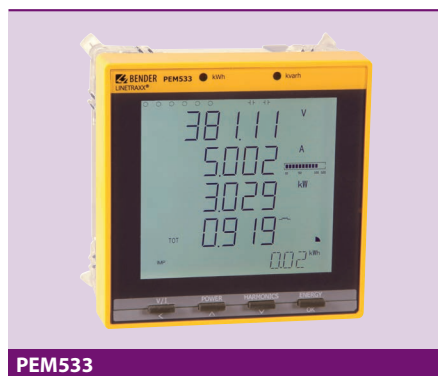


# Power Quality and Energy Measurement PEM533



# Power Quality and Energy Measurement

## PEM533



### Device features

- Accuracy class according to IEC 62053-22: 0.5 S
- Measured quantities
  - Phase voltages  $U_{L1}, U_{L2}, U_{L3}$  in V
  - Line-to-line voltages  $U_{L1L2}, U_{L2L3}, U_{L3L1}$  in V
  - Phase currents  $I_1, I_2, I_3$  in A
  - Neutral current (calculated)  $I_4$  in A
  - Frequency  $f$  in Hz
  - Phase angle for  $U$  and  $I$  in  $^\circ$
  - Power per phase conductor  $S$  in kVA,  $P$  in kW,  $Q$  in kvar
  - Total power  $S$  in kVA,  $P$  in kW,  $Q$  in kvar
  - Displacement factor  $\cos(\varphi)$
  - Power factor  $\lambda$
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Total harmonic distortion (THD) for  $U$  and  $I$
  - k-Factor for  $I$
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive energy
- Modbus-RTU communication via RS-485
- 2 digital outputs
- Demands of energy and current for particular time frames
- Peak demands with timestamps
- Individual current/voltage harmonics up to the 31st harmonic
- Minimum and maximum values

### Product description

The digital universal measuring device PEM533 is suited for measuring and displaying electrical quantities of electricity networks. The PEM575 is able to perform current, voltage, energy consumption and performance measurements as well as displaying individual current/voltage harmonics for assessment of the power quality. The accuracy of active energy measurements corresponds to class 0.5 S in accordance with the requirements of DIN EN 62053-22 (VDE 0418 Part 3-22). 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 PEM533 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
- Cost allocation of energy consumption

### Description of function

- Sampling rate of the measuring channels: 3.2 kHz
- Calculation of the total harmonic distortion THD<sub>U</sub>/THD<sub>I</sub>: up to the 31st harmonic
- Individual current/voltage harmonics
- Password protection
- Clamp mechanism, no tools required
- History memory for minimum and maximum values of current, voltage, energy, power rating etc. for each month
- Inputs and outputs:
  - 2 digital outputs, 6 digital inputs
  - 9 user-programmable setpoints (response values, response delay 0...9999 seconds)
  - System protocol: 64 events, setup changes, setpoint alarming, DI status changes, DO switching operations
- Communication:
  - Galvanically isolated RS-485 interface (1,200 bis 19,200 bit/s)
  - Modbus RTU protocol

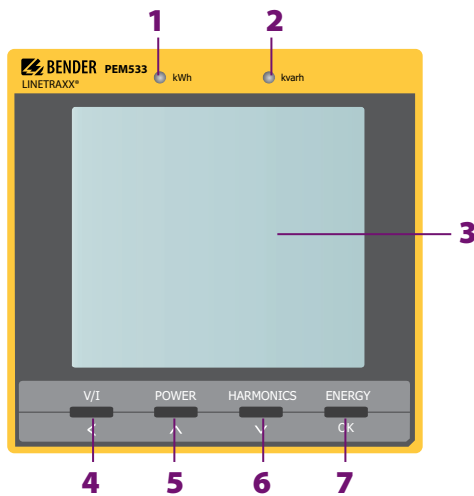
### Standards

The universal measuring device for Power Quality and Energy Measurement/PEM533 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

	PEM533
RS-485	■
Digital inputs	6
Digital outputs	2
Sampling rate	3.2 kHz
THD calculation and harmonics	31.

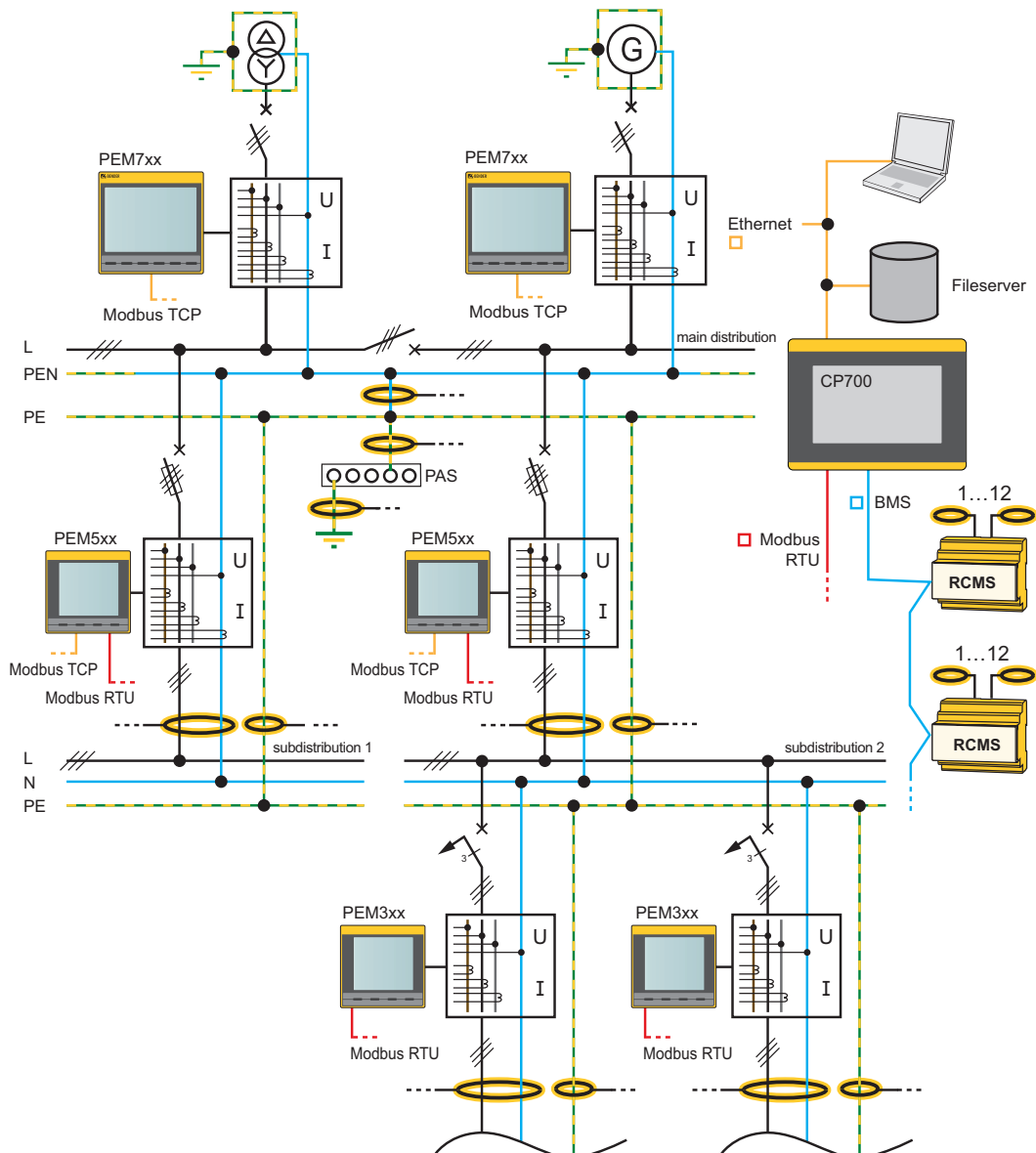
Operating elements



- 1 - Pulse LED: kWh
- 2 - Pulse LED: kvarh
- 3 - Display
- 4 - "V/I" button: Selection (in the menu)
- 5 - "POWER" button: Up (in the menu)
- 6 - "HARMONICS" button: Down (in the menu)
- 7 - "ENERGY" button: OK (in the menu)

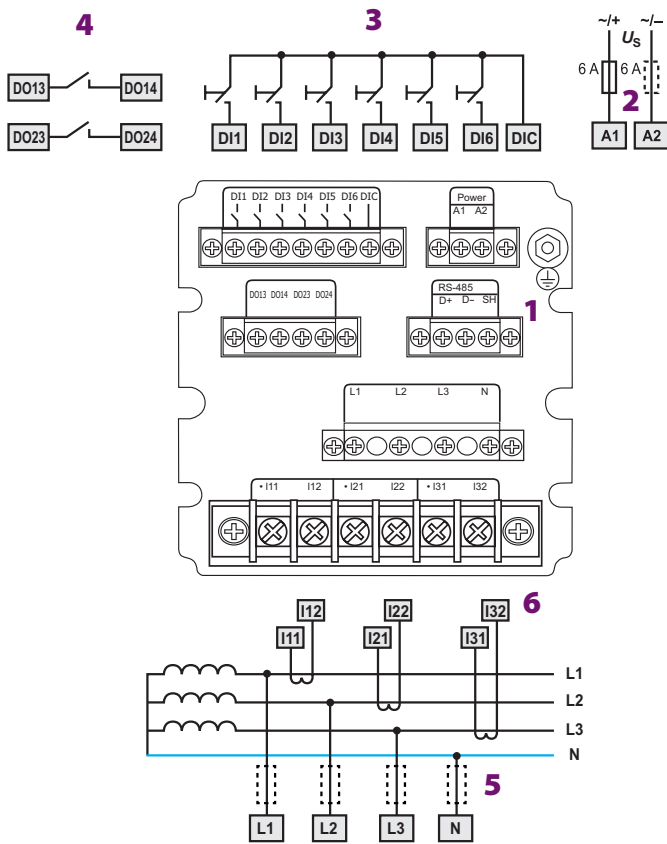
Press the "ENERGY" button > 1.5 s to enter/leave the Setup menu.

Example for system set-up



NSHV = Low-voltage main distribution board

**Wiring diagram**

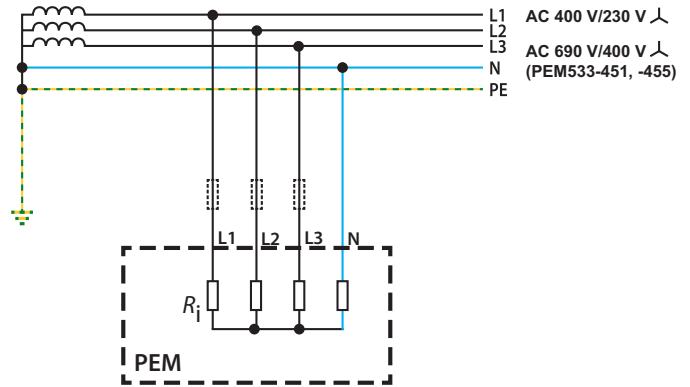


- 1 - Connection RS-485 bus
- 2 - Supply voltage. Power protection by a 6 A fuse, quick response. If being supplied from an IT system, both lines have to be protected by a fuse.
- 3 - Digital inputs
- 4 - Digital outputs (N/O contacts)
- 5 - Measuring voltage inputs
- 6 - Connection to the system to be monitored: The measuring leads should be protected by appropriate fuses.

**Connection diagram voltage inputs**

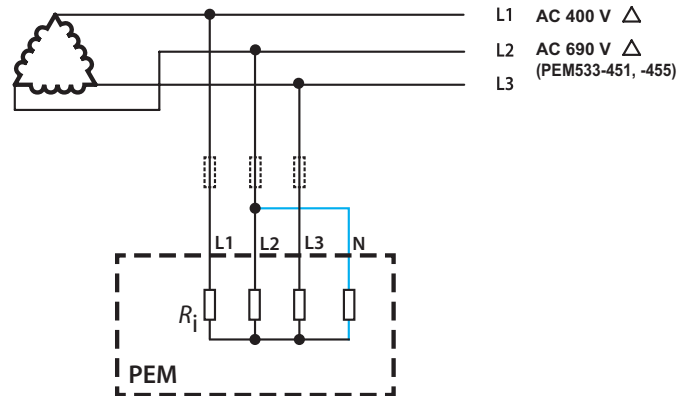
**Three-phase 4-wire system (TN, TT, IT systems)**

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**

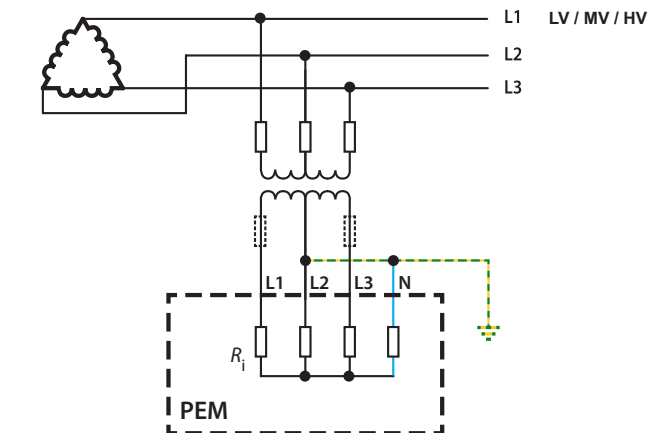
The PEM can be used in three-phase 3-wire systems.



**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 PEM533 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	≤ 5 VA

**Measuring circuit**
**Measuring voltage inputs**

$U_{L1-N, L2-N, L3-N}$	230 V
	400 V (only -451, -455)
$U_{L1-L2, L2-L3, L3-L1}$	400 V
	690 V (only -451, -455)
Measuring range	10... 120 % $U_n$
Rated frequency	45...65 Hz
Internal resistance (L-N)	> 500 k $\Omega$

**Measuring current inputs**

External measuring current transformer should at least comply with accuracy class 0.5 S

Burden	n.A., internal current transformers
Measuring range	0.1... 120 % $I_n$
PEM533/PEM533-455	
$I_n$	5 A
Measuring current transformer ratio	1...6000
Accuracy class according with 5 A measuring current transformer	0.5
Accuracy class according with 1 A measuring current transformer	1
PEM533-251/PEM533-451	
$I_n$	1 A
Measuring current transformer ratio	1...30000
Accuracy class according with 1 A measuring current transformer	0.5

**Accuracies (of measured value/of full scale value)**

Phase voltage $U_{L1-N}, U_{L2-N}, U_{L3-N}$	± 0.2 % of measured value
Current	± 0.2 % of measured value + 0.05 % of full scale value
Neutral current $I_4$	1 % of full scale value
Frequency	± 0,02 Hz
Phase position	± 1 °
Active energy measurement according to	DIN EN 62053-22 (VDE 0418 Part 3-22)
r.m.s. voltage measurement according to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
r.m.s. phase current measurement according to	DIN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurement according to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

**Interface**

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

**Switching elements**

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	6 electrically separated digital inputs
$I_{min}$	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	
Stationary use	3K5
Classification of mechanical conditions acc. to DIN EN 60721	
Stationary use	3M4
Height	to 4000 m

**Connection**

Connection	screw-type terminals
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**Other**

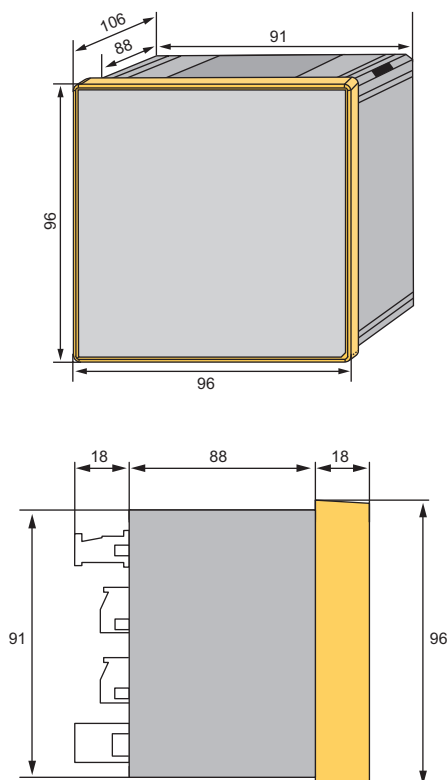
Degree of protection, installation	IP20
Degree of protection, front	IP52
Documentation number	D00013
Weight	≤ 1100 g

## Ordering information

Interface	Nominal system voltage	Current input	Type	Art. No.
	3(N)AC			
RS-485	230/400 V	5 A	PEM533	B 9310 0533
		1 A	PEM533-251	B 9310 0534
	400/690 V	5 A	PEM533-455	B 9310 0535
		1 A	PEM533-451	B 9310 0536

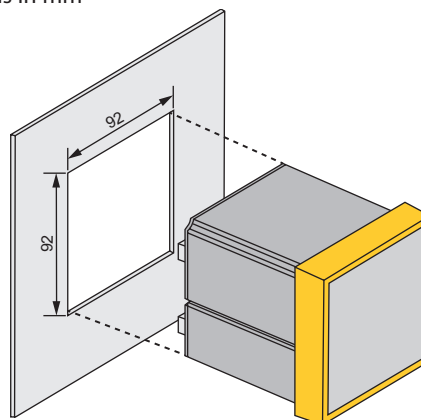
## Dimension diagram

Dimensions in mm



## Panel cut-out

Dimensions in mm



### Bender GmbH & Co. KG

P.O. Box 1161 • 35301 Gruenberg • Germany  
 Londorfer Strasse 65 • 35305 Gruenberg • Germany  
 Tel.: +49 6401 807-0 • Fax: +49 6401 807-259  
 E-Mail: info@bender.de • www.bender.de



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