Technical Information

SMA Modbus® Interface for SUNNY BOY / SUNNY TRIPOWER

Legal Provisions

Trademarks

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1 Information on this Document

Validity

This document is valid for the device types listed in Section 2.6 "Supported SMA Inverters". It describes how the data points of the SMA data model are displayed in the SMA Modbus profile.

This document does not contain any information on the Modbus registers provided in detail by the SMA inverters and on which firmware version must be installed in the respective device (for firmware version and device-specific Modbus registers, see Technical Information SMA Modbus Interface).

This document does not contain any information on software which can communicate with the Modbus interface (see the software manufacturer's manual).

Target Group

This document is intended for qualified persons. Only persons with appropriate skills are allowed to perform the tasks described in this document (see Section 2.2 "Skills of Qualified Persons", P. 8).

Additional Information

SMA Documents

Additional information is available at www.SMA-Solar.com (not all documents are available in all languages):

Document title	Document type
Order Form for the SMA Grid Guard Code	Order Form
SMA Modbus interface	Technical Information
SMA Speedwire data module for Sunny Island	Installation Manual
SMA Speedwire Fieldbus	Technical Information
SMA Speedwire/Webconnect Data Module	Installation Manual
Sunny Explorer	User Manual

Additional Documents

Document title	Source
Service Name and Transport Protocol Port Number Registry	http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml
Modbus Application Protocol Specification	http://www.modbus.org/specs.php
Modbus Messaging Implementation Guide	http://www.modbus.org/specs.php

Symbols

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazardous situation that, if not avoided, can result in death or serious injury.
⚠ CAUTION	Indicates a hazardous situation that, if not avoided, can result in minor or moderate injury.
NOTICE	Indicates a situation which, if not avoided, can result in property damage
	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result

Typographies

Typography	Application	Example
bold	• File names • Parameters	• The file **PICS.xls** • The values **Major** and **Minor**
>	• Connects several elements to be selected	• Select **External communication > Modbus**.
[**Button/Key**]	• Button or key to be selected or pressed	• Select [**Save**].

Nomenclature

Complete designation	Designation in this Document
Modbus register	Register
PV system	PV system
SMA Grid Guard code	Grid Guard code
SMA Speedwire Fieldbus	Speedwire
SMA inverter	Inverters

Abbreviations

Abbreviation	Designation	Explanation
GFDI	Ground-Fault Detection and Interruption	Detection of the grounding error and subsequent interruption of the electric circuit.
MPP	Maximum Power Point	Peak of the current-voltage curve
NaN	Not a Number	No valid value is available.
GMS	Grid management services	Grid management services are functions that enable control of the grid operation to ensure an unlimited electricity supply at all times.
Power Balancer	-	The Power Balancer is a function in SMA devices for controlling three-phase grid feed-in; for example, to avoid unbalanced loads.
SOH	State Of Health	State of health of the battery.
Speedwire	-	Speedwire is a cable-based type of communication based on the Ethernet standard and an SMA communication protocol. This enables inverter-optimized 10/100 Mbit data transmission between SMA devices with Speedwire/Webconnect interfaces in PV systems.
SUSy-ID	SMA update system ID	Numeric value that identifies a specific SMA device type, e.g. 128 = STP nn000TL-10.
WMAX	Set active power limit	The device can generate active power up to this limit.

2 Safety

2.1 Intended Use

The Modbus interface of the supported SMA devices is designed for industrial use and has the following tasks:

- Remote control of the grid management services of a PV system.
- Remote-controlled querying of the measured values of a PV system.
- Remote-controlled changing of the parameters of a PV system.

The Modbus interface can be used via TCP and via UDP. With UDP, no answers are generated.

The enclosed documentation is an integral part of this product.

- Read and observe the documentation.
- Keep the documentation in a convenient place for future reference.

2.2 Skills of Qualified Persons

The activities described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Detailed knowledge of the grid management services
- Knowledge of IP-based network protocols
- Training in the installation and configuration of IT systems
- Knowledge of the Modbus specifications
- Knowledge of and compliance with this document and all safety information

2.3 Safety Information

This section contains safety information that must be observed at all times during work on or with the product. To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

NOTICE

Damage to SMA inverters

The parameters of the SMA inverters that can be changed with writable Modbus registers (RW/WO) are intended for long-term storage of device settings. Cyclical changing of these parameters leads to destruction of the flash memory of the devices.

- Device parameters must not be changed cyclically.

Parameters for the control and limitation of the nominal PV system power - described in chapter 5.4 "SMA Modbus profile – Grid Management Services" on page 57 - are an exception. Such parameters can be changed cyclically.

For automatic remote control of your PV system, you can use the parameters for grid management services (see chapter 0).

2.4 Information on Data Security

Data security in Ethernet networks

You can connect the supported SMA devices to the Internet. When connecting to the Internet, there is a risk that unauthorized users can access and manipulate the data of your PV system.

- Take appropriate protective measures, for example:
  - Set up a firewall
  - Close unnecessary network ports
  - Only enable remote access via VPN tunnel
  - Do not set up port forwarding at the Modbus port in use

Access to data points after activating the Modbus interface

After activating the Modbus interface, the access to all data points (which are not protected by the SMA Grid Guard code) are possible without further input of a password via Modbus. Check if the Modbus interface is still active after carrying out a reset to default settings (Activating the Modbus interface, see chapter 4 "Commissioning and Configuration" on page 17).

2.5 SMA Grid Guard code

Certain parameters are protected by the personal SMA Grid Guard code. If you would like to changes these parameters, you must first unlock the individual inverters via a personal SMA Grid Guard code. When unlocked, the inverter changes its configuration mode to the Grid Guard mode.

SMA Grid Guard-Code

You can obtain the SMA Grid Guard code via SMA Service or via the "Order Form for the SMA Grid Guard Code" at www.SMA-Solar.com (see also Section 8 " Contact", page 71). For more information on accessing a device via Grid Guard code and Sunny Explorer, see user manual of the Sunny Explorer.

Parameter overview SMA Grid Guard code

You will find an overview of the parameters that can be changed with an activated SMA Grid Guard code in Section 5.4 SMA Modbus Profile – Grid Guard Parameters", page 57.

The access to inverters via SMA Grid Guard code is exclusive

With a Grid Guard code, only one person, communication device or software tool can exclusively log into the inverter. If you want to change parameters via your Modbus client, you are not allowed to use a Grid Guard code via Sunny Explorer or via data logger at the same time.

Login and logout

- The SMA Grid Guard code as well as the code for logging out of the Grid Guard mode are described in the Modbus register 43090.
- Log out of the Grid Guard mode with the code = 0.
- Login with the Grid Guard code is only possible with the IP address used during login.

Inverter restart during Grid Guard mode

- If an inverter is restarted during Grid Guard mode, the Grid Guard code must be transmitted again.

Recording the parameter changes

- Changes to the grid management service parameters in Grid Guard mode will be recorded by the inverter.

2.6 Supported SMA Inverters

You will find information on which SMA inverters with integrated Speedwire interface or a retrofitted Speedwire/Webconnect data module are supported by the Modbus interface and which

firmware version must be installed on the respective device in the technical information SMA Modbus interface at www.SMA-Solar.com.

3 Product Description

3.1 Modbus Protocol

The Modbus Application Protocol is an industrial communication protocol that is currently used in the solar sector mainly for system communication in PV power plants.

The Modbus protocol has been developed for reading data from or writing data to clearly defined data areas. The Modbus specification does not prescribe what data is within which data area. The data areas must be defined device-specifically in Modbus profiles. With knowledge of the device-specific Modbus profile, a Modbus client (e.g. a SCADA system) can access the data of a Modbus server (e.g. SMA devices with Modbus interface).

The special Modbus profile for SMA devices is the SMA Modbus profile.

3.2 SMA Modbus Profile

The SMA Modbus profile contains definitions for SMA devices. All available data on SMA devices was assigned to the corresponding Modbus registers for the definition. Not all SMA inverters support all data points of the SMA Modbus profile.

Therefore, the device-specific data points available for an SMA inverter are listed in a separate document (device-specific Modbus register see technical information SMA Modbus interface at www.SMA-Solar.com).

3.3 PV System Topology

An SMA device with Speedwire interface is connected with the SCADA system of the electric utility company or the grid operator via Ethernet. The Speedwire interface also enables communication via the Modbus protocol.

From the perspective of the Modbus protocol, an SMA device with Speedwire interface constitutes a Modbus server that supports the SMA Modbus profile.

3.4 Addressing and Data Transmission in the Modbus Protocol

3.4.1 Unit IDs

The Unit ID is a superordinate addressing type in the Modbus protocol. The SMA Modbus profile is set to the Unit ID = 3.

3.4.2 Modbus Register Address, Register Width and Data Block

A Modbus register is 16 bits wide. For wider data items, connected Modbus registers are used and considered as data blocks. The address of the first Modbus register in a data block is the start address of the data block. The quantity of connected Modbus registers arises from the data type and the offset between the register addresses. Several Modbus registers with different start addresses, that can only be processed as a data block, are specially marked. In addition, larger data blocks can be formed.

3.4.3 Data Transmission

In accordance with the Modbus specification, only a specific volume of data can be transported in a single data transmission in a simple protocol data unit (PDU). The data also contains function-dependent parameters such as the function code, start address or number of Modbus registers to be transmitted. The amount of data depends on the Modbus command used and has to be taken into account during data transmission. You can find the number of possible Modbus registers per command in Section 3.5.

With data storage in the Motorola format "Big Endian", data transmission begins with the high byte and then the low byte of the Modbus register.

3.5 Reading and Writing of Data

The Modbus interface can be used via the protocol Modbus TCP and by the protocol Modbus UDP. Using Modbus TCP enables read- and write access (RW) and using Modbus UDP enables only write access (WO) to the RW Modbus register.

The following Modbus commands are supported by the implemented Modbus interface:

Modbus command	Hexadecimal value	Data volume (number of registers)[1]
Read Holding Registers	0x03	1 to 125
Read Input Registers	0x04	1 to 125
Write Single Register	0x06	1
Write Multiple Registers	0x10	1 bis 123
Read Write Multiple Registers	0x17	Read: 1 to 125, Write: 1 to 121

[1] Number of Modbus registers transferable as data block per command

3.6 SMA Data Types and NaN Values

The following table shows the data types used in the SMA Modbus profile and the possible NaN values. The SMA data types are listed in the assignment tables in the **Type** column. They describe the data widths of the assigned values:

Type	Description	NaN value
S16	A signed word (16-bit).	0x8000
S32	A signed double word (32-bit).	0x8000 0000
STR32	32 byte data field, in UTF8 format.	ZERO
U16	A word (16-bit).	0xFFFF
U32	A double word (32-bit).	0xFFFF FFFF
U32	For status values, only the lower 24 bits of a double word (32-bit) are used.	0xFFFF FD
U64	A quadruple word (64-bit).	0xFFFF FFFF FFFF FFFF

3.7 SMA Data Formats

The following SMA data formats describe how SMA data is to be interpreted. The data formats are important, for example, for the display of data or for its further processing. The SMA data formats are listed in the **Format** column of the assignment tables.

Format	Explanation
Duration	Time in seconds, in minutes or in hours, depending on the Modbus register.
DT	Date/time, in accordance with country setting. Transmission in seconds since 1970-01-01.
ENUM	Coded numerical values. The breakdown of the possible codes can be found directly under the designation of the Modbus register in the SMA Modbus profile – assignment tables.
FIX0	Decimal number, commercially rounded, no decimal place.
FIX1	Decimal number, commercially rounded, one decimal place.
FIX2	Decimal number, commercially rounded, two decimal places.

FIX3	Decimal number, commercially rounded, three decimal places.
FUNCTION_SEC	The date saved in the register will be transmitted in the event of a change to a function and starts this. After execution of the function, no status value is set. A security question must be executed in the client software prior to execution of the function.
FW	Firmware version (see section 3.8, "SMA Firmware Data Format (FW)", 16)
HW	Hardware version e.g. 24.
IP4	4-byte IP address (IPv4) of the form XXX.XXX.XXX.XXX.
RAW	Text or number. A RAW number has no decimal places and no thousand- or other separation indicators.
Outline Purchase Agreement	Revision number of the form 2.3.4.5.
TEMP	Temperature values are stored in special Modbus registers in degrees Celsius (°C), in degrees Fahrenheit (°F), or in Kelvin K. The values are commercially rounded, with one decimal place.
TM	UTC time, in seconds
UTF8	Data in UTF8 format.

3.8 SMA Firmware Data Format (FW)

The SMA firmware data format (abbreviation: FW) describes how SMA firmware data is to be interpreted. The SMA firmware data format is used, for example, in register 30059

Four values are extracted from the delivered DWORD. The values **Major** and **Minor** are contained, BCD-coded, in bytes 1 and 2. Byte 3 contains the **Build** value (not BCD-coded). Byte 4 contains the **Release Type** value according to the following table:

Release type	Release-type coding	Explanation
0	N	No revision number
1	E	Experimental release
2	A	Alpha release
3	B	Beta release
4	R	Release
5	S	Special release
> 5	As number	No special interpretation

Example:

Firmware version of the product: 1.05.10.R
Values from DWORD: Major: 1, Minor: 05, Build: 10, Release type: 4
(Hex: 0x1 0x5 0xA 0x4)

4 Commissioning and Configuration

The two servers Modbus TCP and Modbus UDP are deactivated as default in the supported SMA devices (Supported SMA devices, see Section 2.6 "", Page 9). You must activate the Modbus servers to use them. You can activate the communication ports of both Modbus protocols upon activation of the servers.

Requirements:

☐ All SMA devices with Speedwire interface must be commissioned (see installation manual of the inverter or of the retrofitted Speedwire interface).

☐ Sunny Explorer must be installed on the computer (Sunny Explorer is available free of charge at www.SMA-Solar.com).

Access to data points after activating the Modbus interface

After activating the Modbus interface, the access to all data points (which are not protected by the SMA Grid Guard code) are possible without further input of a password via Modbus.

Check if the Modbus interface is still active after carrying out a reset to Modbus default settings.

Procedure:

1. Start Sunny Explorer on the computer and a create Speedwire plant (see Sunny Explorer user manual).
2. Log into the Speedwire system as **Installer**.
3. Select the SMA inverter to be configured in the system directory.
4. Select the tab **Settings**.
5. Select the parameter group **External Communication**.
6. Select [**Edit**].
   ☑ You will see the categories **TCP Server** and **UDP Server** under the parameter group **Modbus**.
7. To activate the TCP server, make the following settings in the group **Modbus > TCP Server**:
   - In the **Activated** drop-down list, select the entry **Yes**.
   - If required, change the **port** in the field Port (default setting: 502).
8. To activate the UDP server, make the following settings in the group **Modbus > UDP Server**:
   - In the **Activated** drop-down list, select the entry **Yes**.
   - If required, change the **port** in the field Port (default setting: 502).
9. Select [**Save**].

5 SMA Modbus Profile

5.1 Information on the Assignment Tables

The assignment tables of the SMA Modbus profile present the following information:

Information	Explanation
ADR (DEC)	Decimal Modbus address (see Section 0, page 13 onwards)
Description/ number code(s)	Short description of the Modbus register and the number codes used.
Type	Data type, e.g. U32 = 32 bits without prefix (see Section 3.6, page 14).
Format	Data format of saved value, e.g. DT = date, FIX n = output with n decimal places, TEMP = output as temperature (see Section 3.7, page 14).
Access	Access type: RO: Read only (only Modbus TCP) RW: Read and write (only Modbus TCP) With Modbus UDP, all RW registers are write-only (WO register). WO: Write only If an access type is not allowed, a Modbus exception is generated in the event of access with an access type that is not allowed.
Fallback	Fallback settings can be defined for the parameters marked with an X.

NOTICE

Damage to SMA inverters

The parameters of the SMA inverters that can be changed with writable Modbus registers (RW/WO) are intended for long-term storage of device settings. Cyclical changing of these parameters leads to destruction of the flash memory of the devices.

- Device parameters must not be changed cyclically.

Parameters for the control and limitation of the nominal PV system power - described in chapter 5.4 "SMA Modbus profile – Grid Management Services" on page 57 - are an exception. Such parameters can be changed cyclically.

For automatic remote control of your PV system, you can use the parameters for grid management services (see chapter 5.4).

Device-dependent availability of the Modbus registers

Depending on the SMA device type used, only certain Modbus registers are available. You will find a table with Modbus registers supported by each inverter type in the technical information SMA Modbus interface at www.SMA-Solar.com.

Value range of cos φ

The value range of cos φ depends on the device. The value range that can be set via the Modbus protocol cannot be converted by every inverter to physical values (displacement power factor cos φ, see the operating manual of the inverter).

Reactive power in the SMA Modbus profile

For all Modbus registers of this document in which a reactive power is measured or specified, a positive reactive power is "lagging" and a negative reactive power is "leading" as per the IEC convention and generator reference-arrow system.

This information is valid for the following Modbus registers: 30805, 30807, 30809, 30811, 30827, 30829, 30893, 30895, 30897, 30899, 30921, 30923, 31135, 31139, 40145, 40153, 40202, 40204, 40833, 40845 and 40851.

Parameters for grid management services (fallback settings)

For the supported SMA devices with Speedwire interface in Sunny Explorer, you can define intervals which, after they expired, automatically set certain plant parameters for grid management services to fallback values (fallback settings). You can use the fallback settings, for example, to define fallback values for the absence of cyclically sent plant-control requirements. The fallback intervals start after the reception of the respective parameter via the Modbus protocol.

Physical Reaction Time of the Inverters

The physical reaction time of the inverters is typically approximately one second, depending on the inverters used.

The physical reaction time is the time between the changing of setpoints in the inverters until their physical implementation. Such a change would be, for example, changing cos φ.

5.2 SMA Modbus Profile - Register Overview

Network Configuration

A change to the network configuration will only be adopted by the SMA device if each of the registers 40157, 40159, 40167, 40175 and 40513 are changed. If, for example, you change the automatic Speedwire configuration with the register 40157 to the value **1130** (no, manual configuration) and would like to change the IP address with the register 40159, you must change the other three registers within 60 seconds, or reset them to the same values.

In the following table you will find all the measured values and parameters of the SMA Modbus Profile to which you have access without Grid Guard code.

ADR (DEC)	Description/number code	Type	Format	Access
30001	Version number of the SMA Modbus profile	U32	RAW	RO
30003	SUSy-ID	U32	RAW	RO
30005	Serial number	U32	RAW	RO
30007	Modbus data change: Counter value is increased if new data is available.	U32	RAW	RO
30051	Device class: 8000 = All devices 8001 = PV inverter 8002 = Wind power inverter 8007 = battery inverter 8033 = Load 8064 = Sensor technology general 8065 = Energy meter 8128 = Communication products	U32	ENUM	RO
30053	Numerical identification of the device type (information on breakdown see technical information SMA Modbus interface)	U32	ENUM	RO

30055	Manufacturer specification: 461 = SMA	U32	ENUM	RO
30057	Serial number	U32	RAW	RO
30059	Software package	U32	FW	RO
30197	Number of the current event. The number of digits is limited by the device (for event messages, see the inverter service manual).	U32	FIX0	RO
30247	Current, complete event number (code has a maximum of five digits)	U32	FIX0	RO
30199	Time until grid connection attempt, in s	U32	Duration	RO
30201	Status of the device: 35 = Error 303 = Off 307 = OK 455 = Warning	U32	ENUM	RO
30203	Power in "OK" status: Displays the maximum active power (W), if the inverter status is "OK." If the inverter status is another one, the output is 0 (W).	U32	FIX0	RO
30205	Power in "warning" status: Displays the maximum active power, if the inverter is in the "warning" status (device is currently not feeding in; automatic correction attempt is active). If the inverter status is another one, the output is 0 (W).	U32	FIX0	RO
30207	Power in "error" status: Displays the maximum active power, if the inverter is in the "error" status (device is no longer feeding in; user action is required). If the inverter status is another one, the output is 0 (W).	U32	FIX0	RO
30211	Recommended action: 336 = Contact manufacturer 337 = Contact installer 338 = Invalid 887 - No recommended action	U32	ENUM	RO
30213	Status message (code has a maximum of five digits): 886 = No message nnnnn = Last status message. The number of digits is limited by the device.	U32	ENUM	RO
30215	Status description (code has a maximum of five digits): 885 = No description	U32	ENUM	RO

	nnnnn = Last status description. The number of digits is limited by the device.			
30217	Utility grid contactor: 51 = Contactor closed 311 = Contactor open	U32	ENUM	RO
30219	Temperature derating: 302 = No derating 557 = Temperature derating 884 = Not active 1704 = WMAX derating 1705 = Frequency derating 1706 = Derating due to PV current limitation	U32	ENUM	RO
30225	Insulation resistance (Ω)	U32	FIX0	RO
30227	Status of key switch: 381 = Switched off 569 = Switched on	U32	ENUM	RO
30229	Local time of device	U32	DT	RO
30231	Maximum possible permanent active power, fixed configuration. Can be greater than the nominal power, (W)	U32	FIX0	RO
30233	Permanent active power limitation, (W)	U32	FIX0	RO
30235	Backup mode status: 1440 = Grid operation 1441 = Stand-alone mode	U32	ENUM	RO
30237	Grid type: 1433 = 277 volts 1434 = 208 volts 1435 = 240 volts 1436 = 208 V without neutral conductor 1437 = 240 V without neutral conductor	U32	ENUM	RO
30249	Status of the GFDI relay: 51 = Closed 311 = Open	U32	ENUM	RO

30251	Status of current restart interlock: 257 = Frequency not permitted 1690 = Fast shut-down 2386 = Overvoltage 2387 = Undervoltage 2388 = Overfrequency 2389 = Underfrequency 2390 = Passive islanding detection 2490 = Phase lost detection 3165 = Phase locked loop error 3166 = Phase lost detection on low-voltage side 3167 = Active islanding detection	U32	ENUM	RO
30257	State of DC switch: 51 = Closed 311 = Open	U32	ENUM	RO
30267 to 30329	DC switch 1 to 32: 51 = Closed 311 = Open	U32	ENUM	RO
30331 to 30393	Error message DC switch 1 to 32: 1508 = 90% of the DC switch cycles reached 1509 = 100% of the DC switch cycles reached 1694 = DC switch has tripped 1695 = DC switch waiting for connection 1696 = DC switch blocked by spindle 1697 = DC switch manually blocked 1698 = DC switch tripped three times 1699 = DC switch is defective	U32	ENUM	RO
30513	Total AC energy fed in on all line conductors (total yield) (Wh)	U64	FIX0	RO
30517	Energy fed in on the current day on all line conductors (daily yield) (Wh)	U64	FIX0	RO
30521	Operating time (s)	U64	Duration	RO
30525	Feed-in time (s)	U64	Duration	RO
30529	Total AC energy fed in on all line conductors (total yield) (Wh)	U32	FIX0	RO
30531	Total AC energy fed in on all line conductors (total yield) (kWh)	U32	FIX0	RO
30533	Total AC energy fed in on all line conductors (total yield) (MWh)	U32	FIX0	RO
30535	Energy fed in on the current day on all line conductors (daily yield) (Wh)	U32	FIX0	RO

30537	Energy fed in on the current day on all line conductors (daily yield) (kWh)	U32	FIX0	RO
30539	Energy fed in on the current day on all line conductors (daily yield) (MWh)	U32	FIX0	RO
30541	Operating time (s)	U32	Duration	RO
30543	Feed-in time (s)	U32	Duration	RO
30545	Operating time of interior fan 1, in s	U32	Duration	RO
30547	Operating time of interior fan 2 (s)	U32	Duration	RO
30549	Operating time of heat sink fan (s)	U32	Duration	RO
30559	Number of events at User level	U32	FIX0	RO
30561	Number of events at Installer level	U32	FIX0	RO
30563	Number of events at Service level	U32	FIX0	RO
30565	Number of generator starts	U32	FIX0	RO
30567	Meter for battery charging ampere-hours (Ah)	U32	FIX0	RO
30569	Meter for battery discharging in ampere-hours (Ah)	U32	FIX0	RO
30571	Meter reading consumption meter (Wh)	U32	FIX0	RO
30573	Operating time of generator (s)	U32	Duration	RO
30575	Released energy from generator (Wh)	U32	FIX0	RO
30577	Purchased electricity today (Wh)	U32	FIX0	RO
30579	Feed-in today (Wh)	U32	FIX0	RO
30581	Meter reading purchased electricity meter (Wh)	U32	FIX0	RO
30583	Meter reading of grid feed-in meter (Wh)	U32	FIX0	RO
30585	Power outage time (s)	U32	Duration	RO
30587	Meter reading PV production meter (Wh)	U32	FIX0	RO
30589	Total increased self-consumption (Wh)	U32	FIX0	RO
30591	Increased self-consumption today (Wh)	U32	FIX0	RO
30593	Total energy consumed internally (Wh)	U32	FIX0	RO
30595	Consumed energy (Wh)	U32	FIX0	RO
30597	Fed energy (Wh)	U32	FIX0	RO
30599	Number of grid connections	U32	FIX0	RO
30601	Operating time of interior fan 3 (s)	U32	Duration	RO
30769	DC current input 1 (A)	S32	FIX3	RO

30771	DC voltage input 1 (V)	S32	FIX2	RO
30773	DC power input 1 (W)	S32	FIX0	RO
30775	Active power on all line conductors (W)	S32	FIX0	RO
30777	Active power of line conductor L1, in W	S32	FIX0	RO
30779	Active power of line conductor L2, in W	S32	FIX0	RO
30781	Active power of line conductor L3, in W	S32	FIX0	RO
30783	Line voltage, line conductor L1 to N (V)	U32	FIX2	RO
30785	Line voltage, line conductor L2 to N (V)	U32	FIX2	RO
30787	Line voltage, line conductor L3 to N (V)	U32	FIX2	RO
30789	Line voltage, line conductor L1 to L2 (V)	U32	FIX2	RO
30791	Line voltage, line conductor L2 to L3 (V)	U32	FIX2	RO
30793	Line voltage, line conductor L3 to L1 (V)	U32	FIX2	RO
30795	Line current on all line conductors (A)	U32	FIX3	RO
30797	Line current of line conductor L1 (A)	U32	FIX3	RO
30799	Line current of line conductor L2 (A)	U32	FIX3	RO
30801	Line current of line conductor L3 (A)	U32	FIX3	RO
30803	Power frequency (Hz)	U32	FIX2	RO
30805	Reactive power on all line conductors (VAr)	S32	FIX0	RO
30807	Reactive power of line conductor L1 (VAr)	S32	FIX0	RO
30809	Reactive power of line conductor L2 (VAr)	S32	FIX0	RO
30811	Reactive power of line conductor L3 (VAr)	S32	FIX0	RO
30813	Apparent power on all line conductors (VA)	S32	FIX0	RO
30815	Apparent power of line conductor L1 (VA)	S32	FIX0	RO
30817	Apparent power of line conductor L2 (VA)	S32	FIX0	RO
30819	Apparent power of line conductor L3 (VA)	S32	FIX0	RO
30821	Total displacement power factor of all line conductors	U32	FIX2	RO
30823	Excitation type of cos φ: 1041 = Leading 1042 = Lagging	U32	ENUM	RO
30843	Battery current (A)	S32	FIX3	RO
30845	Current battery state of charge (%)	U32	FIX0	RO
30847	Current battery capacity (%)	U32	FIX0	RO

30849	Battery temperature (°C)	S32	TEMP	RO
30851	Battery voltage (V)	U32	FIX2	RO
30853	Active battery charging mode: 1767 = Boost charge 1768 = Full charge 1769 = Equalization charge 1770 = Float charge	U32	ENUM	RO
30855	Current battery charging voltage setpoint (V)	U32	FIX2	RO
30857	Number of battery charge throughputs	S32	FIX0	RO
30859	Battery maintenance charge status: 803 = Inactive 1771 = Charge with solar power 1772 = Charge with solar- and grid current	U32	ENUM	RO
30861	Load power (W)	S32	FIX0	RO
30863	Current PV array power (W)	U32	FIX0	RO
30865	Power purchased electricity (W)	S32	FIX0	RO
30867	Power grid feed-in (W)	S32	FIX0	RO
30869	Power PV generation (W)	S32	FIX0	RO
30871	Current self-consumption (W)	U32	FIX0	RO
30873	Current increased self-consumption (W)	S32	FIX0	RO
30875	Multifunction relay status: 51 = Closed 311 = Open	U32	ENUM	RO
30877	Electricity supply status: 303 = Off 1461 = Utility grid connected 1462 = Backup not available 1463 = Backup	U32	ENUM	RO
30879	Reason for requesting generator: 1773 = No request 1774 = Load 1775 = Time control 1776 = Manual one hour 1777 = Manual start 1778 = External source	U32	ENUM	RO

30881	PV system utility grid connection: 1779 = Disconnected 1780 = Utility grid 1781 = Stand-alone grid	U32	ENUM	RO
30883	Status of utility grid: 303 = Off 1394 = Waiting for valid AC utility grid 1461 = Utility grid connected 1466 = Waiting 1787 = Initialization 2183 = Grid operation without feed-back 2184 = Energy saving in the utility grid 2185 = End energy saving in the utility grid 2186 = Start energy saving in the utility grid	U32	ENUM	RO
30885	Power of external grid connection (W)	U32	FIX0	RO
30887	Power of external grid connection line conductor L1 (W)	U32	FIX0	RO
30889	Power of external grid connection line conductor L2 (W)	U32	FIX0	RO
30891	Power of external grid connection line conductor L3 (W)	U32	FIX0	RO
30893	Reactive power of external grid connection (VAr)	U32	FIX0	RO
30895	Reactive power of external grid connection line conductor L1 (VAr)	U32	FIX0	RO
30897	Reactive power of external grid connection line conductor L2 (VAr)	U32	FIX0	RO
30899	Reactive power of external grid connection line conductor L3 (VAr)	U32	FIX0	RO
30901	Power frequency of external grid connection (Hz)	U32	FIX2	RO
30903	Voltage of external grid connection line conductor L1 (V)	U32	FIX2	RO
30905	Voltage of external grid connection line conductor L2 (V)	U32	FIX2	RO
30907	Voltage of external grid connection line conductor L3 (V)	U32	FIX2	RO
30909	Current external grid connection line conductor L1 (A)	S32	FIX3	RO
30911	Current external grid connection line conductor L2 (A)	S32	FIX3	RO
30913	Current external grid connection line conductor L3 (A)	S32	FIX3	RO

30915	Electricity supply status: 303 = Off 1461 = Utility grid connected 1462 = Backup not available 1463 = Backup	U32	ENUM	RO
30917	Generator status: 303 = Off 1392 = Error 1787 = Initialization 1788 = Ready 1789 = Warm-up 1790 = Synchronize 1791 = Activated 1792 = Re-synchronize 1793 = Generator separation 1794 = Shut-off delay 1795 = Blocked 1796 = Blocked after error	U32	ENUM	RO
30925	Data transfer rate of network terminal A: 1720 = 10 MBit 1721 = 100 MBit 1725 = Not connected	U32	ENUM	RO
30927	Duplex mode of network terminal A: 1725 = Not connected 1726 = Half-duplex 1727 = Full duplex	U32	ENUM	RO
30929	Speedwire connection status of network terminal A: 35 = Alarm 307 = Ok 455 = Warning 1725 = Not connected	U32	ENUM	RO
30931	Data transfer rate of network terminal B: 1720 = 10 MBit 1721 = 100 MBit 1725 = Not connected	U32	ENUM	RO
30933	Duplex mode of network terminal B: 1725 = Not connected 1726 = Half-duplex 1727 = Full duplex	U32	ENUM	RO

30935	Speedwire connection status of network terminal B: 35 = Alarm 307 = Ok 455 = Warning 1725 = Not connected	U32	ENUM	RO
30937	Data transfer rate of network terminal C: 1720 = 10 MBit 1721 = 100 MBit 1725 = Not connected	U32	ENUM	RO
30939	Duplex mode of network terminal C: 1725 = Not connected 1726 = Half-duplex 1727 = Full duplex	U32	ENUM	RO
30941	Speedwire connection status of network terminal C: 35 = Alarm 307 = Ok 455 = Warning 1725 = Not connected	U32	ENUM	RO
30943	Data transfer rate of network terminal D: 1720 = 10 MBit 1721 = 100 MBit 1725 = Not connected	U32	ENUM	RO
30945	Duplex mode of network terminal D: 1725 = Not connected 1726 = Half-duplex 1727 = Full duplex	U32	ENUM	RO
30947	Speedwire connection status of network terminal D: 35 = Alarm 307 = Ok 455 = Warning 1725 = Not connected	U32	ENUM	RO
30949	Displacement power factor	U32	FIX3	RO
30951	DC power without battery (W)	S32	FIX0	RO
30953	Internal temperature (°C)	S32	TEMP	RO
30955	Operating status of battery: 303 = Off 2291 = Battery standby 2292 = Battery charging 2293 = Battery discharging	U32	ENUM	RO

30957	DC current input 2 (A)	S32	FIX3	RO
30959	DC voltage input 2 (V)	S32	FIX2	RO
30961	DC power input 2 (W)	S32	FIX0	RO
30963	DC current input 3 (A)	S32	FIX3	RO
30965	DC voltage input 3 (V)	S32	FIX2	RO
30967	DC power input 3 (W)	S32	FIX0	RO
30969	DC current input 4 (A)	S32	FIX3	RO
30971	DC voltage input 4 (V)	S32	FIX2	RO
30973	DC power input 4 (W)	S32	FIX0	RO
30975	DC link voltage (V)	S32	FIX2	RO
30977	Line current of line conductor L1 (A)	S32	FIX3	RO
30979	Line current of line conductor L2 (A)	S32	FIX3	RO
30981	Line current of line conductor L3 (A)	S32	FIX3	RO
30983	PV power (W)	U32	FIX0	RO
30985	Total current at the external grid connection (A)	S32	FIX3	RO
30987	Error battery state of charge (%)	U32	FIX1	RO
30989	Maximum occurring battery current in charge direction (A)	U32	FIX3	RO
30991	Maximum occurring battery current in discharge direction (A)	U32	FIX3	RO
30993	Charge factor: Ratio battery charging/-discharging	U32	FIX3	RO
30995	Runtime of the battery statistic meter (s)	U32	Duration	RO
30997	Lowest measured battery temperature (°C)	S32	TEMP	RO
30999	Highest measured battery temperature (°C)	S32	TEMP	RO
31001	Maximum occurring battery voltage (V)	U32	FIX2	RO
31003	Remaining time until full charge (s)	U32	Duration	RO
31005	Remaining time until equalization charge (s) * 0.1	U32	Duration	RO
31007	Remaining absorption time of the current battery charge phase (s)	U32	Duration	RO
31009	Lower discharge limit for self-consumption range (%)	U32	FIX0	RO
31011	Total output current of the solar charge controller (A)	U32	FIX3	RO
31013	Remaining minimum run time of the generator (s)	U32	Duration	RO

31015	Operating state of the master in a multicluster (line conductor L1): 307 = Ok 455 = Warning	U32	ENUM	RO
31017	Current Speedwire IP address, in the format XXX.XXX.XXX.XXX	STR 32	UTF8	RO
31025	Current Speedwire subnet mask, in the format XXX.XXX.XXX.XXX	STR 32	UTF8	RO
31033	Current Speedwire gateway address, in the format XXX.XXX.XXX.XXX	STR 32	UTF8	RO
31041	Current Speedwire DNS server address, in the format XXX.XXX.XXX.XXX	STR 32	UTF8	RO
31053	Operating state of the slave 1 in a multicluster (line conductor L2): 35 = Alarm 303 = Off 307 = Ok 455 = Warning	U32	ENUM	RO
31055	Operating state of the slave 2 in a multicluster (line conductor L3): 35 = Alarm 303 = Off 307 = Ok 455 = Warning	U32	ENUM	RO
31057	Status battery use range: 2614 = Self-consumption range 2615 = Conversation range of state of charge 2616 = Backup power supply range 2617 = Deep-discharge protection range 2618 = Deep-discharge range	U32	ENUM	RO
31059	Absorption phase active: 1129 = Yes 1130 = No	U32	ENUM	RO
31061	Battery charging control via communication available: 1129 = Yes 1130 = No	U32	ENUM	RO
31063	Total PV energy (Wh)	U32	FIX0	RO
31065	Total PV energy today (Wh)	U32	FIX0	RO

31067	Number of equalization charges of the battery	U32	FIX0	RO
31069	Number of full charges of the battery	U32	FIX0	RO
31071	Relative battery discharging since the last full charge (%)	U32	FIX0	RO
31073	Relative battery discharging since the last equalization charge (%)	U32	FIX0	RO
31075	Energy meter run time (s)	U32	Duration	RO
31077	PV energy at solar charge controller 1 (Wh)	U32	FIX0	RO
31079	PV energy at solar charge controller 2 (Wh)	U32	FIX0	RO
31081	PV energy at solar charge controller 3 (Wh)	U32	FIX0	RO
31083	PV energy at solar charge controller 4 (Wh)	U32	FIX0	RO
31085	Nominal power in OK mode (W)	U32	FIX0	RO
31091	PV energy produced (today) (Wh)	U32	FIX0	RO
31093	PV energy produced (yesterday) (Wh)	U32	FIX0	RO
31095	PV energy produced (current month) (Wh)	U32	FIX0	RO
31097	PV energy produced (previous month) (Wh)	U32	FIX0	RO
31099	Generator energy produced (today) (Wh)	U32	FIX0	RO
31101	Generator energy produced (yesterday) (Wh)	U32	FIX0	RO
31103	Generator energy produced (current month) (Wh)	U32	FIX0	RO
31105	Generator energy produced (previous month) (Wh)	U32	FIX0	RO
31107	Grid feed-in today (Wh)	U32	FIX0	RO
31109	Energy fed into the utility grid (yesterday) (Wh)	U32	FIX0	RO
31111	Energy fed into the utility grid (current month) (Wh)	U32	FIX0	RO
31113	Energy fed into the utility grid (previous month) (Wh)	U32	FIX0	RO
31115	Energy drawn from the utility grid (yesterday) (Wh)	U32	FIX0	RO
31117	Energy drawn from the utility grid (current month) (Wh)	U32	FIX0	RO
31119	Energy drawn from the utility grid (previous month) (Wh)	U32	FIX0	RO
31121	Consumed energy (today) (Wh)	U32	FIX0	RO
31123	Consumed energy (yesterday) (Wh)	U32	FIX0	RO
31125	Consumed energy (current month) (Wh)	U32	FIX0	RO
31127	Consumed energy (previous month) (Wh)	U32	FIX0	RO
31129	Unused PV power (W)	U32	FIX0	RO
31131	Available PV power (W)	S32	FIX0	RO

31133	Internal PV power limitation (W)	S32	FIX0	RO
31135	Reactive power of the load (VAr)	S32	FIX0	RO
31137	Maximum short-term power reduction (W)	S32	FIX0	RO
31139	Current PV reactive power fed in (VAr)	S32	FIX0	RO
31141	Current PV apparent power fed in (VAr)	S32	FIX0	RO
31143	Monitoring value return	S32	FIX0	RO
31281, 31287, etc., to 31371	DC voltage, inputs 1 to 16 (V). See the following list for a breakdown of the inputs: 31281: Input 1, 31287: Input 2, 31293: Input 3, 31299: Input 4, 31305: Input 5, 31311: Input 6, 31317: Input 7, 31323: Input 8, 31329: Input 9, 31335: Input 10, 31341: Input 11, 31347: Input 12, 31353: Input 13, 31359: Input 14, 31365: Input 15, 31371: Input 16	S32	FIX2	RO
31283, 31289, etc., to 31373	DC current, inputs 1 to 16 (A). See the following list for a breakdown of the inputs: 31283: Input 1, 31289: Input 2, 31295: Input 3, 31301: Input 4, 31307: Input 5, 31313: Input 6, 31319: Input 7, 31325: Input 8, 31331: Input 9, 31337: Input 10, 31343: Input 11, 31349: Input 12, 31355: Input 13, 31361: Input 14, 31367: Input 15, 31373: Input 16	S32	FIX3	RO
31285, 31291, etc., to 31375	DC power, inputs 1 to 16 (W). See the following list for a breakdown of the inputs: 31285: Input 1, 31291: Input 2, 31297: Input 3, 31303: Input 4, 31309: Input 5, 31315: Input 6, 31321: Input 7, 31327: Input 8, 31333: Input 9, 31339: Input 10, 31345: Input 11, 31351: Input 12, 31357: Input 13, 31363: Input 14, 31369: Input 15, 31375: Input 16	S32	FIX0	RO
31791	Number of DC current measurement units	U32	FIX0	RO
31793 to 31919	String current of strings 1 to 64 (A)	S32	FIX3	RO
31921 to 31983	String current of strings 65 to 96 (A)	S32	FIX3	RO

31985 to 32047	String current of strings 97 to 128 (A)	S32	FIX3	RO
32049	ID of current measurement unit where a communication error has occurred.	U32	FIX0	RO
32051	String monitoring unit warning code in the event of a string error	U32	FIX2	RO
32053	Alarm contact 1 status	U32	ENUM	RO
32055	Alarm contact 2 status	U32	ENUM	RO
32057 to 32183	String status of the strings 1 to 64: 307 = Ok 467 = Overcurrent 477 = Reverse current 1392 = Error 1492 = String temporarily deselected due to ground fault 1493 = String permanently deselected due to ground fault 1692 = String deactivated due to WMAX 1693 = No string connected	U32	ENUM	RO
34097	Operating time of interior fan 1, in s	U64	Duration	RO
34101	Operating time of interior fan 2 (s)	U64	Duration	RO
34105	Operating time of heat sink fan (s)	U64	Duration	RO
34109	Heat sink temperature 1 (°C)	S32	TEMP	RO
34113	Interior temperature 1 (°C)	S32	TEMP	RO
34121	Transformer temperature 1 (°C)	S32	TEMP	RO
34125	External temperature 1 of supply air (°C)	S32	TEMP	RO
34127	Highest measured external temperature 1 (°C)	S32	TEMP	RO
34609	Ambient temperature (°C)	S32	TEMP	RO
34611	Highest measured ambient temperature (°C)	S32	TEMP	RO
34613	Total irradiation on the sensor surface (W/m²)	U32	FIX0	RO
34615	Wind speed (m/s)	U32	FIX1	RO
34617	Humidity (%)	U32	FIX2	RO
34619	Air pressure (Pa)	U32	FIX2	RO
34621	PV module temperature (°C)	S32	TEMP	RO
34623	Total irradiation on the external irradiation sensor/pyranometer (W/m²)	U32	FIX0	RO

34625	Ambient temperature (°F)		S32	TEMP	RO
34627	Ambient temperature (K)		S32	TEMP	RO
34629	PV module temperature (°F)		S32	TEMP	RO
34631	PV module temperature (K)		S32	TEMP	RO
34633	Wind speed (km/h)		U32	FIX1	RO
34635	Wind speed (mph)		U32	FIX1	RO
34637	Analog current input 1 (mA)		S32	FIX2	RO
34639	Analog current input 2 (mA)		S32	FIX2	RO
34641	Analog current input 3 (mA)		S32	FIX2	RO
34643	Analog current input 4 (mA)		S32	FIX2	RO
34645	Analog voltage input 1 (V)		S32	FIX2	RO
34647	Analog voltage input 2 (V)		S32	FIX2	RO
34649	Analog voltage input 3 (V)		S32	FIX2	RO
34651	Analog voltage input 4 (V)		S32	FIX2	RO
34653	Digital input group 1, coded as status: 311 = Open 2055 = DI1 2056 = DI1 DI2 2057 = DI1 DI2 DI3 2058= DI1 DI2 DI3 DI4 2059 = DI1 DI2 DI4 2060 = DI1 DI3	2061 = DI1 DI3 DI4 2062 = DI1 DI4 2063 = DI2 2064 = DI2 DI3 2065 = DI2 DI3 DI4 2066 = DI2 DI4 2067 = DI3 2068 = DI3 DI4 2069 = DI4	U32	ENUM	RO
34655	Digital input group 2, coded as status: 311 = Open 2070 = DI5 2071 = DI5 DI6 2072 = DI5 DI6 DI7 2073 = DI5 DI6 DI7 DI8 2074 = DI5 DI6 DI8 2075 = DI5 DI7	2076 = DI5 DI7 DI8 2077 = DI5 DI8 2078 = DI6 2079 = DI6 DI7 2080 = DI6 DI7 DI8 2081 = DI6 DI8 2082 = DI7 2083 = DI7 DI8 2084 = DI8	U32	ENUM	RO
34657	Digital input status: 303 = Off 308 = On		U32	ENUM	RO
35377	Number of events for User		U64	FIX0	RO

35381	Number of events for installer	U64	FIX0	RO
35385	Number of events for Service	U64	FIX0	RO
40001	Reading and setting the UTC system time (s)	U32	DT	RW
40003	Reading and setting the time zone (see Section 0 " Number Codes of the Time Zones", page 69).	U32	ENUM	RW
40005	Automatic daylight saving time conversion active: 1129 = Active 1130 = Not active	U32	ENUM	RW
40007	Type of inverter control: 295 = MPP 443 = Constant voltage 565 = Power specification via characteristic curve	U32	ENUM	RW
40009	Operating state: 295 = MPP 381 = Stop 443 = Constant voltage 1855 = Stand-alone operation 3128 = Remote control via Service	U32	ENUM	RW
40011	Acknowledgement: 26 = Acknowledge error	U32	ENUM	RW
40013	Set language: 777 = Deutsch 778 = English 779 = Italian 780 = Spanish 781 = French 782 = Greek 783 = Korean 784 = Czech 785 = Portuguese 786 = Dutch 796 = Slovenian 797 = Bulgarian 798 = Polish 799 = Japanese 801 = Thai 804 = Hebrew	U32	ENUM	RW
40020	External measurement of the insulation resistance: 303 = Off 308 = On	U32	ENUM	RW
40027	Reaction of the excitation type when changing the direction of power flow (see also Section 5.4.4): 2044 = Change excitation type 2045 = Do not change excitation type	U32	ENUM	RW

40029	Operating status: 295 = MPP 381 = Stop 1392 = Error 1393 = Waiting for DC start conditions 1467 = Start 1469 = Shut down 1480 = Wait for electric utility company 2119 = Derating	U32	ENUM	RO
40031	Nominal capacity of the battery (Ah)	U32	FIX0	RO
40033	Maximum battery temperature (°C)	U32	TEMP	RW
40035	Battery type: 1782 = Valve-regulated lead-acid battery (VRLA) 1783 = Flooded lead-acid battery (FLA) 1784 = Nickel/Cadmium (NiCd) 1785 = Lithium-Ion (Li-Ion)	U32	ENUM	RO
40037	Nominal battery voltage (V)	U32	FIX0	RO
40039	Time for boost charge of battery (min)	U32	Duration	RW
40041	Time for equalization charge of battery (h)	U32	Duration	RW
40043	Time for full charge of battery (h)	U32	Duration	RW
40045	Maximum battery charging current (A)	U32	FIX3	RW
40047	Nominal generator current in A	U32	FIX3	RW
40049	Automatic generator start: 1129 = Yes 1130 = No	U32	ENUM	RW
40051	Battery state of charge limit for generator shutdown (%)	U32	FIX0	RW
40053	Battery state of charge limit for generator start (%)	U32	FIX0	RW
40055	Manual generator control: 381 = Stop 1467 = Start	U32	ENUM	RW
40057	Generator request via power on: 1129 = Yes 1130 = No	U32	ENUM	RW
40059	Generator shutdown load limit (W)	U32	FIX0	RW
40061	Generator start load limit (W)	U32	FIX0	RW

40063	Firmware version of the central assembly	U32	FW	RO
40065	Firmware version of the logic component	U32	FW	RO
40067	Serial number	U32	RAW	RO
40071	Grid-forming generator: 1799 = None 1801 = Utility grid 1802 = Utility grid and generator 1803 = Invalid configuration for the PV production meter	U32	ENUM	RW
40073	Lower discharging limit for increased self-consumption (%)	U32	FIX0	RW
40075	Increased self-consumption switched on: 1129 = Yes 1130 = No	U32	ENUM	RW
40077	Initiate device restart: 1146 = Execute	U32	ENUM	RW
40079	Battery final cut-off voltage (V)	U32	FIX2	RW
40081	Maximum charge current of battery (A)	U32	FIX3	RW
40083	Maximum discharge current of battery (A)	U32	FIX3	RW
40085	Cell charging set voltage for boost charge (V)	U32	FIX2	RW
40087	Cell charging set voltage for full charge (V)	U32	FIX2	RW
40089	Cell charging set voltage for equalization charge (V)	U32	FIX2	RW
40091	Cell charging set voltage for float charge (V)	U32	FIX2	RW
40097	Voltage monitoring hysteresis, minimum threshold (V)	U32	FIX2	RW
40099	Voltage monitoring hysteresis, maximum threshold (V)	U32	FIX2	RW
40105	Frequency monitoring hysteresis, minimum threshold (Hz)	32	FIX2	RW
40107	Frequency monitoring hysteresis, maximum threshold (Hz)	32	FIX2	RW

40109	Set country standard: 27 = Special setting 42 = AS4777.3 305 = Stand-alone mode 333 = PPC 343 = RD1663 438 = VDE0126-1-1 560 = EN50438 561 = EN50438-CZ 1013 = Other standard 1199 = PPDS 7510 = VDE-AR-N4105 7513 = VDE-AR-N4105-MP 7514 = VDE-AR-N4105-HP 7517 = CEI 0-21 internal 7518 = CEI 0-21 external 7522 = NEN-EN50438 7523 = C10/11/2012 7524 = RD1699 7525 = G83/2 7527 = VFR2014 7528 = G59/3 7529 = SI4777_HS131_Pf	U32	ENUM	RO
40111	Voltage monitoring generator, minimum threshold (V)	U32	FIX2	RW
40113	Voltage monitoring generator maximum threshold (V)	U32	FIX2	RW
40115	Voltage monitoring generator hysteresis, minimum threshold (V)	U32	FIX2	RW
40117	Voltage monitoring generator hysteresis, maximum threshold (V)	U32	FIX2	RW
40119	Frequency monitoring generator, minimum threshold (Hz)	U32	FIX2	RW
40121	Frequency monitoring generator, maximum threshold (Hz)	U32	FIX2	RW
40123	Frequency monitoring generator hysteresis, minimum threshold (Hz)	U32	FIX2	RW
40125	Frequency monitoring generator hysteresis, maximum threshold (Hz)	U32	FIX2	RW
40127	Voltage monitoring generator, maximum reverse power (W)	U32	FIX2	RW
40129	Voltage monitoring generator, maximum reverse power tripping time (s)	U32	Duration	RW
40131	Grid connection point nominal current (A)	U32	FIX2	RW

40137	Acknowledge generator errors: 26 = Acknowledge error	U32	ENUM	RW
40141	Maximum start attempts after error	U32	FIX0	RW
40157	Automatic Speedwire configuration switched on: 1129 = Yes (DHCP) 1130 = No (manual configuration) See information "Network configuration", page 19.	U32	ENUM	RW
40159	Speedwire IP address, in the format XXX.XXX.XXX.XXX See information "Network configuration", page 19.	STR 32	IP4	RW
40167	Speedwire subnet mask, in the format XXX.XXX.XXX.XXX See information "Network configuration", page 19.	STR 32	IP4	RW
40175	Speedwire gateway address, in the format XXX.XXX.XXX.XXX See information "Network configuration", page 19.	STR 32	IP4	RW
40183	Line conductor assignment: 325 = Line conductor A 326 = Line conductor ABC 327 = Line conductor B 329 = Line conductor C 402 = Line conductor AB 403 = Line conductor AC 404 = Line conductor BC	U32	ENUM	RW
40185	Maximum device apparent power (VA)	U32	FIX0	RO
40187	Nominal capacity of the battery (Wh)	U32	FIX0	RO
40189	Maximum charge power of the battery (W)	U32	FIX0	RO
40191	Maximum discharge power of the battery (W)	U32	FIX0	RO
40193	Correction voltage, voltage increase protection (V)	U32	FIX3	RW
40195	Set apparent power limit (VA)	U32	FIX0	RW
40197	Current reactive power limit (VAr)	U32	FIX0	RW
40236	Operating Mode of the battery management system: 303 = Off 308 = On 2289 = Battery charging 2290 = Battery discharging 2424 = Default setting	U32	ENUM	RW
40454	Voltage monitoring, normalized lower maximum threshold (%)	U32	FIX3	RW
40460	Voltage monitoring, normalized upper minimum threshold (%)	U32	FIX3	RW

40480	Nominal current across all line conductor (A)	U32	FIX3	RO
40486	Voltage at the zero point 1 of the reactive power characteristic curve (%)	U32	FIX3	RW
40488	Voltage at the zero point 2 of the reactive power characteristic curve (%)	U32	FIX3	RW
40497	MAC address	STR 32	UTF8	RO
40513	Speedwire DNS server address, in the format XXX.XXX.XXX.XXX See information "Network configuration", page 19.	STR 32	IP4	RW
40521	Grid request based on power switched on: 1129 = Yes 1130 = No	U32	ENUM	RW
40523	Grid request connection power limit (W)	U32	FIX0	RW
40525	Grid request disconnection power limit (W)	U32	FIX0	RW
40527	Manual control of the utility grid: 303 = Off 308 = On 1438 = Automatic	U32	ENUM	RW
40529	Grid request based on charge type: 303 = Off 1736 = Full- and equalization charge 1768 = Full charge 1769 = Equalization charge	U32	ENUM	RW
40531	Type of AC subdistribution: 302 = None 2609 = Multicluster Box 6 2610 = Multicluster Box 12 2611 = Multicluster Box 36	U32	ENUM	RW
40533	Manual equalization charge: 381 = Stop 1466 = Waiting 1467 = Start	U32	ENUM	RW
40535	Generator request: 1438 = Automatic 1744 = Manual control	U32	ENUM	RW
40537	Battery state of charge limit, generator start (%)	U32	FIX0	RW
40539	Battery state of charge limit, generator shutdown (%)	U32	FIX0	RW

40541	Start time additional time period, generator request	U32	TM	RW
40543	End time additional time period, generator request	U32	TM	RW
40545	Battery state of charge limit, generator shutdown in additional time period (%)	U32	FIX0	RW
40547	Battery state of charge limit, generator start in additional time period (%)	U32	FIX0	RW
40549	Time-controlled generator operation: 1129 = Yes 1130 = No	U32	ENUM	RW
40551	Start time for time-controlled generator operation	U32	DT	RW
40553	Runtime for time-controlled generator operation (s)	U32	Duration	RW
40555	Repetition cycle of the time-controlled generator operation: 1189 = Daily 2622 = Once 2623 = Weekly	U32	ENUM	RW
40557	Generator request in configured charge mode: 303 = Off 1768 = Full charge 1769 = Equalization charge 1736 = Full- and equalization charge	U32	ENUM	RW
40559	Reaction to digital input of the generator request: 303 = Off 308 = On	U32	ENUM	RW
40561	Averaging time for load-dependent generator request based on power (s)	U32	Duration	RW
40563	Minimum run time of the generator (s)	U32	Duration	RW
40565	Minimum idle time of the generator (s)	U32	Duration	RW
40567	Cool-down time of the generator (s)	U32	Duration	RW
40569	Idle time after generator error (s)	U32	Duration	RW
40571	Warm-up time of the generator (s)	U32	Duration	RW
40573	Nominal generator frequency (Hz)	U32	FIX2	RW

40575 to 40585	Operating mode of the multifunction relay 1 to 6: 258 = Switching status of the grid relay 303 = Off 308 = On 1341 = Error message 1342 = Fan control 1343 = Self-Consumption 1349 = Control via communication 1359 = Battery bank 2632 = Automatic generator request 2633 = One-level load shedding 2634 = 1-level load shedding or first level of 2-level load shedding 2635 = First level of 2-level load shedding 2636 = Timer 1 2637 = Timer 2 2638 = Control of additional loads 2639 = Relay is activated when the generator is running 2640 = Relay is activated when an external source is available 2641 = Relay is activated when the utility grid is available 2642 = Relay is activated in case of error 2643 = Relay is activated during warning 2644 = Relay is activated when the cluster is running 2645 = Battery room fan 2646 = Electrolyte pump 2647 = ComSync 2648 = Relay is activated during output limitation 2649 = Triggering of contactors for grid disconnection in back-up operation 2650 = Triggering of earthing in backup operation 2900 = Battery room fan in a multicluster system 2901 = Load shedding in a multicluster system	U32	ENUM	RW
40587 to 40597	Slave 1, operating mode of the multifunction relay 1 of 6: Description see register number 40575 "Operating mode of the multifunction relay 1 to 6"	U32	ENUM	RW
40599 to 40609	Slave 2, operating mode of the multifunction relay 1 of 6: Description see register number 40575 "Operating mode of the multifunction relay 1 to 6"	U32	ENUM	RW

40611 and 40613	Repetition cycle time relay control for timer 1 and 2: 1189 = Daily 2622 = Once 2623 = Weekly	U32	ENUM	RW
40615 and 40617	Duration for which the multifunction relay remains activated for timer 1 and 2 (s)	U32	Duration	RW
40619 and 40621	Start date relay control for timer 1 and 2	U32	DT	RW
40623	Time-controlled inverter operation: 1129 = Yes 1130 = No	U32	ENUM	RW
40625	Start date for time-controlled inverter operation	U32	DT	RW
40627	Runtime for time-controlled inverter operation (s)	U32	Duration	RW
40629	Repetition cycle for time-controlled inverter operation: 1189 = Daily 2622 = Once 2623 = Weekly	U32	ENUM	RW
40631	Device name	STR 32	UTF8	RW
40647	Automatic updates switched on: 1129 = Yes 1130 = No 1505 = Manual update	U32	ENUM	RW
40649	Time of the automatic update	U32	TM	RW
40651 to 40655	Connection location of the meters 1 to 3 on the measurement interfaces 1 to 3: 230 = Grid measurements 1407 = PV system measurement	U32	ENUM	RW
40657 to 40661	serial numbers of the meters 1 to 3 on the measurement interfaces 1 to 3	U32	RAW	RW
40663	Grid Guard version	U32	Outline Purchase Agreement	RO

40665	Memory card status: 1788 = Ready 1787 = Initialization 3102 = Memory card full 3103 = No file system detected 3104 = Unsupported data system 3105 = Writing parameters 3106 = Writing parameters failed 3107 = Writing log data 3108 = No memory card available	U32	ENUM	RO
40667	Update version of the central assembly	U32	FW	RO
40669	Start time for PV grid feed-in	U32	TM	RW
40671	Stop time for PV grid feed-in	U32	TM	RW
40673	Blocking time until connection to external utility grid (s)	U32	Duration	RW
40675	Automatic frequency synchronization: 303 = Off 308 = On	U32	ENUM	RW
40677	Maximum current from the utility grid (A)	U32	FIX3	RW
40679	Reverse-feeding into the utility grid permitted: 1129 = Yes 1130 = No	U32	ENUM	RW
40681	Grid request based on battery state of charge switched on: 1129 = Yes 1130 = No	U32	ENUM	RW
40683	Battery state of charge limit for connection to the utility grid (%)	U32	FIX0	RW
40685	Battery state of charge limit for disconnection from the utility grid (%)	U32	FIX0	RW
40687	Start time additional time period for grid request	U32	TM	RW
40689	End time additional time period for grid request	U32	TM	RW
40691	Battery state of charge limit for connection to the utility grid in the additional time period	U32	FIX0	RW
40693	Battery state of charge limit for disconnection from the utility grid in the additional time period	U32	FIX0	RW
40695	Energy saving mode switched on: 1129 = Yes 1130 = No	U32	ENUM	RW
40697	Maximum grid reverse power (W)	U32	FIX0	RW

40699	Maximum grid reverse power tripping time (s)	U32	Duration	RW
40701	Time until switchover to energy saving mode (s)	U32	Duration	RW
40703	Maximum duration of the energy saving mode (s)	U32	Duration	RW
40705	Upper state of charge for reactivation of grid feed-in (%)	U32	FIX0	RW
40707	Lower state of charge for blocking grid feed-in (%)	U32	FIX0	RW
40709	Start time battery preservation mode level	U32	TM	RW
40711	End time battery preservation mode level	U32	TM	RW
40713	Battery state of charge for preservation mode (%)	U32	FIX1	RW
40715	Battery connection limit after overtemperature disconnection (°C)	S32	TEMP	RW
40717	Cable resistance of the battery connection (Ω)	U32	FIX3	RW
40719	Lower limit of the deep-discharge protection range for disconnection (%)	U32	FIX0	RW
40721	Minimum width of the deep-discharge protection range (%)	U32	FIX0	RW
40723	Minimum width of the backup power supply range (%)	U32	FIX0	RW
40725	Width of the range for the maintenance of the battery state of charge (%)	U32	FIX0	RW
40727	Minimum width of the self-consumption range (%)	U32	FIX0	RW
40729	Highest yielding month for battery utilization range: 2624 = June high yield 2625 = December high yield	U32	ENUM	RW
40731	Seasonal operation active: 1129 = Yes 1130 = No	U32	ENUM	RW
40733	Setpoint of the battery charging voltage with disabled battery management in V	U32	FIX2	RW
40735	Full charge cycle time (s)	U32	Duration	RW
40737	Equalization charge cycle time (s)	U32	Duration	RW
40739	Battery temperature compensation (V/°C)	S32	FIX3	RW
40741	Automatic equalization charge: 303 = Off 308 = On	U32	ENUM	RW

40743	Type of additional DC sources: 2619 = AC sources and DC charge controllers 2620 = Other DC charge controllers 2621 = Communicative coupled DC charge controllers	U32	ENUM	RW
40745	Type of generator current limitation: 2626 = Fixed threshold for current limitation 2627 = Frequency-dependent current limitation	U32	ENUM	RW
40747	Sensitivity of the generator fault recognition: 2628 = Low 2629 = Medium 2630 = Normal 2631 = High	U32	ENUM	RW
40749	Digital input status: 303 = Off 308 = On	U32	ENUM	RW
40751	Inverter nominal voltage (V)	U32	FIX0	RW
40753	Inverter nominal frequency Hz	U32	FIX0	RW
40755	Maximum AC battery charging current (A)	U32	FIX3	RW
40757	Battery state of charge threshold for the start of load shedding 1 (%)	U32	FIX0	RW
40759	Battery state of charge threshold for load shedding 1 stop (%)	U32	FIX0	RW
40761	Start time additional time period load shedding 1	U32	TM	RW
40763	Time load shedding 1	U32	TM	RW
40765	Battery state of charge limit for load shedding 1 start in additional time period (%)	U32	FIX0	RW
40767	Battery state of charge limit for load shedding 1 stop in additional time period (%)	U32	FIX0	RW
40769	Battery state of charge threshold for load shedding 2 start (%)	U32	FIX0	RW
40771	Battery state of charge threshold for load shedding 2 stop (%)	U32	FIX0	RW
40773	Start time additional time period load shedding 2	U32	TM	RW
40775	Time load shedding 2	U32	TM	RW
40777	Battery state of charge limit for load shedding 2 start in additional time period (%)	U32	FIX0	RW
40779	Battery state of charge limit for load shedding 2 stop in additional time period (%)	U32	FIX0	RW
40781	Temperature limit for multifunction relay with battery room fan	S32	TEMP	RW

	(°C)			
40783	Serial number slave 1 (line conductor L2)	U32	RAW	RO
40785	Serial number slave 2 (line conductor L3)	U32	RAW	RO
40787	Behavior of the cluster in the event of a device fault: 2612 = Continued operation 2613 = Stop all devices	U32	ENUM	RW
40789	Communication version	U32	Outline Purchase Agree-ment	RO
40791	Time-out for communication error message (s)	U32	FIX0	RW
40793	Minimum battery charging power (W)	U32	FIX0	RW
40795	Maximum battery charging power (W)	U32	FIX0	RW
40797	Minimum battery discharging power (W)	U32	FIX0	RW
40799	Maximum battery discharging power (W)	U32	FIX0	RW
40801	Gird transfer power setpoint (W)	S32	FIX0	RW
40803	Determine state of health: 381 = Stop 1467 = Start 3101 = Cancel	U32	ENUM	RW
40805	Energy saving mode: 303 = Off 308 = On	U32	ENUM	RO
40807	Hardware version of the logic component	U32	HW	RO
40809	Revision status of the logic component	U32	FIX0	RO
40811	Update version of the logic component	U32	FW	RO
40813	Serial number of the logic component	U32	RAW	RO
40815	SUSy ID of the logic component	U32	FIX0	RO
40819	Firmware version of the protocol converter	U32	FW	RO
40821	Hardware version of the protocol converter	U32	HW	RO
40823	Revision status of the protocol converter	U32	FIX0	RO
40825	Update version of the protocol converter	U32	FW	RO
40827	Serial number of the protocol converter	U32	RAW	RO
40829	SUSy ID of the protocol converter	U32	FIX0	RO

40833	Reactive power setpoint (VAr)	S32	FIX0	RW
40835	Input monitoring value	S32	FIX0	RW
40837	Estimated fuel consumption since the last reset (m³)	S32	FIX1	RW
40839	Estimated current fuel consumption (l/h)	S32	FIX1	RW
40841	Current generator power (W)	S32	FIX0	RW
40843	Current available generator power (VA)	S32	FIX0	RW
40845	Current generator reactive power (VAr)	S32	FIX0	RW
40847	Minimum generator power to be made available (W)	S32	FIX0	RW
40849	Current utility grid export active power (W)	S32	FIX0	RW
40851	Current utility grid export reactive power (VAr)	S32	FIX0	RW
40853	Reset measurement values: 568 = Execute all available functions 1456 = Consumption 1581 = Grid feed-in 3127 = Fuel Save meter	U32	FUNC-TION_SEC	RW
43090	**SMA Grid Guard code:** **Reading the register**: 0 = Not logged in with the Grid Guard code 1 = Logged in with the Grid Guard code **Writing to the register**: Log in and activate the Grid Guard mode using the SMA Grid Guard code. **Logging out**: Write **0** in the register to log out of Grid Guard mode.	U32	FIX0	RW

SMA Grid Guard code

You will find information on the SMA Grid Guard code in Section 2.5 "SMA Grid Guard code", page 10. You will find an overview of the parameters that can be changed with an activated SMA Grid Guard code in following Section.

5.3 SMA Modbus Profile – Grid Guard Parameters

In the following table you will find an overview of the SMA Modbus profile parameters that you can only change after prior transmission of an SMA Grid Guard code.

SMA Grid Guard code

You will find information on the SMA Grid Guard code in Section 2.5 "SMA Grid Guard code", page 10.

ADR (DEC)	Description/number code	Type	Format	Access
30239	Operating mode of Power Balancer: 303 = Off 1442 = PhaseGuard 1443 = PowerGuard 1444 = FaultGuard	U32	ENUM	RO
30825	Operating mode of the reactive power regulation: 303 = Off 1069 = Reactive power-/voltage characteristic curve Q(V) 1070 = Reactive power Q, direct setpoint 1071 = Reactive power const. Q (kVAr) 1072 = Reactive power Q, setpoint via system control 1073 = Reactive power Q(P) 1074 = cos φ, direct setpoint 1075 = cos φ, setpoint via system control 1076 = cos φ(P) characteristic curve 1387 = Reactive power Q, setpoint via analog input 1388 =cos φ, setpoint via analog input 1389 = Reactive power-/voltage characteristic curve Q(V) with hysteresis and deadband 2899 = Reactive power-/voltage characteristic curve Q(V) with hysteresis, deadband and activation power	U32	ENUM	RO
30827	Reactive power setpoint (VAr)	S32	FIX0	RO
30829	Reactive power setpoint (%)	S32	FIX1	RO
30831	Setpoint of cos φ	S32	FIX2	RO

30833	Setpoint, excitation type of cos φ: 1041 = Leading 1042 = Lagging	U32	ENUM	RO
30835	Operating mode of active power limitation: 303 = Off 1077 = Active power limitation P (W) 1078 = Active power limitation P (% of WMAX) 1079 = Active power limitation P via system control 1390 = Active power limitation P via analog input 1391 = Active power limitation P via digital inputs	U32	ENUM	RO
30837	Active power setpoint (W)	U32	FIX0	RO
30839	Active power setpoint (%)	U32	FIX0	RO
30919	Operating mode of static voltage stability with "Q at Night": 303 = Off 1069 = Reactive power-/voltage characteristic curve Q(V) 1070 = Reactive power Q, direct setpoint 1071 = Reactive power const. Q (kVAr) 1072 = Reactive power Q, setpoint via system control 1387 = Reactive power Q, setpoint via analog input 1389 = Reactive power/voltage characteristic curve Q(V) with hysteresis and deadband 2899 = Reactive power-/voltage characteristic curve Q(V) with hysteresis, deadband and activation power	U32	ENUM	RO
30921	Reactive power setpoint with "Q at Night" (VAr)	S32	FIX0	RO
30923	Reactive power setpoint with "Q at Night" (%)	S32	FIX1	RO
40093	Voltage monitoring minimum threshold (V)	U32	FIX2	RW
40095	Voltage monitoring maximum threshold (V)	U32	FIX2	RW
40101	Frequency monitoring minimum threshold (Hz)	U32	FIX2	RW
40103	Frequency monitoring maximum threshold (Hz)	U32	FIX2	RW
40133	Utility grid nominal voltage (V)	U32	FIX0	RW
40135	Nominal frequency (Hz)	U32	FIX2	RW

40200	Operating mode of the reactive power control: 303 = Off 1069 = Reactive power-/voltage characteristic curve Q(V) 1070 = Reactive power Q, direct setpoint 1071 = Reactive power const. Q (kVAr) 1072 = Reactive power Q, setpoint via system control 1073 = Reactive power Q(P) 1074 = cos φ, direct setpoint 1075 = cos φ, setpoint via system control 1076 = cos φ(P) characteristic curve 1387 = Reactive power Q, setpoint via analog input 1388 =cos φ, setpoint via analog input 1389 = Reactive power-/voltage characteristic curve Q(V) with hysteresis and deadband 2269 = Reactive power charact. curve 2270 = cos(Phi) or Q default setting via plant control	U32	ENUM	RW
40202	Reactive power setpoint (VAr)	S32	FIX0	RW
40204	Reactive power setpoint (%)	S32	FIX1	RW
40206	Setpoint of cos φ	S32	FIX2	RW
40208	Setpoint of excitation type of cos φ: 1041 = Leading 1042 = Lagging	U32	ENUM	RW
40210	Operating mode of active power limitation: 303 = Off 1077 = Active power limitation P (W) 1078 = Active power limitation P (%) of WMAX 1079 = Active power limitation P via system control 1390 = Active power limitation P via analog input 1391 = Active power limitation P via digital inputs	U32	ENUM	RW
40212	Active power setpoint (W)	U32	FIX0	RW
40214	Active power setpoint (%)	U32	FIX0	RW
40216	Operating mode of active power limitation at overfrequency P(f): 303 = Off 1132 = Linear gradient for instantaneous power	U32	ENUM	RW
40218	Linear instantaneous power gradient configuration: difference between starting frequency and power frequency (Hz)	U32	FIX2	RW
40220	Linear instantaneous power gradient configuration: difference between reset frequency and power frequency (Hz)	U32	FIX2	RW

40222	Configuration of the cos φ(P) characteristic curve, cos φ of the starting point	U32	FIX2	RW
40224	Configuration of the cos φ (P) characteristic curve (excitation type of the starting point): 1041 = Leading 1042 = Lagging	U32	ENUM	RW
40226	Configuration of the cos φ (P) characteristic curve, cos φ of the end point	U32	FIX2	RW
40228	Configuration of the cos φ (P) characteristic curve: (excitation type of the end point): 1041 = Leading 1042 = Lagging	U32	ENUM	RW
40230	Configuration of the cos φ (P) characteristic curve, active power of the starting point (%)	U32	FIX0	RW
40232	Configuration of the cos φ (P) characteristic curve, active power of the end point (%)	U32	FIX0	RW
40234	Active power gradient (%)	U32	FIX0	RW
40238	Active power gradient, linear instantaneous power gradient configuration (%)	U32	FIX0	RW
40240	Activation of stay-set indicator function, linear instantaneous power gradient configuration: 303 = Off 308 = On	U32	ENUM	RW
40242	Active power gradient after reset frequency, linear instantaneous power gradient configuration (%)	U32	FIX0	RW
40244	Reactive current droop, full dynamic grid support configuration: 1020 = MVtgDirective 1233 = SDLWindV	U32	ENUM	RW
40246	Gradient K of the reactive current droop for undervoltage with dynamic grid support (%)	U32	FIX2	RW
40248	Gradient K of the reactive current droop for overvoltage with dynamic grid support (%)	U32	FIX2	RW
40250	Operating mode of dynamic grid support, dynamic grid support configuration: 1264 = Complete dynamic grid support 1265 = Limited dynamic grid support	U32	ENUM	RW

40252	Lower limit voltage dead band, full dynamic grid support configuration (%)	S32	FIX0	RW
40254	Upper limit voltage dead band, full dynamic support configuration (%)	U32	FIX0	RW
40256	PWM cut-off voltage, dynamic grid support configuration (%)	U32	FIX0	RW
40258	PWM cut-off delay, configuration of the dynamic grid support (s)	U32	FIX2	RW
40260	Characteristic curve number, configuration of the active power-/voltage characteristic curve P(V). 0 = function is switched off.	U32	FIX0	RW
40262 to 40266	Characteristic curve 1 to 3, number points to be used on the characteristic curve. Maximum number of points per characteristic curve = 12.	U32	FIX0	RW
40282 to 40304	X values 1 to 12 of the characteristic curve 1	S32	FIX3	RW
40306 to 40328	Y values 1 to 12 of the characteristic curve 1	S32	FIX3	RW
40330 to 40352	X values 1 to 12 of the characteristic curve 2	S32	FIX3	RW
40354 to 40376	Y values 1 to 12 of the characteristic curve 2	S32	FIX3	RW
40378 to 40400	X values 1 to 12 of the characteristic curve 3	S32	FIX3	RW
40402 to 40424	Y values 1 to 12 of the characteristic curve 3	S32	FIX3	RW
40426	Frequency monitoring, upper maximum threshold, tripping time (ms)	U32	FIX0	RW
40428	Frequency monitoring, median maximum threshold (Hz)	U32	FIX2	RW
40430	Frequency monitoring, median maximum threshold, tripping time (ms)	U32	FIX0	RW
40432	Frequency monitoring, lower maximum threshold (Hz)	U32	FIX2	RW

40434	Frequency monitoring, lower maximum threshold, tripping time (ms)	U32	FIX0	RW
40436	Frequency monitoring, upper minimum threshold (Hz)	U32	FIX2	RW
40438	Frequency monitoring, upper minimum threshold, tripping time (ms)	U32	FIX0	RW
40440	Frequency monitoring, median minimum threshold (Hz)	U32	FIX2	RW
40442	Frequency monitoring, median minimum threshold, tripping time (ms)	U32	FIX0	RW
40444	Frequency monitoring, upper minimum threshold, tripping time (ms)	U32	FIX0	RW
40446	Voltage monitoring, upper maximum threshold, tripping time (ms)	U32	FIX3	RW
40448	Voltage monitoring, median maximum threshold (V)	U32	FIX2	RW
40450	Voltage monitoring, median maximum threshold, tripping time (ms)	U32	FIX0	RW
40452	Voltage monitoring, lower maximum threshold, (V)	U32	FIX2	RW
40456	Voltage monitoring, lower maximum threshold, tripping time (ms)	U32	FIX0	RW
40458	Voltage monitoring, upper minimum threshold (V)	U32	FIX2	RW
40462	Voltage monitoring, upper minimum threshold, tripping time (ms)	U32	FIX0	RW
40464	Voltage monitoring, median minimum threshold (V)	U32	FIX2	RW
40466	Voltage monitoring, median minimum threshold, tripping time (ms)	U32	FIX0	RW
40468	Voltage monitoring, lower minimum threshold, tripping time (ms)	U32	FIX0	RW
40470	Islanding detection status: 303 = Off 308 = On	U32	ENUM	RW
40472	Reference voltage, system control (V)	U32	FIX0	RW
40474	Reference correction voltage, system control (V)	S32	FIX0	RW
40476	Cos φ of the start point, configuration of the cos φ (P) characteristic curve	S32	FIX2	RW
40478	Cos φ of the end point, configuration of the cos φ (P) characteristic curve	S32	FIX2	RW

40482	Reactive power gradient	U32	FIX0	RW
40484	Activation of the active power gradients: 303 = Off 308 = On	U32	ENUM	RW
40490	Reactive power gradient, reactive power-/voltage characteristic curve Q(V) configuration (%)	U32	FIX1	RW
41193	Operating mode for absent active power limitation 2506 = Keep values 2507 = Use of fallback setting	U32	ENUM	RW
41195	Time out for absent active power limitation (s)	U32	FIX0	RW
41197	Select the parameter Fallback act power lmt P in % of WMax for absent act power lmt and set the required percentage.	U32	FIX2	RW

5.4 SMA Modbus profile – Grid Management Services

5.4.1 Configuring Grid Management Services Control

Procedure:

You will need to perform the following settings on the SMA device with Speedwire interface in order to be able to control grid management via Modbus.

1. Start Sunny Explorer and log in as "Installer".
2. Select the respective SMA device with Speedwire interface in Sunny Explorer.
3. Select **Settings** in the device menu.
4. Select the parameter group **System & device control**.
5. Select [**Edit**].
6. Select the parameter group **Configuration of static voltage stability** and in the drop-down list **Operating mode of static voltage stability** the desired operating mode:
   - **Reactive power Q, setpoint via system control** or
   - **cos Phi, setpoint via system control**
7. Select the parameter group **Configuration of feed-in management** and in the drop-down list **Operating mode Active power** the operating mode **Act. power lim. via PV system ctrl**.

Test the operation mode "System control" via the Modbus protocol

Using the following Modbus registers, you can check for the SMA device with Speedwire interface whether the **setpoint via system control** is activated:

- Reactive power (if enabled in the device): Read Modbus register 30825. Reactive power (if enabled in the device): Modbus holding register (see table)
  If the value 1072 can be read from this register, the reactive power can be specified via system control.
- Cos φ (if enabled in device): Read Modbus register 30825. If the value 1075 can be read from this register, the power factor can be specified via system control.
- Active power: Read Modbus register 30835. If the value 1079 can be read from this register, the active factor can be specified via system control.

5.4.2 Grid Management Services - Assignment Table

In the following table you can find the parameters for the grid management services that you can access:

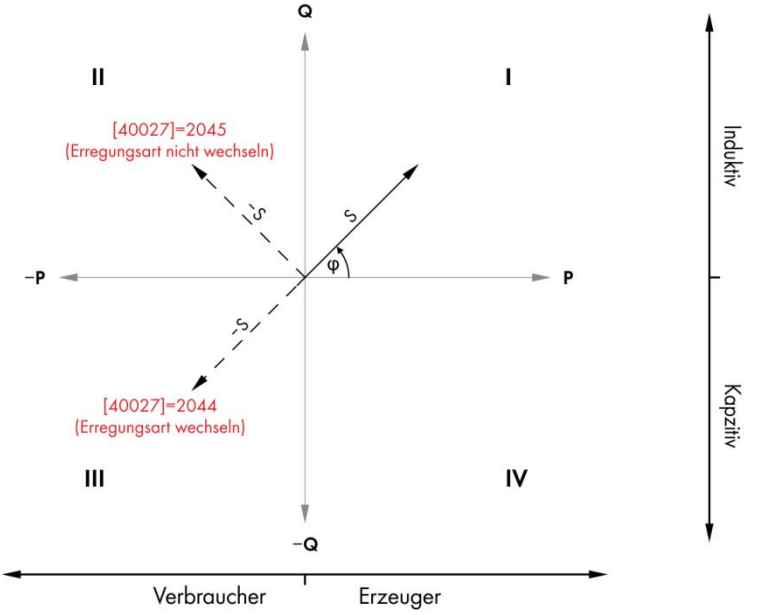
ADR (DEC)	Description/number code	Type	Format	Access	Fallback
40015	Reactive power setpoint Q, in % of the maximum active power (PMAX) of the inverter. Value range: -100% to -1% = load 0% = no reactive power +1% to +100% = generator	S16	FIX0	WO	X
40016	Reactive power setpoint P, in % of the maximum active power (PMAX) of the inverter. Value range: -100% to -1% = load 0% = no active power +1% to +100% = generator	S16	FIX0	WO	X
40018	Quick shut-down of the inverter: 381 = Stop (AC side) 1467 = Start 1749 = Full stop (AC and DC side)	U32	ENUM	WO	
40022	Reactive power setpoint Q, in % of the maximum active power (PMAX) of the inverter. Value range: -100.00% to < 0% = load 0% = no reactive power < 0% to +100.00% = generator	S16	FIX2	WO	X

40023	Reactive power setpoint P, in % of the maximum active power (PMAX) of the inverter. Value range: -100.00% to < 0% = load 0% = no active power < 0% to +100.00% = generator	S16	FIX2	WO	X
40024	Displacement power factor cos φ (also see Section 0 "", page): 0.0000 to 1.0000	U16	FIX4	WO	X
40025	Excitation type of cos φ (also see Section 0): 1041 = Leading 1042 = Lagging	U32	ENUM	WO	X
40492	Direct marketer: Reactive power setpoint Q, in % of the maximum active power (PMAX) of the PV plant. Value range: -100.00% to < 0% = load 0% = no reactive power < 0% to +100.00% = generator	S16	FIX2	WO	
40493	Direct marketer: Reactive power setpoint P, in % of the maximum active power (PMAX) of the PV plant. Value range: -100.00% to < 0% = load 0% = no active power < 0% to +100.00% = generator	S16	FIX2	WO	
40494	Direct marketer: Displacement power factor cos (phi): 0.0000 to 1.0000	U16	FIX4	WO	

40495	Direct marketer: Excitation type of cos φ: 1041 = Leading 1042 = Lagging	U32	ENUM	WO
40999	Cos (phi) setpoint in accordance with EEI convention	S32	FIX4	WO
40143	Active power setpoint for the operating mode "Active power limitation P via PV system control" (A)	S32	FIX2	WO
40145	Reactive current setpoint for the operating mode "Specification via system control" (A)	S32	FIX2	WO
40147	Generator active power limitation for the operating mode "Active power limitation P via system control" (A)	U32	FIX2	WO
40149	Active power setpoint for the operating mode "Active power limitation P via system control" (W)	S32	FIX0	WO
40151	System control (active and reactive power control via communication): 802 = Active 803 = Inactive	U32	ENUM	WO
40153	Reactive power setpoint for operating mode "Specification via system control" (VAr)	S32	FIX0	WO

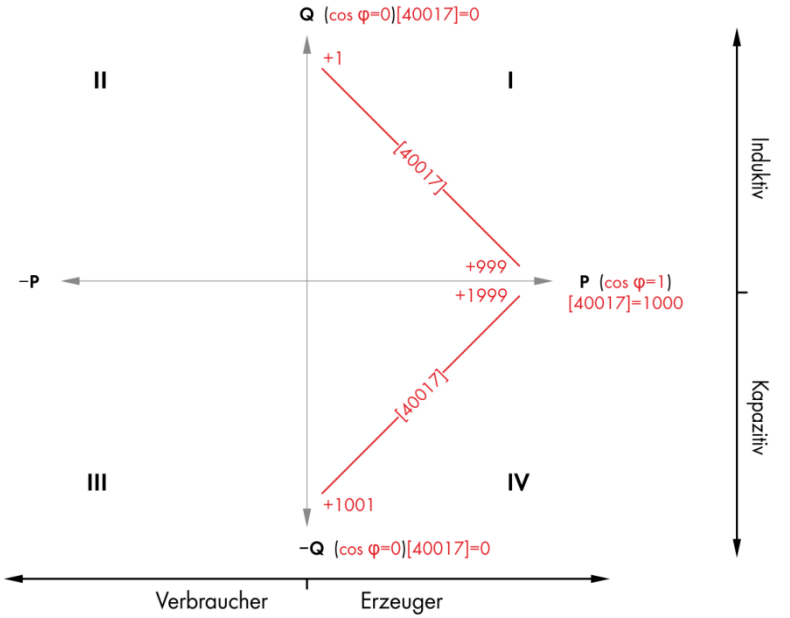
5.4.3 Power Control with cos φ and Excitation Type

The power control by means of cos φ [40024] and the excitation type [40025] are shown in a coordinate system in the following graphic (the square brackets contain the address of the Modbus register to be set):



5.4.4 Reaction of the excitation type

The reaction of the excitation type during power control change [40027] are shown in a coordinate system in the following graphic (the square brackets contain the address of the Modbus register to be set):



6 Troubleshooting

Problem	Cause and corrective measures
The SMA device with Speedwire interface is not available for the Modbus client.	The necessary Modbus server in the SMA device with Speedwire interface may not be enabled. **Corrective measures:** • Ensure that the required Modbus server is enabled (see Section 4 "Commissioning and Configuration", page 17)
	The correct IP address for the SMA device with Speedwire interface may not be set in the Modbus client. **Corrective measures:** • Read off the IP address of the SMA device with Speedwire interface (see router manual). • Ensure that the correct IP address for the SMA device with Speedwire interface is set in the Modbus client (see the Modbus client manufacturer manual).
	The firewall may not be set correctly. **Corrective measures:** • Enable port 502 in the firewall (see firewall manual).
The SMA device with Speedwire interface does not send a reply within the response time specified by the Modbus client.	The Modbus server of the SMA device may be currently overloaded. **Corrective measures:** • Extend the response time set in the Modbus client successively by one second respectively.

A NaN value is reported in the Modbus client (see Section 3.6 "SMA Data Types and NaN Values", page 14).	You may be trying to read from a Modbus register that is not supported by the inverter. **Corrective measures:** • Contrast and compare the available measured values for your SMA device with the requested Modbus registers (see technical information SMA Modbus interface at SMA-Solar.com").
	You may be trying to read from a Modbus register that is not defined in the Modbus profile. **Corrective measures:** • Remove the register address used from the data processing. • Install a newer version of the Modbus profile via a firmware update.
	The NaN value 255 is reported. You may be trying to read a configuration of a non-existent device. **Corrective measures:** • Set the Unit ID = 3 in the Modbus client for the desired SMA device with Speedwire interface. • Check if the configuration read is supported by the device.
	It is possible that you are trying to inquire an energy meter which has had an overflow (e.g. energy meter that measures the amount of electrical energy in Wh). The energy meter has NaN value which corresponds with the respective data type in this case. **Corrective measures:** • Inquire an energy meter that measures for example the amount of electrical energy in kWh.
	You may be trying to read from a write-only Modbus register. **Corrective measures:** • Read off the access type of the affected register from the "Access" column of the corresponding assignment table and correct it in the Modbus client.

Modbus exception 1 "Illegal Function" is reported in the Modbus client.	You may be trying to write to a data block whose target address range has registers that are not writable. **Corrective measures:** • Check whether all registers to be written to are writable.
	It is possible that a person, software or data logger are trying to login with the same Grid Guard code. **Corrective measures:** • Ensure that only one person, software or data logger tries to log into the device via Grid Guard code.
Modbus exception 2 "Illegal Data Address" is reported in the Modbus client.	You may be trying to write to a Modbus register that is not defined in the SMA Modbus profile. **Corrective measures:** • Check the Modbus address to be written to in the Modbus client for errors.
	You may be trying to read or write to a data block whose start or end address does not correspond with that of a register (alignment not correct). **Corrective measures:** • Check the start or end address of the data block. • Check the register at the start or end address of the data block to be read for consistency. It may be that one of the two registers is inconsistent.
	You may be trying to write to a data block and one of the registers to be written to are not supported by the device. **Corrective measures:** • Check that the register to be written to is provided by your SMA device (see Technical Information SMA Modbus Interface at www.SMA-Solar.com).

Modbus exception 3 "Illegal Data Value" is reported in the Modbus client.	You may be trying to write to a data block (Modbus commands 0x10 and 0x17) and one of the values has a data type that is not permitted. **Corrective measures:** • Read off the data type of the register to be written to from the "Type" column of the corresponding assignment table and correct it in the Modbus client.
Modbus exception 4 "Slave Device Failure" is reported in the Modbus client.	You may be trying to read or write to a register of a device, but are using a unit ID that is not permitted. **Corrective measures:** • Set the Unit ID = 3 in the Modbus client for the desired SMA device with Speedwire interface.
Other Modbus exceptions	**Corrective measures:** • For Modbus exceptions, see "Modbus Application Protocol Specification" at http://www.modbus.org/specs.php.
Other errors	**Corrective measures:** • For troubleshooting of the SMA devices, use the Modbus address 30197 and read off the event messages displayed by the devices or the error code shown in the display. To decrypt the event messages of low-power to medium-power inverters, you require additional information (event messages, see the inverter service manual at www.SMA-Solar.com).

7 Technical Data

7.1 Modbus Communication Ports

The following table shows the default setting of the supported network protocols:

Network protocol	Communication port, default setting
TCP	502
UDP	502

Using free communication ports

You should only use free communication ports. The following range is generally available: 49152 to 65535.

You can find more information on occupied ports in the database "Service Name and Transport Protocol Port Number Registry" at http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml.

Changing the communication port

If you change one of the communication ports, you must also change the corresponding communication port of a connected Modbus client system. Otherwise the SMA device can no longer be accessed via the Modbus protocol.

7.2 Data Processing and Time Behavior

In this Section, you can find typical data processing and reaction times of the Speedwire Modbus interface and time details for saving parameters in SMA devices.

NOTICE

Damage to SMA inverters

The parameters of the SMA inverters that can be changed with writable Modbus registers (RW/WO) are intended for long-term storage of device settings. Cyclical changing of these parameters leads to destruction of the flash memory of the devices.

- Device parameters must not be changed cyclically.

Parameters for the control and limitation of the nominal PV system power - described in chapter 5.4 "SMA Modbus profile – Grid Management Services" on page 57 - are an exception. Such parameters can be changed cyclically.

For automatic remote control of your PV system, you can use the parameters for grid management services (see chapter 5.4).

Signal Runtime via the SMA Device with Speedwire Interface

The signal runtime via the SMA device with Speedwire interface is at maximum 100 ms.

The signal runtime is the time required by the SMA device to process incoming Modbus commands.

Data transfer interval via the Modbus protocol

For system stability reasons, the time period between data transfers via the Modbus protocol must be at least ten seconds. No more than five parameters and measured values should be transmitted per inverter.

Reaction time of the Modbus interface

The reaction time of the Modbus interface is five to ten seconds.

The reaction time of the Modbus interface. is the time between the arrival of the parameter specifications in the SMA device until the corresponding measured values are provided to the Modbus interface. Due to this reaction time, parameter specifications can only be displayed via a Modbus client system (e.g. a SCADA system) at a corresponding or larger interval.

7.3 Number Codes of the Time Zones

The following table contains the most important time zones and their number codes in the SMA Modbus profile. If the location is known, you can determine the numerical key (code) and the time zone. In the tables in Section 5 "SMA Modbus Profile", from page 18, with specification of the time zone, this table is referenced. In addition, take account of local regulations for summer/winter time.

City/Country	Code	Time zone
Abu Dhabi, Muscat	9503	UTC+04:00
Adelaide	9513	UTC+09:30
Alaska	9501	UTC-09:00
Amman	9542	UTC+02:00
Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna	9578	UTC+01:00
Arizona	9574	UTC-07:00
Astana, Dhaka	9515	UTC+06:00
Asuncion	9594	UTC-04:00
Athens, Bucharest, Istanbul	9537	UTC+02:00
Atlantic (Canada)	9505	UTC-04:00
Auckland, Wellington	9553	UTC+12:00
Azores	9509	UTC-01:00
Baghdad	9504	UTC+03:00
Baku	9508	UTC+04:00
Bangkok, Hanoi, Jakarta	9566	UTC+07:00
Beirut	9546	UTC+02:00
Belgrade, Bratislava, Budapest, Ljubljana, Prague	9517	UTC+01:00
Bogotá, Lima, Quito	9563	UTC-05:00
Brasilia	9527	UTC-03:00
Brisbane	9525	UTC+10:00
Brussels, Copenhagen, Madrid, Paris	9560	UTC+01:00
Buenos Aires	9562	UTC-03:00
Canberra, Melbourne, Sydney	9507	UTC+10:00
Caracas	9564	UTC-04:30
Casablanca	9585	UTC+00:00
Cayenne	9593	UTC-03:00
Chennai, Kolkata, Mumbai, New Delhi	9539	UTC+05:30

Chicago, Dallas, Kansas City, Winnipeg	9583	UTC-06:00
Chihuahua, La Paz, Mazatlán	9587	UTC-07:00
Darwin	9506	UTC+09:30
Denver, Salt Lake City, Calgary	9547	UTC-07:00
Dublin, Edinburgh, Lisbon, London	9534	UTC+00:00
Yerevan	9512	UTC+04:00
Fiji, Marshall Islands	9531	UTC+12:00
Georgetown, La Paz, San Juan	9591	UTC-04:00
Greenland	9535	UTC-03:00
Guadalajara, Mexico City, Monterrey	9584	UTC-06:00
Guam, Port Moresby	9580	UTC+10:00
Harare, Pretoria	9567	UTC+02:00
Hawaii	9538	UTC-10:00
Helsinki, Kiev, Riga, Sofia, Tallinn, Vilnius	9532	UTC+02:00
Hobart	9570	UTC+10:00
Indiana (East)	9573	UTC-05:00
International Date Line (West)	9523	UTC-12:00
Irkutsk	9555	UTC+08:00
Islamabad, Karachi	9579	UTC+05:00
Yakutsk	9581	UTC+09:00
Yekaterinburg	9530	UTC+05:00
Jerusalem	9541	UTC+02:00
Kabul	9500	UTC+04:30
Cairo	9529	UTC+02:00
Cape Verde Islands	9511	UTC-01:00
Katmandu	9552	UTC+05:45
Caucasus Standard Time	9582	UTC+04:00
Krasnoyarsk	9556	UTC+07:00
Kuala Lumpur, Singapore	9544	UTC+08:00
Kuwait, Riyadh	9502	UTC+03:00
Magadan, Solomon Islands, New Caledonia	9519	UTC+11:00
Manaus	9516	UTC-04:00
Midway Islands, Samoa	9565	UTC-11:00
Minsk	9526	UTC+02:00
Mid-Atlantic	9545	UTC-02:00
Monrovia, Reykjavík	9536	UTC+00:00
Montevideo	9588	UTC-03:00
Moscow, St. Petersburg, Volgograd	9561	UTC+03:00
Nairobi	9524	UTC+03:00
Newfoundland	9554	UTC-03:30
New York, Miami, Atlanta, Detroit, Toronto	9528	UTC-05:00
Novosibirsk	9550	UTC+06:00
Nuku'alofa	9572	UTC+13:00
Osaka, Sapporo, Tokyo	9571	UTC+09:00
Pacific (U.S., Canada)	9558	UTC-08:00
Beijing, Chongqing, Hong Kong, Ürümqi	9522	UTC+08:00
Perth	9576	UTC+08:00
Petropavlovsk-Kamchatsky	9595	UTC+12:00
Port Louis	9586	UTC+04:00
Santiago	9557	UTC-04:00
Sarajevo, Skopje, Warsaw, Zagreb	9518	UTC+01:00
Saskatchewan	9510	UTC-06:00
Seoul	9543	UTC+09:00
Sri Jayawardenepura	9568	UTC+05:30
Taipei	9569	UTC+08:00
Tashkent	9589	UTC+05:00
Teheran	9540	UTC+03:30
Tbilisi	9533	UTC+04:00
Tijuana, Baja California (Mexico)	9559	UTC-08:00
Ulan Bator	9592	UTC+08:00
West-Central Africa	9577	UTC+01:00
Windhoek	9551	UTC+02:00
Vladivostok	9575	UTC+10:00
Yangon (Rangoon)	9549	UTC+06:30
Central America	9520	UTC-06:00

8 Contact

If you experience any technical problems with our products, please contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Modbus client software or hardware used
- Type of communication interface between the inverter and the SCADA system
- Type, serial number and software version of the inverter

Danmark Deutschland Austria Switzerland	SMA Solar Technology AG Niestetal (Germany) SMA Online Service Center: www.SMA.de/Service Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (communication products): +49 561 9522-2499 Fuel Save Controller (PV Diesel Hybrid Systems): +49 561 9522-3199 Sunny Island, Sunny Backup, Hydro Boy: +49 561 9522-399 Sunny Central: +49 561 9522-299	Belgium Belgique België Luxemburg Luxembourg Nederland	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730
		Česko Magyarország Polska România Slovensko	SMA Central & Eastern Europe s.r.o. Praha +420 235 010 417
France	SMA France S.A.S. Lyon +33 472 22 97 00	Ελλάδα Κύπρος	SMA Hellas AE Αθήνα +30 210 9856666
España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899
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Australia	SMA Australia Pty. Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200	Other countries	International SMA Service Line Niestetal (Germany) Toll free worldwide: 00800 SMA SERVICE (+800 762 7378423)

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