Technical Information

SMA Modbus® Interface

Remote Control - Sunny Tripower Storage X / Sunny Island X

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1 Information on this Document

1.1 Validity

This document is valid for:

- STPS30-20 (Sunny Tripower Storage X 30)
- STPS50-20 (Sunny Tripower Storage X 50)
- STPS27-US-20 (Sunny Tripower Storage 27 US208)
- STPS60-US-20 (Sunny Tripower Storage 60 US480)
- SI30-20 (Sunny Island X 30)
- SI50-20 (Sunny Island X 50)
- SI27-US208-20 (Sunny Island X 27 US208)
- SI40-US480-20 (Sunny Island X 40 US480)
- SI60-US480-20 (Sunny Island X 60 US480)

1.2 Target Group

The tasks 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
- Knowledge of the Modbus specifications
- Training in the installation and configuration of IT systems
- Knowledge of and compliance with this document and all safety information

1.3 Contents and structure

This document does not contain any information on the Modbus registers provided by SMA products. Furthermore, no information on the firmware version to be installed on the respective SMA product is included. Information on firmware versions and device-specific Modbus register HTML of SMA products can be found on our product pages or Modbus page at www.SMA-Solar.com.

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

This document contains a general description of the Modbus interface integrated in SMA products.

This document does not contain any information related to parameters for grid management services (system control objects). For more information on these parameters, contact the SMA Service.

This document supplements the documents that are enclosed with each product and does not replace any locally applicable codes or standards. Read and observe all documents supplied with the product.

Illustrations in this document are reduced to the essential information and may deviate from the real product.

1.4 Levels of Warning Messages

The following levels of warning messages may occur when handling the product.

⚠ DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, can result in property damage.

1.5 Symbols in the Document

Symbol	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Required result
	Example

1.6 Typographies in the document

Typography	Use	Example
bold	• Messages • Terminals • Elements on a user interface • Elements to be selected • Elements to be entered	• Connect the insulated conductors to the terminals **X703:1** to **X703:6**. • Enter **10** in the field **Minutes**.
>	• Connects several elements to be selected	• Go to Settings > Date.
[**Button**] [**Key**]	• Button or key to be selected or pressed	• Select [**Enter**].
#	• Placeholder for variable components (e.g., parameter names)	• Parameter **WCtlHz.Hz#**

1.7 Additional Information

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

Title and information content	Type of information
"PUBLIC CYBER SECURITY - Guidelines for a Secure System Communication"	Technical Information
"Direct Marketing Interface"	Technical information

Title and information content	Type of information
"SMA GRID GUARD 10.0 - Grid Management Services via Inverter and System Controller"	Technical Information
"Parameters and Measured Values" Device-specific overview of all parameters and measured values and their setting options Information about the SMA Modbus registers	Technical Information
"SMA Modbus ®-interface - ennexOS" Information on the SMA Modbus interface	Technical Information
"SunSpec Modbus ®-interface - ennexOS" Information about the SunSpec Modbus interface and supported information models	Technical Information
Modbus Application Protocol Specification	Modbus specification under https://modbus.org/specs.php

2 Safety

2.1 Intended Use

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

- Remote control of grid management services
- Remote-controlled querying of measured values
- Remote-controlled changing of parameters
- Interface for direct marketing

All components must remain within their permitted operating ranges and their installation requirements at all times.

The products by SMA Solar Technology AG are not suitable for use in

- Medical devices, in particular products for supplying life-support systems and machines,
- Aircraft, the operation of aircraft, the supply of critical airport infrastructure and airport systems,
- Rail vehicles, the operation and supply of rail vehicles and their critical infrastructure.

The above list is not exhaustive. Contact us if you are unsure whether products by SMA Solar Technology AG are suitable for your application.

Use SMA products only in accordance with the information provided in the enclosed documentation and with the locally applicable laws, regulations, standards and directives. Any other application may cause personal injury or property damage.

The documentation must be strictly followed. Deviations from the described actions and the use of materials, tools, and aids other than those specified by SMA Solar Technology AG are expressly forbidden.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

The documentation supplied is an integral part of SMA products. Keep the documentation in a convenient, dry place for future reference and observe all instructions contained therein.

This document does not replace any regional, state, provincial, federal or national laws, regulations or standards that apply to the installation, electrical safety and use of the product. SMA Solar Technology AG assumes no responsibility for the compliance or non-compliance with such laws or codes in connection with the installation of the product.

2.2 IMPORTANT SAFETY INSTRUCTIONS

Keep the manual for future reference.

This section contains safety information that must be observed at all times when working.

The product has been designed and tested in accordance with international safety requirements. As with all electrical or electronical devices, some residual risks remain despite careful construction. 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 of SMA products due to cyclical changing of parameters

The parameters of SMA products that can be changed with writable Modbus registers (RW) are intended for long-term storage of device settings.

Parameters marked with ⚠, must not be changed more than once a day (see technical information "Parameters and Measured Values").

Parameters for grid management services to control and limit the nominal system power are marked with . These parameters may be changed cyclically (see technical information "Parameters and Measured Values").

- Use the parameters for grid management services for the automated remote control.
- Note the explanation of the symbols (see Technical Information "Parameters and Measured Values").

Access to data points after activating the Modbus interface

The read-only access to data points is possible after activating the Modbus interface. The read-only 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 after activating the Modbus interface.

- Ensure that the Modbus interface is still active after resetting the SMA product to default settings.

3 Assignment Tables

3.1 General information

All Sunny Tripower Storage X and Sunny Island X in the system must be controlled via Unit ID 3. For this, the energy management in the System Manager must be deactivated to prevent the Sunny Tripower Storage X from switching between grid feed-in and battery charging. Since all Sunny Tripower Storage X are controlled directly and the central energy management in the System Manager is deactivated, all safety functions in terms of battery and inverter must be assumed by a third-party energy management system. Basic safety functions are available however, e.g. Deep discharge protection. When using energy management systems by other manufacturers, SMA Solar Technology AG does not provide any warranties in case of damages to batteries and inverters.

NOTICE

No battery control via System Manager with Unit ID 3

When all Sunny Tripower Storage X are directly controlled via Unit ID 3 and the central energy management in the System Manager is deactivated, battery control is no longer guaranteed by the System Manager.

- Battery control must be assumed by a third-party energy management system

To control the battery (charging/discharging) when using Unit ID 3 and deactivated energy management in the System Manager, the following Modbus registers (ADR) must be set:

- Modbus register 40210 to 1079
- Modbus register 41195 to 10
- Modbus register 44029 to 303

To charge and discharge the battery, the maximum (Modbus register 44449) and the minimum (Modbus register 44451) battery power must be set. Percentages between -100% and +100% are accepted. A signed Integer (S32) with two decimals is used (e.g. 20% = 2000).

Also see:

- Unit ID = 3 (device) ⇒ page 13

3.2 Information on the Assignment Tables

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

Information	Explanation
ADR	Decimal Modbus register
Description/number codes	Short description of the Modbus register and the number codes used
CNT	Number of assigned Modbus registers
Type	Data type
Format	Data format of the saved value
Access	Access type

3.3 Unit ID = 1 (Communication Product)

The following table lists the parameters provided by the communication product and measured values that can be accessed at Unit ID = 1:

ADR	Description/number codes	CNT	Type	Format	Access
30005	Serial number Returns the serial number of a device.	2	U32	RAW	RO
30051	Device category: Returns a key figure from the tag list that indicates the device category (e.g. 8009 – Hybrid inverter).	2	U32	ENUM	RO

3.4 Unit ID = 2 (System)

In the following table you can find the system parameters and control addresses for the grid management services that you can access using Unit ID = 2. The system parameters represent measured values and parameters of the communication product and also system devices that are connected via the Modbus protocol. Parameters such as time settings are transferred by the communication product to the devices of the 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	Description/number codes	CNT	Type	Format	Access
33017	Nominal active power WMaxOutRtg Returns the nominal active power of the grid feed-in, e.g. 50,000 W	2	S32	FIX0	RO
41315	Operating mode active power controller Sets the standard regulation mode, default: 3352 (open-loop control). • 3352 = Operating mode Open-loop control • 3353 = Operating mode Closed-loop control	2	U32	TAGLIST	RW
44505	Limitation of active power in % Returns the limitation in percent. Two decimals, range: 0–10,000, default: 10,000 (100%).	2	U32	FIX2	RW

3.5 Unit ID = 2 and 3 (system and device)

In the following table you can find the system and device parameters that you can access via Unit ID= 2 and Unit ID = 3. Some values can be called up via Unit ID = 2 and Unit ID = 3. The values read out in Unit IDs 2 and 3 may differ from each other due to different observation levels (system and device level).

ADR	Description/number codes	CNT	Type	Format	Access
30201	Current state of health; 5-minute value; device status Returns a key figure from the tag list that indicates the state of the device or system. • 307 = OK	2	U32	TAGLIST	RO

ADR	Description/number codes	CNT	Type	Format	Access
30233	Accumulated connected power of the PV inverter (W) Sets the active power limit, e.g. 50,000 W for an STPS 50-20. No decimal offset (FIX0), unit: watt. • 0 W to 60,000 W	2	U32	FIX0	RO
30845	Current battery state of charge (SOC in relation to present capacity), in % Returns the state of charge (SOC) of a single battery (Unit ID 3) in percent, without decimal offset. This value is the "User SOC", i.e. the actual SOC minus the upper and lower charging/discharging limits.	2	U32	FIX0	RO
33019	Nominal active power WMaxInRtg, in W • -60,000 W to -27,000 W Returns the nominal active power of the intake, e.g. -50,000 W.	2	S32	FIX0	RO
40018	Quick shut-down of the inverters: Allows quick disconnection of the system (Unit ID 2) or of individual devices (Unit ID 3) by sending tags: • 381 = Standby • 1467 = start • 1749 = full stop (AC and DC sides)	2	U32	ENUM	RW
40029	General operating status Returns the general operating status: • 303 = Off • 309 = Operation • 569 = Switched on (default) • 1295 = Standby • 1795 = Blocked • 16777213 = Information not available	2	U32	TAGLIST	RO
40187	Nominal battery capacity Returns the nominal capacity in watt hours (Wh) without decimal offset.	2	U32	FIX0	RO
40472	Nominal grid voltage Returns the nominal grid voltage in volt, e.g. 230V or 400V.	2	U32	FIX0	RW

ADR	Description/number codes	CNT	Type	Format	Access
41193	Behavior during failure of external setpoint Sets the fallback behavior: • 2506 = Keep values (default) • 2507 = Use fallback values	2	U32	TAGLIST	RW
41195	Timeout for external setpoint Sets the time in seconds (1 to 1,800s), default: 600s.	2	U32	DURA-TION	RW
41369	Activation threshold, grid feed-in Sets the activation threshold for grid feed-in. S32 with three decimals (FIX3), default: 5%.	2	S32	FIX3	RW
41371	Deactivation threshold grid feed-in Sets the deactivation threshold for grid feed-in. S32 with three decimals (FIX3), default: 5%.	2	S32	FIX3	RW
41373	Activation threshold power consumption Sets the activation threshold for power consumption. S32 with three decimals (FIX3), default: 5%.	2	S32	FIX3	RW
41375	Deactivation threshold power consumption Sets the deactivation threshold for power consumption. S32 with three decimals (FIX3), default: 5%.	2	S32	FIX3	RW
44001	Soft start rate P Indicates the soft start rate in %/min. Range: 1 to 10,000, default: 1,200%/min.	2	U32	FIX0	RW
44013	Soft start P after a grid fault Activates (308) or deactivates (303) the soft start after a grid fault.	2	U32	TAGLIST	RW
44381	Nominal active power WMaxOut Sets the nominal active power of the grid feed-in, e.g. 12,000W.	2	S32	FIX0	RW
44383	Nominal active power WMaxIn Sets the nominal active power of the intake, e.g. -60,000W to 0W.	2	S32	FIX0	RW

3.6 Unit ID = 3 (device)

In the following table you can find the device parameters that you can access via Unit ID= 3. By accessing Unit ID = 3 you have direct access to each individual inverter. The System Manager does not control the individual inverters, which requires a thorough configuration of the individual inverters.

ADR	Description/number codes	CNT	Type	Format	Access
30955	Operating status of battery Returns a key figure from the tag list that indicates the state of the battery: • 303 = Off • 2291 = Battery standby • 2292 = Battery charging (default) • 2293 = Battery discharging	2	U32	TAGLIST	RO
31391	Battery state of charge Returns a key figure from the tag list • 35 = Error • 303 = Off • 307 = OK (default) • 455 = Warning	2	U32	TAGLIST	RO
40210	Operating mode active power setpoint Sets the operating mode for the active power setpoint: • 303 = Off • 1077 = Manual setpoint in W • 1078 = Manual setpoint in % • 1079 = External active power setpoint (default)	2	U32	TAGLIST	RW
40212	Active power limitation, in W Indicates an absolute limitation in watt. • 0 to 60,000 W	2	U32	FIX0	RW
40214	Active power limitation in % Indicates a relative limitation in percent. • 0 to 100%	2	U32	FIX0	RW
40236	Operating mode of the BMS Sets the operating mode of the battery management system: • 303 = Off • 308 = On • 2289 = Battery charging (default) • 2290 = Battery discharging • 2424 = Default setting	2	U32	TAGLIST	RW

ADR	Description/number codes	CNT	Type	Format	Access
40721	Minimum width of deep discharge protection range Sets the minimum width of the discharge protection. Default value: 1%, recommended: > 0%	2	U32	FIX0	RW
44449	Maximum active power battery Important for battery control. S32 with two decimals (%), range: -10,000% to 10,000. e.g. 3500 = 35% of nominal power. Should be written at the same time as register 44451.	2	S32	FIX2	WO
44451	Minimum active power battery Important for battery control. S32 with two decimals (%), range: -10,000% to 10,000. e.g. 3500 = 35% of nominal power. Should be written at the same time as register 44449.	2	S32	FIX2	WO

4 Configuration

In connection with an energy meter, the SMA System Manager takes over closed-loop control at the point of interconnection and can control or regulate subordinate SMA devices. The System Manager also takes over system monitoring and communication to the Sunny Portal powered by ennexOS.

Access to data points after activating the Modbus interface

The read-only access to data points is possible after activating the Modbus interface. The read-only 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 after activating the Modbus interface.

- Ensure that the Modbus interface is still active after resetting the SMA product to default settings.

Requirement:

☐ The correct country standard must be selected during commissioning.

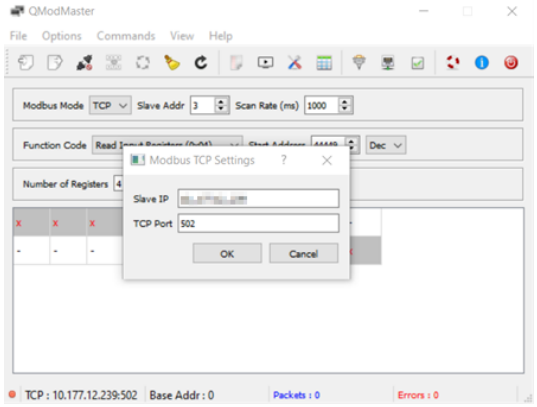
☐ You must be logged in on the user interface of the device that has been configured as System Manager.

☐ The Modbus server must be activated in the device that has been configured as the System Manager. The Modbus server is only available via Modbus TCP (not RTU or UDP).

☐ A Modbus master program must be installed. In this example, the freely available program "QModMaster" was used.

Procedure:

1. Connect to the System Manager via the Modbus master program and select **TCP**.
2. Enter the IP address and TCP port of the System Manager in the TCP options. The default port is 502.



3. Enter the desired Unit ID for **Slave Addr.**.
4. To read Modbus registers, select the option **Read Input Registers (0x04)** under **Function Code**. To write Modbus registers, select the option **Write Multiple Registers (0x10)** under **Function Code**.
5. Enter the desired Modbus register (ADR) for **Start Address**.
6. Enter the desired number of Mobus registers for **Number of Registers**. Usually, the value **2** is used for the number of Modbus registers. To charge and discharge the battery, the two Modbus registers 44449 and 44451 must be set at the same time. To do this, enter value **4**.

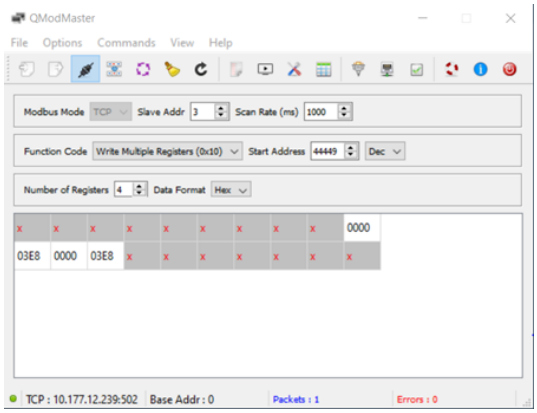
5 Charging and discharging the battery via Modbus

Requirements:

- ☐ You must be logged in on the user interface of the device.
- ☐ The Modbus server must be activated in the device that has been configured as the System Manager. The Modbus server is only available via Modbus TCP (not RTU or UDP).
- ☐ A Modbus master program must be installed. In this example, the freely available program "QModMaster" was used.
- ☐ All devices in the local network must be in operation and be located in a network with a valid IP address.
- ☐ The energy management must be disabled via the user interface of the System Manager.

Procedure:

1. Connect to the System Manager via the Modbus master program (see Section 4, page 15).
2. Enter the IP address and TCP port of the System Manager in the TCP options. The default port is 502.
3. For **Unit ID3**, enter value **3**.
4. For **Start Address**, enter the Modbus register (ADR) **40210** and write the decimal **0000 1079** (external setpoint) or the hexadecimal value **0000 0437**.
5. The parameter **Parameter.Inverter.CtlComCfg.WCtlCom.CtlComMssMod** must be set to **Apply fallback values**.
6. Adjust the parameters **Parameter.Inverter.CtlComCfg.WCtlCom.FlbWMaxNom** and **Parameter.Inverter.CtlComCfg.WCtlCom.FlbWMinNom** to the value **0**.
7. For **Start Address**, enter the Modbus register (ADR) **41195** and write the decimal **0000 0010** (timeout of 10 seconds) or the corresponding hexadecimal value.
8. For **Start Address**, enter the Modbus register (ADR) **44029** and write the decimal **0000 0303** (deactivation of the ramps) or the corresponding hexadecimal value.
   - ☑ The system is ready for the external control. The corresponding ADRs can now be sent at regular intervals (e.g. once per second) (button with purple arrow circle).
9. Send the two setpoints via Modbus register (ADR) **44449** and **44451** to charge and discharge the battery at the specified interval.



   - ☑ For 10% discharge: **0000 1000 0000 1000** (decimal) or **0000 03E8 0000 03E8** (hexadecimal). It is recommended to use hexadecimal values for both Modbus registers to avoid confusion with negative values. The transmitted values result in a discharge capacity of 5 kW. Information: When using decimal numbers, a checkmark **singed** must be placed in certain QMod Master Tools to allow negative values.
   - ☑ First, the Modbus registers show the value **8000 0000 8000 0000** (hexadecimal), which means "no number". After the battery has been charged or discharged, you can reset the values to **0000 0000 0000 0000**. Values from 0% to 100% discharge the battery, values from -100% to 0% charge the battery

6 Contact

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