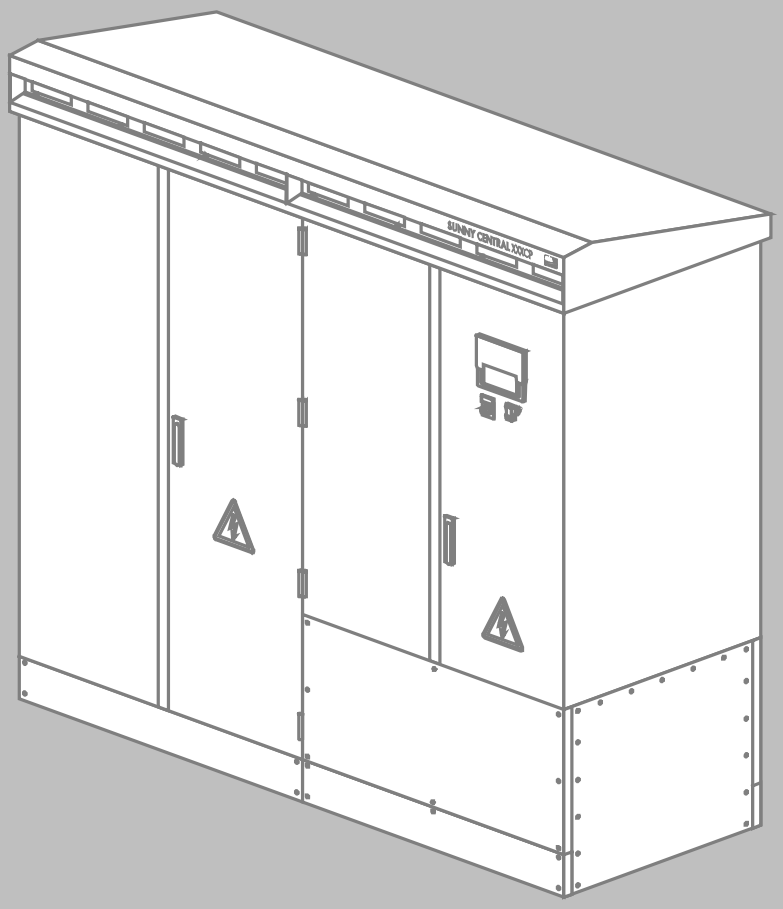
Technical Information

SC-COM Modbus® Interface for SUNNY CENTRAL of the production series CP, CP-US, CP-JP and HE-20



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1 Information on this Document

1.1 Validity

This document is valid for the SMA devices listed in Section 9.1 "Supported SMA Devices", page 52. It describes the variant of the communication protocol "Modbus® Application Protocol" implemented by SMA and also the corresponding parameters, measured values and data exchange formats.

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

1.2 Target Group

This document is intended for qualified persons. The activities described in this document are to be performed by qualified persons only. Qualified persons must have the following skills:

- Knowledge of IP-based network protocols
- Training in the installation and configuration of IT systems
- Knowledge of how SMA inverters work and are operated
- Training in how to deal with dangers and risks associated with operating electrical devices and systems
- Knowledge of and compliance with this document

1.3 Additional Information

SMA Documents

Additional information is available at www.SMA-Solar.com:

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

1.4 Symbols

Symbol	Explanation
i	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
✖	A problem that might occur.

1.5 Typographies

Typography	Usage	Example
bold	File names Elements to be selected Elements on a user interface Elements to be entered Parameters	Select **Settings**. Read off the configured port in the field **Port**. Enter the value **502** in the field **Port**.
>	Connects several elements to be selected	Select **Settings > Port**.
[Button/Key]	Button or key to be selected or pressed	Select [**Next**].
[Source]	Data channel name	Reading of the system time (UTC) [SerTm].

1.6 Nomenclature

Complete Designation	Designation in this Document
SMA Modbus Master Profile	Modbus master profile
Sunny Central Communication Controller	SC-COM, Communication interface

1.7 Terms and Abbreviations

Term/abbreviation	Designation	Explanation
Attribute value	-	Changeable content of an XML attribute, e.g. attribute="My content".
CT	Current measuring unit	Hardware for string-current monitoring
DWORD	-	Data with a width of 32 bits, as per IEC 61131-3
Device ID	-	Numeric value that identifies a specific SMA device type
GFDI	Ground-Fault Detection and Interruption	Detection of the grounding error and subsequent interruption of the electric circuit.
Hex	-	Hexadecimal number
IP	Internet protocol	Network protocol for connections via the Internet
MPP	Maximum Power Point	Maximum Power Point
NaN	Not a Number	No valid value is available.
PMAX	Active power, maximum value	The device can generate active power up to this limit.
Source register	-	Modbus register that is assigned to a different Modbus address (destination register).
RO	Read Only	Value can only be read
RW	Read/Write	Value can be read and written

Term/abbreviation	Designation	Explanation
SCADA	Supervisory Control and Data Acquisition	Control center software; in this document SCADA is used as an example for a Modbus master system.
SMA fieldbus	-	Interface for communication between SMA devices, e.g. RS485 or Ethernet. For information on the communication interfaces that are supported, see the datasheets of the SMA devices.
UTC	Coordinated Universal Time	Universal Time Coordinated
VPN	Virtual private network	VPN is used to establish a connection from one private computer network to another. The point of connection is established on both sides by a VPN gateway. In each case, the VPN gateway may be a computer or a router. The connection itself is described as a VPN tunnel. A secured data stream runs via the tunnel from one network to the other, providing VPN nodes from one network with access to services and devices of the other network.
WO	Write-only value	Value can only be written
WORD	-	Data with a width of 16 bits, as per IEC 61131-3
Destination register	-	Modbus register to which a different Modbus address (source register) is assigned. The destination register is used instead of the source register for further data processing.

2 Safety

2.1 Intended Use

The Modbus interface of the SC-COM 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 the protocol Modbus TCP and via the protocol Modbus UDP.

The enclosed documentation is an integral part of this product. You must read and observe the documentation and keep it in a convenient place for future reference.

2.2 Information on Data Security

Data security in Ethernet networks

The SC-COM can be connected to the Internet. When connecting to the Internet, there is a risk that unauthorized users can access and manipulate the data of your system.

Take appropriate protective measures, e.g.:

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

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 master (e.g. a SCADA system) can access the data of a Modbus slave (e.g. SC-COM).

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

3.2 SMA Modbus Profile

The SMA Modbus profile contains definitions for selected SMA devices. A reduction of the available data on SMA devices was carried out for the definition and this was then assigned to the corresponding Modbus registers. The SMA Modbus profile contains, for example, the total and daily energy, current power, voltage and current levels. The assignment between SMA device data and Modbus addresses is split into ranges in the SMA Modbus profile and these can be addressed via unit IDs (see Section 3.6 "Addressing and Data Transmission in the Modbus Protocol", page 11).

To enable access to the data of an SMA device, a special gateway is required, which is provided via the SC-COM.

3.3 User-Defined Modbus Profile

The user-defined Modbus profile enables you to reassign Modbus addresses of the SMA Modbus profile. One advantage of reassigning Modbus addresses can be that the measured values and parameters which are relevant for a specific purpose, can be applied to consecutive Modbus addresses. These addresses can then be read and placed in a single data block.

3.4 SMA Modbus Master Profile

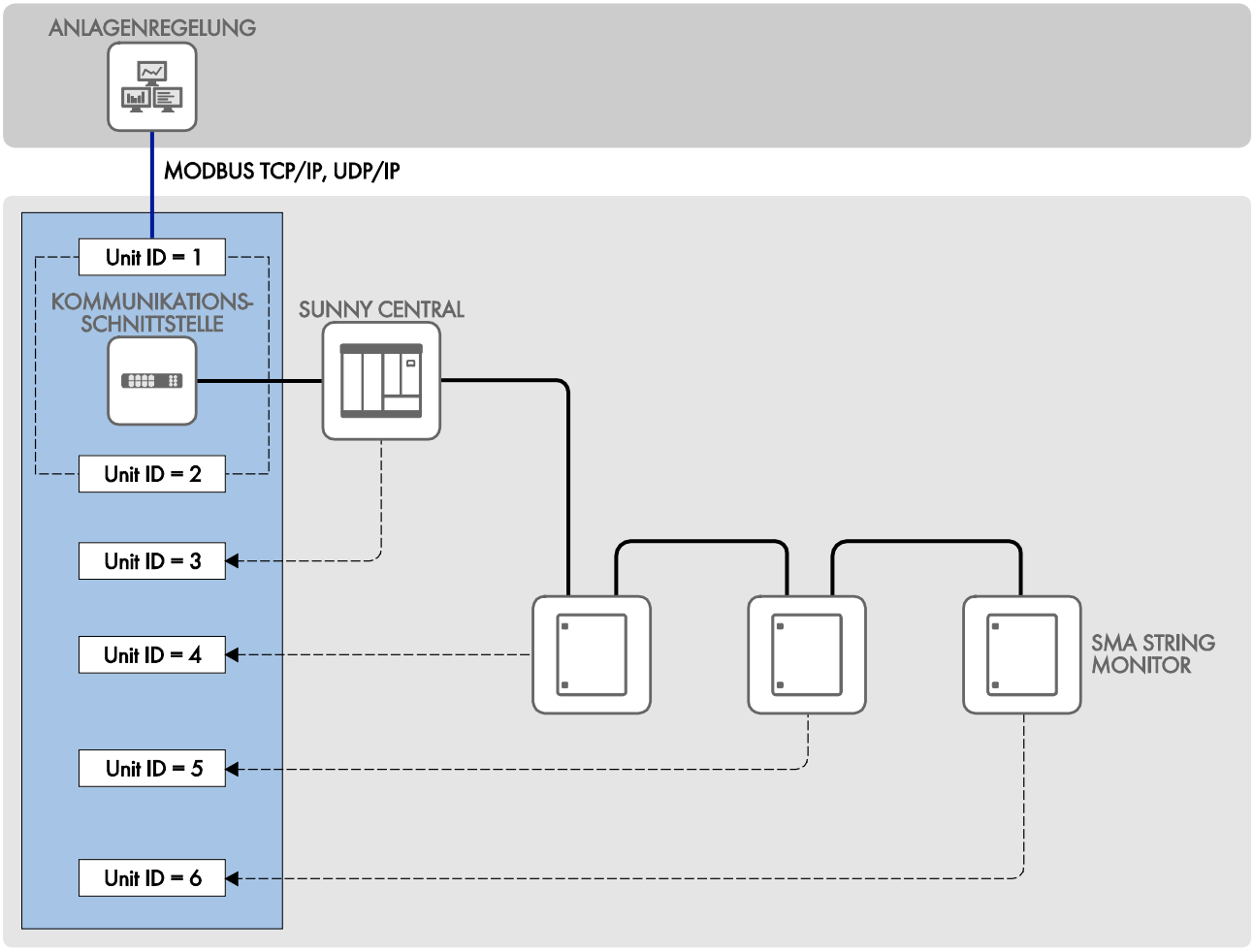
The SMA Modbus master profile is an extension of the Modbus interface, which is used to access Modbus-capable slave devices of other providers. The Modbus registers of such Modbus devices are bundled in an assignment table, the SMA Modbus master profile. The SMA Modbus master profile is stored using unit ID = 120 in the gateway of the SC-COM. By way of this unit ID, the Modbus registers of the slave devices are available for superordinate SCADA systems.

3.5 PV System Topology

The SMA Modbus profile was developed for a hierarchical PV system structure. In this structure, the SC-COM is a communication device which is equipped with a Modbus TCP/IP and Modbus UDP interface. All other SMA devices that are connected to the SC-COM via the SMA fieldbus are subordinate to the SC-COM.

From the perspective of the Modbus protocol, the SC-COM represents a Modbus slave that provides a gateway to SMA devices. The SMA devices can only be addressed using this gateway per unit ID.

Example of PV System Topology from Perspective of SMA Devices



Line	Explanation
———	IP network connection between SCADA system and SC-COM (PV system router)
———	SMA fieldbus
- - -	Logical assignment of SMA device to unit ID

3.6 Addressing and Data Transmission in the Modbus Protocol

3.6.1 Unit IDs

The unit ID is a superordinate addressing type in the Modbus protocol. The SMA Modbus protocol has 247 unit IDs, of which 245 can be assigned to individual devices. If a unit ID is assigned to a device, then the parameters and measured values of this device can be accessed.

The following table shows an overview of the unit IDs in the SMA Modbus profile: Individual unit IDs and unit-ID ranges are reserved and are not used with automatic system detection. With manual detection, however, these can be used:

Unit ID	Explanation
1	This unit ID is reserved for the gateway of the Sunny Central Communication Controller.
2	This unit ID is reserved for the PV system parameters.
3	This unit ID is reserved for the inverter in which the Sunny Central Communication Controller is installed.
4 to 99	Reserved
100	User-defined modbus profile
101 to 104	Reserved
105	Modbus master profile
106 to 109	Reserved
110	Sunny Central String-Monitor Controller, Optiprotect
111 to 119	Reserved
120	SMA Meteo Station, Sunny SensorBox
121 to 139	Reserved
140 to 189	Sunny String-Monitor, Sunny Central String-Monitor US
190 to 247	Reserved
255	Devices that are assigned to this unit ID cannot be addressed. You must assign unit IDs from the range 3 to 247 to these devices (see Section 4.3 "Changing Unit IDs via the Gateway", page 19).

3.6.2 Assignment of the Modbus Register to Unit IDs

The assignment of the parameters and measured values of the SMA devices to Modbus register addresses is achieved using assignment tables and is also shown in this document (see Section 5 "SMA Modbus Profile – Assignment Tables", page 22).

In the assignment table "Gateway (unit ID = 1)", the assignment of SMA devices to individual unit IDs is saved in the Modbus registers from address 42109. Each assignment has an address range of four Modbus registers, although only the corresponding register is writable with the unit ID.

In the assignment table "PV System Parameters (unit ID = 2)", parameters and measured values of the SC-COM and of the PV system are saved.

In the assignment tables "SMA Devices (Unit ID = 3 to 247)", the parameters and measured values used for the individual SMA device families are saved in separate tables.

3.6.3 Modbus Register Address, Register Width and Data Block

A Modbus register is 16 bits wide. For wider data types, connected Modbus registers are used and considered as data blocks. The number of connected Modbus registers is indicated in the assignment tables. The address of the first Modbus register in the data block is the start address of the data block. In addition, larger data blocks can be formed.

3.6.4 Address Range for Modbus Register

For addressing Modbus registers, the address range 0 to 0xFFFF is available with 65536 addresses.

3.6.5 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 3.7.

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.

3.7 Reading and Writing Data in the Modbus Protocol

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 Modbus register.

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

Modbus command	Hexadecimal value	Data volume (number of registers)[1]
Read Coils[2]	0x01	1 to 2000
Read Holding Registers	0x03	1 to 125
Read Input Registers	0x04	1 to 125
Write Single Register	0x06	1
Write Multiple Registers	0x10	1 to 123
Read Write Multiple Registers	0x17	Read: 1 to 125, Write: 1 to 121

Read or write a single Modbus register

If a Modbus register is accessed, which is not contained in the Modbus profile, or if a Modbus command is incorrect, a Modbus exception is generated. Modbus exceptions are also generated when write access occurs on a read-only Modbus register or read access occurs on a write-only Modbus register.

[1] Number of Modbus registers transferable as data block per command (16 bit)

[2] Not available for the SMA Modbus master profile.

Reading or writing of data blocks

To prevent inconsistencies, data blocks of associated registers or register ranges must be read or written consecutively.

Writing multiple Modbus registers as a data block

If multiple registers are written in the data block (Modbus command 0x10 and 0x17) and an error occurs when writing, the next register in the data block is used to proceed. If some data is dependent on other data, or if some data is mutually exclusive, the data is only processed if the entire data block is valid. Otherwise the entire data block is discarded. In the event of an error, a Modbus exception will be generated.

Reading multiple Modbus registers as a data block

If a data block is read and if at least one register defined in the Modbus profile can be determined in its data range, an answer is returned. If this data block also contains Modbus registers that are not defined in the Modbus profile, NaN is used for the query values in each case. If none of the Modbus registers are defined in the data range of a data block in the Modbus profile, the query is invalid and a Modbus exception is generated.

Modbus exceptions

For Modbus exceptions, see "Modbus Application Protocol Specification" at http://www.modbus.org/specs.php.

3.8 SMA Data Types

3.8.1 Data Types and NaN Values

The following table shows the data types used in the SMA Modbus profile and compares these to 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
U16	A word (16-bit/WORD) in the local processor format	0xFFFF
S16	A signed word (16-bit/WORD) in local processor format	0x8000
U32	A double word (32 bit/DWORD) in the local processor format	0xFFFFFFFF
S32	A signed double word (32 bit/DWORD) in the local processor format	0x80000000
U64	A quad word (64-bit/2 x DWORD) in local processor format	0xFFFFFFFFFFFFFFFF

3.8.2 16-Bit Integer Values

16-bit integers are stored in a Modbus register.

Modbus register	1	
Byte	0	1
Bits	8 to 15	0 to 7

3.8.3 32-Bit Integer Values

32-bit integers are stored in two Modbus registers.

Modbus register	1		2	
Byte	0	1	2	3
Bits	24 to 31	16 to 23	8 to 15	0 to 7

3.8.4 64-Bit Integer Values

64-bit integers are stored in four Modbus registers.

Modbus register	1		2		3		4	
Byte	0	1	2	3	4	5	6	7
Bits	56 to 63	48 to 55	40 to 47	32 to 39	24 to 31	16 to 23	8 to 15	0 to 7

3.9 SMA Data Formats

The following SMA data formats describe how SMA data is to be interpreted. The data formats are used, 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	**Duration** Time in seconds, in minutes or in hours, depending on the Modbus register.
DT	**Date/time** Date/time, in accordance with country setting. Transmission as UTC (seconds since 1970-01-01).
FIX0	**Factor 1** Decimal number, commercially rounded, no decimal place.
FIX1	**Factor 0.1** Decimal number, commercially rounded, one decimal place.
FIX2	**Factor 0.01** Decimal number, commercially rounded, two decimal places.
FIX3	**Factor 0.001** Decimal number, commercially rounded, three decimal places.
FW	Firmware version (see "Firmware version extract" below)
RAW	Text or number. A RAW number has no decimal places and no thousand- or other separation indicators.
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 (see also Section 9.8 "Frequently Used Number Codes (ENUM)", page 57).

Format	Explanation
TEMP	**Temperature** Temperature values are stored in special Modbus registers in degrees Celsius, in degrees Fahrenheit, or in Kelvin. The values are commercially rounded, with one decimal place.

Firmware version extract, format "FW": From the delivered DWORD, four values are extracted. 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:	1.5.10.R
Values from DWORD:	Major: 1, Minor: 5, Build: 10, Release type: 4 (Hex: 0x1 0x5 0xA 0x4)

4 Commissioning and Configuration

4.1 Commissioning Steps and Requirements

Requirements:

☐ The devices in the system must be connected to the inverter and the system must be in operation.
☐ Log into the SC-COM as installer (for SC-COM login or logout, see the SC-COM operating manual).

Procedure:

1. Check firmware status and, if necessary, carry out a firmware update (to update firmware, see SC-COM operating manual). A firmware update to a newer version is recommended so that the SC-COM can support the SMA devices contained in the relevant current version of the SMA Modbus profile. For the required firmware versions, see Section 9.1 "Supported SMA Devices", page 52.
2. Activate the Modbus server and, if necessary, configure the communication port (to adjust network port, see the SC-COM operating manual).

Allocation of unit IDs by activation of the Modbus server

On activation of the Modbus server of the SC-COM, the unit IDs of the SMA devices already connected are assigned. If the Modbus server is deactivated and then reactivated, the previously assigned Modbus unit IDs are maintained.

3. Detect a plant if new devices have been added or devices have been replaced (see 4.2 "Detecting a Plant - Automatic Allocation of the Unit IDs", page 18).
4. Change unit IDs if new or replaced devices in the plant cannot be reached via the Modbus protocol. You can change the unit IDs either using the Modbus protocol via the gateway or in the user interface:

- Via the gateway, see Section 4.3 "Changing Unit IDs via the Gateway", page 19
- Via the user interface, see Section 4.4 "Changing Unit IDs via the User Interface", page 20

5. Create and activate a user-defined Modbus profile if required (see Section 7 "User-Defined Modbus Profile", page 48)
6. Activate the SMA Modbus master profile if required (see Section 6.2 "Activating and Deactivating the Modbus Master Profile", page 45)

4.2 Detecting a Plant - Automatic Allocation of the Unit IDs

In a new PV system, or if additional SMA devices are added or replaced, these must be detected in the SC-COM. During detection, SMA devices are assigned unit IDs (see also Section 3.6.1 "Unit IDs", page 11):

Detection of the plant

If the plant is detected once again without any changes being made, existing unit IDs that have been assigned will remain valid.

Unit ID after detection of the plant

During detection, each Modbus-capable SMA device is assigned a unit ID (for possible unit IDs, see 3.6.1 "Unit IDs", page 11). If the number of detected devices exceeds the number of intended unit IDs for this device type, **all** devices are flagged with Modbus unit ID = 255 (NaN) . These devices can therefore no longer be addressed and their measured values and parameters cannot be accessed via the Modbus gateway. These assignment changes must be made manually (see Section 4.4 "Changing Unit IDs via the User Interface", page 20).

Procedure (Detect plant):

1. Select **Plant > Detect**.
   ☑ The page **Plant detection** opens.

Interfaces for plant detection

The SC-COM has different interfaces to which plant devices can be connected. If several of the available interfaces are activated, you must carry out detection for each of these interfaces. The following steps describe the plant detection process for one of these interfaces.

2. In the field **Total number of devices to be detected**, enter the number of devices that are connected to this interface of the SC-COM.
3. Select [**Start detection**].
   ☑ The SC-COM starts detecting the devices connected to this interface and displays its progress. As soon as all devices connected to this interface have been detected, the SC-COM displays "### Device detection finished ###".
4. Select [**OK**].

4.3 Changing Unit IDs via the Gateway

4.3.1 Reading Out the Gateway

You can read the individual unit IDs from the gateway, e.g. with a SCADA system.

Accessing the gateway

You access the gateway via the IP address of the SC-COM, under unit ID = 1.

The assignment of the system devices for unit IDs 3 to 247 is stored in the Modbus registers from address 42109. Each assignment has an address range of four Modbus registers. You can find the Modbus register of the gateway in Section 5.2 "Gateway", page 23.

Example "Read out additional device from the gateway“

Via automatic detection, an additional SMA device was assigned to unit ID = 120 (indicated with C in column "Device #" in the following table). The assignments of the gateway were, as follows here, shown with a SCADA system as a table:

Modbus address	Content	Description	Device #
…	…	…	
42109	*158*	*Device ID*	A
42110	*2145600972*	*Serial number*	A
42112	*3*	*Unit ID*	A
42113	*97*	*Device ID*	B
42114	*2145600320*	*Serial number*	B
42116	*110*	*Unit ID*	B
42117	*232*	*Device ID*	C
42118	*2145600934*	*Serial number*	C
42120	*120*	*Unit ID*	C
…	…	…	…

4.3.2 Changing A Unit ID in the Gateway

You change a unit ID by writing it to the relevant Modbus address. All three of the Modbus registers that belong to a device-unit-ID assignment must be transmitted in a single data block, although only the register with the unit ID is writable. For the following example, this means that all the data of the three Modbus addresses 42117, 42118 and 42120 must be contained in the data block.

Do not assign duplicate unit IDs

You must not assign duplicate unit IDs. If there is a duplicate assignment of a unit ID, the device data that is entered in the assignment table of the gateway under the lowest Modbus address is always read out in the event of a Modbus query with this unit ID.

Example "Changing the Unit ID in the Gateway"

The following table shows an example of assignment of a device to a unit ID. A weather station was subsequently detected with device ID = 232 and the serial number 2145600934, as the third device in the PV system (Modbus addresses 42117 to 42120). The unit ID of this device was manually set to 5:

Modbus address	Designation	After detection	Modified
42117	Device ID	232	232
42118	Serial number	2145600934	2145600934
42120	Unit ID	120	5

4.4 Changing Unit IDs via the User Interface

Overview:

- Display assignment table in the user interface
- Change unit ID in the assignment table of the user interface
  (see also Section 3.6.1 "Unit IDs", page 11)

Automatic check of the unit IDs

You cannot assign a unit ID twice in a user interface and you can only allocate unit IDs from the valid range. If you have accidentally entered a unit ID twice or if a unit ID is not within the valid range, a warning message is displayed when saving. You can then correct your entries and save again.

Procedure:

1. Select **Data > Devices > Modbus.**
   ☑ At the top of the page displayed, you can see the section **Device** with the columns **Device ID** and **Unit ID**.
2. Enter the required unit ID in the column **Unit ID** next to the respective device or profile.
3. Select [**Save**].
   ✖ Warning: the data could not be saved. Please check your entries. Any incorrect entries will be highlighted in red and one of the following information messages is displayed next to the field:
   - "Unit ID is already assigned": Enter a different unit ID.
   - "Unit ID is not within the range (3 to 247)" Please use a unit ID from the range 3 to 247.

   ☑ The SC-COM displays: "Your data has been successfully saved".

4.5 Managing Modbus XML Profile Files

Currently, the following Modbus XML profile files are used by SC-COM:

- SMA Modbus master profile (file name: **modbusmaster.xml**)
  (see Section 6 "SMA Modbus Master Profile", page 42)
- User-defined Modbus profile (file name: **virtualmodbus.xml**)
  (see Section 7 "User-Defined Modbus Profile", page 48)

To activate a Modbus profile, you must upload a corresponding XML file to the SC-COM and confirm the activation. XML profile files are checked for permitted names and valid content when they are uploaded. If either is not valid, an error message is generated.

When deactivating, the corresponding XML profile file is deleted from the SC-COM. It is still possible to download XML profiles.

4.5.1 Uploading an XML Profile File

1. Select Data **> Devices > Modbus**.
   ☑ At the bottom of the page displayed, you can see the section **Manage profiles**.
2. Under manage profiles, **upload [Browse]** a usable XML file in the field **Upload profile** (for usable XML files, see above in this section).
3. Select file ***.xml** by double-clicking in the open dialog box.
4. Select [**Upload**].
   ☑ The SC-COM checks the file for validity and displays "Do you really want to apply the profile?"
   ✖ The SC-COM checks the file for validity and displays "The settings have not been activated because the file has an invalid format or invalid entries."
   - Click on the ℹ symbol.
   - Read the error in the open dialog box and correct the XML file.
   - Ensure that the XML file is valid and correct.
5. Select [**Confirm**].
   ☑ The SC-COM displays: "The profile has been successfully saved."

4.5.2 Downloading the XML Profile File

1. Select **Data > Devices > Modbus.**
   ☑ At the bottom of the page displayed, you can see the section **Manage profiles**. If no profile is loaded, the buttons next to the profile name are gray.
2. Select the button **[Download]** next to the relevant profile.
3. Choose a storage location for the file and save it.

4.5.3 Deleting XML Profile File

1. Log into the SC-COM user interface as an installer.
2. Select **Data > Devices > Modbus.**
   ☑ At the bottom of the page displayed, you can see the section **Manage profiles**. If no profile is loaded, the buttons next to the profile name are gray.
3. Select the button **[Delete]** next to the relevant profile.
   ☑ The SC-COM requests confirmation "Confirm deletion". If a profile file is deleted, the user-defined assignments are lost. For security reasons, you should download the XML file before deleting it (see paragraph above).
4. Select [**OK**].
   ☑ The profile file has been deleted.

5 SMA Modbus Profile – Assignment Tables

5.1 Information on the Assignment Tables

The following subsections are sorted by unit ID. Each contains a table of the Modbus addresses which can be accessed using this unit ID. The tables present the following information:

Information	Explanation
ADR (DEC)	Decimal Modbus address (see Section 3.6 and onwards)
Description/number code(s)	Short description of the Modbus register and the number codes used. The name of the SMA data channel is additionally specified in square brackets if it is available.
CNT	Number of occupied Modbus registers (see Section 3.6 and onwards)
Type	Data type, e.g. U32 = 32 bits without prefix (see Section 3.6).
Format	Data format of saved value, e.g. DT = date, FIX n = output with n decimal places, TEMP = output as temperature (see Section 3.8.4)
Access	Access type for Modbus TCP (see Section 3.7 "Reading and Writing Data in the Modbus Protocol", page 13): RO: Read only RW: Read and write If an access type is not supported, a Modbus exception will be generated.

5.2 Gateway (Unit ID = 1)

In the following table you can find the parameters and measured values provided by the gateway, which you can access under unit ID = 1as well as the assignment of the SMA devices to the unit IDs. You access the gateway via the IP address of the SC-COM:

Assignment of the unit IDs to devices

The assignment of unit IDs to devices is fixed for certain unit ID ranges (see Section 3.6.1 "Unit IDs", page 11).

Unit ID = 255

For unit ID = 255, observe Section 3.6.1 "Unit IDs", page 11.

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30001	Version number of the SMA Modbus profile	2	U32	RAW	RO
30003	Device ID of the SC-COM	2	U32	RAW	RO
30007	Modbus data change: Meter value is increased if data in the profile has been changed.	2	U32	RAW	RO
30057	Serial number of the SC-COM	2	U32	RAW	RO
Unit ID assignment – SMA devices (see Section 4.3 "Changing Unit IDs via the Gateway", page 19):					
42109	Device 1: Device ID	1	U16	RAW	RO
42110	Device 1: Serial number	2	U32	RAW	RO
42112	Device 1: Unit ID, e.g. 3	1	U16	RAW	RW
42113	Device 2: Device ID	1	U16	RAW	RO
42114	Device 2: Serial number	2	U32	RAW	RO
42116	Device 2: Unit ID, e.g. 4	1	U16	RAW	RW
...	...	...	...	...	...
43085	Device 245: Device ID	1	U16	RAW	RO
43086	Device 245: Serial number	2	U32	RAW	RO
43088	Device 245: Unit ID, e.g. 247	1	U16	RAW	RW

5.3 PV System Parameters (Unit ID = 2)

In the following table, you can find the PV system parameters that you can access using unit ID = 2. The PV system parameters represent measured values and parameters of the SC-COM and also PV system devices that are connected via the Modbus protocol. Parameters such as time settings are transferred by the SC-COM to the devices of the PV system and there, depending on the device type, processed further. Measured values such as energy meter values are queried by the devices and made available as accumulated values:

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30001	Version number of the SMA Modbus profile	2	U32	RAW	RO
30003	Device ID of the SC-COM	2	U32	RAW	RO
30007	Modbus data change: Meter value will increase if data in the profile has changed.	2	U32	RAW	RO
30057	Serial number of the SC-COM [Serial Number]	2	U32	RAW	RO
30193	Reading of the system time (UTC) [SerTm]	2	U32	DT	RO
30195	Reading of the time zone (UTC). For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RO
30513	Total yield (Wh) [E-Total]	4	U64	FIX0	RO
30517	Daily yield (Wh) [E-heute]	4	U64	FIX0	RO
30529	Total yield (Wh) [E-Total]	2	U32	FIX0	RO
30531	Total yield (kWh) [E-Total]	2	U32	FIX0	RO
30533	Total yield (MWh) [E-Total]	2	U32	FIX0	RO
30535	Daily yield (Wh) [E-heute]	2	U32	FIX0	RO
30537	Daily yield (kWh) [E-heute]	2	U32	FIX0	RO
30539	Daily yield (MWh) [E-heute]	2	U32	FIX0	RO
30775	AC active power across all phases (W) [Pac].	2	S32	FIX0	RO
40001	Setting of the system time (UTC) [SerTm]	2	U32	DT	RW
40003	Time zone selected for display [TmZn]. For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RW

5.4 SMA Devices (Unit ID = 3 to 247)

5.4.1 Device Family SC nnnCP and SC nnnHE-20

In the following table, you can find the measured values and parameters that are supported by device family SC nnnCP and SC nnnHE-20, which you can access under unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11):

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30057	Serial number [Serial Number]	2	U32	RAW	RO
30193	Reading of the system time (UTC) [SerTm].	2	U32	DT	RO
30195	Reading of the time zone (UTC) [TmZn]: For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RO
30197	Event ID of the current event [ErrNo] (number of characters limited by device); see Section 8 "Troubleshooting", page 42.	2	U32	FIX0	RO
30199	Time until grid connection attempt (s) [TmsRmg].	2	U32	Duration	RO
30211	Recommended action [Prio]: 336 = Contact the manufacturer 337 = Contact the installer 338 = Invalid	2	U32	ENUM	RO
30217	Grid contactor [GriSwStt]: 51 = Contactor closed 311 = Contactor open	2	U32	ENUM	RO
30225	Insulation resistance (ohms) [Riso].	2	U32	FIX0	RO
30227	Status of key switch [DInKeySwStrStp]: 381 = Stop 569 = Activated	2	U32	ENUM	RO
30231	Maximum possible permanent active power, fixed configuration Can be greater than the nominal power (W) [Plimit]	2	U32	FIX0	RO
30233	Permanent active power limitation (W) [Pmax]	2	U32	FIX0	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30241	Operating state [mode]: 309 = Operation 381 = Stop 455 = Warning 1392 = Error 1393 = Wait for PV voltage 1394 = Wait for AC grid 1480 = "Wait for electricity supplier" operating state (for 0% regulation) 1560 = Remote shutdown active 2383 = Manual restart	2	U32	ENUM	RO
30243	Error [Error]: 267 = Inverter 1395 = DC section 1396 = AC grid	2	U32	ENUM	RO
30247	Current, complete event number [ErrNoSma]	2	U32	FIX0	RO
30249	Status of the GFDI relay [DInGfdi]: 51 = Closed 311 = Open	2	U32	ENUM	RO
30251	Status of current restart interlock [ManResStt]: 1690 = Fast shut-down 2386 = Overvoltage 2387 = Undervoltage 2388 = Overfrequency 2389 = Underfrequency 2390 = Passive islanding detection 2490 = Phase lost detection	2	U32	ENUM	RO
30257	DC switch in cabinet [DcSwStt]: 51 = Closed 311 = Open	2	U32	ENUM	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30265	AC switch-disconnector in cabinet [AcDiscon]: 51 = Closed 311 = Open	2	U32	ENUM	RO
30513	Total yield (Wh) [E-Total]	4	U64	FIX0	RO
30517	Daily yield (Wh) [E-heute]	4	U64	FIX0	RO
30521	Operating time (s) [h-On]	4	U64	Duration	RO
30525	Feed-in time (s) [h-Total]	4	U64	Duration	RO
30529	Total yield (Wh) [E-Total]	2	U32	FIX0	RO
30531	Total yield (kWh) [E-Total]	2	U32	FIX0	RO
30533	Total yield (MWh) [E-Total]	2	U32	FIX0	RO
30535	Daily yield (Wh) [E-heute]	2	U32	FIX0	RO
30537	Daily yield (kWh) [E-heute]	2	U32	FIX0	RO
30539	Daily yield (MWh) [E-heute]	2	U32	FIX0	RO
30541	Operating time (s) [h-on]	2	U32	Duration	RO
30543	Feed-in time (s) [h-Total]	2	U32	Duration	RO
30545	Operating time of interior fan 1 (s) [CntFanCab1]	2	U32	Duration	RO
30547	Operating time of interior fan 2 (s) [CntFanCab2]	2	U32	Duration	RO
30549	Operating time of heat sink fan (s) [CntFanHs]	2	U32	Duration	RO
30557	Operating time of interior heater 2 (s) [CntHtCab2]	2	U32	Duration	RO
30601	Operating time of interior fan 3 (s) [CntFanCab3]	2	U32	Duration	RO
30769	DC current input (A) [Ipv].	2	S32	FIX3	RO
30771	DC voltage input (V) [Vpv].	2	S32	FIX2	RO
30773	DC power input (W) [Ppv].	2	S32	FIX0	RO
30775	AC active power across all phases (W) [Pac].	2	S32	FIX0	RO
30789	Grid voltage phase AB (V) [VacL12]	2	U32	FIX2	RO
30791	Grid voltage phase BC (V) [VacL23]	2	U32	FIX2	RO
30793	Grid voltage phase CA (V) [VacL31]	2	U32	FIX2	RO
30795	Grid current AC (A) [Iac]	2	U32	FIX3	RO
30797	Grid current L1 (A) [IacL1]	2	U32	FIX3	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30799	Grid current L2 (A) [IacL2]	2	U32	FIX3	RO
30801	Grid current L3 (A) [IacL3]	2	U32	FIX3	RO
30803	Power frequency (Hz) [Fac].	2	U32	FIX2	RO
30805	Reactive power (var) [Qac]	2	S32	FIX2	RO
30813	Apparent power [1] (VA) [Sac]	2	S32	FIX0	RO
30821	Displacement power factor, across all phases [PF]	2	U32	FIX2	RO
30823	Excitation type of cos φ [PFExt]: 1041 = Capacative 1042 = Inductive	2	U32	ENUM	RO
30825	Operating mode of the reactive power regulation [Q-VArMod]: 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 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	2	U32	ENUM	RO
30827	Reactive power setpoint (var) [SpntPwrRt]	2	S32	FIX0	RO
30829	Reactive power setpoint (%) [Q-VArNom].	2	S32	FIX1	RO
30831	Setpoint cos φ [PF-PFSpt]	2	S32	FIX2	RO
30833	Setpoint excitation type of cos φ [PF-PFExtSpt]: 1041 = Capacative 1042 = Inductive	2	U32	ENUM	RO

[1] With SC nnnCP, due to internal calculation of the apparent power [Sac], it is not guaranteed that this is consistent, with respect to time, with the measured values reactive power [Qac] and active power [Pac].

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30835	Active power limitation operating mode [P-WMod]: 303 = Off 1077 = Active power limitation P (W) 1078 = Active power limitation P in (%) of PMAX 1079 = Active power limitation P via plant control 1390 = Active power limitation P via analog input 1391 = Active power limitation P via digital inputs	2	U32	ENUM	RO
30837	Active power setpoint (W) [P-WSpt]	2	U32	FIX0	RO
30839	Active power setpoint (%) [P-WNom].	2	U32	FIX0	RO
30841	AC voltages (average of all phase voltages) (V) [Vac]	2	U32	FIX2	RO
30919	Operating mode of static voltage stability with "Q at Night" [QoDQ-VArMod]: 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	2	U32	ENUM	RO
30921	Reactive power setpoint with "Q at Night" (var) [QoDQ-VAr]	2	S32	FIX0	RO
30923	Reactive power setpoint with "Q at Night" (%) [QoDQ-VArNom	2	S32	FIX1	RO
34097	Operating time of interior fan 1 (s) [CntFanCab1]	4	U64	Duration	RO
34101	Operating time of interior fan 2 (s) [CntFanCab2]	4	U64	Duration	RO
34105	Operating time of heat sink fan (s) [CntFanHs]	4	U64	Duration	RO
34109	Heat sink temperature 1 (°C) [TmpHs]	2	S32	TEMP	RO
34113	Interior temperature 1 (°C) [TmpCab1]	2	S32	TEMP	RO
34117	Interior temperature 3 (°C) [TmpCab3]	2	S32	TEMP	RO
34125	External temperature 1 (air supply) (°C) [TmpExl1]	2	S32	TEMP	RO
34141	Operating time of interior heater 2 (s) [CntHtCab2]	4	U64	Duration	RO
34145	Temperature of the sinusoidal filter choke (°C) [TmpCol]	2	S32	TEMP	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
34613	Total irradiation on the sensor surface (W/m²) [ExtSolIrr]	2	U32	FIX0	RO
34637	Analog current input 1 (mA) [ExtSolIrr]	2	S32	FIX2	RO
34639	Analog current input 2 (mA) [ExLAnaInCur]	2	S32	FIX2	RO
34645	Analog voltage input 1 (V) [ExIAnaInV1]	2	S32	FIX2	RO
40001	Setting of the system time (UTC) [SerTm]	2	U32	DT	RW
40003	Time zone selected for display [TmZn]. For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RW
40009	Operating state [SpntRemEna]: 381 = Stop 569 = Activated	2	U32	ENUM	RW
40020	External measurement of the insulation resistance: 303 = Off 308 = On	2	U32	ENUM	RW

5.4.2 Optiprotect

In this table you can find the measured values and parameters supported by Optiprotect, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30051	Device class [MainModel]: 8064 = Sensor technology general	2	U32	ENUM	RO
30057	Serial number SMID-CONT [Serial Number]	2	U32	RAW	RO
30061	Firmware SMID-CONT [Firmware]	2	U32	FW	RO
30063	Bootloader SMID-CONT [Firmware 2]	2	U32	FW	RO
30065	Firmware SMID-CT1 [Firmware 3]	2	U32	FW	RO
30067	Bootloader SMID-CT1 [Firmware 4]	2	U32	FW	RO
30069	Firmware SMID-CT2 [Firmware 5]	2	U32	FW	RO
30071	Bootloader SMID-CT2 [Firmware 6]	2	U32	FW	RO
30073	Firmware SMID-CT3 [Firmware 7]	2	U32	FW	RO
30075	Bootloader SMID-CT3 [Firmware 8]	2	U32	FW	RO
30077	Firmware SMID-CT4 [Firmware 9]	2	U32	FW	RO
30079	Bootloader SMID-CT4 [Firmware 10]	2	U32	FW	RO
30097	Serial number SMID-CT1 [Serial Number 1]	2	U32	RAW	RO
30099	Serial number SMID-CT2 [Serial Number 2]	2	U32	RAW	RO
30101	Serial number SMID-CT3 [Serial Number 3]	2	U32	RAW	RO
30103	Serial number SMID-CT4 [Serial Number 4]	2	U32	RAW	RO
30193	Reading of the system time (UTC) [SerTm].	2	U32	DT	RO
30195	Reading of the time zone (UTC). [TmZn] For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RO
30197	Event ID of the current event [ErrNo] (number of characters limited by device); see Section 8 "Troubleshooting", page 42.	2	U32	FIX0	RO
30199	Time until grid connection attempt (s) [TmsRmg].	2	U32	Duration	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30211	Recommended action [Prio]: 336 = Contact the manufacturer 337 = Contact the installer 338 = Invalid	2	U32	ENUM	RO
30225	Insulation resistance (ohms) [Riso].	2	U32	FIX0	RO
30241	Operating state [mode]: 309 = Operation 455 = Warning 1392 = Error	2	U32	ENUM	RO
30243	Error [Error]: 267 = Inverter 1395 = DC section 1396 = AC grid	2	U32	ENUM	RO
30267 to 30297	SMID DC switch 1 to 16 [DcSwStt1.1] to [DcSwStt4.4]: 51 = Closed 311 = Open 1694 = has been activated	2	U32	ENUM	RO
30331 to 30361	Error message SMID DC switch 1 to 16 [DcSwErr1.1] to [DcSwErr4.4] 1508 = 90% of the DC switch cycles reached 1509 = 100% of the DC switch cycles reached 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	2	U32	ENUM	RO
30771	DC voltage (V) [Vpv]	2	S32	FIX2	RO
31791	Number of DC current measurement units [CTNoOf]	2	U32	FIX0	RO
31793 to 31855	String current 1 to 32 (A) [Ipv1.1.B] to [Ipv4.4.B]	2	S32	FIX3	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
32057 to 32119	Status of monitored string 1 to 32 [DcInStt1.1.B] to [DcInStt4.4.B]: 307 = OK 467 = DC overvoltage 477 = Reverse current 1492 = String temporarily deselected due to ground fault 1493 = String permanently deselected due to ground fault 1649 = String x has low power 1650 = Substring x has low power 1692 = String deactivated due to power reduction 1693 = No string connected	2	U32	ENUM	RO
40001	Setting of the plant time (UTC in s) [SerTm]	2	U32	DT	RW
40003	Setting of the time zone [TmZn]. For possible values, see Section 9.7 "Number Codes of the Time Zones", page 54.	2	U32	ENUM	RW
40011	Acknowledgement: 26 = Acknowledge error	2	U32	ENUM	RW

5.4.3 Sunny String-Monitor

In this table you can find the measured values and parameters supported by Sunny String-Monitor, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30057	Serial number [Serial Number]	2	U32	RAW	RO
30245	SMU ID [SSM Identifier].	2	U32	FIX0	RO
31793	String current of string 1 of a SMU/SMID (A) [IString 1]	2	S32	FIX3	RO
31795	String current of string 2 of a SMU/SMID (A) [IString 2]	2	S32	FIX3	RO
31797	String current of string 3 of a SMU/SMID (A) [IString 3]	2	S32	FIX3	RO
31799	String current of string 4 of a SMU/SMID (A) [IString 4]	2	S32	FIX3	RO
31801	String current of string 5 of a SMU/SMID (A) [IString 5]	2	S32	FIX3	RO
31803	String current of string 6 of a SMU/SMID (A) [IString 6]	2	S32	FIX3	RO
31805	String current of string 7 of a SMU/SMID (A) [IString 7]	2	S32	FIX3	RO
31807	String current of string 8 of a SMU/SMID (A) [IString 8]	2	S32	FIX3	RO
32053	Status of alarm contact 1 [Alarm contact 1]: 303 = Off 308 = On	2	U32	ENUM	RO
32055	Status of alarm contact 2 [Alarm contact 2]: 303 = Off 308 = On	2	U32	ENUM	RO

5.4.4 Sunny Central String-Monitor Controller

In this table you can find the measured values and parameters supported by Sunny String-Monitor, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30057	Serial number [Serial Number]	2	U32	RAW	RO
30197	Event ID of the current event (number of characters limited by device); see Section 8 "Troubleshooting", page 42.	2	U32	FIX0	RO
30241	Operating state [Mode]: 309 = Operation 455 = Warning 1392 = Error 1470 = Disturbance	2	U32	ENUM	RO
30243	Error [Error]: 2440 = String current fault (incoming) 2441 = Communication error (incoming) 2442 = SMU error (WD, EEPROM) (incoming) 2443 = String current fault (outgoing) 2444 = Communication error (outgoing) 2445 = SMU error (WD, EEPROM) (outgoing)	2	U32	ENUM	RO
30521	Operating time (s) [h-On]	4	U64	Duration	RO
30541	Operating time (s) [h-On]	2	U32	Duration	RO
31283	PV String current group 1 (A) [MeanCurGr1]	2	S32	FIX3	RO
31289	PV String current group 2 (A) [MeanCurGr2]	2	S32	FIX3	RO
31295	PV String current group 3 (A) [MeanCurGr3]	2	S32	FIX3	RO
31301	PV String current group 4 (A) [MeanCurGr4]	2	S32	FIX3	RO
31307	PV String current group 5 (A) [MeanCurGr5]	2	S32	FIX3	RO
31313	PV String current group 6 (A) [MeanCurGr6]	2	S32	FIX3	RO
32051	SMU Warning code for string error [SSMUWrnCode]	2	U32	FIX0	RO

5.4.5 Sunny Central String-Monitor US

In this table you can find the measured values and parameters supported by Sunny Central String-Monitor US, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30057	Serial number [Serial Number]	2	U32	RAW	RO
30241	Operating state [Mode]: 309 = Operation 455 = Warning 1392 = Error 1470 = Disturbance	2	U32	ENUM	RO
30245	SMU ID [SSMId]	2	U32	FIX0	RO
31793	String current of string 1 of a SMU/SMID (A) [CurCh1]	2	S32	FIX3	RO
31795	String current of string 2 of a SMU/SMID (A) [CurCh2]	2	S32	FIX3	RO
31797	String current of string 3 of a SMU/SMID (A) [CurCh3]	2	S32	FIX3	RO
31799	String current of string 4 of a SMU/SMID (A) [CurCh4]	2	S32	FIX3	RO
31801	String current of string 5 of a SMU/SMID (A) [CurCh5]	2	S32	FIX3	RO
31803	String current of string 6 of a SMU/SMID (A) [CurCh6]	2	S32	FIX3	RO
31805	String current of string 7 of a SMU/SMID (A) [CurCh7]	2	S32	FIX3	RO
31807	String current of string 8 of a SMU/SMID (A) [CurCh8]	2	S32	FIX3	RO

5.4.6 SMA Meteo Station

In this table you can find the measured values and parameters supported by SMA Meteo Station, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30051	Device class [MainModel]: 8064 = Sensor technology general	2	U32	ENUM	RO
30241	Operating state [Stat]: 455 = Warning 1392 = Error 1787 = Initialization	2	U32	ENUM	RO
30243	Error [Stat]: 503 = Disturbance sensor outside temperature 1006 = Unknown error 1118 = Calibration failed 1835 = Disturbance sensor module temperature 1836 = Electrical endurance of fan reached 1837 = Pyranometer fault 1838 = Calibration of pyranometer required	2	U32	ENUM	RO
30521	Operating time (s) [SMA h-On]	4	U64	Duration	RO
34609	Ambient temperature (°C) [TmpAmb C]	2	S32	TEMP	RO
34613	Total irradiation on the sensor surface (W/m²) [IntSollrr]	2	U32	FIX0	RO
34615	Wind speed (m/s) [WindVel m/s]	2	U32	FIX1	RO
34617	Relative humidity (%) [envhmdt]	2	U32	FIX2	RO
34619	Air pressure (Pa) [envpress]	2	U32	FIX2	RO
34621	PV cell temperature (°C) [TmpMdul C]	2	S32	TEMP	RO
34625	Ambient temperature (°F) [TmpAmb F]	2	S32	TEMP	RO
34627	Ambient temperature (K) [TmpAmb K]	2	S32	TEMP	RO
34629	PV cell temperature (°F) [TmpMdul F]	2	S32	TEMP	RO
34631	PV cell temperature (K) [TmpMdul K]	2	S32	TEMP	RO
34633	Wind speed (km/h) [WindVel km/h]	2	U32	FIX1	RO
34635	Wind speed (mph) [WindVel mph]	2	U32	FIX1	RO

5.4.7 Sunny SensorBox

In this table you can find the measured values and parameters supported by Sunny SensorBox, which you can access under the unit IDs = 3 to 247 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30051	Device class [MainModel]: 8064 = Sensor technology general	2	U32	ENUM	RO
30521	Operating time (s) [SMA h-On]	4	U64	Duration	RO
34609	Ambient temperature (°C) [TmpAmb C]	2	S32	TEMP	RO
34613	Total irradiation on the sensor surface (W/m²) [IntSolIrr]	2	U32	FIX0	RO
34615	Wind speed (m/s) [WindVel m/s]	2	U32	FIX1	RO
34621	PV cell temperature (°C) [TmpMdul C]	2	S32	TEMP	RO
34623	Total irradiation on the external irradiation sensor/pyranometer (W/m²) [ExlSolIrr]	2	U32	FIX0	RO
34625	Ambient temperature (°F) [TmpAmb F]	2	S32	TEMP	RO
34627	Ambient temperature (K) [TmpAmb K]	2	S32	TEMP	RO
34629	PV cell temperature (°F) [TmpMdul F]	2	S32	TEMP	RO
34631	PV cell temperature (K) [TmpMdul K]	2	S32	TEMP	RO
34633	Wind speed (km/h) [WindVel km/h]	2	U32	FIX1	RO
34635	Wind speed (mph) [WindVel mph]	2	U32	FIX1	RO

5.5 SMA Devices (Unit ID = 255, Not Assigned)

5.5.1 Zone Monitoring

In this table you can find the measured values and parameters supported by the inverter for the option "Zone Monitoring", which you can access under the unit IDs = 255 (see Section 3.6.1 "Unit IDs", page 11).

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30057	Serial number [Serial Number]	2	U32	RAW	RO
30241	Operating state [Mode]: 302 = Initialization – Zone Monitoring is in the initialization phase 1466 = Waiting – Zone Monitoring is active but the minimum current for evaluation has not been reached 309 = Operation – Zone Monitoring is active and the minimum current for evaluation has been reached 1470 = Disturbance – Zone Monitoring displays a disturbance 1392 = Error – Zone Monitoring displays an error	2	U32	EMUN	RO
30243	Error [Error]: 302 = No error 3492 = ConfigFail – The maximum input current is configured for no input or for one input. 3490 = ZoneValueLow – The input current is too low in at least one zone. 3491 = ZoneValueFail – There is no input current in at least one zone. 1118 = CalibrationFail – The calibration is incorrect. 3493 = DevNotReachable – The zone monitoring unit could not be reached for at least 30 s.	2	U32	ENUM	RO
31793	DC current of zone 1 [A] [DcMs.Amp[1]]	2	S32	FIX3	RO
31795	DC current of zone 2 [A] [DcMs.Amp[2]]	2	S32	FIX3	RO
31797	DC current of zone 3 [A] [DcMs.Amp[3]]	2	S32	FIX3	RO
31799	DC current of zone 4 [A] [DcMs.Amp[4]]	2	S32	FIX3	RO
31801	DC current of zone 5 [A] [DcMs.Amp[5]]	2	S32	FIX3	RO
31803	DC current of zone 6 [A] [DcMs.Amp[6]]	2	S32	FIX3	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
31805	DC current of zone 7 [A] [DcMs.Amp[7]]	2	S32	FIX3	RO
31807	DC current of zone 8 [A] [DcMs.Amp[8]]	2	S32	FIX3	RO
32057	Status of zone 1: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32059	Status of zone 2: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32061	Status of zone 3: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32063	Status of zone 4: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32065	Status of zone 5: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32067	Status of zone 6: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
32069	Status of zone 7: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
32071	Status of zone 8: 302 = no error 3490 = ZoneValueLow – The input current in the zone is too low. 3491 = ZoneValueFail – There is no input current in the zone.	2	U32	ENUM	RO
41109	Alarming Enabled 973 = unknown status 303 = off – Evaluation of the zone currents and alarming are deactivated. 308 = on – Evaluation of the zone currents and alarming are activated.	2	U32	ENUM	RO
40011	Acknowledgement [Ackn] 302 = No action 26 = Acknowledge fault – The confirmation has failed	2	U32	ENUM	RW

6 SMA Modbus Master Profile

With the Modbus master profile, Modbus devices (slaves) from other manufacturers can be integrated in the SC-COM. The Modbus master profile acts like a Modbus device of SMA Solar Technology AG. It can be called up via the gateway under unit ID = 105 (see Section 3.6.1 "Unit IDs", page 11).

The Modbus master profile is an XML file in which, for each channel tag, one Modbus register of a slave device is assigned to any Modbus address. For the assignments, an address range from 0 to 65535 is available in each case. The stored assignments are queried at definable intervals. Currently, the Modbus device profile contains register assignments for the device "Moxa ioLogik E1242-T" (see Section 6.3 "Moxa ioLogik E1242-T", page 45).

6.1 Structure of the XML File for the Modbus Master Profile

The Modbus master profile is created in the file **modbusmaster.xml**.

The basic structure of the XML file is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<modbus_master_profile>
<channel name="device-register" ip="xxx.xxx.xxx.xxx" port="yyy"
slaveunitid="zzz" source="sss" type="t" size="n"
cycletime="c" destination="d" status="st" quality="q"
signed="m" factor="f" divisor="div" offset="o" />
...
        <!–End of the instructions–>
</modbus_master_profile>
```

Legend for XML tags and attributes:

The term "source register" in the following table stands for a specific Modbus register of the slave device, which is used as source for the assignment.

XML tag or attribute	Explanation
<modbus_master_profile> </modbus_master_profile>	Within this XML structure, the Modbus master profile is defined.
<channel />	Within each channel tag, **one** source register of a slave device is assigned to the Modbus master profile.
name="device-register"	Here you can assign any name to the assignment.
ip="xxx.xxx.xxx.xxx"	IPv4 address of the slave device.
port="yyy"	Modbus communication port of the slave device. The default setting is 502.
slaveunitid="zzz"	Unit ID (8 bit) of the slave device. Possible unit IDs for individual devices are 0 to 247.
source="sss"	Decimal address of the source register (see attribute "destination"). You can find possible "source" values in the datasheet of the manufacturer of each Modbus device.

XML tag or attribute	Explanation
type="t"	Type of source register (Modbus command), possible values: Coil = Read Coils (0x01) Holding = Read Holding Registers (0x02) Input = Read Input Registers (0x03) For more information on Modbus commands, see Section 3.7 "Reading and Writing Data in the Modbus Protocol", page 13.
size="n"	Length of the source register (in WORD) (1 = 16, 2 = 32 or 4 = 64 bit), depending on register type: Holding or input register: 1, 2, 4 Coil: 1 Depending on the length of the source register (1, 2 or 4 WORD), the target addresses should be set for the status register and quality register following the "destination" register, e.g., destination = 1000 (size = 2), status = 1002, quality = 1003 + 1004, ensuring that they do not overlap with the subsequent registers.
cycletime="c"	Query interval (ms) for the source register (standard value is 500). This value can be specified for each register. All source registers are queried with the same query interval. The smallest query interval specified for an IP address is used. The query interval can be equal to or greater than 100 ms and equal to or less than 12 h.
destination="d"	Decimal address (0 to 65535) of the Modbus register to which the value is assigned (destination register). Observe the length (in WORD) of the source register (see attribute "size"). The destination register is followed by a status register and a quality register in each case. Therefore, the decimal address of the next highest destination register must not be overlapped by the combined length of these three registers. If a subsequent register overlaps, it becomes incomplete and Modbus exceptions are generated when it is queried.
status="st"	Decimal Modbus address (0 to 65535) for the status register (length = 1 WORD). The status register contains one of the following status information messages about the destination register: 0 = ok 1 = Initialization 2 = Invalid type 3 = Reading failed 4 = Writing failed 5 = Not connected

XML tag or attribute	Explanation
quality="q"	Decimal modbus address (0 to 65534) of the quality register (length = 2 WORD). In the second WORD, the quality register contains the period of time (ms) between two queries of the source register. The value displayed should deviate only slightly from the set cycle time. A typical deviation would be ± 20 ms.
signed="s"	Sign of the source register: 0 = Without sign 1 = With sign
factor="f"	Multiplier with sign (length = 2 WORD) for scaling the source data. The default setting is 1.
divisor="div"	Divisor with sign (length = 2 WORD) for scaling the source data. The default setting is 1.
offset="o"	Offset value with sign (length = 2 WORD) to be added to the source data. The default setting is 0.
<!–xyz–>	Comments out the range xyz, for example, to deactivate an instruction.

Modbus exceptions

For Modbus exceptions, see "Modbus Application Protocol Specification" at http://www.modbus.org/specs.php.

6.2 Activating and Deactivating the Modbus Master Profile

To activate the Modbus master profile, upload the file **modbusmaster.xml** to the SC-COM.

To deactivate the Modbus master profile, delete it. If the Modbus master profile is deactivated on the SC-COM, only the SMA Modbus profile remains active.

Manage profile files

For more detailed information on uploading and downloading and also deletion of the profile file using the user interface of the SC-COM, see Section 4.5 "Managing Modbus XML Profile Files", page 20.

6.3 Moxa ioLogik E1242-T – Assignment Table

In this section you will find a table with an overview of the Modbus registers that are saved in the Modbus master profile for the "Moxa ioLogik E1242-T". In accordance with the XML structure, each line of the table shows the attribute values of a Modbus registration assignment. The attribute values in the columns "source", "type", and "size" correspond to the standard values of the "Moxa ioLogik E1242-T".

Changed settings of the Moxa ioLogik E1242-T

If you change the settings (e.g. ip, port, slaveunitid, etc.) of the "Moxa ioLogik E1242-T", you must also change the attribute values of the Modbus master profile.

You can find a description of the table columns in the legend for the XML tags in Section 6.

Due to space limitations, the following attribute values are not shown in the table:

ip: current IPv4 address of the "Moxa ioLogik E1242-T"
port: current communication port of the "Moxa ioLogik E1242-T"
cycletime: 500 ms

Channel/name	ip	port	slaveunitid	Source	type	size (WORD)	cycle time (ms)	destination	status	quality	signed	factor	divisor	offset
Moxa_AI_RAW_Value_1			0	512	input	1		1000	1001	1002	0	1	1	0
Moxa_AI_RAW_Value_2			0	513	input	1		1004	1005	1006	0	1	1	0
Moxa_AI_RAW_Value_3			0	514	input	1		1008	1009	1010	0	1	1	0
Moxa_AI_RAW_Value_4			0	515	input	1		1012	1013	1014	0	1	1	0
Moxa_AI_FLOAT_Value_1			0	520	input	2		1016	1018	1019	0	1	1	0
Moxa_AI_FLOAT_Value_2			0	521	input	2		1021	1023	1024	0	1	1	0
Moxa_AI_FLOAT_Value_3			0	522	input	2		1026	1028	1029	0	1	1	0
Moxa_AI_FLOAT_Value_4			0	523	input	2		1031	1033	1034	0	1	1	0
Moxa_DO_ALL_Values			0	32	holding	1		1036	1037	1038	0	1	1	0
Moxa_DI_ALL_Values			0	48	input	1		1040	1041	1042	0	1	1	0
Moxa_DI_COUNTER_Value			0	16	input	2		1044	1046	1047	0	1	1	0
Moxa_DO_Value_1			0	0	coil	1		2000	3000	4000	0	1	1	0
Moxa_DO_Value_2			0	1	coil	1		2001	3001	4002	0	1	1	0
Moxa_DO_Value_3			0	2	coil	1		2002	3002	4004	0	1	1	0
Moxa_DO_Value_4			0	3	coil	1		2003	3003	4006	0	1	1	0
Moxa_DI_Value_1			0	0	coil	1		2004	3004	4008	0	1	1	0
Moxa_DI_Value_2			0	1	coil	1		2005	3005	4010	0	1	1	0
Moxa_DI_Value_3			0	1	coil	1		2006	3006	4012	0	1	1	0
Moxa_DI_Value_4			0	3	coil	1		2007	3007	4014	0	1	1	0
Moxa_DI_Value_5			0	4	coil	1		2008	3008	4016	0	1	1	0
Moxa_DI_Value_6			0	5	coil	1		2009	3009	4018	0	1	1	0
Moxa_DI_Value_7			0	6	coil	1		2010	3010	4020	0	1	1	0
Moxa_DI_Value_8			0	7	coil	1		2011	3011	4022	0	1	1	0
Moxa_DI_COUNTER_START_STOP_1			0	256	coil	1		2012	3012	4024	0	1	1	0
Moxa_DI_COUNTER_START_STOP_2			0	257	coil	1		2013	3013	4026	0	1	1	0
Moxa_DI_COUNTER_START_STOP_3			0	258	coil	1		2014	3014	4028	0	1	1	0
Moxa_DI_COUNTER_START_STOP_4			0	259	coil	1		2015	3015	4030	0	1	1	0
Moxa_DI_COUNTER_START_STOP_5			0	260	coil	1		2016	3016	4032	0	1	1	0
Moxa_DI_COUNTER_START_STOP_6			0	261	coil	1		2017	3017	4034	0	1	1	0
Moxa_DI_COUNTER_START_STOP_7			0	262	coil	1		2018	3018	4036	0	1	1	0
Moxa_DI_COUNTER_START_STOP_8			0	263	coil	1		2019	3019	4038	0	1	1	0
Moxa_DI_COUNTER_CLEAR_1			0	272	coil	1		2020	3020	4040	0	1	1	0
Moxa_DI_COUNTER_CLEAR_2			0	273	coil	1		2021	3021	4042	0	1	1	0
Moxa_DI_COUNTER_CLEAR_3			0	274	coil	1		2022	3022	4044	0	1	1	0
Moxa_DI_COUNTER_CLEAR_4			0	275	coil	1		2023	3023	4046	0	1	1	0

Channel/name	ip	port	slaveunitid	Source	type	size (WORD)	cycle time (ms)	destination	status	quality	signed	factor	divisor	offset
Moxa_DI_COUNTER_CLEAR_5			0	276	coil	1		2024	3024	4048	0	1	1	0
Moxa_DI_COUNTER_CLEAR_6			0	277	coil	1		2025	3025	4050	0	1	1	0
Moxa_DI_COUNTER_CLEAR_7			0	278	coil	1		2026	3026	4052	0	1	1	0
Moxa_DI_COUNTER_CLEAR_8			0	279	coil	1		2027	3027	4054	0	1	1	0
Moxa_DO_Pulse_1			0	16	coil	1		2028	3028	4056	0	1	1	0
Moxa_DO_Pulse_2			0	17	coil	1		2029	3029	4058	0	1	1	0
Moxa_DO_Pulse_3			0	18	coil	1		2030	3030	4060	0	1	1	0
Moxa_DO_Pulse_4			0	19	coil	1		2031	3031	4062	0	1	1	0

7 User-Defined Modbus Profile

You can change the assignment of the Modbus addresses by creating a user-defined Modbus profile. In the user-defined Modbus profile, you can assign other Modbus addresses to the address assignments that were defined in the SMA Modbus profile. You can use the entire Modbus address range from 0 to 65535.

The user-defined Modbus profile can be called up via the gateway like an additional device and has a separate unit ID with a default setting of 100 (see Section 3.6.1 "Unit IDs", page 11).

One advantage of the user-defined Modbus profile can be that the measured values and parameters which are relevant for controlling your system can be applied to consecutive Modbus addresses and can therefore be read out or set in one block.

7.1 Structure of the XML File for the User-Defined Modbus Profile

The user-defined Modbus profile is created in the file **virtualmodbus.xml** in addition to the SMA Modbus profile.

The basic structure of the XML file is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<virtual_modbusprofile>
<channel unitid="aaa" source="bbbbb" destination="ccccc" />
...
        <!–End of the instructions–>
</virtual_modbusprofile>
```

Legend for XML tags and attributes:

XML tag or attribute	Explanation
<virtual_modbusprofile> </virtual_modbusprofile>	A user-defined Modbus profile is defined within this XML structure.
<channel />	Within a channel tag, a Modbus address of a unit ID is redefined:
unitid="aaa"	Specifies the unit ID of the device whose Modbus addresses are to be redefined. Possible unit IDs for individual devices are 3 to 247.
source="bbbbb"	Specifies a Modbus address of the device selected under "unitid" whose value is to be used as source. Information on the assignment tables, see Section 5).
destination="ccccc"	Specifies the new Modbus address from which the value is to be retrieved (0 to 65535). Note the number of Modbus registers that are stored at the origin address. The destination registers must not overlap. If incomplete Modbus registers are called up later, a Modbus exception is generated. If register addresses are called up, which are not filled with values, NaN is returned.
<!–xyz–>	Comments out the range xyz, for example, to deactivate an instruction.

Modbus exceptions

For Modbus exceptions, see "Modbus Application Protocol Specification" at http://www.modbus.org/specs.php.

7.2 Example of a User-Defined Modbus Profile

Various registers of the devices saved under unit IDs 3 and 140 are to be called up from address 00000 by consecutive Modbus addresses. The following tables show sample excerpts from the SMA Modbus profile:

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
30531	Total yield (kWh) [E-Total]	2	U32	FIX0	RO
30775	AC active power across all phases (W) [Pac].	2	S32	FIX0	RO

ADR (DEC)	Description/Number code	CNT (WORD)	Type	Format	Access
31793	String current of string 1 of a SMU/SMID (A) [IString 1]	2	S32	FIX3	RO
31795	String current of string 2 of a SMU/SMID (A) [IString 2]	2	S32	FIX3	RO
31797	String current of string 3 of a SMU/SMID (A) [IString 3]	2	S32	FIX3	RO

The exact appearance of the XML file is then as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<virtual_modbusprofile>
<channel unitid="3" source="30531" destination="0" />
<channel unitid="3" source="30775" destination="2" />
<channel unitid="140" source="31793" destination="4" />
<channel unitid="140" source="31795" destination="6" />
<channel unitid="140" source="31797" destination="8" />
</virtual_modbusprofile>
```

7.3 Activating and Deactivating User-Defined Modbus Profile

To activate the user-defined Modbus profile, upload the file **virtualmodbus.xml** to the SC-COM.

To deactivate a user-defined Modbus profile, delete it. Deletion is equivalent to deactivation. If the user-defined Modbus profile on the SC-COM is deactivated, the user-defined assignments are lost and only the SMA Modbus profile remains active.

Manage profile files

For more detailed information on uploading and downloading and also deletion of the profile file using the user interface of the SC-COM, see Section 4.5 "Managing Modbus XML Profile Files", page 20.

8 Troubleshooting

You can find information on error analysis of the SMA Modbus profile in Section 3.7 "Reading and Writing Data in the Modbus Protocol", page 13.

For troubleshooting of the SMA devices, go to Modbus address 30197 and use the event numbers output by the devices here.

The event numbers of the SMA devices cannot be decrypted with the number codes in this document.

The event numbers of the SMA devices are device-specific and cannot be decrypted with the number codes in this document.

To decrypt the event numbers of central inverters, contact the SMA Service Line (see Section 10 "Contact", page 59).

9 Technical Data

9.1 Supported SMA Devices

SMA Modbus profile version

From SC-COM firmware version 1.1, the SMA Modbus profile can be loaded as a separate XML file to the SC-COM and updated. The separate XML file has a profile version. With profile version 1.30, the device IDs which have already been allocated are changed. Note the details of the profile version and of the device ID for all the SMA devices listed below.

This document is only valid for the following SMA devices:

Communication device:

- Sunny Central Communication Controller (SC-COM) with firmware version 1.1, or higher, device ID = 188

Inverters:

- Device family SC nnnCP and SC nnnHE-20:
  - Sunny Central 500CP (firmware version 01.13.07.R or higher), device ID = 160, device model = 9088, from profile version 1.30, device ID=122 is valid
  - Sunny Central 500CP-JP (firmware version 01.18.25.R or higher), device ID = 253, device model = 9206, from profile version 1.30, device ID=122 is valid
  - Sunny Central 500CP-US (firmware version 01.16.16.R or higher), device ID = 262, device model = 9215, from profile version 1.30, device ID=122 is valid
  - Sunny Central 500CP-US 600V (firmware version 01.16.16.R or higher), device ID = 271, device model = 9221, from profile version 1.30, device ID=122 is valid
  - Sunny Central 500HE-20 (firmware version 01.15.41.R or higher), device ID = 202, device model = 9123, from profile version 1.30, device ID=122 is valid
  - Sunny Central 630CP (firmware version 01.13.07.R or higher), device ID = 159, device model = 9089, from profile version 1.30, device ID=122 is valid
  - Sunny Central 630CP-JP (firmware version 01.15.30.R or higher), device ID = 122, device model = 9228
  - Sunny Central 630CP-US (firmware version 01.16.16.R or higher), device ID = 261, device model = 9214, from profile version 1.30, device ID=122 is valid
  - Sunny Central 630HE-20 (firmware version 01.15.41.R or higher), device ID = 201, device model = 9122, from profile version 1.30, device ID=122 is valid
  - Sunny Central 720CP (firmware version 01.13.07.R or higher), device ID = 165, device model = 9095, from profile version 1.30, device ID=122 is valid
  - Sunny Central 720CP-US (firmware version 01.16.16.R or higher), device ID = 263, device model = 9216, from profile version 1.30, device ID=122 is valid
  - Sunny Central 720HE-20 (firmware version 01.15.41.R or higher), device ID = 203, device model = 9124, from profile version 1.30, device ID=122 is valid
  - Sunny Central 750CP-US (firmware version 01.16.16.R or higher), device ID = 264, device model = 9217, from profile version 1.30, device ID=122 is valid
  - Sunny Central 760CP (firmware version 01.13.07.R or higher), device ID = 164, device model = 9094, from profile version 1.30, device ID=122 is valid
  - Sunny Central 760HE-20 (firmware version 01.15.41.R or higher), device ID = 204, device model = 9125, from profile version 1.30, device ID=122 is valid
  - Sunny Central 800CP (firmware version 01.13.07.R or higher), device ID = 158, device model = 9090, from profile version 1.30, device ID=122 is valid
  - Sunny Central 800CP-JP (firmware version 01.15.30.R or higher), device ID = 122, device model = 9227
  - Sunny Central 800CP-US (firmware version 01.16.16.R or higher), device ID = 260, device model = 9213, from profile version 1.30, device ID=122 is valid
  - Sunny Central 800HE-20 (firmware version 01.15.41.R or higher), device ID = 200, device model = 9121, from profile version 1.30, device ID=122 is valid

- Sunny Central 850CP (firmware version 01.13.07.R or higher), device ID = 254, device model = 9207, from profile version 1.30, device ID=122 is valid
- Sunny Central 850CP-US (firmware version 01.15.30.R or higher), device ID = 256, device model = 9209, from profile version 1.30, device ID=122 is valid
- Sunny Central 900CP (firmware version 01.13.07.R or higher), device ID = 255, device model = 9208, from profile version 1.30, device ID=122 is valid
- Sunny Central 900CP-US (firmware version 01.15.30.R or higher), device ID = 257, device model = 9210, from profile version 1.30, device ID=122 is valid
- Sunny Central 1000CP (firmware version 01.15.30.R or higher), device ID = 122, device model = 929

String-monitoring devices:

- Optiprotect (firmware version 1.00, or higher), device ID = 198, device model = 9120, from profile version 1.30, device ID=161 is valid
- Sunny Central String-Monitor Controller (firmware version 1.05 or higher), device ID = 187, device model = 9108, from profile version 1.30, device ID=129 is valid
- Sunny Central String-Monitor US (firmware version 1.04 or higher), device ID = 190, device model = 9110, from profile version 1.30, device ID=97 is valid
- Sunny String-Monitor (firmware version 1.04, or higher), device ID = 171

9.2 Supported Modbus Devices from Other Manufacturers

The Modbus master profile described in this document is valid for the following Modbus-capable devices from other manufacturers:

- Moxa ioLogik E1242-T

9.3 Modbus Communication Ports

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

Network protocol	Communication port, default setting
TCP/UDP	502

Use 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 the Modbus port of the SC-COM, you must also change the Modbus port of a connected Modbus master system. Otherwise the SC-COM can no longer be accessed via the Modbus protocol.

9.4 Modbus Reaction Time

In this section you can find the typical reaction times. The reaction time is the interval within with changes in value are available in the SMA devices at the Modbus interface of the SC-COM. Consequently, value changes in a Modbus master system (e.g. in a SCADA system) can only be displayed in a corresponding or larger interval.

Devices	Reaction time (s)
SC nnnCP and SC nnnHE-20	1
String monitoring unit (provides 5-minute average values)	300

9.5 Interval of the Data Request and Number of Values

Limit of the data processing capacity

For system stability reasons, the time period between data transfers via the Modbus protocol should be at least ten seconds, and no more than 30 Modbus registers should be transferred per data block. This specification is the upper limit for the SMA devices connected via the Modbus protocol, in accordance with section "Number of SMA Devices".

9.6 Number of SMA Devices

Recommended number of SMA devices

For performance reasons, we recommend operating only approx. 25 SMA devices on the SC-COM and not to fully utilize the SC-COM's maximum possible number of 50 SMA devices.

9.7 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 – Assignment Tables", from page 22, with specification of the time zone, this table is referenced.

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

9.8 Frequently Used Number Codes (ENUM)

The following table contains number codes which, as function coding in data format ENUM, are frequently used in the SMA Modbus profile. The enumeration column contains the corresponding abbreviations. Due to the variety of devices, several abbreviations may be specified.

Event Numbers

The event numbers displayed by the devices under the Modbus address 30197 are device-specific. For the details, please use the documentation of the respective device. You cannot decrypt the event numbers with the number codes in this document (see Section 8 "Troubleshooting", page 51).

Code	Meaning	Enumeration
51	Closed	Cls
276	Instantaneous value	LimFst
295	MPP	Mpp, MPP, Mpp-Betrieb, Mpp Operation
303	Off	Off
308	On	On
309	Operation	Operation
311	Open	Opn
336	Contact the manufacturer	PrioA
337	Contact the installer	PrioC
338	Invalid	PrioIna
381	Stop	Stop
455	Warning	Wrn, Disturbance, Stoer, Stoerung, Störung, Warning
461	SMA (manufacturer specification)	
973	Not set, NaN	NaN, ---, ----, -----, ------, -------, --------
1041	Leading	OvExt, Overexcited
1042	Lagging	UnExt, Underexcited
1069	Reactive power/voltage characteristic curve Q(V)	VArCtlVol
1070	Reactive power Q, direct setpoint	VArCnstNom
1071	Reactive power const. Q (kVar)	VArCnst
1072	Reactive power Q, setpoint via system control	VArCtlCom
1073	Reactive power Q(P)	VArCtlW
1074	cos φ, direct setpoint	PFCnst
1075	cos φ, setpoint via system control	PFCtlCom
1076	cos φ(P) characteristic curve	PFCtlW
1077	Active power limitation P (W)	WCnst
1078	Active power limitation P in (%) of PMAX	WCnstNom
1079	Active power limitation P via system control	WCtlCom
1387	Reactive power Q, setpoint via analog input	VArCnstNomAnIn
1388	Cos φ, setpoint via analog input	PFCnstAnIn
1389	Reactive power/voltage characteristic curve Q(U) with hysteresis and deadband	VArCtlVolHystDb

Code	Meaning	Enumeration
1390	Active power limitation P via analog input	WCnstNomAnIn
1391	Active power limitation P via digital inputs	WCnstNomDgIn
1392	Error	Flt
1393	Wait for PV voltage	WaitPV
1394	Wait for valid AC grid	WaitGri
1395	DC section	DcDm
1396	AC grid	Gri
1455	Emergency switch	EvtEmgStop
1466	Wait	Wait
1467	Starting	Str
1468	MPP search	MppSrch
1469	Shutdown	Shtdwn
1470	Disturbance	Dst
1471	Warning/error e-mail OK	EvtWrnErrTxOk
1472	Warning/error e-mail not OK	EvtWrnErrTxNok
1473	System info e-mail OK	EvtPlntDatTxOk
1474	System info e-mail not OK	EvtPlntDatTxNok
1475	Error e-mail OK	EvtErrTxOk
1476	Error e-mail not OK	EvtErrTxNok
1477	Warning e-mail OK	EvtWrnTxOk
1478	Warning e-mail not OK	EvtWrnTxNok
1479	Wait after grid interruption	GriFltMon
1480	Wait for electric utility company	WaitUtil

10 Contact

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

- Modbus master software or hardware used
- Software version of the inverter
- Type of communication interface between the inverter and the devices
- Type, serial numbers, and software version of the devices that are connected to the PV system

Australia	SMA Australia Pty. Ltd. Sydney	Toll free for Australia:	1800 SMA AUS (1800 762 287)
		International:	+61 2 9491 4200
Belgien/Belgique/België	SMA Benelux bvba/sprl Mechelen	+32 15 28 67 30	
Česko	SMA Central & Eastern Europe s.r.o. Praha	+420 235 010 417	
Danmark	Se Deutschland (Tyskland)		
Germany	SMA Solar Technology AG Niestetal (Germany)	Medium Power Solutions	
		Inverters: Communication: SMS with "Callback":	+49 561 9522-1499 +49 561 9522-2499 +49 176 888 222 44
		Hybrid Energy Solutions	
		Sunny Island:	+49 561 9522-399
		Power Plant Solutions	
		Sunny Central:	+49 561 9522-299
España	SMA Ibérica Tecnología Solar, S.L.U. Barcelona	+34 900 14 22 22	
France	SMA France S.A.S. Lyon	Medium Power Solutions	
		Onduleurs: Communication :	+33 (0)4 72 09 04 40 +33 (0)4 72 09 04 41
		Hybrid Energy Solutions	
		Sunny Island:	+33 (0)4 72 09 04 42
		Power Plant Solutions	
		Sunny Central :	+33 (0)4 72 09 04 43

India	SMA Solar India Pvt. Ltd. Mumbai	+91 022 61713844	
Italia	SMA Italia S.r.l. Milano	+39 02 89347 299	
Luxemburg/Luxembourg	See Belgium Voir Belgique		
Magyarország	lásd Česko (Csehország)		
Nederland	zie Belgien (België)		
Austria	See Germany		
Polska	Patrz Česko (Czechy)		
Portugal	SMA Solar Technology Portugal, Unipessoal Lda, Lisboa	+351 212377860	
România	Vezi Česko (Cehia)		
Switzerland	See Germany		
Slovensko	pozri Česko (Česká republika)		
South Africa	SMA Solar Technology South Africa Pty Ltd. Centurion (Pretoria)	Toll free worldwide:	+27 12 643 1785
United Kingdom	SMA Solar UK Ltd. Milton Keynes	+44 1908 304899	
Ελλάδα	SMA Hellas AE Αθήνα	+30 210 9856 666	
България	Виж Ελλάδα (Гърция)		
ไทย	SMA Solar (Thailand) Co., Ltd. กรุงเทพฯ	+66 2 670 6999	
대한민국	SMA Technology Korea Co., Ltd. 서울	+82 2 508 8599	
中国	SMA Beijing Commercial Company Ltd. 北京	+86 010 56701361	
日本	SMA Japan K.K. 東京	+81-(0)3-3451-9530	

+971 2 698 5080	SMA Middle East LLC أبو ظبي	الإمارات العربية المتحدة

Other countries	International SMA Service Line Niestetal (Germany)	00800 SMA SERVICE (+800 762 7378423)

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