacing the fCAL 1 Closing Force Jaws (CFJ).

NOTICE

Incorrect measurement when replacing a single fCAL 1 Closing Force Jaw (CFJ)

The simultaneous use of new and already used fCAL 1 Closing Force Jaws (CFJ) can produce incorrect measured values.

- ▶ Always replace both fCAL 1 Closing Force Jaws (CFJ), even if only one of the closing force jaws is damaged.

NOTICE

Damage to the closing force jaw screw connection caused by overtightening

After replacing the jaws, the Closing Force Jaws (CFJ) are slightly movable. This is an intentional functional characteristic to prevent impairment of measurement accuracy.

- ▶ Do not tighten the screws beyond the maximum tightening torque of 2 Nm.

NOTICE

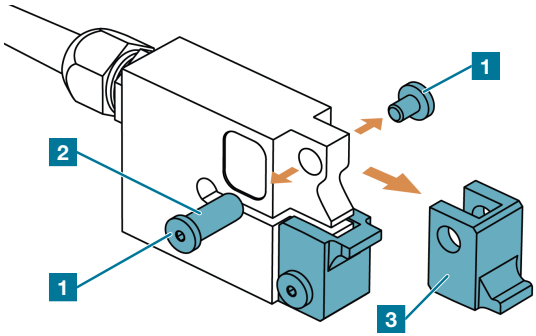
Impaired function of the bolt connection caused by a damaged bolt

Improper handling or careless assembly can damage the bolt.
A damaged bolt compromises the function of the bolt connection — the required measurement accuracy can no longer be guaranteed.

- ▶ Always assemble and handle the bolt carefully.
- ▶ Replace the bolt immediately if any visible damage is present.

The fCAL 1 Closing Force Jaws (CFJ) are supplied complete with screws and bolts.

- ▶ Use only the new screws and bolts included in the scope of delivery when replacing the jaws.



- ▶ Remove one of the two screws 1 using one of the supplied Allen keys. Hold the opposite screw 1 in place with the second Allen key.
- ▶ Remove the second screw 1 as well as the bolt 2 fastened to it.
- ▶ Remove the fCAL 1 Closing Force Jaw (CFJ) 3.
- ▶ Remove the second Closing Force Jaw in the same manner.
- ▶ Clean the contact surfaces of the sensor and the new Closing Force Jaws using a dry cloth.
- ▶ Insert the new Closing Force Jaw (upper or lower).

- ▶ Secure the new Closing Force Jaw with the bolt **2** and the screw **1** fastened to it.
- ▶ Tighten the second screw **1** using the Allen key.
  Hold the opposite screw **1** in place with the second Allen key.
- ▶ Perform three closing operations with the currently set closing force on the replaced fCAL 1 Closing Force Jaws (CFJ) to verify the correct seating of the jaw system.
  - ▷ The fCAL 1 Closing Force Sensor (CFS) is ready for operation.

NOTICE

Damage or loss of the replaced fCAL 1 Closing Force Jaws (CFJ)

Improper storage of the fCAL 1 Closing Force Jaws (CFJ) can lead to damage or loss.

- ▶ Store the replaced fCAL 1 Closing Force Jaws (CFJ) in the container provided.

8.5 Replacing the batteries

- ▶ Proceed in the same way as described in the chapter Inserting the batteries [▸ 38], when replacing the rechargeable batteries.
- ▶ Dispose of rechargeable batteries properly (see Decommissioning and disposal [▸ 71]).

8.6 Repair

⚠ WARNING

Fire and explosion hazard

If rechargeable batteries are left in the device, there is an acute risk of fire or explosion in the event of damage or improper handling.

- ▶ Always remove the rechargeable batteries from the device before returning it.
- ▶ Do NOT include the rechargeable batteries with the return shipment.

8.6.1 Return shipment

In the event of defects or malfunctions, return the defective component (fCAL 1 Measuring Device (MD) / fCAL 1 Closing Force Sensor (CFS)) to your nearest local Oetiker Service Center [▸ 79]. If the faulty component cannot be identified, return the entire unit (fCAL 1 Calibration Measuring Unit (CMU)).

For warranty claims and commissioned repairs, it is a requirement that you fill out the return form for power tools - please go to: https://www.oetiker.com/de-de/powertool-return and follow the instructions there.

Oetiker recommends returning the device in its original packaging.

If this is not possible, the device must be packed in equivalent packaging.

If the device is damaged due to defective packaging, the customer shall bear the costs, irrespective of any justified warranty claims and commissioned repairs.

8.7 Customer service

Please contact your local Oetiker Service Center [▶ 79] if you have any repair questions or questions relating to the functions of the fCAL 1 Calibration Measuring Unit (CMU).

Please have the serial number of the device to hand. This can be found on the nameplate of your fCAL 1 Calibration Measuring Unit (CMU).

8.8 Original spare parts

Oetiker original spare parts can be found in the scope of delivery table (see Scope of delivery [▶ 37]).

⚠ WARNING

Danger as a result of using the wrong spare parts!

The use of spare parts that have not been tested and approved by Oetiker can impair the measuring accuracy and cause serious physical injury due to subsequent faults in Oetiker Power Tools.

▶ Only use Oetiker spare parts.

8.8.1 fCAL 1 spare parts

For spare parts, please contact your local Oetiker Service Center (see Contact details [▶ 79]).

In our endeavor to continuously improve the quality of our products, we reserve the right to introduce improvements without amending the instruction manual.

Accordingly, specifications such as dimensions, weights, materials, performance data, and designations may differ for individual components.

9 Troubleshooting

To prevent faults, see Safety-conscious operation [▸ 12].

9.1 Resolving faults

If the fCAL 1 Measuring Device (MD) can no longer be operated, this is indicated by an error message or a symbol on the display.

If the fCAL 1 Closing Force Sensor (CFS) is not connected to the fCAL 1 Measuring Device (MD), this is indicated by the corresponding symbol on the display.

The error messages contain error codes as well as instructions that must be carried out by the user.

The errors can be identified using the error message codes.

⚠ WARNING

Warning against improper error correction

Failure to observe the error messages and the measures to rectify them can result in personal injury and property damage.

- Have malfunctions or errors that you cannot rectify yourself remedied by qualified personnel (see Target audience [▸ 13]).

NOTICE

Incorrect measurement results due to dropped measurement components

Dropping the fCAL 1 Measuring Device (MD) or the fCAL 1 Closing Force Sensor (CFS) can lead to inaccurate measurement results.

- **Perform a visual inspection:** Check the MD and the CFS for visible damage.
- **Perform a plausibility check:** Verify that the measurement results are within the expected tolerances.
- **Initiate recalibration:** Send the MD or the CFS to a certified calibration laboratory if the measurement results remain inconsistent after the plausibility check.

NOTICE

Use of the fCAL 1 Closing Force Sensor (CFS) above its overload limit

Incorrect measurements and permanent damage to the sensor due to exceeding the overload limit.

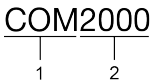
- ▶ Check the measuring range of the fCAL 1 Closing Force Sensor (CFS) on its nameplate.
- ▶ Use the fCAL 1 Closing Force Sensor (CFS) within the measuring range specified on its nameplate.
- ▶ Send the fCAL 1 Closing Force Sensor (CFS) to an accredited body for recalibration if it exceeds 112% of the final value.

Error display

Errors are displayed as follows:

- The error is shown on the display as an error message with a unique identifier.
- Errors that cannot be shown on the display are described separately.

Structure of the error message on the display



Position	Characters	Designation	Description
1	COM	Communication	
	PRO	Process	
	SYS	System	
2	—	Number	The four-digit number describes the unique identification.

Apply the countermeasures in the documented order. Proceed to the next step only if the previous countermeasure is unsuccessful.

Error code	Display information	Countermeasures
COM1000	X3 communication failed. Please try again.	▶ Use original Oetiker X3 cable. ▶ Check connection. ▶ Check readiness of connected device. ▶ Restart Measuring Device. ▶ If this occurs several times, contact your local Oetiker Service Center [▶ 79].
COM1001	X3 data is received with error from connected device. Please try again.	▶ Check readiness of connected device. ▶ Use original Oetiker X3 cable. ▶ Check connection. ▶ Restart Measuring Device.
COM1002	Connected device did not reply. Please verify X3 connection and try again.	▶ Check readiness of connected device. ▶ Use original Oetiker X3 cable. ▶ Check connection. ▶ Restart Measuring Device.
COM1010	USB communication failed. Please try again.	▶ Check connection. ▶ Ensure that correct virtual communication port is active in the PC software (virtual com port software). ▶ Disconnect and reconnect USB cable and reactivate virtual communication port. ▶ Restart Measuring Device. ▶ Connect Measuring Device directly to PC. ▶ Restart PC. ▶ If this occurs several times, contact your local Oetiker Service Center [▶ 79].

Error code	Display information	Countermeasures
COM1020	Sensor ADC communication failed. Device may not work properly. Sensor ADC communication failed. Device might not work properly.	▶ Do not perform any further measurements. ▶ Restart Measuring Device. ▶ If this occurs again, return Measuring Device to your local Oetiker Service Center [▸ 79].
COM1021	Sensor TEDS communication failed. Device might not work properly. Sensor TEDS communication failed. Device might not work properly.	▶ Do not perform any further measurements. ▶ Disconnect and reconnect Closing Force Sensor. ▶ Check Closing Force Sensor connection. ▶ If this occurs several times, contact your local Oetiker Service Center [▸ 79].
COM1030	RTC communication failed. Device time might be inaccurate.	▶ Restart Measuring Device. ▶ Return Measuring Device to local Oetiker Service Center [▸ 79].
COM1040	FRAM communication failed. Device might not work properly.	▶ Restart Measuring Device. ▶ Perform factory reset according to chapter Settings — Factory reset [▸ 33] ▶ Return Measuring Device to your local Oetiker Service Center [▸ 79].
COM1050	FLASH communication failed. Device might not work properly.	▶ Restart Measuring Device. ▶ Perform Factory reset according to chapter Settings — Factory reset [▸ 33]. ▶ Return Measuring Device to your local Oetiker Service Center [▸ 79].

Error code	Display information	Countermeasures
COM1051	Measure storage is full. Please consider freeing up space.	▶ Free up storage space (see Memory [▷ 32]). ▶ Restart Measuring Device. ▶ Perform Factory reset according to chapter Settings — Factory reset [▷ 33].
COM1052	Storing measurement in FLASH failed.	▶ Restart Measuring Device. ▶ Try again. ▶ Perform Factory reset according to chapter Settings — Factory reset [▷ 33]. ▶ If this occurs several times, contact your local Oetiker Service Center [▷ 79].
COM1053	Deleting measurements failed.	▶ Restart Measuring Device. ▶ Try again. ▶ Perform Factory reset according to chapter Settings — Factory reset [▷ 33]. ▶ If this occurs several times, contact your local Oetiker Service Center [▷ 79].
COM1060	Communication to temperature sensor failed.	▶ Restart Measuring Device. ▶ Return Measuring Device to your local Oetiker Service Center [▷ 79].
PROC2000	Amount of CMK closures must be between 5 and 120.	▶ Select the number of closures between 5 and 120 (see CMK [▷ 33]).
PROC2001	CMK target force must be greater than or equal to 500 N (112 lbf).	▶ Select a force greater than or equal to 500 N (112 lbf) (see CMK [▷ 33]).
PROC2002	CMK tolerance must be greater than or equal to 50 N (11 lbf).	▶ Select a tolerance greater than or equal to 50 N (11 lbF) (see CMK [▷ 33]).
PROC2010	Selected time is invalid.	▶ Enter valid time.

Error code	Display information	Countermeasures
PROC2011	Selected date is invalid.	▶ Enter valid date.
PROC2020	No sensor connected. Please connect sensor and try again. No sensor connected. Please connect sensor and try again.	▶ Connect Closing Force Sensor and check plug connection. ▶ Disconnect and reconnect Closing Force Sensor. ▶ If this occurs several times, contact your local Oetiker Service Center [▸ 79].
PROC2030	A force greater than the maximum allowed has been measured.	▶ Check maximum permissible closing force specified on the nameplate of Closing Force Sensor. ▶ Measure again with a force that is less than the maximum permissible force.
PROC2031	A force greater than the maximum allowed has been measured. Recalibration required.	▶ Check maximum permissible closing force specified on nameplate of Closing Force Sensor. ▶ Recalibrate Closing Force Sensor.
PROC2032	A force greater than the maximum allowed has been measured. Sensor is compromised.	▶ Check maximum permissible closing force specified on nameplate of Closing Force Sensor. ▶ Return Closing Force Sensor to your local Oetiker Service Center [▸ 79].
PROC2040	No measurement available. Please perform a measurement and try again.	▶ Perform measurement with a force higher than 200 N.
PROC2050	Measure control error. Please check the logs and consult the Instruction Manual.	▶ Check X3 cable connection. ▶ Ensure that fCAL 1 and EPC 01 are configured according to settings stated in Measure — Measure Control [▸ 31]. ▶ Reboot fCAL 1 and EPC 01. ▶ Read fCAL 1 and EPC 01 logs.

Error code	Display information	Countermeasures
SYS3000	Self-test failed. Device does not work properly.	▶ Do not perform any further measurements. ▶ Restart Measuring Device. If this occurs again, return Measuring Device to your local Oetiker Service Center [▸ 79].
SYS3010	Configuration update failed. Please try again.	▶ Restart Measuring Device. ▶ Perform Factory reset according to chapter Settings — Factory reset [▸ 33]. ▶ Please contact your local Oetiker Service Center [▸ 79] if this occurs several times.
SYS3020	Internal non attributable error. Please consider rebooting.	▶ Restart Measuring Device. ▶ Read log and find for log entries before and after SYS1010 error (see Using USB communication with the fCAL 1 Measuring Device (MD) [▸ 51]). ▶ Contact your local Oetiker Service Center [▸ 79] providing log information.
SYS3030	Invalid production data.	▶ Restart Measuring Device. ▶ Return Measuring device to your local Oetiker Service Center [▸ 79].
SYS3031	Invalid calibration data. Force measurement might not work properly.	▶ Restart Measuring Device. ▶ Return Measuring Device to your local Oetiker Service Center [▸ 79].

Error code	Display information	Countermeasures
SYS3032	Invalid sensor data. Force measurement might not work properly.	▶ Do not perform any further measurements. ▶ Disconnect and reconnect Closing Force Sensor. ▶ Check plug connection of Closing Force Sensor. ▶ Return the Closing Force Sensor to your local Oetiker Service Center [▸ 79].
SYS3040	Strong deviation of zero force. Sensor might be wrongly calibrated.	▶ Zero Closing Force Sensor without load. ▶ Check Closing Force sensor, cable and plug connection for damage. ▶ Return the sensor to your local Oetiker Service Center [▸ 79].
SYS3050	Battery charging failed.	▶ Batteries might not be completely charged. ▶ Restart charge of batteries when they are fully empty according to the Charging the batteries [▸ 39].
SYS3051	USB charger lacks PD capability.	▶ Use a USB power delivery capable charger. ▶ Use a different USB power delivery capable charger.
SYS3060	Battery status monitoring system defective.	▶ Restart measuring device. ▶ Remove and re-insert batteries while keeping device powered with USB cable. ▶ If this occurs several times, contact your local Oetiker Service Center [▸ 79].
SYS3070	Non-rechargeable batteries detected. Please replace with chargeable batteries.	▶ Only use NiMH rechargeable batteries. ▶ Replace entire battery set. ▶ If this occurs several times with NiMH batteries, contact your local Oetiker Service Center [▸ 79].

Error code	Display information	Countermeasures
SYS3071	Battery is low. Please consider charging the device.	▶ Charge Measuring Device via USB-C. ▶ Replace batteries when they have reached the end of their service life. ▶ If this occurs several times during or after charging, contact your local Oetiker Service Center [▸ 79].
SYS3072	Battery is discharged. Device will shut down.	▶ Charge batteries with Measuring Device. ▶ Charge batteries with a dedicated charger. ▶ Replace batteries. ▶ If this occurs several times during or after charging, contact your local Oetiker Service Center [▸ 79].
SYS3080	Device temperature is too high. Device might not work properly.	▶ Only operate Measuring Device within specified ambient conditions (see Technical data [▸ 18]). ▶ Disconnect USB-C cable. ▶ Switch off Measuring Device and allow it to cool down. ▶ If problem occurs several times within the specified ambient conditions, contact your local Oetiker Service Center [▸ 79].
SYS3081	Device temperature is too low. Device might not work properly.	▶ Only operate Measuring Device within specified ambient conditions (see Technical data [▸ 18]). ▶ Allow Measuring Device to acclimatize to a higher ambient temperature. Avoid condensation (see Technical data [▸ 18]). ▶ If this occurs several times within the specified ambient conditions, contact your local Oetiker Service Center [▸ 79].

Error code	Display information	Countermeasures
SYS3090	Device date and time invalid. Please set valid date and time.	▶ Set valid date and time. ▶ If this occurs several times, contact your local Oetiker Service Center [▸ 79].

9.2 Faults that cannot be resolved

If the fCAL 1 Measuring Device (MD) can no longer be operated for no apparent reason or is blocked in a mode and does not respond, a restart must be forced.

9.2.1 Restarting the device

NOTICE

Data loss due to restarting the Measuring Device (MD)

The following data is lost during a restart:
- Unfinished closures
- CMK closures and unsaved CMK results

The device is restarted by switching it off and on again.

▶ Press the middle keypad button (see also Switching on/off and confirming [▸ 26]).
  ▷ Oetiker logo is displayed.
  ▷ Device is switched off.
▶ Press the middle keypad button again (see also Switching on/off and confirming [▸ 26]).
  ▷ Oetiker logo is displayed.
  ▷ Device is switched on.

⚠ CAUTION

Warning against improper operation!

Using the device after an unsuccessful restart (reboot) produces incorrect measurement results.

▶ Send your fCAL 1 Measuring Device (MD) to your local Oetiker Service Center (see Contact details [▸ 79]).

9.2.2 Fatal error

If the fCAL 1 Calibration Measuring Unit (CMU) can no longer be operated properly, a fatal error is generated.

This error, referred to as a «Fatal error», is displayed on the screen in the following form:

When a fatal error is generated, the state of the device is unknown. Therefore, it cannot be determined whether the communication interfaces and other parts of the CMU functionality are available. The device attempts to log the error in the internal memory and on the USB communication interface.

- Document the description of the «Fatal Error» from the internal memory.
- Report the problem to your local Oetiker Service Center [▸ 79].
- Confirm the error using the confirmation check mark.
  - ▷ The fCAL 1 Measuring Device (MD) is restarted.
- Contact your local Oetiker Service Center [▸ 79] if the fCAL 1 Measuring Device (MD) cannot be operated properly after the restart.

10 Decommissioning and disposal

10.1 Decommissioning

- Disconnect the fCAL 1 Closing Force Sensor (CFS) from the fCAL 1 Measuring Device (MD).
- Disconnect the USB C cable.
- Disconnect any Oetiker tools connected to the fCAL 1 Measuring Device (MD).
- Perform the «Factory reset» function if required (see Performing a factory reset [▸ 53]).
- Switch off the fCAL 1 Measuring Device (MD).
- Remove the rechargeable batteries.
- Pack the fCAL 1 Measuring Device (MD) and the fCAL 1 Closing Force Sensor (CFS) in the designated carrying case or in suitable transport containers. Secure the components against damage and sudden changes in position.

Before handing over or disposing of the measuring device, it is recommended to delete user-specific data by performing a factory reset (see Performing a factory reset [▸ 53]).

10.2 Storage conditions

NOTICE

Condensation on the fCAL 1 Measuring Device (MD) due to moisture ingress

Switching on a damp measuring device can lead to damage to the device and its electronic components.

- Dry the measuring device thoroughly.
- Before switching the measuring device on, ensure that no moisture remains in or on the housing.
- Stop using the measuring device immediately if it malfunctions.
- Contact your local Oetiker Service Center [▸ 79].

Non-permitted locations and environmental conditions

- With rapid changes in ambient temperature
- With direct sunlight
- With humidity above 80 % and condensation
- Where excessive dust or debris can accumulate on the fCAL 1 Calibration Measuring Unit (CMU), unless the CMU is stored in the carrying case.
- Where saline moisture can penetrate

Prepare the fCAL 1 Measuring Device (MD) and the fCAL 1 Closing Force Sensor (CFS) for storage as follows:

- Perform Decommissioning [▶ 71].
- Clean the fCAL 1 Measuring Device (MD) and fCAL 1 Closing Force Sensor (CFS).

10.2.1 Ambient conditions fCAL 1 Measuring Device (MD)

Parameter	Value
Humidity	Max. 80 % to 31°C
Storage temperature	-20 °to 50 °C
Altitude	Max. 2000 m a.s.l.
Pollution level	1 (according to EN 61010-1)

10.2.2 Ambient conditions fCAL 1 Closing Force Sensor (CFS)

Parameter	Value
Humidity	Max. 80 % to 31°C
Storage temperature	-20 °to 50 °C
Altitude	Max. 2000 m a.s.l.
Pollution level	1 (according to EN 61010-1)

10.3 Disposal

10.3.1 Principle

Ensure that the raw materials contained in the fCAL 1 Calibration Measuring Unit (CMU) are handled with care. Before disposing of materials and components, their suitability for reuse must be checked. The aim must be to maximize reuse. Careless or incorrect disposal can result in unforeseeable damage to the environment. Follow the manufacturer's instructions and the applicable laws and regulations.

10.3.2 Materials, packaging materials and device parts

The components must be separated according to material and an attempt must be made to recycle:

- Steel scrap
- Copper and non-ferrous metals in electrical parts and conductors
- Rechargeable batteries
- Plastics

10.3.3 Electronic components

The fCAL 1 Calibration Measuring Unit (CMU) must not be disposed of with household waste.

Correct disposal

This symbol requires the separate disposal of electrical and electronic components. Such devices may contain dangerous and environmentally hazardous substances. These devices must be disposed of at a designated collection point for the recycling of electrical and electronic devices. This helps to protect resources and the environment. For further information, please contact your local authorities.

- ▶ Disconnect the fCAL 1 Measuring Device (MD) from the power supply if it is connected via USB-C.
- ▶ Have the components and the packaging material disposed of by a specialist company in accordance with local and statutory regulations.
- ▶ Optionally, send the fCAL 1 Calibration Measuring Unit (CMU) to your local Oetiker Service Center [▸ 79] to have it disposed there.

11 Conformity

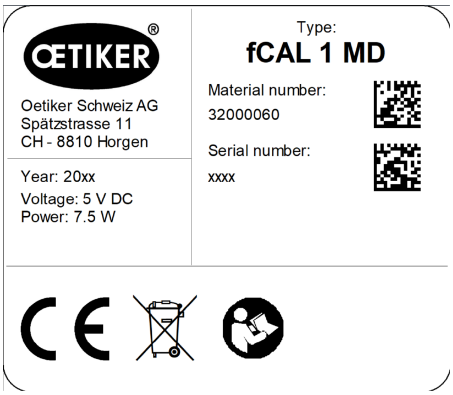
11.1 Symbols and meanings

Symbol	Meaning
	Read the instruction manual and safety instructions before use.
	**Correct disposal** The device must not be disposed of in the regular waste.

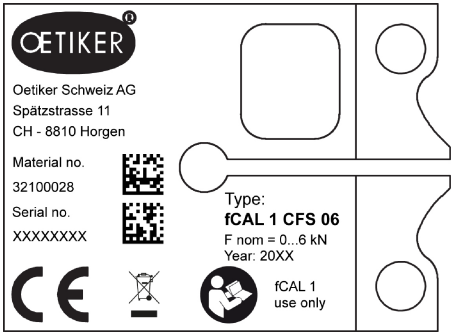
11.2 Examples

The following illustrations show examples of the intended nameplates and Declarations of Conformity (German / English) and are provided for information purposes only.
Only the markings affixed to the delivered product and the Declarations of Conformity valid at the time of delivery are authoritative. Changes and deviations are reserved.

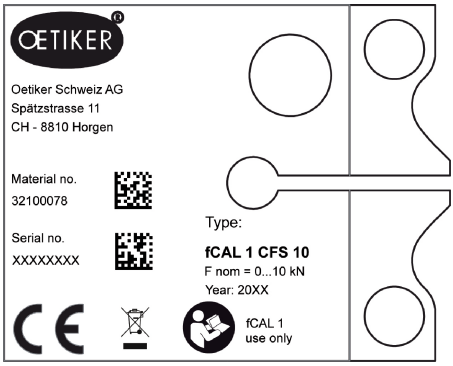
11.2.1 Nameplate for fCAL 1 Measuring Device (MD)



11.2.2 Nameplate for fCAL 1 Closing Force Sensor 6 kN (CFS 06)



11.2.3 Nameplate for fCAL 1 Closing Force Sensor 10 kN (CFS 10)



11.2.4 EU Declaration of Conformity for fCAL 1 Measuring Device (MD)

EG-Konformitätserklärung

EU Declaration of Conformity

(Original-EG-Konformitätserklärung)
(Translation from the German original Declaration of Conformity)

Wir, *We,*	Oetiker Schweiz AG Spätzstrasse 11 CH-8810 Horgen SWITZERLAND

erklären in alleiniger Verantwortung, dass das Produkt als Gesamtsystem, welches das unten aufgeführte Messgerät oder den Sensor enthält:
declare under our sole responsibility that the product as a complete system consisting of the measuring device or the sensor listed below:

Typ */ Type* **Material Nummer** */ Material number* **Serien Nummer** */ Serial number*	fCAL 1 MD
allen grundlegenden Anforderungen der nebenstehenden Richtlinien – jeweils mit deren Änderungen – entspricht: *meets all the essential requirements of the directives listed alongside – in each case with their revisions:*	2014/35/EU – Niederspannungsrichtlinie *2014/35/EU – Low Voltage Directive* 2014/30/EU – EMV-Richtlinie *2014/30/EU – EMC Directive* 2013/56EU– RoHS3-Richtlinie *2013/56/EU – Restriction of Hazardous Substances Directive*

Angewandte harmonisierte Normen: *Applied harmonised standards:*	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*	EN IEC 61326-1:2021
	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*	EN 61010-1:2010+A1:2019
	Technische Dokumentation zur Bewertung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*	EN IEC 63000:2018
Angewandte sonstige technische Normen und Spezifikationen: *Other technical standards and specifications applied:*	– – –	– – –

Bevollmächtigte Person für das Zusammenstellen der technischen Unterlagen:
Authorised person for compiling the technical file:

* Oetiker Schweiz AG
Pascal Moser
Spätzstrasse 11
CH-8810 Horgen
SWITZERLAND

Unterzeichnet für und im Namen von Oetiker Schweiz AG
Signed for and on behalf of Oetiker Schweiz AG

Horgen, 17. Februar 2026

Pascal Moser

Head R&D
CoC Automatic Assembly Tools Oetiker Group

Andreas Pulver

Plant Head Switzerland

11.2.5 EU Declaration of Conformity for fCAL 1 Closing Force Sensor 6 kN (CFS 06)

EG-Konformitätserklärung

EU Declaration of Conformity

(Original-EG-Konformitätserklärung)
(Translation from the German original Declaration of Conformity)

Wir,
We,

Oetiker Schweiz AG
Spätzstrasse 11
CH-8810 Horgen
SWITZERLAND

erklären in alleiniger Verantwortung, dass das Produkt als Gesamtsystem, welches das unten aufgeführte Messgerät oder den Sensor enthält:
declare under our sole responsibility that the product as a complete system consisting of the measuring device or the sensor listed below:

Typ */ Type*
Material Nummer */ Material number*
Serien Nummer */ Serial number*

fCAL 1 CFS 06

allen grundlegenden Anforderungen der nebenstehenden Richtlinien – jeweils mit deren Änderungen – entspricht:
meets all the essential requirements of the directives listed alongside – in each case with their revisions:

2014/35/EU – Niederspannungsrichtlinie
2014/35/EU – Low Voltage Directive
2014/30/EU – EMV-Richtlinie
2014/30/EU – EMC Directive
2013/56EU– RoHS3-Richtlinie
2013/56/EU – Restriction of Hazardous Substances Directive

Angewandte harmonisierte Normen: *Applied harmonised standards:*	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*	EN IEC 61326-1:2021
	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*	EN 61010-1:2010+A1:2019
	Technische Dokumentation zur Bewertung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*	EN IEC 63000:2018
Angewandte sonstige technische Normen und Spezifikationen: *Other technical standards and specifications applied:*	– – –	– – –

Bevollmächtigte Person für das Zusammenstellen der technischen Unterlagen:
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11.2.6 EU Declaration of Conformity for fCAL 1 Closing Force Sensor 10 kN (CFS 10)

EG-Konformitätserklärung

EU Declaration of Conformity

(Original-EG-Konformitätserklärung)
(Translation from the German original Declaration of Conformity)

Wir, *We,*	Oetiker Schweiz AG Spätzstrasse 11 CH-8810 Horgen SWITZERLAND

erklären in alleiniger Verantwortung, dass das Produkt als Gesamtsystem, welches das unten aufgeführte Messgerät oder den Sensor enthält:
declare under our sole responsibility that the product as a complete system consisting of the measuring device or the sensor listed below:

Typ */ Type* **Material Nummer** */ Material number* **Serien Nummer** */ Serial number*	fCAL 1 CFS 10
allen grundlegenden Anforderungen der nebenstehenden Richtlinien – jeweils mit deren Änderungen – entspricht: *meets all the essential requirements of the directives listed alongside – in each case with their revisions:*	2014/35/EU – Niederspannungsrichtlinie *2014/35/EU – Low Voltage Directive* 2014/30/EU – EMV-Richtlinie *2014/30/EU – EMC Directive* 2013/56EU– RoHS3-Richtlinie *2013/56/EU – Restriction of Hazardous Substances Directive*

Angewandte harmonisierte Normen: *Applied harmonised standards:*	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*	EN IEC 61326-1:2021
	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*	EN 61010-1:2010+A1:2019
	Technische Dokumentation zur Bewertung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*	EN IEC 63000:2018
Angewandte sonstige technische Normen und Spezifikationen: *Other technical standards and specifications applied:*	– – –	– – –

Bevollmächtigte Person für das Zusammenstellen der technischen Unterlagen:
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Horgen, 17. Februar 2026

Pascal Moser

Head R&D
CoC Automatic Assembly Tools Oetiker Group

Andreas Pulver

Plant Head Switzerland

12 Contact details

If you require help or technical support, please contact your local Oetiker Service Center.

For further information, see www.oetiker.com.

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Phone number	+1 989 635 3621

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Phone number	+86 22 2697 1183

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Phone number	+81 45 949 3151

Republic of Korea	
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Phone number	+82 2 2108 1239

India	
E-mail	ptsc.in.mumbai@oetiker.com
Phone number	+91 9600526454

Glossary

Authorize PT

Function for authorizing an Oetiker tool for a Pincer Test.

CMK (Machine Capability Index)

Index for assessing machine capability.

CP10 / CP20

Cordless Clamping tool for fast and consistent installation of Oetiker ear clamps; supports monitoring and documentation of process parameters.

ELK 02

Electronically controlled pneumatic pincer for consistent, process-reliable installation of Oetiker clamps; discontinued product, service available until 2035.

EPC 01

High-performance electropneumatic installation system for precise, repeatable closing of Oetiker clamps/bands; supports process monitoring and quality assurance.

Factory reset

Function for fully resetting the device.

FAST 3000

Stationary electromechanical tool for closing the Oetiker WingGuard® band clamp 270; ensures constant closing forces and supports process monitoring including data recording.

fCAL 1 Calibration Measuring Unit (CMU)

Complete system for closing force verification and communication with Oetiker tools; consisting of a measuring device and a closing force sensor.

fCAL 1 Closing Force Jaws (CFJ)

Austauschbare Backen zur Krafteinleitung in der Zangenöffnung.

fCAL 1 Closing Force Sensor (CFS)

Sensor for closing force measurement used for measurements and calibrations.

fCAL 1 Measuring Device (MD)

Display and operating unit of the CMU for displaying, storing, and transferring measurement values (e.g. via USB-C).

HMK

Hand installation pincer with force monitoring for controlled assembly; reduces manual force through mechanical leverage and supports consistent closing quality.

ME Pincer

Pneumatic pincer (ME) as a complete pincer system for consistent installation of Oetiker clamps; available with various pincer heads depending on clamp type, required closing force, and compressed air supply.

Measure control

Function for automating the calibration process (e.g. in combination with EPC 01).

Measure mode

Setting for displaying and processing the measured force.

Measure mode «Dynamic»

Self-test mode; continuous display, not suitable for calibration.

Measure mode «Hold»

Standard mode; the measured value is displayed and retained.

Measurement series

Group of stored measurement values.

Memory

Function for storing, managing, and retrieving measurement values.

NiMH Rechargeable batteries

Battery type for battery operation (AA, 1.2 V for fCAL 1 MD).

SMART

Sensor-monitored assembly and repair tool for correct closing of adjustable ear clamps; monitors closing forces and indicates the result via light and vibration.

USB-C

Interface for PC communication and charging.

X3

Interface for data communication, e.g. with EPC 01.

X5

Interface for connecting the closing force sensor.

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