PumpMeter LSA

Installation/Operating Manual

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Installation/Operating Manual PumpMeter LSA

Original operating manual

Contents

1 General

1.1 Principles

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

The 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 centre 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

2 Safety

DANGER

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 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.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**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.
	**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.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 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.

The safety information in all sections of this manual must be complied with.

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 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 in this operating manual.

2.3 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.

2.4 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.

2.5 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

2.6 Safety awareness

In addition to the safety information contained in this 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

2.7 Software changes

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

It is impermissible to make any changes or additions to the software or parts of the software.

3 Transport/Temporary 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

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.

3.2 Transport

CAUTION

Improper transport

Damage to the device!

- ▷ 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 22) .
- ▷ For transport observe the transport instructions on the original packaging.

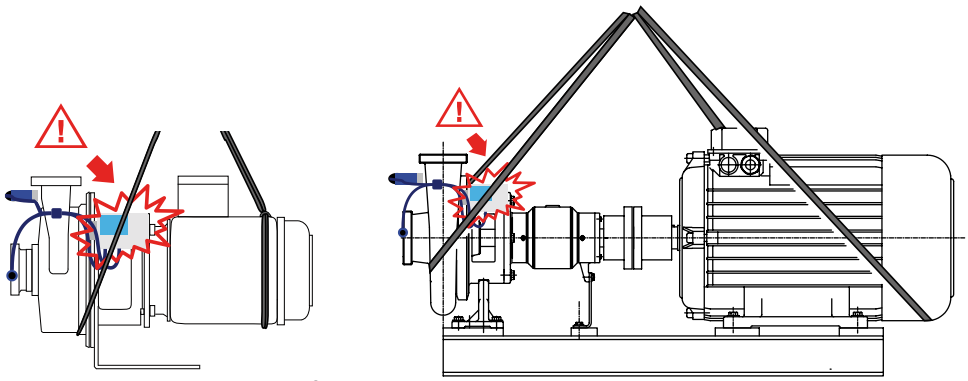


Fig. 1: Incorrect transport of device and pump

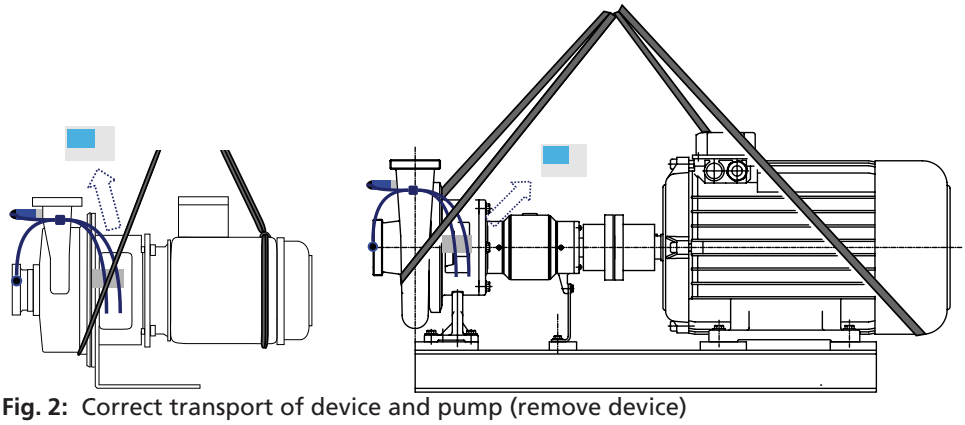


Fig. 2: Correct transport of device and pump (remove device)

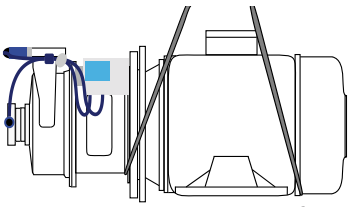


Fig. 3: Correct transport of device and pump (for ≥ 5.5 kW motors)

1. Remove the device if required (⇨ Section 5.5, Page 22) .

3.3 Storage

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

CAUTION

Damage during storage by humidity, dirt or vermin

Corrosion/contamination of the device!

- ▷ For outdoor storage cover the (packed or unpacked) device and accessories with water-proof material.

Table 4: Ambient conditions for storage

Ambient conditions	Value
Relative humidity	Max. 85% (no condensation)
Ambient temperature	-30 °C to +60 °C

1. Store the device in dry conditions, if possible 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 (see table 4).

3.4 Disposal

NOTE

Due to certain components it contains, the device is classified as special waste and meets RoHs 2011/65/EC requirements.

Once decommissioned, the device must be properly disposed of in accordance with local regulations.

4 Description

4.1 General description

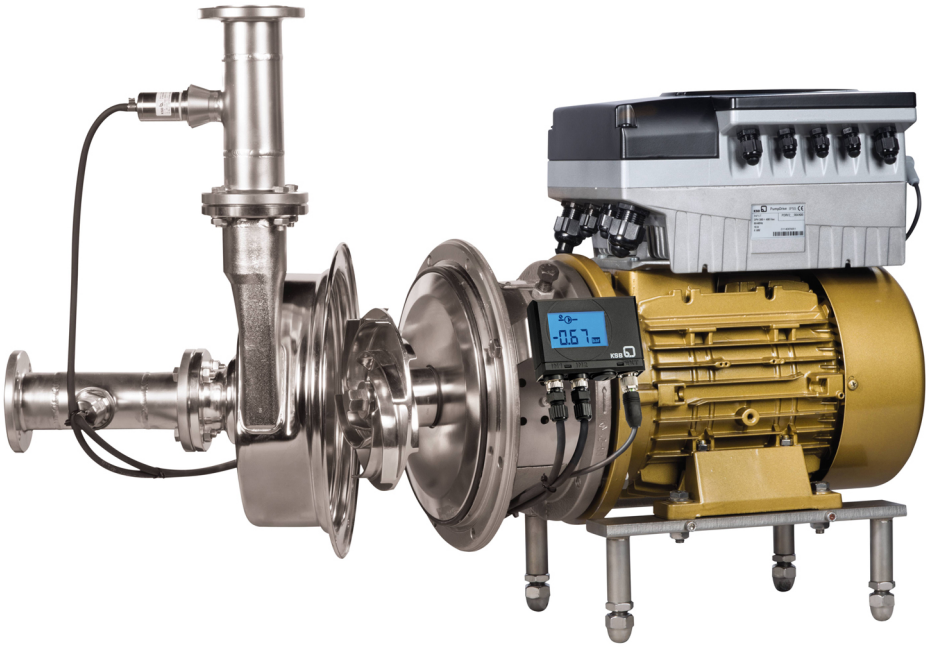


Fig. 4: Vitachrom with PumpMeter LSA

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 Name plate

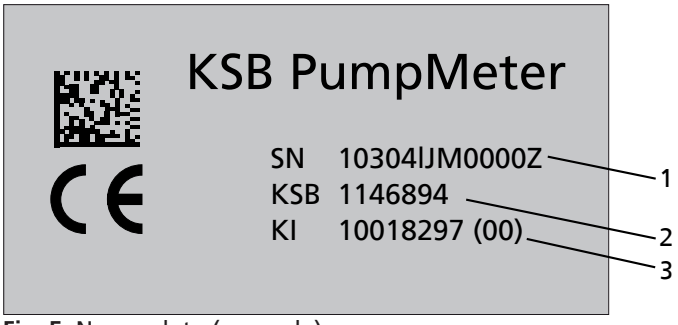


Fig. 5: Name plate (example)

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

4.3 Applications

NOTE

Do not operate the device in potentially explosive atmospheres.

- Enclosure IP65 (complete device) if the sensors are connected correctly, the service interface is closed and the external connection is connected
- Sensors offer utmost chemical resistance (stainless steel)
- Permissible in-service ambient temperature: -10 °C to + 60 °C
- Permissible fluid temperature -30 °C to 125 °C (fluid handled must not solidify inside the sensor.)
- Resistant to oil mist and alkaline industrial cleaning agents

Leak testing

CAUTION

Improper handling

Damage to property!

- ▷ Make sure that test pressures applied during leak testing do not exceed the pump's PN if differential pressure transmitter's pressure sensors are installed:
  Vitachrom PN 12
  Vitacast PN 10
- ▷ If higher test pressures are required, remove the pressure sensors and threaded adapters and replace them with screw plugs.

4.4 Fluids handled

DANGER

Leakage caused by chemically or mechanically affected material

Hot and/or toxic fluid may escape!

Hazard to persons and the environment!

- ▷ 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: Fluids handled

Fluid handled	Concentration	Temperature
	[%]	[°C]
Alcohol (ethanol)	-	60
Alcohol (methanol)	-	60
Alcohol (propanol)	-	60
Aluminium sulphate	Up to 5 %	30
	Up to 10	30
Formic acid	10	20
Malic acid	Unsaturated solution	60
Apple purée	-	20
Apple juice	-	60
Cider	-	60
Benzoic acid	10	100
Beer	-	70
Beer hops	-	100

Fluid handled	Concentration	Temperature
	[%]	[°C]
Beer mash	-	100
Beer trub	-	100
Beer wort	-	100
Spirits	10	60
Buttermilk	-	60
Calcium nitrate	10	30
Potassium acetate	Unsaturated solution	100
Fluids for CIP	-	90
Coke	-	20
Coke concentrate	-	20
Deionised water (fully desalinated water)	-	-
Liqueur with egg yolks	-	50
Vinegar (wine vinegar)	-	60
Vinegar concentrate	25	25
Acetic acid	10	60
	50	20
Fruit juices and fruit acids	-	60
Fruit liqueur	-	60
Vegetable juice	-	100
Tannic acid	Unsaturated solution	100
Glucose	Unsaturated aqueous solution	50
Glycerine	45	100
Glycol (ethylene glycol)	100	60
	50	60
Yeast	-	60
Sal volatile (ammonium carbonate) (ammonium bicarbonate)	Unsaturated solution	20
Evaporated milk	-	60
Evaporated milk, with sugar	-	60
Herbal liqueur	-	60
Lemonade	-	90
Lysol	-	60
Skim milk	-	40
Skim milk (sour)	-	40
Malt	-	100
Methyl alcohol	-	60
Milk	Fresh	40
Must	-	60
Sodium chloride (= common table salt)	2	20
Sodium hydroxide	Up to 20	80
	Up to 50	80
Fruit pulp	-	20
Oxalic acid	Unsaturated solution	20
Orange juice	-	-
Sap	-	50
High-purity water, ultra-pure water	-	100
Sparkling wine	-	50

Fluid handled	Concentration	Temperature
	[%]	[°C]
Syrup	-	40
Water (fresh water)[1)]	-	110
Wine (white and red wine)	-	60
Wine vinegar	See vinegar	-
Spirits of wine	See alcohol	-
Tartaric acid	Unsaturated solution	60
Water for injection	-	100
Wort; hot wort	-	100
Citric acid	Unsaturated solution	80
Sugar solution	< 20	100
	70	95

1) General assessment criteria for results of water analysis: pH ≥ 7; chloride content (Cl) ≤ 250 mg/kg. Chlorine (Cl2) ≤ 0.6 mg/kg.

5 Installation at Site

5.1 Safety regulations

⚠ WARNING

Pressure sensors take on the same temperature as the fluid handled

Risk of burns!

- ▷ Fit protective devices, if required.

⚠ WARNING

Mechanical loads acting on the connections between pumps and sensors

Fluid could spurt out!

Burns, scalding!

- ▷ Never subject the connections between pumps and sensors to mechanical loads.
- ▷ Verify proper installation of sensors.

NOTE

Comply with the safety instructions of the respective pump.

5.2 Checks to be carried out prior to installation

NOTE

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.

5.3 Electrical connection

The electrical connection of the device is effected via the "EXT" port at the device.

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.

CAUTION

Improper handling

Damage as a result of incorrect signals!

- ▷ Only operate the device with the pump it is pre-set for.

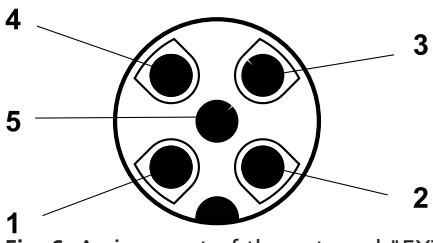


Fig. 6: Assignment of the external "EXT" port (bottom of the display unit)

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

Table 6: Assignment of the external (EXT) port

Pin	Function	Conductor colours[2)]
1,3	Supply (+24 V DC ±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

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.

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 output via a 4 - 20 mA analog signal. 4 mA corresponds to 0 bar and 20 mA corresponds to 12 bar.

NOTE

Pin assignment (⇨ Section 5.3, Page 13)

Fixed speed operation of the pump

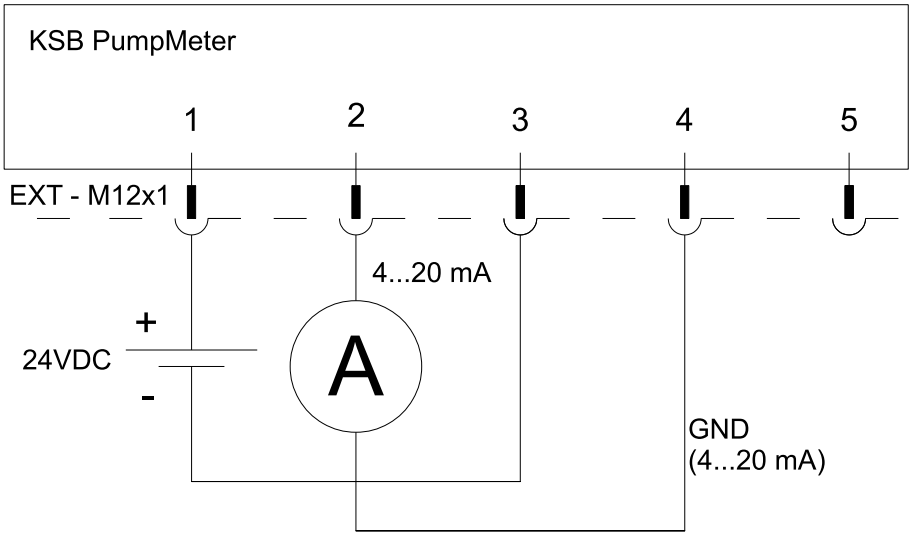


Fig. 7: Connection as discharge pressure sensor for fixed speed operation of the pump

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.

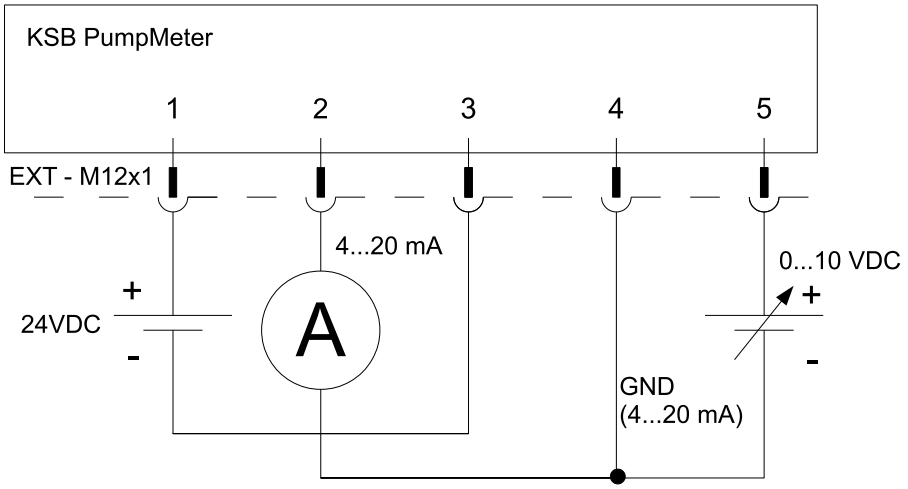


Fig. 8: Connection as discharge pressure sensor for variable speed operation of the pump

Pump operation with PumpDrive

NOTE

Observe the original operating manual of the PumpDrive.

PumpDrive 1

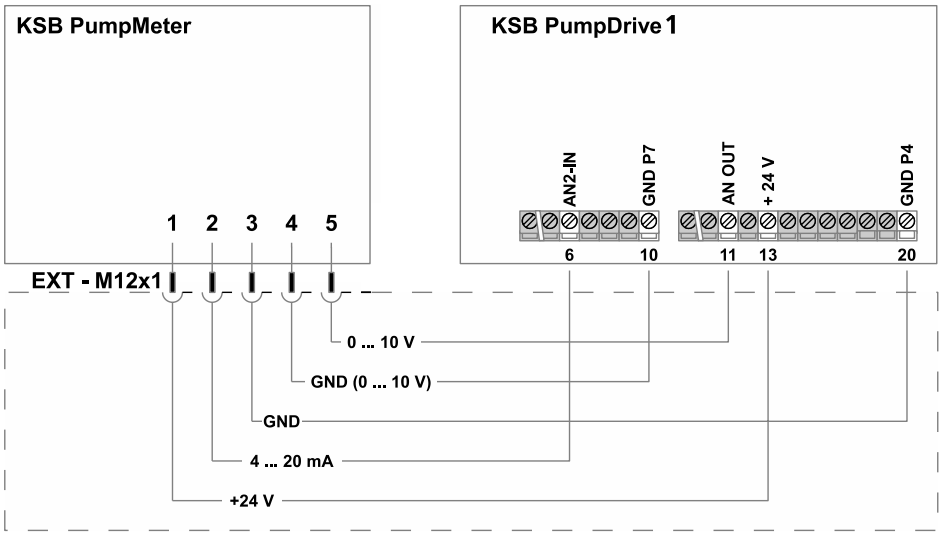


Fig. 9: Connection via analog signal as discharge pressure sensor for pump operation with PumpDrive 1

PumpDrive 2

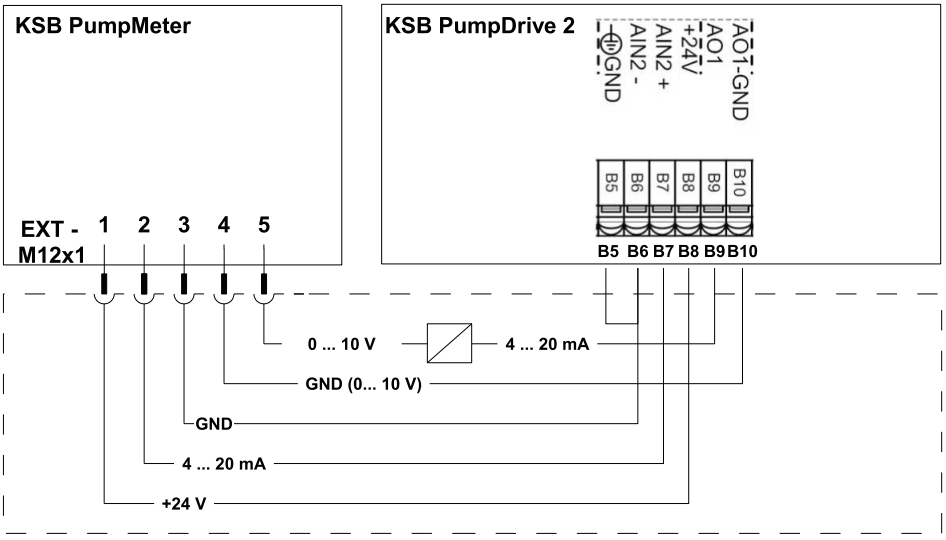


Fig. 10: Connection via analog signal as discharge pressure sensor for pump operation with PumpDrive 2

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 output via a 4 - 20 mA analog signal. 4 mA corresponds to 0 bar and 20 mA corresponds to 12 bar.

NOTE

Pin assignment (⇨ Section 5.3, Page 13)

Fixed speed operation of the pump

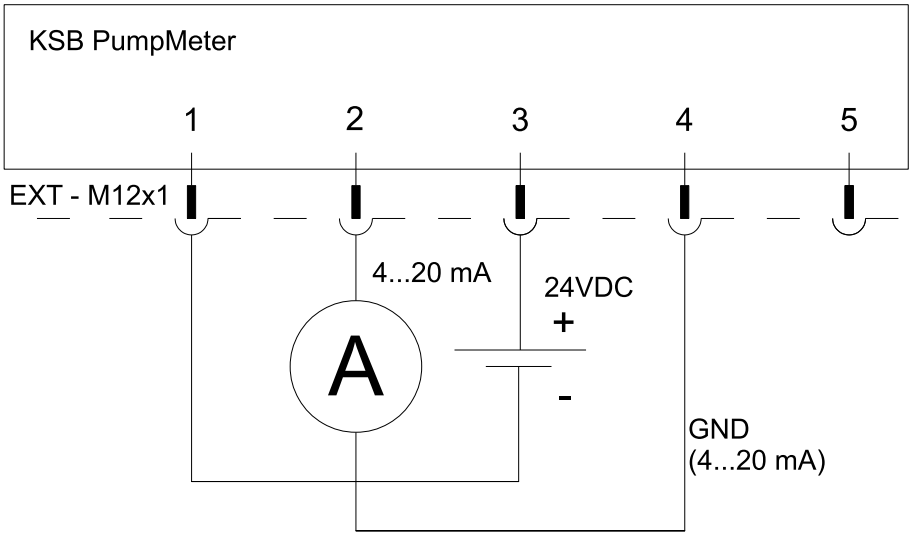


Fig. 11: Connection as differential pressure sensor for fixed speed operation of the pump

Variable speed operation of the pump

NOTE

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.

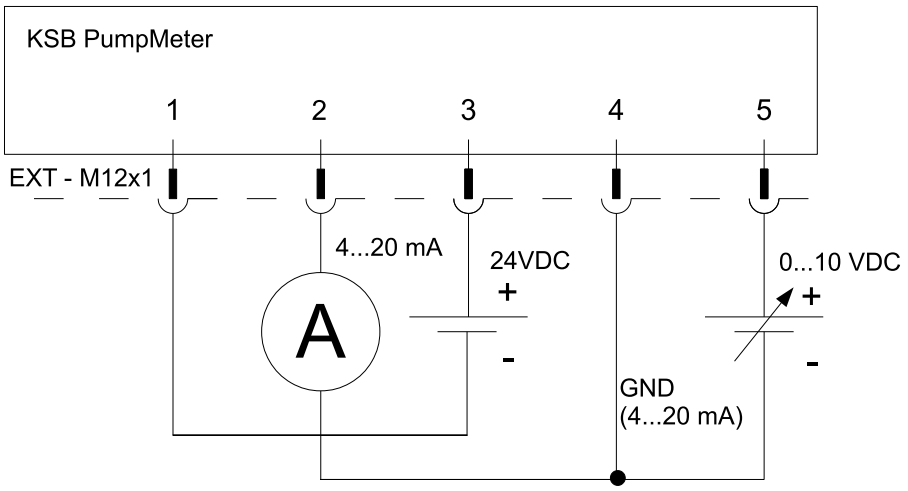


Fig. 12: Connection as differential pressure sensor for variable speed operation of the pump

Pump operation with PumpDrive

NOTE

Observe the original operating manual of the PumpDrive.

PumpDrive 1

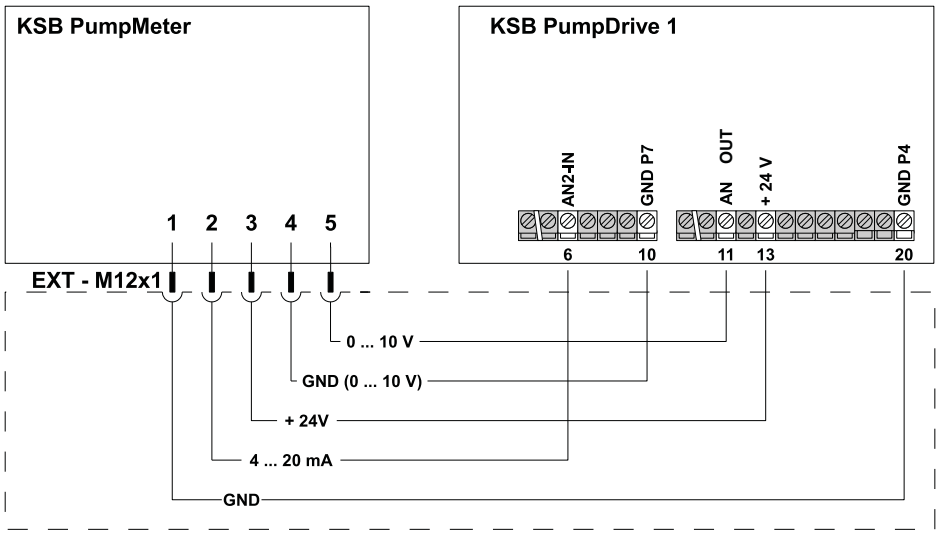


Fig. 13: Connection as differential pressure sensor via analog signal for pump operation with PumpDrive 1

PumpDrive 2

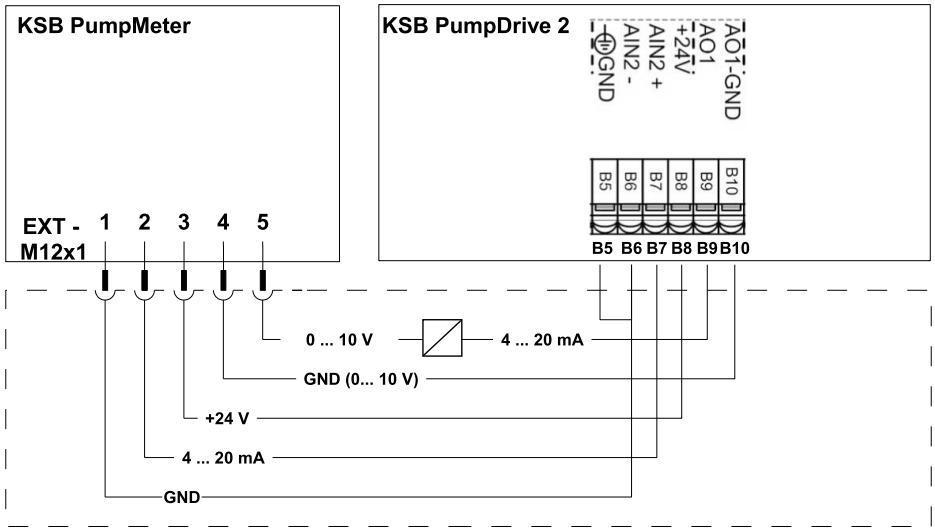


Fig. 14: Connection as differential pressure sensor via analog signal for pump operation with PumpDrive 2

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

NOTE

Pin assignment (⇨ Section 5.3, Page 13)

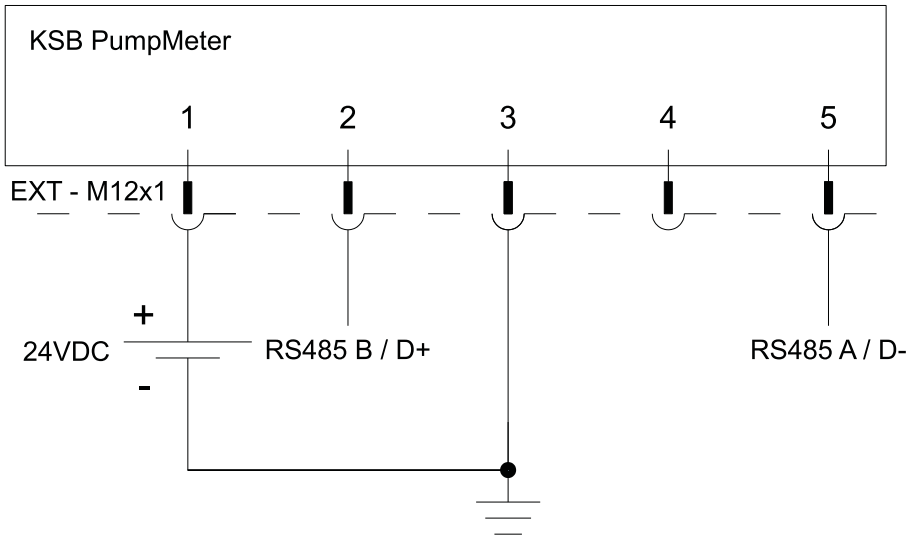


Fig. 15: Connecting the control unit to the power supply and Modbus RTU module

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.

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

Connect PumpMeter (Modbus) to the M12 module, input A.

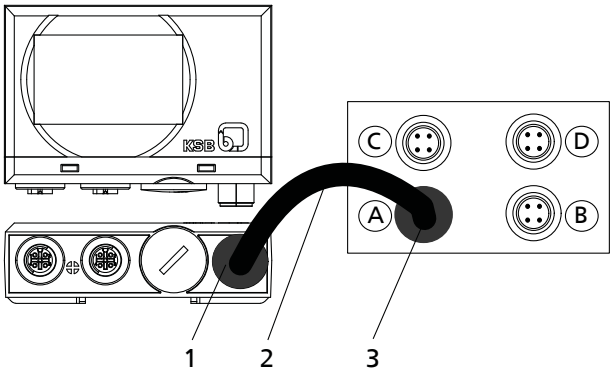


Fig. 16: Connecting PumpMeter to the M12 module in single-pump configurations

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 crosslink cables can be used to switch the PumpMeter Modbus signal from frequency inverter to frequency inverter.

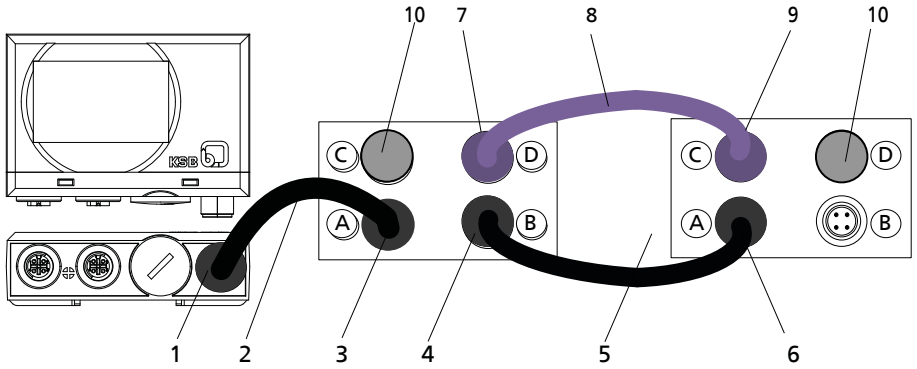


Fig. 17: Connecting PumpMeter in dual and multiple pump configurations

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 bus cable crosslink (Modbus)
5	Pre-configured bus cable crosslink for redundant connection of PumpMeter (colour: black, connector: angled; connector: angled)
6	M12 module, socket A: Connection for bus cable crosslink (Modbus)
7	Connection for dual/multiple pump configuration, PumpDrive 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, PumpDrive No. 2
10	Terminating resistor

5.4 Commissioning/start-up

DANGER

Carrying out work on a running pump

Risk of injury: Limbs can be pulled into or crushed by machinery!

- ▷ De-energise the motor.
- ▷ Take steps to ensure that the motor cannot be switched on again unintentionally.

DANGER

Electric shock

Danger to life!

- ▷ De-energise the mains connections for all devices (e.g. pump, PumpDrive, PumpMeter).
- ▷ Ensure that the mains connections cannot be re-energised unintentionally.

CAUTION

Incorrect commissioning/start-up

Damage to property!

- 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

Improper electrical connections

Damage to the device!

- Check the electrical connection. (⇨ Section 5.3, Page 13)
- Observe the wiring diagrams.

NOTE

The following parameters are preset to the connections of the pump:

3-1-1 Suction-side diameter D1
3-1-2 Discharge-side diameter D2
3-1-3 Measuring point diameter D2x

If the sensors are mounted to deviating pipe diameters, the parameters must be corrected accordingly.

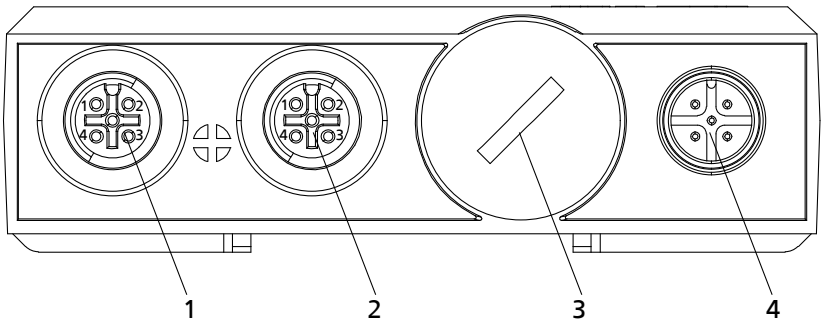


Fig. 18: Connections at the device

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 13)
7. Start up the device.

5.5.2 Welding weld-in sockets into the piping

NOTE

To prevent the weld-in socket from glowing or warping, time the breaks between welding the individual sections so that the weld-in socket can cool down.

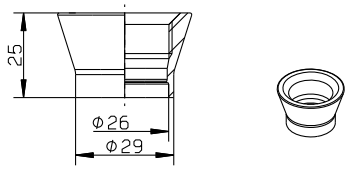


Fig. 19: Dimensions of the weld-in socket

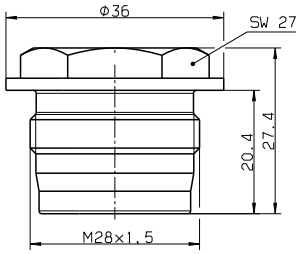


Fig. 20: Dimensions of the welding aid

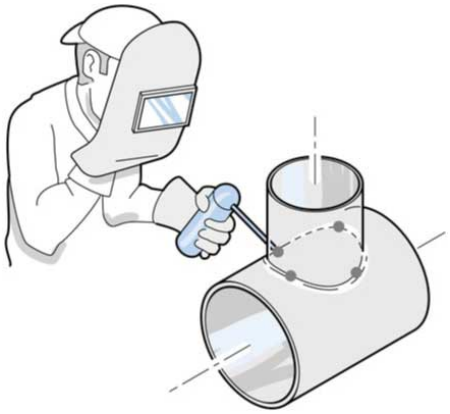


Fig. 21: Welding the weld-in socket into the piping

1. Drill a hole the size of the outside diameter of the weld-in socket and a maximum tolerance of +0.2 mm into the piping (see figure on dimensions of weld-in socket).
2. Position the weld-in socket and attach it using 4 welding points (see figure on welding the weld-in socket into the piping).
3. Screw the welding aid into the weld-in socket (see figure on dimensions of welding aid).
4. Weld the sections between the welding points on the opposite side to avoid warping or distortion and subsequent sealing problems.
5. After welding 2 sections, interrupt the welding procedure until the welding points have cooled down.
6. Let the weld-in socket cool down after welding and remove the welding aid.

5.5.3 Dismantling and reassembling the sensors

Removing the sensors

NOTE

Comply with the original operating manual of the respective pump.

NOTE

When handling sensors, take steps to ensure that the diaphragm is protected from coming into contact with solid particles.

1. Drain the system and/or 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 weld-in sockets.
4. Close the weld-in sockets using plugs.

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 on the suction side and discharge side of the pump differ, the sensor with the higher measuring range limit has to be fitted on the discharge side.

CAUTION

Improper handling

Damage to property!

- ▷ Never exceed the torque value of 20 Nm when screwing the sensors into the weld-in socket.

1. Screw the sensors into the weld-in sockets.
2. Fasten the sensor cables at the fastening points on the pump casing and establish a safe connection with ports "IN1" and/or "IN2".

5.6 Modbus

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

Table 7: Description of Modbus RTU

Characteristic	Value
Communication protocol	Modbus RTU
Bus terminator	120 Ω (depending on the hardware, (⇨ Section 4.2, Page 9)) **Hardware version 01 to 04:** bus terminating resistor fixed, provided internally **Hardware version 05 or higher:** bus terminating resistor not provided internally
Interface	EIA-485 (RS485)
Transmission rate	38,400 bit/s (adjustable)
Device type	Slave
Bus access	Polling between master and slave
Pre-set device address	0xF7 (247)
Communication parameters	▪ 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 8: 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.

5.6.1.1 Modbus RTU operating parameters

Table 9: 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	m³/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 31)	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	m³/h × 1000	Read / write [3)]	✗	-
45 1E	00 01	UINT16	1-1-15	Current speed	rpm	Read only	✗	-

3) 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	individuall y
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	m³/h	Read only	✗	-
45 29	00 02	UINT32	1-1-21	Flow rate based on pump power output	m³/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)[4] 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	-	✗

4) 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	individuall y
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 10: 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 value[5] (**c**yclic **r**edundancy **c**heck) 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 (**c**yclic **r**edundancy **c**heck) 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 (**c**yclic **r**edundancy **c**heck) 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 (**c**yclic **r**edundancy **c**heck) 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 (**c**yclic **r**edundancy **c**heck) 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 (**c**yclic **r**edundancy **c**heck) for error monitoring

Performing reset `F7 05 00 01 FF 00 C9 6C`

5) 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 (**c**yclic **r**edundancy **c**heck) for error monitoring

6 Display Function 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.

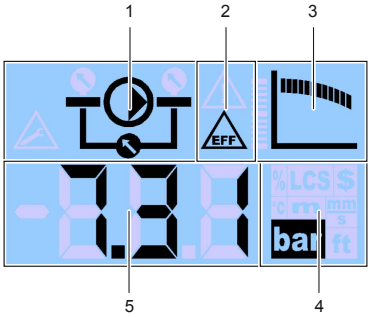


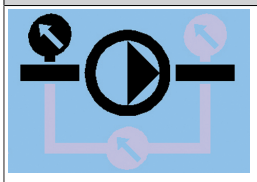
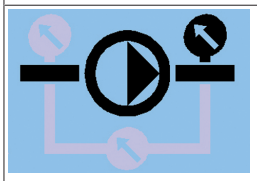
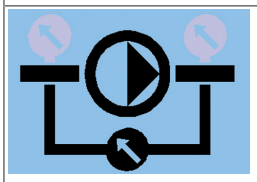
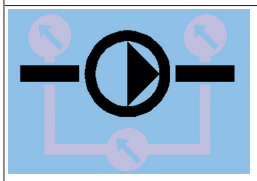
Fig. 22: Display

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 11: 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 13) either the differential pressure or the head of the pump are shown.
	Head Depending on the electrical connection (⇨ Section 5.3, Page 13) either the differential pressure or the head of the pump are shown.

Display field 2: energy efficiency icon

Display field 2

Fig. 23: 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.

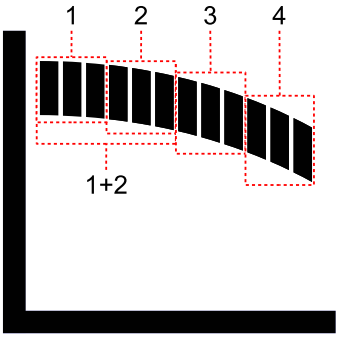
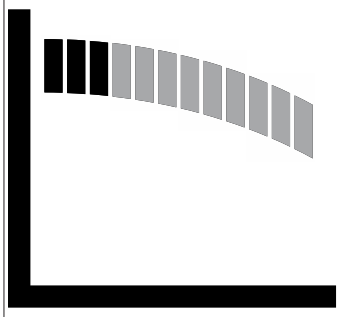
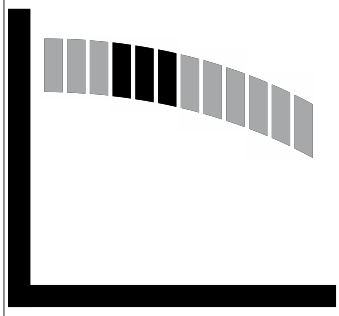
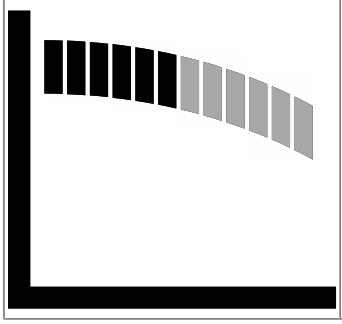
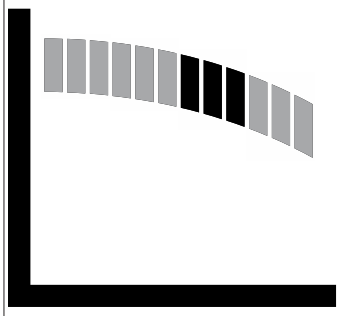
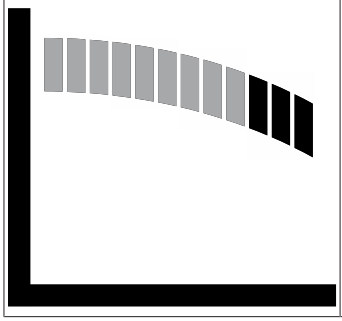


Fig. 24: Pump characteristic curve

Table 12: Key to pump characteristic curve symbols

Operating range	Segment display	Description
Operation at extreme part load 	First quarter flashing (1)	▪ Pump possibly not operated in accordance with its intended use ▪ Increased load on the components
Operation at moderate part load 	Second quarter flashing (2)	▪ Operation with potential for optimising energy efficiency
Operation at part load 	First and second quarter flashing (1+2)	▪ Operation within intended operating range. Potential for optimising energy efficiency and availability

Operating range	Segment display	Description
Operation near BEP 	Third quarter flashing (3)	▪ Operation within intended operating range. Optimum energy efficiency
Operation in overload conditions 	Fourth quarter flashing (4)	▪ 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 13: 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 .

Table 14: 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
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

Error code	Description
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

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).

✓ 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

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.

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

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.

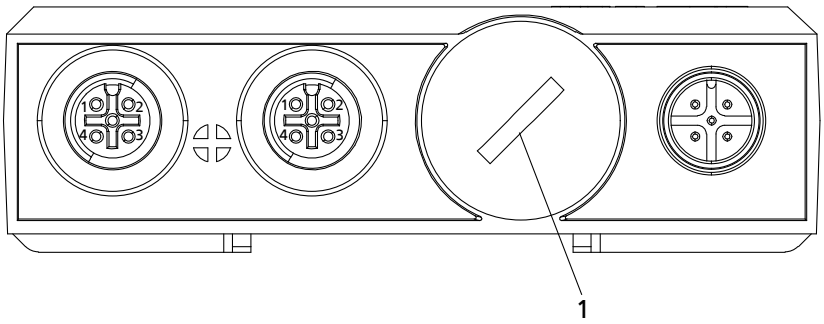


Fig. 25: Service interface connection

✓ 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

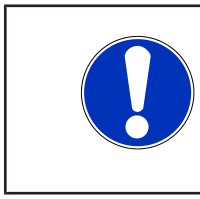
Three access levels have been defined to prevent accidental or unauthorised access to PumpMeter parameters:

Table 15: 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.
   ⇨ The voltage supply of the device has been interrupted.
3. Disconnect the sensors from ports "IN1" and "IN2" at the display unit.
   ⇨ The device can now be removed from the pump casing.
   (⇨ Section 5.5, Page 22)

7 Parameter list

Table 16: 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	m³/h	Current flow rate	-	All	-
1-1-7	Aff. Capacity	m³/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	▪ SEG all on (Pump not running) ▪ SEG 1 blink (Extremely low flow) ▪ SEG 2 blink (Low flow) ▪ SEG 1+2 blink (Low flow at flat characteristic curve) ▪ SEG 3 blink (Optimum) ▪ SEG 4 blink (Overload)	All	-
1-1-10	EFF icon	-	Energy efficiency icon shown on the display	▪ Off ▪ On	All	-
1-1-11	Analog out mode	-	Selected output variable for analog output. Via 3-3-15 "Select. analog out", the following variables can be selected	▪ Disch. Pressure out ▪ Diff. pressure ▪ Capacity Q	All	-
1-1-12	Oper. Time PumpMeter	h	Operating hours of PumpMeter	-	All	-
1-1-13	Switching cycles	-	Start/stop cycles of the pump	-	All	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
1-1-14	Measurement Q Pdrive	m³/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	Speed source	-	Source of speed value	▪ PDrive Modbus ▪ PDrive FU 0…10V ▪ PDrive Modbus	All	-
1-1-20	Capacity Q from H	m³/h	Estimated flow rate based on the characteristic head curve	-	All	-
1-1-21	Capacity Q from P	m³/h	Estimated flow rate based on the power curve	-	All	-
1-1-22	Source Capacity	-	Source of flow rate value	▪ Estimation Qest (Value estimated by PumpMeter) ▪ PumpDrive Q Pdrive (Value estimated or measured by PumpDrive)	All	-
1-1-23	Pump state	-	Pump status	▪ 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	-
1-1-29	Valid speed	rpm	Speed calculated based on pressure pulsation Nominal speed	-	Service	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
1-1-30	Affine Q from H	m³/h	Estimated flow rate value based on the characteristic head curve for the nominal speed	-	Service	-
1-1-31	Affine Q from P	m³/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	Blade passing frequency calculated based on pressure pulsation	-	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	Sample frequency	Hz	Sampling frequency for the discharge-side pressure sensor to determine the blade passing frequency	-	Service	Service
3-1-10	Min SNR	-	Minimum required signal quality to identify the blade passing frequency	-	Service	Service
3-1-11	Inverter frequ. 0V	Hz	Reference point 0 V for scaling the analog input to the PumpDrive output frequency	-	All	All
3-1-12	Inverter frequ. 10V	Hz	Reference point 10 V for scaling the analog input to the PumpDrive output frequency	-	All	All
3-1-13	Analog output type	-	Type of analog output	▪ 0…20 mA ▪ 4…20 mA	All	All

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-1-14	Outlet pressure 0/4mA	bar	Reference point 0/4 mA for scaling the analog output to the discharge pressure	-	All	All
3-1-15	Outlet pressure 20mA	bar	Reference point 20 mA for scaling the analog output to the discharge pressure	-	All	All
3-1-16	Differntl prssr0/4mA	bar	Reference point 0/4 mA for scaling the analog output to the differential pressure	-	All	All
3-1-17	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	Vane freq. Detection	-	Detection of blade passing frequency	▪ On ▪ Off	All	All
3-2	Sensor calibration				Service	Service
3-2-12	Inlet calibration	-	Selection of saved calibration values	▪ 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	▪ 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	m³/h	Flow rate at best efficiency point at nominal speed	-	All	All
3-3-2	Capacity Qgw1	m³/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	m³/h	Flow rate value for activating the characteristic curve segments on the display: Switch from segment 2 to 3.	-	Service	-
3-3-4	Capacity Qgw3	m³/h	Flow rate value for activating the characteristic curve segments on the display: Switch from segment 3 to 4.	-	Service	-

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-3-5	Max flow segment 1	%	Flow rate value in percent 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 percent 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 percent 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	EFF tolerance [%]	%	Limit value for activating the energy efficiency icon in percent of operating hours in sub-optimal operating modes.	▪ 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.	▪ Norm curve ▪ Flat curve	All	All
3-3-11	Pdrive Flow	-	Transmission of the estimated flow rate to PumpDrive1 with System-HMI	▪ 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	▪ PumpHead ▪ Diff. pressure ▪ According connection determined by the polarity of the power supply, see PumpMeter operating manual	All	All
3-3-15	Select. analog out	-	Selection of output variable for the analog output	▪ Disch. Pressure out ▪ Diff. pressure Capacity Q ▪ 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
3-4	Curve points				All	All
3-4-1	Discharge volume Q				All	All
3-4-1-1	Discharge volume Q0	m³/h	Flow rate at characteristic curve reference point 0, always 0 m³/h	-	All	All
3-4-1-2	Discharge volume Q1	m³/h	Flow rate at characteristic curve reference point 1	-	All	All
3-4-1-3	Discharge volume Q2	m³/h	Flow rate at characteristic curve reference point 2	-	All	All
3-4-1-4	Discharge volume Q3	m³/h	Flow rate at characteristic curve reference point 3	-	All	All
3-4-1-5	Discharge volume Q4	m³/h	Flow rate at characteristic curve reference point 4	-	All	All
3-4-1-6	Discharge volume Q5	m³/h	Flow rate at characteristic curve reference point 5	-	All	All
3-4-1-7	Discharge volume Q6	m³/h	Flow rate at characteristic curve reference point 6	-	All	All
3-4-1-8	Q requested	m³/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	-
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 percent 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 percent 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

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
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 rating	-	Service	-
3-5	Display units				All	All
3-5-1	Time unit operation	-	Unit for the operating periods	-	All	All
3-5-2	Head unit	-	Unit for the head	-	All	All
3-6	Service	-		-	Service	Service
3-6-1	Factory Reset	-	Restores the 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/m³	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 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
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	Rated motor power	-	All	All
3-9-3	Rated motor speed	rpm	Rated motor speed	-	All	All
3-9-4	Rated freq	Hz	Rated frequency	-	All	All
3-9-5	Rated voltage	V	Rated voltage	-	All	All
3-9-6	Rated current	A	Rated current	-	All	All

Parameter	Name	Unit	Description	Possible settings	Read-only access	Write access
3-9-7	Rated cosphi	-	Nominal cos phi	-	All	All
3-9-10	Direction of rot.	-	Direction of rotation. For information purposes	▪ Left ▪ Right ▪ Bidirectional	Service	Service
3-10	Modbus settings				All	All
3-10-1	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	IO mode	-	IO mode	▪ Modbus timeout ▪ Analog in/out ▪ Modbus permanent	All	All
4	Info				All	All
4-1	PumpMeter info			-	All	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

Carrying out work on a running pump

Risk of injury: Limbs can be pulled into or crushed by machinery!

- ▷ De-energise the motor.
- ▷ Take steps to ensure that the motor cannot be switched on again unintentionally.

DANGER

Electric shock

Danger to life!

- ▷ De-energise the mains connections for all devices (e.g. pump, PumpDrive, PumpMeter).
- ▷ 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 customer service is required.

Table 17: 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 "IN1" port; sensor defective or broken wire	Sensor not connected correctly to "IN1" port.	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.	1. Replace defective sensor with new one .
E02	Discharge-side sensor not connected to "IN2" port; sensor defective or broken wire	Sensor not connected correctly to "IN2" port.	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.	1. Replace defective sensor with new one .
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 on the suction side and discharge side of the pump, 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. Interchange the sensors (⇨ Section 5.5, Page 22) .
		Sensor connections "IN1" and "IN2" are interchanged.	1. Make sure that the sensors are connected to the device (⇨ Section 5.5, Page 22) .

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 ▪ 3-1-1 Suction-side diameter D1 ▪ 3-1-2 Discharge-side diameter D2 ▪ 3-1-3 Diameter D2x	1. Verify inputs for D1, D2 and D2x and adapt 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 .
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 .
E20	Incorrectly programmed	Device description file missing or faulty.	1. Contact KSB.
–	Implausible measured values	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.
–	Operating point displayed during standstill of the pump	Sensor interchanged. (If the measuring ranges of the sensors differ on the suction side and discharge side of the pump, 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 .

Error code	Error/defect description	Possible cause	Remedy
–	Operating point displayed during standstill of the pump	Sensor connections "IN1" and "IN2" are interchanged.	1. Check that the sensors are connected correctly .
–	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 13) .
–	No output signal	Device connected incorrectly.	1. Check the electrical connection (⇨ Section 5.3, Page 13) .
–	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), visible in 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 connection of a pressure sensor	Sensor not screwed in correctly and/or sealing element not suitable for thread type.	1. Check that the sensors are connected correctly .

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 LSA

Series numbers: 10304QH100001 to 10304TA100001

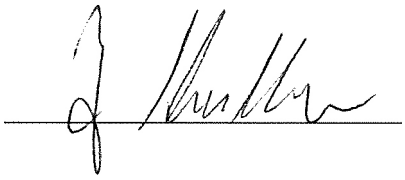
- is in conformity with the provisions of the following Directives as amended from time to time:
  - Electromagnetic Compatibility Directive 2014/30/EU

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 February 2018



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