

OPERATING MANUAL

Hydrocont® HP4 |
Hydrostatic fill level
transmitter
ø22mm
with capacitive ceramic
pressure sensor
with temperature sensor
and conductivity cell



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1 Notes on the document

1.1 Document function

This manual describes the product's design, functions, and use, and helps ensure that the product is operated as intended.

Read the manual carefully before using the product. This will help you avoid potential injury, property damage, and damage to the device.

The operating manual is an integral part of the device and must be kept accessible at all times in the immediate vicinity of the operating site.

The information in this document reflects the knowledge available at the time of printing. Subject to change without notice.

1.2 Terms

NOTE

Information on how to prevent malfunctions, operational failures, and damage to the device or system.



WARNING

Failure to follow these instructions may result in serious or fatal injury.

[04-5]

Reference to a variant >> Product Code section

1.3 Additional documentation

In addition to this document, you can find additional documentation online.

2 Safety instructions

2.1 Authorized personnel

Installation, electrical connection, commissioning, operation, maintenance, disassembly, and disposal of the device must be performed by a qualified and authorized specialist in accordance with the instructions in the operating manual and applicable standards.

This specialist must have read and understood the operating instructions, particularly the safety instructions. The required personal protective equipment must always be worn when working on or with the device.

If the device is intended for use in potentially explosive atmospheres, the safety instructions for electrical equipment intended for use in potentially explosive atmospheres must be observed in particular.

2.2 Intended use

The device is an electronic hydrostatic level transmitter for monitoring, controlling, and continuously measuring liquid levels and temperatures.

The device's operational safety is guaranteed only when used as intended. Improper or unintended use of this product may result in application-specific hazards, such as a tank overflow due to incorrect installation or adjustment. This can result in property damage, personal injury, or environmental damage. Furthermore, this may impair the device's performance.

Improper use, failure to follow the operating instructions and technical regulations, the use of inadequately qualified personnel, unauthorized modifications, and damage to the device exclude the manufacturer's liability for any resulting damages. The manufacturer's warranty is void.

2.3 Operational Safety

The device is designed and tested in accordance with the state of the art to ensure safe operation. It may only be operated when it is in technically sound and safe operating condition. The operator is responsible for ensuring the trouble-free operation of the device. The device must only be used within the permissible operating limits. Any use outside these intended limits can lead to significant hazards.

Before use, the materials must be checked for compatibility with the application requirements. An unsuitable material can lead to damage, malfunction, or destruction of the device and the resulting hazards.

The device must not be used as the sole means of preventing hazardous conditions on machines and systems.

For safety and warranty reasons, any modifications beyond the described operating procedures may only be performed by personnel authorized by the manufacturer. Unauthorized modifications or alterations are expressly prohibited. For safety reasons, only accessories specified by the manufacturer may be used.

The device complies with the requirements of all relevant EU directives. This is confirmed by the CE marking affixed to the device. The corresponding EU Declaration of Conformity can be requested or downloaded from the website.

2.4 Equipment for potentially explosive atmospheres

If a device is installed and operated in potentially explosive atmospheres, the general Ex installation regulations (EN/IEC 60079-14, VDE 0165), these operating instructions, the EU type examination certificate, or the IECEx certificate of conformity, including any supplements, must be observed.

The installation of equipment in potentially explosive atmospheres must be performed by qualified personnel.

The devices are designed for measuring levels in potentially explosive atmospheres. The measured media may include flammable liquids, gases, mists, vapors, or dusts.

Maximum permissible values for intrinsically safe circuits:

Voltage	Ui	30 V
Current	Ii	300 mA
Power	Pi	900 mW
Effective internal capacitance	Ci	1.3 nF + (0.2 nF/m * Lc)
effective internal inductance	Li	5 µH + (6.5 µH/m * Lc)
Maximum cable length	Lc	60 m

The intrinsically safe signal and power supply circuit is considered grounded for safety purposes. Sufficient equipotential bonding must be ensured along the entire length of the

cable run. The cable shield must be connected to the equipotential bonding system of the potentially explosive area. The intrinsically safe circuit must be installed without grounding.

For device models with chargeable plastic parts, a warning label indicates safety measures that must be followed regarding the risk of electrostatic charging during operation and, in particular, during maintenance work:

- Avoid friction
- Do not dry clean
- Do not install in a pneumatic conveying system

If there is a risk of swinging or oscillation, the device must be effectively secured against these hazards.

CATEGORY 1

The device in the electronic output version [09-X] may be installed in potentially explosive atmospheres where Category 1 equipment is required.

Category 1 equipment may be operated in potentially explosive atmospheres where Category 1 equipment is required only if atmospheric conditions are met (temperature—see the following tables; pressure from 0.8 bar to 1.1 bar).

Category 1 equipment must be connected to intrinsically safe circuits with protection level ia.

CATEGORY 2

The device in the electronic output versions [09-A] or [09-X] may be installed in potentially explosive atmospheres where Category 2 equipment is required.

Category 2 equipment may be connected to intrinsically safe circuits with protection level ib.

For applications requiring EPL Ga or Gb devices, the following values apply:

Ex Marking	Ambient / Medium Temperature Range
II 1 G Ex ia IIC T6 Ga II 2 G Ex ib IIC T6 Gb	-20°C...+42°C
II 1 G Ex ia IIC T5 Ga II 2 G Ex ib IIC T5 Gb	-20°C...+57°C
II 1 G Ex ia IIC T4...T1 Ga II 2 G Ex ib IIC T4...T1 Gb	-20°C...+70°C

For applications requiring EPL Da or Db devices, the following values apply:

Ex Marking	Ambient / Medium Temperature Range
II 1 D Ex ia IIIC T ₂₀₀ 100°C Da	-20 °C ... +35 °C
II 1 D Ex ia IIIC T ₂₀₀ 120°C Da	-20 °C ... +55 °C
II 2 D Ex ib IIIC T80°C Db	-20 °C ... +42 °C
II 2 D Ex ib IIIC T95°C Db	-20 °C ... +57 °C
II 2 D Ex ib IIIC T108°C Db	-20 °C ... +70 °C

3 Product description

3.1 Function

The device is an electronic hydrostatic level transmitter for monitoring, controlling, and continuously measuring liquid levels and temperatures.

The device is suitable for level measurement applications in virtually all industrial sectors, particularly for fresh water, wastewater, and saltwater. Its slim design allows for use especially in confined installation spaces, such as in small-diameter sounding tubes.

The highly accurate, long-term stable, and robust ceramic sensing cell, the stainless steel housing, and the thick-walled, dimensionally stable support cable with a heavy-duty steel core ensure reliable, precise measurements and enable operation even under demanding environmental conditions, such as low temperatures or high shock and vibration loads.

The hydrostatic fluid pressure acts directly (dry system) via the process diaphragm on the capacitor mounted on the rear side, causing a change in capacitance there, which is then processed.

An integrated, long-term stable platinum temperature sensor is used for optional temperature measurement.

In the RS485 Modbus-RTU version, the measured temperature value can be read via the digital interface; in the 4...20 mA FSK current version, the resistance signal can be evaluated in parallel with the pressure-related analog current signal using 3-wire technology.

For optional conductivity measurement, a 4-electrode cell is used, which ensures accurate and reliable temperature-compensated measurement over a wide conductivity range, even in the presence of contamination.

Parameterization and operation can be performed via the integrated wired interface.

3.2 Design

3.2.1 Sensor without conductivity measurement cell



Figure 3.1 : grf00013_cmp_hp4s

3.2.2 Sensor with conductivity measuring cell – [10-4]

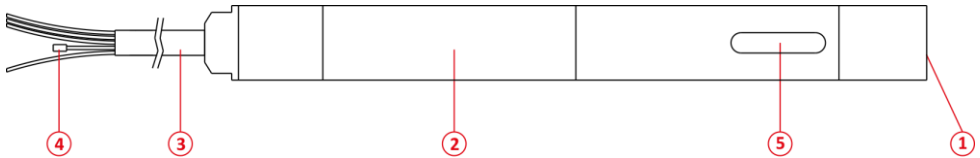


Figure 3.2 : grf00014_cmp_hp4s_lf

- 1 Pressure measuring cell, optionally with temperature sensor
- 2 Electronics housing
- 3 Support cable with capillary tube and steel core
- 4 Ventilation/Pressure Equalization
- 5 Conductivity sensor with temperature sensor

Ceramic pressure membrane (1) for measuring hydrostatic fluid pressure.

A platinum temperature sensor thermally coupled to the metal housing wall is optionally integrated.

Optional conductivity measurement cell (5) with integrated platinum temperature sensor.

Fully encapsulated signal processing electronics in the housing tube (2).

Length-stable support cable (3) with steel core and shielding braid. The reference air supply required for relative pressure measurement is provided via a capillary tube with filter attachment (4) integrated into the support cable.

Laser-etched labeling on the nameplate affixed to the housing tube (2) ensures the device's identifiability throughout its entire service life.

3.3 Nameplate

The nameplate contains the most important data for identifying and using the device.

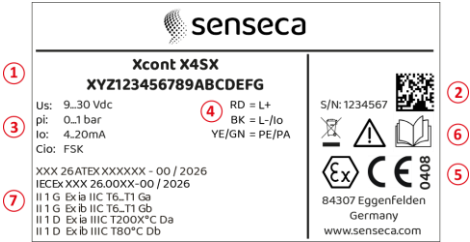


Figure 3.3 : grf00002_lab001

- 1 Product code
- 2 Serial number
- 3 Technical Specifications
- 4 Electrical Connection
- 5 Approvals
- 6 Safety Instructions
- 7 Type of ignition protection

3.4 Product Code

HP4 [01][02][03][04][05][06][07][08][09][10][11][12][13][14][15][80][94/95/96/97/98/99]

	Device	HP4	Level sensor D22mm
01	Model	S	Standard
02	Sensor	C	capacitive – flush-mounted / 99.9% Al ₂ O ₃ ceramic
03	Approval	S	Standard
03		X	ATEX/IECEX: II 1 G Ex ia IIC T6...T1 Ga / II 1 D Ex ia IIIC T ₂₀₀ 100°C Da
03		Z	ATEX/IECEX: II 2 G Ex ib IIC T6...T1 Gb / II 2 D Ex ib IIIC T80°C Db
04	Process connection	0	without
05	Process Seals	1	FKM/FPM
05		3	EPDM, FDA-listed
06	Process connection	V	CrNi steel
06		D	CrNi steel, duplex, seawater-resistant

07	Connection housing	0	without
08	Measurement Range (PV)	01	0...100 mbar
08		02	0...200 mbar
08		03	0...400 mbar
08		04	0...600 mbar
08		05	0...1 bar
08		07	0...2 bar
08		08	0...4 bar
08		09	0...6 bar
08		10	0...10 bar
08		12	0...20 bar
08		0A	0...1 mH ₂ O
08		0B	0...2 mH ₂ O
08		0C	0...4 mH ₂ O
08		0M	0...5 mH ₂ O
08		0D	0...6 mH ₂ O
08		0E	0...10 mH ₂ O
08		0F	0...20 mH ₂ O
08		0L	0...25 mH ₂ O
08		0G	0...40 mH ₂ O
08		0J	0...50 mH ₂ O
08		0K	0...60 mH ₂ O
08		0H	0...100 mH ₂ O
09	Electronics – Output	A	Current 4...20 mA, FSK, 2-wire, overvoltage protection - [03-S/Z]
09		X	Current 4...20 mA, FSK, 2-wire - [03-S/X]

09		V	RS485 Modbus-RTU, 4-wire, surge protection - [03-S]
10	Electronics – Function	0	without
10		1	Temperature Pt100-B, 3-wire – IEC 60751 - [03-S]/[09-A/X]
10		3	Temperature -20...+70 °C (-4...+158 °F) - [09-V]
10		4	Conductivity 0...50 mS/cm [09-V]
11	Process temperature	0	-20...+70 °C (-4...+158 °F)
12	Pressure variant (PV)	R	Relative pressure
13	Measurement Accuracy (PV)	1	0.2%
13		3	0.1%, linearity certificate
13		6	Xcellence – 0.05% [08 ≥ 200 mbar/2 mH ₂ O], linearity report
14	Electrical Connection	K	Cable, stranded wire assembly
14		H	Cable, Hydrolog HLF4 assembly
14		0	Cable, unassembled
15	Material of carrier cable	A	PE cable jacket
15		B	Cable jacket: PUR
80	Length L1	/##### #	mm ([03-S] ≤ 300,000 mm / [03-X/Z] ≤ 60,000 mm)
94	Additional option	+SF	LABS-free, silicone-free / Paint-compatible version
95	Additional option	+ML	Measurement point designation / TAG - laser marking
96	Additional option	+MZ	Material Test Certificate – EN 10204 3.1
97	Additional Option	+WT	Factory Certificate – Suitability for Drinking Water
98	Additional Option	+KF	Configuration / Default Settings

99	Additional Option	+WK	Factory Calibration – Calibration Certificate
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Variants are generally identified by the letter Y in the product code.

3.5 Dimensions

Dimensions in mm

[10-4] = Specifications for electronics Function – Conductivity

3.5.1 Electrical Connection – Cables, Stranded Wire Termination – [14-K]

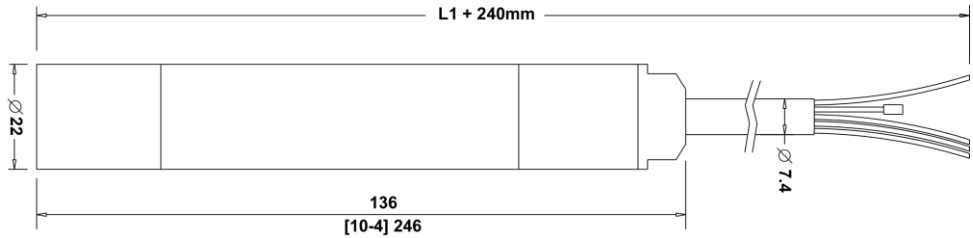


Figure 3.4 : grf00015_dim_hp4sc_k

3.5.2 Electrical Connection – Cables, Stranded Wire Termination – [14-H]

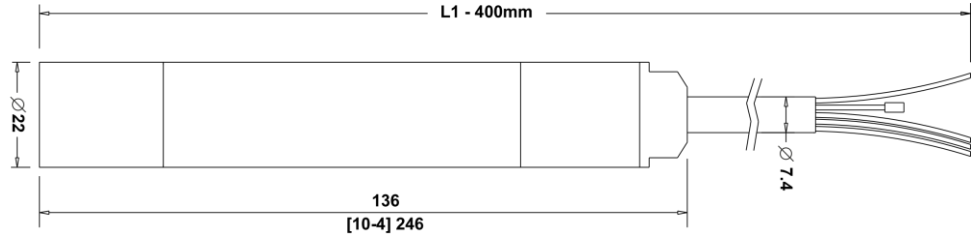


Figure 3.5 : grf00016_dim_hp4sc_h

3.5.3 Electrical Connection – Cable, Unterminated – [14-0]

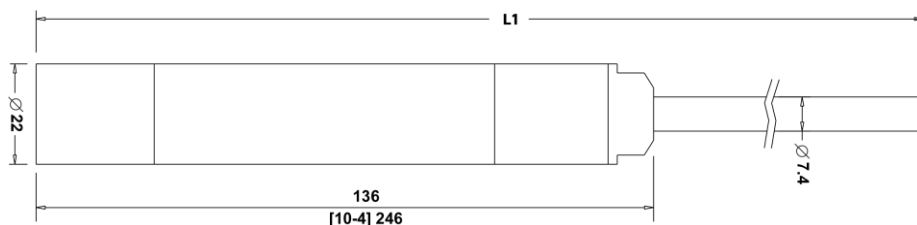


Figure 3.6 : grf00017_dim_hp4sc_0

3.6 Packaging, transport, storage

The device is protected by packaging designed to withstand normal transport stresses. Transport must be carried out in accordance with the instructions on the shipping packaging. Failure to do so may result in damage to the device.

Upon receipt, the shipment must be inspected immediately for correctness, completeness, and any transport damage. Any transport damage or hidden defects found must be handled accordingly.

The packages must be kept sealed until installation and, unless otherwise specified, stored only under the following conditions:

- Do not store outdoors
- Store in a dry, dust-free location
- Do not expose to corrosive substances
- Protect from direct sunlight
- Avoid mechanical shocks
- Storage and transport temperature: -20...+85 °C
- Relative humidity 20...85 %

3.7 Accessories

A comprehensive range of products, perfectly tailored to the device, is available for installation and electrical connection.

4 Installation

4.1 Environmental and process conditions

Correct operation of the device within the specified technical data can only be guaranteed if the permissible ambient and process conditions at the installation site (see the Technical Data section) are not exceeded. Therefore, before installation, ensure that all parts of the device in contact with the process (e.g., measuring diaphragm, process seal, housing, connection cable) are suitable for the prevailing process conditions (e.g., process pressure, process temperature, chemical properties of the media, abrasion, mechanical stresses).

4.2 Installation location

Install the device in a location free of flow and turbulence, or use a guide tube. The inner diameter of the guide tube should be at least 1 mm larger than the outer diameter of the device.

Install the device below the lowest measurement point.

Do not install the device in the flow stream, in the suction zone of a pump, or at a location in the tank where it may be subjected to pressure pulses from an agitator.

The device should be installed in a location with a stable temperature whenever possible. Significant fluctuations in process temperature can cause temporary increases in measurement signal deviations.

If the temperature falls below the dew point—e.g., cold process medium at high ambient temperature—condensation may form in the pressure sensor, which can lead to temporary increased measurement deviations or malfunctions. These deviations are fully reversible once the condensation dries out.

The cable end must terminate in a dry room or in a suitable junction box.

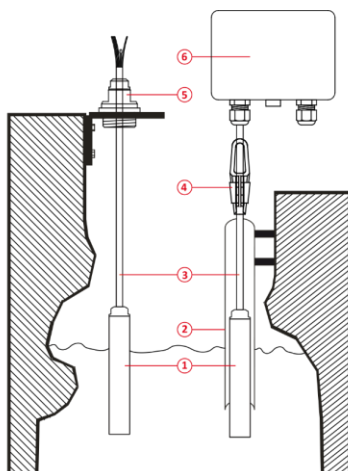


Figure 4.1 : grf00005_ins_hp4s

- 1 Level Sensor
- 2 Guide tube
- 3 Support cable (bending radius > 100 mm)
- 4 Tension clamp – see accessories
- 5 Mounting screw – see accessories
- 6 Field housing – see accessories

4.3 Installation instructions

Do not remove the packaging until immediately before installation, and inspect the device for any damage.

The transport protection cap attached to the process connection or the diaphragm must not be removed until immediately before installation. The transport protection cap must be removed. The diaphragm must not be damaged.

Contamination or damage to the pressure-compensating capillary can lead to incorrect measurement results.

If the cable is shortened, the filter on the pressure-compensating hose must be reattached.

**WARNING**

Install the device only when the system is depressurized. There is a risk of rapidly escaping measured media or a pressure surge.

**WARNING**

Allow the system to cool sufficiently before installation. There is a risk from escaping, hazardous, and hot measured media.

5 Electrical connection

5.1 Electronic output – Current 4...20 mA, FSK – [09-A]/[09-X]

5.1.1 Function

The digital communication protocol uses Frequency Shift Keying (FSK) technology and is superimposed on the 4...20 mA analog sensor signal. This enables two-way communication with the field and thus the transmission of additional information—beyond the standard process variables—to or from a smart field device.

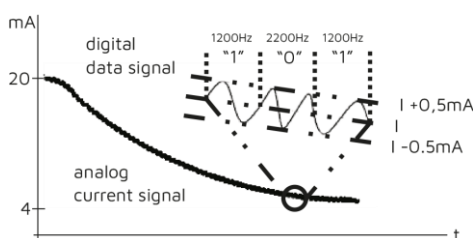


Figure 5.1 : grf00006_eac_fsk

The communication protocol operates at 1,200 bits/s without interrupting the 4...20 mA signal and enables the host application (master) to receive two or more digital updates per second from a smart field device. The digital signal does not interfere with the 4...20 mA signal.

The communication protocol provides two simultaneous communication channels: the analog 4–20 mA signal and a digital signal. The 4–20 mA signal transmits the primary measured value via the 4–20 mA current loop, the fastest and most reliable industry standard. The digital signal provides additional information from the device, including device status, diagnostic data, additional measured values, or calculated values, etc. The combination of these two principles in a single installation enables a cost-effective, exceptionally robust, and comprehensive field communication solution that is easy to use and configure.

5.1.2 Pin assignment

Current 4...20 mA, FSK, non-hazardous area – [10-0]

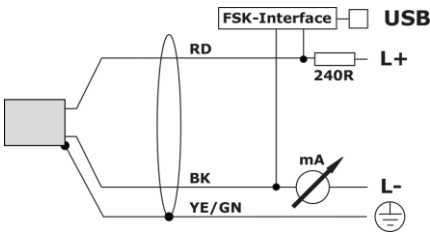


Figure 5.2: grf00007_eac_cab_2p_2w_ma_fsk

Current 4–20 mA, FSK, Pt100–3W, non-hazardous area – [10-1]

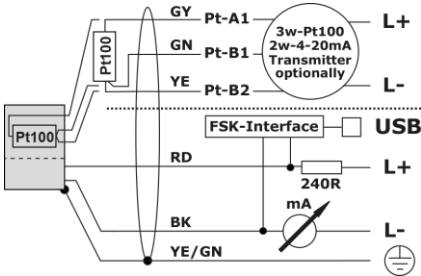


Figure 5.3: grf00019_eac_cab_5p_2w_ma_fsk_3w_pt_hp4

Current 4...20 mA, FSK, hazardous area

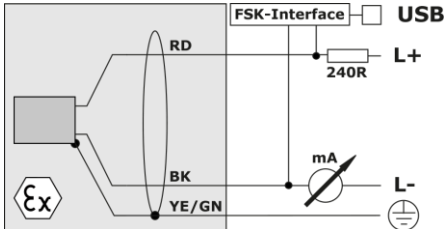


Figure 5.4: grf00009_eac_cab_2p_2w_ma_fsk_ex

Current 4–20 mA, hazardous area

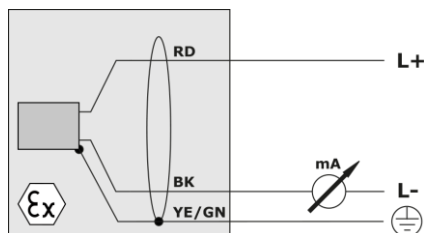


Figure 5.5 : grf00010_eac_cab_2p_2w_ma_ex

NOTE

Include a $240\ \Omega$ resistor in the +L line for connecting an FSK communication device.

5.1.3 Connection cable

Use a 2- or 5-conductor, twisted-pair, shielded cable.

Cable colors: RD = red / BK = black / GY = gray / GN = green / YE = yellow / YE/GN = yellow/green

5.1.4 Connection instructions



WARNING

Install the device only when it is de-energized.

NOTE

Switch off all connected control devices before commissioning.

Observe the maximum permissible supply voltage U_s at the L+/L- terminals:

- $U_s = 9...35\ \text{Vdc}$
- Example: $U_s = 9...30\ \text{Vdc}$

Observe the maximum permissible load resistance R_L of the analog output:

- $R_L \leq (U_s - 9\ \text{V}) / 22.2\ \text{mA}$

Ground the device, preferably via the metal housing, or alternatively via the cable shield.

Route the cable separately from power-carrying lines.

5.1.5 Analog output I_o

An analog current signal is output, which corresponds to the device's nominal measurement range:

- 4 – 20 mA Output signal range 3.9...20.5 mA

Behavior of the output current value when the output signal range is exceeded:

The output current is held at the end value of 3.9 mA / 20.5 mA

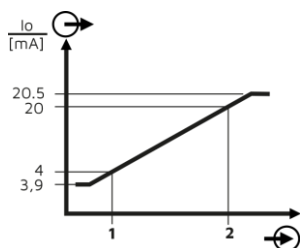


Figure 5.6: grf00181_fun_iout_4_20_hold_39_205

5.2 Electronic output – RS485 Modbus-RTU – [09-V]

5.2.1 Function

The Modbus protocol is a communication protocol based on a master/slave architecture.

All devices are connected via two data lines (A+ / B-) and a COMMON line (C/L-).

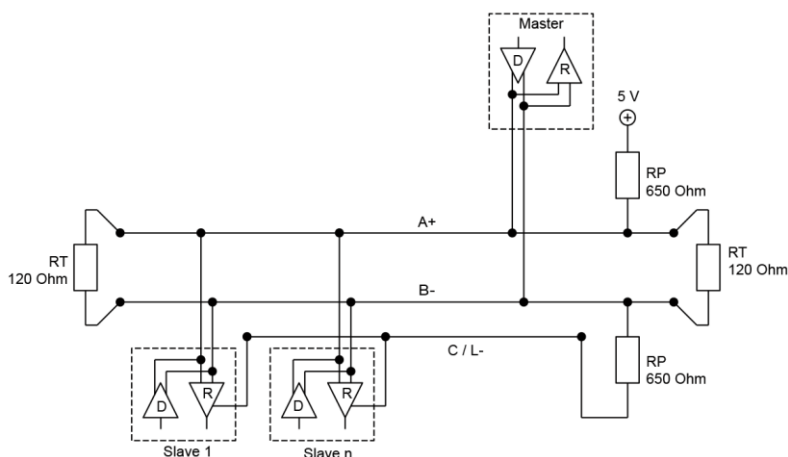


Figure 5.7 : grf00011_eac_modbus_line_termination

A standard RS485 allows for the connection of 32 slaves in a single segment. The device has a load of only 1/8 of the standard load ($R_{in} \geq 96 \text{ k}\Omega$), so that theoretically up to 256 of these devices can be operated in a network segment. However, the number is limited to 247 by the Modbus address space.

The two terminating resistors R_T prevent reflections on the data lines. The optimal resistance value depends on the characteristic impedance of the cable used; however, a value of 120 ohms is a common choice.

The polarization network is required to ensure appropriate potentials when none of the devices are transmitting and the A+ and B- lines are therefore undefined (high-impedance). The value of R_P depends, for example, on the bus load or the terminating resistors. Recommended values range from 450 ohms to 650 ohms.

The use of a bias network is recommended to maintain a stable network. Typically, the bias resistors are built into the master device or can be enabled as needed.

Arrange the devices in a bus topology (line). Avoid branch lines.

5.2.2 Pin assignment

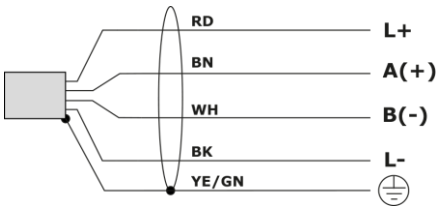


Figure 5.8 : grf00020_eac_cab_4p_4w_rs485_hp4

5.2.3 Connection Cable

Use a 4-wire cable in accordance with the EIA-485 recommendation:

Impedance	135...165 Ω @ 3...20 MHz
Cable capacitance	< 30 pF/m
Cable diameter	> 0.64 mm
Wire Cross-Section	0.34 mm ² / AWG 22
Loop resistance	< 110 Ω /km

Shielding	Braided shield / shielding foil
Cable length	38,400 baud ≤ 1,200 m

Cable colors RD = red / BN = brown / WH = white / BK = black / YE/GN = yellow/green

5.2.4 Connection Instructions



WARNING

Install the device only when it is de-energized.

NOTE

Switch off all connected control devices before commissioning.

Observe the maximum permissible supply voltage U_s at the L+/L- terminals:

- $U_s = 6...35 \text{ Vdc}$

Ground the device, preferably via the metallic process connection, or alternatively via the cable shield.

Route the cable separately from power-carrying lines; ground the cable shield.

6 Operation

6.1 Electronic output – Current 4...20 mA, FSK – [09-A]/[09-X]

Configuration and data transmission are performed via a standard FSK interface, e.g., isHRT USB and configuration software.

Use of the isHRT CommDTM or ICS Generic HART DTM is recommended.

Instructions for installing and using the FSK interface and operating software are not included in this manual.

NOTE

If the damping is set to 0 s...<1 s, communication is active for only 20 s after the supply voltage is turned on. Once a communication connection is established, it remains active. During this time, the damping is set to 1 s. After 4 minutes of inactivity, the connection is terminated and the damping is reset to the set value. When the damping is set to ≥ 1 s, a communication connection can be established at any time.

Factory settings [Setting range]

	Factory Setting	Description
Address	0 [0...15]	
Damping	1 s [0...60 s]	Time interval, dout = 100% din
Initial LRV value	Nominal lower setpoint = 4 mA	LRV < URV, din $\geq 25\%$
Final value URV	Nominal upper setpoint = 20 mA	LRV < URV, din $\geq 25\%$

6.2 Electronic output – RS485 Modbus-RTU – [09-V]

Operation is performed via the wired interface.

Information regarding installation and use of the interface and operating software is not included in this manual.

Parameters

The parameter file and description can be downloaded from the manufacturer's website. Setting ranges and default values are specified for all parameters.

7 Diagnostics and troubleshooting

The system operator is responsible for taking appropriate measures to resolve any malfunctions that occur.

In the event of a malfunction, check:

Component / Area	Check	Remedy
Housing	Damage	Replace or return the device
Pressure diaphragm	Contamination	Clean the device or send it in
	Damage	Replace or return the device
Process seals	Damage	Replace the process seal
		Use a different sealing material if necessary
Pressure-compensating capillary	Contamination	Send the device in for repair
Supply voltage	Operating voltage present	Turn on operating voltage
		Check or repair the connection terminals
	Operating voltage polarity reversed	Reverse the polarity of the operating voltage
	Operating voltage too low	Adjust or repair
	Operating voltage too high	Send the device in for repair
	Load resistance too high	Increase operating voltage
	Connection cable is damaged	Send the unit in for repair

If the malfunction cannot be resolved, please contact the manufacturer.

8 Maintenance

When used as intended, the device is maintenance-free.

Deposits adhering to the membrane or the conductivity measuring cell can cause incorrect readings. In this case, clean the membrane or the conductivity measuring cell regularly. Do not use sharp or hard tools, compressed air, or corrosive chemicals. Device removal: See the “Disassembly” section.

8.1 Calibration of the conductivity sensor

Calibration determines the cell constant of the conductivity sensor. The cell constant takes into account the geometric dimensions, materials, and design of the conductivity sensor, particularly the aging process of the electrodes. The recommended recalibration interval is 12 months; under difficult measurement conditions (deposits, abrasion, chemical influences), it is 4 to 6 months. The calibration procedure is performed in accordance with separate calibration instructions.

9 Repair

The device is not intended for repair by the user. Repairs may only be performed by the manufacturer.

9.1 Disassembly

Use appropriate protective clothing, e.g., safety goggles and gloves.



WARNING

Allow the device and system to cool sufficiently before disassembly. There is a risk from hot surfaces as well as leaking, hazardous, and hot measured media.



WARNING

Disassemble the device only when it is de-energized.



WARNING

Switch off all connected control units before disassembly.

After disassembly, the diaphragm must be fitted with a protective cap.

9.2 Returns

Returns can only be accepted if the device is accompanied by a decontamination declaration. The declaration is available for download on the website and must be fully completed and securely attached to the outside of the packaging to withstand weather and transport conditions.

9.3 Disposal

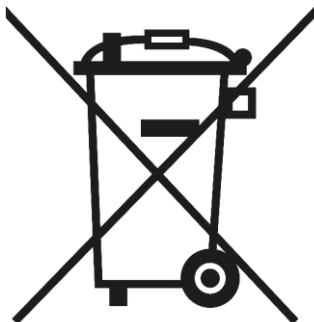


Figure 9.1 : sym00001_weee_can

In accordance with EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), the product is marked with the symbol shown to minimize the disposal of WEEE as unsorted household waste. These products must not be disposed of as unsorted household waste and can be returned to the manufacturer for disposal. Returns are subject to the manufacturer's general terms and conditions or individually agreed terms.

10 Technical data

Reference Conditions	Ta = +15...+25 °C (+59...+77 °F) / Pa = 860...1060 kPa / r.F. = 45...75 %
	Us = 24 Vdc ±0.1 V / ton = 240 s / vertical, sensor at the bottom
Measurement Deviation	EN/IEC 60770-1: Characteristic curve deviation – Setpoint adjustment
Response time	IEC 60751: Water / 0.4 m/s / temperature step 10 K

10.1 Inputs

10.1.1 Pressure/Level Input – [08-##]

Sensor Type	Capacitive cell					
Type code	[08-01]	[08-02]	[08-03]	[08-04]	[08-05]	[08-07]
Measuring range PN, rel. – FSI	0..0.1 bar	0..0.2 bar	0..0.4 bar	0..0.6 bar	0..1 bar	0..2 bar
Overload/burst pressure, rel	5 bar	5 bar	6 bar	10 bar	10 bar	15 bar
Type code	[08-08]	[08-09]	[08-10]	[08-12]		
Measuring Range PN, rel. – FSI	0..4 bar	0..6 bar	0..10 bar	0...20 bar		
Overload/burst pressure, rel	25 bar	40 bar	40 bar	40 bar		
Type code	[08-0A]	[08-0B]	[08-0C]	[08-0M]	[08-0D]	[08-0E]
Measurement Range PN, rel. – FSI	0..1 mH ₂ O	0..2 mH ₂ O	0..4 mH ₂ O	0..5 mH ₂ O	0..6 mH ₂ O	0..10 mH ₂ O

Overload/burst pressure, rel	5 bar	5 bar	6 bar	10 bar	10 bar	10 bar
Type code	[08-OF]	[08-OL]	[08-OG]	[08-OJ]	[08-OK]	[08-OH]
Measurement Range PN, rel. – FSI	0..20 mH ₂ O	0..25 mH ₂ O	0..40 mH ₂ O	0..50 mH ₂ O	0..60 mH ₂ O	0..100 mH ₂ O
Overload/burst pressure, rel	15 bar	25 bar	25 bar	40 bar	40 bar	40 bar
Resolution	FSI ≥ 16 bits					
Characteristic curve deviation	≤ ±0.05% FSI / ±0.1% FSI / ±0.2% FSI					
Effect of auxiliary power	≤ ±0.002% FSI/V					
Hysteresis	negligible					
Repeatability	negligible					
Temperature effect	Tk zero point ≤ ±0.015 %FSI/K, ≤ ±0.75 %FSI					
	Tk span ≤ ±0.015 %FSI/K, ≤ ±0.5 %FSI (≥0.4 bar/4 mH ₂ O)					
	Temperature effect on span ≤ ±0.8% FSI (<0.4 bar/4 mH ₂ O)					
Effect of mounting orientation	Measuring range < 1 bar: ≤ +0.2 mbar (orientation: vertical, sensor at the top)					
	Measuring range ≥ 1 bar: ≤ +0.1 mbar (orientation: vertical, sensor at the top)					
Long-term zero drift	≤ ±0.15% FSI/year					
Resolution	FSI ≥ 16 bits					

10.1.2 Temperature input – Pt100, 3-wire – [10-1]

Sensor Type	Pt100 resistance / Class B / 3-wire – IEC 60751
Measuring range – FSI	-20...+70 °C (-4.... +158 °F)
Time Response	t90 ≤ 60 s

Measurement error	$\leq \pm 0.3 \text{ K} + 0.005 * [T_p]$
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10.1.3 Temperature input – Pt1000 – $[10^{-3}]/[10^{-4}]$

Sensor Type	Resistance Pt1000 – IEC 60751
Measurement range – FSI	-20...+70 °C (-4... +158 °F)
Resolution	$\leq \pm 0.01 \text{ K}$ / FSI ≥ 16 bits
Characteristic Curve Deviation	$\leq \pm 0.2 \text{ K} + 0.005 * [T_p]$
Long-term drift	$\leq \pm 0.1 \text{ K/year}$

10.1.4 Conductivity input $[10^{-4}]$

Sensor type	Conductive 4-electrode cell
Measurement range – FSI	0...50 mS/cm
Resolution	$\leq 1 \mu\text{S/cm}$
Calibration deviation	$\leq \pm 1\%$ of measured value ($\geq \pm 1 \mu\text{S/cm}$)
Temperature compensation	-2 %/K / -5...+45 °C (+23...+113 °F)
Reference temperature	+25 °C

10.2 Outputs

10.2.1 Electronic output – current 4...20 mA, FSK – [09-A]/[09-X]

Interface – Cio	
Specifications	FSK / 1200 bits/s
Coupling resistance	$\geq 240 \Omega$, external
Analog Output – Io	
Signal range	4...20 mA = PV measurement range >> [08-##], limit value/error = 3.9...20.5 mA

Resolution	$\leq 1 \mu\text{A}$
Permissible load RL	$\leq (U_s - 9 \text{ V}) / 20.5 \text{ mA}$
Effect of auxiliary power	$\leq \pm 0.5 \mu\text{A/V}$
Temperature effect Ta	$\leq \pm 1 \mu\text{A/K}$
Auxiliary power	
Supply voltage Us	[09-A/X]/[03-S]: 4...20 mA: 9...35 Vdc, reverse-polarity protected / $\leq 2 \text{ Vpp}$
	[09-A/X]/[03-X/Z]: 4...20 mA Ex: 9...30 Vdc, reverse-polarity protected / $\leq 2 \text{ Vpp}$
Input current Is	$\leq 20.5 \text{ mA}$
Turn-on delay time	$\leq 0.1 \text{ s}$ (td = 0 s)

10.2.2 Electronic output – RS485 Modbus-RTU – [09-V]

Interface - Cio	
Specifications	RS485, bidirectional / Modbus-RTU / 9600 baud (4800...38400 baud)
Input resistance	112 Ω
Time Response	Pressure/level signal: $t_{90} \leq 2 \text{ ms}$ (td = 0 s)
	Temperature signal: $t_{90} \leq 60 \text{ s}$ (td = 0 s)
	Conductivity signal: $t_{90} \leq 2 \text{ s}$ (td = 0 s)
Power supply	
Supply voltage Us	6...35 Vdc, reverse-polarity protected / residual ripple $\leq 2 \text{ Vpp}$
Input current Is	$\leq 10 \text{ mA}$ (no load)
	$\leq 15 \text{ mA}$ (no load) >> [10-4] Temperature/Conductivity
Turn-on delay time	$\leq 0.1 \text{ s}$ (td = 0 s)
	$\leq 4 \text{ s}$ (td = 0 s) >> [10 ⁻⁴] Temperature/Conductivity

10.3 Environmental conditions

Process temperature T_p	-20...+70 °C (-4... +158 °F)
	[03-X/Z]: ATEX/IECEX: see certificate
Pressure cycles	≥ 100 million (1.2xPN)
Ambient temperature T_a	-20...+70 °C (-4... +158 °F)
	[03-X/Z]: ATEX/IECEX: see certificate
Protection class	IP68 [≤ 100 m/ ≤ 20 bar] (EN/IEC 60529)
Climate class	4K4H (EN/IEC 60721-3-4)
Impact resistance	50 g [11 ms] (EN/IEC 60068-2-27)
Vibration resistance	20 g [10...2000 Hz] (EN/IEC 60068-2-6)
EMC	Class B equipment / industrial environment (EN/IEC 61326)
Surge protection	Integrated surge protection (EN/IEC 61000-4-5)
[09-A]/[09-V]	Insulation voltage ≥ 50 Vdc / Rated discharge current 10 kA (8/20 μ s)
Protection class	III
Pollution degree	4
Operating altitude	2,000 m above sea level
MTTF	463.4 years
Weight	0.3 kg + (L1 $\times$ 0.068 kg/m)
	0.375 kg + (L1 $\times$ 0.068 kg/m) $\gg$ [10^{-4}] Temperature/Conductivity

10.4 Materials

In contact with the process	Ceramic Al ₂ O ₃ 99.9%
	Steel 1.4404/316L, Steel 1.4571/316Ti, Steel 1.4462/318LN (duplex)
	FKM/FPM, EPDM, PE, PUR, Epoxy
Support cable	Breaking strength of steel shield: ≥ 920 N
	Bending radius: ≥ 100 mm
	Strand cross-section: 0.22 mm ²
	Resistance: 90 ohms/km

11 Revision

Version	Changes
UMN07.26	Initial release

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