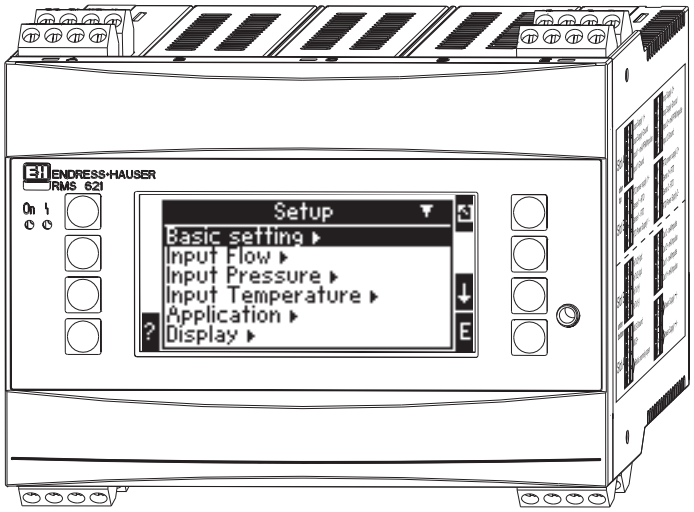
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating manual

RMS 621

Energy manager



BA127R/09/en/08.04
510 04788
Software
Version 2.0

Endress+Hauser

People for Process Automation

Overview

Using the following overview the unit can be swiftly and easily commissioned:

Safety notes	Page 8
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Installation	Page 11
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Electrical connections	Page 13
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Human interface	Page 22
▼	
Commissioning	Page 29
Quick SET-UP - Fast entry into unit set-up for standard operation. Unit set-up - explanation and application of all unit functions with the relevant values and settings. Application examples - Unit set-up in connection with an application example.	

Short form 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 - Set-up example

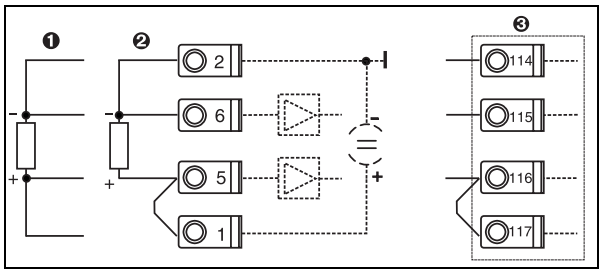
Example 1: Steam heat (or steam mass)

Sensors: DPO10 (orifice), Cerabar T, TR 10

1. Connect device to the power source (terminal L/L+, 220 V)
2. Press any key → Menu → Setup (all parameters)
3. **Basic set-up**
   Date-time (set up date and time) → ⍰
4. **Flow inputs** (flow 1)
   Flow meter: Differential pressure
   Diff. device: Orifice corner tap
   Signal: 4 to20 mA
   Curve: linear (also set up linear curve at the DP transmitter)
   Terminals: Select A10 and connect DP transmitter to terminals: A10(-)/82(+) (because of passive signal)
   Set up start- and end-value (in mbar!)
   Tube data: enter internal tube diameter and diameter ratio (ß) as found on the maufacturers data sheet.

   Caution!
   If tube data is not known, for flow meter: operating volume
   Curve: linear (set up square rooted curve on the DP transmitter)
   Set up start- and end-values einstellen (m^3/h)
5. **Pressure input** (Pressure 1)
   Signal type: e.g. 4 to 20 mA
   Terminals: Select A110 and connect Cerabar T to terminals: A110(-)/A83(+) (passive signal)
   Type: Select absolute (-pressure measurement) or relative (-pressure measurement)
   Set up start- and end-values of the presuure transmitter → ⍰

6. **Temperature inputs** (temp. 1.1)
   Signal type: Pt100
   Sensor type: 3- or 4-wire
   Select terminals E1-6 and connect Pt100 → [ ] → [ ].



Pos. 1: 4-wire input
Pos. 2: 3-wire input
Pos. 3: 3-wire input e.g. optional temp. expansion card (Slot B I)

Fig. 1: Temperature sensor connection, e.g. to input 1 (Slot E I)

7. **Application**
   Application 1: Steam heat
   Steam type: super heated steam
   Allocate flow 1, pressure 1 and temp. 1.1 to the steam measurement.
8. **Display**
   Group 1
   Display mask: 4 values
   Value 1 (...4): flow 1, temp. 1.1, pressure 1 and density 1 → [ ]
   Group 2: select to above system e.g. mass flow 1, heat flow 1, mass sum 1.
9. **Exit set-up**
   Exit set-up by operating ESC [ ] a number of times and acknowledging with [E].

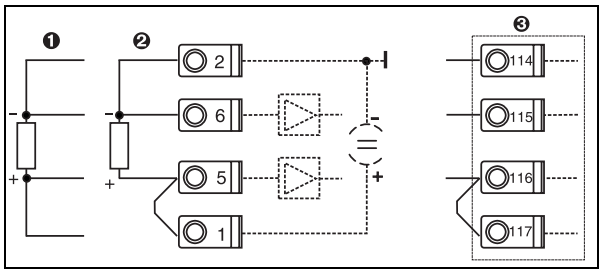
Display

By operating any key you can enter the main menu and select the required group including all the relative display values: Display -> Group -> Group 1. All can also be displayed in an automatic scroll function: Setup -> Display -> Scrolled display (scroll using the arrow under group 6).
If a fault occurs the display automatically changes colour (blue/red). Detailed fault finding and elimination can be found in the relative chapter of these operating instructions.

Example 2: Liquid heat difference

Sensors: 2 x TST90, Promag 50

1. Connect device to the power source (terminal L/L+, 220 V)
2. Press any key → Menu → Setup (all parameters)
3. **Basic set-up**
   Date-time (set up date and time) → [ ]
4. **Flow input** (flow 1)
   Flow meter: Operating volume
   Signal type: 4 to20 mA
   Terminals: select A10 and connect the Prowirl to terminals: A10(+)/11(-) (active signal)
   Set up start- and end-values
5. **Temperature inputs** (temp. 1.1 and temp. 1.2)
   Signal type: Pt100
   Sensor type: 3- or 4-wire
   Terminals: select E1-6 and connect TST90 (temp. 1.1) → [ ]
   Terminals: selectE3-8 and connectTST90 (temp. 1.2)→ [ ] → [ ]



Pos. 1: 4-wire input
Pos. 2: 3-wire input
Pos. 3: 3-wire input e.g. optional temp. expansion card (Slot B I)

Fig. 2: Temperature sensor connection, e.g. to input 1 (Slot E I)

6. **Applications**
   Application 1: Water heat differential
   Operating mode: Heating
   Select "Flow 1"
   Installation point: Cold (means return)
   Allocate temperature sensors 1.1 and 1.2 to heat and cooling section.
7. **Display**
   Group 1
   Display mask: 4 values
   Value 1 (...4): Flow 1, temp. 1.1, temp. 1.2 and density → ⊡
   Group 2: select to above system e.g. mass flow 1, heat flow 1, mass sum 1 etc.
8. **Exit set-up**
   Exit set-up by operating ESC ⊡ a number of times and acknowledging with E.

Display

By operating any key you can enter the main menu and select the required group including all the relative display values: Display -> Group -> Group 1. All can also be displayed in an automatic scroll function: Setup -> Display -> Scrolled display (scroll using the arrow under group 6).
If a fault occurs the display automatically changes colour (blue/red). Detailed fault finding and elimination can be found in the relative chapter of these operating instructions.

An example of steam mass measurement using a Prowirl 77 can be found in the appendix of this operating manual.

Application basic set-up

The values shown are only an indication in order to simplify the commissioning of the device, this means that only the most necessary settings are shown. Special functions (e.g. tables, corrections, etc.) are not shown.

Water applications

Input values: Flow, temperature 1, (temperature 2)

Flow **Pulse/PFM (e.g. ProWirl)**	**Analogue (e.g. Promag)**	**Differential pressure (e.g. Orifice)**
Flow input	Flow input	Flow input
Flow meter: Operating volume	Flow meter: Operating volume	Differential pressure/Orifice/water
Terminals: – Flow meter with active signal connect to e.g. terminals A10(+)/11(-). – Flow meter with passive signal select e.g. terminals A10 and connect to terminals A10(-)/82(+).		
k factor	Start/end value (m^3/h)	Start/end value (mbar)

Flow **Pulse/PFM (e.g. ProWirl)**	**Analogue (e.g. Promag)**	**Differential pressure (e.g. Orifice)**
Pressure		
Select signal type and terminals and then connect sensor (see example).		
Type: Relative- or absolute-pressure? Enter start- and end-values.		
Temperature		
Select signal type and connect sensor(s) (see example). 2 temperature sensors are required for heat differential measurements.		
Application		
Application: e.g. Water- heat differential		
Operating mode: e.g. heating (this means inflow warm, return cold)		
Allocate installation point for flow measurement sensor (warm/cold)		
Allocate temperature sensors		

Note!
Only one temperature available for liquid heat quantity. A direction signal teriminal is required on changing flow direction (bi-directional operating mode).

Steam application

Input values: Flow, pressure, temperature 1, (temperature 2)

Flow **Pulse/PFM (e. g. Prowirl)**	**Analogue (e. g. Prowirl)**	**Differential pressure (e. g. Orifice)**
Flow input	Flow input	Flow input
Flow meter: Operating volume	Flow meter: Operating volume	Differential pressure/Orifice.../Gas
Terminals: – Flow meter with active signal connect to e.g. terminals A10(+)/11(-). – Flow meter with passive signal select e.g. terminals A10 and connect to terminals A10(-)/82(+).		
k factor	Start/end value (m^3/h)	Start/end value (mbar)
Pressure		
Select signal type and terminals and then connect sensor (see example).		
Type: Relative- or absolute-pressure? Enter start- and end-values.		
Temperature		
Select signal type and connect sensor(s) (see example). 2 temperature sensors are required for heat differential measurements.		
Application		
Application (1);		
Application: e.g. steam mass		
Steam type: e.g. superheated		
Allocate sensors for flow, pressure and temperature measurement		

Note!
2 temperature sensors are required for steam diferential applications.

Table of contents

1 Safety notes

Safe operation of the energy manager can only be ensured if all hints and warnings in this installation and operating manual are thorougly read and followed.

1.1 Correct use

The RMS 621 energy manager is a unit for monitoring energy and flows in water and steam applications. It can be used in both heating and cooling systems. A large variety of different flow sensors, temperature and pressure sensors can be connected to the unit. The energy manager accepts the current/PFM/pulse or temperature signals from the individual sensors and from these calculates the liquid and energy values:

– Volume and mass
– Heat flow or energy
– Heat energy differential

all using the international calculation standard IAPWS-IF 97.

– The unit is classified as additional equipment and may not be used in a hazardous area.
– The manufacturer cannot take responsibility for any damage caused by misuse of the unit. It is not permitted to make any changes or reconstruction to the unit.
– The energy manager has been designed for use in an industrial environment and may only be used in an appropriately installed condition.

1.2 Installation, commissioning and operation

The unit is safely manufactured using state-of-the-art technology and complies with the respective EU regulations. The unit could be dangerous if it is incorrectly installed or used.
Mechanical and electrical installation, commissioning and maintenance of the unit must only be carried out by skilled and qualified personnel. The skilled personnel must have read and understood these operating instructions and followed them carefully. Always make sure that the unit is correctly connected following the electrical connection diagrams (see Chap. 4 "Electrical installation"). When the unit covers are removed, all electrical contact protection is lost (danger of electrical shock). The housing must only be opened by qualified skilled personnel.

1.3 Operational safety

Hazardous areas
The energy manager is classified as additional equipment and may not be installed in a hazardous area.

Technical advancement
The manufacturer reserves the right to improve and update the technical details. For details of improvements or additions to these instructions, please contact your local sales organisation.

1.4 Returns

Please contact both the transport agency and your supplier if any transport damage is discovered.

1.5 Safety characters and symbols

Safety notes in these installation and operating instructions are highlighted using the following safety pictograms:

Caution!
This pictogram refers activities or sequences that, if done incorrectly could lead to personal injury or faulty operation or complete damage to the unit.

Warning!
This pictogram refers activities or sequences that, if done incorrectly could lead to personal injury, a safety risk or total damage to the unit

Note!
This pictogram refers activities or sequences that, if done incorrectly could have a direct influence on the units operation or could release an unforeseen unit reaction.

2 Identification

2.1 Unit identification

2.1.1 Legend plate

Compare the unit legend plate with the following diagram:

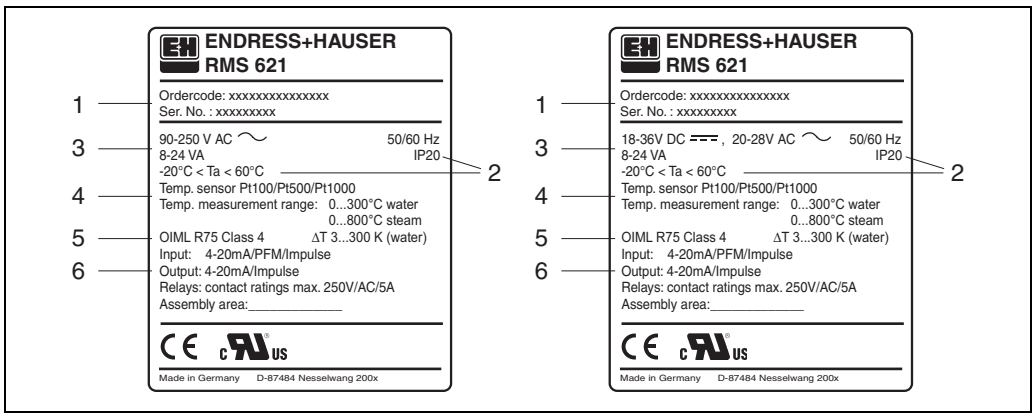


Fig. 3: Energy manager legend plate (example)

1 Order code and unit series number
2 Protection class and allowable ambient temperature
3 Power supply
4 Temperature sensor input with measurement range
5 Approvals with accuracy details
6 Available in/outputs

2.2 Complete delivery

A complete delivery of an energy manager consists of:

- Energy manager RMS 621 for DIN top hat rail mounting
- This installation and operating manual
- CD-ROM data carrier with PC configuration software and RS 232 serial interface cable (optional)
- Remote display for panel mounting (optional)
- Expansion cards (optional)

Note!
Take note of the accessories for the unit in Chap. 8 "Accessories".

2.3 Certificates and approvals

CE approval, certificate of conformity
The energy manager has been produced using the latest state-of-the-art technology, and leaves our factory in a safe and tested condition. The unit complies with the EN 61010 regulations "Safety requirements for electrical measurement, control and laboratory instrumentation".
This means that the unit described in this installation and operating manual fulfils the requirements demanded by the EU regulations. The manufacturer acknowledges successful unit testing by adding the CE mark.
The unit was developed in accordance with the OIML R75 and EN-1434 directives.

3 Mechanical installation

3.1 Installation conditions

The permitted ambient temperature (see "Technical data") must not be exceeded in installation or operation. The unit must be protected from any outside heat sources.

3.1.1 Installation dimensions

Take note of the 135 mm (equals 12 DU) unit installation depth. For further dimensions, please see Chap. 10 "Technical data".

3.1.2 Installation area

Installation inside a control panel on top hat DIN rail according to EN 50 022-35. The installation area must be free of vibration.

3.1.3 Installation orientation

No limitation.

3.2 Installation

First remove the keyed plug-on terminals from the housing. Snap the housing onto the DIN rail by first hooking the unit onto the rail and snap in by using slight downwards pressure (see Fig. 4, Pos. 1 and 2).

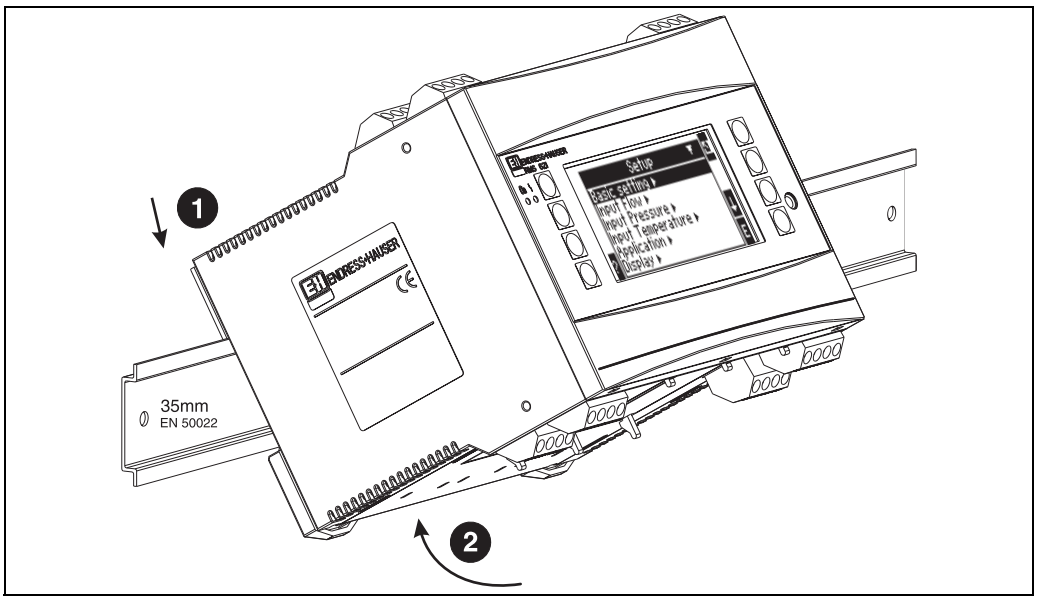


Fig. 4: Unit installation on DIN top hat rail

3.2.1 Installation of expansion cards

It is possible to fit various expansion cards into the unit. For this purpose there are a maximum of three slots available. The expansion card plug in slots are identified as B, C and D (→ Fig. 5) on the unit.

1. When installing or removing expansion cards to or from the unit, always make sure that the power supply is OFF.
2. Remove the blanking plate from the required expansion slot in the unit. This is done by pressing the holding clips on the bottom of the energy manager together (see Fig. 5, Pos. 2), simultaneously push the holding clip on the back of the unit inwards (e.g. using a screwdriver) (see Fig. 5, Pos. 1), then push the blank housing upwards out of the unit.
3. The expansion card is slotted into the unit from the top. The expansion card is only correctly fitted when the holding clips on the lower and rear sides of the unit have clicked into place (see Fig. 5, Pos. 1 and 2). Make sure that the input terminals of the expansion card are at the top and the analogue connection terminals to the base unit are facing the front.
4. The new expansion card is automatically recognised by the unit once it has been correctly connected and set up (see Chap. "Commissioning").

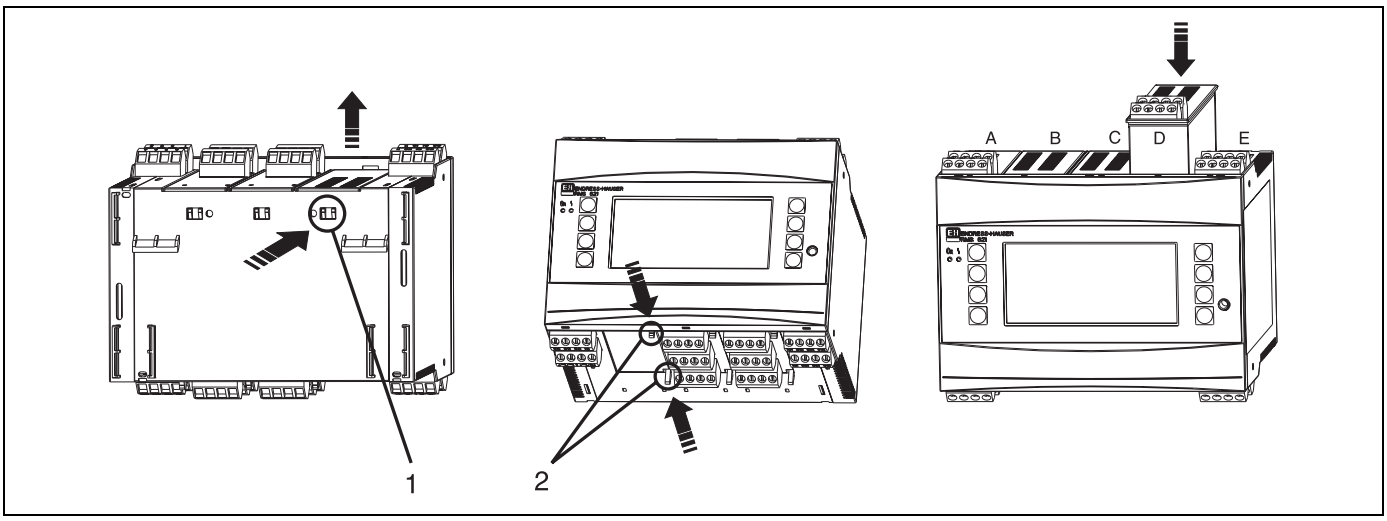


Fig. 5: Installing a new expansion card (example)

Pos. 1: Holding clip on unit base
Pos. 2: Holding clips on lower side of the unit
Pos. A – E: Slot allocation identification

Note!
If existing expansion cards are removed and not replaced, then the spaces must be filled by using blanking cards.

3.3 Installation control

If using expansion cards, always make sure that they are correctly seated in the allocated slots of the unit.

Note!
When using the unit as a heat counter, take note of installation regulations EN 1434 Part 6. This includes the installation of the flow and temperature sensors.

4 Electrical installation

4.1 Electrical connection overview

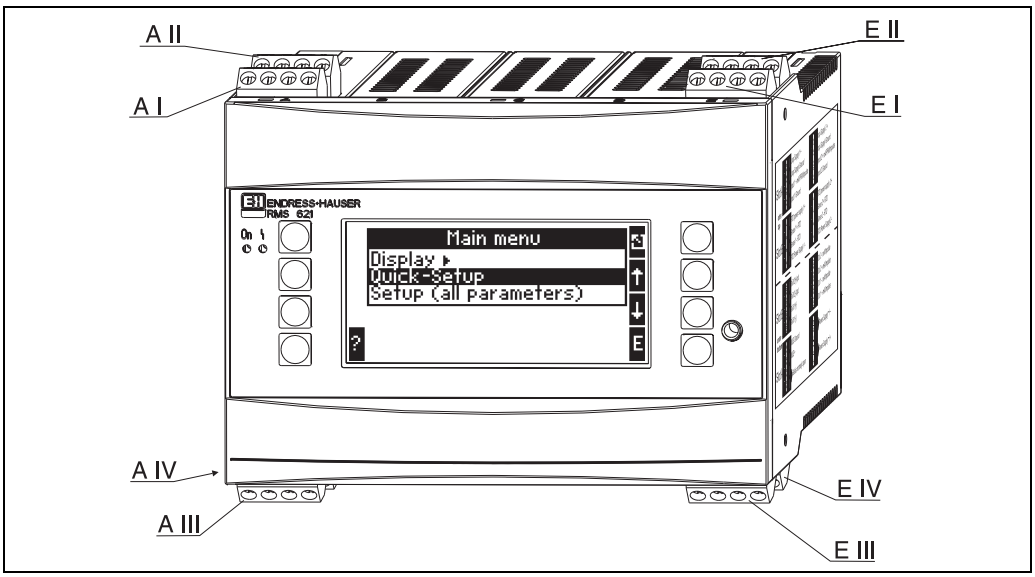


Fig. 6: Energy manager slot connections (base unit)

Terminal layout

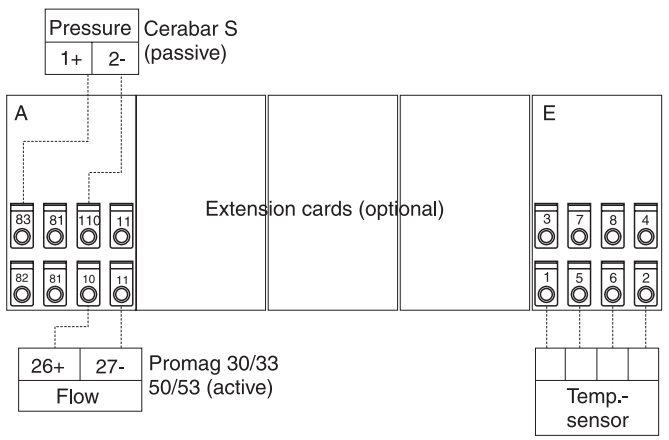
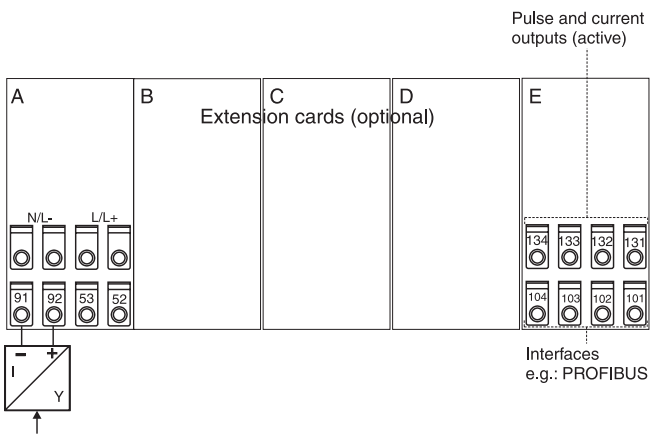
Terminal (Pos.no.)	Terminal layout	Slot	In- and output
82	24 V sensor supply 1	A top front **(A I)**	Current/PFM/pulse input 1
81	Sensor supply ground 1		
10	+ 0/4 to 20 mA/PFM/pulse input 1		
11	Signal ground for 0/4 to 20 mA/PFM/pulse input		
83	24 V sensor supply 2	A top back **(A II)**	Current/PFM/pulse input 2
81	Sensor supply ground 2		
110	+ 0/4 to 20 mA/PFM/pulse input 2		
11	Signal ground for 0/4 to 20 mA/PFM/pulse input		
1	+ RTD supply 1	E top front **(E I)**	RTD input 1
5	+ RTD sensor 1		
6	- RTD sensor 1		
2	- RTD supply1		
3	+ RTD supply 2	E top back **(E II)**	RTD input 2
7	+ RTD sensor 2		
8	- RTD sensor 2		
4	- RTD supply 2		
101	- RxTx 1	E bottom front **(E III)**	RS485
102	+ RxTx 1		
103	- RxTx 2		RS485 (as option)
104	+ RxTx 2		

Terminal (Pos.no.)	Terminal layout	Slot	In- and output
131	+ 0/4 to 20 mA/pulse output 1	E bottom back **(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
53	Relay normally open (NO)		
92	+24 V sensor supply		Additional sensor supply
91	Supply ground		
L/L+	L for AC L+ for DC	A bottom back **(A IV)**	Power supply
N/L-	N for AC L- for DC		
RS232	Interface	3.5 mm jack plug socket on front	Remote set up from PC

Note!
The current/PFM/pulse inputs or RTD inputs in the same slot are not galvanically separated. There is an isolation voltage of 500 V between the above inputs and outputs installed in different slots. Terminals having the same identity are internally linked.

4.2 Connecting measurement sensors

Caution!
Do not install/connect the unit under power. If this is ignored it can lead to total damage of parts of the electronics.

Top of unit connection view (inputs)	Bottom of unit connection view (outputs, interfaces)
	

4.2.1 Power supply connection

Caution!
- Before installing the unit make sure that the supply to be used corresponds with that shown on the unit legend plate.
- When operating with a 90 to 250 V AC (power supply) a power isolator must be situated within easy reach of the unit. This should be fuse protected using a current rating of ≤ 10 A.

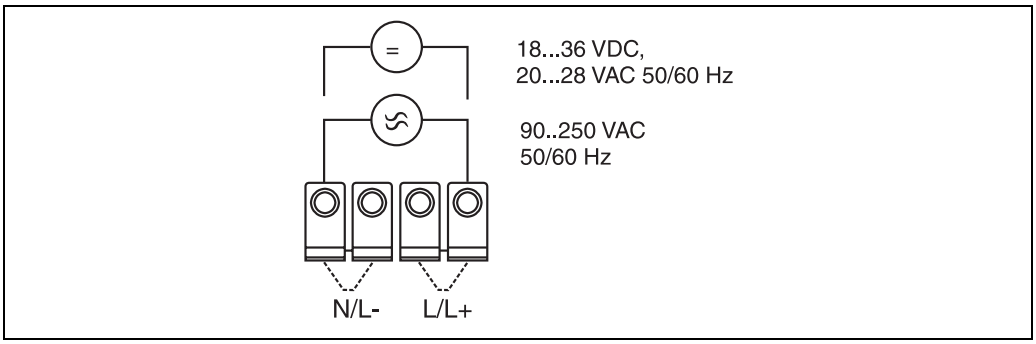


Fig. 7: Power supply connection

4.2.2 Connecting external sensors

Note!
Both active and passive sensors with analogue, PFM, or pulse signals and RTD sensors can be connected to the unit.
Dependent on the signal type, the terminals can be freely selected. This means that the energy manager is very flexible in its application and the terminals are not bound to any particular sensor type, e.g. flow sensor terminal 11, pressure sensor terminal 12 etc. If the unit is to be used as a heat counter according to the OIML R 75, then the connection regulations contained in that norm are valid.

Active sensors
Connection of an active sensor (this means external power supply).

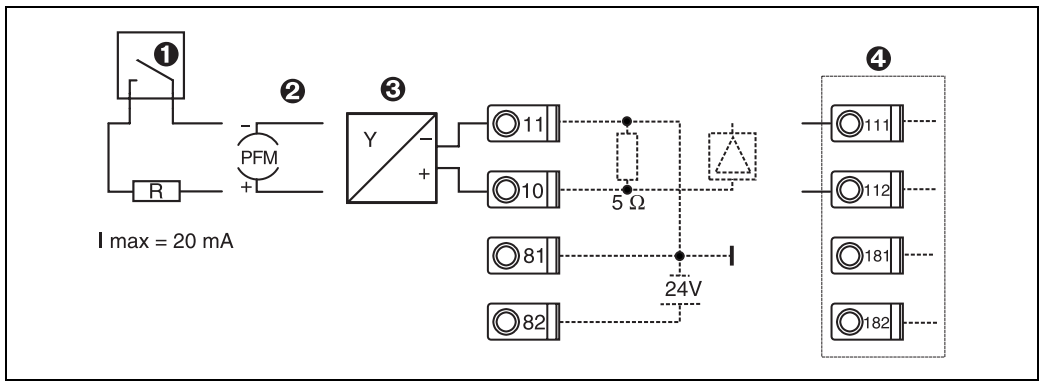


Fig. 8: Connection of an active sensor, e.g. to input 1 (Slot AI)

Pos. 1: Pulse signal
Pos. 2: PFM signal
Pos. 3: 2-wire transmitter (4-20 mA)
Pos. 4: Connection of an active sensor, e.g. optional universal expansion card (Slot B I, → Fig. 13)

Passive sensors

Connection of sensors that are powered using the loop power supply built into the unit.

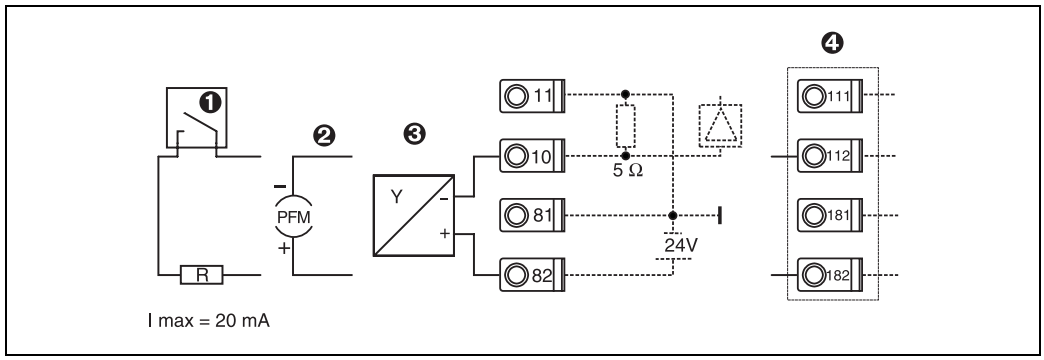


Fig. 9: Connection of a passive sensor, e.g. to input 1 (Slot AI)

Pos. 1: Pulse signal
Pos. 2: PFM signal
Pos. 3: 2-wire transmitter (4-20 mA)
Pos. 4: Connection of a passive sensor, e.g. optional universal expansion card (Slot B I, → Fig. 13)

Temperature sensors

Connection for Pt100, Pt500 and Pt1000

Note!
Terminals 1 and 5 (3 and 7) must be linked when using 3-wire sensors (see Fig. 10).

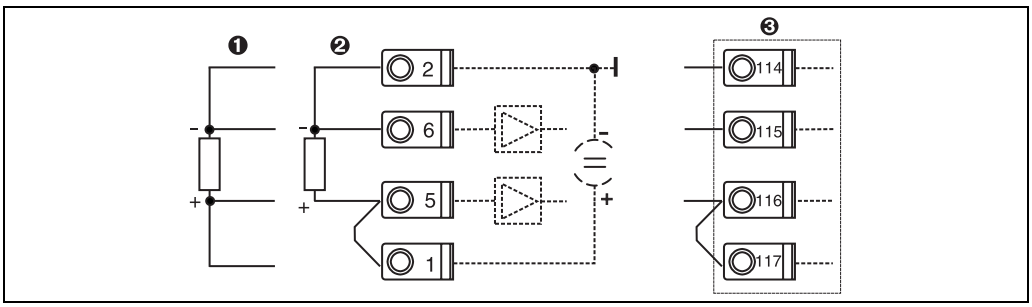


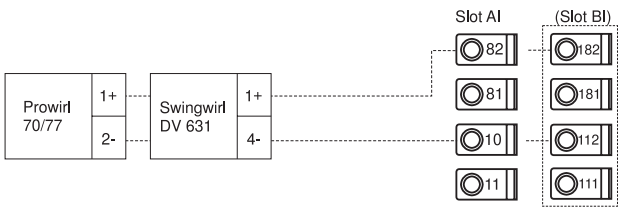
Fig. 10: Connection of temperature sensors, e.g. to input 1 (Slot EI)

Pos. 1: 4-wire input
Pos. 2: 3-wire input
Pos. 3: 3-wire input, e.g. optional temperature expansion card, (Slot B I, → Fig. 13)

E+H specific instrumentation

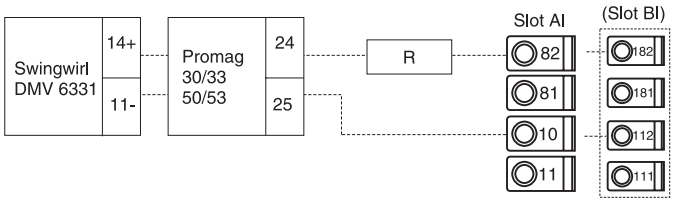
Flow sensors with PFM output

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

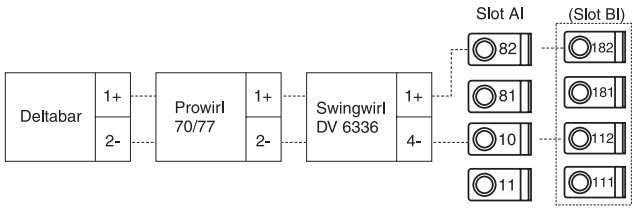


Flow sensors with open collector output

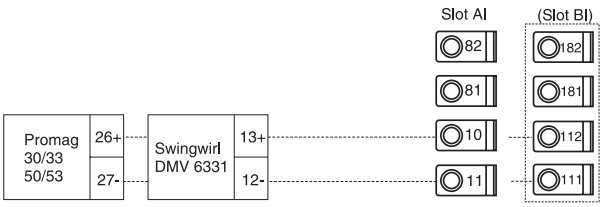
Note!
Select the relative resistance R, so that $I_{max.}$ = does not exceed 20 mA.



Flow sensors with a passive current output (4 to 20 mA)

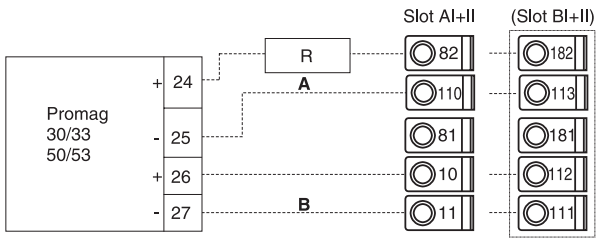


Flow sensors with an active current output (4 to 20 mA)

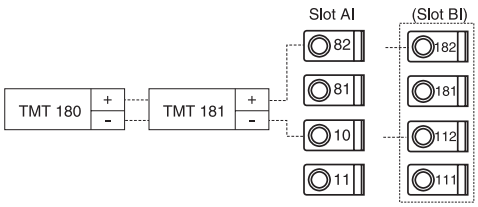


Flow sensors with an active current output and an passive frequency output (measurement of bi-directional flow)

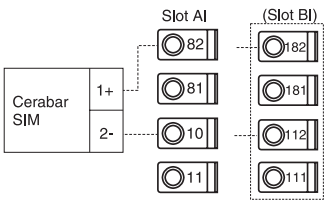
Note!
Select the relative resistance R, so that $I_{max.}$ = does not exceed 20 mA.
Terminals 82/110 = Direction signal
Terminals 10/11 = Flow signal



Temperature sensor using an temperature head transmitter (4 to 20 mA)



Pressure sensors with a passive current output (4 to 20 mA)



4.2.3 Output connections

The unit has two galvanically isolated outputs that can be set up as analogue outputs or active/passive pulse outputs. In additionally there is one output available for connecting a relay and loop power supply. The number of outputs increase if expansion cards are fitted.

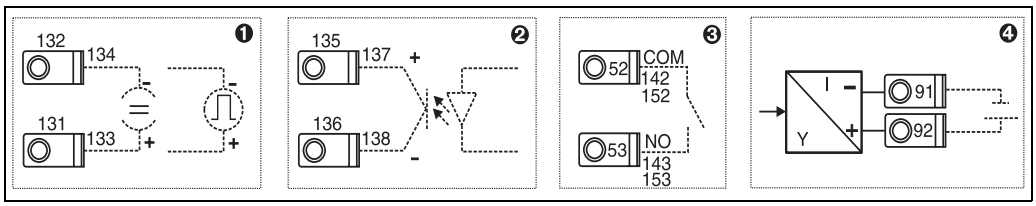


Fig. 11: Output connections

Pos. 1: Pulse and current outputs (active)
Pos. 2: Passive pulse output (Open Collector)
Pos. 3: Relay output (normally open), e.g. Slot A III (Slot BIII, CIII, DIII on optional expansion card)
Pos. 4: Loop power supply output

Interface connection

- RS232 connection
  The RS232 interface is connected using the interface cable delivered with the unit and the jack plug socket on the front of the unit.
- RS485 connection
- Optional: additional RS485 interface
  Terminals 103/104, this interface is only active so long as the RS232 interface is not being used.

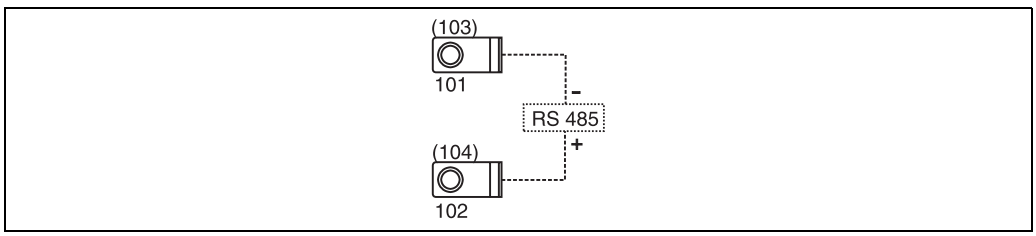


Fig. 12: Interface connection

4.2.4 Connecting expansion cards

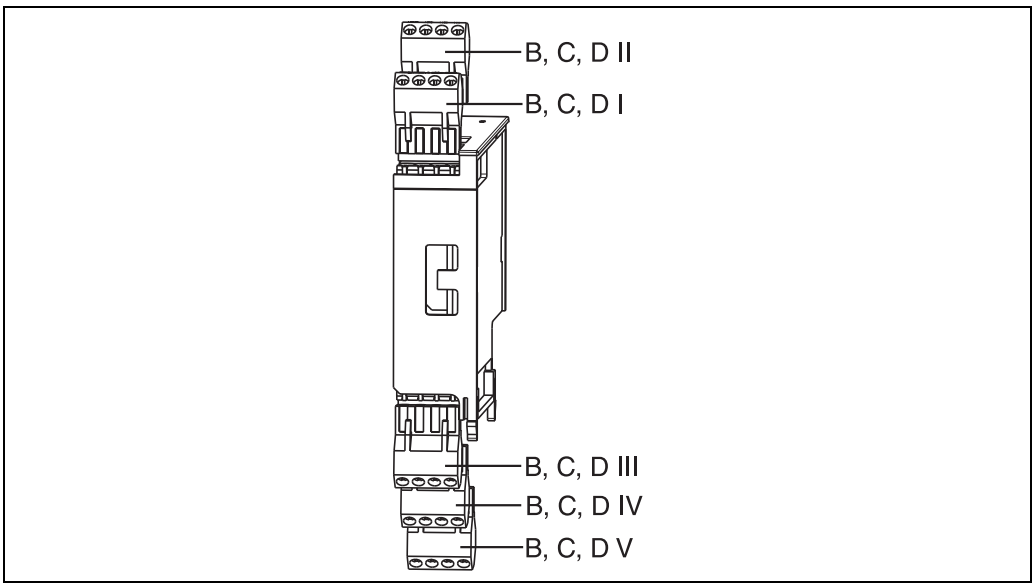


Fig. 13: Expansion cards with terminals

Terminal layout of universal input expansion card (RMS621A-UA)

Terminal (Pos.no.)	Terminal layout	Slot	In- and outputs
182	24 V power supply 1	B, C, D top front **(B I, C I, D I)**	Current/PFM/pulse input 1
181	Ground power supply 1		
112	+ 0/4 to 20 mA/PFM/pulse input 1		
111	Signal ground for 0/4 to 20 mA/PFM/pulse input		
183	24 V power supply 2	B, C, D top back **(B II, C II, D II)**	Current/PFM/pulse input 2
181	Ground power supply 2		
113	+ 0/4 to 20 mA/PFM/pulse input 1		
111	Signal 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)**	Relay1
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 middle **(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 back **(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 layout of the temperature expansion card (RMS621A-TA)

Terminal (Pos.no.)	Terminal layout	Slot	In- and outputs
117	+ RTD 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 supply 1		
121	+ RTD supply 2	B, C, D top back **(B II, C II, D II)**	RTD input 2
120	+ RTD sensor 2		
119	- RTD sensor 2		
118	- RTD supply 2		
142	Relay 1 Common (COM)	B, C, D bottom front **(B III, C III, D III)**	Relay1
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 middle **(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 back **(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 input inputs or RTD inputs of individual cards are not galvanically isolated. There is an isolation voltage of 500 V between the above mentioned inputs and outputs in differing slots as well as the outputs of individual cards. Similar terminals are internally linked.

4.2.5 Connecting the remote display/operating module

Function description

The remote display is an innovative expansion to the powerful DIN rail mounted RMS621 unit. For the user this means that the calculation unit can be installed technically correct and the display and operating module can be mounted in an easily accessible and user friendly position. The display can be connected to a DIN rail mounted unit that has already got an integrated display/operating module as well as one without a display/operating module. In order to connect the remote display a four core cable is supplied, other components are not required.

Note!
Only one remote display/operating unit can be connected to a DIN rail mounted unit and Vica Versa (point to point).

Installation and dimensions

Installation hints:
- The installation point must be free of vibrations.
- The permissable ambient temperature during operation is -20 to +60°C.
- Protect the unit from external heat sources.

Instructions for panel mounting the unit:
1. Make sure that a cut out of 138+1.0 x 68+0.7 mm (to DIN 43700) has been prepared in the panel front, installation depth is 45 mm.
2. Push the unit through the panel cutout from the front, making sure that the gasket is in place.
3. Hold the unit flat and using even pressure push the housing fixing frame over the rear of the unit up to the panel until the fixing clips altch into place. Make sure that the unit sits symmetrically in the fixing frame.

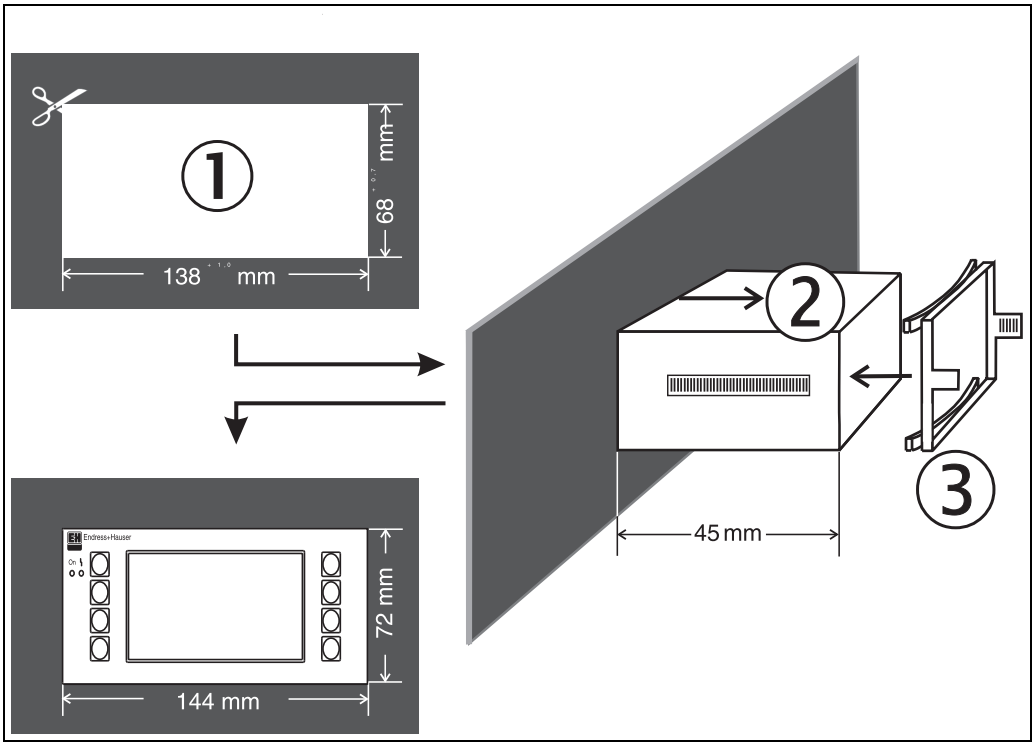


Fig. 14: Panel mounting

Wiring

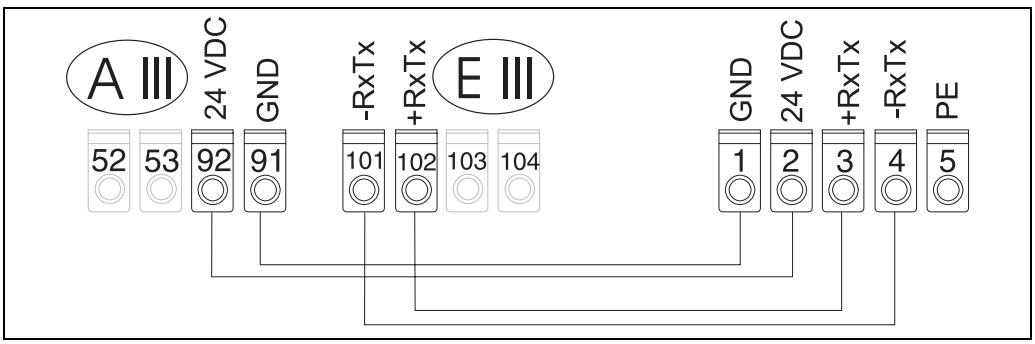


Fig. 15: Terminal layout of the remote display/operating unit

The remote display/operating unit is directly connected to the base unit using the cable supplied.

4.3 Connection control

Once the unit has been connected, run the following control functions:

Unit condition and specifications	Hint
Is the unit or cables visibly damaged (visual control)?	–
Electrical connection	Hint
Does the power supply used correspond with that printed on the unit legend plate?	90 to 250 V AC (50/60 Hz) 18 to 36 V DC 20 to 28 V AC (50/60 Hz)
Are all terminals plugged into the correct position? Is the keying correct for each terminal?	–
Are the cables installed relieved from tension?	–
Are the power and signal cables correctly connected?	See connection schematic on the unit housing
Are all screws tightened?	–

5 Operation

5.1 Operation at a glance

Note!
Depending on the version and application, the unit offers the user a large number of possible settings and software functions. For fast commissioning there is a special "Quick Set up" (short form set-up) available where all application relevant operating addresses are selected one by one. See Chapter 6.3 "Quick Set Up".
For additional set-up assistance, a help text is available for most operating addresses. These can be activated by operating the "?" key. The help text can be called upon for each menu.

5.1.1 Main menu

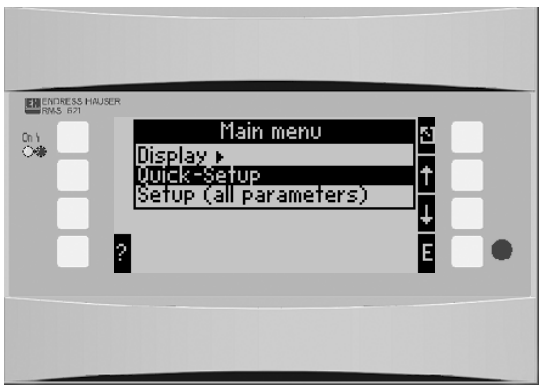
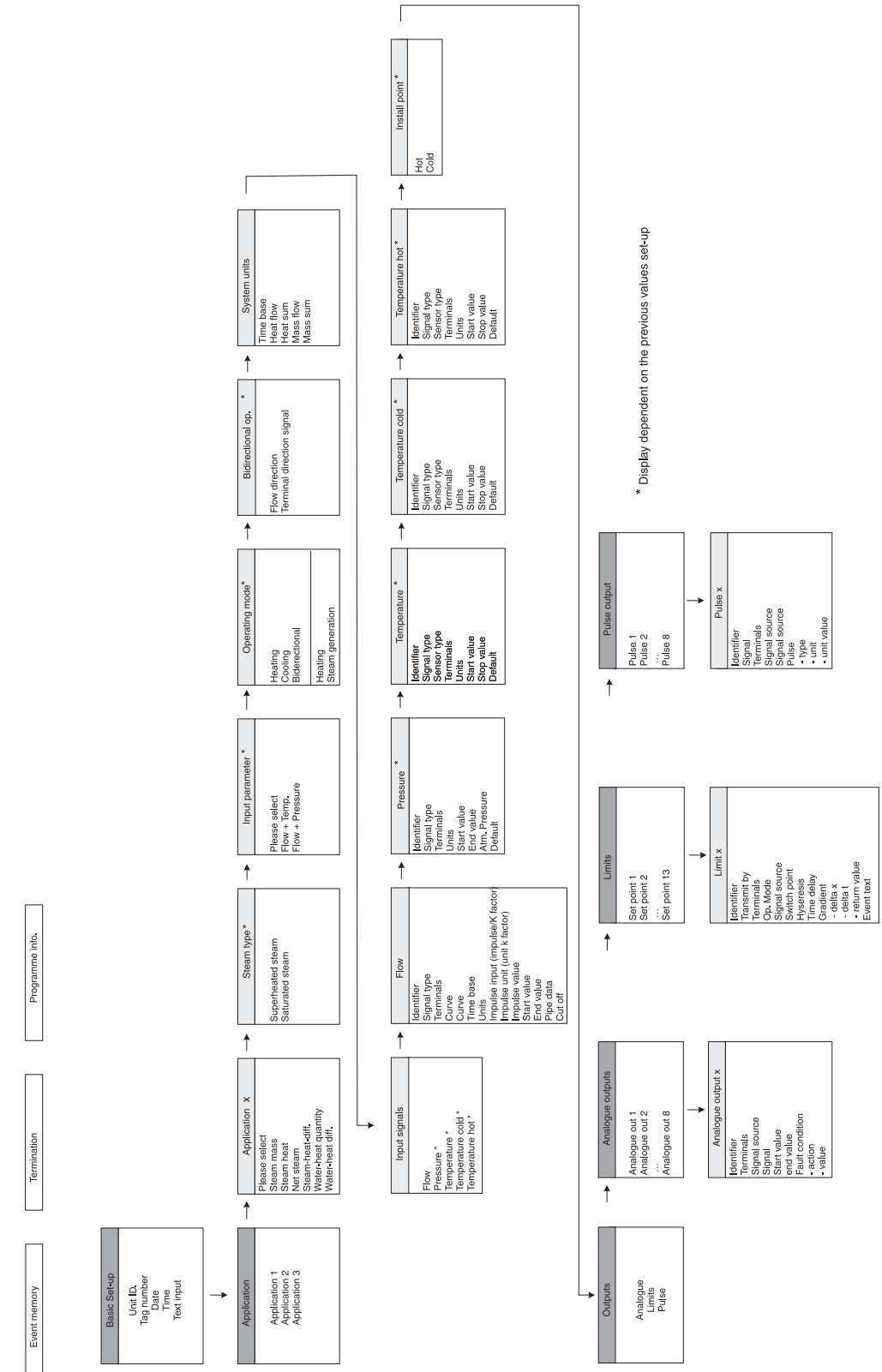


Fig. 16: Main menu

5.1.2 Display / Quick Setup



5.2 Human interface

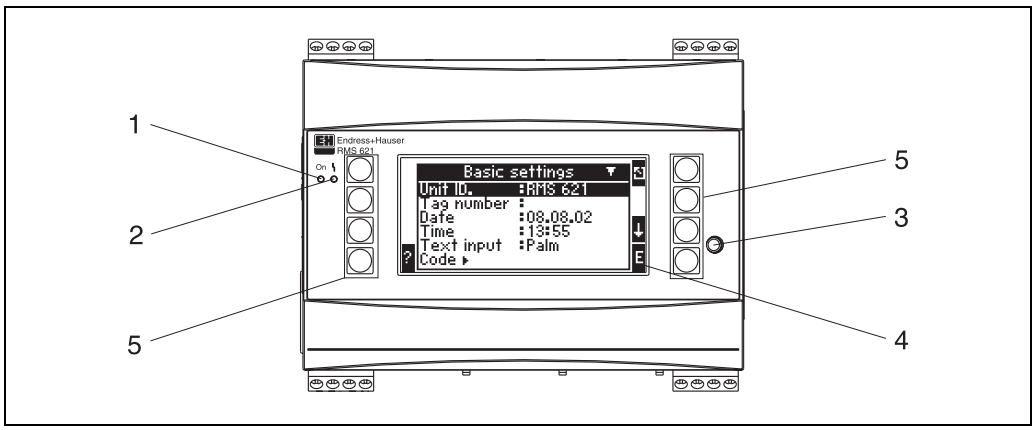


Fig. 17: Display and operating elements

Pos. 1: Operational display: Green LED, illuminates when power supply is active.
Pos. 2: Fault condition display: Red LED, operating conditioning according to NAMUR NE 44.
Pos. 3: Serial interface connection: Jack plug socket for PC connection to the unit in order to set up and read out measured values from the unit using the PC software
Pos. 4: Display 132 x 64 dot-matrix display with interactive dialogue text for set-up and display of the measured values, alarm set points and fault messages. The rear illumination can be set up to change from blue to red in a fault condition. The displayed character size is dependent on the number of parameters to be displayed (see chap. 6.4.3 "Display set-up").
Pos. 5: Entry keys; Eight soft keys, the function of each key changes depending on the menu address. The actual functionality of the key is always indicated on the display. Only the keys required in any particular operating menu are displayed with their individual function.

5.2.1 Display

Fig. 18: Energy manager display functions

Pos.: 1: Measured value display
Pos.: 2: Set-up menu address display
– A: Key symbols
– B: Active set-up menu
– C: Selection of active set-up menu (black highlight).

5.2.2 Key symbols

Note!
The individual key functions are different in both the Quick Set-up and standard set-up. In the Quick Set-up access to the sub menus and return is done using the double arrows. In the standard set-up, access to the individual sub menus and functions is done using the 'E' key and return using the 'Esc' key.
There are no double arrows in the standard set-up function.

Key symbol	Function
E	Change to sub menus and selection of operating addresses. Editing and acknowledgement of preset values.
⌧	Leaves the active editing mask or active menu address without saving any changes made.
↑	Moves the cursor one line or character upwards.
↓	Moves the cursor one line or character downwards.
→	Moves the cursor one character to the right.
←	Moves the cursor one character to the left
?	If a help text is available for the active operating address this is indicated using a question mark. Operating this key initiates the help function.
>>	Switches to the next sub menu. (only in the Quick Set-up)
<<	Switches from the sub menu to the main menu (only in Quick Set-up)
AB	Changes into the Palm key pad in editor mode
ij /iJ	Key pad for upper/lower case (only on Palm use)
½	Key pad for numeric entries (only on Palm use)

5.3 Front end operation

5.3.1 Text entry

There are two possibilities for entering text into an operating address (see: **Setup → Unit settings → Text input**):

a) Standard: Individual characters (letters, numbers etc.) in the text field are selected by scrolling through the complete character set using the up/down arrow keys until the required character appears.
b) Palm key pad: A key pad which can be used for text entry is blended onto the display. Individual characters are selected using the arrow keys (see "Setup/Unit settings").

Using the Palm key pad

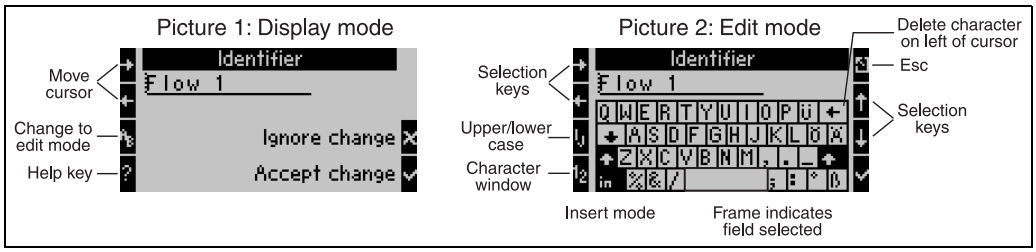


Fig. 19: Example: Editing an identifier using the Palm key pad

1. Move in front of the character where another is to be entered using the cursor right arrow. If the complete text is to be deleted, then bring to the cursor to the right. (→ Fig. 19, picture 1).
2. Operate key AB in order to enter the editing mode.
3. Using the IJ/ij and ½ key select the required key pad upper/lower case or numbers (→ Fig. 19, picture 2).
4. Using the arrow keys, select the required character and acknowledge with the tick key. If the text is to be deleted, select the upper right hand key. (→ Fig. 19, picture 2).
5. Edit other characters in the same way until the required text is complete.
6. In order to change from the editor mode to display mode operate the 'Esc' key and acknowledge the changes using the tick key. (→ Fig. 19, picture 1).

Note!
- The cursor cannot be moved in the editor mode (→ Fig. 19, picture 2)! Change to the previous window (→ Fig. 19, picture 1) using the 'Esc' key in order to move the cursor to the character that is to be changed. Then operate the AB key again.
- Special key functions:
  Key in: Change to overwrite mode
  Key (top right): Delete characters

5.3.2 Lock set-up

The total set-up can be locked from unauthorised tampering. This code is set up in the sub menu: **Unit set up → Code**. All parameters remain visible. If a value is to be changed, then the unit initially requests entry of the user code.
In addition to the user code, there is also an alarm set point code. Once this code has been entered only the alarm set points are released for changing.

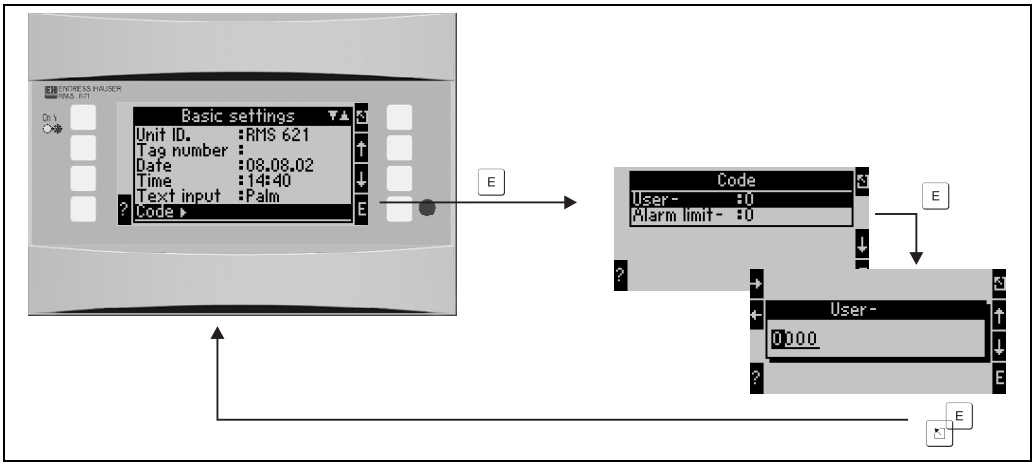


Fig. 20: Set-up user code

5.3.3 Operating example

A complete description of a front end set-up can be found in an application example in chapter 6.5 "Customer-specific application".

5.4 Error message display

The unit differentiates between two types of errors:

- System errors: This group contains all unit errors, e.g. communication errors, hardware errors, etc.

System errors are always displayed by a red rear illumination of the display field. As soon as all errors have been removed the unit returns to the standard blue rear illumination.

- Process errors: This group contains all application errors e.g. "Overrange", including all alarm limit set points etc.

It is possible to define the unit reaction to each individual process error e.g. alarm message, colour change etc. The colour change feature is set up in the operating address **Setup → Display → Colour change** (see chap. 6.4.3). Event text can be defined for any alarm set point condition. This can be blended onto the screen. Additionally it is possible to set up if any error must be acknowledged before the unit returns to its operating mode (**Setup → Alarm limit set point → Event text-GW.Ack,** see chap. 6.4.3).

If more than one system or process errors are active then these are displayed in chronological order and the error displayed is always the oldest error.

System error messages
There is always a rear illumination colour change reaction from blue to red and an error message display to any system or unit error. These must be acknowledged by pressing the '**E' key**. Generally system errors must be removed by E+H Service, with the exception of the **"Config-error"** which can be removed by checking the unit set-up made.

Process error messages
Process errors are placed into an event memory, these can also be indicated by a colour change in the display rear illumination (presettable). The exception is alarm set point conditions. Here an event text can be defined and blended onto the screen, and/or the display changes colour (see chap. 6.4.3: **Setup → Alarm set points; Setup → Display**).

Event memory
The last 20 process errors are stored chronologically in the event memory. These include time of occurrance and counter values. The error messages in the event memory can be viewed using the sub menu: **Display → Event memory**.

5.5 Communication

All units and unit versions can be set up, changed and read out using the standard interface, the ReadWin® 2000 PC software and a serial interface cable (see Chap. 8 'Accessories'). This is recommended if very complicated applications need to be set up (e.g. on initial commissioning).

Note!
For detailed information to how to set up the unit using the ReadWin® 2000 PC operating software can be found in the operating manual found on the data carrier.

6 Commissioning

6.1 Installation control

Make sure that all final installation checks have been made before starting to commission the unit:

- See Chap. 3.3 'Installation control'
- Check list Chap. 4.3 'Connection control'

6.2 Switch unit on

6.2.1 Basic unit

If there are no faults then the green LED illuminates once the power supply has been switched on.

- On initial commissioning of the unit the request "Please set up the unit using Set-up or Quick Setup" appears in the display. Set up the unit as described in chap 6.4.
- When commissioning a unit that has already been set up, the unit immediately starts to take measurements using the set-up configuration. The display indicates the values of the set-up display group. Entry to the main menu is done by pressing any key (see chap. 6.4).

6.2.2 Expansion cards

Once the power supply has been connected, the unit automatically recognises any expansion cards fitted. It is now possible to set up the application by configuring the new connections. Alternatively, this can be set up at a later time.

6.2.3 Remote display/operating module

The remote display/operating module is normally configured at the factory – Unit address 01, Baudrate 56,7k, RS485 master. The display automatically sets up communication with the base unit after the power supply has been switched on and a short initialisation time. Please make sure that the unit address of the base unit is the same as that of the remote display.

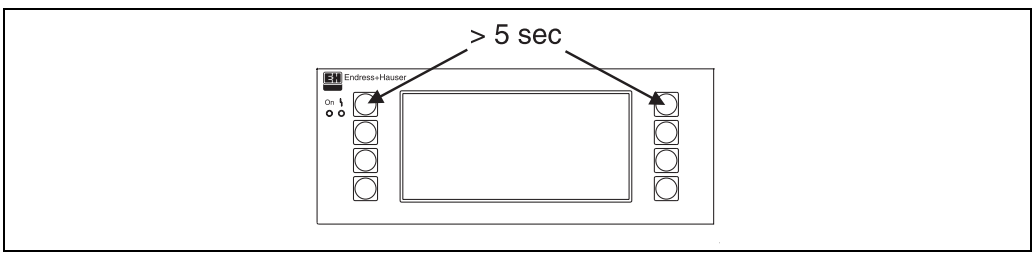


Fig. 21: Start Set-up menu

In the set-up menu the parameters for communication Baudrate and unit address as well as the contrast/viewing angle of the display can be set up. Simultaneous pushing of the left and right upper push buttons for 5 seconds initiates the set-up menu for the display/operating module.

Note!
The set-up menu is only available in English. Operation of the DIN rail mounted unit is not possible using the set-up menu. This is completely described in chapter 5.

Error messages

Should the error message "Communication problem" appear in the remote display/operating module after power up or during operation first check the connection made to the base unit then make sure that the baudrate and unit address set up corresponds with that in the base unit.

6.3 Quick Set-up

See chap. 6.4.2

6.4 Unit set-up

This chapter describes all presettable parameters contained in the unit including the respective range values and default values.
Please take note that the following description of presettable parameters such as terminal connections are dependent on the expansion of the basic unit (see chap. 6.2.2 Expansion cards).

Note!
Default values are highlighted in bold characters.

Main menu
On initial commissioning the request "Please set up unit using either Set-up or Quick Setup" appears in the display. Entry to the main menu is done by acknowledging this message. A correctly set up unit is always in the display mode. Once one of the eight keys is operated, the unit display changes to the main menu with its individual addresses: Display, Quick Setup (short form set-up) and Set-up (comprehensive set-up).

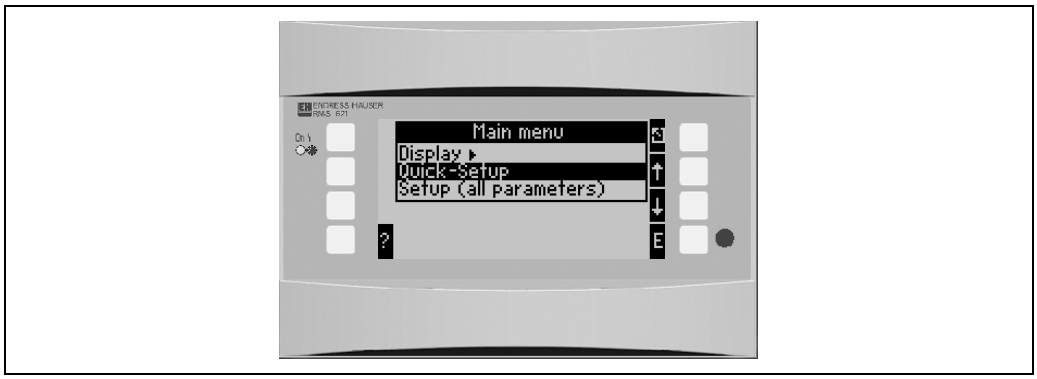


Fig. 22: Main menu display on the energy manager

6.4.1 Main menu - Display

In the display menu individual groups with process values can be selected to appear in the display. It is also possible to call on the event memory where the error protocol and other diverse unit information can be seen.
The contents of individual groups and the display function can only be defined in **Set-up → Display**. A group can contain a maximum of eight process values that can be viewed in one window on the display. When using the Quick Setup for commissioning, 1-2 groups and their most important display parameters are automatically generated.
The set-up for the alternating display (automatic change between one group and another), the contrast etc. is also done in the Set-up (see chap. 6.4.3 Main menu - Set-up: Display set-up).

Function (Menu address)	Parameter set-up	Description
Groups	Group 1 - Group 6	Selects groups of values that are to be indicated in the display.
Event memory		A list of all events recorded. These can be alarm set point conditions, sensor failures or changes to parameter set-up.
Terminal info		Short overview of all terminals available on the unit and the connections made to them. By operating the 'i' push button the instantaneous value (e.g. 10 mA) of the input signal is displayed.

Function (Menu address)	Parameter set-up	Description
Info		Display of unit data such as programme, name, version, software generation time and date (for service use).

6.4.2 Main menu - Quick Setup

Using the Quick Setup menu there is an easy and fast way to work through the application to be run. Here the user is led through the set-up step by step using **only** the operating addresses relevant to the application. More in depth unit set-up can be done in the unit basic set-up (see Chap. 6.4). This is specially valid for the display set-up, as this is automatically generated when using the Quick Setup. The most important process values for each application are displayed in two groups (Water heat quantity application in one group only). The display can be matched or changed in **Main menu - Setup - Display set-up**.

Note!
Flow measurement operating on differential pressure cannot be set up using the Quick Setup. Please configure the differential pressure unit using the standard Setup. (→ Chap. 6.4.3).

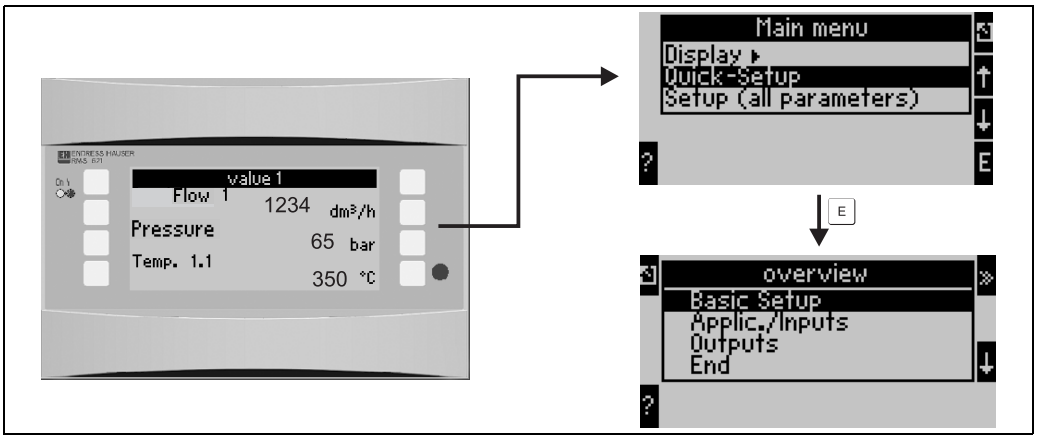


Fig. 23: Main and sub menu in Quick set-up

- **Unit set-up**
  This sub menu contains unit data such as unit identifier, date and time.
- **Application/inputs**
  All important parameters for the application to be calculated are to be found in this sub menu.
- **Outputs**
  Active and passive analogue and pulse outputs as well as relays are set up in this sub menu.
- **End**
  Exit Quick Setup

Quick Set-up - Set-up in individual steps

1. First check the unit set-up and select an application (**Menu: Applications/Inputs**).
2. The following operating addresses are predefined dependent on the application selected. Check the default values in each window and change these if required by the application (**'E' key**), before moving to the next address (**'>>' key**).
3. The application configuration is completed once all relevant addresses have been selected. Now the unit asks **"Set up further applications?"**.
4. Once all required applications have been set up, access to the output menu is possible. Here the units asks if the outputs are to be set up. Acknowledge the request with **OK**. Now the outputs can be set up as described in points 1 to 3.

5. Once the outputs have been defined the unit set-up is complete. The request **"Quick Setup will now end. Accept the changes made?"**. Acknowledge this request. Quick Setup is then ended.
6. The unit is now ready for operation and a group containing preset parameters appears in the display. A further group with preset parameters can be called up using **Display/Group**.

Note!
Please note the use of the double arrow function in the Quick Setup. Access to the next window in the operating structure is done using the double arrow right. To return the previous window use the double arrow left.

Note!
In the Quick Setup the inputs are automatically allocated free connection terminals. Please take note of these terminations when connecting the sensors or change the terminal selection in the set-up.

6.4.3 Main menu - Set-up

The following sub chapters and tables will contain a listing and description of all functions of the setup menu addresses that can be read out or used for configuration of the energy manager.

Set-up - Step by step set-up description

1. Set up inputs, this means allocating sensors to the inputs (terminals), or set up values (pressure/temperature).
2. Set up the application, this means select an application (e.g. steam mass) and allocate the set up sensors to this as well as selecting the system engineering units.
3. Set up outputs and alarm set points.
4. Set up display, this means select the process values, display mode (e.g scrolled display), colour change toggle.
5. Other unit settings required (e.g. communication set-up).

Caution!
When changing any parameter, always check the possible influence this will have on other parameters and on the total measurement system.

Setup → Unit set-up

The basic unit data is defined in this sub menu.

Function (Menu address)	Parameter set-up	Description
Unit identifier	**RMS 621**	Allocates a unit name (max. 12 characters).
TAG number		Allocation of a TAG number, e.g. as seen on circuit diagrams (max. 12 characters)
Date	DD.MM.YY	Actual set-up date. (country dependent) ✎ Note! Important for daylight saving time set-up
TIme	HH:MM	Actual set-up time for the unit's real time clock.
Text input	Standard **Palm**	Selection of text entry mode: • Standard: Each parameter character is scrolled from the available character set until the required character has been reached. • Palm: The required character can be selected from a keyboard seen on the screen by using the arrow keys.
Code		
• User- • Alarm set point-	**0000** - 9999 **0000** - 9999	Set-up operation of the unit is only released once the code has been successfully entered. Only the alarm set point set-up is released. Everything else remains locked out.
Summer/normal time change over		
Change over	off - manually - **auto.**	Type of change over
• Region	**Europe** - USA	Display of change over date from normal (NT) to summer (ST) times and reverse. This function is dependent 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 account the summer/normal time change over in Europe and USA at different times. Only selectable when summer/normal time change over has been set to "off". Time of change over. Only selectable when summer/normal time change over has been set to "off".

Note!
Dependent on the version 4 to 10 current, PFM, pulse and RTD inputs are available on the energy manager. These can be used for measuring flow, temperature, and pressure signals.

Setup → Flow

Up to three flowmeters for measuring flow can be connected to the unit. The signals from these flowmeters are simultaneously recorded and analysed. It is possible to use just one flowmeter for different applications (see menu address Terminals).

Function (Menu address)	Parameter set-up	Description
Flow inputs	Flow 1, 2, 3 Splitting range 1, 2, 3 Average flow	Set up of individual flow meters or a flow meter with expanded measurement range or automatic measurement range change over (split) by using multiple flow meters
Identifier	**Flow 1-3**	Identifies the flowmeter
Flow measurement device	Operational volume Mass Differential pressure	Set up of the flow principle being used e.g. if the flow signal is volume proportional, mass or differential pressure. Examples for flow devices operational volume (e.g. Vortex, mag., turbine), mass (e.g. Coriolis) and differential pressure (orifice plate, nozzle, etc.) Note! When using differential pressure devices please take note of the hints in the appendix "Flow measurement set-up".
Differential pressure device	Pitot Orifice corner tap Orifice D tap Orifice end tap. ISA 1932 nozzle Long radius nozzle Venturi tube Venturi pipe (cast iron) Venturi pipe (machined) Venturi pipe (sheet metal)	Construction of the differential pressure sensor Note! When using Pitot tubes a correction factor must be entered (see appendix 11.2.1) The values in brackets identify the type of venturi pipe. Note! Only active on flow meter/differential pressure.
Medium	Water Steam	Selection of medium to be measured. Note! Only active on differential pressure devices.
Signal type	**Please select** 4-20 mA 0-20 mA PFM Pulse	Select the flowmeter signal mode.
Terminals	**Not used** A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Allocates the terminal to which the flowmeter is connected. It is possible to use one sensor (flow signal) for more than one application. Select the respective terminal to which the signal required is connected in the application. (Multi calculations possible)
Curve	**Linear** Squared	Selection of the output curve used by the flow meter.
Time base	.../s; .../min; **.../h**; .../d	Time base for the flow signal engineering units in format: X per selected time base.
Engineering Units	l/...; hl/...; dm^3/...; **m^3/...**; bbl/...; gal/...; igal/...; ft^3/...; acf/... kg, t, lb, ton (US)	Volume unit for the flow signal in format: selected units times X Selectable only on flow device/mass

Function (Menu address)	Parameter set-up	Description
gal/bbl	31,5 (US), 42,0 (US), 55,0 (US), 36,0 (Imp), 42,0 (Imp), user def. **31,0**	Definition of the value of the used gal/bbl. US: US-Standard Imp: XX-Standard user defined: Freely selectable calculation factor allowed.
Format	9; **9.9**; 9.99; 9.999	Number of decimal points
Meter coeff.	Pulse value k factor	Selection of the meter coefficient type. pulse value (unit/pulse) k factor (pulses/unit)
Pulse unit	l, hl, ft^3, ...	Measurement unit for the pulse factor
Pulse value	0.001 to 99999	Set up what volume flow (in dm^3 or litre) is equal to one pulse of the flowmeter. ✎ Note! Only available on pulse signal mode.
Signal damping	0 to 99 s	Time constant of a 1st order low pass filter for the input signal. This function is used to avoid display fluctuations on high fluctuating input signals. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
K factor unit	pulses/dm^3 pulses/ft^3	Measurement unit for the K factor
K factor	0.001 to 9999.9	Input of the sensor pulse factor for the vortex sensor. This value can be found on the meter. ✎ Note! On vortex sensors using pulse signals the inverse of the K factor (in pulses/dm^3) is entered as the pulse factor (only required for PFM signals)
Diff. press. unit	mbar in/H_2O	Differential pressure engineering units
Start value	0.0000 to 999999	Start value for the flow (differential pressure) at 0 or. 4 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
End value	0.0000 to 999999	End value for the flow (differential pressure) value at 20 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99	Moves the zero point on the sensor curve. this function helps by fine adjustment of the sensor. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Flow Cut-off.	0.00.1 to 99.90.0 % **4.0 %**	Under a certain preset value the flow is no longer recorded or is set to 0. The creapage value is set as a %age of the flow measurement full scale deflection or as a fixed flow value (e.g. in m3/h) dependent on the type of flow meter used.
Correction	Yes **No**	Possibility to correct the flow measurement reading. If "Yes" is selected the sensor used curve can be defined in the sol called correction table and there is also a possibility to compensate the temperature influence on the flow measuring device (see "Thermal coefficient").
Therm. coefficient	0.00 to 999.99 * 10^{-6}	Correction factor used to compensate the temperature influence on the flow measurement device. This factor is often identified on the meter legend plate in. for example, turbulent flow measurement. If the value for the expansion coefficient is not known or the flow measurement device compensates this automatically then a "0" must be entered in this address. ✎ Note! Hint! Only active when the correction address is active. Not selectable for differential pressure devices!

Function (Menu address)	Parameter set-up	Description
Correction table	Current/flow Frequency/K factor Flow/factor	Should the flow curve of the flow measurement device deviate from the ideal (linear or squared) this can be compensated for by set up of the correction table. The parameters in the table are dependent on the selected flow measurement device. • Analogue signal Up to 15 pairs of values (current/flow) • Pulse signal Up to 15 pairs of values (frequency/k factor or frequency/pulse value) • Differential pressure Up to 10 pairs of values (flow/factor) For details see 'Correction tables' in the appendix.
Pipe data	Pipe internal diameter Diameter ratio	Input of the pipe line internal diameter. Input of the diameter ratio (d/D = ß) of the differential pressure device. This value will be supplied by the manufacturer of the differential pressure device. ✎ Note! Addresses are only active on differential pressure devices. On standard pressure devices only enter the pipe internal diameter.
Sums	l, hl, dm^3, m^3	Set up the sum counter
Splitting range		Splitting range or automatic measurement range change over for differential pressure devices. ✎ Note! Only selectable for differential pressure measurements. For details see 'Splitting range' in the appendix.
Term. range 1	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminals for connection to the differential pressure range with the smallest measurement range
Term. range 2	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminals for connection to the differential pressure range with the second largest measurement range
Term. range 3	A-10; A-110; B-112; B-113; C-112; C-113; D-112; D-113	Terminals for connection to the differential pressure range with the largest measurement range
Correction table	Yes No	See above correction table
Range start 1 (2, 3)	0.0000 to 999999	Start value for differential pressure at 0 or 4 mA, defined for the pressure transmitter in range 1 (2,3) ✎ Note! Only active if a terminal has been allocated.
Range end 1 (2, 3)	0.0000 to 999999	End value for differential pressure at 20 mA, defined for the pressure transmitter in range 1 (2,3) ✎ Note! Only active if a terminal has been allocated.
Average flow	**Not used** 2 sensors 3 sensors	Average value calculation from a number of flow signals (For details see 'Average calculation' in the appendix)

Setup → Pressure

A maximum of three pressure sensors can be connected to the unit. A single sensor can be used for two or all three applications, see address "Terminals" in the following table.

Function (Menu address)	Parameter set-up	Description
Identifier	**Pressure 1-3**	Identifies the pressure sensor, e.g. 'Return pressure'. (max. 12 characters)
Signal type	**Please select** 4-20 mA 0-20 mA Default	Selects the signal type for the pressure sensor. On setting "default" the unit operates with a preset pressure.
Terminal	**Not used** A-11; A-12; B-11; B-12; C-11; C-12; D-11; D-12	Allocates the terminal to which the pressure sensor is connected. It is possible to use one sensor (pressure signal) for more than one application. Select the respective terminal to which the signal required is connected in the application. (Multi calculations possible)
Engineering Units	**bar**; kPa; kg/cm^2; psi; bar (g); kPa (g); psi (g)	Physical engineering unit of the measured pressure. (g) = gauge, appears in the display when the engineering unit has been selected as 'relative'. Identifies the relative pressure.
Engineering unit type	**absolute** relative	Indicates if the pressure measured is in absolute or relative pressure (over pressure) units. If relative pressure is selected then atmospheric pressure must also be entered in this section.
Format	9; **9.9**; 9.99; 9.9.9999	Number of decimal points
Signal damping	0 to 99 s	Time constant of a 1st order low pass filter for the input signal. This function is used to avoid display fluctuations on high fluctuating input signals. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Start value	0.0000 to 999999	Start value for the pressure value at 0 or 4 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
End value	0.0000 to 999999	End value for the pressure value at 20 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99	Moves the zero point on the sensor curve. This function helps by fine adjustment of the sensor. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Atmospheric pressure	0.0000 to 10000.0 **1.013**	Set up the ambient atmospheric pressure, in bar, at the point of installation. ✎ Note! Address is only active if the "relative" was selected in engineering unit type.
Default	-19999 to 19999	Set-up of a predefined pressure with which the unit will continue to operate as "default" if the sensor signal fails.
Average	**Not used** 2 sensors 3 sensors	Average value calculation from a number of pressure signals (For details see 'Average calculation' in the appendix)

Setup → Temperature

Dependent on the model of the unit between one and six different temperature sensors (RTD, TC) can be connected. A single sensor can be used for two or all three applications, see address "Terminals" in the following table.

Function (Menu address)	Parameter set-up	Description
Identifier	**Temperature 1-6**	Identifies the temperature sensor, e.g. 'inflow temp.'.
Signal type	**Please select** 4-20 mA 0-20 mA Pt100 Pt500 Pt1000 Default	Selection of the temperature sensor signal type. On setting "Default" the unit operates with a fixed predefined temperature.
Sensor	**3-wire** 4-wire	Set up sensor connection mode in 3- or 4-wire connection. ✎ Note! Selectable only for Pt100/Pt500/Pt1000 signals.
Terminal	**Not used** 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	Allocates the terminal to which the temperature sensor is connected. It is possible to use one sensor (temperature signal) for more than one application. Select the respective terminal to which the signal required is connected in the application. (Multi calculations possible) ✎ Note! Terminal identifier X-1X (e.g. A-11) describes a current input, the identifier X-2X (e.g. E-21) indicates a pure temperature input. The type of input is dependent on the extension cards.
Engineering Units	**°C**; K; °F	Engineering units of the temperature measurement.
Format	9; **9.9**; 9.99; 9.999	Number of decimal points
Signal damping	0 to 99 s **0 s**	Time constant of a 1st order low pass filter for the input signal. This function is used to avoid display fluctuations on high fluctuating input signals. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Start value	-9999.99 to 999999	Start value for the temperature signal at 0 or 4 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
End value	-9999.99 to 999999	End value for the temperature signal at 20 mA. ✎ Note! Only selectable for the 0/4 to 20 mA signal.
Offset	-9999.99 to 9999.99 **0.0**	Moves the zero point on the sensor curve. this function helps by fine adjustment of the sensor. ✎ Note! Only selectable for the signal0/4 to 20 mA signal.
Default	-9999.99 to 9999.99 **20 °C or 70 °F**	Set-up of a predefined temperature with which the unit will continue to operate as "default" if the sensor signal fails.
Average temp.	**Not used** 2 sensors 3 to 8 sensors	Average value calculation from a number of temperature signals (For details see 'Average calculation' in the appendix)

Setup → Application

The energy manager can operate with the following application: **Steam mass, steam heat quantity, net steam heat quantity, steam heat differential, water heat quantity and water heat differential**. Up to **three different applications can be run at the same time** (this means simultaneous operation of up to 3 complete measurement points).
Set-up of an application can be done independently of the applications running. Please note that after successfully setting up a new application or changing values in an already existing application, the new data is only accepted after the user has acknowledged the release of the data. After this release the unit operates a new start.

Function (Menu address)	Parameter set-up	Description
Identifier	**Application 1-3**	Identifies the preset application, e.g. 'Boiler house 1'.
Application	**Not used** Steam mass Steam heat Net. steam S heat diff Water heat Water heat diff	Selects the required application. If an already existing application is to be switched off select "Not used".
Steam type	**Super heat steam** Saturated steam	Select the steam type to be used in the application (only required in steam applications).
Inputs	Q + T **Q + P**	Inputs on sat steam applications Q + T: Flow and temperature Q + P: Flow and pressure Only two input signals are required when measuring saturated steam, the missing value will be automatically calculated by the unit using the built-in saturated steam curve (only on steam type 'saturated steam'). Input signals for flow, pressure and temperature are required for measuring superheated steam. ✎ Note! Only on saturated steam applications.
Operating mode	**Heating** Cooling Bi-directional **Heating** Steam production	Select the mode of the energy application (cooling) on energy use or (heating) on energy distributed. Bi-directional operation, describes a heat circuit that can be used for both heating **and** cooling. ✎ Note! Only applicable for water heat differential applications. Selection whether steam is used for heating purposes or whether steam is being produced from water. ✎ Note! Only applicable for steam heat- heat differential applications.
Flow direction	Constant Changing	Selection if the heat circuit flow direction is in bi-directional mode. ✎ Note! Only applicable on bi-directional operating mode
Direction terminal	Terminal	Terminal for connection to the direction signal of the flowmeter. ✎ Note! Only applicable in bi-directional operating mode with changing flow direction.
Flow	**Please select** Flow 1-3	Allocates the application to a particular flowmeter. Only the flowmeters that have already been set up (see "Setup: Flow") are available for selection.

Function (Menu address)	Parameter set-up	Description
Flow installation point	Warm **Cold**	Set up in which thermal area the flowmeter is installed for this application (only active on water heat difference). On steam/heat differential the installation point is defined as follows: Heating: Warm (means steam flow) Steam production: Cold (means water flow) ✎ Note! On bi-directional operating mode please select the parameters analogue to the heating mode.
Pressure	**Please select** Pressure1-3	Allocate the pressure sensor to the application. Only the sensors that have already been set up (see "Setup: Pressure") are available.
Average pressure	**10.0 bar**	Set up the average process pressure (absolute) in the heating circuit. ✎ Note! Applicable only on water applications
Temperature	**Please select** Temperature 1-6	Allocate the temperature sensor to the application. Only the sensors that have already been set up (see "Setup: Temperature") are available. ✎ Note! Set-up not active for differential applications.
Temperature cold	**Please select** Temperature 1-6	Allocation of the sensor that measures the lowest temperatures in the application. Only the sensors that have already been set up (see "Setup: Temperature") are available. ✎ Note! Set-up only active for heat differential measurement applications.
Temperature warm	**Not used** Temperature. 1-6	Allocation of the sensor that measures the highest temperatures in the application. Only the sensors that have already been set up (see "Setup: Temperature") are available. ✎ Note! Set-up only active for heat differential measurement applications.
Minimum temp. diff.	**0.0** to 99.9	Set-up the minimum temperature difference. If the measured temperature difference is lower than this value then the heat quantity is no longer calculated. ✎ Note! Set-up only active for water heat differential measurement applications.
Engineering units		Set up the engineering units that will be displayed for each individual application. (see "set up units")
Sums		Set up the sum counter.

Engineering units
The unit is capable to operate each individual application using different engineering units. The engineering units for each application are set up in the sub menu **Setup (all parameters) → Application → Application ... → Eng. units**. The following set-up is possible:

Note!
The selection of the engineering units for the flow (volume), pressure and temperature is done in the set-up for each individual sensor.

Function (Menu address)	Parameter set-up	Description
Time base	.../s; .../min; **.../h**; .../d	Time base for the flow engineering units in format: X per selected time 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 preset time unit or the thermal power.
Heat sum	kW * time, MW * time, kcal, Gcal, GJ, KBtu, Mbtu, Gbtu, ton * time **MJ**, kJ	Engineering unit for the heat quantity or thermal energy.
Mass flow	g/time, t/time, ibs/time, tons(US)/time, tons/time **kg/time**	Engineering unit for the mass flow per previously defined time unit.
Mass sum	g, T, ibs, tons (US), tons **kg**	Engineering unit of the calculated mass sum.
Density	kg/dm, Ibs/gal, Ibs/ft **kg/m**	Engineering unit for density.
Temperature difference	°C, K, °F **°C**	Engineering unit for temperature difference.
Enthalpy	kWh/kg, MJ/kg, kcal, kg, Btu/Ibs **MJ/kg**	Engineering units for the specific enthalpy (measurement of the heat content of the medium.)
Format	9 **9.9** 9.99 9.999	Number of decimal points with which the above values are to be indicated in the display.
gal/bbl	31,5 (US), 42,0 (US), 55,0 (US), 36,0 (Imp), 42,0 (Imp), user def. **31,0**	Definition of the value of the used gal/bbl. US: US-Standard Imp: XX-Standard user defined: Freely selectable calculation factor allowed.

A definition of the important system engineering units can be found in Chapter 11 "Appendix" of these operating instructions.

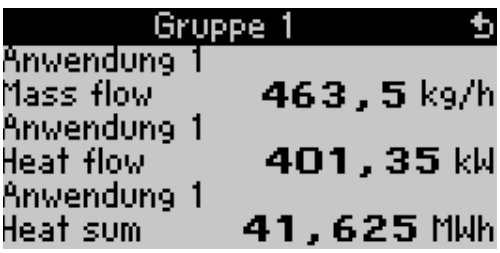
Sum (counters)
For each application there are two counters available for mass and heat quantity. Only one of these can be preset or reset. The non-resettable counter is used for totalisation. This is indicated with a "Σ" in the display. (menu address: **Setup (all parameters) → Display → Group 1... → Value 1... → Σ Heat sum ...**.
Any sum counter overflow is recorded in the event memory (menu address: **Display/Event memory**). Optionally the counters can be set to display exponentially see: **Setup (all parameters) → Display → Indication → Display Sums**.
The sum counters are set up in the sub menu **Setup (all parameters) → Application → Application ... → Sums**.

Function (Menu address)	Parameter set-up	Description
Heat Heat (-) *	0 to 99999999.9	Heat sum counter for the selected application. Can be preset and reset.
Mass Mass (-) *	0 to 99999999.9	Mass sum counter for the selected application. Can be preset and reset.

* There are an additional two sum counters plus two totalisers when operating in bi-directional mode. The additional counters are identified with (-), the other counters with (+). Example: The charging of a boiler is recorded by the "+"-counters, the discharge by the "-"-counters.

Setup → Display

The display operation of the unit can be independently set up. Up to six groups each containing between 1 and 8 presettable process values can be displayed individually or in an automatic scroll mode. The display size of the process values is dependent on the number of values in each group.



When displaying one to three values in one group then all values are shown including the application name and description (e.g. heat sum) as well as the respective engineering units.
From four values only the values and engineering units are displayed.

Display set-up can be found in the menu **Setup (all parameters) → Display.**

Note!
Selection of which group containing process values is to be indicated in the display is done in **Main menu → Display → Group, see chap. 6.4.1.** The selection is invalid on scrolled display operation (automatic change between groups).

Note!
If 7 values are defined in one group the display parameter "Date and Time" is only displayed on the positions 1 – 5. With 8 values in one group the display combination "Date and Time" is only displayed in positions 1 – 4. 'Date' or 'Time' seen as single positions can always be displayed in all positions.

Function (Menu address)	Parameter set-up	Description
Group 1 to 6 Identifier		For better overview of individual groups these can be allocated individual descriptive names, e.g. 'Overview inflow'. (max. 12 characters)

Function (Menu address)	Parameter set-up	Description
Display mask	1 value to 8 values **Please select**	Set the number of process values that are to be displayed next to each other in one window (as a group) in the display. The size of the characters are dependent on the number of selected values to be displayed. The more values in a group the smaller the value characters are shown in the display.
Value1 to 8	**Please select**	Select which process values are to be displayed.
Scrolling display		Change of individual groups shown in the display.
Switch time	0 to 99 **0**	Seconds until the next group is displayed.
Group X	Yes **No**	Select the groups that are to be scrolled in the display.
Colour change		Set up that certain events or faults are signalled by a colour change in the display (from blue to red)
Alarm set point	**Yes** No	The display rear illumination colour changes from blue to red on violation of the preset alarm set points.
Wet steam alarm	**Yes** No	If the temperature in a sat. steam application gets to within 2% of the sat. steam curve an alarm message occurs. The display rear illumination colour changes from blue to red.
Sensor fault	**Yes** No	Failure of a sensor signal is indicated by a change of rear illumination colour to red.
Over range	**Yes** No	If a sensor goes over or under range the rear illumination changes to red.
Display		
OIML display	**Yes** No	Selection if the counter values are to be displayed according to the OIML-Standard.
Disp. sum	Counter mode **Exponential**	Display of the sum counter/totalizers Counter mode: Sum will be shown with a max. of 10 digits and then it will roll over. Exponential: For large values the display will switch to scientific exponential display.
Contrast	2 to 63 **46**	Set-up for the display contrast. This set-up takes immediate effect. The contrast value is stored once the setup has been exited.

Setup → Analogue outputs

The set-up possibilities for the analogue outputs are described in this section. Please note that the outputs can be used as analogue and pulse outputs, the required signal type can be selected in the set-up. Dependent on the model (expansion cards) between 2 and 8 outputs are available.
Sub menu **Setup (all parameters) → Analogue outputs.**

Function (Menu address)	Parameter set-up	Description
Identifier	Analogue out. 1 to 8	For easier identification the analogue output can be allocated an identification name. (max. 12 characters).
Terminal	B-131, B-133 C-131, C-133 D-131, D-133 E-131, E-133 **Not used**	Sets the terminals onto which the analogue output signal is to be transmitted.

Function (Menu address)	Parameter set-up	Description
Signal source	Density 1 Enthalpy 1 Flow 1 Mass flow 1 Pressure 1 Temperature 1 Heat flow 1 **Please select**	Sets which calcualted or measured values are to be transmitted to the analogue output. The number of signal sources is dependent on the number of applications set up and inputs.
Current	**4 to 20 mA**, 0 to 20 mA	Sets the operating mode of the analogue output.
Start value	-999999 to 999999 **0.0**	Smallest output value of the analogue output.
End value	-999999 to 999999 **100**	Largest output value of the analogue output.
Signal damping (time constant)	0 to 99 s **0 s**	Time constant of a 1st order low pass filter for the input signal. This function is used to avoid display fluctuations on high fluctuating input signals. (Only for 0/4 and 20mA signals).
Fault conditioning	Minimum Maximum value **Last measured value**	Defines the behaviour of the output in a fault condition e.g. if the measurement of a sensor fails.
Value	-999999 to 999999 **0.0**	Fixed value that is to be transmitted to the analogue output in a fault condition. ✎ Note! Only valid for the fault conditioning set-up; value selectable.
Simulation	0 - 3,6 - 4 - 10 - 12 - 20 - 21 **off**	The function of the current output is simulated, when the set-up is not equal to "off". The simulation ends once this address has been left.

Setup → Alarm set points

Relays or passive digital outputs (open collector) are available for the alarm set point function in the unit. Dependent on the model between 1 and 13 alarm set points are possible.
Sub menu **Setup (all parameters) → Alarm set points.**

Function (Menu address)	Parameter set-up	Description
Identifier	Alarm set point 1 to 13	For a better overview the alarm set points can be allocated an identification name. (max. 12 characters)
Transmit to	Display Relay Digital **Please select**	Allocation where the alarm set point is to be transmitted (passive digital output only available on extension cards).
Terminal	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 **Not used**	Sets the terminals for the selected alarm set point. Relay: Terminals X-14X, X-15X Digital: Terminals X-13X

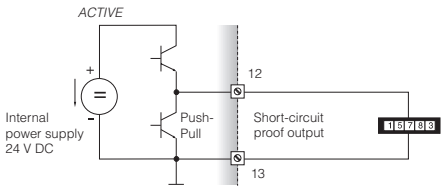
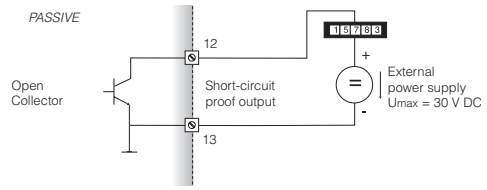
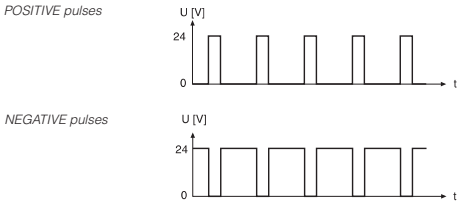
Function (Menu address)	Parameter set-up	Description
Operating mode	Max+Alarm, Grad.+Alarm, Alarm, Min, Max, Gradient, Wet steam Unit fault **Min+Alarm**	Defines the event that is to trigger the alarm set point. • **Min+Alarm** Minimum safety, event message on undercutting the alarm set point with simultaneous monitoring of the signal source to NAMUR NE43 • **Max+Alarm** Maximum safety, event message on undercutting the alarm set point with simultaneous monitoring of the signal source to NAMUR NE43 • **Grad.+Alarm** Gradient analysis event message of exceeding the predefined signal change per time unit of the signal source with simultaneous monitoring of the signal source to NAMUR NE43 • **Alarm** Monitoring of the signal source to NAMUR NE43, No alarm set point function • **Min** Event message on undercutting the alarm set point without monitoring to NAMUR NE43 • **Max** Event message on exceeding the alarm set point without monitoring to NAMUR NE43 • **Gradient** Gradient analysis event message of exceeding the predefined signal change per time unit of the signal source without monitoring to NAMUR NE43 • **Wet steam** Event message on wet steam alarm • **Unit failure** Event message on a unit fault
Signal source	Flow 1, Heat flow 1, Mass 1, Flow 2, etc. **not used**	Signal source for the selected alarm set points. ✎ Note! The number of signal sources is dependent on the number of applications and inputs set up.
Switch threshold	-19999 to 99999 **0.0**	Smallest output value of the analogue output
Hysteresis	-19999 to 99999 **0.0**	Input of the return switch threshold of the alarm set point. This is in order to avoid hunting on the alarm set point.
Time delay	0 to 99 s **0 s**	Time span for the alarm set point condition before it is displayed. Suppression of spikes in the sensor signal.
Gradient -Δx	-19999 to 99999 **0.0**	Counter values for the signal change for the gradient analysis (rise function)
Gradient -Δt	0 to 100 s **0 s**	Time interval for the signal change in the gradient analysis
Gradient -return value	-19999 to 99999 **0**	Return switch threshold for the gradient analysis
Event text - alarm on		The alarm set point violation (exceeding value) can be allocated an event text. Dependent on the settings this will appear in the event buffer and the display (see 'Event text alarm message')
Event text - alarm off		The alarm set point violation (undercut value) can be allocated an event text. Dependent on the settings this will appear in the event buffer and the display (see 'Event text alarm message')

Function (Menu address)	Parameter set-up	Description
Event text alarm message	display+ack. **do not display**	Definition of the alarm set point message mode. **Do not display:** The alarm set point violation or the undercutting of an alarm set point is listed in the event buffer. **Display+ack:** In addition to the entry into the event memory an event message is shown on the display. The message will only disappear after it has been acknowledged.

Pulse outputs

The pulse output function can be set up as active, passive outputs or relays. Dependent on the model between 2 and 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**	Pulse output allocation. **Active:** Active voltage pulses are transmitted. Power is supplied bythe device. **Passive:** Passive open collectors are available in this operating mode. Power must be supplied externally. **Relay:** The pulses are transmitted to a relay. (Max. frequency is 5Hz) ✎ Note! "Passive" can only be selected when expansion 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 from which the pulses are to be transmitted.
Sig. source	Heat sum 1, Heat sum 2, Flow sum 1, Flow sum 2, etc. **Select**	Setting as to which variable should be transmitted at the pulse output.
Pulse		

Function (menu item)	Parameter setting	Description
Type	Negative **Positive**	Makes it possible to transmit 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: rest peak at 0 V ("active-high") • NEGATIVE: rest peak at 24 V ("active-low") or external power supply  For continuous currents up to 15 mA  For continuous currents up to 25 mA  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	Pulse output engineering unit. ✎ Note! Pulse engineering 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: $\text{Pulse value} > \frac{\text{Estimated max. flow (end value)}}{\text{Desired max. output frequency}}$
Set 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.
Pulse width	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**	In this addressthe pulse output function can be simulated. Simulation is active if the setting is not "off". Simulation ends if you leave this address.

Setup → Communication

As a standard an RS232 interface is fitted to the front of the unit and an RS485 interface is available on terminals 101/102.
Sub menu **Setup (all parameters) → Communication.**

Function (Menu address)	Parameter set-up	Description
Unit address	0 to 99 **00**	Unit address for communication using the serial interface.
RS232		
Baudrate	9600 19200 38400 **57600**	Baudrate for the RS232 interface
RS485		
Baudrate	9600 19200 38400 **57600**	Baudrate for the RS485 interface

Setup → Extras

Set-up of general unit data such as software version
Sub menu **Setup (all parameters) → Extras**

Function (Menu address)	Parameter set-up	Description
Prog. name		The name that is saved, together with all settings, on the ReadWin® 2000 operating software.
SW Version		Unit software version.
SW Option		Information, which extension cards are installed.
CPU no.		The unit CPU number operates as identification feature. This is always saved together with all parameters.
Series no.		Unit series number.
Run time 1. Unit 2. LCD		1. Information, how long the unit has been in operation (protected by the service code). 2. Information for the unit display operating time (protected by the service code.)

Setup → Service

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

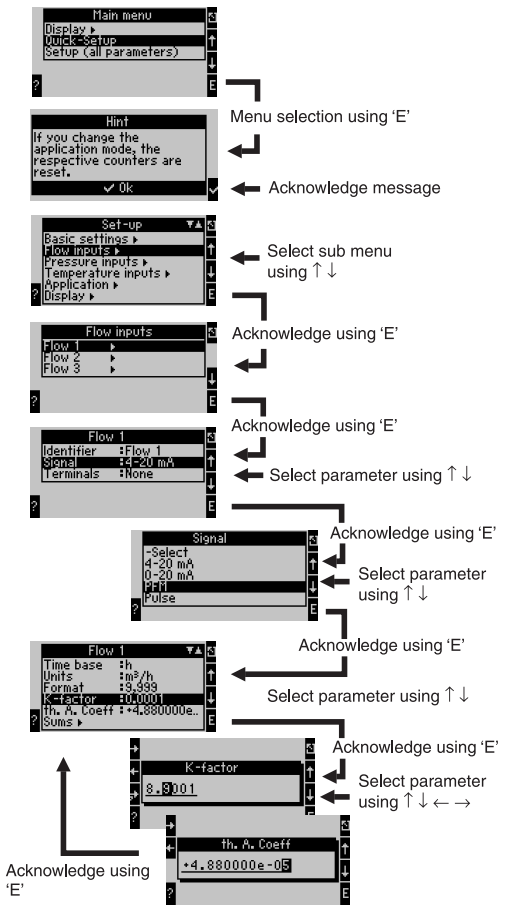
Function (Menu address)	Parameter set-up	Description
Service code		
Preset		In this address the unit can be rest to all factory default settings (protected by the service code). ✎ Note! All setting made will be reset and therefore be null and void.
Counter stop	Yes No	Counter reaction on wet steam alarm. No: Counter is not influenced Yes: Counter freezes until the steam condition stabalises (=saturated steam)
Totalizer	Sums application 1 Sums application 2 Sums application 3	Totalizer display. ✎ Note! Information for service: cannot be edited!

6.5 Customer-specific applications

6.5.1 Steam mass application

Monitoring the superheated steam in a feed pipe of a plant (20 t/h rating, approx. 25 bar). The steam quantity is used to operate the plant. This is never allowed to go below 15 t/h steam flow. This is to be monitored by the alarm set point in the energy manager and retransmitted using a relay.
The display of the energy manager is to scroll through one mask containing mass flow, pressure, temperature and another with summed mass flow.
The following sensors are used for measurement:

- Volume flow: Vortex sensor (e.g. Prowirl)
  Legend plate indication: K-factor: 38.9; Signal type: PFM, Alpha-factor: $4.88x10^6$
- Pressure: Pressure sensor (e.g. Cerabar; 4 to 20 mA, 0.005 to 40 bar)
- Temperature: Pt100 temperature sensor



1. **Flowmeter (Setup-Menu Flow):**
   Flow 1,
   Signal type PFM,
   K-factor: 38.9,
   th. A coeff.:4.88x108
   (operating example see fig. on the left).
2. Pressure sensor (Setup-Menu pressure):
   Pressure 1,
   Signal type: 4 to 20 mA,
   Start value 0.005 bar,
   End value 40 bar,
   Default 25 bar (Pressure with which the RMS 621 will continue to operate on sensor failure)
3. Temperature sensor (Setup-Menu temperature):
   Temp. 1.1,
   Signal type Pt100,
   Default (enter the medium expected operating temperature)
4. Set up application (Setup-Menu application):
   Application1,
   Steam mass,
   Superheated steam,
   Flow1,
   Pressure 1,
   Temp1.1,
   Engineering units: Mass flow t/h, Mass sum t
5. Set up display (Setup-Menu display):
   Group1: 3 values (mass flow, pressure, temperature)
   Group 2: 1 value (mass sum) scrolled: 10 seconds,
   Group 1: Yes,
   Group 2 : Yes
6. Set up alarm set point:
   Relay,
   operating mode Min+Alarm,
   signal source mass flow,
   switch point 15 t/h,
   hysteresis 0.5 t/h (this means relay reset at 15.5 t/h)

7 Maintenance

There is no special maintenance required on the Energy manager.

8 Accessories

Description	Order code
RS232 serial interface cable with 3.5 mm jack plug, with ReadWin® 2000 PC software package, for connection to PC	RMS621A-VK
Remote mounted display for 144 x 72 mm panel mounting	RMS621A-AA
Field housing	52010132
Profibus DP slave module	RMS621A-P1
Housing fixing slide	RMS621X-HC

9 Fault-finding

9.1 Troubleshooting instructions

Should faults occur after commissioning or during operation always start fault-finding using the following check lists. Using various questions the operator is led systematically through the unit to the cause and gives the necessary cure.

9.2 System error messages

Display message	Cause	Cure
Config error (red display): • Pressure • Analogue temperature • PTx Temperature • Analogue flow! • PFM-pulse flow! • Applications! • Alarm set points! • Analogue outputs! • Pulse outputs!	• Faulty or incomplete set-up or loss of calibration data • Incorrect terminal allocation	• Check that all necessary addresses have been defined using plausible values. (→ Chap. 6.4.3 Main menu - Setup) • Check whether inputs have been allocated incorrectly (e.g. Flow 1, allocated two different temperatures). (→ Chap. 6.4.3 Main menu - Setup)
Counter error	• Fault in data recording in the counter register • Data in counter register faulty	• Reset counters (→ Chap. 6.4.3 Main menu - Setup) • Inform E+H-Service, if the fault cannot be removed
Calibration data error Slot „xx“	Factory default calibration data faulty or cannot be read.	Remove card and refit (→ Chap. 3.2.1 Installation of expansion cards). Contact E+H Service if the fault message appears again.

Display message	Cause	Cure
Card not recognised Slot „xx“	• Plug-in card defective • Plug-in card not fitted correctly	Remove card and refit (→ Chap. 3.2.1 Installation of expansion cards). Contact E+H Service if the fault message appears again.
Messages on software errors: • Fault on reading actual read address • Fault on reading actual write address • Fault on reading actual oldest value • adr "Address" • DRV_INVALID_FUNCTION • DRV_INVALID_CHANNEL • DRV_INVALID_PARAMETER • I2C-Bus error	Fault in programme	Inform E+H Service organisation
"Communication problem"	No communication between the remote display/operating unit and the basic unit	Connection control of the remote display/operating unit (→ Fig. 1 53); Baudrate and unit address have to be the same in the basic unit as well as in the remote display/operating unit.

9.3 Process error messages

Display message	Cause	Cure
Wet steam alarm	The steam calculated from temperature and pressure is 2 °C above the saturated steam temperature (danger of condensation of the steam).	• Check the application, transmitters and connected sensors. • If the "WET STEAM ALARM" is not required change the alarm set point function (→ Setup, Alarm set points, Chap. 6.4.3) or deactivate display colour change (Setup → Display → Colour change, Chap. 6.4.3)
Temp. out of steam range!	The measured temperature is outside the allowable steam value range. (0 to 800°C)	Check the set-up and the connected sensors. (→ Setup, Inputs, Chap. 6.4.3)
Pressure out of steam range!	The measured pressure is outside the allowable steam value range. (0 to 1000 bar)	Check the set-up and the connected sensors. (→ Setup, Inputs, Chap. 6.4.3)
Max. sat. steam temp. exceeded!	The measured or calculated temperature is outside the saturated steam range (T>350°C)	• Check the set-up and the connected sensors. • Set-up steam type "super heat" and use measurement using three input values (Q, P, T). (→ Setup, Applications Chap. 6.4.3)

Display message	Cause	Cure
Steam condensate temperature	The measured or calculated temperature equals the condensate temperature of saturated steam	• Check application, transmitters and connected sensors. • Take steps to improve process control - increase temperature, decrease pressure. • Possible inaccurate temperature or pressure measurement; purely a calculation of the phase change from steam to water, that really does not occur; inaccuracy from set up of a temperature compensation (approx. 1 - 3 °C) offset.
Water: Distillation temperature	The measured temperature is equal to the distillation temperature of water (water evaporates!)	• Check application, transmitters and connected sensors. • Take steps to improve process control - decrease temperature, increase pressure.
Signal range violation: "Channel ident." "Signal ident."	Output current signal is smaller than 3.8 mA or higher than 20.5 mA.	• Check if the current output is correctly scaled. • Change the scale start and end values.
Cable open circuit: "Channel ident." "Signal ident.")	Input current is smaller than 3.6 mA or higher than 21 mA. • Incorrect cabling • Sensor not set to 4–20 mA range. • Functional fault at sensor • Incorrect end value set-up on flowmeter.	• Check sensor set-up • Check sensor function • Check end value of connected flowmeter • Check cabling
Cable open circuit: "Channel ident." "Signal ident.")	Too high resistance at the PT 100 input, e.g. caused by short circuit or cable breakage • Incorrect cabling • PT100 sensor defective	• Check cabling • Check PT100 sensor function
Min. temp. diff. undercut	Overhang of the preset temperature differential	Check actual temperature values and the preset minimum temperature differential.
Alarm set point violation • "Alarm set point ident." < "Threshold" "Eng. unit" • "Alarm set point ident." > "Threshold" "Eng. unit" • "Alarm set point ident." > "Gradient" "Eng. unit" • "Alarm set point ident. < "Gradient" "Eng. unit" • "User defined message"	Alarm set point violation (higher or lower than). (→ Setup, Alarm set points, Chap. 6.4.3)	• Acknowledge alarm message if the function “Alarm set point/Event text/Display and acknowledge“ has been set up. (→ Setup, Alarm set points, Chap. 6.4.3) • If required check application • If required reset alarm set points

9.4 Spare parts

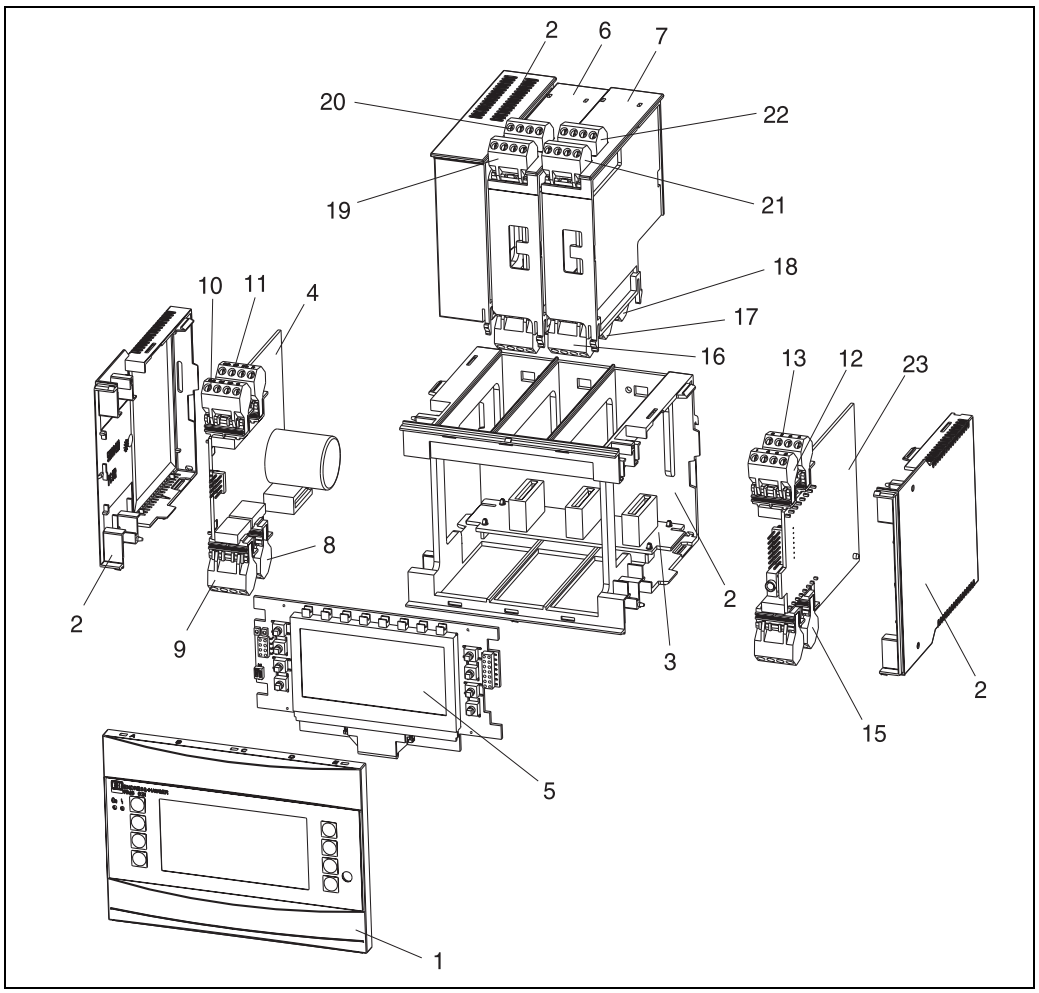


Fig. 24: Energy manager spare parts

Pos.-No.	Order code	Spare part
1	RMS621X-HA	Front cover without display
1	RMS621X-HB	Front cover with display
2	RMS621X-HC	Housing complete without front incl. three blind inserts and three PCB carriers
3	RMS621X-BA	Bus PCB
4	RMS621X-NA RMS621X-NB	90 to 250 V AC power supply 18 to 36 V DC/20 to 28 V AC power supply
5	RMS621X-DA RMS621X-DB RMS621X-DC RMS621X-DD	Display Front PCB for version without display Display + front cover Display + front cover, neutral
6	RMS621A-TA	Temperature extension PCB (Pt100/Pt500/Pt1000) complete incl. terminals and fixing frame
7	RMS621A-UA	Universal input extension PCB (PFM/pulse/analogue/loop power supply) complete incl. terminals and fixing frame
8	51000780	Power terminals
9	51004062	Relay terminals/loop power supply
10	51004063	Analogue terminal 1 (PFM/pulse/analogue/loop power supply)

Pos.-No.	Order code	Spare part
11	51004064	Analogue terminal 2(PFM/pulse/analogue/loop power supply)
12	51004067	Temperature terminal 1 (Pt100/Pt500/Pt1000)
13	51004068	Temperature terminal 2 (Pt100/Pt500/Pt1000)
14	51004065	RS485 terminal
15	51004066	Output terminal (analogue/pulse)
16	51004912	Relay terminal (extension board)
17	51004066	Extension board: Output terminal (4 to 20 mA/pulse)
18	51004911	Extension board: Output terminal (open collector)
19	51004907	Extension board: Input terminal 1 (Pt100/Pt500/Pt1000)
20	51004908	Extension board: Input terminal 2 (Pt100/Pt500/Pt1000)
21	51004910	Extension board: Input terminal 1 (4 to 20 mA/PFM/pulse/loop power supply)
22	51004909	Extension board: Input terminal 2 (4 to 20 mA/PFM/pulse/loop power supply)
23	RMS621X1-	CPU for energy manager (for set-up see below)

Controller/CPU				
	Operating language			
	A	German		
	B	English		
	F	French		
	I	Italian		
	K	Czech		
		Communication		
		A	Standard (RS232 and RS485)	
		B	2. RS485 for communication with remote panel display	
			Model	
			A	Standard
RMS621C-			**A**	**← Order code**

9.5 Returns

When returning the unit, e.g. for repair, please make sure that it is correctly packed. Optimum protection is offered by the original packaging. Repairs must only be done by the service department of the supplier. An overview of the E+H worldwide service network can be found in the addresses on the back page of this operating manual.

Note!
When returning the unit for repair, please add a description of the unit fault and application.

9.6 Disposal

The unit contains electronic components and must be disposed of accordingly. Please take note of the national regulations when disposing of the unit.

10 Technical data

10.0.1 Input

Measured variable

Current, PFM, pulse, temperature

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 ambient temperature • Signal attenuation low-pass filter 1st order, filter constants 0 to 99 s • Resolution 13 Bit • Fault recognition 3.6 mA and 21 mA limit as per NAMUR NE43		
PFM	• Frequency range 0.25 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 ambient temperature		
Pulse	• Frequency range 0.5 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):		
	Designation	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
	• Type of connection: 3- or 4-wire system • Measuring current 500 mA • Resolution 16 Bit • Temperature drift 0.01% / 10 K ambient temperature		

Number:
- 2 x 0/4 to 20 mA/PFM/Pulse
  2 x Pt100/500/1000 (in basic device)

Max. number:
- 10 (depends on number and kind of plug-in cards)

Galvanic isolation

The inputs are galvanically isolated between the individual expansion cards and the basic device.

10.0.2 Output

Output signal

Current, pulse, transmitter power supply and switching output

Galvanic isolation

Basic device:

Connection, terminals	Power supply (L/N)	Input 1/2 0/4 to 20 mA/PFM/pulse (10/11) or (110/11)	Input 1/2 TPS (82/81) or (83/81)	Input 1/2 temperature (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 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 to 20 mA/PFM/pulse	2.3 kV			500 V	500 V	500 V	500 V
Input 1/2 TPS	2.3 kV			500 V	500 V	500 V	500 V
Input 1/2 temperature	2.3 kV	500 V	500 V		500 V	500 V	500 V
Output 1/2 0 to 20 mA/pulse	2.3 kV	500 V	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	500 V
TPS 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, over voltage category II

Current - pulse output variable

Current

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

Pulse

Basic device:
- Frequency range 0.5 Hz to 12.5 kHz
- Voltage level 0 to 1 V low, 24 V high ±15%
- Min. load 1 kΩ
- Max. pulse width 100 ms for frequencies < 4 Hz

Expansion cards (digital passive, open collector):
- Frequency range of 0.5 Hz to 12.5 kHz
- $I_{max.}$ = 200 mA
- $U_{max.}$ = 24 V ± 15%
- $U_{low/max.}$ = 1.3 V at 200 mA
- Max. pulse width 100 ms for frequencies < 4 Hz

Number

Number:
- 2 x 0/4 to 20 mA/Pulse (in basic device)

Maximum number:
- 8 x 0/4 to 20 mA/Pulse (depends on the number of plug-in cards)
- 6 x digital passive (depends on the number of plug-in cards)

Signal sources

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

Switched output

Function

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

Switch behaviour

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

Relay switching capacity

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

Note!
When using relays on expansion cards, a mixture of low voltage and extra-low voltage is not permitted.

Switching frequency

Max. 5 Hz

Switching threshold

Programmable (wet steam alarm is preset to 2 °C (35,6 °F) at the factory)

Hysteresis

0 to 99%

Signal source

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

Number

1 (in basic device)
Max. number: 7 (depends on plug-in cards)

Number of output states

100,000

Scan rate

250 ms

Loop power supply and external power supply

- Transmitter power supply (TPS), terminals 81/82 or 81/83 (optional universal expansion cards 181/182 or 181/183):
  Supply voltage 24 V DC ± 15%
  Max. current 30 mA, short-circuit proof
  HART® communication is not accounted for
  Number 2 (in basic device)
  Maximum number: 8 (depends on number and type of expansion cards)
- Additional power supply (e.g. external display), terminals 91/92:
  Supply voltage 24 V DC ±5%
  Max. current 80 mA, short circuit protected
  1 power supply available
  Source resistance< 10 Ω

10.0.3 Power supply

Supply voltage

- Low voltage power unit: 90 to 250 V AC, 50/60 Hz
- Extra-low voltage power unit: 18 to 36 V DC or 20 to 28 V AC, 50/60 Hz

Power consumption

8 to 26 VA (dependent on the expansion stage)

Connection data interface

RS232

– Connection: 3.5 mm (0.138 in) jack plug on front panel
– Transmission protocol: ReadWin® 2000
– Transmission rate: max. 57,600 Baud

RS-485

– Connection: plug-in terminals 101/102
– Transmission protocol: (serial: ReadWin® 2000; parallel: open standard)
– Transmission rate: max. 57,600 Baud

Optional: additional RS-485 interface

– Connection: plug-in terminals 103/104
– Transmission protocol and transmission rate same as standard RS-485 interface
(Second RS-485 interface is active for as long as the RS232 jack plug is not used.)

10.0.4 Performance characteristics

Reference operating conditions

- Power supply 230 V AC ±10%; 50 Hz ± 0.5 Hz
- Warm-up period > 30 min
- Ambient temperature 25 °C (77 °F) ± 5 K
- Humidity 39% ±10% r. F.

Arithmetic unit

Medium	Variable	Range
Water	Temperature measuring range	0 to 300 °C (32 to 572 °F)
	Temperature differential range DT	0 to 300 K
	Error limit for DT	3 to 20 K < 2.0% of measured value 20 to 250 K < 0.3% of measured value
	Arithmetic unit accuracy class	Class 4 (as per EN 1434-1 / OIML R75)
	Measurement and calculation interval	250 ms
Steam	Temperature measuring range	0 to 800 °C (32 to 1472 °F)
	Pressure measuring range	0 to 1000 bar
	Measurement and calculation interval	250 ms

10.0.5 Installation conditions

Installation instructions

Mounting location

In the cabinet on DIN rail EN 50 022-35

Orientation

no restrictions

10.0.6 Environmental conditions

Ambient temperature

-20 to 60 °C

Storage temperature

-30 to 70 °C

Climate class

As per IEC 60 654-1 Class B2 / EN 1434 Class 'C'

Electr. safety

As per EN 61010-1: Environment < 2000 m above N.N.

Humidity

As per IEC 62-2-30 / EN 1434-4

Max. water content

Condensation permissable

Protection class

- Basic unit: IP 20
- Remote operating and display unit: IP 65

Electromagnetic compatability

Interference emission

EN 61326 Class A

Interference immunity

– Power failure: 20 ms, no influence
– Start current limitation: $I_{max}/I_n \leq 50\%$ (T50% ≤ 50 ms)
– Elektromagnetische 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 (AC power supply): 1 kV/2 kV as per IEC 61000-4-5
– Surge (DC power supply): 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 constructions

Model/dimensions

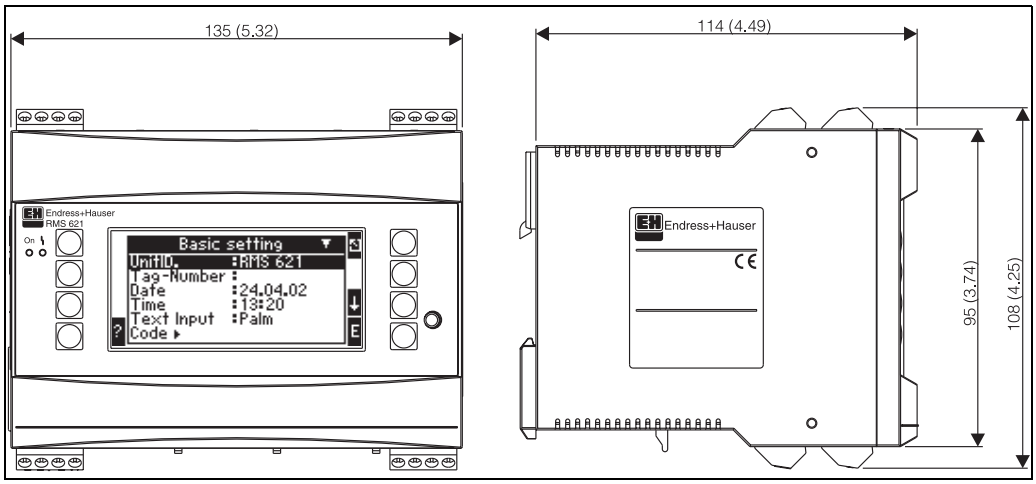


Fig. 25: Housing for DIN top hat rail to EN 50 022-35 mounting; dimensions in mm (inches)

Weight

- Basic device: 500 g (in maximum configuration with expansion cards)
- Remote control unit: 300 g

Materials

Housing: Plastic PC, UL 94V0

Terminals

Coded, plug-on screw terminals, size 1.5 mm^2 single core, 1.0 mm^2 stranded with ferrules (valid for all connections).

10.0.8 Human interface

Display elements

- Display (optional):
  132 x 64 Dot-matrix LCD with blue background lighting
  Colour changes to red in the event of an error (adjustable)
- LED status display:
  Operation: 1 x green (2 mm; 0.079 in)
  Fault message: 1 x red (2 mm; 0.079 in)
- External display and operating unit (optional or as accessory):
  A display and operating unit can also be connected to the energy manager in the panel mounted housing, dimensions: W = 144 mm (5.7 in) x H = 72 (2.84 in) x D = 43 mm (1.7 in). The connection to the integrated RS-485 interface is made using the connecting cable (l = 3 m), which is included in the accessories set. Parallel operation of the external display unit with a device-internal display in the RMS 621 is possible.

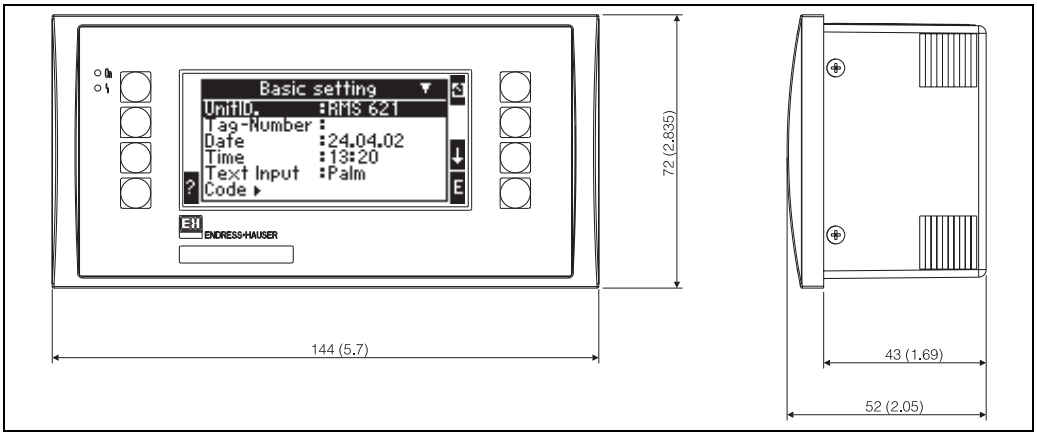


Fig. 26: External display and operating unit for panel mounting (optional or available as accessory); dimensions in mm (inches)

Operating elements	Eight front-panel soft keys interact with the display (function of the keys is shown in the display).
Remote operation	RS232 interface (3.5 mm (0.138 in) jack plug on front panel): configuration via PC with PC operating software ReadWin® 2000.
Real time clock	• Deviation: 2.6 min per year • Power reserve: 14 days
Mathematical functions	Continuous calculation of dimensions, standard volumes, density, enthalpy, quantity of heat via IAWPS-IF97

10.0.9 Certificates and approvals

CE approval	The measurement system fulfils the requirements demanded by the EU regulations. Endress+Hauser acknowledges successful unit testing by adding the CE mark.
Other standards and guidelines	• EN 60529: Degrees of protection by housing (IP Code) • EN 61010: Safety requirements for electrical measurement, control and laboratory instrumentation. • EN 61326 (IEC 1326): Electromagnetic compatibility (EMC requirements) • NAMUR NE21, NE43 Standardization association for measurement and control in chemical and pharmaceutical industries. • IAWPS-IF 97 International 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 from 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 "Energy manager" (PG 006R/09/en)
- ❑ Technical information "System Components for DIN rail devices" (TI 367F/00/en)
- ❑ Technical information "PROline Prowirl 72 flowmeter" (TI 062D/06/en)
- ❑ Technical information "Energy manager RMS621" (TI 092R/09/en)

11 Appendix

11.1 Definition of important system engineering units

Volume	
bbl	1 barrel, for definition see 'Setup Æ Application'
gal	1 US-gallon, equals 3.7854 litre
igal	Imperial gallon, equals 4.5609 litre
l	1 litre = 1 dm^3
hl	1 Hektoliter = 100 litre
m^3	equals 1000 litres
ft^3	eequals 28.37 litres
Temperature	
	Calculation factor: • 0 ° C = 273.15 K • ° C = °F - 32/1.8)
Pressure	
	Calculation factor: 1 bar = 100 kPa = 100000 Pa = 0.001 mbar = 14.504 psi
Mass	
ton (US)	1 US ton, equals 2000 lbs (= 907.2 kg)
ton (long)	1 long ton, equals 2240 lbs (= 1016 kg)
Power (heat flow)	
ton	1 ton (refrigeration) equals 200 Btu/m
Btu/s	1 Btu/s equals 1.055 kW
Energy (heat quantity)	
tonh	1 tonh, equals 1200 Btu
Btu	1 Btu equals 1.055 kJ
kWh	1 kWh equals 3600 kJ equals 3412.14 Btu

11.2 Configuration flow measurement

The energy manager generates output signals from a number of standard flow meters.

- Operating volume:
  Flow meters that transmit a signal proportional to the flow volume (e.g. Vortex, MIF, Turbine).
- Mass:
  Flow meters that transmit a signal proportional to the mass (e.g. Coriolis)
- Differential pressure:
  Flow meters (DPT) that transmits a signal proportional to the differential pressure.

11.2.1 Differential pressure flow calculation

The device offers 2 possible differential pressure measurements:
- Traditional differential pressure methods
- Improved differential pressure methods

Traditional differential pressure methods	Improved differential pressure methods
Only accurate as a complete system (pressure, temperature, flow)	Accurate to every operating point due to fully compensated flow measurement calculation
DP transmitter signal is squared, that means scaled to operating volume or mass	DP transmitter signal curve is linear, that means scaled to differential pressure

Traditional differential pressure method:

All flow calculation coefficients are calculated using the actual system design and are then brought together as a single constant.

$$Qm = \underbrace{c \cdot \sqrt{\frac{1}{1-\beta^4}} \cdot \varepsilon \cdot d^2 \cdot \frac{\pi}{4}} \cdot \sqrt{2 \cdot \Delta p \cdot \cancel{\rho}}$$

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

Improved differential pressure method:

Compared to the traditional cacluation method the coefficient of the flow equation (flow coefficient, velocity factor, expansion number, density) is continuously being recalculated according to the ISO 5167. This has the advantage that the flow can be exactly calculated even under highly fluctuating process conditions, which could be far outside the rated condition (temperature and pressure within their rating) thus guaranteeing a high accuracy on the flow measurement.

For this the device needs the following data:
- Internal pipe diameter
- Diameter ratio ß (the K factor on Pitot tubes)

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

f = Correction factor (measurement correction, e.g. taking the pipe roughness into consideration)

Pitot tubes

When using Pitot tubes a correction factor needs to be entered instead of the pipe diameter ratio. This factor (resistance value) is allocated by the sensor manufacturer, On the "E+H Deltatop" this is in the form of the K Factor.
The input of the correction factor is absolutely required (see following example)!
The flow rate is calculated as follows:

The flow rate is calculated from:

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

f = Correction factor (K-Factor or from the correction tables)
d = Tube internal diameter
ΔP = Differential pressure
ρ = Density under operational conditions

Example:
Flow measurement in a steam pipe line using a Deltatop Pitot tube

- Tube internal diameter: 350 mm
- k-factor (correction factor for the resistance factor of the tube): 0.634
- Working range DP: 0 - 51. 0 mbar (Q: 0-15000 m^3/h)

Hints for set up:
- Flow → Flow 1; Differential pressure → Pitot pressure; Signal type → 4...20 mA; Correction → Yes; Tube data →Internal diameter 350 mm; Correction table → Point 1: Flow 0 m^3; Factor 0.634; Correction table → Point 2: Flow 15000 m^3/h; Factor 0.634.

Hint to differential pressure measurement

If all differntial pressure measurement point data is available (tube internal diameter, ß or k-factor) it is recomended that the improved method be used (fully compensated flow calculation).
If the required data are not available the differential pressure transmitter output signal is scaled and transmitted as volume or mass (see the following table). Please note however, that a signal scaled to mass can no longer be compensated therefore it is always recommended that the DP transmitter should be scaled to operating volume (mass : density in rated condition = operating volume). The mass flow can then be calculated in the device using the operating density dependent on the temperature and pressure. Here it is a partially compensated flow rate calculation because the rated squared density is contained within the operating volume (see above).

How should the device and sensor be set up?

	Sensor	Device
1. traditional method	No data available re: tube diameter and diameter ratio ß (K factor on Pitot tubes).	
a) (Default)	**Squared curve e.g. 0...1000 m^3 (t)**	**Flow rate input (operating volume or mass)** **Linear curve, e.g. 0...1000 m^3 (t)**
b)	Linear curve, e.g. 0...2500 mbar	Flow rate input (operating volume or mass) Squared curve, e.g. 0...1000 m^3 (t)
2. improved method	Tube diameter and diameter ratio ß (k factor on Pitot tubes) available.	
a) (Default)	**Linear curve e.g. 0...2500 mbar**	**Special flow rate (DP) e.g. Orifice** **Linear curve, e.g. 0...2500 mbar**
b)	Squared curve, e.g. 0...1000 m^3 (t)	Special flow rate (DP) e.g. Orifice Squared curve 0...2500 mbar

Example:
Accuracy of a steam flow measurement using an oriface plate dependent on measurement method

- Corner tap orifice plate DP0 50: Internal pipe diameter 200 mm; ß = 0.7
- Flow operating range: 10 to 6785 m^3/h (0 to1635 mbar)
- Ratings: 10 bar; 180 °C; 5,15 kg/m^3; 4000 m^3/h
- Process temperature: 190 °C
- Process pressure (real value): 9.5 bar
- Differential pressure: 526 mbar

- Result using the traditional differential pressure method:
  Operating volume: 4000 m^3/h Mass flow: 20.58 t/h (density: 5.15 kg/m)

- Result using the improved or fully compensated differential pressure method:
  Operating volume: 3140 m^3/h Mass flow: 14.8 t/h (density: 4.71 kg/m)

The measurement error using the traditional flow measurement method is approx. 27%. If the DPT is scaled to "Mass" (this means a little compensation possible), the **total error would be approx. 39%.**

Splitting Range (measurement range expansion)

The measurement range of a differential pressure transmitter lies in the range of 1:3 to 1:7. This function offers the possibility to expand the measurement range of the flow measurement to 1:20 by using up to three differential pressure transmitters per flow measurement point.

Hint of the set-up:

1. Select flow/splitting range 1 (2,3)
2. Define the signal type and select the differential pressure transmitters (valid for all differential pressure transmitters!)
3. Select the connection terminals for the transmitters and define the respective measurement range.
   Range 1: Transmitter with the smallest measurement range
   Range 2: Transmitter with the next highest measurement range, etc.
4. Set up "Curve, Units, Format, Sums, Pipe data etc." (valid for all transmitters)

✎ Note!
For Splitting Range operation differential pressure transmitters that transmit a current > 20 mA (< 21 mA) on exceeding the measurement range must be used. The change between measuring ranges is fully automatic (hysteresis in the threshold point).

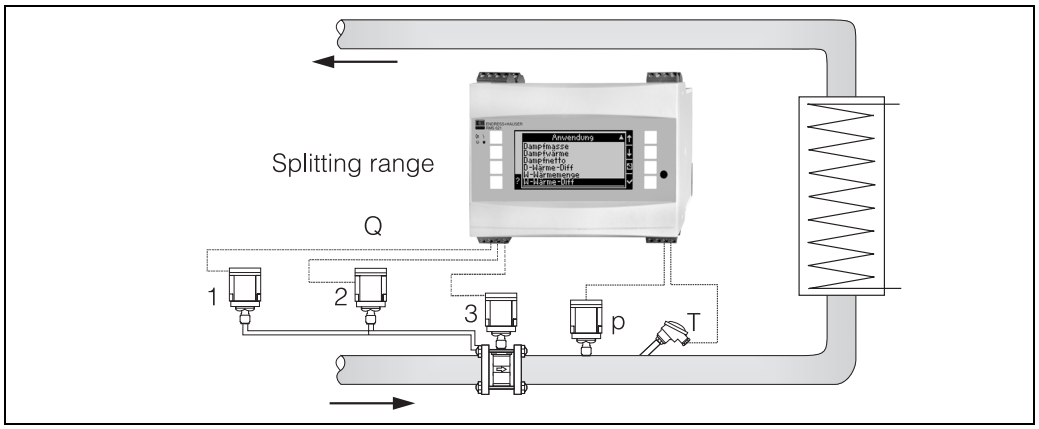


Fig. 27: Splitting range operation

Mean value calculation (averaging)

The mean value calculation function offers the possibility to generate an input signal from a number of sensors positioned at different points and then calculate the mean value of these. This function is helpful when a number of measurement points are required on a plant in order to calculate the measurement point accurately enough. Example: Application of a number of Pitot tube sensors for flow measurement in a pipe line that has either not got enough inflow length or is of a large cross section area.
Mean value calculation is available for pressure, temperature and flow (differential pressure) inputs.

11.2.2 Correction tables

Flow meters deliver an output signal proportional to the flow rate. The relationship between the output signal and the flow can be described in a so called curve. The flow of a transmitter does not always accurately follow this curve over the total measurement range. This means that the flow

meter deviates from the ideal flow curve. Using the correction table this deviation can be compensated.

This correction is done in different ways dependent on the type of flow meter:
- Analogue signal (volumetric, mass)
  Table with up to 15 paired values current/flow
- Pulse signal (volumetric, mass)
  Table with up to 15 paired values (frequency/k factor or frequency/pulse value, dependent on signal type)
- Differential pressure/square root extracted
  Table with up to 10 paired values (flow/factor f)

Note!
When using a Pitot tube sensor the so called resistance value ζ (blockage factor) can be mirrored by the correction factor f. Should the resistance value be constant then it is sufficient to define two paired values flow/(correction) factor. This correction factor is then valid for the total measurement range.

Note!
The correction points are automatically sorted by the device, this means the points can be defined in any order.
Please note that the operational mode lies within the limits of the table as values outside the table range are calculated by extrapolation. This can lead to high inaccuracies.

11.3 Applications

Water/heat (quantity)

Application areas

Calculation of heat quantity in a water circuit, e.g. calculation of the heat rests in a heat exchanger return.

Measurements

Measurement of operating volume and temperature in a water circuit. A pressure sensor can also be connected in order to measure the operational pressure in the circuit. This pressure measurement has no influence on the actual calculation (see inputs).

Inputs

- Flow (q)
- Temperature (T)

Note!

For an exact calculation of the process values and measurement range limits, a further input for the operating pressure of the water network is required. The average operating pressure (p) is a preset value (not an input signal). The pressure can only be entered as an average signal, even if the pressure is measured using a pressure sensor.

Calculated values

Calculation of mass flow, heat flow, specific Enthalpy, density
(IAPWS–IF97 Standard).

Output values/display at the unit

- Heat flow (power), mass flow, flow (operating volume), temperature, specific Enthalpy, density
- Heat sum, mass sum, flow sum.

Outputs

All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.

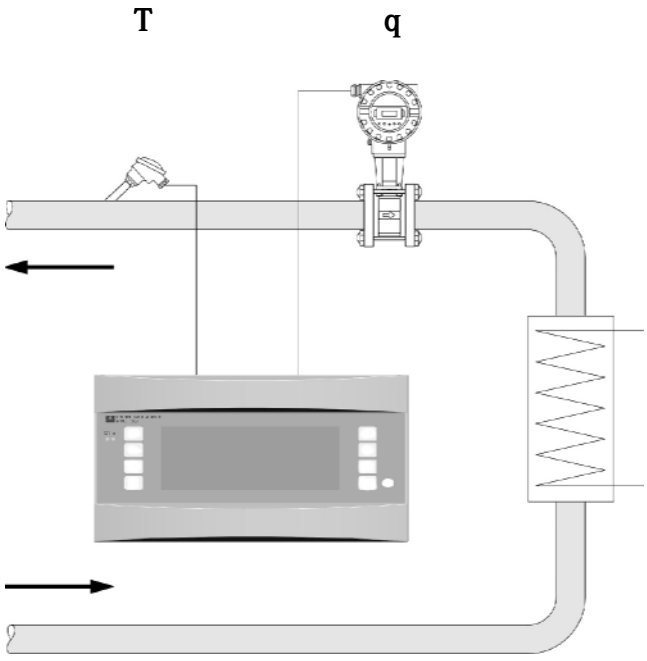
Applications

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

Up to 3 measurement points with the input values (measurements) q, T.
Two measurement points are covered by the basic unit. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

Diagram/calculation formula



$$E = q * \rho (T, p) * h (T)$$

E: Heat quantity
q: Operating volume
ρ: Density
T: Operating temperature
p: Average operating pressure
h: Specific Enthalpy of water

Water/heat differential
(Heating/cooling)

Application areas

Calculation of the heat quantity, which is transmitted to or from a heat exchanger in a water circuit. Typical application for energy measurement in a heating or cooling network.

Measurements

Measurement of operating volume and temperature in a water circuit immediately before and after a heat exchanger (in the inflow and return circuit).
A pressure sensor can also be connected in order to measure the operational pressure in the circuit. This pressure measurement has no direct influence on the actual calculation (see inputs).

Inputs

- Inflow: Flow (q), temperature (T_1)
- Return: Temperature (T_2)

Note!

- For an exact calculation of the process values and measurement range limits, a further input value for the operating pressure of the water network is required. The average operating pressure (p) is a preset value (not an input signal). The pressure can only be entered as an average signal, even if the pressure is measured using a pressure sensor.
- The flow meter installation point is selectable!
- The installation point is defined as the warm/cold side and not the inflow/return, as this definition is clear for all operating modes.
- It is recommended to place the flow meter in a position in the circuit where the temperature is closest to the ambient (room) temperature.

Calculated values

Calculation of mass flow, heat differential (heat flow or power), temperature difference, Enthalpy difference, density (IAPWS–IF97 Standard).

Output values/display at unit

- Heat flow, mass flow, flow (operating volume), temperature 1, temperature 2, temperature difference, Enthalpy difference, density.
- Heat quantity sum, mass sum, flow sum.

Outputs

All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.

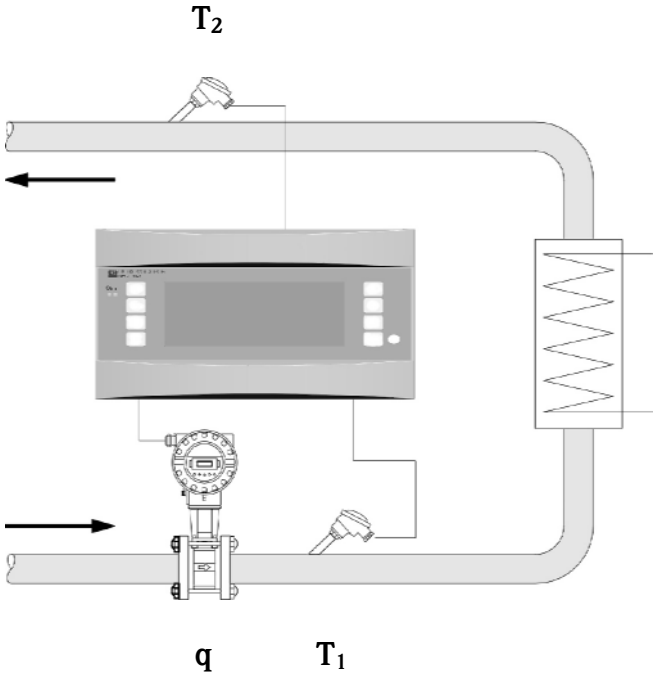
Applications

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

Up to 3 measurement points with the input values (measurements) q, T. T
One measurement point is covered by the basic unit. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

Diagram/calculation formula



Heat output (heating)
$$\mathbf{E = q * \rho\,(T_1, p) * [h\,(T_1) - h\,(T_2)]}$$

Heat input (cooling)
$$\mathbf{E = q * \rho\,(T_1, p) * [h\,(T_2) - h\,(T_1)]}$$

E: Heat quantity
q: Operating volume
ρ: Density
T_1: Temperature in inflow
T_2: Temperature in return
p: Average operating pressure
h (T_1): Specific Enthalpy of water at temperature 1
h (T_2): Specific Enthalpy of water at temperature 2

Water/heat differential
(Bi-directional)

Application areas

Calculation of the heat quantity, which is transmitted to or from heat a exchanger in a water circuit. Typical application for energy measurement when heating or cooling a heat accumulator. Bi-directional operation is possible in either a single flow direction or in alternating flow directions.

Measurements

Measurement of the operating volume in a water circuit as well as the water temperature immediately before and after the heat exchanger (in inflow as well as return).
A pressure sensor can also be connected in order to measure the operational pressure in the circuit. This pressure measurement has no influence on the actual calculation (see inputs).

Inputs

- Inflow: Flow (q) plus direction signal if required, temperature (T_1)
- Return: Temperature (T_2)

Note!

- For an exact calculation of the process values and measurement range limits, a further input value for the operating pressure of the water network is required. The average operating pressure (p) is a preset value (not an input signal). The pressure can only be entered as an average signal, even if the pressure is measured using a pressure sensor.
- The flow meter installation point is selectable!
- The installation point is defined as the warm/cold side and not the inflow/return, as this definition is clear for all operating modes.
- It is recommended to place the flow meter in a position in the circuit where the temperature is closest to the ambient (room) temperature.

Calculated values

Separate calculation of: mass flows, heat differential (heating flows), Enthalpy difference, density (IAPWS–IF97 Standard).

Output values/display at unit

- Heat flow (+), heat flow (-), mass flow (+), mass flow (-), operating volume, temperature 1, temperature 2, Enthalpy difference, density.
- Heat sum (+), mass sum (+), heat sum (-), mass sum (-), operating volume sum.

(+): Heat output (heating)
(-): Heat input (cooling)

Applications

Outputs

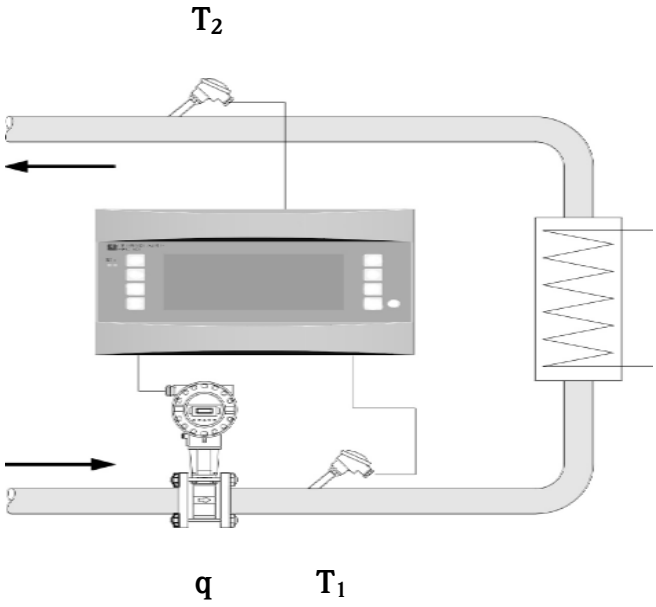
All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

Up to 3 measurement points with the input values (measurements) q, T_1, T_2 plus a direction signal with flow direction change if required. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

Diagram/calculation formula



Heat output (heating)
$$\mathbf{E = q * \rho\,(T_1, p) * [h\,(T_1) - h\,(T_2)]}$$

Heat input (cooling)
$$\mathbf{E = q * \rho\,(T_1, p) * [h\,(T_2) - h\,(T_1)]}$$

E: Heat quantity
q: Operating volume
ρ: Density
T_1: Temperature in inflow
T_2: Temperature in return
p: Average operating pressure
h (T_1): Specific Enthalpy of water at temperature 1
h (T_2): Specific Enthalpy of water at temperature 2

Steam/heat (quantity)

Application areas

Calculation of a mass circuit (mass flow) and the heat quantity contained at the output of a steam producer or at individual users.

Measurements

Measurement of operating volume, temperature and pressure in a steam network.

Inputs

- Super-heated steam: Flow (q), pressure (p), temperature (T)
- Saturated steam: Flow (q), pressure (p) or
  Flow (q), temperature (T)

Calculated values

- Calculation of: mass flow, heat flow, density, specific Enthalpy, (IAPWS–IF97 Standard).
- Only 2 inputs are required for saturated steam calculations (flow, pressure/temperature), the missing input is calculated using the internally memorised saturated steam curves.

Note!

For higher accuracy or for control purposes it is recommended to calculate the steam condition using 3 inputs (super heated steam). This is recommended because in this operating mode the wet steam alarm function (see outputs) can be used.

Output values /display at unit

- Heat flow, mass flow, flow (operating volume), temperature, pressure, density, specific Enthalpy.
- Heat quantity sum, mass sum, flow sum

Outputs

- All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.
- If a relay is set up for the “wet steam alarm”, this will operate as soon as the super-heated steam reaches 2% of the saturated steam curve. An alarm message also appears in the display.

Applications

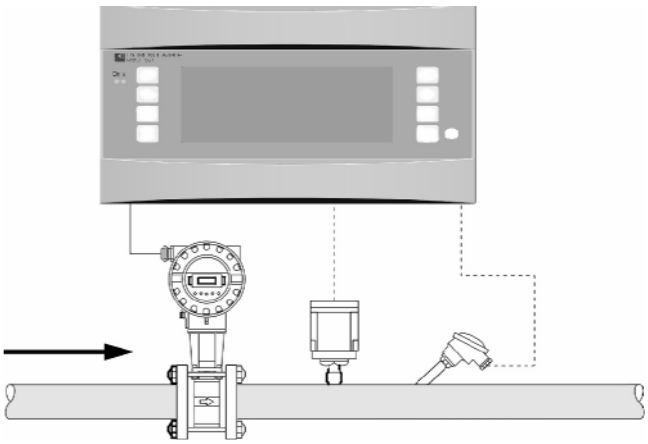
Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

a) Super-heated steam:
   Up to 3 measurement points with the input values (measurements) q, p, T.
   One measurement point is covered by the basic unit. expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

b) Saturated steam:
   Up to 3 measurement points with the inputs (measurements) q, p/T.
   One measurement point is covered by the basic unit. expansion cards are required if further measurement points are to be added. If only the inputs q and T are being used, 2 measurement points can be covered by the basic unit.

Diagram/calculation formula



$$E = q\,(\Delta p, T, p) * \rho\,(T, p) * h_D\,(T, p)$$

E: Heat quantity
q: Operating volume
ρ: Density
T: Temperature
p: Pressure

Steam/mass

Application areas

Calculation of a mass circuit (mass flow) and the heat quantity contained at the output of a steam producer or at individual users.

Measurements

Measurement of operating volume, temperature and pressure in a steam network.

Inputs

- Super-heated steam: Flow (q), pressure (p), temperature (T)
- Saturated steam: Flow (q), pressure (p) or
  Flow (q), temperature (T)

Calculated values

- Calculation of: mass flow, density, specific Enthalpy, (IAPWS–IF97 Standard).
- Only 2 inputs are required for saturated steam calculations (flow, pressure/temperature), the missing input is calculated using the internally memorised saturated steam curves.

Note!

For higher accuracy or for control purposes, it is recommended to calculate the steam condition using 3 inputs (super heated steam). This is recommended because in this operating mode the wet steam alarm function (see outputs) can be used.

Output values /display at unit

- Mass flow, flow (operating volume), temperature, pressure, density.
- Mass sum, flow sum.

Outputs

- All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.

- If a relay is set up for the “wet steam alarm”, this will operate as soon as the super-heated steam reaches 2% of the saturated steam curve. An alarm message also appears in the display.

Applications

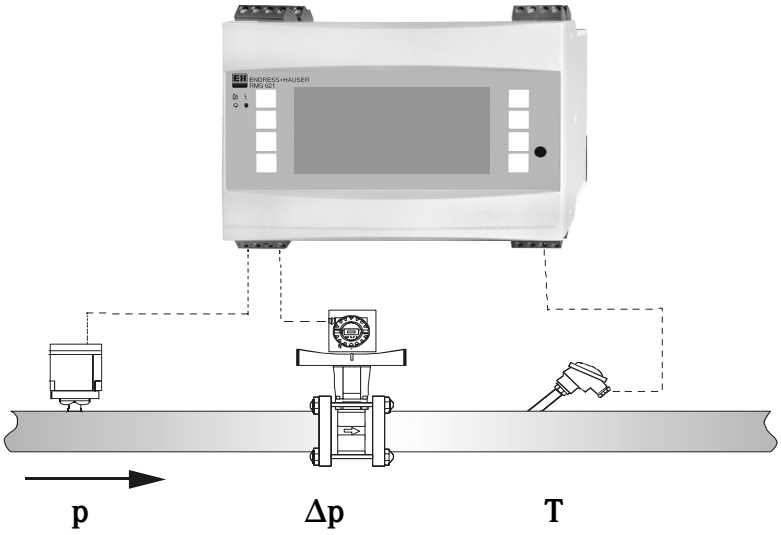
Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

a) Super-heated steam:
Up to 3 measurement points with the input values (measurements) q, p, T.
One measurement point is covered by the basic unit. expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

b) Saturated steam:
Up to 3 measurement points with the inputs (measurements) q, p/T.
One measurement point is covered by the basic unit. expansion cards are required if further measurement points are to be added. If only the inputs q and T are being used, 2 measurement points can be covered by the basic unit.

Diagram/calculation formula



$$E = q\,(\Delta p, T, p) * \rho\,(T, p) * h_D\,(T, p)$$

E: Heat quantity
q: Operating volume
ρ: Density
T: Temperature
p: Pressure

Steam/heat differential
(Heating)

Application areas

Calculation of a steam mass circuit (mass flow) and the amount of heat contained that is then transferred to a heat exchanger. Here the condensate contained the heat energy is taken into account, i.e. heat energy used = heat energy up to the steam condensation plus heat energy removed from the condensate during cooling.

Measurements

Measurement of: operating volume, pressure and temperature in a steam circuit directly before a heat exchanger (in the inflow) as well as measurement of the condensate temperature directly after the heat exchanger (in the return).

Inputs

• Steam circuit:	Super-heated steam:	Flow (q), pressure (p), temperature (T_D)
	Saturated steam:	Flow (q), pressure (p) or
		Flow (q), temperature (T_D)
• Condensation circuit:	Temperature (T_W)	

Calculated values

- Calculation of: mass flow, heat differential (heat contents steam minus heat contents condensate), density, specific Enthalpy, (IAPWS–IF97 Standard).
- Only 2 inputs are required for saturated steam calculations (flow, pressure/temperature), the missing input is calculated using the internally memorised saturated steam curves.

Note!

For higher accuracy or for control purposes, it is recommended to calculate the steam condition using 3 inputs (super heated steam). This is recommended because in this operating mode the wet steam alarm function (see outputs) can be used.

Output values /display at unit

- Heat flow, mass flow, flow (operating volume), temperature, pressure, density, Enthalpy difference
- Heat quantity sum, mass sum, flow sum

Outputs

- All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.
- If a relay is set up for the “wet steam alarm”, this will operate as soon as the super-heated steam reaches 2% of the saturated steam curve. An alarm message also appears in the display.

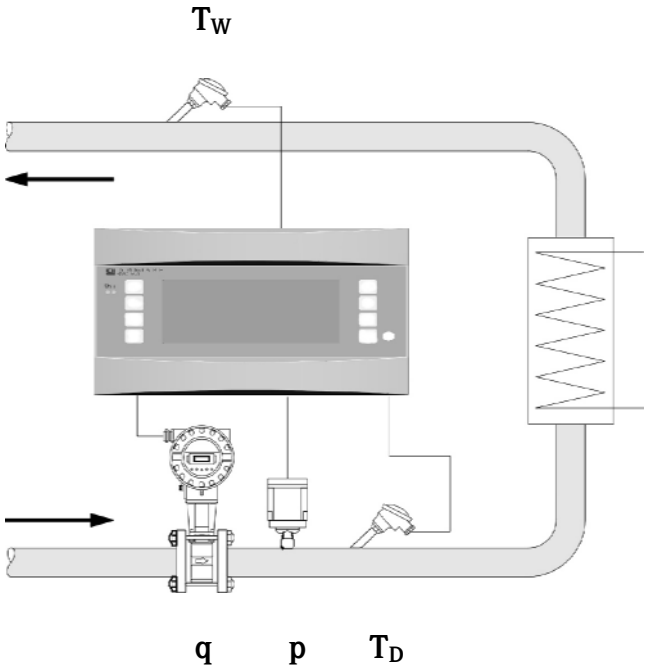
Applications

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

Up to 2 measurement points using the input values (measurements) q, p, T_p, T_w, when using saturated steam then up to 3 measurement points using the inputs q, p/ T_p, T_w.
One measurement point is covered by the basic unit. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

Diagram/calculation formula



$$E = q * \rho (p, T_D) * [h_D (p, T_D) - hw (T_W)]$$

E: Heat quantity
q: Operating volume
ρ: Density
T_D: Temperature in inflow (steam)
T_W: Temperature in return (water)
p: Pressure (steam)
$h_{D:}$ Specific Enthalpy of steam
$h_{W:}$ Specific Enthalpy of water

Steam/heat differential
(Steam production)

Application areas

Calculation of the heat quantity (energy) used to produce steam, as well as the calculation of the steam mass flow and the heat quantity it contains. The heat energy contained in the feed water is taken into account.

Measurements

Measurement of: operating volume and temperature in the feed water, as well as the measurement of pressure and temperature directly after a steam producer.

Inputs

- Feed water circuit: Flow (q), temperature (T_W)
- Steam network: Superheated steam: Temperature (T_D) pressure (p)
  Saturated steam: Temperature (T_D)

Note!

Flow measurement can also be done in the steam pipes. In this case the operating mode “heating” must be selected.

Calculated values

- Calculation of: mass flow, heat differential (steam heat content minus feed water heat content), density, differential Enthalpy (IAPWS–IF97 Standard).
- Only 2 inputs are required for saturated steam calculations (flow, pressure/temperature), the missing input is calculated using the internally memorised saturated steam curves.

Note!

For higher accuracy or for control purposes, it is recommended to calculate the steam condition using 3 inputs (super heated steam). This is recommended because in this operating mode the wet steam alarm function (see outputs) can be used.

Output values /display at unit

- Heat flow, mass flow, flow (operating volume), temperature 1, temperature 2, pressure, density, differential Enthalpy.
- Heat quantity sum, mass sum, flow sum.

Outputs

- All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.
- If a relay is set up for the “wet steam alarm”, this will operate as soon as the super-heated steam reaches 2% of the saturated steam curve. An alarm message also appears in the display.

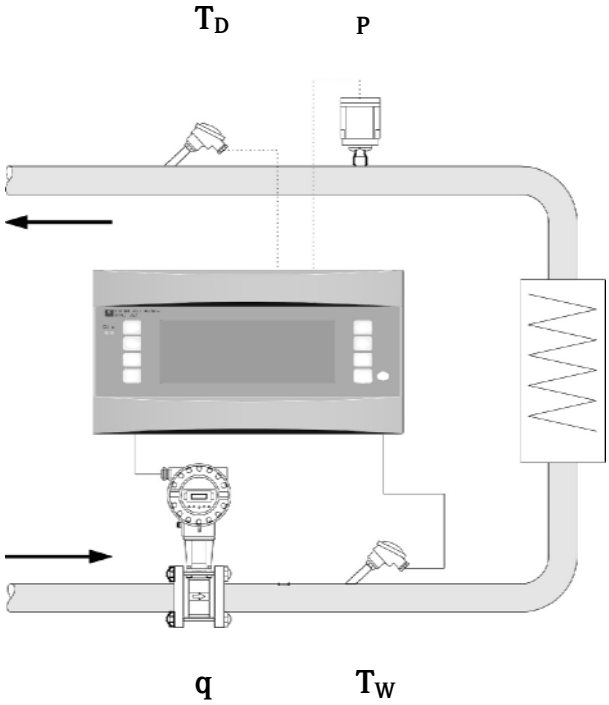
Applications

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details, please see the table for applications/measurement points.
In general, the following measurements are possible:

Up to 2 measurement points using the inputs (measurements) q, p, T_p, T_w, when using saturated steam then up to 3 measurement points using the inputs q, p/T_p, T_w.
One measurement point is covered by the basic unit. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values. Relay outputs are also available.

Diagram/calculation formula



$$E = q * \rho (T_W) * [h_D (p_D, T_D) - hw (T_W)]$$

E: Heat quantity
q: Operating volume
ρ: Density
T_W: Feed water temperature
T_D: Steam temperature
p: Pressure (steam)
$h_{D:}$ Specific Enthalpy of steam
$h_{W:}$ Specific Enthalpy of water

Steam/nett heat (quantity)

Application areas

Calculation of the mass flow and the heat quantity it contains that can be gained from a heat exchanger, provided that only the energy contained in the steam (up to the condensate) is used. The heat energy contained in the condensate remains unused.

Measurements

Measurement of: operating volume, temperature and pressure in a steam circuit directly before a heat exchanger.

Inputs

- Steam circuit: Super-heated steam: Flow (q), pressure (p), temperature (T_D)
  Saturated steam: Flow (q), pressure (p) or
  Flow (q), temperature (T_D)
- Condensation circuit: Temperature (T_W)

Calculated values

- Calculation of: mass flow, heat differential (heat contents of steam minus heat contents of the condensate at saturated steam temperature), density, sp. Enthalpy (IAPWS–IF97 Standard).
  In the simplified case it is supposed that the condensate (water) has a saturated steam temperature which is equal to the pressure in front of the heat exchanger.
- Only 2 inputs are required for saturated steam calculations (flow, pressure/temperature), the missing input is calculated using the internally memorised saturated steam curves.

Note!

For higher accuracy or for control purposes, it is recommended to calculate the steam condition using 3 inputs (super heated steam). This is recommended because in this operating mode the wet steam alarm function (see outputs) can be used.

Output values /display at unit

- Heat flow, mass flow, flow (Operating volume), temperature 1, temperature 2, pressure, density, specific Enthalpy.
- Heat quantity sum, mass sum, flow sum.

Outputs

- All output values can be transmitted using the output terminals, this means both unchanged inputs as well as calculated values. Please note that the number of outputs available is dependent on the unit type.
- If a relay is set up for the “wet steam alarm”, this will operate as soon as the super-heated steam reaches 2% of the saturated steam curve. An alarm message also appears in the display.

Applications

Number of measurement points

The number of measurement points vary according to the unit model and application. For further details please see the table for applications/measurement points.
In general, the following measurements are possible:

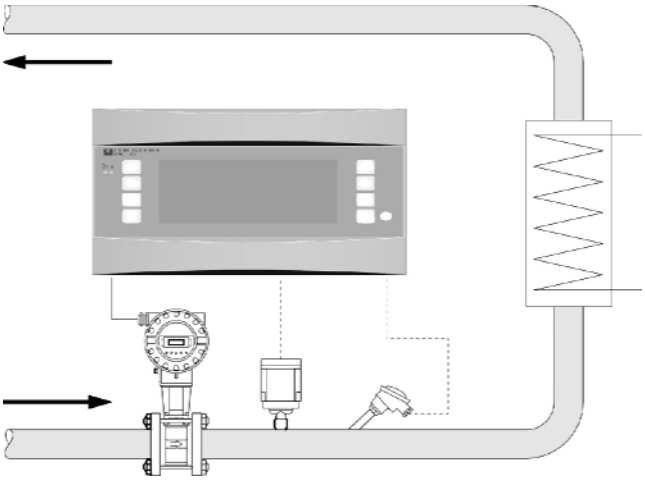
a) Super-heated steam:

Up to 3 measurement points with the inputs (measurements) q, p, T_p.
One measurement points are covered by the basic unit. Expansion cards are required if further measurement points are to be added. Each expansion card is fitted with outputs (analogue/impulse) for retransmission of process values or relay.

b) Saturated steam:

Up to 3 measurement points with the inputs (measurements) q, p/T_p.
One measurement points are covered by the basic unit. Expansion cards are required if further measurement points are to be added. If only the inputs q and T are being used, 2 measurement points can be covered by the basic unit.

Diagram/calculation formula



q **p** **T_D**

$$E = q * \rho (T_D, p) * [h_D (T_D, p) - hw (T_{K(P)})]$$

E: Heat quantity
q: Operating volume
ρ: Density
T_p: Temperature (steam)
p: Pressure (steam)
$h_{D:}$ Specific Enthalpy of steam
$h_{W:}$ Specific Enthalpy of water
$T_{K:}$ Condensation temperature (calculated from the pressure at the inflow)

Index

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

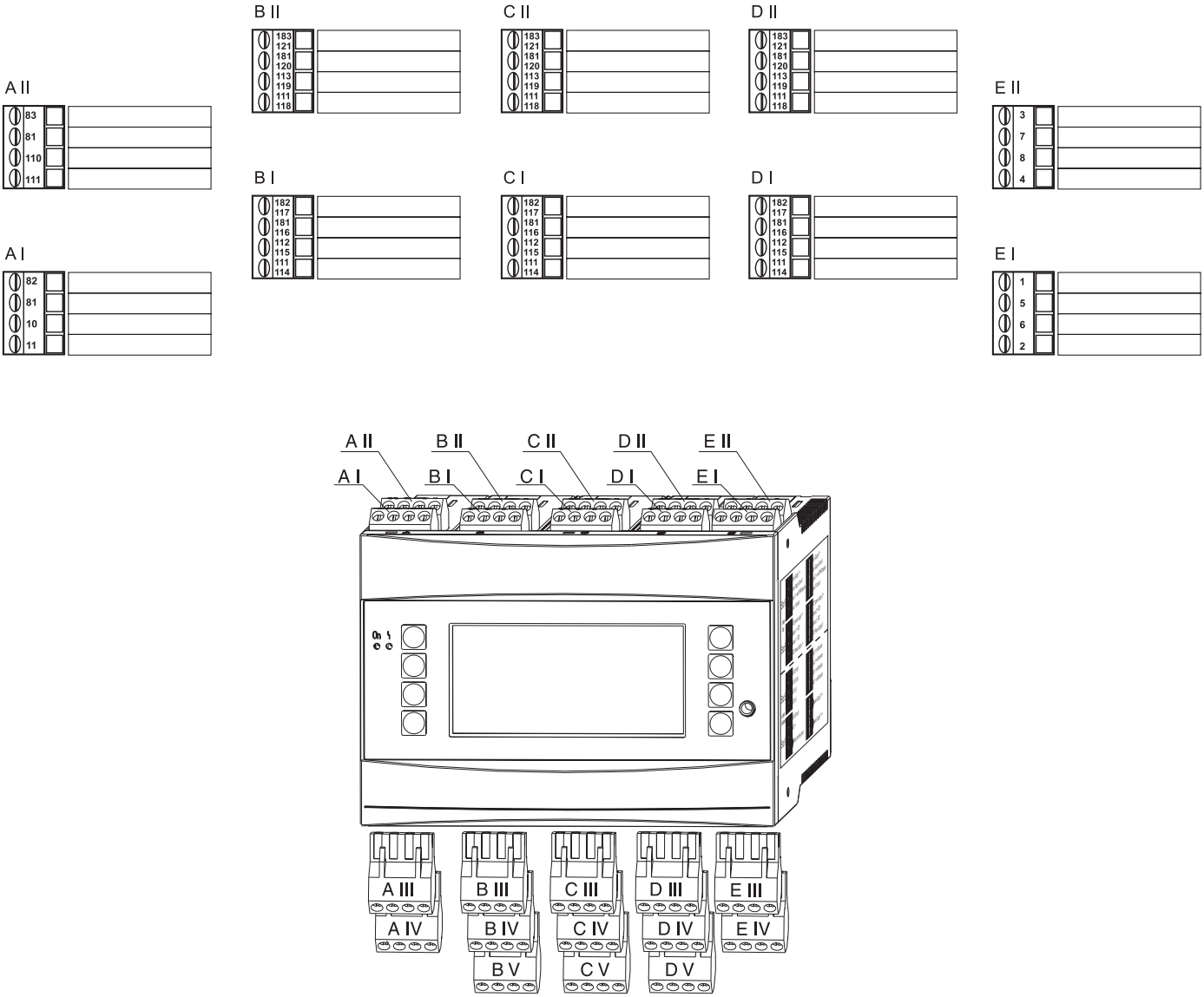
Pressure	Signal type	Start value	End value	Eng. Units

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



Setup

Basic settings	Unit ID	Tag number	Date	Time	Text input (Palm)	Code	Summer/ normal time
						User code	Change over
						Alarm limit	NT/ST region
							Date NT->ST
							Time NT->ST
							Date ST->NT
							Time ST->NT

Inputs Flow	Flow 1...3	Identifier	Flow type	Signal	Terminals	Curve *	Time base	Units	Format	Signal damp *	Enter pulse value	Pulse unit *	Pulse valuet *	Unit K factor *	K factor *	Start value *	End value *	Offset *	Cut off *	Correction	Sums	
			Volumetric																		Therm. exp. coefficient*	Units
			Mass			Signal	Terminals	Curve *	Time base	Units	Format	Press. Units	Start value	End value	Offset *	Cut off *	Correction	Pipe data	Sums		Correction table*	Format
			Diff. Pressure	Diff. Press. Type	Medium												tab.diff. Pres.*	Pipe internal dia.				Total (preset.)
				Pitot, Orifice, etc.														Geometric ratio*				

	Splitting Range 1...3	Identifier	Signal	Diff. Press. type	Curve *	Time basis	Units	Format	Fl. Units	Terminal range 1	Terminal range 2	Terminal range 3	Offset *	Cut off *	Correction	Pipe data	Sums
				Orifice, nozzle,...						Start value*	Start value*	Start value*			tab.diff. Pres.*	Pipe internal dia.	
						Format	Sums			End value*	End value*	End value*				Geometric ratio*	

	Mean value	Number	Sensor 1-3	Time base	Units
Inputs Pressure	Pressure 1...3	Identifier	Signal	Terminals	Units

	Unit type	Format	Signal damp	Start value	End value	Offset	Atmosphere Pressure*	Default
Inputs Pressure								

	Mean value	Number	Sensor 1-3	Time base	Units	Format	Sums
Inputs temperature	Temperature 1.1....3.2	Identifier	Signal	Sensor type *	Terminals	Units	Format

	Signal damp	Start value *	End value *	Offset	Default
Inputs temperature					

	Mean value	Number	Sensor 1-3	Time base	Units	Format	Sums

Application	Application 1...3	Identifier	Application	Steam type *	Input types *	Op. mode *	Flow direction *	Term. direction sig.	Flow	Instal point flow *	Pressure *	Average pressure *	Temperature *	Temperatur e cold *	Temperature hot *	min. temp. difference *	System units	Sums
																		Heat
																		Heat (-) *

Display	Group 1...6	Scrolling display	Colour change	Display type	Contrast	Start value	End value	Time constant	Fault condition	Fault condition	Simulation (current)
Analogue outputs	Analogue output 1...8	Identifier	Terminals	Signal source	Signal						
Set point values	Set point 1...13	Identifier	Transmit by	Terminals	Op. mode	Signal source	Switch point	Hysteresis	Time delay	delta x (gradient) *	delta t (gradient) *

	Return value (grad.) *	Event text limit on	Event text limit off	Event text limit disp. +
Set point values				

Pulse outputs	Pulse output 1...8	Identifier	Signal	Terminals	Signal source	Pulse type	Pulse unit	Pulse unit value	Simulation (frequency)

Miscellaneous	Programme name	Software version	SW options	CPU no.	Series number	Run times	LCD run time
Service	Preset	Total sums					
	Service code	Application 1...3	Heat sum	Mass sum	Heat sum (-)	Mass sum (-)	

* Display dependent on previous parameter set up

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