PEM353

Universal measuring device

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Certifications

CE UKCA

Product description

The digital universal measuring device PEM353 is used to record and display measured quantities of an electricity supply network, and make them available via the communication interface.

The range of measurements extends from voltages and currents to power and energy meters to measured quantities of the voltage quality, such as THD and the individual harmonics up to the 31st order.

The PEM353 is suitable for use in 2-, 3- and 4-wire systems and in their respective versions as TN, TT and IT systems. This allows monitoring single and polyphase systems.
With its standardised dimensions of 96 x 96 mm, the device is intended for front panel mounting.

Areas of application

• Modern indicating instrument for electrical quantities, e.g. as a replacement for analogue indicating instruments
• Power quality monitoring
• Limit value monitoring (setpoints) with alarm forwarding
• Measurement and monitoring of the N conductor
• Energy and power measurement, e.g. as part of energy data monitoring

Standards

PEM353 was designed in accordance with the following standards:

• DIN EN 62053-22 (VDE 0418 Part 3-22)
  Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 and 0.5) (IEC 62053);
• DIN EN 61557-12 (VDE 0413-12)
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 12: Performance measuring and monitoring devices (PMD)
• DIN IEC 61554:2002-08
 Panel mounted equipment – Electrical measuring instruments – Dimensions for panel mounting (IEC 61554:1999)

Features, variants and ordering details

|		PEM353	PEM353-P	PEM353-N
	Ordering details	B93100355	B93100354	B93100353
Measurement technique	**Accuracy class of the active energy (acc. to IEC 62053-22)**	Current transformer 5 A: Class 0,5 Current transformer 1 A: Class 1,0		
	Volatage inputs (L1, L2, L3)	45…65 Hz TN and TT system (earthed): AC 230/400…400/690 V, CAT III 600 V IT system (unearthed): AC 400…480 V, CAT III 300 V / AC 500…690 V, CAT II 1000 V		
	Current inputs (I_1, I_2, I_3)	5 A / 1 A		
	I_4	–	–	5 A
	Harmonic / Distortion U/I	up to the 31st		
	Sampling rate	3,2 kHz		
Data logger	**Setpoints limit value monitoring**	9		
	Logs	Event log (SOE log), Max./Min. log Peak demand log, Energy meter log (monthly values)		
	4 MB · **Data recorder**	–	–	5
	4 MB · **Load data log (daily and monthly values)**	–	–	■
Properties	**Digital inputs**	4		
	Digital outputs	2 x relay	2 x pulse	2 x relay
	Supply voltage	95…250 V; DC, AC 47…440 Hz		
	Communication interface	RS-485 (Modbus RTU, BACnet MS/TP, DNP)		
	Language	English		

Functions

1. Measurement of electrical quantities such as
   - Phase voltages (individually + Σ) U_{L1}, U_{L2}, U_{L3} in V
   - Line-to-line voltages (individually + Σ) U_{L1L2}, U_{L2L3}, U_{L3L1} in V
   - Phase currents (individually + Σ) I_1, I_2, I_3 in A
   - Neutral current I_n (calculated) in A
     I_4 (measured, PEM353-N only) in A
   - Residual current I_r (calculated, PEM353-N only) in A
   - Frequency f in Hz
   - Power per phase conductor (individually + Σ)
     P in kW, Q in kvar, S in kVA
   - Displacement factor (individually + Σ) cos (φ)
   - Power factor (individually + Σ) λ
   - Active and reactive energy import (individually + Σ) in kWh, kvarh
   - Active and reactive energy export (individually + Σ) in kWh, kvarh
   - Voltage phase angle (LN or LL, individually) in °
   - Current phase angle (individually) in °
   - Voltage unbalance in %
   - Current unbalance in %
   - Harmonic distortion (THD, TOHD, TEHD) for U and I
   - k-factor for I
   - Crest factor for I
   - Total demand distortion (TDD) for I

2. Energy meters
   - Accuracy class of the active energy acc. to IEC 62053-22: 0.5
   - LED (pulse) for active or reactive energy
   - 2 pulse outputs (PEM353-P only)
   - Total phase and individual phase energy metering
     - Import, export, net and total per active and reactive energy
     - Total apparent energy
   - Up to 4 pulse counters (e.g. gas, water, air, heat)

3. Times of Use for energy measurement
   - Up to 8 tariffs
   - Tariff switching via digital inputs or
   - Tariff switching according to schedule, 2 schedules
   - Total phase and individual phase energy metering per tariff
     - Import and export per active and reactive energy
     - Total apparent energy
   - Peak demand of the total phase power (P, Q, S) per tariff

4. Energy meter log – 12 monthly values
   - Total phase energy metering
     - Import, export, net and total per active and reactive energy
     - Apparent energy
   - Total phase energy metering per tariff
     - Import and export per active and reactive energy
     - Total apparent energy

5. Load data for total phase power (P, Q, S) and currents
   - Configurable sliding average values/averaging (demand)
   - Demand forecasts of the next average value
   - Peak demand log with timestamp
     - Total phase power and currents (P, Q, S)
     - Total phase power per tariff (P, Q, S)

6. Log for max. and min. values for 45 measured quantities with time-stamp

7. Limit value monitoring by means of setpoints and alarm forwarding
   - 9 parametrisable monitoring points (setpoints)
   - 25 measured quantities to choose from
   - Alerting via display and/or digital outputs (DO)
   - Monitoring for limit value violation (over/under limit value)
   - Hysteresis adjustable

8. Event log (SOE log)
   - 100 entries with timestamp, resolution 1 ms
   - Changes to setup, setpoints and DI/DO
   - System messages
   - Limit value violations

9. Load data log: daily and monthly values (PEM353-N only)
   - Daily log
     - 60 days (2 months)
     - Total phase energy per active, reactive and apparent energy
     - Peak demands of total phase power (P, Q, S)
   - Monthly log
     - 36 months (3 years)
     - Total phase energy per active, reactive and apparent energy
     - Monthly peak demands of total phase power with timestamp (P, Q, S)

10. Data recorders (PEM353-N only)
    - 5 recorders with up to 16 channels each
    - Channel selection from 328 measured quantities
    - Interval configurable: 60 s to 40 days
    - Recording time e.g. 100 days at a 15-minute interval

11. Easy and convenient operation
    - Large backlit graphic display
    - Display password protection
    - Standard display with 4 selectable measured quantities

12. Other functions
    - Connection fault detection (frequency, voltage/current failure, wrong polarity of measuring current transformer, rotating field)
    - Operating hours counter

13. Communication interface and protocols
    - Galvanically isolated RS-485 interface (1,200 to 38,400 bit/s)
    - LED for communication activities
    - Modbus RTU protocol
    - BACnet MS/TP
    - DNP

Operating elements
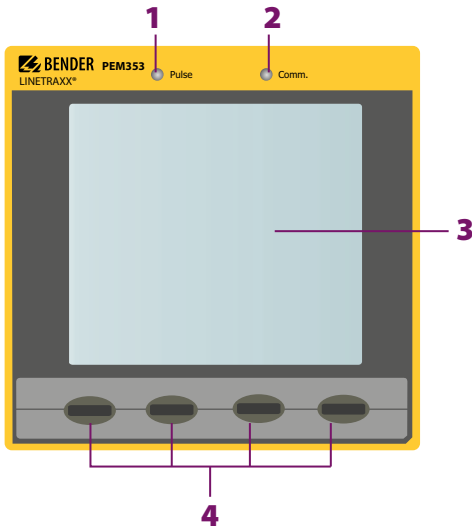
1 - Pulse LED (red)
   Indication of energy pulsing

2 - Comm. LED (green)
   Indication of communication activity

3 - Display
   LCD graphic display

4 - Buttons 1 to 4
   The function of the buttons varies depending on the context. The meaning is always shown on the display above the corresponding button.

Terminals
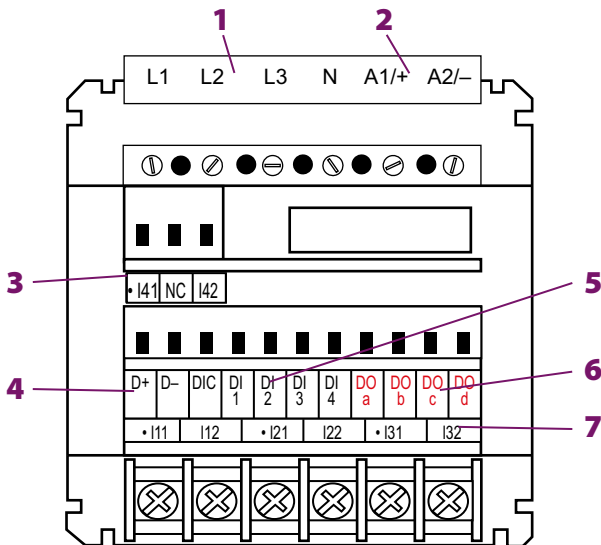
1 - Measuring voltage inputs:
   The measuring leads should be protected with appropriate fuses.

2 - Supply voltage: Power protection by a 6 A fuse, quick response. If being supplied from an IT system, both lines have to be protected by a fuse.

3 - Measuring current inputs I_4 (only PEM353-N)

4 - RS-485 bus connection

5 - Digital inputs

6 - Digital outputs (N/O contacts)

7 - Measuring current inputs $I_{1…3}$

	DO a	DO b	DO c	DO d
PEM353(-N)	DO13	DO14	DO23	DO24
PEM353-P	E1+	E1-	E2+	E2-

Wiring diagrams direct connection (without voltage transformer)
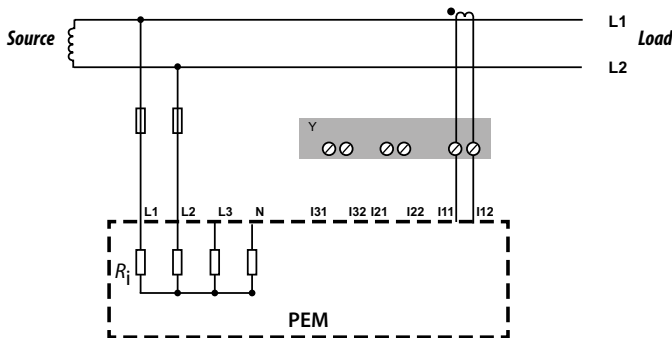
Single-phase 2-wire system 1P2W L-N
When using this wiring, the connection type
(Setup > Basic > Wiring Mode) must be set to **1P2W L-N**.
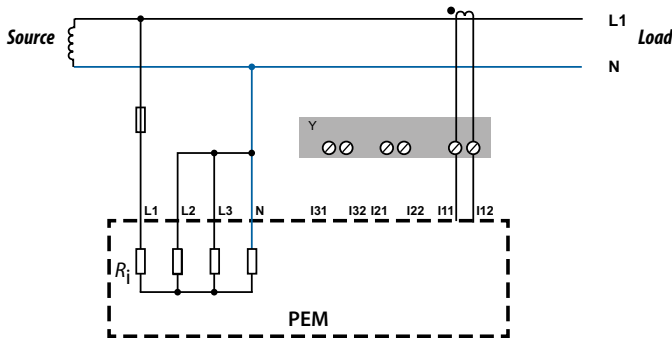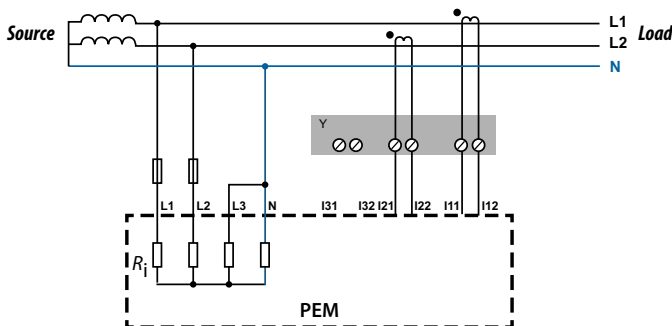

Single-phase 2-wire system 1P2W L-L
When using this wiring, the connection type
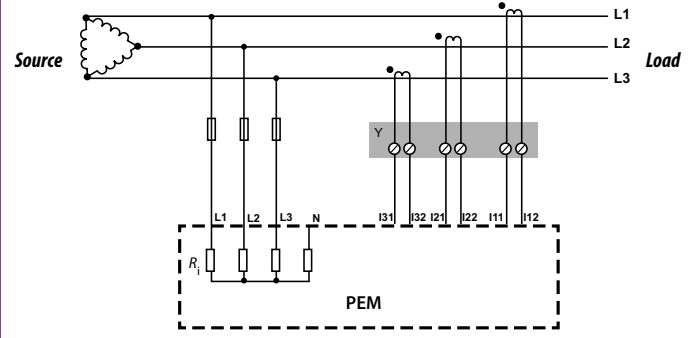(Setup > Basic > Wiring Mode) must be set to **1P2W L-L**.

Single-phase 3-wire system 1P3W with 2 measuring current transformers
When used in a 3-wire system, the connection type
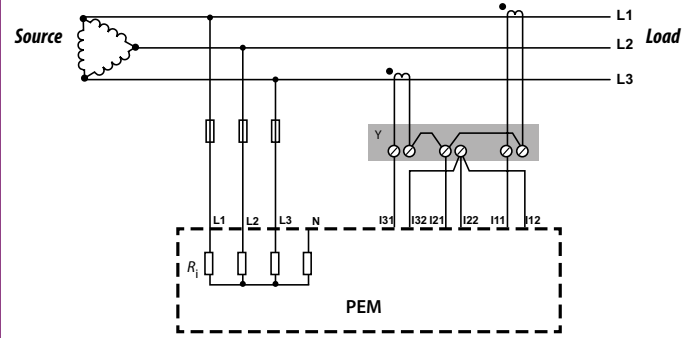(Setup > Basic > Wiring Mode) must be set to **1P3W**.

3P3W with 3 measuring current transformers
When used in a 3-wire system, the connection type
(Setup > Basic > Wiring Mode) must be set to **3P3W**.

3P3W with 2 measuring current transformers (Aron circuit)

3P4W with 3 (4) measuring current transformers
When using this wiring, the connection type
(Setup > Basic > Wiring Mode) must be set to **3P4W**.

Y   Isolating terminal of the measuring current transformers

Y   Isolating terminal of the measuring current transformers

I_4 Measurement I_4 for PEM353-N only

Wiring diagrams with voltage transformers (medium and high voltage)

Three-phase 3-wire system 3P3W with 3 measuring current transformers

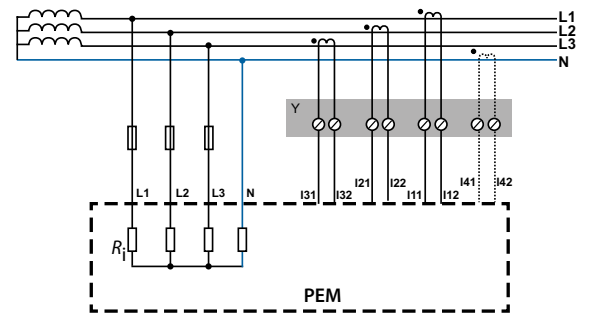When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **3P3W**.

Y Isolating terminal of the measuring current transformers

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.

Three-phase 4-wire system (example TN-S system) 3P4W with 3 voltage transformers

When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **3P4W**.

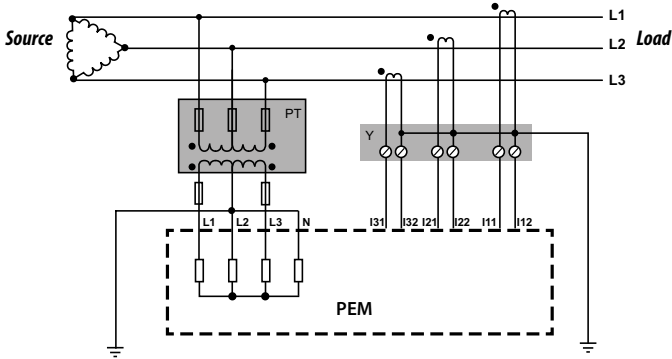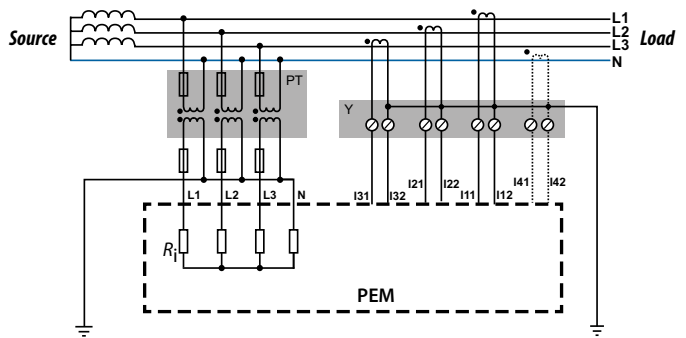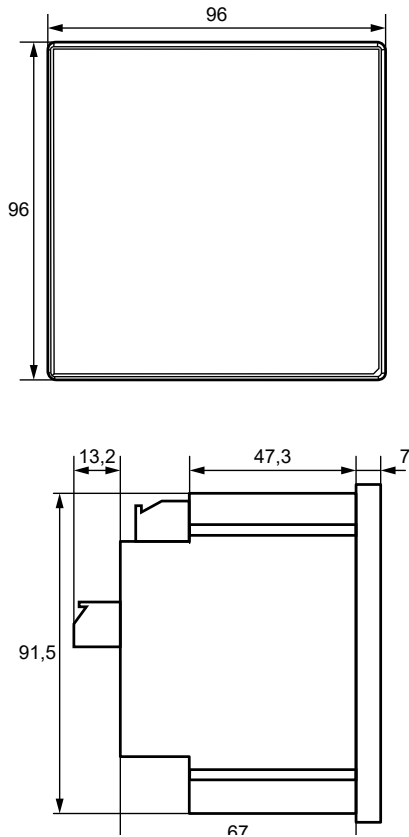Y Isolating terminal of the measuring current transformers

I_4 Measurement I_4 for PEM353-N only

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.
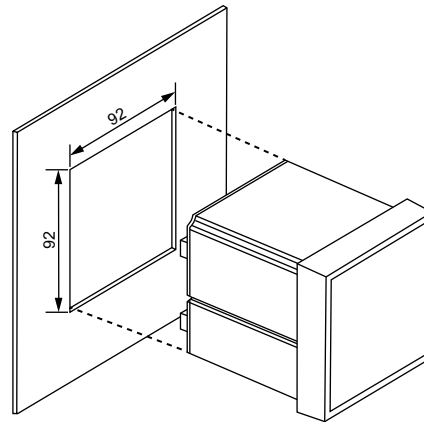
Dimension diagram

Dimensions in mm

Panel cutout

Dimensions in mm

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Pollution degree	2
Climate category operation	3K24
Max. installation altitude above NN:	2000 m

Definitionen

Measuring circuit 1 (IC1)	(L1, L2, L3, N)
TN and TT system	
Nominal voltage	400/690 V
Overvoltage category/Rated insulation voltage	III/600 V
IT system	
Nominal voltage	480 V
Overvoltage category/Rated insulation voltage	III/300 V
Nominal voltage	690 V
Overvoltage category/Rated insulation voltage	II/1000 V
Measuring circuit 2 (IC2)	(•I11, I12, •I21, I22, •I31, I32)
Overvoltage category/Rated insulation voltage	III/300 V
Supply circuit (IC3)	(A1/+, A2/-)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 1 (IC4) at PEM353-N and PEM353	(DO13, DO14)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 1 (IC4) at PEM353-P	(E1+, E1-)
Overvoltage category/Rated insulation voltage	III/50 V
Output circuit 2 (IC5) at PEM353-N and PEM353	(DO23, DO24)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 2 (IC5) at PEM353-P	(E2+, E2-)
Overvoltage category/Rated insulation voltage	III/50 V
Control circuit 1 (IC6)	(DIC, DI1, DI2, DI3, DI4)
Overvoltage category/Rated insulation voltage	III/50 V
Control circuit 2 -RS-485 (IC7)	(D+, D-)
Overvoltage category/Rated insulation voltage	III/50 V
Rated impulse voltage	
IC1/(IC2…7)	6 kV
IC2/(IC3…7)	4 kV
IC3/(IC4…7)	4 kV
IC4/(IC5…7)	4 kV
IC5/(IC6…7)	4 kV
IC6/IC7	800 V
Rated insulation voltage	
IC1/(IC2…7)	1000 V
IC2/(IC3…5)	250 V
IC2/(IC6…7)	250 V
IC3/(IC4…7)	250 V
IC4/(IC5…7)	250 V
IC5/(IC6…7)	250 V
IC6/IC7	32 V
Safe separation (reinforced insulation) between	
IC1/(IC2…7)	overvoltage category III, 600 V
IC2/(IC3…7)	overvoltage category III, 300 V
IC3/(IC4…7)	overvoltage category III, 300 V
IC4/(IC5…7)	overvoltage category III, 300 V
IC5/(IC6…7)	overvoltage category III, 300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC1/(IC2…7)	AC 2.0 kV, 1 minute
IC2/(IC3…7)	AC 2.0 kV, 1 minute
IC3/(IC4…7)	AC 2.0 kV, 1 minute
IC4/(IC5…7)	AC 2.0 kV, 1 minute
IC5/(IC6…7)	AC 2.0 kV, 1 minute

Supply voltage

Supply voltage	AC/DC 95…250 V (±10 %)
Frequency range	DC, 47…440 Hz
Power consumption	< 5 VA

Measuring voltage inputs

see insulation coordination	
Measuring range	10…828 V (120 % U_n, max)
Rated frequency	45…65 Hz
Internal resistance $U_{L1-N, L2-N, L3-N}$	> 12 MΩ

Transformation ratio of the measuring voltage transformer

Primary	1…1,000,000 V
Secondary	1…690 V
Max. transformation ratio	10,000

Measuring current transformer inputs

I_{nom}	5 A
Measuring range	0.1…200 % I_{nom}
Burden	< 0.15 VA
Overload range	2 x I_{nom} permanent, 20 x I_{nom} ≤ 1 s

Transformation ratio of the measuring current transformer

Primary	1…30000 A
Secondary	1…5 A

Accuracies (OMV = of measured value/OFS = of full-scale value)

Phase voltage $U_{L1-N, L2-N, L3-N}$	±0.2 % OMV, +0.05 % OFS
Current $I_{1, 2, 3}$	±0.2 % OMV, +0.05 % OFS
Neutral current I_4 (PEM353-N)	±0.2 % OMV
Frequency f	±0.02 Hz
Phasing	±1 °
Active power, reactive power	±0.5 % OMV, +0.05 % OFS
Power factor λ	±0.5 %
Measurement of the active energy acc. to DIN EN 62053-22 (VDE 0418 part 3-22)	
Accuracy class with 5 A measuring current transformers	0.5
Accuracy class with 1 A measuring current transformers	1
Measurement of the voltage r.m.s. values	
	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
Measurement of the phase current r.m.s. values	
	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurement	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

Interface

Interface: Protocol	RS-485: Modbus RTU, BACnet MS/TP, DNP
Baud rate	1.2…38.4 kbit/s
Cable length	0…1200 m
Recommended cable (shielded)	J-Y(St)Y min. 2 x 0.8

Switching elements

Outputs	2 N/O contacts
Operating principle	N/O operation
PEM353-N, PEM353	
Relay contacts, N/O operation, AC 250 V or DC 30 V	5 A
Minimum current I_{min}	1 mA at AC/DC ≥ 10 V
PEM353-P	
Pulse output	max. DC 30 V, max. 30 mA
Cable length	≤ 30 m
Inputs	4 common galv. isolated digital inputs
I_{min}	1 mA
U_{DI}	DC 24 V

Technical data (continued)

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 ℃
Classification of climatic conditions acc. to IEC 60721 (stationary use)	3K24
Classification of mechanical conditions acc. to IEC 60721 (stationary use)	3M11
Range of use	< 2000 m

Connection

Connection type	screw-type terminals, plug-in connector

Other

Degree of protection, installation	IP20
Degree of protection, front (with rubber seal)	IP54
Documentation number	D00335
Weight	≤ 350 g