

PumpMeter

Installation/Operating Manual



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Installation/Operating Manual PumpMeter

Original operating manual

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series, the main operating data and the serial number. The serial number uniquely describes the product and is used as identification in all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.3 Other applicable documents


Table 1: Overview of other applicable documents

Document	Contents
Operating manual(s) for the pump(s)	Proper and safe use of the pump in all phases of operation
Operating manual for the PumpDrive (optional)	Proper and safe use of the pump with PumpDrive in all phases of operation

For accessories and/or integrated machinery components, observe the relevant manufacturer's product literature.



1.4 Symbols





Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇨	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.

Symbol	Description
	<p>CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.</p>
	<p>General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.</p>
	<p>Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.</p>
	<p>Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.</p>



2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
 - Markings for connections
 - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- The values specified in the technical product literature for the mains voltage and ambient temperature must not be exceeded. The device must only be operated in accordance with the instructions provided in the operating manual and other applicable documents.

2.3 Personnel qualification and personnel training

All personnel involved must be fully qualified to install, operate, maintain and inspect the equipment this manual refers to. The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the device must always be supervised by specialist technical personnel.

2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
 - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
 - Failure of important product functions
 - Failure of prescribed maintenance and servicing practices
 - Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Software changes

The software has been specially created for this product and thoroughly tested.

Making changes or additions to the software or parts of the software is prohibited.

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

	NOTE
	<p>To check that the pump with PumpMeter has been transported correctly, a tilting or impact indicator can be fitted to the pump packaging as an option. If this indicator has tripped, do not accept the delivery as it might have been damaged during transport.</p>

3.2 Transport

	CAUTION
	<p>Improper transport Damage to the device!</p> <ul style="list-style-type: none"> ▷ Observe the transport instructions for the pump unit/pump set and PumpDrive (optional). ▷ Always transport the pump unit/pump set, PumpDrive (optional) and device correctly. ▷ The device, pressure sensors and the connected cables must not be jammed, crushed or subjected to mechanical loads. ▷ Remove the device and sensors if required (⇒ Section 5.5, Page 25) . ▷ For transport observe the transport instructions on the original packaging.

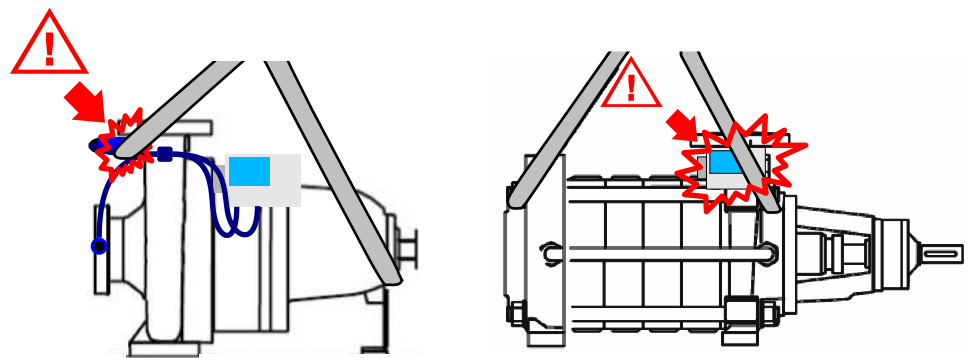


Fig. 1: Incorrect transport of device and pump

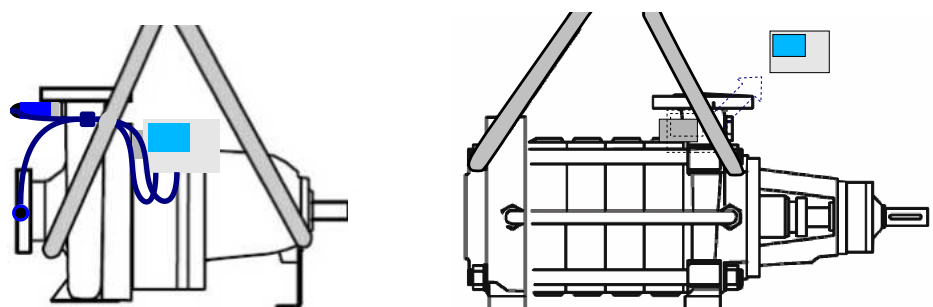


Fig. 2: Correct transport of device and pump

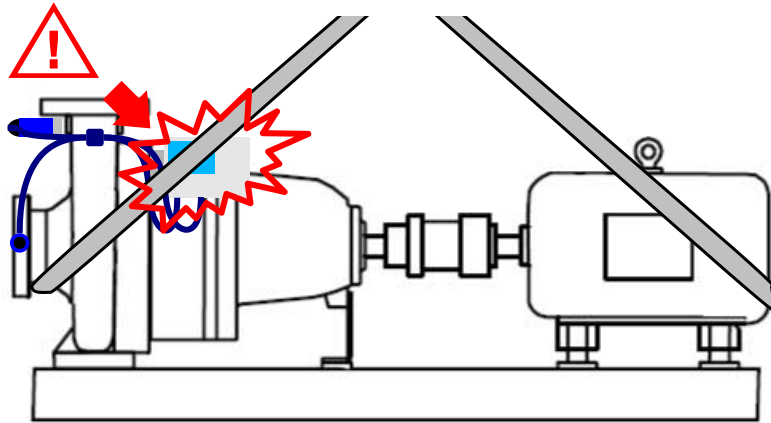


Fig. 3: Incorrect transport of device and pump set

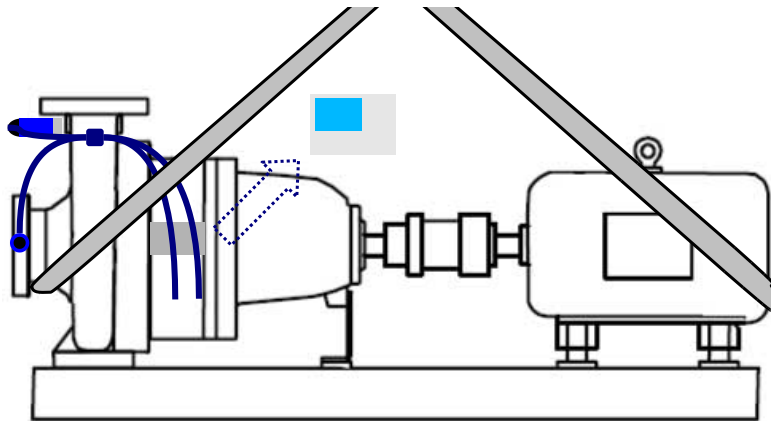


Fig. 4: Correct transport of device and pump set

1. Remove the device if required (⇒ Section 5.5, Page 25) .

3.3 Storage

If the ambient conditions for storage are met, the function of the device will be ensured even after a prolonged period of storage.


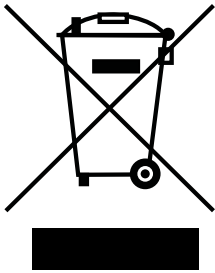
	CAUTION
	<p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the device!</p> <p>▷ For outdoor storage cover the (packed or unpacked) device and accessories with water-proof material.</p>

Table 4: Ambient conditions for storage

Ambient condition	Value
Relative humidity	85 % max. (non-condensing)
Ambient temperature	-30 °C to +60 °C

1. Store the device in dry conditions and in its original packaging.
2. Store the device in a dry room in which the atmospheric humidity is maintained at a constant level (as far as this is possible).
3. Prevent excessive fluctuations in atmospheric humidity.


3.4 Disposal



Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

	<p>NOTE</p> <p>Due to certain components it contains, the device is classified as special waste and meets RoHs 2011/65/EC requirements.</p> <p>Once decommissioned, the device must be properly disposed of in accordance with local regulations.</p>
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4 Description

4.1 General description

The device is an intelligent pressure transmitter for KSB's centrifugal pumps.

The following information is provided by the device:

- Display of suction pressure, discharge pressure, as well as either head or differential pressure
- Qualitative indication of the pump's current operating point
- Load profile for the pump
- Output of the flow rate, the discharge pressure or differential pressure via a 4–20 mA analog output or via an RS485 serial interface, Modbus RTU

4.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see <http://www.ksb.com/reach>.

4.3 Name plate

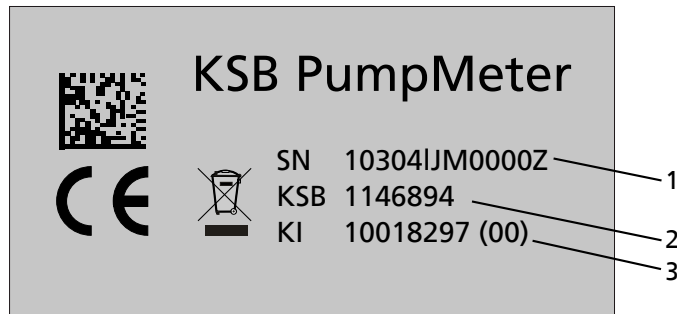


Fig. 5: Name plate (example)


1	Serial number	2	KSB ident. number
3	Hardware revision number		

4.4 Operating conditions


	<p>CAUTION</p> <p>Improper handling Damage to property!</p> <ul style="list-style-type: none"> ▸ Only use the device with solids-free fluids handled which are not liable to stick, encrust, solidify, crystallise or polymerise.
	<p>NOTE</p> <p>Do not operate the device in potentially explosive atmospheres.</p>

- Enclosure IP65 (complete device) if the sensors are connected correctly, the service interface is closed and the external connection is connected.
- Sensors of highest chemical resistance (seal-less; stainless steel)
- Permissible in-service ambient temperature: -10 °C to + 60 °C

- Permissible fluid temperature -30 °C to 140 °C (fluid handled must not solidify inside the sensor.)
- Resistant to oil mist and alkaline industrial cleaning agents
- Free from paint-wetting impairment substances (silicone-free)

	NOTE
	<p>If the device is used for a twin pump (Etaline-Z) the operating point is only displayed correctly if only one of the two pumps is in operation. If both pumps are in operation at the same time, the operating point cannot be determined correctly.</p>

Leak test

	CAUTION
	<p>Improper handling Damage to property!</p> <ul style="list-style-type: none"> ▷ If differential pressure transmitters are installed make sure that the test pressure for the leak test does not exceed the pressure sensors' PN (sensor measuring range -1...3 bar to -1...40 bar = PN 40 bar; -1...65 bar and -1...80 bar = PN 100 bar). ▷ For testing the device at higher pressures, remove the pressure sensors and threaded adapters and replace them with screw plugs.

4.5 Fluids handled

	DANGER
	<p>Leakage caused by chemically or mechanically affected material</p> <p>Hot and/or toxic fluid may escape! Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Only use the equipment for fluids which are neither chemically nor mechanically aggressive to the equipment materials. ▷ Only use the equipment for the fluids indicated in the operating manual or the data sheet, or consult KSB.

Table 5: Overview of fluids handled

Fluid handled	Concentration	Max. temperature	Fluid handled	Concentration	Max. temperature
	[%]	[°C]		[%]	[°C]
Alum, acid-free	3	80	Water-oil emulsion (95 % / 5 %), free of solids	–	80
Alkaline solution, bottle rinsing, max. 2 % sodium hydroxide	–	40	Propanol	–	80
Alcohol	–	–	Cleaning agents	–	–
Aluminium sulphate, acid-free	5	60	Fuel	–	–
Ammonium bicarbonate	10	40	Water	–	–
Ammonium sulphate	20	60	Deionised water (fully desalinated)	–	140
Anolyte (dialyte) with acetic acid or formic acid, free of solids	–	30	Dealkalised water	–	120
Accelerator (as preparation)	–	–	Decarbonised water	–	120
Drilling/grinding emulsion	–	60	Fire-fighting water ¹⁾	–	60
Spirits (40 % ethanol)	–	60	River water	–	60
Service water	–	60	Heating water ²⁾	–	140
Brewery applications	–	–	Boiler feed water to VdTÜV1466	–	140
Brewing water	–	60	Cooling water ¹⁾ (without antifreeze)	–	60
Ice water (brewery)	–	60	Closed circuit cooling water	–	100
Vapour condensate (brewery)	–	140	Open circuit cooling water	–	100
Butanol	–	60	Cooling water pH > 7.5 (with antifreeze) ³⁾	–	110
Calcium acetate, acid-free	10	60	Slightly contaminated water ¹⁾	–	60
Calcium nitrate, acid-free	10	60	Tap water	–	60
Diethylene glycol	–	100	Seawater	–	60 ⁴⁾
Aqueous dipping paint for electrochemical coating, anodic E-coating (anaphoresis)	–		Pure water ⁵⁾	–	60

1 General criteria for results of water analysis: pH ≥ 7; chloride content (Cl) ≤ 250 mg/kg. Chlorine (Cl 2) ≤ 0.6 mg/kg

2 Treatment to VdTÜV 1466; additional requirement: O₂ ≤ 0.02 mg/l

3 Antifreeze on ethylene glycol basis with inhibitors. Content: > 20 % to 50 % (e.g. Antifrogen N)

4 Can only be used in combination with suitably certified sensors made of titanium.

5 No ultra-pure water: conductivity at 25 °C: < 800 µS/cm, neutral with regard to chemical corrosion

Fluid handled	Concentration	Max. temperature	Fluid handled	Concentration	Max. temperature
	[%]	[°C]		[%]	[°C]
Aqueous dipping paint for electrochemical coating, cathodic E-coating (cataphoresis)	–	35	Raw water ¹⁾	–	60
Ethanol	–	35	Swimming pool water (fresh water) ¹⁾	–	60
Ethylene glycol	–	60	Lake water (fresh water)	–	60
Ethylene glycol base antifreeze, inhibited, closed system	50	100	Barrier fluid	–	70
Glycerine	40	110	Fresh water	–	60
Potassium hydroxide	5	80	Sulphuric acid ⁴⁾	5	60
Potassium nitrate, acid-free	5	40	Dam water	–	60
Potassium sulphate, acid-free	3	30	Partly desalinated water	–	120
Jet fuel	–	20	Drinking water ¹⁾	–	60
Condensate ²⁾	–	80	Permeate (osmosis)	–	140
Condensate, not conditioned	–	120	Fully desalinated water, free of solids	–	60
Copper sulphate	5	120	Fully desalinated water	–	120
Magnesium sulphate	10	80	Hot water (brewery)	–	60
Sodium carbonate	6	80	Water treated to VdTÜV1466	–	140
Sodium hydroxide	5	60	Water with antifreeze, pH > 7.5 ¹⁾³⁾	–	110
Sodium nitrate, acid-free	10	40	Water, waste water, slightly contaminated water, surface water	–	60
Sodium sulphate, acid-free	5	60	Water, fire-fighting water	–	60
Sodium hydroxide	15-20	60	Water, surface water	–	60
Diesel oil	–	20	Water, rainwater, with strainer	–	60
Diesel oil, extra light fuel oil	–	80	Water, raw water	–	60
Lubricating oil, turbine oil, does not apply to SF-D oils (hardly flammable)	–	60	Water, drinking water	–	60
Fuel oil	–	80	Lyes for bottle rinsers	–	90

5 Installation at Site

5.1 Safety regulations

	<p>WARNING</p> <p>Pressure sensors take on the same temperature as the fluid handled Risk of burns!</p> <ul style="list-style-type: none"> ▷ Fit protective devices, if required.
	<p>WARNING</p> <p>Mechanical loads acting on the connections between pumps and sensors Fluid could spurt out! Burns, scalding!</p> <ul style="list-style-type: none"> ▷ Never subject the connections between pumps and sensors to mechanical loads. ▷ Verify proper installation of sensors.
	<p>NOTE</p> <p>Comply with the safety instructions of the respective pump.</p>

5.2 Checks to be carried out prior to installation

	<p>NOTE</p> <p>The device is pre-fitted to the pump. The installation conditions of the pump must be complied with. The device is pre-set for a specific pump and must not be interchanged with any other devices. Contact the manufacturer if the device is to be used under conditions other than those stated above.</p>
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5.3 Electrical connection

The electrical connection of the device is effected via the "EXT" port at the device.
 (⇒ Section 5.4, Page 23)

1. Use a KSB connection cable or another 5-pole connection cable with an M12x1 connector.

The pin assignments and typical connection variants are described as follows.

	<p>CAUTION</p> <p>Improper handling Damage as a result of incorrect signals!</p> <ul style="list-style-type: none"> ▷ Only operate the device with the pump it is pre-set for.
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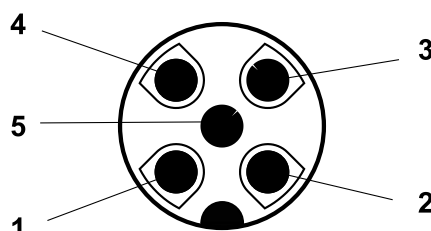


Fig. 6: Assignment of the external "EXT" port (bottom of the display unit)


Table 6: Assignment of the external (EXT) port

Pin	Function	Conductor colours ⁶⁾
1,3	Supply (+24 V DC \pm 15 %, minimum 150 mA)	Pin 1 = brown Pin 3 = blue
2	Analog output (4...20 mA) or RS485 B/D+ (not electrically isolated)	Pin 2 = white
4	Ground (GND)	Pin 4 = black
5	Analog input for motor control frequency (0...10 V corresponds to 0 f_{max}) or RS485 A/ D- (not electrically isolated)	Pin 5 = grey

The analog output can be parameterised to the following functions using the KSB Service Tool, irrespective of the electrical connection:

- As connected (default)
- Discharge pressure output
- Differential pressure
- Flow rate Q

For more information refer to the Service Tool manual.

NOTE	
	<p>The device automatically recognises whether the signal is transmitted as analog signal (4...20 mA) or digital signal via a Modbus RTU interface. This initialisation process starts as soon as the device is switched on. The initialisation process takes a maximum of 15 seconds. If there has not been any communication between a connected Modbus master and the device within this initialisation period, the device will automatically switch to analog transmission.</p>

5.3.1 Connecting the control unit with discharge pressure sensor function

In this operating mode, the information displayed alternates between:

- Suction pressure
- Discharge pressure
- Head

The discharge pressure of the pump is transmitted via the analog output and displayed using the following scale.

Table 7: Scale of the analog output for discharge pressure sensor function (unless otherwise specified)

Label colour of discharge-side sensor	Colour code of discharge-side sensor	Measuring range of discharge-side sensor [bar]		Scale of the analog output (factory setting) [bar]	
		Min.	Max.	4 mA	20 mA
-	Red	-1	3	0	3
-	Blue	-1	10	0	10
-	Blue ⁷⁾	-1	10	0	10
-	Light grey	-1	16	0	16
-	Light grey ⁷⁾	-1	16	0	16
-	Green	-1	25	0	25

⁶⁾ These conductor colours only apply to the cables supplied by KSB.

⁷⁾ Can only be used in combination with suitably certified sensors made of titanium.

Label colour of discharge-side sensor	Colour code of discharge-side sensor	Measuring range of discharge-side sensor [bar]		Scale of the analog output (factory setting) [bar]	
		Min.	Max.	4 mA	20 mA
-	Black	-1	40	0	40
Silver	-	-1	65	0	65
Yellow	-	-1	80	0	80

	NOTE
	Pin assignment (⇒ Section 5.3, Page 15)

Fixed speed operation of the pump

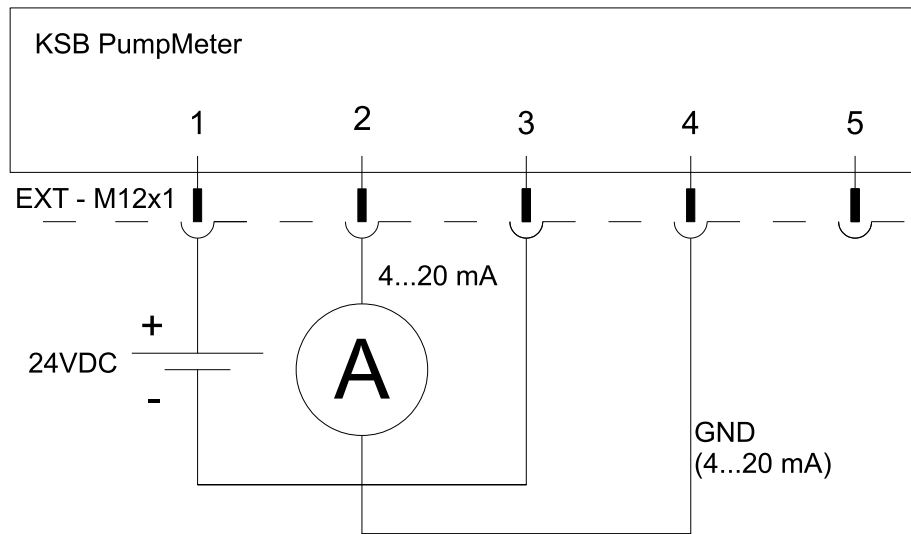


Fig. 7: Connection as discharge pressure sensor for fixed speed operation of the pump

Variable speed operation of the pump

	NOTE
	For variable speed operation of the pump the output frequency of the frequency inverter or the pump speed must be transmitted from the frequency inverter to PumpMeter. Transmission can be effected by an analog signal or via Modbus RTU. Without this transmission the flow rate will not be determined correctly.

	NOTE
	Observe the original operating manual of the speed control system.

4072.8/10-EN

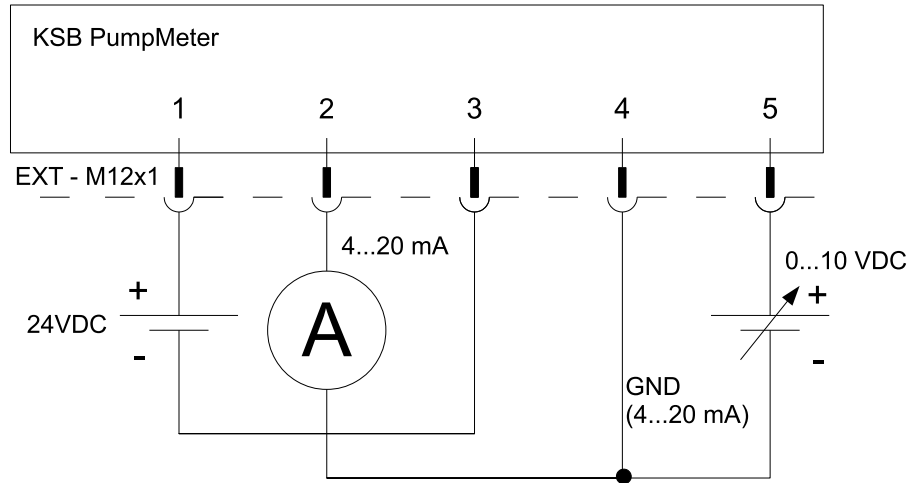


Fig. 8: Connection as discharge pressure sensor for variable speed operation of the pump

Pump operation with PumpDrive

NOTE

Observe the original operating manual of the PumpDrive.

PumpDrive 1

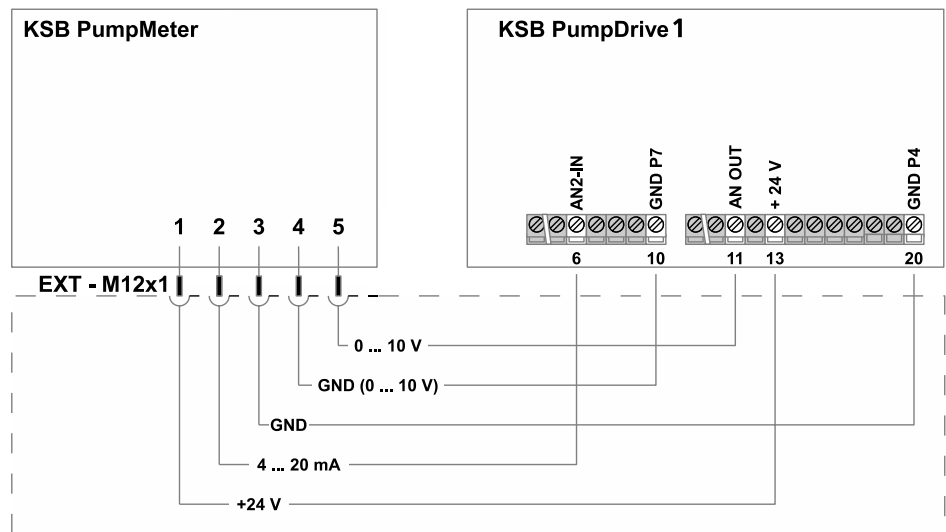


Fig. 9: Connection via analog signal as discharge pressure sensor for pump operation with PumpDrive 1

PumpDrive 2

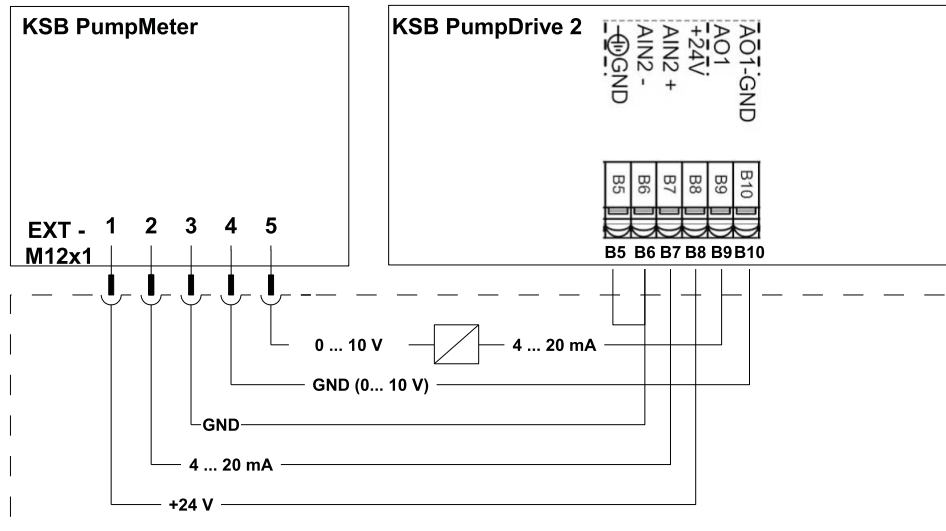


Fig. 10: Connection via analog signal as discharge pressure sensor for pump operation with PumpDrive 2

5.3.2 Connecting the control unit with differential pressure sensor function

In this operating mode, the information displayed alternates between:

- Suction pressure
- Discharge pressure
- Differential pressure

The differential pressure of the pump is transmitted via the analog output and displayed using the following scale.

Table 8: Scale of the analog output for differential pressure sensor function (unless otherwise specified)

Label colour of discharge-side sensor	Colour code of discharge-side sensor	Measuring range of discharge-side sensor [bar]		Scale of the analog output (factory setting) [bar]	
		Min.	Max.	4 mA	20 mA
-	Red	-1	3	0	3
-	Blue	-1	10	0	10
-	Blue ⁸⁾	-1	10	0	10
-	Light grey	-1	16	0	16
-	Light grey ⁸⁾	-1	16	0	16
-	Green	-1	25	0	25
-	Black	-1	40	0	40
Silver	-	-1	65	0	65
Yellow	-	-1	80	0	80

	NOTE
	Pin assignment (⇒ Section 5.3, Page 15)

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⁸⁾ Can only be used in combination with suitably certified sensors made of titanium.

Fixed speed operation of the pump

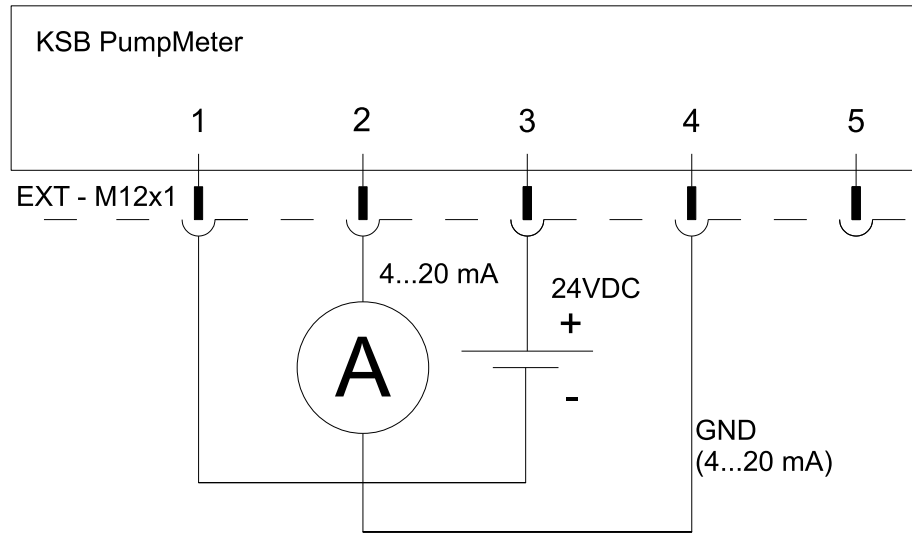


Fig. 11: Connection as differential pressure sensor for fixed speed operation of the pump

Variable speed operation of the pump

	NOTE
	<p>For variable speed operation of the pump the output frequency of the frequency inverter or the pump speed must be transmitted from the frequency inverter to PumpMeter. Transmission can be effected by an analog signal or via Modbus RTU. Without this transmission the flow rate will not be determined correctly.</p>
	NOTE
	<p>Observe the original operating manual of the speed control system.</p>

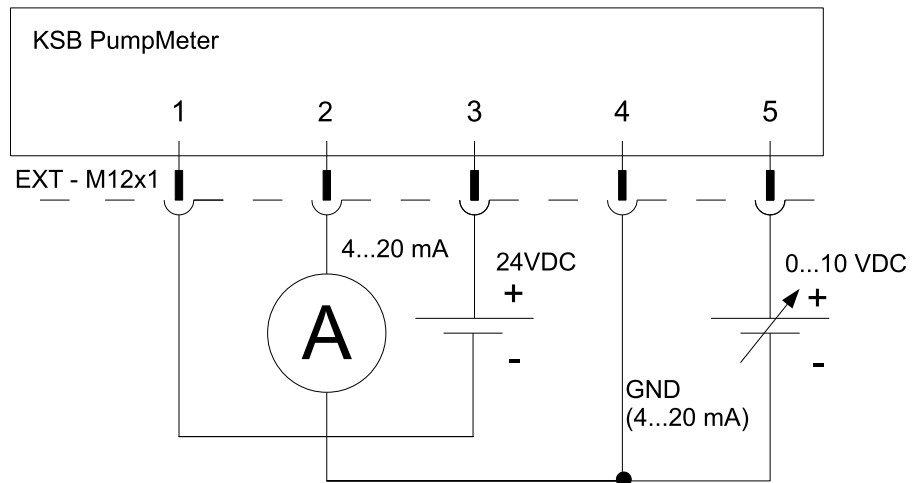



Fig. 12: Connection as differential pressure sensor for variable speed operation of the pump

4072.8/10-EN

Pump operation with PumpDrive

	NOTE
	Observe the original operating manual of the PumpDrive.

PumpDrive 1

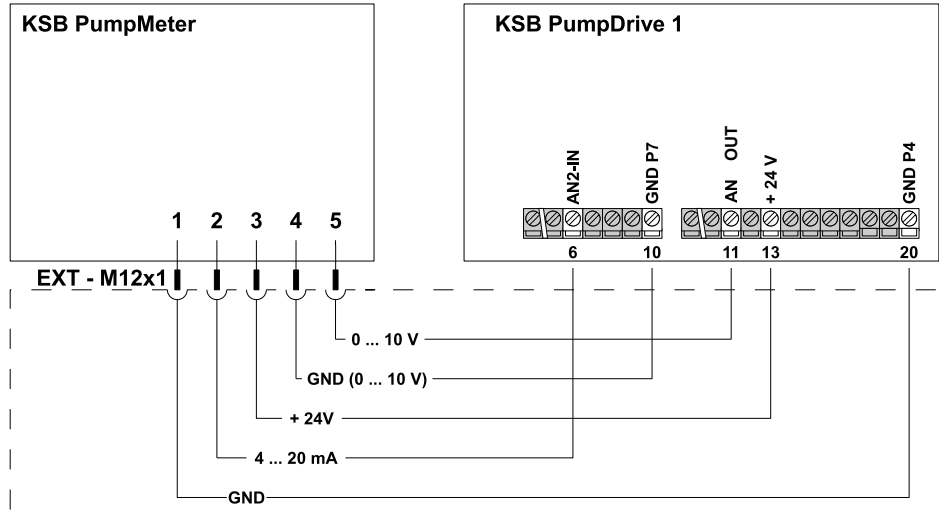


Fig. 13: Connection as differential pressure sensor via analog signal for pump operation with PumpDrive 1

PumpDrive 2

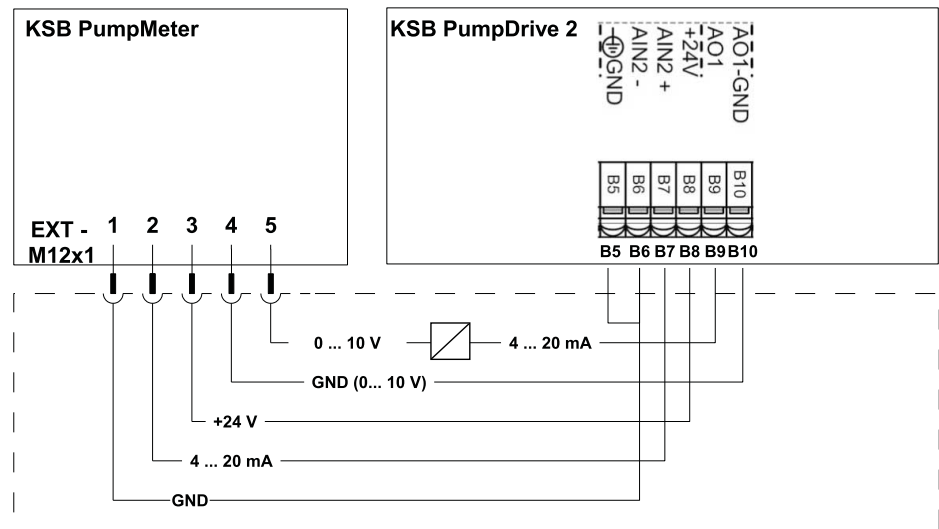



Fig. 14: Connection as differential pressure sensor via analog signal for pump operation with PumpDrive 2

5.3.3 Connecting the control unit to the power supply and Modbus RTU

	NOTE
	Pin assignment (⇒ Section 5.3, Page 15)

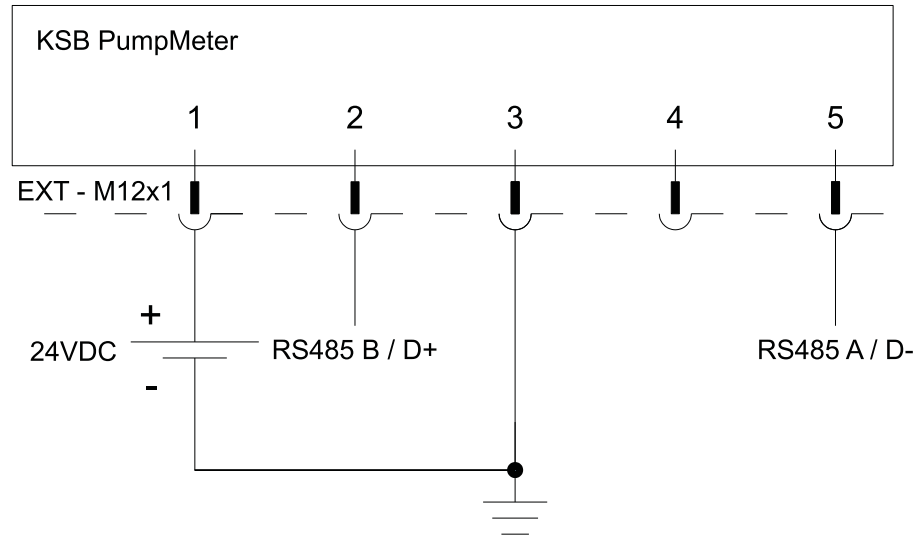


Fig. 15: Connecting the control unit to the power supply and Modbus RTU module

	NOTE
	<p>For variable speed operation of the pump the output frequency of the frequency inverter or the pump speed must be transmitted from the frequency inverter to PumpMeter. Transmission can be effected by an analog signal or via Modbus RTU. Without this transmission the flow rate will not be determined correctly.</p>

PumpDrive 2 Connecting PumpMeter to the M12 module

The M12 module of PumpDrive 2 enables PumpMeter to be connected via Modbus.

Connecting PumpMeter in single-pump configurations

Use a pre-configured cable (see PumpDrive 2).

	NOTE
	<p>Connect PumpMeter (Modbus) to the M12 module, input A.</p>

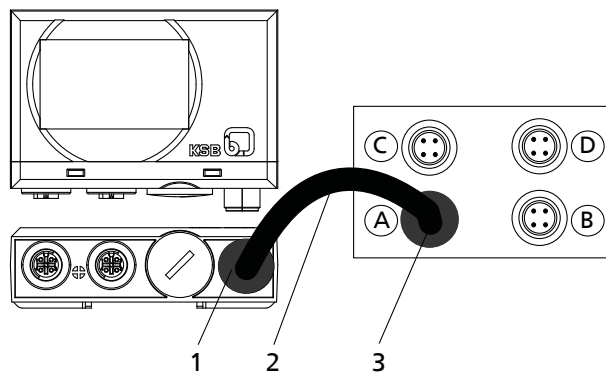


Fig. 16: Connecting PumpMeter to the M12 module in single-pump configurations

1	PumpMeter: Modbus connection
2	Pre-configured bus cable for connecting PumpMeter to M12 module (colour: black, socket: straight, connector: angled)
3	M12 module: Connection for PumpMeter (Modbus)

Connecting PumpMeter in dual and multiple pump configurations

Pre-configured cross-link cables can be used to switch the PumpMeter Modbus signal from frequency inverter to frequency inverter.

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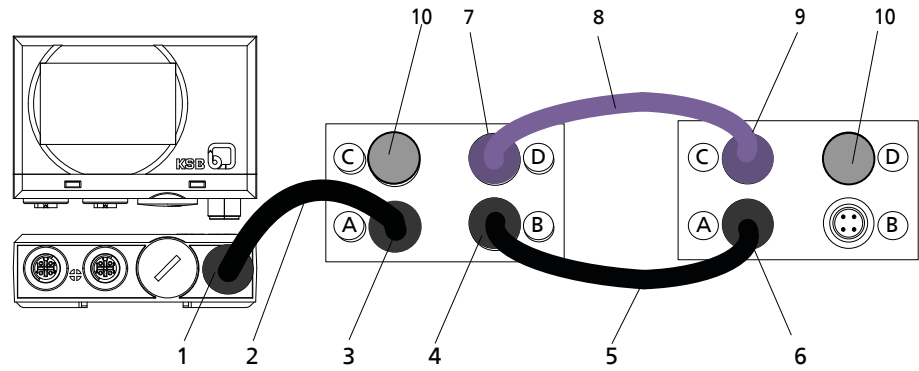


Fig. 17: Connecting PumpMeter in dual and multiple pump configurations

1	PumpMeter: Modbus connection
2	Pre-configured bus cable for connecting PumpMeter to M12 module (colour: black, socket: straight, connector: angled)
3	M12 module, socket A: Connection for PumpMeter (Modbus)
4	M12 module, socket B: Connection for cross-link bus cable (Modbus)
5	Pre-configured cross-link bus cable for redundant connection of PumpMeter (colour: black, connector: angled; connector: angled)
6	M12 module, socket A: Connection for cross-link bus cable (Modbus)
7	Connection for dual/multiple pump configuration, frequency inverter No. 1
8	Pre-configured bus cable for dual and multiple pump configuration (colour: light purple, connector: angled, connector: angled)
9	Connection for dual/multiple pump configuration, frequency inverter No. 2
10	Terminating resistor

5.4 Commissioning/start-up

	⚠ DANGER
	<p>Carrying out work on a running pump Risk of injury: Limbs can be pulled into or crushed by machinery!</p> <ul style="list-style-type: none"> ▷ De-energise the motor. ▷ Take steps to ensure that the motor cannot be switched on again unintentionally.
	⚠ DANGER
	<p>Electric shock Danger to life!</p> <ul style="list-style-type: none"> ▷ De-energise the mains connections of all devices (e.g. pump, PumpDrive, PumpMeter, leakage sensor). ▷ Ensure that the mains connections cannot be re-energised unintentionally.

	CAUTION
	<p>Incorrect commissioning/start-up Damage to property!</p> <ul style="list-style-type: none"> ▷ Ensure that all local applicable regulations and directives – particularly the machinery and low-voltage directives – are fulfilled. ▷ Before commissioning/start-up, check all connected cables against the wiring diagram. ▷ If the PumpMeter is connected to a PumpDrive speed control system, observe the original operating manual of the PumpDrive. ▷ Prior to commissioning, check both sensor connections (1, 2) before activating the power supply.

Handle the device with care to prevent any damage to the components.

Connections at the device

	CAUTION
	<p>Improper electrical connections Damage to the device!</p> <ul style="list-style-type: none"> ▷ Check the electrical connection. (⇒ Section 5.3, Page 15) ▷ Observe the wiring diagrams.

	NOTE
	<p>The sensors (1, 2) are supplied fitted to the pump and connected to the display unit.</p>

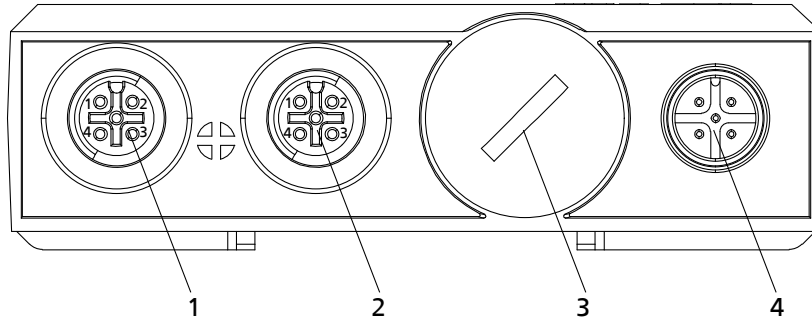


Fig. 18: Connections at the device

1	IN1 / port for the suction-side pressure sensor
2	IN2 / port for the discharge-side pressure sensor
3	Service interface
4	EXT / external port for energy supply and signal output

External port for power supply and signal output

- ✓ The place of installation meets the requirements described above.
 - ✓ The device is firmly fitted to the pump.
 - ✓ The sensors have been fitted at the factory.
1. Connect the M12 plug to the external interface (4).

5.5 Dismantling and reassembly

5.5.1 Dismantling and reassembling the display unit

- ✓ The PumpMeter as well as all electrical devices connected to it have been de-energised.
- 1. Disconnect the plug from the "EXT" (4) port of the device.
- 2. Disconnect the plug-type connections at ports "IN1" (1) and "IN2" (2).
- 3. Remove the device from the pump.
- 4. Fit the device again in the required position.
- 5. Re-connect both sensors (1, 2) to the device.
- 6. Re-connect the plug for power supply and signal output to the "EXT" (4) port of the device.
 - ⇒ PumpMeter is now connected. (⇒ Section 5.3, Page 15)
- 7. Start up the device. (⇒ Section 5.4, Page 23)

5.5.2 Dismantling and reassembling the sensors

	NOTE
	Joint rings must not be re-used. When reassembling the device, replace the joint rings.

Removing the sensors

	NOTE
	Comply with the original operating manual of the respective pump.

1. Drain the system/pump.
2. Disconnect the sensor cables from ports "IN1" (1) and "IN2" (2) and from the fastening points on the pump casing.
3. Unscrew the sensors from the threaded adapters.
4. Remove the adapters from the pump casing.

Fitting the sensors

	NOTE
	Ensure that the suction-side sensor is connected to "IN1" and the discharge-side sensor to "IN2". If the measuring ranges of the sensors differ, the sensor with the higher measuring range limit has to be fitted on the discharge side.

1. Seal the threaded adapters as suitable for their thread type and screw them into the pump casing.
2. Wet the joint ring of the sensor. Then insert it into the recess of the threaded adapter. Make sure that the joint ring is centred.

	CAUTION
	Improper handling Damage to property! ▷ Do not to exceed the maximum tightening torque of 10 Nm when screwing the sensors into the threaded adapters.

3. Screw the sensors into the threaded adapters.
4. Fasten the sensor cables at the fastening points on the pump casing and establish a safe connection with ports "IN1" and "IN2".

5.6 Modbus

The device has an RS485 interface with Modbus RTU protocol to specification V1.1b.

Table 9: Description of Modbus RTU

Characteristic	Value
Communication protocol	Modbus RTU
Bus terminator	120 ohms (depending on the hardware, (⇒ Section 4.3, Page 11)) Hardware version 01 to 04: bus terminator fixed, provided internally Hardware version 05 or higher: bus terminator not provided internally
Interface	EIA-485 (RS485)
Transmission rate	38,400 bit/s (adjustable)
Device type	Slave ⁹⁾
Bus access	Polling between master and slave
Pre-set device address	0xF7 (247)
Communication parameters	<ul style="list-style-type: none"> ▪ Parity: Even ▪ Stop bits: 1 ▪ Data bits: 8

If several PumpMeter devices are connected via Modbus, they must be assigned different addresses within the range of 1 to 246.

5.6.1 Measured values and parameters via Modbus


Various measured values and parameters are provided as device information via the Modbus system.

Table 10: Reading/writing device information

Function	Function code
Reading	Function code 03 (0x03 Read Holding Registers)
Writing	Function code 16 (0x10 Write Multiple Registers)
Coil commands	Function code 05 (0x05 Write Single Coil)

Modbus RTU uses an exclusive 16-bit register. Values which are saved as 32-bit values require two registers to be read.

Register and length are shown as hexadecimals and can be transferred directly to the Modbus RTU protocol in this format.

	NOTE
	The registers (4500 ... 4537) can be read out via function code 03 (0x03 Read Holding Registers) as one unit. If an address is incomplete or if read access is denied, 00 is returned.

⁹⁾ Master for Etaline Z

5.6.1.1 Modbus RTU operating parameters

Table 11: Overview of Modbus operating parameters

Register	Length in byte	Type/format	Parameter	Parameter description	Unit	Access	Read out	
							as one unit	individually
45 00	00 02	UINT32	1-1-1	Active error, bit code	Bit 1 = error code E01...bit 20 Error code E20	Read only	✗	-
45 02	00 02	INT32	1-1-2	Measured suction pressure	Pa (1 bar = 1×10^5 Pa)	Read only	✗	-
45 04	00 02	INT32	1-1-3	Measured discharge pressure	Pa (1 bar = 1×10^5 Pa)	Read only	✗	-
45 06	00 02	INT32	1-1-4	Calculated differential pressure	Pa (1 bar = 1×10^5 Pa)	Read only	✗	-
45 08	00 02	UINT32	1-1-5	Calculated head	1/1000 m	Read only	✗	-
45 15	00 02	UINT32	1-1-6	Flow rate	m ³ /h × 1000	Read only	✗	-
45 0C	00 02	UINT32	1-1-8	Pump input power	Watt	Read only	✗	-
45 0E	00 01	ENUM	1-1-9	Qualitative indication of the operating point (⇒ Section 6.1, Page 32)	0 = flow rate not displayed 1 = extreme part load (1st quarter) 2 = moderate part load (2nd quarter) 3 = BEP (3rd quarter) 4 = overload (4th quarter) 5 = part load (1st and 2nd quarter) 6 = error EXX (display of operating point disabled)	Read only	✗	-
45 0F	00 01	ENUM	1-1-10	Display of EFF icon	0 = EFF icon not displayed (pump operating efficiently) 1 = EFF icon displayed (optimisation required)	Read only	✗	-
45 10	00 01	ENUM	1-1-11	Analog output mode	Output 0 = discharge pressure Output 1 = differential pressure Output 2 = flow rate Q	Read only	✗	-
45 11	00 02	UINT32	1-1-12	Operating hours of PumpMeter	h	Read only		-
45 13	00 02	UINT32	1-1-13	Number of pump starts	-	Read only	✗	-
45 1C	00 02	UINT32	1-1-14	Measured value Q PumpDrive	m ³ /h × 1000	Read / write ¹⁰⁾	✗	-
45 1E	00 01	UINT16	1-1-15	Current speed	rpm	Read only	✗	-

¹⁰⁾ Values have to be updated periodically at least every 14 seconds.

Register	Length in byte	Type/format	Parameter	Parameter description	Unit	Access	Read out	
							as one unit	individually
45 1F	00 01	UINT16	1-1-16	Frequency inverter output frequency	Hz × 10	Read / write ³⁾	✗	-
45 20	00 01	UINT16	1-1-17	Rotational speed of PumpDrive	rpm	Read / write ³⁾	✗	-
45 21	00 02	UINT32	1-1-18	Effective power of PumpDrive	kW × 100	Read / write ³⁾	✗	-
45 24	00 01	ENUM	1-1-19	Source of speed value	0 = nominal speed of the motor 1 = PDrive frequency inverter 0...10V 2 = PDrive Modbus	Read only	✗	-
45 25	00 02	UINT32	1-1-20	Flow rate based on head	m ³ /h	Read only	✗	-
45 29	00 02	UINT32	1-1-21	Flow rate based on pump power output	m ³ /h	Read only	✗	-
45 35	00 01	ENUM	1-1-22	Source of flow rate value	0 = estimated value Q _{est} 1 = PumpDrive Q _{PDrive}	Read only	✗	-
45 36	00 01	ENUM	1-1-23	Pump status	0 = pump OFF 1 = pump running	Read only	✗	-
45 37	00 02	UINT32	1-1-24	Pump operating hours	Depending on Register 01 02 "Time Unit Operation" (default = h)	Read only	✗	-
34 00	00 01	UINT8	3-10-1	Modbus address	Default 247	Read / write	-	✗
34 01	00 01	ENUM	3-10-2	Modbus baud rate	0 = 9600 1 = 19200 2 = 38400 3 = 115200	Read / write	-	✗
34 02	00 01	UINT8	3-10-3	Modbus Timeout	Default 15s	Read / write	-	✗
34 03	00 01	ENUM	3-10-4	IO Mode	0 = Modbus timeout (1 = analog ON/OFF) ¹¹⁾ 2 = Modbus permanent	Read / write	-	✗
33 09	00 01	ENUM	3-3-12	Operating point display	0 = ON 1 = OFF	Read / write	-	✗
33 04	00 001	UINT8	3-3-9	EFF tolerance	0 ... 100 %	Read / write	-	✗
33 0D	00 01	ENUM	3-3-14	Selectable display value	0 = as connected 1 = head 2 = differential pressure	Read / write	-	✗

¹¹ Do not set the IO mode to 1="analog ON/OFF" via Modbus, otherwise the device cannot be activated via Modbus again.

Register	Length in byte	Type/format	Parameter	Parameter description	Unit	Access	Read out	
							as one unit	individually
46 24	00 01	ENUM	3-3-15	Selectable analog output	0 = as connected 1 = head 2 = differential pressure 3 = flow rate Q	Read / write	-	✗
45 66	00 01	ENUM	3-1-21	Detection of blade passing frequency	0 = ON 1 = OFF	Read / write	-	✗
00 44	00 02	UINT 16	3-7-3	Fluid density	kg/m ³	Read / write	-	✗
01 02	00 01	ENUM	3-5-1	Time unit operation	0 = seconds 1 = minutes 2 = hours 3 = days	Read / write	-	✗
70 7B	00 02	UINT32	3-9-4	Nominal frequency	Hz	Read / write	-	✗

Table 12: Overview of coil commands

Function code	Output address	Output value	Description
0x05	0x0001	0xFF00	Coil command for resetting the device
0x05	0x0003	0xFF00	Coil command for storing the changed data

5.6.1.2 Examples

Example: read parameter 1-1-2 (4502) suction pressure

Request: F7 03 45 02 00 02 64 51
 F7 Slave address (247 = F7 hex)
 03 Function code (read Analog Output Holding Registers)
 45 02 Data address of first requested register
 00 02 Total number of requested registers
 64 51 CRC value¹²⁾ (cyclic redundancy check) for error monitoring

Response: F7 03 04 00 00 05 54 6E 93
 F7 Slave address (247 = F7 hex)
 03 Function code (read Analog Output Holding Registers)
 04 Number of following data bytes (2 registers x 2 bytes = 4 bytes)
 00 00 05 54 554 hex (value of parameter 0x4502 in [Pa])
 6E 93 CRC value (cyclic redundancy check) for error monitoring

Example: write parameter 1-1-20 (4520) Speed PumpDrive -> 2500 rpm

Request: F7 10 45 20 00 01 02 09 C4 9D 93
 F7 Slave address (247 = F7 hex)
 10 Function code (Preset Multiple Registers 16 = 10 hex)
 45 20 Data address of first register
 00 01 Number of registers to be written
 02 Number of following data bytes (1 register x 2 bytes = 2 bytes)
 09 C4 Value to be written in register 45 20
 9D 93 CRC value (cyclic redundancy check) for error monitoring

Response: F7 10 45 20 00 01 01 99
 F7 Slave address (247 = F7 hex)
 10 Function code (Preset Multiple Registers 16 = 10 hex)
 45 20 Data address of first register
 00 01 Number of registers to be written
 01 99 CRC value (cyclic redundancy check) for error monitoring

Example: Changing the Modbus address of PumpMeter (parameter 3-10-1) via Modbus

Writing parameter 3-10-1 F7 10 34 00 00 01 02 00 01 37 07
 F7 Slave address (247 = F7 hex; default address)
 10 Function code (Preset Multiple Registers 16 = 10 hex)
 34 00 Data address of first register
 00 01 Number of registers to be written
 02 Number of following data bytes (1 register x 2 bytes = 2 bytes)
 00 01 Value to be written in register 34 00 (new Modbus address = 1)
 37 07 CRC value (cyclic redundancy check) for error monitoring

Saving parameters F7 05 00 03 FF 00 68 AC
 F7 Slave address (247 = F7 hex; make sure to enter old address here!)
 05 Function code (Write Single Coil)
 00 03 Coil command (Save Parameters)
 FF 00 Coil value (FF 00 = ON), saving is activated
 68 AC CRC value (cyclic redundancy check) for error monitoring

Performing reset F7 05 00 01 FF 00 C9 6C

¹² CRC-16 (Modbus) as per valid Modbus specification V1.1b

F7	Slave address (247 = F7 hex; make sure to enter old address here!)
05	Function code (Write Single Coil)
00 01	Coil command (Reset Device)
FF 00	Coil value (FF 00 = ON), reset is performed
C9 6C	CRC value (cyclic redundancy check) for error monitoring

6 Display functions during operation

6.1 Display

The device is equipped with a display for indicating the suction pressure, the discharge pressure, and either the differential pressure or the head.

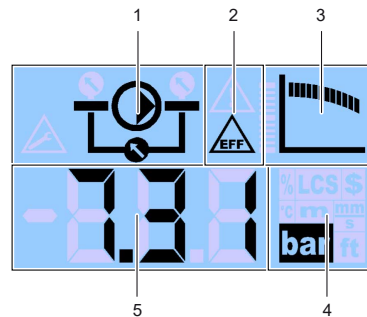


Fig. 19: Display

1	Symbol of the measured variable (measurement position)
2	Energy efficiency icon (optional display)
3	Pump characteristic curve
4	Physical unit of the measured variable
5	Value of the measured unit

Display field 1: symbol of the measured variable (measurement position)

Display field 1 This display field indicates the measured variable whose value is currently shown in display field 5. This is expressed by the following symbols:

Table 13: Overview of symbols of the measured variable (measurement position)

Display	Description
	Suction pressure
	Discharge pressure
	Differential pressure Depending on the electrical connection (⇒ Section 5.3, Page 15) either the differential pressure or the head of the pump are shown.
	Head Depending on the electrical connection (⇒ Section 5.3, Page 15) either the differential pressure or the head of the pump are shown.

Display field 2: energy efficiency icon

Display field 2



Fig. 20: Energy efficiency icon

The energy efficiency icon is displayed when the pump is continuously operated outside the optimum operating range.

Display field 3: pump characteristic curve

Display field 3

This display field shows a generalised pump characteristic curve. The flashing segment indicates the position of the current operating point on the characteristic curve.

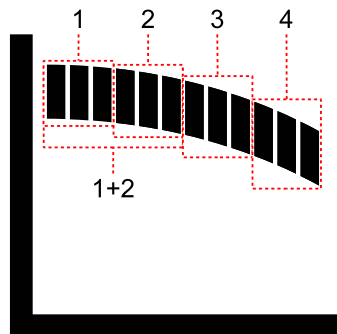
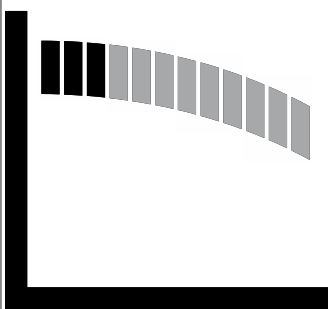
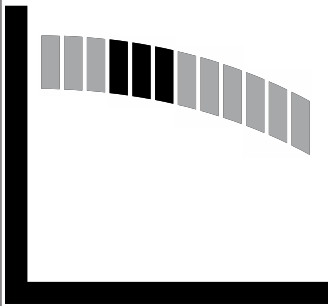
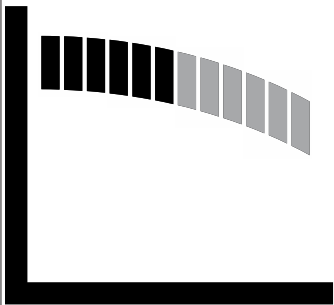
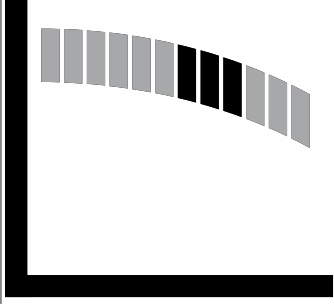
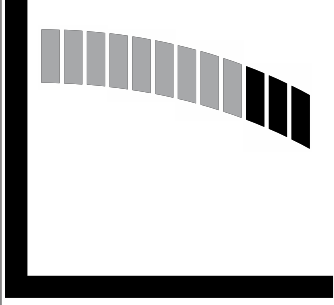


Fig. 21: Pump characteristic curve

Table 14: Key to pump characteristic curve symbols

Operating range	Segment display	Description
<p>Operation at extreme part load</p> 	First quarter flashing (1)	<ul style="list-style-type: none"> Pump possibly not operated in accordance with its intended use Increased load on the components
<p>Operation at moderate part load</p> 	Second quarter flashing (2)	<ul style="list-style-type: none"> Operation with potential for optimising energy efficiency

Operating range	Segment display	Description
<p>Operation at part load</p> 	First and second quarter flashing (1+2)	<ul style="list-style-type: none"> Operation within intended operating range. Potential for optimising energy efficiency and availability
<p>Operation near BEP</p> 	Third quarter flashing (3)	<ul style="list-style-type: none"> Operation within intended operating range. Optimum energy efficiency
<p>Operation in overload conditions</p> 	Fourth quarter flashing (4)	<ul style="list-style-type: none"> Limit of the intended operating range Possibly overload of pump and/or motor

Display field 4: physical unit of the measured variable

Display field 4 This display field shows the unit of the currently measured variable.

Table 15: Overview of physical units of measured variables

Display	Description
m	Head displayed in metres
bar	Pressure displayed in bar
ft	Head displayed in feet

Display field 5: value of measured variable

Display field 5 This display field shows the value of the currently measured variable. In the event of an error, an error code is displayed in addition to or instead of the measured value (⇒ Section 8, Page 46) .

Table 16: Overview of error codes

Error code	Description
E00	Display unit defective
E01	Suction-side sensor not connected to the "IN1" port, sensor defective or broken wire
E02	Discharge-side sensor not connected to "IN2" port, sensor defective or broken wire

Error code	Description
E03	Suction pressure higher than discharge pressure of pump, possibly sensors interchanged or connected incorrectly
E04	Calculated head in invalid range
E05	Invalid geometry, D1, D2, D2x
E06	Error when transmitting speed information via analog signal
E07	Entered H/Q curve data inconsistent
E08	Internal fault
E09	Communication via RS485 disturbed or interrupted
E10	Entered Q/P curve data inconsistent
E11	Measuring range of suction-side sensor exceeded, or sensor or sensor cable at "IN1" defective or connected incorrectly
E12	Measuring range of discharge-side sensor exceeded, or sensor or sensor cable at "IN2" defective or connected incorrectly
E20	Device description file missing or faulty

6.2 Commissioning/starting up the pump with the device

The device makes it easy, safe and fast to start up the pump as the operating point is permanently displayed.

	NOTE
	<p>Observe the original operating manuals of the pump and PumpDrive (optional). Observe the safety instructions of the pump and PumpDrive (optional). Observe the instructions on commissioning/starting up the pump and PumpDrive (optional).</p>

- ✓ All steps to be carried out prior to the actual start-up of the pump have been completed.
- ✓ The PumpMeter is ready for operation.
 1. Start up the pump in accordance with the original operating manual.
- ⇒ To assess the operating point of the pump refer to the PumpMeter display.

6.3 Monitoring and analysing the mode of operation

	NOTE
	<p>For measures to optimise the mode of operation of the pump, especially to increase its energy efficiency, don't hesitate to contact KSB's service. Find your contact in the attached "Addresses" booklet or on the internet at www.ksb.com/contact.</p>

6.4 Service interface

The service interface allows a PC/notebook to be connected via a special cable (USB-RS232). The PumpMeter service software can be used to configure and/or parameterise the device, and to install firmware updates.

	NOTE
	<p>The USB-RS232 connection cable can be ordered from KSB. The service software and the corresponding manual can be downloaded on the internet at www.ksb.com.</p>

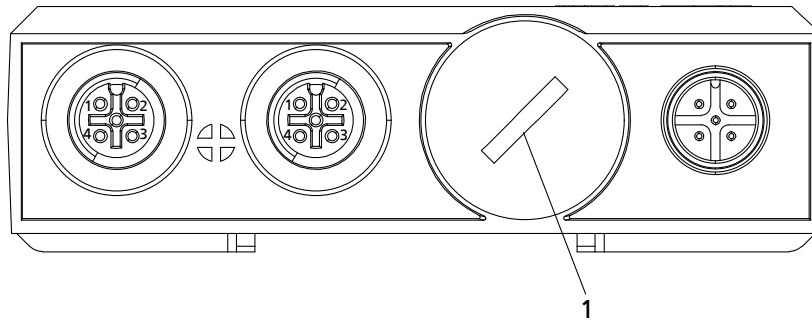


Fig. 22: Service interface connection

- ✓ Connection cable USB–RS232 is available.
 - ✓ The service software has been downloaded and installed.
1. Remove the cap from the service interface (1).

	NOTE
	When the service cable is connected to the service interface, the device no longer complies with the requirements of enclosure IP65.

2. Connect the connection cable.
 - ⇒ PumpMeter can now be configured and/or parameterised.
3. Once the device has been parameterised, disconnect the connection cable.
4. Close the service interface with the cap.

6.4.1 Access levels

Three access levels have been defined to prevent accidental or unauthorised access to PumpMeter parameters:

Table 17: Access levels

Access level	Description
Standard	Standard access level
Customer	Access level for the expert user with access to all parameters required for commissioning
Service	Access level for service personnel

The hardware protection (dongle) must be connected to enable the Customer and Service access levels. Observe the Service Tool operating manual.

6.5 Shutting down the pump with the device

	NOTE
	Observe the original operating manuals of the pump and PumpDrive (optional). Observe the safety instructions of the pump and PumpDrive (optional). Observe the instructions on shutting down the pump and PumpDrive (optional).

	NOTE
	The device is pre-set for a specific pump and must not be interchanged with any other devices.

1. Perform the shutdown procedure described in the original operating manual.
2. Disconnect the M12 plug from the "EXT" port at the device.
 - (⇒ Section 5.4, Page 23)
 - ⇒ The voltage supply of the device has been interrupted.

3. Disconnect the sensors from ports "IN1" and "IN2" at the display unit.
(⇒ Section 5.4, Page 23)
 - ⇒ The device can now be removed from the pump casing.
(⇒ Section 5.5, Page 25)

7 Parameter list

Table 18: Overview of parameters

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
1	Operation				All	-
1-1	System				All	-
1-1-1	Active errors	-	Active errors E01 - E20	-	All	-
1-1-2	Inlet pressure	bar	Current pressure on the suction side	-	All	-
1-1-3	Disch pressure	bar	Current pressure on the discharge side	-	All	-
1-1-4	Difference pressure	bar	Current differential pressure	-	All	-
1-1-5	Pressure head	m	Current head	-	All	-
1-1-6	Capacity	m ³ /h	Current flow rate	-	All	-
1-1-7	Aff. Capacity	m ³ /h	Calculated flow rate for the nominal speed for comparison with the nominal values (e.g. optimum flow rate at nominal speed)	-	All	-
1-1-8	Shaft power	kW	Current pump input power	-	All	-
1-1-9	Operating p. segment	-	Flashing segment of the characteristic head curve on the display illustrating the operating point	<ul style="list-style-type: none"> ▪ SEG all on (Pump not running) ▪ SEG 1 blink (Extreme part load) ▪ SEG 2 blink (Part load) ▪ SEG 1+2 blink (Part load at flat characteristic curve) ▪ SEG 3 blink (BEP) ▪ SEG 4 blink (Overload) 	All	-
1-1-10 ¹³⁾	EFF icon	-	Energy efficiency icon shown on the display	<ul style="list-style-type: none"> ▪ Off ▪ On 	All	-
1-1-11 ⁶⁾	Analog out mode	-	Selected output variable for analog output. Via 3-3-15 "Select. analog out" the following variables can be selected	<ul style="list-style-type: none"> ▪ Disch. Pressure out ▪ Diff. pressure ▪ Capacity Q 	All	-

¹³⁾ Not available for Etaline Z with PumpDrive 2.

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
1-1-12	Oper. Time PumpMeter	h	Operating hours of PumpMeter	-	All	-
1-1-13	Switching cycles	-	Start/stop cycles of the pump	-	All	-
1-1-14	Measurement Q Pdrive	m ³ /h	Current flow rate measured/calculated by PumpDrive connected via Modbus	-	All	-
1-1-15	Actual rot. Speed	rpm	Current speed in case of frequency inverter operation, or nominal speed in case of mains operation	-	All	-
1-1-16	Frequency PumpDrive	Hz	Current output frequency of PumpDrive	-	All	-
1-1-17	Rot. Speed PumpDrive	rpm	Current speed of PumpDrive connected via Modbus	-	All	-
1-1-18	Power PumpDrive	kW	Current power of PumpDrive connected via Modbus	-	All	-
1-1-19 ⁶⁾	Speed source	-	Source of speed value	<ul style="list-style-type: none"> ▪ PDrive Modbus ▪ PDrive FU 0...10V ▪ PDrive Modbus 	All	-
1-1-20	Capacity Q from H	m ³ /h	Estimated flow rate based on the characteristic head curve	-	All	-
1-1-21	Capacity Q from P	m ³ /h	Estimated flow rate based on the power curve	-	All	-
1-1-22 ⁶⁾	Source Capacity	-	Source of flow rate value	<ul style="list-style-type: none"> ▪ Estimation Qest (Value estimated by PumpMeter) ▪ PumpDrive Q Pdrive (Value estimated or measured by PumpDrive) 	All	-
1-1-23	Pump state	-	Pump status	<ul style="list-style-type: none"> ▪ On ▪ Off 	All	-
1-1-24	Operating time pump	h	Operating hours of the pump	-	All	-
1-1-25	Disch press. Red p2x	bar	Current discharge pressure p2x at measurement point D2x	-	Service	-
1-1-26	Rel. Dev. P2x/p2	%	Relative deviation between p2 and p2x (internal variable)	-	Service	-
1-1-27	Press. Head red norm	m	Head at nominal speed without dynamic component (internal variable)	-	Service	-
1-1-28	Affine head Hn	m	Calculated head for the nominal speed for comparison with the nominal values (e.g. optimum head at nominal speed)	-	Service	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
1-1-29 ⁶⁾	Valid speed	rpm	Speed calculated based on pressure pulsation Nominal speed	-	Service	-
1-1-30	Affine Q from H	m ³ /h	Estimated flow rate value based on the characteristic head curve for the nominal speed	-	Service	-
1-1-31	Affine Q from P	m ³ /h	Estimated flow rate value based on the power curve for the nominal speed	-	Service	-
1-1-32	Affine Shaft Power	kW	Pump input power for nominal speed	-	Service	-
1-1-35	Vanes frequency	Hz	Speed calculated based on blade passing frequency	-	Service	-
3	Settings				All	All
3-1	Sensor Parameter				All	All
3-1-1	Flange diameter D1	m	Inside diameter at the suction-side pressure measuring point	-	All	All
3-1-2	Flange diameter D2	m	Inside diameter of the discharge nozzle	-	All	All
3-1-3	Measure diameter D2x	m	Inside diameter at the discharge-side pressure measuring point	-	All	All
3-1-4	Delta z meas. pos.	m	Height difference between pressure measuring points	-	All	All
3-1-5	Inlet pressure 4mA	bar	Start of measuring range of suction-side pressure sensor	-	All	All
3-1-6	Inlet pressure 20mA	bar	End of measuring range of suction-side pressure sensor	-	All	All
3-1-7	Outlet pressure 4mA	bar	Start of measuring range of discharge-side pressure sensor	-	All	All
3-1-8	Outlet pressure 20mA	bar	End of measuring range of discharge-side pressure sensor	-	All	All
3-1-9 ⁶⁾	Sample frequency	Hz	Sampling frequency for the discharge-side pressure sensor to determine the blade passing frequency	-	Service	Service
3-1-10 ⁶⁾	Min SNR	-	Minimum required signal quality to identify the blade passing frequency	-	Service	Service
3-1-11 ⁶⁾	Inverter frequ. 0V	Hz	Reference point 0 V for scaling the analog input to the PumpDrive output frequency	-	All	All
3-1-12 ⁶⁾	Inverter frequ. 10V	Hz	Reference point 10 V for scaling the analog input to the PumpDrive output frequency	-	All	All

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-1-13 ⁶⁾	Analog output type	-	Type of analog output	<ul style="list-style-type: none"> ▪ 0...20 mA ▪ 4...20 mA 	All	All
3-1-14 ⁶⁾	Outlet pressure 0/4mA	bar	Reference point 0/4 mA for scaling the analog output to the discharge pressure	-	All	All
3-1-15 ⁶⁾	Outlet pressure 20mA	bar	Reference point 20 mA for scaling the analog output to the discharge pressure	-	All	All
3-1-16 ⁶⁾	Differntl prssr0/4mA	bar	Reference point 0/4mA for scaling the analog output to the differential pressure	-	All	All
3-1-17 ⁶⁾	Differntl prssr.20mA	bar	Reference point 20 mA for scaling the analog output to the differential pressure	-	All	All
3-1-20	Deviation p1>p2	%	Limit value for error E03: Suction pressure higher than discharge pressure of pump, possibly sensors interchanged or connected incorrectly	-	All	All
3-1-21 ⁶⁾	Vane freq. Detection	-	Detection of blade passing frequency	<ul style="list-style-type: none"> ▪ On ▪ Off 	All	All
3-2	Sensor calibration				Service	Service
3-2-12	Inlet calibration	-	Selection of saved calibration values:	<ul style="list-style-type: none"> ▪ Service ▪ Manufacturer 	Service	Service
3-2-13	Servicecal. Inletpr.	-	Zero point calibration for suction-side pressure sensor	-	Service	Service
3-2-15	Dis. Calibration	-	Selection of saved calibration values:	<ul style="list-style-type: none"> ▪ Service ▪ Manufacturer 	Service	Service
3-2-16	Servicecal. Dis.pr.	-	Zero point calibration for discharge-side pressure sensor	-	Service	Service
3-3	Pump curve parameters				All	All
3-3-1	BEP Capacity	m ³ /h	Flow rate at best efficiency point at nominal speed	-	All	All
3-3-2	Capacity Qgw1	m ³ /h	Flow rate value for activating the characteristic curve segments on the display: switch from segment 1 to 2.	-	Service	-
3-3-3	Capacity Qgw2	m ³ /h	Flow rate value for activating the characteristic curve segments on the display: switch from segment 2 to 3.	-	Service	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-3-4	Capacity Qgw3	m ³ /h	Flow rate value for activating the characteristic curve segments on the display: switch from segment 3 to 4.	-	Service	-
3-3-5	Max flow segment 1	%	Flow rate value in per cent of Qopt for activating the characteristic curve segments on the display: switch from segment 1 to 2.	-	Service	-
3-3-6	Max flow segment 2	%	Flow rate value in per cent of Qopt for activating the characteristic curve segments on the display: switch from segment 2 to 3.	-	Service	-
3-3-7	Max flow segment 3	%	Flow rate value in per cent of Qopt for activating the characteristic curve segments on the display: switch from segment 3 to 4.	-	Service	-
3-3-8	Hysteresis Qgw [%]	%	Hysteresis for activating the characteristic curve segments on the display	-	Service	-
3-3-9 ⁶⁾	EFF tolerance [%]	%	Limit value for activating the energy efficiency icon in per cent of operating hours in sub-optimal operating modes.	<ul style="list-style-type: none"> ▪ 0% (Always ON) ▪ 100% (Always OFF) 	All	All
3-3-10	Steepness of curve	-	Differentiation by steepness of characteristic head curves In the case of flat characteristic curves no difference is made between characteristic curve segments 1 and 2.	<ul style="list-style-type: none"> ▪ Norm curve ▪ Flat curve 	All	All
3-3-11 ⁶⁾	Pdrive Flow	-	Transmission of the estimated flow rate to PumpDrive1 with System-HMI	<ul style="list-style-type: none"> ▪ Enabled ▪ Disabled 	Service	Service
3-3-12	Operation Point View	-	Status of operating point display ON/OFF	-	All	All
3-3-14	Select. display value	-	Selection of characteristic to be displayed	<ul style="list-style-type: none"> ▪ PumpHead ▪ Diff. pressure ▪ According connection determined by the polarity of the power supply, see PumpMeter operating manual 	All	All

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-3-15 ⁶⁾	Select. analog out	-	Selection of output variable for the analog output	<ul style="list-style-type: none"> ▪ Disch. Pressure out ▪ Diff. pressure Capacity Q ▪ According connection determined by the polarity of the power supply, see PumpMeter operating manual 	All	All
3-4	Curve points				All	All
3-4-1	Discharge volume Q				All	All
3-4-1-1	Discharge volume Q0	m ³ /h	Flow rate at characteristic curve reference point 0, always 0 m ³ /h	-	All	All
3-4-1-2	Discharge volume Q1	m ³ /h	Flow rate at characteristic curve reference point 1	-	All	All
3-4-1-3	Discharge volume Q2	m ³ /h	Flow rate at characteristic curve reference point 2	-	All	All
3-4-1-4	Discharge volume Q3	m ³ /h	Flow rate at characteristic curve reference point 3	-	All	All
3-4-1-5	Discharge volume Q4	m ³ /h	Flow rate at characteristic curve reference point 4	-	All	All
3-4-1-6	Discharge volume Q5	m ³ /h	Flow rate at characteristic curve reference point 5	-	All	All
3-4-1-7	Discharge volume Q6	m ³ /h	Flow rate at characteristic curve reference point 6	-	All	All
3-4-1-8	Q requested	m ³ /h	Flow rate at requested operating point	-	Service	Service
3-4-2	Pressure head H				All	All
3-4-2-1	Pressure head H0	m	Head at characteristic curve reference point 0	-	All	All
3-4-2-2	Pressure head H1	m	Head at characteristic curve reference point 1	-	All	All
3-4-2-3	Pressure head H2	m	Head at characteristic curve reference point 2	-	All	All
3-4-2-4	Pressure head H3	m	Head at characteristic curve reference point 3	-	All	All
3-4-2-5	Pressure head H4	m	Head at characteristic curve reference point 4	-	All	All
3-4-2-6	Pressure head H5	m	Head at characteristic curve reference point 5	-	All	All
3-4-2-7	Pressure head H6	m	Head at characteristic curve reference point 6	-	All	All
3-4-2-8	Switch head	m	Limit value of the head to differentiate if the pump is running or not	-	All	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-4-2-9	Head vol. optimal	m	Head at best efficiency point at nominal speed	-	All	All
3-4-2-10	Switch head [%]	%	Limit value in per cent of H6 of the head to differentiate if the pump is running or not	-	All	All
3-4-2-11	Speed factor [%]	%	Limit value in per cent of the nominal speed to differentiate if the pump is running or not	-	All	All
3-4-2-12	H requested	m	Head at requested operating point	-	Service	Service
3-4-3	Shaft power P				All	All
3-4-3-1	Shaft power P0	kW	Power at characteristic curve reference point 0	-	All	All
3-4-3-2	Shaft power P1	kW	Power at characteristic curve reference point 1	-	All	All
3-4-3-3	Shaft power P2	kW	Power at characteristic curve reference point 2	-	All	All
3-4-3-4	Shaft power P3	kW	Power at characteristic curve reference point 3	-	All	All
3-4-3-5	Shaft power P4	kW	Power at characteristic curve reference point 4	-	All	All
3-4-3-6	Shaft power P5	kW	Power at characteristic curve reference point 5	-	All	All
3-4-3-7	Shaft power P6	kW	Power at characteristic curve reference point 6	-	All	All
3-4-3-8	P max	-	Maximum motor power	-	Service	-
3-5	Display units				All	All
3-5-1	Time unit operation	-	Unit for the operating period	-	All	All
3-5-2	Head unit	-	Unit for the head	-	All	All
3-6	Service				Service	Service
3-6-1	Factory Reset	-	Restoration of factory settings	-	Service	Service
3-6-3	Reset Op. History	-	Delete operating hours, pump start-ups and all histograms	-	Service	Service
3-7	Fluid parameters				All	All
3-7-1	Fluid variant	-	KSB fluid code. For information purposes	-	Service	Service
3-7-2	Temperature fluid	°C	Fluid temperature. For information purposes	-	Service	Service
3-7-3	Fluid density	kg/m ³	Fluid density during application	-	All	All
3-7-4	Viscosity	-	Fluid viscosity. For information purposes	-	All	All
3-8	Pump settings				All	All
3-8-3	Shaft axis position	-	Orientation of the shaft axis. For information purposes	-	All	All
3-8-4	Number of vanes	-	Number of vanes/blades	-	All	All
3-8-5	Impeller diameter	-	Impeller diameter. For information purposes	-	All	All
3-8-6	Rated pump speed	rpm	Nominal pump speed	-	All	All

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-8-7	Number of stages	-	Number of stages. For information purposes	-	All	All
3-9	Motor data				All	All
3-9-2	Rated motor power	kW	Nominal motor power	-	All	All
3-9-3	Rated motor speed	rpm	Nominal motor speed	-	All	All
3-9-4	Rated freq	Hz	Nominal frequency	-	All	All
3-9-5	Rated voltage	V	Nominal voltage	-	All	All
3-9-6	Rated current	A	Nominal current	-	All	All
3-9-7	Rated cosphi	-	Nominal cos phi	-	All	All
3-9-10	Direction of rot.	-	Direction of rotation. For information purposes	<ul style="list-style-type: none"> ▪ Left ▪ Right ▪ Bidirectional 	Service	Service
3-10	Modbus settings				All	All
3-10-1 ⁶⁾	Modbus address	-	Modbus address	-	All	All
3-10-2	Modbus baudrate	-	Modbus baud rate	-	All	All
3-10-3	Modbus timeout	s	Modbus timeout	-	All	All
3-10-4 ⁶⁾	IO mode	-	IO mode	<ul style="list-style-type: none"> ▪ Modbus timeout ▪ Analog in/out ▪ Modbus permanent 	All	All
4	Info				All	All
4-1	PumpMeter info				-	All
4-1-1	Serial number	-	Serial number of PumpMeter	-	All	-
4-1-2	Firmware Version	-	Firmware version	-	All	-
4-1-3	Parameter set	-	Parameter set	-	All	-
4-1-4	Firmware Revision	-	Firmware revision	-	All	-
4-2	Further data				All	Service
4-2-1	General				All	Service
4-2-1-1	Order number	-	Order number	-	All	Service
4-2-1-2	Pos. Nr PM	-	PM item number	-	All	Service
4-2-2	Start Adjust				Service	Service
4-2-2-1	Sernum Inlet	-	Serial number of suction-side pressure sensor	-	Service	Service
4-2-2-2	Sernum Outlet	-	Serial number of discharge-side pressure sensor	-	Service	Service
4-2-2-3	Sernum PM	-	Serial number of PumpMeter analysing unit	-	Service	Service

8 Trouble-shooting

	⚠ DANGER
	<p>Carrying out work on a running pump Risk of injury: Limbs can be pulled into or crushed by machinery!</p> <ul style="list-style-type: none"> ▷ De-energise the motor. ▷ Take steps to ensure that the motor cannot be switched on again unintentionally.
	⚠ DANGER
	<p>Electric shock Danger to life!</p> <ul style="list-style-type: none"> ▷ De-energise the mains connections of all devices (e.g. pump, PumpDrive, PumpMeter, leakage sensor). ▷ Ensure that the mains connections cannot be re-energised unintentionally.

If problems occur that are not described in the following table, consultation with the KSB service is required.

Table 19: Trouble-shooting

Error code	Error/defect description	Possible cause	Remedy
E00	Display unit defective	Display unit defective	Contact KSB.
E01	Suction-side sensor not connected to the "IN1" port, sensor defective or broken wire	Sensor not connected correctly to the "IN1" port	<ol style="list-style-type: none"> 1. Check plug-type connection at "IN1". 2. Re-connect sensor to "IN1", if required. 3. Make sure that the connector is screwed in tightly and that the cable is undamaged.
		Damaged suction-side pressure sensor or sensor cable	<ol style="list-style-type: none"> 1. Replace defective sensor with new one (⇒ Section 5.5.2, Page 25) .
E02	Discharge-side sensor not connected to "IN2" port, sensor defective or broken wire	Sensor not connected correctly to "IN2" port	<ol style="list-style-type: none"> 1. Check plug-type connection at "IN2". 2. Re-connect sensor to "IN2", if required. 3. Make sure that the connector is screwed in tightly and that the cable is undamaged.
		Damaged discharge-side pressure sensor or sensor cable	<ol style="list-style-type: none"> 1. Replace defective sensor with new one (⇒ Section 5.5.2, Page 25) .
E03	Suction pressure higher than discharge pressure of pump, possibly sensors interchanged or connected incorrectly	Sensors interchanged. (If the measuring ranges of the sensors differ, the sensor with the higher measuring range limit has to be fitted on the discharge side.)	<ol style="list-style-type: none"> 1. Make sure that the sensor with the higher measuring range limit is fitted on the discharge side of the pump. 2. Interchange the sensors (⇒ Section 5.5, Page 25) .
		Sensor connections "IN1" and "IN2" interchanged	<ol style="list-style-type: none"> 1. Make sure that the sensors are connected to the device (⇒ Section 5.5, Page 25) .

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Error code	Error/defect description	Possible cause	Remedy
E03	Suction pressure higher than discharge pressure of pump, possibly sensors interchanged or connected incorrectly	Incorrect parameterisation of the measuring ranges for the suction-side and/or discharge-side sensor	1. Check on the display that suction and discharge pressure are almost identical during standstill of the pump.
E04	Calculated head in invalid range	Incorrectly entered characteristic curve data	1. Correct the pump characteristic curve data (with the Service Tool) or contact KSB.
E05	Invalid geometry, D1, D2, D2x	Incorrectly entered parameters <ul style="list-style-type: none"> ▪ 3-1-1 Suction-side diameter D1 ▪ 3-1-2 Discharge-side diameter D2 ▪ 3-1-3 Diameter D2x 	1. Verify input for D1, D2 and D2x and correct if necessary. 2. Contact KSB Service; replace device if necessary.
E06	Error in transmission of frequency information via analog signal	No or incorrect transmission of frequency information from the frequency inverter to the device	1. Make sure that for variable speed operation the frequency information is transmitted as an analog signal (0...10 V with 0 V... f_{max}) via PIN 5.
E07	Entered H/Q curve data inconsistent	Entered H/Q curve not clearly defined, operating point cannot be assessed	1. Correct the pump characteristic curve data (with the Service Tool) or contact KSB.
E08	Internal fault	No calibration parameters	Contact KSB.
E09	Modbus timeout	Communication via RS485 disturbed or interrupted	1. Check the connection and reset the device by switching it off and then on again.
E10	Entered Q/P curve data inconsistent	Entered Q/P curve not clearly defined, operating point cannot be assessed	Correct the pump characteristic curve data (with the Service Tool) or contact KSB.
E11	Measuring range of suction-side sensor exceeded, or sensor or sensor cable at "IN1" defective or connected incorrectly	Measuring range of sensor exceeded, pressure sensor or sensor cable damaged	1. Replace sensor (⇒ Section 5.5.2, Page 25) .
E12	Measuring range of discharge-side sensor exceeded, or sensor or sensor cable at "IN2" defective or connected incorrectly	Measuring range of sensor exceeded, pressure sensor or sensor cable damaged	1. Replace sensor (⇒ Section 5.5.2, Page 25) .
E20	Incorrectly programmed	Device description file missing or faulty	1. Contact KSB.
–	Implausible measured values	Pressure sensor blocked (the device may only be used with solids-free fluids which are not liable to stick, encrust, solidify, crystallise or polymerise).	1. Clean the pressure sensor and the hole for measuring equipment in the pump casing.
		Wrong direction of rotation of the pump	1. Check the direction of rotation of the pump.
–	Implausible operating point displayed for variable speed operation	No or incorrect transmission of speed information from the frequency inverter to the device	1. Make sure that for variable speed operation the frequency information is transmitted as an analog signal (0...10 V with 0 V... f_{max}) via PIN 5.

Error code	Error/defect description	Possible cause	Remedy
-	Operating point displayed during standstill of the pump	Pressure sensor is clogged. (Device may only be used with solids-free fluids which are not liable to stick, encrust, solidify, crystallise or polymerise .)	1. Clean the pressure sensor and the hole for measuring equipment in the pump casing.
		Sensors interchanged. (If the measuring ranges of the sensors differ, the sensor with the higher measuring range limit has to be fitted on the discharge side.)	1. Make sure that the sensor with the higher measuring range limit is fitted on the discharge side of the pump. 2. Replace defective sensor with new one (⇒ Section 5.5.2, Page 25) .
		Sensor connections "IN1" and "IN2" interchanged	1. Check that the sensors are connected correctly (⇒ Section 5.5.2, Page 25) .
-	Operating point displayed during standstill of the pump	Incorrect parameterisation of the measuring ranges for the suction-side and/or discharge-side sensor	1. Check on the display that suction and discharge pressure are almost identical during standstill of the pump.
-	Display slow, sluggish or frozen	Ambient temperature too low	The display behaviour will return to normal once the temperatures have risen above freezing point.
-	Display unit displays no information	Display unit defective	1. Contact KSB.
		Device connected incorrectly	1. Check the electrical connection (⇒ Section 5.3, Page 15) .
-	No output signal	Device connected incorrectly	1. Check the electrical connection (⇒ Section 5.3, Page 15) .
-	Mechanical damage of device	Mechanical effects	1. Shut down the device to prevent any further damage. 2. Contact KSB.
-	Moisture inside the device (e.g. in the display unit) detected on the display	Connectors not connected to ports "IN1", "IN2", "EXT", or protective cap on Service Tool interface not screwed on correctly	1. Shut down the device to prevent short circuit.
-	Venting error of gauge pressure sensors	Other than original cable used for connecting the pressure sensors, or cable jammed, crushed or subjected to mechanical loads	1. Only use the sensor cables provided by KSB. 2. Make sure that the connected cables are not jammed, crushed or subjected to mechanical loads.
-	Leakage in the area of the threaded adapter of a pressure sensor	Sensor not screwed in correctly and/or sealing used not suitable for thread type	1. Check that the sensors are connected correctly (⇒ Section 5.5.2, Page 25) .

9 EU Declaration of Conformity

Manufacturer: **KSB SE & Co. KGaA**
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that the product:

PumpMeter

Serial number range: 10304TA100001 to 10304WA100001

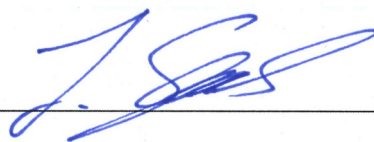
- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - 2014/30/EU: Electromagnetic Compatibility (EMC)
 - Electrical components: 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

The manufacturer also declares that

- the following harmonised international standards have been applied:
 - EN 61326-1
 - EN 55011
- Applied national technical standards and specifications, in particular:
 - ISO 14121-1
 - IEC 61000-4-2
 - IEC 61000-4-3
 - IEC 61000-4-4
 - IEC 61000-4-5
 - IEC 61000-4-6

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 January 2020



Jochen Schaab
Head of Product Development Pump Systems and Drives
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