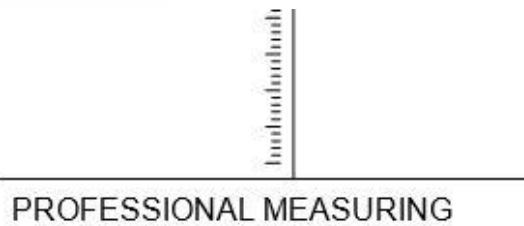# Manual

SAUTER FS

V. 1.0
01/2022
EN

Measuring channel CH4 (optional)

Measuring channel CH3 (optional)

Measuring channel CH2

Measuring channel CH1

Interface socket (optional)

PROFESSIONAL MEASURING

FS-BA-en-2210.docx

SAUTER FS

V. 1.0 01/2022

Manual

Congratulations on your purchase of a digital force gauge with internal or external measuring cell from SAUTER. We hope you enjoy your quality measuring device with its wide range of functions. If you have any questions, requests or suggestions, please do not hesitate to contact us.

Table of contents:

1 Introduction

Read these operating instructions carefully before commissioning, even if you already have experience with SAUTER measuring devices.

SAUTER offers the software and accessories as an option to make the measuring device more versatile in use. Please enquire with SAUTER or your SAUTER dealer or visit our website at www.sauter.eu.

2 Check before use

After receiving the unit, check in advance whether there has been any transport damage, whether the outer packaging, the plastic housing, other parts or even the unit itself has been damaged. If any damage is apparent, please notify the specialist dealer or manufacturer immediately.

3 Intended use

The SAUTER FS device is intended for measuring forces and torques in industrial environments.

4 Warnings

4.1 Transport

A lithium-ion battery is built into the unit. The technical data of the battery is described in chapter 8.1 is described. Observe the national and international transport regulations for devices with a permanently installed lithium-ion battery.

4.2 Electrostatic sensitive device

The unit can be destroyed by electrostatic discharges. Connectors for HF signals are particularly at risk. Please observe the handling instructions for electrostatically sensitive components.

4.3 Risk of accident

Observe the national accident prevention regulations. Incorrect use of the equipment can lead to serious injuries, death, property damage and personal injury. Use may only be carried out by trained and experienced personnel. Never load load cells and force gauges beyond the Emax range (nominal load, max. capacity) of the sensor used. Overloaded load cells no longer have the required accuracy. Overloaded or deformed load cells must not be used any longer and must be replaced immediately. Never step under suspended loads. Always fit overload or breakage protection devices to your system. Always observe the permissible static and dynamic loads of the accessories you are using.

Check measuring cells regularly for deformations and cracks.

Shocks, vibrations and torsion on the force application bolt can damage the sensor! Only transport the unit in the transport case supplied!

4.4 Damage / defective equipment

Do not use damaged measuring instruments, cables, plug-in power supplies or similar! Contact the service department of the dealer or manufacturer.

Do not ship units with defective batteries! Pack devices with defective batteries in suitable fireproof containers. Contact the service department of the specialist dealer or manufacturer.

4.5 Accuracy

Have force gauges and load cells calibrated at regular intervals. Load the load cell only in its specified load direction. Avoid transverse forces. For load cells with a 4-wire connection, the characteristic value changes when the cable supplied is shortened or lengthened.

4.6 Maximum measuring range

Never load the unit beyond the maximum measuring range! The max. measuring range of your unit with internal measuring cell can be found on the type plate on the back of the unit! The maximum measuring range of external sensors can be found on the type plate on the sensors!

Overloads are signalled by a warning tone when the signal tones are activated. Overload values are stored. Overloaded units and sensors are excluded from warranty, return and exchange.

5 Available models

Model	internal measuring cell	Measuring range internal measuring cell [Max] N	Readability internal measuring cell N	Number of measuring channels	Max. possible resolution per channel d
FS 2	-	-	-	2	10.000
FS 2-20	-	20	0,004	2	10.000
FS 2-50	-	50	0,01	2	10.000
FS 2-100	-	100	0,02	2	10.000
FS 2-200	-	200	0,04	2	10.000
FS 2-500	-	500	0,1	2	10.000
FS 4	-	-	-	4	10.000
FS 4-20	-	20	0,004	4	10.000
FS 4-50	-	50	0,01	4	10.000
FS 4-100	-	100	0,02	4	10.000
FS 4-200	-	200	0,04	4	10.000
FS 4-500	-	500	0,1	4	10.000

6   Scope of delivery
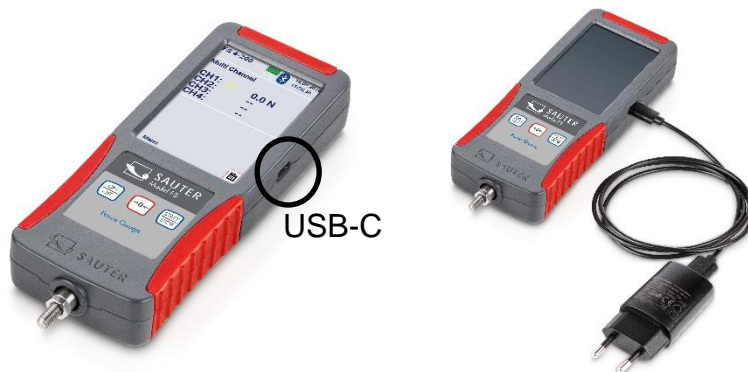

- Force gauge FS
- Transport case Systainer®
- Touch-Pen
- USB C cable
- EU plug-in power supply unit
- Operating instructions

7   Connections

7.1   USB C socket

Your unit is supplied with power via the USB C socket on the right-hand side of the unit and serves as an interface for data transfer to a PC. The interface description can be found in chapter 15 Interface chapter.

USB-C

7.2 Connection sockets for external sensors

Depending on the model, 2 or 4 strain gauge sensors can be connected to your force gauge and measured simultaneously. There are always 5 sockets on your device. The measuring channels 3 and 4 and the interface socket are only optionally assigned!

Measuring channel
CH4 (optional)

Measuring channel
CH3 (optional)

Measuring channel CH2
Measuring channel CH1
Interface socket
(optional)

You will receive the connectors when you order a sensor from SAUTER, as described in section 13.2 "" described.

7.2.1 Compatibility and necessary accessories

It is recommended to purchase the sensors directly from SAUTER. There you will receive compatible sensors with the corresponding necessary services. The services listed in chapter 13.2 include the adjustment of the measuring chain, the connector and the required data memory chip.

7.2.2 Plug & play from external sensors

External sensors can be unplugged and replaced by other adjusted sensors. Due to the tolerances of the respective input channels, the sensors must be adjusted with the device used. For this purpose, the unit must be sent to the KERN laboratory when sensors are reordered.

If possible, always connect the sensor to the channel on which it was adjusted and calibrated. It is best to keep a record of this! This will give you the highest possible accuracy.

7.2.3 Pin assignment connector
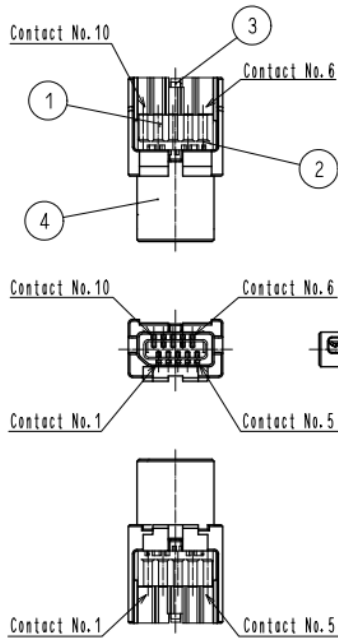
Pin	Connection
1	N.C.
2	Memory chip IO
3	Memory chip GND
4	N.C.
5	N.C.
6	Supply +
7	Input +
8	Input -
9	Supply +
10	N.C.

7.3 Expansion from 2 to 4 measuring channels

Each unit is factory-equipped with sockets for 4 measuring channels, even if you have purchased a variant with 2 channels.

7.4 Connection socket for optional data interface

The socket is available on the unit! Interface currently not available.

8 Technical data

8.1 Battery

- Lithium-ion rechargeable battery
- Nominal voltage 3.7V
- Capacity 2400mAh or 8.88Wh

⚠ Safety data sheets are available in the manufacturer's webshop or on request! Do not use devices with defective batteries! Do not send defective batteries or devices with defective batteries!

8.2 Display and measurement

- 3.5" touch screen
- Standard version with 2 or 4 measuring channels for external force sensors (subsequently expandable from 2 to 4)
- An internal measuring cell is possible (will be deactivated if slot 1 has a external measuring cell is plugged in)
- Suitable for 4-wire and 6-wire sensors with strain gauges up to 3mV/V
- Bridge supply voltage 6V
- High resolution: up to 10000 points per measuring channel
- Internal measuring frequency: 1000 Hz per measuring channel
- Measurement accuracy:
    - with internal measuring cell: 0.1 % of [Max].
    - with external measuring cell: among other things, from the measuring cells used
- Overall dimensions W×D×H 71×31×180 mm
- Overload protection: 150 % of [Max] with internal measuring cell
- Thread on load receptor: M6 (external)
- Internal battery operation, standard, operating time up to 8 h, charging time approx. 8 h
- External mains adapter, for connection to the USB-C socket, as standard
- Net weight approx. 0.4 kg
- Protection class IP40

8.3 Temperature

8.3.1 Storage temperature

-10°C to 40°C
Recommended storage temperature for lithium-ion battery: +10°C to 20°C

8.3.2 Use temperature

10°C to 40°C
In this range the measuring system is temperature compensated.

8.4   Fastening option

The unit can be attached to test stands, fixtures and handholds (AFK 02 is available as an option) using M3 screws at the four threaded holes on the rear:
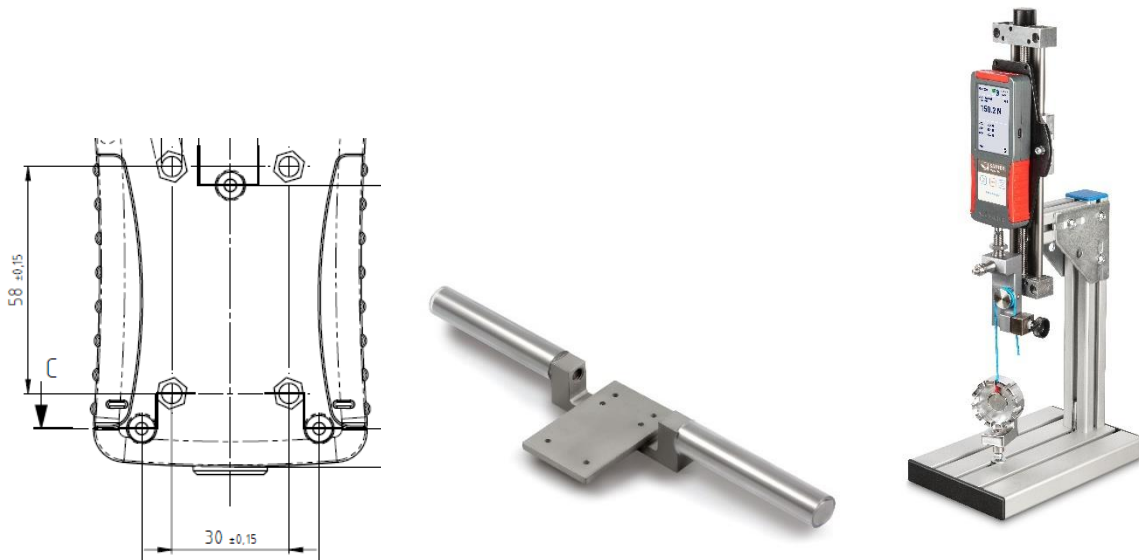
9   Prepare measurement

9.1   Switch on

Press and hold the ON/OFF button for approx. 3 sec.

9.2   Activate display with activated energy saving options

If you have activated the energy-saving mode of the display as described in section 11.1.3 it is possible that your unit is switched on and only the display is switched off. To activate the display, briefly press the START/STOP key or touch the display. If the display cannot be activated, start the machine as described in section 9.1 described.

9.3 Measuring with internal sensor

For units equipped with an internal sensor (not FS 2 and FS 4), the internal sensor is displayed as channel 0 (CH0) when you click on the "Measurement" function. If an external sensor is connected, CH0 is automatically deactivated and the external channels are displayed instead.

9.4 Measuring with external sensors

The external measuring channels are displayed as CH1 and CH2 for FS 2-x and CH1 to CH4 for FS 4-x. On the external channels CH1 to CH4 it is possible to measure and save the data simultaneously.

9.5 Plugging in and unplugging external sensors

To plug in or unplug the external sensors, the meter must be switched off or must be in the main menu, press briefly. The start screen appears and you are in the main menu.

10 Measurement

10.1 Start screen
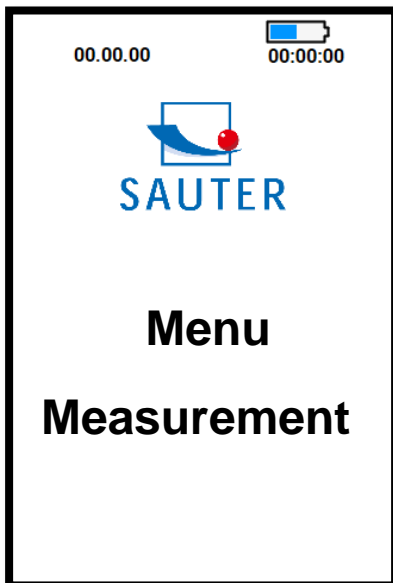
10.2 Start measurement

Click on Measurement on the touch screen

10.3 Initialise measuring channels

Press the START/STOP button to display the measured values of the connected sensors.

10.4 Tare measuring channels

10.4.1 Channel single

To set a single channel to zero, click with the touch pen on →0←"" to the right of the displayed channel.

10.4.2 Set all channels to zero (tare)

Press and hold the button for at least →0←3 seconds to set all connected sensors to 0.

10.5 Save measurement data

The different measuring functions that you can use and how the measured values are stored is described in section 11.2.3

10.6 Force direction

Units with internal sensor can measure forces in tension direction (positive measured value) and in compression direction (negative measured value). External sensors can differ. You can use sensors for tensile and compressive force or tensile force sensors or compressive force sensors. For more information on external sensors, see chapter 13.2 External measuring cells.

The forces on the FS encoder must always be applied in the axial direction of the load application bolt. Avoid transverse forces. These cause measurement errors and can damage the sensor.

Ideal force application
Incorrect force application
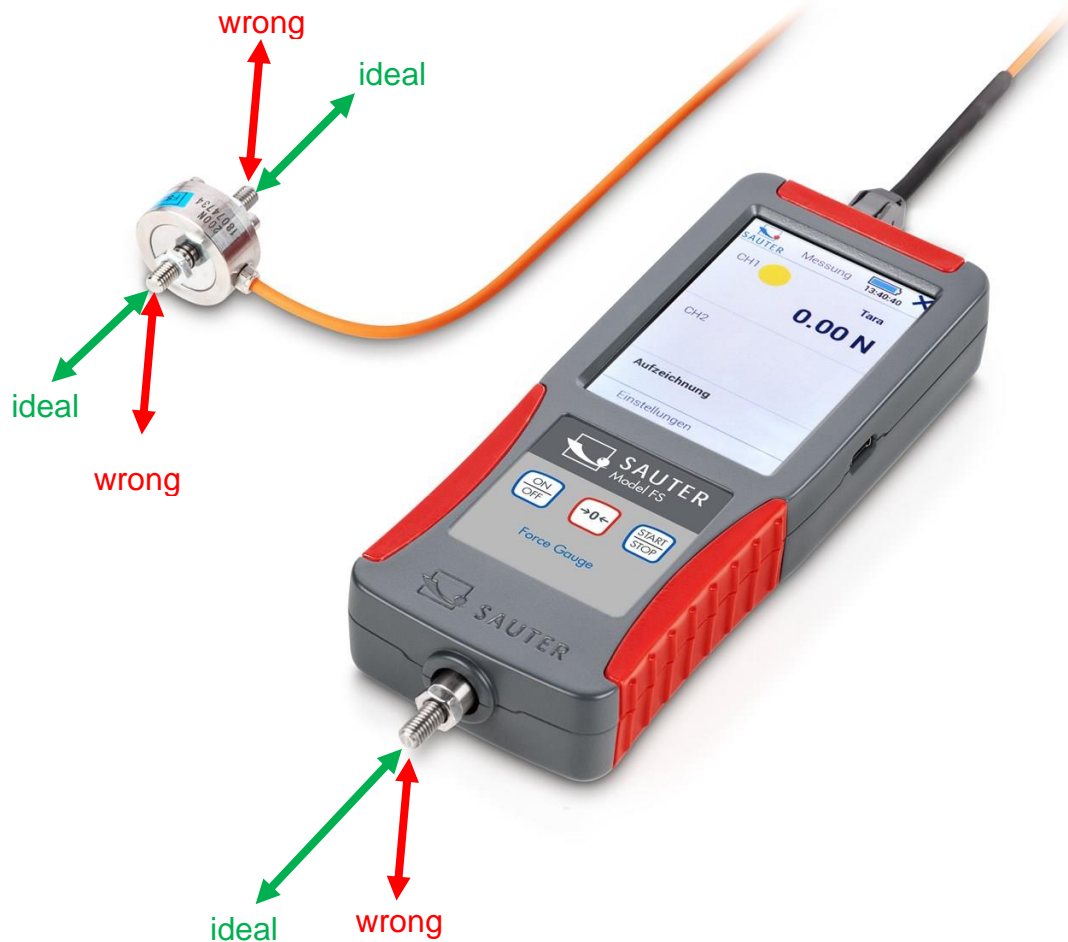
11 Main menu settings

When your device is in the start menu, you can make settings by clicking on "Menu". This will take you to the main menu with the following sub-pages:
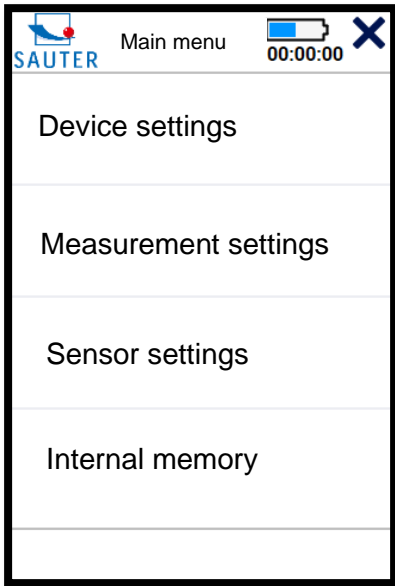
Clicking on or takes ✕ ↩ you to the previous page. Press the ON / OFF button to return to the start screen.

11.1 Menu unit settings
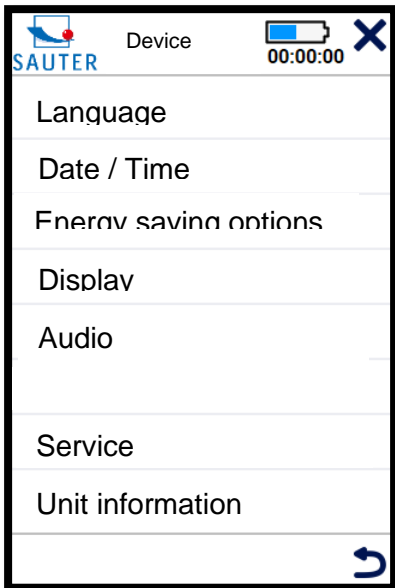
11.1.1 Select language

Select your desired language:
Menu Device settings→ Language→

11.1.2 Set time and date

Menu Machine Settings→ Date →/ Time
Click on "Change" with the touch pen and set the current time and date with the arrows.
Save the entered values by clicking on "OK".

11.1.3 Set energy saving options

Menu Machine Settings→ Energy→ Saving Options
Set here when the unit or display should switch off to save energy! Switching off the display is only recommended for long-term measurements! As a rule, never switch off the unit and display.

To reactivate the display, briefly press the START/STOP button or touch the display.

11.1.4 Display brightness

Menu Device settings→ Display→
Set the desired brightness of the display by pressing the slider on the display.

11.1.5 Switching tones on and off

Menu Unit→ settings Switch tones→ on and off

11.1.6 Service

Menu Unit Settings→ Service→

11.1.6.1 Display raw data

Switch here to display the raw measured values during adjustment as AD value or as voltage in mV.

11.1.6.2 Reset unit

Do not use this function! Contact the service department!

11.1.7 Device info

Menu Device Settings→ Device Info→
Here they receive information about
- Device name or model
- Installed firmware revision
- Serial number of the unit

11.2 Measurement menu Setting

11.2.1 Measuring frequency

11.2.1.1 Setting

By clicking on change, you can change the frequency with which the measured values are stored in the "Track" mode or transmitted to the interface! The following frequencies are possible: 1000, 500, 100, 50, 10, 5 and 1 Hz.

11.2.1.2 What frequency is needed?

Choose the frequency as low as possible and as high as necessary! High frequency data storage or transmission causes a large amount of data which takes a long time to transmit.

11.2.1.2.1 For long-term measurements

such as a fatigue test, select a very low frequency, max. 50Hz.

11.2.1.2.2 For short time measurements

Such as maximum load measurement to destruction, which lasts only a few seconds choose a higher frequency.

11.2.2 Readability

By clicking on change you can increase the readability by the displayed factor. The maximum resolution is n=10,000
The smallest adjustable readability for a sensor is calculated as follows:

$$d_{min}: kleinste\ Ablesbarkeit\ in\ N$$
$$MAX: Kennwert\ in\ N$$
$$n: maximale\ Auflösung$$
$$d: eingestellte\ Ablesbarkeit\ in\ N$$
$$STEP: Ablesbarkeitsfaktor$$

$$d_{min} = \frac{MAX}{n}$$
$$d = d_{min} * STEP = \frac{MAX}{n} * STEP$$

Example FS 2-100:

$$MAX = 100\ N$$
$$d_{min} = \frac{100N}{10.000} = 0{,}01N$$
$$STEP = 2$$
$$d = \frac{MAX}{n} * STEP = \frac{100N}{10.000} * 2 = 0{,}02N$$

Set the readability factor as high as possible and as low as necessary! Very low readability often leads to unstable display values with the measuring technology used and the high sampling frequencies. Readability factor 1 should only be set if the measured data is subsequently processed with additional PC programs, for example to filter, smooth, etc. the stored values.

If values are only read or stored manually, it is recommended to set the readability factor ≥ 5.

11.2.3 Functions

11.2.3.1 Track

Measured values are displayed continuously and stored with the set sampling frequency if required.

To save the readings:

1. Press the Start/Stop button
2. The measured values are now saved and the generated file name in which the data are saved appears in the display under the "Recording in progress" indicator.
3. Pressing the Start/Stop key briefly stops the storage of the measurement series, "Recording paused" appears in the display.
4. Pressing briefly again continues the recording. Recording in progress" is displayed
5. Press the Start/Stop button for more than 3 seconds to end the recording in the displayed file. Recording finished" display
6. To save a new measurement series in a new file, proceed again as in point 1.

11.2.3.2 Peak

To detect a peak value, select the Peak setting. When the measured value is shown in the display, start the detection by briefly pressing the START/STOP button.

Please note that a peak can only be detected above the threshold value of +/- 5% of the nominal measured value. For example 100N measuring range: Peak detection from +5N or -5N.

The message "Peak running" appears in the display. Carry out your measurement. If a peak value is reached and then falls again, the measurement is ended. You can now see the file name of the measurement in the display and transfer it to your measurement protocol.

11.2.3.3 Manual without statistics

Use this mode to manually save the measured values currently displayed after initialisation at the touch of a button.

1. Press the START/STOP button. The display shows "Manual running". This value is not yet saved.
2. Each additional short press of the START/STOP button saves the currently displayed readings. The number of stored values is displayed at the bottom right. To the left is the file name in which the data is saved.
3. Press and hold START/STOP until the display shows "Manually ended" to end the measurement series. No further points can be saved in this file.
4. By pressing the START/STOP button again, the mode starts from the beginning and a new file is created.

11.2.3.4 Manual with statistics

The manual storage of the measured values is the same as described in chapter 11.2.3.3 described.
In addition, the min, max and average values of the stored measured values are displayed here.

11.2.4 Channel limits

This setting controls the traffic light displayed when you are working in the Measurement window. Change the values by clicking on them with the touch pen.
If the function is not required, enter the negative value of the sensor as MIN and the positive value as MAX. The traffic light remains permanently yellow.

11.2.4.1 Yellow

Displayed measured value is below the entered value MIN

11.2.4.2 Green

Displayed value is between the entered values MIN and MAX

11.2.4.3 Red

Displayed measured value is above the entered value MAX

11.3 Sensor settings

Select the channel on which you want to make settings. Only external channels to which a sensor is connected are displayed. Only use the plugs with memory chip fitted by SAUTER for external sensors.

Force gauges and optional external sensors, as described in chapter 13.2 are delivered adjusted. Only make adjustments on this page if your device no longer displays the correct (and checked) measured values and you have experience with the adjustment of force measuring devices. Calibrated measuring instruments must be recalibrated after an adjustment.

11.3.1 Adjustment

To recalibrate a device, you need a calibration weight. Ideally with the nominal load of the sensor to be adjusted.

11.3.1.1 Measuring range and unit

Do not change these values. A new adjustment and possibly also a recalibration will be necessary!

11.3.1.2 Readability

The displayed value is the smallest adjustable readability. Set the readability required for your application 11.2.2 chapter, set the readability required for your application before using the meter.

11.3.1.3 Two-point adjustment

Click on Adjustment and then on Two-Point Adjustment.

11.3.1.3.1 Enter the values of the calibration weights

Enter your adjustment points in the upper part of the display at "Value? For example:
- Positive adjustment point: 500N
- Negative adjustment point: 0N

It is recommended to adjust with a weight that is close to the nominal value. For example, a weight of 400N to 500N for a force gauge with a maximum measuring range of 500N. Too small adjustment weights lead to a high measuring error!

11.3.1.3.2 Load and unload before adjustment

Load and unload the unit at least 3 times with the nominal load.

11.3.1.3.3 Read in adjustment points

Now read in the adjustment 11.3.1.3.1 adjustment points. When you have attached the respective adjustment weight, click on positive adjustment point and negative adjustment point in the lower area of the display. After successful recording, the raw values are displayed to the right with a tick next to them.

11.3.1.3.4 Save adjustment

Save the adjustment by clicking on Save. When the adjustment has been successfully saved, a tick symbol appears to the right of it.

11.3.1.3.5 Check adjustment

Check with your adjustment weights whether the settings you have made are correct. Proceed as described in chapter 10 described.

11.3.2 Calibration data

On this page you will find information if a measuring device with internal cell (CH0) or a device with external measuring cell (CH1 to CH4) has been calibrated in the KERN laboratory.

The specified measuring channel indicates to which channel (CH1 to CH4) an external sensor was connected during adjustment and calibration. It is recommended to always use external sensors on the same channel and on the same measuring device on which it was also adjusted and calibrated in order to keep the measurement error to a minimum.

The calibration date indicates the last calibration. Under Certificate, enter the number of the calibration to be able to assign the corresponding certificate.

11.3.3 Overload values

On this page you can see the three highest overload values, if there were overloads above the nominal load. Avoid overloads! They lead to measurement inaccuracies, can damage the sensor and void the warranty on your unit!

11.4 Internal memory

11.4.1 Composition File name

f_ddMMyy_hhmmss

f: stored measuring function
> M= Measuring function manual
> T= Mandatory function Track
> P= measuring function peak

The remaining file name is composed of the date and time at which the file was created.

11.4.2 Send file

If you connect the measuring instrument to a PC via an interface, you can send the selected files to the PC. The optionally available plug-in for MS Excel SAUTER AFI 2.0 is recommended for this purpose.

11.4.3 Delete file

Select the files you no longer need to delete them. Do not collect data on the device. Transfer them to another storage medium as soon as possible and delete the entire data memory of the FS!

11.4.4 Read out files

Reading out files with a PC is not possible. The PC must be set to receive at the interface to be able to receive the files sent by the FS.

12 Switch off the unit

Press and hold the ON/OFF button until the unit switches off.

13 Accessories

⚠️ When attaching accessories to your sensor, please note that the dead weight of the accessories must be taken into account!

13.1 Standard accessories for force gauges with internal measuring cell

- AC 43 Standard Attachments Metal
- AE 01 Standard clamp Clamping range from 0 to 7 mm, 0 to 500 N
- AE 02 Wide jaw clamp Clamping range from 0 to 6 mm, 0 to 500 N
- AE 03 Strap tension clamp Clamping width from 0 to 2.5 mm, 0 to 500 N
- AE 04 Strap tension clamp Clamping width from 0 to 6 mm, 0 to 500 N
- AE 05 Rope and thread tension clamp 0 to 500 N
- AE 06 Cable pull-off clamp Clamping width 1.5 to 6 mm, 0 to 500 N
- AE 07 Wedge clamp Clamping width 0 to 6 mm, 0 to 500 N
- AE 2K screw clamp Clamping width 0 to 15 mm, 0 to 2000 N
- AE 500 Screw clamp Clamping range from 0 to 10 mm, 0 to 500 N
- AFK 02 Holder for force gauges

Further accessories can be found in the webshop www.sauter.eu

13.2 External measuring cells

External sensors are available in the webshop www.sauter.eu. For each sensor you need the service corresponding to the nominal load from the following table, incl. connector and memory chip:

FS 402	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 0.5kN
FS 403	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 2kN
FS 404	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 5kN
FS 405	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 20kN
FS 406	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 50kN
FS 407	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 120kN
FS 408	Connector for FS incl. PARAMETER MEMORY mounted on measuring cell and two-point adjusted with weight up to 250kN

13.2.1 Adjust and calibrate

In order to adjust and calibrate the entire measuring chain, a measuring device and sensor are required in the core laboratory! Your QM representative can provide you with information on the period in which recalibration is necessary. In any case, we recommend a DAkks calibration certificate for every new device and sensor.

13.2.2 Additional sensors

If you purchase sensors for your device at a later date, it is necessary to send the device to the KERN laboratory, as the entire measuring chain is required for adjustment and calibration.

Check which other sensors in your range currently need recalibration or will need it in the foreseeable future and send them together to the KERN laboratory to minimise freight costs and downtime. Observe the national and international transport regulations for devices with permanently installed lithium-ion batteries.

13.3 Transport case for accessories

For the transport and storage of external sensors, accessories and tools, the transport case for accessories is available with the article designation FS TKZ. The transport case for the force gauge included in the scope of delivery can be connected to several other cases via the "T-LOCK" fastener.

13.4 Read out stored measured values with EXCEL plug-in

With the optionally available EXCEL plug-in SAUTER AFI 2.0, stored measurement data can be transferred to a PC. (EXCEL software not included in delivery!)

14 Power supply

14.1 Charging the battery

The device is equipped with a rechargeable battery at the factory. Charge the battery using the supplied USB-C cable and a power source with the following values:
- Voltage: 5V DC
- Current: 1A

If a power source and USB cable have been connected correctly, the plug symbol appears in the display to the right of the battery charge status when the unit is switched on.

14.2 Plug-in power supply unit

In some countries, a different plug-in power supply unit may be required for connection to the local mains supply. The adapter or plug-in power supply used must not exceed the output values at the USB output:
- Voltage: 5V DC
- Current: 1A

> Do not use a defective or damaged plug-in power supply! There is a danger to life due to high voltage!

14.3 Power supply via PC

The unit can also be powered from a PC using a USB C cable to simultaneously transfer data via the USB interface.

15 Interface

15.1 Interface description

15.1.1 USB

This is a virtual USB interface. The device is not recognised as a storage medium!
Baud rate: 115200 Databits: 8   Stopbits:1   Parity: none

15.2 Interface protocol

The interface protocol KCP (KERN Communication Protocol) can be downloaded from the website www.kern-sohn.com.
Important ASCII interface commands:
- SI   Sends the current reading immediately without waiting for stable conditions.
- SIR   Send current display immediately and repeat
- U   Query of the display unit
- ZI   immediately zero
- @   cancel / unsubscribe

16 Declaration of conformity

To view the CE Declaration, please click on the following link:
https://www.kern-sohn.com/shop/de/DOWNLOADS/