

Operating manual

HUMY/SCS 3000

MODBUS-RTU communication



Operating manual for HUMY/SCS 3000

MODBUS-RTU communication

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Disclaimer

We have checked the content of the printed document for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded and consequently we cannot assume any guarantee for complete accordance. The data in this printed document are checked regularly. Corrections and additions are made in the following version in each case. We would be grateful for any suggestions for improvement.

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Subject to technical modifications

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Classification of the safety instructions

This manual contains instructions that you have to observe for your personal safety as well as to avoid material damage. These instructions are highlighted using a triangular warning sign and shown as follows, depending on the degree of risk.



HAZARD

means that death or severe physical injury will occur if the appropriate precautionary measures are not taken.



WARNING

means that death or severe physical injury may occur if the appropriate precautionary measures are not taken.



CAUTION

with a triangular warning sign means that minor physical injury may occur if the appropriate precautionary measures are not taken.

CAUTION

without a triangular warning sign means that material damage may occur if the appropriate precautionary measures are not taken.



ATTENTION

means that an undesired result or state may ensue if the corresponding instruction is not followed.



NOTE

denotes important information about the product, handling of the product or the respective part of the documentation, is aimed at drawing special attention to the latter and should be complied with.

In addition to the instructions in this manual, the generally applicable safety and accident prevention regulations must be observed.

If the information contained in this document should not be sufficient in any specific case, you can obtain more detailed information from our telephone service.

Please read this manual carefully prior to installation and commissioning.

CE mark

This product meets the specifications according to the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC.

General instructions

This device left the plant in flawless condition in terms of its safety features. To preserve this condition and ensure safe operation of the device, the user has to observe the instructions and warning notes indicated in this operating manual.

NOTE

For the sake of clarity the manual does not contain complete detailed information on all product types and can therefore not take into account every conceivable case with respect to installation, operation and maintenance.

Should you wish further information or should special problems arise that are not treated in sufficient detail in the manual, you can obtain the necessary information by telephone.

Moreover, we point out that the content of the manual shall not constitute part of or amend a previous or existing contract, agreement or legal relationship. All obligations of Mütec Instruments GmbH shall result from the respective contract of purchase, which also contains the complete and solely valid warranty terms. These contractual warranty terms shall neither be extended nor limited by the information contained in the manual.

The content reflects the technical state of the art regarding printing. It is subject to technical modifications in the course of further development.

WARNING

Devices with the type of protection designated as “intrinsic safety” lose their conformity certification as soon as they have been operated in circuits that do not meet the values specified in the test certificate. Flawless and safe operation of this device requires proper transport, proper storage, installation and assembly as well as careful operation and maintenance. The device may only be used for the purposes specified in this operating manual.

DISCLAIMER

All modifications to the device fall within the responsibility of the user unless expressly specified otherwise in the operating manual.

The delivered interface cable is not a standard cable. If using other or standard cable may occur problems and damage device.

Qualified PERSONNEL

are persons who are familiar with installation, assembly, repair and operation of the product and have the qualifications necessary for their work, such as:

- Training, instruction and/or authorization to operate and maintain equipment/systems in accordance with the standards of safety technology for electrical circuits, high pressures and corrosive as well as hazardous media.
- In the case of equipment with explosion protection: training, instruction and/or authorization to perform work on electrical circuits for potentially explosive equipment.
- Training or instruction in accordance with the standards of safety technology regarding care and use of appropriate safety equipment.

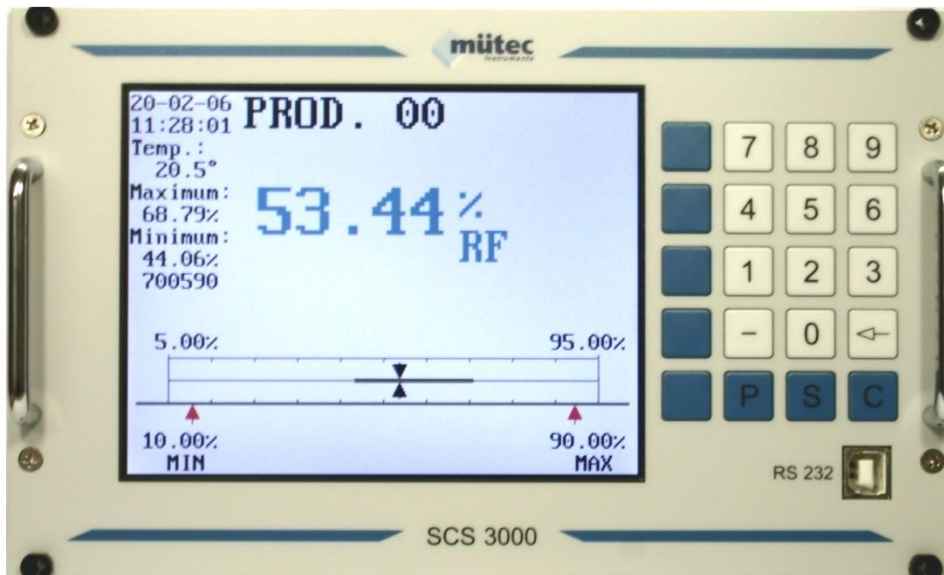
CAUTION

Potentially electrostatic components may be destroyed by voltage that is far below the limits of human perception. Such voltage occurs even when you touch a component or electrical connections of a component and are not electrostatically discharged. The damage that occurs to a component because of overvoltage usually cannot be detected immediately and does not become noticeable until after a longer operating period.



1.0 Description of the HUMY/SCS 3000

The HUMY/SCS 3000 system consists of the **SCS 3000** 19" module and the **FMS 410** HUMY sensor. The inline measuring system for process monitoring guarantees trouble-free measurement of the internal product moisture of solids and emulsions. A graphic user interface with softkeys and a clearly arranged display of the measured, alarm and MIN/MAX values, combined with easy editing and parameterization, enables uncomplicated and simple operation.



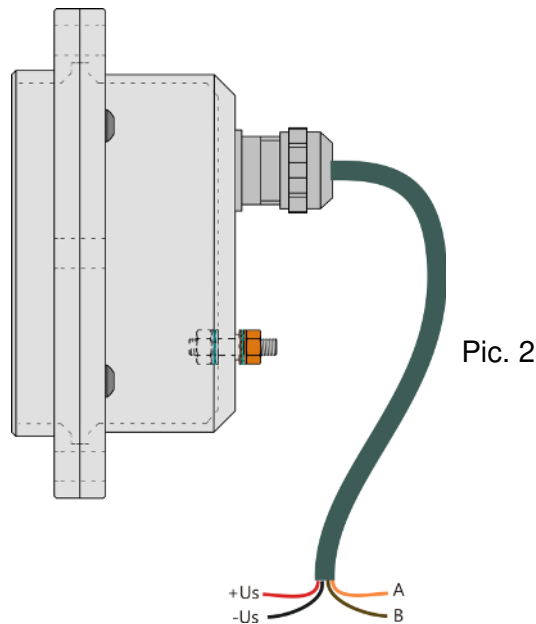
Pic. 1

Features

- QVGA-TFT- display and membrane keyboard with softkey support
- Galvanic separated RS485 and RS232-interface
- HUMY-WINSMART-program (optional) for MS-Windows®
- Data logger (optional) for recording measurements with up to 1 GB flash memory
- Real-time clock for time-stamping the measurement protocols
- 24 independent product settings
- Analog drag indicator display for MIN/MAX values (thicker line width)
- Digital representation of the MIN and MAX values as a percentage of the size
- Direct analog band representation of the measurement
- Threshold representation for the MIN and MAX alarm
- Galvanic separated analog output for moisture
- Galvanic separated analog output for temperature
- 2 galvanic separated digital inputs for an external regulation
- 2 galvanic separated digital output for MIN- and MAX-pre-alarm
- 2 relay contact outputs for MIN- und MAX-alarm
- Pt100-input in 2-/3-wire circuit for product temperature compensation
- mA-input for the product temperature compensation
- Galvanic separated connection for the HUMY-sensor

2.0 Description of the sensor FMS 410

The HUMY sensor for capacitive moisture measurement is based on the open capacitor principle. The bulk material in front of the measuring window serves as the dielectric of the measuring capacitor. Electronic processing of the measured value and temperature compensation in the sensor make it possible to securely transfer data over longer distances.



The electronics installed behind the measuring window are encapsulated in a sturdy, hermetically sealed plastic case. Mounted in a solid cylindrical stainless steel housing, the sensor is extensively insensitive to external influences. Special internal casting protects the entire electronics against penetration of moisture and increases resistance to caustic solutions, acids and solvents. The power supply is provided via a fixed cable connection in the sensor and guarantees tightness to IP67 thanks to a high-quality PG cable gland. The thickness of the dielectric can vary between 20 and 100 mm and is determined by the type of bulk material. Electrical conductivity, pH value and surface structure hardly have any influence on the measurement, but do influence density. The measuring surface of the sensor is sensitive and has to be protected against mechanical impacts. In the case of special applications with high abrasion risk, the measuring surface can be reinforced by means of a built-in ceramic disk.

Features

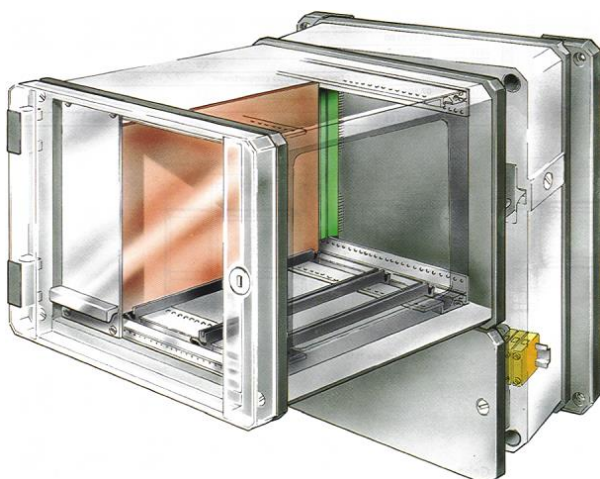
- 20-bit measured value acquisition and measured value processing in the sensor
- Automatic temperature compensation according to stored table
- High degree of functional reliability combined with self-monitoring function
- Low power input (≤ 350 mW)
- Digital transmission of measured values immune to interference via RS485 interface
- 1000 m maximum cable length between sensor and HUMY 300
- Sturdy cylindrical stainless steel flange housing
- Little installation effort required for 4-core connecting line
- Easy, space-saving installation

3.0 Housing/Form of construction

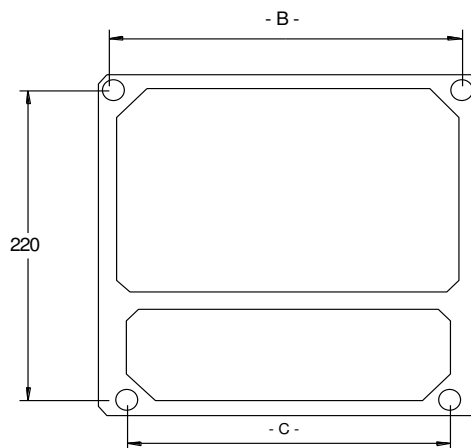
For HUMY/SCS 3000 are 3 housing options available.

a) **Housing F – Field housing/Wall mounting**

- Standard width 42TE, suitable for three HUMY 3019
- Front view with transparent, protective door
- Protection class according to IEC 529 / EN 60529 - IP65
- Cable inlet through five fittings Pg13,5
- Housing material: AL Mg Si 0,5
- Surface: Synthetic resin enamel finish RAL 7035 light gray
- Dimensions: W = 265 mm, H = 240 mm, D = 250 mm



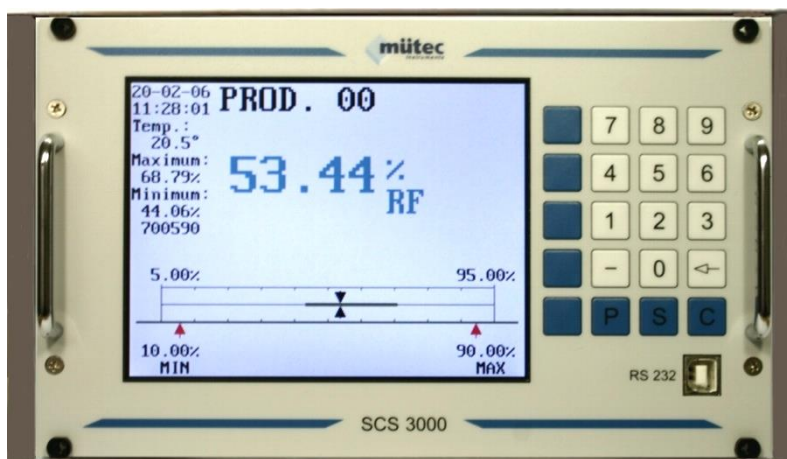
Pic. 3



Pic. 4

b) **Form of construction T – Desk housing**

- Standard width 42TE, suitable for three HUMY 3019.
- Dimensions: W = 236 mm, H = 132 mm; D = 330 mm

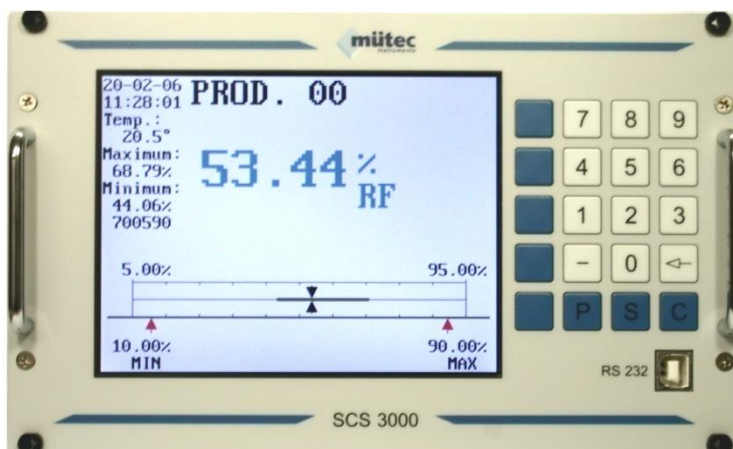


Pic. 5

c) Form of construction E – 19“-plugin

Standard width 42TE and 3 HE

Dimensions: W = 213 mm, H = 128,2 mm; D = 176 mm

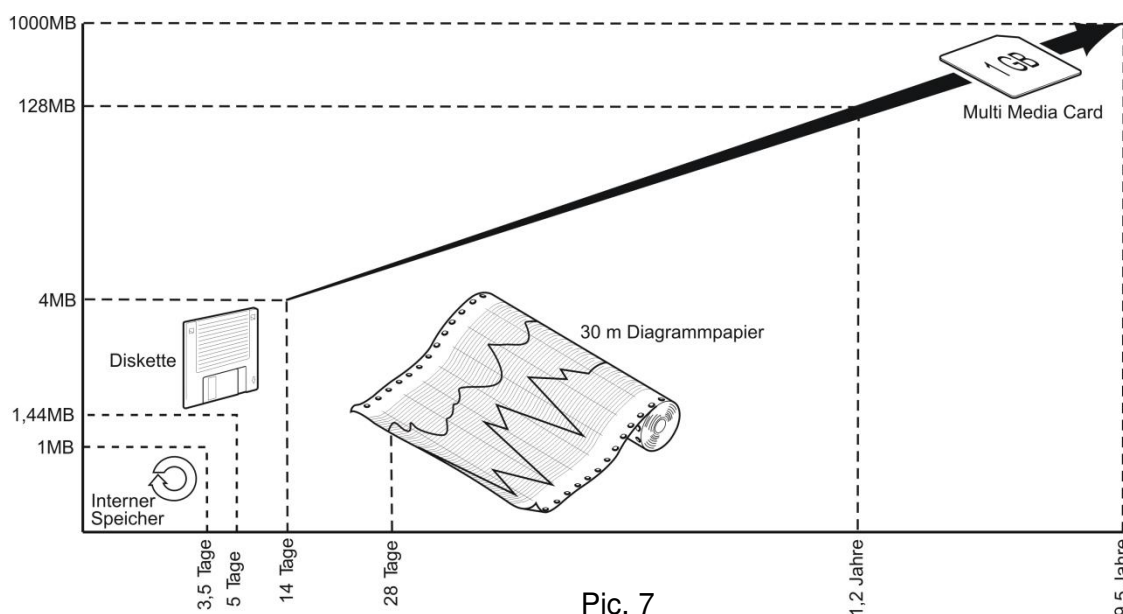


Pic. 6

4.0 Data logger

Optional, a data-logger function is available for HUMY 3000 and SCS 3000. This allows for permanent storage of computed measurements for moisture and temperature. Both, on-line data and archived data can be viewed for interpretation. A separately available Windows based download program allows transfer of data to a connected personal computer. Data can be viewed and analyzed with the Windows program Excel.

The following chart shows the maximum available time interval for data acquisition depending from the flash memory installed in the data-logger (triggering interval 5 sec.).



Pic. 7

5.0 Technical Data of the HUMY/SCS 3000

Indicator:	¼ VGA-TFT-LCD (320 x 240 Pixel) 100 x 77 mm
Keyboard:	15 keys + 5 softkeys
Display:	Date, time, kind of product temperature, value of residual, moisture or value of dehydrated substance, Min- and Max-alarm values, analog bar graph indication, dragging pointer, width of deviation of measuring value with intensified indication of width of deviation of measuring value, digital indication and description of Min-/Max-limit values and the softkeys
1. Measuring value:	0-85% residual moisture or 15-100% dehydrated substance
Indicator:	Percentage with max. 3 decimal places
Accuracy:	max. 0,2 % (depending on product)
Average value:	0-999 sec.
2. Measuring value:	Temperature of the sensor, measuring range from 0-5°C till 0-120°C
Indicator:	°C-value with 1 decimal place
Accuracy:	max. 0,1°C
Product memory:	24 products (optionally up to 100 products)
Data logger:	Storage of moisture and temperature with time and date
Flash memory:	1 GB with 1 s scan rate results in a memory capacity for 2 years

ANALOG OUTPUT AA-1 (moisture), AA-2 (temperature)

For the analog outputs, a filter of the 1st order (0.1 – 9.9)s can be parameterized. Galvanic separation between the analog outputs, to the auxiliary energy and to all other inputs/outputs.

	Constant current	Voltage
Max. range:	0...22 or 22...0 mA	0...11 or 11...0 V
Standard range:	0/4-20 mA	0/2-10 V
Load:	max. 750 Ohm	min. 50 kOhm
Accuracy:	0,02 % of final value	0,02 % of final value
Load influence:	<0,005 %	0,5 % at R _L =100 kΩ
Rise time:	<150 ms	<150 ms

CONTACT OUTPUTS REL-1 (MAX-Alarm), REL-2 (MIN-Alarm)

Galvanic separation between the contact outputs, to the auxiliary energy and to all other inputs/outputs.

Alarm number:	2 independently adjustable limit values
Setting:	%-value of moisture
Alarm delay:	free configurable from 0 ... 9,9 s
Hysteresis:	free configurable from 0 ... 99,9 %
Operating mode:	NO- or NC-principle
Contact:	Open and closed switch
Switching power:	max. 62,5 VA or max. 30 W
Switching voltage:	max. 125 V AC or 110 V DC
Switching current:	max. 1 A
Min-contact voltage:	10 mVDC
Min-contact current:	10 µA
Contact material:	AG Pd + 10 µAu
Relay-Type:	according to IEC 947-5-1 or EN60947

TRANSISTOR OUTPUTS DA-1 (MAX-pre-alarm), DA-2 (MIN-pre-alarm)

Galvanic separation between the transistor outputs, to the auxiliary energy and to all other inputs/outputs.

Alarm number:	2 independently adjustable limit values
Setting:	%-value of moisture
Alarm delay:	free configurable from 0 ... 9,9 s
Hysteresis:	free configurable from 0 ... 99,9 %
Operating:	NO- or NC-principle
Output:	Open Collector
Switching power:	<1,4 W
Switching voltage:	<28 VDC
Switching current:	<50 mA

DIGITAL INPUTS DE-1 (diff. functions), DE-2 (diff. functions)

Galvanic separation between the digital inputs, to the auxiliary energy and to all other inputs/outputs.

Direction of effect:	direct or invers
Control voltage:	min. 8 VDC, max. 36 VDC
Control current:	min. 2 mA, max. 14 mA

Pt100-INPUT / mA-INPUT AE-1 for ext. temperature compensation

For the two inputs, there is no galvanic separation from the inner circuitry.

Pt100-connection:	2 or 3-Lt.-switch
Measuring range:	0°C to +100°C
mA-range:	0/4 – 20 mA according to 0 – 100°C

INTERFACES RS232, RS485

Galvanic separation between the RS232/RS485 to the auxiliary energy and to all other inputs/outputs.

Protocol:	MODBUS, RTU-Modus
RS232/COM:	via front socket connection at PC with Mütec-interface cable
RS485:	Half-duplex, termination with jumper
Baudrate/device address:	2400-19200 bps, 1-248

HUMY-SENSOR-CONNECTION

Galvanic separation of the sensor to the auxiliary energy and to all other inputs/outputs.

Supply:	20 VDC, 20 mA
RS485:	Half-duplex
Baudrate/ device address:	19200 bps, 1

AUXILIARY POWER

Supply circuit-1:	115 or 230 VAC, - 15 % to +10 %, Change with Jumper at the VP 3000 – circuit board!
Supply circuit -2:	24 VAC (50-60 Hz) or 24 VDC, +/- 25 %
Power consumption:	max. 6 W

For redundant power, the HUMY/SCS 2000 can also be run with both power supply circuits at the same time.

CONFORMITY

EMV-directive 2004/108/EG: EN 61000-6-2, EN 61000-6-4, EN 61326-1

GENERAL DATA

Accuracy

Maximal: <0,2 % of final value
Typical: <0,5 % of final value

Temperature coefficient

Maximal: <0,05 %/K
Typical: <0,03 %/K

Galvanic separation

In-/Output/Supply: 300 Veff (rated insulation voltage, overvoltage II, Contamination level 2, secure division according to EN 61010, EN 50178)

Housing options

Form of construction T: Desk housing - weight ca. 4,5 kg
W=236 x H=132 x D=330 mm
Form of construction F: field housing-/ wall mounting (IP65) with transparent door
W=265 x H=240 x D=290 mm, weight ca. 6,5 kg
Form of construction E: 19"- 3HE/42TE, weight ca. 2 kg
Form of construction S: Control panel housing (IP58) with transparent door
W=270 x H=183 x D=223 mm, weight ca. 3 kg

Electrical connection

Form of construction T: Screw-plug in connection/green with 2,5 mm²
Form of construction F: screw connection/green with 2,5 mm²
Form of construction E: Female connector (32/48-polig) according to DIN 41612 – Housing F

Housing protection class

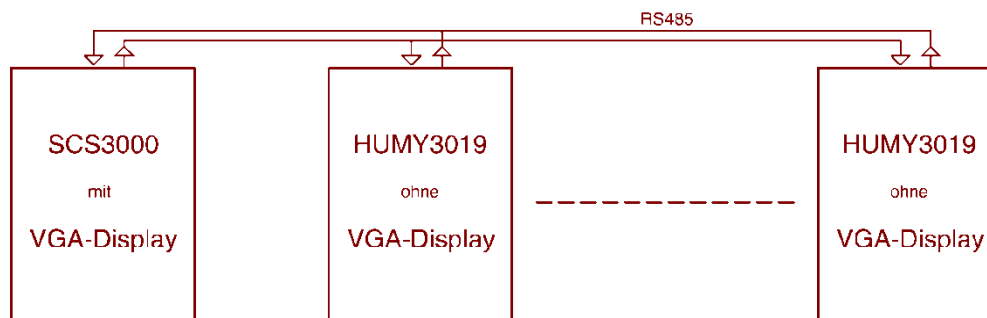
Form of construction T: IP20 according to EN 60529
Form of construction F: IP65 according to EN 60529
Form of construction E: IP20 according to EN 60529

Ambient conditions

Permissible temperature: -10 °C ... +60 °C
Storage/transport: -10 °C ... +70 °C
Permissible humidity while operation: 10 % ... 95 % r.F. without condensation

SCS3000 with HUMY3019 in Master-Slave-Mode

To connect the SCS3000 with one or more HUMY3019 is optionally an additional galvanic separated RS485-full duplex-interface available.



Pic. 8

6.0 Technical Data of the HUMY - sensor FMS410

ELECTRICAL DATA

Supply:	20 VDC, 20 mA
RS485:	Half-duplex
Baudrate/device address:	19200 bps, 1
Power consumption:	0,4 W

MECHANICAL DATA

Housing:	St. s 1.4301
Protection class:	IP 67 according to EN 60529
Weight:	ca. 1050 g
Response time:	ca. 1 sec
Connection cable:	shielded cable, 4-wire, min. 0,5 mm ²
Wire length:	max. 1000 m

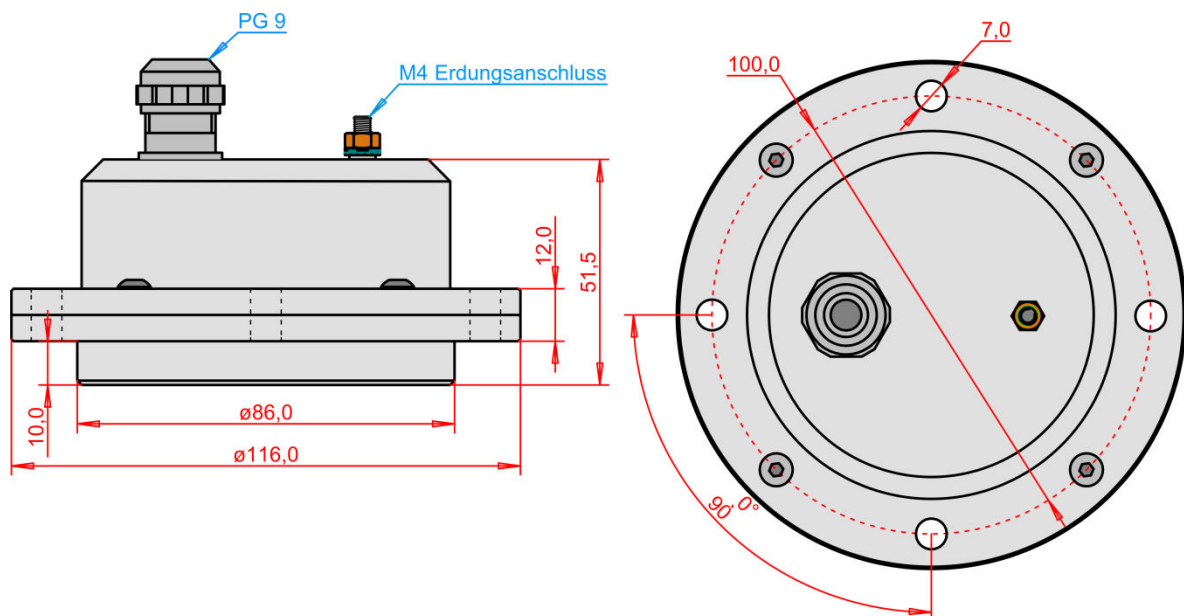
MATERIAL of the MEASURING AREA

FMS410K:	POM
FMS410C:	Ceramic
FMS410T:	PTFE
FMS410S:	Ceramic (inner cup made by PTFE)
Other versions on request	

LIMIT VALUES

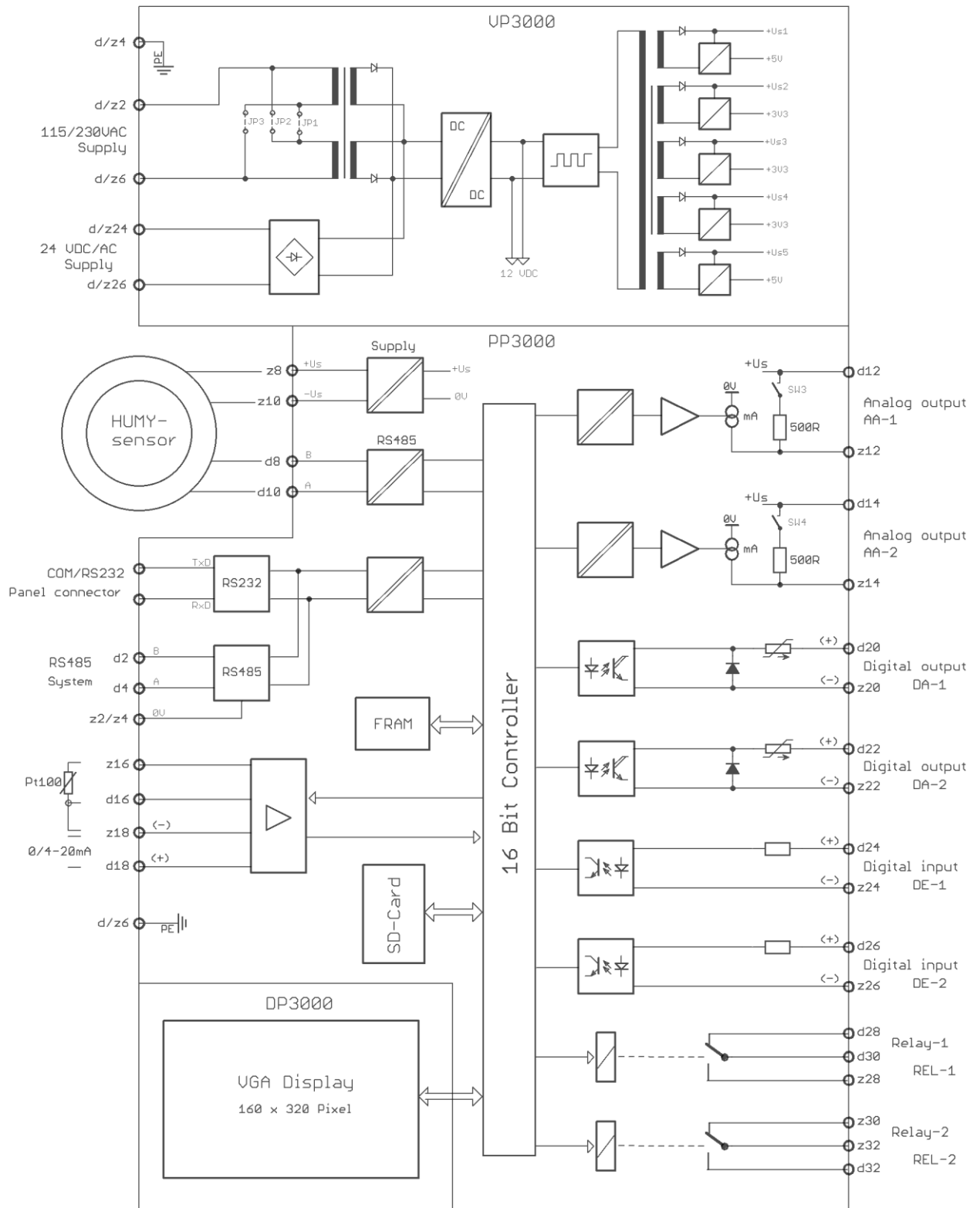
Pressure resistance:	max. 6 bar, short-term 10 bar
Working temperature:	0°C to +80°C in the sensor
Process temperature:	-10°C to +90 °C at the measuring area, with separating layer or cooling up to 140°C
Storage temperature:	-10 to 80°C

DIMENSIONS



Pic. 9

7.0 Basic circuit diagram



Pic. 10

8.0 Jumper-Settings

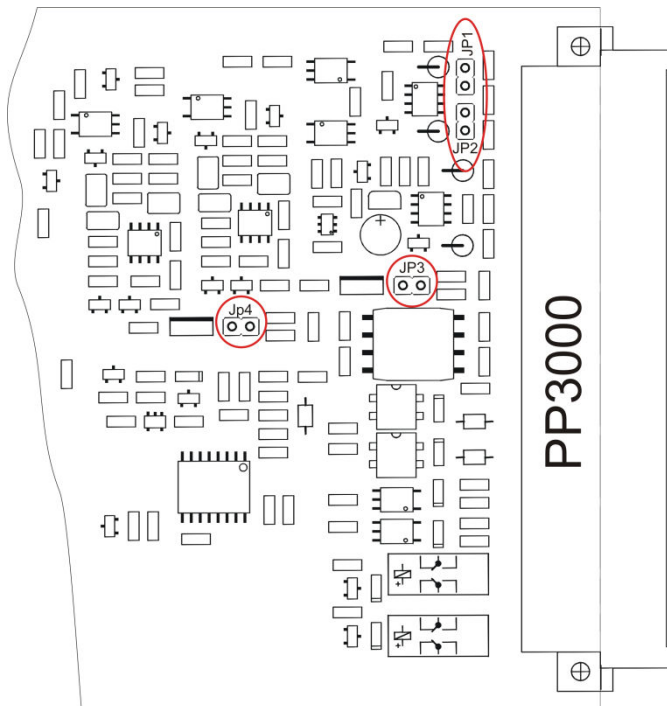
1. Termination of the RS485-interface:

For termination of the RS485-interface, the jumpers JP1/JP2 have to be closed.

2. Switching the analog outputs from constant current to voltage:

The jumper JP3 for AA1 or JP4 for AA2 switches from constant current (JP3/JP4 open) to voltage (JP3/JP4 closed).

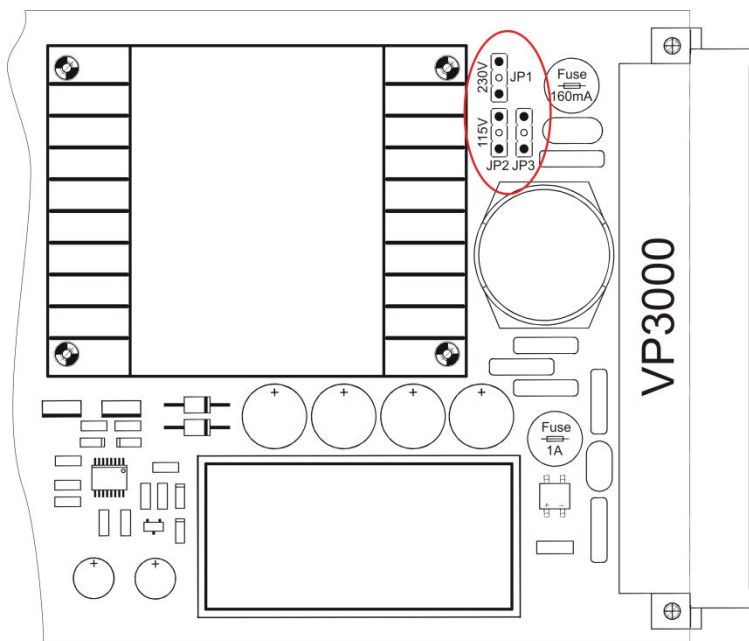
Pic. 11



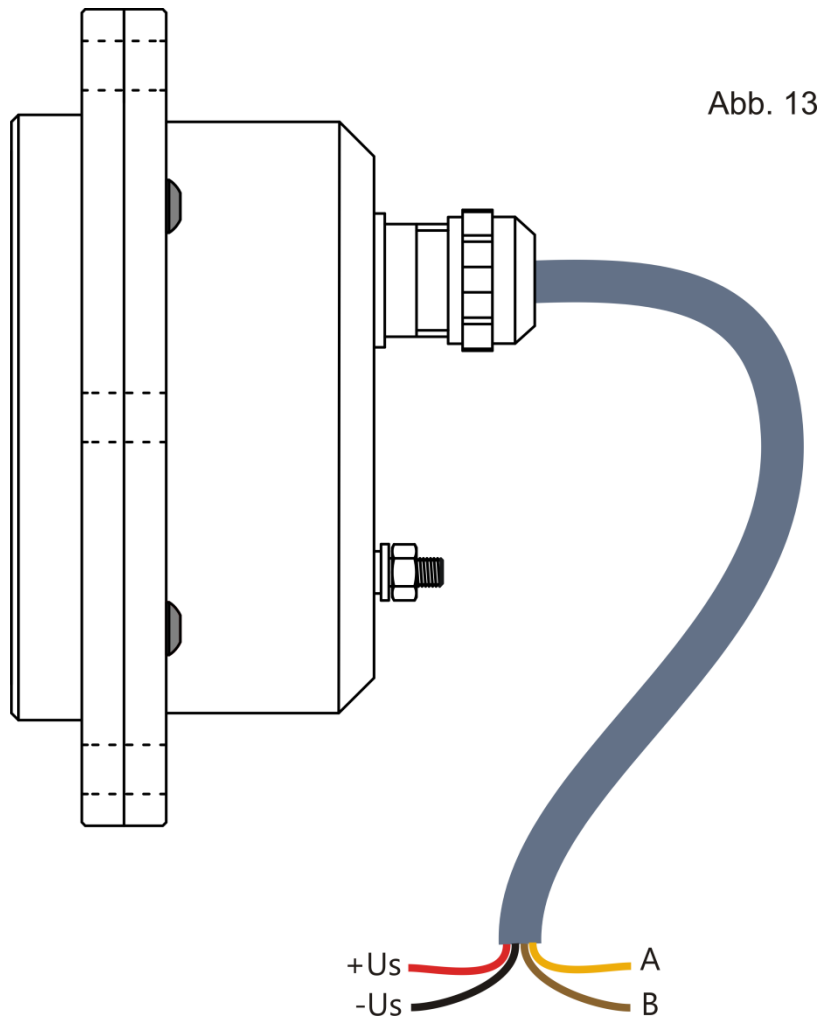
3. Switching the power voltage: 230 VAC or 115 VAC

230 VAC: Jumper JP1 closed, JP2+JP3 opened
 115 VAC: Jumper JP1 opened, JP2+JP3 closed

Pic. 12

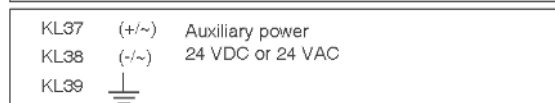
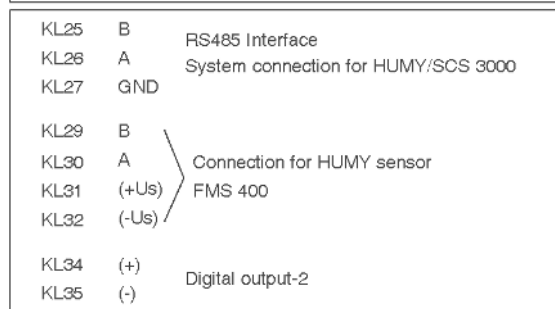
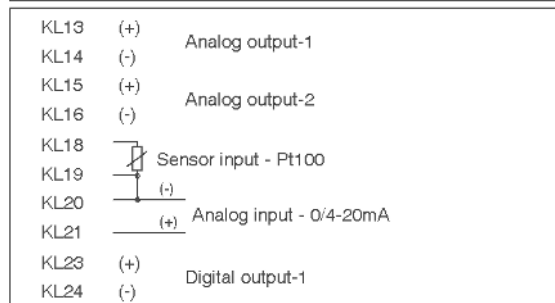
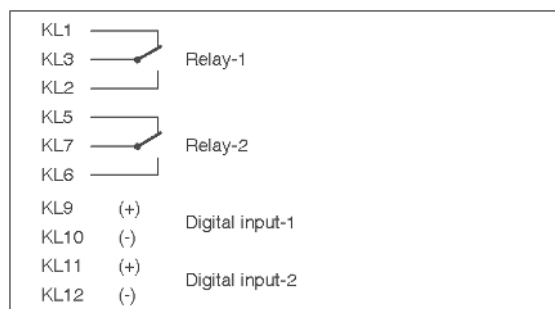
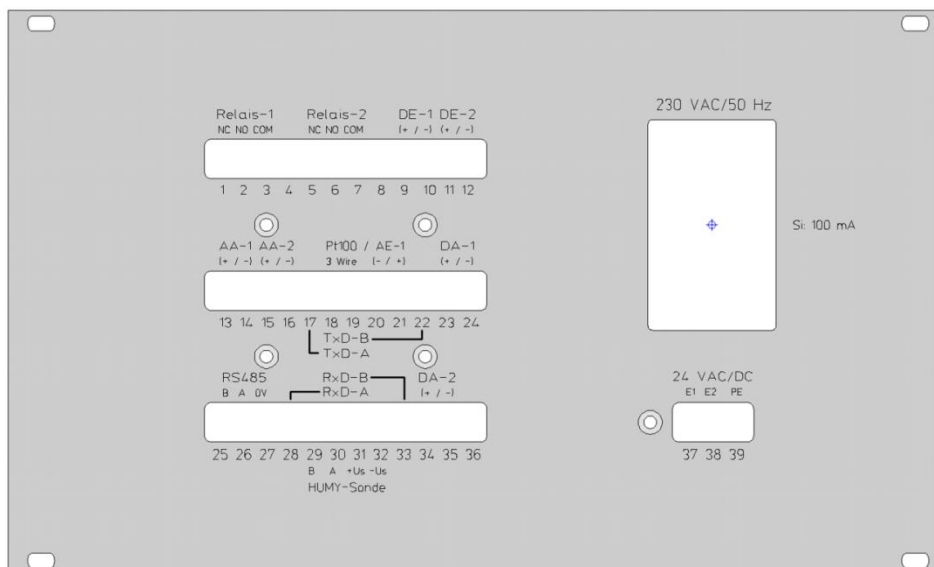


9.0 Cable connection of the HUMY - sensor



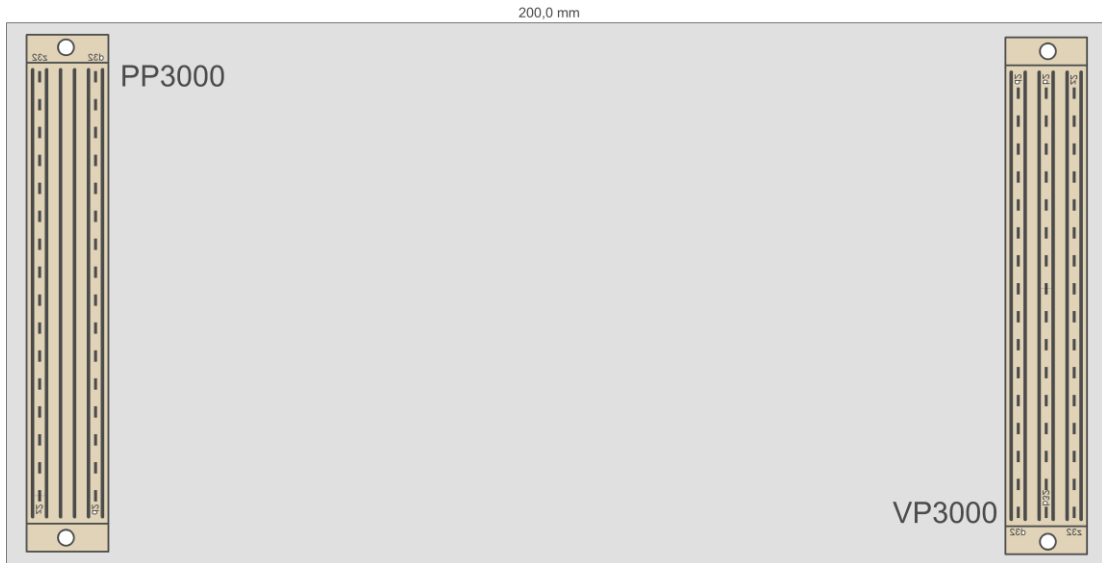
The cable shield is connected to the ground contact in the sensor. If the cable shield is also grounded at the other end of the line and there is a significant potential difference between the two grounding points, the result is a considerable flow of compensating current via the cable shield with all related impacts.

10.0 Terminal assignment for the 19" - desk housing



Pic. 14

11.0 Assignment of the female connector for the 19"

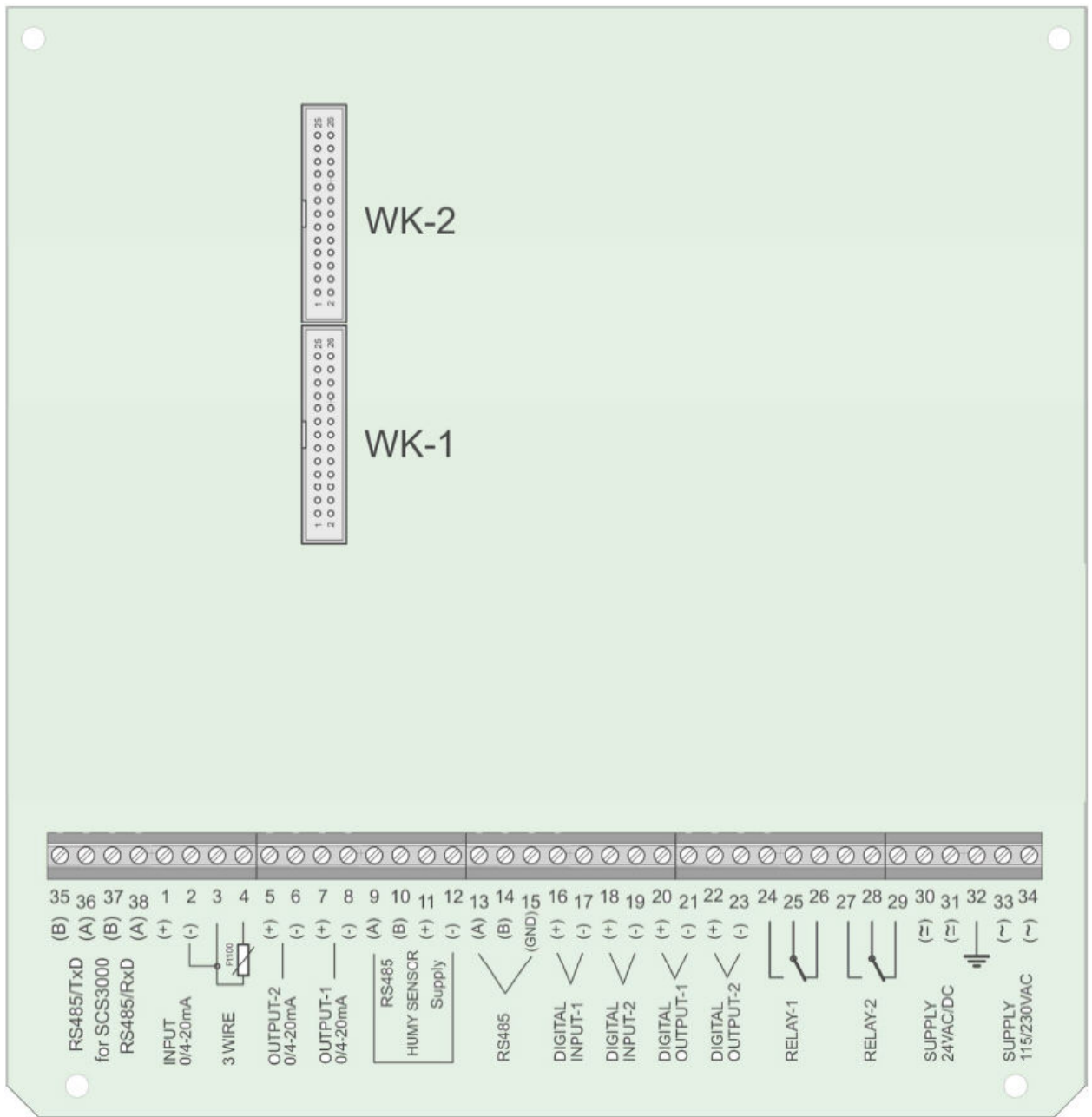


Rear view at the Humy/SCS3000
Pic. 15

Contact assignment of PP3000		
d2	B	RS485 System
d4	A	
z2/4	0V	
d/z6	PE	
d8	B	HUMY Sensor
d10	A	
z8	+Us	
z10	-Us	
d12	(+)	AA-1
z12	(-)	
d14	(+)	AA-2
z14	(-)	
z16		Pt100
d16	(-)	
z18	(+)	0/4-20mA
d18	(-)	
d20	(+)	DA-1
z20	(-)	
d22	(+)	DA-2
z22	(-)	
d24	(+)	DE-1
z24	(-)	
d26	(+)	DE-2
z26	(-)	
d28		REL-1
d30		
z28		REL-2
z30		
z32		
d32		

Contact assignment of VP3000		
d/z2	—	115VAC or 230VAC
d/z6	—	
b2	PE	
b8		
b/d/z4		
b/d/z8		
b/d/z10		
b/d/z12		
b/d/z14		
b/d/z16		
b/d/z18		
b/d/z20		
d/z22	24VDC and/or 24VAC	
d/z28		
d/z30	Supply for scheduling network	
d/z32		
d/z24	0V	Supply for scheduling network
d/z26		
b26	B	RS485-Interface for SCS3000 + HUMY3019 connection
b28	A	
b30	B	
b32	A	

12.0 Terminal assignment for the field-/ wall housing



Pic. 16

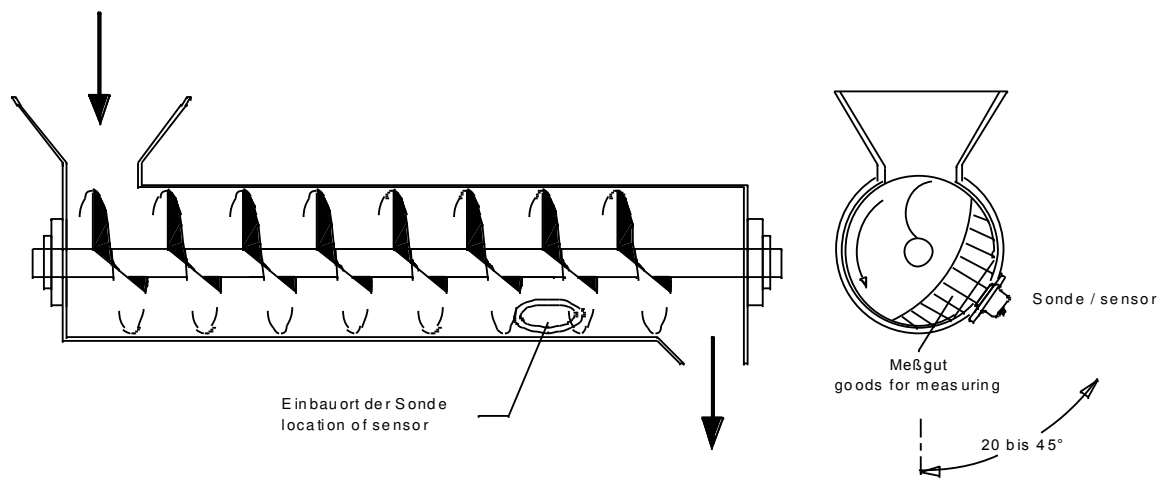
13.0 Mounting instructions and installation examples

The HUMY 3000 is designed for continuous moisture measurement in production flow. A prerequisite for correct moisture measurement in bulk materials is always to select the right place to install the moisture sensor. In connection with bulk material chutes or conveyor belts, you additionally have to ensure that the material to be measured is fed over the sensor at a constant layer height as far as possible.

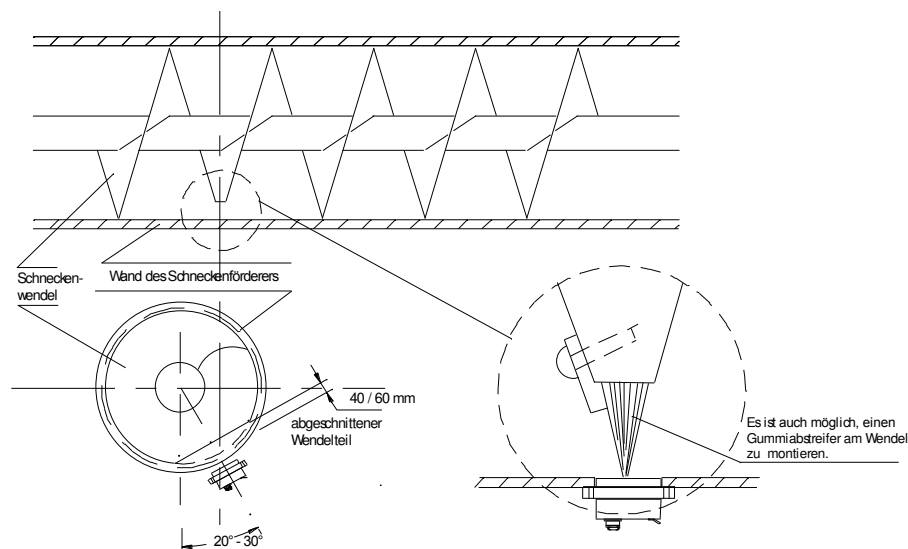
13.1 Mounting in a screw conveyor

Mounting the moisture sensor in the spiral conveyor has proven to be particularly advantageous since the measured product is guided over the sensor at regular intervals with a constant thickness.

The moisture sensor has to be placed underneath the screw conveyor.



Pic. 17



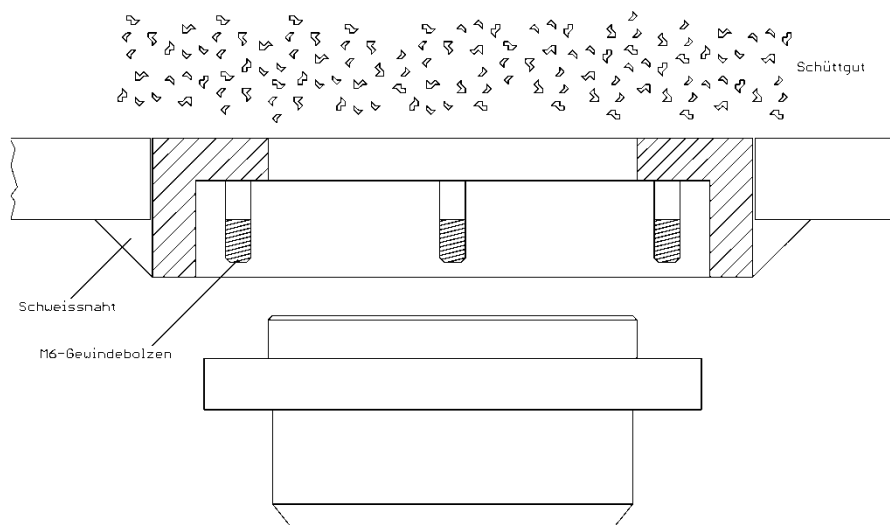
Pic. 18



In the case of hard bulk materials, the sensor surface is subject to a latent risk of material getting stuck between the screw conveyor and the HUMY sensor. This can be prevented here by cutting off the spiral. As a substitute for the cut-off spiral, you can install a rubber scraper that then performs the function of material transport.

13.2 Indirect mounting

Indirect installation of the HUMY sensor is necessary if the wall thickness is 10 mm or more or the wall is curved. In such cases use of a welded flange is recommended.

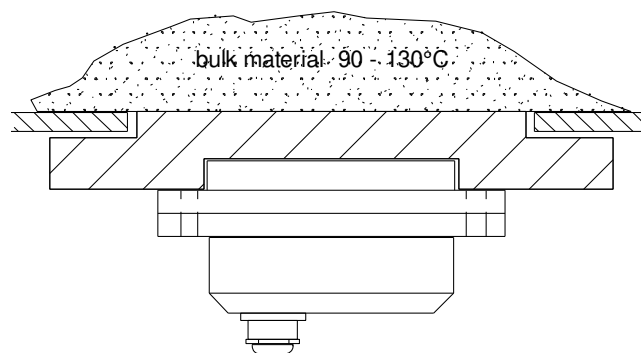


Pic. 19

13.3 Mounting at a measurement window or separation layer

For most applications direct contact of the sensor surface with the product is desired. In some applications this might not be possible / suitable. Here, a neutral separator layer made out of Plexiglas, glass, or similar material can be fitted between sensor and product. A metallic separator layer is NOT permitted.

Maximum thickness of the separator material is 30 mm.



Pic. 20

Use of a separating layer of 5 to 15 mm is recommended with chain conveyors or for measurements with media having a temperature of over 80°C up to max. 130°C. The permissible thickness depends on the material to be measured and the residual water content. The measuring surface of the moisture sensor must always have mechanical contact to the separating layer.