Operating instructions

DP 400 | Pressure calibrator

MECOTEC

Dear Customer,

We are delighted that you have decided to buy a MECOTEC device. Please read these operating instructions for the **pressure calibrator DP 400** carefully before connecting and configuring it, and operate the device in compliance with the instructions. Operational safety and the function of the device can only be guaranteed if the generally applicable legal safety and accident prevention regulations, plus the safety instructions provided in the operating instructions, are complied with.

We do not accept liability for any damage caused by improper use or incorrect operation. Please ensure that all persons operating the device have read and understood the operating instructions.

Keep these operating instructions in a safe place so that they are accessible at all times when needed.

If you require further information, please don't hesitate to contact us using the following contact details:

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1 Description

The DP 400 is a hand-held measuring device that can be equipped with up to four pressure measuring ranges. When using an (internal) barometric sensor, it can be used for offsettinge.

The features shown and described in this manual may not be available on some models.

2 For your safety

2.1 Symbol description

2.1.1 Personal protective equipment!

High sound pressure may occur due to escaping pressure media.
Wear hearing protection!

When working with and on the precision pressure controller,
safety goggles must be worn at all times!

2.1.2 Other symbols

Danger!

Used to warn of danger due to electrical current. There is a risk of severe or fatal injuries if the safety instructions are not complied with.

Warning!

As hazardous material, this device may not be disposed of in normal household waste. It must be disposed of correctly in compliance with local regulations.

Read the operating instructions **before assembly** and commissioning!

2.2 Safety instructions

Please read these operating instructions carefully before commissioning the pressure calibrator DP 400 and ensure that all persons operating the device have read and understood the operating instructions.

The manufacturer has designed this device to ensure safe use as long as it is used in compliance with the method described in these operating instructions. This device may only be used for the purpose indicated in these operating instructions.

The safety instructions **("Warning, Attention")** are intended to protect the user and the device from injuries and damage. The following chapters provide you with all the information you need for safe handling.

There is a danger of death if the warnings, particularly the safety instructions, are not complied with. Severe physical injuries or damage to property may occur. Any use of the DP 400 other than the intended use is not permitted. The pressure calibrator must be handled with care. The technical specifications for the pressure calibrator listed in these operating instructions must be complied with.

Warning!

Ensure that the device is suitable with regard to the measurement range, implementation and specific measurement conditions before assembly, commissioning and operation.

Ensure that all components used are functional and in good working order before the pressure calibrator is pressurised. The components used must be suitable for the specified maximum pressure. Screw connections must be checked for tight fit and leaks.

Pressure

Do not use any pressure higher than the maximum sensor pressure range.

If the actual pressure value exceeds the sensor's pressure range, the colour of the displayed measured value will change from white to red.

Do not open the device!

The device may only be opened by qualified personnel. There is a risk of electric shock. If the device is moved from a cold to a warm environment, its function may be impaired due to the **formation of condensation**. In this case, wait for the device temperature to adjust to the room temperature before starting it up again.

If malfunctions cannot be rectified with the aid of these operating instructions, the device must be taken out of operation immediately and secured against unintentional restart. Claims of any kind due to incorrect use are excluded.

Repairs may only be carried out by the manufacturer. Tampering with or modifying the device is not permitted.

3 Specifications

Measuring range	Accuracy	0.01% FS to 0.05% FS
	Relative pressure	See measuring range table (p. 36)
Permissible media	Gases and fluids	
Permissible pressure	See rating plate of single pressure ranges	
Display	Display	7" touch panel; colour
	Warm-up time	> 15 min
Device	Device design	Hand-held (battery-operated)
	Sensors/channels	Up to 4 pieces
	Dimensions in mm	74 x 255 x 155 mm (H x W x D)
	Weight	2 000 g
Connections	Pressure connections	3 x G ¼" inside
Power supply	External power supply unit	AC / DC 100 ... 240 V; 50/60 Hz / 20 V; 1,85 A
	Battery	12 x 1,2 V / 1900 mAh Approx. 6 hours: continuous operation with 1 sensor
Permitted ambient temperature	Storage temperature	-10 – 70°C
	Air humidity	5 – 95% rH (relative humidity without condensation)
	Compensated temperature range	0 – 70°C
Communication	Interfaces	RS232 USB Netzwerk RJ45

4 Preparation

4.1 Unpacking the device

4.1.1 Visual inspection

A visual inspection for defects and a function test are carried out before each device leaves the factory. Check the device on delivery for transport damage. Ensure that the electrical cables and the pressure lines comply with the installation requirements. Check the pressure hoses for damage and any penetrating dirt or moisture. Immediately notify the shipping agent of any recognisable damage.

4.1.2 Scope of delivery

Check the package contents following delivery of the DP 400 using the following list:

1) Pressure calibrator DP 400
2) AC/DC converter
3) Operating instructions
4) Interface cable
5) Case

4.2 Set-up and assembly

4.2.1 Location

The device is available as a table-top or installation module. To ensure maximum stability and accuracy, avoid setting the device up on surfaces affected by motor or machine vibrations.

The device has two types of feet that allow it to be placed upright (a) and at an angle (b).


MECOTEC
1024.28
mbara
0...35 bar
0...7 bar
0...1,3 bara

(a)


MECOTEC
1024.27
mbara

(b)

4.2.2 Enviroment

The location where the device is set up must meet the following criteria:

- Operating temperature: 15 – 45 °C
- Air humidity: 0 – 95% relative humidity without condensation

Avoid the following influences:

- Direct sunlight or proximity to hot objects
- Unstable installation location
- Mechanical vibrations
- Proximity to sources with strong electromagnetic fields such as high-voltage devices, mobile phones or high-voltage cables
- Soot, steam, dust and corrosive gases
- Potentially explosive environments or flammable atmospheres

4.3 Connections

4.3.1 Pressure connections

The DP 400 is used for pressure calibration with one or optionally several channels. Each channel is used for pressure measurement.

WARNING!

Vent the pressure lines before connection/disconnection. Carefully release the pressure from the lines. Only use devices with the correct nominal pressure. Check all fittings and devices for damage before pressurising the system. Replace any damaged fittings and devices.

Do not use any damaged fittings or devices!

The pressure connections are located on the right side of the device.
Connections: G ¼" inside

4.3.2 Electronic connections

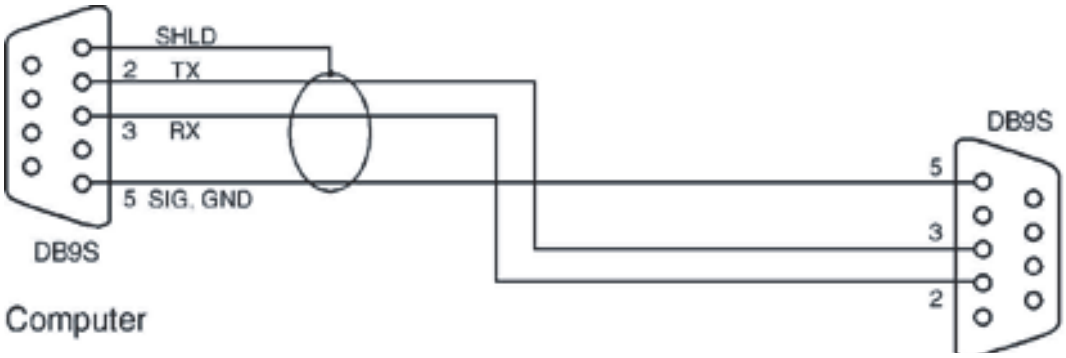
The following connections are located on the left side of the device:

- ON/OFF switch
- Charging connector for battery pack
- USB connection
- RJ45 network connection
- Serial communication interface connection (RS232)

4.3.2.1 RS232 interface

To connect the device to a computer, a special adapter cable (optional) is required. The adapter cable has a USB and an RS232 port. Before connecting the adapter cable to the USB port of the device, it must be switched on and ready for use. Under **Util → Serial interface** the mode is set (chapter 6.3.10.3). If the device is switched on with the adapter cable plugged in, an error message appears. Remedy: Remove the adapter cable and restart the device.

The contact assignments for the 9-pin D-connector, the RS232 connector and the relationship between the device and the RS232 control signals are shown, together with the transmission interfaces of the device, in the following image.



4.3.2.2 USB interface

See chapter 6.11.4

4.3.2.3 Network connection

This is only to be used for servicing by the manufacturer and by appropriately trained users. Further information on this topic in chapter 6.11.5.

5 Commissioning

The device must be tested before use. Obtain an overview and familiarise yourself with the entire procedure before starting a process on a component or the system.

WARNING!

When the DP 400 is switched off, all valves are closed and no pressure value is displayed. However, there may still be compressed air in the system. To be on the safe side, the connected measuring line should be removed before switching off the device.

6 Operation

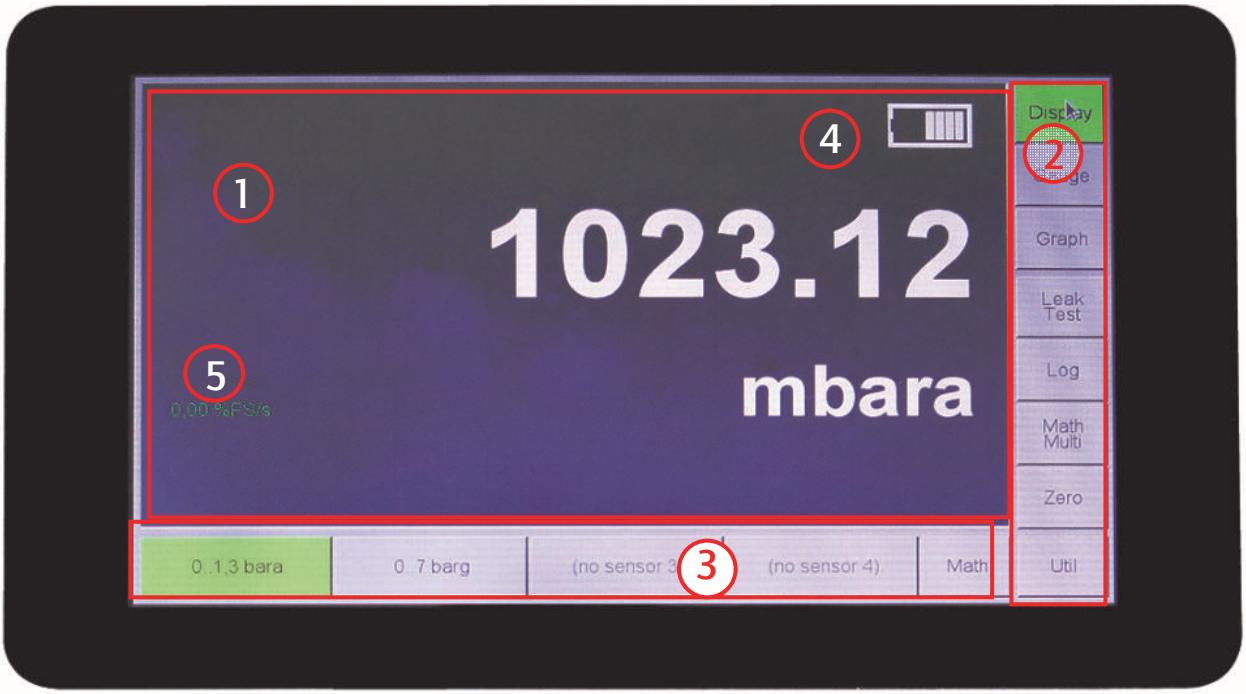
6.1 Switching the DPC 400 on/off and charging

Switch the device on/off with the button on the left-hand side. After being switched on, the pressure calibrator carries out an initialisation process and system check. Once initialisation is complete, control mode is started.

The device should warm up for at least 15 minutes before any measurements are carried out.

Use only the supplied AC adapter to charge the device. The charging socket is located on the left side of the device. While charging, an arrow appears in the battery indicator. **Please remove connected measuring leads before switching off the DP 400.**

6.2 Displays



The 7" touch display is divided into three sections: the display panel (1), the function buttons (2) and the sensor selection (3). In the display field (depending on the mode selection) for example, the pressure readings with unit, the status of the battery (4) and the stabilization indicator (5) are displayed.

6.2.1 Sensor selection

The DP 400 can optionally be equipped with up to four pressure ranges. Three pressure areas are led outwards. The fourth pressure range can be used as a barometric reference sensor for offsetting. The installed pressure sensors with the pressure ranges are displayed

horizontally below the display field. After switching on the device, the current sensor with its measured value is highlighted in green.

6.2.2 Function buttons

Above the buttons, which are perpendicular to each other on the right edge, you get into the individual functional areas. If a function is activated, the button also turns green here.

6.3 Functions

6.3.1 Display

The display shows the currently active sensor. If the device has several sensors, these can be additionally activated via the function **Math ⁄ Multi** (chapter 6.9). If this is the case, they will be displayed simultaneously in the **Display** mode. If the **Math ⁄ Multi**-function is activated, the offsetting of the sensors is also displayed.

6.3.2 Stabilization indicator

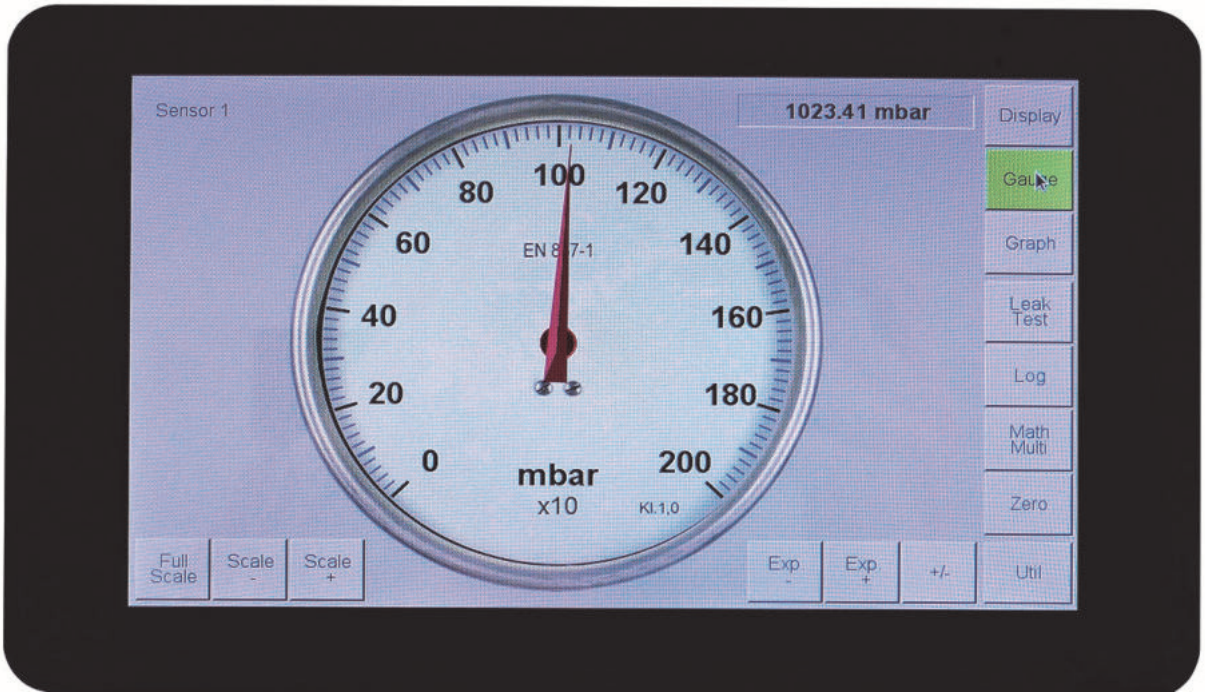
The value is given as a percentage of the full scale value in seconds. If the measured value is stable, the display changes to green.

6.3.3 Battery status

The display has 6 bars. If only one bar is displayed, the device should be charged to display reliable readings.

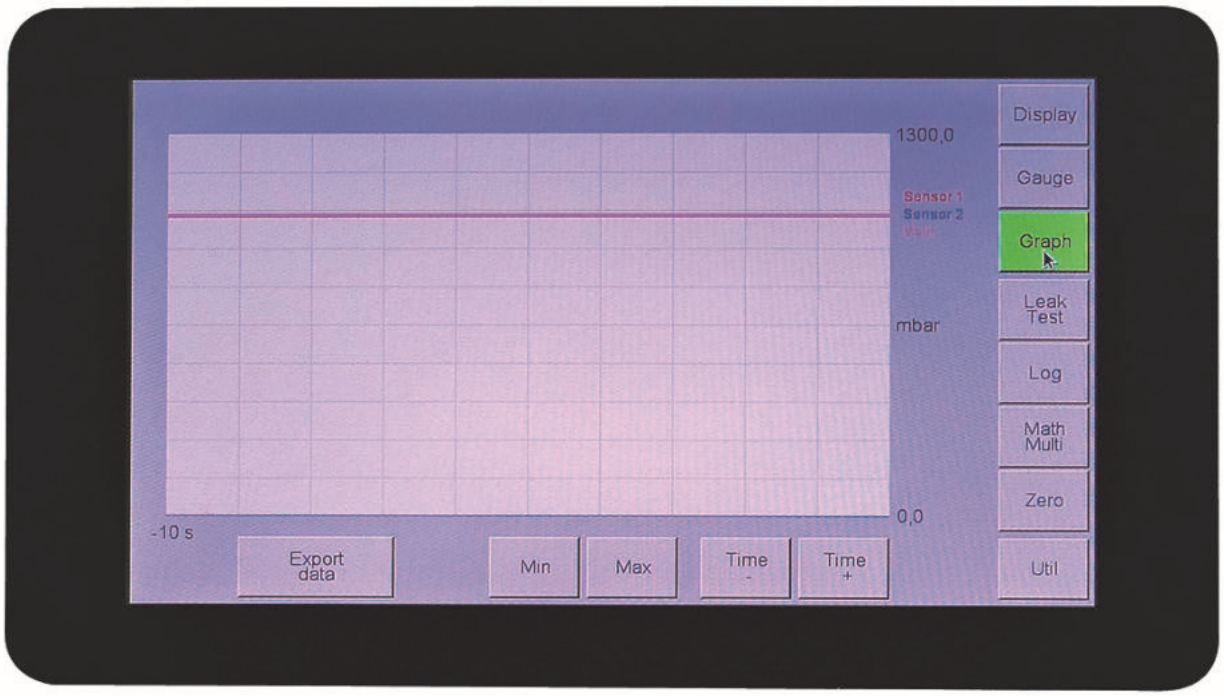
6.3.4 Gauge

In **Gauge** mode, the **Scale +/-** buttons can be used to set scaling with an analogue pressure gauge display. The buttons **Exp. +/-** are used as multipliers.

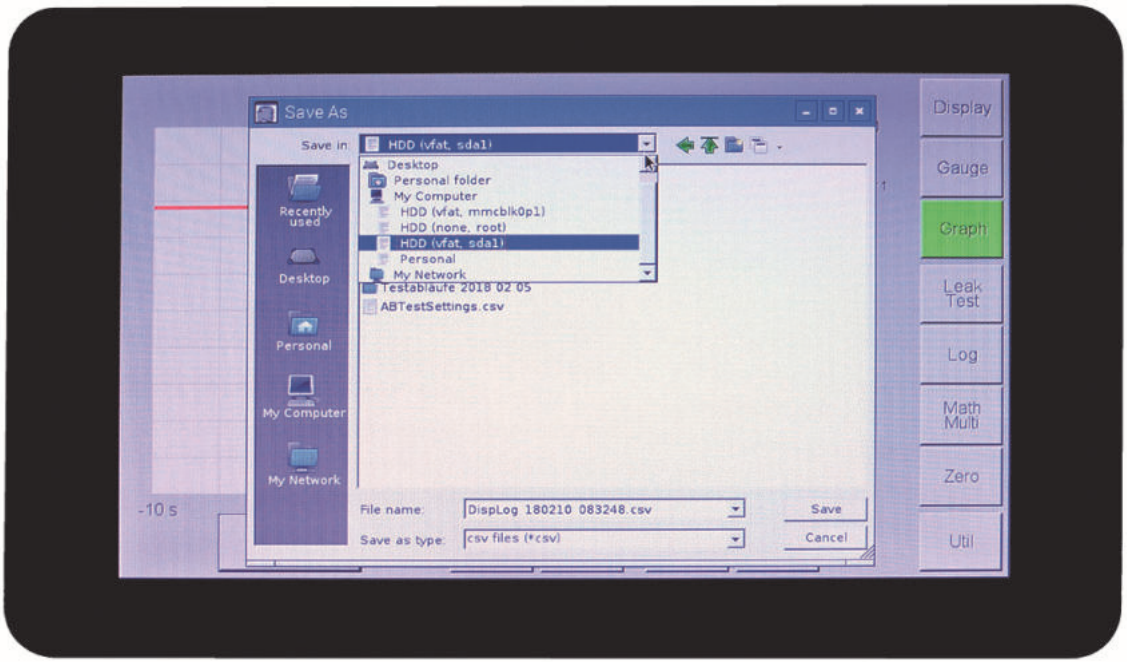


6.3.5 Graph

Pressure trends are displayed in **Graph** mode. The y-axis display range can be selected via a number field using **Min/Max**. The development over time of the x-axis can be increased/decreased with the **Time** buttons.

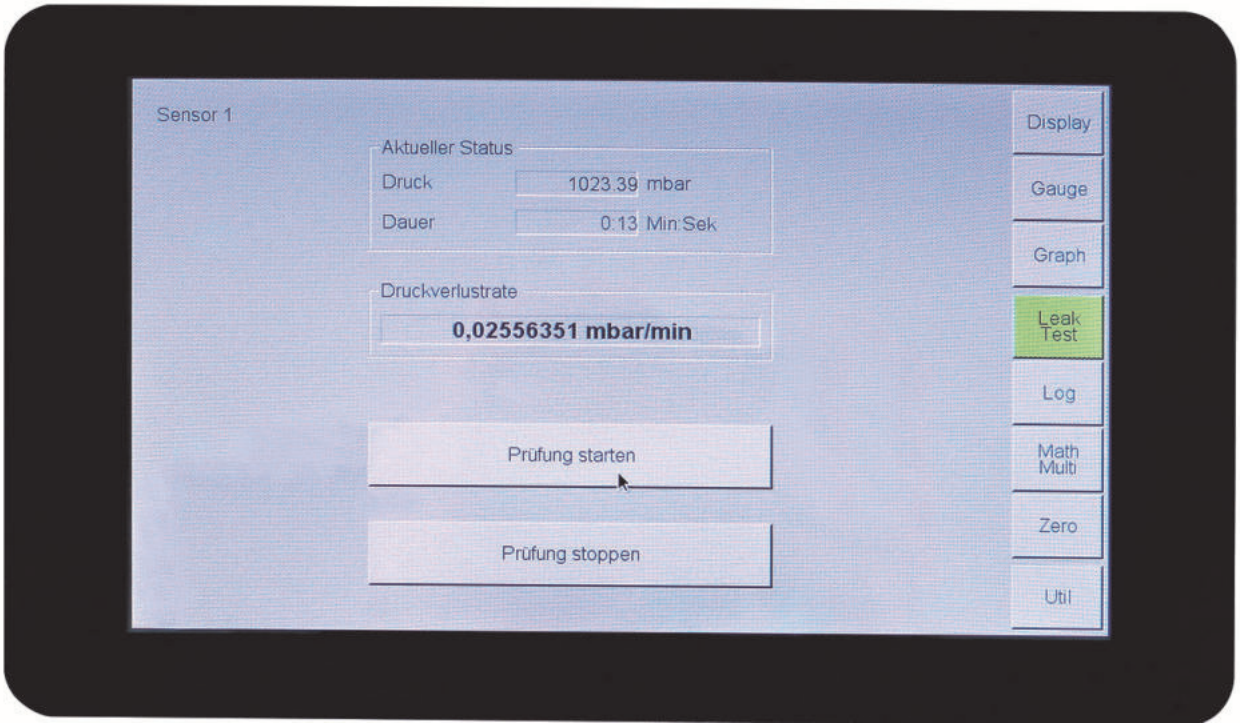


The measuring rate is set to one second. The pressure curves of the sensors selected in the **Math / Multi** interface (chapter 6.9) are displayed in different colors. Via **Export data**, the data can be saved as a CSV file on a USB stick. The USB stick must be integrated in advance (Chapter 6.11.4).



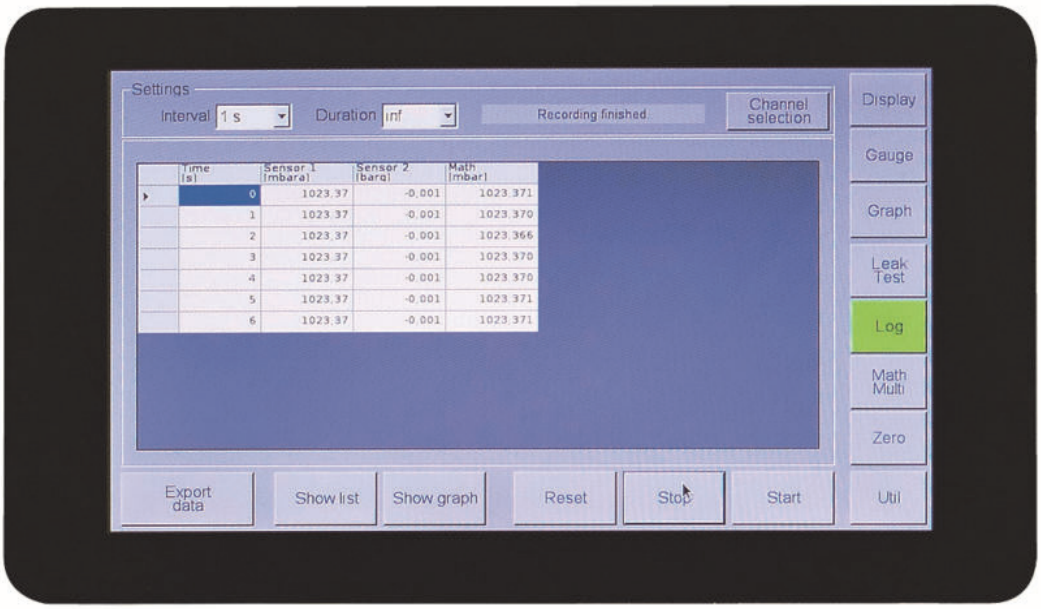
6.3.6 Leak Test

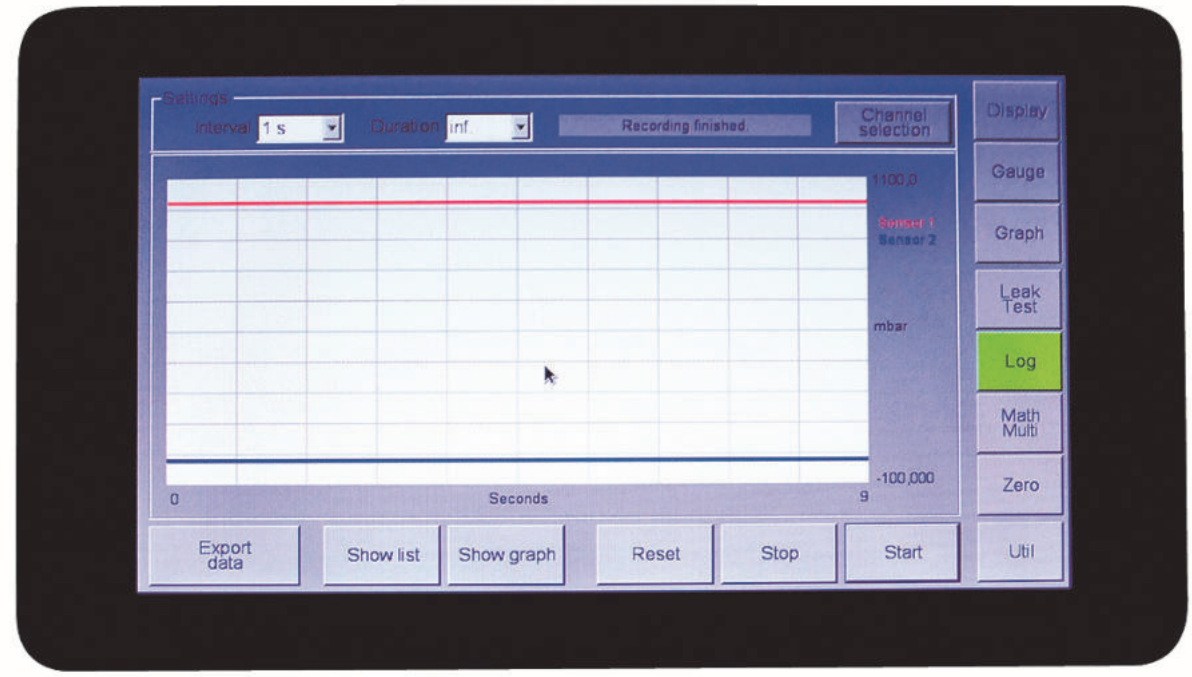
After setting the external test pressure, the leak test is started by pressing the **Start test** button. The test duration is displayed in minutes and seconds. The pressure drop rate is displayed in mbar per minute. The test is stopped with the **Stop test** button.



6.3.7 Log

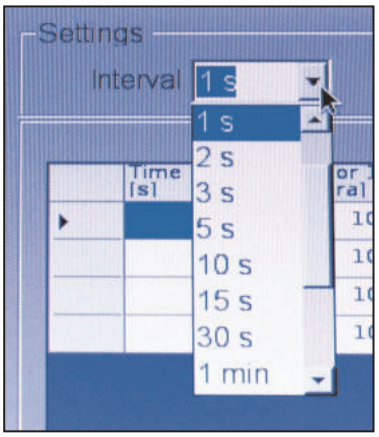
The measurements of the sensors can be recorded individually or in parallel with offset in the **Log** area. The readings of the individual sensors are displayed as lists or graph.



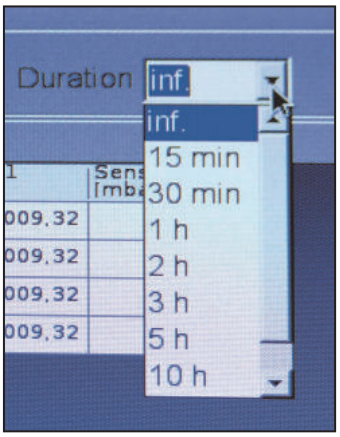


The pressure curves of the sensors are displayed in different colours in the Graph display. Before starting the recording, one or more sensors can be selected with **the Channel selection** button. If no sensor is selected, the user is shown the following message: No channel selected for recording.

Once the button is pressed, the **Math/Multi** interface is opened, in which users can make their selection. A detailed description can be found in chapter 6.9.



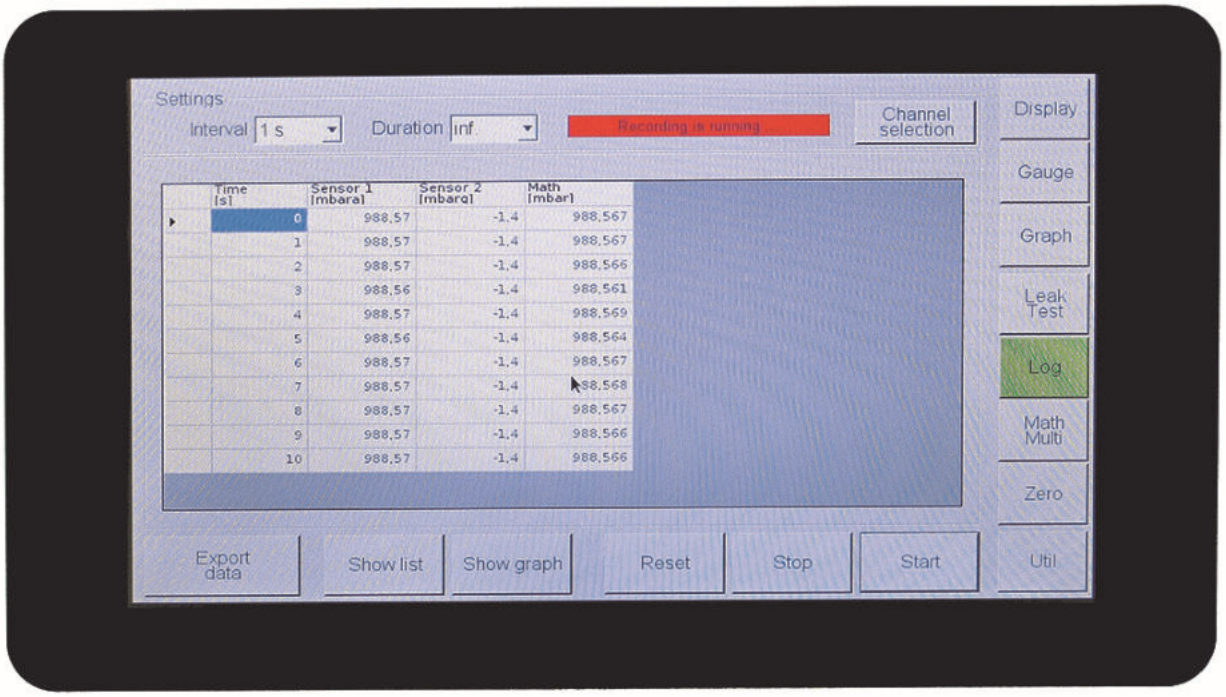
(a) Measuring interval



(b) Duration

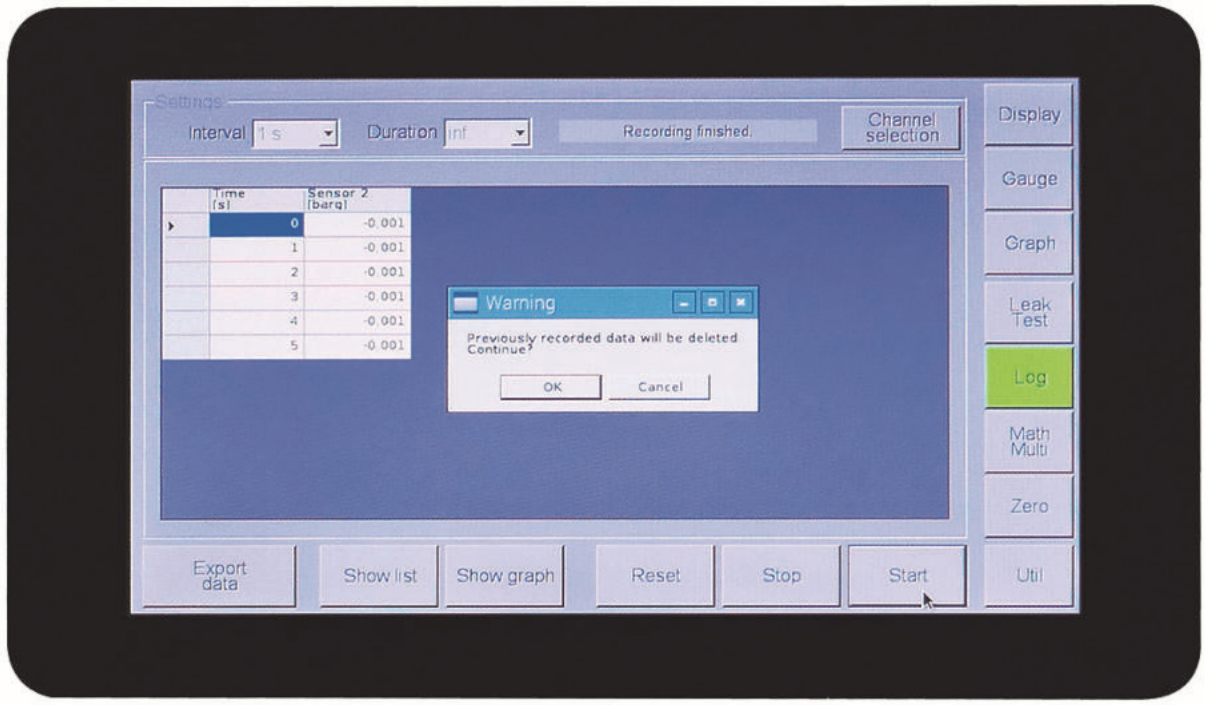
The measuring interval can be set to between 1 second and up to 30 minutes in the dropdown list. The duration of the recording can be set to between 15 minutes and one day (24 hours). If **inf.** is selected, the recording time is unlimited.

Recording begins by pressing the **Start** button. The message **Recording is running** ... is shown highlighted in red.



Changing to **Display** mode during recording, the display at the top left shows *Logging active* flashing in red.

Recording is stopped with the **Stop** button. **Reset** deletes the recording **without saving** it!!!! If recording is started again without **Reset**, the following warning is displayed:



The data are deleted by pressing **OK**, and a new recording is started. Pressing **Cancel** keeps the measured data.

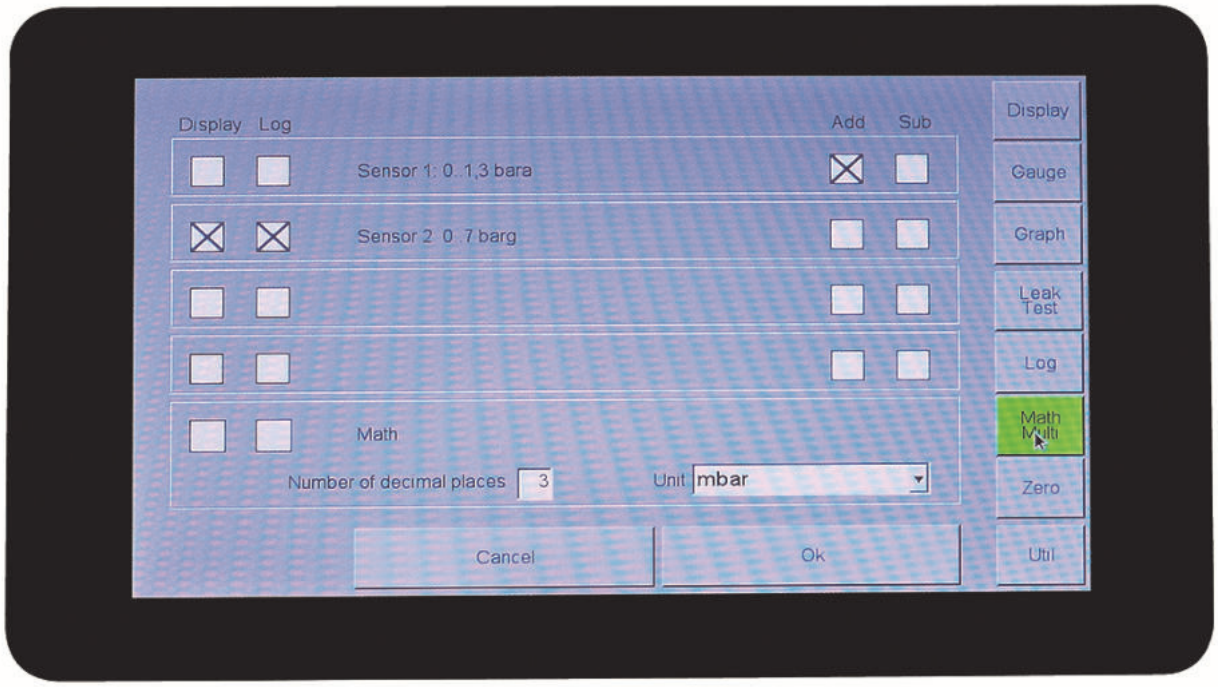
With the **Export data** button, the measured data are stored on the device or an external USB stick. The preparation for storage on a USB stick is described in chapter 6.11.4.

Reading in of measured data is not possible.

6.3.8 Math / Multi

In this area it can be configured which sensor is shown in **Display** mode in the display field and is recorded where applicable (*Log*). If no sensor is activated for the display setting (*cross*), the sensors are only shown as horizontal sensor bar in the **Display** mode.

If the Math function is activated, available sensors can be offset against each other. The number of decimal places as well as the physical unit can also be specified here. Changes must be confirmed with **OK**. The result is now shown in the **Display** mode in the line *Math*.



Example for sensor offset (device with two sensors):

Sensor 1: 1.3 bar absolute
Sensor 2: 7 bar

Following settings are possible:

		Add	Sub
Sensor 1	0...1,3 bar A		
Sensor 2	0...7bar g		

If no operation is activated: Math value = zero.

		Add	Sub
Sensor 1	0...1,3 bar A	X	
Sensor 2	0...7bar g		

Math = Sensor 1 positive

		Add	Sub
Sensor 1	0...1,3 bar A		X
Sensor 2	0...7bar g		

Math = Sensor 1 negative

		Add	Sub
Sensor 1	0...1,3 bar A		
Sensor 2	0...7bar g	X	

Math = Sensor 2 positive

		Add	Sub
Sensor 1	0...1,3 bar A	X	
Sensor 2	0...7bar g	X	

Math = Sensor 1 + Sensor 2

		Add	Sub
Sensor 1	0...1,3 bar A		X
Sensor 2	0...7bar g		X

Math = Sensor 1 + Sensor 2: sum with a negative sign

		Add	Sub
Sensor 1	0...1,3 bar A	X	
Sensor 2	0...7bar g		X

Math= Sensor 1 - Sensor 2

		Add	Sub
Sensor 1	0...1,3 bar A		X
Sensor 2	0...7bar g	X	

Math = Sensor 2 – Sensor1

6.3.9 Zero

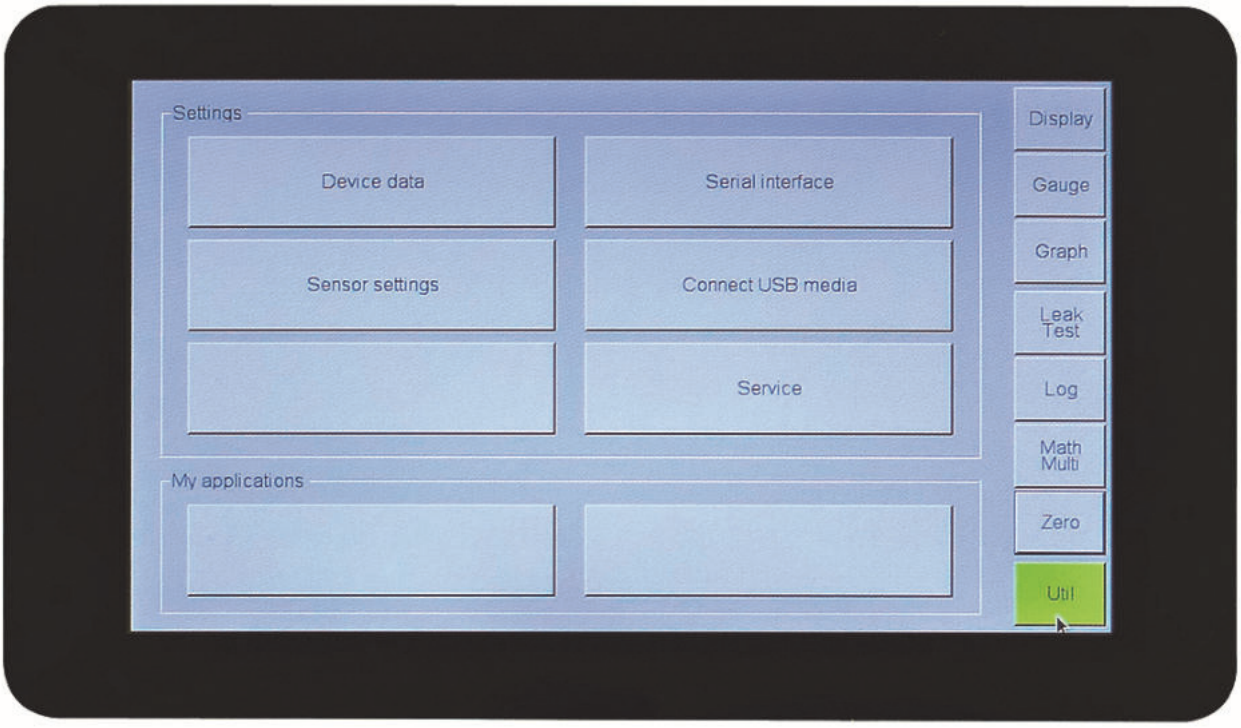
The displayed reading is set to zero with the **Zero** function. Before starting each measurement, the desired pressure sensor should be set to zero. This requires the measuring connection to be opened to the atmosphere.

If the **Zero** function is now activated, the sensors set to zero are indicated by the **Zero** button highlighted in yellow and the **Zero Offs: xxx** of the respective sensor is shown in the display field of the **Display** mode.

If several sensors or the **Math** function are displayed at the same time, the following display is shown when pressing the **Zero** button:

6.3.10 Util

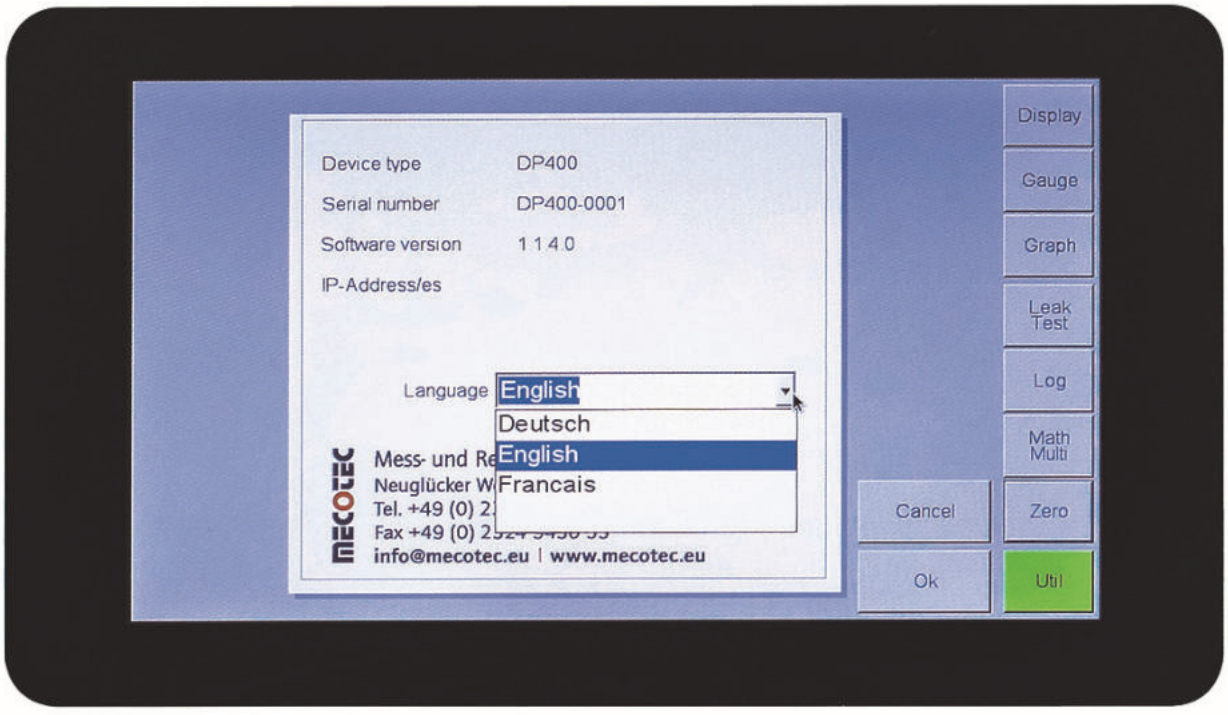
The **Util** button opens a window that displays information about the device and where default device settings can be changed.



If desired, this area can be protected with a password (4-digit number combination). If this option was requested, **1234** has been programmed on delivery. Number combinations can only be programmed by the manufacturer.

6.3.10.1 Device data

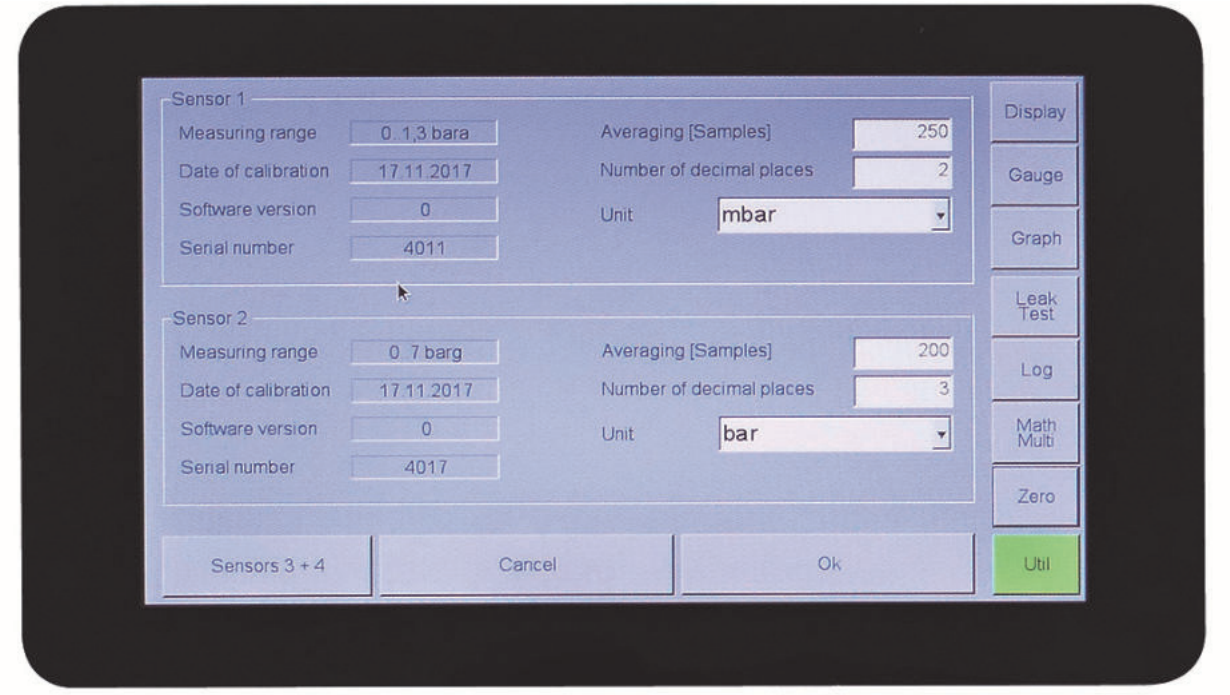
Detailed information like the serial number and software version of the device are shown here.



The system language can be selected via a dropdown list. German, English and French can be selected. If the DP 400 is connected to a network, its IP address(es) is(are) displayed. Chapter 6.11.5 describes how to establish a connection via the network.

6.3.10.2 Sensor settings

In this area, two of the four possible sensors are displayed. If the device should have a third or fourth sensor, they are selected with the **Sensors 3+4** button.



The left area of the display shows the measuring range of the sensor, the calibration date of the last calibration, the software version of the sensor (if available) and the serial number of the sensor (if available).

Number of decimal places

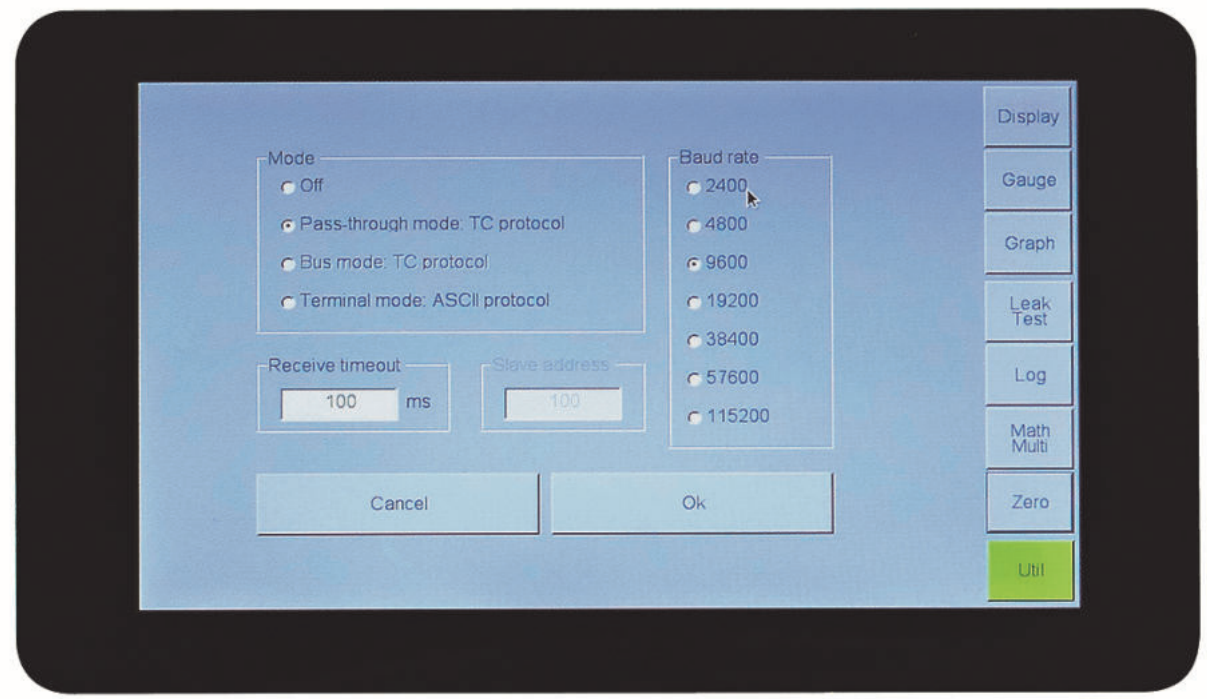
The resolution of the displayed reading is set in the menu item **Number of decimal places**. The resolution refers to the set unit.

Units

The physical units **bar, mbar, inH2O, inHg, mmH2O, mmHg, psi, Pa** and more can be selected in the menu item. Changes are saved with **OK** and discarded with **Cancel**.

6.3.10.3 Serial interface

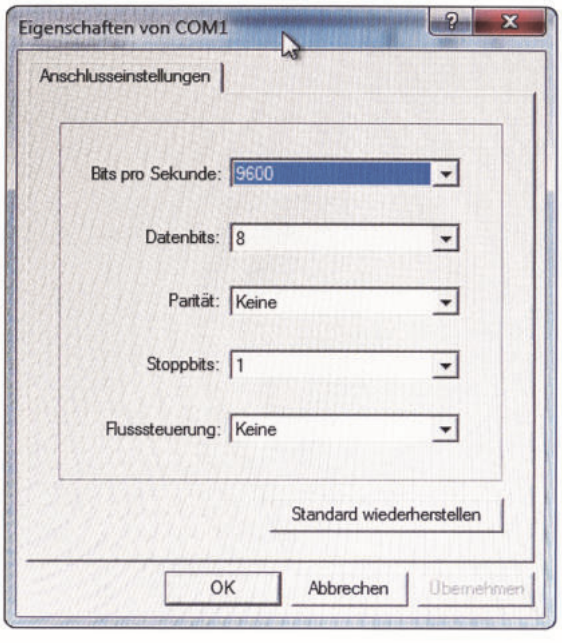
The baud rate is set using the communications menu. The bus mode is still under development. The delivery condition is set to **Pass-through mode: TC protocol.**

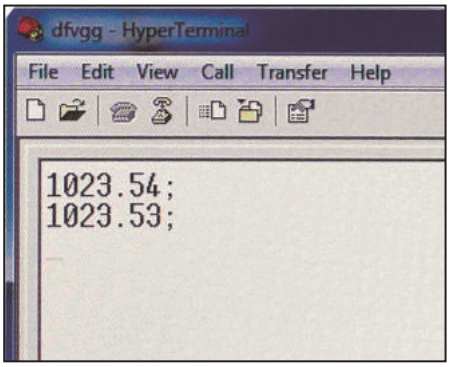


Terminal mode

If the readings are read out via a terminal program, Terminal Mode must be selected and confirmed with **OK**. The **Display** mode is opened again by pressing the **Display** button.

Settings in the Terminal program:





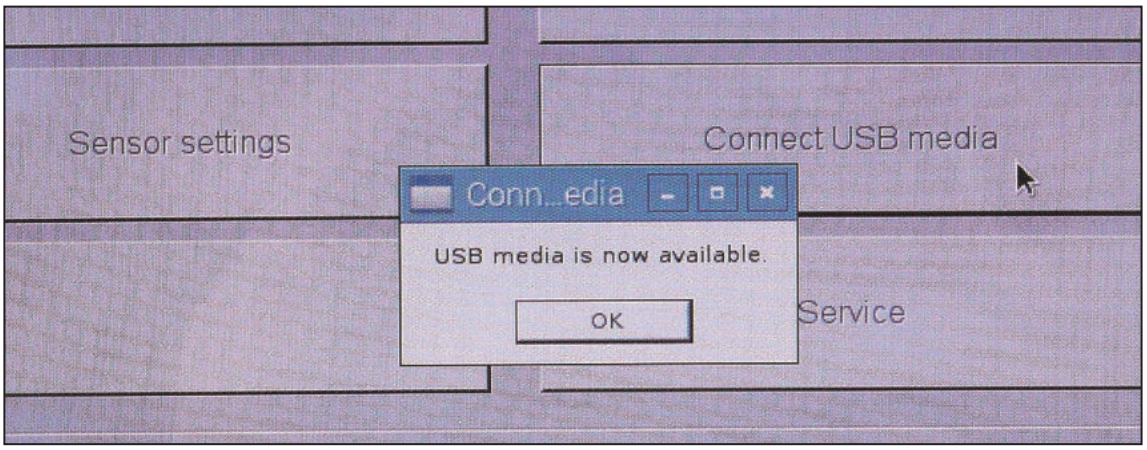
Input of "S" with the keyboard.

The individual pressure value is issued.

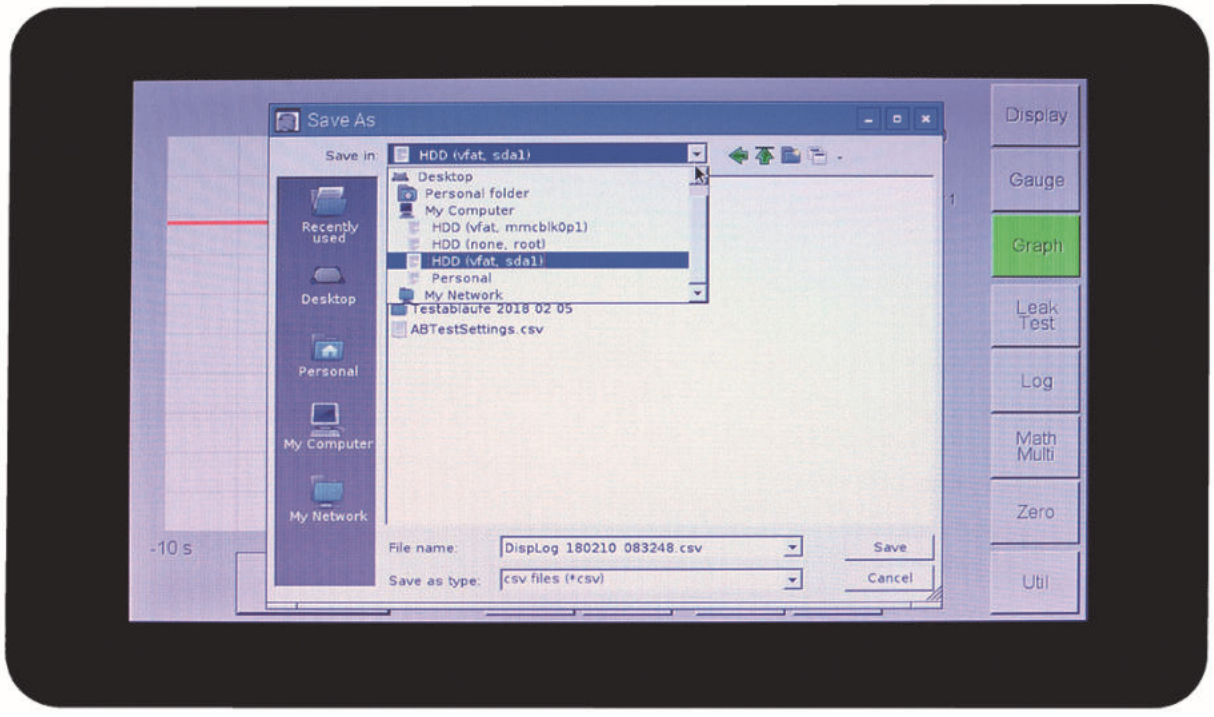
The commands are described in chapter 8.

6.3.11 Integrating the USB medium

Insert the USB stick into the DP 400. Press the **Connect USB Media** button. After integration, the following message is displayed:



Now data can also be stored on an external USB medium in the **Graph** mode with the **Export files** button.



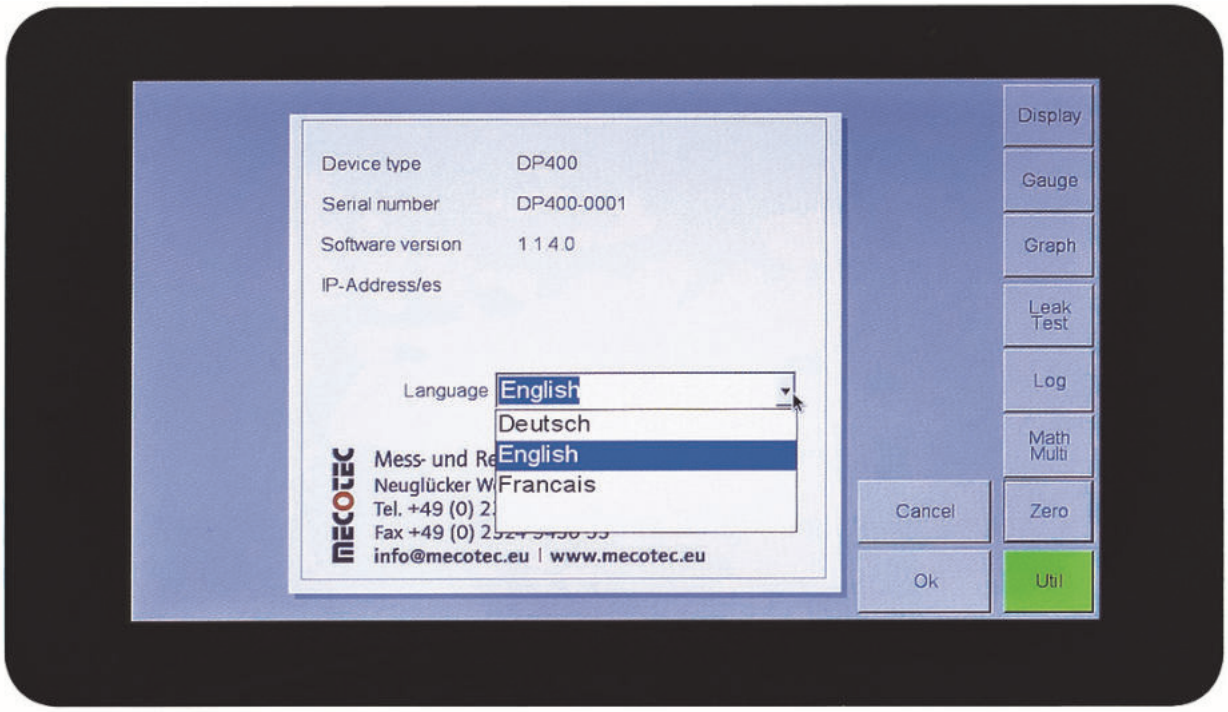
The memory stick is displayed as HDD (vfat, sdal). To name files, a keyboard can be integrated via USB.

6.3.12 Service (connecting the DP 400 with a PC)

Please note!

This area should only be made accessible to the service technician of the manufacturer or trained users.

To transfer stored data to a PC, open the **Util** area and access the device information via the menu **About the device.**



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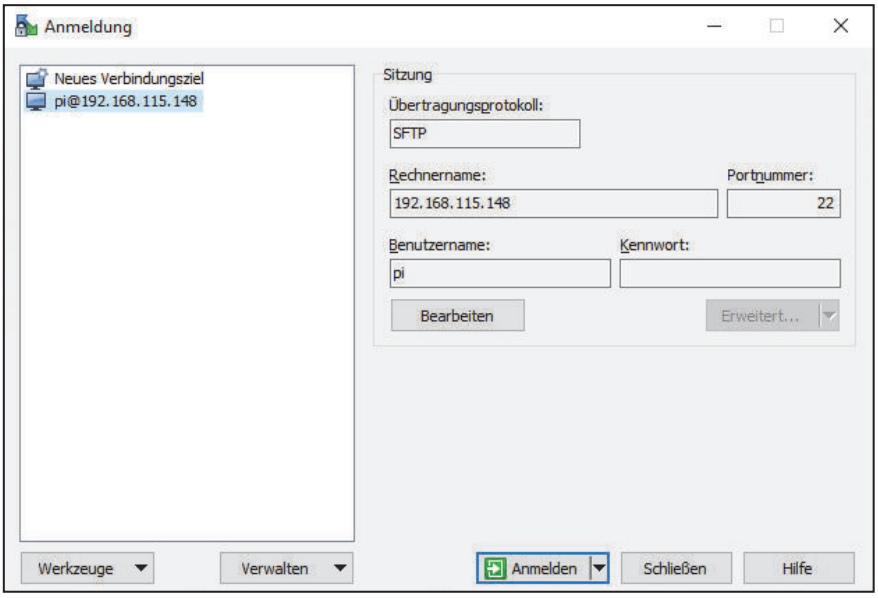
Now connect the pressure calibrator DP 400 to the local network via the RJ45 socket using a network cable. The IP address of the DP 400 is displayed if the connection was successful.

To establish a connection with the DP 400, the following freeware software is required:

https://winscp.net/download/winscp577setup.exe

Install and open the WinSCP freeware software:



Enter following data ...

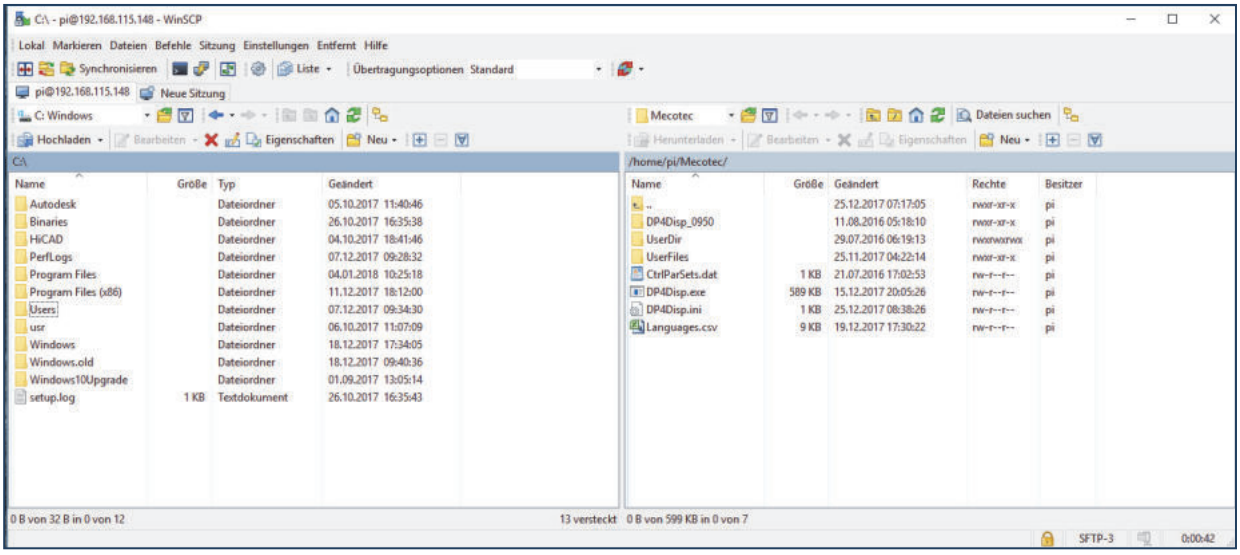
Computer name: IP address of the DP 400

User name: pi

Password: p@ssword

... and confirm with **Login**.

The directories of the DP 400 are displayed on the right. The left side shows the directories of the connected PC.



The measurement data are stored in the **Mecotec / User Files** directory. Drag and drop data files can be copied or moved to the PC. The stored measurement data has the data format .csv and can be further processed, for example, with Excel.

7 Servicing

7.1 Maintenance

The device must be maintained in compliance with the manufacturer's instructions, and only by authorised service representatives or by an employee of the manufacturer's service department.

7.2 Technical advice/service

Please contact the manufacturer or supplier if you have any questions about assembly, storage, operation or any special uses of the device.

7.3 Returning the device

WARNING!

The device must be free of hazardous substances such as acids, alkalis, solutions, etc. for shipping.

Use the original packaging or suitable transport packaging to return the device.

To prevent damage:

- Wrap the device in antistatic plastic film.
- Place the device and insulating material in the packaging and uniformly insulate the transport packaging on all sides.
- If possible, add a bag containing desiccant to the packaging.
- Mark the shipment with **Transport of highly sensitive measuring device**.

7.4 Disposal

Incorrect disposal can present a risk to the environment. Dispose of device components and packing materials in compliance with national waste treatment and disposal regulations in an environmentally friendly manner.

8 Interface description

DP-400 Serial Interface (User-Mode)
Stand 15.11.2003

It is possible to read measuring data from DP-400 via the serial (RS-232) Interface by usage of 4 different commands. A special mode for communication with a computer is also available but not described in this leaflet.

The serial interface has to be configured as follows: 9600 baud, 8 data bits, no parity, no handshake.

The data is transferred by means of readable ASCII characters. The master (mostly a personal computer) initiates a transmission by sending one character as described below.

The first character sent by the master must be an <ESC>. This is necessary to switch the DP-400 to user-mode. The transfer can only be started after the DP-400 entered the display - mode, this is when the measuring value is displayed.

A measuring value will only be available if it is displayed.

It has to be avoided pressing any key on the panel of the DP-400 while transferring data.

Description of the commands:

1) Request the device configuration:

Master sends: 'R'
DP-300 answers: miscellaneous information:

For a better understanding the following c-code is used for output:

```
sprintf (str,"SERNO %u ",serno);
                                    //Serial number
sprintf (str,"MODE %u ",(unsigned int)main_mode);                    //Internal
mode of operation
sprintf (str,"AVGCNT %u ",(unsigned int)avg_cnt); // number of values for mean-value
display
sprintf (str,"NUMDP %u ",(unsigned int)n);                           // number
of characters after decimal point
sprintf (str,"DHEAD %d ",(int)delta_head);                           // Delta-
Head if available

sprintf (str,"RLOW %09.0f ",range_low  * 1000.0F);                   // range
low value
sprintf (str,"RHIGH %09.0f ",range_high  * 1000.0F);                 // range
high value
```

sprintf (str,"UNIT %s;",hi_range_tab[range].dimension); // Unit of the value

<CR><LF>

2) Request a single value

Master sends: 'S' (single)
DP-300 answers: " 1520.000;<CR><LF>" (Example) (9 bis 10 Zeichen)

3) Request multiple values automatically

Master sends: 'M' (multi)
DP-300 answers: " 1520.000;<CR><LF>" (Example) (9 bis 10 Zeichen)
The DP-300 will send a new value every time it is available.

4) Stop automatic value stream

Master sends: 'Q' (multi)
DP-300 answers: ";<CR><LF>"

9 Table of measuring ranges

DP 400 with one of the following sensors
Precision sensor 0.01% of final value, only for air, measuring absolute pressure
Repeatability 0.001% of final value
Hysteresis 0.001% of final value
Long-term stability 0.005% of final value/year
Measuring ranges
0.35 mbara....1300 mbara
0.35 mbara....2600 mbara
0.35 mbara....3500 mbara
0.35 mbara....10.000 mbara
0.35 mbara....50.000 mbara

Only 2 sensors of this design possible in one device

DP 400 with one of the following sensors
Stainless steel diaphragms, for all media, absolute pressure and overpressure
Accuracy 0.025% FS + 0.025% rdg
100 mbar
500 mbar
1 bar
3 bar
5 bar
10 bar
30 bar
50 bar
100 bar
150 bar
200 bar
300 bar
400 bar
600 bar

Other ranges on request

DP 400 with one of the following sensors
Measuring cells for air, absolute and overpressure, differential pressure
Accuracy 0.08% FS
70 mbar
100 mbar
1 bar
2 bar
7 bar
10 bar

Two connections are used in case of differential pressure!

DP 400 with one of the following sensors – low pressure
Measuring cells for air, absolute and overpressure, differential pressure
Accuracy 0.1% FS
1 mbar, 0.15% FS
2,5 mbar, 0.12% FS
10 mbar
20 mbar

Two connections are used in case of differential pressure!

Reliable regulation with precision and control

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