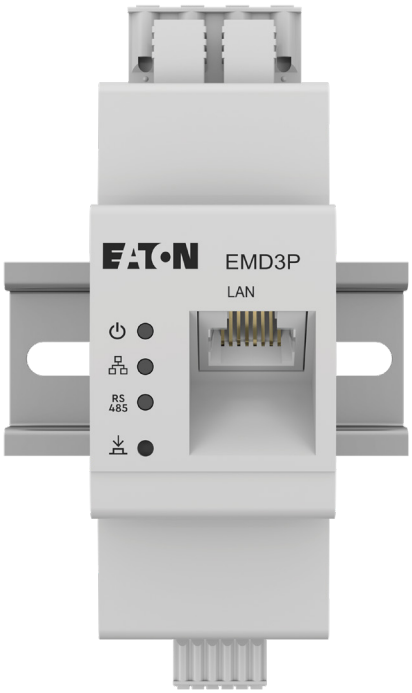
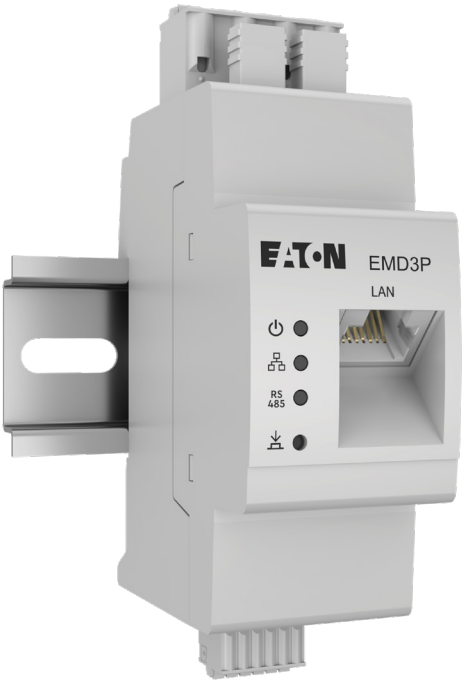
Technical Data **PS005001EN** Effective February 2025

EMD3P Modbus Specification





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Content

1 Document Scope

1.1 Purpose of the Document

This Modbus specification describes the requirements for the network or bus, as well as the supported Modbus functions and registers of the EMD3P

1.2 Legal Notice

1.3 Referenced Documents

Table 1: Referenced documents

Reference	Document Title/Description	Version Date	Creator
IEC 61158	Industrial communication networks - Fieldbus specifications	2.0	IEC
Modbus Specification	MODBUS APPLICATION PROTOCOL SPECIFICATION	V1.1b3	Modbus Organization

1.4 Used Abbreviations

Table 2: Abbreviations

Abbreviation	Designation
dec	Decimal
hex	Hexadecimal
IEC	International Electrotechnical Commission
OBIS	Object Identification System
RO	Read Only
RW	Read Write
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
TCP	Transmission Control Protocol
WO	Write Only

2 EMD3P Modbus Specification

The following describes the functionality, operating modes, and Modbus registerspecification. A detailed description of the Modbus protocol and its operation can be found in the Modbus specification (for example, see www.modbus.org). Modbus TCP is part of the IEC 61158 standard.

The Modbus data interface can be used in the following operating modes:

- Modbus RTU Slave
- Modbus TCP Slave

2.1 Modbus RTU

The EMD3P provides measurement data via a Modbus RTU Slave interface.

2.1.1 Parameters

In general, Modbus parameters are configured customer specifically. The following parameters have been set as default:

- **Baud Rate:** 115200
- **Data Bits:** 8
- **Parity:** Even
- **Stop Bits:** 1

The Server ID can be found on the type plate on the side of the EMD3P and on the additional label provided with the product.

2.1.2 Configuring the Baud Rate

The baud rate can be set via register 258 (0x0102). The values to be set represent the baud rates as follows:

Value	Baud Rate
0	9600 Bd
1	14400 Bd
2	19200 Bd
3	38400 Bd
4	57600 Bd
5	115200 Bd

2.2 Modbus TCP

As a TCP Slave mode, the EMD3P provides its Modbus registers via TCP/IP. For access to this interface, network connection via Ethernet is required. The Modbus Slave is reachable by default on port number 502. The TCP Unit ID is 1.

2.3 Register Specification

The data registers can be divided into various areas. The data points of the EMD3P are encoded according to the OBIS standard. In addition, in the register range 40000-40177, the data points are encoded according to the standards of the SunSpec Alliance:

- SunSpec Alliance Interoperability Specification – Common Models
- SunSpec Alliance Interoperability Specification – Meter Models

2.3.1 Reading Registers

Most data points of the EMD3P are distributed across multiple 16-bit registers. This means that an RTU Master / TCP Client should request all registers of a data point in one and the same request. In other words, atomicity can only be guaranteed at the level of a single request.

Interpretation of data points with multiple registers:
In the case of a multi-register data point, the registers with the lower addresses contain the most significant bits. The least significant bits are contained in the registers with the higher addresses.

Example Principle: A fictitious data point "TotalOperatingHours" (uint32) is located at offset 0x1000. The data point is to contain 2293828 operating hours.

- Address **0x1000** contains **0x23**
- Address **0x1001** contains **0x44**

During the request, both registers are transmitted in network byte order (big endian) as specified by the Modbus specification. A **"Read Holding Registers"** for both registers yields **0x00 0x23 0x00 0x44.**

Example Conversion:
To read the imported active power (+), you can use the (integer) values of the "holding registers" 0 and 1:

Active power+ [W] = ({Register 0} · 2^16 + {Register 1}) · 0.1 [W]

To read the imported active energy (+), i.e., the imported active energy over all phases, you can use (integer) registers 512 to 515:

Active energy+ [Wh] = ({Register 512} · 2^48 + {Register 513} · 2^32 + {Register 514} · 2^16 + {Register 515}) · 0.1 [Wh]

Reading unused registers: If a client tries to read unspecified registers, an error code “0x02” (ILLEGAL_DATA_ADDRESS) is sent. Unspecified registers are the registers not listed in the register specification in the appendix.

2.3.2 Register Ranges

An overview of all available registers can be found in the appendix Modbus - Register Range Overview.

2.4 Exception Codes

The following chapters describe the occurring exception codes.

2.4.1 0x01 Illegal Function

0x01 Illegal Function is returned for register accesses with unsupported Modbus functions.

2.4.2 0x02 Illegal Data Address

0x02 Illegal Data Address is returned when attempting to access an unsupported register.

2.4.3 0x03 Illegal Data Value

The error code is returned for a write access to a register with parameters outside the per- missible range or with the Read Only flag enabled.

2.4.4 0x04 Slave Device Failure

If the EMD3P is in a fault state, every Modbus access returns the Exception Code 0x04 Slave Device Failure.

A OBIS Code System

To transmit data and differentiate between various measurement data from a data source, so-called OBIS codes are used. **OBIS** stands for **Ob**ject Identification **S**ystem and is used for electronic data communication in the energy market.

OBIS codes consist of six value groups (A-F) from which the specification of a value is derived by their combination. They are represented in the form **A-B:C.D.E*F.**

The OBIS codes specifically used in the EMD3P are described in the document appendix de- pending on the data source. The basis is the OBIS code system version 2.5 (as of: 01.10.2023), which follows DIN EN 62056-6-1:2021-06 and can be found at edi-energy.de.

Below, the individual groups are explained in the context of the EMD3P.

Group A (Medium) A = 1 (Electricity) **Group B (Channel)**

Used to differentiate between the three possible data sources:

- for “Smart Meter” values: B = 0
- for sensor values: B = sensor ID + 1
- for group values: B = group ID + 100

Group C (Measured Quantity)

Key value of the resulting measured quantity according to the OBIS code system

Group D (Measurement Type)

Key value of the applied measurement type according to the OBIS code system

Group E (Tariff Level)

Key value of the tariff, usually E = 0 (Total)

Group F (Previous Counter Reading)

F = 255

Note: The values of groups A and F are fixed, while the values of the remaining groups are variable.

B Modbus - Overview of register areas

Table 1: Overview of register areas

Start address (dec)	End address (dec	Start address (hex)	End address (hex	Size	R/W	Function codes	Description
0	147	0x0000	0x0093	148	RO	0x03	Internal instantaneous registers
256	511	0x0100	0x01FF	100	RW	0x03 0x06 0x10	Configuration registers
512	791	0x0200	0x0317	280	RO	0x03	Internal Energy registers (counters)
8192	8248	0x2000	0x2038	56	RO	0x03	Eaton/RM PnP registers
40000	40177	0x9C40	0x9CF1	178	RO	0x03	SunSpec registers
61440	61467	0xF000	0xF01B	26	RO	0x03	Fast registers
61613	61614	0xF0AD	0xF0AE	2	RW	0x03 0x06 0x10	Identification registers
61615	61616	0xF0AF	0xF0B0	2	WO	0x06 0x10	Restart registers

Table 2: Internal instantaneous registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Units	OBIS-Code	Description
0	1	0x0000	0x0001	2	uint32	0.1 W	1-0:1.4.0*255	Active power+
2	3	0x0002	0x0003	2	uint32	0.1 W	1-0:2.4.0*255	Active power-
4	5	0x0004	0x0005	2	uint32	0.1 var	1-0:3.4.0*255	Reactive power+
6	7	0x0006	0x0007	2	uint32	0.1 var	1-0:4.4.0*255	Reactive power-
8	9	0x0008	0x0009	2				(reserved)
10	11	0x000A	0x000B	2				(reserved)
12	13	0x000C	0x000D	2				(reserved)
14	15	0x000E	0x000F	2				(reserved)
16	17	0x0010	0x0011	2	uint32	0.1 VA	1-0:9.4.0*255	Apparent power+
18	19	0x0012	0x0013	2	uint32	0.1 VA	1-0:10.4.0*255	Apparent power-
20	21	0x0014	0x0015	2				(reserved)
22	23	0x0016	0x0017	2				(reserved)
24	25	0x0018	0x0019	2	int32	0.001 (unit- less)	1-0:13.4.0*255	Power factor
26	27	0x001A	0x001B	2	uint32	0.001 Hz	1-0:14.4.0*255	Supply frequency
28	29	0x001C	0x001D	2				(reserved)
30	31	0x001E	0x001F	2				(reserved)
32	33	0x0020	0x0021	2				(reserved)
34	35	0x0022	0x0023	2				(reserved)
36	37	0x0024	0x0025	2				(reserved)
38	39	0x0026	0x0027	2				(reserved)
40	41	0x0028	0x0029	2	uint32	0.1 W	1-0:21.4.0*255	Active power+ (L1)
42	43	0x002A	0x002B	2	uint32	0.1 W	1-0:22.4.0*255	Active power- (L1)
44	45	0x002C	0x002D	2	uint32	0.1 var	1-0:23.4.0*255	Reactive power+ (L1)
46	47	0x002E	0x002F	2	uint32	0.1 var	1-0:24.4.0*255	Reactive power- (L1)
48	49	0x0030	0x0031	2				(reserved)
50	51	0x0032	0x0033	2				(reserved)
52	53	0x0034	0x0035	2				(reserved)
54	55	0x0036	0x0037	2				(reserved)
56	57	0x0038	0x0039	2	uint32	0.1 VA	1-0:29.4.0*255	Apparent power+ (L1)
58	59	0x003A	0x003B	2	uint32	0.1 VA	1-0:30.4.0*255	Apparent power- (L1)
60	61	0x003C	0x003D	2	uint32	0.001 A	1-0:31.4.0*255	Current (L1)
62	63	0x003E	0x003F	2	uint32	0.001 V	1-0:32.4.0*255	Voltage (L1)
64	65	0x0040	0x0041	2	uint32	0.001 (unit- less)	1-0:33.4.0*255	Power factor (L1)
66	67	0x0042	0x0043	2				(reserved)
68	69	0x0044	0x0045	2				(reserved)
70	71	0x0046	0x0047	2				(reserved)
72	73	0x0048	0x0049	2				(reserved)

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Units	OBIS-Code	Description
74	75	0x004A	0x004B	2				(reserved)
76	77	0x004C	0x004D	2				(reserved)
78	79	0x004E	0x004F	2				(reserved)
80	81	0x0050	0x0051	2	uint32	0.1 W	1-0:41.4.0*255	Active power+ (L2)
82	83	0x0052	0x0053	2	uint32	0.1 W	1-0:42.4.0*255	Active power- (L2)
84	85	0x0054	0x0055	2	uint32	0.1 var	1-0:43.4.0*255	Reactive power+ (L2)
86	87	0x0056	0x0057	2	uint32	0.1 var	1-0:44.4.0*255	Reactive power- (L2)
88	89	0x0058	0x0059	2				(reserved)
90	91	0x005A	0x005B	2				(reserved)
92	93	0x005C	0x005D	2				(reserved)
94	95	0x005E	0x005F	2				(reserved)
96	97	0x0060	0x0061	2	uint32	0.1 VA	1-0:49.4.0*255	Apparent power+ (L2)
98	99	0x0062	0x0063	2	uint32	0.1 VA	1-0:50.4.0*255	Apparent power- (L2)
100	101	0x0064	0x0065	2	uint32	0.001 A	1-0:51.4.0*255	Current (L2)
102	103	0x0066	0x0067	2	uint32	0.001 V	1-0:52.4.0*255	Voltage (L2)
104	105	0x0068	0x0069	2	uint32	0.001 (unit- less)	1-0:53.4.0*255	Power factor (L2)
106	107	0x006A	0x006B	2				(reserved)
108	109	0x006C	0x006D	2				(reserved)
110	111	0x006E	0x006F	2				(reserved)
112	113	0x0070	0x0071	2				(reserved)
114	115	0x0072	0x0073	2				(reserved)
116	117	0x0074	0x0075	2				(reserved)
118	119	0x0076	0x0077	2				(reserved)
120	121	0x0078	0x0079	2	uint32	0.1 W	1-0:61.4.0*255	Active power+ (L3)
122	123	0x007A	0x007B	2	uint32	0.1 W	1-0:62.4.0*255	Active power- (L3)
124	125	0x007C	0x007D	2	uint32	0.1 var	1-0:63.4.0*255	Reactive power+ (L3)
126	127	0x007E	0x007F	2	uint32	0.1 var	1-0:64.4.0*255	Reactive power- (L3)
128	129	0x0080	0x0081	2				(reserved)
130	131	0x0082	0x0083	2				(reserved)
132	133	0x0084	0x0085	2				(reserved)
134	135	0x0086	0x0087	2				(reserved)
136	137	0x0088	0x0089	2	uint32	0.1 VA	1-0:69.4.0*255	Apparent power+ (L3)
138	139	0x008A	0x008B	2	uint32	0.1 VA	1-0:70.4.0*255	Apparent power- (L3)
140	141	0x008C	0x008D	2	uint32	0.001 A	1-0:71.4.0*255	Current (L3)
142	143	0x008E	0x008F	2	uint32	0.001 V	1-0:72.4.0*255	Voltage (L3)
144	145	0x0090	0x0091	2	int32	0.001 (unit- less)	1-0:73.4.0*255	Power factor (L3)
146	147	0x0092	0x0093	2	uint32	0.1 W		Minimum active power+ * 3

Table 3: Configuration registers

Start address (dec)	End address (dec	Start address (hex)	End address (hex	Size	Type	Description	Values
256	256	0x0100	0x0100	1	uint16	Measuring interval	0 - 20 ms 1 - 100 ms 2 - 200 ms 3 - 500 ms 4 - 1000 ms
257	257	0x0101	0x0101	1	uint16	Current transformer profile	0 - CT profile 0 1 - CT profile 1 2 - CT profile 2 3 - CT profile 3
258	258	0x0102	0x0102	1	uint16	Modbus RTU Baudrate	0 - 9600 Bd 1 - 14400 Bd 2 - 19200 Bd 3 - 38400 Bd 4 - 57600 Bd 5 - 115200 Bd
259	262	0x0103	0x0106	4	uint16	Static IP Address[1]	Static IP Address for network configuration.
263	266	0x0107	0x010A	4	uint16	Subnet Mask[1]	Subnet Mask for network configuration.
267	267	0x010B	0x010B	1	uint16	DHCP on/off[1]	DHCP on/off for network configuration. 1 - enable DHCP 0 disable DHCP.
268	268	0x010C	0x010C	1	uint16	Activate Read Only[1]	Writing '1' disables the write access for all configuration register and remote restart register.
269	269	0x010D	0x010D	1	uint16	Voltage Assignment	Adjustable phase assignment of current to voltage. See voltage assignment table.
270	270	0x010E	0x010E	1	uint16	Phase polarity	Inverse the current of a phase. See phase polarity table.[2]

For the static IP address and the subnet mask, each of the four octets must be written into a register

1 Changes become active after restart. Please refer to Restart Register
2 The polarity configuration has to be performed after voltage assignment has been configured.

The following table represents the value mapping of the voltage assignment configuration. E.g., if value is set to "1", the voltage measured on phase L2 is assigned to the current measured on L3 and vice versa.

Table 4: Voltage Assignment Configuration Mapping

Value	V1	V2	V3
0	I1	I2	I3
1	I1	I3	I2
2	I2	I1	I3
3	I2	I3	I1
4	I3	I1	I2
5	I3	I2	I1

The following table represents the value mapping of the phase polarity configuration. E.g., if value is set to "1", the current measured on L3 is calculated with a reversed sign.

Table 5: Phase Polarity Configuration Mapping

Value	L1 Polarity	L2 Polarity	L3 Polarity
0	Normal	Normal	Normal
1	Normal	Normal	Reverse
2	Normal	Reverse	Normal
3	Normal	Reverse	Reverse
4	Reverse	Normal	Normal
5	Reverse	Normal	Reverse
6	Reverse	Reverse	Normal
7	Reverse	Reverse	Reverse

Table 6: Internal Energy registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Units	OBIS-Code	Description
512	515	0x0200	0x0203	4	uint64	0.1 Wh	1-0:1.8.0*255	Active energy+
516	519	0x0204	0x0207	4	uint64	0.1 Wh	1-0:2.8.0*255	Active energy-
520	523	0x0208	0x020B	4	uint64	0.1 varh	1-0:3.8.0*255	Reactive energy+
524	527	0x020C	0x020F	4	uint64	0.1 varh	1-0:4.8.0*255	Reactive energy-
528	531	0x0210	0x0213	4				(reserved)
532	535	0x0214	0x0217	4				(reserved)
536	539	0x0218	0x021B	4				(reserved)
540	543	0x021C	0x021F	4				(reserved)
544	547	0x0220	0x0223	4	uint64	0.1 VAh	1-0:9.8.0*255	Apparent energy+
548	551	0x0224	0x0227	4	uint64	0.1 VAh	1-0:10.8.0*255	Apparent energy-
552	555	0x0228	0x022B	4				(reserved)
556	559	0x022C	0x022F	4				(reserved)
560	563	0x0230	0x0233	4				(reserved)
564	567	0x0234	0x0237	4				(reserved)
568	571	0x0238	0x023B	4				(reserved)
572	575	0x023C	0x023F	4				(reserved)
576	579	0x0240	0x0243	4				(reserved)
580	583	0x0244	0x0247	4				(reserved)
584	587	0x0248	0x024B	4				(reserved)
588	591	0x024C	0x024F	4				(reserved)
592	595	0x0250	0x0253	4	uint64	0.1 Wh	1-0:21.8.0*255	Active energy+ (L1)
596	599	0x0254	0x0257	4	uint64	0.1 Wh	1-0:22.8.0*255	Active energy- (L1)
600	603	0x0258	0x025B	4	uint64	0.1 varh	1-0:23.8.0*255	Reactive energy+ (L1)
604	607	0x025C	0x025F	4	uint64	0.1 varh	1-0:24.8.0*255	Reactive energy- (L1)
608	611	0x0260	0x0263	4				(reserved)
612	615	0x0264	0x0267	4				(reserved)
616	619	0x0268	0x026B	4				(reserved)
620	623	0x026C	0x026F	4				(reserved)
624	627	0x0270	0x0273	4	uint64	0.1 VAh	1-0:29.8.0*255	Apparent energy+ (L1)
628	631	0x0274	0x0277	4	uint64	0.1 VAh	1-0:30.8.0*255	Apparent energy- (L1)
632	635	0x0278	0x027B	4				(reserved)
636	639	0x027C	0x027F	4				(reserved)
640	643	0x0280	0x0283	4				(reserved)
644	647	0x0284	0x0287	4				(reserved)
648	651	0x0288	0x028B	4				(reserved)
652	655	0x028C	0x028F	4				(reserved)
656	659	0x0290	0x0293	4				(reserved)

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Units	OBIS-Code	Description
660	663	0x0294	0x0297	4				(reserved)
664	667	0x0298	0x029B	4				(reserved)
668	671	0x029C	0x029F	4				(reserved)
672	675	0x02A0	0x02A3	4	uint64	0.1 Wh	1-0:41.8.0*255	Active energy+ (L2)
676	679	0x02A4	0x02A7	4	uint64	0.1 Wh	1-0:42.8.0*255	Active energy- (L2)
680	683	0x02A8	0x02AB	4	uint64	0.1 varh	1-0:43.8.0*255	Reactive energy+ (L2)
684	687	0x02AC	0x02AF	4	uint64	0.1 varh	1-0:44.8.0*255	Reactive energy- (L2)
688	691	0x02B0	0x02B3	4				(reserved)
692	695	0x02B4	0x02B7	4				(reserved)
696	699	0x02B8	0x02BB	4				(reserved)
700	703	0x02BC	0x02BF	4				(reserved)
704	707	0x02C0	0x02C3	4	uint64	0.1 VAh	1-0:49.8.0*255	Apparent energy+ (L2)
708	711	0x02C4	0x02C7	4	uint64	0.1 VAh	1-0:50.8.0*255	Apparent energy- (L2)
712	715	0x02C8	0x02CB	4				(reserved)
716	719	0x02CC	0x02CF	4				(reserved)
720	723	0x02D0	0x02D3	4				(reserved)
724	727	0x02D4	0x02D7	4				(reserved)
728	731	0x02D8	0x02DB	4				(reserved)
732	735	0x02DC	0x02DF	4				(reserved)
736	739	0x02E0	0x02E3	4				(reserved)
740	743	0x02E4	0x02E7	4				(reserved)
744	747	0x02E8	0x02EB	4				(reserved)
748	751	0x02EC	0x02EF	4				(reserved)
752	755	0x02F0	0x02F3	4	uint64	0.1 Wh	1-0:61.8.0*255	Active energy+ (L3)
756	759	0x02F4	0x02F7	4	uint64	0.1 Wh	1-0:62.8.0*255	Active energy- (L3)
760	763	0x02F8	0x02FB	4	uint64	0.1 varh	1-0:63.8.0*255	Reactive energy+ (L3)
764	767	0x02FC	0x02FF	4	uint64	0.1 varh	1-0:64.8.0*255	Reactive energy- (L3)
768	771	0x0300	0x0303	4				(reserved)
772	775	0x0304	0x0307	4				(reserved)
776	779	0x0308	0x030B	4				(reserved)
780	783	0x030C	0x030F	4				(reserved)
784	787	0x0310	0x0313	4	uint64	0.1 VAh	1-0:69.8.0*255	Apparent energy+ (L3)
788	791	0x0314	0x0317	4	uint64	0.1 VAh	1-0:70.8.0*255	Apparent energy- (L3)

Table 7: /RM PnP registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Name	Default value / example	Description
8192	8192	0x2000	0x2000	1	uint16	ManufacturerID	0x5233	Fixed value to identify every Eaton device
8193	8193	0x2001	0x2001	1	uint16	ProductID	0x0003=EMD3P	Indicates the hardware type
8194	8194	0x2002	0x2002	1	uint16	ProductVersion	Example: 0x0103 = 1.3.x	(Hardware) Revision of the Eaton EMD3P-CB processor board
8195	8195	0x2003	0x2003	1	uint16	FirmwareVersion	Example: 0x0103 = 1.3.x	Firmware Revision of the EMD3P
8196	8211	0x2004	0x2013	16	string (32)	VendorName	Example: Eaton Industries	Contains the vendor name as a string, padded with NUL bytes
8212	8227	0x2014	0x2023	16	string (32)	ProductName	Example: EMD3P	Contains the product name as a string, padded with NUL bytes
8228	8243	0x2024	0x2033	16	string (32)	SerialNumber	Example: 30380912332211	Contains the serial number of the device as a string, padded with NUL bytes
8244	8244	0x2034	0x2034	1	uint16	MeasuringInterval	Example: 0x01F4 =500 ms	Contains the measuring interval for measurement chip in ms
8245	8245	0x2035	0x2035	1	uint16	SubSwVersion	Example: 0x0204=x.x.2-rc4	Indicates the Patch level of the SW version and the release candidate number. A final release has RC number 0

The EATON/RM PnP register area contains information about the identity of the device.

- **ManufacturerID** is a static value containing the manufacturer's ID. In addition, a higher-level SCADA system can distinguish between different devices on the RS-485.
- **ProductID** depends on the hardware installed in the product.
- **ProductVersion** shows the version of the product's hardware.
- **FirmwareVersion** shows the version of the product's software.
- **VendorName** and **ProductName** contain the brand name of the manufacturer and the brand name of the product as strings.

All strings are filled to their full length with NUL bytes. The Modbus RTU Master / TCP Client should automatically truncate these before the strings are used.

Table 8: SunSpec registers

Start address (dec)	End address (dec)	Size	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40000	40001	2	C_SunSpec_ID	uint32	N/A	N/A	Indicates that it is a valid SunSpec Modbus map.	0x53756E53
40002	40002	1	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid SunSpec Common Model block.	0x0001
40003	40003	1	C_SunSpec_Length	uint16	registers	N/A	Length of Common Model	66
40004	40019	16	C_Manufacturer	string (16)	N/A	N/A	Manufacturer name[4]	Eaton Industries (Austria) GmbH
40020	40035	16	C_Model	string (16)	N/A	N/A	Model name[4]	EMD3P
40036	40043	8	C_Options	string (8)	N/A	N/A	Manufacturer-specific lue[Seite 25, 4]	{empty}
40044	40051	8	C_Version	string (8)	N/A	N/A	Manufacturer-specific value	1.0
40052	40067	16	C_SerialNumber	string (16)	N/A	N/A	Manufacturer-specific lue[Seite 25, 4]	1900221992
40068	40068	1	C_DeviceAddress	uint16	N/A	N/A	Modbus ID (Modbus address)	247
40069	40069	1	Alignment	uint16	N/A	N/A	Alignment	0xFFFF
40070	40070	1	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid SunSpec Meter Model block	203
40071	40071	1	C_SunSpec_Length	uint16	registers	N/A	Length of Meter Model	105
40072	40072	1	M_AC_Current	int16	A	M_AC_Current_SF	AC Current (sum of active phases)	0x8000
40073	40073	1	M_AC_Current_A	int16	A	M_AC_Current_SF	Phase A AC current	1-0:31.4.0*255
40074	40074	1	M_AC_Current_B	int16	A	M_AC_Current_SF	Phase B AC current	1-0:51.4.0*255
40075	40075	1	M_AC_Current_C	int16	A	M_AC_Current_SF	Phase C AC current	1-0:71.4.0*255
40076	40076	1	M_AC_Current_SF	sunssf	N/A	N/A	AC Current Scale Factor[5]	dynamic
40077	40077	1	M_AC_Voltage_LN	int16	V	M_AC_Voltage_SF	Line to Neutral AC Voltage (average of active phases)	0x8000
40078	40078	1	M_AC_Voltage_AN	int16	V	M_AC_Voltage_SF	Phase A to Neutral AC Voltage	1-0:32.4.0*255
40079	40079	1	M_AC_Voltage_BN	int16	V	M_AC_Voltage_SF	Phase B to Neutral AC Voltage	1-0:52.4.0*255
40080	40080	1	M_AC_Voltage_CN	int16	V	M_AC_Voltage_SF	Phase C to Neutral AC Voltage	1-0:72.4.0*255
40081	40081	1	M_AC_Voltage_LL	int16	V	M_AC_Voltage_SF	Line to Line AC Voltage (average of active phases)	0x8000
40082	40082	1	M_AC_Voltage_AB	int16	V	M_AC_Voltage_SF	Phase A to Phase B AC Voltage	No OBIS available map
40083	40083	1	M_AC_Voltage_BC	int16	V	M_AC_Voltage_SF	Phase B to Phase C AC Voltage	No OBIS available map
40084	40084	1	M_AC_Voltage_CA	int16	V	M_AC_Voltage_SF	Phase C to Phase A AC Voltage	No OBIS available map
40085	40085	1	M_AC_Voltage_SF	sunssf	N/A	N/A	AC Voltage Scale Factor[Seite 25, 5]	dynamic
40086	40086	1	M_AC_Freq	int16	Hz	M_AC_Freq_SF	AC Frequency	1-0:14.4.0*255
40087	40087	1	M_AC_Freq_SF	sunssf	N/A	N/A	AC Frequency Scale Factor[Seite 25, 5]	dynamic
40088	40088	1	M_AC_Power	int16	W	M_AC_Power_SF	Total Real Power (sum of active phases)	>0: 1-0:1.4.0*255; <0: 1-0:2.4.0*255
40089	40089	1	M_AC_Power_A	int16	W	M_AC_Power_SF	Phase A AC Real Power	>0: 1-0:21.4.0*255; <0: 1-0:22.4.0*255
40090	40090	1	M_AC_Power_B	int16	W	M_AC_Power_SF	Phase B AC Real Power	>0: 1-0:41.4.0*255; <0: 1-0:42.4.0*255
40091	40091	1	M_AC_Power_C	int16	W	M_AC_Power_SF	Phase C AC Real Power	>0: 1-0:61.4.0*255; <0: 1-0:62.4.0*255

Table 8: SunSpec registers

Start address (dec)	End address (dec)	Size	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40092	40092	1	M_AC_Power_SF	sunssf	N/A	N/A	AC Real Power Scale Factor Seite 25, 5	dynamic
40094	40094	1	M_AC_VA_A	int16	VA	M_AC_VA_SF	Phase A AC Apparent Power	>0: 1-0:29.4.0*255; <0: 1-0:30.4.0*255
40095	40095	1	M_AC_VA_B	int16	VA	M_AC_VA_SF	Phase B AC Apparent Power	>0: 1-0:49.4.0*255; <0: 1-0:50.4.0*255
40096	40096	1	M_AC_VA_C	int16	VA	M_AC_VA_SF	Phase C AC Apparent Power	>0: 1-0:69.4.0*255; <0: 1-0:70.4.0*255
40097	40097	1	M_AC_VA_SF	sunssf	N/A	N/A	AC Apparent Power Scale FactorSeite 25, 5	dynamic
40098	40098	1	M_AC_VAR	int16	var	M_AC_VAR_SF	Total AC Reactive Power (sum of active phases)	> 0: 1-0:3.4.0*255; < 0: 1-0:4.4.0*255
40099	40099	1	M_AC_VAR_A	int16	var	M_AC_VAR_SF	Phase A AC Reactive Power	>0: 1-0:23.4.0*255; <0: 1-0:24.4.0*255
40100	40100	1	M_AC_VAR_B	int16	var	M_AC_VAR_SF	Phase B AC Reactive Power	>0: 1-0:43.4.0*255; <0: 1-0:44.4.0*255
40101	40101	1	M_AC_VAR_C	int16	var	M_AC_VAR_SF	Phase C AC Reactive Power	>0: 1-0:63.4.0*255; <0: 1-0:64.4.0*255
40102	40102	1	M_AC_VAR_SF	sunssf	N/A	N/A	AC Reactive Power Scale Factor Seite 25, 5	dynamic
40103	40103	1	M_AC_PF	int16	%	M_AC_PF_SF	Average Power Factor (average of active phases)	1-0:13.4.0*255 -1000...+1000
40104	40104	1	M_AC_PF_A	int16	%	M_AC_PF_SF	Phase A Power Factor	1-0:33.4.0*255 -1000...+1000
40105	40105	1	M_AC_PF_B	int16	%	M_AC_PF_SF	Phase B Power Factor	1-0:53.4.0*255 -1000...+1000
40106	40106	1	M_AC_PF_C	int16	%	M_AC_PF_SF	Phase C Power Factor	1-0:73.4.0*255 -1000...+1000
40107	40107	1	M_AC_PF_SF	sunssf	N/A	N/A	AC Power Factor Scale Factor Seite 25, 5	dynamic
40108	40109	2	M_Exported	acc32	Wh	M_Energy_W_SF	Total Exported Real Energy	1-0:2.8.0*255
40110	40111	2	M_Exported_A	acc32	Wh	M_Energy_W_SF	Phase A Exported Real Energy	1-0:22.8.0*255
40112	40113	2	M_Exported_B	acc32	Wh	M_Energy_W_SF	Phase B Exported Real Energy	1-0:42.8.0*255
40114	40115	2	M_Exported_C	acc32	Wh	M_Energy_W_SF	Phase C Exported Real Energy	1-0:62.8.0*255
40116	40117	2	M_Imported	acc32	Wh	M_Energy_W_SF	Total Imported Real Energy	1-0:1.8.0*255
40118	40119	2	M_Imported_A	acc32	Wh	M_Energy_W_SF	Phase A Imported Real Energy	1-0:21.8.0*255
40120	40121	2	M_Imported_B	acc32	Wh	M_Energy_W_SF	Phase B Imported Real Energy	1-0:41.8.0*255
40122	40123	2	M_Imported_C	acc32	Wh	M_Energy_W_SF	Phase C Imported Real Energy	1-0:61.8.0*255
40124	40124	1	M_Energy_W_SF	sunssf	N/A	N/A	Real Energy Scale Factor Seite 25, 5	dynamic
40125	40126	2	M_Exported_VA	acc32	VAh	M_Energy_VA_SF	Total Exported Apparent Energy	1-0:10.8.0*255
40127	40128	2	M_Exported_VA_A	acc32	VAh	M_Energy_VA_SF	Phase A Exported Apparent Energy	1-0:30.8.0*255
40129	40130	2	M_Exported_VA_B	acc32	VAh	M_Energy_VA_SF	Phase B Exported Apparent Energy	1-0:50.8.0*255
40131	40132	2	M_Exported_VA_C	acc32	VAh	M_Energy_VA_SF	Phase C Exported Apparent Energy	1-0:70.8.0*255
40133	40134	2	M_Imported_VA	acc32	VAh	M_Energy_VA_SF	Total Imported Apparent Energy	1-0:9.8.0*255
40135	40136	2	M_Imported_VA_A	acc32	VAh	M_Energy_VA_SF	Phase A Imported Apparent Energy	1-0:29.8.0*255
40137	40138	2	M_Imported_VA_B	acc32	VAh	M_Energy_VA_SF	Phase B Imported Apparent Energy	1-0:49.8.0*255

Start address (dec)	End address (dec)	Size	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40139	40140	2	M_Imported_VA_C	acc32	VAh	M_Energy_VA_SF	Phase C Imported Apparent Energy	1-0:69.8.0*255
40141	40141	1	M_Energy_VA_SF	sunssf	N/A	N/A	Apparent Energy Scale Factor[Seite 25, 5]	dynamic
40142	40143	2	M_Import_VARh_Q1	acc32	VARh	M_Energy_VAR_SF	Quadrant 1: Total Imported Reactive Energy	0x0
40144	40145	2	M_Import_VARh_Q1A	acc32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 1: Imported Reactive Energy	0x0
40146	40147	2	M_Import_VARh_Q1B	acc32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 1: Imported Reactive Energy	0x0
40148	40149	2	M_Import_VARh_Q1C	acc32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 1: Imported Reactive Energy	0x0
40150	40151	2	M_Import_VARh_Q2	acc32	VARh	M_Energy_VAR_SF	Quadrant 2: Total Imported Reactive Energy	0x0
40152	40153	2	M_Import_VARh_Q2A	acc32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 2: Imported Reactive Energy	0x0
40154	40155	2	M_Import_VARh_Q2B	acc32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 2: Imported Reactive Energy	0x0
40156	40157	2	M_Import_VARh_Q2C	acc32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 2: Imported Reactive Energy	0x0
40158	40159	2	M_Export_VARh_Q3	acc32	VARh	M_Energy_VAR_SF	Quadrant 3: Total Imported Reactive Energy	0x0
40160	40161	2	M_Export_VARh_Q3A	acc32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 3: Imported Reactive Energy	0x0
40162	40163	2	M_Export_VARh_Q3B	acc32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 3: Imported Reactive Energy	0x0
40164	40165	2	M_Export_VARh_Q3C	acc32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 3: Imported Reactive Energy	0x0
40166	40167	2	M_Export_VARh_Q4	acc32	VARh	M_Energy_VAR_SF	Quadrant 4: Total Imported Reactive Energy	0x0
40168	40169	2	M_Export_VARh_Q4A	acc32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 4: Imported Reactive Energy	0x0
40170	40171	2	M_Export_VARh_Q4B	acc32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 4: Imported Reactive Energy	0x0
40172	40173	2	M_Export_VARh_Q4C	acc32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 4: Imported Reactive Energy	0x0
40174	40174	1	M_Energy_VAR_SF	sunssf	N/A	N/A	Reactive Energy Scale Factor[Seite 25, 5]	dynamic
40175	40176	2	M_Events	uint32	N/A	N/A	Event flags	0
40177	40177	1	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid SunSpec End Model block	0xFFFF
40178	40178	1	C_SunSpec_Length	uint16	registers	N/A	Length of End Model	0

[3] Note to avoid off-by-one errors: The SunSpec specification (as found on www.sunspec.org) always refers to register numbers, whereas this document always refers to register addresses. To access SunSpec register 40001, register address 40000 must be used, i.e. hexadecimal offset 0x9C40.

[4] These fields can receive customer branding upon request

[5] Example: If register M_AC_Freq contains the value 4950 and M_AC_Freq_SF contains the value -2, then the frequency can be calculated as:

4950 Hz * 10^{-2} = 49.50 Hz

Important note: The values can change dynamically in order to optimally represent the respective measured values. Please always query the scaling factors together with the associated values integrate this into your source code for dynamic calculation.

Table 9: Fast registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Units	OBIS-Code	Description
61440	61441	0xF000	0xF001	2	uint32	0.1 W	1-0:21.4.0*255	Active power+ (L1)
61442	61443	0xF002	0xF003	2	uint32	0.1 W	1-0:22.4.0*255	Active power- (L1)
61444	61445	0xF004	0xF005	2	uint32	0.001 A	1-0:31.4.0*255	Current (L1)
61446	61447	0xF006	0xF007	2	uint32	0.001 V	1-0:32.4.0*255	Voltage (L1)
61448	61449	0xF008	0xF009	2	uint32	0.1 W	1-0:41.4.0*255	Active power+ (L2)
61450	61451	0xF00A	0xF00B	2	uint32	0.1 W	1-0:42.4.0*255	Active power- (L2)
61452	61453	0xF00C	0xF00D	2	uint32	0.001 A	1-0:51.4.0*255	Current (L2)
61454	61455	0xF00E	0xF00F	2	uint32	0.001 V	1-0:52.4.0*255	Voltage (L2)
61456	61457	0xF010	0xF011	2	uint32	0.1 W	1-0:61.4.0*255	Active power+ (L3)
61458	61459	0xF012	0xF013	2	uint32	0.1 W	1-0:62.4.0*255	Active power- (L3)
61460	61461	0xF014	0xF015	2	uint32	0.001 A	1-0:71.4.0*255	Current (L3)
61462	61463	0xF016	0xF017	2	uint32	0.001 V	1-0:72.4.0*255	Voltage (L3)
61464	61467	0xF018	0xF01B	4	uint64			Number of measurements

In the fast register area, the current, voltage and active power values can be called up for all phase conductors.

Table 10: Identification Registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Description	Value
61613	61613	0xF0AD	0xF0AD	1	uint16	Set the blin- king frequency in mHz	100 - 10000. Default is 100
61614	61614	0xF0AE	0xF0AE	1	uint16	Set the blinking duration in seconds	0 - 600. Writing a value other than 0 activates the identification. Writing a 0 stops the identification process. Re- ading this value shows the remaining time of the identification process.

Table 11: Restart und Bootloader Registers

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Type	Description	Value
61615	61615	0xF0AF	0xF0AF	1	uint16	Restart[6]	0x1 restart device
61616	61616	0xF0B0	0xF0B0	1	uint16	Start Bootloader	0xA0B1 start bootloader

With the Restart Register and Bootloader Register it is possible to restart or start the bootloader. Access with Modbus Function Code 3 (Read Holding Registers) always returns the value “0”..

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