Instruction manual digital force gauge

SAUTER FL

Version 2.0
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GB

PROFESSIONAL MEASURING

SAUTER FL

V. 2.0 01/2020

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

Table of contents:

1 Introduction

Please read these operating instructions carefully before commissioning, even if you already have experience with SAUTER measuring instruments.
After receipt of the force gauge, it should be checked in advance that no transport damage has occurred, that the outer packaging, the plastic housing, other parts or even the gauge itself have not been damaged. If any damage is evident, please notify SAUTER GmbH immediately.

The FL can measure tensile and compressive forces very accurately and it is easy to operate. It can be held in the hand for measurements or mounted on top of a suitable test stand.
SAUTER offers optional software and accessories to make the measuring instrument more versatile in use. Please ask SAUTER or the SAUTER supplier or visit our website www.sauter.eu.

2 Scope of delivery

- SAUTER FL, incl. internal battery
- Transport case
- Battery charger
- 5 pieces M3 x 8 screws for mounting on SAUTER test benches

3 Additional information when using the AFH software

If you want to connect an FL with the combination test bench and software (AFH-LD or AFH-FD) to a PC, you must connect the FL to the equipment port of the test bench via the FL-A04 cable (Sub-D 9-pin to PS2) and connect the test bench to the PC via the computer port.

4 Technical data

4.1 Technical data FL with internal loadcell up to 1kN

Measuring device	FL 5	FL 10	FL 20	FL 50	FL 100	FL 200	FL 500	FL 1K
Capacity	5N	10N	20N	50N	100N	200N	500N	1000N
Measurement uncertainty	±0.2% of Max (measuring range)							
Work temperature	15°C to 35°C							
Relative air humidity	15% to 80% Humidity							
Weight (without accessories)	Approx. 500g							
Dimensions Display unit (LxWxH)	160x75x30mm							
Thread	M6							

4.2 Technical data FL with external loadcell from 2kN

Measuring device	FL 2k	FL 5k	FL 10k	FL 20k
Capacity	2000N	5000N	10000N	20000N
Measurement uncertainty	±0.2% of Max (measuring range)			
Working temperature	15°C to 35°C			
Relative air humidity	15% to 80% Humidity			
Weight display unit	Approx. 500g			
Dimensions display unit (LxWxH)	160x75x30mm			

4.3 Technical data external load cell (from 2kN)

Maximum load	LxWxH	Thread type	Cable length
2 kN	70x60x24mm	M12x1.75	
5 kN	70x60x25mm	M12x1.75	Approx. 2,5m
10 kN	70x60x25mm	M12x1.75	
20 kN	70x64x25mm	M12x1.75	

4.4 Technical Data FL TM

Adjustable measuring ranges	5N; 10N; 25N; 50N; 100N; 250N; 500N	1kN; 2,5kN; 5kN; 10kN; 20kN; 50kN
Characteristic value max.	1mV/V	2mV/V
Measurement uncertainty	±0,2% bis 1% von Max (Messbereich), abhängig von verwendetem Sensor	
Working temperature	15°C bis 35°C	
Weight display unit	Ca. 500g	
Dimensions display unit (LxWxH)	160x75x30mm	

4.4.1 Sensors

Sensor must be ordered separately. Service FL-C01 necessary.

4.4.2 Load cell connection

Solder the cable from the measuring cell to the supplied connector. The pin assignment at the connector is as follows:

Pin 1: Supply (-)
Pin 2: Signal (+)
Pin 3: Signal (-)
Pin 4: Supply (+)

Pin 1: EXC (-)
Pin 2: Signal (+)
Pin 3: Signal (-)
Pin 4: EXC (+)

5 Battery indicator / power supply

■ Battery level > 4.8 V

▪◗ 4.8 V > Battery level > 4.7 V

▭◗ 4.7 V > Battery level > 4.4 V

▭ 4.4 V > Battery level > 4.0 V

▭ Battery level < 4.0 V

- If the battery voltage is less than 3.9V, a message appears that the battery is exhausted and the device switches off automatically

The FL is equipped with four Nickel Metal Hybrid (NiMH) batteries type AAA. For safety reasons during transport, the batteries are supplied uncharged. For maximum battery life, we recommend that you charge the batteries only with the original charger (supplied) for a period of 14-16 hours before using the meter for the first time.

6 Display indication
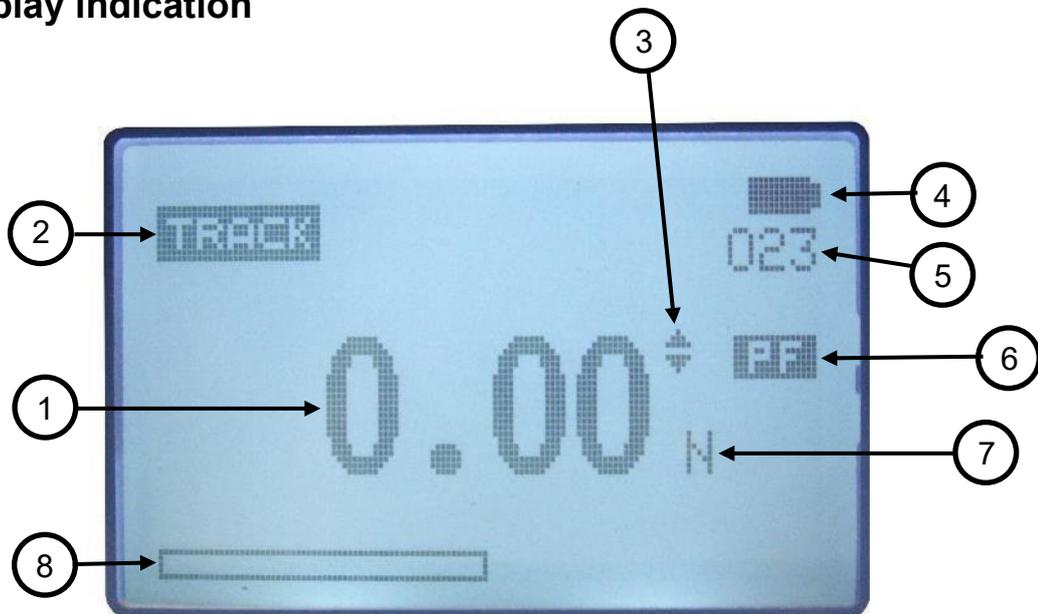
Position	Description
1	Measurement result
2	Display mode (track, peak (pull), peak (push)
3	Display of the direction of force
4	battery charge indicator
5	Number of occupied memory locations
6	Activated pass-fail criterion
7	Display unit of the measurement result
8	Force diagram

7   Control buttons

MENU/ESC:

- Opens the menu window with the individual submenus
- By pressing the MENU/ESC button in the menu, you can return to the previous page

ZERO (zeroing):

- Zeroing the display in track mode (tare function)

ENTER:

- Confirm the selection in the menu
- Saving a measured value in PEAK mode

PRINT (print function):
- Output of the memory contents to PC or printer

RESET (delete function):

- Delete the current PEAK value

UNIT (units of measurement):

- Press the key briefly: Switch between N, gf, kgf, ozf, lbf, mN

Mode (mode change):
Assignment with three functions:
- Track mode (continuous measurement)
- Peak⇕Mode Train
- Peak⊼Mode Print

ON / OFF:

- On / Off button (press button for approx. 1 s)

8 Functions

8.1 Limit value display Good / Bad

LED display for good / bad tests

Colour	Function
Red	Exceeding the upper limit value
Green	Indicates that the pass-fail criterion has been reached
Yellow	Falling below the lower limit value

An upper and a lower limit value can be programmed. The measuring instrument compares the measurement result with the limit values and outputs the result as a signal in red or green light diodes.

Setting of the limit values see MENU →PASS-FAIL
With the left arrow key the cursor is moved to the desired value. With the UP or DOWN key the value can be changed. By pressing and holding one of these keys, scrolling is possible. With the right arrow key the unit can be changed. With the ENTER-key the settings are saved and you return to the main menu.
The display now shows a "PF".
The PASS-FAIL option is automatically disabled if the upper and lower limits are set to 0 Newton. The lower value must also always be smaller than the upper one.

8.2 Invert display

The display can be rotated by 180°. To do this, do the following:
When the power is off, press and hold the "MENU/ESC" key. In addition, the "On/Off" key is pressed and the unit switches on, thus rotating the display.

8.3 Store measured value in memory

Any measured value can be stored in the memory at any time by pressing the ENTER key. A maximum of 500 readings can be stored.

8.4 **Memory / Storage**

The memory is used to view the stored data. It can store 500 readings. Currently, individual entries or all entries can be deleted, or the measurement data of the memory can be printed out.

To enter the MEMORY menu, the MENU/ESC button must be pressed. Use the UP or DOWN button to move the cursor to MEMORY. Then confirm with the ENTER button and you are on the memory page. Press the ESC button to return to the main menu page.

With the arrow keys UP and DOWN the page can be changed within the memory and by pressing and holding one of these two keys it is possible to scroll up or down.

By pressing the PRINT key, the memory contents can be printed out via the serial port.

By pressing the ZERO button, the DELETE menu is accessed
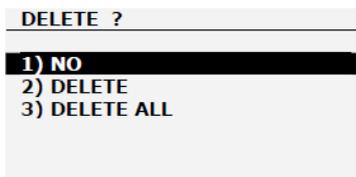
Use the UP and DOWN arrow keys to select the desired delete option. If NO is selected here and confirmed with the ENTER key, the meter returns to the memory page.

When DELETE is selected and the ENTER button is pressed to confirm, the currently stored measurement is deleted and the instrument returns to the memory page.

When DELETE ALL is selected and the ENTER button is pressed to confirm, all stored measurements are deleted and the instrument returns to the memory page.

8.5 Diagnostics

This function is used to check the loadcell. If it is suspected that the loadcell has been overloaded, the status can be determined immediately.

To do this, place the device in a horizontal position on a flat surface and call up the main menu page. To enter the DIAGNOSTIC menu, the MENU/ESC button must be pressed. Use the UP or DOWN button to move the cursor to DIAGNOSTIC and confirm with the ENTER button. You are now on the DIAGNOSTIC page.

Press the ESC key to return to the main menu page.
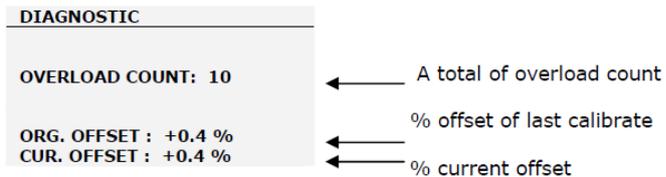
If the percentage drop is between 5% - 10%, please contact the supplier to have the loadcell replaced. These values are given as a guide only. The actual need for calibration/replacement of the loadcell varies with its individual characteristics.

8.6 Select Output

With this option the used data output, RS 232 or USB is selected.

There is an analog output on the device. This generates a signal that goes from +2V to -2V. This signal is a percentage of the maximum value of the force gauge. FOR EXAMPLE..: FL100 50N is measured in the direction of pull, then a -1V signal is applied to the analog output. 75N in compression direction, then + 1.5V is present at the analog output. If the instrument is in PASS - Fail mode, 2V for PASS and 0V for FAIL are present at the analog output.

9 Computer control of the force gauge

With the RS 232 interface a connection from the force gauge to the PC can be established by sending RS232 commands.

RS232 command	Action
"„m"	Change measuring mode
"„u"	Change measuring unit
"„z"	Set device to "zero
"„r"	Perform reset on the device

10 RS232 output signal

The reading of the FL shown on the display can be transferred to the PC by pressing the PRINT button or by issuing a command instruction to the force gauge from the PC.

RS232 command	Action
""l"	Send the direct reading with unit
""p"	Send peak value (on pull) with unit
""c"	Send peak value (on pressure) with unit
"x" or pressing PRINT KEY	- Send the direct reading with unit if the current mode is the track mode - Send peak value (on pull) with unit if the current mode is peak mode - Send peak value (on pressure) with unit if the current mode is the peak value print mode
""d"	Send save
""!"	Send information about the device such as model, capacity, serial number, firmware check, original offset, current offset, overload counter

10.1 Interface protocol

RS-232 Parameters
- Baud rate: 9600
- Data bit: 8
- Parity: none
- Stop bit: 1
- Start bit 1

The measured value is requested by the ASCII character "9".

The returned measured value looks like this:

e.g.   0011.70 means -11.70 Newton if Newton is set
      |_____ > first character describes the sign (0 = minus = pressure; 1 = plus = pull)

      | |____>-------- the remaining 6 digits describe the measured value as ASCII character string

or: 1021.15 means +21.15 N (tractive force)

## 10.2 Assignment of the RS232 data interface
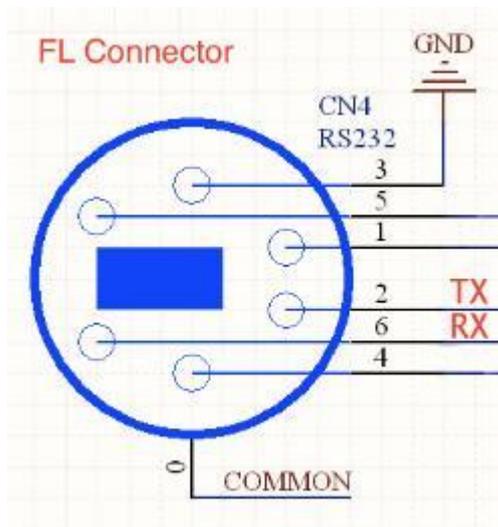
Pin	Signal	Illustration
2	TxD	Data output
3	GND	Ground
6	RxD	Input for control signal

11 Warnings

Incorrectly performed force measurements can lead to serious injury to persons and damage to objects and must therefore only be performed by trained and experienced personnel.
In particular, it must be avoided that forces act on the purchased measuring instrument which exceed the maximum load (Max) of the instrument or which do not act axially via the external and internal load cell; or if high impulse forces act on the measuring instrument.

Avoid twisting the loadcell, otherwise it could be damaged and the measuring accuracy will decrease in any case.
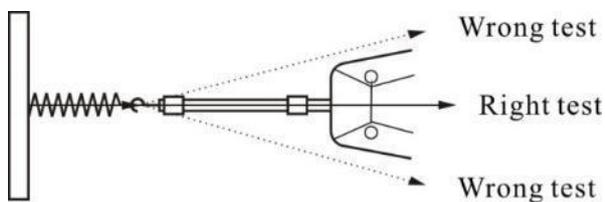
Inappropriate use
Do not use the measuring instrument for medical weighing.
If small quantities of the material to be measured are removed or added, incorrect measurement results may be displayed due to the "stability compensation" in the measuring instrument! (Example: Slow flow of liquids out of a container suspended from the measuring cell).
Do not apply a continuous load to measuring instruments with external measuring cell.

Overloads
Please prevent the measuring instrument from being overloaded beyond the specified maximum load (Max), minus any tare load that may already be present.
This can damage the measuring instrument (danger of breakage!)

Attention:

- Make sure that never let people or objects
  are under the load, as it injures
  or could be damaged!
- The measuring instrument is not suitable for weighing people, do not use it as an infant measuring instrument!
- The measuring device does not comply with the German Medical Devices Act (MPG).
- Never operate the measuring instrument in rooms where there is a risk of explosion. The standard version is not explosion-proof.
- The design of the measuring instrument must not be changed. This can lead to incorrect measurement results, safety-related defects and the destruction of the measuring device.
- The measuring instrument may only be operated or maintained by trained personnel.
- The measuring instrument may only be used in accordance with the described specifications.
- SAUTER must give written approval for any other areas of use / applications.

Warranty

The warranty is void if

- Non-compliance with our guidelines of the operating instructions
- Use outside the described field of application
- Modifying or opening the device
- mechanical damage and damage caused by agents such as liquids or liquids have been caused
- improper assembly or electrical installation
- Overloading the measuring cell

Test equipment monitoring

As part of quality assurance, the metrological characteristics of the measuring instrument and any test weight that may be present must be checked at regular intervals. The user responsible must define a suitable interval for this purpose as well as the type and scope of this inspection.

Information on the monitoring of measuring instruments and the necessary test weights is available on the SAUTER homepage (www.sauter.eu). The weights and measuring instruments can be checked and adjusted quickly and at favourable prices in KERN's accredited DAkkS laboratory (traceability to the national standard).

Note:

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

12 Adjustment instruction FL

Introduction:
This manual describes the adjustment procedure, although some programming modes are password protected.
Important! During the adjustment procedure, all weights for loading the sensor should be calibrated.

Tempering:
Before the measuring instrument is handed over to the calibration laboratory, the respective instrument must be checked for possible damage and the order specification.
Before starting adjustment, allow the measuring instrument to reach the working temperature of the calibration laboratory for at least 2 hours.

Preparation:
Insert a full set of charged batteries in the battery compartment or connect a standard power supply

Calibration:

1. Switch on the measuring instrument
2. Select the main menu by pressing the MENU key and select the menu function CALIBRATION with the cursor keys UP and DOWN. Then press the ENTER key. The ENTER PASSWORD window will appear on the screen.

<div align="center">

ENTER PASSWORD [Enter password].
4 FIGURES
PASSWORD: 0000*

</div>

* Master password = 7780

Use the UP and DOWN arrow keys to scroll up and down. The left and right arrows can be used to select the left and right positions. To change a digit, press and hold for a moment.
Press the ENTER key to confirm the password. If the password is correct, the display shows the calibration menu window.

CALIBRATION MENU

1) MAX CAPACITY
2) TENSION GAIN
3) COMPRESSION GAIN
4) SET NEW PASSWORD

3. Select the correct value of the weight for the respective measuring instrument. To set the load, use the UP and DOWN arrow keys to select the MAX CAPACITY menu function and press ENTER. The menu window for setting the maximum load appears on the screen.

SET MAX CAPACITY   1/2

1) 5 N
2) 10 N
3) 25 N
4) 50 N
5) 100 N
6) 250 N

SETTING MAX. LOAD 1/2

SET MAX CAPACITY   2/2

7) 500 N
8) 1000 N
9) 2500 N

SETTING MAX. LOAD 2/2

4. Use the UP and DOWN arrow keys to select the maximum load, press the selected value and hold for a moment.
Press the ENTER key to save the selected value. Then return to the calibration menu.

5. To calibrate in the voltage direction: use the UP and DOWN arrow keys to select TENSION GAIN in the calibration menu and then press ENTER. The display shows a menu window for voltage increase.

TENSION GAIN

0.00 N

GAIN : 29200

5.1. Zero voltage
- Set up the measuring device together with the necessary accessories for performing the voltage calibration
- apply a force of 100% of the meter's power to the weight
- Remove the load, leave the device standing
- as soon as the display becomes stable, press the ZERO key to save the zero display

5.2. maximum stress
- apply the voltage force of 100% of the meter power
- Calibrate the voltage increase with the UP and DOWN arrow keys and RIGHT and LEFT until the meter displays the maximum voltage result
- touch the ENTER key to save the results for the entire voltage scale.

6. Compression calibration: In the calibration menu, use the UP and DOWN arrow keys to select the COMPRESSION GAIN menu function and then press ENTER. The display will show a menu window for compression gain.

COMPRESSION GAIN

0.00 N

GAIN : 29200

6.1. Zero Compression
- Set up the measuring device and all necessary accessories for performing the compression calibration
- apply a force of 100% of the meter's power to the weight
- Remove the load, leave the device standing
- as soon as the display becomes stable, press the ZERO key to save the zero display

6.2. maximum compression
- apply the compression force of 100% of the gauge power
- Calibrate the compression gain with the UP and DOWN arrow keys and RIGHT and LEFT until the meter displays the maximum compression result
- touch the ENTER key to save the results for the entire compression scale

7. After successful calibration, remove all accessories from the meter and place the meter on a flat surface with its backside facing up.
   Select the voltage increase menu window, press the ZERO key to obtain the primary calibration offset, date and time and reset the overload counter.

13 Technical drawings

SECTION A-A