Technical Information
RIA452

Panel meter

Digital process meter in panel mounted housing for monitoring and displaying analog measured values with pump control and batch functions
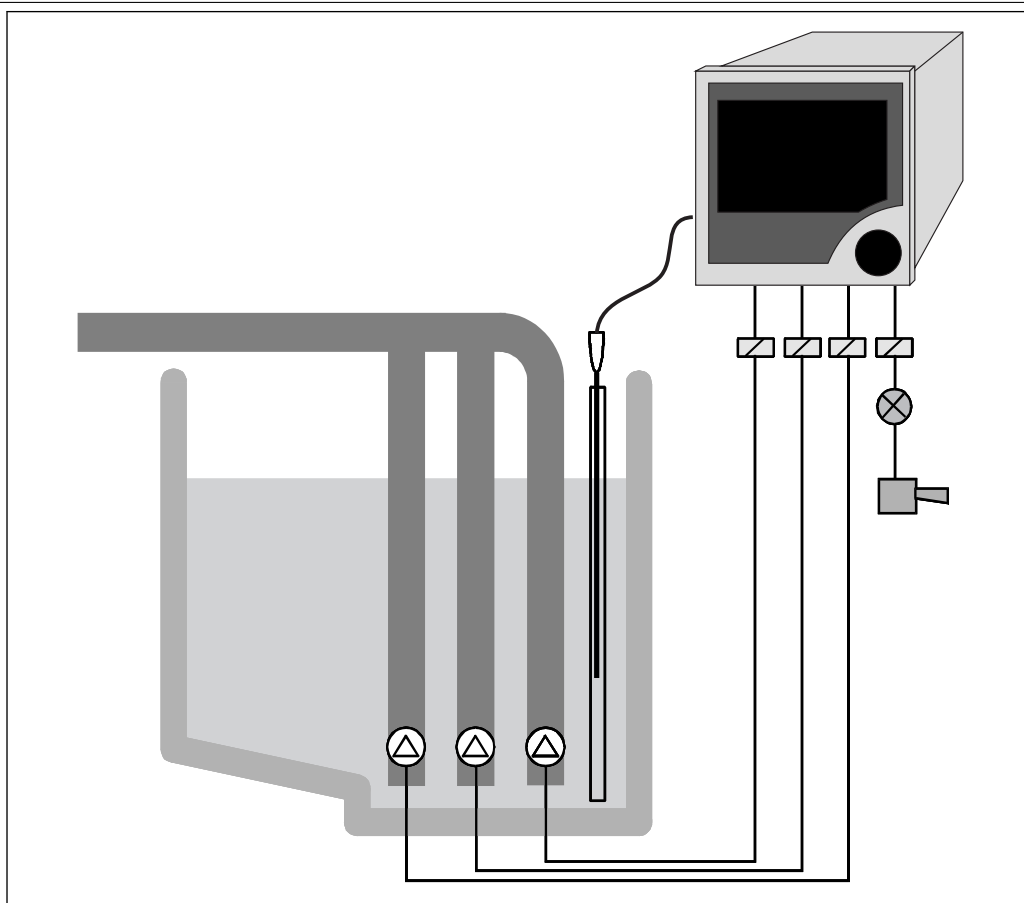
Application

- Water/wastewater sector
- Power industry
- Raw materials
- Chemicals industry
- Food industry

Your benefits

- 7-digit 14-segment LC display
- Multicolored
- Large bar graph with overrange and underrange
- Intrinsically safe input with transmitter power supply
- Digital status inputs for pump monitoring
- Universal input
- Up to eight relays
- Min/Max value saved
- Pump control functions
- Batch functions
- Flow measurement for open channels and weirs
- Linearization table with 32 support points
- Analog output
- Pulse output with totalizer
- Jog-shuttle operation
- Freely programmable units
- Configuration via interface and operating software
- Tank linearization via PC software

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Function and system design

Measuring principle

☒ *1*   *Example of an application of the process display unit*

The single-channel process meter RIA452 monitors and displays analog measured values. Pumps can be monitored with the digital status inputs. The measured value is displayed using the seven-digit 14-segment LC display. Numbers and units are displayed in white, the bar graph in yellow, overrange and underrange in red and the limit value flags and digital status inputs in green and yellow. The RIA452 can provide power directly to two-wire transmitters connected. You have the option of selecting the input and the transmitter power supply as intrinsically safe for Ex applications. Up to eight freely programmable relays monitor the measured value for limit value overshoot and undershoot. Other operating modes for the relays include sensor or device malfunction, batch and pump control functions (e.g. alternating pump control). Furthermore, the RIA452 can be used as a preset counter and for measuring flow at open channels and measuring weirs.

The scalable analog output offers many different ways of forwarding the input signal: zoom function, linearization, offset, inversion and signal conversion (input/output conversion). The optional pulse output gives the user the option of outputting integrated process values.

Measuring system

Microcontroller controlled meter in panel mounted housing with multicolored, illuminated LC display. The analog measured value acquisition takes place via an analog/digital converter. The digital status inputs are scanned cyclically. Power can be supplied directly to two-wire sensors with the transmitter power supply integrated as standard. The current input is optionally available as an intrinsically safe version for Ex applications. Here, the RIA452 has a second, intrinsically safe transmitter power supply.

The freely scalable analog output is output via a digital/analog conversion. The digital pulse output is output directly.

Up to eight relays are available in the device for monitoring limit values, pump control and batch functions.

The device can be operated on site, using the jog/shuttle dial or via the PC with an operating software. Operation can be locked using the hardware key or software code.

| Linearization | The following flow curves are stored for open channels and weirs: |

The following flow curves are stored for open channels and weirs:
- Khafagi-Vernturi channel
- ISO-Venturi channel
- BST [1]-Venturi channel
- Parshall channel
- Palmer-Bowlus channel
- Rectangular weir
- Rectangular weir with constriction
- NFX [2] rectangular weir
- NFX [2] rectangular weir with constriction
- Trapezoidal weir
- Triangular ("V") weir
- BST [1] triangular weir
- NFX [2] triangular weir

Flow formula can be freely configured

$Q = C * (h^\alpha + \gamma * h^\beta)$

The parameters α, β, γ and C can be entered freely.

Linearization function

Up to 32 freely definable support points are available in the device to linearize the input, e.g. for tank linearization.

The linearization table for standard tanks and customer-specific tanks can be generated with the ReadWin 2000 operating software.

Input

| Measured variable | • Current (standard)
• Digital inputs (standard)
• Current/voltage, resistance, resistance thermometer, thermocouples (universal input option) |

| Measuring range | **Current input:** |

Current input:

- 0/4 to 20 mA +10% overrange, 0 to 5 mA
- Short-circuit current: max. 150 mA
- Input impedance: ≤ 5 Ω
- Reaction time: ≤ 100 ms

Universal input:

Current::
- 0/4 to 20 mA + 10% overrange, 0 to 5 mA
- Short-circuit current: max. 100 mA
- Input impedance: ≤ 50 Ω

Voltage:
- ±150 mV, ±1 V, ±10 V, ±30 V, 0 to 100 mV, 0 to 200 mV, 0 to 1 V, 0 to 10 V
- Input impedance: ≥ 100 kΩ

Resistance:
30 to 3 000 Ω in 3/4-wire technology

Resistance thermometer:
- Pt100/500/1000, Cu50/100, Pt50 in 3/4-wire technology
- Measuring current for Pt100/500/1000 = 0.25 mA

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1) BST: British Standard
2) NFX: French Standard NFX 10-311

Thermocouple types:
- J, K, T, N, B, S, R as per IEC584
- D, C as per ASTME998
- U, L as per DIN43710/GOST
- Reaction time: ≤ 100 ms

Digital input:

- Voltage level −3 to 5 V low, 12 to 30 V high (as per DIN19240)
- Input voltage max. 34.5 V
- Input current typ. 3 mA with overload and reverse polarity protection
- Sampling frequency max. 10 Hz

Galvanic isolation	Towards all other circuits

Output

Output signal	• Relay, transmitter power supply (standard) • Current, voltage, pulse, intrinsically safe transmitter power supply (option)
Signal on alarm	No measured value visible on the LC display, no background illumination, no sensor power supply, no output signals, relays behave in safety-oriented manner.
Current/voltage output	Span: 0/4 to 20 mA (active), 0 to 10 V (active) Load: • ≤ 600 Ω (current output) • Max. loop current 22 mA (voltage output) Signal characterization: Signal freely scalable Galvanic isolation towards all other circuits
Pulse output (open collector)	• Frequency range to 2 kHz • I_{max} = 200 mA • U_{max} = 28 V • $U_{low/max}$ = 2 V at 200 mA • Pulse width = 0.04 to 2 000 ms
Relay	Signal characterization: Binary, switches when the limit value is reached Switch function: limit relay switches for the operating modes: • Minimum/maximum safety • Alternating pump control function • Batch function • Time control • Window function • Gradient • Device malfunction • Sensor malfunction Switching threshold: Freely programmable Hysteresis: 0 to 99% Signal source: • Analog input signal • Integrated value • Digital input

Number:
4 in basic unit (can be extended to 8 relays, option)

Electrical specifications:
- Relay type: changeover
- Relay switching capacity: 250 V_{AC} / 30 V_{DC}, 3 A
- Switch cycles: typically 10^5
- Switching frequency: max. 5 Hz
- Minimum switching load: 10 mA / 5 V_{DC}

Galvanic isolation towards all other circuits

 Mixed assignment of low and extra-low voltage circuits is not permitted for neighboring relays.

Transmitter power supply	**Transmitter power supply 1, terminal 81/82 (optionally intrinsically safe):**

Transmitter power supply 1, terminal 81/82 (optionally intrinsically safe):

Electrical specifications:
- Output voltage: 24 V ±15%
- Output current: max. 22 mA (at $U_{out} \geq 16$ V, sustained short-circuit proof)
- Impedance: ≤ 345 Ω

Approvals:
- ATEX
- FM
- CSA

Transmitter power supply 2, terminal 91/92:

Electrical specifications:
- Output voltage: 24 V ±15%
- Output current: max. 250 mA (sustained short-circuit proof)

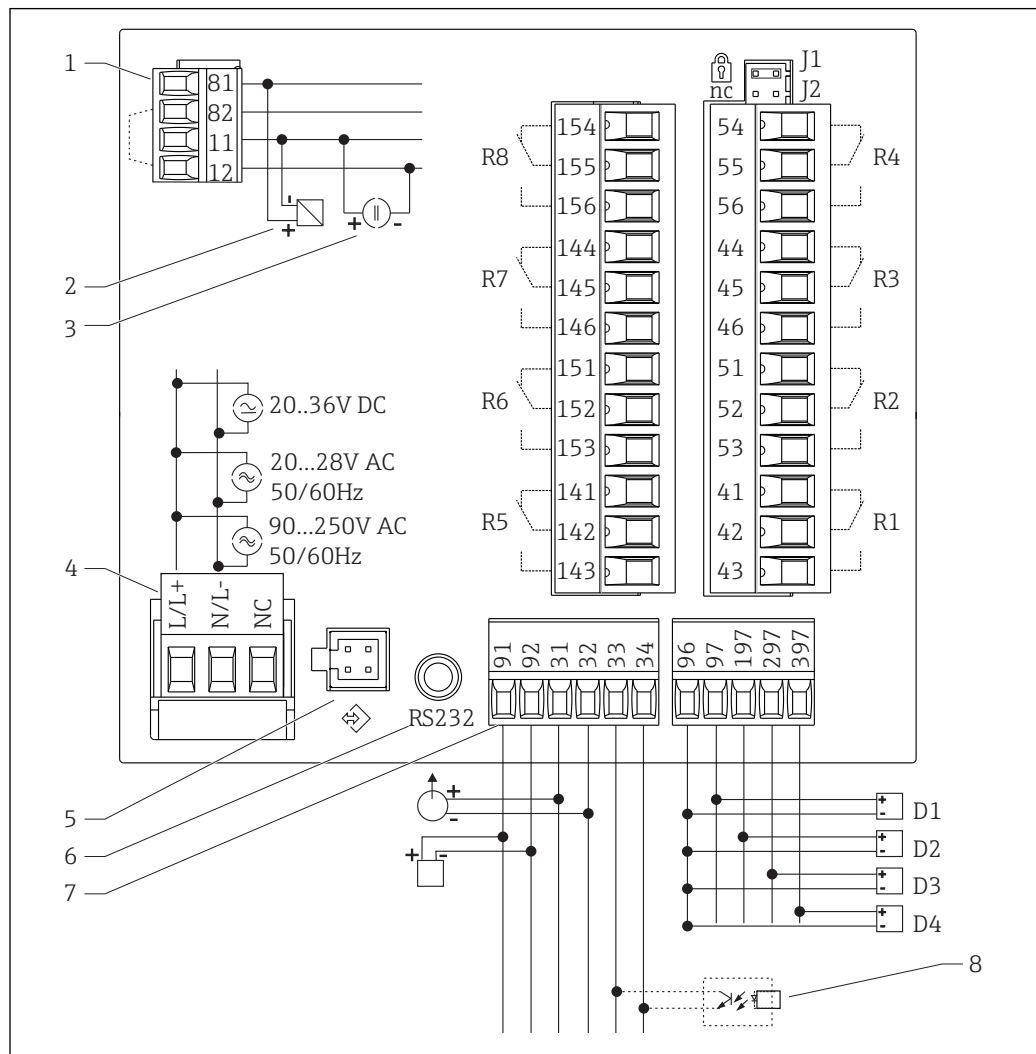**Transmitter power supply unit 1 and 2:**

Galvanic isolation:
Towards all other circuits

HART®

No HART® signal influence

Power supply

Terminal assignment

⊡ *2   Terminal layout of process meter*

1	*Current input (12 and 82 internally bridged)*	*7*	*Transmitter power supply and analog output*
2	*- passive sensor*	*8*	*Open collector output*
3	*- active sensor*	*D1...D4*	*Digital inputs*
4	*Voltage supply*	*R1...R4*	*Relay outputs*
5	*Interface for PC operating software*	*R5...R8*	*Relay outputs (optional)*
6	*RS232 interface*	*J1*	Hardware write protection

Option universal input
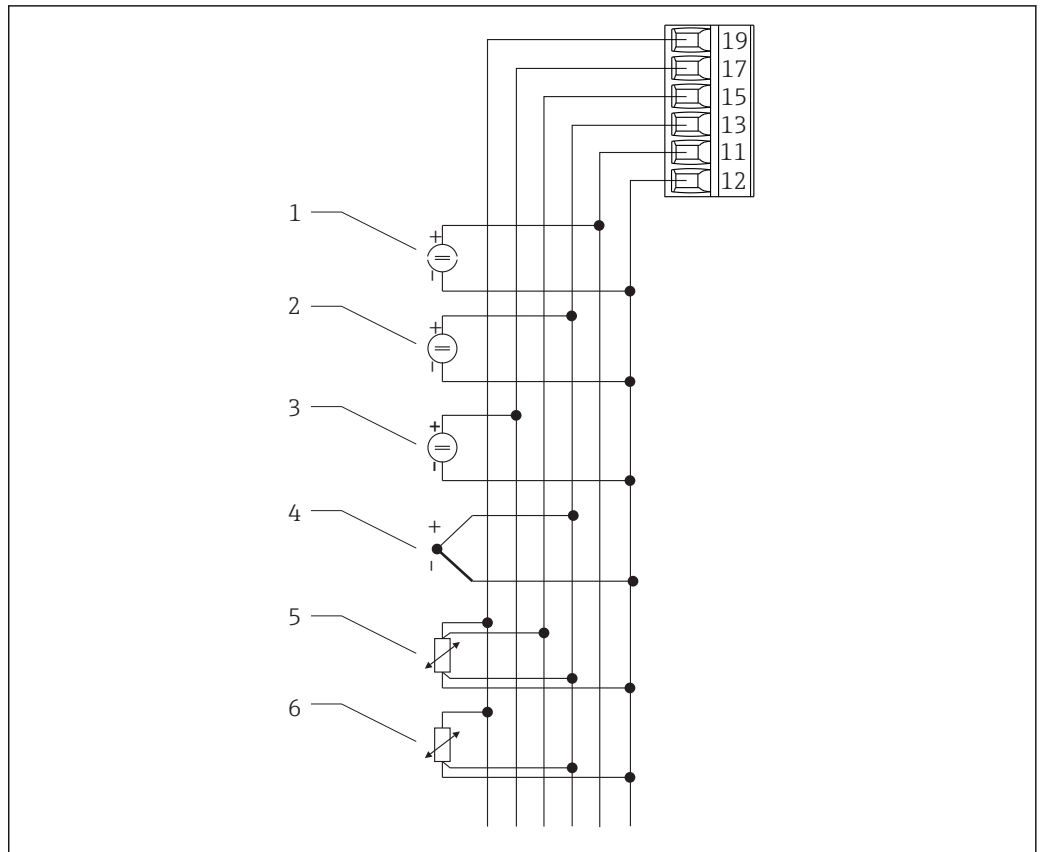
⊞ *3   Terminal layout universal input*

1	*Current input 0/4 to 20 mA*	*4*	*Thermocouples*
2	*Voltage input ±1 V*	*5*	*Resistance thermometers, 4-wire*
3	*Voltage input ±30 V*	*6*	*Resistance thermometers, wire*

Connection data interface

RS232
- Connection: jack socket 3.5 mm, rear of device
- Transmission protocol: ReadWin 2000
- Transmission rate: 38 400 Baud

Supply voltage

Power unit 90 to 250 V_{AC} 50/60 Hz

Low voltage power unit 20 to 36 V_{DC} bzw. 20 to 28 V_{AC} 50/60 Hz

Power consumption

max. 24 VA

Performance characteristics

Reference operating conditions

Power supply: 230 V_{AC} ±10%, 50 Hz ±0.5 Hz

Warm-up period: 90 min

Ambient temperature: 25 ℃ (77 ℉)

Maximum measured error **Current input**

Accuracy	0.1% of full scale
Resolution	13 bit
Temperature drift	≤ 0.4%/10 K (18 ℉)

Universal input

	Input:	Range:	Maximum measured error of measuring range (oMR):
Accuracy	Current	0 to 20 mA, 0 to 5 mA, 4 to 20 mA; overrange: to 22 mA	±0.10%
	Voltage > 1 V	0 to 10 V, ±10 V, ±30 V	±0.10%
	Voltage ≤ 1 V	±1 V, 0 to 1 V, 0 to 200 mV, 0 to 100 mV, ±150 mV	±0.10%
	Resistance thermometer	Pt100, −200 to 600 ℃ (−328 to 1 112 ℉) (IEC751, JIS1604, GOST) Pt500, −200 to 600 ℃ (−328 to 1 112 ℉) (IEC751, JIS1604) Pt1000, −200 to 600 ℃ (−328 to 1 112 ℉) (IEC751, JIS1604)	4-wire: ± (0.10% oMR + 0.3 K (0.54 ℉) 3-wire: ± (0.15% oMR + 0.8 K (1.44 ℉))
		Cu100, −200 to 200 ℃ (−328 to 392 ℉) (GOST) Cu50, −200 to 200 ℃ (−328 to 392 ℉) (GOST) Pt50, −200 to 600 ℃ (−328 to 1 112 ℉) (GOST)	4-wire: ± (0.20% oMR + 0.3 K (0.54 ℉) 3-wire: ± (0.20% oMR + 0.8 K (1.44 ℉))
	Resistance measurement	30 to 3 000 Ω	4-wire: ± (0.20% oMR + 0.3 K (0.54 ℉) 3-wire: ± (0.20% oMR + 0.8 K (1.44 ℉))
	Thermocouples	Typ J (Fe-CuNi), −210 to 999.9 ℃ (−346 to 1 382 ℉) (IEC584)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −100 ℃ (−148 ℉)
		Typ K (NiCr-Ni), −200 to 1 372 ℃ (−328 to 2 502 ℉) (IEC584)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −130 ℃ (−234 ℉)
		Typ T (Cu-CuNi), −270 to 400 ℃ (−454 to 752 ℉) (IEC584)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −200 ℃ (−328 ℉)
		Typ N (NiCrSi-NiSi), −270 to 1 300 ℃ (−454 to 2 372 ℉) (IEC584)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −100 ℃ (−148 ℉)
		Typ B (Pt30Rh-Pt6Rh), 0 to 1 820 ℃ (32 to 3 308 ℉) (IEC584)	± (0.15% oMR + 1.5 K (2.7 ℉)) from 600 ℃ (1 112 ℉)
		Typ D (W3Re/W25Re), 0 to 2 315 ℃ (32 to 4 199 ℉) (ASTME998)	± (0.15% oMR + 1.5 K (2.7 ℉)) from 500 ℃ (932 ℉)
		Typ C (W5Re/W26Re), 0 to 2 315 ℃ (32 to 4 199 ℉) (ASTME998)	± (0.15% oMR + 1.5 K (2.7 ℉)) from 500 ℃ (932 ℉)
		Typ L (Fe-CuNi), −200 to 900 ℃ (−328 to 1 652 ℉) (DIN43710, GOST)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −100 ℃ (−148 ℉)
		Typ U (Cu-CuNi), −200 to 600 ℃ (−328 to 1 112 ℉) (DIN43710)	± (0.15% oMR + 0.5 K (0.9 ℉)) from −100 ℃ (−148 ℉)
		Typ S (Pt10Rh-Pt), 0 to 1 768 ℃ (32 to 3 214 ℉) (IEC584)	± (0.15% oMR + 3.5 K (6.3 ℉)) for 0 to 100 ℃ (32 to 212 ℉) ± (0.15% oMR + 1.5 K (2.7 ℉)) for 100 to 1 768 ℃ (212 to 3 214 ℉)
		Typ R (Pt13Rh-Pt), −50 to 1 768 ℃ (−58 to 3 214 ℉) (IEC584)	± (0.15% oMR + 1.5 K (2.7 ℉)) for 100 to 1 768 ℃ (212 to 3 214 ℉)
Resolution		16 bit	
Temperature drift		Temperature drift: ≤ 0.1%/10 K (18 ℉)	

Current output

Linearity	0.1% of full scale
Resolution	13 bit
Temperature drift	Temperature drift: ≤ 0.1%/10 K (18 ℉)
Output Ripple	10 mV at 500 Ω for frequencies ≤ 50 kHz

Voltage output

Linearity	0.1% of full scale
Resolution	13 bit
Temperature drift	Temperature drift: ≤ 0.1%/10 K (18 ℉)

Installation

Mounting location Panel, cut-out 92 x 92 mm (3.62x3.62 in) (see 'Mechanical construction').

Orientation Horizontal +/- 45° in every direction

Environment

Ambient temperature range −20 to 60 ℃ (−4 to 140 ℉)

Storage temperature −30 to 70 ℃ (−22 to 158 ℉)

Operating height < 3 000 m (9 840 ft) above MSL

Climate class As per IEC 60654-1, Class B2

Degree of protection Front IP 65 / NEMA 4

Device casing IP 20

Shock and vibration resistance 2 Hz (+3/-0) ... 13.2 Hz: ±1 mm (±0.04 in)

13.2 to 100 Hz: 0.7 g

Electromagnetic compatibility (EMC)

CE compliance

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details refer to the EU Declaration of Conformity.

Maximum measurement error < 1% of measuring range.

Interference immunity as per IEC/EN 61326 series, industrial requirements.

Interference emission as per IEC/EN 61326 series, Class B equipment.

Electrical protection class IEC 60529 (IP code) / NEMA 250

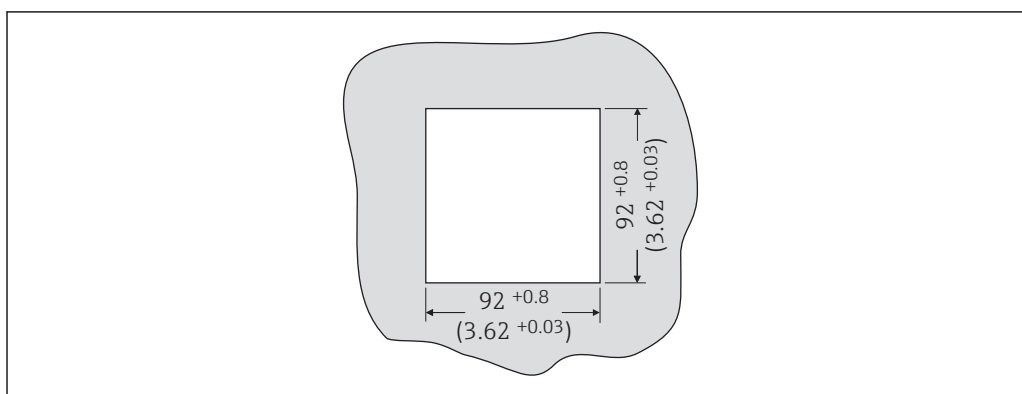**Condensation** Front: permitted

Device casing: not permitted

Mechanical construction

Design, dimensions
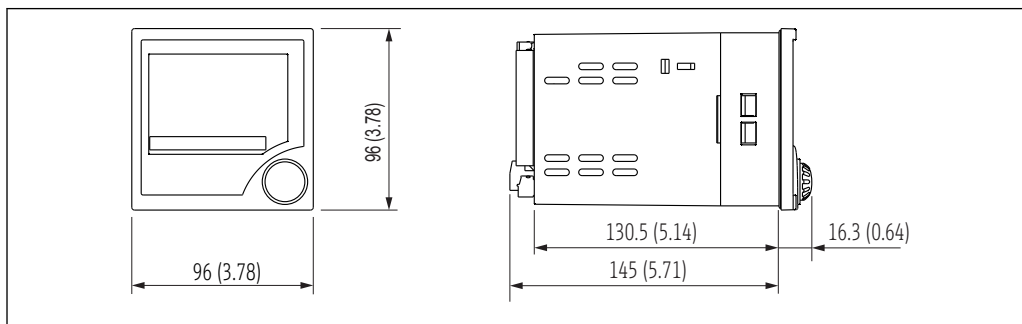
🖼 *4   Dimensions of the panel meter in mm (in)*

🖼 *5   Panel cutout, dimensions in mm (in)*

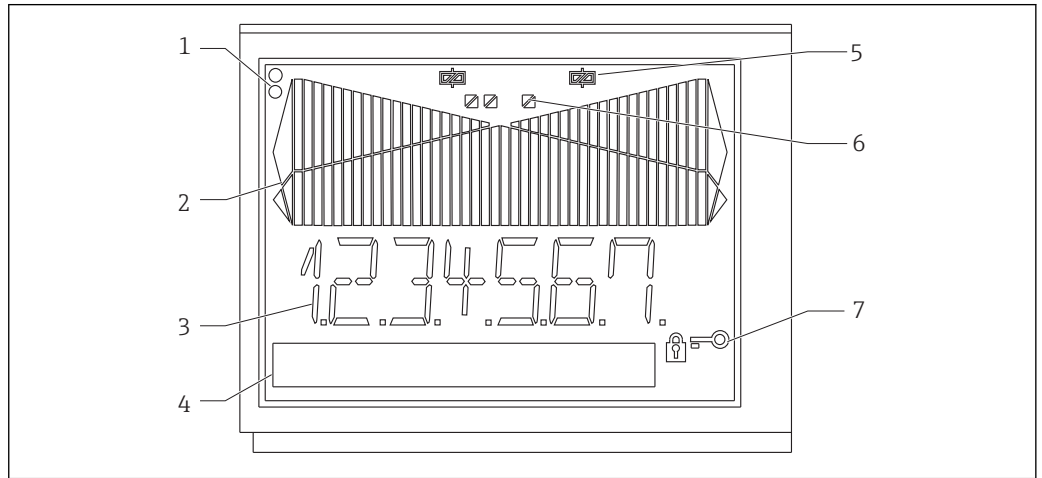| **Weight**	500 g (17.64 oz)

Material
- Housing front: ABS plastic, galvanized
- Housing casing: plastic PC10GF

Terminals   Pluggable screw terminals, core size 1.5 mm² (16 AWG) solid, 1 mm² (18 AWG) strand with wire ferrule

Operability

Local operation

Display elements

6 *Display elements of the panel meter*

1 *Device status LEDs: green - device ready for operation; red - device or sensor malfunction*
2 *Bar graph with overrange and underrange*
3 *7-digit 14-segment display*
4 *Unit and text field 9x77 dot matrix*
5 *Relay status display: if power is supplied to a relay, the symbol is displayed*
6 *Status display, digital inputs*
7 *Symbol for 'device operation locked'*

- Display range
  - -99999 to +99999 for measured values
  - 0 to 9999999 for counter values
- Signaling
  - Relay activation
  - Measuring range overshoot/undershoot

Operating elements

Jog/shuttle dial

Remote operation

Configuration

The device can be configured with PC software ReadWin 2000.

Interface

CDI interface at device; connection to PC via USB box (see "Accessories")

RS232 interface at device; connection with serial interface cable (see "Accessories")

Certificates and approvals

CE mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress +Hauser confirms successful testing of the device by affixing to it the CE mark.
UL approval	UL recognized component (see www.ul.com/database, search for Keyword "E225237")
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.
Ex approvals	Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.
Other standards and guidelines	• IEC 60529: Degrees of protection by housing (IP code) • IEC 61010-1: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures • CSA 1010.1 Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements • FM 3610 Intrinsically safe apparatus and associated apparatus for use in class 1, 2 and 3, division 1 hazardous (classified) locations • CSA C22.2.157 Intrinsically safe & non-incendive equipment for use in hazardous locations • CSA E79-11 Electrical apparatus for explosive gas atmospheres - intrinsic safety "i" • EN 50020 Electrical apparatus for hazardous areas - intrinsic safety "I"

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select your country → Products → Select measuring technology, software or components → Select the product (picklists: measurement method, product family etc.) → Device support (right-hand column): Configure the selected product → The Product Configurator for the selected product opens.
- 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

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

Designation	Order no.
PC configuration software ReadWin 2000 and serial configuration cable with jack connector 3.5 mm for RS232 port	RIA452A-VK
PC configuration software ReadWin 2000 and serial configuration cable for USB-port with CDI connector	TXU10-AA
Field housing IP65 → ⬚ 7, 🕮 13	51009957
Current simulator active 4-20mA 1-channel, compact housing, 9V-battery	SONDST-S1
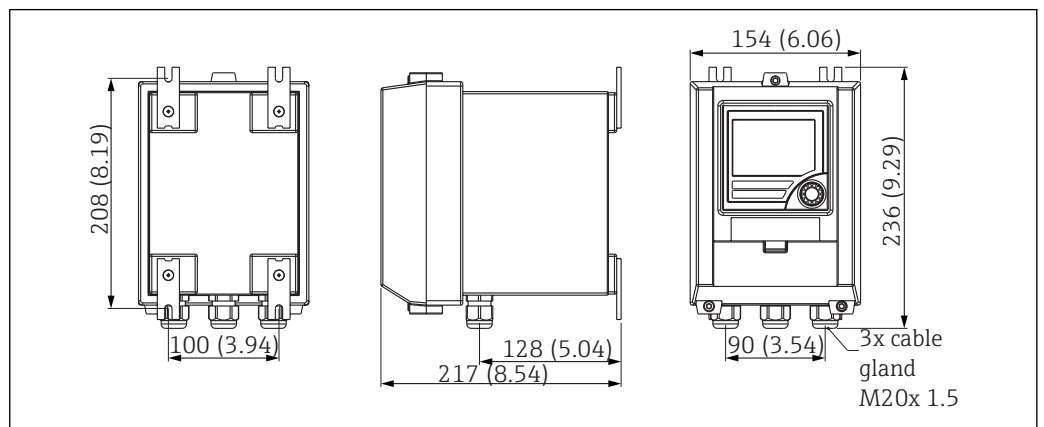
⬚ 7   *Dimensions of field housing*

Supplementary documentation

- System components and data manager - solutions to complete your measuring point:
  FA00016K/09
- Brief Operating Instructions for process display unit RIA452: KA00264R/09
  Operating Instructions for process display unit RIA452: BA00265R/09
- Ex-related additional documentation:
  ATEX II(1)GD: XA00053R/09/a3

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