SOLAR ELECTRIC

KOSTAL

KSEM G1/G2

KOSTAL Smart Energy Meter

Interface Description MODBUS

Version

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Inhalt

1. Introduction

1.1 MODBUS Protocol

The following describes the functionality of the Modbus App in the form of possible configuration, operating modes and the Modbus register specification. A detailed description of the Modbus protocol and its operation can be found in the Modbus specification (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 RTU Master
- Modbus TCP Slave
- Modbus TCP Master

1.2 Modbus RTU via RS485 interface

In Modbus RTU Slave mode, the KOSTAL Smart Energy Meter provides its Modbus registers via RS485. Both RS485 interfaces, RS485 A and RS485 B, can be individually configured for this purpose. Details on the connection to the RS-485 socket and the polarity reversal of the interface can be found in the KOSTAL Smart Energy Meter installation manual.

1.3 Modbus TCP via Ethernet interface

1.3.1 TCP - Master

In **Modbus TCP > Maste**r operating mode, the Energy Manager writes to the registers of one or more connected devices that act as Modbus slaves. These can be PLC controllers or external energy management systems, for example, which have standardised Modbus connections. This does not necessarily have to be hardware that is specifically suitable for this purpose. For example, web services can also receive data via this mode. However, these must be specially configured to receive these register areas.

Both the device‘s internal power and energy value registers can be written. In addition, you can decide whether only the total values of all three phases or the respective individual values should be transmitted. The corresponding register ranges can be switched on and off in the **Extended Modbus configuration > Register configuration** card. The KSEM/RM PnP registers and the SunSpec registers are not transmitted via Modbus Master.

Parameter	Explanation
Slave adress	Specifies the address of a TCP slave. This can be specified in the form of an IP address or a URL.
Port	Specifies the TCP port on which the slave expects Modbus communication.

Es können bis zu 10 TCP Slaves konfiguriert werden.

1.3.2 TCP - Slave

In Modbus TCP **Slave** mode, the KOSTAL Smart Energy Meter provides its Modbus registers over TCP/IP. Access to this interface requires network connection via Ethernet.

The Modbus **Slave** can be reached in accordance with the industry standard under port number 502.

- **Activate TCP slave** activates and deactivates the Modbus slave functionality.
- **Enable encryption (TLS)** activates or deactivates encryption using TLS for Modbus slave connections. If encryption is activated, the Modbus slave can only be reached via port 802. Unencrypted connections to port 502 are then no longer possible.

In **Slave** mode, the KOSTAL Smart Energy Meter provides its measurement data (Modbus register) via the LAN interface (TCP/IP). This setting allows the KSEM to be read out by third parties.

The Modbus **Slave** can be reached by default under port number 502. Encrypted connections must be made via port number 802.

Parameter	Erklärung
Aktivate TCP Slave	**Activated** The Modbus **Slave** functionality on the Ethernet interface (LAN) is activated. Data can only be retrieved from the KOSTAL Smart Energy Meter via the interface once the interface has been activated and the settings have been saved. The Modbus **Slave** is accessible by default under **port number 502**. **Deactivated** The Modbus interface is deactivated. activates or deactivates the Modbus slave functionality.
Enable encryption (TLS)	**Activated** Activates encryption using TLS for Modbus slave connections. When encryption is activated, the Modbus slave can only be reached via **port number 802**. **Deactivated** Encryption is deactivated.

Handling self-signed TLS certificates

A TLS certificate and the corresponding private key are required to establish an encrypted Mobus TCP connection. In the simplest case, such a key pair can be generated with the **openssl** programme. This is then a so-called self-signed certificate. TLS versions below version 1.2 are not supported.

INFO

ACCESSING SENSITIVE DATA

Unknown TLS certificates should always be checked carefully to prevent unauthorised third-party access to the device‘s measurement data.

A secure TLS connection is automatically established for remote stations that use known or already accepted certificates.

The device has a number of trustworthy certificates and certification authorities (CA). If a connection is initiated for the first time to a remote station that has a self-signed certificate, this is recognised by the device and must be actively accepted by the user. Until this confirmation, all read and write access to Modbus registers is denied.

An overview of added and unknown certificates can be found in the drop-down table **Certificates**, which is located directly below the Modbus TCP configuration. Certificates are described there as follows:

Status: Accepted

- The status shows a green tick. This certificate is trusted by the device. The certificate can be removed from the device via **Delete**.
- Remote stations that use this certificate are trusted and a secure TLS connection can be established to them.
- Click **Delete** to delete the certificate from the list of trusted certificates. This certificate is now no longer trusted and open connections that use this certificate are terminated immediately.

Status: Not accepted

- The status shows a red cross. Behind it is an **Accept** button. This certificate is not trusted.
- In order to establish a secure TLS connection to remote stations that use this certificate, this certificate must first be actively trusted.
- By clicking on **Accept**, the certificate is added to the trusted certificates and is now considered accepted. A secure TLS connection from remote peers using this certificate can now be established.

2. MODBUS protocol description

2.1 Register Specification

The data registers can be divided into different areas. The data points of the KOSTAL Smart Energy Meter are coded according to the OBIS standard. In addition, in the register area 40000-40177, the data points are encoded according to SunSpec Alliance standards:

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

2.2 Reading out registers

Most data points of the KOSTAL Smart Energy Meter are distributed to several 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.

Interpretation of data points with multiple registers: In the case of a multi-register data point, the registers with the lower address contain the „mustsignificant“ bits. The „least siginificant“ bits are contained in the registers with the higher address.

Example Principle:

A fictitious data point „TotalOperatingHours“ (uint32) is located at offset 0x1000. The data point should contain 2293828 operating hours.

- the address 0x1000 contains 0x23
- the address 0x1001 contains 0x44

During the request, both registers are transmitted in the network byte order (Big Endian) as specified by the Modbus specification. A „Read Holding Register“ for both registers provides 0x00 0x23 0x00 0x44.

Example conversion:

In order to read the referenced active power (+), the (integer) values of the „holding registers“ 0 and 1 can be used:

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

In order to read out the related active energy (+), that is to say the related active energy over all phases, the (integer) registers 512 to 515 can use:

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

Reading unspecified registers If a client attempts to read unspecified registers, an error code ‘0x02’ (ILLEGAL_DATA_ADDRESS) is sent. Unspecified registers are registers that are not listed in the register specification in the appendix.

2.3 Functionality of the area with dynamic register blocks

The register area with dynamic register blocks in the address range 49152 - 59391 plays a special role. This corresponds to a size of 10240 registers, each of which can store 2 bytes. Depending on the functional scope of the firmware, different types of register blocks can be created in this area. Different types of register blocks differ both in the number of registers they contain and the data that can be retrieved. The supported types of dynamic register blocks are listed in the appendix. The number of these register blocks can vary depending on the type and number of connected and configured external devices.

Dynamic register blocks are usually generated automatically; more detailed information can be found in the appendix for the respective register blocks. New register blocks are always created directly after the last register block currently in use. Register blocks of devices that cannot currently be accessed (e.g. due to a connection error) are kept in the configuration. These devices are labelled with the status Offline in the overview table.

Defragmentation of the area with dynamic register blocks

There is a button with which the register area can be defragmented. Devices with the Offline status are removed from the table. The arrangement of the register blocks is changed so that register blocks of the same type are directly behind each other and there is no gap of unused registers between two register blocks. The defragmentation therefore changes the Modbus interface in the area of the dynamic register blocks that is addressed by external devices. Therefore, confirmation is requested again when the Defragment button is clicked.

2.4 Modbus E-Mobility

The Modbus charging device app manages data from connected charging devices and makes it available as required.

How it works

If the parameters for a charging process are updated, these data points are forwarded to the app. There, the information received is then processed so that it can be written directly to the corresponding register area of the static Modbus.

2.5 Modbus charger

The Modbus charger app manages data from connected chargers and makes it available as required.

How it works

If the values of a connected charging device are updated, these data points are forwarded to the app. There, the information received is then processed so that it can be written directly to the corresponding register area of the dynamic modbus. This register area has 130 registers and then contains the data block of a charger.

An overview of the register definition of an individual register area of a charger can be found in the appendix Modbus charger - Overview of registers.

2.6 Modbus energy flow

The Modbus energy flow app manages data from the energy flow app and makes it available as required.

How it works

If the values of the energy flow app are updated, these data points are forwarded to the app. There, the information received is then processed so that it can be written directly to the corresponding register area of the static Modbus. The register area in the static Modbus starts at address 40960 and contains 200 registers, each of which can store 2 bytes.

An overview of all available registers can be found in the Modbus energy flow - register overview appendix.

2.7 OBIS key figures system

So-called OBIS codes are used to transfer data and differentiate between the various measurement data from a data source. OBIS stands for Object Identification System and is used for electronic data communication in the energy market.

OBIS key figures consist of six value groups (A-F) from the combination of which the speci fi cation of a value is derived. They are shown in the form A-B: C.D.E * F.

The specific OBIS codes used in the Energy Manager are described in the document attachment depending on the data source. The OBIS key figure system in version 2.0 (status: 02.02.2009), which is based on DIN EN 62056-61: 2007-06 and can be found at edi-energy.de, serves as the basis. The individual groups are explained below in the context of the KOSTAL Smart Energy Meter. Note: The values of groups A and F are fi xed, those of the remaining groups are variable.

Group A (medium)

A = 1 (electricity)

Group B (channel)

Used to differentiate 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 variable)

Key value of the resulting measured variable according to the OBIS key figure system

Group D (measurement type)

Key value of the type of measurement used according to the OBIS key figure system

Group E (tariff level)

Key value of the tariff, mostly E = 0 (total)

Group F (pre-value counter)

F = 255

3. MODBUS Register table

3.1 Overview Register Areas

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Description
0	147	0x0000	0x0093	148	Internal instantaneous registers
512	791	0x0200	0x0317	280	Internal Energy registers (counters)
8192	8249	0x2000	0x2039	57	KSEM/RM PnP registers
40000	40177	0x9C40	0x9CF1	178	SunSpec registers
40960	49151	0xA000	0xBFFF	8192	Static modbus registers
49152	59391	0xC000	0xE7FF	10240	Dynamic modbus registers
59392	61311	0xE800	0xEF7F	1920	Group registers
61440	65279	0xF000	0xFED8	3840	Sensor registers

3.2 Overview internal instantaneous register

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Func-tion codes	Type	Units	OBIS-Code	Description
0	1	0x0000	0x0001	2	RO	0x03	uint32	0.1 W	1-0:1.4.0*255	Active power+
2	3	0x0002	0x0003	2	RO	0x03	uint32	0.1 W	1-0:2.4.0*255	Active power-
4	5	0x0004	0x0005	2	RO	0x03	uint32	0.1 var	1-0:3.4.0*255	Reactive power+
6	7	0x0006	0x0007	2	RO	0x03	uint32	0.1 var	1-0:4.4.0*255	Reactive power-
16	17	0x0010	0x0011	2	RO	0x03	uint32	0.1 VA	1-0:9.4.0*255	Apparent power+
18	19	0x0012	0x0013	2	RO	0x03	uint32	0.1 VA	1-0:10.4.0*255	Apparent power-
24	25	0x0018	0x0019	2	RO	0x03	int32	0.001 (unit- less)	1-0:13.4.0*255	Power factor
26	27	0x001A	0x001B	2	RO	0x03	uint32	0.001 Hz	1-0:14.4.0*255	Supply frequency
40	41	0x0028	0x0029	2	RO	0x03	uint32	0.1 W	1-0:21.4.0*255	Active power+ (L1)
42	43	0x002A	0x002B	2	RO	0x03	uint32	0.1 W	1-0:22.4.0*255	Active power- (L1)
44	45	0x002C	0x002D	2	RO	0x03	uint32	0.1 var	1-0:23.4.0*255	Reactive ower+(L1)
46	47	0x002E	0x002F	2	RO	0x03	uint32	0.1 var	1-0:24.4.0*255	Reactive power- (L1)
56	57	0x0038	0x0039	2	RO	0x03	uint32	0.1 VA	1-0:29.4.0*255	Apparent power+ (L1)
58	59	0x003A	0x003B	2	RO	0x03	uint32	0.1 VA	1-0:30.4.0*255	Apparent power- (L1)
60	61	0x003C	0x003D	2	RO	0x03	uint32	0.001 A	1-0:31.4.0*255	Current (L1)
62	63	0x003E	0x003F	2	RO	0x03	uint32	0.001 V	1-0:32.4.0*255	Voltage (L1)
64	65	0x0040	0x0041	2	RO	0x03	int32	0.001 (unit- less)	1-0:33.4.0*255	Power factor (L1)

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Func-tion codes	Type	Units	OBIS-Code	Description
80	81	0x0050	0x0051	2	RO	0x03	uint32	0.1 W	1-0:41.4.0*255	Active power+ (L2)
82	83	0x0052	0x0053	2	RO	0x03	uint32	0.1 W	1-0:42.4.0*255	Active power- (L2)
84	85	0x0054	0x0055	2	RO	0x03	uint32	0.1 var	1-0:43.4.0*255	Reactive power+(L2)
86	87	0x0056	0x0057	2	RO	0x03	uint32	0.1 var	1-0:44.4.0*255	Reactive power- (L2)
96	97	0x0060	0x0061	2	RO	0x03	uint32	0.1 VA	1-0:49.4.0*255	Apparent power+(L2)
98	99	0x0062	0x0063	2	RO	0x03	uint32	0.1 VA	1-0:50.4.0*255	Apparent power- (L2)
100	101	0x0064	0x0065	2	RO	0x03	uint32	0.001 A	1-0:51.4.0*255	Current (L2)
102	103	0x0066	0x0067	2	RO	0x03	uint32	0.001 V	1-0:52.4.0*255	Voltage (L2)
104	105	0x0068	0x0069	2	RO	0x03	int32	0.001 (unit- less)	1-0:53.4.0*255	Power factor (L2)
120	121	0x0078	0x0079	2	RO	0x03	uint32	0.1 W	1-0:61.4.0*255	Active power+ (L3)
122	123	0x007A	0x007B	2	RO	0x03	uint32	0.1 W	1-0:62.4.0*255	Active power- (L3)
124	125	0x007C	0x007D	2	RO	0x03	uint32	0.1 var	1-0:63.4.0*255	Reactive power+(L3)
126	127	0x007E	0x007F	2	RO	0x03	uint32	0.1 var	1-0:64.4.0*255	Reactive power- (L3)
136	137	0x0088	0x0089	2	RO	0x03	uint32	0.1 VA	1-0:69.4.0*255	Apparent power+(L3)
138	139	0x008A	0x008B	2	RO	0x03	uint32	0.1 VA	1-0:70.4.0*255	Apparent power- (L3)
140	141	0x008C	0x008D	2	RO	0x03	uint32	0.001 A	1-0:71.4.0*255	Current (L3)
142	143	0x008E	0x008F	2	RO	0x03	uint32	0.001 V	1-0:72.4.0*255	Voltage (L3)
144	145	0x0090	0x0091	2	RO	0x03	int32	0.001 (unit- less)	1-0:73.4.0*255	Power factor (L3)
146	147	0x0092	0x0093	2	RO	0x03	uint32	0.1 W		Minimum active power+ * 3

3.3 Overview internal Energy register

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Func-tion codes	Type	Units	OBIS-Code	Description
512	515	0x0200	0x0203	4	RO	0x03	uint64	0.1 Wh	1-0:1.8.0*255	Active energy+
516	519	0x0204	0x0207	4	RO	0x03	uint64	0.1 Wh	1-0:2.8.0*255	Active energy-
520	523	0x0208	0x020B	4	RO	0x03	uint64	0.1 varh	1-0:3.8.0*255	Reactive energy+
524	527	0x020C	0x020F	4	RO	0x03	uint64	0.1 varh	1-0:4.8.0*255	Reactive energy-
544	547	0x0220	0x0223	4	RO	0x03	uint64	0.1 VAh	1-0:9.8.0*255	Apparent energy+
548	551	0x0224	0x0227	4	RO	0x03	uint64	0.1 VAh	1-0:10.8.0*255	Apparent energy-
592	595	0x0250	0x0253	4	RO	0x03	uint64	0.1 Wh	1-0:21.8.0*255	Active energy+ (L1)
596	599	0x0254	0x0257	4	RO	0x03	uint64	0.1 Wh	1-0:22.8.0*255	Active energy- (L1)
600	603	0x0258	0x025B	4	RO	0x03	uint64	0.1 varh	1-0:23.8.0*255	Reactive energy+(L1)
604	607	0x025C	0x025F	4	RO	0x03	uint64	0.1 varh	1-0:24.8.0*255	Reactive energy- (L1)
624	627	0x0270	0x0273	4	RO	0x03	uint64	0.1 VAh	1-0:29.8.0*255	Apparent energy+(L1)
628	631	0x0274	0x0277	4	RO	0x03	uint64	0.1 VAh	1-0:30.8.0*255	Apparent energy-(L1)
672	675	0x02A0	0x02A3	4	RO	0x03	uint64	0.1 Wh	1-0:41.8.0*255	Active energy+ (L2)
676	679	0x02A4	0x02A7	4	RO	0x03	uint64	0.1 Wh	1-0:42.8.0*255	Active energy- (L2)
680	683	0x02A8	0x02AB	4	RO	0x03	uint64	0.1 varh	1-0:43.8.0*255	Reactive energy+(L2)
684	687	0x02AC	0x02AF	4	RO	0x03	uint64	0.1 varh	1-0:44.8.0*255	Reactive energy- (L2)
704	707	0x02C0	0x02C3	4	RO	0x03	uint64	0.1 VAh	1-0:49.8.0*255	Apparent energy+(L2)
708	711	0x02C4	0x02C7	4	RO	0x03	uint64	0.1 VAh	1-0:50.8.0*255	Apparent energy-(L2)
752	755	0x02F0	0x02F3	4	RO	0x03	uint64	0.1 Wh	1-0:61.8.0*255	Active energy+ (L3)
756	759	0x02F4	0x02F7	4	RO	0x03	uint64	0.1 Wh	1-0:62.8.0*255	Active energy- (L3)
760	763	0x02F8	0x02FB	4	RO	0x03	uint64	0.1 varh	1-0:63.8.0*255	Reactive energy+(L3)
764	767	0x02FC	0x02FF	4	RO	0x03	uint64	0.1 varh	1-0:64.8.0*255	Reactive energy- (L3)
784	787	0x0310	0x0313	4	RO	0x03	uint64	0.1 VAh	1-0:69.8.0*255	Apparent energy+(L3)
788	791	0x0314	0x0317	4	RO	0x03	uint64	0.1 VAh	1-0:70.8.0*255	Apparent energy-(L3)

3.4 Overview KSEM/RM PnP register

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Function codes	Type	Name	Default value / example	Description
8192	8192	0x2000	0x2000	1	RO	0x03	uint16	ManufacturerID	0x5233	Fixed value to identify every KOSTAL device
8193	8193	0x2001	0x2001	1	RO	0x03	uint16	ProductID	0x4852	Indicates that this device is a KOSTAL Smart Energy Meter
8194	8194	0x2002	0x2002	1	RO	0x03	uint16	ProductVersion	Example: 0x0000	(Hardware) Revision of the KOSTAL Smart Energy Meter processor board
8195	8195	0x2003	0x2003	1	RO	0x03	uint16	FirmwareVersion	Example: 0x0103 = 1.3.x	Firmware Revision of the KOSTAL Smart Energy Meter
8196	8211	0x2004	0x2013	16	RO	0x03	string 32	VendorName	Example: KOSTAL Solar electric	Contains the vendor name as a string, padded with NUL bytes
8212	8227	0x2014	0x2023	16	RO	0x03	string 32	ProductName	Example: KOSTAL Smart Energy Meter	Contains the product name as a string, padded with NUL bytes
8228	8243	0x2024	0x2033	16	RO	0x03	string 32	SerialNumber	Example: 30380912332211	Contains the serial number of the device as a string, padded with NUL bytes
8244	8244	0x2034	0x2034	1	RO	0x03	uint16	MeasuringInterval	Example: 0x01F4 = 500 ms	Contains the measuring interval for measurement chip in ms
8245	8248	0x2035	0x2038	4	RO	0x03	uint64	UNIXTimestamp	Example: 1552323559000 = 2019-03-11 16:59:19	Contains the Current UNIX timestamp in ms
8249	8249	0x2039	0x2039	1	RO	0x03	uint16	ModbusSpecVersion	Example: 0x0007	Version of the Modbus specification being used

The KSEM/RM PnP register contains information on the identity of the device.

- ManufacturerID is a static value that contains the ID of the manufacturer. An overriding SCADA system can differentiate between different devices on the RS-485.
- ProductID is also a static value that allows the identification of the specific product via this key.
- ProductVersion is the version of the hardware of the product.
- FirmwareVersion is the version of the software of the product.
- VendorName and product name include the name of the manufacturer and the name of the product as strings.

All strings are padded with NUL bytes and spaces (0x32) to their full length. The Modbus RTU Master / TCP Client should automatically truncate these before the strings are used.

If the system time of the device is not set, the UNIX timestamp registers are set to zero.

3.5 Overview SunSpec register

Start address (dec)	End address (dec)	Size	R/W	Function codes	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40000	40001	2	RO	0x03	C_SunSpec_ID	uint32	N/A	N/A	Indicates that it is a valid SunSpec Modbus map.	0x53756e53
40002	40002	1	RO	0x03	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid SunSpec Common Model block.	0x0001
40003	40003	1	RO	0x03	C_SunSpec_Length	uint16	registers	N/A	Length of Common Model	65
40004	40019	16	RO	0x03	C_Manufacturer	String (32)	N/A	N/A	Manufacturer name[2]	KOSTAL Solar Electric
40020	40035	16	RO	0x03	C_Model	string (32)	N/A	N/A	Model name[2]	KSEM
40036	40043	16	RO	0x03	C_Options	String (16)	N/A	N/A	Manufacturer-specific value[2]	{empty}
40044	40051	8	RO	0x03	C_Version	String (16)	N/A	N/A	Manufacturer-specific value	1.0
40052	40067	16	RO	0x03	C_SerialNumber	String (32)	N/A	N/A	Manufacturer-specific value[2]	1900221992
40068	40068	1	RO	0x03	C_DeviceAddress	uint16	N/A	N/A	Modbus ID (Modbus address)	247
40069	40069	1	RO	0x03	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid Sun-Spec Meter Model block.	203
40070	40070	1	RO	0x03	C_SunSpec_Length	uint16	registers	N/A	Length of Meter Model	105
40071	40071	1	RO	0x03	M_AC_Current	int16	A	M_AC_Current_SF	AC Current (sum of active phases)	0x8000
40072	40072	1	RO	0x03	M_AC_Current_A	int16	A	M_AC_Current_SF	Phase A AC current	1-0:31.4.0*255
40073	40073	1	RO	0x03	M_AC_Current_B	int16	A	M_AC_Current_SF	Phase B AC current	1-0:51.4.0*255
40074	40074	1	RO	0x03	M_AC_Current_C	int16	A	M_AC_Current_SF	Phase C AC current	1-0:71.4.0*255
40075	40075	1	RO	0x03	M_AC_Current_SF	int16	N/A	N/A	AC Current Scale Factor[3]	-2
40076	40076	1	RO	0x03	M_AC_Voltage_LN	int16	V	M_AC_Voltage_SF	Line to Neutral AC Voltage (average of active phases)	0x8000

Start address (dec)	End address (dec)	Size	R/W	Function codes	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40077	40077	1	RO	0x03	M_AC_Voltage_AN	int16	V	M_AC_Voltage_SF	Phase A to Neutral AC Voltage	1-0:32.4.0*255
40078	40078	1	RO	0x03	M_AC_Voltage_BN	int16	V	M_AC_Voltage_SF	Phase B to Neutral AC Voltage	1-0:52.4.0*255
40079	40079	1	RO	0x03	M_AC_Voltage_CN	int16	V	M_AC_Voltage_SF	Phase C to Neutral AC Voltage	1-0:72.4.0*255
40080	40080	1	RO	0x03	M_AC_Voltage_LL	int16	V	M_AC_Voltage_SF	Line to Line AC Voltage (average of active phases)	
40081	40081	1	RO	0x03	M_AC_Voltage_AB	int16	V	M_AC_Voltage_SF	Phase A to Phase B AC Voltage	0x8000
40082	40082	1	RO	0x03	M_AC_Voltage_BC	int16	V	M_AC_Voltage_SF	Phase B to Phase C AC Voltage	0x8000
40083	40083	1	RO	0x03	M_AC_Voltage_CA	int16	V	M_AC_Voltage_SF	Phase C to Phase A AC Voltage	0x8000
40084	40084	1	RO	0x03	M_AC_Voltage_SF	int16	N/A	N/A	AC Voltage Scale Factor[3]	-2
40085	40085	1	RO	0x03	M_AC_Freq	int16	Hz	M_AC_Freq_SF	AC Frequency	1-0:14.4.0*255
40086	40086	1	RO	0x03	M_AC_Freq_SF	int16	N/A	N/A	AC Frequency Scale Factor[3]	-2
40087	40087	1	RO	0x03	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
40088	40088	1	RO	0x03	M_AC_Power_A	int16	W	M_AC_Power_SF	Phase A AC Real Power	>0: 1-:21.4.0*255; <0: 1-0:22.4.0*255
40089	40089	1	RO	0x03	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
40090	40090	1	RO	0x03	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
40091	40091	1	RO	0x03	M_AC_Power_SF	int16	N/A	N/A	AC Real Power Scale Factor[3]	1
40092	40092	1	RO	0x03	M_AC_VA	int16	VA	M_AC_VA_SF	Total AC Apparent Power (sum of active phases)	>0: 1-0:9.4.0*255; <0: 1-0:10.4.0*255
40093	40093	1	RO	0x03	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
40094	40094	1	RO	0x03	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
40095	40095	1	RO	0x03	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

Start address (dec)	End address (dec)	Size	R/W	Function codes	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40096	40096	1	RO	0x03	M_AC_VA_SF	int16	N/A	N/A	AC Apparent Power Scale Factor[3]	1
40097	40097	1	RO	0x03	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
40098	40098	1	RO	0x03	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
40099	40099	1	RO	0x03	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
40100	40100	1	RO	0x03	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
40101	40101	1	RO	0x03	M_AC_VAR_SF	int16	N/A	N/A	AC Reactive Power Scale Factor[3]	1
40102	40102	1	RO	0x03	M_AC_PF	int16	%	M_AC_PF_SF	Average Power Factor (average of active phases)	1-0:13.4.0*255 - 1000...+1000
40103	40103	1	RO	0x03	M_AC_PF_A	int16	%	M_AC_PF_SF	Phase A Power Factor	1-0:33.4.0*255 - 1000...+1000
40104	40104	1	RO	0x03	M_AC_PF_B	int16	%	M_AC_PF_SF	Phase B Power Factor	1-0:53.4.0*255 - 1000...+1000
40105	40105	1	RO	0x03	M_AC_PF_C	int16	%	M_AC_PF_SF	Phase C Power Factor	1-0:73.4.0*255 - 1000...+1000
40106	40106	1	RO	0x03	M_AC_PF_SF	int16	N/A	N/A	AC Power Factor Scale Factor[3]	-3
40107	40108	2	RO	0x03	M_Exported	uint32	Wh	M_Energy_W_SF	Total Exported Real Energy	1-0:2.8.0*255
40109	40110	2	RO	0x03	M_Exported_A	uint32	Wh	M_Energy_W_SF	Phase A Exported Real Energy	1-0:22.8.0*255
40111	40112	2	RO	0x03	M_Exported_B	uint32	Wh	M_Energy_W_SF	Phase B Exported Real Energy	1-0:42.8.0*255
40113	40114	2	RO	0x03	M_Exported_C	uint32	Wh	M_Energy_W_SF	Phase C Exported Real Energy	1-0:62.8.0*255
40115	40116	2	RO	0x03	M_Imported	uint32	Wh	M_Energy_W_SF	Total Imported Real Energy	1-0:1.8.0*255
40117	40118	2	RO	0x03	M_Imported_A	uint32	Wh	M_Energy_W_SF	Phase A Imported Real Energy	1-0:21.8.0*255
40119	40120	2	RO	0x03	M_Imported_B	uint32	Wh	M_Energy_W_SF	Phase B Imported Real Energy	1-0:41.8.0*255
40121	40122	2	RO	0x03	M_Imported_C	uint32	Wh	M_Energy_W_SF	Phase C Imported Real Energy	1-0:61.8.0*255

Start address (dec)	End address (dec)	Size	R/W	Function codes	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40123	40123	1	RO	0x03	M_Energy_W_SF	int16	N/A	N/A	Real Energy Scale Factor[3]	0
40124	40125	2	RO	0x03	M_Exported_VA	uint32	VAh	M_Energy_VA_SF	Total Exported Apparent Energy	1-0:10.8.0*255
40126	40127	2	RO	0x03	M_Exported_VA_A	uint32	VAh	M_Energy_VA_SF	Phase A Exported Apparent Energy	1-0:30.8.0*255
40128	40129	2	RO	0x03	M_Exported_VA_B	uint32	VAh	M_Energy_VA_SF	Phase B Exported Apparent Energy	1-0:50.8.0*255
40130	40131	2	RO	0x03	M_Exported_VA_C	uint32	VAh	M_Energy_VA_SF	Phase C Exported Apparent Energy	1-0:70.8.0*255
40132	40133	2	RO	0x03	M_Imported_VA	uint32	VAh	M_Energy_VA_SF	Total Imported Apparent Energy	1-0:9.8.0*255
40134	40135	2	RO	0x03	M_Imported_VA_A	uint32	VAh	M_Energy_VA_SF	Phase A Imported Apparent Energy	1-0:29.8.0*255
40136	40137	2	RO	0x03	M_Imported_VA_B	uint32	VAh	M_Energy_VA_SF	Phase B Imported Apparent Energy	1-0:49.8.0*255
40138	40139	2	RO	0x03	M_Imported_VA_C	uint32	VAh	M_Energy_VA_SF	Phase C Imported Apparent Energy	1-0:69.8.0*255
40140	40140	1	RO	0x03	M_Energy_VA_SF	int16	N/A	N/A	Apparent Energy Scale Factor[3]	0
40141	40142	2	RO	0x03	M_Import_VARh_Q1	uint32	VARh	M_Energy_VAR_SF	Quadrant 1: Tota Imported Reactive Energy	0x80000000
40143	40144	2	RO	0x03	M_Import_VARh_Q1A	uint32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 1: Imported Reactive Energy	0x80000000
40145	40146	2	RO	0x03	M_Import_VARh_Q1B	uint32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 1: Imported Reactive Energy	0x80000000
40147	40148	2	RO	0x03	M_Import_VARh_Q1C	uint32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 1: Imported Reactive Energy	0x80000000
40149	40150	2	RO	0x03	M_Import_VARh_Q2	uint32	VARh	M_Energy_VAR_SF	Quadrant 2: Total Imported Reactive Energy	0x80000000
40151	40152	2	RO	0x03	M_Import_VARh_Q2A	uint32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 2: Imported Reactive Energy	0x80000000
40153	40154	2	RO	0x03	M_Import_VARh_Q2B	uint32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 2: Imported Reactive Energy	0x80000000

Start address (dec)	End address (dec)	Size	R/W	Function codes	Name	Type	Units	Scale factor	Description	Value range / OBIS mapping
40155	40156	2	RO	0x03	M_Import_VARh_Q2C	uint32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 2: Imported Reactive Energy	0x80000000
40157	40158	2	RO	0x03	M_Export_VARh_Q3	uint32	VARh	M_Energy_VAR_SF	Quadrant 3: Total Imported Reactive Energy	0x80000000
40159	40160	2	RO	0x03	M_Export_VARh_Q3A	uint32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 3: Imported Reactive Energy	0x80000000
40161	40162	2	RO	0x03	M_Export_VARh_Q3B	uint32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 3: Imported Reactive Energy	0x80000000
40163	40164	2	RO	0x03	M_Export_VARh_Q3C	uint32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 3: Imported Reactive Energy	0x80000000
40165	40166	2	RO	0x03	M_Export_VARh_Q4	uint32	VARh	M_Energy_VAR_SF	Quadrant 4: Tota Imported Reactive Energy	0x80000000
40167	40168	2	RO	0x03	M_Export_VARh_Q4A	uint32	VARh	M_Energy_VAR_SF	Phase A – Quadrant 4: Imported Reactive Energy	0x80000000
40169	40170	2	RO	0x03	M_Export_VARh_Q4B	uint32	VARh	M_Energy_VAR_SF	Phase B – Quadrant 4: Imported Reactive Energy	0x80000000
40171	40172	2	RO	0x03	M_Export_VARh_Q4C	uint32	VARh	M_Energy_VAR_SF	Phase C – Quadrant 4: Imported Reactive Energy	0x80000000
40173	40173	1	RO	0x03	M_Energy_VAR_SF	int16	N/A	N/A	Reactive Energy Scale Factor[3]	0
40174	40175	2	RO	0x03	M_Events	uint32	N/A	N/A	Event flags	0
40176	40176	1	RO	0x03	C_SunSpec_DID	uint16	N/A	N/A	Indicates that it is a valid SunSpec End Model block.	0xffff
40177	40177	1	RO	0x03	C_SunSpec_Length	uint16	registers	N/A	Length of End Model	0

Notes:

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

[2] These fields may receive a customer fire request upon request

[3] Example: The 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

[4] Important Note: Although the scaling factors are given here as fixed values, they should not be considered fixed. The values can change dynamically to match the readings. Please always ask the scaling factors together with the associated values and include code to dynamically calculate the values.

3.6 Overview of static Modbus

A size of 8192 registers in the address range 40960 - 49159 is reserved for the static Modbus. Depending on the system configuration, this register range can contain various additional register blocks. The characteristic of static Modbus devices is that the connected devices are always located at the same address.

Start address (dec)	End address (dec)	Size	Description
40960	41159	8192	Modbus Register - Energy Flow/Dashboard
41160	41180	20	Modbus Register - E-Mobility/Wallbox

3.6.1 Modbus register overview - Energy flow/dashboard

The following is the register specification for the Modbus energy flow (register range 40960-41159).

Start address (dec)	End address (dec)	Size	R/W	Function codes	Type	Units	Description
40960	40963	4	RO	0x03	string (8)		Block type
40964	40967	4	RO	0x03	string (8)		Block type version
40972	40973	2	RO	0x03	int32	W	Grid power Total
40974	40975	2	RO	0x03	int32	W	Sum output inverter AC
40976	40977	2	RO	0x03	int32	W	Sum pv power inverter DC
40982	40983	2	RO	0x03	int32	W	Home consumption
40984	40985	2	RO	0x03	int32	W	Sum battery charge / discharge DC
40986	40986	1	RO	0x03	uint16	%	System state of charge
40988	40989	2	RO	0x03	uint32	W	Home consumption from PV
40990	40991	2	RO	0x03	uint32	W	Home consumption from battery
40992	40993	2	RO	0x03	uint32	W	Home consumption from grid
40994	40994	1	RO	0x03	uint16		Active charge mode
40996	40997	2	RO	0x03	uint32	W	Sum wallbox charge power total
40998	40999	2	RO	0x03	uint32	W	Sum wallbox charge power PV
41000	41001	2	RO	0x03	uint32	W	Sum wallbox charge power battery
41002	41003	2	RO	0x03	uint32	W	Sum wallbox charge power grid
41010	41011	2	RO	0x03	uint32	W	Sum inverter control values
41012	41012	1	RO	0x03	uint16		Curtailment active

Status messages - Modbus register 40994 - Active charge mode

Description of the individual status messages.

Status	Bedeutung
0	No comfort functions for the wallbox activated in the KOSTAL Solar app
1	Lock (Lock Mode)
2	Power (Power Mode)
3	Solar Pure (Solar Pure Mode)
4	Solar Plus (Solar Plus Mode)

3.6.2 Overview of registers - Modbus-E-Mobility/Wallbox

The registers described in this section enable external control of the connected wallbox. Please note that the connection must be changed from Modbus TCP via port 502 to Modbus TCP with TLS encryption on port 802. In this case, this applies to all connections.

The register specification for Modbus-E-Mobility/Wallbox can be found below (register range 41160-41180).

Start address (dec)	End address (dec)	Size	R/W	Function codes	Type	Units	Description
41160	41163	4	RO	0x03	string (8)		Block type
41164	41167	4	RO	0x03	string (8)		Block type version
41168	41168	1	R/W	0x03	uint16		Configured charging mode
41169	41169	1	R/W	0x03	uint16		Time Mode - Configured charging mode
41170	41170	1	R/W	0x03	uint16		PV power quota in Solar Plus Mode
41172	41172	1	R/W	0x03	uint16		Minimum charging power quota in Solar Plus Mode

Status messages - Modbus register 41168 - Configured charging mode

Description of the individual status messages.

Status	Description
0	No comfort functions for the wallbox activated in the KOSTAL Solar app
1	Lock Mode
2	Power Mode
3	Solar Pure Mode
4	Solar Plus Mode
5	Time Mode

Status messages - Modbus register 41169 - Time mode configured charging mode

Description of the individual status messages.

Status	Description
0	No comfort functions for the wallbox activated in the KOSTAL Solar app
1	Lock Mode
2	Power Mode
3	Solar Pure Mode
4	Solar Plus Mode

Status messages - Modbus register 41170 - PV power quota in Solar Plus Mode

Description of the individual status messages.

Status	Description
0	0 % PV share
10	10 % PV share
20	20 % PV share
30	30 % PV share
40	40 % PV share
50	50 % PV share
60	60 % PV share
70	70 % PV share
80	80 % PV share
90	90 % PV share
100	100 % PV share

Status messages - Modbus register 41172 - Minimum power quota in Solar Plus Mode

Description of the individual status messages.

Status	Description
0	Minimum charging current
50	50 % maximum charging current
75	75 % maximum charging current
100	100 % maximum charging current

3.7 Dynamic Modbus overview

A size of 10239 registers in the address range 49152 - 59391 is reserved for the dynamic Modbus. Depending on the system configuration, this register range can contain various additional register blocks. In contrast to the static Modbus devices, the dynamic Modbus devices have variable addresses and are located in different positions in the Modbus registers depending on the number, type and connection sequence.

Start address (dec)	End address (dec)	Size	Description
49152	59391	130	Modbus Register - Wallbox

3.7.1 Overview of Modbus registers - Wallbox

A register range of a charging device in dynamic Modbus is 130 registers, each of which can store 16 bytes. A size of 10240 registers in the address range 49152 - 59391 is reserved for the dynamic Modbus.

Start address (dec)	End address (dec)	Size	R/W	Function codes	Type	Units	Description
49152	49155	4	RO	0x03	string (8)		Block type
49156	49159	4	RO	0x03	string (8)		Block type version
49160	49163	4	RO	0x03	string (8)		Label
49164	49179	16	RO	0x03	string (32)		Serial
49180	49183	4	RO	0x03	string (8)		Model
49184	49187	4	RO	0x03	string (8)		Version
49188	49191	4	RO	0x03	string (8)		Manufacturer
49192	49192	1	RO	0x03	uint16		EVSE status code
49202	49205	4	RO	0x03	uint64		Error code
49206	49209	4	RO	0x03	uint64		Wallbox Status code
49216	49217	2	RO	0x03	uint32	mA	Maximum current supported by the EVSE (EvseHwImax)
49218	49219	2	RO	0x03	uint32	mA	Charging current L1
49220	49221	2	RO	0x03	uint32	mA	Charging current L2
49222	49223	2	RO	0x03	uint32	mA	Charging current L3
49224	49225	2	RO	0x03	uint32	mA	Max charging current limit L1
49226	49227	2	RO	0x03	uint32	mA	Max charging current limit L2
49228	49229	2	RO	0x03	uint32	mA	Max charging current limit L3
49246	49249	4	RO	0x03	uint64	mW	Active power charging
49250	49253	4	RO	0x03	uint64	mW	(reserved: Active power discharging)
49254	49257	4	RO	0x03	uint64	mWh	Current session energy
49258	49261	4	RO	0x03	uint64	s	Current session duration

Status messages - Modbus register 49192 - EVSE status code

Description of the individual status messages.

Status		Description
0	Unknown	Default state
1	Offline	No vehicle connected.
2	Finished	The connected vehicle has finished charging - this status is not currently used.
10	Charging	The connected vehicle is charging or waiting to charge.
11	Probing	The charging process is being initialised.
12	Paused	The charging process has been paused by the control algorithm.
13	Paused, external	The charging process has been paused externally, for example by the energy provider.
14	Paused, manual	The charging process was paused by user input.
20	EVSE error	The charging device reports an error.
21	Communication error	The communication between the vehicle and the charging device has broken down.

Status messages - Modbus register 49206 - Wallbox status codes

Description of the individual status messages.

Status		Description
0	Unknown	Default status
1	Offline	No vehicle connected.
2	Connected	Vehicle connected
3	Paused	The charging process has been paused by internal control.
4	Probing	The charging process is being initialised.
5	Charging	The connected vehicle is charging or waiting for charging.
6	Communication error	Communication between the vehicle and the charging device has been interrupted
7	Service mode	Service mode

3.8 Overview group register

This register area contains group-specific information. There are a total of 48 blocks of group registers. Each register block has 40 registers and corresponds to a group that is con fi gured in the Energy Manager. The group registers are only available if groups have been activated and con fi gured on the device.

The o ff set of each group register block is calculated as follows:

offset = 0xE800 + (Gruppen-ID) * 0x0028

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Description
59392	59431	0xE800	0xE827	40	Group 0
59432	59571	0xE828	0xE8B3	40	Group 1
…	…	…	…	…	…
61272	61311	0xEF58	0xEF7F	40	Group 47

The register block is the same for all groups. Therefore, only the register block for the first group is described in the following table.

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Func-tion codes	Type	Name	Default value / example	Description
59392	59395	0xE800	0xE803	4	RO	0x10	uint64	unitless		Group label
59401	59404	0xE809	0xE80C	4	RO	0x10	uint64	1Wh	1-x:1.8.0*255	Active Energy + (group sum)
59405	59408	0xE80D	0xE810	4	RO	0x10	uint64	1Wh	1-x:2.8.0*255	Active Energy - (group sum)
59409	59412	0xE811	0xE814	4	RO	0x10	uint64	1VAh	1-x:9.8.0*255	Apparent Energy + (group sum)
59413	59416	0xE815	0xE818	4	RO	0x10	uint64	1VAh	1-x:10.8.0*255	Apparent Energy - (group sum)
59417	59418	0xE819	0xE81A	2	RO	0x10	uint32	0.001W	1-x:1.4.0*255	Active Power + (group sum)
59419	59429	0xE81B	0xE81C	2	RO	0x10	uint32	0.001W	1-x:2.4.0*255	Active Power - (group sum)
59421	59422	0xE81D	0xE81E	2	RO	0x10	uint32	0.001VA	1-x:9.4.0*255	Apparent Power + (group sum)
59423	59424	0xE81F	0xE820	2	RO	0x10	uint32	0.001VA	1-x:10.4.0*255	Apparent Power - (group sum)
59425	59426	0xE821	0xE822	2	RO	0x10	uint32	0.001A	1-x:11.4.0*255	Current (group sum)

The class of a group can contain the following values:

- 0: Unknown
- 1: Consumer
- 2: Producer
- 3: Hybrid

3.9 Overview sensor register

This register area contains sensor-specific information. There are a total of 96 blocks of sensor registers. Each register block has a size of 40 registers and corresponds to a sensor that is connected to the Energy Manager. The sensor registers are only available if sensors are activated and con fi gured on the device.

The o ff set of each sensor register block is calculated as follows:

offset = 0xF000 + (Sensor-ID) * 0x0028

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	Description
61440	61479	0xF000	0xF027	40	Sensor 0
61480	61519	0xF028	0xF04F	40	Sensor 1
…	…	…	…	…	…
65240	65279	0xFED8	0xFEFF	40	Sensor 95

The register block is the same for all groups. Therefore, only the register block for the first sensor is described in the following table. The OBIS codes are used here for illustration purposes only, as the real OBIS code depends on the con fi gured phase of the sensor. If the phase of a sensor has not been con fi gured, its registers do not contain any values, since the phase is required to calculate the further values from the internal measured values with the help of the voltage and phase angle.

Start address (dec)	End address (dec)	Start address (hex)	End address (hex)	Size	R/W	Func-tion codes	Type	Name	Default value / example	Description
61440	61443	0xF000	0xF003	4	RO	0x10	uint64	unitless		Label
61444	61447	0xF004	0xF007	4	RO	0x10	uint64	unitless		Serial number+Index
61448	61448	0xF008	0xF008	1	RO	0x10	uint16	unitless		Phase (1,2,3)
61449	61452	0xF009	0xF00C	4	RO	0x10	uint64	1Wh	1-x:1.8.0*255	Active Energy +
61453	61456	0xF00D	0xF010	4	RO	0x10	uint64	1Wh	1-x:2.8.0*255	Active Energy -
61457	61460	0xF011	0xF014	4	RO	0x10	uint64	1Vah	1-x:9.8.0*255	Apparent Energy +
61461	61464	0xF015	0xF018	4	RO	0x10	uint64	1Vah	1-x:10.8.0.*255	Apparent Energy -
61465	61466	0xF019	0xF01A	2	RO	0x10	uint32	0.001W	1-x:1.4.0*255	Active Power +
61467	61468	0xF01B	0xF01C	2	RO	0x10	uint32	0.001W	1-x:2.4.0*255	Active Power -
61469	61470	0xF01D	0xF01E	2	RO	0x10	uint32	0.001VA	1-x:9.4.0*255	Apparent Power +
61471	61472	0xF01F	0xF020	2	RO	0x10	uint32	0.001VA	1-x:10.4.0*255	Apparent Power -
61473	61474	0xF021	0xF022	2	RO	0x10	uint32	0.001A	1-x:11.4.0*255	Current
61475	61476	0xF023	0xF024	2	RO	0x10	uint32	0.001V	1-x:12.4.0*255	Voltage
61477	61478	0xF025	0xF026	2	RO	0x10	int32	0.001	1-x:13.4.0.*255	Power factor

The class of a sensor can contain the following values:

- 0: Unknown
- 1: Consumer
- 2: Producer

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08/2024- EN - DOC02348405-0006 - Subject to technical changes, errors excepted.
You can find current information at www.kostal-solar-electric.com.