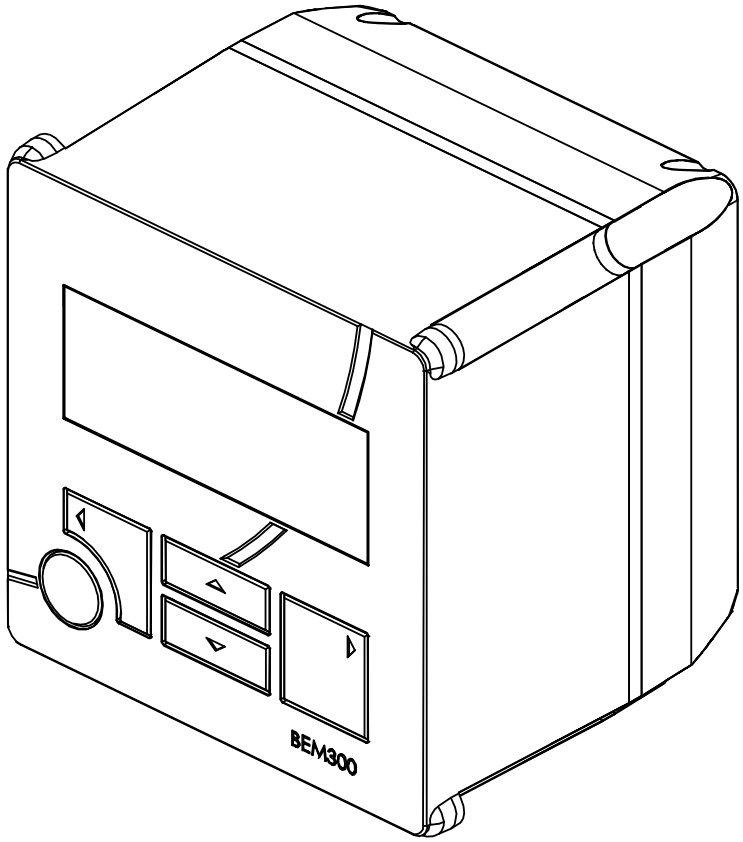
Operating instructions



KRAL display and processing unit

BEM 300

SW 2.004

OIE 15en-GB
Edition 2020-03
Original instructions

Table of contents

1 About this document

1.1 General information

These instructions form part of the product and must be kept for future reference. Furthermore please observe the associated documents.

Notice In these operating instructions the designation "Electronic unit" is used for the "Display and processing unit".

1.2 Target groups

The instructions are intended for the following persons:

- ☐ Persons who work with the product
- ☐ Operator-owners who are responsible for the use of the product

Persons who work with the product must be qualified. The qualification ensures that possible dangers and damage to property that are connected to the activity are detected and avoided. These persons are qualified personnel who carry out the work properly due to their training, knowledge and experience and on the basis of the relevant provisions.

Information on the qualification of the personnel is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

Target group	Activity	Qualification
Fitter	Mounting, connection	Qualified personnel for mounting
Electrician	Electrical connection	Qualified personnel for electric installation
Trained personnel	Delegated task	Personnel trained by the operator-owner who know the task delegated to them and the possible dangers arising through improper behaviour.

Tab. 1: Target groups

1.3 Associated documents

- ☐ Declaration of conformity according to EU Directive 2014/30/EU
- ☐ Corresponding operating instructions of the flowmeter
- ☐ Corresponding operating instructions of the sensor
- ☐ Calibration certificate
- ☐ Work sheet
- ☐ Wiring diagram

1.4 Symbols

1.4.1 Danger levels

	Signal word	Danger level	Consequences of non-observance
	DANGER	Immediate threat of danger	Serious personal injury, death
	WARNING	Possible threat of danger	Serious personal injury, invalidity
	CAUTION	Potentially dangerous situation	Slight personal injury
	ATTENTION	Potentially dangerous situation	Material damage

1.4.2 Danger signs

	Meaning	Source and possible consequences of non-observance
	Electrical voltage	Electrical voltage causes serious physical injury or death.

1.4.3 Symbols in this document

	Meaning
	Warning personal injury
	Safety instruction
	Request for action
1. ▶ 2. ▶ 3. ▶	Multi-step instructions for actions
⇨	Action result
	Cross-reference

2 Safety

2.1 Proper use

- ☐ The electronic unit is provided for usage with a KRAL flowmeter.
- ☐ Use the electronic unit only within the operating limits specified in the "Technical data" chapter.

2.2 Foreseeable misuse

- ☐ Any use that extends beyond the proper use or any other use is misuse.

2.3 Fundamental safety instructions

The following safety instructions must be observed:

- ☐ Read the operating instructions carefully and observe them.
- ☐ Have work only carried out by qualified personnel/trained personnel.
- ☐ Wear personal protective equipment and work carefully.
- ☐ Observe the operating instructions of the flowmeter and of the sensors.

3 Technical data

3.1 Dimensional drawing

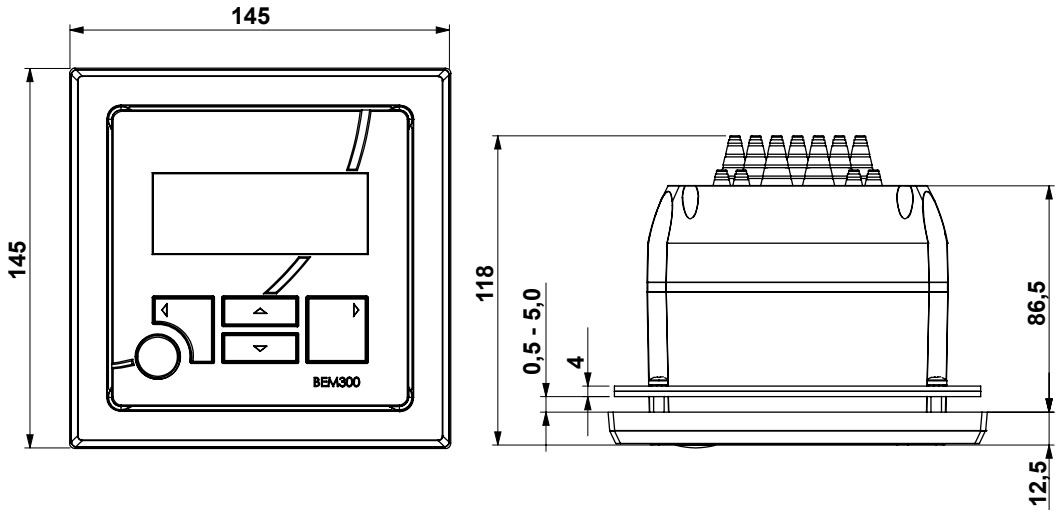


Fig. 1: Dimensional drawing

Parameter	Unit	Value
H x W x D	[mm]	145 x 145 x 118

Tab. 2: Dimensions

3.2 Display

Criterion	Data
Text display	4 lines/20 characters
Updating rate	100 ms
Background illumination	20 levels, can be adjusted via software or analog input
Contrast	20 levels, can be adjusted via software
Language selection	☐ German ☐ English ☐ French ☐ Spanish

3.3 Connection data

3.3.1 Power supply

Parameter	Unit	Value
Power supply	[V DC]	24 ± 20 %
Max. current consumption	[mA]	0.5
Insulation voltage	[V]	<500

3.3.2 Tension spring terminals

Cable type	Unit	Terminating range
Strand	[mm^2]	0.08 – 2.5
Litz wires	[mm^2]	0.08 – 2.5
Wire end ferrule	[mm^2]	0.08 – 1.5

3.3.3 Pulse input and analog input

Component	Designation		Unit	Value
Pulse input	Limit frequency min. - max.		[Hz]	0.5 – 20000
	Power supply for pick up	NPN/PNP	[V DC]	24
		Namur	[V]	8.2
	Input impedance	NPN/PNP	[kΩ]	3.2
		Namur	[kΩ]	1
	Can be configured for counter mode or encoder mode			
Analog input 0 – 10 V (background illumination)	Input resistance		[kΩ]	3.4
	Only possible for U = 0 V setting in the menu			

3.3.4 Analog output and pulse output

Component	Designation		Unit	Value
Analog output 4 – 20 mA	Active current source			
	Short-circuit proof			
	Scalable			
	Load		[Ω]	<500
	Electrical isolation		[V_{eff}]	500
	Resolution		[µA]	1
	Temperature drift		[%]	±0.1
	Calibration tolerance		[%]	±0.1
	Reaction time: 0.15 s x smoothing value			
Analog output 0 – 10 V	Active voltage source			
	Short-circuit proof			
	Scalable			
	Load		[Ω]	>500
	Resolution		[mV]	1
	Temperature drift		[%]	±0.1
	Calibration tolerance		[%]	±0.1
	Reaction time: 0.15 s x smoothing value			
Pulse output	Active pulse sources (PNP transistor switches power supply)			
	Output current max.		[mA]	20
	Short-circuit proof			
	Load		[kΩ]	>1
	Scalable			
	Signal level at 24 V DC power supply	High	[V DC]	>20
		Low	[V DC]	<1
	Pulse width adjustable	High	[ms]	2 – 200
	Flow direction detection in the Encoder mode possible			
	Max. output frequency at pulse width 2 ms		[Hz]	250

3.3.5 Modbus interface

Designation	Unit	Data/value
Interface type		☐ RS 232 (SLAVE) ☐ RS 485 (SLAVE)
Baud rate	[Bd]	9600
Data format		8N1 (8 data bits, no parity, 1 stop bit)
Protocol		Modbus RTU
Processor cycle time	[ms]	20

3.4 Connection field

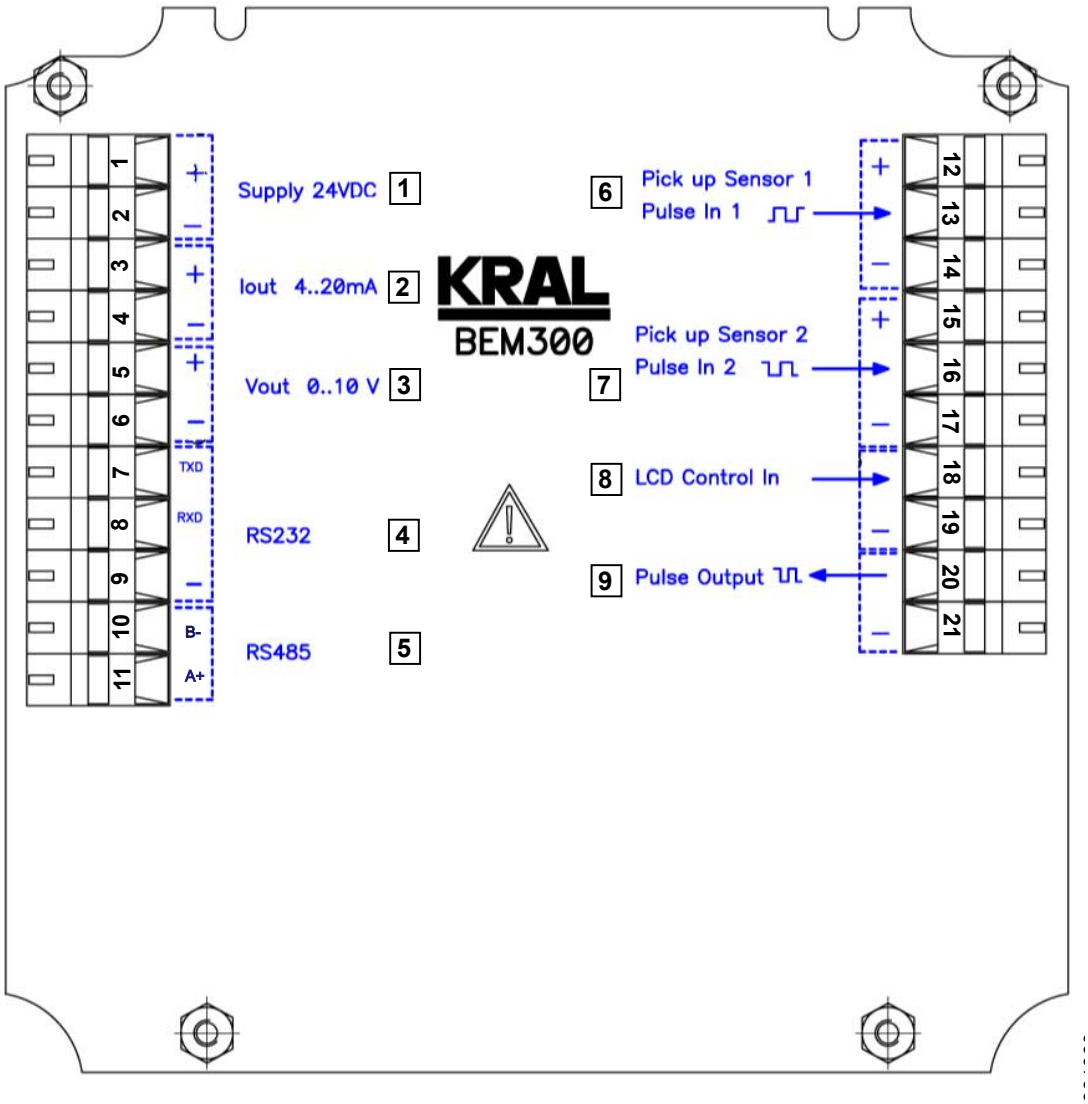


Fig. 2: Termination panel electronic unit

1 Power supply (24 V DC)
2 Analog output (4 - 20 mA)
3 Analog output (0 – 10 V)
4 Serial interface (RS 232)
5 Modbus interface (RS 485)
6 Pick up 1
7 Pick up 2
8 Analog input (0 – 10 V)background illumination
9 Pulse output

The Modbus connection takes place via terminals. The assignment of the terminals is shown in the wiring diagram. The address of the electronic unit at the Modbus can be selected per software, see ***2.10 Modbus address***.

3.5 Pin assignment

Component	Connection/function			Terminal
Pick up		**NPN/PNP Push-pull**	**Namur**	
	Pick up 1	U+24 V DC	U+8.2 V DC	12
		Signal	Signal	13
		Gnd	–	14
	Pick up 2 (+90°)	U+24 V DC	U+8.2 V DC	15
		Signal	Signal	16
		Gnd	–	17

Component	Connection/function		Terminal	
Analog output			**4 – 20 mA**	**0 – 10 V**
		Signal	3	5
		Gnd	4	6
Pulse output		Signal	20	
		Gnd	21	
Analog input	Background illumination			
	0 – 10 V		18	
	Gnd		19	
Serial interface	RS 485	B	10	
		A	11	
	RS 232	TxD	7	
		RxD	8	
		Gnd	9	
Power supply	Different power supply units are available as accessories Accessories, Page 26.			
	+24 V DC		1	
	Gnd		2	

Tab. 3: Pin assignment

3.6 Ambient conditions

Parameter	Unit	Data/value
Storage temperature min. – max.	[°C]	-20 ... +80
Operating temperature min. – max.	[°C]	-20 ... +70
Humidity (relative humidity, non-condensing)	[%]	97
EMC emitted interference/immunity to interference		EN 61326
Vibration		☐ EN 60068–2–47 ☐ EN 60068–2–64
Shock		EN 61373
Isolation min.	[V]	500
Degree of protection		IP 65

Tab. 4: Ambient conditions

3.7 Accessories

Notice The technical data of the accessories are specified separately Accessories, Page 26.

4 Function description

4.1 Functional principle

4.1.1 Usage

The electronic unit is provided for usage with a KRAL flowmeter.

Flowmeters generate a specific number of pulses per flow volume unit - depending on the size and working point. This device-specific characteristic is called the K-factor (unit: pulses/liter) and is specified on the calibration certificate.

The pulse signals of one flowmeter can be evaluated. A pulse input for pick up with the following functions is available:

- ☐ NPN
- ☐ PNP
- ☐ Namur

Either NPN or PNP can be selected for push-pull pick ups. In addition the flowmeter can also be equipped with pick ups for flow direction detection. The electronic unit is supplied with settings in accordance with the customer requirements.

4.1.2 Volume measurement

Each positive edge of the pulse signal starts a period measurement and at the same time stops the previous measurement. The flow rate is then calculated via the frequency (= inverse of the period duration) and the K-factor. The inverse of the K-factor is the pulse value in I/P. This is retroactively added to the total sums for each positive edge of the signal.

4.1.3 Mass calculation

The volume can be converted into mass via a configurable fixed density value (menu 4).

4.1.4 Averaging

A strongly fluctuating flow rate causes a jumping display or as a result a fluctuating analog output. The averaging function reduces this effect by generating a averaging across several measured values. The number of measured values for averaging can be set. See ***2.07 Averaging analog output*** and see ***2.12 Averaging display rate***.

4.1.5 Flow direction detection

In extreme cases the flow direction can change through pulsations, meaning through liquid waves in the pipe system. Through the use of two pick ups that supply signals out of phase by 90° (square wave encoder signals), a reversal in the flow direction is recognized by means of the flow direction sensor and taken into account when calculating the total value. The electronic unit offers incremental encoding inputs for each flowmeter. This means that the flow direction can be determined without additional components and taken into account in the calculation at any time.

4.1.6 Electronic evaluation

The electronic unit receives signals from the pick ups and calculates the measured values which are indicated in the display unit and which can be called up at the analog output or at the Modbus interface.

Possibilities of the electronic unit:

- ☐ Language selection
- ☐ Display of the measured values in different units (volumes, masses and temperatures)
- ☐ Averaged display values
- ☐ A density for conversion to mass
- ☐ Information message at faults or invalid inputs
- ☐ 1 scalable and assignable analog output 0 - 10 V or 4 - 20 mA
- ☐ 1 scalable and assignable pulse output
- ☐ 1 analog input 0 – 10 V for background illumination

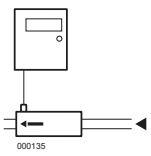
4.1.7 Modbus connection

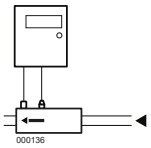
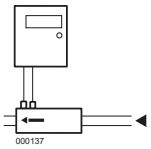
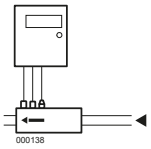
The electronic unit can be connected to the system by means of a Modbus interface and can thus be integrated into existing systems. This ensures simple, reliable and rapid data exchange.

4.1.8 Applications

Different extension stages of the electronic unit are presented on the basis of the following examples. This allows the required functional scope to be selected in accordance with the requirements.

Single-line measurement

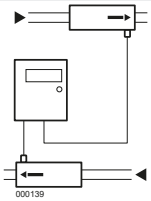
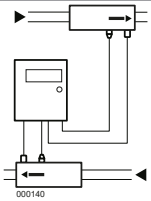
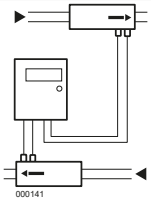
Extension stage	Components	Functions
 Basic	☐ 1 flowmeter ☐ 1 pick up ☐ 1 BEM 300 electronic unit	☐ Electronic evaluation ☐ Volume measurement ☐ 1 analog output ☐ 1 pulse output

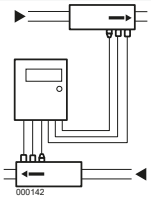
Extension stage	Components	Functions
 Basic + temperature compensation	☐ 1 flowmeter ☐ 1 pick up ☐ 1 temperature sensor Pt100 ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Volume measurement ☐ Mass flow measurement ☐ Temperature compensation ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs ☐ Filling
 Basic + flow direction detection	☐ 1 flowmeter ☐ 2 pick ups ☐ 1 BEM 300 electronic unit	☐ Electronic evaluation ☐ Volume measurement ☐ Flow direction detection ☐ 1 analog output ☐ 1 pulse output
 Basic + flow direction detection + temperature compensation	☐ 1 flowmeter ☐ 2 pick ups ☐ 1 temperature sensor Pt100 ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Volume measurement ☐ Flow direction detection ☐ Mass flow measurement ☐ Temperature compensation ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs ☐ Filling

Tab. 5: Extension stages single-line measurement

Notice The BEM 500 electronic unit can also be used for two separate single-line measurements.

Differential measurement

Extension stage	Components	Functions
 Basic	☐ 2 flowmeters ☐ 1 pick up each ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Differential measurement ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs
 Basic + temperature compensation	☐ 2 flowmeters ☐ 1 pick up each ☐ 1 temperature sensor Pt100 each ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Differential measurement ☐ Mass flow measurement ☐ Temperature compensation ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs
 Basic + flow direction detection	☐ 2 flowmeters ☐ 2 pick up each ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Differential measurement ☐ Flow direction detection ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs

Extension stage	Components	Functions
 Basic + flow direction detection + temperature compensation	☐ 2 flowmeters ☐ 2 pick up each ☐ 1 temperature sensor Pt100 each ☐ 1 BEM 500 electronic unit	☐ Electronic evaluation ☐ Differential measurement ☐ Flow direction detection ☐ Mass flow measurement ☐ Temperature compensation ☐ 2 relay outputs ☐ 2 analog outputs ☐ 2 pulse outputs

Tab. 6: Extension stages differential measurement

4.2 Modbus interface

Menu item	Variable designation	Data address (HEX)	No. of words	Raw data (decimal)	Decimal places	Explanation of data value	Data reading command to BEM (HEX)
1.01	QA rate	4006	2	+/-2 147 483 647	1 ... 3	Unit rate	0103 4006 0002 31CA
1.02	Total A1	4100	2	+/-2 000 000 000	1 ... 3	Unit total	0103 4100 0002 D037
	Total A2	4102	2	+/-2 000 000 000	1 ... 3	Unit total	0103 4102 0002 71F7
1.04	Serial number	4012	2	0...999 999	0	–	0103 4012 0002 71CE
	Software	4020	1	0...65 535	3	–	0103 4020 0001 9000
	Hardware	410A	1	0...65 535	3	–	0103 410A 0001 B034

Tab. 7: Modbus variables

Data value	Value	Meaning	Value	Meaning	Value	Meaning
Unit rate	1	l/sec	9	lb/sec	17	galUK/h
	2	l/min	10	lb/min	18	m^3/min
	3	l/h	11	lb/h	19	m^3/h
	4	kg/sec	12	galUS/sec	20	g/sec
	5	kg/min	13	galUS/min	21	g/min
	6	kg/h	14	galUS/h	22	ml/sec
	7	t/min	15	galUK/sec	23	ml/min
	8	t/h	16	galUK/min		
Unit total	1	l	4	lb	7	m^3
	2	kg	5	galUS	8	g
	3	t	6	galUK	9	ml
No. of decimal places	1	1 decimal place, this means all values with 1 ... 3 decimal places must be divided by 10 (10^1) to get the actual value.				
	2	2 decimal places, this means all values with 1 ... 3 decimal places must be divided by 100 (10^2) to get the actual value.				
	3	3 decimal places, this means all values with 1 ... 3 decimal places must be divided by 1000 (10^3) to get the actual value.				

Tab. 8: Data values

Example for Total TA1

Data reading command to BEM (query): 0103 4100 0002 D037

Response from BEM: 0103 0400 0160 9E02 5B

Value	Meaning
0103 0400 0160 9E...	**01** = Modbus device address 1
01**03** 0400 0160 9E...	**03** = Read holding registers function

Value	Meaning		
0103 **04**00 0160 9E...	**04** = Response of BEM consists of 4 bytes:		
	00 0160 9E	1. Data byte 0 * 2^{28} + 0 * 2^{24} =	0
	00 **01**60 9E	2. Data byte 0 * 2^{20} + 1 * 2^{16} =	65536
	00 01**60** 9E	3. Data byte 6 * 2^{12} + 0 * 2^{8} =	24576
	00 0160 **9E**	4. Data byte 9 * 2^{4} + 14 * 2^{0} =	158
The Modbus value therefore corresponds to the sum			90270

If the value of a data query of the data address is 4186 = 2 (see Tab. Data values number of decimal places), the Modbus value has to be divided by 100. The result is then 902.7.

If the value of a data query of the data address is 4015 = 5 (see Tab. Data values unit total). The unit is Total galUS.

The end result for Total TA1 is therefore 902.7 galUS.

Notice The numbering of the register addresses starts at 1, the data addressing at 0. This is how e.g. when reading register 1 the data address 0 is used.

Notice All units and the number of decimal places should be read out at least during initialization of the electronic unit, i.e. during switch-on, because these values can be modified manually.

Notice For parameter settings of the electronic unit via Modbus function 10 (hex) = write holding registers (preset multiple registers) can be used. Data exchange via the Modbus connection is not password-protected – avoid unintended overwriting of the total values or parameter addresses!

Notice All data can be read out or written in packages of up to 64 words.

Reset of the total values via the Modbus:

- ☐ Reset command Total T1: 0110 4100 0002 0400 0000 00CF FC
- ☐ Reset command Total T2: 0110 4102 0002 0400 0000 004E 25

5 Transportation, storage

5.1 Scope of delivery

The following components belong to the scope of delivery of the electronic unit:

- ☐ Operating instructions
- ☐ Password
- ☐ Work sheet
- ☐ Mounting frame with screws and wedge lock washers
- ☐ Terminal tool
- ☐ KRAL tool set

5.2 Unpacking and checking the state of delivery

Personnel qualification:	☐ Trained personnel

1. ▶ Upon delivery check the product for damage during transportation.
2. ▶ Report damage during transportation immediately to the manufacturer.
3. ▶ Dispose of packing material in accordance with the locally applicable regulations.

6 Installation, removal

6.1 Dangers during installation, removal

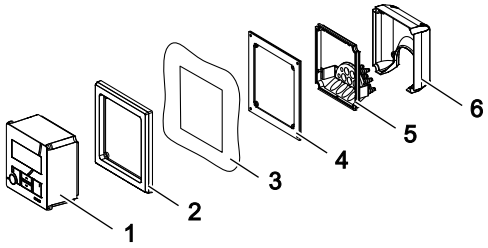
The following safety instructions must be strictly observed:

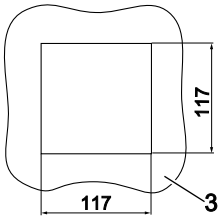
- ☐ Have all work only carried out by electricians.
- ☐ Do not take apart the electronic unit.

6.2 Installing the electronic unit in the control cabinet

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set

Notice When the space is limited, mounting is also possible without a housing cover and without a seal with cable entries.





1 Electronic unit
2 Front frame
3 Control cabinet (section)
4 Sealing frame
5 Seal with cable entries
6 Housing cover

Requirement:
✓ Control cabinet with plate thickness 0.5 - 5.0 mm
✓ Mounting depth min. 80 mm

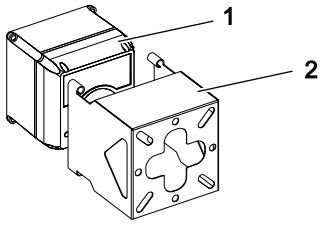
1. Create a control cabinet section.
2. If the space is limited, remove the housing cover **6** and seal with cable entries **5**.
3. Slide the front frame **2** from behind onto the electronic unit **1**.
4. Place the electronic unit with the front frame from the front into the control cabinet section.
5. Slide the sealing frame **4** from behind onto the electronic unit. In the process the sealing surface must point to the front.
6. Fasten the front frame **2** and sealing frame **4** using the 4 supplied screws and wedge lock washers. Carefully tighten with 1 Nm torque.

⇨ The electronic unit is ready for the connection of the cables.

6.3 Mounting the electronic unit to the wall

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set

For wall mounting a universal mount is available as an accessory ↳ Accessories, Page 26.



1 Electronic unit
2 Universal mount

Requirement:
✓ Universal mount mounted to the wall
✓ All cables have been shortened and connected

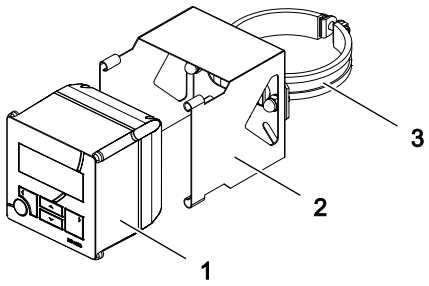
1. Slide the electronic unit **1** into the universal mount **2**.
2. Fasten the electronic unit using the supplied screws, washers and wedge lock washers.

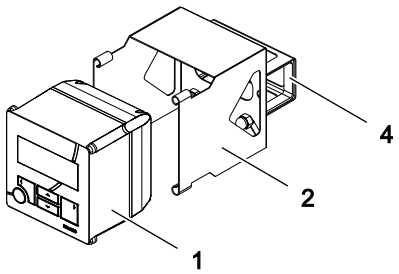
⇨ The electronic unit is ready to operate after the power supply has been switched on.

6.4 Mounting the electronic unit at the pipe/flowmeter

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set

The electronic unit can be mounted to the pipe or on the flowmeter by means of the universal mount and the corresponding fixing kit. The required fixing kit is available as an accessory. ↳ Accessories, Page 26





1 Electronic unit
2 Universal mount
3 Fixing kit for mounting at pipe (for flowmeter OMG)
4 Fixing kit for flowmeter (for flowmeter OME)

Requirement:
✓ All cables have been shortened and connected

1. Mount the universal mount **2** on the fixing kit **3** or **4**.
2. Mount the fixing kit including universal mount to the pipe or flowmeter.
3. Slide the electronic unit into the universal mount.
4. Fasten the electronic unit using the supplied screws, washers and wedge lock washers.

⇨ The electronic unit is ready to operate after the power supply has been switched on.

7 Connection

7.1 Dangers during connection work

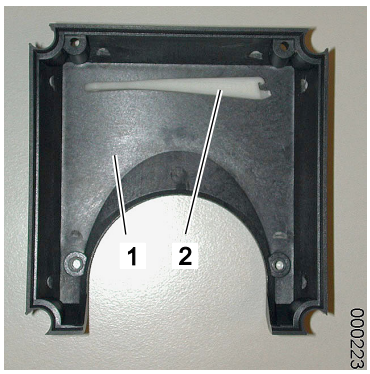
The following safety instructions must be strictly observed:

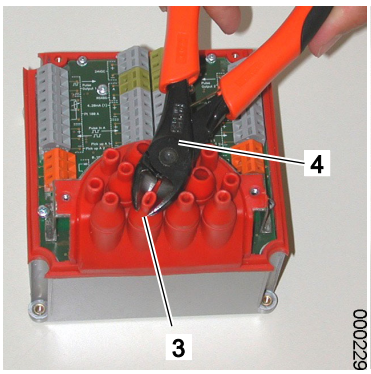
- ☐ Have all work only carried out by electricians.
- ☐ The connecting lines of the sensor connections are to be shielded and laid separately from the supply and measuring lines.
- ☐ Ensure that the power supply is correct (24 V DC).

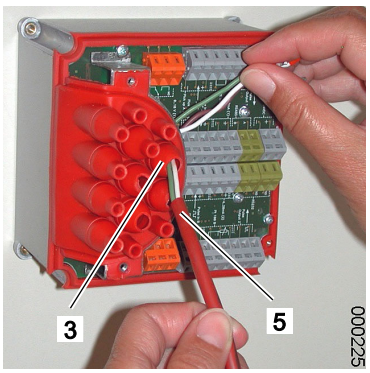
7.2 Connecting cables to the tension spring terminals

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set ☐ Diagonal cutter

Requirement:
✓ Cable shortened to correct length
✓ All wires stripped to approx. 5 mm

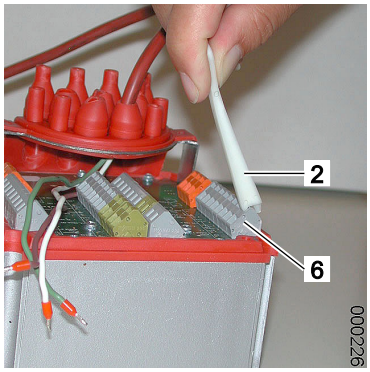


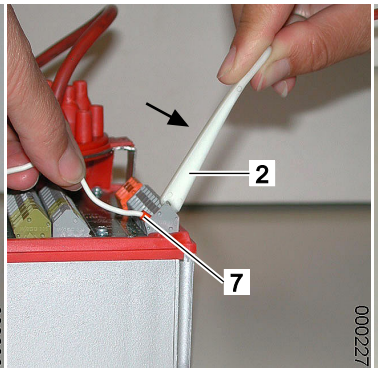


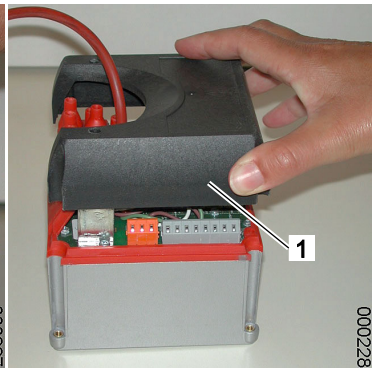


1. Remove the rear device cover **1** and remove the terminal tool **2**.

2. Use the diagonal cutter **4** to adapt the cable entry **3** to the cable diameter.
3. Pull the cable **5** through the cable entry **3**.







4. Hook the short arbour of the terminal tool **2** into the tension spring terminal **6** and press away from the cable opening so that the cable opening opens.
5. Insert the wire **7** into the cable opening and remove the terminal tool **2**.
6. Repeat Steps 4 and 5 for all the wires.
7. Replace the rear device cover **1**.

7.3 Connecting the pick up

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set ☐ Diagonal cutter ☐ Wiring diagram

ATTENTION

Device damage through incorrect connection

- ► Observe pin assignment and connection data of the electronic unit ↳ Technical data, Page 5.
- ► Before connecting the electronic unit to the power supply, ensure that all consumers (sensors) are connected correctly. See the wiring plan.

Requirement:
✓ Pick up for flowmeter installed

1. Remove the rear device cover.
2. Use the diagonal cutter to adapt the cable entry to the cable diameter.
3. Pull the cables of the pick ups individually through the cable entries.
4. Connect the cables for pick ups of flowmeter A in accordance with the wiring diagram on the electronic unit.
5. Replace the rear device cover.

7.4 Connecting analog outputs and pulse inputs

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set ☐ Diagonal cutter ☐ Wiring diagram

ATTENTION

Device damage through incorrect connection.

- ► Observe pin assignment and connection data of the electronic unit Technical data, Page 5.
- ► Do not supply voltage to the analog outputs or pulse outputs (active outputs!).

1. ▶ Remove the rear device cover.
2. ▶ Use the diagonal cutter to adapt the cable entry to the cable diameter.
3. ▶ Pull the cables for the analog outputs or pulse outputs individually through the cable entries.
4. ▶ Connect the cables for the analog outputs or pulse outputs in accordance with the terminal diagram.
5. ▶ Route the cable for analog outputs or pulse outputs to the load and connect the load.
6. ▶ Replace the rear device cover.

7.5 Connecting the power supply

Personnel qualification:	☐ Electrician
Personal protective equipment:	☐ Work clothing
Aids:	☐ KRAL tool set ☐ Diagonal cutter ☐ Wiring diagram

ATTENTION

Device damage through incorrect connection

- ► Observe pin assignment and connection data of the electronic unit Technical data, Page 5.
- ► Before connecting the electronic unit to the power supply, ensure that all consumers (sensors) are connected correctly. See the wiring plan.

Requirement:

✓ All sensors correctly connected

✓ System in a deenergized state and secured against being switched on

1. ▶ Remove the rear device cover.
2. ▶ Use the diagonal cutter to adapt the cable entry to the cable diameter.
3. ▶ Pull the supply cable (24 V DC) through the cable entry and connect.
4. ▶ Replace the rear device cover.
5. ▶ Connect the supply cable (24 V DC) to the power supply of the system.

⇨ The electronic unit is ready to operate.

8 Commissioning

8.1 Checking the electronic unit

Some basic checks must be performed before commissioning the electronic unit:

Test	Procedure
Installation	1. ▶ Check that the electronic unit is seated firmly. 2. ▶ In case of wall mounting/pipe mounting or mounting on flowmeter: Ensure that the rear device cover and cable entries seal properly.
Electrical installation	1. ▶ Ensure that the system is deenergized. 2. ▶ Remove the rear device cover. 3. ▶ Check that the wiring of the power supply at the termination panel is firm. 4. ▶ Check the connection of the power supply to the system. 5. ▶ Check the numbering of the pick ups. 6. ▶ Check the assignment of the pick ups. 7. ▶ Check the pick up connections, see wiring diagram.

Test	Procedure
Function test	Electronic unit: ⟶ Switch on the power supply. ⇨ The start message is displayed on the display unit. ⇨ The following is displayed no later than 3 seconds: ***1.01 Display Volumeter A***.

9 Decommissioning

9.1 Taking the electronic unit out of operation

⚠ DANGER

Risk of death resulting from electric shock.

► The electronic unit may only be separated from the power supply by an authorized electrician.

⟶ Switch off the power supply of the system.

Notice All the settings and total values are retained when the electronic unit is switched off or the power supply fails. After recommissioning, instantaneous values (***Q***, ***T***) can be recalculated.

10 Operation

10.1 Abbreviations, units and signals

10.1.1 Abbreviations

Abbreviation	Meaning
Q_{nom}	Nominal flow rate
QA	Current flow flowmeter A
∑A1	Total flow flowmeter A since last reset (without password protection)
∑A2	Total flow flowmeter A since last reset (with password protection)
Rho	Density
f	Frequency
K	K-factor

10.1.2 Units

In order to make extensive conversions by the user superfluous, various country-specific units and quantities of a unit are available for the display.

Abbreviations	Meaning
Volume	ml, l, galUS, galUK, m^3
Masses	g, kg, t, lb
Flow, volumetric	ml/s, ml/min, l/s, l/min, l/h, galUS/s, galUS/min, galUS/h, galUK/s, galUK/min, galUK/h, m^3/min, m^3/h
Flow, mass-specific	g/s, g/min, kg/s, kg/min, kg/h, t/min, t/h, lb/s, lb/min, lb/h
Density	kg/m^3, lb/galUS, lb/galUK
Frequency	Hz
K-factor	P/l

10.1.3 Pulse signals

A pulse input for pick up with the following functions is available:

☐ NPN
☐ PNP
☐ Namur

Either NPN or PNP can be selected for push-pull pick ups, see ***2.11 Setting Function Pick up***.

10.2 Key assignment

The electronic unit is operated by means of five keys.

Button	Function
SET	☐ Confirm the entry ☐ Reset the total values ☐ Confirm the selection
▲	☐ Switch to the following menu item ☐ Select the previous unit ☐ Increase the digit
▼	☐ Switch to the previous menu item ☐ Select the next unit ☐ Decrease the digit
→	Navigate one menu higher
←	Navigate one menu lower

Menu items can be called up via key combinations.

Key combination	Function
← + →	***1.12 Help operation***
SET + →	***1.07 Setting select language***
SET + ←	***Menu 7: Alarms***
▲ + ▼	***1.01 Display Volumeter A***

10.3 Operation at a glance

General operating steps

The following table describes the entry of the password as well as general operating steps, such as the changing of values and units. The password is included in the scope of delivery and consists of four digits.

Aim	Operating steps
Enter the password, see ***2.01 Setting Enable Password***	**Deactivate password protection** 1. SET Press . ⇨ The password prompt is displayed. ⇨ Flashing cursor indicates the active input field. 2. With ← or → change the position within the number input. 3. With ▲ or ▼ increase or decrease the digits. 4. Repeat Steps 2 and 3 for all the digits. 5. SET Press . ⇨ Password protection is deactivated: The text ***No*** is displayed. Change of settings possible. Password protection is reactivated automatically after approx. 30 minutes. **Activate password protection** 1. SET Press . 2. With ▲ or ▼ ***select Yes*** . 3. SET Press .

Aim	Operating steps
Change the value	Requirement: ***2.01 Setting Enable Password*** Set to ***No*** . 1. SET Press . ⇨ Flashing cursor indicates the active input field. 2. With ◀ or ▶ change the position within the number input. 3. With ▲ or ▼ increase or decrease the digits. 4. Repeat Steps 2 and 3 for all the digits. 5. SET Press .
Change the unit	Requirement: ***2.01 Setting Enable Password*** Set to ***No*** . 1. SET Press . ⇨ Flashing cursor indicates the active input field. 2. Select with ▲ or ▼ . 3. SET Press .

Operating the basic functions

The following table describes the basic operating steps. They can be carried out in part without a password having to be entered.

Aim	Operating steps
Read the load, see ***1.01 Display Volumeter A***	**Call up menu item** ▲ Press + ▼ simultaneously.
Reset sum, see ***1.02 Display Volumeter A Total***	**Reset of the total values** 1. SET Press . ⇨ Total value 1 is selected. 2. SET Press for three seconds. ⇨ Total value 1 is reset. 3. SET Press . ⇨ Total value 2 is selected. 4. SET Press for three seconds. ⇨ Entry of password required. 5. Enter password and SET press . ⇨ Total value 2 is reset.
Select the language, see ***1.07 Setting language selection***	**Call up menu item** SET Press + ▶ simultaneously. **Select the language** 1. SET Press . ⇨ Flashing cursor indicates the active input field. 2. With ▲ or ▼ select the language. 3. SET Press . ⇨ The selected language is applied after a different menu item has been called up.

Aim	Operating steps
Call up help, see ***1.12 Help operation***	**Call up menu item** Press + simultaneously. **Navigate** 1. Browse with or . 2. SET Press to exit the help.

11 Menu description

11.1 Start

Menu item	Description
1.04 Information	= Start message with display of the serial number as well as version of the software and hardware. After switching on the start message shows for three seconds that the electronic unit is ready to operate. After that the following is displayed ***1.01 Display Volumeter A*** **Note:** Activate or deactivate the start message, see ***2.09 Setting Display Start Message*** .

11.2 Menu structure

	Menu	Information
0	Settings (protected)	☐ ***...*** ☐ ***0.09 Pulse output pulse width setting*** ☐ ***...***
1	Display	☐ ***1.01 Display Volumeter A*** ☐ ***1.02 Display Volumeter A Total*** ☐ ***1.03 Display Reset Group Error Message*** ☐ ***1.04 Information*** ☐ ***1.05 Setting Display Brightness*** ☐ ***1.06 Setting Display Contrast*** ☐ ***1.07 Setting select language*** ☐ ***1.12 Help operation*** ☐ ***1.13 Enter Password***
2	Settings	☐ ***2.01 Setting Enable Password*** ☐ ***2.02 Setting Select Unit Rate*** ☐ ***2.03 Setting Select Unit Total*** ☐ ***2.04 Setting Select Unit Density*** ☐ ***2.05 Setting Function Analog Output*** ☐ ***2.06 Setting Scale Analog Output 1*** ☐ ***2.07 Setting Averaging Analog Average*** ☐ ***2.08 Setting Scale Pulse Output 1*** ☐ ***2.09 Setting Display Start Message*** ☐ ***2.10 Setting Address Modbus*** ☐ ***2.11 Setting Function Pick up***
3	K-factors flowmeter A	☐ ***3.01 K-factor Volumeter A Point 1***
4	Density table 1	☐ ***4.01 Density table Point 1***
7	Alarms	☐ ***7.01 No alarm. The electronic unit works without problems.*** ☐ ***7.07 Alarm 6 maximum flow is exceeded. Check the volumeter!*** ☐ ... ☐ ***7.19 Alarm 18 unit changed Correct the scale of pulse output!***

11.3 Menu 0: Settings (protected)

☐ Protected area (access only with system password)
☐ Should only be used by the user to the set the pulse width
☐ Operation, Page 17

Menu item	Description
0.09 Pulse output pulse width setting	This function is only possible after entry of the system password 1919 ***2.01 Setting Enable Password*** . Increasing the pulse width always involves a reduction in the maximum output frequency (e.g. pulse width 200 ms – maximum frequency 2.5 Hz). **Note:** After the setting has been changed, the electronic unit has to be restarted.

11.4 Menu 1: Display

- ☐ Display of measured values
- ☐ Resetting the sum
- ☐ Setting contrast and background illumination
- ☐ ↳ Operation, Page 17

Menu item	Description
1.01 Display Volumeter A	Shows the current flow in flowmeter A.
1.02 Display Volumeter A Total	Shows the total values since the last resetting. **Note**: Total value remains with the following minimum value or maximum value: ☐ 3 decimal places: +/-1 999 999.999 ☐ 1 decimal place: +/-199 999 999.9 Decrease decimal places or change the unit ↳ Troubleshooting, Page 24.
1.03 Display Reset Group Error Message	Reset the group error message after eliminating the cause for the activation of the group error message.
1.04 Information	Shows serial number, software version and hardware version.
1.05 Setting Display Brightness	Adjusting the brightness of the display.
1.06 Setting Display Contrast	Adjusting the contrast of the display.
1.07 Setting select language	Selection of the language.
1.12 Help on operation	Shows the brief instruction.

11.5 Menu 2: General settings

- ☐ Changing general settings in accordance with the requirements of the measuring task
- ☐ Changes only possible with password
- ☐ ↳ Operation, Page 17

Menu item	Description
2.01 Setting Enable Password	Factory settings: ☐ Password: ***1000*** ☐ Password protection: ***Yes*** ***Yes*** ☐ Password protection is active - no changes is possible ***No*** ☐ Password protection is not active - changes are possible **Note:** The pulse width of the pulse input can be changed in ***0.09 Pulse output pulse width setting*** after entering the system password 1919. No further changes may be made by the user in menu 0!

Menu item	Description
2.02 Setting Select Unit Rate	Setting unit rate
2.03 Setting Select Unit Total	Setting unit total
2.04 Setting Select Unit Density	Set unit density
2.05 Setting Function Analog Output	Setting analog output ☐ 1 output ***4 – 20 mA*** ☐ 1 output ***0 – 10 V***
2.06 Setting Scale Analog Output 1	The scale of the analog output is used to set the maximum value. The maximum value is set slightly higher than the highest possible occurring flow rate. If the value ***0*** is entered here, Analog output 1 is deactivated and 0 V or 4 mA respectively is output.
2.07 Setting Averaging Analog Average	The averaging allows for a stable display with varying flow amounts. Possible values, adjusted to the requirements, are between 1 and 10000. In case of averaging the display of quick changes takes place with a time delay. Examples of reaction time for a change of 99.9 % of the actual frequency jump: ☐ Averaging ***1***: 0.02 s ☐ Averaging ***2***: 0.3 s ☐ Averaging ***9***: 1.35 s ☐ Averaging ***10***: 1.5 s ☐ Averaging ***500***: 75 s ☐ Averaging ***1000***: 150 s ☐ Averaging ***10000***: 1500 s No filter is active for Averaging 1. A V_Z1 filter is active as of Averaging 2. In the process the old measured value is weighted higher by the averaging value than the new measured value. Averaging of the display is also active on the Modbus.
2.08 Setting Scale Pulse Output 1	The scale of the pulse output is used to set the pulse significance. Since the pulse values can also be output in packets, the manufacturer recommends using the pulse output only for total values. Select the scale so that the limit frequency of 250/125 Hz is not exceeded. ***0*** Pulse output is switched off. No pulses are output anymore. **Note:** After the setting has been changed, the electronic unit has to be restarted. After the system password 1919 was entered in ***2.01 Setting Enable Password*** the pulse with can be set to 2 - 200 ms in ***0.09 Pulse output pulse width setting*** .
2.09 Setting Display Start Message	Activate or deactivate the start message.
2.10 Setting Address Modbus	The transfer of data by means of the Modbus is possible via the serial interface. The address can be set here. **Note:** Data exchange via the Modbus connection is not password-protected! Write access deletes existing values. Therefore the manufacturer only recommends reading of the data.
2.11 Setting Function Pick up	The pulse input must be adjusted to the pick up used. The following are available: ☐ ***NPN*** ☐ ***PNP*** ☐ ***Namur*** For push-pull pick ups you can either use ***NPN*** or ***PNP*** . **Note:** With this setting you can also switch the supply voltage for the pick up ↳ Technical data, Page 5.

Menu item	Description
2.12 Setting Averaging Display Rate Average	The averaging allows for a stable display with varying flow amounts. Possible values, adjusted to the requirements, are between 1 and 10000. In case of averaging the display of quick changes takes place with a time delay. Examples of reaction time for a change of 99.9 % of the actual frequency jump: ☐ Averaging ***1***: 0.02 s ☐ Averaging ***2***: 0.3 s ☐ Averaging ***9***: 1.35 s ☐ Averaging ***10***: 1.5 s ☐ Averaging ***500***: 75 s ☐ Averaging ***1000***: 150 s ☐ Averaging ***10000***: 1500 s No filter is active for Averaging 1. A V_Z1 filter is active as of Averaging 2. In the process the old measured value is weighted higher by the averaging value than the new measured value. Averaging of the display is also active on the Modbus.
2.13 Setting Function pulse inputs	***Counter*** Flowmeter with a pick up is used. ***Encoder*** Flowmeter with two pick ups is used (flow direction detection option)
2.14 Setting Reset to Factory Setting	Reset of all settings to factory settings (delivery state).
2.15 Setting Number of Decimal Places	Select number of decimal places. 1-3 decimal values are available. Display without decimal place is not possible.

11.6 Menu 3: K-factors flowmeter A

- ☐ Entering the resulting K-factor into the flowmeter
- ☐ K-factors, associated frequencies and resulting K-factor, see calibration certificate of the flowmeter
- ☐ Resulting K-factor, also see rating plate of the flowmeter
- ☐ Changes only possible with password
- ☐ Operation, Page 17

Menu item	Description
3.01 K-factor Volumeter A Point 1	Entering the resulting K-factor into the flowmeter. The frequency is used to monitor the flow range of the connected flowmeter.

11.7 Menu 4: Density table 1

- ☐ A density value can be requested from the supplier of the liquid.
- ☐ Changes only possible with password
- ☐ Operation, Page 17

Menu item	Description
4.01 Density table Point 1	Make the mass conversion of the flow values possible. Prerequisite is that the process temperature is constant and is known and that the density at this temperature has been entered.

11.8 Menu 7: Alarms

The electronic unit evaluates different measured values during operation and analyzes the operating state. If an error occurs, an alarm message is displayed. This provides information used to eliminate the error.

SET	Confirming the alarm. The alarm message disappears from the display. Suitable measures for eliminating the error can be taken subsequently.
SET +	Activated alarm displayed again

12 Maintenance

12.1 Required maintenance

The electronic unit is maintenance-free.

12.2 Cleaning the electronic unit

ATTENTION

Device damage through water.

► Ensure that no water enters the electronic unit.

⟶ Wipe the housing with a soft cloth. In the case of strong soiling wipe off the housing surface slightly moist with a common detergent.

13 Disposal

13.1 Disposing of the electronic unit

ATTENTION

Environmental damage through improper disposal.

► Dispose of all the components in an environmentally friendly manner in accordance with the applicable local regulations.

⟶ As electronic waste the electronic unit has to be disposed of properly.

14 Troubleshooting

14.1 Fault table

Thanks to the high quality standard faults in the display and processing unit are very rare. Implausible display values therefore usually indicate faults in the system. The following fault table lists the various fault messages as well as their cause and remedy.

Alarms

Fault display	Cause and elimination
7.01 No alarm. The electronic unit works without problems.	There is no fault.
7.07 Alarm 6 maximum flow is exceeded. Check the volumeter!	The maximum permissible flow rate was exceeded in a flowmeter. ☐ Limit the flow rate. ☐ Check the flowmeter. ☐ Use a larger size.
7.09 Alarm 8 analog output scaling max exceeded.	The flow rate exceeds the maximum scale value of an analog output. ☐ Correct the scale, see ***2.06 Setting Scale Analog Output 1***.
7.10 Alarm 9 pulse output scaling max exceeded.	The flow rate exceeds the maximum scale value of a pulse output. ☐ Correct the scale, see ***2.08 Setting Scale Pulse Output 1***. The maximum frequency of the pulse output amounts to 250 Hz.
7.11 Alarm 10 Sensor failure pick up volumeter A.	A pick up at flowmeter A has failed. This error message is only displayed at the Setting Function Pulse Inputs***Encoder***, see ***2.13 Setting Function Pulse Inputs*** ☐ Check the connection of the pick up. ☐ Check the position of the pick up in the dry sleeve. ☐ Replace the pick up.

Fault display	Cause and elimination
7.15 Alarm 14 Temperature range electronics exceeded.	The temperature range of the electronic unit has been exceeded. ☐ Check the electronic unit. ☐ Replace the electronic unit.
7.16 Alarm 15 Unit density changed. Correct the density table!	The unit of density has been changed. ☐ Convert the numerical value and correct the density value.
7.18 Alarm 17 Unit changed Correct the scale of analog output!	The unit of the rate has been changed. ☐ Check the scale of the analog outputs and correct it.
7.19 Alarm 18 Unit changed Correct the scale of pulse output!	The unit of Total has been changed. ☐ Check the scale of the pulse outputs and correct it.

Further faults

Further faults	Cause and elimination
Rate = 0, although pulse signals can be measured at the terminals of the electronic unit with the oscilloscope.	One pick up each is connected and the function Pulse input ***Encoder*** selected. ☐ ***2.13 Setting Function Pulse Inputs*** Set to ***Counter*** .
Analog output does not function.	Analog output function selected incorrectly. ☐ Select the correct function, see ***2.05 Setting Function Analog Output*** Signal cable connected to an incorrect analog output. ☐ Correct the connection.
Negative flow	The signal wires at the respective flowmeter are connected incorrectly. ☐ Swap the signal wires.
No flow or flow rate too low	☐ Check the alarms, see ***Menu 7 Alarms*** ☐ Check the connection of the pick up. ☐ Check the pick up and replace it if necessary.
Double flow when the option flow direction detection is used	☐ Switch the function of the pulse input from ***Counter*** to ***Encoder*** , see ***2.13 Setting Function Pulse Inputs***.
When the electronic unit is switched on, the following alarms are displayed: ☐ ***7.07 Alarm 6 Maximum flow is exceeded. Check volumeter!*** ☐ ***7.09 Alarm 8 Analog output scaling max exceeded.*** ☐ ***7.11 Alarm 10 Sensor failure pick up volumeter A.***	☐ Use a power pack 24 V DC 15 W or insert a debounced switch between the electronic unit and power pack ☐ Shield the lines to the pick ups and terminate the shield to Gnd (chassis) or ground.
Keyboard background illumination flashes.	There is an input error. ☐ SET Press + simultaneously. -> The existing errors are displayed. ☐ Eliminate errors.

Further faults	Cause and elimination
Overflow of the total value	After an overflow of the total value the electronic unit displays the following: ☐ For 3 decimal places: ±1 999 999,999 ☐ For 1 decimal place: ±199 999 999,9 ☐ Specify another unit for Total, e.g. m^3 instead of l. After the modification, the Total value is still available after the overflow. ☐ Reduce the number of decimal places.

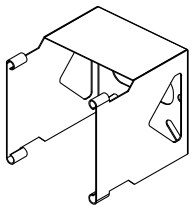
15 Accessories

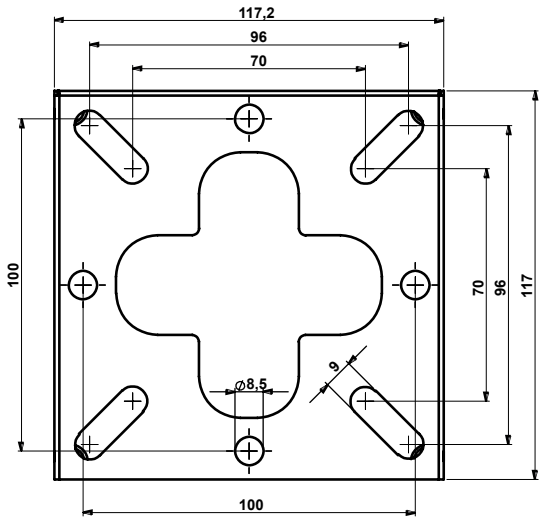
15.1 Installation

15.1.1 Fixing kits

The electronic unit can be installed by various methods. In addition to the mounting frame that forms part of the scope of delivery, diverse fixing kits for mounting the electronic unit are available as accessories.

15.1.2 Universal mount fixing kit

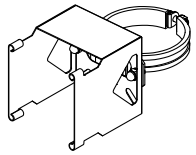
Fixing kit	Application	Article No.	Suitable for
	Wall mounting	UZA 20	BEM 300 BEM 500



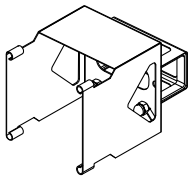
Mounting: M8

Fig. 3: Mounting dimensions of universal mount UZA 20

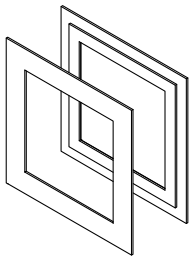
15.1.3 Fixing kit for pipe mounting/mounting on OMG

Fixing kit	Application	Article No.	Suitable for	Pipe diameter [mm] min.	max.
	Pipe mounting/ mounting on flowmeter OMG	UZA 28	BEM 300 / OMG-013 BEM 500 / OMG-013	85	92
		UZA 25	BEM 300 / OMG-020 BEM 500 / OMG-020	72	80
		UZA 26	BEM 300 / OMG-032 BEM 500 / OMG-032	102	110
		UZA 27	BEM 300 / OMG-052 BEM 500 / OMG-052	115	122

15.1.4 Fixing kit mounting on OME

Fixing kit	Application	Article No.	Suitable for
	Mounting on flowmeter OME	UZA 21[1.2]	BEM 300 / BEM 500 / OME-013
		UZA 22[1.2]	BEM 300 / BEM 500 / OME-020
		UZA 24[2]	BEM 300 / BEM 500 / OME-032
	[1] Not suitable for OME with DIN flanges [2] Not suitable for OME with temperature sensor connection		

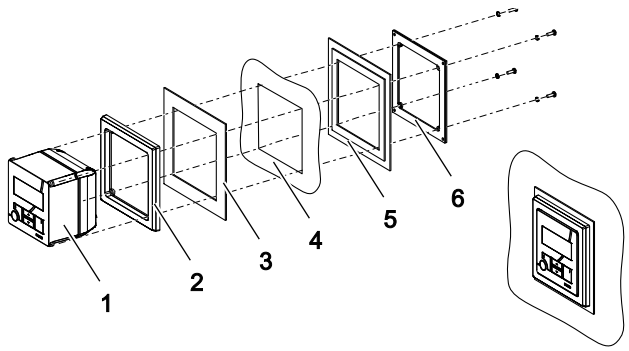
15.1.5 Adapter set for conversion of BEM 4U to BEM 300 / BEM 500

Adapter set	Application	Article No.	Suitable for
	☐ Mounting in the control cabinet ☐ Conversion of BEM 4U to BEM 300 / BEM 500	EGT 23	BEM 300 BEM 500 Scope of delivery: ☐ 1 sheeting bonded to seal ☐ 1 sheeting

Change BEM 4U to BEM 500

Notice The previously used temperature sensors have to be replaced by temperature sensors with Pt100 output. These temperature sensors are available from KRAL. During conversion, observe setting the temperature sensor units.

Notice Depending on the sheeting thickness of the control cabinet the supplied screws may have to be replaced by longer screws.



1	Electronic unit	**5**	Sheeting**
2	Front frame*	**6**	Sealing frame*
3	Sheeting bonded to seal**	**7**	Screws and wedge lock washers*
4	Control cabinet		
*	Included in the scope of delivery of the BEM 300/BEM 500	**	Adapter set

1. Remove the BEM 4U.
2. Slide the front frame **2** and sheeting with seal **3** from the rear onto the electronic unit **1**.
3. Position the electronic unit in the control cabinet section.
4. Slide on the sheeting **5** and sealing frame **6** and fasten using the screws and wedge lock washers **7**.

15.2 Electrical connection

15.2.1 Different voltage

The electronic unit operates with a power supply of 24 V DC. If a deviating voltage is available in the system, a suitable power supply unit can be used.

15.2.2 Rack mounting power supply unit EEN 12

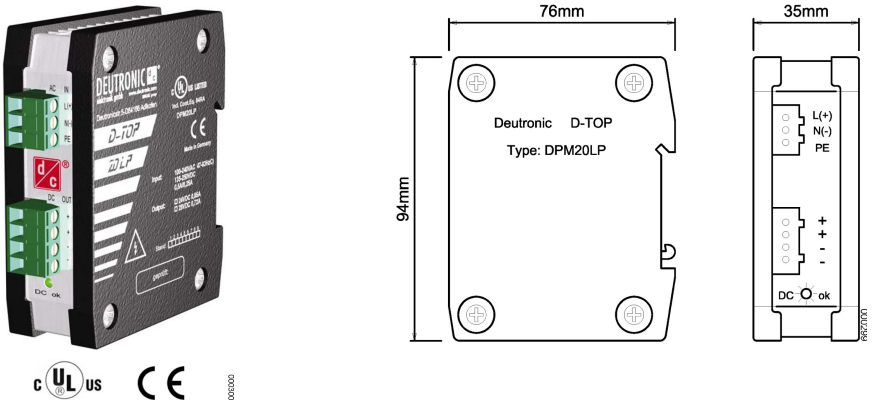


Fig. 4: Rack mounting power supply unit EEN 12

Component	Parameter	Unit	Value
Input	Input voltage	[V AC] [Hz] [V DC]	☐ 100 – 240 (tolerance: 93 – 265) ☐ 47 – 63 ☐ 135 – 370
	Starting current inrush max.	[V AC]	☐ 30 (at 230 V AC) ☐ 15 (at 115 V AC) max. limited by NTC, in heated state higher
	Overvoltage protection at the input		Varistor
	Fuse		Internal fuse T4A 250 V, additional external fuse not required
	Current consumption	[A typ.]	☐ 0.25 (at 230 V AC) ☐ 0.5 (at 115 V AC)

Component	Parameter	Unit	Value
Output	Output voltage	[V DC]	24
	Output current max.	[mA]	850
	Output power	[W]	20
	Function display		LED at front panel
	Current limitation		Fold-back, set to approx. 1.05 x I_{nom}
	System deviation at load change stat. 10 – 90 %	[%]	0.1
	System deviation at load change dyn. 10 – 90 %	[%]	1.0
	Adjusting time	[ms]	1
	System deviation at input change ±10 %	[%]	0.1
	Mains buffering	[ms]	> 20
	Residual ripple	[mVss]	<50
	Switching peaks	[mVss]	<100
	Overvoltage protection at the output		Suppressor diode (Transil diode)
Environment	Storage temperature	[°C]	-40 ~ +85
	Operating temperature	[°C]	-25 ~ +60, above 50 °C performance reduction 1.5 %/°C
	Cooling		Air convection
	Electrical safety		Design to EN 60950
	Degree of protection		IP 20
	Insulation voltage (input/output)	[kV]	3, routine tested
	EMC emitted interference		EN 55011-B
	EMC immunity to interference		EN 61000–6–2
	Efficiency	[%]	83, depending on input voltage and output voltage
	Connections: Screw terminals, pluggable	[mm^2]	☐ Input: 0.5 – 2.5 ☐ Output Ua^+: 2 x 0.5 – 2.5 ☐ Output GND: 2 x 0.5 – 2.5
	Dimensions (WxDxH)	[mm]	36 x 76 x 94
	Weight	[g]	Approx. 250
	Model		Sheet steel, can be snapped onto a DIN rail TS35 (EN 60715) or can be screwed on

Tab. 9: Technical data EEN 12

Terminal assignment

Connection	Function	Terminal
Input	IN L+	1
	IN N-	2
	PE	3
Output	+Ua	4
	+Ua	5
	GND	6
	GND	7

15.2.3 Plug-in power supply unit EEN 13

The accessory set includes exchangeable connectors that can be used in most countries of the world.

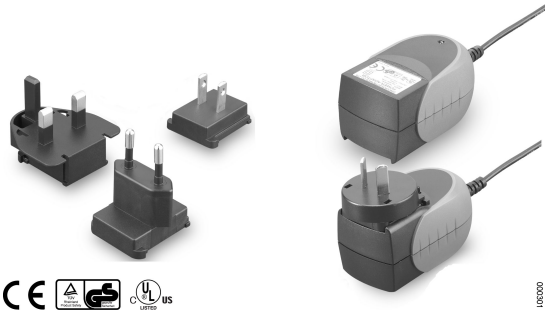


Fig. 5: Plug-in power supply unit EEN 13

Component	Parameter	Unit	Value
Input	Power consumption	[W]	20
	Input voltage	[V AC]	90 – 264
	Frequency	[Hz]	47 – 63
	Max. current consumption	[A]	0.4.
	Leak flow max.	[mA]	0.25
Output	Output voltage	[V DC]	24 ± 2 %
	Output current max.	[mA]	625
	Output power	[W]	15
	Short-circuit protection		Continuous (auto recovery)
	Overvoltage protection		Yes
Environment	Operating temperature	[°C]	0 ~ +40
	Storage temperature	[°C]	-20 °C ~ +85
	Dimensions	[mm]	80.6 x 47.9 x 43.3
	Weight	[g]	130

Tab. 10: Technical data EEN 13

Cable assignment

Connection	Function	Color
Output	+ 24 V	White
	GND	Black

16 Appendix

16.1 Glossary

Designation	Meaning
Updating rate	☐ Shortest period in which a change is displayed in the display
Analog output	☐ Represents an internal digital value as an electrical value (0–10 V, 4–20 mA) ☐ Is updated with the cycle time
Analog input	☐ Converts an electrical value (0–10 V, 4–20 mA) into a digital value
Resolution	☐ Maximum number of possible subdivision steps for describing a value
Baud rate	☐ Rate of data transfer per time unit (bit/s)
Density	☐ Ratio of mass-to-volume (e.g. kg/m^3)
Density table	☐ Describes the relationship of density-to-temperature ☐ Only contains one fixed density value for BEM 300
Differential measurement	☐ The values of two flowmeters are measured and subtracted
Flow rate	☐ Amount flowing per time unit (e.g. l/s)
Flow direction detection	☐ Detection of the flow direction through two sensors with square wave signals out of phase by 90°

Designation	Meaning
Adjusting time	☐ Time span after whose expiry the output is identical with the input
Single-line measurement	☐ The values of a flowmeter are measured and evaluated
Electronic unit	☐ Display and processing unit BEM 300/BEM 500 ☐ Display and processing unit BEM 100/BEM 150
Galvanic isolation	☐ Isolation of differing voltage potentials
Averaging	☐ Low-pass filter function for suppressing abrupt changes
Limit frequency	☐ Minimum or maximum frequency that can be used
Pulse (signal)	☐ A rising edge is followed after a certain period by a falling edge ☐ As a rule corresponds to a square wave signal
Pulse output	☐ Generates pulses with 24 V signal level conforming to the scale of an input variable
Pulse input	☐ Processes pulse signals
Pick up 1	☐ Sensor that generates one pulse per defined flow rate
Pick up 2	☐ Sensor that generates one pulse with +90° phase shift per defined flow rate ☐ Allows a flow direction recognition in combination with Pick up 1
Incremental encoding input	☐ Processes two square wave signals out-of-phase by 90° ☐ Provides a counting function under consideration of the flow direction and a frequency measuring function
K-factor	☐ Number of pulses per flow volume unit ☐ Characteristic of a flowmeter
Linearization	☐ Maps the dependence of the K-factor of a flowmeter across the flow range in an electronic unit
Linearity	☐ Dependence of the K-factor across the flow range
Mass calculation	☐ Volumetric values are converted into mass values under consideration of the temperature by means of the density table.
Modbus connection	☐ Digital communication with connected users
Modbus interface	☐ Makes available the hardware (e.g. RS 232) and software (e.g. Modbus RTU protocol) required for digital communication
Rate	☐ Volume per time unit
Reaction time	☐ Time for a change of 99.9 % of the actual jump
Square wave signal	☐ Pulse signal with square wave form
Relay output	☐ Potential-free change-over contact
Group fault message	☐ Message that indicates the occurrence of at least one fault
Serial interface	☐ Sends or receives data in chronological sequence
Scale	☐ Assigning of a maximum input value to a maximum output value
Temperature input	☐ Processes signals of a temperature sensor
Temperature sensor	☐ Converts the physical value temperature into an electrical value (e.g. resistance)
Temperature compensation	☐ Consideration of the current temperature at the volume calculation and mass calculation in order to compensate density changes
Total	☐ Volume values that have been measured since the last reset
Consumption	☐ Consumption Q=QA-QB
Volume measurement	☐ The volume that passes the flowmeter is calculated from the K-factor [P/l] and the pulses of the flowmeter
Volumeter	☐ Flowmeter
Reset	☐ Setting the variable to the value 0
Cycle time	☐ Time section in which all the calculations are carried out, inputs processed and outputs operated

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