16. Modbus Register Map

This chapter provides a complete description of the Modbus register map for the PEM353 series to facilitate the 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 PEM353 supports the following Modbus functions:

1. For reading out values:
   Read Holding Register; Function code 0x03
2. For setting DO status:
   Force Single Coil; Function code 0x05
3. For writing values:
   Preset Multiple Registers; Function code 0x10

Register formats used:

Float	IEEE754 32-bit (single precision floating point number)
INT16	Signed 16-bit integer
INT32	Signed 32-bit integer
UINT16	Unsigned 16-bit integer
UINT32	Unsigned 32-bit integer

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

16.1 Basic measured values

Register	Property	Description	Format	Scale/unit
0000	RO	U_{L1} 1)	Float	V
0002	RO	U_{L2} 1)	Float	
0004	RO	U_{L3} 1)	Float	
0006	RO	Ø U_{LN}	Float	
0008	RO	U_{L1L2}	Float	
0010	RO	U_{L2L3}	Float	
0012	RO	U_{L3L1}	Float	
0014	RO	Ø U_{LL}	Float	
0016	RO	I_1	Float	A
0018	RO	I_2	Float	
0020	RO	I_3	Float	
0022	RO	Ø I	Float	
0024	RO	P_{L1} 1)	Float	W
0026	RO	P_{L2} 1)	Float	
0028	RO	P_{L3} 1)	Float	
0030	RO	P_{tot}	Float	
0032	RO	Q_{L1} 1)	Float	var
0034	RO	Q_{L2} 1)	Float	
0036	RO	Q_{L3} 1)	Float	
0038	RO	Q_{tot}	Float	
0040	RO	S_{L1} 1)	Float	VA
0042	RO	S_{L2} 1)	Float	
0044	RO	S_{L3} 1)	Float	
0046	RO	S_{tot}	Float	
0048	RO	λ_{L1} 1)	Float	—
0050	RO	λ_{L2} 1)	Float	
0052	RO	λ_{L3} 1)	Float	
0054	RO	λ_{tot}	Float	
0056	RO	f	Float	Hz

Register	Property	Description	Format	Scale/unit
0058	RO	Phase angle U_{L1N} or U_{L1L2} (3P3W)	Float	°
0060	RO	Phase angle U_{L2N} or U_{L2L3} (3P3W)	Float	
0062	RO	Phase angle U_{L3N} or U_{L3L1} (3P3W)	Float	
0064	RO	Phase angle I_1	Float	
0066	RO	Phase angle I_2	Float	
0068	RO	Phase angle I_3	Float	
0070	RO	I_n (calculated)	Float	A
0072	RO	I_4 (measured)	Float	
0074	RO	Displacement factor cos φ L1	Float	—
0076	RO	Displacement factor cos φ L2	Float	
0078	RO	Displacement factor cos φ L3	Float	
0080	RO	Displacement factor total	Float	—
0082…0094	Reserved			
0096	RO	Status digital inputs [2]	UINT16	
0097	Reserved			
0098	RO	Status digital outputs [3]	UINT16	
0099	Reserved			
0100	RO	Setpoint status [4]	UINT16	
0101	RO	Status: Wiring diagnostic [5]	UINT16	
0102	RO	SOE log pointer [6]	UINT32	
0104	RO	Operating hours counter [7]	UINT32	0.1 h
0106…0111	Reserved			—
0112	RO	$P_{L1(f0)}$	Float	W
0114	RO	$P_{L2(f0)}$	Float	
0116	RO	$P_{L3(f0)}$	Float	
0118	RO	$P_{tot\ (f0)}$	Float	
0120	RO	P_{THD}	Float	
0122	RO	Pointer data recorder 1 [8]	UINT32	—
0124	RO	Pointer data recorder 2 [8]	UINT32	
0126	RO	Pointer data recorder 3 [8]	UINT32	
0128	RO	Pointer data recorder 4 [8]	UINT32	
0130	RO	Pointer data recorder 5 [8]	UINT32	
0132…0148	RO	Reserved		
0150	RO	$U_{L1(f0)}$ / $U_{L1L2(f0)}$ [9]	Float	V
0152	RO	$U_{L2(f0)}$ / $U_{L2L3(f0)}$ [9]	Float	
0154	RO	$U_{L3(f0)}$ / $U_{L3L1(f0)}$ [9]	Float	

Register	Property	Description	Format	Scale/unit
0156	RO	$I_{1(f0)}$ [9]	Float	A
0158	RO	$I_{2(f0)}$ [9]	Float	
0160	RO	$I_{3(f0)}$ [9]	Float	
0162	RO	U1 (positive sequence component *U*) [10]	Float	V
0164	RO	U2 (negative sequence component *U*) [10]	Float	
0166	RO	U0 (zero sequence component *U*) [10]	Float	
0168	RO	I1 (positive sequence component *I*) [10]	Float	A
0170	RO	I2 (negative sequence component *I*) [10]	Float	
0172	RO	I0 (zero sequence component *I*) [10]	Float	
0174	RO	Ir (residual current) [8]	Float	

Tab. 16.1: Basic measured values

Notes Tab. 16.1:

1) Only in the case of wye connection.

2) **Status register 0096**:
Represents the **status of the four digital inputs**
B0…B3 for DI1…DI4 (1 = active/closed; 0 = inactive/open)

3) **Status register 0098:**
Represents the **status of the two digital outputs**
B0 for DO1 (1 = active/closed; 0 = inactive/open)
B1 for DO2 (1 = active/closed; 0 = inactive/open)

4) **Status register 0100** indicates the different setpoints (1 = active, 0 = inactive). .

Bit in register 0100	Status	Bit in register 0082	Status
B0	Setpoint 1	B5	Setpoint 6
B1	Setpoint 2	B6	Setpoint 7
B2	Setpoint 3	B7	Setpoint 8
B3	Setpoint 4	B8	Setpoint 9
B4	Setpoint 5	B9…15	Reserved

Tab. 16.2: Bit sequence status setpoints (0100)

5) The diagnostic register 0101 shows wiring errors. In 3P4W and 3P3W mode, there is an error detection feature that detects voltage problems already during the PEM353 setup phase.

The diagnosis is based on the following assumptions:
- Voltage/current rotating field is equal
- The measured active energy is assumed as the related active energy and is > 0 W
- The wiring of the measuring inputs (current and voltage) is correct

Status register 0101 (1 = feature fulfilled, 0 = feature not fulfilled)

Bit	Parameter	3P3W	3P4W
00	Summary bit (set when one of bits 1…15 is set)	x	x
01	Frequency deviation outside 45…65 Hz	x	x
02	*U* < 10 % of PT primary voltage (register 6000)	—	x
03	*I* < 10 % of CT primary current (register 6004)	x	x
04	Reserved	—	—
05	Reserved	—	—
06	The voltage rotating field rotates anticlockwise.	—	x
07	The current rotating field rotates anticlockwise.	x	x
08	The total active power is negative.	—	x
09	The active power on L1 is negative.	—	x
10	The active power on L2 is negative.	—	x
11	The active power on L3 is negative.	—	x
12	Measuring current transformer 1 polarity may be reversed.	—	x
13	Measuring current transformer 2 polarity may be reversed.	—	x
14	Measuring current transformer 3 polarity may be reversed.	—	x
15	Reserved	—	—

6) The SOE log pointer points to the last entry added. The event log works like a ring buffer according to the FIFO principle: If the pointer has reached the value 0xFFFFFFFFFF, the next event resets the pointer to 0x00000000 (overflow). The event log can be cleared in the setup parameters (write 0xFF00 to register 9609) or using the device buttons (Setup > Maintenance > Clear Registers). The SOE log can store a maximum of 100 events.

7) Time during which the device has measured a higher current than the threshold value set in register 6049 on any phase on the secondary side (i.e. without CTs).

8) for PEM353-N only

9) When wiring mode "1P2W L-N" or "1P2W L-L" is selected, the registers are reserved.

10) When wiring mode "1P2W L-N", "1P2W L-L" or "1P3W" is selected, the registers are reserved.

16.2 Energy measurement

After reaching the maximum value of 999,999,999 kWh/kvarh/kVAh, the measurement will roll over to 0 (overflow).

16.2.1 Energy meters and tariffs (present measured values)

Register Σ L1…3	Register L1	Register L2	Register L3	Prop-erty	Energy meters	Description	Format	Unit
0500	0620	0740	0860	RW	Global	Active energy import	INT32	0.1 x kWh
0502	0622	0742	0862	RW		Active energy export	INT32	
0504	0624	0744	0864	RO		Net active energy	INT32	
0506	0626	0746	0866	RO		Total active energy	INT32	
0508	0628	0748	0868	RW		Reactive energy import	INT32	0.1 x kvarh
0510	0630	0750	0870	RW		Reactive energy export	INT32	
0512	0632	0752	0872	RO		Net reactive energy	INT32	
0514	0634	0754	0874	RO		Total reactive energy	INT32	
0516	0636	0756	0876	RW		Apparent energy	INT32	0.1 x kVAh
0518	0638	0758	0878	RW		Reactive energy Q1	INT32	0.1 x kvarh
0520	0640	0760	0880	RW		Reactive energy Q2	INT32	
0522	0642	0762	0882	RW		Reactive energy Q3	INT32	
0524	0644	0764	0884	RW		Reactive energy Q4	INT32	
0526	0646	0766	0886	RW	Tariff 1	Active energy import	INT32	0.1 x kWh
0528	0648	0768	0888	RW		Active energy export	INT32	
0530	0650	0770	0890	RW		Reactive energy import	INT32	0.1 x kvarh
0532	0652	0772	0892	RW		Reactive energy export	INT32	
0534	0654	0774	0894	RW		Apparent energy	INT32	0.1 x kVAh
0536	0656	0776	0896	RW	Tariff 2	Active energy import	INT32	0.1 x kWh
0538	0658	0778	0898	RW		Active energy export	INT32	
0540	0660	0780	0900	RW		Reactive energy import	INT32	0.1 x kvarh
0542	0662	0782	0902	RW		Reactive energy export	INT32	
0544	0664	0784	0904	RW		Apparent energy	INT32	0.1 x kVAh

Register Σ L1…3	Register L1	Register L2	Register L3	Property	Energy meters	Description	Format	Unit
0546	0666	0786	0906	RW	Tariff 3	Active energy import	INT32	0.1 x kWh
0548	0668	0788	0908	RW		Active energy export	INT32	
0550	0670	0790	0910	RW		Reactive energy import	INT32	0.1 x kvarh
0552	0672	0792	0912	RW		Reactive energy export	INT32	
0554	0674	0794	0914	RW		Apparent energy	INT32	0.1 x kVAh
0556	0676	0796	0916	RW	Tariff 4	Active energy import	INT32	0.1 x kWh
0558	0678	0798	0918	RW		Active energy export	INT32	
0560	0680	0800	0920	RW		Reactive energy import	INT32	0.1 x kvarh
0562	0682	0802	0922	RW		Reactive energy export	INT32	
0564	0684	0804	0924	RW		Apparent energy	INT32	0.1 x kVAh
0566	0686	0806	0926	RW	Tariff 5	Active energy import	INT32	0.1 x kWh
0568	0688	0808	0928	RW		Active energy export	INT32	
0570	0690	0810	0930	RW		Reactive energy import	INT32	0.1 x kvarh
0572	0692	0812	0932	RW		Reactive energy export	INT32	
0574	0694	0814	0934	RW		Apparent energy	INT32	0.1 x kVAh
0576	0696	0816	0936	RW	Tariff 6	Active energy import	INT32	0.1 x kWh
0578	0698	0818	0938	RW		Active energy export	INT32	
0580	0700	0820	0940	RW		Reactive energy import	INT32	0.1 x kvarh
0582	0702	0822	0942	RW		Reactive energy export	INT32	
0584	0704	0824	0944	RW		Apparent energy	INT32	0.1 x kVAh
0586	0706	0826	0946	RW	Tariff 7	Active energy import	INT32	0.1 x kWh
0588	0708	0828	0948	RW		Active energy export	INT32	
0590	0710	0830	0950	RW		Reactive energy import	INT32	0.1 x kvarh
0592	0712	0832	0952	RW		Reactive energy export	INT32	
0594	0714	0834	0954	RW		Apparent energy	INT32	0.1 x kVAh

Register Σ L1…3	Register L1	Register L2	Register L3	Property	Energy meters	Description	Format	Unit
0596	0716	0836	0956	RW	Tariff 8	Active energy import	INT32	0.1 x kWh
0598	0718	0838	0958	RW		Active energy export	INT32	
0600	0720	0840	0960	RW		Reactive energy import	INT32	0.1 x kvarh
0602	0722	0842	0962	RW		Reactive energy export	INT32	
0604	0724	0844	0964	RW		Apparent energy	INT32	0.1 x kVAh

Tab. 16.3: Register of energy meters and tariffs (present measured values)

16.2.2 Monthly energy log (Energy Log)

Register	Property	Energy meters	Description	Format	Value/unit
0980	RW	Global	Month [1)]	INT16	0*…12
0981	RO		HiByte: year (0…99) LoByte: month (1…12)	INT16	Timestamp (20YY/MM/DD hh:mm:ss) [2)]
0982	RO		HiByte: Day (1…31) LoByte: hour (0…23)	INT16	
0983	RO		HiByte: minute (0…59) LoByte: second (1…59)	INT16	
0984	RW		Active energy import	INT32	0.1 x kWh
0986	RW		Active energy export	INT32	
0988	RO		Net active energy	INT32	
0990	RO		Total active energy	INT32	
0992	RW		Reactive energy import	INT32	0.1 x kvarh
0994	RW		Reactive energy export	INT32	
0996	RO		Net reactive energy	INT32	
0998	RO		Total reactive energy	INT32	
1000	RW		Apparent energy	INT32	0.1 x kVAh
1002	RW		Reactive energy Q1	INT32	0.1 x kvarh
1004	RW		Reactive energy Q2	INT32	
1006	RW		Reactive energy Q3	INT32	
1008	RW		Reactive energy Q4	INT32	
1010	RW	Tariff 1	Active energy import	INT32	0.1 x kWh
1012	RW		Active energy export	INT32	
1014	RW		Reactive energy import	INT32	0.1 x kvarh
1016	RW		Reactive energy export	INT32	
1018	RW		Apparent energy	INT32	0.1 x kVAh
1020	RW	Tariff 2	Active energy import	INT32	0.1 x kWh
1022	RW		Active energy export	INT32	
1024	RW		Reactive energy import	INT32	0.1 x kvarh
1026	RW		Reactive energy export	INT32	
1028	RW		Apparent energy	INT32	0.1 x kVAh
1030	RW	Tariff 3	Active energy import	INT32	0.1 x kWh
1032	RW		Active energy export	INT32	
1034	RW		Reactive energy import	INT32	0.1 x kvarh
1036	RW		Reactive energy export	INT32	
1038	RW		Apparent energy	INT32	0.1 x kVAh

Register	Property	Energy meters	Description	Format	Value/unit
1040	RW	Tariff 4	Active energy import	INT32	0.1 x kWh
1042	RW		Active energy export	INT32	
1044	RW		Reactive energy import	INT32	0.1 x kvarh
1046	RW		Reactive energy export	INT32	
1048	RW		Apparent energy	INT32	0.1 x kVAh
1050	RW	Tariff 5	Active energy import	INT32	0.1 x kWh
1052	RW		Active energy export	INT32	
1054	RW		Reactive energy import	INT32	0.1 x kvarh
1056	RW		Reactive energy export	INT32	
1058	RW		Apparent energy	INT32	0.1 x kVAh
1060	RW	Tariff 6	Active energy import	INT32	0.1 x kWh
1062	RW		Active energy export	INT32	
1064	RW		Reactive energy import	INT32	0.1 x kvarh
1066	RW		Reactive energy export	INT32	
1068	RW		Apparent energy	INT32	0.1 x kVAh
1070	RW	Tariff 7	Active energy import	INT32	0.1 x kWh
1072	RW		Active energy export	INT32	
1074	RW		Reactive energy import	INT32	0.1 x kvarh
1076	RW		Reactive energy export	INT32	
1078	RW		Apparent energy	INT32	0.1 x kVAh
1080	RW	Tariff 8	Active energy import	INT32	0.1 x kWh
1082	RW		Active energy export	INT32	
1084	RW		Reactive energy import	INT32	0.1 x kvarh
1086	RW		Reactive energy export	INT32	
1088	RW		Apparent energy	INT32	0.1 x kVAh

Tab. 16.4: Monthly energy log register (Energy Log)

Notes Tab. 16.4:

1) This register represents the month that has been read out. In addition to the present month, the last 12 months are available. Register content 0 = this month, 1 = last month, 2 = two months back, etc. To read out the data of a certain month, the correct value for this month must be written into register 980.

2) The timestamp shows when the period for each stored month log ended; for the present month, it shows the present date and time since the recording has not finished yet.

The monthly log of the present month (not yet ended) can still be modified. Stored concluded monthly logs, however, can only be read out.

16.2.3 Interval energy measurement (EN Period)

The final values of the energies counted in the last completed interval (EN Period) can be read out here.

Register	Property	Description	Format	Unit
1100	RW	Active energy import	INT32	0.1 kWh
1102	RW	Active energy export	INT32	
1104	RW	Reactive energy import	INT32	0.1 kvarh
1106	RW	Reactive energy export	INT32	
1108	RW	Apparent energy	INT32	0.1 kVAh

Tab. 16.5: Interval energy measurement register (EN Period)

16.2.4 Pulse counter digital inputs

Register	Property	Description	Format	Unit
1200	RW	DI1 pulse counter	UINT32	0…1.000.000.000 DIx pulse counter = pulse counter x pulse width
1202	RW	DI2 pulse counter	UINT32	
1204	RW	DI3 pulse counter	UINT32	
1206	RW	DI4 pulse counter	UINT32	

Tab. 16.6: Register of pulse counter digital inputs

16.3 Power Quality

Register	Property	Description	Format	Unit
1300	RO	TDD_{I1}	Float	
1302	RO	TDD_{I2}	Float	
1304	RO	TDD_{I3}	Float	
1306	RO	$TODD_{I1}$	Float	
1308	RO	$TODD_{I2}$	Float	
1310	RO	$TODD_{I3}$	Float	
1312	RO	$TEDD_{I1}$	Float	
1314	RO	$TEDD_{I2}$	Float	
1316	RO	$TEDD_{I3}$	Float	—
1318	RO	k-factor I_1	Float	
1320	RO	k-factor I_2	Float	
1322	RO	k-factor I_3	Float	
1324	RO	Crest factor I_1	Float	
1326	RO	Crest factor I_2	Float	
1328	RO	Crest factor I_3	Float	
1330	RO	Voltage unbalance	Float	
1332	RO	Current unbalance	Float	

Tab. 16.7: Power quality register

16.4 Harmonics currents

Register	Property	Description	Format	Unit
1400	RO	THD_{I1}	Float	—
1402	RO	THD_{I2}	Float	
1404	RO	THD_{I3}	Float	
1406	RO	$TOHD_{I1}$	Float	
1408	RO	$TOHD_{I2}$	Float	
1410	RO	$TOHD_{I3}$	Float	
1412	RO	$TEHD_{I1}$	Float	
1414	RO	$TEHD_{I2}$	Float	
1416	RO	$TEHD_{I3}$	Float	
1418	RO	$HD02_{I1}$	Float	
1420	RO	$HD02_{I2}$	Float	
1422	RO	$HD02_{I3}$	Float	
…				
1592	RO	$HD31_{I1}$	Float	
1594	RO	$HD31_{I2}$	Float	
1596	RO	$HD31_{I3}$	Float	

Tab. 16.8: Harmonics currents register

Note Tab. 16.8

The registers 1400…1596 depend on the calculation setting of register 6028.

16.5 Harmonics voltages

Register	Property	Description	Format	Unit
1600	RO	THD_{UL1} or THD_{UL1L2}	Float	—
1602	RO	THD_{UL2} or THD_{UL2L3}	Float	
1604	RO	THD_{UL3} or THD_{U31L1}	Float	
1606	RO	$TOHD_{UL1}$ or $TOHD_{UL1L2}$	Float	
1608	RO	$TOHD_{UL2}$ or $TOHD_{UL2L3}$	Float	
1610	RO	$TOHD_{UL3}$ or $TOHD_{UL3L1}$	Float	
1612	RO	$TEHD_{UL1}$ or $TEHD_{UL1L2}$	Float	
1614	RO	$TEHD_{UL2}$ or $TEHD_{UL2L3}$	Float	
1616	RO	$TEHD_{UL3}$ or $TEHD_{UL3L1}$	Float	
1618	RO	$HD02_{UL1}$ or $HD02_{UL1L2}$	Float	
1620	RO	$HD02_{UL2}$ or $HD02_{UL2L3}$	Float	
1622	RO	$HD02_{UL3}$ or $HD02_{UL3L1}$	Float	
…				
1792	RO	$HD31_{UL1}$ or $HD31_{UL1L2}$	Float	
1794	RO	$HD31_{UL2}$ or $HD31_{UL2L3}$	Float	
1796	RO	$HD31_{UL3}$ or $HD02_{UL3L1}$	Float	

Tab. 16.9: Harmonics voltages register

Note Tab. 16.9

The registers 1600…1796 depend on the calculation setting of register 6028.

16.6 Demand

Register	Property	Description	Format	Scale/unit
3000	RO	Demand I_1	Float	A
3002	RO	Demand I_2	Float	A
3004	RO	Demand I_3	Float	A
3006	RO	Demand P_{tot}	Float	W
3008	RO	Demand Q_{tot}	Float	var
3010	RO	Demand S_{tot}	Float	VA

Tab. 16.10: Demands register

16.7 Predicted demand

Register	Property	Description	Format	Scale/unit
3200	RO	Predicted demand I_1	Float	A
3202	RO	Predicted demand I_2	Float	A
3204	RO	Predicted demand I_3	Float	A
3206	RO	Predicted demand P_{tot}	Float	W
3208	RO	Predicted demand Q_{tot}	Float	var
3210	RO	Predicted demand S_{tot}	Float	VA

Tab. 16.11: Predicted demand register

16.8 Peak demand of this month

Register	Property	Energy meters	Description	Format	Unit
3400…3405	RO	Global	Peak demand I_1 of this month	See data structure Tab. 16.14	A
3406…3411	RO		Peak demand I_2 of this month		A
3412…3417	RO		Peak demand I_3 of this month		A
3418…3423	RO		Peak demand *P* of this month		W
3424…3429	RO		Peak demand *Q* of this month		var
3430…3435	RO		Peak demand *S* of this month		VA
3436…3441	RO	Tariff 1	Peak demand *P* of this month		W
3442…3447	RO		Peak demand *Q* of this month		var
3448…3453	RO		Peak demand *S* of this month		VA
3454…3459	RO	Tariff 2	Peak demand *P* of this month		W
3460…3465	RO		Peak demand *Q* of this month		var
3466…3471	RO		Peak demand *S* of this month		VA
3472…3477	RO	Tariff 3	Peak demand *P* of this month		W
3478…3483	RO		Peak demand *Q* of this month		var
3484…3489	RO		Peak demand *S* of this month		VA
3490…3495	RO	Tariff 4	Peak demand *P* of this month		W
3498…3502	RO		Peak demand *Q* of this month		var
3503…3507	RO		Peak demand *S* of this month		VA
3508…3513	RO	Tariff 5	Peak demand *P* of this month		W
3514…3519	RO		Peak demand *Q* of this month		var
3520…3525	RO		Peak demand *S* of this month		VA
3526…3531	RO	Tariff 6	Peak demand *P* of this month		W
3532…3537	RO		Peak demand *Q* of this month		var
3538…3543	RO		Peak demand *S* of this month		VA
3544…3549	RO	Tariff 7	Peak demand *P* of this month		W
3550…3555	RO		Peak demand *Q* of this month		var
3556…3561	RO		Peak demand *S* of this month		VA
3562…3567	RO	Tariff 8	Peak demand *P* of this month	See data structure Tab. 16.14	W
3568…3573	RO		Peak demand *Q* of this month		var
3574…3579	RO		Peak demand *S* of this month		VA

Tab. 16.12: Register of peak demand this month

16.9 Peak demand of last month

"Last month" is the period before the last self-read time.

Register	Property	Energy meters	Description	Format	Unit
3600…3605	RO	Global	Peak demand I_1 of last month	See data structure Tab. 16.14	A
3606…3611	RO		Peak demand I_2 of last month		A
3612…3617	RO		Peak demand I_3 of last month		A
3618…3623	RO		Peak demand *P* of last month		W
3624…3629	RO		Peak demand *Q* of last month		var
3630…3635	RO		Peak demand *S* of last month		VA
3636…3641	RO	Tariff 1	Peak demand *P* of last month		W
3642…3647	RO		Peak demand *Q* of last month		var
3648…3653	RO		Peak demand *S* of last month		VA
3654…3659	RO	Tariff 2	Peak demand *P* of last month		W
3660…3665	RO		Peak demand *Q* of last month		var
3666…3671	RO		Peak demand *S* of last month		VA
3672…3677	RO	Tariff 3	Peak demand *P* of last month		W
3678…3683	RO		Peak demand *Q* of last month		var
3684…3689	RO		Peak demand *S* of last month		VA
3690…3695	RO	Tariff 4	Peak demand *P* of last month		W
3698…3702	RO		Peak demand *Q* of last month		var
3703…3707	RO		Peak demand *S* of last month		VA
3708…3713	RO	Tariff 5	Peak demand *P* of last month	See data structure Tab. 16.14	W
3714…3719	RO		Peak demand *Q* of last month		var
3720…3725	RO		Peak demand *S* of last month		VA
3726…3731	RO	Tariff 6	Peak demand *P* of last month		W
3732…3737	RO		Peak demand *Q* of last month		var
3738…3743	RO		Peak demand *S* of last month		VA
3744…3749	RO	Tariff 7	Peak demand *P* of last month		W
3750…3755	RO		Peak demand *Q* of last month		var
3756…3761	RO		Peak demand *S* of last month		VA
3762…3767	RO	Tariff 8	Peak demand *P* of last month		W
3768…3773	RO		Peak demand *Q* of last month		var
3774…3779	RO		Peak demand *S* of last month		VA

Tab. 16.13: Register of peak demand last month

Peak demand data structure

Offset	Description	Note
+ 0	HiWord: year	1…99 (year-2000)
	LoWord: month	1…12
+ 1	HiWord: day	1…28/29/30/31
	LoWord: hour	0…23
+2	HiWord: minute	0…59
	LoWord: second	0…59
+ 3	Millisecond	0…999
+4…+5	Peak demand value	

Tab. 16.14: Peak demand data structure

16.10 Max./Min. log

16.10.1 Maximum values of this month

Register	Property	Description	Format	Unit
4000…4005	RO	$U_{L1\ max}$	See data structure Tab. 16.19	V
4006…4011	RO	$U_{L2\ max}$		
4012…4017	RO	$U_{L3\ max}$		
4018…4023	RO	Ø $U_{LN\ max}$		
4024…4029	RO	$U_{L1L2\ max}$		
4030…4035	RO	$U_{L2L3\ max}$		
4036…4041	RO	$U_{L3L1\ max}$		
4042…4047	RO	Ø $U_{LL\ max}$		
4048…4053	RO	$I_{1\ max}$		A
4054…4059	RO	$I_{2\ max}$		
4060…4065	RO	$I_{3\ max}$		
4066…4071	RO	Ø I_{max}		
4072…4077	RO	$P_{L1\ max}$		W
4078…4083	RO	$P_{L2\ max}$		
4084…4089	RO	$P_{L3\ max}$		
4090…4095	RO	$P_{tot\ max}$		
4096…4101	RO	$Q_{L1\ max}$		var
4102…4107	RO	$Q_{L2\ max}$		
4108…4113	RO	$Q_{L3\ max}$		
4114…4119	RO	$Q_{tot\ max}$		
4120…4125	RO	$S_{L1\ max}$		VA
4126…4131	RO	$S_{L2\ max}$		
4132…4137	RO	$S_{L3\ max}$		
4138…4143	RO	$S_{tot\ max}$		
4144…4149	RO	$\lambda_{1\ max}$		—
4150…4155	RO	$\lambda_{2\ max}$		
4156…4161	RO	$\lambda_{3\ max}$		
4162…4167	RO	$\lambda_{tot\ max}$		
4168…4173	RO	f_{max}		Hz
4174…4179	RO	$I_{n\ max}$ (calculated)		A
4180…4185	RO	$THD_{UL1\ max}$ or $THD_{UL1L2\ max}$		
4186…4191	RO	$THD_{UL2\ max}$ or $THD_{UL2L3\ max}$		

Register	Property	Description	Format	Unit
4192…4197	RO	$THD_{UL3\ max}$ or $THD_{UL3L1\ max}$	See data structure Tab. 16.19	
4198…4203	RO	$THD_{I1\ max}$		
4204…4209	RO	$THD_{I2\ max}$		
4210…4215	RO	$THD_{I3\ max}$		
4216…4221	RO	k-factor $I_{1\ max}$		
4222…4227	RO	k-factor $I_{2\ max}$		
4228…4233	RO	k-factor $I_{3\ max}$		
4234…4239	RO	Crest factor $I_{1\ max}$		
4240…4245	RO	Crest factor $I_{2\ max}$		
4246…4251	RO	Crest factor $I_{3\ max}$		
4252…4257	RO	Max. voltage unbalance		
4258…4263	RO	Max. current unbalance		
4264…4269	RO	$I_{4\ max}$		A
4270…4275	RO	$I_{r\ max}$		A

Tab. 16.15: Maximum values of this month

16.10.2 Minimum values of this month

Register	Property	Description	Format	Unit
4300…4305	RO	$U_{L1\ min}$	See data structure Tab. 16.19	V
4306…4311	RO	$U_{L2\ min}$		
4312…4317	RO	$U_{L3\ min}$		
4318…4323	RO	Ø $U_{LN\ min}$		
4324…4329	RO	$U_{L1L2\ min}$		
4330…4335	RO	$U_{L2L3\ min}$		
4336…4341	RO	$U_{L3L1\ min}$		
4342…4347	RO	Ø $U_{LL\ min}$		
4348…4353	RO	$I_{1\ min}$		A
4354…4359	RO	$I_{2\ min}$		
4360…4365	RO	$I_{3\ min}$		
4366…4371	RO	Ø I_{min}		
4372…4377	RO	$P_{L1\ min}$		W
4378…4383	RO	$P_{L2\ min}$		
4384…4389	RO	$P_{L3\ min}$		
4390…4395	RO	$P_{tot\ min}$		

Register	Property	Description	Format	Unit
4396…4401	RO	$Q_{L1\ min}$	See data structure Tab. 16.19	var
4402…4407	RO	$Q_{L2\ min}$		
4408…4413	RO	$Q_{L3\ min}$		
4414…4419	RO	$Q_{tot\ min}$		
4420…4425	RO	$S_{L1\ min}$		VA
4426…4431	RO	$S_{L2\ min}$		
4432…4437	RO	$S_{L3\ min}$		
4438…4443	RO	$S_{tot\ min}$		
4444…4449	RO	$\lambda_{1\ min}$		—
4450…4455	RO	$\lambda_{2\ min}$		
4456…4461	RO	$\lambda_{3\ min}$		
4462…4467	RO	$\lambda_{tot\ min}$		
4468…4473	RO	f_{min}		Hz
4474…4479	RO	$I_{n\ min}$ (calculated)		A
4480…4485	RO	$THD_{UL1\ min}$ or $THD_{UL1L2\ min}$		
4486…4491	RO	$THD_{UL2\ min}$ or $THD_{UL2L3\ min}$		
4492…4497	RO	$THD_{UL3\ min}$ or $THD_{UL3L1\ min}$		
4498…4503	RO	$THD_{I1\ min}$		
4504…4509	RO	$THD_{I2\ min}$		
4510…4515	RO	$THD_{I3\ min}$		
4516…4521	RO	k-factor $I_{1\ min}$		
4522…4527	RO	k-factor $I_{2\ min}$		
4528…4533	RO	k-factor $I_{3\ min}$		
4534…4539	RO	Crest factor $I_{1\ min}$		
4540…4545	RO	Crest factor $I_{2\ min}$		
4546…4551	RO	Crest factor $I_{3\ min}$		
4552…4557	RO	Min. voltage unbalance		
4558…4563	RO	Min. current unbalance		
4564…4569	RO	$I_{4\ min}$		A
4570…4575	RO	$I_{r\ min}$		A

Tab. 16.16: Minimum values of this month

16.10.3 Maximum values of last month

Register	Property	Description	Format	Unit
4600…4605	RO	$U_{L1\ max}$	See data structure Tab. 16.19	V
4606…4611	RO	$U_{L2\ max}$		
4612…4617	RO	$U_{L3\ max}$		
4618…4623	RO	Ø $U_{LN\ max}$		
4624…4629	RO	$U_{L1L2\ max}$		
4630…4635	RO	$U_{L2L3\ max}$		
4636…4641	RO	$U_{L3L1\ max}$		
4642…4647	RO	Ø $U_{LL\ max}$		
4648…4653	RO	$I_{1\ max}$		A
4654…4659	RO	$I_{2\ max}$		
4660…4665	RO	$I_{3\ max}$		
4666…4671	RO	Ø I_{max}		
4672…4677	RO	$P_{L1\ max}$		W
4678…4683	RO	$P_{L2\ max}$		
4684…4689	RO	$P_{L3\ max}$		
4690…4695	RO	$P_{tot\ max}$		
4696…4701	RO	$Q_{L1\ max}$		var
4702…4707	RO	$Q_{L2\ max}$		
4708…4713	RO	$Q_{L3\ max}$		
4714…4719	RO	$Q_{tot\ max}$		
4720…4725	RO	$S_{L1\ max}$		VA
4726…4731	RO	$S_{L2\ max}$		
4732…4737	RO	$S_{L3\ max}$		
4738…4743	RO	$S_{tot\ max}$		
4744…4749	RO	$\lambda_{1\ max}$		—
4750…4755	RO	$\lambda_{2\ max}$		
4756…4761	RO	$\lambda_{3\ max}$		
4762…4767	RO	$\lambda_{tot\ max}$		
4768…4773	RO	f_{max}		Hz
4774…4779	RO	$I_{n\ max}$ (calculated)		A
4780…4785	RO	$THD_{UL1\ max}$ or $THD_{UL1L2\ max}$		
4786…4791	RO	$THD_{UL2\ max}$ or $THD_{UL2L3\ max}$		
4792…4797	RO	$THD_{UL3\ max}$ or $THD_{UL3L1\ max}$		
4798…4803	RO	$THD_{I1\ max}$		

Register	Property	Description	Format	Unit
4804…4809	RO	$THD_{I2\ max}$		
4810…4815	RO	$THD_{I3\ max}$		
4816…4821	RO	k-factor $I_{1\ max}$		
4822…4827	RO	k-factor $I_{2\ max}$		
4828…4833	RO	k-factor $I_{3\ max}$		
4834…4839	RO	Crest factor $I_{1\ max}$		
4840…4845	RO	Crest factor $I_{2\ max}$	See data structure Tab. 16.19	
4846…4851	RO	Crest factor $I_{3\ max}$		
4852…4857	RO	Max. voltage unbalance		
4858…4863	RO	Max. current unbalance		
4864…4869	RO	$I_{4\ max}$		A
4870…4875	RO	$I_{r\ max}$		A

Tab. 16.17: Maximum values of last month

16.10.4 Minimum values of last month

Register	Property	Description	Format	Unit
4900…4905	RO	$U_{L1\ min}$	See data structure Tab. 16.19	V
4906…4911	RO	$U_{L2\ min}$		
4912…4917	RO	$U_{L3\ min}$		
4918…4923	RO	Ø $U_{LN\ min}$		
4924…4929	RO	$U_{L1L2\ min}$		
4930…4935	RO	$U_{L2L3\ min}$		
4936…4941	RO	$U_{L3L1\ min}$		
4942…4947	RO	Ø $U_{LL\ min}$		
4948…4953	RO	$I_{1\ min}$		A
4954…4959	RO	$I_{2\ min}$		
4960…4965	RO	$I_{3\ min}$		
4966…4971	RO	Ø I_{min}		
4972…4977	RO	$P_{L1\ min}$		W
4978…4983	RO	$P_{L2\ min}$		
4984…4989	RO	$P_{L3\ min}$		
4990…4995	RO	$P_{tot\ min}$		

Register	Property	Description	Format	Unit
4996…5001	RO	$Q_{L1\ min}$	See data structure Tab. 16.19	var
5002…5007	RO	$Q_{L2\ min}$		
5008…5013	RO	$Q_{L3\ min}$		
5014…5019	RO	$Q_{tot\ min}$		
5020…5025	RO	$S_{L1\ min}$		VA
5026…5031	RO	$S_{L2\ min}$		
5032…5037	RO	$S_{L3\ min}$		
5038…5043	RO	$S_{tot\ min}$		
5050…5049	RO	$\lambda_{1\ min}$		—
5050…5055	RO	$\lambda_{2\ min}$		
5056…5061	RO	$\lambda_{3\ min}$		
5062…5067	RO	$\lambda_{tot\ min}$		
5068…5073	RO	f_{min}		Hz
5074…5079	RO	$I_{n\ min}$ (calculated)		A
5080…5085	RO	$THD_{UL1\ min}$ or $THD_{UL1L2\ min}$		
5086…5091	RO	$THD_{UL2\ min}$ or $THD_{UL2L3\ min}$		
5092…5097	RO	$THD_{UL3\ min}$ or $THD_{UL3L1\ min}$		
5098…5103	RO	$THD_{I1\ min}$		
5104…5109	RO	$THD_{I2\ min}$		
5110…5115	RO	$THD_{I3\ min}$		
5116…5121	RO	k-factor $I_{1\ min}$		
5122…5127	RO	k-factor $I_{2\ min}$		
5128…5133	RO	k-factor $I_{3\ min}$		
5134…5139	RO	Crest factor $I_{1\ min}$		
5140…5145	RO	Crest factor $I_{2\ min}$		
5146…5151	RO	Crest factor $I_{3\ min}$		
5152…5157	RO	Min. voltage unbalance		
5158…5163	RO	Min. current unbalance		
5164…5169	RO	$I_{4\ min}$		A
5170…5175	RO	$I_{r\ min}$		A

Tab. 16.18: Minimum values of last month

16.10.5 Max./Min. log data structure

Offset	Property	Description	Note
+ 0	RO	HiWord: year	1…99 (year-2000)
	RO	LoWord: month	1…12
+ 1	RO	HiWord: day	1…28/29/30/31
	RO	LoWord: hour	0…23
+ 2	RO	HiWord: minute	0…59
	RO	LoWord: second	0…59
+ 4…+5	RO	Max. or Min. value	

Tab. 16.19: Max./Min. log data structure

16.11 Setup parameters (basic)

* = factory settings

Register	Property	Description	Format	Range/unit
6000	RW	PT primary side [1)]	UINT32	1…1,000,000 V; 100* V
6002	RW	PT secondary side	UINT32	1…690 V; 100* V
6004	RW	CT primary side	UINT32	1…30,000 A; 5* A
6006	RW	CT secondary side	UINT32	1…5 A; 5* A
6008	RW	Reserved	UINT32	
6010	RW	Reserved	UINT32	
6012	RW	I_4 primary side	UINT32	1…30,000 A; 5* A
6014	RW	I_4 secondary side	UINT32	1…5 A; 5* A
6016	RW	Reserved	UINT32	
6018	RW	Reserved	UINT32	
6020	RW	Wiring mode	UINT16	0 = Demo 1 = 1P2W L-N 2 = 1P2W L-L 3 = 1P3W 4 = 3P3W 5 = 3P4W*
6021	RW	Power factor λ rule	UINT16	0 = IEC* 1= IEEE 2 = -IEEE
6022	RW	Calculation method *S*	UINT16	0 = vector* 1 = scalar
6023	RW	Current transformer L1 polarity	UINT16	0 = normal* 1 = reversed
6024	RW	Current transformer L2 polarity	UINT16	0 = normal * 1= reversed
6025	RW	Current transformer L3 polarity	UINT16	0 = normal * 1= reversed

Register	Property	Description	Format	Range/unit
6026	RW	Reserved	UINT16	
6027	RW	Reserved	UINT16	
6028	RW	THD calculation [2) 3)]	UINT16	0 = THDf* 1 = THDr
6029	RW	Demand measurement period	UINT16	1, 2, 3, 5, 10, 15*, 60 minutes
6030	RW	Number of sliding windows	UINT16	1*…15
6031	RW	Dynamics of the demand prediction	UINT16	70*…99 (High value = high dynamics, but also high sensitivity to noise)
6032	RW	Method for setting and resetting the DO and RO [4)]	UINT16	0* = disabled 1 = enabled
6033	RW	Self-read time for the peak demand log and the Max./Min. log [5)]	UINT16	0 = beginning of the month 0xFFFF* = manual Other value = automatic
6034	RW	Self-read time for the monthly energy log [6)]	UINT16	0*
6035	RW	Energy pulse constant	UINT16	0 = 1000 pulses/kxh 1 = 3200 pulses/kxh
6036	RW	LED energy pulses	UINT16	0 = disabled 1 = active energy 2 = reactive energy
6037	RW	Screen dark after	UINT16	0…60 minutes; 5*
6038	RW	Language	UINT16	1 = English
6039	RW	Date format (on display)	UINT16	0*= YYMMDD 1 = MMDDYY 2 = DDMMYY
6040	RW	Decimal separator	UINT16	0 = . (decimal point) 1 = , (decimal comma)
6041	RW	Monthly freeze self-read time (monthly log/freeze log) [6)]	UINT16	0*
6042	RW	Daily freeze self-read time (daily log/freeze log) [7)]	UINT16	0*
6043	RW	Standard display (1st measured quantity) [8)]	UINT16	0…36, 7*
6044	RW	Standard display (2nd measured quantity) [8)]	UINT16	0…36, 11*
6045	RW	Standard display (3rd measured quantity) [8)]	UINT16	0…36, 12*
6046	RW	Standard display (4th measured quantity) [8)]	UINT16	0…36, 15*

Register	Property	Description	Format	Range/unit
6047	RW	EN Period [9)]	UINT16	5…60* min
6048	RW	Setpoint alarm signalled by flashing display lighting	UINT16	0 = return 1 = enabled
6049	RW	Load current response value from which the operating hours counter counts [10)]	UINT16	1*…1000 (x 0.1 % I prim)
6050	RW	Calculation method for reactive energy	UINT16	0 = rms 1 = fund (refers to the fundamental)
6051	RW	DNP polling object	UINT16	0…65535, 0x3F*

Tab. 16.20: Setup parameters (basic)

Notes Tab. 16.20

1) Potential transformer primary side/Potential transformer secondary side ≤ 10,000

2) THDf = refers to the fundamental f_0

THDr = refers to the r.m.s. value (distortion factor)

$$THDf = \frac{\sqrt{\sum_{h=2}^{\infty} I_h^2}}{I_1} \times 100\ \% \qquad THDr = \frac{\sqrt{\sum_{h=2}^{\infty} I_h^2}}{\sqrt{\sum_{h=1}^{\infty} I_h^2}} \times 100\ \%$$

with I_1 = r.m.s. value of the fundamental, I_h = r.m.s. value of the h^{th} harmonic

3) The harmonics (HD; registers 1400 ff. and 1600 ff) are shown as relative values. The calculation or reference value depends on the settings made here.

4) see register 9100 ff.

5) 0: Data transfer takes place at 00:00 h of the first day of each month.

0xFFFF: Data transfer does not happen automatically at a specific time, but only by writing 0xFF00 to register 9603 (peak demand) or to register 9605 (Max./Min. log). By doing this, the data of the "Peak demand of this month" become the values of the "Peak demand of last month"; the "Peak demand of this month" is determined again from this date. The same applies to the Max./Min. log.

Other numeric value: Data transfer takes place independently at a different time. Encoding according to the following formula:
Time = (day x 100 + hour) where day = 1…28 and hour = 0…23.
Example: 1512 = data transfer at 12:00 h on the 15th of each month

6) 0: Data transfer/Freeze log takes place at 00:00 h of the first day of each month.

Other numeric value: Data transfer takes place independently at a specific time. Encoding according to the following formula:
Time = (day x 100 + hour) where day = 1…28 and hour = 0…23.
Example: 1512 = data transfer at 12:00 h on the 15th of each month

7) 0 = freeze log takes places daily at 00:00 h

Other numeric value: Freeze log takes place independently at a specific time. Encoding according to the following formula:
Time = (hour x 100 + minute) where hour = 0…23 and minute = 0…59.
Example: 1512 = data transfer daily at 15:12 h

8) Key for measured quantities 1…4 on the standard display

Key	Parameter	Key	Parameter	Key	Parameter	Key	Parameter
0	U_{L1}	**10**	I_3	**20**	Import active energy, tariff 1	**30**	$P_{tot\ (f0)}$
1	U_{L2}	**11**	Ø I	**21**	Import active energy, tariff 2	**31**	Total displacement factor
2	U_{L3}	**12**	P_{tot}	**22**	Import active energy, tariff 3	**32**	I_4
3	Ø U_{LN}	**13**	Q_{tot}	**23**	Import active energy, tariff 4	**33**	THD $_{UL1}$
4	U_{L1L2}	**14**	S_{tot}	**24**	Demand I_1	**34**	THD $_{UL2}$
5	U_{L2L3}	**15**	λ_{tot}	**25**	Demand I_2	**35**	THD $_{UL3}$
6	U_{L3L1}	**16**	f	**26**	Demand I_3	**36**	I_r
7	Ø U_{LL}	**17**	Active energy import	**27**	Demand P		
8	I_1	**18**	Active energy export	**28**	Demand Q		
9	I_2	**19**	Total active energy	**29**	Demand S		

9) If EN Period is changed, the previous recording of the interval energy meter is reset.

10)

$$\text{I prim} = 5\ \text{A} \times \frac{\text{CT}_{\text{primary}}}{\text{CT}_{\text{secondary}}}$$

The register content corresponds to % values of I prim
where 1 = 0.1 %
1000 = 100 %)

16.12 Setup (inputs and outputs)

Setup register (inputs and outputs)

Register	Property	Description	Format	Unit
6200	RW	DI1 function	UINT16	0* = digital input 1 = pulse counter 2 = tariff switch
6201	RW	DI2 function	UINT16	
6202	RW	DI3 function	UINT16	
6203	RW	DI4 function	UINT16	0* = digital input 1 = pulse counter
…	Reserved			
6208	RW	DI1 debounce time	UINT16	1…9999 ms; 20* ms
6209	RW	DI2 debounce time	UINT16	
6210	RW	DI3 debounce time	UINT16	
6211	RW	DI4 debounce time	UINT16	
…	Reserved			
6216	RW	DI1 pulse width	UINT32	1*…1.000.000
6218	RW	DI2 pulse width	UINT32	
6220	RW	DI3 pulse width	UINT32	
6222	RW	DI4 pulse width	UINT32	
…	Reserved			
6230	RW	DO1 function	UINT16	0* = remote control/setpoint *the following only PEM353-P:* *1 = kWh import* *2 = kWh export* *3 = kWh total* *4 = kvarh import* *5 = kvarh export* *6 = kvarh total*
6231	RW	DO2 function	UINT16	
…	Reserved			
6236 [1)]	RW	DO1 pulse width	UINT16	0…6000 (x 0.1 s); 10* 0 = latch mode
6237 [1)]	RW	DO2 pulse width	UINT16	

Tab. 16.21: Setup register (inputs and outputs)

Notes Tab. 16.21

[1)] Registers 6036 and 6037 are only valid for PEM353-P.

16.13 Setup (communication)

Register	Property	Description		Format	Value
6400	RW	COM1	Protocol	UINT16	0* = Modbus RTU 1 = BACnet MS/TP 3 = DNP
6401	RW		Device address	UINT16	1…247 (100*)
6402	RW		Baud rate	UINT16	0 = 1200 1 = 2400 2 = 4800 3 = 9600* 4 = 19200 5 = 38400 bps
6403	RW		Parity bit configuration	UINT16	0 = 8N2 1 = 8O1 2 = 8E1* 3 = 8N1 4 = 8O2 5 = 8E2

Tab. 16.22: Setup (communication)

16.14 Setup (setpoints)

Register	Property	Description		Format	Unit
6500	RW	Setpoint 1	Setpoint type	UINT16	0 = disabled 1 = ">" setpoint 2 = "<" setpoint
6501	RW		Parameters [1)]	UINT16	0…32
6502	RW		Upper limit [2)]	Float	0*
6504	RW		Lower limit [2)]	Float	0*
6506	RW		Active delay	UINT16	0…9999 s; 10*
6507	RW		Inactive delay	UINT16	
6508	RW		Trigger action 1 [3)]	UINT16	0…4
6509	RW		Trigger action 2 [3)]	UINT16	
…	…				

Register	Property	Description		Format	Unit
6580	RW	Setpoint 9	Setpoint type	UINT16	0 = disabled 1 = ">" setpoint 2 = "<" setpoint
6581	RW		Parameters [1]	UINT16	0…32
6582	RW		Upper limit	Float	0*
6584	RW		Lower limit	Float	0*
6586	RW		Active delay	UINT16	0…9999 s; 10*
6587	RW		Inactive delay	UINT16	
6588	RW		Trigger action 1	UINT16	0…4
6589	RW		Trigger action 2	UINT16	

Tab. 16.23: Setup register (setpoints)

Notes Tab. 16.23

1) Setpoint parameter key

Key	Parameter	Key	Parameter	Key	Parameter
0	—	**10**	Present demand P_{tot}	**20**	$TOHD_I$
1	U_{LN}	**11**	Present demand Q_{tot}	**21**	$TEHD_I$
2	U_{LL}	**12**	Present demand S_{tot}	**22**	Voltage unbalance
3	I	**13**	Predicted demand P_{tot}	**23**	Current unbalance
4	I_n	**14**	Predicted demand Q_{tot}	**24**	Rotating field
5	f	**15**	Predicted demand S_{tot}	**25**	I_4
6	P_{tot}	**16**	THD_U	**26…29**	Reserved
7	Q_{tot}	**17**	$TOHD_U$	**30**	I_r
8	S_{tot}	**18**	$TEHD_U$	**31**	U2
9	λ	**19**	THD_I	**32**	U0

2) **">" setpoint:** The measured value must exceed the upper limit to become active (response threshold value) and fall below the lower limit to become inactive (release threshold value).

"<" setpoint: The measured value must fall below the lower limit to become active (response threshold value) and exceed the upper limit to become inactive (release threshold value).

3) Trigger action key

Key	Parameter
0	—
1	DO1 closed
2	DO2 closed
Others	Reserved

16.15 TOU setup

16.15.1 Setup schedules register

Register	Property	Description	Format	Range/Option
Status register				
7000	RO	Currently active tariff	UINT16	0…7 (T1…T8)
7001	RO	Currently active season	UINT16	0…11 (season 1…12)
7002	RO	Currently active period of the daily profile	UINT16	0…11 (period 1…12)
7003	RO	Currently active daily profile	UINT16	0…19 (profile 1…20)
7004	RO	Currently active day type	UINT16	0 = day type 1 1 = day type 2 2 = day type 3 3 = alternate day
7005	RO	Currently active schedule	UINT16	0 = schedule 1 1 = schedule 2
Switching between schedules				
7006	RW	Automatic switching time of the schedule [1)]	UINT32	Tab. 16.25
7008	WO	Manual switching of the schedule	UINT16	0xFF00
Assignment weekday to day types				
7009	RW	Sunday setup	UINT16	0* = day type 1 1 = day type 2 2 = day type 3
7010	RW	Monday setup	UINT16	
7011	RW	Tuesday setup	UINT16	
7012	RW	Wednesday setup	UINT16	
7013	RW	Thursday setup	UINT16	
7014	RW	Friday setup	UINT16	
7015	RW	Saturday setup	UINT16	

Tab. 16.24: Setup schedules register

Notes Tab. 16.24

1) If DI1 is configured for the tariff switch, the schedules are ignored and instead the status of the DI is used for the tariff switch.

Register content 0xFFFFFFFF deactivates the automatic tariff switch.

16.15.2 Data structure switching time:

Byte 3	Byte 2	Byte 1	Byte 0
Year - 2000 (0…37)	Month (1…12)	Day (1…31)	Hour (0…23)

Tab. 16.25: Data structure switching time

16.15.3 Season

There are two sets of setup parameters (one for schedule 1, one for schedule 2).

The respective register address is the start address + offset. 12 seasons can be defined for each schedule.

Start address schedule 1: register 7100.
Start address schedule 2: register 8100.

Offset	Property	Description		Format	Range/Option
0	RW	Season 1	Start date [1)]	UINT16	0x0101
1	RW		Weekday 1 daily profile	UINT16	0…19
2	RW		Weekday 2 daily profile	UINT16	
3	RW		Weekday 3 daily profile	UINT16	
4	RW	Season 2	Start date [2)]	UINT16	HiByte: month LoByte: day
5	RW		Weekday 1 daily profile	UINT16	0…19
6	RW		Weekday 2 daily profile	UINT16	
7	RW		Weekday 3 daily profile	UINT16	
8	RW	Season 3	Start date [2)]	UINT16	HiByte: month LoByte: day
9	RW		Weekday 1 daily profile	UINT16	0…19
10	RW		Weekday 2 daily profile	UINT16	
11	RW		Weekday 3 daily profile	UINT16	
12	RW	Season 4	Start date [2)]	UINT16	HiByte: month LoByte: day
13	RW		Weekday 1 daily profile	UINT16	0…19
14	RW		Weekday 2 daily profile	UINT16	
15	RW		Weekday 3 daily profile	UINT16	
16	RW	Season 5	Start date [2)]	UINT16	HiByte: month LoByte: day
17	RW		Weekday 1 daily profile	UINT16	0…19
18	RW		Weekday 2 daily profile	UINT16	
19	RW		Weekday 3 daily profile	UINT16	
20	RW	Season 6	Start date [2)]	UINT16	HiByte: month LoByte: day
21	RW		Weekday 1 daily profile	UINT16	0…19
22	RW		Weekday 2 daily profile	UINT16	
23	RW		Weekday 3 daily profile	UINT16	
24	RW	Season 7	Start date [2)]	UINT16	HiByte: month LoByte: day
25	RW		Weekday 1 daily profile	UINT16	0…19
26	RW		Weekday 2 daily profile	UINT16	
27	RW		Weekday 3 daily profile	UINT16	

Offset	Property	Description		Format	Range/Option
28	RW	Season 8	Start date [2]	UINT16	HiByte: month LoByte: day
29	RW		Weekday 1 daily profile	UINT16	0…19
30	RW		Weekday 2 daily profile	UINT16	
31	RW		Weekday 3 daily profile	UINT16	
32	RW	Season 9	Start date [2]	UINT16	HiByte: month LoByte: day
33	RW		Weekday 1 daily profile	UINT16	0…19
34	RW		Weekday 2 daily profile	UINT16	
35	RW		Weekday 3 daily profile	UINT16	
36	RW	Season 10	Start date [2]	UINT16	HiByte: month LoByte: day
37	RW		Weekday 1 daily profile	UINT16	0…19
38	RW		Weekday 2 daily profile	UINT16	
39	RW		Weekday 3 daily profile	UINT16	
40	RW	Season 11	Start date [2]	UINT16	HiByte: month LoByte: day
41	RW		Weekday 1 daily profile	UINT16	0…19
42	RW		Weekday 2 daily profile	UINT16	
43	RW		Weekday 3 daily profile	UINT16	
44	RW	Season 12	Start date [2]	UINT16	HiByte: month LoByte: day
45	RW		Weekday 1 daily profile	UINT16	0…19
46	RW		Weekday 2 daily profile	UINT16	
47	RW		Weekday 3 daily profile	UINT16	

Tab. 16.26: Data structure schedule (season)

1) The start date for season 1 is always January 01. This cannot be modified.

2) Start date: The start date of a season must always be later than the start date of the previous season. Register content 0xFFFF deactivates the respective season and all following seasons.

16.15.4 Daily profiles

Daily profiles register (of schedules 1 and 2)

Register schedule 1	Register schedule 2	Property	Description	Format
7200…7223	8200…8223	RW	Daily profile 1	See daily profile data structure Tab. 16.28
7224…7247	8224…8247	RW	Daily profile 2	
7248…7271	8248…8271	RW	Daily profile 3	
7272…7295	8272…8295	RW	Daily profile 4	
7296…7319	8296…8319	RW	Daily profile 5	
7320…7343	8320…8343	RW	Daily profile 6	
7344…7367	8344…8367	RW	Daily profile 7	
7368…7391	8368…8391	RW	Daily profile 8	
7392…7415	8392…8415	RW	Daily profile 9	
7416…7439	8416…8439	RW	Daily profile 10	
7440…7463	8440…8463	RW	Daily profile 11	
7464…7487	8464…8487	RW	Daily profile 12	
7488…7511	8488…8511	RW	Daily profile 13	
7512…7535	8512…8535	RW	Daily profile 14	
7536…7559	8536…8559	RW	Daily profile 15	
7560…7583	8560…8583	RW	Daily profile 16	
7584…7607	8584…8607	RW	Daily profile 17	
7608…7631	8608…8631	RW	Daily profile 18	
7632…7655	8632…8655	RW	Daily profile 19	
7656…7679	8656…8679	RW	Daily profile 20	

Tab. 16.27: Daily profiles register

Setup (daily profile data structure)

Offset	Property	Period		Format	Value
0	RW	1	Start time [1)]	UINT16	0x0000
1	RW		Tariff to be used	UINT16	0…7 (T1…T8)
2	RW	2	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
3	RW		Tariff to be used	UINT16	0…7 (T1…T8)
4	RW	3	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
5	RW		Tariff to be used	UINT16	0…7 (T1…T8)
6	RW	4	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
7	RW		Tariff to be used	UINT16	0…7 (T1…T8)
8	RW	5	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
9	RW		Tariff to be used	UINT16	0…7 (T1…T8)
10	RW	6	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
11	RW		Tariff to be used	UINT16	0…7 (T1…T8)
12	RW	7	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
13	RW		Tariff to be used	UINT16	0…7 (T1…T8)
14	RW	8	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
15	RW		Tariff to be used	UINT16	0…7 (T1…T8)
16	RW	9	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
17	RW		Tariff to be used	UINT16	0…7 (T1…T8)
18	RW	10	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
19	RW		Tariff to be used	UINT16	0…7 (T1…T8)
20	RW	11	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
21	RW		Tariff to be used	UINT16	0…7 (T1…T8)
22	RW	12	Start time [2)]	UINT16	HiByte: hour (0…23) LoByte: minute (0…59)
23	RW		Tariff to be used	UINT16	0…7 (T1…T8)

Tab. 16.28: Daily profile data structure

Notes Tab. 16.28:

1) The start time for period 1 is 00:00 h and cannot be modified.

2) Register content 0xFFFF terminates the settings of the daily profile. The corresponding period ends at 23:59 h.

The minimum interval for a period is 15 minutes.
The start time of a period must always be later than the start time of the previous period.

16.15.5 Alternate days

Alternate days are, for example, holidays. They have a higher priority than seasons and specify the daily profile to be used. For the two schedules 1 and 2, the alternative days must be determined individually. The register address is the start address + offset.

Start address schedule 1 = 7700

Start address schedule 2 = 8700

Setup (data structure alternate days)

Offset	Property	Description		Format	Value
0	RW	Alternate day 1	Date	UINT32	See data structure Tab. 16.30
2	RW		Daily profile	UINT16	0…19
3	RW	Alternate day 2	Date	UINT32	See data structure Tab. 16.30
5	RW		Daily profile	UINT16	0…19
6	RW	Alternate day 3	Date	UINT32	See data structure Tab. 16.30
8	RW		Daily profile	UINT16	0…19
…					
261	RW	Alternate day 88	Date	UINT32	See data structure Tab. 16.30
263	RW		Daily profile	UINT16	0…19
264	RW	Alternate day 89	Date	UINT32	See data structure Tab. 16.30
266	RW		Daily profile	UINT16	0…19
267	RW	Alternate day 90	Date	UINT32	See data structure Tab. 16.30
269	RW		Daily profile	UINT16	0…19

Tab. 16.29: Setup (data structure alternate days)

Data structure alternate day date

Byte 3	Byte 2	Byte 1	Byte 0
Reserved	Year - 2000 (0…37)	Month (1…12)	Day (1…31)

Tab. 16.30: Data structure alternate day date

Alternate days can also be programmed as recurring dates by writing "0xFF" to the corresponding byte for month and/or year.

16.16 Time setting

There are two time register formats supported by the PEM353:

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

When sending the time via Modbus, 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, 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…28/29/30/31) 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. 16.31: Timestamp register

16.17 Clearing logs and meters

Register	Property	Description	Format	Content
9600	WO	Clear all concluded logs of the monthly energy log [1)]	UINT16	Write 0xFF00 to the register to trigger the described action
9601	WO	Clear all energy logs [2)]	UINT16	
9602	WO	Clear energy log of this month [3)]	UINT16	
9603	WO	Clear present peak demand (since last reset) [4)]	UINT16	
9604	WO	Clear all demand values [5)]	UINT16	
9605	WO	Clear present Max./Min. log (since last reset) [6)]	UINT16	
9606	WO	Clear all Max./Min. logs [7)]	UINT16	
9607	WO	Clear operating hours counter [8)]	UINT16	
9608	WO	Clear all measured values [9)]	UINT16	
9609	WO	Clear SOE event log	UINT16	
9610	WO	Clear DI1 pulse counter	UINT16	
9611	WO	Clear DI2 pulse counter	UINT16	
9612	WO	Clear DI3 pulse counter	UINT16	
9613	WO	Clear DI4 pulse counter	UINT16	
Reserved				
9618		Clear all pulse counters	UINT16	

Tab. 16.32: "Clear" register

Notes Tab. 16.32

1) Writing 0xFF00 to register 9600 clears all concluded logs of the monthly energy log. The present, not yet concluded monthly log is not cleared.

2) Clears the total phase and individual phase energy registers

3) Clears the energy log of the present month

4) The clearing behaviour depends on the settings in register 6033:

When register 6033 = automatic is set
Clears the present peak demand, the peak demand of last month is not changed.

When register 6033 = manual is set
The present peak demand is written to the registers of the "Peak demand of last month". Afterwards, the present peak demand is cleared.

5) All demand registers and logs are cleared (present demand, peak demand of this month and last month).

6) The clearing behaviour depends on the settings in register 6033:
When register 6033 = automatic is set
Clears only the present Max./Min. log, the Max./Min. log of last month is not changed.

When register 6033 = manual is set
The present Max./Min. log is written to the "Max./Min. log of last month". Afterwards, the present Max./Min. log is cleared.

7) Clears the Max./Min. logs of this month and last month.

8) Operating hours counter: Time during which the device has measured more than 100 mA on any phase (secondary side, i.e. without considering the measuring current transformers).

9) Executes the actions determined for registers 9600...9607 and 9610...9615. In addition, the PEM353-N clears the daily and monthly logs (freeze logs).

16.18 Event log (SOE log)

Each event entry occupies 8 registers, as shown in the following table. The internal data structure of the event log is listed in Tab. 16.34.

Register	Property	Description	Format
10000…10007	RO	Event 1	See Tab. 16.34
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	
…			
10792…10799	RO	Event 100	

Tab. 16.33: Event log (SOE log)

Event data structure (SOE log)

The internal data structure of the 8 registers belonging to each event in the SOE log is described in the table below.

Offset	Property	Description
+0	RO	HiByte: event classification LoByte: event sub-classification (see Tab. 16.35)
+1	RO	HiByte: year-2000 LoByte: month (1…12)
+2	RO	HiByte: day (0…31) LoByte: hour (1…23)

Offset	Property	Description
+3	RO	HiByte: minute (0…59) LoByte: second (0…59)
+4	RO	Millisecond (0…999)
+5	RO	HiByte: Reserved LoByte: Status
+6…+7	RO	Event value

Tab. 16.34: Event data structure

Event classification (SOE log)

Event classification	Event sub-classification	Status	Event value	Meaning
1 (DI)	1	1/0		Digital input 1 closed/open
	2	1/0		Digital input 2 closed/open
	3	1/0		Digital input 3 closed/open
	4	1/0		Digital input 4 closed/open
	5	Reserved		
	6			
2 (DO)	1	1/0		Digital output 1 closed/open via Modbus access
	2	1/0		Digital output 2 closed/open via Modbus access
	3…10	Reserved		
	11	1/0		Digital output 1 closed/open via setpoint
	12	1/0		Digital output 2 closed/open via setpoint
	13…20	Reserved		
	21	1/0		Digital output 1 closed/open via front panel operation
	22	1/0		Digital output 2 closed/open via front panel operation
	23…30		Reserved	
	31	0		Digital output 1 open after "Pulse width DO1" (register 6236) has elapsed
	32	0		Digital output 2 open after "Pulse width DO2" (register 6237) has elapsed
	33…34	Reserved		
3 (Setpoint)	1	1/0	Trigger value	Status 1 = ">" setpoint U_{LN} exceeded Status 0 = return
	2	1/0	Trigger value	Status 1 = ">" setpoint U_{LL} exceeded Status 0 = return
	3	1/0	Trigger value	Status 1 = ">" setpoint *I* exceeded Status 0 = return
	4	1/0	Trigger value	Status 1 = ">" setpoint I_n exceeded Status 0 = return
	5	1/0	Trigger value	Status 1 = ">" setpoint *f* exceeded Status 0 = return

Event classification	Event sub-classification	Status	Event value	Meaning
3 (Setpoint)	6	1/0	Trigger value	Status 1 = ">" setpoint P_{tot} exceeded Status 0 = return
	7	1/0	Trigger value	Status 1 = ">" setpoint Q_{tot} exceeded Status 0 = return
	8	1/0	Trigger value	Status 1 = ">" setpoint S_{tot} exceeded Status 0 = return
	9	1/0	Trigger value	Status 1 = ">" setpoint λ_{tot} exceeded Status 0 = return
	10	1/0	Trigger value	Status 1 = ">" setpoint demand P_{tot} exceeded Status 0 = return
	11	1/0	Trigger value	Status 1 = ">" setpoint demand Q_{tot} exceeded Status 0 = return
	12	1/0	Trigger value	Status 1 = ">" setpoint demand S_{tot} exceeded Status 0 = return
	13	1/0	Trigger value	Status 1 = ">" setpoint predicted demand P_{tot} exceeded Status 0 = return
	14	1/0	Trigger value	Status 1 = ">" setpoint predicted demand Q_{tot} exceeded Status 0 = return
	15	1/0	Trigger value	Status 1 = ">" setpoint predicted demand S_{tot} exceeded Status 0 = return
	16	1/0	Trigger value	Status 1 = ">" setpoint THD_U exceeded Status 0 = return
	17	1/0	Trigger value	Status 1 = ">" setpoint $TOHD_U$ exceeded Status 0 = return
	18	1/0	Trigger value	Status 1 = ">" setpoint $TEHD_U$ exceeded Status 0 = return
	19	1/0	Trigger value	Status 1 = ">" setpoint THD_I exceeded Status 0 = return
	20	1/0	Trigger value	Status 1 = ">" setpoint $TOHD_I$ exceeded Status 0 = return
	21	1/0	Trigger value	Status 1 = ">" setpoint $TEHD_I$ exceeded Status 0 = return
	22	1/0	Trigger value	Status 1 = ">" setpoint unbalance *U* exceeded Status 0 = return
	23	1/0	Trigger value	Status 1 = ">" setpoint unbalance *I* exceeded Status 0 = return
	24	1/0	Trigger value	Status 1 = ">" setpoint rotating field active Status 0 = return
	25	1/0	Trigger value	Status 1 = ">" setpoint I_4 exceeded Status 0 = return
	26…31	Reserved		
	32	1/0	Trigger value	Status 1 = ">" setpoint I_r active Status 0 = return

Event classification	Event sub-classification	Status	Event value	Meaning
3 (Setpoint)	33	1/0	Trigger value	Status 1 = ">" setpoint U2 (negative sequence component) active Status 0 = return
	34	1/0	Trigger value	Status 1 = ">" setpoint U0 (zero sequence component) active Status 0 = return
	35…40	Reserved		
	41	1/0	Trigger value	Status 1 = below "<" setpoint U_{LN} Status 0 = return
	42	1/0	Trigger value	Status 1 = below "<" setpoint U_{LL} Status 0 = return
	43	1/0	Trigger value	Status 1 = below "<" setpoint I Status 0 = return
	44	1/0	Trigger value	Status 1 = below "<" setpoint I_n Status 0 = return
	45	1/0	Trigger value	Status 1 = below "<" setpoint f Status 0 = return
	46	1/0	Trigger value	Status 1 = below "<" setpoint P_{tot} Status 0 = return
	47	1/0	Trigger value	Status 1 = below "<" setpoint Q_{tot} Status 0 = return
	48	1/0	Trigger value	Status 1 = below "<" setpoint S_{tot} Status 0 = return
	49	1/0	Trigger value	Status 1 = below "<" setpoint λ_{tot} Status 0 = return
	50	1/0	Trigger value	Status 1 = below "<" setpoint demand P_{tot} Status 0 = return
	51	1/0	Trigger value	Status 1 = below "<" setpoint demand Q_{tot} Status 0 = return
	52	1/0	Trigger value	Status 1 = below "<" setpoint demand S_{tot} Status 0 = return
	53	1/0	Trigger value	Status 1 = below "<" setpoint predicted demand P_{tot} Status 0 = return
	54	1/0	Trigger value	Status 1 = below "<" setpoint predicted demand Q_{tot} Status 0 = return
	55	1/0	Trigger value	Status 1 = below "<" setpoint predicted demand S_{tot} Status 0 = return
	56	1/0	Trigger value	Status 1 = below "<" setpoint THD_U Status 0 = return
	57	1/0	Trigger value	Status 1 = below "<" setpoint $TOHD_U$ Status 0 = return
	58	1/0	Trigger value	Status 1 = below "<" setpoint $TEHD_U$ Status 0 = return
	59	1/0	Trigger value	Status 1 = below "<" setpoint THD_I Status 0 = return

Event classification	Event sub-classification	Status	Event value	Meaning
3 (Setpoint)	60	1/0	Trigger value	Status 1 = below "<" setpoint TOHD $_{I}$ Status 0 = return
	61	1/0	Trigger value	Status 1 = below "<" setpoint TEHD $_{I}$ Status 0 = return
	62	1/0	Trigger value	Status 1 = below "<" setpoint unbalance *U* Status 0 = return
	63	1/0	Trigger value	Status 1 = below "<" setpoint unbalance *I* Status 0 = return
	64	1/0	Trigger value	Status 1 = below "<" setpoint I_4 Status 0 = return
	65…68		Reserved	
	69	1/0	Trigger value	Status 1 = ">" setpoint I_r active Status 0 = return
	70	1/0	Trigger value	Status 1 = "<" setpoint U2 (negative sequence component) active Status 0 = return
	71	1/0	Trigger value	Status 1 = "<" setpoint U0 (zero sequence component) active Status 0 = return
4 (Diagnosis)	1	1	0	System parameter fault
	2	1	0	Internal device fault
	3	1	0	Tariff schedule parameter fault
	4	1	0	Memory fault
5 (Operation)	1	1	0	Supply voltage on
	2	2	0	Supply voltage off
	3	0	0	Present energy log cleared via front panel operation [1]
	4	0	0	Stored energy log cleared via front panel operation [2]
	5	0	0	Peak demand of this month cleared via front panel operation
	6	0	0	Present demand, present peak demand and peak demand of the previous month cleared via front panel operation
	7	0	0	Max./Min. value log of this month cleared via front panel operation
	8	0	0	All Max./Min. value logs cleared via front panel operation
	9	0	0	All logs cleared via front panel operation [3]
	10	0	0	SOE event log cleared via front panel operation
	11	0	x = 1…4	DIx pulse counter cleared via front panel operation
	12	0		All DIx pulse counters cleared via front panel operation
	13	0		Device operating time cleared via front panel operation
	14	0	0	Time set via front panel operation
	15	0	0	Setup changed via front panel operation
	16…29	Reserved		

Event classification	Event sub-classification	Status	Event value	Meaning
5 (Operation)	30	0	0	All energy logs cleared via communication [4]
	31	0	0	Energy log of this month cleared via communication [5]
	32	0	0	Concluded monthly energy logs cleared via communication [6]
	33	0	0	Peak demand of this month cleared via communication
	34	0	0	Present demand, present peak demand and peak demand of the previous month cleared via communication
	35	0	0	Max./Min. log of this month cleared via communication
	36	0	0	All Max./Min. value logs cleared via communication
	37	0	0	All logs cleared via communication [3]
	38	0	0	SOE event log cleared via communication
	39	0	x = 1…4	DIx pulse counter cleared via communication
	40	0	0	All DI pulse counters cleared via communication
	41	0	0	Device operating time cleared via communication
	42	Reserved		
	43	0	0	Setup changed via communication
	44	0	0	Energy meters were set via communication
	45	0	0	Scheduled tariffs (T1...T8) were set via communication
	46	0	1…4	Tariff schedule has been switched [7]
	47	0	x = 1…5	DRx log cleared via communication
	48			All data recorder logs cleared via communication

Tab. 16.35: Event classification

Notes Tab. 16.35

1) Clear register from „Chapterl 16.2.1 Energy meters and tariffs (present measured values)“ and „Chapterl 16.2.2 Monthly energy log (Energy Log)“ (only this month)

2) Clear register of the concluded energy logs(chapter 16.2.2) (except this month)

3) Clear all energy meters and tariffs (see footnote 1), peak demand and Max./Min. logs, device operating time, DI pulse counters
For PEM353-N only: clear also data recorders, daily and monthly logs (freeze logs)

4) Clear register for energy measurement (chapter 16.2) (except this month)

5) Clear monthly energy log of the present month (chapter 16.2.2, register content 0980 = 0)

6) Clear all concluded energy logs of the last months (chapter 16.2.2, register content 0980 = 1…12)

7) Tariff schedule has been switched with the following event values:

Entry	Description
1	Manual switching from schedule 1 to schedule 2
2	Manual switching from schedule 2 to schedule 1
3	Automatic switching from schedule 1 to schedule 2
4	Automatic switching from schedule 2 to schedule 1

16.19 DOx control

The control registers of the digital outputs are implemented as Write-Only registers (WO) and can be controlled with the function code 0x05 or 0x10. In order to query the current DO status, **register 0098** has to be read out.

When **register 6032 = 1** is set, the PEM353 supports the execution of commands on the outputs in two steps (**Arm Before Executing**): Before sending an open or close command to one of the outputs, it must be "armed" first. This is achieved by writing 0xFF00 to the respective DO register. If the armed output does not receive a command to be executed within 15 seconds, this output will be disarmed again and will not be available for adjustment.

If a command to be executed is sent to an output which has not been "armed" previously, the PEM353 ignores the command and instead returns it as exception code 0x04.

*When **register 6032 = 0 is set**, "arming" is not necessary: Writing 0xff00 to an "Execute" register will immediately "arm" the DO. However, if an attempt is made to bring a DO to the state in which it already is, an exception code will also be generated.*

Control register digital outputs (DO)

Register	Property	Format	Description
9100	WO	UINT16	Arm DO1 close
9101	WO	UINT16	Execute DO1 close
9102	WO	UINT16	Arm DO1 open
9103	WO	UINT16	Execute DO1 open
9104	WO	UINT16	Arm DO2 close
9105	WO	UINT16	Execute DO2 close
9106	WO	UINT16	Arm DO2 open
9107	WO	UINT16	Execute DO2 open
9108…9165	Reserved		

Tab. 16.36: Control register digital outputs (DO)

16.20 Universal measuring device information

Register	Property	Description	Format	Note
9800… 9819	RO	Model [1)]	UINT16	
9820	RO	Software version	UINT16	E.g.: 10000 = V1.00.00
9821	RO	Protocol version	UINT16	E.g.: 40 = V4.0
9822	RO	Date of software update (year-2000)	UINT16	E.g.: 080709 = July 9, 2008
9823	RO	Date of software update: month	UINT16	
9824	RO	Date of software update: day	UINT16	
9825	RO	Serial number		
9827…9828	Reserved			
9829	RO	Feature code	Bit map	Bit 0…2: 010 = I_4 Storage bit 6 : 0 = without flash 1 = with flash Basic functions bit 7…8: 00 = 4 x DI + 2 x relay outputs RO 01 = — 10 = 4 x DI + 2 x Solid State outputs SS Other bits: Reserved

Tab. 16.37: Universal measuring device information

Notes Tab. 16.37

[1)] The universal measuring device model appears in registers 9800…9819. An encoding example is given in the table below using the "PEM353" by way of example.

Register	Value (Hex)	ASCII
9800	0x50	P
9801	0x45	E
9802	0x4D	M
9803	0x33	3
9804	0x35	5
9805	0x33	3
9806…9819	0x20	Null

Tab. 16.38: ASCII encoding of "PEM353"