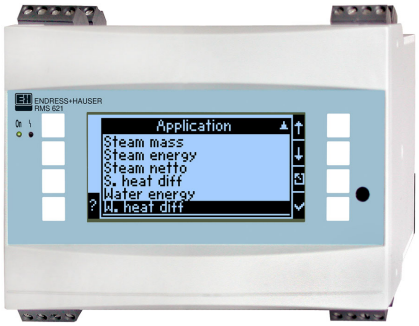
Technical Information
RMS621

Energy manager



Steam and Heat Computer for Industrial Energy Calculation of Steam and Water

Application

- Energy management
- Chemical industry
- Heating and air conditioning
- Pharmaceutical industry
- Food and beverage
- Plant and panel manufacture

Your benefits

- Calculation of the following applications:
  Steam mass, steam heat quantity, net steam quantity, steam-heat differential, water heat quantity, waterheat differential
- Simultaneous calculation of up to three applications per device
- Real time clock
- Log book function for error messages and parameter changes with date and time
- Presettable allocation of the inputs/outputs to each application
- Configuration and operation using a serial interface and ReadWin 2000 PC software
- Modular expansion using plug-in cards
- Large back-lit LC display with color change in the event of an error
- Quick and safe configuration with application-guided operation (Quick Setup)
- Online help function on all parameters optional
- Calculation as per IAPWS-IF 97
- Meets standards EN 1434-1, 2, 5 and 6 and OIML R75
- Bi-directional flow applications or energy measurement is possible
- Split-range flow measurements
- Averaging of several input signals
- Flow compensation due to improved differential pressure procedure

Table of contents

Function and system design

Measuring principle

Up to three different applications per device can be processed simultaneously. Two separate counters are available for each application, each of them is resettable.

Connection of measured variables 0/4 to 20 mA, PFM or pulse for sensors such as flow (differential pressure probes, vortex, turbine, orifice plate, among others) or pressure. When measuring temperatures, Pt100, Pt500 and Pt1000 in a 3- or 4-wire system can be connected directly or as a 4 to 20 mA signal using temperature transmitters (e.g. TMT181). A separate transmitter power supply is installed for each analog or pulse input. The available outputs are signal types 0/4 to 20 mA, pulse, digital and relay. The number of inputs, outputs, relays and transmitter power supplies contained in the basic device can be individually extended over a maximum of three plug-in cards.

In applications with overheated steam, the process is monitored for saturated steam or wet steam. If the saturated steam curve is reached, this can be output as an alarm value. The summation of the calculated values is not interrupted when process limits (e.g. saturated steam curve) are exceeded or below set values. The most recently valid values are registered in the event memory when they leave or return to the valid process limits.

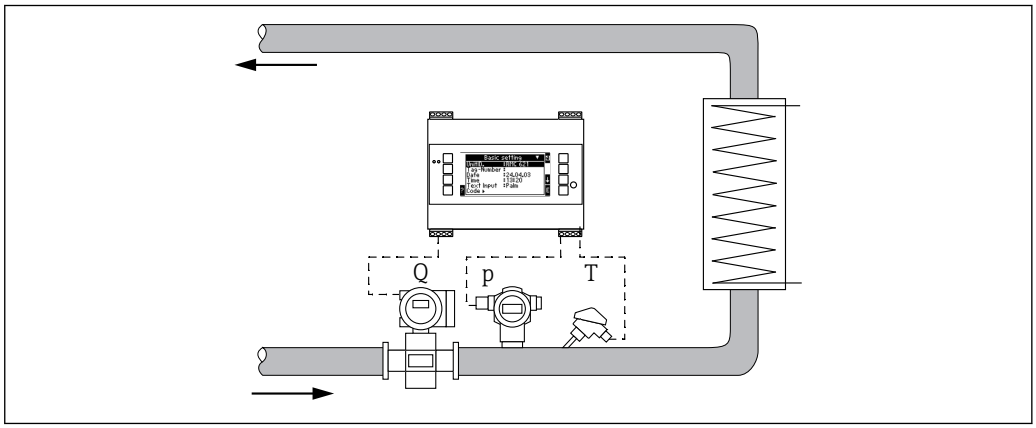
Applications

Steam mass

Calculation of the mass flow in a steam line from the process variables for flow, pressure and temperature. In saturated steam operation, the mass flow is calculated from two input variables (pressurecompensated or temperature-compensated).

Steam heat quantity

Calculation of the mass flow and its quantity of heat (energy) in a steam line from the process variables for flow, pressure and temperature. Saturated steam operation is possible, calculation is the same as for steam mass.



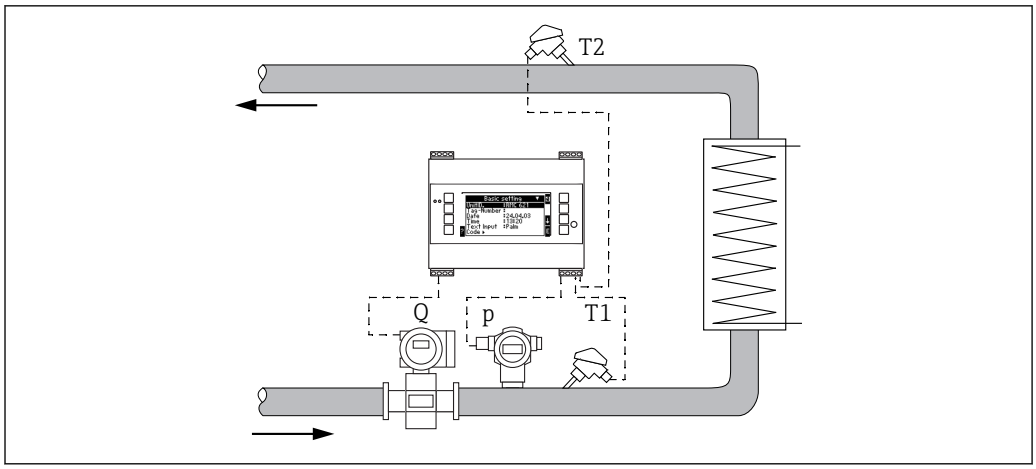
1 *Calculation of the steam mass flow and steam heat quantity from the input variables for flow (Q), pressure (p) and temperature (T)*

Steam - heat - differential

Calculation of the quantity of heat emitted or absorbed in a steam application using temperature differential measurement from the process variables for flow, pressure and two temperature values. Balancing a steam generation process (phase transition: water → steam) or a steam heating process (phase transition: steam → water) is possible.

Net steam quantity

Calculation of the quantity of heat that can be extracted from a steam mass flow until it condenses to water. Process variables: flow, pressure, temperature. For saturated steam, the calculation is made from two input variables.



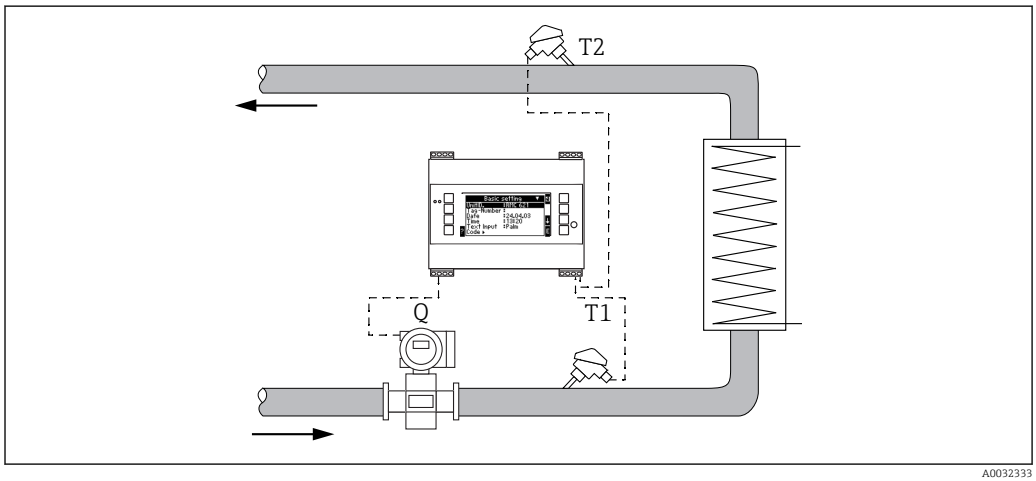
2 Calculation of the steam-heat differential and net steam quantity from the input variables for flow(Q), pressure (p) and the temperature differential (T1 - T2)

Water heat quantity

Calculation of the quantity of heat in a water flow from the process variables for flow and temperature.

Water-heat differential

Calculation of the quantity of heat that is emitted or absorbed by a water flow in a heating or cooling system. The quantity of heat is calculated from the process variable for flow and the differential from the feed and return temperature. Bidirectional energy calculations, such as the calculating systems with changing flow direction (charging/discharging the heat accumulator) are also possible.



3 Calculation of the water heat quantity and water-heat differential from the input variables for flow (Q) and the temperature differential (T1 - T2)

Measuring system

The analog input variables are digitized, the pulse and PFM signals recorded using period length/ frequency measurement and processed further in the arithmetic unit controlled by the microcontroller. The energy values are calculated in accordance with the highly precise equations of the international industry standard IAPWS-IF97, which makes the calculation quicker and more precise. This guarantees maximum precision and high calculating speed in all temperature ranges. The internal real time clock with power reserve is used to integrate the flow values. Both the input variables and the results can be transferred via the outputs.

When a differential pressure signal is used, the sensor data is recalculated over the entire working range of the flow sensors.

Configuration of the inputs, outputs, alarm values, the display as well as commissioning and maintenance of the device can be performed via 8 soft keys with the back-lit dot matrix display, or using the RS232 interface with the ReadWin 2000 PC software or using an external display and operating unit.

A menu-guided quick setup is available on request for the initial start-up. Online help makes on-site operation easier. The color change of the background lighting visualizes alarm value violations or faults. A function expansion of the device by means of expansion cards can be made at any time.

Arithmetic unit

Medium	Variable	Range
Water	Temperature measuring range	0 to 374 °C (32 to 705.2 °F)
	Maximum temperature differential range ΔT	0 to 374 K (0 to 673.2 °F)
	Error limit for ΔT	3 to 20 K (5.4 to 36 °F) < 1.0% of measured value 20 to 250 K (36 to 450 °F) < 0.3% of measured value
	Arithmetic unit accuracy class	as per EN 1434-1 / OIML R75 (< 1.5%)
	Measurement and calculation interval	500 ms
Steam	Temperature measuring range	0 to 800 °C (32 to 1 472 °F)
	Pressure measuring range	0 to 1 000 bar (0 to 14 503.8 psi)
	Measurement and calculation interval	500 ms

Input

Measured variable

Current, PFM, pulse, temperature

Input signal

Flow, differential pressure, pressure, temperature

Measuring range

Measured variable	Input	
Current	▪ 0/4 to 20 mA +10% overrange ▪ Maximum input current 150 mA ▪ Input impedance < 10 Ω ▪ Signal attenuation low-pass filter 1st order, filter constants 0 to 99 s configurable ▪ Fault recognition 3.6 mA and 21 mA limit as per NAMUR NE43	
PFM	▪ Frequency range when using an input on the mainboard (Slot A): 0.25 Hz to 12.5 kHz ▪ Frequency range when using an input on an extension board (Slot B, C, D): 0.01 Hz to 12.5 kHz ▪ Signal level 2 to 7 mA low; 13 to 19 mA high ▪ Measurement method: period length/frequency measurement	
Pulse	▪ Frequency range when using an input on the mainboard (Slot A): 0.25 Hz to 12.5 kHz ▪ Frequency range when using an input on an extension board (Slot B, C, D): 0.01 Hz to 12.5 kHz ▪ Signal level 2 to 7 mA low; 13 to 19 mA high with approximately 1.3 kΩ dropping resistor at 24 V voltage level	
Temperature	Resistance thermometer (RTD) according to ITS 90:	
	Designation	Measuring range
	Pt100	−200 to 800 °C (−328 to 1 472 °F)
	Pt500	−200 to 250 °C (−328 to 482 °F)
	Pt1000	−200 to 250 °C (−328 to 482 °F)
	▪ Type of connection: 3- or 4-wire system ▪ Measuring current 500 µA	

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

Maximum number:
10 (depends on the number and type of expansion cards)

Galvanic isolation

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

Ouput

Output signal

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

Galvanic isolation

Basic device:

Connection with terminal designation	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)	Temperature input 1/2 (1/5/ 6/2) or (3/7/8/4)	Output 1/2 0 to 20 mA/ pulse (132/131) or (134/133)	Interface RS232/485 housing front or (102/101)	TPS external (92/ 91)
Power supply		2 300 V	2 300 V	2 300 V	2 300 V	2 300 V	2 300 V
Input 1/2 0/4 to 20 mA/ PFM/ pulse	2 300 V			500 V	500 V	500 V	500 V
Input 1/2 TPS	2 300 V			500 V	500 V	500 V	500 V
Temperature input 1/2	2 300 V	500 V	500 V		500 V	500 V	500 V
Output 1/2 0 to 20 mA/ pulse	2 300 V	500 V	500 V	500 V		500 V	500 V
Interface RS232/RS485	2 300 V	500 V	500 V	500 V	500 V		500 V
TPS external	2 300 V	500 V	500 V	500 V	500 V	500 V	

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

Basis for assessment: IEC 61010-1 (EN 61010-1), protection class II, overvoltage category II.

Current - pulse output variable

Current

- 0/4 to 20 mA +10% overrange, invertible
- maximum loop current 22 mA (short-circuit current)
- Load maximum 750 Ω at 20 mA
- Accuracy 0.1% of full scale value
- Temperature drift: 0.1% / 10 K (18 °F) ambient temperature change
- Output Ripple < 10 mV at 500 Ω for frequencies < 50 kHz
- Resolution 13 Bit
- Error signals 3.6 mA and 21 mA limits as per NAMUR NE43 adjustable

Pulse

Basic device:
- Frequency range to 2 kHz
- Voltage level 0 to 1 V low, 24 V high ±15%
- Load minimum 1 kΩ
- Pulse width 0.25 to 1 000 ms

Expansion cards (digital passive, open collector):
- Frequency range to 2 kHz
- I_{max} = 200 mA
- U_{max} = 24 V ±15%
- $U_{low/max}$ = 1.3 V bei 200 mA
- Pulse width 0.25 to 1 000 ms

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 expansion cards)
- 6 x digital passive (depends on the number of expansion cards)

Signal sources

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

Switching output

Function

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

Switch behavior

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

Relay switching capacity

maximum 250 V_{AC}, 3 A / 30 V_{DC}, 3 A

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

Switching frequency

maximum 5 Hz

Switching threshold

Programmable (wet steam alarm is preset at 2 °C (3.6 °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)
- Maximum number: 7 (depends on the number and type of expansion cards)

Number of output states

100 000

Scan rate

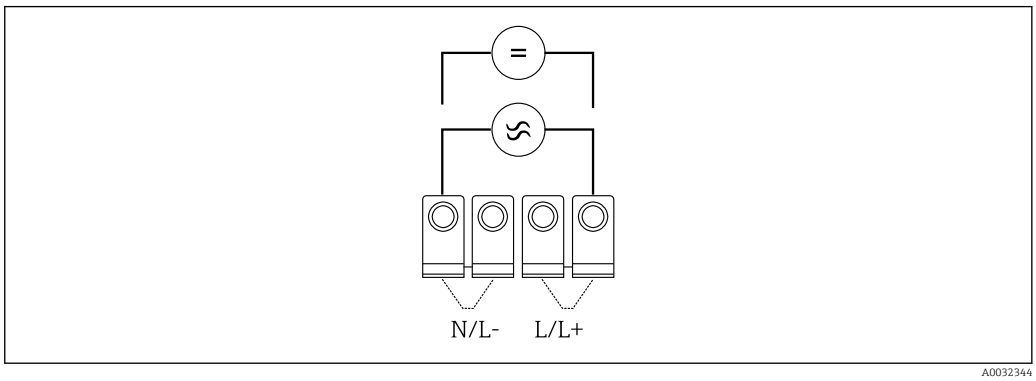
500 ms

Transmitter power supply and external power supply

- Transmitter power supply unit, terminals 81/82 or 81/83 (optional universal expansion cards 181/182 or 181/183):
  - Maximum supply voltage 24 V_{DC} ±15%
  - Impedance < 345 Ω
  - Maximum output current 22 mA (for U_{out} > 16 V)
  - HART® communication is not impaired
  - Number: 2 (in basic device)
  - maximum number: 8 (depending on the number and type of expansion cards)
- Additional power supply (e.g. external display), terminals 91/92:
  - Supply voltage 24 V_{DC} ±5%
  - Maximum current 80 mA, short-circuit proof
  - Number: 1
  - Source resistance < 10 Ω

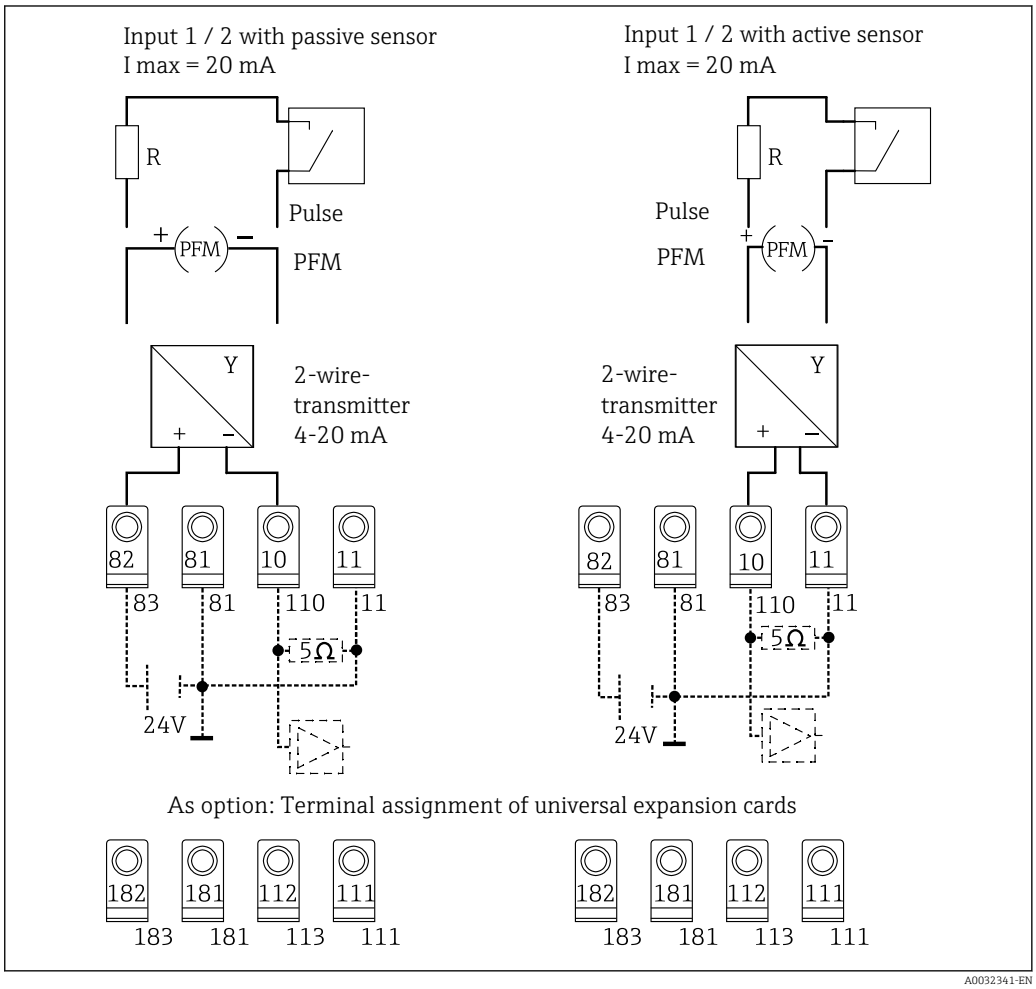
Power supply

Terminal assignment

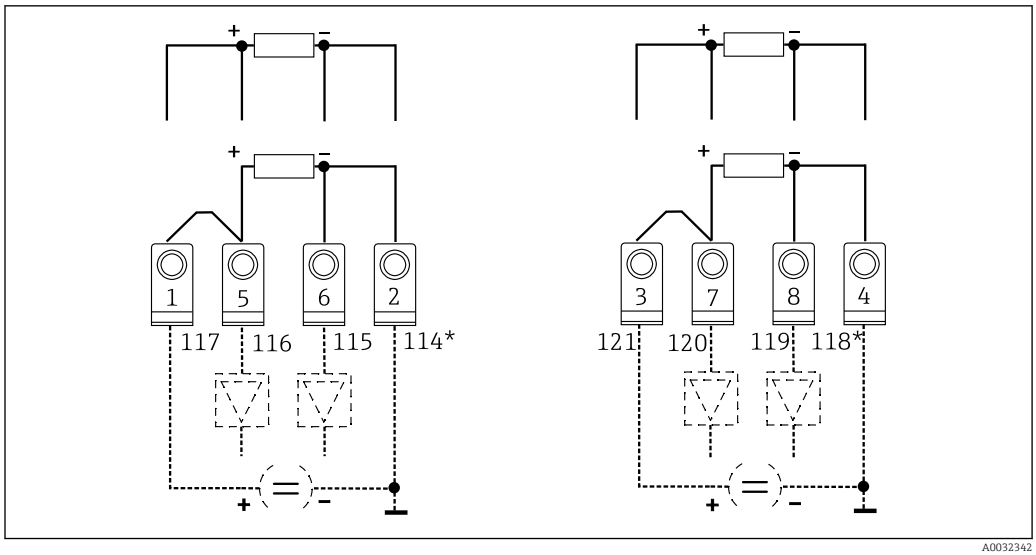


4 *Power supply; 90 to 250 V_{AC} 50/60 Hz, 20 to 36 V_{DC}, 20 to 28 V_{AC} 50/60 Hz*

The terminals are bridged internally and can be used as support points for series wiring.



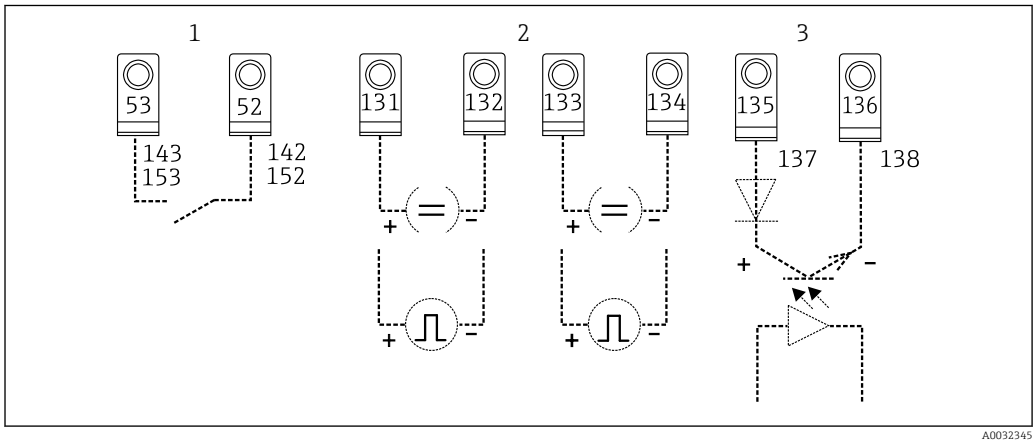
5 *PFM, current and pulse inputs of the energy manager*



6 *Temperature inputs of the energy manager; terminals 1, 2, 5, 6: input 1; terminals 3, 4, 7, 8: input 2*

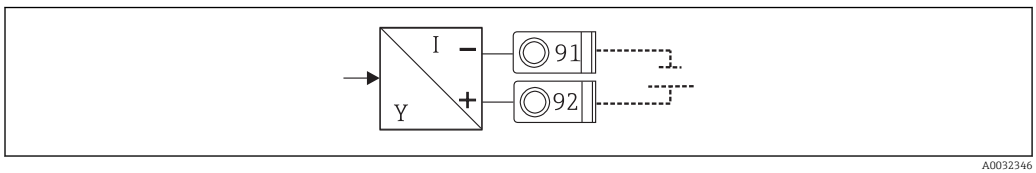
* *Optional: Terminal assignment temperature expansion card*

The terminals 1 and 5 or 3 and 7 respectively must be bridged for 3-wire connection.

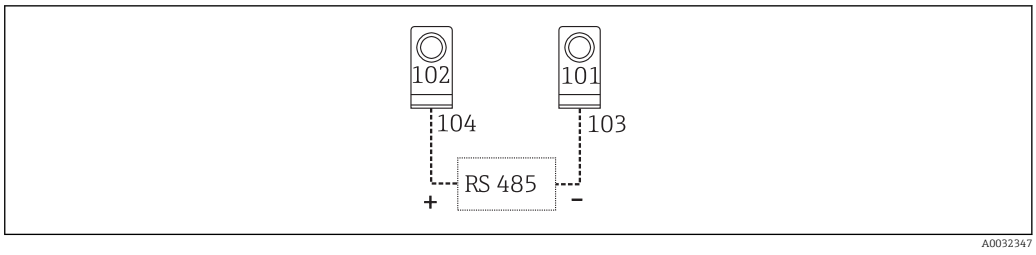


7 *Outputs of the energy managers*

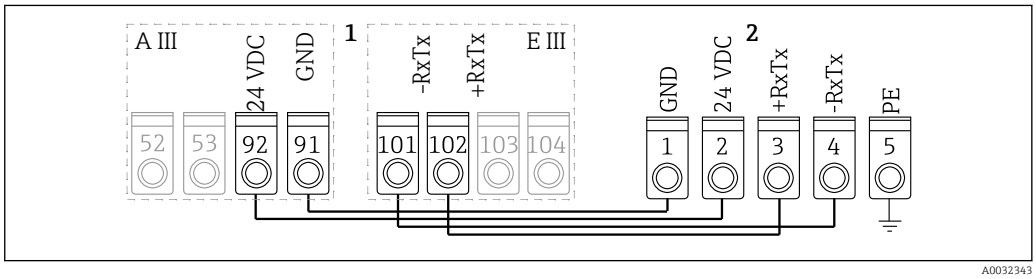
1 *Relay 1; terminal 142, 143 (relay 1) and 152, 153 (relay 2) as an option in expansion card*
2 *Pulse and current outputs*
3 *Pulse outputs (Open Collector) as an option in expansion card*



8 *Transmitter power supply*



9 Interfaces RS485



10 Connection of remote display and operating unit (option)

1 Energy manager
2 Display and operating unit

Supply voltage

- Low voltage power unit: 90 to 250 V_{AC} 50/60 Hz
- Extra-low voltage power unit: 20 to 36 V_{DC}, 20 to 28 V_{AC} 50/60 Hz

Power consumption

8 to 26 VA (depending on the configuration)

Connection data interface

RS232
- Connection: 3.5 mm jack plug on front panel
- Transmission protocol: ReadWin 2000
- Transmission rate: maximum 57600 Baud

RS485
- Connection: plug-in terminals 101/102 (in basic device)
- Transmission protocol: (serial: ReadWin 2000; parallel: open standard)
- Transmission rate: maximum 57600 Baud

Optional: additional RS485 interface
- Connection: plug-in terminals 103/104
- Transmission protocol and transmission rate same as standard RS485 interface

Performance characteristics

Reference operating conditions

- Power supply 230 V_{AC} ±10%; 50 Hz ±0.5 Hz
- Warm-up period > 30 min
- Ambient temperature range 25 °C (77 °F) ±5 K (±9 °F)
- Air humidity 39% ± 10% relative humidity

Maximum measured error

- Current: 0.1% of full scale value
- PFM: 0.01% of full scale value
- Temperature (4-wire connection):
  - Pt100: 0.03% of full scale value
  - Pt500: 0.1% of full scale value
  - Pt1000: 0.08% of full scale value

Resolution

- Current: 13 Bit
- Temperature: 16 Bit

Influence of ambient temperature

- Current: 0.4% / 10 K (18 °F) ambient temperature change
- PFM: 0.1% / 10 K (18 °F) ambient temperature change
- Temperature: 0.01%/ 10 K (18 °F) ambient temperature change

Installation

Mounting location

In the cabinet on DIN rail according to IEC 60715 TH 35

NOTICE

Device overheating when using expansion cards

▶ When using extension cards, venting with an air current of at least 0.5 m/s is necessary.

Orientation

No restrictions.

Environment

Ambient temperature range

−20 to 60 °C (−4 to 140 °F)

Storage temperature

−30 to 70 °C (−22 to 158 °F)

Climate class

As per IEC 60 654-1 Class B2 / EN 1434 Klasse 'C' (no condensation permitted)

Electrical safety

As per IEC 61010-1: ambient < 2 000 m (6 560 ft) above sea level

Degree of protection

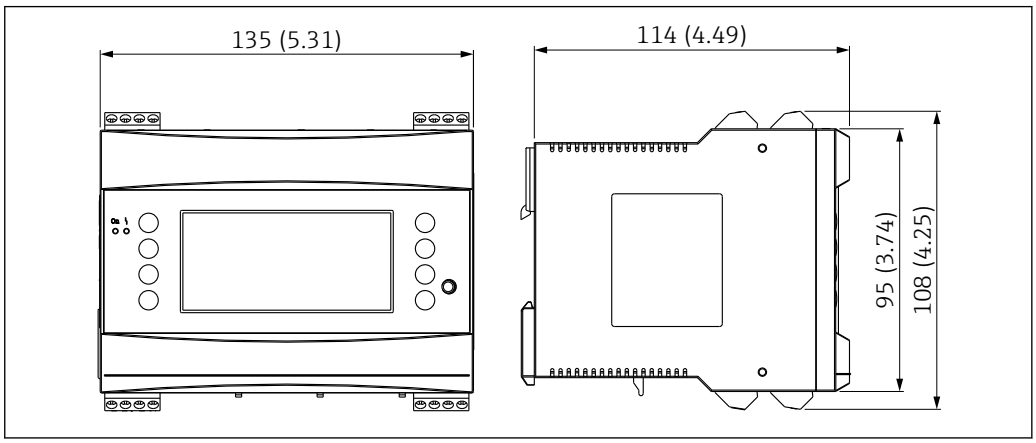
- Basic device: IP 20
- External display: IP 65

Electromagnetic compatibility

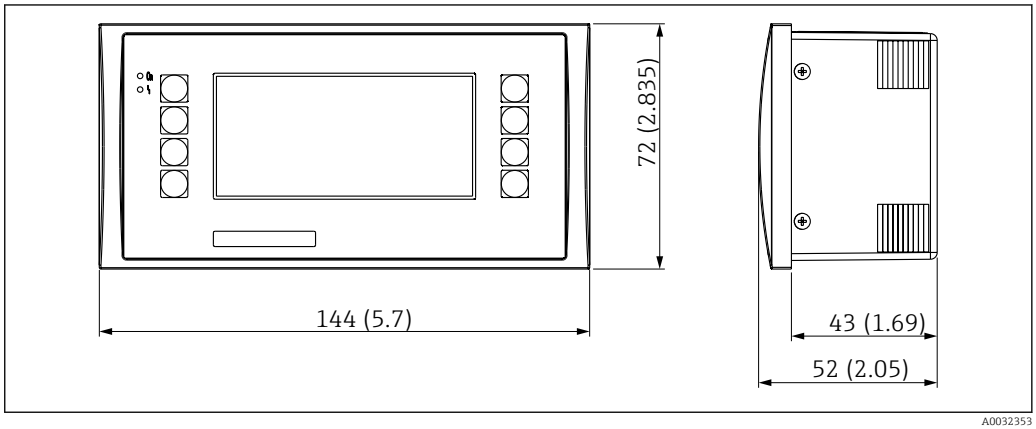
- Interference emission:
  IEC 61326 Class A
- Interference immunity:
  - Power failure: 20 ms, no influence
  - Starting current limitation: $I_{max}/I_n \leq 50\%$ (T50% ≤ 50 ms)
  - Electromagnetic fields: 10 V/m as per IEC 61000-4-3
  - Conducted HF: 0.15 to 80 MHz, 10 V as per IEC 61000-4-3
  - Electrostatic discharge: 6 000 V contact, indirect as per IEC 61000-4-2
  - Burst (power supply): 2 000 V as per IEC 61000-4-4
  - Burst (signal): 1 000 V/2 000 V as per IEC 61000-4-4
  - Surge (AC power supply): 1 000 V/2 000 V as per IEC 61000-4-5
  - Surge (DC power supply): 1 000 V/2 000 V as per IEC 61000-4-5
  - Surge (signal): 500 V/1 000 V as per IEC 61000-4-5

Mechanical construction

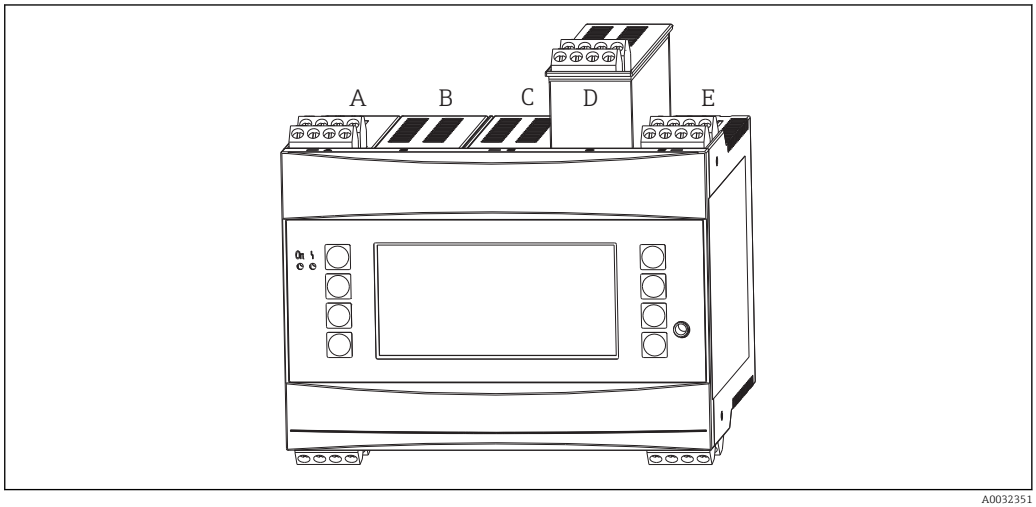
Design, dimensions



11 *Housing for DIN rail as per IEC 60751 TH35; dimensions in mm (in)*



12 *Display and operating unit for panel mounting (available as an option or as an accessory); dimensions in mm (in)*



13 *Unit upgrade with expansion cards (optional or available as accessories)*

A, E Slots A and E equipped in the basic device
B, C, Slots B, C and D can be upgraded with expansion cards
D

Weight

- Basic device: 500 g (17.6 oz) (in maximum configuration with expansion cards)
- Remote control unit: 300 g (10.6 oz)

Material

Housing: polycarbonate plastic, UL 94V0

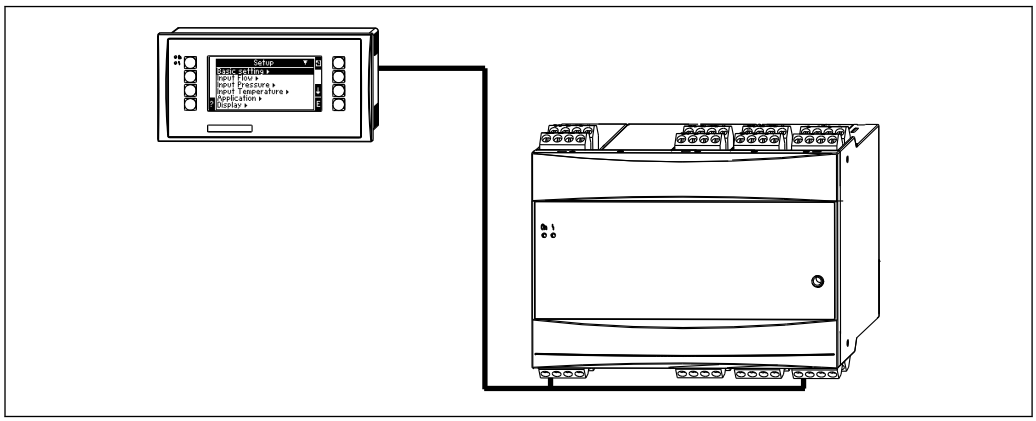
Terminals

Coded, pluggable screw terminals; Clamping area 1.5 mm^2 (16 AWG) solid, 1.0 mm^2 (18 AWG) flexible with wire end ferrule (applies to all connections).

Operability

Operating concept

- Display (optional):
  160 x 80 Dot-matrix LCD with blue background lighting
  Color changes to red in the event of an error (adjustable)
- LED status display:
  Operation: 1 x green
  Fault message: 1 x red
- 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 (WxHxT) 144 (5.67) x 72 (2.83) x 43 (1.69) mm (in))The connection to the integrated RS485 interface is made using the connecting cable (l = 3 m (9.84 ft)) which is included in the accessories set. Parallel operation of the external display unit with a device-internal display in the RMS621 is possible.



14 External display and operating unit in the panel mounted housing

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 (0.14 in)): jack plug on front panel): configuration via PC operating software.

Real time clock

- Deviation: 2.6 min per year
- Power reserve: 14 days

Mathematical functions

- Flow, difference pressure calculation: EN ISO 5167
- Continuous calculation of mass, density, enthalpy, heat quantity using stored algorithms and tables
- Water / steam calculation as per IAPWS-IF97

Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

EAC mark

The product meets the legal requirements of the EEU guidelines. The manufacturer confirms the successful testing of the product by affixing the EAC mark.

Other standards and guidelines

- IEC 60529:
  Degrees of protection by housing (IP code)
- IEC 61010-1:
  Safety requirements for electrical measurement, control and laboratory instrumentation.
- IEC 61326-Serie:
  Electromagnetic compatibility (EMC requirements).
- NAMUR NE21, NE43:
  Standardization association for measurement and control in chemical and pharmaceutical industries (www.namur.com).
- IAPWS-IF 97:
  International applicable and recognized 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 und 6
- EN ISO 5167:
  Flow measurement of fluids with throttle devices.

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Application packages

The following table contains an overview of the order codes for the expansion cards with the possible applications.

Applications in a device	Number of inputs	Product structure (expansion cards)
1 x saturated steam measurement	1 x pulse flow 1 x 4 to 20 mA pressure	RMS621-xxAAAxxxx
1 x steam mass	1 x 4 to 20 mA flow 1 x 4 to 20 mA pressure 1 x Pt100 temperature	
1 x steam heat differential	1 x 4 to 20 mA pressure 1 x 4 to 20 mA flow 2 x Pt100 temperature	
2 x satureated steam	2 x flow pulse 2 x 4 to 20 mA pressure	RMS621-xxBAAxxxx
1 x steam mass 1 x steam heat differential	2 x PFM flow 2 x 4 to 20 mA pressure 2 x Pt500 temperature	

Applications in a device	Number of inputs	Product structure (expansion cards)
1 x saturated steam measurement 1 x water heat quantity	2 x pulse flow 1 x 4 to 20 mA pressure 2 x Pt100 temperature	
2 x water heat differential	2 x 4 to 20 mA flow 4 x Pt100 temperature	RMS621-xxCAAxxxx
1 x water heat quantity 1 x water heat differential	2 x 4 to 20 mA flow 4 x Pt100 temperature	
3 x saturated steam measurement	3 x pulse flow 3 x 4 to 20 mA pressure	RMS621-xxBBAxxxx
1 x steam heat quantity 1 x water heat differential	1 x PFM flow 1 x pulse flow 1 x 4 to 20 mA pressure 3 x Pt100 temperature	RMS621-xxBCAxxxx
1 x steam heat differential 1 x water heat differential	2 x PFM flow 1 x 4 to 20 mA pressure 4 x Pt100 temperature	
1 x steam mass 1 x steam net heat quantity 1 x water heat quantity	3 x PFM flow 2 x 4 to 20 mA pressure 4 x Pt100 temperature	RMS621-xxBBCxxxx
3 x steam mass	3 x 4 to 20 mA flow 3 x 4 to 20 mA pressure 3 x Pt500 temperature	
1 x steam mass 2 x water heat differential	3 x PFM flow 1 x 4 to 20 mA pressure 5 x Pt100 temperature	RMS621-xxBCCxxxx
3 x water heat differential	3 x pulse flow 6 x Pt100 temperature	

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

- Display and operating unit (optional or as an accessory):
  Remote display for panel mounting (dimensions (WxHxD) 144 (5.67) x 72 (2.83) x 43 (1.69) mm (in))
- IP 66 protective housing for field mounting DIN rail instrumentation

Expansion cards

A function expansion of the device by means of max. 3 extension cards (universal and/or temperature cards) is possible.

- Extension card temperature
  Inputs: 2 x Pt100/500/1000
  Outputs: 2 x 0/4 to 20 mA/pulse, 2 x digital, 2 x relay
- Extension card universal
  Inputs: 2 x 0/4 to 20 mA/PFM/pulse with TPS
  Outputs: 2 x 0/4 to 20 mA/pulse, 2 x digital, 2 x relay
- PC configuration software ReadWin 2000 and serial configuration cable with jack plug 3.5 mm (0.14 in).

Communication-specific accessories

PROFIBUS interface

Documentation

- System components and data managers - Solutions for the loop: FA00016K
- Operating instructions RMS621: BA00255R
- Appendix to the Operating Instructions M-Bus interface RMC621/RMS621: BA00216R
- Brief Operating Instructions RMC621/RMS621: KA01321K

www.addresses.endress.com

Endress+Hauser

People for Process Automation