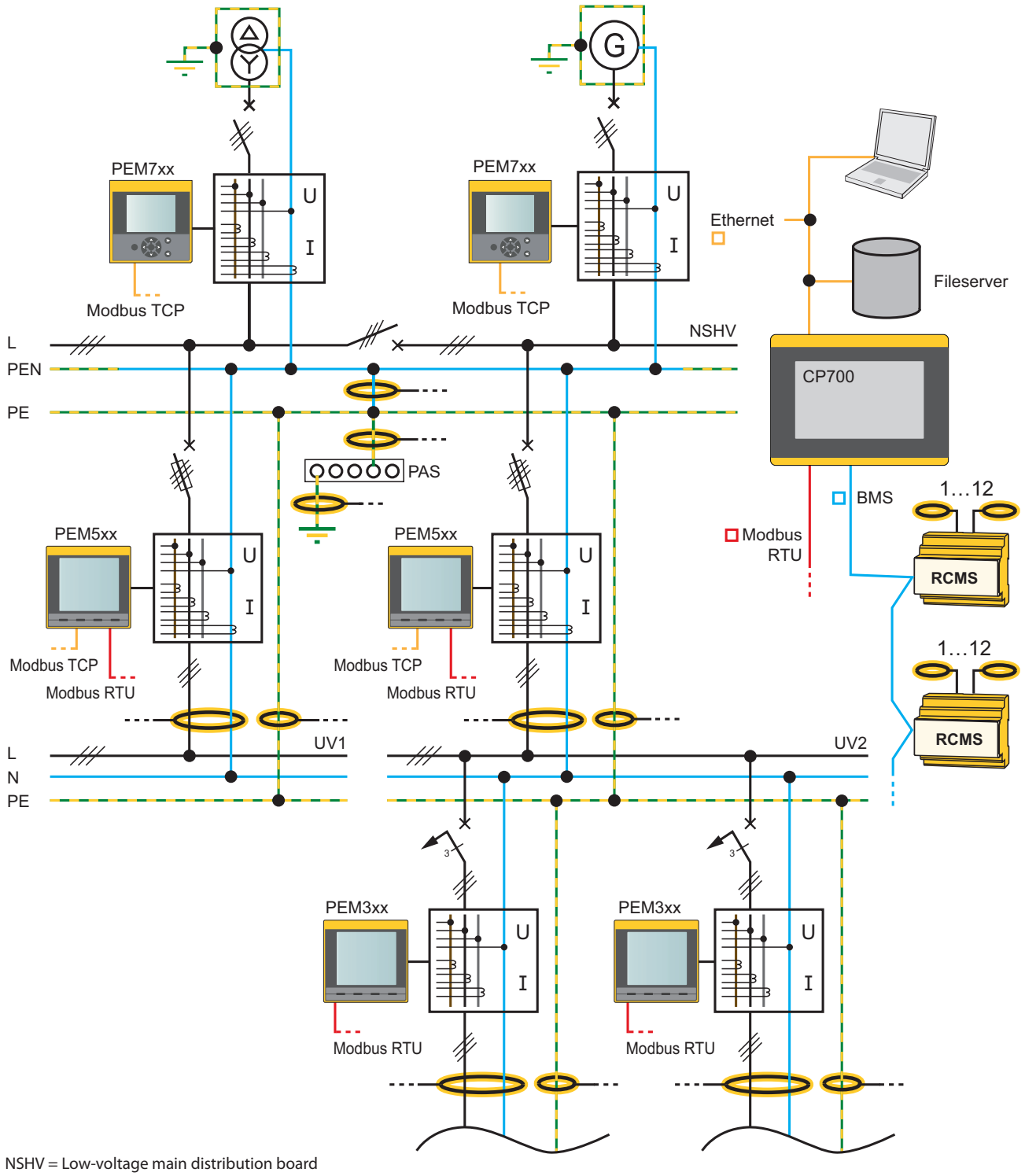
Device overview Universal Devices for Power Quality and Energy Measurement PEM

		 LINETRAXX® PEM330	 LINETRAXX® PEM333	 LINETRAXX® PEM533	 LINETRAXX® PEM555	 LINETRAXX® PEM575	 * LINETRAXX® PEM735	 * LINETRAXX® PEM755
	Page	164	164	167	170	170	–	–
Normative requirements	Accuracy class according to IEC 62053-22	0.5 s	0.5 s	0.5 s	0.2 s	0.2 s	0.2 s	0.2 s
	DIN EN 50160						■	■
	DIN EN 61000-4-7, DIN EN 61000-4-15, DIN EN 61000-4-30						■	■
	DIN EN 61000-2-2, DIN EN 61000-2-4							■
Parameters	Phase voltages/ Line voltages	■	■	■	■	■	■	■
	Phase currents	■	■	■	■	■	■	■
	Neutral current I_4				■	■	■	■
	Neutral current I_4 (calculated)	■	■	■	■	■	■	■
	Frequency/phase angle	■	■	■	■	■	■	■
	Reactive and active power import/ Reactive and active power export	■	■	■	■	■	■	■
	Voltage unbalance/current unbalance	■	■	■	■	■	■	■
	Power	per phase and total S in kVA, P in kW, Q in kvar						
	Displacement factor cos (φ)/ power factor λ	■	■	■	■	■	■	■
	Total harmonic distortion (THD_U/THD_I)	up to the 15th	up to the 15th	up to the 31st	up to the 31st	up to the 63rd	up to the 63rd	up to the 63rd
	Harmonic components voltage			up to the 31st	up to the 31st	up to the 63rd	up to the 63rd	up to the 63rd
	Harmonic components current			up to the 31st	up to the 31st	up to the 63rd	up to the 63rd	up to the 63rd
	Transient detection					longer than 80 µs	longer than 40 µs	longer than 40 µs
	Overvoltage (swell)					■	■	■
	Undervoltage (sag)					■	■	■
	Flicker severity P_{ST}						■	■
Features	Digital inputs		2	6	6	6	8	8
	Digital outputs		2	2	3	3	2	3
Technical aspects	Voltage supply	AC 95…260 V (47…440 Hz), DC						
	Sampling rate	1.6 kHz	1.6 kHz	3.2 kHz	3.2 kHz	12.8 kHz	25.6 kHz	25.6 kHz
	Temperature	-25…+55 °C						
	Communication		Modbus RTU	Modbus RTU	Modbus RTU & TCP	Modbus RTU & TCP	Modbus RTU & TCP	Modbus RTU & TCP

* Delivery on request

Example of system design



NSHV = Low-voltage main distribution board

Power Quality and Energy Measurement PEM330/PEM333

Typical applications

- 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

3.2

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 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 °
  - 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 (φ)
  - Power factor λ
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for U and I
  - k-factor for I
- Programmable setpoint monitoring (PEM333 only)
- LED pulse outputs for active and reactive energy
- Modbus RTU communication via RS-485 (PEM333 only)
- 2 digital outputs (PEM333 only)
- Demands of energy and current for particular time frames
- Peak demands with timestamps

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)

Further information

For further information refer to our product range on www.bender-de.com.

Ordering information

Interface	Digital inputs/outputs	Current input	Type	Art. No.
–	–	5 A	PEM330	B 9310 0330
		1 A	PEM330-251	B 9310 0331
RS-485	2/2	5 A	PEM333	B 9310 0333
		1 A	PEM333-251	B 9310 0334

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

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	230 V
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	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	
Burden	n.A., internal current transformers
Measuring range	0.1… 120% I_N
PEM330/333	
I_N	5 A
Measuring current transformer ratio	1…6000
PEM330-251/PEM333-251	
I_N	1 A
Measuring current transformer ratio	1…30000

Accuracies (of measured value/of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	± 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 cable J-Y(St)Y min. 2 x 0.8

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	2 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

Connection

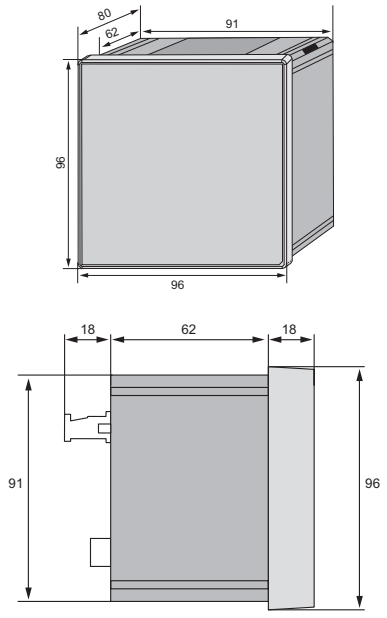
Connection	screw-type terminals

Other

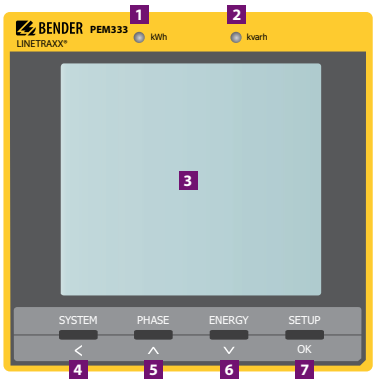
Degree of protection, installation	IP20
Degree of protection, front	IP54
Operating manual	TGH1476
Weight	≤ 550 g

* PEM333 only

Dimension diagram (dimensions in mm)

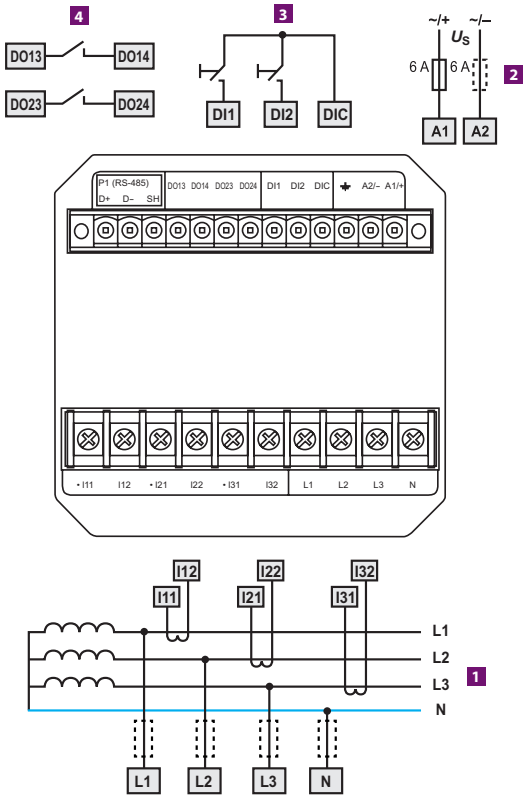


Displays and controls



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.

Wiring diagram



1 Connection to the system to be monitored:
The measuring leads should be protected with appropriate fuses.
2 Supply voltage. Line protection by a fast-acting 6-A fuse. 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)

Power Quality and Energy Measurement PEM533

Typical applications

- 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
- Energy consumption allocation to cost accounting centers

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 °
  - 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 (φ)
  - Power factor λ
  - 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

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)

Further information

For further information refer to our product range on www.bender-de.com.

Ordering information

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

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	≤ 4 VA

Measuring circuit

Measuring voltage inputs

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	230 V
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	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	
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
PEM533-251/PEM533-451	
I_N	1 A
Measuring current transformer ratio	1…30000

Accuracies (of measured value/of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	± 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 cable J-Y(St)Y min. 2 x 0.8

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

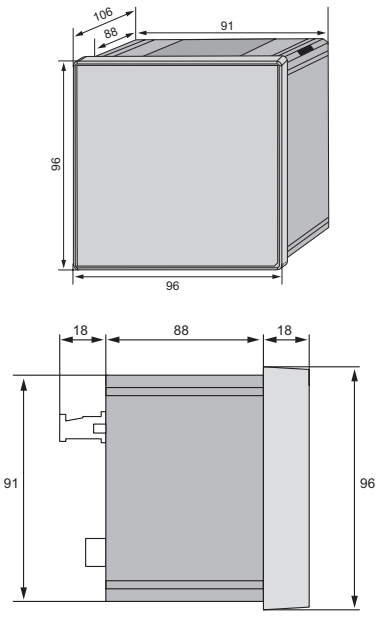
Connection

Connection	screw-type terminals

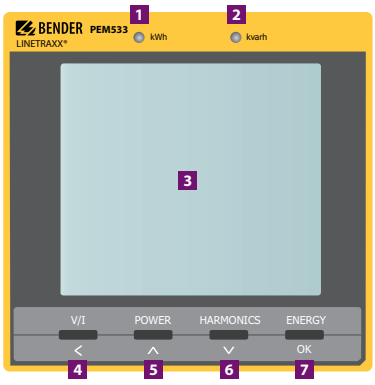
Other

Degree of protection, front	IP54
Operating manual	TGH1476
Weight	≤ 1100 g

Dimension diagram (dimensions in mm)

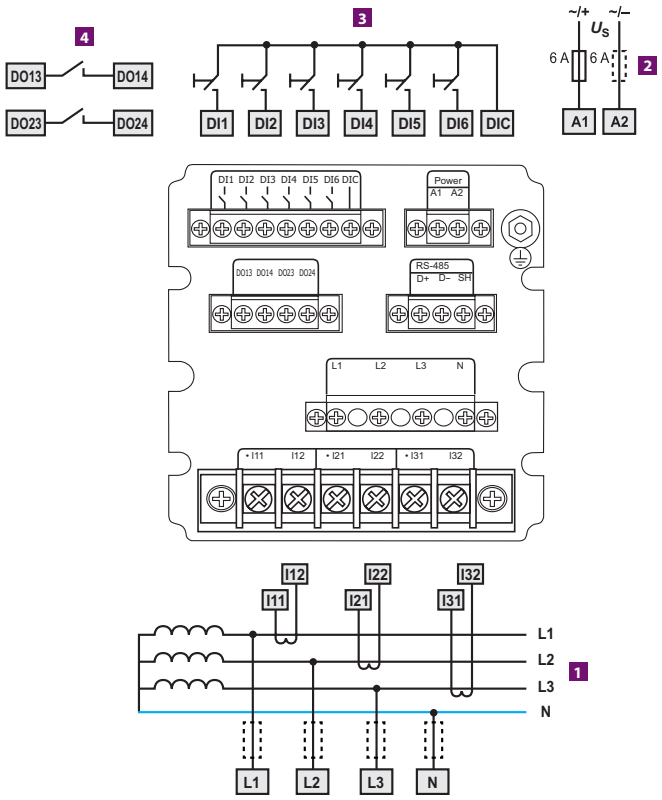


Displays and controls



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.

Wiring diagram



1 Connection to the system to be monitored:
The measuring leads should be protected with appropriate fuses.
2 Supply voltage. Line protection by a fast-acting 6-A fuse. 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)

Power Quality and Energy Measurement PEM555/PEM575

Typical applications

- As a compact device for front panel mounting, the PEM575 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
- Cost allocation of energy consumption
- High-resolution waveform recording allows analysis of power quality phenomena

3.2

Device features

- Accuracy class according to IEC 62053-22: 0.2S
- Parameters
  - Phase conductor voltages U_{L1}, U_{L2}, U_{L3} in V
  - 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 °
  - 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 (φ)
  - Power factor λ
  - Active and reactive power import in kWh, kvarh
  - Active and reactive power export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for U and I
  - Harmonic factor for I
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive power
- Modbus-RTU communication via RS-485
- 2 digital outputs
- Demands of energy and current for particular time frames
- Peak demands with timestamps
- Individual, harmonic components in current and voltage up to the 31st harmonic
- Minimum and maximum values
- Waveform test (12.8 kHz)
- Data recorder
- Sag/swell detection
- High-resolution recording can be triggered by transient events (PEM575 only)

Standards

The universal measuring device for Power Quality and Energy Measurement PEM555/PEM575 was developed in accordance with the following standards: DIN EN 62053-22 (VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12)

Further information

For further information refer to our product range on www.bender-de.com.

Ordering information

Interface	Nominal system voltage 3(N)AC	Current input	Type	Art. No.
RS-485/Ethernet	400/230 V	5 A	PEM555	B 9310 0555
		1 A	PEM555-251	B 9310 0556
	690/400 V	5 A	PEM555-455	B 9310 0557
		1 A	PEM555-451	B 9310 0558
RS-485/Ethernet	400/230 V	5 A	PEM575	B 9310 0575
		1 A	PEM575-251	B 9310 0576
	690/400 V	5 A	PEM575-455	B 9310 0577
		1 A	PEM575-451	B 9310 0578

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

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	230 V
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	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	
Burden	n.A., internal current transformers
Measuring range	0.1… 120 % I_N
PEM575/PEM575-455	
I_N	5 A
Measuring current transformer ratio	1…6000
PEM575-251/PEM575-451	
I_N	1 A
Measuring current transformer ratio	1…30000

Accuracies (of measured value/of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	± 0.1 % of measured value.
Current	± 0.1 % of measured value + 0.05 % of full scale value.
Neutral current I_4	0.5 % of full scale value
Frequency	± 0.01 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 EN 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 cable J-Y(St)Y min. 2 x 0.8

Switching elements

Outputs	3 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

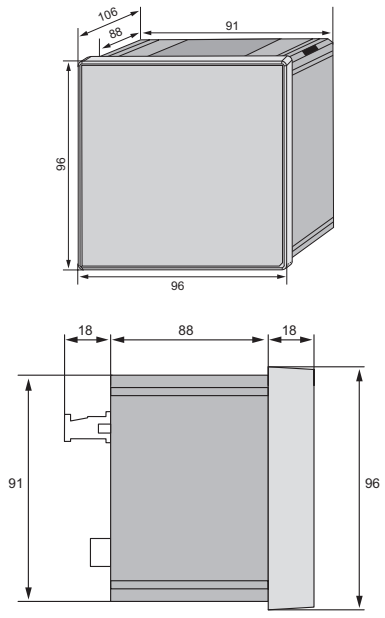
Connection

Connection	screw-type terminals

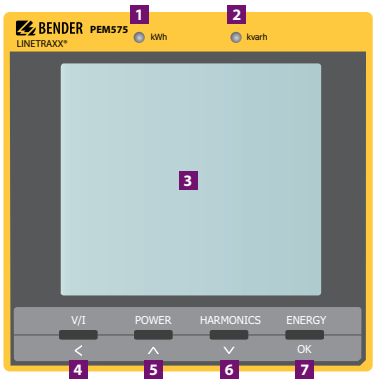
Other

Degree of protection, front	IP54
Operating manual	TGH1476
Weight	≤ 1100 g

Dimension diagram (dimensions in mm)

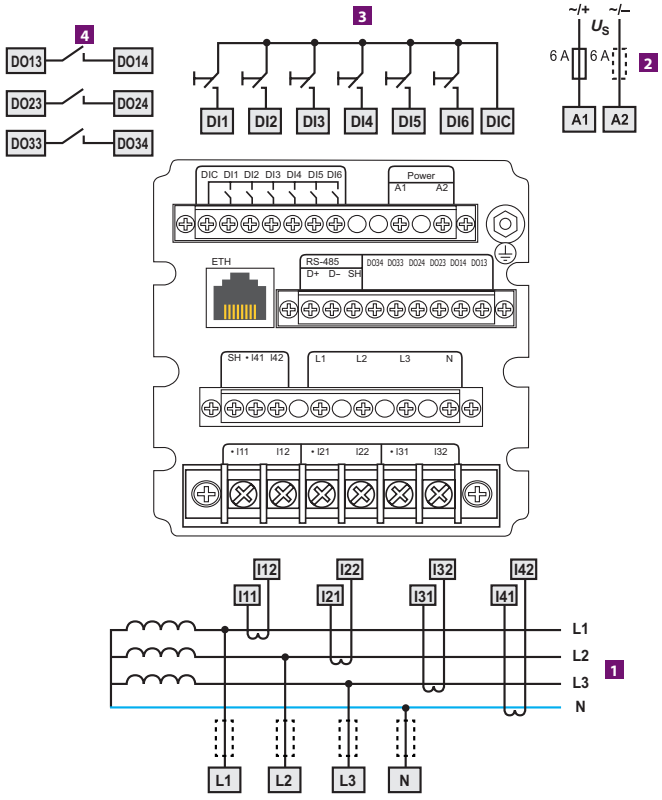


Displays and controls



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.

Wiring diagram



1 Connection to the system to be monitored:
The measuring leads should be protected with appropriate fuses.
2 Supply voltage. Line protection by a fast-acting 6-A fuse. 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)