OPERATING MANUAL - BA06.25

Conducont LP4SL

Conductivity transmitter
with 4-pole-graphite electrodes and
temperature sensor

Index

1. About this document

1.1. Dokument function

These instructions for use describe the structure, functions and the use of the product and will help to operate the product as intended.

Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device.

The Operating manual is part of the device and must be kept always accessible nearest its installation location.

All statements within this document correspond to the information available at the time of printing. Subject to change without prior notice.

1.2. Terms

NOTE	Notes to prevent failures, malfunctions, damage to devices or plants.

WARNING	Non-observance of the information may result in serious or fatal personal injury.

[04-5]	Exemplary notice to a type variant (>> chapter Product description - Product code)

1.3. Other documents

Besides this document the following material can be found on the Internet at www.acs-controlsystem.com:

- EU Declaration of Conformity (current version)
- Manufacturer declarations
- Certificates
- Parameter lists
- 3D-CAD models

2. Safety instructions

2.1. Autorized personnel

Installation, electrical connection, commissioning, operation, maintenance, dismounting and disposal of the device must be made by a qualified and authorized expert according to the information's in the Operating manual and the relevant standards and rules.

This expert must have read and understood the Operating manual and especially the safety instructions. During work on and with the device, the required personal protective equipment must always be worn.

2.2. Appropriate use

The device is an electronic conductivity transmitter for monitoring, control and continuous measurement of conductivities and temperatures in liquids.

The operational reliability of the device is ensured only at the intended use. Inappropriate or incorrect use of this product can give risk to application specific hazards, e.g. vessel overflow through incorrect mounting or adjustment.
Damage to property and persons or environmental contamination can result. Also, the characteristics of the instrument can be impaired.

An inappropriately use, disregarding the Operating manual and the technical rules, using under-qualified personnel, making unauthorized alterations as well as damage of the device releases the manufacturer from liability for any resulting damage. This renders the manufacturer‘s warranty null and void.

2.3. Operational safety

The device is safely built and tested according to state-of-the-art technology. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument.
The device may only be used within the permitted operation limits. Every use besides these limits as agreed can lead to serious dangers.

The materials of the device must be checked for compatibility with the respective application requirements before use.
An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The sensors may not be used as sole device for prevention of dangerous conditions in machines and plants.

For safety and warranty reasons, any invasive work on the device beyond that described may be carried out only by personnel authorized by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by the manufacturer must be used.

The device meets the requirements of all relevant EU directives. This is confirmed by attaching the CE mark to the device.
The associated EU-Declaration of Conformity can be ordered or downloaded from the homepage.

3. Product description

3.1. Function

The device is an electronic conductivity transmitter for monitoring, control and continuous measurement of conductivities and temperatures in liquids.

The device is suitable for applications in virtually all industries for conductivity measurement, especially for fresh water, wastewater and salt water. The slim construction design allows the use especially at confined space conditions, e.g. at bore holes and wells with small diameter.

The high precise, long term stable and robust conductivity measuring cell, the stainless steel enclosure and the thick-walled, length stable extension cable with highly stressable steel core ensures reliable precise measuring values and allows the operation also at demanding environmental conditions, e.g. low temperatures, high shock and vibration loads or at problematic liquids.

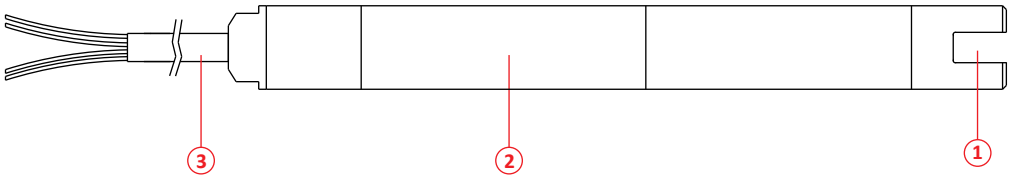
For measuring the conductivity, a 4-electrode-sensor is used, which ensures accurate and reliable temperature-compensated measurement over a wide conductivity range, even when dirty.

For measuring the temperature, an integrated long-term stable platinum temperature sensor is used. The measured temperature value can be read out at the version RS485 Modbus-RTU by the digital interface.

The parameterization and operation can be made by the integrated wired interface.

3.2. Construction

(1) Conductivity measuring cell with temperature sensor (2) Electronics housing (3) Carrying cable with steel core	



Conductivity measuring cell (1) with integrated platinum temperature sensor.

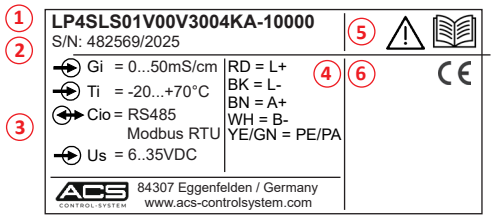
The fully cast signal processing electronics is located in the housing tube (2).

Longitudinal carrying cable (3) with steel core and shielding braid.

A laser marking of the product label on the housing tube (2) ensures the identifiability of the device throughout the entire lifetime.

3.3. Product label

The product label contains the most important data for identification and use of the instrument.

	(1) Product code (2) Serial number (3) Technical data supply / input (4) Electrical connection (5) Approvals (6) Safety notes

3.4. Product code

LP4 [01][02][03][04][05][06][07][08][09][10][11][12][13][14][15][80][94/95/98]

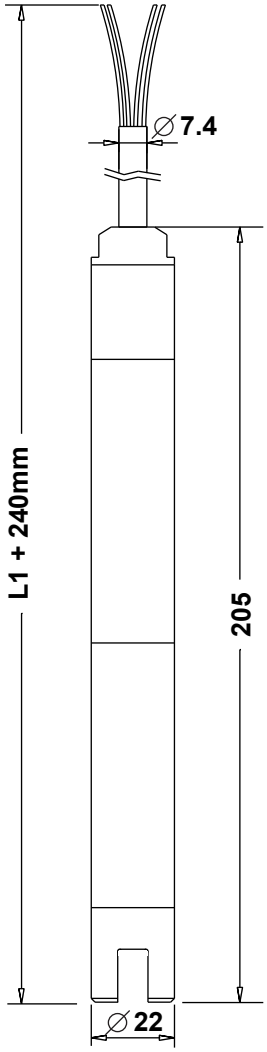
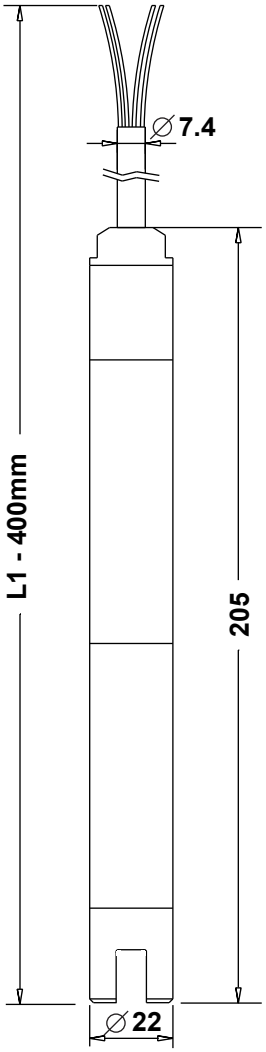
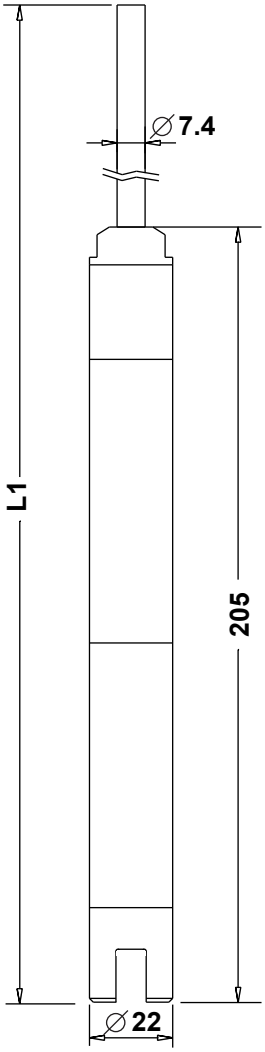
	Device	LP4	Conductivity sensor D22mm
01	Version	S	Standard
02	Sensor / material diaphragm	L	Potentiometric, 4-pin / graphite epoxy
03	Approval	S	Standard
04	Process connection	0	without
05	Material process seal	1	FKM/FPM
06	Material process connection	V	CrNi-steel
07	Terminal enclosure	0	without
08	Measuring range (PV)	0	1...50.000µS/cm
09	Electronic – Output	V	RS485 Modbus-RTU, 4- wire, over voltage protection
10	Electronic – Function	3	Temperature -20°C...+70°C (-4°F... +158°F)
11	Process temperature	0	-20°C...+70°C (-4°F... +158°F)
12		0	
13	Measuring accuracy (PV)	4	1% MW / 2µS/cm
14	Electrical connection	K	Cable, confection stranded wires
14		H	Cable, confection Hydrolog HLF4
14		0	Cable, without confection
15	Material extension cable	A	Cable sheath PE
15		B	Cable sheath PUR
80	Length L1	-###.###	mm (≤ 300.000mm)

94	Additional option	-SF	LABS-free, silicone-free / paint compatible version
95	Additional option	-ML	Measurement point designation / TAG – Laser marking
98	Additional option	-KF	Configuration / Preset

Differing versions are normally marked by the character Y at the product code.

3.5. Dimensions

Dimensions in mm

Electrical connection 14-K Confection stranded wires	Electrical connection 14-H Confection Hydrolog HLF4	Electrical connection 14-0 Without confection
		

3.6. Packaging, transport, storage

The device is protected by packaging. It can handle normal loads during transport. Transport must be carried out in due consideration of the notes on the transport packaging.
Nonobservance of these instructions can cause damage to the device.

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Up to the time of installation, the packages must be left closed and, unless otherwise indicated, must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration
- Storage and transport temperature -20...+85°C
- Relative humidity 20...85%

3.7. Accessories

For installation and electrical connection an extensive portfolio, that is optimally matched to the device is available:

- Monunting clamp
- Mounting screw
- Welding sockets
- Reduction adapter
- Gaskets
- Connection cables
- Confectionable connection jacks
- Field enclosure
- RS-485 interface converter

4. Installation

4.1. Ambient and process conditions

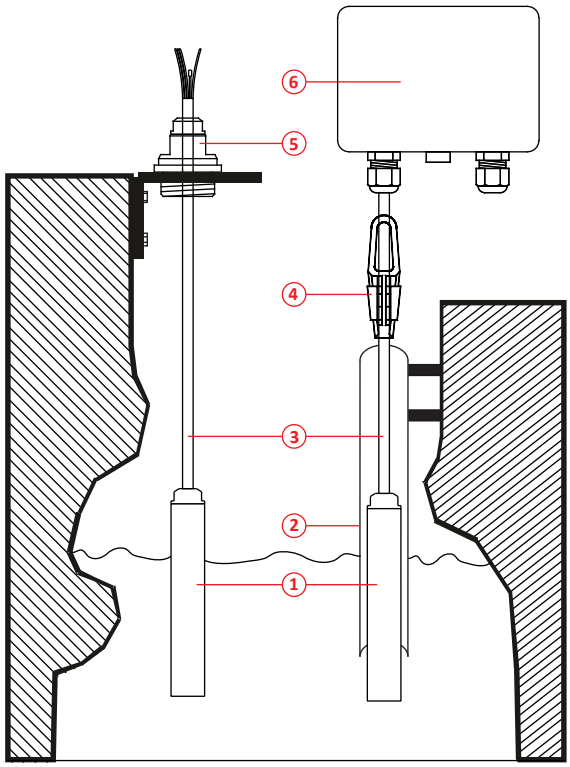
The correct function of the device within the specific technical data can only be guaranteed, if the permitted ambient and process conditions at the installation place (see chapter Technical Data) will not be exceeded. Hence make sure before mounting that all parts of the instrument exposed to the process (e.g. electrodes, process seal, enclosure, extension cable) are suitable for the existing process conditions (e.g. process pressure, process temperature, chemical properties of the medium, abrasion, mechanical influences).

4.2. Installation place

The device should be installed at a point free from flow and turbulence, or a guide tube should be used. The internal diameter of the guide tube should be at least 1 mm bigger than the outer diameter of the device.

The installation of the device should be made if possible at temperature calmed places. High process temperature steps can produce short-time higher measuring signal deviations.

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



① Conductivity sensor
② Guide tube
③ Carrying cable (Bending radius > 80mm)
④ Mounting clamp – see accessories
⑤ Mounting screw – see accessories
⑥ Field enclosure – see accessories

4.3. Installation notes

Do not remove packaging until just before mounting and check the device for any damage.

The transport protection cap, which is attached at the measurincell, must only be removed immediately before the installation. The transport protection cap must be removed. The measuring cell may not be damaged.

WARNING	Install the device only when the system is pressureless. There is a risk of fast escaping media resp. pressure blow.

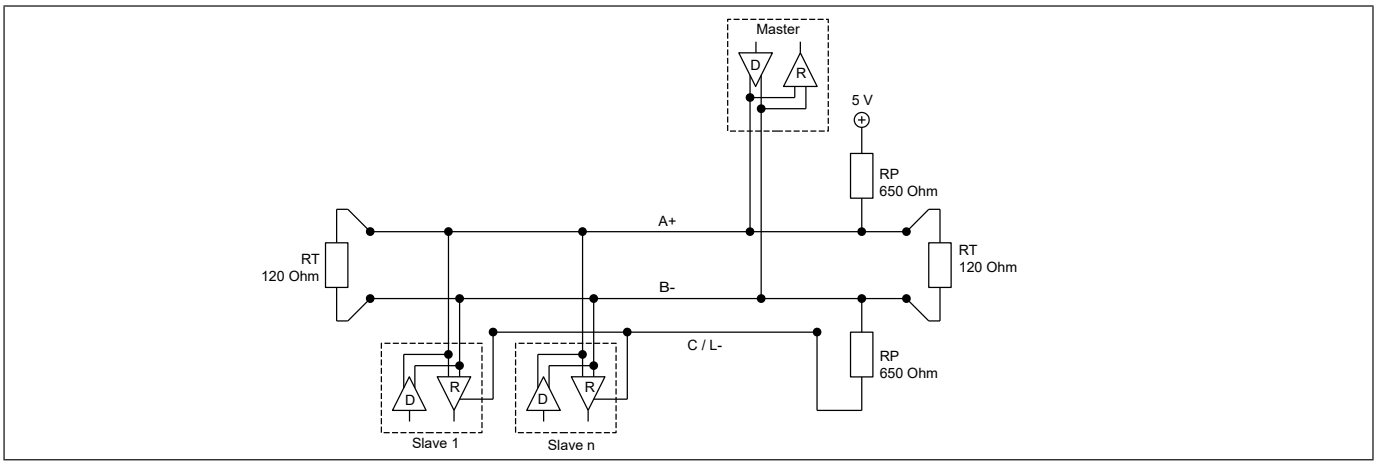
WARNING	Let the system cool down sufficiently before installing the device. There is a risk of dangerous and hot media escaping.

5. Electrical connection

5.1. Electronic output [09-V] – RS485 Modbus-RTU

5.1.1. Function

The Modbus protocol is a communication protocol, that base on a master/slave architecture.
All devices are connected by two data wires (A+ / B-) and by one COMMON-wire (C/L-).



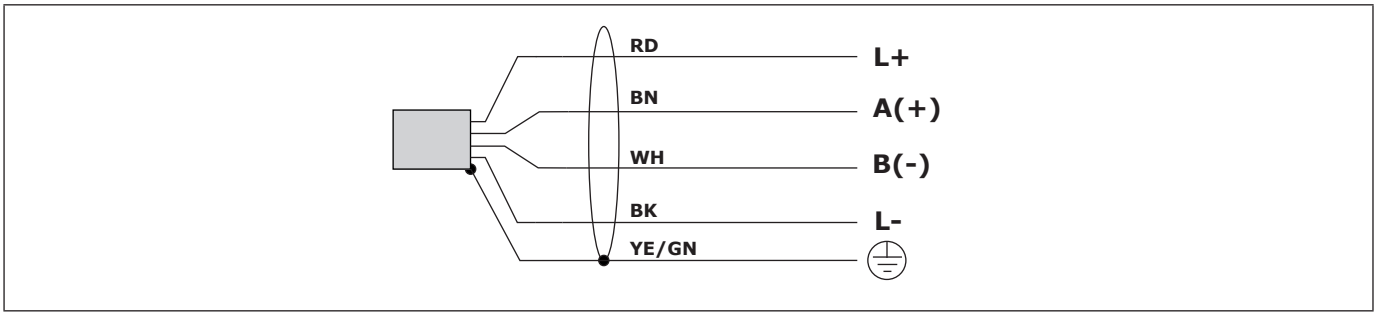
An original RS485 allows the connection of 32 slaves within one segment. The device has a load of only 1/8 of the standard load (Rin ≥ 96 kΩ), thus up to 256 of the devices can be theoretically operated within one network segment. However the number is limited to 247 due to the Modbus address space.

The both termination resistors RT prevent reflections on the data wires. The optimum resistor value depends on the wave impedance of the used cable, but a value of 120 Ohm is a popular choice.

The polarisation network is necessary, to ensure suitable potentials, if none of the devices transmits and thus the wires A+ and B- are undefined (high impedance). The value for RP depends e.g. on bus load or the termination resistors. Recommended values are between 450 Ohm and 650 Ohm.
The use of a polarisation network is recommended, to ensure a stable network. Usually the polarisation resistors are implemented within the master device or they are connectible.

Connect the device at bus topology (line). A stub line must be avoided.

5.1.2. Terminal assignment



5.1.3. Connection cable

Use a cable 4-core acc. to the EIA485 recommendations:

Impedance	135...165Ω @ 3...20Mhz
Cable capacity	< 30pF/m
Cable diameter	> 0,64mm
Cable cross section	0,34 mm2 / AWG 22
Loop resistance	< 110Ω/km
Shielding	Braided shield /shield foil
Cable length	38400 Baud ≤ 1200m

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

5.1.4. Connection notes

WARNICG	Install the device only in de-energized state.

NOTE	For start-up deactivate all connected control devices, to avoid unwanted control reactions.

Observe maximum permitted supply voltage Us at the terminals L+/L-:

- Us = 6...35VDC

The device must be grounded, preferred by the metallic process connection, alternatively by the cable shield.

Install cable separated from power leading cables, if existing connect shield to earth.

6. Operation

6.1. Electronic output [09-V] – RS485 Modbus-RTU

The operation of the device is made exclusively by the wired interface and the operating software.

Information's for installation und using the RS485 interface and operating software are not content of this manual.

Abbreviation	Description	Measurand
PV	Primary value	Conductivity, temperature compensated
SV	Second value	Temperature
TV	Third value	Conductivity, not compensated

Function code	Register type
03	Read Holding Register
04	Read Input Register
06	Write Single Register
16	Write Multiple Register

Device settings - Input Register

Address	Register name	Byte / Type	Default	Description
1000	Device Type	2 / UInt16 - r		
1001	Serial Number	4 / UInt32 - r		
1003	Calibration Date	2 / UInt16 - r		
1004	Hardware Version	2 / UInt16 - r		
1010	ReportedLimit_Upper PV	4 / Float – r		Max. valid measuring value conductivity
1012	ReportedLimit_Lower PV	4 / Float – r		Min. valid measuring value conductivity
1014	Maximum PV	4 / Float – r		Max. permissible measuring conductivity
1016	Miniumum PV	4 / Float – r		Min. permissible measuring conductivity
1018	ReportedLimit_Upper SV	4 / Float – r		Max. valid measuring value temperature
1020	ReportedLimit_Lower SV	4 / Float – r		Min. valid measuring value temperature
1022	Maximum SV	4 / Float – r		Max. permissible measuring value temperature
1024	Miniumum SV	4 / Float – r		Min. permissible measuring value temperature

Measuring values - Input Register

Address	Register name	Byte / Type	Default	Description
1100	Status	2 / UInt16 - r		Bit 0: 0 = meas. value conductivity is valid Bit 0: 1 = meas. value conductivity is invalid Bit 1: 0 = meas. value temperature is valid Bit 1: 1 = meas. value temperature is invalid Bit 2: 0 = meas. value conductivity n.c. is valid Bit 2: 1 = meas. value conductivity n.c. is invalid
1101	Unit PV	2 / UInt16 - r	[Unit]	Unit conductivity
1102	Measure Value PV	4 / Float – r		Measuring value conductivity
1104	Unit SV	2 / UInt16 – r	[Unit]	Unit temperature
1105	Measure Value SV	4 / Float - r		Measuring value temperature
1107	Unit TV	2 / UInt16 – r	[Unit]	Unit conductivity - not compensated
1108	Measure Value TV	4 / Float - r		Measuring value conductivity - not compensated

Device settings - Holding Register

Address	Register name	Byte / Type	Default	Description
2000	Address	2 / Uint16 - r/w	1	Modbus ID / 1 ... 247
2001	Baud-Rate	2 / Uint16 - r/w	3	0 = 1200 / 1 = 2400 / 2 = 4800 / 3 = 9600 4 = 19200 / 5 = 38400 / 6 = 57600 / 7 = 115200
2002	Parity	2 / Uint16 - r/w	2	0 = None / 1 = Odd / 2 = Even
2003	Stopbits	2 / Uint16 - r/w	0	0 = 1 Stop Bit / 1 = 2 Stop Bit
2004	Byte Order	2 / Uint16 - r/w	0	0 = ABCD / 1 = CDAB

Measurand - Holding Register

Address	Register name	Byte / Type	Default	Description
2020	Damping PV	2 / Uint16 - r/w	1000	Damping conductivity [ms] exponentially / value x 0,01s = 99,9% meas. value
2024	Unit PV	2 / UInt16 - r/w	[Unit]	Unit conductivity Code 66 = Unit mS/cm Code 67 = Unit µS/cm
2028	Offset PV	4 / Float32 - r/w	0.0	Offset conductivity
2021	Damping SV	2 / Uint16 - r/w	1000	Damping temperature [ms] exponentially / value x 0,01s = 99,9% meas. value
2025	Unit SV	2 / UInt16 – r/w	[Unit]	Unit temperature Code 32 = Unit °C Code 33 = Unit °F Code 34 = Unit R Code 35 = Unit K
2030	Offset SV	4 / Float32 - r/w	0.0	Offset temperature
2022	Damping TV	2 / Uint16 - r/w	1000	Damping conductivity - not compensated [ms] exponentially / value x 0,01s = 99,9% meas. value
2026	Unit TV	2 / UInt16 – r/w	[Unit]	Unit conductivity - not compensated Code 66 = Unit mS/cm Code 67 = Unit µS/cm
2032	Offset TV	4 / Float32 - r/w	0.0	Offset conductivity - not compensated

7. Error diagnosis and Troubleshooting

The operator of the system is responsible for taking suitable measures to rectify faults.

In case of malfunction check:

Component / area	Check	Rectification
Enclosure	Damage	Replace device resp. send in for repair
Conductivity measuring cell	Pollution	Clean device resp. send in for repair
	Damage	Replace device resp. send in for repair
Process seal	Damage	Replace process seal Use other seal material if necessary
Supply voltage	Operating voltage available	Switch-on resp. repair operating voltage
		Check terminals resp. repair
	Operating voltage reverse connected	Reverse operation voltage connection
	Operating voltage too low	Adapt resp. repair
	Operating voltage too high	Send in the device for repair
	Load resistance too high	Reduce resistance / Increase operating voltage
	Connection cable damaged	Send in device for repair

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

8. Maintenenance

At appropriate use, the device is free of maintenance.

Solid coatings on the conductivity measuring cell can lead to faulty measurement results. In this case the conductivity measuring cell must be regularly cleaned. Don't use sharp resp. hard tools, pressured air or aggressive chemicals. For dismounting the device see chapter "Dismounting".

8.1. Calibration conductivity sensor

The 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, especially the aging process of the electrodes. The recommended recalibration interval is 12 months; in difficult measuring point conditions (deposits, abrasion, chemical influences) 4 to 6 months. The calibration process is carried out in accordance with separate calibration instructions.

9. Repair

The device is not intended for repair by the user. A repair may only be carried out by the manufacturer.

9.1. Dismounting

Use suitable protective clothing, e.g. goggles, gloves.

WARNING	Let the device and the system cool down sufficiently fore dismounting it. There is a risk of hot surfaces as well as dangerous and hot media escaping.

WARNING	Install the device only in de-energized state.

NOTE	For start-up deactivate all connected control devices

After dismounting the diaphragm must be fitted with protective caps.

9.2. Return

Returns can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration is available at https://www.acs-controlsystem.com at the download area and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

9.3. Disposal

As required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), products of ACS are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Such products may not be disposed of as unsorted municipal waste and can be returned to ACS for disposal.
The return follows the conditions stipulated in the General Terms and Conditions or as individually agreed by ACS.

10. Technical Data

Reference conditions	Ta = +15°C..+25°C (+59°F..+77°F) / Pa = 860..1060kPa / r.h. = 45..75% ton = 240s / vertical, sensor downside
Messabweichung	EN/IEC 60770-1: Characteristic deviation – Limit value adjustment
Ansprechzeit	IEC 60751: water / 0,4 m/s / temperature step 10K

10.1. Inputs

10.1.1. Input conductivity

Sensor type	conductive 4-electrode-cell
Measuring range – FSI	≤ 1... ≥ 50.000µS/cm
Resolution	≤ 0,1% Measuring value (≥ ±0,2µS/cm)
Characteristic deviation	≤ ±1% Measuring value (≥ ±2µS/cm)
Temp. compensation	-2%/K / -20...+70°C (-4°F... +158F)
Reference temperature	+25°C
Influence auxiliary power	≤ ±0,002%FSI/V
Long term drift zero value	≤ ±0,15%FSI/year

10.1.2. Input temperature

Sensor type	Resistior Pt1000 – IEC 60751
Measuring range – FSI	-20...+70°C (-4°F... +158F)
Resolution	≤ ±0,01K / FSI ≥ 16 Bit
Characteristic deviation	≤ ±0,2K + 0,005 * [Tp]
Influence auxiliary power	≤ ±0,002%FSI/V
Long term drift	≤ ±0,1K/year

10.2. Ausgänge

10.2.1. Electronic output [09-V] – RS485 Modbus-RTU

Interface - Cio	
Specification	RS485, bidirectional / Modbus-RTU / 9600 Baud (4800...38400 Baud)
Input resistance	112Ω
Time behaviour	Signal conductivity: t90 ≤ 2s (td = 0s)
	Signal temperature: t90 ≤ 60s (td = 0s)
Auxiliary power	
Supply voltage Us	6...35VDC reverse polarity protected / Ripple voltage ≤ 2Vpp
Input current Is	≤ 15mA (without load)
Ready delay time	≤ 4s (td = 0s)

10.3. Environmental conditions

Process temperature Tp	-20...+70°C (-4°F... +158F)
Process pressure	≤ 5bar
Ambient temperature Ta	-20...+70°C (-4°F... +158°F)
Protection level	IP68 [≤50m/≤5bar] (EN/IEC 60529)
Climatic classification	4K4H (EN/IEC 60721-3-4)
Shock classification	50g [11ms] (EN/IEC 60068-2-27)
Vibration classification	20g [10...2000 Hz] (EN/IEC 60068-2-6)
EM compatibility	Operation device class B / Industrial range (EN/IEC 61326)
Overvoltage protection	Integrated overvoltage protection (EN/IEC 61000-4-5)
	Isolation voltage ≥ 50VDC / Rated leakage current 10kA (8/20µs)
Protection class	III
Pollution degree	4

Altitude above sea level	2000m above NN
MTTF	463,4 years
Weight	0,25kg + (L1 x 0,068kg/m)

10.4. Materials

process wetted	Graphite, Epoxyd Steel 1.4404/316L FKM/FPM, PE, PUR
Carrying cable	Breaking force steel core > 920N Bending radius > 80mm Cross-section strands 0,22mm2 Resistance 90Ohm/km

11. Revision

Version	**Changes**
BA06.25	Original version

CONTROL-SYSTEM

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