Power Quality and Energy Measurement
PEM330/PEM333
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Product description
The universal measuring device PEM330/333 is used to record and indicate electrical quantities of a public electricity network. The scope of measurements ranges from currents and voltages through energy consumption and performance to total harmonic distortion and voltage quality assessment. The active energy measurements are in compliance with the DIN EN 62053-22 class 0.5 S accuracy standard. The current inputs are connected via external …/1 A or …/5 A measuring current transformers.

Typical application
- As a compact device for front panel mounting, the PEM330/333 is a replacement for analogue indicating instruments
- Typical application in low and medium-voltage networks (via measuring voltage transformer)
- Power quality monitoring
- Collection of relevant data for energy management systems
- Energy consumption allocation to cost accounting centers

Description of function
- Sampling rate of the measuring channels: 1,6 kHz
- Calculation of the total harmonic distortion THD \(_U/THDI\): up to the 15th harmonics
- Password protection
- Easy installation with mounting clips, no tools required
- Inputs and outputs (PEM333 only):
  - 2 digital outputs
  - 2 pulse outputs (PEM333-P only)
  - 6 user-programmable setpoints (response values, response delay 0…9999 seconds)
- System protocol: 32 events, setup changes, DI/setpoint status changes, DO operations
- Communication (PEM333 only):
  - Electrically isolated RS-485 interface (1,200 bit/s to 19,200 bit/s)
  - Modbus-RTU protocol

Standards
The universal measuring device for Power Quality and Energy Measurement PEM330/PEM333 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Features

<table>
<thead>
<tr>
<th>Features</th>
<th>PEM330</th>
<th>PEM333</th>
<th>PEM333-P</th>
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<tbody>
<tr>
<td>RS-485</td>
<td>–</td>
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<tr>
<td>Digital inputs</td>
<td>–</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Digital outputs</td>
<td>–</td>
<td>2</td>
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<tr>
<td>Digital pulse outputs</td>
<td>–</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>1.6 kHz</td>
<td>1.6 kHz</td>
<td>1.6 kHz</td>
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<tr>
<td>THD calculation</td>
<td>15.</td>
<td>15.</td>
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</tbody>
</table>
Operating elements

1 - Pulse LED: kWh
2 - Pulse LED: kvarh
3 - Display
4 - “SYSTEM” button: Selection (in the menu)
5 - “PHASE” button: Up (in the menu)
6 - “ENERGY” button: Down (in the menu)
7 - “SETUP” button: OK (in the menu)

Press the “SETUP” button > 1.5 s to enter/leave the Setup menu.

Example for system set-up

NSHV = Low-voltage main distribution board
1 - Connection RS-485 bus
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 - Digital inputs
4 - Digital outputs (N/O contacts)
5 - Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.
6 - Connection to the system to be monitored

Wiring diagram PEM330/PEM333

1 - Connection RS-485 bus
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 - Digital inputs
4 - Digital outputs (N/O contacts)
5 - Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.
6 - Connection to the system to be monitored

Wiring diagram PEM333-P

1 - Connection RS-485 bus
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 - Digital inputs
4 - Pulse outputs for kWh and kvarh
5 - Measuring voltage inputs: The measuring leads should be protected by appropriate fuses.
6 - Connection to the system to be monitored
Connection diagram voltage inputs

Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).

Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.
The line-to-line voltage must not exceed AC 400 V.

Connection via voltage transformers
The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems.
The transformation ratio in PEM330/PEM333 can be adjusted (1...2200).
### Technical data

#### Insulation co-ordination

**Measuring circuit**
- Rated insulation voltage: 300 V
- Overvoltage category: III
- Pollution degree: 2

**Supply circuit**
- Rated insulation voltage: 300 V
- Overvoltage category: II
- Pollution degree: 2

#### Supply voltage
- Rated supply voltage: $U_s$ 95…250 V
- Frequency range of $U_s$: DC, 44…440 Hz
- Power consumption: ≤ 3 VA

#### Measuring circuit

**Measuring voltage inputs**
- $U_{L1-N, L2-N, L3-N}$ 230 V
- $U_{L1-L2, L2-L3, L3-L1}$ 400 V
- Measuring range: 10…120% $U_n$
- Rated frequency: 45…65 Hz
- Internal resistance (L-N): > 500 kΩ

**Measuring current inputs**
- External measuring current transformer should at least comply with accuracy class 0.5 S

<table>
<thead>
<tr>
<th>Measuring current transformer ratio</th>
<th>Accuracy class according with 5 A measuring current transformer</th>
<th>Accuracy class according with 1 A measuring current transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1…6000</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>1…30000</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

#### Interface

**PEM333**
- Interface/protocol: RS-485/Modbus RTU
- Baud rate: 1.2…19.2 kbits/s
- Cable length: 0…1200 m
- Shielded cable (shield connected to terminal SH on one side): recommended: J-Y(ST)Y min. 2x0.8

**PEM333-P**
- Outputs: 2 x electronic
- Max. permissible extraneous voltage: 80 V
- Max. switching current: 50 mA
- Input: 2 electrically separated digital inputs
  - $I_{in}$: 2.4 mA
  - $U_{di}$: DC 24 V

#### Environment/EMC

**EMC**
- DIN EN 61326-1
- Operating temperature: -25…+55 °C
- Climatic class acc. to DIN EN 60721: 3K5
- Classification of mechanical conditions acc. to DIN EN 60721: 3M4
- Height: to 4000 m

#### Switching elements

**PEM333**
- Outputs: 2 N/O contacts
- Operating principle: N/O operation
- Rated operational voltage: AC 230 V, DC 24 V, AC 110 V, DC 12 V
- Rated operational current: 5 A, 5 A, 6 A, 5 A
- Minimum contact rating: 1 mA at AC/DC ≥ 10 V
- Inputs: 2 electrically separated digital inputs
  - $I_{in}$: 2.4 mA
  - $U_{di}$: DC 24 V

**PEM333-P**
- Outputs: 2 x electronic

#### Connection

**Connection**
- Connection: screw-type terminals

#### Other

- Degree of protection, installation: IP20
- Degree of protection, front: IP52
- Documentation number: D00004
- Weight: ≤ 550 g

**Warning!** This is a class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
### Ordering information

<table>
<thead>
<tr>
<th>Interface</th>
<th>Digital inputs/outputs</th>
<th>Current input</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5 A</td>
<td>PEM330</td>
<td>B 9310 0330</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM330-251</td>
<td>B 9310 0331</td>
</tr>
<tr>
<td>RS-485</td>
<td>2/2</td>
<td>5 A</td>
<td>PEM333</td>
<td>B 9310 0333</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM333-251</td>
<td>B 9310 0334</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 A</td>
<td>PEM333-255P</td>
<td>B 9310 0335</td>
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<tr>
<td></td>
<td></td>
<td>1 A</td>
<td>PEM333-251P</td>
<td>B 9310 0336</td>
</tr>
</tbody>
</table>

### Dimension diagram

Dimensions in mm

![Dimension diagram](image)

### Panel cut out

Dimensions in mm

![Panel cut out](image)