EN Manual

PEM575

Universal measuring device
Software version 2.00.xx

B 9310 0575
B 9310 0576
B 9310 0577
B 9310 0578

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BENDER
The Power in Electrical Safety©

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Table of Contents

1. Making effective use of this document

1.1 How to use this manual

This manual is aimed at qualified personnel in electrical engineering and communications technology, installers and users of the product and must be kept ready for referencing in the immediate vicinity of the device.
To make it easier for you to understand and revisit certain sections of text and instructions in the manual, we have used symbols to identify important instructions and information. The meaning of these symbols is explained below:

DANGER	*The signal word indicates that there is a **high risk of danger,**, that will result in **death** or **serious injury** if not avoided.*
WARNING	*This signal word indicates a **medium risk of danger** that can lead to **death** or **serious injury** if not avoided.*
CAUTION	*This signal word indicates a **low level risk** that can result in **minor or moderate injury** or **damage to property** if not avoided.*
i	*This symbol denotes information intended to assist the user in making **optimum use** of the product.*

Although great care has been taken in the drafting of this operating manual, it may nevertheless contain errors and mistakes. Bender cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.
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1.2 Technical support: Service and support

For commissioning and troubleshooting Bender offers you:

First level support

Technical support by phone or e-mail for all Bender products

- All questions about customer applications
- Commissioning
- Troubleshooting

Phone:	+49 6401 807-760*
Fax:	+49 6401 807-259
only available in Germany:	0700BenderHelp (Tel. and Fax)
E-mail:	support@bender-service.com

Repair service

Repair, calibration, update and replacement service for all Bender products

- Repair, calibration, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices for faulty or incorrectly delivered Bender devices
- Extended warranty for Bender devices with in-house repair service resp. replacement devices at no extra cost

Phone:	+49 6401 807-780** (technical issues)
	+49 6401 807-784**, -785** (commercial matters)
Fax:	+49 6401 807-789
E-mail:	repair@bender-service.com

Please send the devices for **repair** to the following address:

Bender GmbH, Repair Service
Londorfer Strasse 65
35305 Gruenberg, Germany

Field service
On-site service for all Bender products

- Commissioning, parameter setting, maintenance, trouble shooting for Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Practical training courses for customers

Phone:	+49 6401 807-752**, -762 **(technical issues) +49 6401 807-753** (commercial matters)
Fax:	+49 6401 807-759
E-mail:	fieldservice@bender-service.com
Internet:	www.bender.de.

*Available from 7.00 a.m. to 8.00 p.m. on 365 days of the year (CET/UTC+1)
**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m.

1.3 Workshops

Bender would be happy to provide training in respect of the use of the universal measuring device.
Current dates of training courses and workshops can be found on the Internet at www.bender.de -> Know-how -> Seminars.

1.4 Delivery conditions, guarantee, warranty and liability

The conditions of sale and delivery set out by Bender apply.
For software products, the "Softwareklausel zur Überlassung von Standard- Software als Teil von Lieferungen, Ergänzung und Änderung der Allgemeinen Lieferbedingungen für Erzeugnisse und Leistungen der Elektroindustrie" (software clause in respect of the licensing of standard software as part of deliveries, modifications and changes to general delivery conditions for products and services in the electrical industry) set out by the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e.V., (German Electrical and Electronic Manufacturers' Association) also applies.
Conditions of sale and delivery can be obtained from Bender in printed or electronic format.

2. Safety

2.1 Intended use

The universal measuring device PEM575 is suitable for

- the analysis of energy and power
- monitoring of the power supply quality
- data recording for energy management.

As a compact device for front panel mounting, it is a replacement for analogue indicating instruments. Das PEM575 is suitable for 2, 3 and 4-wire systems and can be used in TN, TT and IT systems. The current measurement inputs of the PEM are connected via external ../1 A or ../5 A measuring current transformers. In principle, measurements in medium and high voltage systems are carried out via measurement transformers and voltage transformers.
Use for the intended purpose also includes:

- Device-specific settings according to local equipment and operating conditions.
- The observation of all information in the operating manual.

2.2 Qualified personnel

Only electrically skilled persons are authorised to install and commission this device.
Electrically skilled persons are those who have the relevant education, knowledge and experience, as well as knowledge of the relevant safety standards and who are able to perceive risks and to avoid hazards which electricity can create when work activities are carried out on electrical installations. The electrically skilled person is specially trained for carrying out work activities in his specific working environment and has a thorough knowledge of the relevant standards and regulations. In Germany, an electrically skilled person must meet the requirements of the accident prevention regulation BGV A3. In other countries the applicable regulations have to be observed and followed.

2.3 General safety instructions

Bender devices are designed and built in accordance with the state of the art and accepted rules in respect of technical safety. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to Bender equipment or other property.

DANGER

Danger of electric shock!
Touching live parts will cause danger of electric shock with fatal consequences.
All work activities on electrical installations as well as installation activities, commissioning activities and work activities with the device in operation may only be carried out by electrically skilled persons!

- Only use Bender equipment:
  - as intended
  - in perfect working order
  - in compliance with the accident prevention regulations and guidelines applicable at the location of use
- Eliminate all faults immediately which may endanger safety.
- Do not make any unauthorised changes and only use replacement parts and optional accessories purchased from or recommended by the manufacturer of the equipment. Failure to observe this requirement can result in fire, electric shock and injury.
- Information plates must always be clearly legible. Replace damaged or illegible plates immediately.
- If the device is overloaded by overvoltage or a short-circuit current load, it must be checked and replaced if necessary.
- If the device is being used in a location outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. European standard EN 50110 can be used as a guide.

3. Device description

3.1 Area of application

For humans, electric current is not immediately visible. Universal measuring devices for monitoring electrical parameters are used wherever energy consumption, performance measurements or the quality of the supply voltage are to be made visible.
The PEM575 is suitable for monitoring

- power generation systems (PV systems, CHPs, hydro power and wind power plants)
- energy-intensive equipment and parts of installation
- sensitive equipment

3.2 Device features

The universal measuring device PEM575 for power quality and energy management is characterised by the following features:

- Accuracy class in accordance withIEC 62053-22: 0.2 S
- Password protection
- 16 programmable setpoints
- LED pulse outputs for active and reactive energy
- Modbus RTU communication via RS-485 interface
- 6 digital inputs
- 3 digital outputs
- Power and current demands for particular time frames
- Peak demands with timestamps
- Individual, current/voltage harmonics up to the 63^{rd} harmonic
- Max and Min values
- High-resolution waveform recording (12.8 kHz)
- Data recorder
- Event log: 512 events, setup changes, setpoint alarming, DI status changes, DO switching operations
- Sag/swell detection
- Detection of transient events
- Communication:

- Galvanically isolated RS-485 interface (1,200 … 19,200 bit/s)
- Modbus/RTU protocol
- Modbus/TCP (10/100 Mbit/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_0 in A
– Neutral current (measured)	I_4 in A
– Frequency	*f* in Hz
– Phase angle	for *U* and *I* in °
– Power per phase conductor	*P* in kW, *Q* in kvar, *S* in kVA
– Total power	*P* in kW, *Q* in kvar, *S* in kVA
– 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, TOHD, TEHD)	for *U* and *I*
– K-factor	for *I*

3.3 Versions

PEM575	230/400 V; Current input 5 A
PEM575-251	230/400 V Current input 1 A
PEM575-455	400/690 V, 50 Hz Current input 5 A
PEM575-451	400/690 V, 50 Hz Current input 1 A

3.4 Application example

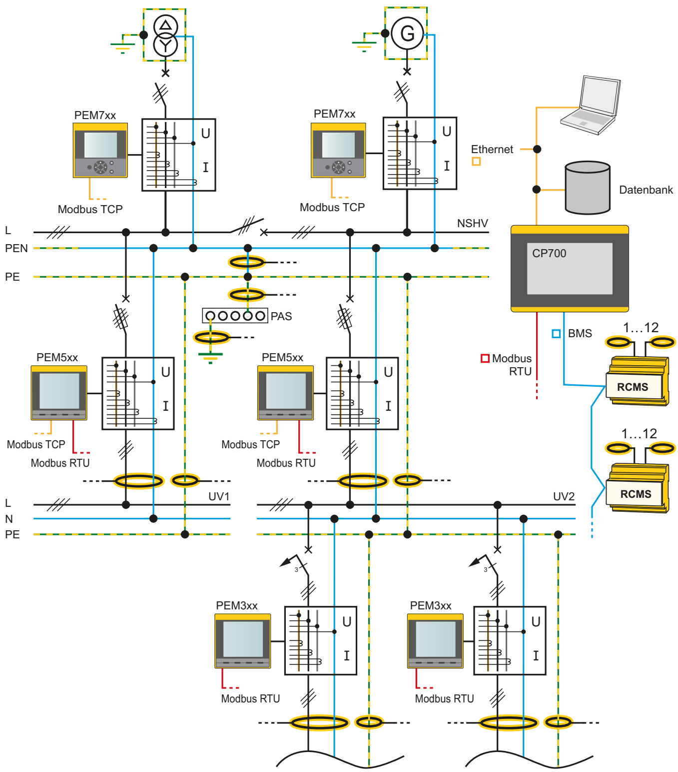


Fig. 3.1: Application example

3.5 Description of function

The digital universal measuring device PEM575 is suited for measuring and displaying electrical quantities of a public electricity network. The PEM575 is able to perform current, voltage, energy consumption and performance measurements as well as displaying individual harmonic components of current and voltage for assessment of the voltage and current quality.

The accuracy of the active energy metering corresponds to class 0.2 S in compliance with the DIN EN 62053-22 (VDE 0418 Part 3-22):2003-11.

The large display of the panel mounting device makes the relevant measured quantities easily legible and enables fast configuration. In addition, the RS-485 interface allows a central evaluation and processing of data. Switching operations can be monitored or initiated via the digital inputs and outputs (Example: Switching off uncritical loads if the peak load limit value is exceeded).

The universal measuring device PEM575 provides the following functions:

- Provision of energy consumption data for a well-thought-out energy management
- Allocation of energy costs
- Power quality monitoring for cost reduction and increased plant availability
- High-resolution waveform recording allow analysis of power quality phenomena

3.6 Front view and rear view

The connecting terminals are located at the rear of the device.

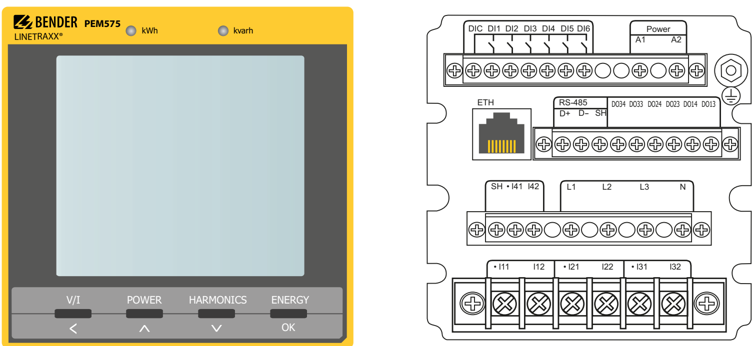


Fig. 3.2: Front view (left) and rear view (right) PEM575

4. Installation and connection

4.1 Project planning

For any questions associated with project planning, please contact Bender:
Internet: www.bender.de
Tel.: +49-6401-807-0

4.2 Safety instructions

Only electrically skilled persons are allowed to connect and commission the device. Such persons must have read this manual and understood all instructions relating to safety.

DANGER

Danger of electric shock!
Follow the basic safety rules when working with electricity.
Consider the data on the rated voltage and supply voltage *as specified in the technical data!*

4.3 Installing the device

4.3.1 Dimension diagrams

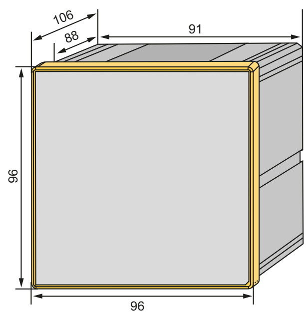


Fig. 4.1: Dimension diagram PEM575 (front view)

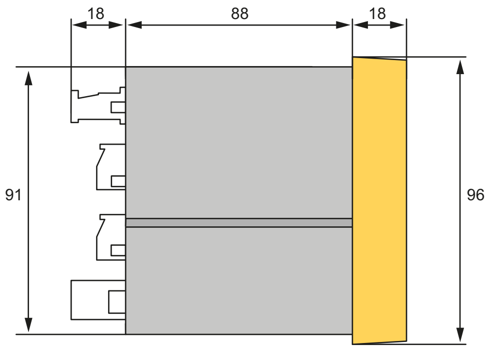


Fig. 4.2: Dimension diagram PEM575 (side view)

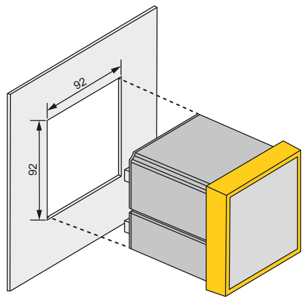


Fig. 4.3: Dimension diagram PEM575 (panel cutout)

4.3.2 Front panel mounting

A front panel cutout of 92 mm x 92 mm is necessary for installation.

1. Insert the device through the cutout in the front panel.
2. Insert the two installation clips into the equipment rail from behind.
3. Push the clips towards the front panel and tighten the associated screws by hand.
4. Check the device to ensure that it is firmly installed in the front panel.

The device is installed.

4.4 Connection of the device

4.4.1 Safety information

DANGER

Danger of electric shock!
Follow the basic safety rules when working with electricity.
Consider the data on the rated voltage and supply voltage *as specified in the technical data!*

4.4.2 Back-up fuses

Back-up fuse supply voltage: 6 A
Short-circuit protection Protect the measuring inputs according to the requirements of the standards. (Recommendation: 2 A). A suitable isolation means must be provided. For details refer to the operating manuals of the measuring current transformers currently used.

If the supply voltage U_s is supplied by an ***IT system***, ***both lines are to be protected***.

4.4.3 Connection of measuring current transformers

When connecting the measuring current transformers it is important to consider the requirements of DIN VDE 0100-557 (VDE 0100-557) –
Low voltage installations - Part 5: Selection and erection of electrical equipment - Section 557: Auxiliary circuits.

4.5 Instructions for connection

- Connect the PEM575 to the supply voltage (terminals A1 and A2 resp. +/-). Connect terminal " ⏚ " to the protective conductor.
- 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.
- Connection to the RS-485 bus is made via the terminals D+, D- and SH. Up to 32 devices can be connected to the bus. The maximum cable length for the bus connection of all devices is 1200 m.

4.6 Wiring diagram

Connect the device according the wiring diagram. The connections are located at the rear of the device.

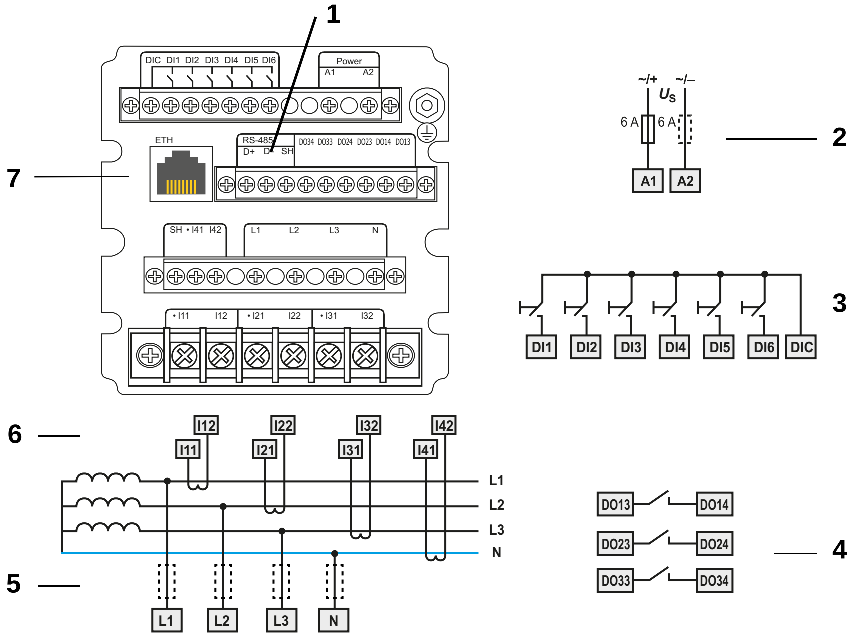


Fig. 4.4: Wiring diagram

Legend to 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: The measuring leads should be protected with appropriate fuses.
6	Connection to the system to be monitored
7	Connection Modbus TCP

4.7 Connection diagram voltage inputs

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

The universal measuring device PEM575 can be used in three-phase-4-wire systems, independent of the type of distribution system (TN, TT, IT system).

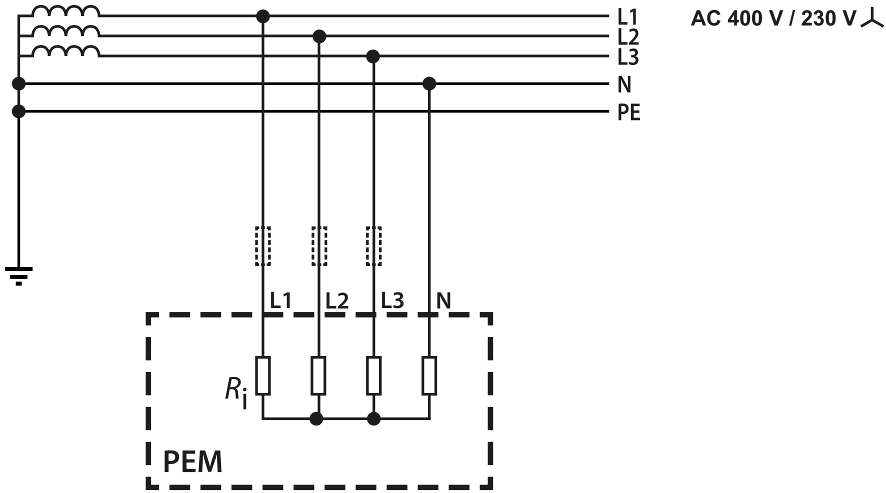


Fig. 4.5: Connection diagram three-phase 4-wire system (e.g. TN-S system)

4.7.2 Three-phase 3-wire system

The universal measuring device PEM575 can be used in three-phase-3-wire systems.
The line voltage must not exceed AC 400 V.

*When used in 3-wire systems, the connection type (**TYPE**) has to be set to **DELTA** (refer to page 46). For this purpose, **the measuring inputs L2 and N** are to be **bridged**.*

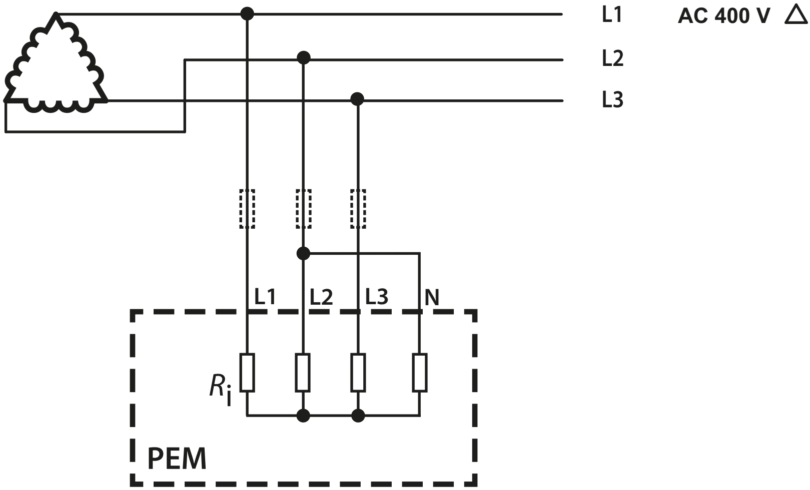


Fig. 4.6: Connection diagram three-phase-3-wire system

4.7.3 Connection via voltage transformers

The coupling via voltage transformers allows the use of the measuring device in medium and high voltage systems.

The transformation ratio can be adjusted in the PEM575 (1…2200).

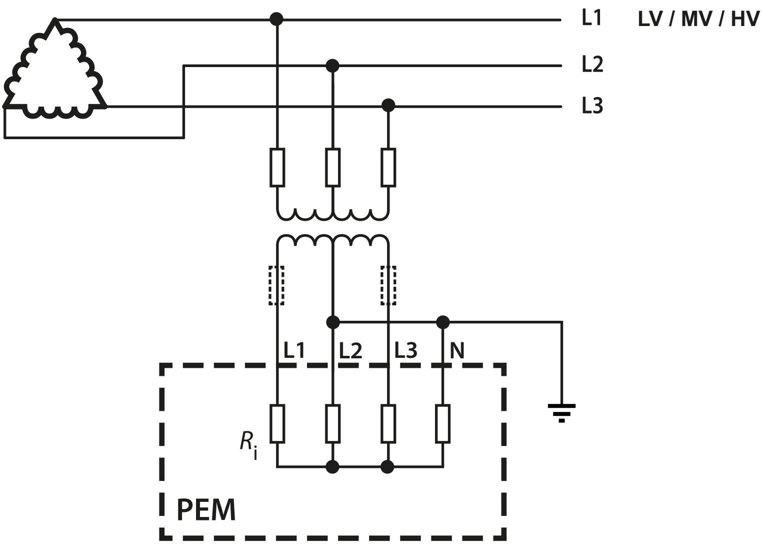
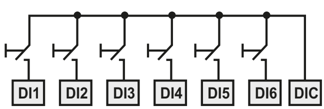


Fig. 4.7: Connection diagram 3-wire system via voltage transformers

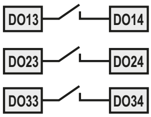
4.8 Digital inputs

The universal measuring device PEM575 provides 6 digital inputs. The inputs are supplied by a galvanically isolated DC 24 V voltage. An external circuit providing at least a current of I_{min} > 2.4 mA is required for triggering the inputs.

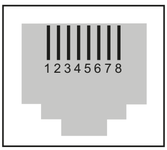


4.9 Digital outputs

The universal measuring device PEM575 features 3 configurable outputs (N/O contact).

<table>
<tr><td rowspan="2">
</td><td>Rated operational voltage</td><td>AC 230 V</td><td>DC 24 V</td><td>AC 110 V</td><td>DC 12 V</td></tr>
<tr><td>Rated operational current</td><td>5 A</td><td>5 A</td><td>6 A</td><td>5 A</td></tr>
</table>

4.10 Modbus TCP (connector pin assignment)

<table>
<tr><th>RJ45</th><th>Pin</th><th>assignment</th></tr>
<tr><td rowspan="5">
</td><td>1</td><td>Transmit Data +</td></tr>
<tr><td>2</td><td>Transmit Data –</td></tr>
<tr><td>3</td><td>Receive Data +</td></tr>
<tr><td>4, 5, 7, 8</td><td>not used</td></tr>
<tr><td>6</td><td>Receive Data –</td></tr>
</table>

5. Commissioning

5.1 Check proper connection

Observe the relevant standards and regulations that have to be observed for installation and connection as well as the operating manual of the respective device.

5.2 Before switching on

Before switching on think carefully about these questions:

1. Does the connected supply voltage correspond to the nameplates' information?
2. Are you sure that the nominal insulation voltage of the measuring current transformer has not been exceeded?
3. Does the measuring current transformer's maximum current correspond to the nameplate information of the connected device?

5.3 Switching on

After switching on, proceed as follows:

1. Connect the supply voltage.
2. Set the bus address/IP address.
3. Set the CT transformation ratio (for each channel).
4. Change the measuring current transformer's counting direction, if required.
5. Set the nominal voltage (line-to-line voltage U_{LL}).
6. Select wye connection or delta connection.

5.4 System

The universal measuring device PEM575 can be programmed and queried via Modbus RTU. For details refer to „chapter 10. Modbus Register Map“ or the Internet www.modbus.org.

In addition, it is possible to integrate the device into Bender's own BMS (Bender measuring device interface) bus protocol via additional communication modules. In this way, communication with (already existing) Bender devices for device parameterisation and visualisation of measured values and alarms can be achieved.

Help and examples of system integration can be found on the Bender homepage www.bender.de or you can contact our Bender Service for personal advice (see „chapter 1.2 Technical support: Service and support“).

6. Operation

6.1 Getting to know the operating elements

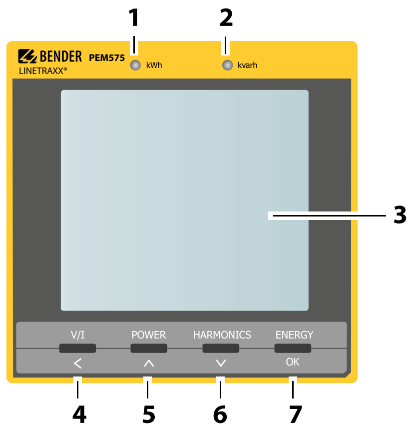


Fig. 6.1: Operating elements

Legend to operating elements

No.	Element	Description
1	LED kWh	Pulse output, see page 37
2	LED kvarh	
3	LC display	
4	"V/I" button <	Display mean values and total values (current, voltage) in the menu: in case of numerical values: move the cursor one to the left by one position
5	"POWER" button ∧	Display power-related measured quantities in the menu: go up one entry in case of numerical values: increments a value
6	"HARMONICS" button ∨	Display harmonics in the menu: go back to the last parameter in the menu in case of numerical values: decrements a value
7	"ENERGY" button OK	Press > 3 s: toggles between setup and standard display mode Display measured values: active and reactive energy import/active and reactive energy export (line 5) in the menu: select parameters for modification save the new setting

6.2 LCD testing

Pressing both the "**POWER"** and "**HARMONICS"** buttons simultaneously for > 2 seconds enters the LCD testing mode.

During testing, all LCD segments are illuminated for one second and then turned off for 1 second. This cycle will be repeated 3 times. After completion of the test run, the device automatically returns to its normal display mode.

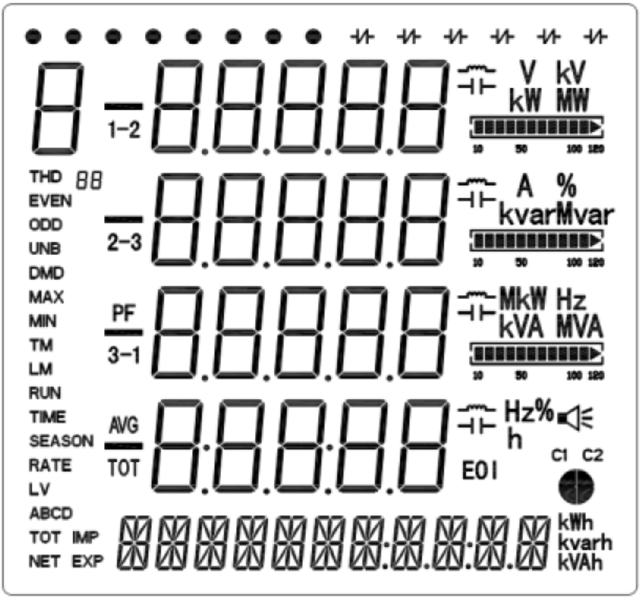
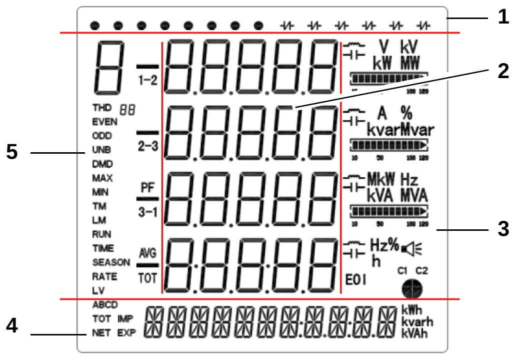


Fig. 6.2: Display during an LCD test

6.3 Getting to know standard display areas

The display can generally be divided into five areas.



Legend to standard display areas

No.	Description
1	Displays the indicators for DI status and DO status
2	Measured values
3	Harmonic Distortion HD, unbalance (unb), quadrant, measurement units
4	Displays energy information such as active energy (import, export, net energy and total energy in kWh), reactive energy (import, export, energy net amount and total energy in kvar), apparent energy (S_{ges} in kVAh)
5	Shows parameters for voltage, current, fundamental, power, total harmonic distortions THD, TOHD, TEHD (2nd…3st harmonic), k-factor, unbalance (unb), phase angle for voltages and currents, demands

Fig. 6.3: Display areas

Description of standard display indications (ranges 1, 3 and 4)

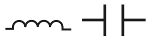
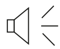
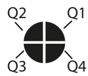
<table>
<tr><th>Area</th><th>Segments</th><th colspan="3">Symbol description</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2"></td><td colspan="2">○ DI open</td><td>● DI closed</td></tr>
<tr><td colspan="2">DO open</td><td>DO closed</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3"></td><td colspan="2">V, kV, A, %, Hz
Measurement units for
U, I, THD, f</td><td>kW, MW, kvar, kVA, MVA
Measurement units for
P, Q, S</td></tr>
<tr><td colspan="2">
Current value expressed as a percentage</td><td>
inductive, capacitive</td></tr>
<tr><td>C1
Status communication interface</td><td>
Alarm symbol</td><td>
Quadrant</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3"></td><td>IMP kWh
Active energy import</td><td>EXP kWh
Active energy export</td><td>NET kWh
Active energy net amount</td></tr>
<tr><td>TOT kWh
Total active energy</td><td>IMP kvarh
Reactive energy import</td><td>EXP kvarh
Reactive energy export</td></tr>
<tr><td>NET kvarh
Reactive energy net amount</td><td>TOT kvarh
Total reactive energy</td><td> kVAh
Apparent energy</td></tr>
</table>

Fig. 6.4: Standard display indications

6.4 Power and current demands (demand display)

The **demands** are indicated on the display according to the following scheme:

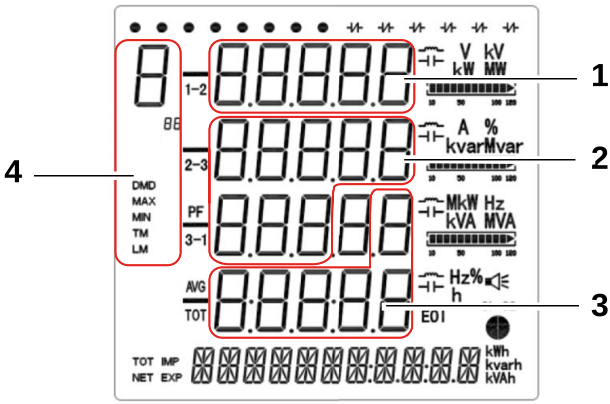


Fig. 6.5: Display: peak demand

Legend to demand display

No.	Display
1	Peak demand value
2	Peak demand timestamp (date): JJJJ.MM.TT
3	Peak demand timestamp (time): HH:MM:SS
4	Demand displays: **A**: I_1 **b**: I_2 **C**: I_3 **P**: Active energy demand P **q**: Reactive energy demand Q **S**: Apparent energy demand **DMD**: Demand **MAX** Maximum **TM:** this month **LM**: last month

6.5 LED indication

The universal measuring device features two red LEDs on its front panel: kWh and kvarh.
The two LED indicators are used for the indication of kWh and kvar, if the **EN PULSE function** is **enabled**. The setting can be carried out in the setup menu using the buttons on the front or via the communications interface..
The LEDs flash each time a certain amount of energy is reached (1 kWh resp.1 kvarh).
The amount of energy displayed corresponds to the amount of energy measured by the measuring device. In order to determine the actual amount of energy, the flashing frequency can be calculated from the CT ratio and the pulse constant.

6.6 Standard display

The universal measuring device automatically shows the default display screen, if there is no button pressed for 3 minutes in the Setup mode.

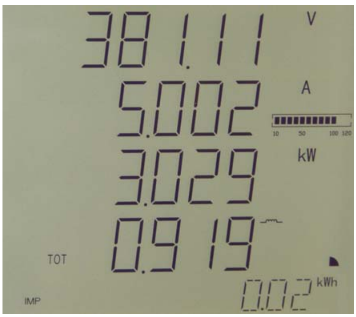


Fig. 6.6: Standard display

6.7 Data display

There are **four buttons** on the display to view measuring data: "V/I", "POWER" , "HARMONICS" and "ENERGY". The following tables illustrate how to retrieve individual values.
PEM575 also provides the fundamental components (related to $f_{(0)}$) for the measured quantities listed in the following table (in display shown as "d").

6.7.1 "V/I" button

Left column	Right column	First line	Second line	Third line	Fourth line
TOT	V A W	Ø U	Ø I	P_{ges}	Power factor λ_{ges}
U1 2 3 AVG	V	*U_{L1}	*U_{L2}	*U_{L3}	*Ø U_{LN}
U1-2 2-3 3-1 AVG	V	U_{L1L2}	U_{L2L3}	U_{L3L1}	Ø U_{LL}
I1 2 3 AVG	A	I_1	I_2	I_3	Ø I
I_4	A		I_4		
I_0	A		Neutral current I_0 (calculated)		
d 1 2 3 AVG	V	$U_{L1(f0)}$	$U_{L2\ (f0)}$	$U_{L3\ (f0)}$	Ø $U_{LN\ (f0)}$
d 1 2 3 AVG	A	$I_{1\ (f0)}$	$I_{2\ (f0)}$	$I_{3\ (f0)}$	Ø $I_{(f0)}$
F	Hz			f	
U unb	%		Unbalance U		
I unb	%		Unbalance I		
U1 PA 2 3		Phase angle U_{L1}	Phase angle U_{L2}	Phase angle U_{L3}	
I1 PA 2 3		Phase angle I_1	Phase angle I_2	Phase angle I_3	

Left column	Right column	First line	Second line	Third line	Fourth line
I1 DMD 2 3	A	Demand I_1	Demand I_2	Demand I_3	Ø Demand I
DMD I_4	A		Demand *I4*		
A DMD MAX TM	A	Peak demand I_1 this month	JJJJ.MM.TT hh:mm:ss		
b DMD MAX TM	A	Peak demand I_2 this month	JJJJ.MM.TT hh:mm:ss		
C DMD MAX TM	A	Peak demand I_3 this month	JJJJ.MM.TT hh:mm:ss		
A DMD MAX LM	A	Peak demand I_1 last month	JJJJ.MM.TT hh:mm:ss		
b DMD MAX LM	A	Peak demand I_2 last month	JJJJ.MM.TT hh:mm:ss		
C DMD MAX LM	A	Peak demand I_3 last month	JJJJ.MM.TT hh:mm:ss		

Tab. 6.1: Display screens via the "V/I" button

Note table 6.1:

* When the wiring mode is "DELTA", the display will be bypassed and does not appear.

6.7.2 "POWER"button

Left column	Right column	First line	Second line	Third line	Fourth line
* P_1 2 3 TOT	W	P_{L1}*	P_{L2}*	P_{L3}*	P_{ges}
*q_1 2 3 TOT	var	Q_{L1}*	Q_{L2}*	Q_{L3}*	Q_{ges}
*S_1 2 3 TOT	VA	S_{L1}*	S_{L2}*	S_{L3}*	S_{ges}
*PF_1 2 3 TOT		λ_{L1}*	λ_{L2}*	λ_{L3}*	λ_{ges}
d_1 2 3 TOT	W	$P_{L1\ (f0)}$	$P_{L2\ (f0)}$	$P_{L3\ (f0)}$	$P_{ges\ (f0)}$
d_1 2 3 TOT	var	$Q_{L1\ (f0)}$	$Q_{L2\ (f0)}$	$Q_{L3\ (f0)}$	$Q_{ges\ (f0)}$
d_1 2 3 TOT	VA	$S_{L1\ (f0)}$	$S_{L2\ (f0)}$	$S_{L3\ (f0)}$	$S_{ges\ (f0)}$
*dPF1 2 3 TOT		Displacement factor cos $(\varphi)_{L1\ f(0)}$*	Displacement factor cos $(\varphi)_{L2\ f(0)}$*	Displacement factor cos $(\varphi)_{L3\ f(0)}$*	Displace-ment factor cos $(\varphi)_{f(0)}$
TOT	W var VA	P_{ges}	Q_{ges}	S_{ges}	λ_{ges}

Left column	Right column	First line	Second line	Third line	Fourth line
d TOT	W var VA	P_{ges} (f0)	Q_{ges} (f0)	S_{ges} (f0)	λ_{ges} (f0)
DMD TOT	W var VA	Demand P_{ges}	Demand Q_{ges}	Demand S_{ges}	Demand λ_{ges}
P DMD TOT	W var VA	Predicted demand P_{ges}	Predicted demand Q_{ges}	Predicted demand S_{ges}	Predicted demand λ_{ges}
P DMD MAX TM	kW	Peak demand *P* this month	YYYY.MM.DD hh:mm:ss		
q DMD MAX TM	kvar	Peak demand *Q* this month	YYYY.MM.DD hh:mm:ss		
S DMD MAX TM	kVA	Peak demand *S* this month	YYYY.MM.DD hh:mm:ss		
P DMD MAX LM	kW	Peak demand *P* last month	YYYY.MM.DD hh:mm:ss		
Q DMD MAX LM	kvar	Peak demand *Q* last month	YYYY.MM.DD hh:mm:ss		
S DMD MAX LM	kVA	Peak demand *S* last month	YYYY.MM.DD hh:mm:ss		

Tab. 6.2: Display possibilities via the "POWER" button

Note table 6.2:

* When the wiring mode is "DELTA", the display will be bypassed and does not appear.

6.7.3 "HARMONICS" button

Left column	Right column	First line	Second line	Third line	Fourth line
THD U_1 2 3 AVG	%	THD_{UL1}	THD_{UL2}	THD_{UL3}	Ø THD_{ULN}
THD $_I$1 2 3 AVG	%	THD_{I1}	THD_{I2}	THD_{I3}	Ø THD_I
k 1 2 3		k-factor I_1	k-factor I_2	k-factor I_3	
U THD Even	%	$TEHD_{UL1}$	$TEHD_{UL2}$	$TEHD_{UL3}$	Ø $TEHD_{ULN}$
I THD Even	%	$TEHD_{I1}$	$TEHD_{I2}$	$TEHD_{I3}$	Ø $TEHD_I$
U THD ODD	%	$TOHD_{UL1}$	$TOHD_{UL2}$	$TOHD_{UL3}$	Ø $TOHD_{ULN}$
I THD ODD	%	$TOHD_{I1}$	$TOHD_{I2}$	$TOHD_{I3}$	Ø $TOHD_I$
HD2 U_1 2 3 AVG	%	2^{nd}	2^{nd}	2^{nd}	Ø 2^{nd}
HD2 I1 2 3 AVG	%	2^{nd}	2^{nd}	2^{nd} harmonic I_3	Ø 2^{nd} harmonic I
HD3 U1 2 3 AVG	%	3^{rd}	3^{rd}	3^{rd}	Ø 3^{rd}
...					
HD31 U_1 2 3 AVG	%	31^{st}	31^{st}	31^{st}	Ø 31^{st}

Left column	Right column	First line	Second line	Third line	Fourth line
*HD31 I1 2 3 AVG	%	31st	31st	31st harmonic I_3	Ø 31st harmonic I

Tab. 6.3: Display screens via the "HARMONICS" button

Note table 6.3:

* The harmonics 32…63 can only be queried via the communication interface.

6.7.4 "ENERGY" button

The "Energy" button switches through the displays of the fifth line:

Left column	Right column	Value
IMP	kWh	Active energy import
EXP	kWh	Active energy export
NET	kWh	Active energy net amount
TOT	kWh	Total active energy
IMP	kvarh	Reactive energy import
EXP	kvarh	Reactive energy export
NET	kvarh	Reactive energy net amount
TOT	kvarh	Total reactive energy
S	kVAh	Apparent energy

Tab. 6.4: Display screens via the "ENERGY" button

6.8 Setup configuration via the front panel

Pressing the "ENERGY" button for more than 3 seconds enters the Setup configuration mode.
Upon completion, pressing the "ENERGY" button for more than 3 seconds returns to the data display mode.

*A **correct password must be entered** before parameter changes are allowe (factory default password is 0).*

6.8.1 Setup: Function of buttons

The meanings of the buttons in the Setup mode are indicated below each button:

"**V / I":** arrow button " < "	moves the cursor to the left by one position if the parameter being changed is a numerical value
"**POWER":** arrow button " ∧ "	advances to the next parameter in the menu or increments a numerical value
"**HARMONICS"**: arrow button " ∨ "	goes back to the last parameter in the menu or decrements a numerical value
"**ENERGY":** OK	to confirm the value entered

6.8.2 Setup: Overview diagram menu

The following diagram will help you to familiarise yourself with the menu.

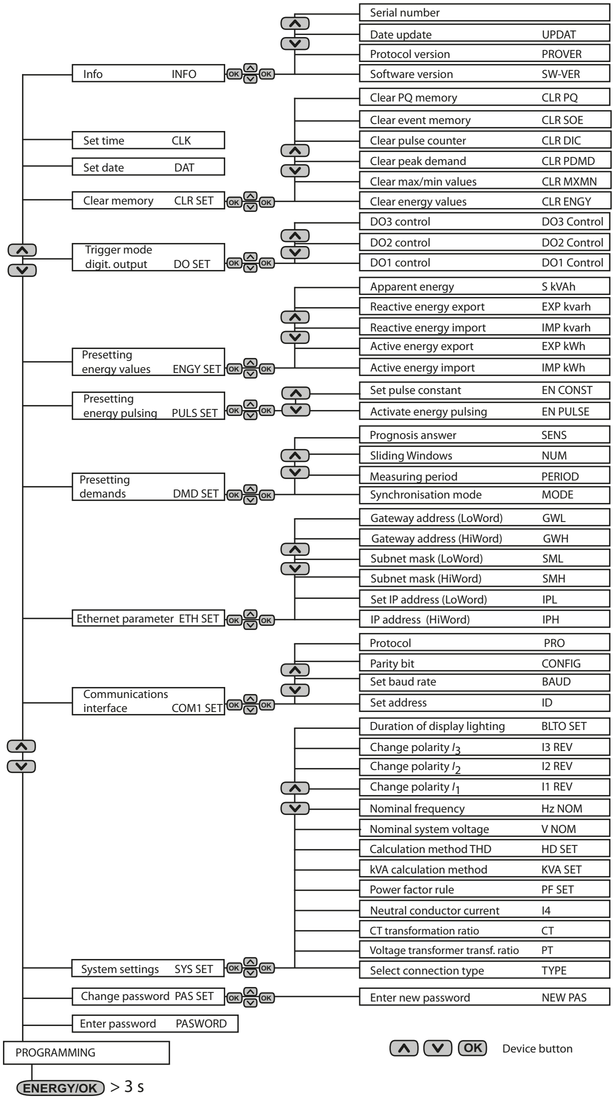


Fig. 6.7: Setup: Overview of setting options

6.9 Setup: adjustment possibilities

The table illustrates the display screens, their meaning and the adjustment possibilities.

Display screen Level 1 / Level 2	Parameters	Description	Adjustment possibilities	Default setting
PROGRAMMING	Setup mode			
PASWORD	Password	Enter password	/	0
PAS SET		Change password?	YES/NO	NO
NEW PAS	New password	Enter new password	0000…9999	0
SYS SET	System settings		YES/NO	NO
TYPE	Wiring mode	Select wiring mode	WYE/DELTA/ DEMO	WYE
PT	Voltage transformer	Select voltage transformer transformation ratio	1…10,000	1
CT	Measuring current transformers	Select CT transformation ratio	1…30,000 (1 A) 1…6,000 (5 A)	1
I4	Neutral current	Select CT transformation ratio for I_4	1…10,000	1
PF SET	Power factor rule	Power factor rule*	IEC/IEEE/-IEEE	IEC
KVA SET	S calculation method **		V/S	V
HD SET	Harmonic distortion calculation method ***		FUND/RMS	FUND
V NOM	Nominal voltage U_{nom} (equals U_{LL})		100…700 (V)	100
Hz NOM	Nominal frequency f_{nom}		50/60 (Hz)	50
I1 REV	I_1 CT	Reverse phase I_1 CT polarity	YES/NO	NO

Display screen Level 1 / Level 2	Parameters	Description	Adjustment possibilities	Default setting
I2 REV	I_2 CT	Reverse phase I_2 CT polarity	YES/NO	NO
I3 REV	I3 CT	Reverse phase I_3 CT polarity	YES/NO	NO
BLTO SET	Display backlight	Backlight timeout	0…60 (minutes)	3
COM 1 SET	Configure communications interface		YES/NO	NO
ID1	Measuring device address	Set address for measuring device	1…247	100
BAUD1	Baud rate	Set baud rate	1200/2400/ 4800/9600/ 19200 bps	9600
CONFIG1	Parity bit	Parity bit configuration	8N2/8O1/8E1/ 8N1/8O2/8E2	8E1
PRO	Protocol		MODBUS/ EGATE	Modbus
ETH SET	Configure Ethernet parameters		YES/NO	NO
IPH	IP address (HiWord)			192.168
IPL	IP address (LoWord)			8.97
SMH	Subnet mask (HiWord)			255.255
SML	Subnet mask (LoWord)			255.0
GWH	Gateway address (HiWord)			192.168
GWL	Gateway address (LoWord)			8.1
DMD SET	Demand measurement on/off		YES/NO	NO
MODE	Synchronisation mode demand		SLD/SYNC	SLD

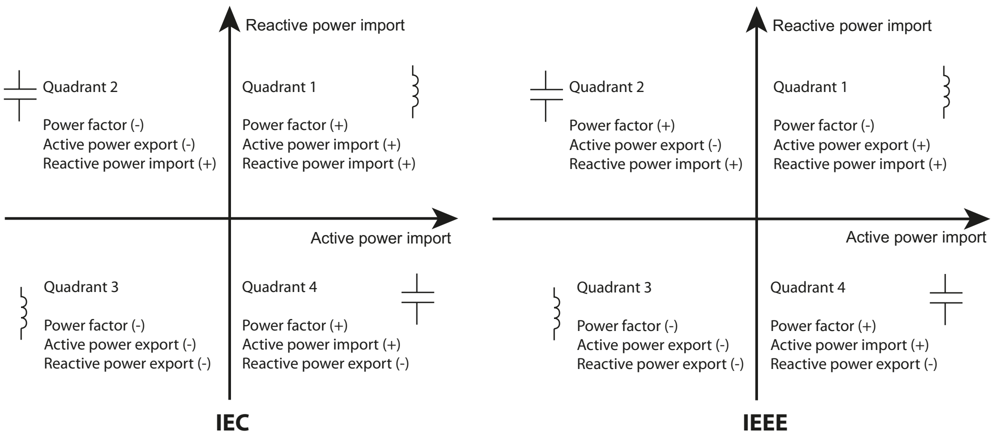
Display screen Level 1 Level 2	Parameters	Description	Adjustment possibilities	Default setting
PERIOD	Sliding window interval	Set sliding window interval	1…99 (minutes)	15
NUM	Demand cycles (sliding windows)	Set the number of sliding windows	1…15	1
SENS	Predicted demand sensitivity		70…99	70
PULS SET	Set pulse output		YES/NO	NO
EN PULSE	Energy pulsing	Enable kWh and kvarh energy pulsing	YES/NO	NO
EN CONST	Pulse constant	Number of LED pulses per amount of energy	1K	1K
ENGY SET	Presetting of energy values		YES/NO	NO
IMP kWh	Active energy import	Preset active energy import	0… 999.999.999	0
EXP kWh	Active energy export	Preset active energy export	0… 999.999.999	0
IMP kvarh	Reactive energy import	Preset reactive energy import	0… 999.999.999	0
EXP kvarh	Reactive energy export	Preset reactive energy export	0… 999,999,999	0
kVAh	Apparent energy	Preset apparent energy	0… 999,999,999	0
DO SET	Change trigger mode for digital outputs		YES/NO	NO
DO1	Operating mode DO1	Set operating mode DO1	NORMAL/ON/OFF	NORMAL
DO2	Operating mode DO2	Set operating mode DO2	NORMAL/ON/OFF	NORMAL

Display screen Level 1 Level 2	Parameters	Description	Adjustment possibilities	Default setting
DO3	Operating mode DO3	Set operating mode DO3	NORMAL/ON/ OFF	NOR-MAL
CLR SET	Clear memory		YES/NO	NO
CLR ENGY	Clear energy values	Clear kWh, kvarh and kVAh	YES/NO	NO
CLR MXMN	Clear Max and Min values of this month		YES/NO	NO
CLR PDMD	Clear peak demand values of this month		YES/NO	NO
CLR DIC	Clear pulse counter		YES/NO	NO
CLR SOE	Clear event log		YES/NO	NO
CLR PQ	Clear PQ log		YES/NO	NO
DAT	Date	Set current date	YY-MM-DD	/
CLK	Time	Set current time	HH:MM:SS	/
Info	Device information (read only)		YES/NO	NO
SW-VER	Software version		/	/
PRO VER	Protocol version (50 means V5.0)		/	/
UPDAT	Date of the latest software update	yymmdd	/	/
	Serial number device		/	/

Tab. 6.5: Setup adjustment possibilities

Explanatory notes table 6.5

*Power factor λ rules



"**IEEE"** is the same as "**-IEEE"** but with the opposite sign.

There are two ways **to calculate the apparent power *S*:

Vector method V:

$$S_{ges} = \sqrt{P_{ges}^{\ 2} + Q_{ges}^{\ 2}}$$

Scalar method S:

$$S_{ges} = S_{L1} + S_{L2} + S_{L3}$$

Choose the calculation method:
V = Vector method
S = Scalar method

***There are two ways to **calculate** the **individual harmonic distortion:**

FUND
"Fundamental":

THD calculation of an individual harmonic (related to fundamental U_1 resp. I_1)

$$THD_{U(k)} = \frac{U_k}{U_1} \times 100\ \%$$

$$THD_{I(k)} = \frac{I_k}{I_1} \times 100\ \%$$

RMS
"Root Mean Square":

Distortion factor calculation of an individual harmonic (THF, related to the total value U_{ges} resp. I_{ges})

$$THF_{U(k)} = \frac{U_k}{\sqrt{\sum_{k=1}^{\infty} U_k^2}} \times 100\ \%$$

$$THF_{I(k)} = \frac{I_k}{\sqrt{\sum_{k=1}^{\infty} I_k^2}} \times 100\ \%$$

6.10 Configuration example:

Setting the measuring current transformer ratio to 200

Button	Display text	Description
OK > 3 s	PROGRAMMING	
⋀	PASWORD ****	
OK	PASWORD 0	0 flashes
OK	PASWORD 0	0 = factory setting
⋀	PAS SET NO	
⋀	SYS SET NO	
OK	SYS SET NO	NO flashes
⋀or⋁	SYS SET YES	YES flashes
OK	SYS SET YES	
⋀	TYPE WYE	Factory setting
⋀	PT 1	Factory setting
⋀	CT 1	Factory setting
OK	CT 1	1 flashes (units place)
⋁	CT 0	0 flashes (units place)
<	CT 00	0 on the left flashes (tens place)
<	CT 0 0	0 on the left flashes (hundreds place)
⋀⋀	CT 200	2 flashes
OK	CT 200	CT ratio 200 set
OK > 3 s	Standard display	

7. Application/inputs and outputs

7.1 Digital inputs (DI)

The device features six digital inputs which are internally operated with DC 24 V. Digital inputs are typically used for **monitoring external statuses**. The real-time statuses of the digital inputs are available on the front panel LC display as well as through connected system components. Changes in external statuses are stored as events in the SOE log in 1 ms resolution.

One of the digital inputs can be programmed to **receive pulses for the synchronisation of the demand measurement**. The setting is to be carried out via register 6021 (page 128).

Digital inputs can also be used as **external time synchronisation pulse** (see page 86).

7.2 Digital outputs (DO)

The device features three digital outputs. **Digital outputs** are typically used for **setpoint alarming**, **load control** or **remote control applications**.

Examples:

1. Manually operated from the front panel (Chapter 6.8 Setup configuration via the front panel)
2. Operation via communications interface (Chapter 10.19 DOx output control).
3. Control setpoints: Control actions in response to a specific condition (Chapter 7.6 Setpoints)
4. Digital outputs triggered by logic modules (Chapter 10.12 Logic module).
5. Triggered by undervoltage or overvoltage (Chapter 9.4 Undervoltage/overvoltage setpoint (sag/swell setpoint)).
6. Triggered by transient events (Chapter 9.5 Transient events setpoint).
7. Control via digital inputs

Priority: Front panel control has a higher priority and overwrites the other applications.

For a general alarm, all setpoints can be programmed to control the same digital output. However, if the user intends to generate a control signal in response to a specific setpoint condition, each DO may be controlled by only one source.

7.3 Energy pulsing output

The two LED pulse outputs are used for kWh and kvarh indication, if the function EN PULSE is enabled. Energy pulsing can be enabled from the front panel through the EN Pulse setup parameter or via the communications interface.
The LEDs flash each time a certain amount of energy is reached (1 kWh resp. 1 kvarh).
In order to relate the flashing frequency to the amount of energy, the transformation ratios and the pulse constant have to be considered.

$$\text{Pulses per kWh} = \frac{\text{Pulse constant}}{\text{ratio VT x ratio CT}}$$

$$\text{Amount of energy per pulse} = \frac{\text{ratio VT x ratio CT}}{\text{Pulse constant}}$$

Note:
VT = voltage transformer
CT = measuring current transformer

7.4 Power and energy

7.4.1 Basic measurements

The PEM575 provides the following basic measurements with a 1 second update rate:

- three-phase voltages
- three-phase currents
- three-phase power
- three-phase power factorsλ
- Neutral current
- Frequency
- Energy import and export
- Voltage and current phase angles

7.4.2 High-speed measurements

In addition to the basic measurements, the PEM575 provides the following high-speed measurements:

- three-phase voltages (10 ms)
- three-phase currents (20 ms)
- three-phase power (20 ms)
- λ three-phase power factors (20 ms)
- Neutral current (20 ms)

7.4.3 Voltage and current phase angles

Phase angle analysis is used to identify the angle relationship between the voltages and currents of the three line conductors.

7.4.4 Energy

Basic energy parameters include

- active energy (import, export, net energy and total energy in kWh)
- reactive energy (import, export, net energy and total energy in kvarh) as well as reactive energy related to the quadrants Q1…Q4
- apparent energy (S_{ges} in kVAh)

The maximum value to be displayed is ± 999,999,999,99. When the maximum value is reached, the register will automatically roll over to zero. The counter value can be edited via software or through the front panel, password required.

7.5 Demand DMD

The demand is defined as an average consumption value over a fixed demand period.
PEM575 supports the "Sliding windows" demand calculation; in addition to the demand period also the demand cycles, which are to be considered, are specified here. The following parameters can be set:

- **Synchronisation mode**
  - SLD internally synchronised to the PEM's clock
  - SYNC DI externally synchronised to a digital input that has been programmed as a demand synchronisation input (DI function = SYNC DI)
- **Demand cycles** (1…15)

- **Demand period** (1…99 min)
  Example of a total demand period:
  Demand cycles: 3
  Demand period: 20 min
  Total demand period: 3 x 20 min = 60 min

- Predicted demand sensitivity SENS (70…99)

Values are determined for present demand and predicted demand

- Voltages (U_1, U_2, U_3, $ØU_{LN}$, U_{L1L2}, U_{L2L3}, U_{L3L1}, $ØU_{LL}$)
- Currents (I_1, I_2, I_3, Ø I, I_4)
- Active power P (P_1, P_2, P_3, P_{ges})
- Apparent power S (S_1, S_2, S_3, S_{ges})
- Reactive power Q (Q_1, Q_2, Q_3, Q_{ges})
- Power factor λ (λ_1, λ_2, λ_3, λ_{ges})
- Frequency
- Voltage unbalance
- Current unbalance
- Total harmonic distortion, voltage (THD_{U1}, THD_{U2}, THD_{U3})
- Total harmonic distortion, current (THD_{I1}, THD_{I2}, THD_{I3})

The demand period can be set using the buttons on the front panel or via the communications interface. The following options are available:
1, 2, 3, 5, 10, 15, 30, 60 minutes
In addition to the demand period also the demand cycles (sliding window) between 1 and 15 are to be specified.

During the total demand period (duration multiplied by the number), the consumption resp. the imported power is measured. Then the **average demand value is indicated on the display** and output via the communications interface.
The maximum demand value (peak demand) determined over the whole recording period will be saved and displayed. The peak demand can be reset manually.
Setting possibilities: Chapter 6.9 Setup: adjustment possibilities.

7.5.1 Max/Min values per demand period

The PEM575 records the min and max values of the following measurements for each demand period

- three-phase voltages
- three-phase currents
- three-phase frequencies
- three-phase power
- three-phase power factors λ
- Voltage unbalance
- Current unbalance
- Total harmonic distortion, voltage (THD_U)
- Total harmonic distortion, current (THD_I)

All recorded measuring values can be accessed via the communications interface.

7.6 Setpoints

The PEM575 features 24 user-programmable control setpoints (registers 6600…6839) which provide extensive control by allowing a user to initiate an action in response to a specific condition. The alarm symbol 🔈 at the right side of the LC display is lit if there are any active setpoints.

The first 16 setpoints (1…16) are **standard setpoints,** the other setpoints (17…24) are **high-speed setpoints**.
Typical setpoint applications are alarming, fault location and power quality monitoring (PQ monitoring).
Setpoints can be programmed via the **communications interface.**
The following **setup parameters** are provided:

1. **Setpoint type:** Specifies the monitoring condition (over setpoint or under setpoint) or is disabled.
2. **Setpoint parameters**: Specifies the parameters to be monitored;
   for standard setpoints all parameters are available, for high-speed setpoints only the keys 1…14 apply.

Setpoints

Key for setpoint	Parameters	Factor; Unit
1	U_{LN}	x 100; V
2	U_{LL}	x 100; V
3	I	x 1000; A
4	$I4$	x 1000; A
5	Δf	x 100, Hz
6	P_{ges}	kW
7	Q_{ges}	kvar
8	λ	x1,000
9	DI1	**Over setpoint** active limit: DI= 1 (close) inactive limit: DI = 0 (open) **Under setpoint** active limit: DI= 0 (open) inactive limit: DI = 1 (close)
10	DI2	
11	DI3	
12	DI4	
13	DI5	
14	DI6	
15	Reserved	
16	Demand P_{ges}	kW
17	Demand Q_{ges}	kvar
18	Demand λ	x1,000
19	Predicted demand P_{ges}	kW
20	Predicted demand Q_{ges}	kvar
21	Predicted demand λ	x1,000
22	THD_U	x 100, %
23	$TOHD_U$	x 100, %

Key for setpoint	Parameters	Factor; Unit
24	$TEHD_U$	x 100, %
25	THD_I	x 100, %
26	$TOHD_I$	x 100, %
27	$TEHD_I$	x 100, %
28	Unbalance *U*	x 10, %
29	Unbalance *I*	x 10, %
30	ΔU	x 100, %
31	Phase sequence	**Over setpoint** active limit: negative phase sequence inactive limit: positive phase sequence **Under setpoint** active limit: positive phase sequence inactive limit: negative phase sequence

Tab. 7.1: Setpoint parameters

3. **Setpoint limit (active limit)**: Specifies the
   upper limits (over setpoint) resp.
   lower limits (under setpoint)
   that the setpoint parameter must exceed for over setpoint or go below for under setpoint for the setpoint to become active (response threshold).
4. **Setpoint limit (inactive limit)**: Specifies the
   lower limits (under setpoint) resp.
   upper limits (over setpoint)
   that the setpoint parameter must go below for over setpoint or exceed for under setpoint for the setpoint to become inactive, e.g. back to normal state (release threshold).
5. **Response delay:** Specifies the minimum period that a limit value must have been violated before an action is triggered.
   Each status change of a setpoint generates an event that is stored in the event log. The response value for standard setpoints can be indicated in the range of 0…9.999 seconds. The response value for high-speed setpoints can be indicated in the range of 0…9.999 cycles.

6. **Delay on release:** Specifies the minimum period that the setpoint return condition must have met before returning to normal condition.
   Each status change generates an event which is stored in the event log. The delay on release can be indicated for standard setpoints in the range of 0…9.999 seconds. The delay on release for high-speed setpoints can be indicated in the range of 0…9.999 cycles.
7. Setpoint trigger: Specifies what action the setpoint will take when it becomes active. This action includes "No Trigger" and "Trigger DOx".

Key	Action	Key	Action
0	-	12	DR 9
1	DO1	13	DR 10
2	DO2	14	DR 11
3	DO3	15	DR 12
4	DR 1	16	DR 13
5	DR 2	17	DR 14
6	DR 3	18	DR 15
7	DR 4	19	DR 16
8	DR 5	20	WFR1
9	DR 6	21	WFR2
10	DR 7	22	Alarm e-mail
11	DR 8		

Tab. 7.2: Setpoint trigger

7.7 Logic modules

The PEM575 provides six programmable logic modules which perform AND, NAND, OR or NOR logical operations. Each logic module is capable of linking four different setpoint conditions with each other.

Logical expression =

{(source 1 *[mode 1]* **source 2)** *[mode 2]* **source 3}** *[mode 3]* **source 4**

The alarm symbol 🔈 at the right side of the LC display appears when there are active logic modules. Logic modules are programmed via the communications interface.

Details about the applied **registers** and their data structure you will find on **page 134**.

The following **setup parameters** are provided:

1. **Activating** logic modules
2. **Mode** 1…3: Specifies the type of logical evaluation to be performed (AND, NAND, OR, NOR).
3. **Source** 1…4: Specifies the source inputs (table 10.30).
4. **Trigger** : Trigger 1 and Trigger 2 specify what action the logic module will take when it becomes active (table 10.31).

8. Logging

8.1 Peak demand log

The PEM575 stores the demand data of the last month and this month with timestamp for I_1, I_2, I_3, P_{ges}, Q_{ges} and S_{ges}. All values can be accessed through the front panel buttons as well as the communications interface. Data for this month can be deleted through the front panel buttons as well as the communications interface.

8.2 Max/Min log

The PEM575 stores each new maximum and minimum value of this month and last month. Details about the applied **registers** and their data structure you will find on **page 114**.

The stored values are listed in the table below.

This month		Last month	
Maximum values	**Minimum values**	**Maximum values**	**Minimum values**
$U_{L1\ max}$	$U_{L1\ min}$	$U_{L1\ max}$	$U_{L1\ min}$
$U_{L2\ max}$	$U_{L2\ min}$	$U_{L2\ max}$	$U_{L2\ min}$
$U_{L3\ max}$	$U_{L3\ min}$	$U_{L3\ max}$	$U_{L3\ min}$
Ø $U_{LN\ max}$	Ø $U_{LN\ min}$	Ø $U_{LN\ max}$	Ø $U_{LN\ min}$
$U_{L1L2\ max}$	$U_{L1L2\ min}$	$U_{L1L2\ max}$	$U_{L1L2\ min}$
$U_{L2L3\ max}$	$U_{L2L3\ min}$	$U_{L2L3\ max}$	$U_{L2L3\ min}$
$U_{L3L1\ max}$	$U_{L3L1\ min}$	$U_{L3L1\ max}$	$U_{L3L1\ min}$
Ø $U_{LL\ max}$	Ø $U_{LL\ min}$	Ø $U_{LL\ max}$	Ø $U_{LL\ min}$
$I_{1\ max}$	$I_{1\ min}$	$I_{1\ max}$	$I_{1\ min}$
$I_{2\ max}$	$I_{2\ min}$	$I_{2\ max}$	$I_{2\ min}$
$I_{3\ max}$	$I_{3\ min}$	$I_{3\ max}$	$I_{3\ min}$
Ø I_{max}	Ø I_{min}	Ø I_{max}	Ø I_{min}
I_{4max}	I_{4min}	I_{4max}	I_{4min}

This month		Last month	
Maximum values	**Minimum values**	**Maximum values**	**Minimum values**
$P_{ges\ max}$	$P_{ges\ min}$	$P_{ges\ max}$	$P_{ges\ min}$
$Q_{ges\ max}$	$Q_{ges\ min}$	$Q_{ges\ max}$	$Q_{ges\ min}$
$S_{ges\ max}$	$S_{ges\ min}$	$S_{ges\ max}$	$S_{ges\ min}$
$\lambda_{ges\ max}$	$\lambda_{ges\ min}$	$\lambda_{ges\ max}$	$\lambda_{ges\ min}$
f_{max}	f_{min}	f_{max}	f_{min}
THD $U_{L1\ max}$	THD $U_{L1\ min}$	THD $U_{L1\ max}$	THD $U_{L1\ min}$
THD $U_{L2\ max}$	THD $U_{L2\ min}$	THD $U_{L2\ max}$	THD $U_{L2\ min}$
THD $U_{L3\ max}$	THD $U_{L3\ min}$	THD $U_{L3\ max}$	THD $U_{L3\ min}$
THD $I_{1\ max}$	THD $I_{1\ min}$	THD $I_{1\ max}$	THD $I_{1\ min}$
THD $I_{2\ max}$	THD $I_{2\ min}$	THD $I_{2\ max}$	THD $I_{2\ min}$
THD $I_{3\ max}$	THD $I_{3\ min}$	THD $I_{3\ max}$	THD $I_{3\ min}$
(k-factor I1)$_{max}$	(k-factor I1)$_{min}$	(k-factor I1)$_{max}$	(k-factor I1)$_{min}$
(k-factor I2)$_{max}$	(k-factor I2)$_{min}$	(k-factor I2)$_{max}$	(k-factor I_2)$_{min}$
(k-factor I_3)$_{max}$	(k-factor I_3)$_{min}$	(k-factor I_3)$_{max}$	(k-factor I_3)$_{min}$
max. unbalance *U*	min. unbalance *U*	max. unbalance *U*	min. unbalance *U*
max. unbalance *I*	min. unbalance *I*	max. unbalance *I*	min. unbalance *I*

Tab. 8.1: Max/Min log for this month and last month

8.3 Data recorder (DR)

PEM575 has an internal memory of 4 MB and provides

- 4 high speed data recorders
- 12 standard recorders

Each of these recorders can record 16 parameters. The data recorders are programmed solely via the communications interface.

Details about the applied **registers** and their data structure you will find on **page 136.**

8.3.1 Setup parameters

The following set-up parameters are supported:

No.	Parameters	Setting
1	Trigger mode	0 = disabled 1 = triggered by timer 2 = triggered by setpoint
2	Recording mode	Standard DR: 0 = stop-when-full 1 = FIFO (first-in-first-out) (ring memory) High speed DR: 1 = stop-when-full
3	Recording depth	0…65535 (entries)
4	Recording interval	Standard DR: 0…3456000 seconds (40 days) High speed DR: 0…60 cycles
5	Recording delay[1)]	0…43200 seconds (12 h)
6	Number of measured variables	0…16
7	Parameters 1…16 (see table 8.3)	Standard DR: 0…328 High speed DR: 0…28

Tab. 8.2: Setup data recorder

Notes: table 8.2

> *The **data recorder is only operational** when the **parameters 1…4 are all non-zero**!*

[1] "Recording delay":

In Trigger mode 1, a fixed time can be set in seconds to delay the start of the measurement (triggered by timer). Example: "300" means that the recording will take place at 5 minutes after the DR is enabled. In order to obtain evaluable results, the programmed value of the recording offset parameter should be less than that of the recording interval parameter.

For Trigger mode 2, recording delay is ignored.

For details refer to
- Modbus register 7000…7383 (page 136).
- Data structure high speed data recorder (page 138)
- Data standard data recorder (page 140)

8.3.2 Selectable measured quantities for data recorders DR

16 measured quantities per data recorder can be selected from the table below:

Key	Measured quantities (data recorder)	Factor/unit
0	U_{L1}	x 100, V
1	U_{L2}	x 100, V
2	U_{L3}	x 100, V
3	Ø U_{LN}	x 100, V
4	U_{L1L2}	x 100, V
5	U_{L2L3}	x 100, V
6	U_{L3L1}	x 100, V
7	Ø U_{LL}	x 100, V
8	$I1$	x 1,000, A
9	$I2$	x 1,000, A
10	$I3$	x 1,000, A
11	Ø I	x 1,000, A
12	I_4 (measured)	x 1,000, A
13	P_{L1}	W
14	P_{L2}	W
15	P_{L3}	W
16	P_{ges}	W

Key	Measured quantities (data recorder)	Factor/unit
17	Q_{L1}	var
18	Q_{L2}	var
19	Q_{L3}	var
20	Q_{ges}	var
21	S_{L1}	VA
22	S_{L2}	VA
23	S_{L3}	VA
24	S_{ges}	VA
25	λ_{L1}	x 1,000
26	λ_{L2}	x 1,000
27	λ_{L3}	x 1,000
28	λ_{ges}	x 1,000
29	F	x 100, Hz
30	Counter DI1	
31	Counter DI2	
32	Counter DI3	
33	Counter DI4	
34	Counter DI5	
35	Counter DI6	
36	Voltage unbalance	x 1000
37	Current unbalance	x 1000
38	k-factor I_1	x 10
39	k-factor I_2	x 10
40	k-factor I_3	x 10
41	THD_{UL1}	x 10,000
42	THD_{UL2}	x 10,000
43	THD_{UL3}	x 10,000
44	$TOHD_{UL1}$	x 10,000
45	$TOHD_{UL2}$	x 10,000
46	$TOHD_{UL3}$	x 10,000
47	$TEHD_{UL1}$	x 10,000
48	$TEHD_{UL2}$	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
49	$TEHD_{UL3}$	x 10,000
50	THD_{I1}	x 10,000
51	THD_{I2}	x 10,000
52	THD_{I3}	x 10,000
53	$TOHD_{I1}$	x 10,000
54	$TOHD_{I2}$	x 10,000
55	$TOHD_{I3}$	x 10,000
56	$TEHD_{I1}$	x 10,000
57	$TEHD_{I2}$	x 10,000
58	$TEHD_{I3}$	x 10,000
59	U_{L1} 2^{nd} harmonic	x 10,000
60	U_{L2} 2^{nd} harmonic	x 10,000
61	U_{L3} 2^{nd} harmonic	x 10,000
62	U_{L1} 3^{rd} harmonic	x 10,000
63	U_{L2} 3^{rd} harmonic	x 10,000
64	U_{L3} 3^{rd} harmonic	x 10,000
65	U_{L1} 4^{th} harmonic	x 10,000
66	U_{L2} 4^{th} harmonic	x 10,000
67	U_{L3} 4^{th} harmonic	x 10,000
68	U_{L1} 5^{th} harmonic	x 10,000
69	U_{L2} 5^{th} harmonic	x 10,000
70	U_{L3} 5^{th} harmonic	x 10,000
71	U_{L1} 6^{th} harmonic	x 10,000
72	U_{L2} 6^{th} harmonic	x 10,000
73	U_{L3} 6^{th} harmonic	x 10,000
74	U_{L1} 7^{th} harmonic	x 10,000
75	U_{L2} 7^{th} harmonic	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
76	U_{L3} 7^{th} harmonic	x 10,000
77	U_{L1} 8^{th} harmonic	x 10,000
78	U_{L2} 8^{th} harmonic	x 10,000
79	U_{L3} 8^{th} harmonic	x 10,000
80	U_{L1} 9^{th} harmonic	x 10,000
81	U_{L2} 9^{th} harmonic	x 10,000
82	U_{L3} 9^{th} harmonic	x 10,000
83	U_{L1} 10^{th} harmonic	x 10,000
84	U_{L2} 10^{th} harmonic	x 10,000
85	U_{L3} 10^{th} harmonic	x 10,000
86	U_{L1} 11^{th} harmonic	x 10,000
87	U_{L2} 11^{th} harmonic	x 10,000
88	U_{L2} 11^{th} harmonic	x 10,000
89	U_{L1} 12^{th} harmonic	x 10,000
90	U_{L2} 12^{th} harmonic	x 10,000
91	U_{L3} 12^{th} harmonic	x 10,000
92	U_{L1} 13^{th} harmonic	x 10,000
93	U_{L2} 13^{th} harmonic	x 10,000
94	U_{L3} 13^{th} harmonic	x 10,000
95	U_{L1} 14^{th} harmonic	x 10,000
96	U_{L2} 14^{th} harmonic	x 10,000
97	U_{L3} 14^{th} harmonic	x 10,000
98	U_{L1} 15^{th} harmonic	x 10,000
99	U_{L2} 15^{th} harmonic	x 10,000
100	U_{L3} 15^{th} harmonic	x 10,000
101	U_{L1} 16^{th} harmonic	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
102	U_{L2} 16th harmonic	x 10,000
103	U_{L3} 16th harmonic	x 10,000
104	U_{L1} 17th harmonic	x 10,000
105	U_{L2} 17th harmonic	x 10,000
106	U_{L3} 17th harmonic	x 10,000
107	U_{L1} 18th harmonic	x 10,000
108	U_{L2} 18th harmonic	x 10,000
109	U_{L3} 18th harmonic	x 10,000
110	U_{L1} 19th harmonic	x 10,000
111	U_{L2} 19th harmonic	x 10,000
112	U_{L3} 19th harmonic	x 10,000
113	U_{L1} 20th harmonic	x 10,000
114	U_{L2} 20th harmonic	x 10,000
115	U_{L3} 20th harmonic	x 10,000
116	U_{L1} 21st harmonic	x 10,000
117	U_{L2} 21st harmonic	x 10,000
118	U_{L2} 21st harmonic	x 10,000
119	U_{L1} 22nd harmonic	x 10,000
120	U_{L2} 22nd harmonic	x 10,000
121	U_{L3} 22nd harmonic	x 10,000
122	U_{L1} 23rd harmonic	x 10,000
123	U_{L2} 23rd harmonic	x 10,000
124	U_{L3} 23rd harmonic	x 10,000
125	U_{L1} 24th harmonic	x 10,000
126	U_{L2} 24th harmonic	x 10,000
127	U_{L3} 24th harmonic	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
128	U_{L1} 25th harmonic	x 10,000
129	U_{L2} 25th harmonic	x 10,000
130	U_{L3} 25th harmonic	x 10,000
131	I_1 2nd harmonic	x 10,000
132	I_2 2nd harmonic	x 10,000
133	I_3 2nd harmonic	x 10,000
134	I_1 3rd harmonic	x 10,000
135	I_2 3rd harmonic	x 10,000
136	I_3 3rd harmonic	x 10,000
137	I_1 4th harmonic	x 10,000
138	I_2 4th harmonic	x 10,000
139	I_3 4th harmonic	x 10,000
140	I_1 5th harmonic	x 10,000
141	I_2 5th harmonic	x 10,000
142	I_3 5th harmonic	x 10,000
143	I_1 6th harmonic	x 10,000
144	I_2 6th harmonic	x 10,000
145	I_3 6th harmonic	x 10,000
146	I_1 7th harmonic	x 10,000
147	I_2 7th harmonic	x 10,000
148	I_3 7th harmonic	x 10,000
149	I_1 8th harmonic	x 10,000
150	I_2 8th harmonic	x 10,000
151	I_3 8th harmonic	x 10,000
152	I_1 9th harmonic	x 10,000
153	I_2 9th harmonic	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
154	I_3 9th harmonic	x 10,000
155	I_1 10th harmonic	x 10,000
156	I_2 10th harmonic	x 10,000
157	I_3 10th harmonic	x 10,000
158	I_1 11th harmonic	x 10,000
159	I_2 11th harmonic	x 10,000
160	I_2 11th harmonic	x 10,000
161	I_1 12th harmonic	x 10,000
162	I_2 12th harmonic	x 10,000
163	I_3 12th harmonic	x 10,000
164	I_1 13th harmonic	x 10,000
165	I_2 13th harmonic	x 10,000
166	I_3 13th harmonic	x 10,000
167	I_1 14th harmonic	x 10,000
168	I_2 14th harmonic	x 10,000
169	I_3 14th harmonic	x 10,000
170	I_1 15th harmonic	x 10,000
171	I_2 15th harmonic	x 10,000
172	I_3 15th harmonic	x 10,000
173	I_1 16th harmonic	x 10,000
174	I_2 16th harmonic	x 10,000
175	I_3 16th harmonic	x 10,000
176	I_1 17th harmonic	x 10,000
177	I_2 17th harmonic	x 10,000
178	I_3 17th harmonic	x 10,000
179	I_1 18th harmonic	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
180	I_2 18th harmonic	x 10,000
181	I_3 18th harmonic	x 10,000
182	I_1 19th harmonic	x 10,000
183	I_2 19th harmonic	x 10,000
184	I_3 19th harmonic	x 10,000
185	I_1 20th harmonic	x 10,000
186	I_2 20th harmonic	x 10,000
187	I_3 20th harmonic	x 10,000
188	I_1 21st harmonic	x 10,000
189	I_2 21st harmonic	x 10,000
190	I_2 21st harmonic	x 10,000
191	I_1 22nd harmonic	x 10,000
192	I_2 22nd harmonic	x 10,000
193	I_3 22nd harmonic	x 10,000
194	I_1 23rd harmonic	x 10,000
195	I_2 23rd harmonic	x 10,000
196	I_3 23rd harmonic	x 10,000
197	I_1 24th harmonic	x 10,000
198	I_2 24th harmonic	x 10,000
199	I_3 24th harmonic	x 10,000
200	I_1 25th harmonic	x 10,000
201	I_2 25th harmonic	x 10,000
202	I_3 25th harmonic	x 10,000
203	Demand U_{L1}	x 100, V
204	Demand U_{L2}	x 100, V
205	Demand U_{L3}	x 100, V

Key	Measured quantities (data recorder)	Factor/unit
206	Ø Demand U_{LN}	x 100, V
207	Demand U_{L1L2}	x 100, V
208	Demand U_{L2L3}	x 100, V
209	Demand U_{L3L1}	x 100, V
210	Ø Demand U_{LL}	x 100, V
211	Demand I_1	x 1000, A
212	Demand I_2	x 1000, A
213	Demand I_3	x 1000, A
214	Ø Demand I	x 1000, A
215	Demand I_4 1)	x 1000, A
216	Demand P_{L1}	W
217	Demand P_{L2}	W
218	Demand P_{L3}	W
219	Demand P_{ges}	W
220	Demand Q_{L1}	var
221	Demand Q_{L2}	var
222	Demand Q_{L3}	var
223	Demand Q_{ges}	var
224	Demand S_{L1}	VA
225	Demand S_{L2}	VA
226	Demand S_{L3}	VA
227	Demand S_{ges}	VA
228	Demand λ_1	x 1000
229	Demand λ_2	x 1000
230	Demand λ_3	x 1000
231	Demand λ_{ges}	x 1000
232	Demand f	x 100, Hz
233	Demand voltage unbalance	x 1000
234	Demand current unbalance	x 1000
235	Demand THD_{UL1}	x 10,000

Key	Measured quantities (data recorder)	Factor/unit
236	Demand THD_{UL2}	x 10,000
237	Demand THD_{UL3}	x 10,000
238	Demand THD_{I1}	x 10,000
239	Demand THD_{I2}	x 10,000
240	Demand THD_{I3}	x 10,000
241	$U_{L1\ max}$ (per demand period)	x 100, V
242	$UL2_{max}$ (per demand period)	x 100, V
243	$UL3_{max}$ (per demand period)	x 100, V
244	Ø $U_{LN\ max}$ (per demand period)	x 100, V
245	$U_{L1L2\ max}$ (per demand period)	x 100, V
246	$UL2L3_{max}$ (per demand period)	x 100, V
247	$UL3L1_{max}$ (per demand period)	x 100, V
248	Ø $U_{LL\ max}$ (per demand period)	x 100, V
249	$I_{1\ max}$ (per demand period)	x 1000, A
250	$I2_{max}$ (per demand period)	x 1000, A
251	$I3_{max}$ (per demand period)	x 1000, A
252	Ø I_{max} (per demand period)	x 1000, A
253	$I4_{max}$ (per demand period)	x 1000, A
254	$P_{L1\ max}$ (per demand period)	W
255	$P_{L2\ max}$ (per demand period)	W
256	$P_{L3\ max}$ (per demand period)	W
257	$P_{ges\ max}$ (per demand period)	W
258	$Q_{L1\ max}$ (per demand period)	var
259	$Q_{L2\ max}$ (per demand period)	var
260	$Q_{L3\ max}$ (per demand period)	var
261	$Q_{ges\ max}$ (per demand period)	var
262	$S_{L1\ max}$ (per demand period)	VA
263	$S_{L2\ max}$ (per demand period)	VA
264	$S_{L3\ max}$ (per demand period)	VA
265	$S_{ges\ max}$ (per demand period)	VA

Key	Measured quantities (data recorder)	Factor/unit
266	$\lambda_{1\ max}$ (per demand period)	x 1000
267	$\lambda_{2\ max}$ (per demand period)	x 1000
268	$\lambda_{3\ max}$ (per demand period)	x 1000
269	$\lambda_{ges\ max}$ (per demand period)	x 1000
270	f_{max} (per demand period)	x 100, Hz
271	max. voltage unbalance (per demand period)	x 1000
272	max. current unbalance (per demand period)	x 1000
273	$THD_{UL1\ max}$ (per demand period)	x 10,000
274	$THD_{UL2\ max}$ (per demand period)	x 10,000
275	$THD_{UL3\ max}$ (per demand period)	x 10,000
276	$THD_{I1\ max}$ (per demand period)	x 10,000
277	THDI2 $_{max}$ (per demand period)	x 10,000
278	THDI3 $_{max}$ (per demand period)	x 10,000
279	$U_{L1\ min}$ (per demand period)	x 100, V
280	*UL2* $_{min}$ (per demand period)	x 100, V
281	*UL3* $_{min}$ (per demand period)	x 100, V
282	Ø $U_{LN\ min}$ (per demand period)	x 100, V
283	$U_{L1L2\ min}$ (per demand period)	x 100, V
284	$U_{L2L3\ min}$ (per demand period)	x 100, V
285	*UL3L1* $_{min}$ (per demand period)	x 100, V
286	Ø $U_{LL\ min}$ (per demand period)	x 100, V
287	$I_{1\ min}$ (per demand period)	x 1000, A
288	$I_{2\ min}$ (per demand period)	x 1000, A
289	$I_{3\ min}$ (per demand period)	x 1000, A
290	Ø I_{min} (per demand period)	x 1000, A
291	$I_{4\ min}$ (per demand period)	x 1000, A
292	$P_{L1\ min}$ (per demand period)	W
293	$P_{L2\ min}$ (per demand period)	W
294	$P_{L3\ min}$ (per demand period)	W

Key	Measured quantities (data recorder)	Factor/unit
295	$P_{ges\ min}$ (per demand period)	W
296	$Q_{L1\ min}$ (per demand period)	var
297	$Q_{L2\ min}$ (per demand period)	var
298	$Q_{L3\ min}$ (per demand period)	var
299	$Q_{ges\ min}$ (per demand period)	var
300	$S_{L1\ min}$ (per demand period)	VA
301	$S_{L2\ min}$ (per demand period)	VA
302	$S_{L3\ min}$ (per demand period)	VA
303	$S_{ges\ min}$ (per demand period)	VA
304	$\lambda_{1\ min}$ (per demand period)	x 1000
305	$\lambda_{2\ min}$ (per demand period)	x 1000
306	$\lambda_{3\ min}$ (per demand period)	x 1000
307	$\lambda_{ges\ min}$ (per demand period)	x 1000
308	f_{min} (per demand period)	x 100, Hz
309	min. voltage unbalance (per demand period)	x 1000
310	min. current unbalance (per demand period)	x 1000
311	$THD_{UL1\ min}$ (per demand period)	x 10,000
312	$THD_{UL2\ min}$ (per demand period)	x 10,000
313	$THD_{UL3\ min}$ (per demand period)	x 10,000
314	$THD_{I1\ min}$ (per demand period)	x 10,000
315	$THD_{I2\ min}$ (per demand period)	x 10,000
316	$THD_{I3\ min}$ (per demand period)	x 10,000
317	$U_{L1\ (f0)}$ / $U_{L1L2\ (f0)}$	x 100, V
318	$U_{L2\ (f0)}$ / $U_{L2L3\ (f0)}$	x 100, V
319	$U_{L3\ (f0)}$ / $U_{L1L3\ (f0)}$	x 100, V
320	$I_{1\ (f0)}$	x 1,000, A
321	$I_{2\ (f0)}$	x 1,000, A
322	$I_{3\ (f0)}$	x 1,000 A
323	Active energy import $_{ges}$	kWh

Key	Measured quantities (data recorder)	Factor/unit
324	Active energy export $_{ges}$	kWh
325	Active energy $_{ges}$	kWh
326	Reactive energy import $_{ges}$	kvarh
327	Reactive energy export $_{ges}$	kvarh
328	Reactive energy $_{ges}$	kvarh

Tab. 8.3: Selectable measured quantities, data recorder

8.4 Energy log

The energy log stores the interval energy consumption for

- Active energy import
- Active energy export
- Reactive energy import
- Reactive energy export
- Apparent energy

These measured values are stored in a non-volatile memory and will not suffer any loss in the event of power failure. For the recording of the total energy values such as P_{ges} or Q_{ges} the data recorder has to be used.
The programming of the energy log is only supported over communications.
The following set-up parameters are supported:

No.	Parameters	Setting
1	Recording mode	0 = disabled 1 = stop-when-full 2 = FIFO (First-In-First-Out)
2	Number of measurements	0…65535 (entries)
3	Recording interval	0 = 5 min 1 = 10 min 2 = 15 min 3 = 30 min 4 = 60 min
4	Start time	yy/mm/dd, hh:mm:ss

No.	Parameters	Setting
5	Number of parameters	0…5
6	Parameters 1…5	0 = Import *P* 1 = Export *P* 2 = Import *Q* 3 = Export *Q* 4 = *S*

Tab. 8.4: Setup energy log

The energy log will only become active when the values of the Setup settings 1…5 are all non-zero.
For details refer to Modbus registers 7700…7712.

8.5 Waveform recording (WFR)

The PEM575 provides two waveform recorders capable of recording waveforms independently from one another. The total capacity of WFR 1 and WFR 2 is 32. Each waveform recorder can simultaneously record 3-phase voltage and current signals at a maximum resolution of 256 samples per cycle.
Waveform recorders can be triggered by

- Setpoints
- Undervoltage/overvoltage (sag/swell)
- Transient events
- Communications interface (manual)

During this process the **control via communications interface has the highest priority**. Other WFR triggers will be ignored until recording is completed.

Each WFR log has a capacity of 32 entries. If there are more than 32 entries, the newest entry will replace the oldest entry on a first-in-first-out basis: Der 33rd entry overwrites the 1st entry, the 34th the 2nd etc.
WFR data is stored in a non-volatile memory and will not suffer any loss in the event of power failure.

The programming of the waveform recorder log is only supported by the communications interface. For details about the applied **registers** and their data structure refer to **page 141**.

The following set-up parameters are supported:

No.	Parameters	Setting
1	Number of measurements	0…32 (entries)
2	Number of samples per cycle	16, 32, 64, 128, 256 samples
3	Cycles per record	320, 160, 80, 40, 20 cycles
4	Number of cycles before the event	0…10 cycles

The total capacity of WFR1 and WFR 2 is 32 entries. The valid formats from the number of samples per cycle and number of cycles are:

16 x 320
32 x 160
64 x 80
128 x 40
256 x 20

When the WFR format is 256 samples per cycle, the "number of pre-fault cycles" can only be set between 0 and 5.

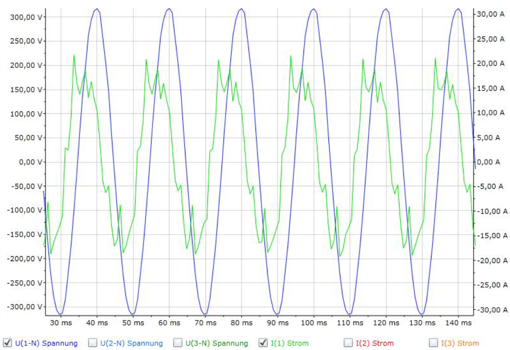


Fig. 8.1: Waveform recording displayed in CP700

8.6 Power Quality log (PQ log)

The PQ log can store up to 1,000 events such as undervoltage/overvoltage and transients. The newest event will replace the oldest event on a first-in-first-out basis: If there are more than 1000 entries, the 1001st entry will replace the first one, the 1002nd will replace the second one etc.
Each entry includes the event classification, its relevant voltage values and a timestamp in 1 ms resolution.
The PQ log can only be read via the communications interface. For details about the applied **registers** and their data structure refer to **page 146**.
The PQ log can be reset from the front panel or via the communications interface.

8.7 Event log (SOE log)

The device can store up to 512 events. The newest event will replace the oldest event on a first-in-first-out basis: The 513th event overwrites the first event, the 514th the second one, etc.
Possible events:

- Failure supply voltage
- Setpoint status change
- Relay actions
- Digital input status changes
- Setup changes

Each event record includes the event classification, the relevant parameter values and a timestamp in 1 ms resolution.
All event entries can be retrieved via the communications interface. For details about the applied **registers** and their data structure refer to **page 148**.
The event log can be cleared using the buttons on the front panel or via communications interface.

9. Power Quality

9.1 Fundamentals

PEM575 also provides the fundamental components (related to $f_{(0)}$) for the measured quantities listed in the following table.

Fundamental components			
$U_{L1(f0)}$	$U_{L2(f0)}$	$U_{L3(f0)}$	Ø $U_{LN\ (f0)}$
$U_{L1L2(f0)}$	$U_{L2L3(f0)}$	$U_{L3L1(f0)}$	Ø $U_{LL(f0)}$
$I_{1(f0)}$	$I_{2(f0)}$	$I_{3(f0)}$	Ø $I_{\ (f0)}$
$P_{L1(f0)}$	$P_{L2(f0)}$	$P_{L3(f0)}$	$P_{ges\ (f0)}$
$Q_{L1(f0)}$	$Q_{L2(f0)}$	$Q_{L3\ (f0)}$	$Q_{ges\ (f0)}$
$S_{L1\ (f0)}$	$S_{L2\ (f0)}$	$S_{L3\ (f0)}$	$S_{ges\ (f0)}$
$\lambda_{L1(f0)}$	$\lambda_{L2\ (f0)}$	$\lambda_{L3\ (f0)}$	$\lambda_{ges(f0)}$
$I_{4\ (f0)}$ (measured)			

Tab. 9.1: Fundamental components

9.2 Harmonic distortion

The device provides an analysis of

- Total Harmonic Distortion (THD)
- Even total harmonic distortion (TEHD)
- odd total harmonic distortion (TOHD)
- k-factor
- all harmonics up to the 63rdorder

An evaluation of the harmonic components takes place provided that there is a current flow of at least 150 mA (current input 1 A) resp. 750 mA (current input 5 A). Individual harmonic distortions (THD) or individual distortion factors (THF) are determined.

Harmonic distortion (THD)

$$THD_{U(k)} = \frac{U_k}{U_1} \times 100\ \%$$

$$THD_{I(k)} = \frac{I_k}{I_1} \times 100\ \%$$

Distortion factor (THF)

$$THF_{U(k)} = \frac{U_k}{\sqrt{\sum_{k=1}^{\infty} U_k^2}} \times 100\ \%$$

$$THF_{I(k)} = \frac{I_k}{\sqrt{\sum_{k=1}^{\infty} I_k^2}} \times 100\ \%$$

k-factor calculation

$$\text{k-Faktor} = \frac{\sum_{h=1}^{h=h_{max}} (I_h h)^2}{\sum_{h=1}^{h=h_{max}} (I_h)^2}$$

I_h = Effektivwert I der h-ten Harmonischen

h_{max} = Nummer größte Harmonische

h = h-te Harmonische

All harmonics parameters are available through the communications interface. For details about the applied **registers** and their data structure refer to **page 98**.
Up to the 31st harmonic the values can also be accessed through the buttons on the front panel.
The following parameters are supported:

	L1	**L2**	**L3**
Harmonics, **voltage**	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	2nd harmonic	2nd harmonic	2nd harmonic
	…	…	…
	63rd harmonic	63rd harmonic	63rd harmonic

	L1	L2	L3
Harmonics, **current**	THD	THD	THD
	TEHD	TEHD	TEHD
	TOHD	TOHD	TOHD
	k-factor	k-factor	k-factor
	2^{nd} harmonic	2^{nd} harmonic	2^{nd} harmonic
	…	…	…
	63^{rd} harmonic	63^{rd}harmonic	63^{rd} harmonic

Tab. 9.2: Parameters, harmonic distortion

9.3 Deviation from the pre-set nominal value (ΔU, Δf)

The universal measuring device can measure voltage deviations U_{L1}, U_{L2} and U_{L3} as well as the frequency deviation f from the pre-set nominal values U_{nom} resp. f_{nom}. The calculation method is listed below:

$$\textbf{Spannungs}\text{abweichung } \Delta U = \frac{U - U_{nom}}{U_{nom}} \times 100\ \%$$

$$\textbf{Frequenz}\text{abweichung } \Delta f = \frac{f - f_{nom}}{f_{nom}} \times 100\ \%$$

Application:
Register 0072…0075
table 10.26

9.4 Undervoltage/overvoltage setpoint (sag/swell setpoint)

The universal measuring device monitors the supply voltage for undervoltages and overvoltages (sag/swell) . The programming of the sag/swell setpoint is only carried out via the communications interface. For details about the applied **registers** and their data structure refer to **page 143**.

The following set-up parameters are supported:

1. Enable undervoltage/overvoltage	disabled/enabled
2. Overvoltage limit	1.05…2 x U_{nom}
3. Undervoltage limit	0.11…0.95 U_{nom}
4. Trigger 1/Trigger 2 for undervoltage/overvoltage	DO1…3 /DR 1…16/ WFR1…2/alarm e-mail

9.5 Transient events setpoint

The universal measuring device can detect transient events in the event of voltage disturbances. The programming of the transient setpoints is only supported by the communications interface (**registers 6178… 6181**). The following set-up parameters are supported:

1. Enable transient events	disabled/enabled
2. Transient events limit	0.05…1.00 x U_n
3. Trigger 1/Trigger 2 for transient events	DO1…3/DR 1…16/ WFR1…2/alarm e-mail

9.6 Time synchronisation

The universal measuring device provides timestamps for all recorded data. The clock needs to be configured properly to achieve precise events and power quality analysis. The PEM575 features a clock that has a maximum error of 0.5 s per day. The internal battery keeps the real-time clock running in case of voltage interruption. There are two methods to synchronise the clock:

- SNTP server
- GPS via external device

9.7 E-mail notification

The universal measuring device supports the SMTP and ESMTP protocol and can be configured to send alarm messages via e-mail. Alarm messages includes events for setpoints, undervoltages/overvoltages and transients. The e-mail shows the following information in text format:

- PEM575's serial number
- Event description
- Event timestamp

The programming of the e-mail is only supported via the communications interface. The following set-up parameters are supported:

Setup parameters	**Options**
SMTP TCP Port	0…65535 (25*)
SMTP server IP address	The SMTP server's IP address
Source e-mail address	Source e-mail address that appears in the "From" field of the e-mail; this string may be up to 35 characters long.
Password	Set the logon password to send an e-mail using the source e-mail account; this string may be up to 19 characters long.
Destination e-mail address	Destination e-mail address that appears in the "To" field of the e-mail; this string may be up to 35 characters long.
Test e-mail	Sends a test e-mail to the destination e-mail address

Tab. 9.3: E-mail notification setup parameters

* Factory setting

10. Modbus Register Map

This chapter provides a complete description of the Modbus register (protocol version 6.0) for the PEM575 series to facilitate access to information. In general, the registers are implemented as Modbus Read Only Registers (RO = read only). with the exception of the DO control registers, which are implemented as Write Only Registers (WO = write only).
The PEM575 supports the 4-digit addressing scheme and the following Modbus functions.

1. Holding register for reading values
   (Read Holding Register; function code 0x03)
2. Register for DO status setup
   (Force Single Coil; function code 0x05)
3. Register for device programming
   (Preset Multiple Registers; function code 0x10)
4. Read general reference
   (Read General Reference; function code 0x14)

For a complete Modbus protocol specification, visit
http://www.modbus.org.

Explanatory comments relating to the read reference (function code 0x14)
The Modbus function code "0x14" is used to access the stored data from the

- data recorder log (DR log)
- energy log
- power quality log (PQ log)
- waveform recorder log (WFR log)

Structure of data packet (function code 0x14)

Read reference request packet (master to PEM)		**Read reference response packet (PEM to master)**	
Slave address	1 byte	Slave address	1 byte
Function code (0x 14)	1 byte	Function code (0x 14)	1 byte
Byte count	1 byte	Byte count	1 byte
Sub-Req X, reference type (0x06)	1 byte	Sub-Res X, byte count	1 byte
Sub-Req X, File number	2 bytes	Sub-Res X, Reference type (0x06)	1 byte
Sub-Req X, Start address	2 bytes	Sub-Res X, Register data	NxN_0 bytes
Sub-Req X, Register count	2 bytes	Sub-Res X+1…	
Sub-Req X+1…			
Error check	2 bytes	Error check	2 bytes

Tab. 10.1: Data packets structure (function code 0x1)4

10.1 Basic measurements

Register	Property	Description	Format	Scale/unit
0000	RO	U_{L1} [1)]	Float	V
0002	RO	U_{L2} [1)]	Float	V
0004	RO	U_{L3} [1)]	Float	V
0006	RO	Ø U_{LN}	Float	V
0008	RO	U_{L1L2}	Float	V
0010	RO	U_{L2L3}	Float	V
0012	RO	U_{L3L1}	Float	V
0014	RO	Ø U_{LL}	Float	V
0016	RO	I_1	Float	A
0018	RO	I_2	Float	A
0020	RO	I_3	Float	A
0022	RO	Ø I	Float	A
0024	RO	P_{L1} [1)]	Float	W
0026	RO	P_{L2} [1)]	Float	W
0028	RO	P_{L3} [1)]	Float	W
0030	RO	P_{ges}	Float	W
0032	RO	Q_{L1} [1)]	Float	var
0034	RO	Q_{L2} [1)]	Float	var
0036	RO	Q_{L3} [1)]	Float	var
0038	RO	Q_{ges}	Float	var
0040	RO	S_{L1} [1)]	Float	VA
0042	RO	S_{L2} [1)]	Float	VA
0044	RO	S_{L3} [1)]	Float	VA
0046	RO	S_{ges}	Float	VA
0048	RO	λ_{L1} [1)]	Float	

Register	Property	Description	Format	Scale/unit
0050	RO	λ_{L2} 1)	Float	
0052	RO	λ_{L3} 1)	Float	
0054	RO	λ_{ges}	Float	
0056	RO	f	Float	Hz
0058	RO	I_4 (measured)	Float	A
0060	RO	I_0 (= I_4 calculated)	Float	A
0062…0069	Reserved			
0070	RO	Voltage unbalance	UINT16	x 1000 2)
0071	RO	Current unbalance	UINT16	x 1000
0072	RO	ΔU_{L1}	INT16	x 10,000
0073	RO	ΔU_{L2}	INT16	x 10,000
0074	RO	ΔU_{L3}	INT16	x 10,000
0075	RO	Δf_n	INT16	x 10,000
0076	RO	Phase angle U_{L1}	UINT16	x 100, °
0077	RO	Phase angle U_{L2}	UINT16	x 100, °
0078	RO	Phase angle U_{L3}	UINT16	x 100, °
0079	RO	Phase angle I_1	UINT16	x 100, °
0080	RO	Phase angle I_2	UINT16	x 100, °
0081	RO	Phase angle I_3	UINT16	x 100, °
0082…0084	Reserved			
0085	RO	Status digital inputs 3)	UINT16	
0086	RO	Status digital outputs 4)	UINT16	
0087	RO	Alarm 5)	UINT32	
0089	RO	SOE Pointer 6)	UINT32	
0091	RO	PQ Log Pointer 7)	UINT32	
0093	RO	WFR1 Log Pointer 8)	UINT32	
0095	RO	WFR2 Log Pointer 8)	UINT32	
0097	RO	Energy Log Pointer 9)	UINT32	

Register	Property	Description	Format	Scale/unit
0099	RO	DR1 Pointer (highspeed)[10)]	UINT32	
0101	RO	DR2 Pointer (highspeed)[10)]	UINT32	
0103	RO	DR3 Pointer (highspeed)[10)]	UINT32	
0105	RO	DR4 Pointer (highspeed)[10)]	UINT32	
0107	RO	DR5 pointer (standard)[10)]	UINT32	
...				
0129	RO	DR16 pointer (standard)[10)]	UINT32	
0131	RO	Total memory [11)]	UINT32	
0133	RO	Available memory[11)]	UINT32	

Tab. 10.2: Basic measurements

Notes on table 10.2:

1) Only in the case of wye connection (WYE).

2) "x 1000" indicates the value returned in the register is 1000 times the measured value (the value of the register must be divided by 1000 for an accurate measuring value).

3) Status register 0085:
Represents the **status of the six digital inputs**
B0 B5 for DI1 DI6 (1 = active/closed; 0 = inactive/open)

4) Status register 0086:
Represents the **status of the three digital outputs**
B0 for DO1 (1 = active/closed; 0 = inactive/open)
B1 for DO2 (1 = active/closed; 0 = inactive/open)
B2 for DO3 (1 = active/closed; 0 = inactive/open)

5) The **alarm register 0087** indicates the various alarm statuses (1 = active, 0 = inactive). Details of the alarm register are shown in the following table:

Bit No.	Alarm event	Bit No.	Alarm event	Bit No.	Alarm event
B0	Setpoint 1 (standard)	**B11**	Setpoint 12 (standard)	**B22**	Setpoint 23 (high-speed)
B1	Setpoint 2(standard)	**B12**	Setpoint 13 (standard)	**B23**	Setpoint 24 (high-speed)
B2	Setpoint 3 (standard)	**B13**	Setpoint 14 (standard)	**B24**	Logic module 1
B3	Setpoint 4 (standard)	**B14**	Setpoint 15 (standard)	**B25**	Logic module 2
B4	Setpoint 5 (standard)	**B15**	Setpoint 16 (standard)	**B26**	Logic module 3
B5	Setpoint 6 (standard)	**B16**	Setpoint 17 (high-speed)	**B27**	Logic module 4
B6	Setpoint 7 (standard)	**B17**	Setpoint 18 (high-speed)	**B28**	Logic module 5
B7	Setpoint 8 (standard)	**B18**	Setpoint 19 (high-speed)	**B29**	Logic module 6
B8	Setpoint 9 (standard)	**B19**	Setpoint 20 (high-speed)	**B30**	Reserved
B9	Setpoint 10 (standard)	**B20**	Setpoint 21 (high-speed)	**B31**	Reserved
B10	Setpoint 11 (standard)	**B21**	Setpoint 22 (high-speed)		

Tab. 10.3: Bit sequence alarm register (0087)

6) The SOE pointer points to the last entry added. The event log can store up to 512 events. It works like a ring buffer according to the FIFO principle: The 513rd value overwrites the first value, the 514th the second one and so on. The event log can be reset in the setup parameter menu (see page 49).

7) Der PQ log pointer points to the last value added. The PQ log can store up to 1000 events. It works like a ring buffer according to the FIFO principle: The 1001st value overwrites the first value, the 1002nd the second one and so on. A reset of the PQ log can be carried out in the set-up parameters (see page 49).

8) The PEM575 utilises two waveform recorders (WFR). Each WFR has its own pointer that indicates the most recently added entry in each case. The two WFR together can store up to 32 events. It works like a ring buffer according to the FIFO principle: the 33rd entry overwrites the first value, the 34th the second and so on. The WFR log can be reset via the communications interface.

9) The range of the **Energy Log Pointer** can be between 0 and 0xFFFFFFFF. As soon as the maximum value is reached, it starts again with 0. The Energy Log can always be reset via the communications interface.

10) The PEM575 provides 16 data recorders (DR1…DR16). Each DR has its own pointer that points to the last entry in each case. Each DR can be reset via the communications interface.

11) The total memory size of the PEM575 is 4 MB (4096 kB).
Used memory = 3936 kB–Available memory.

10.2 Energy measurement

Register	Property	Description	Format	Unit
0200	RW	Active energy import	UINT32	kWh
0202	RW	Active energy export	UINT32	kWh
0204	RO	Active energy net amount	INT32	kWh
0206	RO	Total active energy	UINT32	kWh
0208	RW	Reactive energy import	UINT32	kvarh
0210	RW	Reactive energy export	UINT32	kvarh
0212	RO	Reactive energy net amount	INT32	kvarh
0214	RO	Total reactive energy	UINT32	kvarh
0216	RW	Apparent energy	UINT32	kVAh
0218	RW	1^{st} Quadrant reactive energy	UINT32	kvarh
0220	RW	2^{nd} Quadrant, reactive energy	UINT32	kvarh
0222	RW	3^{rd} Quadrant, reactive energy	UINT32	kvarh
0224	RW	4^{th} Quadrant, reactive energy	UINT32	kvarh
0226	RO	Active energy import, fractional value	Float	Ws
0228	RO	Active energy export, fractional value	Float	Ws
0230	RO	Active energy net value	Float	Ws
0232	RO	Total active energy value	Float	Ws
0234	RO	Reactive energy import, fractional value	Float	vars
0236	RO	Reactive energy export, fractional value	Float	vars
0238	RO	Reactive energy net value	Float	vars
0240	RO	Total amount of reactive energy	Float	vars
0242	RO	Apparent energy amount	Float	VAs

Register	Property	Description	Format	Unit
0244	RO	Reactive energy 1st quadrant, fractional value	Float	vars
0246	RO	Reactive energy 2nd quadrant, fractional value	Float	vars
0248	RO	Reactive energy 3rd quadrant, fractional value	Float	vars
0250	RO	Reactive energy 4th quadrant, fractional value	Float	vars

Tab. 10.4: Energy measurements

Note:
After reaching the maximum value of 999.999.999 kWh/kvarh/kVAh, the measurement starts again with 0.

10.3 Pulse counter

The value stored in the registers **0350...0360** is 1000 times the actual value, i.e. the register value must be divided by 1000 for an accurate measuring value.

Register	Property	Description	Format
0350	RW	Pulse counter DI1	UINT32
0352	RW	Pulse counter DI2	UINT32
0354	RW	Pulse counter DI3	UINT32
0356	RW	Pulse counter DI4	UINT32
0358	RW	Pulse counter DI5	UINT32
0360	RW	Pulse counter DI6	UINT32

Tab. 10.5: Pulse counter

10.4 Fundamental measurements (Power quality)

The registers **0400...0456** contain measured values which relate to the fundamental f_0.

Register	Property	Description	Format	Unit
0400	RO	$U_{L1(f0)}$ 1)	Float	V
0402	RO	$U_{L2\ (f0)}$ 1)	Float	V
0404	RO	$U_{L3\ (f0)}$ 1)	Float	V
0406	RO	Ø $U_{LN\ (f0)}$ 1)	Float	V
0408	RO	$U_{L1L2\ (f0)}$ 2)	Float	V
0410	RO	$U_{L2L3\ (f0)}$ 2)	Float	V
0412	RO	$U_{L3L1\ (f0)}$ 2)	Float	V
0414	RO	Ø $U_{LL\ (f0)}$ 2)	Float	V
0416	RO	$I_{1(f0)}$	Float	A
0418	RO	$I_{2\ (f0)}$	Float	A
0420	RO	$I_{3(\ f0)}$	Float	A
0422	RO	Ø $I_{\ (f0)}$	Float	A

Register	Property	Description	Format	Unit
0424	RO	$I_{4\ (f0)}$ [3] or reserved	Float	A
0426	RO	$P_{L1(f0)}$ [1]	Float	W
0428	RO	$P_{L2(f0)}$ [1]	Float	W
0430	RO	$P_{L3\ (f0)}$ [1]	Float	W
0432	RO	$P_{ges\ (f0)}$	Float	W
0434	RO	$Q_{L1\ (f0)}$ [1]	Float	var
0436	RO	$Q_{L2\ (f0)}$ [1]	Float	var
0438	RO	$Q_{L3\ (f0)}$ [1]	Float	var
0440	RO	$Q_{ges\ (f0)}$	Float	var
0442	RO	$S_{L1\ (f0)}$ [1]	Float	VA
0444	RO	$S_{L2\ (f0)}$ [1]	Float	VA
0446	RO	$S_{L3\ (f0)}$ [1]	Float	VA
0448	RO	$S_{ges\ (f0)}$	Float	VA
0450	RO	$\lambda_{L1\ (f0)}$ [1]	Float	
0452	RO	$\lambda_{L2\ (f0)}$ [1]	Float	
0454	RO	$\lambda_{L3\ (f0)}$ [1]	Float	
0456	RO	$\lambda_{ges\ (f0)}$	Float	

Tab. 10.6: Fundamental measurement

table 10.6Notes:

1) Only when the wiring mode is WYE.

2) Only when the wiring mode is DELTA.

3) Only if the device is equipped with the I_4 input, otherwise it is reserved.

10.5 Harmonic measurements (Power quality)

Register	Property	Description	Format	Unit
0458	RO	k-factor I_1	UINT16	x10
0459	RO	k-factor I_2	UINT16	x10
0460	RO	k-factor I_3	UINT16	x10
0461	RO	THD_{UL1}	UINT16	x 10,000
0462	RO	THD_{UL2}	UINT16	x 10,000
0463	RO	THD_{UL3}	UINT16	x 10,000
0464	RO	THD_{I1}	UINT16	x 10,000
0465	RO	THD_{I2}	UINT16	x 10,000
0466	RO	THD_{I3}	UINT16	x 10,000
0467	RO	THD_{I4} [1)] or reserved	UINT16	x 10,000
0468	RO	$TOHD_{UL1}$	UINT16	x 10,000
0469	RO	$TOHD_{UL2}$	UINT16	x 10,000
0470	RO	$TOHD_{UL3}$	UINT16	x 10,000
0471	RO	$TOHD_{I1}$	UINT16	x 10,000
0472	RO	$TOHD_{I2}$	UINT16	x 10,000
0473	RO	$TOHD_{I3}$	UINT16	x 10,000
0474	RO	$TOHD_{I4}$ [1)] or reserved	UINT16	x 10,000
0475	RO	$TEHD_{UL1}$	UINT16	x 10,000
0476	RO	$TEHD_{UL2}$	UINT16	x 10,000
0477	RO	$TEHD_{UL3}$	UINT16	x 10,000
0478	RO	$TEHD_{I1}$	UINT16	x 10,000
0479	RO	$TEHD_{I2}$	UINT16	x 10,000
0480	RO	$TEHD_{I3}$	UINT16	x 10,000

Register	Property	Description	Format	Unit
0481	RO	$TEHD_{I4}$ [1] or reserved	UINT16	x 10,000
0482	RO	U_{L1} 2nd harmonic	UINT16	x 10,000
0483	RO	U_{L2} 2nd harmonic	UINT16	x 10,000
0484	RO	U_{L3} 2nd harmonic	UINT16	x 10,000
0485	RO	I_1 2nd harmonic	UINT16	x 10,000
0486	RO	I_2 2nd harmonic	UINT16	x 10,000
0487	RO	I_3 2ndharmonic	UINT16	x 10,000
0488	RO	I_4 2nd harmonic	UINT16	x 10,000
…	RO	…	UINT16	x 10,000
0909	RO	U_{L1} 63rd harmonic	UINT16	x 10,000
0910	RO	U_{L2} 63rd harmonic	UINT16	x 10,000
0911	RO	U_{L3} 63rd harmonic	UINT16	x 10,000
0912	RO	I_1 63rd harmonic	UINT16	x 10,000
0913	RO	I_2 63rd harmonic	UINT16	x 10,000
0914	RO	I_3 63rd harmonic	UINT16	x 10,000
0915	RO	I_4 63rd harmonic	UINT16	x 10,000

Tab. 10.7: Harmonic measurements

Note table 10.7:

1) Only if the device is equipped with the I_4 input, otherwise it is reserved.

10.6 High-speed measurement

Register	Property	Description	Format	Unit
0930	RO	U_{L1} 1)	Float	V
0932	RO	U_{L2} 1)	Float	V
0934	RO	U_{L3} 1)	Float	V
0936	RO	Ø U_{LN} 1)	Float	V
0938	RO	U_{L1L2}	Float	V
0940	RO	U_{L2L3}	Float	V
0942	RO	U_{L3L1}	Float	V
0944	RO	Ø U_{LL}	Float	V
0946	RO	*I1*	Float	A
0948	RO	*I2*	Float	A
0950	RO	*I3*	Float	A
0952	RO	Ø *I*	Float	A
0954	RO	I_4 2) or reserved	Float	A
0956	RO	P_{L1} 1)	Float	W
0958	RO	P_{L2} 1)	Float	W
0960	RO	P_{L3} 1)	Float	W
0962	RO	P_{ges}	Float	W
0964	RO	Q_{L1} 1)	Float	var
0966	RO	Q_{L2} 1)	Float	var
0968	RO	Q_{L3} 1)	Float	var
0970	RO	Q_{ges}	Float	var
0972	RO	S_{L1} 1)	Float	VA
0974	RO	S_{L2} 1)	Float	VA
0976	RO	S_{L3} 1)	Float	VA
0978	RO	S_{ges}	Float	VA

Register	Property	Description	Format	Unit
0980	RO	λ_{L1} 1)	Float	
0982	RO	λ_{L2} 1)	Float	
0984	RO	λ_{L3} 1)	Float	
0986	RO	λ_{ges}	Float	

Tab. 10.8: Register high-speed measurement

Note table 10.8:

1) Only when the wiring mode is WYE.

2) Only if the device is equipped with the I_4 input, otherwise it is reserved

10.7 Demand

10.7.1 Present demand

Register	Property	Description	Format	Unit
1000	RO	Demand U_{L1}	INT32	x 100, V
1002	RO	Demand U_{L2}	INT32	x 100, V
1004	RO	Demand U_{L3}	INT32	x 100, V
1006	RO	Ø Demand U_{LN}	INT32	x 100, V
1008	RO	Demand U_{L1L2}	INT32	x 100, V
1010	RO	Demand U_{L2L3}	INT32	x 100, V
1012	RO	Demand U_{L3L1}	INT32	x 100, V
1014	RO	Ø Demand U_{LL}	INT32	x 100, V
1016	RO	Demand I_1	INT32	x 1000, A
1018	RO	Demand I_2	INT32	x 1000, A
1020	RO	Demand I_3	INT32	x 1000, A
1022	RO	Ø Demand I	INT32	x 1000, A
1024	RO	Demand I_4 1) or reserved	INT32	x 1000, A
1026	RO	Demand P_{L1}	INT32	W
1028	RO	Demand P_{L2}	INT32	W
1030	RO	Demand P_{L3}	INT32	W
1032	RO	Demand P_{ges}	INT32	W
1034	RO	Demand Q_{L1}	INT32	var
1036	RO	Demand Q_{L2}	INT32	var
1038	RO	Demand Q_{L3}	INT32	var
1040	RO	Demand Q_{ges}	INT32	var
1042	RO	Demand S_{L1}	INT32	VA
1044	RO	Demand S_{L2}	INT32	VA
1046	RO	Demand S_{L3}	INT32	VA
1048	RO	Demand S_{ges}	INT32	VA

Register	Property	Description	Format	Unit
1050	RO	Demand λ_1	INT32	x 1,000
1052	RO	Demand λ_2	INT32	x 1,000
1054	RO	Demand λ_3	INT32	x 1,000
1056	RO	Demand λ_{ges}	INT32	x 1,000
1058	RO	Demand *f*	INT32	x 100, Hz
1060	RO	Demand voltage unbalance	INT32	x 1,000
1062	RO	Demand current unbalance	INT32	x 1,000
1064	RO	Demand THD_{UL1}	INT32	x 10,000
1066	RO	Demand THD_{UL2}	INT32	x 10,000
1068	RO	Demand THD_{UL3}	INT32	x 10,000
1070	RO	Demand THD_{I1}	INT32	x 10,000
1072	RO	Demand THD_{I2}	INT32	x 10,000
1074	RO	Demand THD_{I3}	INT32	x 10,000

Tab. 10.9: Register: Present demands

1) Only if the device is equipped with the I_4 input, otherwise it is reserved

10.7.2 Predicted demand

Register	Property	Description	Format	Unit
1200	RO	Predicted demand U_{L1}	INT32	x 100, V
1202	RO	Predicted demand U_{L2}	INT32	x 100, V
1204	RO	Predicted demand U_{L3}	INT32	x 100, V
1206	RO	Ø Predicted demand U_{LN}	INT32	x 100, V
1208	RO	Predicted demand U_{L1L2}	INT32	x 100, V
1210	RO	Predicted demand U_{L2L3}	INT32	x 100, V
1212	RO	Predicted demand U_{L3L1}	INT32	x 100, V
1214	RO	Ø Predicted demand U_{LL}	INT32	x 100, V
1216	RO	Predicted demand I_1	INT32	x 1,000, A
1218	RO	Predicted demand I_2	INT32	x 1,000, A
1220	RO	Predicted demand I_3	INT32	x 1,000, A
1222	RO	Ø Predicted demand I	INT32	x 1,000, A
1224	RO	Predicted demand I_4 [1)]	INT32	x 1,000, A
1226	RO	Predicted demand P_{L1}	INT32	W
1228	RO	Predicted demand P_{L2}	INT32	W
1230	RO	Predicted demand P_{L3}	INT32	W
1232	RO	Predicted demand P_{ges}	INT32	W
1234	RO	Predicted demand Q_{L1}	INT32	var
1236	RO	Predicted demand Q_{L2}	INT32	var
1238	RO	Predicted demand Q_{L3}	INT32	var
1240	RO	Predicted demand Q_{ges}	INT32	var
1242	RO	Predicted demand S_{L1}	INT32	VA
1244	RO	Predicted demand S_{L2}	INT32	VA
1246	RO	Predicted demand S_{L3}	INT32	VA
1248	RO	Predicted demand S_{ges}	INT32	VA

Register	Property	Description	Format	Unit
1250	RO	Predicted demand λ_1	INT32	x 1,000
1252	RO	Predicted demand λ_2	INT32	x 1,000
1254	RO	Predicted demand λ_3	INT32	x 1,000
1256	RO	Predicted demand λ_{ges}	INT32	x 1,000
1258	RO	Predicted demand *f*	INT32	x 100, Hz
1260	RO	Predicted demand, voltage unbalance	INT32	x 1,000
1262	RO	Predicted demand, current unbalance	INT32	x 1,000
1264	RO	Predicted demand THD_{UL1}	INT32	x 10,000
1266	RO	Predicted demand THD_{UL2}	INT32	x 10,000
1268	RO	Predicted demand THD_{UL3}	INT32	x 10,000
1270	RO	Predicted demand THD_{I1}	INT32	x 10,000
1272	RO	Predicted demand THD_{I2}	INT32	x 10,000
1274	RO	Predicted demand THD_{I3}	INT32	x 10,000

Tab. 10.10: Predicted demand

1) **Register 1224** is valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.7.3 Maximum values per demand period

Register	Property	Description	Format	Unit
1400	RO	$U_{L1\ max}$	INT32	x 100, V
1402	RO	$U_{L2\ max}$	INT32	x 100, V
1404	RO	$U_{L3\ max}$	INT32	x 100, V
1406	RO	Ø $U_{LN\ max}$	INT32	x 100, V
1408	RO	$U_{L1L2\ max}$	INT32	x 100, V
1410	RO	$U_{L2L3\ max}$	INT32	x 100, V
1412	RO	$U_{L3L1\ max}$	INT32	x 100, V
1414	RO	Ø $U_{LL\ max}$	INT32	x 100, V
1416	RO	$I_{1\ max}$	INT32	x 1,000, A
1418	RO	$I_{2\ max}$	INT32	x 1,000, A
1420	RO	$I_{3\ max}$	INT32	x 1,000, A
1422	RO	Ø I_{max}	INT32	x 1,000, A
1424	RO	$I_{4\ max}$ [1)] or reserved	INT32	x 1,000, A
1426	RO	$P_{L1\ max}$	INT32	W
1428	RO	$P_{L2\ max}$	INT32	W
1430	RO	$P_{L3\ max}$	INT32	W
1432	RO	$P_{ges\ max}$	INT32	W
1434	RO	$Q_{L1\ max}$	INT32	var
1436	RO	$Q_{L2\ max}$	INT32	var
1438	RO	$Q_{L3\ max}$	INT32	var
1440	RO	$Q_{ges\ max}$	INT32	var
1442	RO	$S_{L1\ max}$	INT32	VA
1444	RO	$S_{L2\ max}$	INT32	VA
1446	RO	$S_{L3\ max}$	INT32	VA
1448	RO	$S_{ges\ max}$	INT32	VA

Register	Property	Description	Format	Unit
1450	RO	$\lambda_{1\ max}$	INT32	x 1,000
1452	RO	$\lambda_{2\ max}$	INT32	x 1,000
1454	RO	$\lambda_{3\ max}$	INT32	x 1,000
1456	RO	$\lambda_{ges\ max}$	INT32	x 1,000
1458	RO	f_{max}	INT32	x 100, Hz
1460	RO	max. voltage unbalance	INT32	x 1,000
1462	RO	max. current unbalance	INT32	x 1,000
1464	RO	$THD_{UL1\ max}$	INT32	x 10,000
1466	RO	$THD_{UL2\ max}$	INT32	x 10,000
1468	RO	$THD_{UL3\ max}$	INT32	x 10,000
1470	RO	$THD_{I1\ max}$	INT32	x 10,000
1472	RO	$THD_{I2\ max}$	INT32	x 10,000
1474	RO	$THD_{I3\ max}$	INT32	x 10,000

Tab. 10.11: Maximum values per demand period

1) **Register 1424** is valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.7.4 Minimum values per demand period

Register	Property	Description	Format	Unit
1600	RO	$U_{L1\ min}$	INT32	x 100, V
1602	RO	$U_{L2\ min}$	INT32	x 100, V
1604	RO	$U_{L3\ min}$	INT32	x 100, V
1606	RO	Ø $U_{LN\ min}$	INT32	x 100, V
1608	RO	$U_{L1L2\ min}$	INT32	x 100, V
1610	RO	$U_{L2L3\ min}$	INT32	x 100, V
1612	RO	$U_{L3L1\ min}$	INT32	x 100, V
1614	RO	Ø $U_{LL\ min}$	INT32	x 100, V
1616	RO	$I_{1\ min}$	INT32	x 1,000, A
1618	RO	$I_{2\ min}$	INT32	x 1,000, A
1620	RO	$I_{3\ min}$	INT32	x 1,000, A
1622	RO	Ø I_{min}	INT32	x 1,000, A
1624	RO	$I_{4\ min}$ [1) or reserved	INT32	x 1,000, A
1626	RO	$P_{L1\ min}$	INT32	W
1628	RO	$P_{L2\ min}$	INT32	W
1630	RO	$P_{L3\ min}$	INT32	W
1632	RO	$P_{ges\ min}$	INT32	W
1634	RO	$Q_{L1\ min}$	INT32	var
1636	RO	$Q_{L2\ min}$	INT32	var
1638	RO	$Q_{L3\ min}$	INT32	var
1640	RO	$Q_{ges\ min}$	INT32	var
1642	RO	$S_{L1\ min}$	INT32	VA
1644	RO	$S_{L2\ min}$	INT32	VA
1646	RO	$S_{L3\ min}$	INT32	VA
1648	RO	$S_{ges\ min}$	INT32	VA

Register	Property	Description	Format	Unit
1650	RO	$\lambda_{1\ min}$	INT32	x 1,000
1652	RO	$\lambda_{2\ min}$	INT32	x 1,000
1654	RO	$\lambda_{3\ min}$	INT32	x 1,000
1656	RO	$\lambda_{ges\ min}$	INT32	x 1,000
1658	RO	f_{min}	INT32	x 100, Hz
1660	RO	min. voltage unbalance	INT32	x 1,000
1662	RO	min. current unbalance	INT32	x 1,000
1664	RO	$THD_{UL1\ min}$	INT32	x 10,000
1666	RO	$THD_{UL2\ min}$	INT32	x 10,000
1668	RO	$THD_{UL3\ min}$	INT32	x 10,000
1670	RO	$THD_{I1\ min}$	INT32	x 10,000
1672	RO	$THD_{I2\ min}$	INT32	x 10,000
1674	RO	$THD_{I3\ min}$	INT32	x 10,000

Tab. 10.12: Minimum values per demand period

1) **Register 1624** is valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.7.5 Peak demand of this month

The value of the peak demand register is 1,000 times the actual value. To obtain a value in kW, kVA or kvar, the value of the register has to be divided by 1,000.

Register	Property	Description	Format	Unit
1800…1805	RO	Peak demand P_{ges} of this month	see Tabelle 10.15 auf Seite 113	W
1806…1811	RO	Peak demand Q_{ges} of this month		var
1812…1817	RO	Peak demand S_{ges} of this month		VA
1818…1823	RO	Peak demand I_1 of this month		x 1,000, A
1824…1829	RO	Peak demand I_2 of this month		x 1,000, A
1830…1835	RO	Peak demand I_3 of this month		x 1,000, A

Tab. 10.13: Peak demand of this month

10.7.6 Peak demand last month

The value of the peak demand register is 1,000 times the actual value. To obtain a value in kW, kVA or kvar, the value of the register has to be divided by 1,000.

Register	Property	Description	Format	Unit
1850…1855	RO	Peak demand P_{ges} *of* last month	see Tabelle 10.15 auf Seite 113	W
1856…1861	RO	Peak demand Q_{ges} of last month		var
1862…1867	RO	Peak demand S_{ges} of last month		VA
1868…1873	RO	Peak demand I_1 of last month		x 1,000, A
1874…1879	RO	Peak demand I_2 of ast month		x 1,000, A
1880…1885	RO	Peak demand I_3 of last month		x 1,000, A

Tab. 10.14: Peak demand of last month

10.7.7 Peak demand data structure

Offset	Property	Description	Format	Note
+ 0	RO	Peak demand value	INT32	
+ 2	RO	HiWord: Year	UINT16	1…99 (year-2000)
	RO	LoWord: Month		1…12
+ 3	RO	HiWord: Date: Day	UINT16	1…28/29/30/31
	RO	LoWord: Hour		0…23
+ 4	RO	HiWord: Minute	UINT16	0…59
	RO	LoWord: Second		0…59
+ 5	RO	Milliseconds	UINT16	1…999

Tab. 10.15: Peak demand data structure

10.8 Max/Min log

10.8.1 Maximum values of this month

Register	Property	Description	Format	Factor/unit
2000…2005	RO	$U_{L1\ max}$	see table 10.20	x 100, V
2006…2011	RO	$U_{L2\ max}$		x 100, V
2012…2017	RO	$U_{L3\ max}$		x 100, V
2018…2023	RO	Ø $U_{LN\ max}$		x 100, V
2024…2029	RO	$U_{L1L2\ max}$		x 100, V
2030…2035	RO	$U_{L2L3\ max}$		x 100, V
2036…2041	RO	$U_{L3L1\ max}$		x 100, V
2042…2047	RO	Ø $U_{LL\ max}$		x 100, V
2048…2053	RO	$I_{1\ max}$		x 1,000, A
2054…2059	RO	$I_{2\ max}$		x 1,000, A
2060…2065	RO	$I_{3\ max}$		x 1,000, A
2066…2071	RO	Ø I_{max}		x 1,000, A
2072…2077	RO	$I_{4\ max}$ [1)] or reserved		x 1,000, A
2078…2083	RO	$P_{ges\ max}$		W
2084…2089	RO	$Q_{ges\ max}$		var
2090…2095	RO	$S_{ges\ max}$		VA
2096…2101	RO	$\lambda_{ges\ max}$		x 1,000
2102…2107	RO	f_{max}		x 100, Hz
2108…2113	RO	$THD_{UL1\ max}$		x 10,000
2114…2119	RO	$THD_{UL2\ max}$		x 10,000
2120…2125	RO	$THD_{UL3\ max}$		x 10,000
2126…2131	RO	$THD_{I1\ max}$		x 10,000
2132…2137	RO	$THD_{I2\ max}$		x 10,000
2138…2143	RO	$THD_{I3\ max}$		x 10,000

Register	Property	Description	Format	Factor/unit
2144…2149	RO	k-factor I_1	see table 10.20	x10
2150…2155	RO	k-factor I_2		x10
2156…2161	RO	k-factor I_3		x10
2162…2167	RO	max. voltage unbalance		x1,000
2168…2173	RO	max. current unbalance		x1,000

Tab. 10.16: Max log of this month

1) **Register 2072…2077** are valid only if the device is equipped with the I_4 input, otherwise it is reserved

10.8.2 Min log of this month

Register	Property	Description	Format	Factor/unit
2300…2305	RO	$U_{L1\ min}$	see table 10.20	x 100, V
2306…2311	RO	$U_{L2\ min}$		x 100, V
2312…2317	RO	$U_{L3\ min}$		x 100, V
2318…2323	RO	Ø $U_{LN\ min}$		x 100, V
2324…2329	RO	$U_{L1L2\ min}$		x 100, V
2330…2335	RO	$U_{L2L3\ min}$		x 100, V
2336…2341	RO	$U_{L3L1\ min}$		x 100, V
2342…2347	RO	Ø $U_{LL\ min}$		x 100, V
2348…2353	RO	$I_{1\ min}$		x 1,000, A
2354…2359	RO	$I_{2\ min}$		x 1,000, A
2360…2365	RO	$I_{3\ min}$		x 1,000, A
2366…2371	RO	Ø I_{min}		x 1,000, A
2372…2377	RO	$I_{4\ min}$ [1)] or reserved		x 1,000, A
2378…2383	RO	$P_{ges\ min}$		W

Register	Property	Description	Format	Factor/unit
2384…2389	RO	$Q_{ges\ min}$	see table 10.20	var
2390…2395	RO	$S_{ges\ min}$		VA
2396…2401	RO	$\lambda_{ges\ min}$		x 1,000
2402…2407	RO	f_{min}		x 100, Hz
2408…2413	RO	$THD_{UL1\ min}$		x 10,000
2414…2419	RO	$THD_{UL2\ min}$		x 10,000
2420…2425	RO	$THD_{UL3\ min}$		x 10,000
2426…2431	RO	$THD_{I1\ min}$		x 10,000
2432…2437	RO	$THD_{I2\ min}$		x 10,000
2438…2443	RO	$THD_{I3\ min}$		x 10,000
2444…2449	RO	k-factor I_1		x10
2450…2455	RO	k-factor I_2		x10
2456…2461	RO	k-factor I_3		x10
2462…2467	RO	min. voltage unbalance		x1,000
2468…2473	RO	min. current unbalance		x1,000

Tab. 10.17: Min log of this month

1) **Register 2372…2377** are valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.8.3 Max log of last month

Register	Property	Description	Format	Factor/unit
2600…2605	RO	$U_{L1\ max}$	see table 10.20	x 100, V
2606…2611	RO	$U_{L2\ max}$		x 100, V
2612…2617	RO	$U_{L3\ max}$		x 100, V
2618…2623	RO	Ø $U_{LN\ max}$		x 100, V
2624…2629	RO	$U_{L1L2\ max}$		x 100, V
2630…2635	RO	$U_{L2L3\ max}$		x 100, V
2636…2641	RO	$U_{L3L1\ max}$		x 100, V
2642…2647	RO	Ø $U_{LL\ max}$		x 100, V
2648…2653	RO	$I_{1\ max}$		x 1,000, A
2654…2659	RO	$I_{2\ max}$		x 1,000, A
2660…2665	RO	$I_{3\ max}$		x 1,000, A
2666…2671	RO	Ø I_{max}		x 1,000, A
2672…2677	RO	$I_{4\ max}$ [1)] or reserved		x 1,000, A
2678…2683	RO	$P_{ges\ max}$		W
2684…2689	RO	$Q_{ges\ max}$		var
2690…2695	RO	$S_{ges\ max}$		VA
2696…2701	RO	$\lambda_{ges\ max}$		x 1,000
2702…2707	RO	f_{max}		x 100, Hz
2708…2713	RO	$THD_{UL1\ max}$		x 10,000
2714…2719	RO	$THD_{UL2\ max}$		x 10,000
2720…2725	RO	$THD_{UL3\ max}$		x 10,000

Register	Property	Description	Format	Factor/unit
2726…2731	RO	$THD_{I1\ max}$	see table 10.20	x 10,000
2732…2737	RO	$THD_{I2\ max}$		x 10,000
2738…2743	RO	$THD_{I3\ max}$		x 10,000
2744…2749	RO	k-factor I_1		x10
2750…2755	RO	k-factor I_2		x10
2756…2761	RO	k-factor I_3		x10
2762…2767	RO	max. voltage unbalance		x1,000
2768…2773	RO	max. current unbalance		x1,000

Tab. 10.18: Max log of last month

1) **Register 2672…2677** are valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.8.4 Min log last month

Register	Property	Description	Format	Factor/unit
2900…2905	RO	$U_{L1\ min}$	see table 10.20	x 100, V
2906…2911	RO	$U_{L2\ min}$		x 100, V
2912…2917	RO	$U_{L3\ min}$		x 100, V
2918…2923	RO	Ø $U_{LN\ min}$		x 100, V
2924…2929	RO	$U_{L1L2\ min}$		x 100, V
2930…2935	RO	$U_{L2L3\ min}$		x 100, V
2936…2941	RO	$U_{L3L1\ min}$		x 100, V
2942…2947	RO	Ø $U_{LL\ min}$		x 100, V
2948…2953	RO	$I_{1\ min}$		x 1,000, A
2954…2959	RO	$I_{2\ min}$		x 1,000, A
2960…2965	RO	$I_{3\ min}$		x 1,000, A
2966…2971	RO	Ø I_{min}		x 1,000, A
2972…2977	RO	$I_{4\ min}$ 1) or reserved		x 1,000, A
2978…2983	RO	$P_{ges\ min}$		W
2984…2989	RO	$Q_{ges\ min}$		var
2990…2995	RO	$S_{ges\ min}$		VA
2996…3001	RO	$\lambda_{ges\ min}$		x 1,000
3002…3007	RO	f_{min}		x 100, Hz
3008…3013	RO	$THD_{UL1\ min}$		x 10,000
3014…3019	RO	$THD_{UL2\ min}$		x 10,000
3020…3025	RO	$THD_{UL3\ min}$		x 10,000

Register	Property	Description	Format	Factor/unit
3026…3031	RO	$THD_{I1\ min}$	see table 10.20	x 10,000
3032…3037	RO	$THD_{I2\ min}$		x 10,000
3038…3043	RO	$THD_{I3\ min}$		x 10,000
3044…3049	RO	k-factor I_1		x10
3050…3055	RO	k-factor I_2		x10
3056…3061	RO	k-factor I_3		x10
3062…3067	RO	min. voltage unbalance		x1,000
3068…3073	RO	min. current unbalance		x1,000

Tab. 10.19: Minimum log of last month

1) **Register 2972…2977** are valid only if the device is equipped with the I_4 input, otherwise it is reserved.

10.8.5 Max/Min log data structure

Offset	Property	Description	Format	Note
+ 0	RO	Max resp. Min value	INT32	
+ 2	RO	HiWord: Year	UINT16	1…99 (year-2000)
	RO	LoWord: Month		1…12
+ 3	RO	HiWord: Date: Day	UINT16	1…28/29/30/31
	RO	LoWord: Hour		0…23
+ 4	RO	HiWord: Minute	UINT16	0…59
	RO	LoWord: Second		0…59
+ 5	RO	Millisecond	UINT16	0…999

Tab. 10.20: Max/Min log data structure

10.9 Setup parameters

Register	Property	Description	Format	Range/unit
6000	RW	Voltage transformation ratio	UINT16	1*…10,000
6001	RW	Measuring current transformer transformation ratio	UINT16	1*…6,000 (current input 5 A) 1*…30,000 (current input 1 A)
6002	RW	Measuring current transformer transformation ratio I_4	UINT16	1…10,000 (2*)
6003	RW	Wiring mode	UINT16	0 = WYE* 1 = DELTA 2 = DEMO
6004	RW	U_{nom}	UINT16	100*…700 V (U_{LL})
6005	RW	f_{nom}	UINT16	0 = 50 Hz* 1 = 60 Hz
6006	RW	Port 1 protocol (RS-485)	UINT16	0* = Modbus 1 = EGATE
6007	RW	Port 1, device address (RS-485)	UINT16	1…247 (100*)
6008	RW	Port 1, baud rate (RS-485)	UINT16	0 = 1200 1 = 2400 2 = 4800 3 = 9600* 4 = 19200 5 = 38,400
6009	RW	Port 1, parity (RS-485)	UINT16	0 = 8N2; 1 = 8O1 2 = 8E1* ; 3 = 8N1 4 = 8O2 ; 5 = 8E2
6010…6012	Reserved			
6013	RW	IP address	UINT32	192.168.8.97* Contents of register for factory setting: 0xC0A80861

Register	Property	Description	Format	Range/unit
6015	RW	Subnet mask	UINT32	288.255.255.0* Contents of register for factory setting: 0xFFFFFF00
6017	RW	Gateway address	UINT32	192.168.8.1* Contents of register for factory setting: 0x0A80801
6019	RW	Power factor λ rule	UINT16	0* = IEC 1 = IEEE 2 = -IEEE
6020	RW	Calculation method *S*	UINT16	0* = vector 1 = scalar
6021	RW	Synchronisation demand	UINT16	0* = SLD 1 = SYNC DI
6022	RW	Demand period	UINT16	1…99 minutes (15*)
6023	RW	Demand cycles (sliding windows)	UINT16	1*…15
6024	RW	Predicted demand sensitivity	UINT16	70*…99
6025	RW	Function DI1	UINT16	0 = digital input 1 = pulse counter 2 = SYNC DI 3 = PPS
6026	RW	Function DI2	UINT16	
6027	RW	Function DI3	UINT16	
6028	RW	Function DI4	UINT16	
6029	RW	Function DI5	UINT16	
6030	RW	Function DI6	UINT16	
6031	RW	Debounce time DI1	UINT16	1…1,000 ms (20*)
6032	RW	Debounce time DI2	UINT16	
6033	RW	Debounce time DI3	UINT16	
6034	RW	Debounce time DI4	UINT16	
6035	RW	Debounce time DI5	UINT16	
6036	RW	Debounce time DI6	UINT16	

Register	Property	Description	Format	Range/unit
6037	RW	Resolution of setting DI1	UINT32	1*…1.000.000
6039	RW	Resolution of setting DI2	UINT32	
6041	RW	Resolution of setting DI3	UINT32	
6043	RW	Resolution of setting DI4	UINT32	
6045	RW	Resolution of setting DI5	UINT32	
6047	RW	Resolution of setting DI6	UINT32	
6049	RW	Function DO1	UINT16	0*= digital output
6050	RW	Function DO2	UINT16	
6051	RW	Function DO3	UINT16	
6052	RW	Pulse width DO1	UINT16	0…999 (x 0.1 s) 0 = Latch mode (10*)
6053	RW	Pulse width DO2	UINT16	
6054	RW	Pulse width DO3	UINT16	
6055…6065	Reserved			
6066	RW	Polarity measuring current transformer L1	UINT16	0* = normal 1 = reversed
6067	RW	Polarity measuring current transformer L2	UINT16	0* = normal 1 = reversed
6068	RW	Polarity measuring current transformer L3	UINT16	0* = normal 1 = reversed
6069	RW	Calculation method harmonic distortion***	UINT16	0 = Fundamental 1*= RMS
6070	RW	Enable energy pulsing	UINT16	0*= disable 1 = enable
6071	RW	Pulse constant	UINT16	0 = 1,000 imp/kxh 1 = 3200 imp/kxh 2* = 5000 imp/kxh
6072	Reserved			
6073	RW	Enable undervoltage/overvoltage	UINT16	0*= disable 1 = enable
6074	RW	Overvoltage limit	UINT16	105*…200 (x 0.01 U_{nom})

Register	Property	Description	Format	Range/unit
6075	RW	Undervoltage limit	UINT16	11…95 (x 0.01 U_{nom}) (70*)
6076	RW	Trigger 1 undervoltage/overvoltage	UINT16	0*= none 1…3 = DO1…DO 4…19=DR1…DR16 20 = WFR1 21 = WFR2 22 = Alarm e-mail
6077	RW	Trigger 2 undervoltage/overvoltage	UINT16	
6078	RW	Enable SNTP	UINT16	0*= disable 1 = enable
6079	RW	Time zone	UINT16	0…32 (26*)
6080	RW	Synchronisation interval SNTP	UINT16	10…1440 (min) (60*)
6081	RW	IP address of time server		192.168.8.94* Contents of register for factory setting: 0xC0A8085E
6083	RW	IP port SMTP	UINT16	0…65535 (25*)
6084	RW	IP address of SMTP server		191.0.0.6* Contents of register for factory setting: 0xBF000006
6086…6121	RW	Source e-mail	UINT16	
6122…6141	RW	Log on password	UINT16	
6142…6177	RW	Destination e-mail	UINT16	
6178	RW	Enable transient events	UINT16	0*= disable 1 = enable
6179	RW	Limit for transient events	UINT16	5…100 (x 0.01 U_{nom}) (50*)

Register	Property	Description	Format	Range/unit
6180	RW	Trigger 1 for transient events	UINT16	0*= none 1...3 = DO1…DO 4...19 = DR1…DR16 20 = WFR1 21 = WFR2 22 = Alarm e-mail
6181	RW	Trigger 2 for transient events	UINT16	
6182	RW	Language e-mail	UINT16	0* = English
6183	RW	Backlight timeout	UINT16	0 = Display always bright 1…60 min (3*)
6184…6187	Reserved			
6188	WO	Send test e-mail	UINT16	Writing "0xFF00" to the register sends a test e-mail to the specified destina-tion e-mail address.

Tab. 10.21: Setup parameters

table 10.21Notes:

Register 6000 and 6001

Current input 5 A: Transformation ratio current x transformation ratio voltage < 1,000,000

Current input 1 A: Transformation ratio current x transformation ratio voltage < 5,000,000

Register 6078 is disabled if not equipped with an Ethernet port

Register 6079: Time zones without summertime

CODE	Time zone	CODE	Time zone
0	GMT – 12 h	17	GMT + 03:30 h
1	GMT - 11 h	18	GMT + 04 h
2	GMT - 10 h	19	GMT + 04:30 h
3	GMT - 09 h	20	GMT + 05 h
4	GMT - 08 h	21	GMT + 05:30 h
5	GMT - 07 h	22	GMT + 05:45 h
6	GMT - 06 h	23	GMT + 06 h
7	GMT - 05 h	24	GMT + 06:30 h
8	GMT - 04 h	25	GMT + 07 h
9	GMT - 03 h	26	GMT + 08 h
10	GMT – 03:30 h	27	GMT + 09 h
11	GMT - 02 h	28	GMT + 09:30 h
12	GMT - 01 h	29	GMT + 10 h
13	GMT	30	GMT + 11 h
14	GMT + 01 h	31	GMT + 12 h
15	GMT + 02 h	32	GMT + 13 h
16	GMT + 03 h		

Register 6086: The character string stored in these registers is the **source** alarm-e-mail address. This string may be up to 35 characters long. Add the value "0000" at the end of the string as the string terminator of the source address.
Example:
If the e-mail address is "PEM575@bender.de", set the registers in hexadecimal form as 0050 0045 004D 0035 0037 0035 0040 0062 0065 006E 0064 0065 0072 002E 0064 0065 0000.

Register 6122: The string register specifies the **Log-on password** to log in the source e-mail account. This string may be up to 19 characters long. Add the value "0000" at the end of the string as the string terminator for the password.
Example:
The password "PEM575" is coded in hexadecimal form as
0050 0045 004D 0035 0037 0035.

Register 6142: The string register specifies the **destination address** of the alarm e-mail. This string may be up to 35 characters long. Add the value "0000" at the end of the string as the string terminator for the destination address.
Example:
The e-mail address "PEM575@bender.de" is coded in hexadecimal form as
0050 0045 004D 0035 0037 0035 0040 0062 0065 006E 0064 0065 0072 002E 0064 0065 0000.

10.10 Clear/reset register

Register	Property	Description	Format	Unit
6400	WO	Manual WFR1 Trigger	UINT16	Writing 0xFF00 to the register triggers the respective waveform recorder
6401	WO	Manual WFR2 Trigger	UINT16	
6402	WO	Clear DR1 (high speed)	UINT16	Writing 0xFF00 to the register clears the respective DR
6403	WO	Clear DR2 (high speed)	UINT16	
6404	WO	Clear DR3 (high speed)	UINT16	
6405	WO	Clear DR4 (high speed)	UINT16	
6406	WO	Clear DR5 (standard)	UINT16	
		...		
6416	WO	Clear DR15 (standard)	UINT16	
6417	WO	Clear DR16 (standard)	UINT16	
6418	WO	Clear WFR1	UINT16	Writing 0xFF00 to the register clears the respective log
6419	WO	Clear WFR2	UINT16	
6420	WO	Clear energy log	UINT16	
6421	WO	Clear PQ log	UINT16	
6422	WO	Clear event log	UINT16	
6423	WO	Clear energy register	UINT16	
6424	WO	Clear Max/Min log of this month	UINT16	
6425	WO	Clear peak demand log of this month	UINT16	

Register	Property	Description	Format	Unit
6426	WO	Clear counter DI1	UINT16	Writing 0xFF00 to the register clears the respective counter
6427	WO	Clear counter DI2	UINT16	
	WO	…	UINT16	
6430	WO	Clear counter DI5	UINT16	
6431	WO	Clear counter DI6	UINT16	
6432…6436	Reserved			
6437	WO	Clear all logs (registers 6400…6431)	UINT16	Writing 0xFF00 to the register clears all logs mentioned above

Tab. 10.22: Clear/reset register

10.11 Setpoint setup parameters

Register	Property	Description	Format
6600…6609	RW	Setpoint 1 (standard)	Chapter 10.11.1 Structure of the setpoint register (standard)
6610…6619	RW	Setpoint 2 (standard)	
6620…6629	RW	Setpoint 3 (standard)	
6630…6639	RW	Setpoint 4 (standard)	
6640…6649	RW	Setpoint 5 (standard)	
6650…6659	RW	Setpoint 6 (standard)	
6660…6669	RW	Setpoint 7 (standard)	
6670…6679	RW	Setpoint 8 (standard)	
6680…6689	RW	Setpoint 9 (standard)	
6690…6699	RW	Setpoint 10 (standard)	
6700…6709	RW	Setpoint 11 (standard)	
6710…6719	RW	Setpoint 12 (standard)	
6720…7629	RW	Setpoint 13 (standard)	
6730…6739	RW	Setpoint 14 (standard)	
6740…6749	RW	Setpoint 15 (standard)	
6750…6759	RW	Setpoint 16 (standard)	
6760…6769	RW	Setpoint 17 (highspeed)	Chapter 10.11.2 Setpoint register structure (high speed)
6770…6779	RW	Setpoint 18 (highspeed)	
6780…6789	RW	Setpoint 19 (highspeed)	
6790…6799	RW	Setpoint 20 (highspeed)	
6800…6809	RW	Setpoint 21 (highspeed)	
6810…6819	RW	Setpoint 22 (highspeed)	
6820…6829	RW	Setpoint 23 (highspeed)	
6830…6839	RW	Setpoint 24 (highspeed)	

Tab. 10.23: Setpoints

10.11.1 Structure of the setpoint register (standard)

Offset	Property	Description	Format	Unit
0	RW	Type	UINT16	0 = disabled 1 = over setpoint 2 = under setpoint
+1	RW	Measured quantity[1)]	UINT16	1*…31
+2	RW	Active limit	INT32	5000*
+4	RW	Inactive limit	INT32	1,000*
+6	RW	Active delay	UINT16	0…9,999 s (1*)
+7	RW	Inactive delay	UINT16	0…9,999 s (1*)
+8	RW	Trigger 1 [2)]	UINT16	0…22 (1*)
+9	RW	Trigger 2 [2)]	UINT16	0…22 (2*)

Tab. 10.24: Setpoint register structure (standard)

10.11.2 Setpoint register structure (high speed)

Offset	Property	Description	Format	Unit
0	RW	Type	UINT16	0 = disabled 1 = over setpoint 2 = under setpoint
+1	RW	Measured Quantity[1)]	UINT16	1*…14
+2	RW	Active limit	INT32	5000*
+4	RW	Inactive limit	INT32	1,000*
+6	RW	Active delay	UINT16	0…9,999 cycles (1*)
+7	RW	Inactive delay	UINT16	0…9,999 cycles (1*)
+8	RW	Trigger 1 [2)]	UINT16	0…22 (1*)
+9	RW	Trigger 2 [2)]	UINT16	0…22 (2*)

Tab. 10.25: Setpoint register structure (high speed)

Notes table 10.24 and table 10.25:

[1)] Measured quantity: "Measured quantity" specifies the parameter to be monitored. The following measured quantities can be set:

Setpoint parameter "Measured quantity"

Key	Measured quantity	Scale/unit
1	U_{LN}	x 100, V
2	U_{LL}	x 100, V
3	*I*	x 1,000, A
4	*I4*	x 1,000, A
5	$f_{\Delta n}$	x 100, Hz
6	P_{ges}	kW
7	Q_{ges}	kvar
8	λ	x1,000
9	DI1	**Over setpoint**: active limit will close DI (DI = 1), inactive limit will open DI (DI = 0) **Under setpoint**: active limit will open DI (DI = 0), inactive limit will close DI (DI = 1)
10	DI2	
11	DI3	
12	DI4	
13	DI5	
14	DI6	
15	Reserved	
16	Demand P_{ges}	kW
17	Demand Q_{ges}	kvar
18	Demandλ	x1,000
19	Predicted demand P_{ges}	kW
20	Predicted demand Q_{ges}	kvar
21	Predicted demand λ	x1,000
22	THD_U	x 10,000
23	$TOHD_U$	x 10,000
24	$TEHD_U$	x 10,000

Key	Measured quantity	Scale/unit
25	THD_I	x 10,000
26	$TOHD_I$	x 10,000
27	$TEHD_I$	x 10,000
28	Unbalance *U*	x1,000
29	Unbalance *I*	x1,000
30	Deviation *U*	x 10,000
31	Phase reversal	**Over setpoint**: active limit at negative phase sequence; inactive limit at positive phase sequence **Under setpoint:** active limit at positive phase sequence; inactive limit at negative phase sequence

Tab. 10.26: Setpoint parameter

[2] Trigger

The trigger specifies what action the setpoint will take when it becomes active.

Key	Action	Key	Action	Key	Action
0	—	**8**	DR5	**16**	DR13
1	DO1	**9**	DR6	**17**	DR14
2	DO2	**10**	DR7	**18**	DR15
3	DO3	**11**	DR8	**19**	DR16
4	DR1	**12**	DR9	**20**	WFR1
5	DR2	**13**	DR10	**21**	WFR2
6	DR3	**14**	DR11	**22**	Alarm e-mail
7	DR4	**15**	DR12		

Tab. 10.27: Setpoint trigger

10.12 Logic module

10.12.1 Logic module registers

Register	Property	Description	Format
6840…6849	RW	Logic module 1	table 10.29
6850…6859	RW	Logic module 2	
6860…6869	RW	Logic module 3	
6870…6879	RW	Logic module 4	
6880…6889	RW	Logic module 5	
6890…6899	RW	Logic module 6	

Tab. 10.28: Logic module register

10.12.2 Logic module data structure

Offset	Property	Description	Format	Range/options
+ 0	RW	Enable logic module	UINT16	0* = disabled 1 = enabled
+ 1	RW	Mode 1	UINT16	0*= AND 1 = OR 2 = NAND 3 = NOR
+ 2	RW	Mode 2	UINT16	
+ 3	RW	Mode 3	UINT16	
+4	RW	Source 1 [1)]	UINT16	0…24 (1*)
+5	RW	Source 2 [1)]	UINT16	0…24 (2*)
+ 6	RW	Source 3 [1)]	UINT16	0…24 (3*)
+ 7	RW	Source 4 [1)]	UINT16	0…24 (4*)
+ 8	RW	Trigger 1	UINT16	0…21 (1*)
+ 9	RW	Trigger 1	UINT16	0…21 (0*)

Tab. 10.29: Logic module data structure

Notes: table 10.29

1) A logic module can have up to four source inputs. The following table provides a list of logic module sources:

Key	Source	Key	Source
0	—	13	Setpoint 13 (standard)
1	Setpoint 1 (standard)	14	Setpoint 14 (standard)
2	Setpoint 2 (standard)	15	Setpoint 15 (standard)
3	Setpoint 3 (standard)	16	Setpoint 16 (standard)
4	Setpoint 4 (standard)	17	Setpoint 17 (highspeed)
5	Setpoint 5 (standard)	18	Setpoint 18 (highspeed)
6	Setpoint 6 (standard)	19	Setpoint 19 (highspeed)
7	Setpoint 7 (standard)	20	Setpoint 20 (highspeed)
8	Setpoint 8 (standard)	21	Setpoint 21 (highspeed)
9	Setpoint 9 (standard)	22	Setpoint 22 (highspeed)
10	Setpoint 10 (standard)	23	Setpoint 23 (highspeed)
11	Setpoint 11 (standard)	24	Setpoint 24 (highspeed)
12	Setpoint 12 (standard)	—	—

Tab. 10.30: Sources for logic modules

2) Triggers of logic modules
The trigger specifies what action the setpoint will take when it becomes active.

Key	Action	Key	Action	Key	Action
0	—	8	DR5	16	DR13
1	DO1	9	DR6	17	DR14
2	DO2	10	DR7	18	DR15
3	DO3	11	DR8	19	DR16
4	DR1	12	DR9	20	WFR1
5	DR2	13	DR10	21	WFR 2
6	DR3	14	DR11		
7	DR4	15	DR12		

Tab. 10.31: Trigger logic module

10.13 Data recorder (DR)

10.13.1 Data recorder register

Register	Property	Description	Format
7000…7022	RW	Data recorder 1 (DR1, high speed)	table 10.33
7023…7045	RW	Data recorder 2 (DR2, high speed)	
7046…7068	RW	Data recorder 3 (DR3, high speed)	
7069…7091	RW	Data recorder 4 (DR4, high speed)	
7092…7114	RW	Data recorder 5 (DR5, standard)	table 10.34
7115…7137	RW	Data recorder 6 (DR6, standard)	
7138…7160	RW	Data recorder 7 (DR7, standard)	
7161…7138	RW	Data recorder 8 (DR8, standard)	
7134…7206	RW	Data recorder 9 (DR9, standard)	
7107…7229	RW	Data recorder 10 (DR10, standard)	
7230…7252	RW	Data recorder 11 (DR11, standard)	
7253…7275	RW	Data recorder 12 (DR12, standard)	
7276…7298	RW	Data recorder 13 (DR13, standard)	
7299…7321	RW	Data recorder 14 (DR14, standard)	
7322…7344	RW	Data recorder 15 (DR15, standard)	
7345…7367	RW	Data recorder 16 (DR16, standard)	
7368	RO	DR1record size (bytes)	UINT16
7369	RO	DR2 record size (bytes)	UINT16
7370	RO	DR3 record size (bytes)	UINT16
7371	RO	DR4 record size (bytes)	UINT16
7372	RO	DR5 record size (bytes)	UINT16
7373	RO	DR6 record size (bytes)	UINT16
7374	RO	DR7 record size (bytes)	UINT16
7375	RO	DR8 record size (bytes)	UINT16
7376	RO	DR9 record size (bytes)	UINT16
7377	RO	DR10 record size (bytes)	UINT16
7378	RO	DR11 record size (bytes)	UINT16

Register	Property	Description	Format
7379	RO	DR12 record size (bytes)	UINT16
7380	RO	DR13 record size (bytes)	UINT16
7381	RO	DR14 record size (bytes)	UINT16
7382	RO	DR15 record size (bytes)	UINT16
7383	RO	DR16 record size (bytes)	UINT16

Tab. 10.32: Data recorder registers

10.13.2 High-speed data recorder register structure

Offset	Property	Description	Format	Range/options
+ 0	RW	Trigger mode [1)]	UINT16	0* = disabled 1 = triggered by timer 2 = triggered by setpoint
+ 1	RW	Recording mode [2)]	UINT16	0*= stop-when-full
+ 2	RW	Recording depth	UINT16	0*…65535
+ 3	RW	Recording interval	UINT32	1…60 (2*) cycles
+ 5	RW	Recording delay [3)]	UINT16	0*…43200 s
+ 6	RW	Number of measured quantities [4)]	UINT16	0…16*
+ 7	RW	Measured Quantity 1	UINT16	0*…28
+ 8	RW	Measured Quantity 2	UINT16	0*…28
+ 9	RW	Measured Quantity 3	UINT16	0*…28
+ 10	RW	Measured Quantity 4	UINT16	0*…28
+ 11	RW	Measured Quantity 5	UINT16	0*…28
+ 12	RW	Measured Quantity 6	UINT16	0*…28
+ 13	RW	Measured Quantity 7	UINT16	0*…28
+ 14	RW	Measured Quantity 8	UINT16	0*…28
+ 15	RW	Measured Quantity 9	UINT16	0*…28
+ 16	RW	Measured Quantity 10	UINT16	0*…28
+ 17	RW	Measured Quantity 11	UINT16	0*…28
+ 18	RW	Measured Quantity 12	UINT16	0*…28
+ 19	RW	Measured Quantity 13	UINT16	0*…28
+ 20	RW	Measured Quantity 14	UINT16	0*…28
+ 21	RW	Measured Quantity 15	UINT16	0*…28
+ 22	RW	Measured Quantity 16	UINT16	0*…28

Tab. 10.33: High-speed data recorder register structure

Notes: table 10.33

The data recorder only becomes active if the ***offset entries +1, +2, +3 and +6*** *marked in the table are non-zero!*

1) High-speed data recorders can be triggered by a timer (the internal clock) or a setpoint. In trigger mode 2 when the setpoint goes active, the recorder starts to record, and when the setpoint becomes inactive, the data recorder stops.
2) For high-speed data recorders, the recording mode only supports stop-when-full without overwriting other data.
3) Recording delay: The delay in seconds is specified when a measurement is to be started in Trigger mode 1 (triggered by timer). Example: When the delay is set to "300", the measurement will start 300 s (= 5 minutes) after the timer period has elapsed. In order to obtain evaluable results, the programmed value of the recording delay parameter should be less than that of the recording interval parameter. For Trigger mode 2, recording offset is ignored.
4) For high-speed data recorders only the parameters 0…28 from table 8.3.2 can be used.

Modifying an offset parameter ***will clear the DR log*** *and reset the pointer to 0.*

10.13.3 Standard data recorder register structure

Offset	Property	Description	Format	Range/options
+ 0	RW	Trigger mode [1)]	UINT16	0* = disabled 1 = triggered by timer 2 = triggered by setpoint
+ 1	RW	Recording mode	UINT16	0*= stop-when-full 1 = FIFO (First-In-First-Out)
+ 2	RW	Recording depth	UINT16	0…65,535 (5,760*)
+ 3	RW	Recording interval	UINT32	1…3,456,000 s (900*)
+ 5	RW	Recording delay [2)]	UINT16	0*…43,200 s
+ 6	RW	Number of measured quantities [3)]	UINT16	0…16*
+ 7	RW	Measured Quantity 1	UINT16	0*…328
+ 8	RW	Measured Quantity 2	UINT16	0*…328
+ 9	RW	Measured Quantity 3	UINT16	0*…328
+ 10	RW	Measured Quantity 4	UINT16	0*…328
+ 11	RW	Measured Quantity 5	UINT16	0*…328
+ 12	RW	Measured Quantity 6	UINT16	0*…328
+ 13	RW	Measured Quantity 7	UINT16	0*…328
+ 14	RW	Measured Quantity 8	UINT16	0*…328
+ 15	RW	Measured Quantity 9	UINT16	0*…328
+ 16	RW	Measured Quantity 10	UINT16	0*…328
+ 17	RW	Measured Quantity 11	UINT16	0*…328
+ 18	RW	Measured Quantity 12	UINT16	0*…328
+ 19	RW	Measured Quantity 13	UINT16	0*…328
+ 20	RW	Measured Quantity 14	UINT16	0*…328
+ 21	RW	Measured Quantity 15	UINT16	0*…328
+ 22	RW	Measured Quantity 16	UINT16	0*…328

Tab. 10.34: Standard data recorder register structure

Notes: table 10.34

*The data recorder is only operational when the **offset entries +1, +2, +3 and +6 are all non-zero**!*

1) The standard data recorder **can be triggered by a Timer** (the internal clock) **or** by **Setpoint**. In trigger mode 2 when the setpoint goes active, the recorder starts to record, and when the setpoint becomes inactive, the data recorder stops.

2) Recording delay: In Trigger mode 1, a fixed time can be set in seconds to delay the start of the measurement (triggered by timer). Example: When the delay is set to "300", the measurement will start 300 s (= 5 minutes) after the timer period has elapsed. In order to obtain evaluable results, the programmed value of the recording delay parameter should be less than that of the recording interval parameter. For Trigger mode 2, recording delay is ignored.

3) For standard data recorders all the measured quantities 0…328 from table 8.3.2 can be used.

*Modifying an offset parameter will **clear the DR log** and reset the pointer to 0.*

10.14 Waveform recording (WFR)

The PEM575 provides two waveform recorders capable of recording waveforms independently from one another (waveform recorder WFR1 and WFR2). The total capacity of WRF 1 and WFR 2 is 32.

Each waveform recorder can simultaneously record 3-phase voltage and current signals at a maximum resolution of 256 samples per cycle.

Register	Property		Description	Format
7600	RW	WFR 1	Number of measurements [1)]	0*…32
7601	RW		Number of samples [2)]	0 = 16 1 = 32 2 = 64 3 = 128 4*= 256
7602	RW		Number of cycles [2)]	320 / 160 / 80 / 40 / 20 / 10*
7603	RW		Number of cycles before the event	0*…10
7604	RW	WFR2	Recording depth [1)]	0*…32
7605	RW		Number of samples [2)]	0*= 16 1 = 32 2 = 64 3 = 128 4= 256
7606	RW		Number of cycles [2)]	320* / 160 / 80 / 40 / 20
7607	RW		Pre-fault cycles [3)]	0*…10

Tab. 10.35: Waveform recording register

table 10.35: Notes:

1) The total capacity of the waveform recorders is 32, i.e. the total of the number of measurements in WFR 1 WFR 2 must be ≤ 32. The waveform recorder is disabled when register 7600 is set to 0.

2) Valid WFR formats (number of samples/cycle x number of cycles) are 16 x 320, 32 x 160, 64 x 80, 128 x 40 and 256 x 20.

3) When the WFR format is 256 x 20, the number of pre-fault cycles is 0…5, otherwise the range is 0…10.

*Modifying any of the registers **7600…7607** will clear the WFR log and reset the pointer to 0.*

Waveform recorder data structure (WFR log)

The waveform recorder data contains the values of the secondary side. The voltage data returned is 10 times of the actual secondary voltage and the current data is 1,000 times of the actual secondary current. The voltage and current values of the primary side are calculated as follows:
$U_{primary} = U_{secondary}$ x voltage transformer transformation ratio/10
$I_{primary} = I_{secondary}$ x CT transformation ratio/1,000

Offset	Property	Description	Format	Range/options
+ 0	RO	Trigger mode	UINT16	0*= disabled 1 = manual 2 = Setpoint 3 = Sag/swell
+ 1	RO	HiWord: Year	UINT16	0…99 (year- 2000)
	RO	LoWord: month		1…12
+ 2	RO	HiWord: Date: Day	UINT16	1…31
	RO	LoWord: Hour		1…23
+ 3	RO	HiWord: Minute	UINT16	0…59
	RO	LoWord: Second		0…59
+ 4	RO	Millisecond	UINT16	0…999
+ 5…N+4	RO	U_{L1} of sample N#	UINT16	x 10, V
N+5…2N+4	RO	U_{L2} of sample N#	UINT16	x 10, V
2N+5…3N+4	RO	U_{L3} of sample N#	UINT16	x 10, V
3N+5…4N+4	RO	I_1 of sample N#	UINT16	x 1,000, A
4N+5…5N+4	RO	I_2 of sample N#	UINT16	x 1,000, A
5N+5…6N+4	RO	I_3 of sample N#	UINT16	x 1,000, A

Tab. 10.36: Waveform recorder data structure

N# = number of sample (1…N)

10.15 Energy log

Register	Property	Description		Format	Range/options	
7700	RW	Recording mode		UINT16	0*= disabled 1 = stop-when-full 2 = FIFO	
7701	RW	Number of measurements[1]		UINT16	0…65535 (5760*)	
7702	RW	Recording interval		UINT16	0 = 5 min 1 = 10 min 2*= 15 min 3 = 30 min 4 = 60 min	
7703	RW	Start-up time[2]	HiWord: Year	UINT16	0…99 (year- 2000)	
			LoWord: month		1…12	
7704	RW		HiWord: Date: Day	UINT16	1…31	
			LoWord: Hour		1…23	
7705	RW		HiWord: Minute	UINT16	0…59	
			LoWord: Second		0…59	
7706	RW	Number of parameters (N)		UINT16	0…5*	
7707	RW	Parameter 1		UINT16	0 = active energy import 1 = active energy export 2 = reactive energy import 3 = reactive energy export 4 = apparent energy	0*
7708	RW	Parameter 2		UINT16		1*
7709	RW	Parameter 3		UINT16		2*
7710	RW	Parameter 4		UINT16		3*
7711	RW	Parameter 5		UINT16		4*
7712	RO	Data record size		UINT16	Unit: bytes	

Tab. 10.37: Energy log registers

table 10.37: Notes:

1) Writing "Number of measurements = 0" will disable the energy log.

2) When the current time meets or exceeds the start-up time, the energy log starts to record.

Modifying any of the registers 7701…7711 will clear the WFR log and reset the pointer to 0.

Energy log data structure

Offset	Property	Description	Format	Range/options
+0	RO	Parameter 1	INT32	
+2	RO	Parameter 2	INT32	
…	RO	…	INT32	
+2N	RO	Parameter N (N = 0…5)	INT32	
+2N+1	RO	HiWord: Year	UINT16	0…99 (year - 2000)
		LoWord: month		1…12
+2N+2	RO	HiWord: Date: Day	UINT16	1…31
		LoWord: Hour		1…23
+2N+3	RO	HiWord: Minute	UINT16	0…59
		LoWord: Second		0…59
+2N+4	RO	Millisecond	UINT16	0…999

Tab. 10.38: Energy log data structure

10.16 PQ log

Offset	Property	Description	Format
0…7	RO	PQ log 1	see table 10.39
8…15	RO	PQ log 2	
16…23	RO	PQ log 3	
…	RO	…	
7992…7999	RO	PQ log 1,000	

PQ log data structure

Offset	Property	Description	Format	Range/ options
+ 0	RO	Reserved	UINT16	
+ 1	RO	HiWord: Classification		
	RO	LoWord: sub classification 1)		
+ 2	RO	HiWord: Year	UINT16	0…99 (year – 2000)
	RO	LoWord: month		1…12
+ 3	RO	HiWord: Date: Day	UINT16	1…31
	RO	LoWord: Hour		1…23
+ 4	RO	HiWord: Minute	UINT16	0…59
	RO	LoWord: Second		0…59
+ 5	RO	Millisecond	UINT16	0…999
+ 6 4)	RO	max. disturbance U_{LN} 2) / max. transient U_{LN} 3)	INT32	x 100, %
+ 8	RO	Duration		µs
+ 10	RO	max. disturbance U_{L1} 2) / max. transient U_{L1} 3)	INT32	x 100, %
+ 12	RO	max. disturbance U_{L2} 2) / max. transient U_{L2} 3)	INT32	x 100, %
+ 14	RO	max. disturbance U_{L3} 2) / max. transient U_{L3} 3)	INT32	x 100, %

Tab. 10.39: PQ log data structure

table 10.39: Notes:

1) The PQ log classification is "7".
The following sub classifications are used:

Sub classification	Description
1	Start: sag/swell event
2	End: sag/swell event
3	Transient event

2) Sag/swell inactive value: max. value of disturbance U_{Lx}
$U_{Lx} = ((U_{Lx\,max} - U_{Lx\,nenn}) / U_{Lx\,nenn}) \times 100\,\%$ (with $L_x = L_1 \ldots L_3$)
Max. disturbance U_{LN} is the maximum value of max. disturbance U_{Lx}

3) Transient events:
$U_{Lx\,transient\,max} = (U_{Lx\,max} / U_{nenn}) \times 100\,\%$
(with $L_x = L_1 \ldots L_3$)
Max. U_{LN} transient is the maximum value of $U_{Lx\,transient}$

4) For sag/swell events, the offsets + 6…+ 14 are reserved.

10.17 Event log (SOE log)

Each SOE event occupies 8 registers, as shown in the following table. The internal data structure of the event log is listed in table 10.41.

10.17.1 Energy log register

Register	Property	Description	Format
10000…10007	RO	Event 1	see table 10.41
10008…10015	RO	Event 2	
10016…10023	RO	Event 3	
10024…10031	RO	Event 4	
10032…10039	RO	Event 5	
10040…10047	RO	Event 6	
10048…10055	RO	Event 7	
10056…10063	RO	Event 8	
10064…10071	RO	Event 9	
10072…10079	RO	Event 10	
10080…10087	RO	Event 11	
…			
14088…14095	RO	Event 512	

Tab. 10.40: Event log (SOE log)

10.17.2 Event log data structure

The following table describes the internal data structure of the 8 registers which belong to each event in the SOE log.

Offset	Property	Description	Format
+ 0	RO	Reserved	UINT16
+ 1	RO	HiWord: Event classification LoWord: Sub classification (refer to page 150)	UINT16
+ 2	RO	HiWord: Year-2000 LoWord: Month (1…12)	UINT16
+ 3	RO	HiWord: Day (0…31) LoWord: Hour (1…23)	UINT16
+ 4	RO	HiWord: M inute (0…59) LoWord: Second (0…59)	UINT16
+ 5	RO	Millisecond (0…999)	UINT16
+ 6	RO	Event value	INT32

Tab. 10.41: Event data structure

10.17.3 Event classification (SOE log)

Event classification	Event sub classification	Event value Unit Option	Description
1	1	1/0	DI1 close/open
	2	1/0	DI2 close/open
	3	1/0	DI3 close/open
	4	1/0	DI4 close/open
	5	1/0	DI5 close/open
	6	1/0	DI6 close/open
2	1	1/0	DO 1 close/open by communications interface
	2	1/0	DO2 close/open by communications interface
	3	1/0	DO3 close/open by communications interface
	4	1/0	DO1 close/open by setpoint
	5	1/0	DO2 close/open by setpoint
	6	1/0	DO3 close/open by setpoint
	7	1/0	DO1 close/open by undervoltage/overvoltage
	8	1/0	DO2 close/open by undervoltage/overvoltage
	9	1/0	DO3 close/open by undervoltage/overvoltage
	10	1/0	DO1 close/open by transient event
	11	1/0	DO2 close/open by transient event
	12	1/0	DO3 close/open by transient event

Event classification	Event sub classification	Event value Unit Option	Description
3	1	Trigger value x 100	>-Setpoint U_{LN} exceeded
	2	Trigger value x 100	>-Setpoint U_{LL} exceeded
	3	Trigger value x 1000	>-Setpoint I exceeded
	4	Trigger value x 1000	>-Setpoint I_4 exceeded
	5	Trigger value x 100	>-Setpoint Δf exceeded
	6	Trigger value	>-Setpoint P_{ges} exceeded
	7	Trigger value	>-Setpoint Q_{ges} exceeded
	8	Trigger value x 1000	>-Setpoint λ_{ges} exceeded
	9	1	Close setpoint DI1 active
	10	1	Close setpoint DI2 active
	11	1	Close setpoint DI3 active
	12	1	Close setpoint DI4 active
	13	1	Close setpoint DI5 active
	14	1	Close setpoint DI6 active
	15	Reserved	
	16	Trigger value	>-Demand setpoint P_{ges} exceeded
	17	Trigger value	>-Demand setpoint Q_{ges} exceeded
	18	Trigger value x 1000	>Demand setpoint λ_{ges} exceeded
	19	Trigger value	>-Predicted setpoint P_{ges} exceeded
	20	Trigger value	>Predicted setpoint Q_{ges} exceeded
	21	Trigger value x 1000	>Predicted setpoint λ_{ges} exceeded
	22	Trigger value x 100	>-Setpoint THD_U exceeded
	23	Trigger value x 100	>-Setpoint $TOHD_U$ exceeded
	24	Trigger value x 100	>-Setpoint $TEHD_U$ exceeded
	25	Trigger value x 100	>-Setpoint THD_I exceeded
	26	Trigger value x 100	>-Setpoint $TOHD_I$ exceeded

Event classification	Event sub classification	Event value Unit Option	Description
3	27	Trigger value x 100	>-Setpoint $TEHD_I$ exceeded
	28	Trigger value x 10	>Voltage unbalance setpoint exceeded
	29	Trigger value x 10	>Current unbalance setpoint exceeded
	30	Trigger value x 100	>-Voltage deviation setpoint exceeded
	31	1	>-Phase reversal setpoint exceeded
		Reserved	
	46	Return value x 100	>-Setpoint U_{LN} return
	47	Return value x 100	>-Setpoint U_{LL} return
	48	Return value x 1000	>-Setpoint I return
	49	Return value x 1000	>-Setpoint I_4 return
	50	Return value x 100	>-Setpoint Δf return
	51	Return value	>-Setpoint P_{ges} return
	52	Return value	>-Setpoint Q_{ges} return
	53	Return value x 1000	>-Setpoint λ_{ges} return
	54	0	DI1 close setpoint return
	55	0	DI2 close setpoint return
	56	0	DI3 close setpoint return
	57	0	DI4 close setpoint return
	58	0	DI5 close setpoint return
	59	0	DI6 close setpoint return
	60	Reserved	
	61	Return value	>- Setpoint demand P_{ges} return

Event classification	Event sub classification	Event value Unit Option	Description
3	62	Return value	>-Setpoint demand Q_{ges} return
	63	Return value x 1000	>-Demand setpoint λ_{ges} return
	64	Return value	>-Predicted setpoint P_{ges} return
	65	Return value	>-Predicted setpoint Q_{ges} return
	66	Return value x 1000	>-Predicted setpoint λ_{ges} return
	67	Return value x 100	>-Setpoint THD_U return
	68	Return value x 100	>-$TOHD_U$ setpoint return
	69	Return value x 100	>-Setpoint $TEHD_U$ return
	70	Return value x 100	>-Setpoint THD_I return
	71	Return value x 100	>-Setpoint $TOHD_I$ return
	72	Return value x 100	>-Setpoint $TEHD_I$ return
	73	Return value x 10	>-Voltage unbalance setpoint return
	74	Return value x 10	>-Current unbalance setpoint return
	75	Return value x 100	>-Voltage deviation setpoint return
	76	0	>-Phase reversal setpoint return
		Reserved	
	91	Trigger value x 100	Under <-Setpoint U_{LN}
	92	Trigger value x 100	Under <-Setpoint U_{LL}
	93	Trigger value x 1000	Under <-Setpoint I
	94	Trigger value x 1000	<-Under I_4 setpoint
	95	Trigger value x 100	<-Under Δf setpoint
	96	Trigger value	Under <-Setpoint P_{ges}
	97	Trigger value	<-Under Q_{ges} setpoint

Event classification	Event sub classification	Event value Unit Option	Description
3	98	Trigger value x 1000	Under <-Setpoint λ_{ges}
	99	1	DI1 open setpoint active
	100	1	DI2 open setpoint active
	101	1	DI3 open setpoint active
	102	1	DI4 open setpoint active
	103	1	DI5 open setpoint active
	104	1	DI6 open setpoint active
	105	Reserved	
	106	Trigger value	Under <-Setpoint demand P_{ges}
	107	Trigger value	Under <-Setpoint demand Q_{ges}
	108	Trigger value x 1000	<-Under λ_{ges} demand setpoint
	109	Trigger value	<-Under P_{ges} predicted setpoint
	110	Trigger value	<-Under Q_{ges} predicted setpoint
	111	Trigger value x 1000	<-Under λ_{ges} predicted setpoint
	112	Trigger value x 100	Under <-Setpoint THD_U
	113	Trigger value x 100	Under <-Setpoint $TOHD_U$
	114	Trigger value x 100	Under <-Setpoint $TEHD_U$
	115	Trigger value x 100	Under <-Setpoint THD_I
	116	Trigger value x 100	Under <-Setpoint $TOHD_I$
	117	Trigger value x 100	Under <-Setpoint $TEHD_I$
	118	Trigger value x 10	<-Under voltage unbalance setpoint
	119	Trigger value x 10	<-Under current unbalance setpoint
	120	Trigger value x 100	<-Under voltage deviation setpoint
	121	1	<-Under phase reversal setpoint
	Reserved		

Event classification	Event sub classification	Event value Unit Option	Description
3	136	Return value x 100	<-Setpoint U_{LN} return
	137	Return value x 100	<-Setpoint U_{LL} return
	138	Return value x 1000	<-Setpoint I return
	139	Return value x 1000	<- I_4 setpoint return
	140	Return value x 100	<- Δf setpoint return
	141	Return value	<-Setpoint P_{ges} return
	142	Return value	<-Setpoint Q_{ges} return
	143	Return value x 1000	<-Setpoint λ_{ges} return
	144	1	DI1 open setpoint return
	145	1	DI2 open setpoint return
	146	1	DI3 open setpoint return
	147	1	DI4 open setpoint return
	148	1	DI5 open setpoint return
	149	1	DI6 open setpoint return
	150	Reserved	
	151	Return value	<-Setpoint demand P_{ges} return
	152	Return value	<-Setpoint demand Q_{ges} return
	153	Return value x 1000	<-Setpoint demand λ_{ges} return
	154	Return value	<- Predicted demand setpoint P_{ges} return
	155	Return value	<-Predicted demand setpoint Q_{ges} return
	156	Return value x 1000	<-Predicted demand setpoint λ_{ges} return
	157	Return value x 100	<-Setpoint THD_U return
	158	Return value x 100	<-Setpoint $TOHD_U$ return

Event classification	Event sub classification	Event value Unit Option	Description
3	159	Return value x 100	<-Setpoint TEHD_U return
	160	Return value x 100	<-Setpoint THD_I return
	161	Return value x 100	<-Setpoint TOHD_I return
	162	Return value x 100	<-Setpoint TEHD_I return
	163	Return value x 10	<-Voltage unbalance setpoint return
	164	Return value x 10	<-Current unbalance setpoint return
	165	Return value x 100	<-Voltage deviation setpoint return
	166	0	<-Phase reversal setpoint return
4	1	0	Battery voltage low
	2	0	Fault power supply CPU
	3	0	A/D fault
	4	0	NVRAM fault
	5	0	System parameter fault
	6	0	Calibration parameter fault
	7	0	Setpoint parameter fault
	8	0	Data recorder parameter fault
	9	0	Waveform recorder parameter fault
	10	0	Energy log parameter fault
5	1	0	Supply voltage on
	2	0	Supply voltage off
	3	0	Clock set via front panel
	4	0	Setup changed via device buttons
	5	0	DI counter cleared via front panel
	6	0	Event log cleared via device buttons
	7	0	PQ log cleared via front panel

Event classification	Event sub classification	Event value Unit Option	Description
5	8	0	Energy values cleared via device buttons
	9	0	Data recorder cleared via front panel
	10	0	Waveform recording cleared via front panel
	11	0	Energy log cleared via front panel
	12	0	Max/Min value log of this month cleared via device buttons
	13	0	Peak demand of this month cleared via device buttons
	14	0	Setup changed via communications interface
	15	0	DI counter cleared via communications interface
	16	0	Event log cleared via communications interface
	17	0	PQ log cleared via communications interface
	18	0	Energy values cleared via communications interface
	19	0	Data recorder cleared via communications interface
	20	0	Waveform recording cleared via communications interface
	21	0	Energy log cleared via communications interface
	22	0	Max/Min value log of this month cleared via communications interface
	23	0	Peak demand of this month cleared via communications interface

Event classification	Event sub classification	Event value Unit Option	Description
6	1	0	Waveform recording triggered by communications interface
	2	Setpoint 1…24	Waveform recording triggered by setpoint
	3	0	Waveform recording triggered by undervoltage/overvoltage
	4	Setpoint 1…24	Data recorder (standard) triggered by setpoint
	5	Setpoint 1…24	Data recorder (highspeed) triggered by setpoint
	6	0	Data recorder (standard) triggered by undervoltage/overvoltage
	7	0	Data recorder (highspeed) triggered by undervoltage/overvoltage
	8	Setpoint 1…24	Alarm e-mail triggered by setpoint
	9	0	Alarm e-mail triggered by undervoltage/overvoltage
	10	0	Waveform recording triggered by transient event
	11	0	Data recorder (standard) triggered by transient event
	12	0	Data recorder (highspeed) triggered by transient event
	13	0	Alarm e-mail triggered by transient event

Tab. 10.42: Event classification

10.18 Time setting

There are two time register formats supported by PEM575:

1. Year/Month/Day/Hour/Minute/Second register 9000…9002
2. UNIX-time register 9004

When sending the time via Modbus communications, care should be taken to only write one of the two time register sets. All registers within a time register set must be written in a single transaction.

If all the registers **9000…9004** are set, both timestamp registers will be updated to reflect the new time specified in the UNIX time register set. Time specified in the first display format will be ignored.

Optionally, the register **9003** displays milliseconds. When broadcasting time, the function code has to be set to 0x10 (Preset Multiple Register). Incorrect date or time values will be rejected by the universal measuring device.

Register	Property	Description	Format	Note
9000	RW	Year and month	UINT16	HiWord: Year - 2000 LoWord: Month (1…12)
9001	RW	Day and Hour	UINT16	HiWord: day (1…31) LoWord: Hour (0…23)
9002	RW	Minute and second	UINT16	HiWord: minute (0…59) LoWord: Second (0…59)
9003	RW	Millisecond	UINT16	0…999
9004	RW	UNIX time	UINT32	Time in seconds elapsed since January 01, 1970 (00:00:00 h) (0…4102444799)

Tab. 10.43: Timestamp register

10.19 DOx output control

The control register of the digital outputs are implemented as Write-Only registers (WO) and can be controlled with the function code 0x05. In order to query the current DO status, the register **0086** have to be read out.

PEM575 supports the execution of commands to the outputs in two steps (**ARM before EXECUTING**): Before sending an open or close command to one of the outputs, it must be activated first. This is achieved by writing 0xFF00 to the appropriate DO register. If an "Execute" command is not received within 15 seconds, the output will be deactivated again.

Each command to be executed sent to an output not being activated before, will be ignored by the PEM575 and returned as an exception code 0x04.

Register	Property	Format	Description	Note
9100	WO	UINT16	Activate DO1 close	Writing 0xFF00
9101	WO	UINT16	Execute DO1 close	Writing 0xFF00
9102	WO	UINT16	Activate DO1 open	Writing 0xFF00
9103	WO	UINT16	Execute DO1 open	Writing 0xFF00
9104	WO	UINT16	Activate DO2 close	Writing 0xFF00
9105	WO	UINT16	Execute DO2 close	Writing 0xFF00
9106	WO	UINT16	Activate DO2 open	Writing 0xFF00
9107	WO	UINT16	Execute DO2 open	Writing 0xFF00
9108	WO	UINT16	Activate DO3 close	Writing 0xFF00
9109	WO	UINT16	Execute DO3 close	Writing 0xFF00
9110	WO	UINT16	Activate DO3 open	Writing 0xFF00
9111	WO	UINT16	Execute DO3 open	Writing 0xFF00

Tab. 10.44: Digital output control register

10.20 Universal measuring device information

Register	Property	Description	Format	Note
9800… 9819	RO	Model*	UINT16	see table 10.46
9820	RO	Software version	UINT16	e.g.: 10000 = V1.00.00
9821	RO	Protocol version	UINT16	e.g.: 40 = V4.0
9822	RO	Software update date (year-2000)	UINT16	e.g.: 080709 = July 9, 2008
9823	RO	Software update date: month	UINT16	
9824	RO	Software update date: day	UINT16	
9825	RO	Serial number	UINT32	
9827…9829	Reserved			
9830	RO	Measuring current configuration	UINT16	0 = 5 A, 1 = 1 A
9831	RO	U_S	UINT16	100/400 (V)

Tab. 10.45: Measuring device information

* The model of the universal measuring device is included in the registers 9800…9819. A coding example is given in the table below using the "PEM575" by way of example.

Register	Value (Hex)	ASCII
9800	0x50	P
9801	0x45	E
9802	0x4D	M
9803	0x35	5
9804	0x37	7
9805	0x35	5
9806…9819	0x20	Null

Tab. 10.46: ASCII coding of "PEM575"

11. 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 .... ≤ 11 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
Internal resistance (L-N) .... > 500 kΩ

Measuring current inputs

External measuring current transformer .... should at least comply with accuracy class 0.2 S
Burden .... n.A., internal current transformers
Measuring range .... 0.1 . . . 120% I_N
PEM575
I_N .... 5 A
.... CT transformation ratio1 . . . 6,000
PEM575-251
I_N .... 1 A
.... CT transformation ratio1 . . . 30.000

Accuracies (v.M. = of measured value/v.S. = of full scale value)

Phase voltage U_{L1-N}, U_{L2-N}, U_{L3-N} .... ± 0.1 % of measured value.
Current .... ±0.1 % v.M./ +0.05% v.S.
Neutral current I_4 .... 0.5 % v. S.
Frequency .... ± 0.01 Hz
Phasing .... ± 1 °
Measurement of the active energy 0.2S .... acc. to DIN EN 62053-22 (VDE 0418 Part 3-22)
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
Measurement of the frequency .... acc. 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 kBit/s
Cable length .... 0 . . . 1200 m
Recommended cable
(shielded, shield connected to PE on one side) .... min. J-Y(St)Y min. 2x0.8

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 .... IEC 61326-1
Operating temperature .... −25 . . . +55 °C
Climatic class according to IEC 60721 (stationary use) 3K5
Classification of mechanical conditions acc. to IEC 60721 (stationary use) 3M4

Connection

Connection .... screw terminals

Other

Degree of protection, installation IP20
Degree of protection, front IP54
Weight .... ≤ 1100 g

11.1 Standards and certifications

PEM575 was designed in accordance with the following standards:

DIN EN 62053-22 (VDE 0418 Part 3-22)
Electricity meter equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S (IEC 62053));

DIN EN 61557-12 (VDE 0413-12)
Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12: (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V - Equipment for testing, measuring or monitoring of protective measures _ Part 12) Performance measuring and monitoring device (PMD)

11.2 Ordering information

Type	Current input	Article number
PEM575 230/400 V, 50 Hz	5 A	B 9310 0575
PEM575-251 230/400 V, 50 Hz	1 A	B 9310 0576
PEM575-455 400/690 V, 50 Hz	5 A	B 9310 0577
PEM575-451 400/690 V, 50 Hz	1 A	B 9310 0578

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