



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

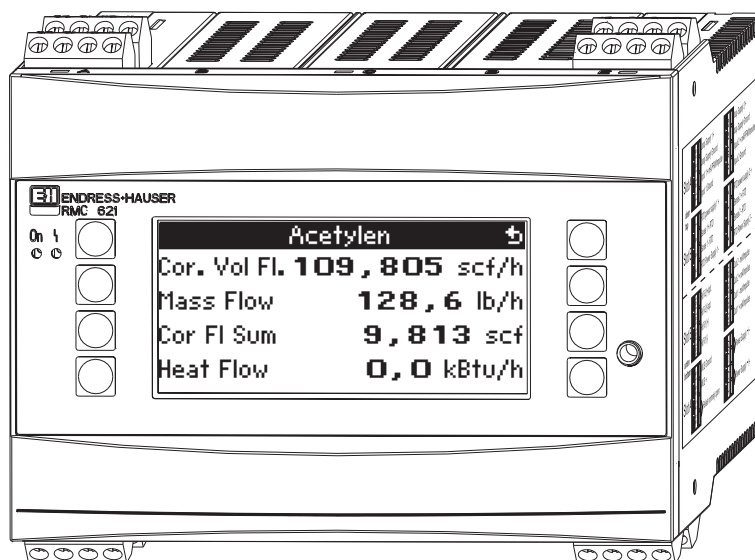


Solutions

Operating Instructions

RMC 621

Energy Manager

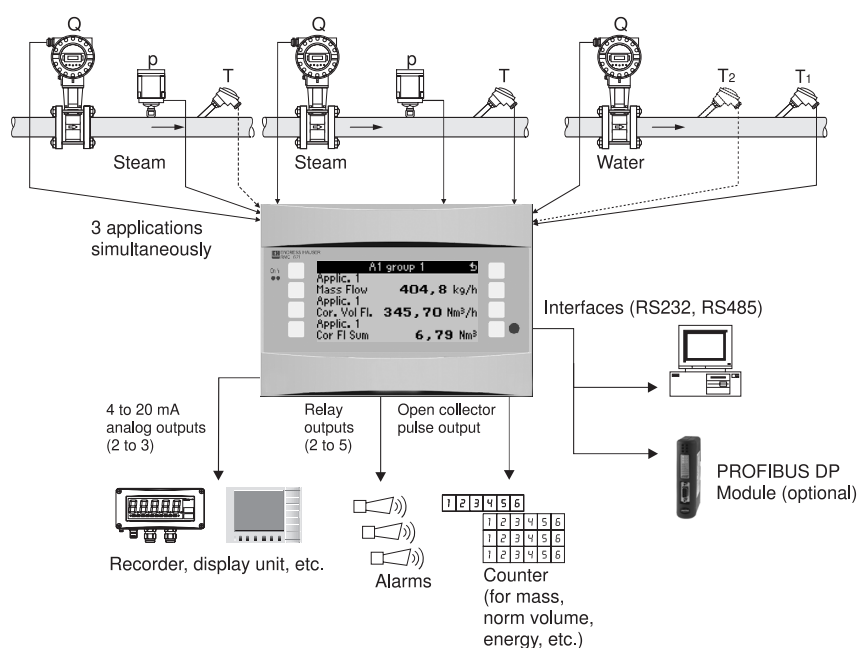


Brief overview

For quick and easy commissioning:

Safety instructions	Page 8
↓	
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Wiring	Page 13
↓	
Display and operating elements	Page 23
↓	
Commissioning	Page 28
Quick start via the navigator to device configuration for standard operation. Device configuration – explanation and use of all configurable device functions with the associated value ranges and settings. Application example – configuration of the device.	

Applications for the Energy Manager



The device compensates flow measurements of gas, liquid and steam based on the following methods of calculation:

Gases:

- Improved ideal gas law: flow correction by taking the temperature, pressure and average compressibility into account.
- Real gas equations (SRK, RK) and possibility of entering tables for calculating the compressibility and density of technical gases or density input.
- Natural gas using international calculation standard NX19, SGERG88 and AGA8 (optional).

Liquids:

- Determining density via algorithms and tables
- Thermal capacity as constant or table (heating value as constant)
- Mineral oil density as per calculation standards ASTM 1250, API 2540, OIML R63 (optional)

Steam/water:

- International calculation standard IAPWS IF-97 (ASME tables)

Brief operating instructions



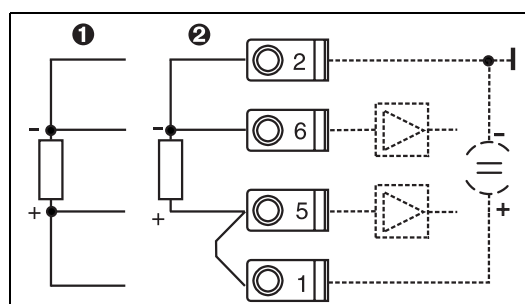
Caution!

The information contained in these Operating Instructions serves as a guide to help you commission your device easily, i.e. the most important settings are listed here but special functions (e.g. Tables, Corrections etc.) are not.

Configuring a measurement

Example: gas normal volume, sensors: (Prowirl 77, Cerabar T, TR10)

1. Connect device to the power source (terminal L/L+, 220 V)
2. Press any key → Menu → Setup
3. Basic set-up
Date-Time (set the date and time) →
System eng. units (select metric or American) →
4. Inputs → Flow inputs (flow 1)
DPT: volumetric
Signal: PFM
Terminals: select A10 and connect Prowirl to terminal A10(-)/82(+) (as passive signal)
Configure the K-factor (as per Prowirl nameplate) →
5. Pressure inputs (pressure 1)
Signal: e.g. 4 to 20 mA
Terminals: select A110 and connect pressure transmitter to terminal A110(-)/83(+)
-Type: select absolute pressure measurement or relative pressure measurement
Configure the start and end value of the pressure transmitter →
6. Temperature inputs (Temp 1.1.)
Signal: e.g. PT100
Sensor type: 3 or 4-wire
Select terminal E1/6 and connect Pt100 → → .



Item 1: 4-wire input
Item 2: 3-wire input

Fig. 1: Connecting a temperature sensor, e.g. to input 1 (slot E1)

7. Applications (Applic. 1)
Media: gas
Medium: e.g. air
Assign flow sensor, pressure sensor and temperature sensor for the gas measurement.
Reference value: only set if normal conditions are not 0C/1.013 bar.
Exit setup by pressing → several times and confirming the changes.

Display

When you press any key, you can select a group with display values (>A... Group...) or display all groups with automatic alternating display (↻ display). If a fault occurs, the display changes colour (blue/red). Detailed information on fault elimination can be found in the Operating Instructions.

Application settings

Programming data at a glance for configuring the measurement

Gas norm volume/gas mass/gas heat val

1. Gases already stored in the device

(Air, O₂, CO₂, N₂, CH₄, Ar, H₂, acetylene, ammonia, natural gas)

Press any key → Menu → Setup.

Flow Pulse/PFM (e.g. vortex)	Analog (e.g. vortex)	Differential pressure (e.g. orifice)
Flow input	Flow input	Special flow meters
DPT: volumetric	DPT: volumetric	Meas. point: DPT
Signal: PFM or pulse	Signal: 4 to 20 mA	Flow type: orifice plate (corner tap...)
		Medium: gas
		Signal: 4 to 20 mA
Terminal connection – Flow transmitter with active signal: e.g. select terminal A10 and connect flow meter to terminal A10(+)/11(-). – Flow transmitter with passive signal: e.g. select terminal A10 and connect flow meter to terminal A10(-)/82(+). Terminal 82 is 24 V sensor power supply.		
K-factor	Start value/end value: ... (m ³ /h)	Range start/range end: ...(mbar)
		Pipe data: (as per manufacturer) Inner dia. Ø: (mm) Geom. ratio:
Pressure		
Select signal and terminal, connect sensor (see example).		
Type: relative pressure or absolute pressure? Enter start value and end value.		
Temperature		
Select signal and terminals. Connect sensor (see example).		
Applications		
Application/gas/norm volume. Assign sensors for measuring flow, pressure and temperature. Change reference values if normal conditions are not 0°C/1.013 bar.		

2. Gases not already stored in the device

Press any key → Menu → Setup.

Medium
Gas
Row factor: real gas; Equation: Redlich Kwong
Enter critical temperature and pressure of the gas.
Enter heating value (only for burnable gas!).
Viscosity "No" , only for differential pressure measurement "Yes" . If "Yes" , enter two temperature/viscosity value pairs and the isentropic exponent (if known).

Make other settings for the inputs and application as explained in Point 1.

Liquid heat difference, heat quantity, heating value

Input variables: flow, temperature, density (optional)

1. Liquids already stored in the device (propane, butane)

Flow Pulse/PFM (e.g. vortex)	Analog (e.g. EFM)	Differential pressure (e.g. orifice)
Flow input	Flow input	Special flow meters
DPT: volumetric	DPT: volumetric	Meas. point: DPT
Signal: PFM or pulse	Signal: 4 to 20 mA	Flow type: orifice plate (corner tap...)
		Medium: liquid
		Signal: 4 to 20 mA
Terminal connection – Flow transmitter with active signal: e.g. select terminal A10 and connect flow meter to terminal A10(+)/11(-). – Flow transmitter with passive signal: e.g. select terminal A10 and connect flow meter to terminal A10(-)/82(+). Terminal 82 is 24 V sensor power supply.		
K-factor	Start value/end value: ... (m ³ /h)	Range start/range end: ...(mbar)
		Pipe data: (as per manufacturer), inner dia. Ø:...(mm) Geom. ratio:
Temperature		
Select signal, terminals, connect sensor(s) (see example). Heat difference measurements require 2 temperature sensors.		
Applications		
Application(1); media: liquid; meas. media: e.g. butane		
Liquid appl.: heating val		
Assign sensors for measuring flow and temperature.		

2. Liquids not already stored in the device

Any heat transfer fluids or combustible fluids.

Input variables: flow, temperature 1, (temperature 2), density (optional)

Spec. fluid
Liquid
Density calc.: linear
Enter density at a certain temperature (ref temperature, ref density)
Expansion: enter liquid expansion coefficient (if known)
Enter sp. heat cap. or heating value (for combustible fluid)
Viscosity "No", "Yes" for differential pressure measurement, then enter two temperature/viscosity value pairs and the isentropic exponent (if known).
Flow and temperature
Make other settings for the inputs as explained in Point 1.
Applications
Application(1); media: liquid; meas. media: xxx
Liquid appl.: e.g. heat difference
Op. mode: (e.g. heating)
Assign sensors for measuring flow and temperature.
Inst. point: assign warm/cold T



Note!

For the bidirectional operating mode, or if measuring density with a sensor, configure additional terminals if necessary.

Water applications

Input variables: flow, temperature 1, (temperature 2)

Flow Pulse/PFM (e.g. vortex)	Analog (e.g. vortex)	Differential pressure (e.g. orifice)
Flow input	Flow input	Special flow meters
DPT: volumetric	DPT: volumetric	Diff. press./orifice.../water
Terminal connection – Flow transmitter with active signal: e.g. select terminal A10 and connect flow meter to terminal A10(+)/11(-). – Flow transmitter with passive signal: e.g. select terminal A10 and connect flow meter to terminal A10(-)/82(+). Terminal 82 is 24 V sensor power supply.		
K-factor	Start value/end value (m ³ /h)	Start value/end value (mbar)
Temperature		
Select signal and connect sensor(s) (see example). Heat difference measurements require 2 temperature sensors.		
Applications		
Application(1); media: water/steam		
Application: e.g. water heat diff.		
Op. mode: (e.g. heating)		
Assign sensors for measuring flow and temperature.		
Inst. point: assign warm/cold T		



Note!

If the application is heat quantity, only one temperature is available. For the bidirectional operating mode, an additional terminal for direction signal may be necessary.

Steam applications

Input variables: flow, pressure, temperature 1, (temperature 2)

Flow Pulse/PFM (e.g. vortex)	Analog (e.g. vortex)	Differential pressure (e.g. orifice)
Flow input	Flow input	Special flow meters
DPT: volumetric	DPT: volumetric	Diff. press./orifice.../steam
Terminal connection – Flow transmitter with active signal: e.g. select terminal A10 and connect flow meter to terminal A10(+)/11(-). – Flow transmitter with passive signal: e.g. select terminal A10 and connect flow meter to terminal A10(-)/82(+). Terminal 82 is 24 V sensor power supply.		
K-factor	Start value/end value (m ³ /h)	Start value/end value (mbar)
Pressure		
Select signal and terminal and connect sensor (see example).		
Type: relative pressure or absolute pressure? Enter start value and end value.		
Temperature		
Select signal and connect sensor(s) (see example). Steam difference measurements require 2 temperature sensors.		
Applications		
Application(1); media: water/steam		
Application: e.g. steam mass/heat		
Steam type: e.g. superheated steam		
Assign sensors for measuring flow, pressure and temperature.		

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1 Safety instructions

Safe operation of the Flow and Energy Manager is only guaranteed if these Operating Instructions have been read and the safety instructions have been observed.

1.1 Designated use

The Flow and Energy Manager is an instrument for measuring the flow, mass and energy flow of gases, liquids, steam and water. The multi-channel concept allows simultaneous measurement of fluid and applications, e.g. calculation of a gas norm volume flow and/or energy balancing in a heating or cooling system.

A wide range of different types of flow transmitters, temperature sensors and pressure sensors can be connected to the device.

The Flow and Energy Manager offers a wide variety of calculation methods for determining the desired process values for the industrial requirements, real gas equations, editable tables for density, thermal capacity, compressibility, international calculation standards for natural gas (e.g. SGERG88) or steam (IAPWS IF-97), flow-differential pressure method (ISO5167) etc.

- The device is seen as accessory equipment and may not be installed in hazardous areas.
- The manufacturer does not accept liability for damage caused by improper or non-designated use. The device may not be converted or modified in any way.
- The device is designed for use in industrial environments and may only be operated in an installed state.

1.2 Installation, commissioning and operation

This device has been safely built with state-of-the-art technology and meets the applicable requirements and EU Directives. The device can be a source of application-related danger if used improperly or other than intended.

Installation, wiring, commissioning and maintenance of the device must only be carried out by trained technical personnel. Technical personnel must have read and understood these Operating Instructions and must adhere to them. The information in the electrical wiring diagrams (see Section 4 'Wiring') must be observed closely.

1.3 Operational safety

Technical improvement

The manufacturer reserves the right to adapt technical details to the most up-to-date technical developments without any special announcement. Contact your local sales centre for information about the current state of and possible extensions to the Operating Instructions.

1.4 Return

For a return, e.g. in case of repair, the device must be sent in protective packaging. The original packaging offers the best protection. Repairs must only be carried out by your supplier's service organisation.



Note!

When sending for repair, please enclose a note with a description of the error and the application.

1.5 Notes on safety conventions and icons

The safety instructions in these Operating Instructions are labelled with the following safety icons and symbols:



Caution!

This symbol draws attention to activities or procedures that can lead to defective operation or to destruction of the device if not carried out properly.



Warning!

This symbol draws attention to activities or procedures that can lead to injuries to persons, to a safety risk or to destruction of the device if not carried out properly.



Note!

This symbol draws attention to activities or procedures that have an indirect effect on operation, or can trigger an unforeseen device reaction if not carried out properly.

2 Identification

2.1 Device designation

2.1.1 Nameplate

Compare the nameplate on the device with the following diagram:

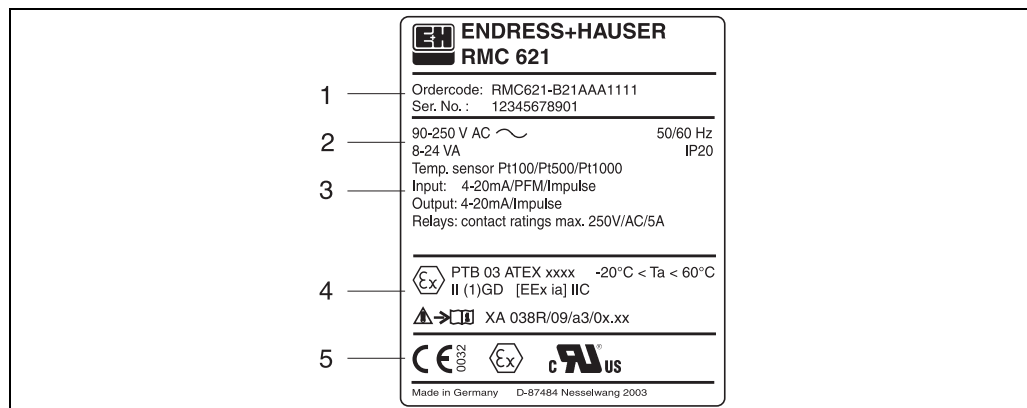


Fig. 2: Nameplate of the Energy Manager (example)

- 1 Order code and serial number of the device
- 2 Energy supply, degree of protection - temperature sensor input
- 3 Inputs/outputs available
- 4 Code for Ex-area (if selected)
- 5 Approvals

2.2 Scope of delivery

The scope of delivery of the Energy Manager comprises:

- Energy Manager for top-hat rail mounting
- Operating Instructions
- CD-ROM with PC configuration software and interface cable RS232 (optional)
- Remote display for panel mounting (optional)
- Extension cards (optional)



Note!

Please note the device accessories in Section 8 'Accessories'.

2.3 Certificates and approvals

CE mark, declaration of conformity

The Energy Manager has been constructed and tested to state-of-the-art operational safety standards and left the factory in perfect condition as regards technical safety. The device meets the relevant standards and directives as per EN 61 010 "Safety requirements for electrical equipment for measurement, control and laboratory use".

Thus, the device described in these Operating Instructions meets the legal requirements of the EU Directives. The manufacturer confirms successful testing of the device by affixing to it the CE mark. The device has been developed in accordance with the requirements of the Directives OIML R75 (heat counter) and EN-1434 (flow measurement).

3 Installation

3.1 Installation conditions

The permitted ambient temperature (see "Technical data" Section) must be observed when installing and operating. The device must be protected against the effects of heat.

3.1.1 Dimensions

Observe the device length of 135 mm (corresponds to 8TE). More dimensions can be found in Section 10 "Technical data".

3.1.2 Mounting location

Top-hat rail mounting as per EN 50 022-35 in the cabinet. The mounting location must be free from vibrations.

3.1.3 Orientation

No restrictions.

3.2 Installation instructions

First remove the plug-in terminals from the device slots. Now snap the housing onto the top-hat rail by firstly hanging the device on the top-hat rail and then pressing it down gently until it engages (see Fig. 3, item 1 and 2).

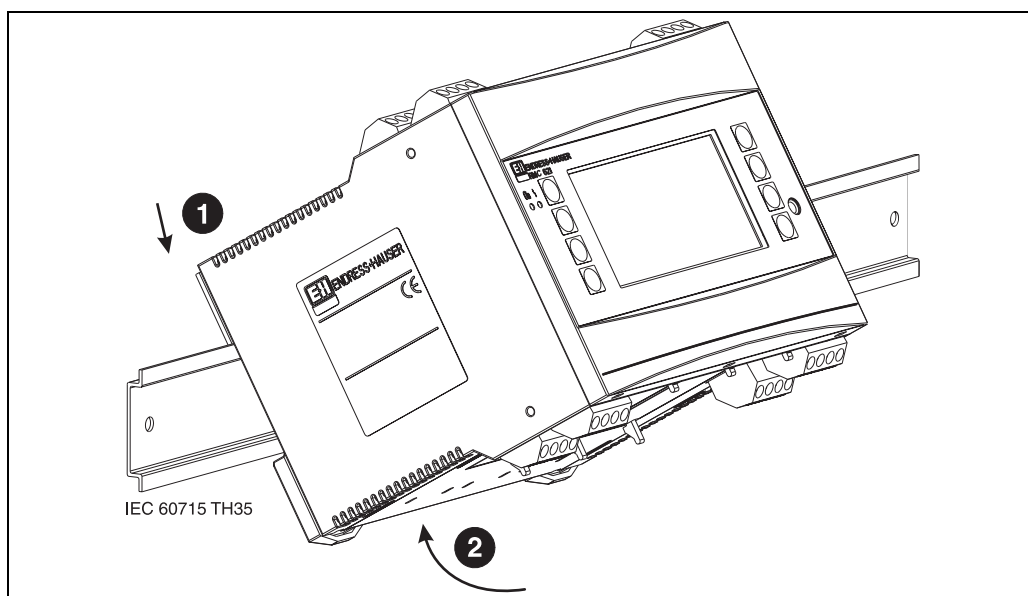


Fig. 3: Mounting device on top-hat rail

3.2.1 Installing extension cards

You can equip the device with various extension cards. A maximum of three slots are available in the device for this. The slots for the extension cards are marked with B, C and D (→ Fig. 4) on the device.

1. Make sure that the device is not connected to the power supply when installing and removing an extension card.
2. Remove the blanking cover from the slot (B, C or D) of the basic unit by pressing together the catches on the bottom of the Energy Manager (see Fig. 4, item 2), while at the same time pressing in the catch on the rear of the housing (e.g. with a screwdriver) (see Fig. 4, item 1). Now you can pull the blanking cover up out of the basic unit.
3. Insert the extension card into the basic unit from above. The extension card is not correctly installed until the catches on the bottom and rear of the device (see Fig. 4, items 1 and 2) lock into place. Ensure that the input terminals of the extension card are on top and the connection terminals are pointing to the front, as with the basic unit.
4. The device automatically recognises the new extension card once the device has been corrected wired and has been commissioned (see 'Commissioning' Section).



Note!

If you remove an extension card and do not replace it with another card, you must seal the empty slot with a blanking cover.

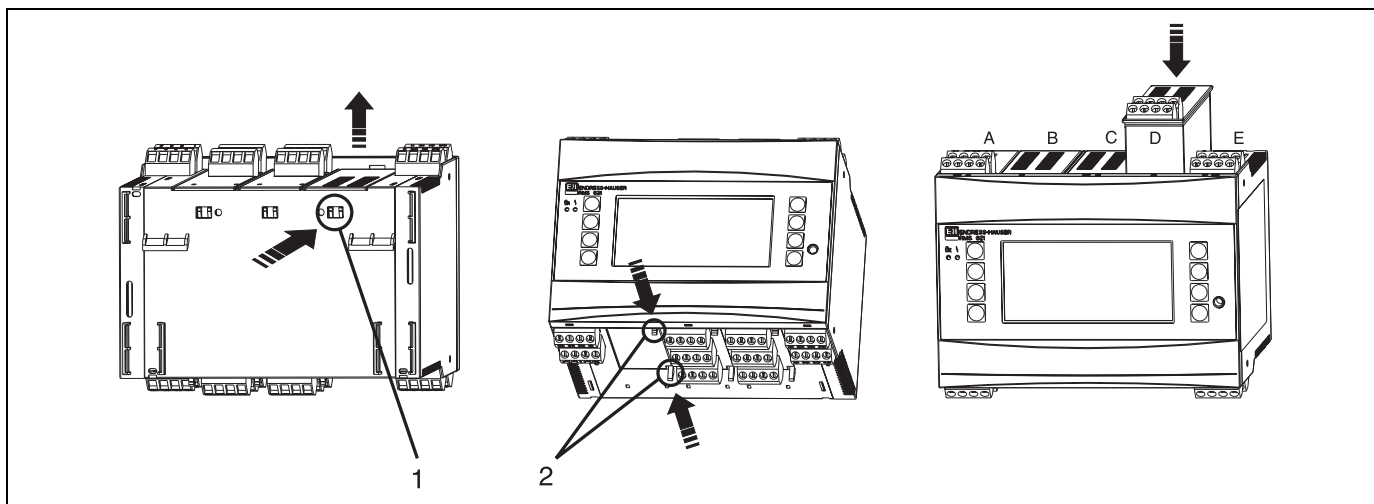


Fig. 4: Installing an extension card (example)

Item 1: catch on the rear of the device

Item 2: catches on the bottom of the device

Items A - E: identifier for slot assignment

3.3 Post-installation check

When using extension cards, ensure that the cards are sitting correctly in the device slots.



Note!

When using the device as a heat counter, observe the installation instructions EN 1434 Part 6 when mounting the device. This also includes the installation of the flow and temperature sensors.

4 Wiring

4.1 Quick wiring guide

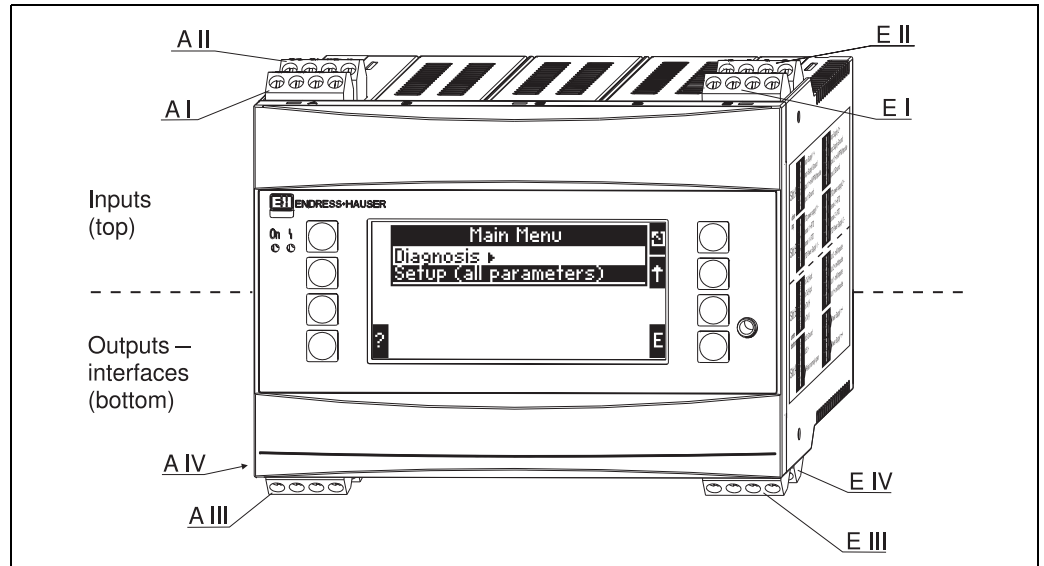


Fig. 5: Slot assignment (basic unit)

Terminal assignment

Terminal (item no.)	Terminal assignment	Slot	Input
10	+ 0/4 to 20 mA/PFM/pulse input 1	A top, front (A I)	Current/PFM/pulse input 1
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 1		
82	24 V sensor power supply 1		
110	+ 0/4 to 20 mA/PFM/pulse input 2	A top, rear (A II)	Current/PFM/pulse input 2
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 2		
83	24 V sensor power supply 2		
1	+ RTD power supply 1	E top, front (E I)	RTD input 1
2	- RTD power supply 1		
5	+ RTD sensor 1		
6	- RTD sensor 1		
3	+ RTD power supply 2	E top, rear (E II)	RTD input 2
4	- RTD power supply 2		
7	+ RTD sensor 2		
8	- RTD sensor 2		
Terminal (item no.)	Terminal assignment	Slot	Output - interface
101	+ RxTx 1	E bottom, front (E III)	RS485
102	- RxTx 1		
103	+ RxTx 2		RS485 (optional)
104	- RxTx 2		

131	+ 0/4 to 20 mA/pulse output 1	E bottom, rear (E IV)	Current/pulse output 1
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2
134	- 0/4 to 20 mA/pulse output 2		
52	Relay Common (COM)	A bottom, front (A III)	Relay 1
53	Relay normally open (NO)		
91	Sensor power supply ground		Additional sensor power supply
92	+ 24 V sensor power supply		
L/L+	L for AC L+ for DC	A bottom, rear (A IV) Power supply	
N/L-	N for AC L- for DC		

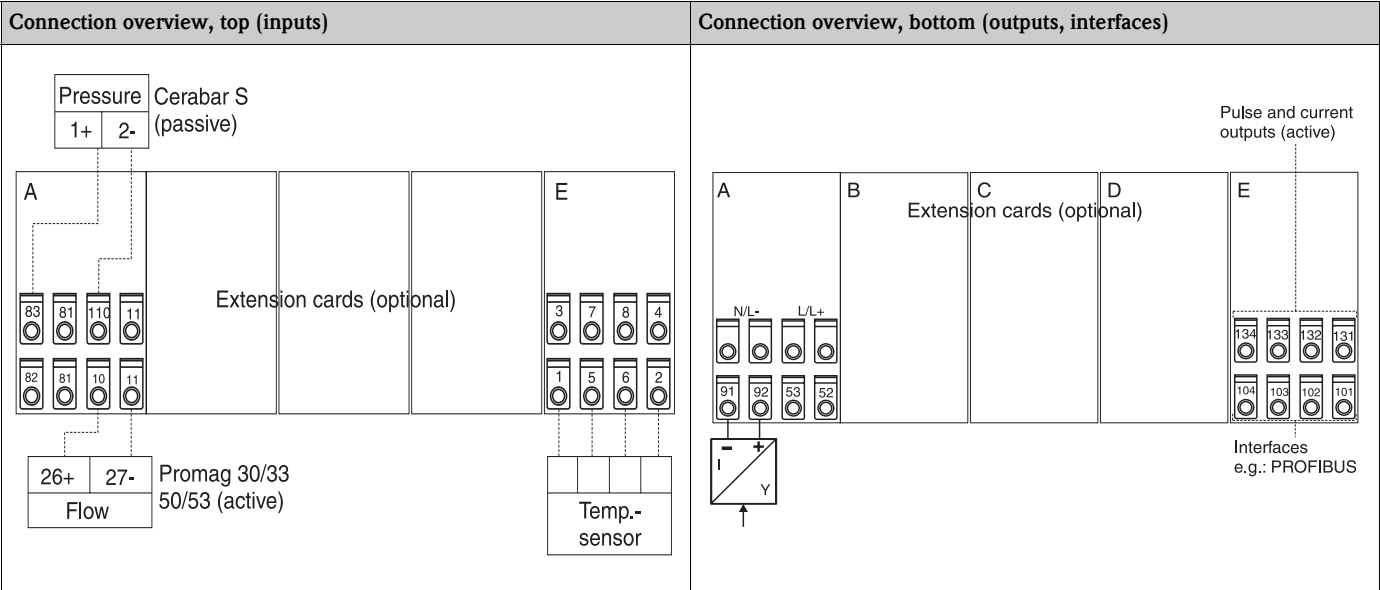


Note!
The current/PFM/pulse inputs or the RTD inputs in the same slot are not galvanically isolated. There is a separation voltage of 500 V between the aforementioned inputs and outputs in various slots. Terminals with the same second digit are jumpered internally (Terminals 11 and 81).

4.2 Connecting the measuring unit



Caution!
Do not install or wire the device when it is connected to the power supply. Not conforming with this can lead to the destruction of electronic components.



4.2.1 Power supply connection



Caution!

- Before wiring the device, ensure that the supply voltage corresponds to the specification on the nameplate.
- For the 90 to 250 V AC version (mains connection), a switch marked as a separator, as well as an overvoltage organ (rated current ≤ 10 A), must be fitted in the supply line near the device (easy to reach).

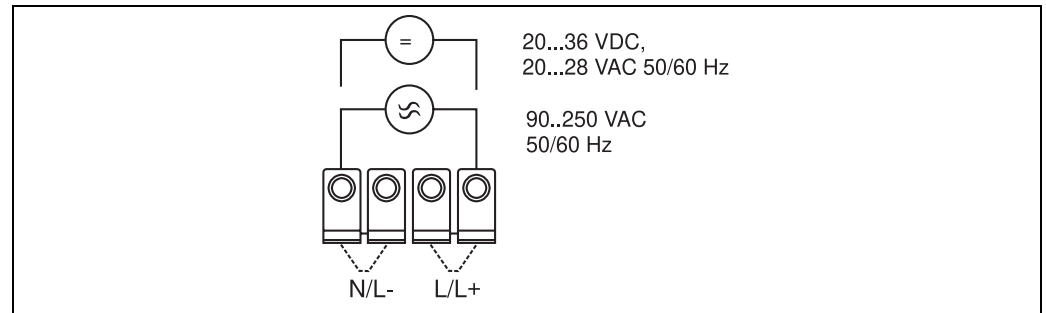


Fig. 6: Power supply connection

4.2.2 Connecting external sensors



Note!

Active and passive sensors with analog, PFM or pulse signal and RTD sensors can be attached to the device.

Depending on the type of signal of the sensor in question, the terminals can be freely selected which means the Energy Manager can be used with great flexibility. This means that the terminals are not fixed to the sensor type, e.g. flow sensor-terminal 11, pressure sensor-terminal 12 etc. If the device is used as a heat counter in accordance with EN 1434, the connection regulations mentioned there apply.

Active sensors

Connection method for an active sensor (i.e. external power supply).

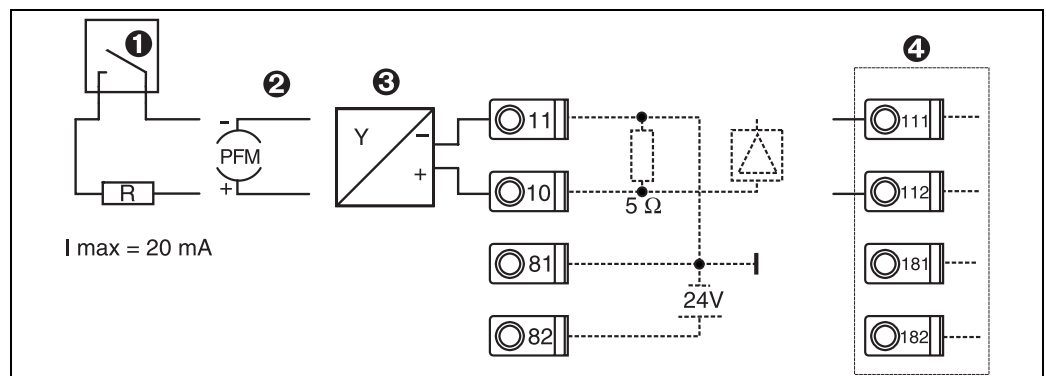


Fig. 7: Connecting an active sensor, e.g. to input 1 (Slot A I).

Item 1: pulse signal

Item 2: PFM signal

Item 3: 2-wire transmitter (4 to 20 mA)

Item 4: active sensor connection, e.g. optional Universal extension card in slot B (slot B I, → Fig. 12)

Passive sensors

Connection method for sensors which are supplied with power by means of the sensor power supply integrated in the device.

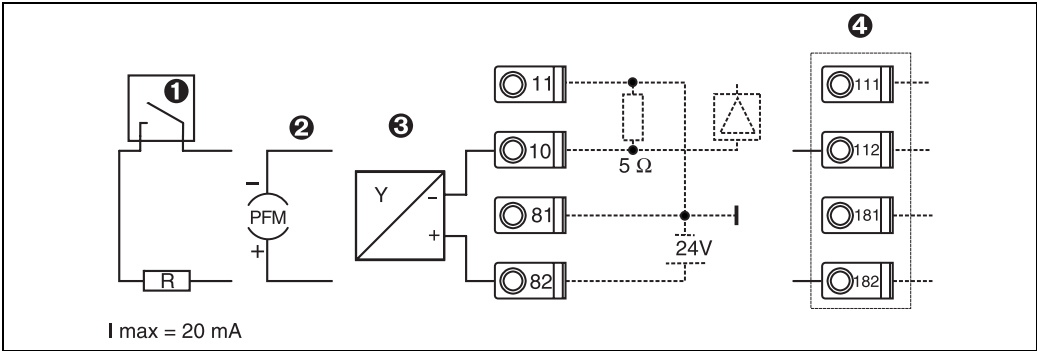


Fig. 8: Connecting a passive sensor, e.g. to input 1 (slot A I).
Item 1: pulse signal
Item 2: PFM signal
Item 3: 2-wire transmitter (4-20 mA)
Item 4: passive sensor connection, e.g. optional Universal extension card in slot B (slot B I, → Fig. 12)

Temperature sensors

Connection for Pt100, Pt500 and Pt1000



Note!
Terminals 1 and 5 (3 and 7) must be jumpered when connecting 3-wire sensors (see Fig. 5).

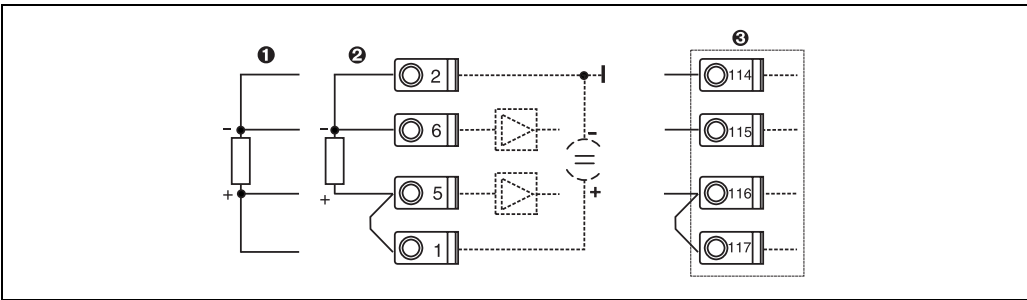
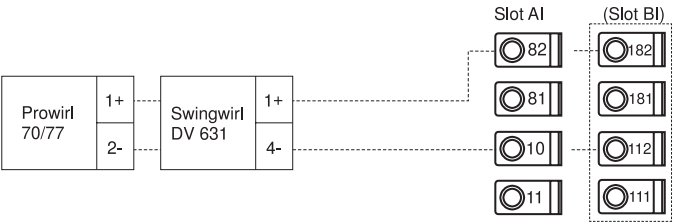


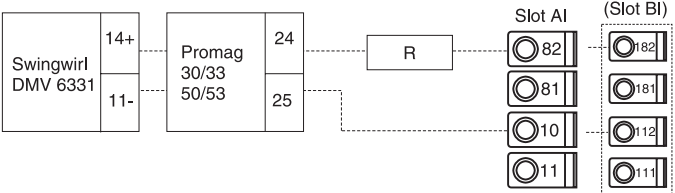
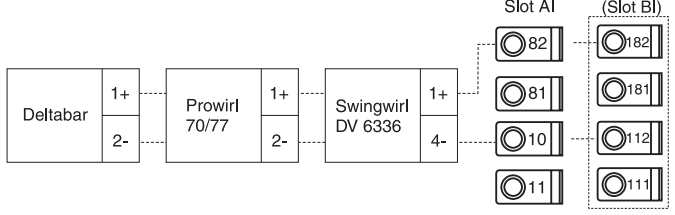
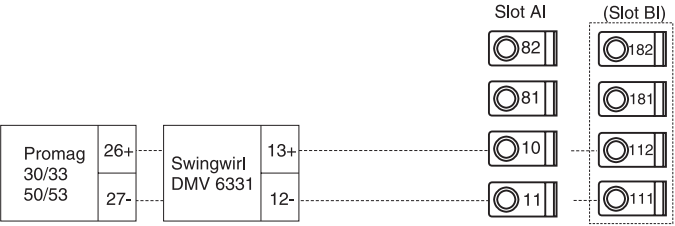
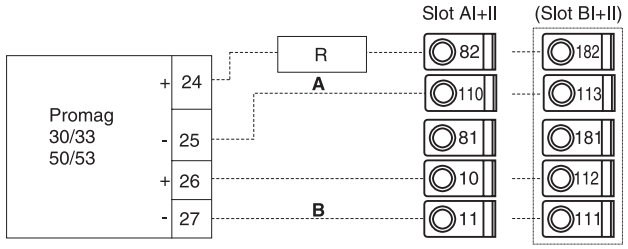
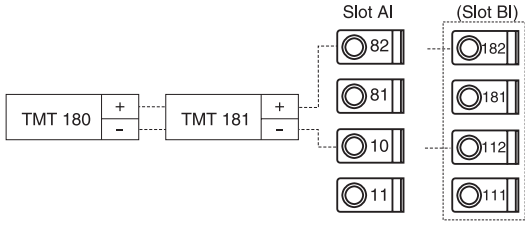
Abb. 9: Connecting a temperature sensor, e.g. to input 1 (slot E I)
Item 1: 4-wire input
Item 2: 3-wire input
Item 3: 3-wire input, e.g. optional temperature extension card in slot B (slot B I, → Fig. 12)

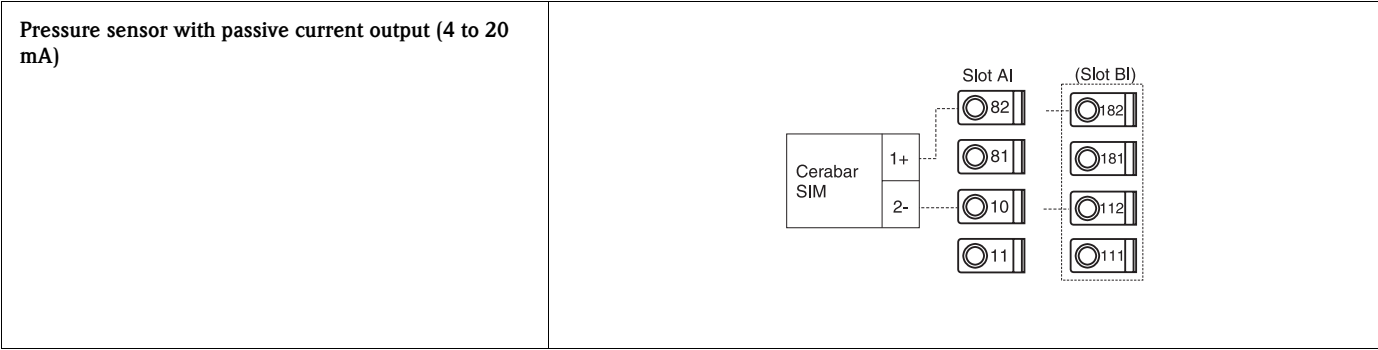
E+H-specific devices

Flow sensors with PFM output

Note!
Set the Prowirl measuring device to PFM output (→ FU 20: ON, PF)



Flow sensor with open collector output  Note! Select an appropriate dropping resistor R, so that $I_{max.} = 20$ mA is not exceeded.	
Flow sensor with passive current output (4 to 20 mA)	
Flow sensor with active current output (0/4 to 20 mA)	
Flow sensor with active current output and passive frequency output (measurement of bidirectional flow)  Note! Select an appropriate dropping resistor R, so that $I_{max.} = 20$ mA is not exceeded. ■ Item A: direction signal ■ Item B: flow	
Temperature sensor via temperature head transmitter (4 to 20 mA)	



4.2.3 Connection of outputs

The device has two galvanically isolated outputs which can be configured as an analog output or an active pulse output. In addition, an output for connecting a relay and transmitter power supply is available. The number of outputs increases accordingly when the extension cards are installed (see Section 4.2.4).

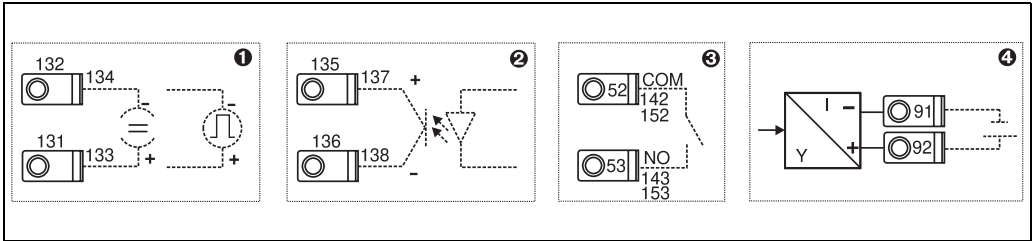


Fig. 10: Connection of outputs
Item 1: pulse and current outputs (active)
Item 2: passive pulse output (open collector)
Item 3: relay output (NO), e.g. slot A III (slot BIII, CIII, DIII on optional extension card)
Item 4: transmitter power supply (transmitter power supply unit) output

Interface connection

- **RS232 connection**
The RS232 is contacted by means of the interface cable and the jack socket on the front of the housing.
- **RS485 connection**
- **Optional: additional RS485 interface**
Plug-in terminals 103/104, the interface is only active as long as the RS232 interface is not used.
- **PROFIBUS connection**
Optional connection of Energy Manager to PROFIBUS DP via the serial RS485 interface with the external module HMS AnyBus Communicator for Profibus (see Section 8 'Accessories').

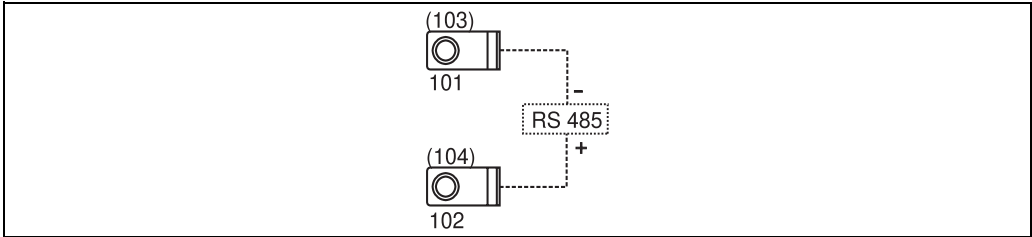


Fig. 11: Interface connection

4.2.4 Extension card connection

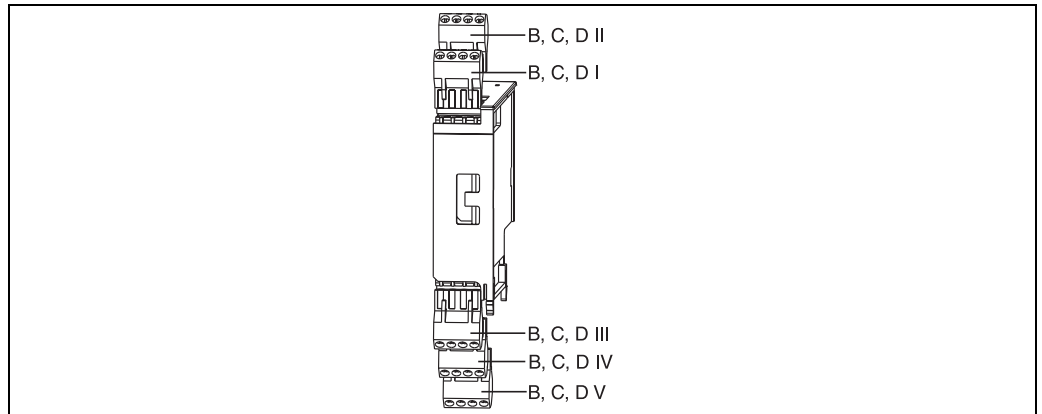


Fig. 12: Extension card with terminals

Terminal assignment of Universal extension card (RMC621A-UA); with intrinsically safe inputs (RMC621A-UB)

Terminal (item no..)	Terminal assignment	Slot	Input and output
182	24 V sensor power supply 1	B, C, D top, front (B I, C I, D I)	Current/PFM/pulse input 1
181	Sensor power supply ground 1		
112	+ 0/4 to 20 mA/PFM/pulse input 1		
111	Ground for 0/4 to 20 mA/PFM/pulse input		
183	24 V sensor power supply 2	B, C, D top, rear (B II, C II, D II)	Current/PFM/pulse input 2
181	Sensor power supply ground 2		
113	+ 0/4 to 20 mA/PFM/pulse input 2		
111	Ground for 0/4 to 20 mA/PFM/pulse input		
142	Relay 1 Common (COM)	B, C, D bottom, front (B III, C III, D III)	Relay 1
143	Relay 1 normally open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 normally open (NO)		
131	+ 0/4 to 20 mA/pulse output 1	B, C, D bottom, centre (B IV, C IV, D IV)	Current/pulse output 1 active
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2 active
134	- 0/4 to 20 mA/pulse output 2		
135	+ pulse output 3 (open collector)	B, C, D bottom, rear (B V, C V, D V)	Passive pulse output
136	- pulse output 3		
137	+ pulse output 4 (open collector)		Passive pulse output
138	- pulse output 4		

Terminal assignment of temperature extension card (RMC621A-TA); with intrinsically safe inputs (RMC621A-TB)

Terminal (item no..)	Terminal assignment	Slot	Input and output
117	+ RTD power supply 1	B, C, D top, front (B I, C I, D I)	RTD input 1
116	+ RTD sensor 1		
115	- RTD sensor 1		
114	- RTD power supply 1		
121	+ RTD power supply 2	B, C, D top, rear (B II, C II, D II)	RTD input 2
120	+ RTD sensor 2		
119	- RTD sensor 2		
118	- RTD power supply 2		
142	Relay 1 Common (COM)	B, C, D bottom, front (B III, C III, D III)	Relay 1
143	Relay 1 normally open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 normally open (NO)		
131	+ 0/4 to 20 mA/pulse output 1	B, C, D bottom, centre (B IV, C IV, D IV)	Current/pulse output 1 active
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2 active
134	- 0/4 to 20 mA/pulse output 2		
135	+ pulse output 3 (open collector)	B, C, D bottom, rear (B V, C V, D V)	Passive pulse output
136	- pulse output 3		
137	+ pulse output 4 (open collector)		Passive pulse output
138	- pulse output 4		



Note!

The current/PFM/pulse inputs or the RTD inputs in the same slot are not galvanically isolated. There is a separation voltage of 500 V between the aforementioned inputs and outputs in various slots. Terminals with the same second digit are jumpered internally. (Terminals 111 and 181)

4.2.5 Connecting remote display/operating unit

Functional description

The remote display is an innovative addition to the powerful RMX 621 top-hat rail devices. The user has the opportunity to optimally install the arithmetic unit to suit the installation and mount the display and operating unit in a user-friendly way at easily accessible locations. The display can be connected to both a top-hat rail device without, as well as a top-hat rail device with, an installed display/operating unit. A 4-pin cable is supplied to connect the remote display with the basic unit; other components are not necessary.



Note!

Only one display/operating element can be attached to a top-hat rail device and vice versa (point-to-point).

Installation/dimensions

Mounting instructions:

- The mounting location must be free from vibrations.
- The permitted ambient temperature during operation is -20 to +60C.
- Protect the device against the effects of heat.

Procedure for panel mounting:

1. Provide a panel cutout of 138+1.0 x 68+0.7 mm (as per DIN 43700), the installation depth is 45 mm.
2. Push the device with the sealing ring through the panel cutout from the front.
3. Hold the device horizontal and, applying uniform pressure, push the securing frame over the rear of the housing against the panel until the retaining clips engage. Make sure the securing frame is seated symmetrically.

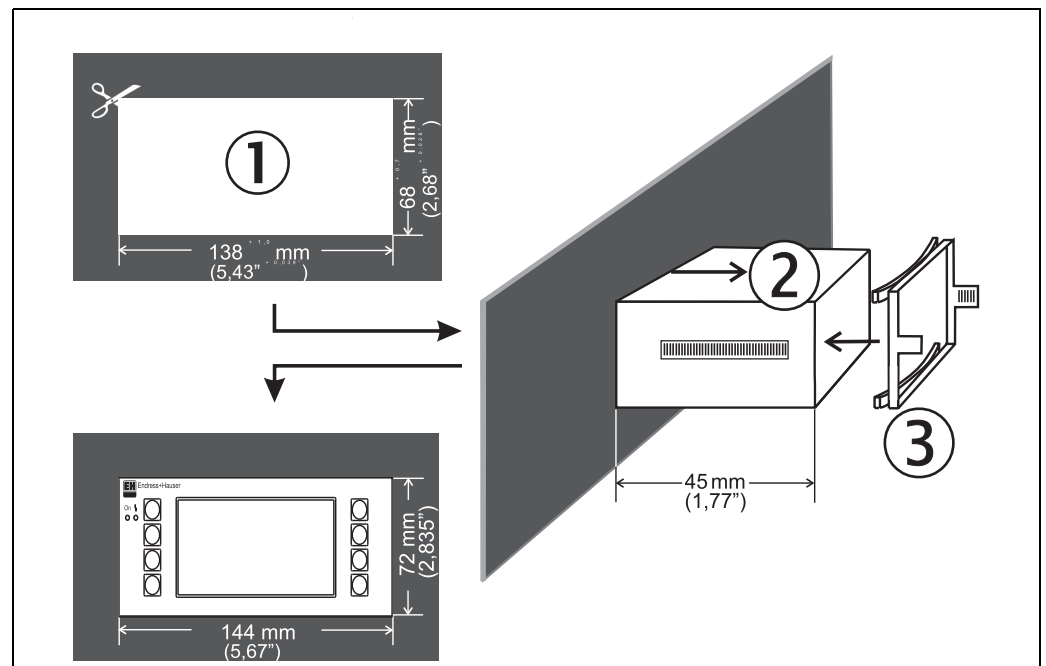


Fig. 13: Panel mounting

Wiring

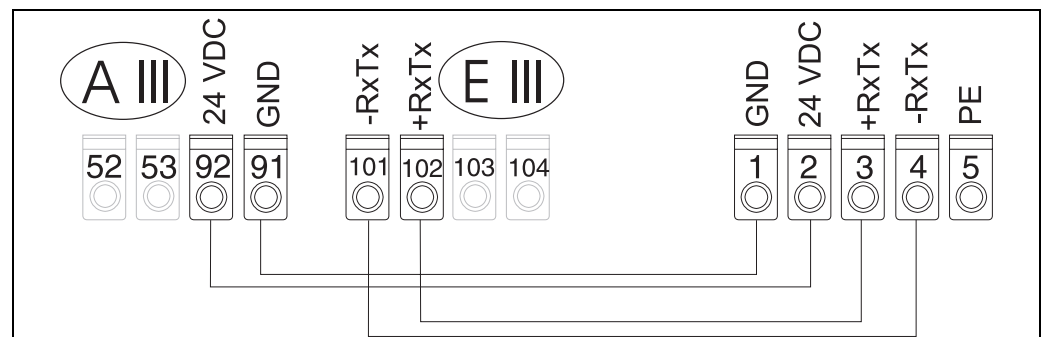


Fig. 14: Terminal plan of remote display/operating unit

The remote display/operating unit is connected directly to the basic unit with the cable supplied.

4.3 Post-connection check

After completing the device's electrical installation, carry out the following checks:

Device status and specifications	Notes
Is the device or cable damaged (visual inspection)?	-
Electrical connection	Notes
Does the supply voltage match the information on the nameplate?	90 to 250 V AC (50/60 Hz) 20 to 36 V DC 20 to 28 V AC (50/60 Hz)
Are all of the terminals firmly engaged in their correct slots? Is the coding on the individual terminals correct?	-
Are the mounted cables relieved of tension?	-
Are the power supply and signal cables connected correctly?	See wiring diagram on the housing
Are all of the screw terminals well-tightened?	-

5 Operation

5.1 Display and operating elements



Note!

Depending on the application and version, the Flow and Energy Manager offers a wide range of configuration options and software functions.

Help text is available for nearly every operating item to assist when programming the device. This help text can be called up by pressing the "?" button. (The help text can be called up in every menu). Please note that the configuration options described below refer to a basic unit (without extension cards).

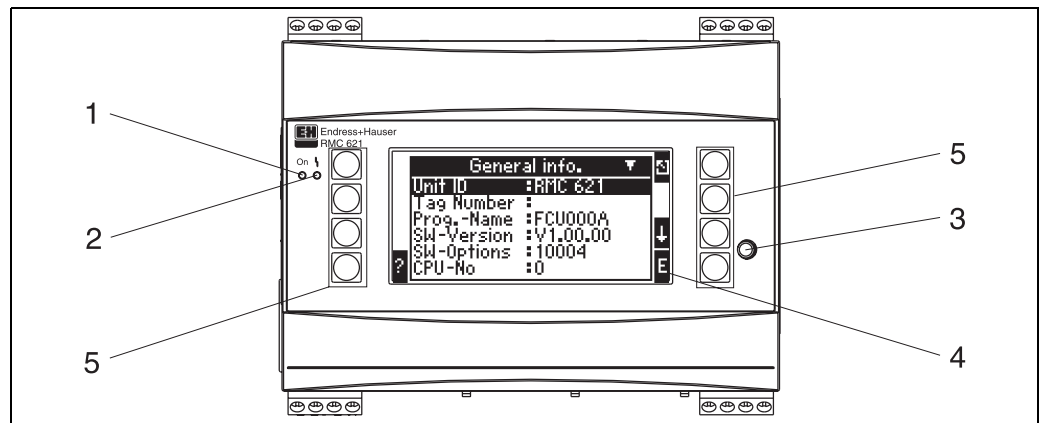


Fig. 15: Display and operating elements

Item 1: operating display: LED green, lights up when supply voltage applied.

Item 2: fault indicator: LED red, operating status as per NAMUR NE 44

Item 3: serial interface connection: jack socket for PC connection for device configuration and measured value read-out with the PC software

Item 4: display 160 x 80 dot-matrix display with dialog text for configuring as well as measured value, limit value and fault message display. Should a fault occur, the background lighting changes from blue to red. The size of the characters displayed depends on the number of measured values to be displayed (see Section 6.3.3 'Display configuration').

Item 5: input keys; eight soft keys which have different functions, depending on the menu item. The current function of the keys is indicated on the display. Only the keys which are required in the operating menu in question are assigned with functions or can be used.

5.1.1 Display

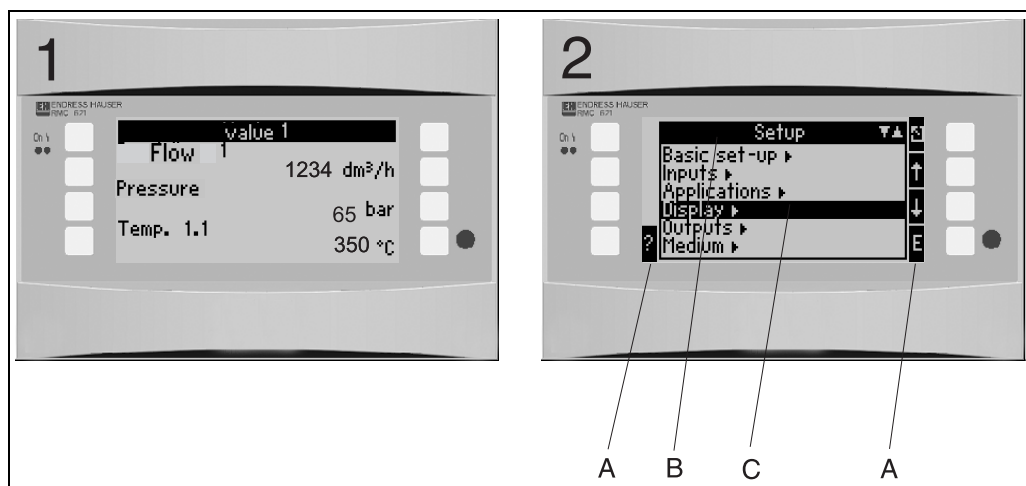


Fig. 16: How the display of the energy computer appears

Item: 1: measured value display

Item: 2: display of configuration menu item

- A: row of key icons
- B: current configuration menu
- C: configuration menu activated for selection (highlighted in black).

5.1.2 Key icons

Key icon	Function
E	Change to submenus and select operating items. Edit and confirm configured values.
	Exit the current editing mask or the menu item currently active without saving any changes.
↑	Move the cursor up a line or a character.
↓	Move the cursor down a line or a character.
→	Move the cursor a character to the right.
←	Move the cursor a character to the left.
?	If Help text is available on an operating item, this is indicated with the question mark. The Help is called up by actuating this function key.
AB	Change to the editing mode of the Palm keyboard
ij/ij	Key field for upper case/lower case (only with Palm)
½	Key field for numerical entries (only with Palm)

5.2 Local operation

5.2.1 Entering text

There are two ways of entering text in the operating items (see: **Setup** → **Basic set-up** → **Text input**):

- a) Standard: individual characters (letters, numbers, etc.) in the text field are defined by scrolling through the entire row of characters with the up/down cursor until the desired character is displayed.
- b) Palm: a visual key field appears for entering text. The characters on this keyboard are selected with the cursors. (see "Setup → Basic set-up")

Using the Palm keyboard

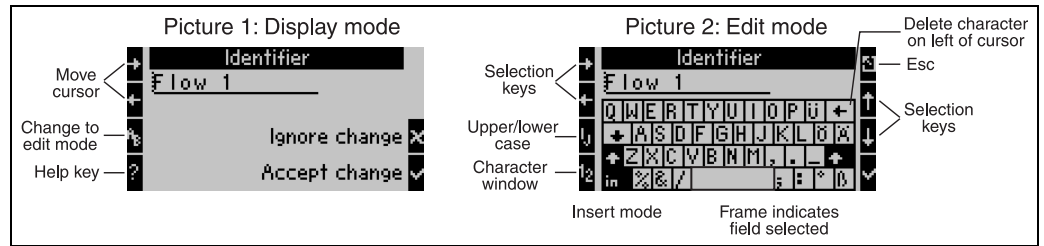


Fig. 17: Example: editing an identifier with the Palm keyboard

1. Using the cursor keys, place the cursor in front of the character before which another character should be entered. If the entire text should be deleted and rewritten, move the cursor completely to the right. (see Fig. 17, graphic 1)
2. Press the AB key to enter the editing mode
3. Use the ij/IJ and ½ key to select upper/lower case or numerals. (see Fig. 17, graphic 2)
4. Use the cursors to select the key required and use the tick sign to confirm. If you want to delete text, select the key in the top right. (see Fig. 17, graphic 2)
5. Edit other characters in this way until the desired text has been entered.
6. Press the Esc key to switch from the editing mode to the display mode and accept changes with the 'tick' key. (see Fig. 17, graphic 1)

Notes

- The cursor cannot be moved in the editing mode (see Fig. 17, graphic 2)! Use the Esc key to go to the previous window (see Fig. 17, graphic 1) to move the cursor to the character which should be changed. Then confirm the AB key again.
- Special key functions:
in key: change to overwrite mode
key (top right): delete character

5.2.2 Lock configuration

The entire configuration can be protected against unintentional access by means of a four-digit code. This code is assigned in the submenu: **Basic set-up** → **Code**. All the parameters remain visible. If the value of a parameter should be changed, you are first asked for the user code. In addition to the user code, there is also the alarm limit code. When this code is entered, only the alarm limits are enabled for change.

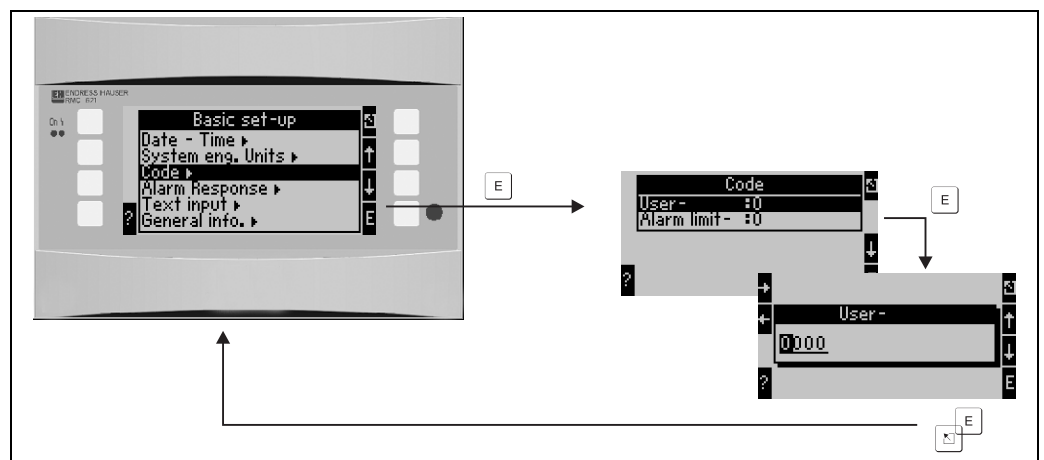


Fig. 18: Configuring the user code

5.2.3 Operating example

A detailed description of on-site operation with an application as an example can be found in Section 6.4 'User-specific applications'.

5.3 Error message display

The device differentiates between two types of errors:

- *System error*: this group comprises all the device errors, e.g. communication errors, hardware errors, etc. System errors are always signalled by **fault messages**.
- *Process error*: this group comprises all application errors, e.g. “range overshoot”, including limit value alarms etc.

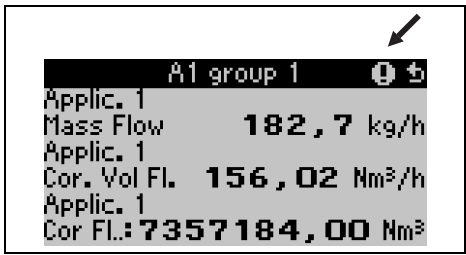
For process errors, you can configure how the device reacts in the event of an error, i.e. whether a **fault message** or a **notice message** is displayed.

On leaving the factory, all process errors are preset **as notice messages** with a colour change.

Fault messages

A fault is signalled by the display changing colour from blue to red and by an **exclamation mark (!)** along the top edge of the display. The error is displayed as plain text. The fault is acknowledged by actuating any key. Via the Navigator menu, you can get to the error list and to the Main menu to rectify the error if necessary. When a fault message occurs, all measurements and the counters are stopped. The input signals behave as per their configured failsafe mode (see Section 6.3.3 'Main menu - Setup'). The device does not resume normal operation until all the faults are rectified.

Notice messages



A notice is signalled by an **exclamation mark (!)** in the display. It can also be signalled (as an option) by a colour change and by displaying an alarm on the display. The exclamation mark is along the top edge of the display. In addition, some errors are signalled by an icon beside the corresponding measured values. Notices do not have any affect on the operation and counters but rather merely indicate that a certain event has arisen (e.g. range has been overshoot).

Icons appear along the top edge of the display next to the display parameter affected by the error which has occurred.	
	Signal overshooting (x > 20.5 mA) or undershooting (x < 3.8 mA)
	Error: fault or notice pending; → error list
	Phase transition: steam condensing, water boiling
	Range overshoot: Pressure or temperature outside permitted gas range limits

Configuring the error type for process errors

Process errors are defined as notice messages in the factory setting. You can change the alarm response of process errors, i.e. process errors are indicated by a fault message.

1. Configure as **Setup → Basic set-up → Alarm response → Random**
2. Individual alarm responses for the inputs and applications can then be defined in the device menu for inputs (Q, P, T), applications and outputs.

The following process errors can be configured:

- Inputs:
 Open circuit, sensor signal range violation

- Applications:
Wet steam alarm, phase transition, range violation (gas range limits)

Event buffer

Main menu → Diagnosis → Event buffer

In the event buffer, the last 100 events, i.e. fault messages, notices, limit values, power failure etc. are recorded in chronological order with the time of occurrence and counter reading.

Error list

The error list provides assistance in quickly localising current device errors. Up to ten alarms are listed in the error list in chronological order. In contrast to the event buffer, only the errors currently pending are displayed, i.e. rectified errors are cleared from the list.

Quick overview of the error concept

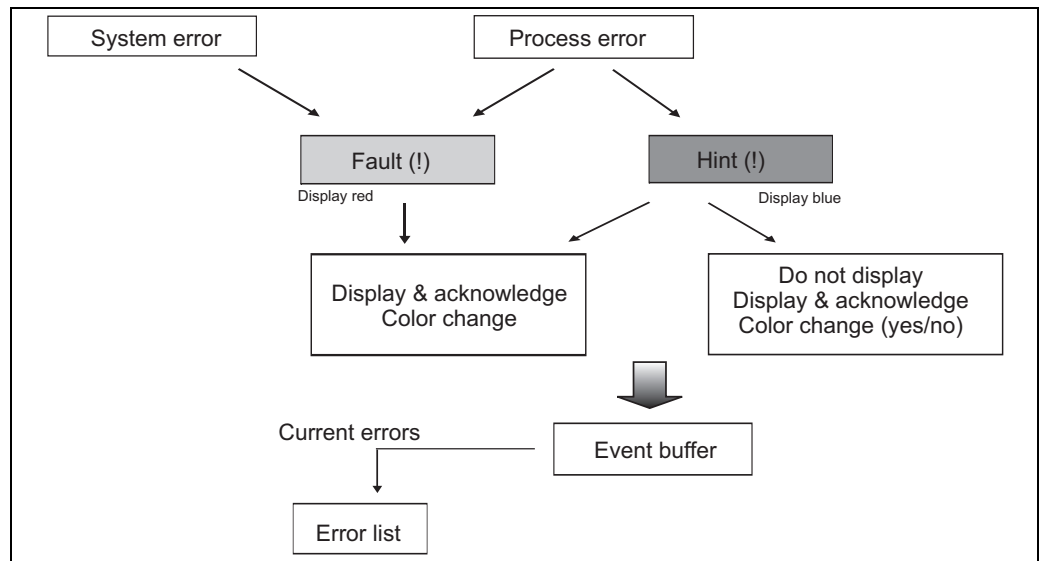


Fig. 19: Procedure when a system or process error occurs

5.4 Communication

In all devices and device versions, the parameters can be configured, altered and read out via the standard interface with the aid of PC operating software and an interface cable (see Section 8 'Accessories'). This is recommended in particular if extensive settings are to be made (e.g. when commissioning).

There is the additional option of reading out all the process and display values via the RS485 interface with an external PROFIBUS module (HMS AnyBus Communicator for PROFIBUS-DP) (see 'Accessories' Section).



Note!

Detailed information for configuring the device using the PC operating software can be found in the accompanying Operating Instructions which are also located on the data carrier.

6 Commissioning

6.1 Function check

Make sure that all post-connection checks have been carried out before you commission your device:

- See Section 3.3 'Post-installation check'
- Checklist Section 4.3 'Post-connection check'

6.2 Switching on the measuring device

6.2.1 Basic unit

Once the operating voltage is applied, the green LED (= device operating) lights up if no fault is present.

- When the device is first commissioned, the prompt "Please set up device" appears on the display. Program the device as per the description → Chap. 6.3.
- When commissioning a device already configured or preset, measuring is immediately started as per the settings. The values of the display group currently set appear on the display. By pressing any key, you get to the navigator (quick start) and from there back to the Main menu (see Section 6.3).

6.2.2 Extension cards

When the operating voltage is applied, the device automatically recognises the installed and wired extension cards. You can now follow the prompt to configure the new connections or perform the configuration at a later date.

6.2.3 Remote display and operating unit

The remote display/operating unit is preconfigured at the factory - device address 01, baudrate 56.7k, RS485-Master. Once the supply voltage has been applied and after a short initialisation period, the display unit automatically starts communication to the connected basic unit. Make sure that the device address of the basic unit and of the remote display match.

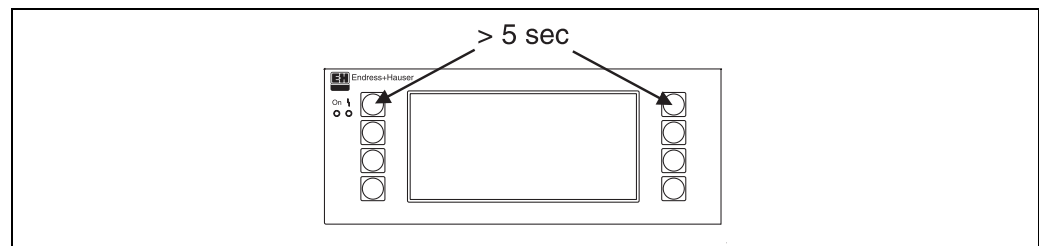


Fig. 20: Start Setup menu

You can get to the Setup menu of the display/operating unit by pressing the left and right top key at the same time for 5 seconds. Here, the baudrate and device address for communication, as well as the contrast and display viewing angle can be configured. Press ESC to exit the Setup menu of the display/operating unit and to get to the display window and the Main menu to configure the Energy Manager.



Note!

The Setup menu for configuring the basic settings of the display/operating unit is only available in English.

Error messages

After switching on or configuring the device, the message **"Communication problem"** appears briefly on the remote display/operating unit until a stable connection has been established. If this error message is displayed during operation, please check the wiring to the Energy Manager and ensure that the baudrate and the device address match the Energy Manager.

6.3 Device configuration

This section describes all the configurable device parameters with the associated value ranges and factory settings (default values).

Please note that the parameters available for selection, e.g. the number of terminals, depend on the device version (see Section 6.2.2 Extension cards).

Function matrix

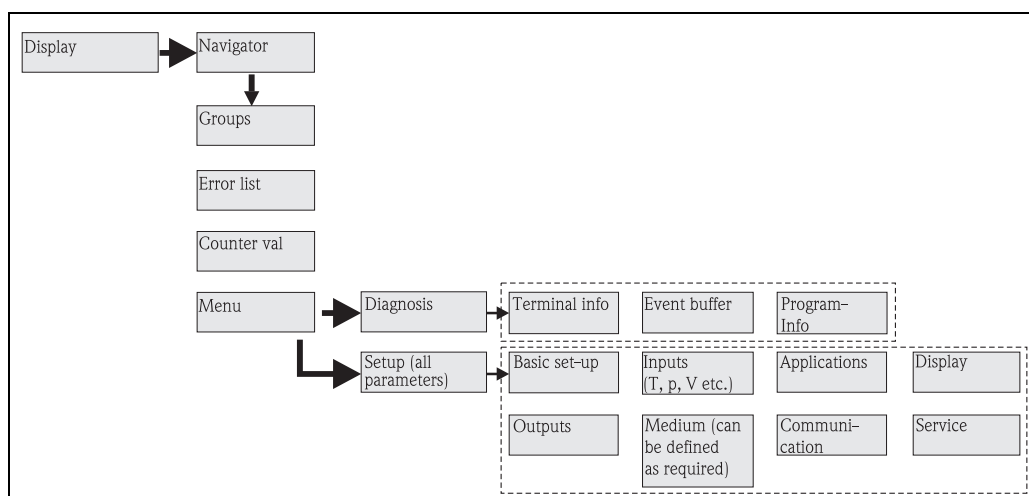


Fig. 21: Function matrix (extract) for on-site Energy Manager configuration. A detailed function matrix can be found in the Appendix.

6.3.1 Navigator (quick start)

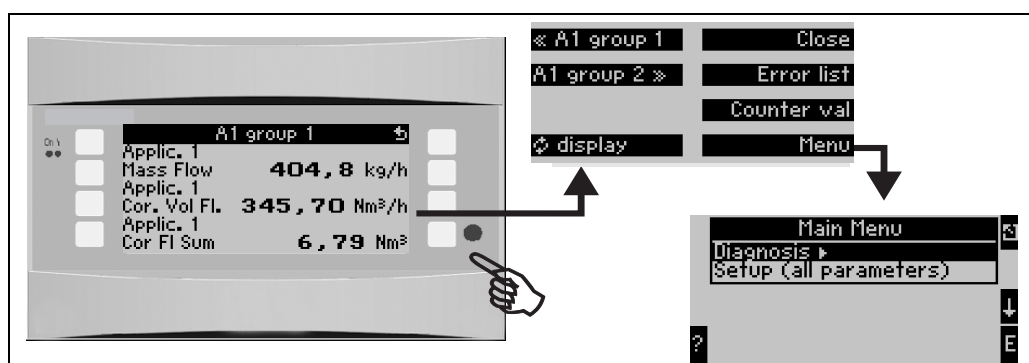


Fig. 22: Quick start to configuration via the Navigator menu of the Energy Manager.

In the operating mode of the Energy Manager (measured value displayed), the operating window **"Navigator"** opens up by pressing any key: the Navigator menu offers quick access to important information and parameters. Pressing one of the keys available takes you directly to the following items:

Function (menu item)	Description
Group	For selecting individual groups with display values.
↻ Display	For displaying the groups alternately, setting in the setup menu "Display" .
Error list	For quickly localising current device errors.
Counter val	For reading off and, if necessary, resetting all the totalizers.
Menu	Main menu for configuring the device.

The contents of the groups with display values can only be defined in the **Setup → Display** menu. A group comprises a maximum of eight process variables which are displayed in a window in the display. When commissioning the device, 2 groups with the most important display parameters are automatically created when an application is selected. Automatically created groups are also marked with a value in brackets (A1..3) which refers to the application, e.g. Group 1 (A1) means Group 1 with display values for Application 1.

The settings for the display functionalities, e.g. contrast, scrolling display, special groups with display values etc. are also made in the menu Setup → Display.



Note!

When commissioning, the prompt **"Please set up device"** is displayed. Confirming this message takes you to the Navigator menu. Select **'Menu'** here to get to the Main menu.

A device already configured is in the display mode as standard. The device changes to the Navigator menu as soon as one of the eight operating keys is pressed. From here, you get to the Main menu by selecting **'Menu'**.



Note!

If you continue navigating through the Main menu, the message **"If you change the application, the respective counters will be reset" is displayed**. Confirming this message takes you to the Main menu.

6.3.2 Main menu - Diagnosis

The Diagnosis menu is used to analyse the device functionality, such as locating device malfunctions.

Function (menu item)	Parameter setting	Description
Terminal info	A10	Lists all the terminals of the device and the connected sensors. Display the signal values present (in mA, Hz, Ohm) by pressing the key i .
Event buffer		Log of all the events, e.g. error messages, parameter changes, etc. in chronological order. (ring buffer with approx. 100 values, cannot be deleted!)
Program info		Displays the device data such as program, name, software version, date and time.

6.3.3 Main menu - Setup

The Setup menu is used for configuring the Energy Manager. The following subsections and tables list and describe all the configuration parameters of the Energy Manager.

Procedure when configuring the Energy Manager

1. Select system units (device settings).
2. Configure inputs (flow, pressure, temperature), i.e. assign terminals to the sensors and scale the input signals, if necessary configure default values for pressure and temperature.
3. Application (e.g. gas/norm volume) and medium (e.g. methane). (If no suitable medium is stored, a special medium can be selected in the Main menu).
4. Configure application, i.e. assign the configured inputs (sensors) .
5. Configure outputs (analog, pulse or relay/limit values).
6. Check display settings (values are preset automatically).
7. Make optional device settings (e.g. communication settings).



Caution!

If you change configuration parameters, check whether this has an effect on other parameters and your overall measuring system.

Set-up → Basic set-up



Note!

Factory settings are indicated in bold.

The basis data of the device are defined in this submenu.

Function (menu item)	Parameter setting	Description
Date-Time		
Date	DD.MM.YY DD.MM.YY	For configuring the current date (country-specific). Note! Important for summertime/wintertime changeover
Time	SS:MM	Current time for the real time clock of the device.
Summertime/normal time changeover		
■ Changeover	Off - Manual - Auto.	Kind of time changeover.
■ Region	Europe - USA	Displays the changeover date from normal time (NT) to summertime (ST) and vice versa. This function depends on the region selected.
■ NT→ST ST→NT – Date – Time	■ 31.03 (Europe) 07.04 (USA) ■ 27.10 (Europe) 27.10 (USA) ■ 02:00	Takes into consideration the summertime/normal time changeover in Europe and USA at different times. This can only be selected if summertime/normal time changeover is not set to 'Off'. Time of changeover. This can only be selected if summertime/normal time changeover is not set to 'Off'.
System eng. units		
System eng. units	Metric American Random	Sets the unitary system. "Random" means that a picklist with different unitary systems, incl. time basis and format, appears in the individual operating items.
Code		
■ User ■ Alarm lim.	0000 - 9999 0000 - 9999	Device operation is only enabled once the previously defined code has been entered. Only the alarm limits are enabled for configuration. All other parameters remain locked.
S-DAT module		
End set-up	Automatic On request	Saves the settings automatically when you exit the setup or confirm a prompt/question.

Function (menu item)	Parameter setting	Description
Save	Yes No	Write data to the S-DAT module.
Read in		Transfer counter readings and operating data from the module to the device.
Op. data	Date Time Read in	
S-DAT data	Prog. name, Prog. ver., CPU No.	Program name, program version and CPU number of the S-DAT module.
Alarm response		
Fault category	Default set-up - Random	Alarm response when process errors occur. As per the factory setting, all process errors are signalled by a warning message. By selecting "Random", additional operating items appear in the inputs and the application to assign a different fault category (fault message) to the individual process errors (see Section 5.3 'Error message display').
Text input		
	Standard Palm	Selects the way of entering text: ■ Standard: Per parameter item, runs up or down the row of characters until the desired character appears. ■ Palm: The desired character can be selected from the visual key field with the cursors.
General info		
Unit ID		Assigns a device name (max. 12 characters long).
TAG number		Assigns a TAG number, as in wiring diagrams for example (max. 12 characters long).
Prog. name		Name which is saved in the PC operating software along with all the settings.
SW version		Software version of your device.
SW option		Information as to which extension cards are installed.
CPU No.:		The CPU number of the device is used as an identifier. It is saved with all the parameters.
Series No.:		This is the serial number of the device.
Run time 1. Unit 2. LCD		1. Information on how long the device has been in operation (protected by service code.) 2. Information on the operating time of the device display (protected by service code.)

Setup → Inputs

Note!

Depending on the version, 4 to 10 current, PFM, pulse and RTD inputs are available in the energy computer to record the flow, temperature and pressure signals.

Flow inputs

The Energy Manager processes all common flow measurement methods (volume, mass, differential pressure). You can connect up to three flow transmitters at the same time. There is also the option of using just one flow transmitter in various applications, see 'Terminals' menu item).

Special flow meters

Item for very exact flow based on differential pressure method with compensation calculation as per ISO 5167 as well as splitting range function for extending the measuring range, e.g. for orifice measurement (up to three DP transmitters) and possibility of computing the mean value from several DPTs.

Pressure inputs

A maximum of three pressure sensors can be connected. One sensor can also be used for two or all three applications, see the 'Terminal' item in the related table.

Temperature inputs

For connecting between two and six (max.) temperature sensors (RTD). A sensor can be used in several applications here, see the 'Terminal' item in the related table.

Flow inputs

Function (menu item)	Parameter setting	Description
Flow inputs	Flow 1, 2, 3	Configuration of individual flow transmitters.
Identifier		Name of the flow transmitter (max. 12 characters).
DPT	Volumetric Mass	Setting of the measuring principle of your flow transmitter or as to whether the flow signal is in proportion to the volume, (e.g. vortex, EFM, turbine) or mass (e.g. Coriolis). (For details, see Section 11.2 'Flow measurement configuration')
Signal	Select 4-20 mA 0-20 mA PFM Pulse Default	Selects the signal of the flow transmitter.
Terminals	None A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Defines the terminal to which the flow transmitter in question is connected. It is possible to use a transmitter (flow signal) for several applications. For this, in the application in question, select the terminal where the transmitter is located (multiple selection possible).
Curve	Linear Sqr. root	Select the curve of the flow transmitter used.
Unit	l/...; hl/...; dm ³ /...; m³ /...; bbl/...; gal/...; igal/...; ft ³ /...; acf/... kg, t, lb, ton (US)	Flow unit in format: <i>selected unit</i> by X Note! Only visible if the "Random" system unit has been selected. Can only be selected for flow transmitter/mass
Time base	.../s; .../min; .../h; .../d	Time basis for the flow unit in the format: <i>X per time unit selected</i> . Note! Only visible if the "Random" system unit has been selected.

Function (menu item)	Parameter setting	Description
gal/bbl	31.5 (US), 42.0 (US), 55.0 (US), 36.0 (Imp), 42.0 (Imp), User def. 31.0	Definition of technical unit Barrel (bbl), given in gallons per barrel. US: US gallons Imp: Imperial gallons User def.: free to set the conversion factor.
Format	9; 9.9 ; 9.99; 9.999	Number of places after the decimal point  Note! Only visible if the "Random" system unit has been selected.
Meter coeff.	Pulse value K-factor	Select the reference variable for the pulse value. Pulse value (unit/pulse) K-factor (pulse/unit)
Pulse value	0.001 to 99999	Setting as to what volume flow (in dm ³ or litre) a pulse of the flow transmitter corresponds to.  Note! Only available for Pulse signal.
K Fact. unit	Pulse/dm ³ Pulse/ft ³	
K-factor	0.001 to 9999.9	Enter the pulse value of the vortex sensor. You can find this value on your flow sensor.  Note! This can only be selected for the PFM signal. For vortex sensors with pulse signal, the reciprocal value of the K-factor (in pulse/dm ³) is entered as a pulse value.
Start value	0.0000 to 999999	Start value for the volume flow (differential pressure) with 0 or 4 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
End value	0.0000 to 999999	End value for the volume flow (differential pressure) with 20 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
Flow cut off	0.0 to 99.9% 4.0 %	Below the set value, the flow is no longer recorded or 0 is set. Depending on the type of flow transmitter, the flow cutoff can be set in % of the full scale value of the flow measuring range or as a fixed flow value (e.g. in m ³ /h).
Correction	Yes No	Possibilities for correcting the flow measurement by offset, signal damping, flow cut off, sensor expansion coefficient and correction table for curve description.
Signal damp	0 to 99 s	Time constant of the first order low pass for the input signal. This function is used to reduce display fluctuations in the event of severely fluctuating signals.  Note! This can only be selected for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99	Shifts the zero point of the response curve. This function is used to adjust sensors.  Note! This can only be selected for the 0/4 to 20 mA signal.
Correction	Yes No	Possibility for correcting the flow measurement. If "YES" is selected, the sensor curve can be defined in the correction table and there is the possibility of compensating the temperature effect on the flow transmitter (see "Exp. coeff.")

Function (menu item)	Parameter setting	Description
Expan. coeff.	0 to 9.9999e-XX	Correction factor for compensating the temperature effect on the flow transmitter. This factor is often indicated on the nameplate for vortex flowmeters, for example. If no value is known for the expansion coefficient or if this has already been compensated by the device itself, please set 0 here. Default: 4.88e-05  Note! Note! Only active if correction setting is active.
Table	Use Not used	If the flow curve of your transmitter deviates from the ideal pattern (linear or square root), this can be compensated by entering a correction table. For details, see the 'Correction tables' in Section 11.2.1.
No. of rows	01 - 15	Number of points in the table.
Corr. tab. pulse	Point (used/delete) Current/flow frequency/ k-factor	If the flow curve of your transmitter deviates from the ideal pattern (linear or square root), this can be compensated by entering a correction table. The parameters in the table depend on the flow transmitter selected. ■ Analog signal, linear curve Up to 15 value pairs (current/flow) ■ Pulse signal, linear curve Up to 15 value pairs (frequency/k-factor or frequency/pulse value). For details, see the 'Correction tables' in Section 11.2.1.
Sums	Unit Format Total Signal reset Terminals	Possibility of configuring or resetting the totalizers for the volume flow. Signal reset, i.e. resetting the totalizer by an input signal (e.g. remote read-out of totalizers with subsequent reset). (Terminal for this input signal only active if "Signal Reset = YES")
Alarm response		
Range violation Open circuit	Alarm type Colour change Fault text	For this input, individually specify which alarms should be displayed when faults occur: range violation (as per NAMUR43) or open circuit.  Note! Only active if the option Random was selected in the 'Alarm response' menu item in Setup → Basic set-up.
Alarm type	Fault Hint	Fault message, totalizer stop, colour change (red) and message in plain text.
Colour change	Yes No	Select whether the alarm should be signalled by a colour change from blue to red.  Note! Only active if the 'Hint' alarm type has been selected.
Fault text	Display+acknowledge Do not display	Select whether an alarm message should appear to describe the fault when a fault occurs. This is cleared (acknowledged) by pressing a key.  Note! Only active if the 'Hint' alarm type has been selected.

Special flow meters

Function (menu item)	Parameter setting	Description
Special flow meters	Differential pressure 1, 2, 3 Mean flow	Configuration of individual or several differential pressure transmitters (DPT).  Note! Only use if your DP transmitter outputs a pressure-scaled signal (mbar, inH ₂ O etc.)
Identifier		Name of the flow transmitter (max. 12 characters).
Meas. point	Select DPT Splitting Range	Select whether one DP transmitter or several DPTs are used for extending the measuring range (Splitting Range). (See Section 11.2.1 for details of the 'Splitting Range')
Differential pressure transmitter		
Flow type	Pitot Orifice corner tap Orifice D2 Orifice flange tap ISA 1932 nozzle Long rad. nozzle Venturi nozzle Venturi tube (cast) Venturi tube (mach.) Venturi tube (steel) V-cone	Type of differential pressure transmitter The data in brackets refer to the type of Venturi tube.
Medium	Water Steam Gas (Argon, etc.) Liquid (Propane, etc.)	Select the medium for which the flow should be measured.
Signal	Select 4-20 mA 0-20 mA PFM Pulse Default	See Setup 'Flow inputs'
Terminals	None A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	See Setup 'Flow inputs'
Curve	Linear Sqr. root	Curve of the DP transmitter used.  Note! Please observe information in Section 11.2.1!
Time base	.../s; .../min; .../h; .../d	See Setup 'Flow inputs'
Unit	l/...; hl/...; dm ³ /...; m³ /...; bbl/...; gal/...; ical/...; ft ³ /...; acf/... kg, t, lb, ton (US)	See Setup 'Flow inputs'  Note! Only visible if the "Random" system unit has been selected. Can only be selected for flow transmitter/mass
gal/bbl	31.5 (US), 42.0 (US), 55.0 (US), 36.0 (Imp), 42.0 (Imp), User def. 31.0	See Setup 'Flow inputs'
Format	9; 9.9 ; 9.99; 9.999	See Setup 'Flow inputs'  Note! Only visible if the "Random" system unit has been selected.
Rng. units	mbar in/H ₂ O	Unit of differential pressure
Range start	mbar in/H ₂ O	Start value for the differential pressure with 0 or 4 mA.

Function (menu item)	Parameter setting	Description
Range end	mbar in/H ₂ O	End value for the differential pressure with 20 mA.
Factor		K-factor for describing the resistance coefficient of E+H Pitot tubes (see data sheet).
Correction	Yes No	Possibilities for correcting the flow measurement by offset, signal damping, flow cut off, expansion coefficient of the device (e.g. orifice plate) and correction table for curve description.
Flow cut off	0.0 to 99.9% 4.0 %	Below the set value, the flow is no longer recorded or 0 is set. Depending on the type of flow transmitter, the flow cutoff can be set in % of the full scale value of the flow measuring range or as a fixed flow value (e.g. in m ³ /h).
Signal damp	0 to 99 s	Time constant of the first order low pass for the input signal. This function is used to reduce display fluctuations in the event of severely fluctuating signals.  Note! This can only be selected for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99	Shifts the zero point of the response curve. This function is used to adjust sensors.  Note! This can only be selected for the 0/4 to 20 mA signal.
Table	Use Not used	If the flow curve of your transmitter deviates from the ideal pattern (linear or square root), this can be compensated by entering a correction table. For details, see Setup 'Flow inputs'.
Pipe data	Inner dia. Geom. ratio	Enter the internal diameter of the pipe. Enter the diameter ratio ($d/D = \beta$) of the differential pressure transmitter, data in the data sheet of the DP transmitter.  Note! In dynamic pressure measurements, the K-factor must be given to describe the resistance coefficient of the probe (see Section 11.2.1 for details).
Coefficient	Fixed value Table	Flow coefficient c for calculating the flow.  Note! Only if using a V-cone flow transmitter.
Coeff. (c)	0.0001 to 99999	Enter the flow coefficient c.
Num. coeff.	01 - 15	Number of points in the table.
Coeff. tab.	Points (used/delete) Reynolds No./coefficient	Table for describing the flow coefficient depending on the Reynolds number. For details on the V-cone calculation method, see Section 11.2.1
Sums	Unit Format Actual Total Signal reset Terminals	See Setup 'Flow inputs'
Splitting range		
Splitting range		Splitting range or automatic measuring range switching for differential pressure measuring devices. See Section 11.2.1 for details of the 'Splitting Range'.
Rng.1 Term.	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminal for connecting the differential pressure transmitter with the smallest measuring range
Rng.2 Term.	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminal for connecting the differential pressure transmitter with the second largest measuring range

Function (menu item)	Parameter setting	Description
Rng.3 Term.	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminal for connecting the differential pressure transmitter with the largest measuring range
Range 1 (2, 3) start	0.0000 to 999999	Start value for the differential pressure at 0 or 4 mA, defined for the pressure transmitter in range 1 (2, 3)  Note! Only active after a terminal has been assigned.
Range 1 (2, 3) end	0.0000 to 999999	End value for the differential pressure at 20 mA, defined for the pressure transmitter in range 1 (2, 3)  Note! Only active after a terminal has been assigned.
Correction	Yes No	Possibilities for correcting the flow measurement by offset, signal damping, flow cut off, sensor expansion coefficient and correction table for curve description. see Setup 'Differential pressure transmitter'
Pipe data	Units (mm/inch) Inner dia. Geom. ratio K-factor	See Setup 'Differential pressure transmitter'.
Sums	Unit Format Actual Total Signal reset Terminals	See Setup 'Flow inputs'.
Alarm response		See Setup 'Flow inputs'.
Mean flow		
Identifier	Mean flow	Name for computing the mean value from several flow signals (max. 12 characters).
Number	Unused 2 sensors 3 sensors	Mean value computed from several flow signals (See Section 11.2.1 for details of the 'Mean value computation')
Sums	Unit Format Actual Total Signal reset Terminals	See Setup 'Flow inputs'.

Pressure inputs

Function (menu item)	Parameter setting	Description
Identifier	Pressure 1-3	Name of pressure sensor, e.g. 'pressure in' (max. 12 characters).
Signal	Select 4-20 mA 0-20 mA Default	Selects the signal of the pressure sensor. If 'Default' is set, the device works with a fixed default pressure.
Terminals	None A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Defines the terminal for connecting the pressure sensor. It is possible to use a sensor signal for several applications. For this, in the application in question, select the terminal where the sensor is located. (multiple selection possible)

Function (menu item)	Parameter setting	Description
Unit	bar ; kPa; kg/cm ² ; psi; bar (g); kPa (g); psi (g)	Physical unit of the measured pressure. ■ (a) = appears on the display if 'absolute' was selected as the type. Refers to the absolute pressure. ■ (g) = gauge, appears on the display if 'relative' was selected as the type. Refers to the relative pressure. (a) or (g) appears automatically on the display depending on the type selected.  Note! Only visible if the "Random" system unit has been selected.
Type	Absolute Relative	Indicates whether the measured pressure is absolute or relative (gauge) pressure. With relative pressure measurement, the atmospheric pressure has to be entered afterwards.
Format	9; 9.9 ; 9.99; 9.999	Number of places after the decimal point  Note! Only visible if the "Random" system unit has been selected.
Start value	0.0000 to 999999	Start value for the pressure with 0 or 4 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
End value	0.0000 to 999999	End value for the pressure with 20 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
Signal damp	0 to 99 s	Time constant of the first order low pass for the input signal. This function is used to reduce display fluctuations in the event of severely fluctuating signals.  Note! This can only be selected for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99	Shifts the zero point of the response curve. This function is used to adjust sensors.  Note! This can only be selected for the 0/4 to 20 mA signal.
Atm. press.	0.0000 to 10000.0 1.013	Configuration of the ambient pressure (in bar) present at the device installation location.  Note! Item is only active if 'relative' is selected as the type.
Default	-19999 to 19999	Sets the default pressure which is worked with if the sensor signal fails and the 'Default' signal is set.
Alarm response		See Setup 'Flow inputs'.
Mean value	Unused 2 sensors 3 sensors	Mean value computed from several pressure signals (See Section 11.2.1 for details of the 'Mean value computation')

Temperature inputs

Function (menu item)	Parameter setting	Description
Identifier	Temperature 1-6	Name of temperature sensor, e.g. 'Temp 1' (max. 12 characters).
Signal	Select 4-20 mA 0-20 mA Pt100 Pt500 Pt1000 Default	Selects the signal of the temperature sensor. If 'Default' is set, the device works with a fixed default temperature.
Sensor type	3-wire 4-wire	Configures the sensor connection in 3-wire or 4-wire technology.  Note! Can only be selected for the Pt100/Pt500/Pt1000 signal.
Terminals	None A-10; A-110; B-112; B-113; C-112; C-113; D- 112; D-113; B-117; B- 121; C-117; C-121; D- 117; D-121; E-1-6; E-3-8	Defines the terminal for connecting the temperature sensor. It is possible to use a sensor signal for several applications. For this, in the application in question, select the terminals where the sensor is located (multiple selection possible).  Note! The term in brackets X-1X (e.g. A-11) describes a current input, the term X-2X (e.g. E-21) a pure temperature input. The type of input depends on the extension cards.
Unit	°C; K; °F	Physical unit of the measured temperature.  Note! Only visible if the "Random" system unit has been selected.
Format	9; 9.9 ; 9.99; 9.999	Number of places after the decimal point  Note! Only visible if the "Random" system unit has been selected.
Signal damp	0 to 99 s 0 s	Time constant of the first order low pass for the input signal. This function is used to reduce display fluctuations in the event of severely fluctuating signals.  Note! This can only be selected for the 0/4 to 20 mA signal.
Start value	-9999.99 to 999999	Start value for the temperature with 0 or 4 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
End value	-9999.99 to 999999	End value for the temperature with 20 mA.  Note! This can only be selected for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99 0.0	Shifts the zero point of the response curve. This function is used to adjust sensors.  Note! This can only be selected for the 0/4 to 20 mA signal.
Default	-9999.99 to 9999.99 20 °C or 70 °F	Sets the temperature which is worked with if the sensor signal fails and the 'Default' signal is set.
Alarm response		See Setup 'Flow inputs'.
Temperature mean value	Unused 2 sensors 3 to 6 sensors	Mean value computed from several temperature signals (See Section 11.2.1 for details of the 'Mean value computation')

Setup → Applications

Energy Manager applications:

- Gas:
Norm volume - mass - heating value
- Steam:
Mass - heat quantity - net heat quantity - heat difference
- Liquids:
Heat quantity - heat difference - heating value
- Water:
Heat quantity - heat difference

Up to three different applications can be calculated simultaneously. The configuration of an application is possible without restricting the applications available up to now in the operating status. Please note that when you have successfully configured a new application or changed the settings of an already existing application, the data are not accepted until the user enables the application at the end (question before exiting the setup).

Function (menu item)	Parameter setting	Description
Identifier	Application 1-3	Name of the configured application, e.g. 'boiler room 1'.
Media		
Gas Liquids Water/steam	Norm volume/mass N.vol/mass/heat value Heat diff. Heating val. Steam mass/heat Net steam S-heat diff Water heat quantity Water-heat diff	Select the desired application (depending on the type of media). If an application in operation should be switched off, choose 'Select' here.
Medium	Select Argon Methane Acetylene ...	Select your medium 8 gases (argon, methane, acetylene, oxygen, nitrogen, ammonia, hydrogen, natural gas and 2 liquids (butane, propane) can be selected (stored). Other media can be defined under " Setup → Medium ". See 'Setup → Medium'
Flow	Select Flow 1-3	Assign a flow sensor to your application. Only the sensors that were configured previously (see 'Setup: Inputs - Flow inputs') can be selected here.
Pressure	Select Pressure 1-3	Assign the pressure sensor. Only the sensors that were configured previously (see 'Setup: Inputs - Pressure inputs') can be selected here.
Temperature	Select Temperature 1-6	Assign the temperature sensor. Only the sensors that were configured previously (see 'Setup: Inputs - Temperature inputs') can be selected here.  Note! Not for differential applications.
Reference value	Temperature Pressure Density z-factor Heating val* Gravity* * Only for AGA8 or SGERG	Data in the normal gas state: these values are reference values for calculating the gas norm volume. 0 °C (32 °F) and 1.013 bar (14.69 psi) are set as standard.  Note! If you change the standard settings, adjust the density and z-factor if necessary!
Equation	NX 19 SGERG 88 (optional) AGA 8 (optional)	Equation standard for calculating the norm volume for natural gas.  Note! It can only be selected if natural gas is the medium!

Function (menu item)	Parameter setting	Description
Mole content	N ₂ CO ₂ H ₂ - only for AGA 8 and SGERG 88	Gas content in Mol-%. Temp. - 40 to 200 °C (-40 to 392 °F), pressure < 345 bar (5003 psi) Mol-% CO ₂ : 0 to 15 % Mol-% N ₂ : 0 to 15 % Mol-% H ₂ : 0 to 15 %  Note! Only for natural gas applications.
Steam type	Superheated steam Saturated steam	Sets the type of steam.  Note! Only for steam applications.
Input param.	Q + T Q + P	Input parameters for saturated steam applications. Q + T: flow and temperature Q + P: flow and pressure Only two input variables are required to measure saturated steam. The missing variable is determined by the computer with the saturated steam curve stored (only for 'Saturated steam' steam type). The input parameters flow, pressure and temperature are required for measuring superheated steam.  Note! Only for saturated steam applications.
Op. mode	Heating Cooling Bidirectional Heating Steam generation	Setting as to whether your application absorbs energy (cooling) or gives off energy (heating). Bidirectional operation describes a circuit which is used for heating and for cooling.  Note! This can only be selected for the "Water heat difference" or "Liquid heat difference" application. Setting as to whether steam is used for heating purposes or whether steam is generated from water.  Note! This can only be selected for the "Steam-heat difference" application.
Flow direct.	Constant Changing	Information on the direction of flow in the circuit with bidirectional operation.  Note! Only for the Bidirectional operating mode.
Dir. signal	Terminals	Terminal for connecting the direction signal output of the flow transmitter.  Note! Only for the Bidirectional, Changing flow direction operating mode.
Flow	Select Flow 1-3	Assign a flow sensor to your application. Only the sensors that were configured previously (see 'Setup: Inputs - Flow inputs') can be selected here.
Inst. point	Warm Cold	Set the 'thermal' installation point at which the flow sensor is located in your application (only active for water/heat difference or liquid heat difference). The installation point is specified as follows for steam/heat difference: Heating: warm (i.e. steam flow) Steam generation: cold (i.e. water flow)  Note! In the event of bidirectional operation, make the settings as per the heating operating mode.
Mean pres.	10.0 bar	Indicates the average process pressure (absolute) in the heating circuit.  Note! Only for water applications.

Function (menu item)	Parameter setting	Description
Temperature cold	Select Temperature 1-6	Assign the sensor which records the lower temperature in your application. Only the sensors that were configured previously (see 'Setup: Inputs - Temperature inputs') can be selected here.  Note! Only for heat diff. applications.
Temperature Warm	Unused Temperature 1-6	Assign the sensor which records the higher temperature in your application. Only the sensors that were configured previously (see 'Setup: Inputs - Temperature inputs') can be selected here.  Note! Only for heat diff. applications.
Min. T-Diff.	0.0 to 99.9	Sets the minimum temperature difference. If the measured temperature difference undershoots the set value, the heat quantity is no longer calculated.  Note! Only for water heat diff. applications.

Units

Configuration of the units for the totalizers and process variables.



Note!

The units are automatically preset depending on the system unit selected (Setup: **Basic set-up** → **System eng. units**).

Function (menu item)	Parameter setting	Description
Time base	.../s; .../min; .../h; .../d	Time basis for the flow unit in the format: <i>X per time unit selected</i> .
Cor vol. fl.	Nm ³ /time scf/time	Corrected volume unit.
Cor. fl. sum	Nm ³ scf	Corrected flow sum unit.
Heat flow	kW, MW, kcal/time, Mcal/time, Gcal/time, kJ/h , MJ/time, GJ/time, KBtu/time, Mbtu/time, Gbtu/time, ton (refrigeration)	Defines the heat quantity per the time unit set previously or the thermal performance.
Heat sum	kW * time, MW * time, kcal, Gcal, GJ, KBtu, Mbtu, Gbtu, ton * time MJ, kJ	Unit for the totalised heat quantity or the thermal energy.
Mass flow	g/time, t/time, lb/time, ton(US)/time, ton(long)/ time kg/time	Unit of mass flow per time unit defined previously.
Mass sum	g, t, lb, ton(US), ton(long) kg	Unit of calculated mass sum.
Density	kg/dm ³ , lb/gal ³ , lb/ft ³ kg/m³	Unit of density.
Temp. diff.	K, °F °C	Unit of temperature difference.
Enthalpy	kWh/kg, kcal/kg, Btu/ lbs, kJ/kg MJ/kg	Unit of specific enthalpy (measurement for the heat contents of the medium.)
Format	9 9.9 9.99 9.999	Number of places after the decimal point with which the values above are shown in the display.

Function (menu item)	Parameter setting	Description
gal/bbl	31.5 (US), 42.0 (US), 55.0 (US), 36.0 (Imp), 42.0 (Imp), User def. 31.0	Definition of technical unit Barrel (bbl), given in gallons per barrel. US: US gallons Imp: Imperial gallons User def.: free to set the conversion factor.

Important system units are defined in Section 11 of these Operating Instructions.

Sums (totalizers)

Two resettable and two non-resettable totalizers (grand totalizers) are available for mass, heat or corrected volume flow. The grand totalizer is marked by "Σ" in the display element picklist. (Menu item: **Setup (all parameters) → Display → Group 1... → Value 1... → Σ Heat sum** Sum overflows are recorded in the event buffer (menu item: **Display/Event buffer**). The totalizers can also be displayed as an exponential value to avoid overflow (Setup: **Display → No. of sums**). The totalizers are configured in the submenu **Setup (all parameters) → Applications → Applications ... → Sums**. The totalizers can also be reset to zero by signal (e.g. after remotely reading the totalizers via PROFIBUS).



Note!

In the Setup **"Navigator → Counter val"**, all the totalizers are listed and can be read out and, if necessary, reset to zero individually or all together.

Function (menu item)	Parameter setting	Description
Corr. vol.	Nm ³ scf	Unit for corrected volume Nm ³ = norm cubic metre scf = standard cubic feet Note! Only for gas applications.
Heat Heat (-) *	0 to 99999999.9	Heat totalizer of the application selected. Can be configured and reset. Note! Not for gas applications.
Mass Mass (-) *	0 to 99999999.9	Mass totalizer of the application selected. Can be configured and reset.
Flow-	0 to 99999999.9	Flow totalizer (volume flow) of the application selected. Can be configured and reset.
Signal reset	Yes - No	Select whether to reset the totalizer by input signal.
Terminals	A10, A110,...	Input terminal for signal reset.

* In the bidirectional mode of operation (water-heat difference) there are two additional totalizers plus two grand totalizers. The additional totalizers are marked with (-). Example: A boiler load process is recorded by the 'heat' totalizer and the unload process by the '-heat' totalizer.

Alarm response



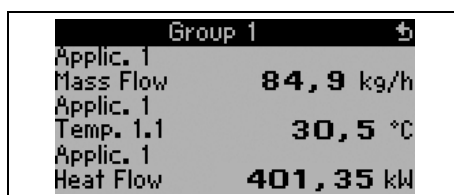
Note!

Item only active if the Random option was selected in the Alarm response menu item under **"Setup → Basic set-up"**.

Function (menu item)	Parameter setting	Description
Range error		Permitted temperature and pressure range for gas and liquid calculations exceeded.
Wet steam alarm Phase transition		 Note! Only active if 'Water/steam' was selected in the Media menu item. Wet steam: Risk that steam partially condenses! The alarm is triggered 2 °C (3.6 °F) above the saturated steam temperature (=condensate temperature). Phase transition: Condensate temperature (=saturated steam temperature) reached, i.e. state of aggregation can no longer be defined. Wet steam is present!
Alarm type	Fault Hint	Fault: totalizer stop, colour change (red) and message in plain text. Hint: totalizer unaffected, colour change and message display can be configured.
Colour change	Yes No	Select whether the alarm should be signalled by a colour change from blue to red.  Note! Only active if the 'Hint' alarm type has been selected.
Fault text	Display+acknowledge Do not display	Select whether an alarm message should appear to describe the fault when a fault occurs. This is cleared (acknowledged) by pressing a key.  Note! Only active if the 'Hint' alarm type has been selected.

Setup → Display

The device display can be freely configured. Up to six groups, each with 1 to 8 freely definable process values, can be displayed individually or alternately. For each application, the most important values are automatically shown in two windows (groups) in the display: this does not apply if the display groups have already been defined. The way the process values are displayed depend on the number of values in a group.



Group 1	
Applic. 1	
Mass Flow	84,9 kg/h
Applic. 1	
Temp. 1.1	30,5 °C
Applic. 1	
Heat Flow	401,35 kW

If displaying one to three values in a group, all values with the name of the application and identifier (e.g. heat totalizer) and the related physical unit are displayed.
As of four values, only the values and the physical unit are displayed.



Note!

In Setup "**Display**", the display functionality is configured. In "**Navigators**", then select which group(s) appear(s) with process values on the display.

Function (menu item)	Parameter setting	Description
Group 1 to 6 Identifier		A name (max. 12 characters) can be given to the groups for a better overview.
Display mask	1 value to 8 values Select	Here, set the number of process values which should be displayed beside one another in a window (as a group). The way the value is displayed depends on the number of selected values. The more values in a group, the smaller the display.
Value type	Inputs, process values, counter, totalizer, miscellaneous	The display values can be selected from 4 categories (types).

Function (menu item)	Parameter setting	Description
Value 1 to 8	Select	Selects which process values should be displayed.
Scrolling display		Alternating display of individual groups on the display.
Swit. time	0 to 99 0	Seconds until the next group is displayed.
Group X	Yes No	Select the groups that should be displayed alternately. The alternating display is activated in the "Navigator" / "↻ Display" (see 6.3.1).
Display		
OIML	Yes No	Selects whether the counter readings should be displayed as per the OIML standard.
No. of sums	Counter mode Exponential	Sum display Counter mode: sums are displayed with max. 10 positions up to overflow. Exponential: exponential display is used for large values.
Contrast	2 to 63 46	For configuring the display contrast. This setting has an immediate affect. The contrast value is not saved until the setup is exited.

Setup → Outputs

Analog outputs

Please note that these outputs can be used as both analog and pulse outputs; the desired signal type can be selected for each setting. Depending on the version (extension cards), 2 to 8 outputs are available.

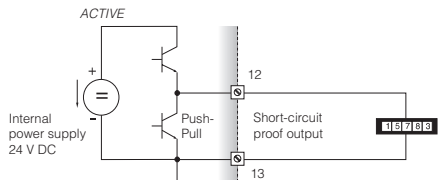
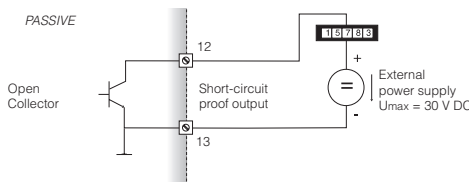
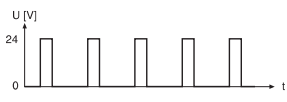
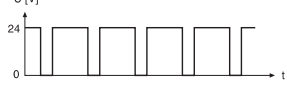
Function (menu item)	Parameter setting	Description
Identifier	Anal. outp. 1 to 8	An identifier can be given to the analog output in question for a better overview (max. 12 characters).
Terminals	B-131, B-133 C-131, C-133 D-131, D-133 E-131, E-133 None	Defines the terminal at which the analog signal should be output.
Sig. source	Density 1 Enthalpy 1 Flow 1 Mass flow 1 Pressure 1 Temperature 1 Heat flow 1 Select	Setting as to which calculated or measured variable should be output at the analog output. The number of signal sources depends on the number of configured applications and inputs.
Curr. range	4 to 20 mA , 0 to 20 mA	Specifies the mode of operation of the analog output.
Start value	-999999 to 999999 0.0	Smallest output value of the analog output.
End value	-999999 to 999999 100	Largest output value of the analog output.
Time const. (signal damping)	0 to 99 s 0 s	Time constant of the first order low pass for the input signal. This is used to prevent large fluctuations in the output signal (can only be selected for the signal type 0/4 and 20 mA).
Fault cond. action	Minimum Maximum Value Last value	Defines the behaviour of the output in the event of a fault, e.g. if a sensor in the measurement fails.

Function (menu item)	Parameter setting	Description
Value	-999999 to 999999 0.0	Fixed value which should be output at the analog output in the event of a fault.  Note! Only for the Fault cond. action setting; value can be selected.
Simulation	0 - 3.6 - 4 - 10 - 12 - 20 - 21 Off	The function of the current output is simulated. Simulation is active if the setting is not 'off'. Simulation ends as soon as you leave this item.

Pulse outputs

The pulse output function can be configured with active, passive output or relay. Depending on the version, 2 to 8 pulse outputs are available.

Function (menu item)	Parameter setting	Description
Identifier	Pulse 1 to 8	An identifier can be assigned to the pulse output in question for a better overview (max. 12 characters).
Signal	Active Passive Relay Select	Assign the pulse output. Active: Active voltage pulses are output. Power is supplied from the device. Passive: Passive open collectors are available in this operating mode. Power must be supplied externally. Relay: The pulses are output on a relay. (The frequency is max. 5Hz)  Note! "Passive" can only be selected when extension cards are used.
Terminals	B-131, B-133, C-131, C-133, D-131, D-133, E-131, E-133 B-135, B-137, C-135, C-137, D-135, D-137 A-52, B-142, B-152, C-142, C-152, D-142, D-152 None	Defines the terminal at which pulses should be output.
Sig. source	Heat sum 1, Heat sum 2, Flow sum 1, Flow sum 2, etc. Select	Setting as to which variable should be output at the pulse output.
Pulse		

Function (menu item)	Parameter setting	Description
Type	Negative Positive	Makes it possible to output pulses in a positive or negative direction (e.g. for external electronic totalizers): ■ ACTIVE: the device-internal power supply is used (+24 V) ■ PASSIVE: external power supply necessary ■ POSITIVE: quiescent level at 0 V ("active-high") ■ NEGATIVE: quiescent level at 24 V ("active-low") or external power supply  For continuous currents up to 15 mA  For continuous currents up to 25 mA POSITIVE pulses  NEGATIVE pulses  PASSIVE-NEGATIVE PASSIVE-POSITIVE ACTIVE-NEGATIVE ACTIVE-POSITIVE
Unit	g, kg, t for mass sum signal source kWh, MWh, MJ for heat sum signal source dm³ for flow signal source	Unit of the output pulse.  Note! Pulse unit depends on the signal source selected.
Unit value	0.001 to 10000.0 1.0	Setting as to which value a pulse corresponds to (unit/pulse).  Note! The max. possible output frequency is 50 Hz. The suitable pulse value can be determined as follows: $\text{Pulse value} > \frac{\text{Estimated max. flow (end value)}}{\text{Desired max. output frequency}}$
Width	Yes No	The pulse width limits the max. possible output frequency of the pulse output. Standard = pulse width fixed, i.e. always 100 ms. User defined = pulse width can be freely configured.
Value	0.01 to 10.00 s	Configuration of the pulse width suiting the external totalizer. The maximum permitted pulse width can be calculated as follows: $\text{Pulse width} < \frac{1}{2 \times \text{max. output frequency [Hz]}}$

Function (menu item)	Parameter setting	Description
Simulation	0.0 Hz - 0.1 Hz - 1.0 Hz - 5.0 Hz - 10 Hz - 50 Hz - 100 Hz - 200 Hz - 500 Hz - 1000 Hz - 2000 Hz Off	The function of the pulse output is simulated with this setting. Simulation is active if the setting is not "off". Simulation ends if you leave this item.

Relay/set point

Relays or passive digital outputs (open collector) are available in the relay for limit functions. Depending on the version, 1 to 13 limit values (set points) are available.

Function (menu item)	Parameter setting	Description
Identifier	Set point 1 to 13	An identifier can be assigned to the set point in question for a better overview (max. 12 characters).
Transmit by	Display Relay Digital Select	Assigns where the set point is output (passive digital output only available with extension card).
Terminals	A-52, B-142, B-152, C-142, C-152, D-142, D-152 B-135, B-137, C-135, C-137, D-135, D-137 None	Defines the terminal of the set point selected. Relay: terminals X-14X, X-15X Digital: terminals X-13X
Op. mode	Max+Alarm, Grad.+Alarm, Alarm, Min, Max, Gradient, Wet steam alarm, Unit failure Min+Alarm	Definition of the event which should activate the set point. ■ Min+Alarm Minimum safety, event report when set point is undershot with simultaneous signal source monitoring to NAMUR NE43. ■ Max+Alarm Maximum safety, event report when set point is overshoot with simultaneous signal source monitoring to NAMUR NE43. ■ Grad.+Alarm Gradient analysis, event report when set signal change is overshoot per time unit of the signal source with simultaneous signal source monitoring to NAMUR NE43. ■ Alarm Signal source monitoring to NAMUR NE43, no set point function. ■ Min Event report when set point is undershot without taking NAMUR NE43 into consideration. ■ Max Event report when set point is overshoot without taking NAMUR NE43 into consideration. ■ Gradient Gradient analysis, event report when set signal change is overshoot per time unit of the signal source without taking NAMUR NE43 into account. ■ Wet steam alarm Relay (output) switches in the event of a wet steam alarm (2 °C (3.6 °F) above saturated steam temperature). ■ Unit failure Relay (output) switches if a device fault is present (fault message).
Sig. source	Flow 1, Heat flow 1, Mass sum 1, Flow 2, etc. Select	Signal sources for the selected set point.  Note! The number of signal sources depends on the number of configured applications and inputs.
Swit. point	-99999 to 99999 0.0	Smallest output value of the analog output.

Function (menu item)	Parameter setting	Description
Hysteresis	-99999 to 99999 0.0	Specify set point switch-back threshold to suppress set point bounce.
Time delay	0 to 99 s 0 s	Time span of limit value violation before it is displayed. Suppresses peaks in the sensor signal.
Gradient - Δx	-19999 to 99999 0.0	Value of signal change for gradient analysis (inclination function).
Gradient - Δt	0 to 100 s 0 s	Time interval for the signal change of the gradient analysis.
Gradient -reset value	-19999 to 99999 0	Switch-back threshold for gradient analysis.
Limit on		You can write a message for when the limit value (set point) is overshoot. Depending on the setting, this appears in the event buffer and the display (see 'Lim. display')
Limit off		You can write a message for when the limit value (set point) is undershoot. Depending on the setting, this appears in the event buffer and the display (see 'Lim. display')
Limit dis.	Disp.+Ackn. Not display	Definition of the way of reporting the limit value. Not display: Limit value violation or violated limit value undershooting is recorded in the event buffer. Disp.+Ackn.: Entered in the event buffer and shown on the display. The message does not disappear until it is acknowledged with a key.

Setup → Medium

This item can be used to describe a specific medium, e.g. if the medium required is not already stored in the device.

For this you need key data on the medium properties. From these data, the density, heating value and gas compressibility in the operating mode are determined with the aid of tables and equations.



Note!

8 gases and 2 liquids are stored in the device with all the data on compressibility, density, etc. (see 'Setup → Applications'), these media are not listed in the '**Medium**' menu.

Function (menu item)	Parameter setting	Description
Liquid 1 to 3 Gas 1 to 3		Up to three liquids and three gases can be freely defined by entering diverse key data. This does not affect media stored in the device.
Liquid		
Identifier		Identifier for the medium (max. 12 characters).
Ref temp.	-9999.99 to +9999.99 2.0 °C	For entering temperature in the standard state (°C).
Density calc.	Linear Table Analog signal	Method of calculating density Linear: Density calculated using reference density, reference temperature and expansion coefficient (linear function). Table: Up to 10 points with temperature/density value pairs (interpolation). Analog signal: Density measurement with sensor (input signal).
Ref density	-9999.99 to +9999.99 0.0	For entering density in the standard state (kg/m ³).
Expansion	+4.88000000e-5	For entering thermal expansion coefficient of liquid (for temperature compensation of the volume).
Category	Heat transfer fluid Combustible fluid	Select whether the medium is used as a heat transfer medium or a combustible medium.

Function (menu item)	Parameter setting	Description
Sp. heat cap.	Constant Table	Specific heat capacity of the liquid (used for calculating the heat quantity).  Note! Item active if 'Heat transfer fluid' was selected under Category!
Heating val.	-9999.99 to +9999.99 0.0	For entering heating value of the medium (in kJ/Nm ³). Heating value = energy released when liquid combusts.  Note! Item active if 'Combustible fluid' was selected under Category!
Viscosity	Yes No	Viscosity of the medium. Only required if the flow is measured according to the differential pressure method (see Setup 'Special flow meters').
Viscosity tab.	Points Points	Temperature/viscosity value pair at 2 points. The viscosity at process conditions is calculated from these values.
Density units analog signal		Density input for directly measuring the operating density with a sensor.  Note! Item active if 'Analog signal' was selected under Density calc!
Signal	Select 0 to 20 mA 4 to 20 mA	Type of output signal of the density sensor.
Terminals	None A-10; A-110	Defines the terminal for connecting the density sensor.
Start value	0.0000 to 999999	Start value for density with 0 or 4 mA.
End value	0.0000 to 999999	End value for density with 20 mA.
Signal damp	0 to 99 s	Time constant of the first order low pass for the input signal. This function is used to reduce display fluctuations in the event of severely fluctuating signals.
Offset	-9999.99 to 9999.99 0.0	Shifts the zero point of the response curve. This function is used to adjust sensors.
Default	1.2929 kg/m ³	Default value for the density. This value is used if the density signal fails (e.g. cable open circuit).
Gas		
Identifier		Identifier for the medium (max. 12 characters).
z-factor	Not in use Constant Real gas Table	The real gas factor (z-factor) describes the deviation of the gas from the "ideal gas" and is the key parameter in precisely establishing the norm volume. Not in use If you receive the density of the gas as an input signal (density sensor), it is not necessary to calculate the compr. Constant Approximate information on the compressibility in the form of the average z-factor. Real gas Real gas equat. for exact calculation of the compressibility and the normal volume (recommended). Table Definition of the compressibility depending on the temperature and pressure. Such data can be found in specific tables on the subject (VDI heat atlas, DECHEMA data collection, etc.)

Function (menu item)	Parameter setting	Description
Equation	Redlich Kwong Soave Redlich Kwong	Selects a real gas equation for calculating the compressibility or the normal volume. Redlich Kwong Equation with 2 parameters (critical pressure, critical temperature). Soave Redlich Kwong Equation with 3 parameters (critical pressure, critical temperature, acentricity).  Note! The SRK equation returns more precise results by taking the intermolecular interaction into account (acentricity). If you do not have any information on the acentricity, use the Redlich Kwong equation.
Critical temperature	-9999.99 to 999999 0.0000 °C	Critical temperature of the gas.
Critical pressure	-9999.99 to 999999 1.013 bar	Critical pressure of the gas.
Acentricity	-9999.99 to 999999 0.0101	Parameter for describing intermolecular interreaction. If you do not have any information on the acentricity, please use the Redlich Kwong equation (see above).
Heating val.	kJ/Nm ³ MJ/Nm ³	Unit of the heating value. kJ/Nm ³ , MJ/Nm ³ , MWh/Nm ³ , kJ/kg, MJ/kg, kWh/kg, Btu/ft ³ , Btu/lb
	-9999.99 to 999999 0.0000	Heating value of the gas (H _u). Only relevant for combustible media. The heating value is used to calculate the energy released during combustion (energy contents of the flow).
Viscosity	Yes (for dp) No	See Setup Medium → Liquids
Isentrop. exp.	1.3	Isentropic exponent of the gas selected. This is necessary for calculating flow based on the differential pressure method (ISO5167). If no value is entered, the device automatically calculates with an average value for gases (1.4).
Density units	Signal Select	See Setup Medium → Liquids  Note! Only active if "Not in use" is selected for the z-factor (row factor)
Row factor table Selects a table type to describe the compressibility (z-factor) of the gas.  Note! It is possible to enter tables directly in the device but it is far more comfortable to do so with the free PC operating software. A matrix (table with 3 parameters) can only be entered with the PC operating software.		
Table type	Temp const./pres. var Pres. const/temp. var Temp var./press. var.	Selects the table type to describe the compressibility (z-factor) of the gas. Temp const./pres. var Values pairs with temperature/z-factor at constant pressure. Pres. const/temp. var Values pairs with pressure/z-factor at constant temperature. Temp var./press. var. 3-dimensional table (matrix) for describing the z-factor depending on the temperature and pressure.
No. of rows temperature No. of rows pressure	01-15	Number of points to describe the compressibility.
Compress. table	Points 01-15	Table to describe the compressibility of the gas. Use or delete point, i.e. remove it from the table. Define the individual points by entering the pressure value or temperature value (depends on table type) and the related z-factor.

Function (menu item)	Parameter setting	Description
z-Matrix	Temp 01-15, Pressure 01-15, Rows1, Rows2, etc.	Possibility to view a 3-dimensional matrix. Indicate temperatures in rows (x-axis), specify pressure in columns (y-value)  Note! The values for the matrix can only be entered using the free PC operating software.

Setup → Communication

An RS232 interface at the front and an RS485-interface at terminals 101/102 can be selected as standard. In addition, all process values can be read out via the PROFIBUS DP protocol.

Function (menu item)	Parameter setting	Description
Unit adr.	0 to 99 00	Device address for communicating via the interface.
RS232		
Baudrate	9600, 19200, 38400 57600	Baudrate for the RS232 interface
RS485		
Baudrate	9600, 19200, 38400 57600	Baudrate for the RS485 interface
PROFIBUS-DP		
Number	0 to 48 0	Number of values which should be read out via the PROFIBUS-DP protocol (max. 49 values).
Adr. 0...4	e.g. density x	Assigns the values to be read out to the addresses.
Adr. 5...9 to Adr. 235...239	e.g. temp. diff. x	49 values can be read out via an address. Addresses in bytes (0...4, ... 235...239) in numerical order.



Note!

A detailed description of how to integrate the device into a PROFIBUS system can be found in the operating instructions on the accessory (see Section 8 'Accessories'):

PROFIBUS Interface Module HMS AnyBus Communicator for PROFIBUS

Set-up → Service

Service menu. **Setup (all parameters) → Service.**

Function (menu item)	Parameter setting	Description
Preset		Resets the device to the delivery status with the factory default settings (protected by service code).  Note! This resets all the parameters you configured.
Total sums	Sums appl. 1 Sums appl. 2 Sums appl. 3	Cumulative totalizer display  Note! Info for service: cannot be edited or reset!

6.4 User-specific applications

6.4.1 Example of application: gas normal volume

Calculation of the gas normal volume flow with the aid of the gas properties stored in the device. The gas normal flow is determined by taking into account the pressure and temperature effect and the compressibility of the gas which describes the deviation of a gas from the ideal gas. The compressibility (z-factor) and density of the gas is determined using calculation standards or stored tables, depending on the type of gas.

The following sensors are used for measuring:

- Volume flow: vortex sensor Prowirl 70
Nameplate specifications: K-factor: 8.9; signal: PFM, alpha-factor: 4.88×10^{-5}
- Pressure: pressure sensor Cerabar (4 to 20 mA, 0.005 to 40 bar)
- Temperature: temperature sensor TR10 (Pt100)

The screenshots illustrate the following sequence of actions:

- Main Menu:** Select 'Setup (all Parameters)'.
- Hint:** Acknowledge the message.
- Setup:** Select 'Inputs'.
- Inputs:** Select 'Temperature inputs'.
- Temperature Inputs:** Select 'Temp. 1.1'.
- Temp. 1.1:** Select 'Signal'.
- Signal:** Select 'Pt100'.
- Temp. 1.1:** Select 'Sensor Type'.
- Sensor Type:** Select '3-wire'.
- Temp. 1.1:** Select 'Terminals'.
- Terminals:** Select 'E-1/5/6/2'.
- Temp. 1.1:** Select 'Signal Damp'.
- Signal Damp:** Select '10 s'.
- Temp. 1.1:** Select 'Offset'.
- Offset:** Select '0.0 °C'.
- Temp. 1.1:** Acknowledge the selection.
- Final Display:** Shows '00020.0 °C'.

- Flow transmitter (Setup Inputs - Flow inputs)
Flow 1
DPT: volumetric
Signal: PFM
Terminals: select A10 and connect sensor to terminal A10(-)/82(+) (as passive signal)
K-factor: 8.9
Exp. coeff: 4.88×10^{-5}
- Pressure sensor (Setup Pressure):
Pressure 1
Signal: 4 to 20 mA,
Terminals: select A110(+) and connect pressure transmitter to terminal A110(-)/A83(+)
-Type: select absolute pressure measurement or relative pressure measurement
Start value 0.005 bar,
End value 40 bar,
Default 25 bar (pressure the energy computer keeps working with if the sensor fails)
- Temperature sensor (Setup Temperature):**
Temp. 1.1.
Signal: Pt100.
Sensor type: 3-wire or 4-wire.
Select terminal E1/6 and connect Pt100 temperature sensor.
Default (enter average operating temperature expected).
(See graphics on left for operating example).
- Configure application (Setup Applications):
Applications (Applic. 1)
Media: gas
Medium: e.g. air
Gas appl.: norm volume/mass
Assign flow sensor, pressure sensor and temperature sensor for the gas measurement.
Reference value: only set if normal conditions are not 0 °C (32 °F)/1.013 bar (14.69 psi).
- Configure display (Setup Display), works automatically when commissioning (optional for application changes):
Groups:
Group 1: 3 value types and values (mass flow 1, pressure 1, temperature 1.1)
Group 2: 1 value type and value (correct vol. flow 1)
Scrolling display:
Swit. time: 10 seconds
Group1: yes
Group2: yes

Exit setup by pressing ESC several times and confirming the changes.

Display

When you press any key, you can select a group with display values or display all groups with automatic alternating display (→ Fig. 23). If a fault occurs, the display changes colour (blue/red). See Section 5.3 'Error message display' for information on how to eliminate the error.

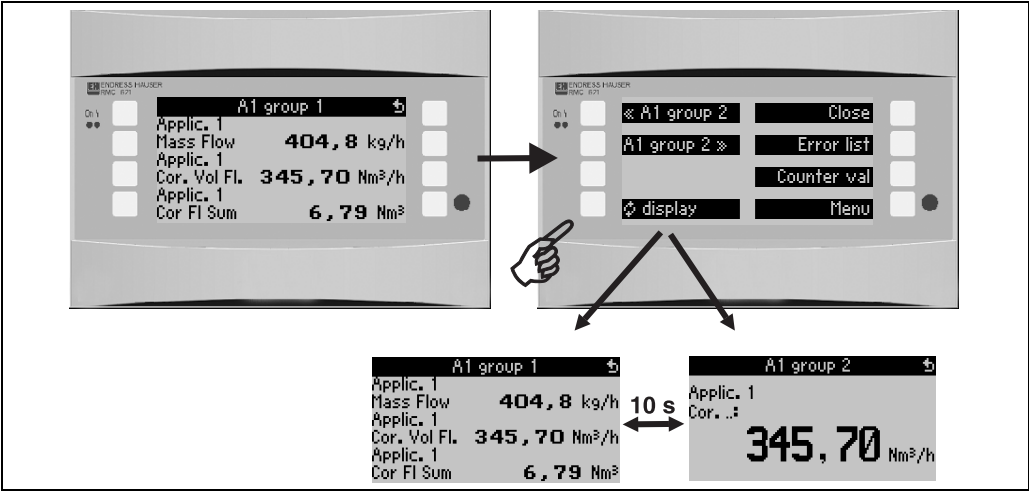


Fig. 23: Automatic changing of different display groups

7 Maintenance

No special maintenance work is required for the device.

8 Accessories

Identifier	Order code
RS232 interface cable 3.5 mm jack to connect to PC, with PC software	RMC621A-VK
Remote display for panel mounting 144 x 72 mm	RMC621A-AA
Protective housing IP 66 for top-hat rail devices	52010132
PROFIBUS Interface Module HMS AnyBus Communicator for PROFIBUS	RMC621A-P1

9 Trouble-shooting

9.1 Trouble-shooting instructions

Always begin trouble-shooting using the following checklists if faults occur after commissioning or during operation. Different questions will guide you to the cause of the error and will suggest appropriate remedial action.

9.2 System error messages

Display	Cause	Remedy
Counter data error	■ Data acquisition error in the counter ■ Data in the counter faulty	■ Reset counter (→ Section 6.3.3 Main menu - Setup) ■ Contact E+H Service if fault cannot be eliminated.
Calibration data error slot "xx"	Calibration data set at the factory faulty/cannot be read.	Remove card and insert it again (→ Section 3.2.1 Installing extension cards). Contact E+H Service if error message appears again.
Board/card not found "xx"	■ Plug-in card defect ■ Plug-in card not inserted correctly	Remove card and insert it again (→ Section 3.2.1 Installing extension cards). Contact E+H Service if error message appears again.
Device software error: ■ Error on reading the actual read address ■ Error on reading the actual write read address ■ Error on reading the actual oldest value ■ adr "Address" ■ DRV_INVALID_FUNCTION ■ DRV_INVALID_CHANNEL ■ DRV_INVALID_PARAMETER ■ I2C bus error ■ Checksum error – Pressure outside steam range! – No computation! – Temp. outside steam range! – Max. saturated steam temperature overshoot!	Error in the program	Contact your local E+H Service organisation.
S-Dat module error (div. messages)	Error when reading data into or out of the S-Dat module	Detach S-Dat module and attach it again. If necessary, contact your local E+H Service organisation.
"Communication problem"	No communication between the remote display/operating unit and the basic unit	Check wiring; the same baudrate and device address must be set in the basic device and the remote display/operating unit.

9.3 Process error messages

Display	Cause	Remedy
Config error: ■ Pressure ■ Analog temperature ■ Temperature RTD sensor ■ Analog flow! ■ PFM flow! ■ Applications! ■ Limit values! ■ Analog outputs! ■ Pulse outputs! ■ Pressure mean value ■ Temperature mean value ■ Flow mean value ■ Flow differential pressure (DP) ■ Flow splitting range ■ Flow DP: range error ■ Flow DP: incorrect medium ■ Flow DP: no computation ■ Invalid natural gas composition; natural gas computation: invalid heating value	■ Incorrect or incomplete programming or loss of calibration data ■ Contradictory terminal assignment ■ Error in computation ■ Medium selected in the DP sensor configuration does not correspond to the medium of the application ■ No computation takes place due to the incorrect configuration	■ Check whether all necessary items have been defined with plausible values. (→ Section 6.3.3 Main menu - Setup) ■ Check whether there is contradictory input assignment (e.g. flow 1 assigned to two different temperatures). (→ Section 6.3.3 Main menu - Setup) ■ Check parameters for natural gas calculation (see Section 6.3.3 Main menu - Setup)
Wet steam alarm	The steam status calculated from the temperature and pressure is near (2 C) the saturated steam curve	■ Check the application, devices and connected sensors. ■ Change the limit function if you do not need the "WET STEAM ALARM". (→ Set point settings, Section 6.3.3)
Temp. outside steam range!	Measured temperature outside the permitted steam value range. (0 to 800 C)	Check settings and connected sensors. (→ Input settings, Section 6.3.3)
Pressure outside steam range!	Measured pressure outside the permitted steam value range. (0 to 1000 bar)	Check settings and connected sensors. (→ Input settings, Section 6.3.3)
Temperature exceeds sat. steam range!	Measured or calculated temperature outside the saturated steam range (T>350 C)	■ Check settings and connected sensors. ■ Set "superheated" steam and carry out measurement task with three input variables (Q, P, T). (→ Application settings, Section 6.3.3)
Steam: condensate temperature	Phase transition! Measured or calculated temperature corresponds to condensate temperature of the saturated steam.	■ Check application, devices and connected sensors. ■ Measures for process control: increase temperature, reduce pressure. ■ Possibly imprecise temperature or pressure measurement; purely computed transition from steam to water which does not really occur. Compensate inaccuracies by setting an offset for temperature (approx. 1-3 C).
Water: boiling temperature	Measured temperature corresponds to the boiling temperature of the water (water evaporates!)	■ Check application, devices and connected sensors. ■ Measures for process control: reduce temperature, increase pressure.

Display	Cause	Remedy
Signal range error "channel name" "signal name"	Current output signal below 3.6 mA or above 21 mA.	- Check whether the current output is scaled correctly. - Change the start and/or end value of the scaling
Cable open circuit: "channel name" "signal name"	Input current at current input smaller than 3.6 mA (with setting 4 to 20 mA) or larger than 21 mA. - Incorrect wiring - Sensor not set to 4–20 mA range. - Sensor malfunction - Incorrectly configured end value for flow transmitter	- Check sensor configuration. - Check function of the sensor. - Check end value of the connected flow meter. - Check wiring.
Range error	$3.6 \text{ mA} < x < 3.8 \text{ mA}$ (with setting 4 to 20 mA) or $20.5 \text{ mA} < x < 21 \text{ mA}$ - Incorrect wiring - Sensor not set to 4–20 mA range. - Sensor malfunction - Incorrectly configured end value for flow transmitter	- Check sensor configuration. - Check function of the sensor. - Check measuring range/scaling of the connected flow meter. - Check wiring.
Cable open circuit: "channel name" "signal name"	Resistance too high at PT100 input, e.g. due to short-circuit or cable break - Incorrect wiring - PT100 sensor defect	- Check wiring. - Check function of the PT100 sensor.
Temp. difference range undercut	Range of the set differential temperature overshoot	Check current temperature values and set minimum temperature differential.
Limit value over/under cut Limit value 'number' ok (blue) "Limit value identifier" < "threshold value" "unit" "Limit value identifier" > "threshold value" "unit" "Limit value identifier" > "gradient" "unit" "Limit value identifier" < "gradient" "unit" "User defined message"	Limit value undershot or overshoot (→ Set point configuration, Section 6.3.3)	- Acknowledge alarm if the function "Set point/ Lim. display/Disp.+Ackn." was configured (→ Set point configuration, Section 6.3.3). - Check application if necessary. - Adjust set point if necessary.
- Temp. difference range undercut (red) - Temp. difference ok (blue)	Range of set differential temperature overshoot.	Check current temperature values and set minimum temperature differential.
W-heat diff: error: neg. temp. diff.	The temperature assigned to the temperature sensor on the cold side is larger than the temperature on the warm side.	- Check whether the temperature sensors are correctly wired. - Adjust process temperatures.
W-heat diff: error flow direction	In bidirectional water-heat-diff. operation; If flow direction is configured as changing and the direction of flow does not suit the temperature values.	- Change flow direction signal at the direction terminal. - Check the wiring of the temperature sensors.
- Pulse width must be between 0.04 and 1000 ms! - Pulse width must be between 100 and 1000 ms!	Active/passive pulse output: configured pulse width not within valid range.	Change the pulse width to the value range given.
- Invalid value, too high - Invalid value, too low	- Heating value entered too high - Heating value entered too low	For correct use in SGERG88/AGA8, the heating value must be in the range 19-48 MJ/Nm. Correct value to a value in this value range.
Entry must lie between 1 and 15!	Incorrect number of points.	Correct value to a value in this value range.

Display	Cause	Remedy
Pulse buffer overflow	Too many pulses accumulated so the pulse counter overflows: pulses lost.	Increase pulse factor
Real gas calculation: excessive temperature	Process temperature too high, limit ranges of the algorithm used overshoot.	Enter process temperature < 200 C
Real gas calculation: temperature undercut	Process temperature too low, limit ranges of the algorithm used undershoot.	Enter process temperature -60 C
Real gas calculation: exces. pressure	Process pressure too high, limit ranges of the algorithm used overshoot.	Enter process pressure < 120 bar
■ Natural gas calculation: hydrogen range violation ■ Natural gas calc.: conv. not achieved on density calculation ■ Natural gas calculation: conv. not achieved	Gas composition incorrect: mole contents outside applicable limits.	Please correct the gas composition to values as per SGERG88/AGA8.
Other messages/events (only appear in the event buffer)		
■ Low flow: undershot!	Low flow cut off configured is undershot, i.e. flow valued at zero.	Reduce low flow cut off if necessary. (see Section 6.3.3)
■ Minimum temp. difference	Minimum temperature differential configured is undershot, i.e. temperature differential valued at zero.	Reduce low flow cut off if necessary. (see Section 6.3.3)

9.4 Spare parts

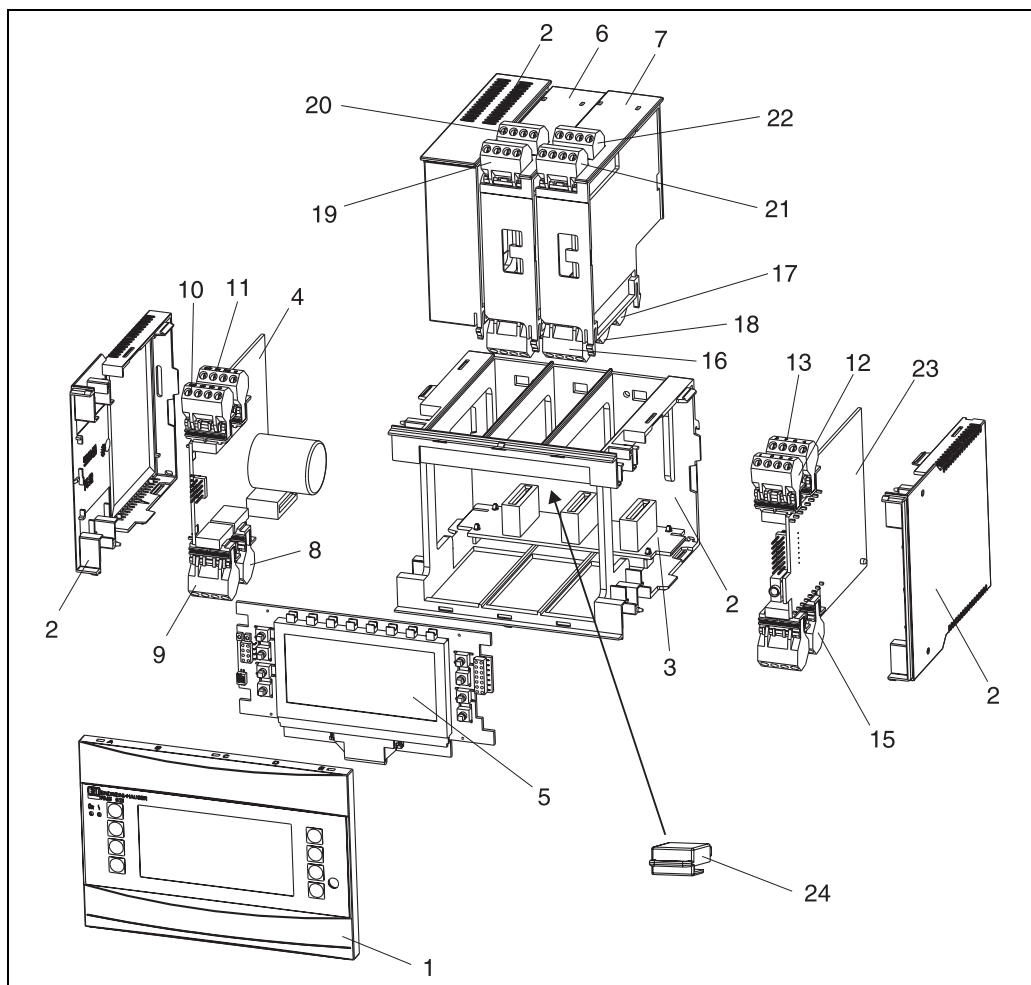


Fig. 24: Energy Manager spare parts

Item no..	Order number	Spare part
1	RMC621X-HA RMC621X-HB RMC621X-HD RMC621X-HE	Front cover, version without display Front cover, version with display Front cover neutral without display Front cover neutral with display
2	RMC621X-HC	Complete housing without front incl. three blanking inserts and three PCB carriers
3	RMC621X-BA	Bus board
4	RMC621X-NA RMC621X-NB RMC621X-NC RMC621X-ND	Power unit 90 to 250 V AC Power unit 20 to 36 V DC // 20 to 28 V AC Power unit 90 to 250 V AC (ATEX version) Power unit 20 to 36 V DC // 20 to 28 V AC (ATEX version)
5	RMC621X-DA RMC621X-DB RMC621X-DC RMC621X-DD RMC621X-DE RMC621X-DF RMC621X-DG RMC621X-DH	Display incl. front board Front board for version without display Display + front cover, non Ex Display + front cover, neutral, non Ex Display incl. Ex Front cover, version without display, Ex Display + front cover, Ex Display + front cover, neutral, Ex

Item no..	Order number	Spare part
6	RMC621A-TA	Temperature extension card (Pt100/Pt500/Pt1000) complete, incl. terminals and securing frames
	RMC621A-TB	Temperature extension card with intrinsically safe inputs to ATEX (Pt100/Pt500/Pt1000) complete, incl. terminals and securing frames
7	RMC621A-UA	Universal extension card (PFM/pulse/analog/transmitter power supply unit) complete, incl. terminals and securing frames
	RMC621A-UB	Universal extension card with intrinsically safe inputs to ATEX (PFM/pulse/analog/transmitter power supply unit) complete, incl. terminals and securing frames
8	51000780	Mains terminal
9	51004062	Relay terminal/transmitter power supply unit
10	51004063 51005957	Analog terminal 1 (PFM/pulse/analog/transmitter power supply unit) Analog terminal 1 (PFM/pulse/analog/transmitter power supply unit), Ex
11	51004064 51005954	Analog terminal 2 (PFM/pulse/analog/transmitter power supply unit) Analog terminal 2 (PFM/pulse/analog/transmitter power supply unit), Ex
12	51004067 51005955	Temperature terminal 1 (Pt100/Pt500/Pt1000) Temperature terminal 1 (Pt100/Pt500/Pt1000), Ex
13	51004068 51005956	Temperature terminal 2 (Pt100/Pt500/Pt1000) Temperature terminal 2 (Pt100/Pt500/Pt1000), Ex
14	51004065	RS485 terminal
15	51004066	Output terminal (analog/pulse)
16	51004912	Relay terminal (extension card)
17	51004911	Extension card: open collector output terminal
18	51004066	Extension card: output terminal (4 to 20 mA/pulse)
19	51004907 51005958	Extension card: input 1 terminal (Pt100/Pt500/Pt1000) Extension card: Ex input 1 terminal (Pt100/Pt500/Pt1000)
20	51004908 51005960	Extension card: input 2 terminal (Pt100/Pt500/Pt1000) Extension card: Ex input 2 terminal (Pt100/Pt500/Pt1000)
21	51004910	Extension card: input 1 terminal (4 to 20 mA/PFM/pulse/transmitter power supply)
	51005959	Extension card: Ex input 1 terminal (4 to 20 mA/PFM/pulse/transmitter power supply unit)
22	51004909	Extension card: input 2 terminal (4 to 20 mA/PFM/pulse/transmitter power supply unit)
	51005953	Extension card: Ex input 2 terminal (4 to 20 mA/PFM/pulse/transmitter power supply unit)
23	RMC621C-	CPU for energy computer (configuration, see below)
24	RMC621S-	S-DAT module (configuration, see Table on next page)

Control/CPU Item no. 23				
				Version 1 Version for non-hazardous area 2 ATEX approvals Operating language A German B English C French D Italian E Spanish F Dutch G Polish H American K Czech Software 1 Standard software 2 Standard software + SGERG (88) /AGA8 3 Standard software + API2544/ASTM D1240/OIIML R63 4 Standard software + SGERG (88) /AGA8 + API2544/ASTM D1240/OIIML R63 Communication 1 1 x RS232 + 1 x RS485 5 2. RS485 for communication with panel display (for remote display) Version A Standard
RMC621C-				A ← Order code
S-DAT module Item no. 24				
				Software 1 Standard software 2 Standard software + SGERG (88) /AGA 3 Standard software + API2540/ASTM D1240/OIIML R63 Version A Standard
RMC621S-				A ← Order code

9.5 Return

For a return, e.g. in case of repair, the device must be sent in protective packaging. The original packaging offers the best protection. Repairs must only be carried out by your supplier's service organisation. An overview of the service network can be found on the address page of these Operating Instructions.



Note!

When sending for repair, please enclose a note with a description of the error and the application.

9.6 Disposal

The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please also observe local regulations governing disposal.

10 Technical data

10.0.1 Input

Measured variable Current, PFM, pulse, temperature

Input signal Flow, differential pressure, pressure, temperature, density

Measuring range

Measured variable	Input												
Current	■ 0/4 to 20 mA +10% overreach ■ Max. input current 150 mA ■ Input impedance < 10 Ω ■ Accuracy 0.1% of full scale value ■ Temperature drift 0.04% / K (0.022% / °F) ambient temperature ■ Signal damping low filter 1st order, filter constant adjustable 0 to 99 s ■ Resolution 13 bit ■ Fault recognition 3.6 mA or 21 mA limit as per NAMUR NE43												
PFM	■ Frequency range 0.01 Hz to 12.5 kHz ■ Signal level 2 to 7 mA low; 13 to 19 mA high ■ Measurement method: period length/frequency measurement ■ Accuracy 0.01% of measured value ■ Temperature drift 0.1% / 10 K (18°F) ambient temperature												
Pulse	■ Frequency range 0.01 Hz to 12.5 kHz ■ Signal level 2 to 7 mA low; 13 to 19 mA high with approx. 1.3 kΩ dropping resistor at max. 24 V voltage level												
Temperature	Resistance thermometer (RTD) as per ITS 90: <table><tr><th>Identifier</th><th>Measuring range</th><th>Accuracy (4-wire connection)</th></tr><tr><td>Pt100</td><td>-200 to 800 °C (-328 to 1472 °F)</td><td>0.03% of full scale value</td></tr><tr><td>Pt500</td><td>-200 to 250 °C (-328 to 482 °F)</td><td>0.1% of full scale value</td></tr><tr><td>Pt1000</td><td>-200 to 250 °C (-328 to 482 °F)</td><td>0.08% of full scale value</td></tr></table> ■ Type of connection: 3-wire or 4-wire system ■ Measuring current 500 μA ■ Resolution 16 Bit ■ Temperature drift 0.01% / 10 K (18 °F) ambient temperature	Identifier	Measuring range	Accuracy (4-wire connection)	Pt100	-200 to 800 °C (-328 to 1472 °F)	0.03% of full scale value	Pt500	-200 to 250 °C (-328 to 482 °F)	0.1% of full scale value	Pt1000	-200 to 250 °C (-328 to 482 °F)	0.08% of full scale value
Identifier	Measuring range	Accuracy (4-wire connection)											
Pt100	-200 to 800 °C (-328 to 1472 °F)	0.03% of full scale value											
Pt500	-200 to 250 °C (-328 to 482 °F)	0.1% of full scale value											
Pt1000	-200 to 250 °C (-328 to 482 °F)	0.08% of full scale value											

Number:

- 2 x 0/4 to 20 mA/PFM/pulse (in basic unit)
- 2 x Pt100/500/1000 (in basic unit)

Maximum number:

- 10 (depending on the number and type of extension cards)

Galvanic isolation

The inputs are galvanically isolated between the individual extension cards and the basic unit (see also 'Galvanic isolation' under Output).

10.0.2 Output

Output signal Current, pulse, transmitter power supply (TPS) and switching output

Galvanic isolation

Basic unit:

Connection with terminal designation	Power supply (L/N)	Input 1/2 0/4 to 20 mA/ PFM/pulse (10/11) or (110/11)	Input 1/2 TPS unit (82/81) or (83/81)	Temperature input 1/2 (1/5/6/2) or (3/7/8/4)	Output 1/2 0 to 20 mA/ pulse (132/131) or (134/133)	Interface RS232/485 housing front or (102/101)	TPS unit, external (92/91)
Power supply		2.3 kV	2.3 kV	2.3 kV	2.3 kV	2.3 kV	2.3 kV
Input 1/2 0/4-20 mA/ PFM/ pulse	2.3 kV			500 V	500 V	500 V	500 V
Input 1/2 TPS unit	2.3 kV			500 V	500 V	500 V	500 V
Temperature input 1/2	2.3 kV	500 V	500 V		500 V	500 V	500 V
Output 1/2 0-20 mA/pulse	2.3 kV	500 V	500 V	500 V		500 V	500 V
Interface RS232/ RS485	2.3 kV	500 V	500 V	500 V	500 V		500 V
TPS unit, external	2.3 kV	500 V	500 V	500 V	500 V	500 V	



Note!

The specified insulation voltage is the AC testing voltage U_{eff} which is applied between the connections.

Basis for assessment: EN 61010-1, protection class II, overvoltage category II

Output variable current - pulse

Current

- 0/4 to 20 mA +10% overreach, invertible
- Max. loop current 22 mA (short-circuit current)
- Load max. 750 Ω at 20 mA
- Accuracy 0.1% of full scale value
- Temperature drift: 0.1% / 10 K (18 °F) ambient temperature
- Output ripple < 10 mV at 500 Ω for frequencies < 50 kHz
- Resolution 13 bit
- Error signals 3.6 mA or 21 mA limit adjustable as per NAMUR NE43

Pulse

Basic unit:

- Frequency range to 12.5 kHz
- Voltage level 0 to 1 V low, 24 V high $\pm 15\%$
- Load min. 1 k Ω
- Pulse width 0.04 to 1000 ms

Extension cards (digital passive, open collector):

- Frequency range to 12.5 kHz
- $I_{max.} = 200$ mA
- $U_{max.} = 24$ V $\pm 15\%$
- $U_{low/max.} = 1.3$ V at 200 mA
- Pulse width 0.04 to 1000 ms

Number

Number:

- 2 x 0/4 to 20 mA/pulse (in basic unit)

Max. number:

- 8 x 0/4 to 20 mA/pulse (depends on the number of extension cards)
- 6 x digital passive (depends on the number of extension cards)

Signal sources

All available multifunctional inputs (current, PFM or pulse inputs) and results can be freely allocated to the outputs.

Switching output

Function

Limit relay switches in the operating modes: minimum/maximum safety, gradient, alarm, saturated steam alarm, frequency/pulse, device error

Switch behaviour

Binary, switches when the limit value is reached (potential-free NO contact)

Relay switching capacity

Max. 250 V AC, 3 A / 30 V DC, 3 A



Note!

A mixture of low voltage and extra-low voltage is not permitted for the relays of the extension cards.

Switching frequency

Max. 5 Hz

Threshold

Freely programmable (wet steam alarm is preset at 2 °C (35.6 °F) at the factory)

Hysteresis

0 to 99%

Sig. source

All available inputs and calculated variables can be allocated freely to the switching outputs.

Number

1 (in the basic unit)

Max. number: 7 (depends on the number and type of extension cards)

No of output states

100,000

Scan rate

500 ms

Transmitter power supply and external power supply

- Transmitter power supply unit, terminals 81/82 or 81/83 (optional universal extension cards 181/182 or 181/183):
 - Max. output voltage 24 V DC $\pm$ 15%
 - Impedance < 345 Ω
 - Max. loop current 22 mA (at $U_{out} > 16$ V)
- Technical data RMC 621:
 - HART[®] communication is not impaired
 - Number: 2 (in the basic unit)

- Max. number: 8 (depends on the number and type of extension cards)
- Additional power supply (e.g. external display), terminals 91/92:
Supply voltage 24 V DC $\pm$ 5%
Current max. 80 mA, short-circuit proof
Number 1
Source resistance < 10 Ω

10.0.3 Power supply

- | | |
|----------------|--|
| Supply voltage | <ul style="list-style-type: none"> ■ Low voltage power unit: 90 to 250 V AC 50/60 Hz ■ Extra-low voltage power unit: 20 to 36 V DC or 20 to 28 V AC 50/60 Hz |
|----------------|--|

- | | |
|-------------------|-----------------------------------|
| Power consumption | 8 to 26 VA (depending on version) |
|-------------------|-----------------------------------|

- | | |
|---------------------------|--|
| Connection data interface | <p><i>RS232</i></p> <ul style="list-style-type: none"> – Connection: jack socket 3.5 mm, front – Transmission protocol: ReadWin® 2000 – Transmission rate: max. 57,600 baud <p><i>RS485</i></p> <ul style="list-style-type: none"> – Connection: plug-in terminals 101/102 (in the basic unit) – Transmission protocol: (serial: ReadWin® 2000; parallel: open standard) – Transmission rate: max. 57,600 baud <p><i>Optional: additional RS485 interface</i></p> <ul style="list-style-type: none"> – Connection: plug-in terminals 103/104 – Transmission protocol and transmission rate as standard interface RS485 |
|---------------------------|--|

10.0.4 Performance characteristics

- | | |
|--------------------------------|---|
| Reference operating conditions | <ul style="list-style-type: none"> ■ Power supply 230 V AC $\pm$ 10%; 50 Hz $\pm$ 0.5 Hz ■ Warm-up period > 30 min ■ Ambient temperature range 25 °C $\pm$ 5 °C (77 °F $\pm$ 9 °F) ■ Air humidity 39% $\pm$ 10% r. h. |
|--------------------------------|---|

Arithmetic unit

Medium	Variable	Range
Liquids	Temperature measuring range	-200 to 800 °C (-328 to 1472 °F)
	Maximum temperature differential range ΔT	0 to 1000 K (0 to 1800 °F)
	Error limit for ΔT	3 to 20 K (5.4 to 36 °F) < 1.0% of measured value 20 to 250 K (36 to 450 °F) < 0.3% of meas. value
	Arithmetic unit accuracy class	Class 4 (as per EN 1434-1 / OIML R75)
	Measurement and calculation interval	500 ms
Steam	Temperature measuring range	0 to 800 °C (32 to 1472 °F)
	Pressure measuring range	0 to 1000 bar (0 to 14290 psi)
	Measurement and calculation interval	500 ms
Techn. gas	Temperature measuring range	-137 to 800 °C (-214.6 to 1472 °F)
	Pressure measuring range	0 to 500 bar (0 to 7145 psi)
	Measurement and calculation interval	500 ms

Medium	Variable	Range
Natural gas	Temperature measuring range	-40 to 200 °C (-40 to 392 °F) (Nx-19) -60 to 200 °C (-76 to 392 °F) (SGerg88)
	Pressure measuring range	0 to 120 bar (0 to 1724.8 psi)
	Measurement and calculation interval	500 ms

10.0.5 Installation conditions

Installation instructions	<i>Mounting location</i>
	In cabinet on top-hat rail EN 50 022-35
	<i>Orientation</i>
	No restrictions

10.0.6 Environment

Ambient temperature range	-20 to 60 °C (-4 to 140 °F)
Storage temperature	-30 to 70 °C (-22 to 158 °F)
Climate class	As per IEC 60 654-1 Class B2 / EN 1434 Class 'C'
Electr. safety	As per EN 61010-1: environment < 2000 m height above MSL
Degree of protection	■ Basic unit: IP 20 ■ Remote operating/display unit: IP 65
Electromagnetic compatibility	<i>Interference emission</i>
	EN 61326 Class A
	<i>Interference immunity</i>
	– Power failure: 20 ms, no influence – Starting current limitation: $I_{\max}/I_n \leq 50\%$ ($T50\% \leq 50$ ms) – Electromagnetic fields: 10 V/m as per IEC 61000-4-3 – Conducted HF: 0.15 to 80 MHz, 10 V as per EN 61000-4-3 – Electrostatic discharge: 6 kV contact, indirect as per EN 61000-4-2 – Burst (power supply): 2 kV as per IEC 61000-4-4 – Burst (signal): 1 kV/2 kV as per IEC 61000-4-4 – Surge (power supply AC): 1 kV/2 kV as per IEC 61000-4-5 – Surge (power supply DC): 1 kV/2 kV as per IEC 61000-4-5 – Surge (signal): 500 V/1 kV as per IEC 61000-4-5

10.0.7 Mechanical construction

Design, dimensions

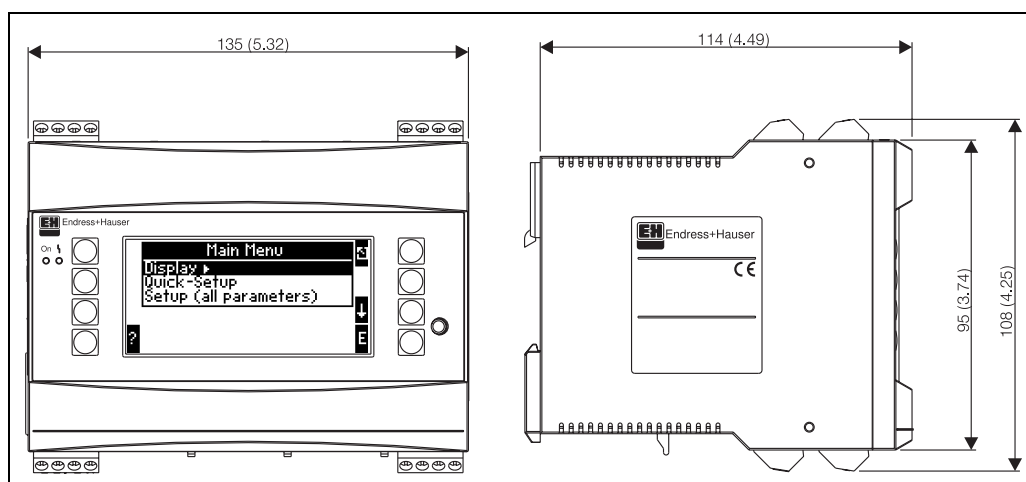


Fig. 25: Housing for top-hat rail as per EN 50 022-35; dimensions in mm

Weight	■ Basic unit: 500 g (in maximum configuration with extension cards) ■ Remote operating unit: 300 g
Material	Housing: polycarbonate plastic, UL 94V0
Terminals	Coded, pluggable screw terminals; area 1.5 mm ² massive, 1.0 mm ² flexible with wire end ferrule (applies to all connections).

10.0.8 Human interface

Display elements	■ Display (optional): 160 x 80 DOT matrix LCD with blue background illumination Colour change to red in the event of an error (adjustable) ■ LED status display: Operation: 1 x green (2 mm) Fault message: 1 x red (2 mm) ■ Operating and display unit (optional or as accessory): An operating and display unit can also be attached to the energy manager in the panel-mounted housing (dimensions B = 144 x H = 72 x D = 43 mm). The connection to the integrated RS484 interface is made using the connecting cable (l = 3 m) which is included in the accessories kit. Parallel operation of the operating and display unit with a device-internal display in the RMC 621 is possible.
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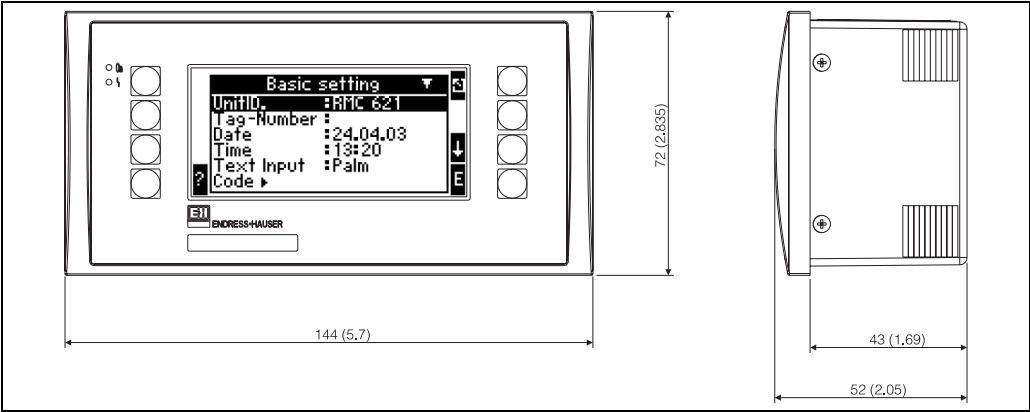


Fig. 26: Operating and display unit for panel mounting (optional or available as accessory); dimensions in mm

Operating elements	Eight front-panel soft keys interact with the display (key functions are shown on the display).
Remote operation	RS232 interface (jack socket on front panel, 3.5 mm): configuration via PC with ReadWin® 2000 PC operating software. RS485 interface
Real time clock	■ Deviation: 30 min per year ■ Power reserve: 14 days
Mathematical functions	Flow, differential pressure calculation: EN ISO 5167 Continuous calculation of mass, standard volume, density, enthalpy, quantity of heat using stored algorithms and tables. ■ Water / steam: IAWPS-IF97 ■ Liquids: linear density function and tables for density and heat capacity Mineral oil: API 2540, ASTM 1250, OIML R63 ■ Technical gases: real gas equations (Soave Redlich Kwong), compressibility tables and improved ideal gas equation ■ Natural gas: NX19; optional: SGERG88, AGA8 (gross-method) Tables for density, heat value and compressibility can be freely edited and saved.

10.0.9 Certificates and approvals

CE mark	The measuring system meets the legal requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.
Other standards and guidelines	■ EN 60529: Degrees of protection through housing (IP code) ■ EN 61010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures ■ EN 61326 (IEC 1326): Electromagnetic compatibility (EMC requirements) ■ NAMUR NE21, NE43

Association for Standards for Control and Regulation in the Chemical Industry

- IAWPS-IF 97

Internationally applicable and recognised calculation standard (since 1997) for steam and water. Issued by the International Association for the Properties of Water and Steam (IAPWS).

- OIML R75

International construction regulation and test specification for water energy managers of the Organisation Internationale de Métrologie Légale.

- EN 1434 1, 2, 5 and 6

- EN ISO 5167

Flow measurement of fluids with throttle devices

10.0.10 Documentation

- ☐ Product group brochure 'Energy manager' (PG 006R/09/en)

- ☐ Technical Information 'Flow and energy manager RMC 621' (TI 098R/09/en)

- ☐ Technical Information 'Vortex flow measuring system PROline Prowirl 72' (TI062D/06/en)

11 Appendix

11.1 Definition of important system units

Volume	
bbl	1 barrel, definition see 'Setup → Application'
gal	1 US gallon, corresponds to 3.7854 litres
igal	Imperial gallon, corresponds to 4.5609 litres
l	1 litre = 1 dm ³
hl	1 hectolitre = 100 litres
m ³	corresponds to 1000 litres
ft ³	corresponds to 28.37 litres
Norm volume	
Nm ³	Norm cubic metre (m ³ at standard conditions)
Scf	Standard cubic feet (ft ³ at standard conditions)
Temperature	
	Conversion: ■ 0 °C = 273.15 K ■ °C = (°F - 32) / 1.8
Pressure	
	Conversion: 1 bar = 100 kPa = 100000 Pa = 0.001 mbar = 14.504 psi
Mass	
ton (US)	1 US ton, corresponds to 2000 lbs (= 907.2 kg)
ton (long)	1 long ton, corresponds to 2240 lbs (= 1016 kg)
Performance (heat flow)	
ton	1 ton (refrigeration) corresponds to 200 Btu/m
Btu/s	1 Btu/s corresponds to 1.055 kW
Energy (heat quantity)	
tonh	1 tonh, corresponds to 1200 Btu
Btu	1 Btu corresponds to 1.055 kJ
kWh	1 kWh corresponds to 3600 kJ which corresponds to 3412.14 Btu

11.2 Flow measurement configuration

The Energy Manager processes output signals from a wide range of common flow transmitters.

- Volumetric:

Flow transmitter which outputs a signal in proportion to the operating volume (e.g. vortex, EFM, turbine).

- Mass

Flow transmitter which outputs a signal in proportion to the mass (e.g. Coriolis).

- Differential pressure:

Flow transmitter (DPT) which outputs a signal in proportion to the differential pressure.

11.2.1 Flow calculation based on the differential pressure method

RMx621 has 2 ways of measuring differential pressure:

- Traditional differential pressure method
- Improved differential pressure method

Traditional differential pressure method	Improved differential pressure method
Only accurate in design parameter (pressure, temperature, flow)	Accurate in every operating point thanks to fully compensated flow calculation
Signal of the DP transmitter is square root, i.e. scaled to the operating volume or mass	Curve of the DP transmitter signal is linear, i.e. scaled to the differential pressure

Traditional differential pressure method:

All the coefficients of the flow calculation equation are calculated once in the design parameter and are combined to form a constant.

$$Q_m = c \cdot \underbrace{\sqrt{\frac{1}{1-\beta^4}} \cdot \epsilon \cdot d^2 \cdot \frac{\pi}{4}}_{k \cdot \sqrt{2 \cdot \Delta p}} \cdot \sqrt{2 \cdot \Delta p \cdot \rho}$$

$$Q_m = k \cdot \sqrt{2 \cdot \Delta p}$$

Improved differential pressure method:

In contrast to the traditional method, the coefficients of the flow equation (flow coefficient, preacceleration factor, expansion number, density, etc.) are constantly recomputed as per ISO 5167. This has the advantage that the flow is determined exactly even under fluctuating process conditions, far beyond the design parameter (temperature and pressure in sizing parameter), thereby ensuring greater accuracy in flow measurement.

For this, the device just needs the following data:

- Internal diameter
- Diameter ratio β (K-factor for Pitot tubes)

$$Q_m = f \cdot c \cdot \sqrt{\frac{1}{1-\beta^4}} \cdot \epsilon \cdot d^2 \cdot \frac{\pi}{4} \cdot \sqrt{2 \cdot \Delta p \cdot \rho}$$

f = correction factor (correction of measurement, e.g. to take pipe roughness into account)

Temperature effect on internal diameter and diameter ratio β

Please note: the pipe data often refer to the manufacturing temperature (approx. 20 °C) or process temperature. The data are automatically converted to the operating temperature. For this purpose, just the expansion coefficient of the pipe material has to be entered.

(Differential pressure1 → Correction: yes → Expansion coefficient: ...)

Temperature compensation can be omitted in the event of minor deviation (± 50 °C) from the calibration temperature.

Pitot tubes

When using Pitot tubes, a correction factor has to be entered instead of the diameter ratio. This factor (resistance coefficient) is specified by the probe manufacturer, and in the form of the K-factor by E+H for "Deltatop".

It is absolutely imperative that this correction factor be entered! (See following example).

The flow is calculated as follows:

$$Q_m = f \cdot d^2 \cdot \frac{\pi}{4} \cdot \sqrt{2 \cdot \Delta p \cdot \rho}$$

f = correction factor (K-factor or from the correction table)

d = internal diameter

Δp = differential pressure

ρ = density in operating status

Example:

Flow measurement in a steam line with a Deltatop Pitot tube

- Internal diameter: 350 mm
- k-factor (correction factor for the resistance coefficient of the probe): 0.634
- Working range Δp : 0 - 51, 0 mbar (Q: 0-15000 m³/h)

Notes on the configuration:

- Flow → Flow 1; Diff.pressure → Pitot; Signal → 4...20 mA; → Range start/range end (mbar);
Pipe data → Inner dia. 350 mm; → Factor 0.634.

Flow measurement with V cone transmitter

The following data are needed when using V-cone flow transmitters:

- Internal diameter
- Diameter ratio β
- Flow coefficient c

The flow coefficient can be entered as a fixed value or in the form of a table depending on the Reynolds number. Please refer to the data sheet of the manufacturer for data regarding this. The flow is calculated from the input signals differential pressure, temperature and static pressure as per ISO 5167 (see Improved method). The temperature effect on the V-cone (F_a value) is calculated automatically when the thermal expansion coefficient of the V-cone is entered (see "Temperature effect on internal diameter and diameter ratio β " above).

If the data available are insufficient, scale the DP transmitter to volume and use the flow input in RMC621.

General notes on differential pressure measurement

If all the data on the differential pressure measuring point are available (internal pipe diameter, β or k-factor), we recommend you use the improved method (fully compensated flow calculation).

If the data required are not available, the output signal of the differential pressure transmitter is output scaled to volume or mass (see the following table). Please note that a signal scaled to mass can no longer be compensated. For this reason, scale the DP transmitter to operating volume if possible (mass: density in design parameter = operating volume). The mass flow is then calculated in the device based on the density in the operating status, depending on the temperature and pressure. This is partially compensated flow calculation, since the square root density is in the design parameter when measuring the operating volume.

How should RMC621 and the sensor be configured?

	Sensor type	Unit
1. Traditional method	No data available on the pipe diameter and diameter ratio β (k-factor for Pitot tube).	
a) (Default)	Square root curve e.g. 0...1000 m ³ (t)	Flow input (operating volume or mass) Linear curve e.g. 0...1000 m ³ (t)
b)	Linear curve e.g. 0...2500 mbar	Flow input (operating volume or mass) Curve square root, e.g. 0...1000 m ³ (t)
2. Improved method	Pipe diameter and diameter ratio β (k-factor for Pitot tube) known.	
a) (Default)	Linear curve e.g. 0...2500 mbar	Special flow (DP) e.g. orifice plate Linear curve e.g. 0...2500 mbar
b)	Square root curve e.g. 0...1000 m ³ (t)	Special flow (DP) e.g. orifice plate Curve square law 0...2500 mbar

Accuracy of air flow measurement with an orifice plate depending on the measurement method

Example:

- Orifice corner tap DP0 50: internal diameter 200 mm; $\beta = 0.7$
 - Flow operational range: 22.6 to 6785 m³/h (0 to 662.19 mbar)
 - Sizing parameter: 3 bar; 20 °C; 3.57 kg/m³; 4000 m³/h
 - Process temperature: 30 °C
 - Process pressure (true value): 2.5 bar
 - Differential pressure: 204.9 mbar
 - Reference operating conditions: 0 °C; 1.013 bar
- a. Result when measuring based on the traditional differential pressure method:
Operating volume: 4000 m³/h standard volume: 11041 Nm³/h (density: 3.57 kg/m³)
 - b. Result with improved, fully compensated differential pressure method (real flow):
Operating volume: 4436 m³/h standard volume 9855 Nm³/h (density: 2.87 kg/m³)

The measured error for traditional flow measurement is approx. 10.9%. If the DPT is scaled to standard volume and both T and P are taken as constant (i.e. no compensation possible), the **total error is approx. 12%.**

Splitting Range (measuring range extension)

The measuring range of a differential pressure transmitter is between 1:3 and 1:7. This function gives you the opportunity of extending the measuring range of the flow measurement to 1:20 and more by using up to three differential pressure transmitters per flow measuring point.

Notes on the configuration:

1. Select Flow/Splitting Range 1 (2, 3)
2. Define the signal and select the differential pressure transmitter (applies to all differential pressure transmitters!)
3. Select the terminals for the transmitters and define the measuring ranges.
Range 1: transmitter with the smallest measuring range
Range 2: transmitter with the next biggest measuring range etc.
4. Specify curve, units, format, sums, pipe data etc. (applies to all transmitters)



Note!

In the Splitting Range mode, it is compulsory to use differential pressure transmitters which output currents > 20 mA (< 4.0 mA) when the measuring range is overshoot. The system automatically switches between the measuring ranges (hysteresis in switchover point).

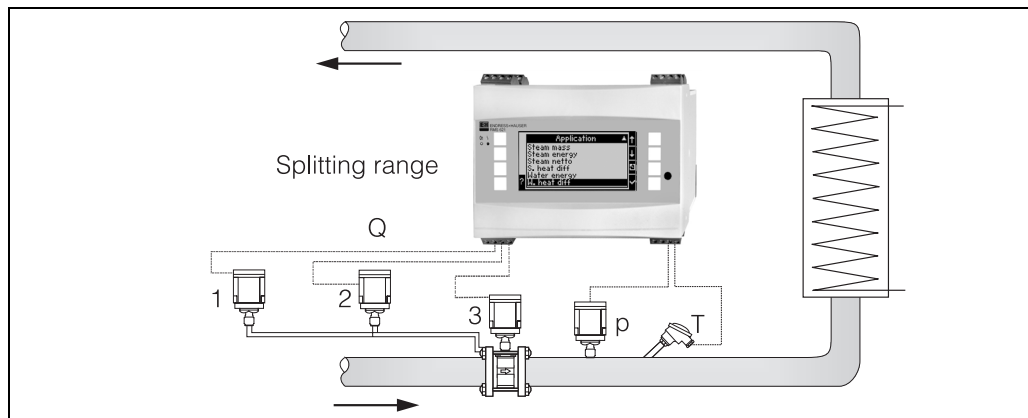


Fig. 27: Splitting Range mode

Mean value computation

Mean value computation gives you the opportunity of measuring an input variable using several sensors at different points and then getting the mean value from them. This function helps if several measuring points are required in a system in order to determine the measured variable with sufficient accuracy. Example: use of several Pitot tubes to measure flow in pipes with insufficient inlet runs or a large cross section.

Mean value computation is available for the input variables pressure, temperature and special flow meters (differential pressure).

Correction tables

Flow transmitters return an output signal in proportion to the flow. The relationship between the output signal and the flow can be described in the curve. The flow cannot always be determined exactly by a curve in the entire measuring range of a transmitter, i.e. the flow transmitter shows a deviation from the ideal curve pattern. This deviation can be compensated for with the correction table.

The correction is different, depending on the type of flow transmitter:

- Analog signal (volumetric, mass)
Table with up to 15 current/flow value pairs
- Pulse signal (volumetric, mass)
Table with up to 15 value pairs (frequency/k-factor or frequency/pulse value, depending on the type of signal)
- Differential pressure square root/not square root
Table with up to 10 value pairs (flow/factor f)



Note!

The points are automatically sorted by the device, i.e. you can define the points in any order.

Make sure that the operating status is within the table limits since values outside the table range are determined by extrapolation. This can result in greater inaccuracies.

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Set-up table

Customer	
Order code	
Unit no.	
Operator	

Expansion cards	
Type	Slot
Universal	
Temperature	

Application	Measurement	Application type

Flow	Signal type	Start value	End value	Pulse value	Eng. Units

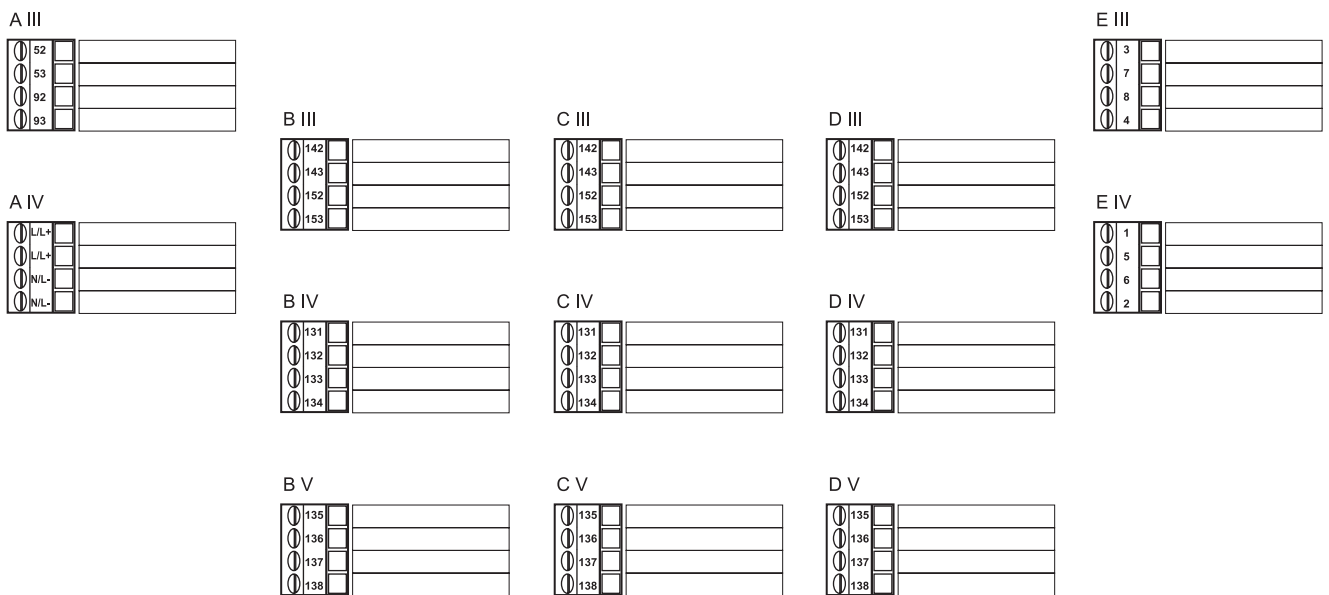
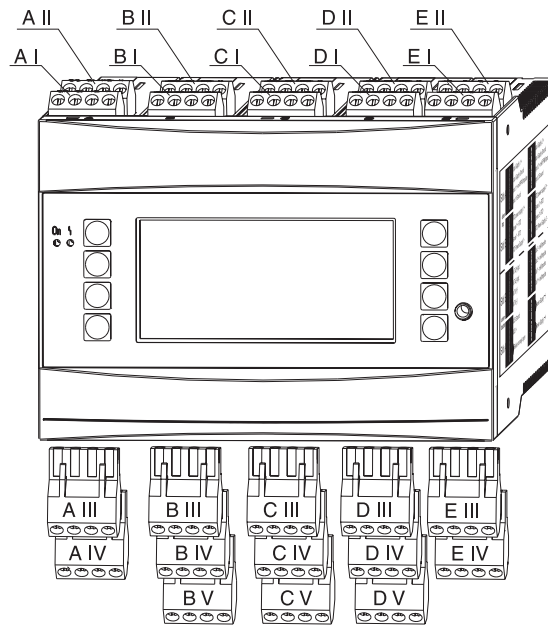
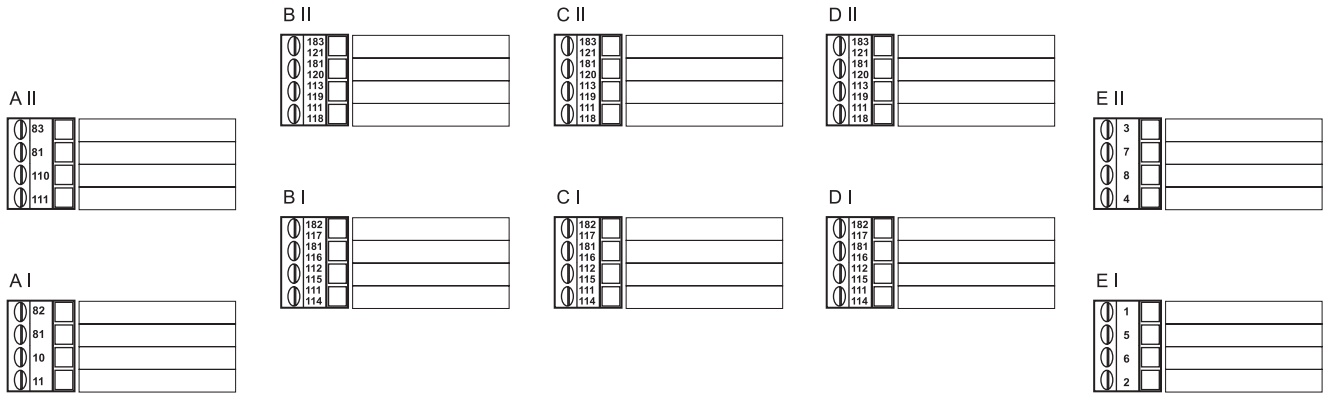
Pressure	Signal type	Start value	End value	Eng. Units

Temperature	Signal type	Start value	End value	Eng. Units

Outputs	Signal source	Signal type	Start value	End value	Pulse value	Eng. Units

For terminal connections see next page

Termination plan



Overview function matrix

Basic set-up	Date-Time	System eng. units System eng. units	Code	S-DAT module	Alarm response	Text input	General info	Display	Group	Scrolling display	Display	Contrast						
	Date		User	End set-up	Fault Category	Text input	Unit ID		Group 1.to.6	Swit. time	OIML							
	Time		Alarm lim.	Save			Tag-number		Identifier	Group X Yes/No	No. of Sums							
	Summertime-/normal time			Operation data			Prog.- name		Display mask									
				-Date: -Time: Read in			SW version		Value type									
				S-DAT data			CPU- No.		Value 1 to 8									
Inputs	Flow inputs	Special flow meters Differential pressure Identifier DPT/ Splitting Range Flow type Signal Terminals (1, 2, 3) Time base Units Range start (1, 2, 3) Range end (1, 2, 3) Flow cut off Correction Signal damp Offset Correction table Sums Alarm response	Mean flow Identifier Number Sums Sums external	Pressure inputs	Temperature inputs	Outputs	Analog outputs	Pulse outputs	Relay/set point									
	Identifier			Signal	Identifier		Transmit by											
	DPT			Terminals	Terminals		Signal	Terminals										
	Signal			Unit	Unit		Terminals	Operation mode										
	Terminals			Relative/ Absolute	3-wire/4-wire		Sig. source	Sig. source										
	Curve			Start value	Start value		Pulse	Switch point										
	Units			End value	End value		Type	Hysteresis										
	Pulse value / K Fact. unit			Signal damp	Signal damp		Unit value	Time delay										
	Start value			Offset	Offset		Width	Gradient										
	End value			Default	Default		Simulation	Limit display										
	Flow cut off			Mean flow	Mean flow													
	Correction			Identifier	Identifier													
	Signal damp			Number	Number													
	Offset			Alarm response	Alarm response													
	Correction table																	
	Sums																	
	Alarm response																	
	Application			Application	Signal Reset		Sums Signal Reset	Sums Signal Reset	Alarm response	Medium (specific describable)	Liquid (1 to 3)	Gas (1 to 3)						
				Identifier							Identifier							
Media (Gas/ liquids/H ₂ O)		Density calc. linear/Table/Input	Z-factor. (Not in use/Constant/ Real Gas/Table															
Medium (Gas)		Eh. Temp.	Z-Const															
Medium (liquids)		Ref Temp.	Equation															
Application		Eh. Density	Eh. Temperature															
Steam type		Ref Density	Eh. Pressure															
Flow		Expansion	Critical temperature & pressure															
Install. point		Category (Heat transf./Combustible)	Acentricity															
Mean pressure		Sp. heat cap.	Heating value															
Temperature (cold & warm)		Constant / Table	Viscosity (only for Diff-press-sensor)															
Units		Heat cap.	Z-factor table/matrix															
Sums		Heating value	Density input															
Alarm response		Viscosity (only for Diff. press. sensor)																
		Density table																
		Density input																
		Heat cap. table																
Communication		RS485(1)	RS 232/RS 485(2)	PROFIBUS-DP														
		Baudrate	Baudrate	Number (0 to 48)														
Service	Preset	Total sums	Adr 0...4... Adr .235...239.															

Grey function blocks are set-up units with submenus. Dependent on the menu selection, some positions will be hidden.

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