EN

Competence in Solids

GLOBAL TECHNOLOGY SYSTEMS

SWR engineering

M-Sens 2

Online-Moisture Meter for Solids

Operating Instructions

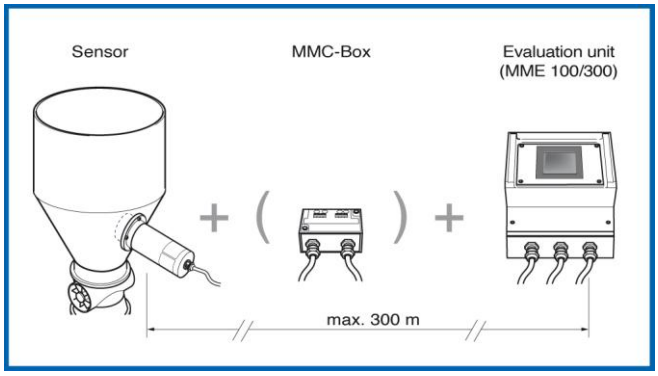
SWR engineering Messtechnik GmbH

SUMMARY

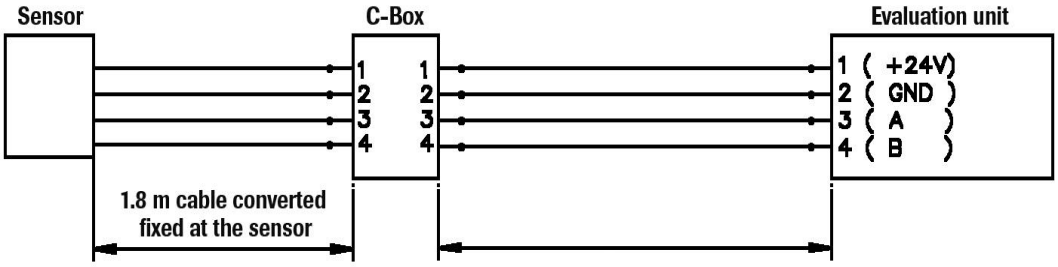
1. System overview

A complete M-Sens 2 unit consists of the following components:

- Flange (mounting in screw, hopper)
- 1 to 3 sensors with 1,8 m connecting cable
- Evaluation unit MME 100 resp. MME 300 in a field housing
- C-box for connecting of sensor and evaluation unit



The sensor is connected by a shielded, 4-wired cable to the evaluation unit; the maximal distance between these devices can be at most 300 m.



2. Function

The M-Sens 2 sensor functionality is based on precise high-frequency measurement and direct digitalization of measured values, wherefrom results a high resolution. As the materials surface and capillary moisture influences strongly its specific conductive capacity, the moisture can be measured exactly by a constant averaged bulk density.

The calibration can be done very simply by the operator by pressing the button and entering the referenced moisture contents.

In this context it is convenient that measured value fluctuations by bulk density variations are balanced by an internal filter function. Additionally, measured value fluctuations by temperature variations are compensated automatically by the sensor.

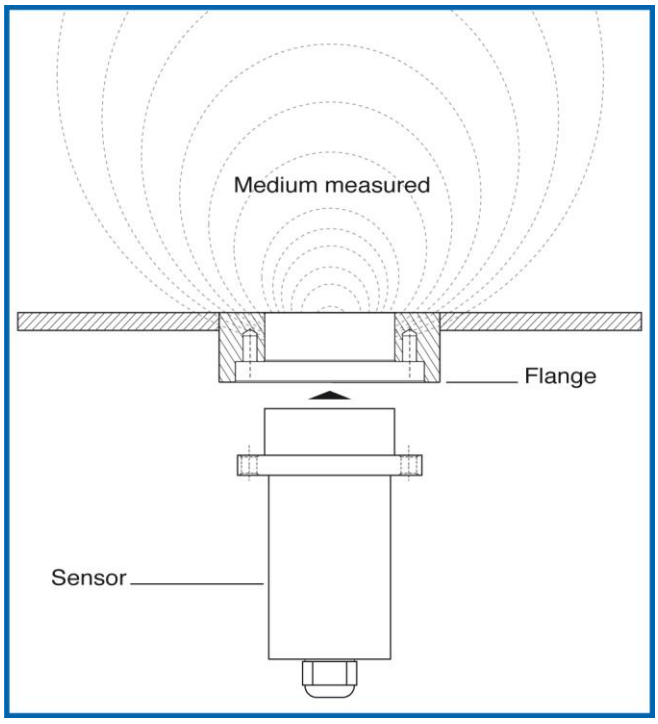


Fig. 3: Injection and reflexion of high frequency

3. Safety

The measuring system M-Sens designed and built according the latest technology has been tested to be safe and was shipped in safe condition. Nevertheless persons or objects may be endangered by components of the system if these are operated in an inexpert manner. Therefore the operational instructions must be read completely and the safety notes must be followed. In case of inexpert or irregular use, the manufacturer will refuse any liability or guarantee.

3.1 Regular Use

- Only original spare parts and accessories of SWR engineering must be used.

3.2 Marking of dangers

Possible dangers when using the measuring system are marked by the following symbols in the operating instructions:

Warning!

This symbol in the operating instructions marks actions, which may represent a danger for life and limb of persons when carried out in an inexpert manner.

Danger!

All actions which may endanger objects are marked with this symbol in the operating instructions.

3.3 Operational safety

- The measuring system must be installed by trained and authorised personnel only.
- Switch off the supply voltage for all maintenance, cleaning or inspection works on the tubes or on components of the M-Sens 2. Follow the notes of the chapter "maintenance".
- Before hot-work the sensor must be removed from the installation place.
- The components and electrical connections must be checked for damages regularly.
- If a damage is found, it is to be repaired before further operation of the instruments.

3.4 Technical progress

SWR reserves the right to adapt technical data to the technical progress without particular advance notice. If you have any questions, SWR engineering will be pleased to inform you on possible changes and extensions of the operating instructions.

4. Mounting and installation

4.1 Delivery scope

- Evaluation unit in the field housing
- Sensor
- Mounting
- C-box

4.2 Necessary auxiliaries

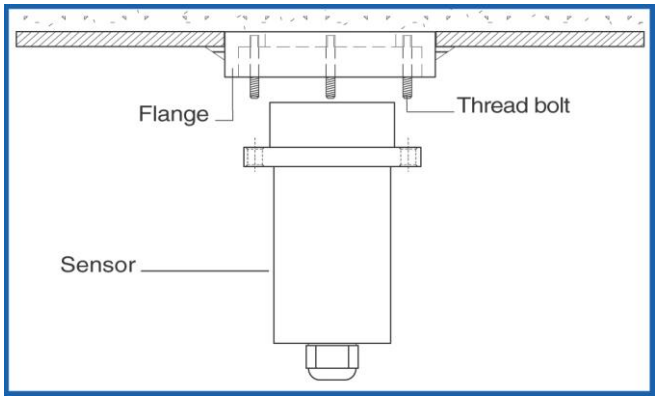
- Screw driver 2,5 mm
- Allen key 5 mm

4.3 Mounting of the sensors

M-Sens 2 is designed for continuous moisture measurement. Most important condition for correct measurement is the right choice of the mounting place of the sensor. That is, when using chutes or conveyor belts, it is very important to have a almost even material height in front of the sensor window.

The flange is welded without sensor and dummy plate in the opening at determined mounting place. Sensor and dummy plate are mounting by means of plumbing lubricant. For applications without over-pressure it is possible to renounce the 2 sealing rings.

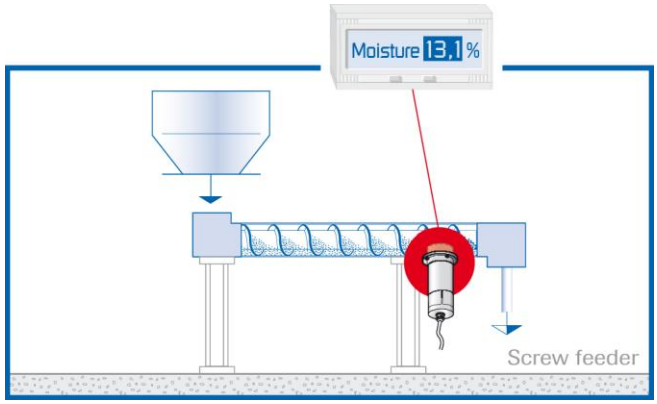
Attention!
The Flange mustn't be welded together with the sensor or dummy plate (incl. the sealing rings).



APPLICATIONS – PRACTICAL EXAMPLES

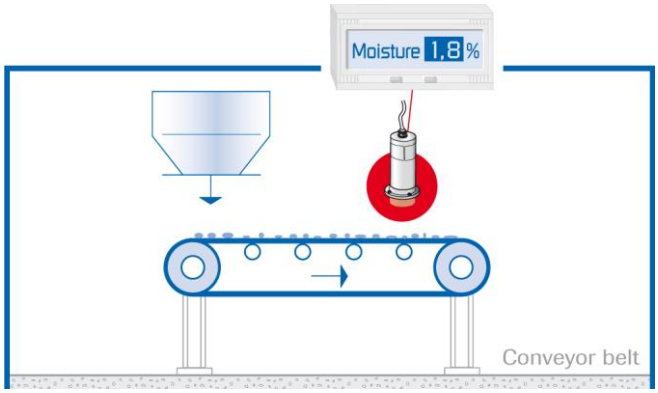
- **Installation in a screw**

The installation of a moisture sensor in screw feeders proved to be very advantageous, since the material passes by the sensor window in even intervals and with relatively constant bulk density.



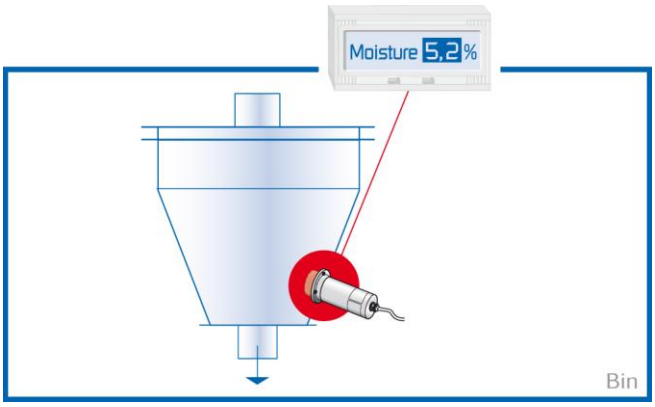
- **Installation on a conveyor belt**

By means of the online moisture measurement of solids on a conveyor belt, the operator can react in due time if the material is too humid or too dry. In consequence, plugging of subsequent aggregates can be prevented.



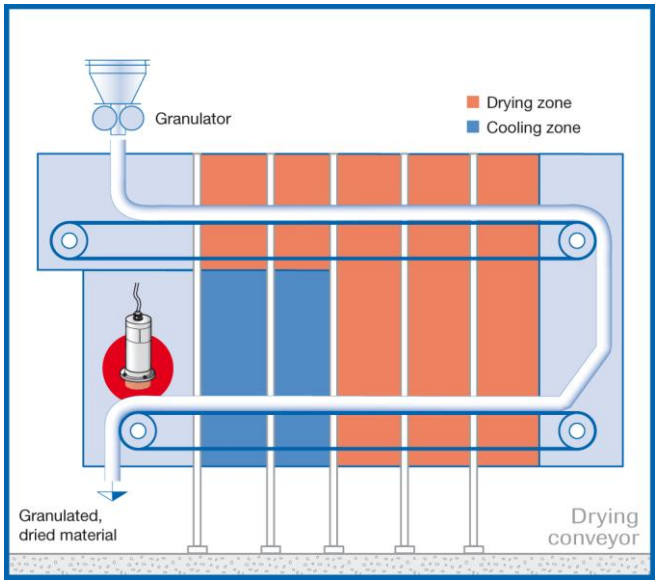
- **Installation in a bin**

Another installation alternative is to mount a sensor at a bins outlet. Due to constant bulk density in case of a filled bin, the sensor finds an almost unchanging measuring field for monitoring the residual moisture. Thus, M-Sens 2 avoids that too damp material reaches the next production level or arrives into the loading.



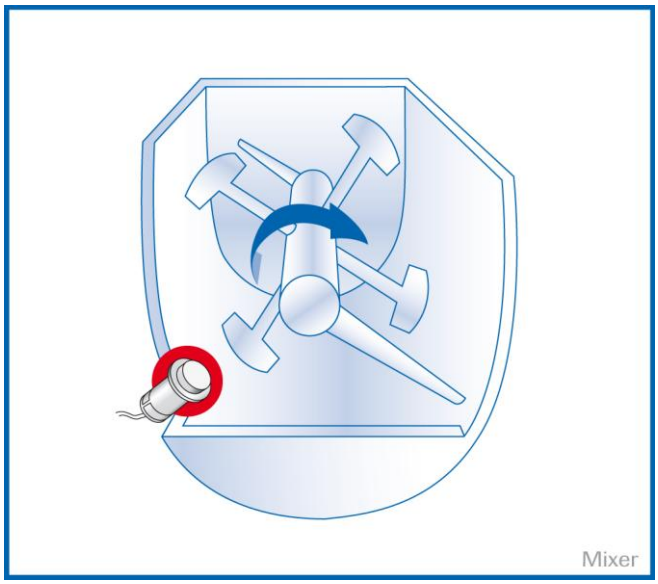
- **Control of dryer by means of moisture measurement**

After the material, lying on the belt, has passed through the dryer tunnel, it gets withdrawn from the hot air zone. At the end of the belt the dried material falls in a screw conveyor which transports it to the processing.
The operator queries the following points: Has the material reached really the desired residual moisture value? That is, has he chosen the right cycle time and temperature?
M-Sens 2 provides accurate and reliable online moisture values for the process control, by which constant moisture in close tolerances of the output material can be met.
This process optimization enables the operator to manage high savings and quality improvements.



- **Moisture measurement in a mixer**

M-Sens 2 can be installed, even later on, in all types of mixers. The measuring values logging is done by within the moving material during the mixer procedure.
With the measured moisture value of the material in the dryer process parameters like detention time and dosage quantity can be controlled.
For this purpose M-Sens 2 is connected to a PLC or another process control system.



4.4 Mounting of the evaluation unit

The whole electronic equipment can be installed at a maximum distance of 300m from the sensor. The housing is prepared for wall mounting

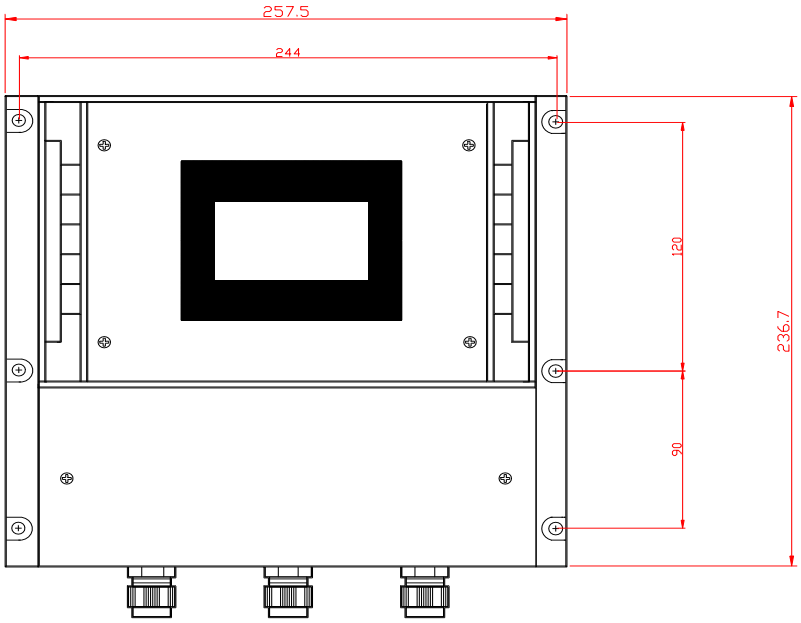


Fig. 10: Field housing for the evaluation unit

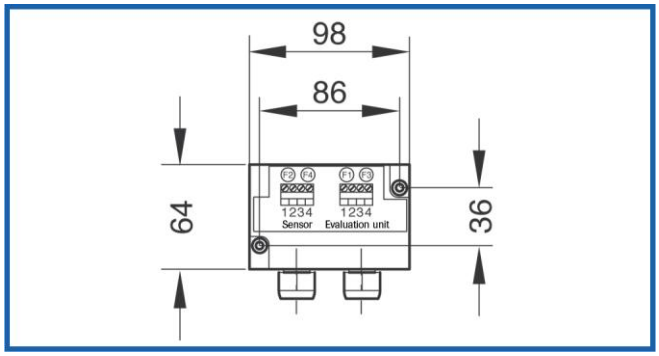
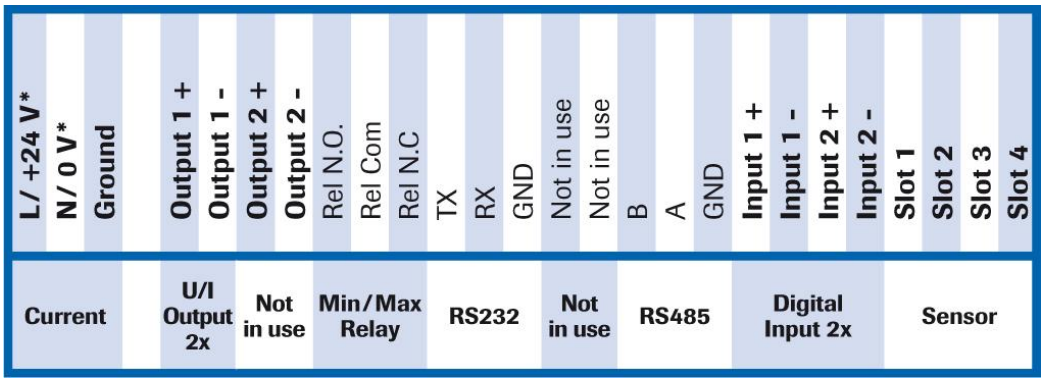


Fig. 11: Field housing for the C-box

The C-box contains fuses and resistances in order to guarantee the communication by the Mod-bus between sensor and evaluation unit.

5. Electrical connection



Supply voltage according to the version.

Fig. 12: Electrical connection of the evaluation unit

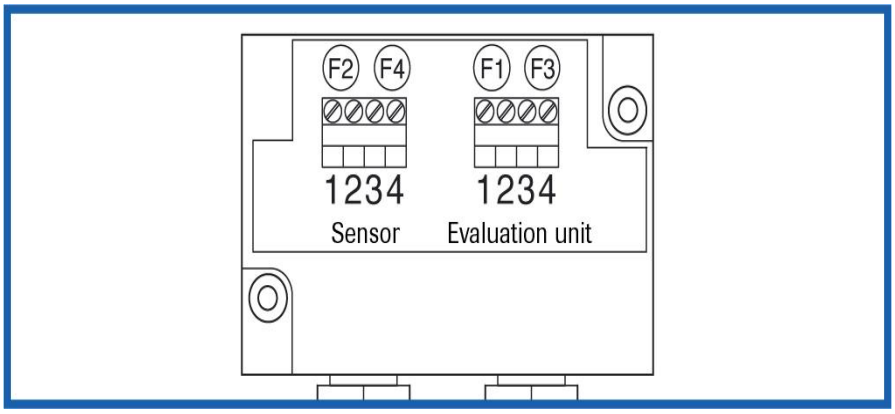


Fig. 13: Electrical connection of the C-box

6. Commissioning

AT the first commissioning of the M-Sens 2 it is necessary to calibrate the sensor.

Please consider:

- Correct connection between sensor, C-box and evaluation unit
- Correct installation of the sensor in respect to the wall thickness

In case of negative results in spite of consideration of the points as stated above, please contact SWR.

Commissioning of the M-Sens 2

After the delivery the sensor is ***not calibrated to the product(s)***, so each calibration and parameterization has to be executed during the commissioning. Therefore it is necessary to assign the measured moisture to the desired display and to the initial value. The menu functions are very self-explanatory. In the following a short introduction to the menu overview:

Changed values are confirmed and saved by pushing the arrow button. To abandon the menu without saving the changes push the C-button.

Starting the menu:	Entering the menu takes place by pushing 5 sec the invisible key lower right corner of the touch screen panel.
Basic function	For the measurement and display of the moisture in %, there 2-3 moisture measurement executed with known and different moisture values. After having entered the according moisture values by the panel, the system calculates the moisture in % on the basis of those measurement values. Hereby the basic function is initiated.
Adjustment	The menu point 1 “products” can be used for every of the 4 possible products.
Alarm	Alarm can be determined for every product in the menu point “measurement range”.
Current / Voltage output	The definition of the initial values has to be done in the Voltage menu point “analogue outputs”. The output value (current/value) is assigned to the measurement range. Standard MIN = 4 mA MAX = 20 mA The measurement range filter serves to the adjustment to slower measuring devices or to continuous output at the analogue output.
Digital inputs	Under menu point 3 you define the digital inputs. Every digital input can be used to start and stop the moisture measurement.

Analogue outputs	The analogue outputs can be defined in menu point 5. They can be adapted to the operator's requirements (e.g. 0-20mA).
Basic points	The measurement can be checked for linearity by means of varying moisture values. To improve the accuracy those values have to be determined. If there are deviations the non existent linearity can be corrected / levelled by means of the use of more than 2 base points.
System	Settings according language, time, temperature of sensor and LCD contrast. The communication with the evaluation unit by Modbus, address and data rate is done according to the system settings. Adjustment of the Modbus by entering the baud rate and address. Adjustment of the ergonomics by setting the contrast and lightning time.

In the following there is the menu structure:

7. Menu structure

1 Products	Products 1…4
1.1 Measurement range	
1.1.1 Product name	Choice of material (8 char)
1.1.2 Unity	Choice unit text, e.g. % H_2O
1.1.3 Decimal place	Decimal place position
1.1.4 Measurement range init	Range of 0…100 %
1.1.5 Measurement range end	Range of 0…100 %
1.1.6 Filter value	Range of 0,1…999,9 s
1.2 Alarm 1	
1.2.1 Alarm type	MIN / MAX / none
1.2.2 Alarm value	Range of 0…100 % in phys. units
1.2.3 Alarm dead time	Range of 0,1…99,9 s
1.2.4 Alarm hysteresis	Range of 0,1…99,9 %
1.2.5 Operation modus	Operational- or closed current principle
1.3 Alarm 2	
1.3.1 Alarm type	MIN / MAX / none
1.3.2 Alarm value	Range of 0…100 % in phys. units
1.3.3 Alarm dead time	Range of 0,1…99,9 s
1.3.4 Alarm hysteresis	Range of 0,1…99,9 %
1.3.5 Operation modus	Operational- or closed current principle

1.4 Calibration

1.4.1 Calibration filter	Range of 0,1…999,9 s
1.4.2 Number of calibration points	Range of 2…5 base points
1.4.3 Calibration factor for sensor 1	Rating of sensor signal with several sensors used and disconnecting of 1 sensor with 0
1.4.4 Calibration factor for sensor 2	Rating of sensor signal with several sensors used and disconnecting of 1 sensor with 0
1.4.5 Calibration factor for sensor 3	Rating of sensor signal with several sensors used and disconnecting of 1 sensor with 0
1.4.6 Calibration point 1	Measurement range init and end
1.4.7 Measured value	Record of input value
1.4.8 Calibration point 2	
1.4.9 Calibration	*… (depends on the number of the calibration points)*
1.4.10 Calibration point N	Measurement range init and end
1.4.11 Measured value	Record of input value

For 2.1 to 2.4 / 3.1 to 3.4 / 4.1 to 4.4 – same way

5 Analogue output

5.1 Beginning of range	Range of 0…22 mA (Std. 4 mA)
5.2 End of range	Range of 0…22 mA (Std. 20 mA)
5.3 MIN limit	Range of 0…22 mA (Standard 3 mA)
5.4 MAX limit	Range of 0…22 mA (Std. 20 mA)
5.5 Alarm value	Range of 0…22 mA (Standard 3 mA)
5.6 Filter time	Range of 0,1…999,9 s (Standard 1 s)
5.7 Calibration: 4 mA	Adjust output current (calibration to 4 mA)
5.8 Calibration: 20 mA	Adjust output current (calibration to 20 mA)

6 Digital inputs

6.1 Digital input 1

6.1.1 Function	none; measurement stop or product choice
6.1.2 Effect direction	direct or inverted
6.1.3 Filter	Range of 0,1…99,9 s

6.2 Digital input 2

6.2.1 Function	none; measurement stop or product choice
6.2.2 Effect direction	direct or inverted
6.2.3 Filter	Range of 0,1…99,9 s

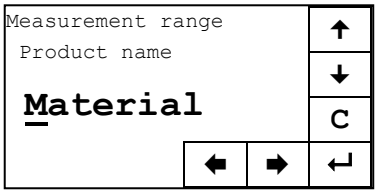
7 System

7.1.1 Baud rate	4800 / 9600 / 19200 / 38400
7.1.2 Modbus address	Range of 1…250
7.1.3 Contrast	
7.1.4 Language	D / F / E
7.1.5 Backlight	
7.1.6 T-Display	ON / OFF

8. System adjustments in detail

1.1 Measurement range

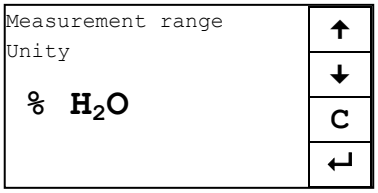
1.1.1 Product name



Select the name of medium and location (max. 8 char).

Choose the characters with ↑ and ↓ and the each corresponding position (1...8) with ← and → With C you clear the character and with ↵ the input is accepted and you quit the menu level.

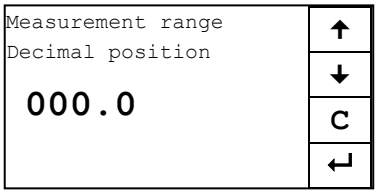
1.1.2 Unity



Choice of the measurement value as % H_2O or % TS.

Choose the characters with ↑ and ↓ and the each corresponding position (1...6) with ← and → With C you clear the character and with ↵ the input is accepted and you quit the menu level.

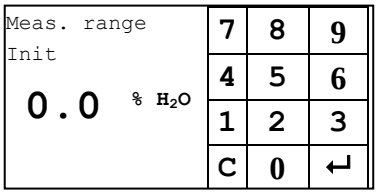
1.1.3 Decimal position



Fixation of the decimal position in the display.

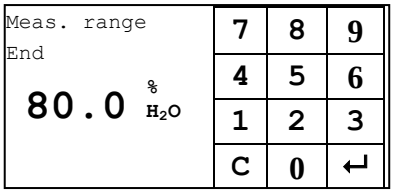
With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

1.1.4 Measurement range init



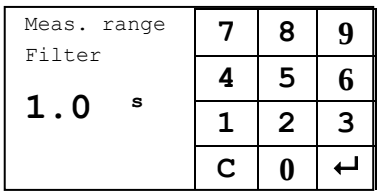
Input of beginning value of the measurement range between 0…100 %. Standard: 0.0
With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

1.1.5 Measurement range end



Input of end value of the measurement range between 0…100 %. Standard: 0.0
With C you set the value to 1.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

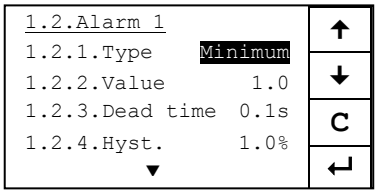
1.1.6 Filter value



Setting of the damping time between (range between 0,1 ... 999,9 s).

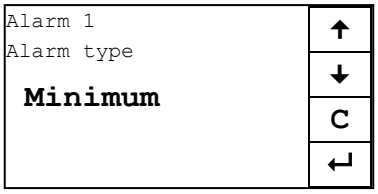
With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

1.2 Alarm 1



With ↑ and ↓ you choose the menu point. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

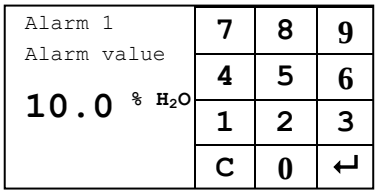
1.2.1 Alarm type



Choose the limits: MIN und MAX or none.

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

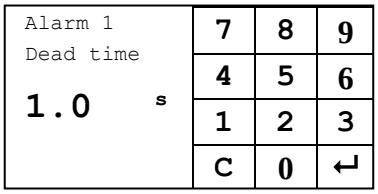
1.2.2 Alarm value



Choose the response threshold of measurement end values in phys. unities (range between 0 ... 100 %).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

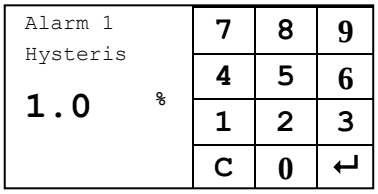
1.2.3 Alarm dead time



Choose the time, how long the value above and under the limit has to be, before the alarm relay switches
(range between 0,1 ... 99,9 s).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

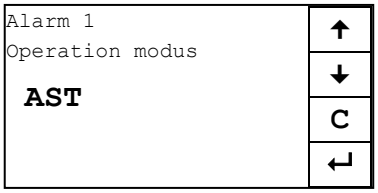
1.2.4 Alarm hysteresis



Choose the value for clearing the alarm.
Range between 0,1 ... 99,9 % in the defined measurement range.

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

1.2.5 Operation modus



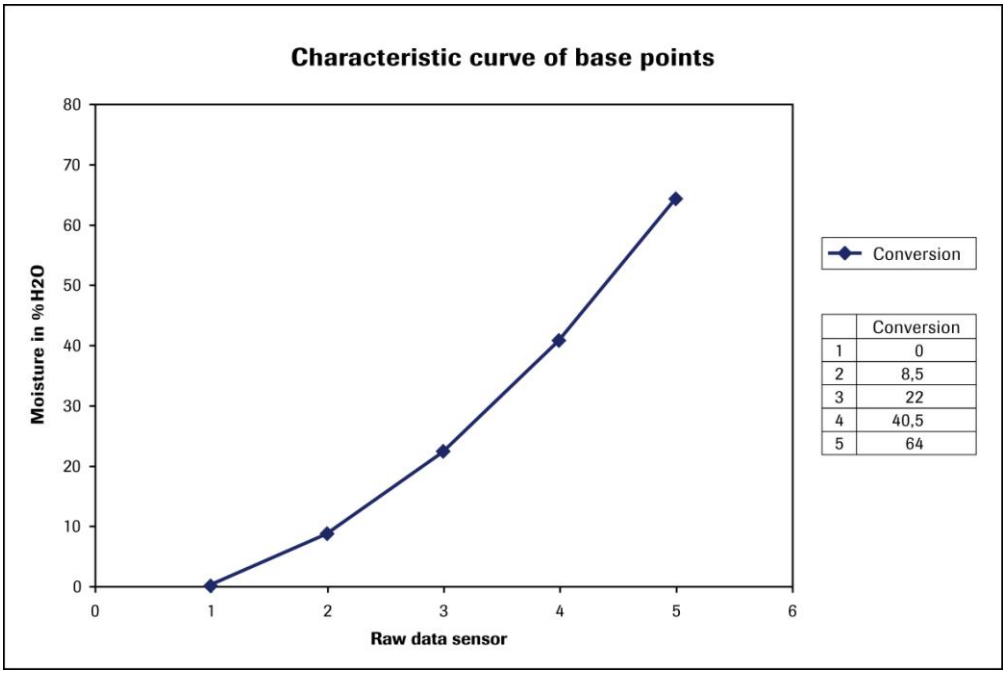
Choice of switching contact:
AST Open current
RST Closed current

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

1.3 Alarm 2

According to alarm 1

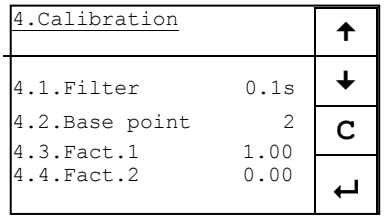
1.4 Calibration



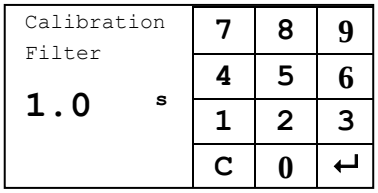
Only necessary in case of disturbing nonlinearity (see right chart).

The base points of the ideal characteristic curve are entered and calibrated down to the actual characteristic curve. The following adjustment is done on the sensor the signal output is linear.

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

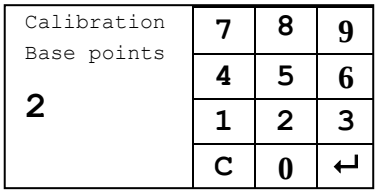


1.4.1 Calibration filter



Damping filter in order to slow down disturbed signals during the calibration (no effect on output and display); Range between 0,1 and 999,9 s.
With [C] you set the value to 0.0. With the numbers you input the beginning value and with [↵] the input is accepted and you quit the menu level.

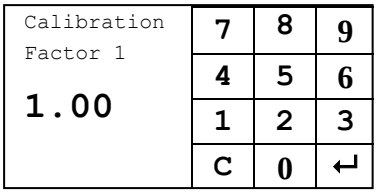
1.4.2 Number of calibration points



Enter the necessary number of base points (between 2-5).

With [C] you set the value to 0.0. With the numbers you input the beginning value and with [↵] the input is accepted and you quit the menu level.

1.4.3 Calibration factor for sensor 1



Weighting of sensor signals by using several sensors; Disconnection of a sensor with 0.

With [↑] and [↓] you make a choice according to the display. With [C] you quit the menu point without any change and with [↵] the input is accepted and you arrive 1 menu point lower to make your settings.

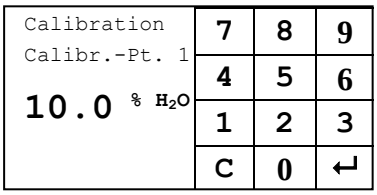
1.4.4 Calibration factor for sensor 2

According to sensor 1

1.4.5 Calibration factor for sensor 3

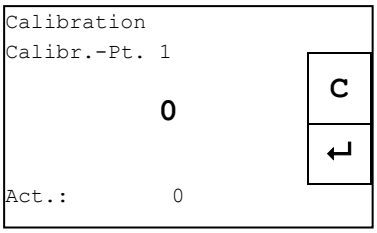
According to sensor 1

1.4.6 Calibration point 1



Choose the measured value in physical unities – beginning and end of measurement range.

1.4.7 Measured value



Input value is collected and assigned to the shown measured value.

1.4.8 Calibration point 2

Choose the measured value in physical unities – beginning and end of measurement range.

1.4.9 Measured value

…(depends on the number of calibration points)

1.4.10 Calibration point N

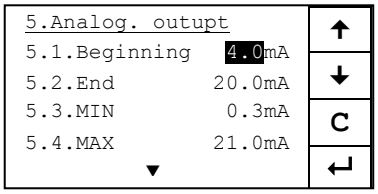
Choose the measured value in physical unities – beginning and end of measurement range.

1.4.11 Measured value

Input value is collected and assigned to the shown measured value.

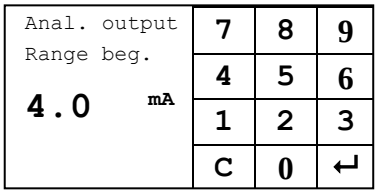
For 2.1 to 2.4 / 3.1 to 3.4 / 4.1 to 4.4 : analogue to point 1

5. Analogue output



With ↑ and ↓ you make a choice according to the accentuation. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

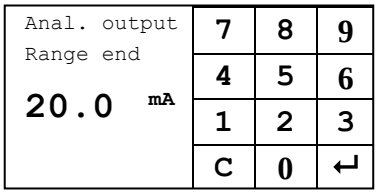
5.1 Beginning of range



Choose the output in the range of 0 ... 22 mA (Standard 4 mA).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

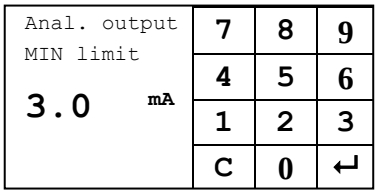
5.2 End of range



Choose the output in the range of 0 ... 22 mA (Standard 20 mA).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

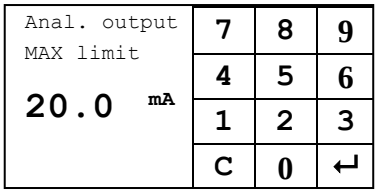
5.3 MIN limit



Choose the minimal output value in the range of 0 ... 22 mA (Standard 3 mA).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

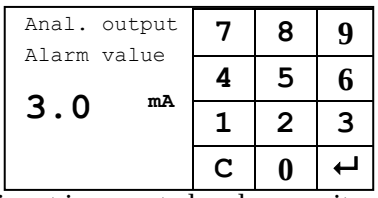
5.4 MAX limit



Choose the minimal output value in the range of 0 ... 22 mA (Standard 20 mA).

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

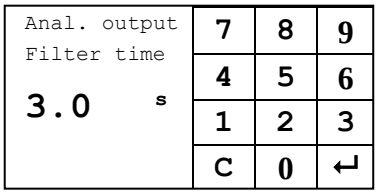
5.5 Alarm value



Choose the output value for the alarm (sensor error or an internal alarm); at the same time the relay 3 drops down. Range of 0 ... 22 mA (Std 3 mA)

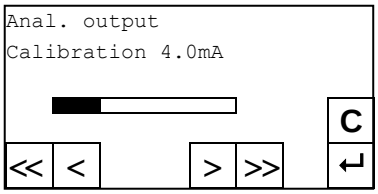
With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

5.6 Filter time



Choose the filter time for the current output in the range of 0,1 ... 999,9 s (Standard 1 s)
With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

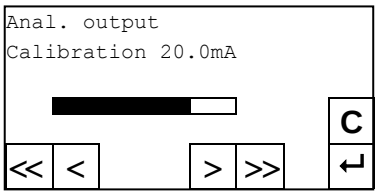
5.7 Calibration: 4mA



Set the minimal current output. Fit to the external measurement system (at differing display).

Adapt the current output to 4 mA with the keys ≪ and ≫ quickly and with the keys < und > slowly. With ↵ the input is accepted and you quit the menu level, with C you quit the menu point without any change.

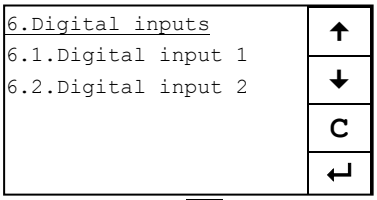
5.8 Calibration: 20mA



Set the maximal current output. Fit to the external measurement system (at differing display).

Adapt the current output to 4 mA with the keys ≪ and ≫ quickly and with the keys < und > slowly. With ↵ the input is accepted and you quit the menu level, with C you quit the menu point without any change.

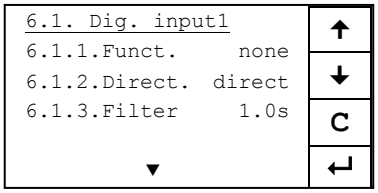
6. Digital inputs



It is only necessary for stopping and starting the measurement via an external control line (for wiring see 8.1).

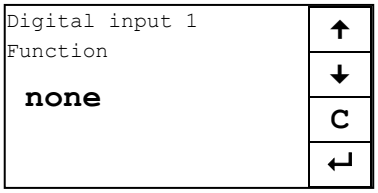
With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

6.1 Digital input 1



With ↑ and ↓ you make a choice according to the accentuation. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

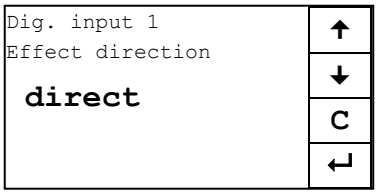
6.1.1 Function



No function / M-Stop – Start/Stop of the device via external control signal.

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

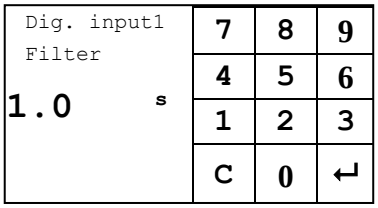
6.1.2 Effect direction



Direct / inverted

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

6.1.3 Filter



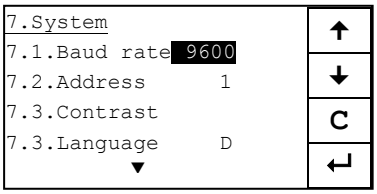
Dead time after activating (for debouncing of mechanical switching contacts).
Range of 0…99,9 s

With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

6.2 Digital input 2

Analogue to digital input 1

7 System



Setting of the Mod-bus interface parameters when connecting to the system bus.

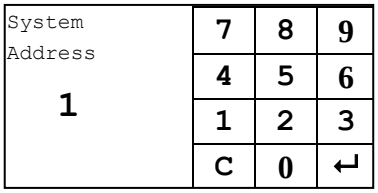
With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you arrive 1 menu point lower to make your settings.

7.1 Baud rate

Choice of baud rate between 4800 / 9600 / 19200 / 38400

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

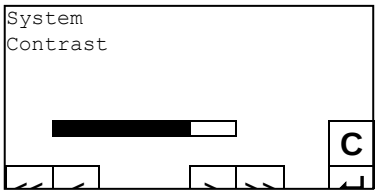
7.2 Modbus Address



Setting of Mod-bus address between 1 ... 250.

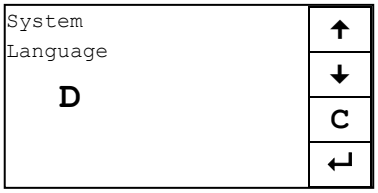
With C you set the value to 0.0. With the numbers you input the beginning value and with ↵ the input is accepted and you quit the menu level.

7.3 Contrast



Adapt the contrast to desired value with the keys ≪ und ≫ quickly and with the keys < und > slowly. With ↵ the input is accepted and you quit the menu level. With C you quit the menu point without any change.

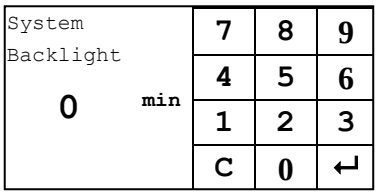
7.4 Language



Choose of language between D / F / ENG

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

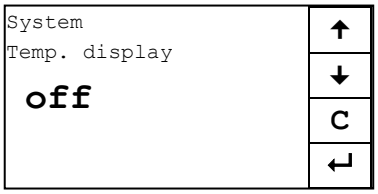
7.5 Backlight



Setting of durable lightning or the luminescence (in min).

With C you set the value to 0 (equals to durable lightning) by means of the numbers and with ↵ the input is accepted and the menu level is quitted.

7.6 T. -Display



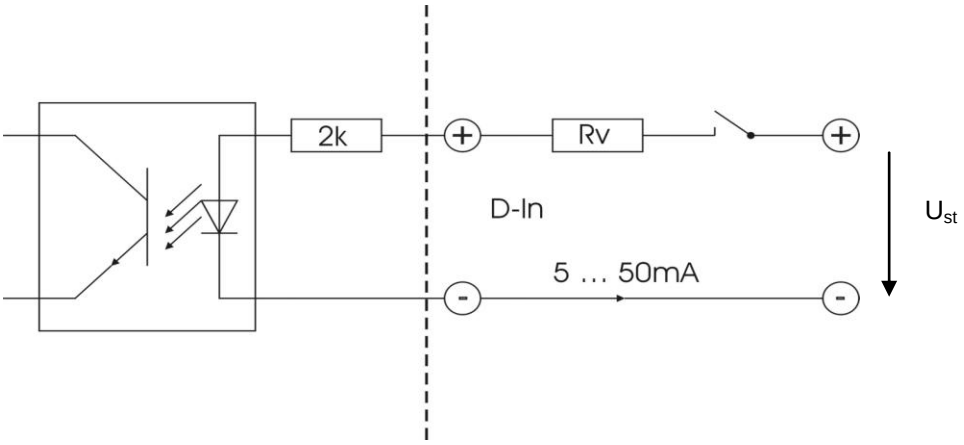
Determine if the temperature is shown in the display – the values are on and off

There is no temperature output by analogue output!

With ↑ and ↓ you make a choice according to the display. With C you quit the menu point without any change and with ↵ the input is accepted and you quit the menu level.

9. Wiring example

Digital inputs



R_V= ((U_{st} - 1,6V) / 20mA) - 2kOhm

10. Maintenance

Warning!
Danger of shock with open housing!

- Switch off the supply voltage for all maintenance or repair works on the measuring system. The tube must not be in operation during a sensor exchange.
- Repair and maintenance work must be carried out by trained or expert personnel only.
- The system is maintenance-free.

11. Warranty

Warranty is granted for one year starting from delivery date under the condition that the operational instructions have been followed, no interventions on the appliances have been made and the components of the system show no mechanical damage or wear resistance.

In case of a defect during the warranty period, defective components are repaired or are replaced free of charge. Replaced parts turn into the property of SWR. If desired by the customer that the parts should be repaired or replaced in its factory, then the customer has to take over the costs for the SWR-service staff.

SWR is not responsible for damage, which did not develop at the delivery article; especially SWR is not responsible for escaped profit or other financial damages of the customer.

12. Trouble shooting

Warning!
The electrical installation must be checked only by expert personnel.

Problem	Cause	Measure
System out of work	Power supply interrupted	Check the power supply.
	Cable break	Check the connecting cables for a possible break of a cable
	Defective fuse	Exchange fuse in the field housing
	Defective device	Contact SWR
Measuring system outputs wrong values	Incorrect calibration	Delete input signal correction, new calibration according to section 6
	Calibration shifted by Abrasion or caking on front end of sensor	Delete input signal correction, new calibration according to section 6
Malfunction of sensor	Sensor not properly connected	Check cable
	Sensor damaged	Replace sensor
	No 24 VDC supply on sensor	Assure right power supply
	Voltage drop on the supply line too highly	Examine cable lengths on the basis of the table in chapter 4.5
Relay flickering	Hysteresis too small	Increase hysteresis, check effects caused by external devices.
Do not open, otherwise the warranty claims expire!		

13. Technical data

Sensor	
Housing	Stainless Steel 1.4571
Sensor surface	Ceramics
Ex protection	Zone 22 (dust), zone 2 (gas)
Protection category	IP 67 according to EN 60529
Ambient temperature	0 … +80 °C
Working pressure	Max. 10 bar
Power consumption	0,6 W
Response time	0,1 sec
Weight	Ca. 1000 g
Measuring range	0 … 85 % residual moisture
Accuracy	0,1 % absolutely in the calibrated measurement range
Connection channel	Shielded cable 4-wired, 0,25 mm^2
Evaluation unit	
Supply voltage	110/230 VAC (50 Hz) / 24 VDC
Power consumption	20 W / 24 V
Current consumption	Max. 1 A @ 24 V
Protection category	IP65 according to EN 60529/10.91
Ambient temperature	-10 … +45 °C
Dimensions	258 x 237 x 174 mm (WxHxD)
Weight	Ca. 2,5 kg
Interface	RS232, RS485
Cable gland	3 x M16 (4,5-10 mm ø)
Connecting terminals/ Conductor cross-section	0,2-2,5 mm2 [AWG 24-14]
Current output signal / voltage output signal	2 x 4 … 20 mA (0 … 20 mA), load < 700 Ω or 2 … 10 V (0 … 10 V), load > 2 kΩ
Switched output measurement alarm	Relay with switching contact Max. 250 VAC, 1A
Digital inputs	2 inputs for active external control signals
Data protection	Flash