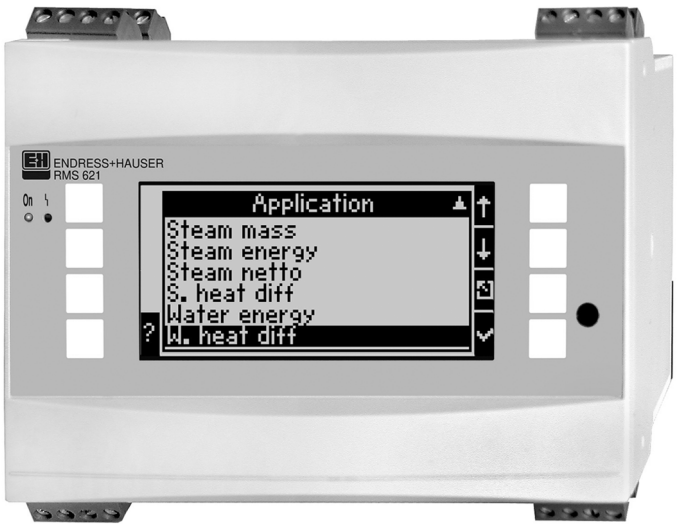
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

RMS621

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



Application areas

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

Features and benefits

- Calculation of the following applications:
  Steam mass, steam heat quantity, net steam quantity, steam-heat differential, water heat quantity, water-heat differential
- Simultaneous calculation of up to 3 applications per device
- Real time clock
- Logbook function for error messages and parameter changes with date and time
- Presettable allocation of the in/outputs to each application
- Configuration and operation using a serial interface and PC software ReadWin® 2000
- Modular expansion using plug-in cards
- Large back-lit LC display with colour change in the event of an error
- Quick and safe commissioning 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
- Bidirectional flow applications or energy measurement possible
- Splitting range flow measurements
- Averaging of several input signals
- Flow compensation thanks to improved differential pressure procedure
- UL recognized component to UL 3111-1

CE UL

TI092R/09/en
51004476

Endress+Hauser
People for Process Automation

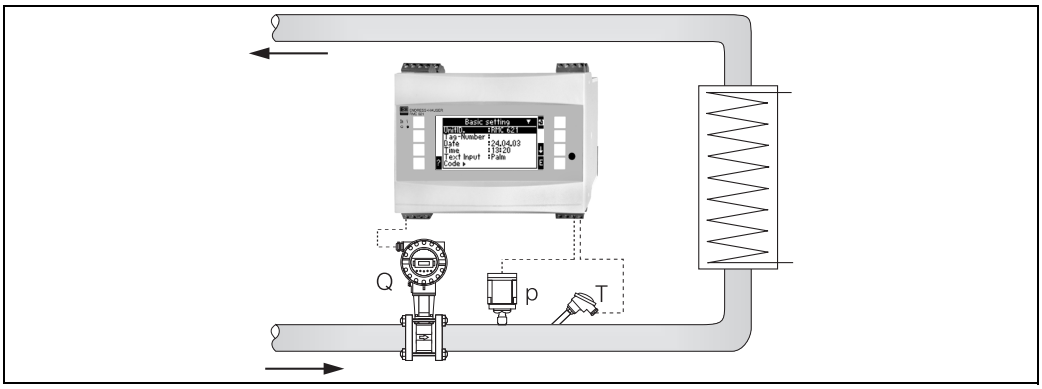
Function and system design

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 as a 4 to 20 mA signal directly or using temperature transmitters (e.g. TMT181). A separate transmitter power supply is installed for each analogue 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 undershot. The most recently valid values are registered in the event memory when they leave or return to the valid process limits.

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 (pressure-compensated or temperature-compensated).

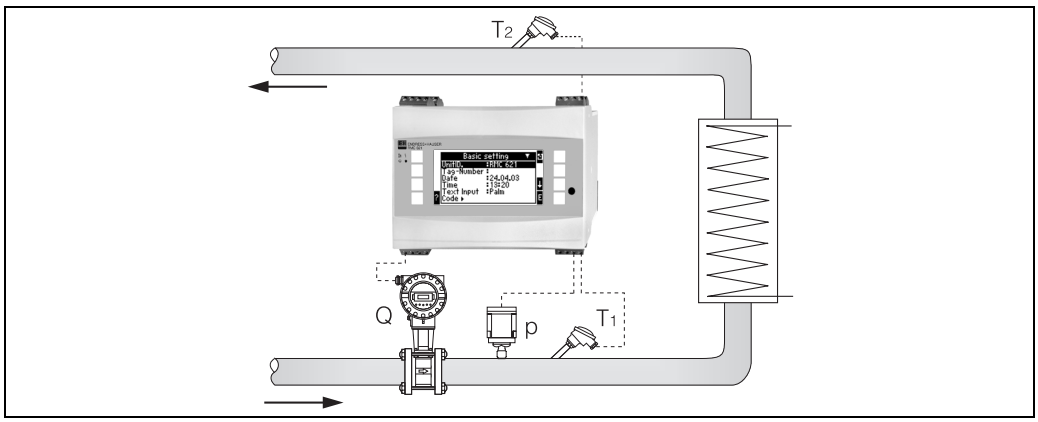
Steam heat quantity
Calculation of the mass flow and its quantity of heat (energy) in a steam line from the process variables for flow, pressure and temperature. Saturated steam operation possible, calculation same as for steam mass.



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) possible.

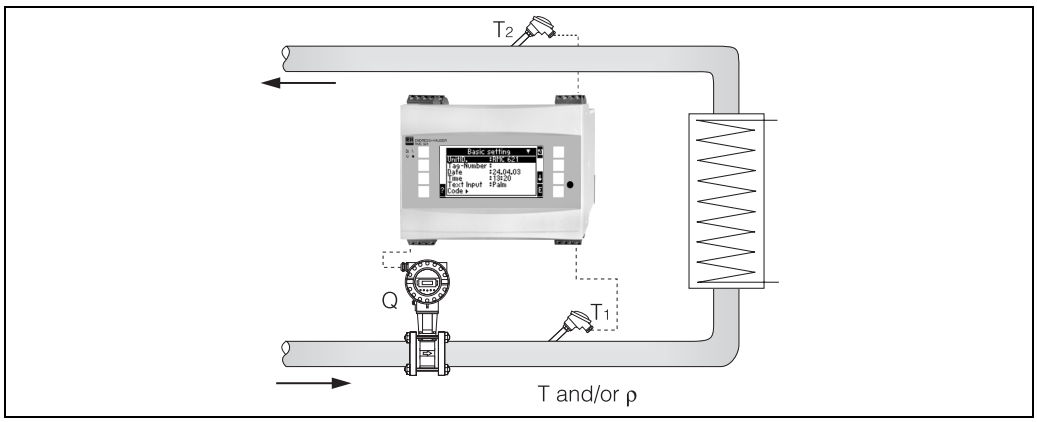
Net steam quantity
Calculation of the quantity of heat that can be extracted from a steam mass flow until it condenses to water. Process variables: flow, pressure, temperature. For saturated steam, the calculation is made from two input variables.



Calculation of the steam-heat differential and net steam quantity from the input variables for flow (Q), pressure (p) and the temperature differential (T_1 - T_2)

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.



Calculation of the water heat quantity and water-heat differential from the input variables for flow (Q) and the temperature differential (T_1 - T_2)

Measuring system

The analogue input variables are digitised, 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 colour change of the background lighting visualises alarm value violations or faults. A function expansion of the device by means of expansion cards can be made at any time.

Input

Measured variable

Current, PFM, pulse, temperature

Measuring range

<table>
<tr><th>Measured variable</th><th colspan="3">Input</th></tr>
<tr><td>Current</td><td colspan="3">■ 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 configurable
■ Resolution 13 Bit
■ Fault recognition 3.6 mA and 21 mA limit as per NAMUR NE43</td></tr>
<tr><td>PFM</td><td colspan="3">■ Frequency range 0.01 Hz to 12.5 kHz
■ Signal level 2 to 7 mA low; 13 to 19 mA high
■ Measurement method: period length/frequency measurement
■ Accuracy 0.01% of measured value
■ Temperature drift 0.1% / 10 K ambient temperature</td></tr>
<tr><td>Pulse</td><td colspan="3">■ Frequency range 0.01 Hz to 12.5 kHz
■ Signal level 2 to 7 mA low; 13 to 19 mA high with approx. 1.3 kΩ dropping resistor at max. 24 V voltage level</td></tr>
<tr><td rowspan="5">Temperature</td><td colspan="3">Resistance thermometer (RTD) as per ITS 90:</td></tr>
<tr><td>Designation</td><td>Measuring range</td><td>Accuracy (4-wire connection)</td></tr>
<tr><td>Pt100</td><td>-200 to 800 °C (-328 to 1472 °F)</td><td>0.03% of full-scale value</td></tr>
<tr><td>Pt500</td><td>-200 to 250 °C (-328 to 482 °F)</td><td>0.1% of full-scale value</td></tr>
<tr><td>Pt1000</td><td>-200 to 250 °C -328 to 482 °F)</td><td>0.08% of full-scale value</td></tr>
<tr><td colspan="3">■ Type of connection: 3- or 4-wire system
■ Measuring current 500 µA
■ Resolution 16 Bit
■ Temperature drift 0.01% / 10 K ambient temperature</td></tr>
</table>

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 (see also 'galvanic isolation' → Page 5).

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: IEC 61010-1, protection class II, overvoltage 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 and 21 mA limit configurable as per NAMUR NE43

Pulse

Basic device:
- Frequency range to 12.5 kHz
- Voltage level 0 to 1 V low, 24 V high ±15%
- Min. load 1 kΩ
- Max. pulse width 0.04 to 1000 ms

Expansion cards (digital passive, open collector):
- Frequency range 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 0.04 to 1000 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 plug-in cards)
- 6 x digital passive (depends on the number of plug-in 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 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 number and kind of plug-in cards)

Number of output states

100,000

Scanrate

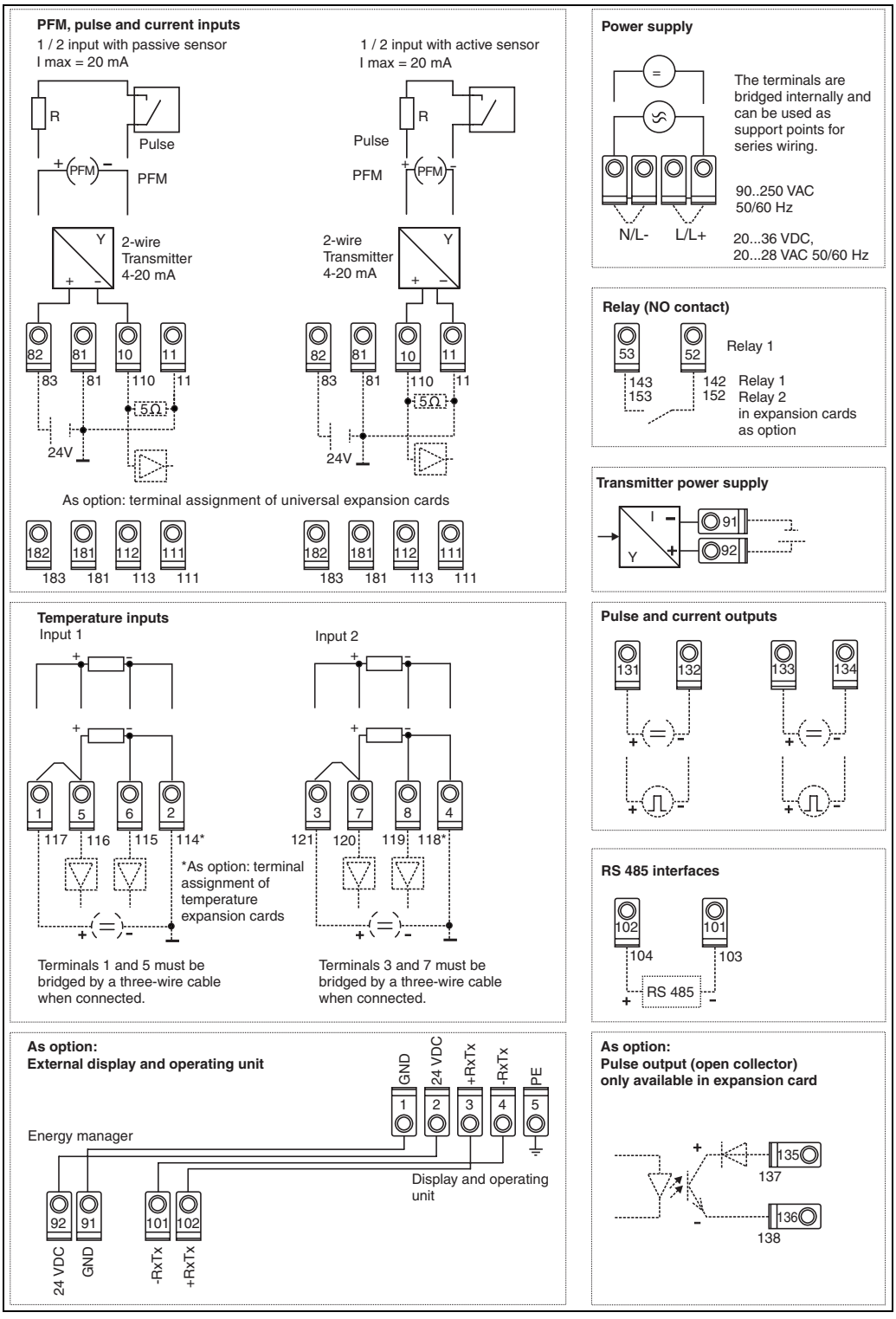
250 ms

Transmitter 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%
  Impedance < 345 Ω
  max. output current 22 mA (for U_{out} > 16 V)
  Max. current 30 mA, short-circuit proof
  HART® communication is not accounted for
  Number 2 (in basic device)
  Maximum number: 5 (depends on number and kind of plug-in cards)
- Additional power supply (e.g. external display), Terminals 91/92:
  Supply voltage 24 V DC ± 5%
  Max. current 80 mA, short-circuit proof
  Number 1
  Source resistance < 10 Ω

Power supply

Electrical connection (wiring diagrams)



RMS621 terminal assignment - basic device + expansion cards (optional)

Supply voltage

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

Power consumption

8 to 26 VA (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 (in basic device)
– 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

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 374 °C (32 to 705 °F)
	Maximum Temperature differential range ΔT	0 to 374 K
	Error limit for ΔT	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	500 ms
Steam	Temperature measuring range	0 to 800 °C (32 to 1472 °F)
	Pressure measuring range	0 to 1000 bar
	Measurement and calculation interval	500 ms

Installation conditions

Installation instructions

Mounting location

In the cabinet on DIN rail IEC 60715

Orientation

no restrictions

Environmental conditions

Ambient temperature

-20 to 60 °C (-4 to 140 °F)

Storage temperature

-30 to 70 °C (-22 to 158 °F)

Climate class

as per IEC 60654-1 Class B2 / EN 1434 Class 'C'

Electrical safety

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

Degree of protection

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

Electromagnetic compatibility

Interference emission

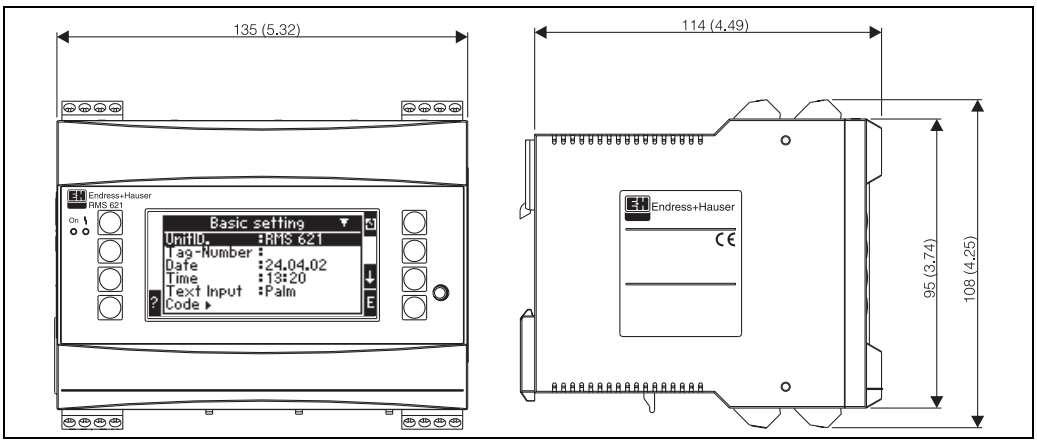
IEC 61326 Class A

Interference immunity

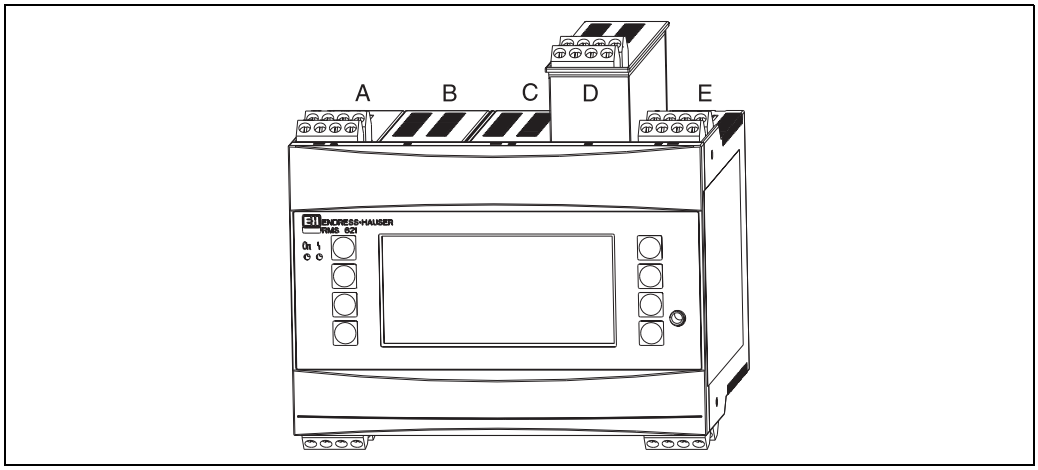
– Power failure: 20 ms, no influence
– Starting current limitation: $I_{max}/I_n \leq 50\%$ (T50% ≤ 50 ms)
– Electromagnetic fields: 10 V/m as per IEC 61000-4-3
– Conducted HF: 0.15 to 80 MHz, 10 V as per IEC 61000-4-3
– Electrostatic discharge: 6 kV contact, indirect as per IEC 61000-4-2
– Burst (power 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

Mechanical construction

Design, dimensions



Housing for DIN rail as per IEC 60715; dimensions in mm (inch)



Unit upgrade with expansion cards (optional or available as accessories)
– Slots A and E equipped in the basic device
– Slots B, C and D can be upgraded with expansion cards

Weight

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

Material

Housing: polycarbonate plastic, UL 94V0

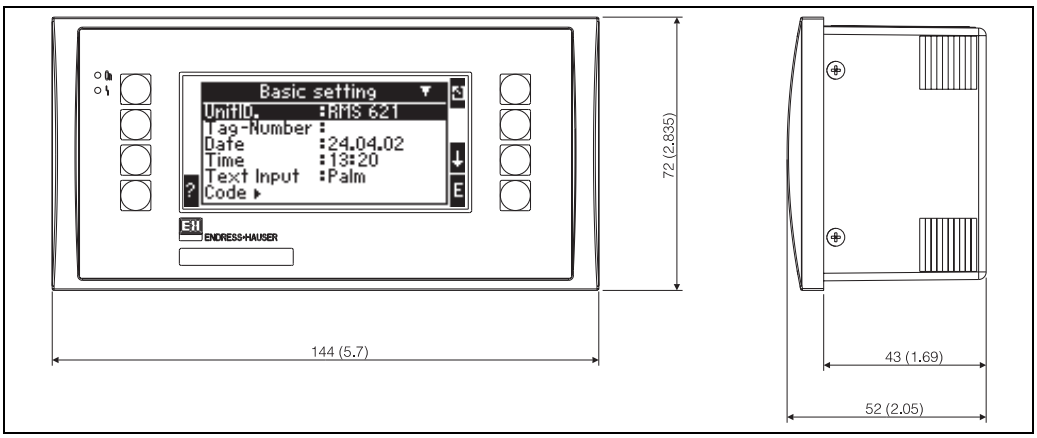
Terminals

Coded, pluggable screw terminals; Clamping area 1.5 mm^2 (0.0023 in^2) solid, 1.0 mm^2 (0.0016 in^2) flexible with wire end ferrule (applies to all connections).

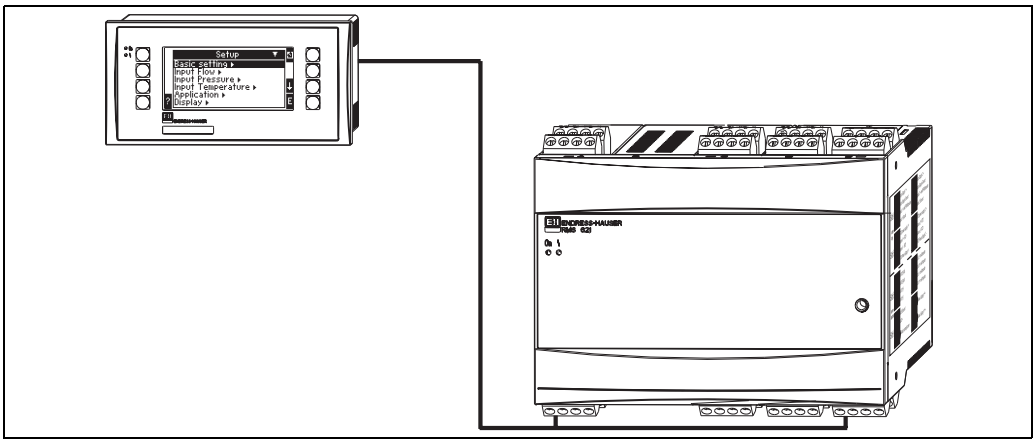
Human interface

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 panelmounted 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 RS485 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 RMS621 is possible.



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



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 (0.138 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	Flow, differential pressure calculation: EN ISO 5167. Continuous calculation of mass, standard volume, density, enthalpy, quantity of heat using stored algorithms and tables. Water / steam as per IAWPS-IF97.

Certificates and approvals

CE-approval

The device meets the legal requirements of the EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

Other standards and guidelines

- IEC 60529:
  Degree of protection provided by housing (IP-Code)
- IEC 61010:
  Safety requirements for electrical measurement, control and laboratory use.
- IEC 61326:
  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
- IEC ISO 5167
  Flow measurement of fluids with throttle devices

UL approval

Recognized component to UL 3111-1.

Ordering information

Product structure

RMS621	**Steam- and heat computer** For calculating steam mass, heat and differential between water/steam. Calculation formula to IAPWS-IF 97; Standard input: 2 x 0/4 to 20 mA/PFM/Pulse, 2 x Pt100/500/1000; Standard output: 2 x 0/4 to 20 mA/Pulse, 1 x relay (closing cont.), 1 x transmitter power supply

	Operation	
	1	Software ReadWin® 2000, w/o button
	2	Alphanumeric display, button 8
	3	Remote, RS485, panel mounting 72 x 144 mm
	4	Remote, 2 x RS485, panel mounting 72 x 144 mm

		Power supply	
		1	90 to 250 V AC, 50/60Hz
		2	20 to 36 V DC / 20 to 28 V AC, 50/60Hz

			Slot B	
			A	Not used
			B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse 2 x digital, 2 x relays SPST
			C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST

				Slot C	
				A	Not used
				B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST
				C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse 2 x digital, 2 x relays SPST

					Slot D	
					A	Not used
					B	Input: 2 x 0/4 to 20 mA/PFM/Pulse + 2 x loop power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST
					C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays SPST

						User Mode	
						1	Basic version
						2	1 x application, pre-installed

							Operation Language	
							1	German
							2	English
							3	French
							4	Italian
							5	Czech
							6	American

								Communication	
								1	1 x RS232 + 1 x RS485
								2	1 x RS232 + 1 x RS485 + cable + software ReadWin® 2000
								3	1 x RS232 + ext. PROFIBUS-DP slave module
								4	1 x RS232 + cable + ext. PROFIBUS-DP slave module + software ReadWin® 2000
								5	1x RS232/1x M-Bus + 1x RS485
								6	1x RS232/1x M-Bus + 1x RS485 + cable + software ReadWin® 2000

									Additional Option	
									K	Standard model, North American region
									1	Basic version
									2	Works calib. certif., 5-point

RMS621-										⇐ **Order code (complete)**

Product structure selection aid

The following table contains an overview of the order codes for the expansion cards with the possible applications in a RMS621 energy manager:

Applications in one unit	Number of input	Order code (expansion cards)
1 x saturated steam mass	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 differencial	1 x 4 to 20 mA flow 1 x 4 to 20 mA pressure 2 x Pt100 temperature	
2 x saturated steam mass	2 x Pulse flow 2 x 4 to 20 mA pressure	RMS621-xxBAAxxxx
1 x steam mass 1 x steam heat quantity	2 x PFM flow 2 x 4 to 20 mA pressure 2 x Pt500 temperature	
1 x saturated steam mass 1 x water heat quantity	2 x Pulse flow 1 x 4 to 20 mA pressure 2 x Pt100 temperature	
2 x water heat quantity	2 x 4 to 20 mA flow 4 x Pt100 temperature	RMS621-xxCAAxxxx
1 x water heat quantity 1 x water heat differencial	2 x 4 to 20 mA flow 4 x Pt100 temperature	
3 x saturated steam mass	3 x Pulse flow 3 x 4 to 20 mA pressure	RMS621-xxBBAxxxx
1 x steam heat quantity 1 x water heat differencial	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 differencial 1 x water heat differencial	2 x PFM flow 1 x 4 to 20 mA pressure 4 x Pt100 temperature	
1 x steam mass 1 x net steam 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 differencial	3 x PFM flow 1 x 4 to 20 mA pressure 5 x Pt100 temperature	RMS621-xxBCCxxxx
3 x water heat differencial	3 x Pulse flow 6 x Pt100 temperature	

Accessories

- PC configuration software ReadWin® 2000 and serial configuration cable with 3.5 mm (0.138 in) jack plug.
  Order No.: RMS621A-VK
- External display and operating unit in the panel mounted housing 144 x 72 x 43 mm (5.7 x 2.84 x 1.7 inches)
  Order No.: RMS621A-AA
- IP 66 protective housing for field mounting DIN rail instrumentation
  Order No.: 52010132
- PROFIBUS Interface
  Order No.: RMS621A-P1

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 Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays	Order No.: RMS621A-TA
Extension card universal Input: 2 x 0/4 to 20 mA/PFM/Pulse with transmitter power supply Output: 2 x 0/4 to 20 mA/Pulse, 2 x digital, 2 x relays	Order No.: RMS621A-UA

Documentation

❑ Operating manual 'Energy Manager RMS621' (BA127R/09/en)
❑ Technical information 'System components for DIN rail devices' (TI367F/00/en)
❑ Technical information "PROline Prowirl 72 flowmeter" (TI062D/06/en)

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