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

Table10.1: 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

Register	Property	Description	Format	Scale/unit
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	
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 10002
0071	RO	Current unbalance	UINT16	x 1000
0072	RO	ΔU_{L1}	INT16	x 10,000
0073	RO	ΔU_{L2}	INT16	x 10,000

Register	Property	Description	Format	Scale/unit
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	
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	

Table10.2: 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)		

Table10.3: 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 47).

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 1001rd value overwrites the first value, the 1002th the second one and so on. A reset of the PQ log can be carried out in the set-up parameters (see page 47).

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	1st Quadrant reactive energy	UINT32	kvarh
0220	RW	2nd Quadrant, reactive energy	UINT32	kvarh
0222	RW	3rd Quadrant, reactive energy	UINT32	kvarh

Register	Property	Description	Format	Unit
0224	RW	4th 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
0244	RO	Reactive energy 1st quadrant, fractional value	Float	vars
0246	RO	Reactive energy 2st 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

Table10.4: 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

Table10.5: 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	

Table10.6: 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} 2^{nd} harmonic	UINT16	x 10,000
0483	RO	U_{L2} 2^{nd} harmonic	UINT16	x 10,000
0484	RO	U_{L3} 2^{nd} harmonic	UINT16	x 10,000
0485	RO	I_1 2^{nd} harmonic	UINT16	x 10,000
0486	RO	I_2 2^{nd} harmonic	UINT16	x 10,000
0487	RO	I_3 2^{nd}harmonic	UINT16	x 10,000
0488	RO	I_4 2^{nd} harmonic	UINT16	x 10,000
…	RO	…	UINT16	x 10,000
0909	RO	U_{L1} 63^{rd} harmonic	UINT16	x 10,000
0910	RO	U_{L2} 63^{rd} harmonic	UINT16	x 10,000
0911	RO	U_{L3} 63^{rd} harmonic	UINT16	x 10,000
0912	RO	I_1 63^{rd} harmonic	UINT16	x 10,000
0913	RO	I_2 63^{rd} harmonic	UINT16	x 10,000
0914	RO	I_3 63^{rd} harmonic	UINT16	x 10,000
0915	RO	I_4 63^{rd} harmonic	UINT16	x 10,000

Table10.7: 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	

Table10.8: 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

Register	Property	Description	Format	Unit
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
1050	RO	Demand λ_1	INT32	x 1000
1052	RO	Demand λ_2	INT32	x 1000
1054	RO	Demand λ_3	INT32	x 1000
1056	RO	Demand λ_{ges}	INT32	x 1000
1058	RO	Demand f	INT32	x 100, Hz
1060	RO	Demand voltage unbalance	INT32	x 1000
1062	RO	Demand current unbalance	INT32	x 1000
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

Table10.9: 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 1000, A
1218	RO	Predicted demand I_2	INT32	x 1000, A
1220	RO	Predicted demand I_3	INT32	x 1000, A
1222	RO	Ø Predicted demand I	INT32	x 1000, A
1224	RO	Predicted demand I_4 [1)]	INT32	x 1000, 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 demandλ_1	INT32	x 1000
1252	RO	Predicted demand λ_2	INT32	x 1000
1254	RO	Predicted demand λ_3	INT32	x 1000
1256	RO	Predicted demand λ_{ges}	INT32	x 1000
1258	RO	Predicted demand *f*	INT32	x 100, Hz
1260	RO	Predicted demand, voltage unbalance	INT32	x 1000
1262	RO	Predicted demand, current unbalance	INT32	x 1000
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

Table10.10: 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

Register	Property	Description	Format	Unit
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 1000, A
1418	RO	$I_{2\ max}$	INT32	x 1000, A
1420	RO	$I_{3\ max}$	INT32	x 1000, A
1422	RO	Ø I_{max}	INT32	x 1000, A
1424	RO	$I_{4\ max}$ [1)] or reserved	INT32	x 1000, 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
1450	RO	$\lambda_{1\ max}$	INT32	x 1000
1452	RO	$\lambda_{2\ max}$	INT32	x 1000
1454	RO	$\lambda_{3\ max}$	INT32	x 1000
1456	RO	$\lambda_{ges\ max}$	INT32	x 1000
1458	RO	f_{max}	INT32	x 100, Hz
1460	RO	max. voltage unbalance	INT32	x 1000
1462	RO	max. current unbalance	INT32	x 1000

Register	Property	Description	Format	Unit
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

Table10.11: 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 1000, A
1618	RO	$I_{2\ min}$	INT32	x 1000, A
1620	RO	$I_{3\ min}$	INT32	x 1000, A
1622	RO	Ø I_{min}	INT32	x 1000, A
1624	RO	$I_{4\ min}$ [1)] or reserved	INT32	x 1000, A
1626	RO	$P_{L1\ min}$	INT32	W
1628	RO	$P_{L2\ min}$	INT32	W

Register	Property	Description	Format	Unit
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
1650	RO	$\lambda_{1\ min}$	INT32	x 1000
1652	RO	$\lambda_{2\ min}$	INT32	x 1000
1654	RO	$\lambda_{3\ min}$	INT32	x 1000
1656	RO	$\lambda_{ges\ min}$	INT32	x 1000
1658	RO	f_{min}	INT32	x 100, Hz
1660	RO	min. voltage unbalance	INT32	x 1000
1662	RO	min. current unbalance	INT32	x 1000
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

Table10.12: 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 1000 times the actual value. To obtain a value in kW, kVA or kvar, the value of the register has to be divided by 1000.

Register	Property	Description	Format	Unit
1800…1805	RO	Peak demand P_{ges} of this month	see Tabelle 10.15 auf Seite 107	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 1000, A
1824…1829	RO	Peak demand I_2 of this month		x 1000, A
1830…1835	RO	Peak demand I_3 of this month		x 1000, A

Table10.13: Peak demand of this month

10.7.6 Peak demand last month

The value of the peak demand register is 1000 times the actual value. To obtain a value in kW, kVA or kvar, the value of the register has to be divided by 1000.

Register	Property	Description	Format	Unit
1850…1855	RO	Peak demand P_{ges} of last month	see Tabelle 10.15 auf Seite 107	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 1000, A
1874…1879	RO	Peak demand I_2 of ast month		x 1000, A
1880…1885	RO	Peak demand I_3 of last month		x 1000, A

Table10.14: 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

Table10.15: 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 1000, A
2054…2059	RO	$I_{2\ max}$		x 1000, A
2060…2065	RO	$I_{3\ max}$		x 1000, A
2066…2071	RO	Ø I_{max}		x 1000, A
2072…2077	RO	$I_{4\ max}$ 1) or reserved		x 1000, 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 1000
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

Table10.16: 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 1000, A
2354…2359	RO	$I_{2\ min}$		x 1000, A
2360…2365	RO	$I_{3\ min}$		x 1000, A
2366…2371	RO	Ø I_{min}		x 1000, A
2372…2377	RO	$I_{4\ min}$ 1) or reserved		x 1000, 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 1000
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

Table10.17: 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

Register	Property	Description	Format	Factor/unit
2630…2635	RO	$U_{L2L3\ max}$	see Table 10.20	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 1000, A
2654…2659	RO	$I_{2\ max}$		x 1000, A
2660…2665	RO	$I_{3\ max}$		x 1000, A
2666…2671	RO	Ø I_{max}		x 1000, A
2672…2677	RO	$I_{4\ max}$ 1) or reserved		x 1000, 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 1000
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
2726…2731	RO	$THD_{I1\ max}$		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

Table10.18: 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 1000, A
2954…2959	RO	$I_{2\ min}$		x 1000, A
2960…2965	RO	$I_{3\ min}$		x 1000, A
2966…2971	RO	Ø I_{min}		x 1000, A
2972…2977	RO	$I_{4\ min}$ [1)] or reserved		x 1000, 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 1000
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

Table10.19: 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

Table10.20: 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 2 = 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…1000 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 = 1000 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	10…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*)
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	

Register	Property	Description	Format	Range/unit
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.

Table10.21: 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.com", set the registers in hexadecimal form as 0050 0045 004D 0035 0037 0035 0040 0062 0065 006E 0064 0065 0072 002D 0064 0065 002E 0063 006F 006D.

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.com" is coded in hexadecimal form as 0050 0045 004D 0035 0037 0035 0040 0062 0065 006E 0064 0065 0072 002D 0064 0065 002E 0063 006F 006D.

10.10 Clear/reset register

<table>
<tr><th>Register</th><th>Property</th><th>Description</th><th>Format</th><th>Unit</th></tr>
<tr><td>6400</td><td>WO</td><td>Manual WFR1 Trigger</td><td>UINT16</td><td rowspan="2">Writing 0xFF00 to the register triggers the respective waveform recorder</td></tr>
<tr><td>6401</td><td>WO</td><td>Manual WFR2 Trigger</td><td>UINT16</td></tr>
<tr><td>6402</td><td>WO</td><td>Clear DR1 (high speed)</td><td>UINT16</td><td rowspan="8">Writing 0xFF00 to the register clears the respective DR</td></tr>
<tr><td>6403</td><td>WO</td><td>Clear DR2 (high speed)</td><td>UINT16</td></tr>
<tr><td>6404</td><td>WO</td><td>Clear DR3 (high speed)</td><td>UINT16</td></tr>
<tr><td>6405</td><td>WO</td><td>Clear DR4 (high speed)</td><td>UINT16</td></tr>
<tr><td>6406</td><td>WO</td><td>Clear DR5 (standard)</td><td>UINT16</td></tr>
<tr><td colspan="4">...</td></tr>
<tr><td>6416</td><td>WO</td><td>Clear DR15 (standard)</td><td>UINT16</td></tr>
<tr><td>6417</td><td>WO</td><td>Clear DR16 (standard)</td><td>UINT16</td></tr>
<tr><td>6418</td><td>WO</td><td>Clear WFR1</td><td>UINT16</td><td rowspan="8">Writing 0xFF00 to the register clears the respective log</td></tr>
<tr><td>6419</td><td>WO</td><td>Clear WFR2</td><td>UINT16</td></tr>
<tr><td>6420</td><td>WO</td><td>Clear energy log</td><td>UINT16</td></tr>
<tr><td>6421</td><td>WO</td><td>Clear PQ log</td><td>UINT16</td></tr>
<tr><td>6422</td><td>WO</td><td>Clear event log</td><td>UINT16</td></tr>
<tr><td>6423</td><td>WO</td><td>Clear energy register</td><td>UINT16</td></tr>
<tr><td>6424</td><td>WO</td><td>Clear Max/Min log of this month</td><td>UINT16</td></tr>
<tr><td>6425</td><td>WO</td><td>Clear peak demand log of this month</td><td>UINT16</td></tr>
</table>

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

Table10.22: 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)	

Table10.23: 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	1000*
+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*)

Table10.24: 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	1000*
+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*)

Table10.25: 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}	x 1,000, kW
7	Q_{ges}	x 1,000, 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

Key	Measured quantity	Scale/unit
23	$TOHD_U$	x 10,000
24	$TEHD_U$	x 10,000
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

Table10.26: Setpoint parameter

[2)] Trigger

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

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

Table10.27: 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	

Table10.28: 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*)

Table10.29: 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)	—	—

Table10.30: 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		

Table10.31: Trigger logic module

10.13 Data recorder (DR)

10.13.1 Data recorder register

Register	Property	Description	Format
7000…7022	RW	Data recorder 1 (high speed)	Chapter 10.13.2 High-speed data recorder register structure
7023…7045	RW	Data recorder 2 (high speed)	
7046…7068	RW	Data recorder 3 (high speed)	
7069…7091	RW	Data recorder 4 (high speed)	
7092…7114	RW	Data recorder 5 (standard)	
7115…7137	RW	Data recorder 6 (standard)	
7138…7160	RW	Data recorder 7 (standard)	
7161…7138	RW	Data recorder 8 (standard)	
7134…7206	RW	Data recorder 9 (standard)	
7107…7229	RW	Data recorder 10 (standard)	
7230…7252	RW	Data recorder 11 (standard)	
7253…7275	RW	Data recorder 12 (standard)	
7276…7298	RW	Data recorder 13 (standard)	
7299…7321	RW	Data recorder 14 (standard)	
7322…7344	RW	Data recorder 15 (standard)	
7345…7367	RW	Data recorder 16 (standard)	
7368	RO	DR1 Size data record (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

Table10.32: 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

Offset	Property	Description	Format	Range/options
+ 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

Table10.33: 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…65535 (5760*)
+ 3	RW	Recording interval	UINT32	1…3456000 s (900*)
+ 5	RW	Recording delay [2)]	UINT16	0*…43200 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

Table10.34: 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

Register	Property		Description	Format
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

Table10.35: 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.

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 1000 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/1000

Offset	Property	Description	Format	Range/options
+ 0	RO	Trigger mode	UINT16	0*= disabled 1 = manual 2 = Setpoint 3 = Setpoint 4 = 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 1000, A
4N+5…5N+4	RO	I_2 of sample N#	UINT16	x 1000, A
5N+5…6N+4	RO	I_3 of sample N#	UINT16	x 1000, A

Table10.36: 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*)

<table>
<tr><th>Register</th><th>Property</th><th colspan="2">Description</th><th>Format</th><th colspan="2">Range/options</th></tr>
<tr><td>7702</td><td>RW</td><td colspan="2">Recording interval</td><td>UINT16</td><td colspan="2">0 = 5 min
1 = 10 min
2*= 15 min
3 = 30 min
4 = 60 min</td></tr>
<tr><td rowspan="2">7703</td><td rowspan="2">RW</td><td rowspan="6">Start-up time[2)]</td><td>HiWord: Year</td><td rowspan="2">UINT16</td><td colspan="2">0…99 (year- 2000)</td></tr>
<tr><td>LoWord: month</td><td colspan="2">1…12</td></tr>
<tr><td rowspan="2">7704</td><td rowspan="2">RW</td><td>HiWord: Date: Day</td><td rowspan="2">UINT16</td><td colspan="2">1…31</td></tr>
<tr><td>LoWord: Hour</td><td colspan="2">1…23</td></tr>
<tr><td rowspan="2">7705</td><td rowspan="2">RW</td><td>HiWord: Minute</td><td rowspan="2">UINT16</td><td colspan="2">0…59</td></tr>
<tr><td>LoWord: Second</td><td colspan="2">0…59</td></tr>
<tr><td>7706</td><td>RW</td><td colspan="2">Number of parameters (N)</td><td>UINT16</td><td colspan="2">0…5*</td></tr>
<tr><td>7707</td><td>RW</td><td colspan="2">Parameter 1</td><td>UINT16</td><td rowspan="5">0 = active energy import
1 = active energy export
2 = reactive energy import
3 = reactive energy export
4 = apparent energy</td><td>0*</td></tr>
<tr><td>7708</td><td>RW</td><td colspan="2">Parameter 2</td><td>UINT16</td><td>1*</td></tr>
<tr><td>7709</td><td>RW</td><td colspan="2">Parameter 3</td><td>UINT16</td><td>2*</td></tr>
<tr><td>7710</td><td>RW</td><td colspan="2">Parameter 4</td><td>UINT16</td><td>3*</td></tr>
<tr><td>7711</td><td>RW</td><td colspan="2">Parameter 5</td><td>UINT16</td><td>4*</td></tr>
<tr><td>7712</td><td>RO</td><td colspan="2">Data record size</td><td>UINT16</td><td colspan="2">Unit: bytes</td></tr>
</table>

Table10.37: 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

Table10.38: 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 1000	

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, %

Table10.39: 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	

Table10.40: 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 141)	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	HiWord: Event value	UINT16
+ 7	RO	LoWord: Event value	INT32

Table10.41: 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

Event classification	Event sub classification	Event value Unit Option	Description
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
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

Event classification	Event sub classification	Event value Unit Option	Description
3	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
	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

Event classification	Event sub classification	Event value Unit Option	Description
3	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
	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

Event classification	Event sub classification	Event value Unit Option	Description
	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
3		Reserved	
	91	Trigger value x 100	Under <-Setpoint U_{LN}
	92 2	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
	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

Event classification	Event sub classification	Event value Unit Option	Description
3	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 10,000	Under <-Setpoint THD_U
	113	Trigger value x 10,000	Under <-Setpoint $TOHD_U$
	114	Trigger value x 10,000	Under <-Setpoint $TEHD_U$
	115	Trigger value x 10,000	Under <-Setpoint THD_I
	116	Trigger value x 10,000	Under <-Setpoint $TOHD_I$
	117	Trigger value x 1000	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		Clock set via front panel
	4		Setup changed via device buttons
	5	0	DI counter cleared via front panel
	6		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

Table10.42: 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)

Table10.43: 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

Table10.44: 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	

Register	Property	Description	Format	Note
9825	RO	Serial number	UINT32	
9827…9829	Reserved			
9830	RO	Measuring current configuration	UINT16	1 / 5 (A)
9831	RO	U_S	UINT16	100/400 (V)

Table10.45: 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

Table10.46: ASCII coding of "PEM575"