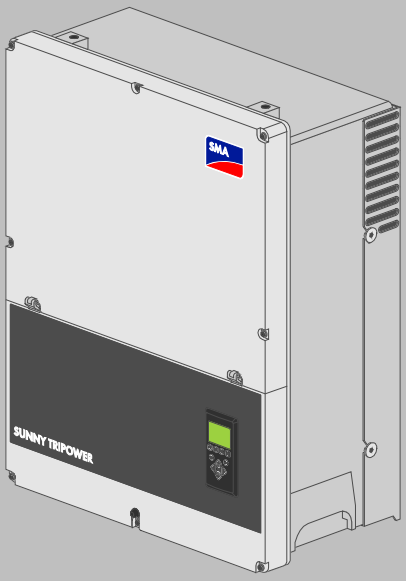
Technical information

SUNNY TRIPOWER 60 / SUNNY HIGHPOWER PEAK1
SunSpec® Modbus® Interface



Legal Provisions

The information contained in these documents is the property of SMA Solar Technology AG.
Any publication, whether in whole or in part, requires prior written approval by SMA Solar Technology AG. Internal reproduction used solely for the purpose of product evaluation or other proper use is allowed and does not require prior approval.

SMA reserves the right to modify the implementation of communication interfaces and protocols at any time without notifying the user. It is the user's responsibility to determine whether the downloaded content is up to date and to comply with it. SMA shall not be held liable for any damage as well as any assumption of consequential costs for customer systems by SMA that may result from the user's failure to do so.

Trademarks

All trademarks are recognized, even if not explicitly identified as such. Missing designations do not mean that a product or brand is not a registered trademark.
SunSpec® is a registered trademark of SunSpec Alliance, Inc.
Modbus® is a registered trademark of Schneider Electric and is licensed by the Modbus Organization, Inc.

SMA SOLAR TECHNOLOGY AG

Sonnenallee 1
34266 Niestetal
Germany
Tel. +49 561 9522-0
Fax +49 561 9522-100
www.SMA.de
E-Mail: info@SMA.de

Table of Contents

1 Information on this Document

Validity

This document is valid for the device types listed in Section 2.4 "Supported SMA ", page 8. It describes the general functioning of the Modbus interface as well as the Modbus registers provided by the devices and the manufacturer-specific events and status for the SunSpec Modbus profile of the supported device types. The basis of this figure is the file **PICS.xls** contained in the version "SunSpec Specification from June 2013".

This document does not contain any details on the parameters and measured values provided by the inverter in detail (see technical information "Description of the operating parameters - SUNNY TRIPOWER 60 / SUNNY HIGHPOWER PEAK 1").

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

Target Group

This document is intended for qualified persons. Only persons with appropriate skills are allowed to perform the tasks described in this document (see Section 2.2 "Skills of Qualified Persons", p. 7).

Additional Information

SMA Documents

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

Document title	Document type
SUNNY TRIPOWER 60	Installation Manual
SUNNY HIGHPOWER PEAK1	Installation Manual
SUNNY TRIPOWER 60 / SUNNY HIGHPOWER PEAK1 - Description of the Operating Parameters	Technical Information
SunSpec PlugFest Protocol Implementation Conformance Statement for the STP60 (PICS.xlsx)	Specification

Additional Documents

Document title	Source
Modbus Application Protocol Specification	http://www.modbus.org/specs.php
Modbus Messaging Implementation Guide	http://www.modbus.org/specs.php
SunSpec specifications	http://www.sunspec.org

Symbols

Icon	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant.

Typographies

Typography	Use	Example
bold	• File names • Parameters	• The file **PICS.xls** • The column **Typ**

Nomenclature

Complete designation	Designation in this document
Modbus register	Register
Photovoltaic system	PV system
SUNNY TRIPOWER 60 inverter	STP 60, inverter
SUNNY HIGHPOWER PEAK1 inverter	SHP 75, inverter
SMA Inverter Manager	Inverter Manager

Abbreviations

Abbreviation	Designation	Explanation
LCS-Tool	Local Commissioning and Service tool	Configuration software for the Inverter Manager
PICS	Protocol Implementation Conformance Statement	SunSpec conforming summary of the data points of a particular device.

2 Safety

2.1 Intended Use

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

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

The Modbus interface can be used via Modbus TCP.

The enclosed documentation is an integral part of this product:

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

2.2 Skills of Qualified Persons

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

- Knowledge of IP-based network protocols
- Knowledge of the Modbus specifications
- Knowledge of the SunSpec specifications
- Knowledge of and compliance with this document and all safety information

2.3 Information on Data Security

Data security in Ethernet networks

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

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

2.4 Supported SMA Devices

The following devices are supported:

- Inverters of the SUNNY TRIPOWER production series in the 60°kW power class (STP 60)
- Inverters of the SUNNY HIGHPOWER PEAK 1 production series in the 75°kW power class (SHP 75)
- SMA Inverter Manager

3 Product Description

3.1 Modbus Protocol

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

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

The Modbus profile specially developed by SunSpec is the SunSpec Modbus profile.

The mapping of the data model of the inverter on the SunSpec data model is specified in the SunSpec Modbus profile.

3.2 SunSpec Modbus Profile for SMA Devices

The SunSpec Modbus profile from the SunSpec Alliance contains a comprehensive set of measured values and parameters for energy-generating devices in PV systems. SMA has performed a mapping of the special data points of the inverter on the data points required by SunSpec. The inverter therefore conforms with the SunSpec Modbus profile of the underlying specification version (see Section 1 "Information on this Document", P. 5).

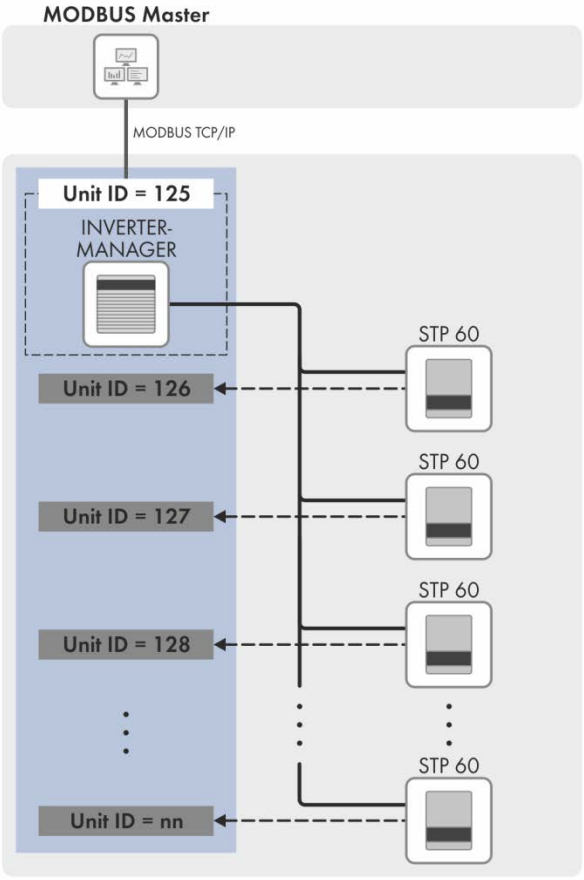
The SunSpec Modbus profile for the inverter starts at the register number 40001 (see Section 3.4 "Addressing and Data Transmission in the Modbus Protocol", page 11).

3.3 PV System Topology

The Inverter Manager is connected with the SCADA system of the electric utility company or the grid operator and can thus communicate via the IP protocol. The IP interface also enables communication via the Modbus protocol. The inverter that are connected to the Inverter Manager via an SMA fieldbus are subordinate to the Inverter Manager.

From the perspective of the Modbus protocol, the Inverter Manager represents a Modbus slave that supports the SunSpec Modbus profile and provides a gateway to the inverter. The inverter can only be addressed using this gateway per unit ID.

Example: PV System Topology from the Perspective of the SMA Devices



Line	Explanation
———	IP network connection between SCADA system and Inverter Manager (PV system router)
———	SMA fieldbus
- - -	Logical assignment of inverter to unit ID

3.4 Addressing and Data Transmission in the Modbus Protocol

3.4.1 Unit IDs

The Unit ID is a superordinate addressing type in the Modbus protocol. The assignment of the unit IDs in the SunSpec Modbus profile for inverter is performed automatically by the Inverter Manager. You can determine the unit IDs assigned by the Inverter Manager for the connected inverter using the Local Commissioning and Service tool (LCS tool).

The following table shows an overview of the unit IDs in the SunSpec Modbus profile:

Unit ID	Explanation
125*	This unit ID is reserved for the Inverter Manager.
126 to 167*	The unit IDs from 126 to 167 are reserved for the inverter.

*Deviation for firmware version < 1.45: Inverter Manager ID = 1; Inverter ID 2 to 43

3.4.2 Assignment of the SunSpec Modbus Registers to Unit IDs

The assignment of the parameters and measured values of the SMA devices to Modbus registers is achieved using assignment tables and is also shown in this document (see Section 5 "SunSpec Modbus Profile – Allocation Tablesn", page 15).

The assignment table "Gateway (Unit ID = 125)" contains the SunSpec Modbus registers that are provided by the Inverter Manager.

The assignment table (Unit ID = 126 to 167) contains a summary of the SunSpec Modbus registers supported by the inverter as well as a brief description of the register data.

3.4.3 Modbus Register Number, Register Width and Data Block

A Modbus register is 16 bits wide. For wider data items, connected Modbus registers are used and considered as data blocks. The number (CNT) of connected Modbus registers is indicated in the SunSpec assignment tables. The register number of the first Modbus register in a data block is the start address of the data block. The register numbering begins with 40001.

Offset of the Modbus register numbers (No.)

For the reading or writing of Modbus registers, use the register numbers reduced by the offset 1 in each case. Example: Modbus register address = register number in the SunSpec Modbus profile – offset = 40001 – 1 = 40000.

3.4.4 Data Transmission

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

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

3.5 Reading and Writing of Data

The Modbus interface can be used via the protocol Modbus TCP. Using Modbus TCP enables read- and write access (RW) 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 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

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

3.6 SunSpec Data Types and NaN Values

The following table shows the data types used in the SunSpec Modbus profile and the possible NaN values. The SunSpec data types are listed in the **Type** column of the assignment tables. They describe the data width and the format of the data value saved at a register address. The format, such as bit field, describes how SunSpec data is to be interpreted. The formats are important, for example, for the displaying of data or for its further processing:

Type	Description	NaN value
acc32	Accumulated value (32 bit). Is used for all sequentially increasing values.	0x0000 0000
acc64	Accumulated value (64 bit). Is used for all sequentially increasing values. Only positive values are permitted. The overflow of the number range takes place at 0x7FFF FFFF FFFF FFFF.	0x0000 0000 0000 0000
bitfield16	Bit field (16 bit). A combination of individual bits. Is used for multi-value alarm messages or status. Value range 0 to 0x7FFF. If the MSB is set in a bit field, all other bits are ignored.	0xFFFF
bitfield32	Bit field (32 bit). A combination of individual bits. Is used for multi-value alarm messages or status. Value range 0 to 0x7FFF FFFF. If the MSB is set in a bit field, all other bits are ignored.	0xFFFF FFFF
enum16	Number code (16 bit). The breakdown of the possible codes can be found directly under the designation of the Modbus register in the SunSpec Modbus profile assignment tables.	0xFFFF
int16	Signed integer (16 bit).	0x8000
int32	Signed integer (32 bit).	0x8000 0000
string	String (multiple of 2 bytes). A zero-terminating value or a value of fixed length.	0x0000 to nnnn
sunssf	SunSpec scale factor as signed integer (16 bit). Scale factors are used as exponents of a power of ten. Negative scale factors push the decimal point to the left, positive scale factors to the right.	0x8000
uint16	Unsigned integer (16 bit).	0xFFFF
uint32	Unsigned integer (32 bit).	0xFFFF FFFF
uint64	Unsigned integer (64 bit).	0xFFFF FFFF FFFF FFFF

4 Commissioning and Configuration

The Modbus TCP server of the Inverter Manager is enabled as default. The communication port in the Inverter Manager is set to 502 and can not be changed.

The Modbus interface can be used if all inverter devices connected to the Inverter Manager as well as the Inverter Manager itself have been commissioned (see the inverter installation manual).

5 SunSpec Modbus Profile – Allocation Tablesn

5.1 Information on the Assignment Tables

In the assignment tables you will find the SunSpec Modbus register numbers which can be accessed under the corresponding unit ID. The tables provide the following information and are divided into the sections "Header" and "Fixed Block", in accordance with the PICS:

Information	Explanation
No. (DEC)	Decimal register number (see also Section 3.4.2 "Assignment of the SunSpec Modbus Registers to Unit IDs The assignment of the parameters and measured values of the SMA devices to Modbus registers is achieved using assignment tables and is also shown in this document (see Section 5 "SunSpec Modbus Profile – Allocation Tablesn", page 15). The assignment table "Gateway (Unit ID = 125)" contains the SunSpec Modbus registers that are provided by the Inverter Manager. The assignment table (Unit ID = 126 to 167) contains a summary of the SunSpec Modbus registers supported by the inverter as well as a brief description of the register data. Modbus Register Number, Register Width and Data Block", page 11 onwards).
Description/ number code(s)	[SunSpec description of the Modbus register][(SunSpec name of the Modbus register)] {<, (SMA: SMA parameter designation)>}{<: Parameter>}{<: Number code(s)/bit(s), designation(s)/codes>} The following description scheme is also used in the table sections "Fixed Block" and "Repeating Block": • [SunSpec description of the Modbus register] [(SunSpec name of the Modbus register)], <Unit><*$10^{\text{SunSpec scale factor}}$ (Register address of the scale factor)>, <(SMA: SMA parameter designation>:<standard value> For scale factors: • [Description of the scale factor (SunSpec scale factor): (integer)] Legend: [...] Mandatory entry, <...> Optional entry, {...} Parameter group
CNT (WORD)	Number of combined Modbus registers at this Modbus register number (No.).
Type	Data type, e.g. uint32 = 32 bits without prefix (see Section 0, page 13).

Access	Access type RO: Read only RW: Read and write If an access type is not allowed, a Modbus exception is generated in the event of access with an access type that is not allowed.

Offset of the Modbus register numbers (No.)

For the reading or writing of Modbus registers, use the register numbers reduced by the offset 1 in each case. Example: Modbus register address = register number in the SunSpec Modbus profile – offset = 40001 – 1 = 40000.

Reactive power in the SunSpec Modbus profile

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

This information is valid for the following SunSpec Modbus registers: 40354 and 40359.

5.2 Gateway (Unit ID = 125)

In the following tables you will find the SunSpec Modbus registers provided by the gateway (Inverter Manager) that you can access under unit ID = 125. You can access the gateway via the IP address of the Inverter Manager:

5.2.1 Table C 001 (Common Model)

No. (DEC)	Description/Number Code(s)	CNT (WORD)	Type	Access
Header:				
40001	SunSpec ID (SID): 0x53756e53 = SunSpec Modbus Map	2	uint32	RO
40003	Model ID (ID): 1 = SunSpec common model	1	uint16	RO
40004	Number of the following Modbus registers in accordance with the PICS table (L): 66	1	uint16	RO
Fixed block:				
40005	Manufacturer (Mn): "SMA"	16	string	RO
40021	Model (Md): "SMA Inverter Manager"	16	string	RO
40037	Options (Opt): "Inverter Manager name"	8	string	RO
40045	Version (Vr): Version number of the installed firmware.	8	string	RO
40053	Serial number (SN) of the device that uses the Modbus unit ID stored in the following register.	16	string	RO
40069	Modbus unit ID of the device (DA): 125: Inverter Manager	1	uint16	RO
40070	Padding register (Pad): NAN	1	pad	RO

5.2.2 Table NC011 (Ethernet Link Layer Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40071	Model ID (ID): 11 = SunSpec Ethernet link layer model	1	uint16	RO
40072	Number of the following Modbus registers in accordance with the PICS table (L): 13	1	uint16	RO

NC 011 block was included for reasons of compatibility and only contains NaN values in the registers 40073 to 40085

5.2.3 Table NC 012 (IPv4 Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40086	Model ID (ID): 12 = SunSpec IPv4 model	1	uint16	RO
40087	Number of the following Modbus registers in accordance with the PICS table (L): 98	1	uint16	RO
Fixed block:				
40088	Interface Name (Name): NaN	4	string	RO
40092	Config Status (CfgSt): NaN	1	enum16	RO
40093	Change Status (ChgSt): NaN	1	bitfield16	RO
40094	Config Capability (Cap) : NaN	1	bitfield16	RO
40095	IPv4 Config (Cfg) : NaN	1	enum16	RO
40096	Control (Ctl) : NaN	1	enum16	RO

40097	IP address (Addr)	8	string	RO
40105	Network mask (Msk)	8	string	RO
40113	Gateway address (Gw)	8	string	RO
40121	DNS1: NaN	8	string	RO
40129	DNS2: NaN	8	string	RO
40137	NTP1: NaN	12	string	RO
40149	NTP2: NaN	12	string	RO
40161	Domain (DomNam) : NaN	12	string	RO
40173	Host Name (HostNam) : NaN	12	string	RO
40185	Pad: : NaN	1	pad	RO

NC 012 block was included for reasons of compatibility and only contains NaN values in the registers 40088 to 40185

5.2.4 Tables I 101, 102, 103 (Inverter Integer Map)

Accumulation of the values

The Inverter Manager can be considered as a virtual inverter that combines the individual measured values of the inverters, where useful.

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40186	Model ID (ID): 103 = SunSpec inverter model (phsABC)	1	uint16	RO
40187	Number of the following Modbus registers in accordance with the PICS table (L): 50	1	uint16	RO

Fixed block:				
40188	AC current (A), in A^{A_SF} (40192): sum of all inverters	1	uint16	RO
40189	Current, line conductor L1 (AphA), in A^{A_SF} (40192) : sum of all inverters	1	uint16	RO
40190	Current, line conductor L2 (AphB), in A^{A_SF} (40192) : sum of all inverters	1	uint16	RO
40191	Current, line conductor L3 (AphC), in A^{A_SF} (40192) : sum of all inverters	1	uint16	RO
40192	Scale factor current (A_SF): -1	1	sunssf	RO
40193	Voltage, line conductor L1 to L2 (PPVphAB), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40194	Voltage, line conductor L2 to L3 (PPVphBC), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40195	Voltage, line conductor L3 to L1 (PPVphCA), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40196	Voltage, line conductor L1 to N (PPVphA), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40197	Voltage, line conductor L2 to N (PPVphB), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40198	Voltage, line conductor L3 to N (PPVphC), in V^{V_SF} (40199) : average value of all inverters	1	uint16	RO
40199	Scale factor voltage (V_SF): -1	1	sunssf	RO
40200	Active power (W), in W^{W_SF} (40201): sum of all inverters	1	int16	RO
40201	Scale factor active power (W_SF): 2	1	sunssf	RO
40202	Power frequency (Hz), in Hz^{Hz_SF} (40203): Average value of all inverters	1	uint16	RO
40203	Scale factor power frequency (Hz_SF): -3	1	sunssf	RO
40204	Apparent power (VA), in VA^{VA_SF} (40205) sum of all inverters	1	int16	RO
40205	Scale factor apparent power (VA_SF): 3	1	sunssf	RO

40206	Reactive power (VAr), in var^{VAr_SF} (40207) sum of all inverters	1	int16	RO
40207	Scale factor reactive power (VAr_SF): 3	1	sunssf	RO
40208	Displacement power factor cos φ (PF)$^{PF\_SF}$ (40209): Average value of all inverters	1	int16	RO
40209	Scale factor displacement power factor (PF_SF): -2	1	sunssf	RO
40210	Total yield (WH), in Wh^{WH_SF} (40212): sum of all inverters	2	acc32	RO
40212	Scale factor total yield (WH_SF): 3	1	sunssf	RO
40213	DC current (DCA), in A^{DCA_SF} (40214): average value of all inverters	1	uint16	RO
40214	Scale factor DC current (DCA_SF): -1	1	sunssf	RO
40215	DC voltage (DCV), in A^{DCV_SF} (40216): average value of all inverters	1	uint16	RO
40216	Scale factor DC voltage (DCV_SF): -1	1	sunssf	RO
40217	DC power (DCW), in W^{DCW_SF} (40218): sum of all inverters	1	int16	RO
40218	Scale factor DC power (DCW_SF): 2	1	sunssf	RO
40219	Internal temperature (TmpCab), in °C^{Tmp_SF} (40223): average value of all inverters	1	int16	RO
40220	Heat sink temperature (TmpSnk), in °C^{Tmp_SF} (40223): average value of all inverters	1	int16	RO
40221	Transformer temperature (TmpTrns), in °C^{Tmp_SF} (40223): NaN	1	int16	RO
40222	Other temperature (TmpOt), in °C*10^{Tmp_SF} (40223): NaN	1	int16	RO
40223	Scale factor temperature (Tmp_SF): -1	1	sunssf	RO
40224	Operating status (St): NaN	1	enum16	RO
40225	Manufacturer-specific status code (StVnd): highest error code not equal to 60, otherwise 60, description see Register 40225 section 5.3.4	1	uint16	RO
40226	Event number (Evt1): NaN	2	bitfield32	RO

40228	Event number (Evt2): NaN	2	bitfield32	RO
40230	Manufacturer-specific event code (EvtVnd1): NaN	2	bitfield32	RO
40232	Manufacturer-specific event code (EvtVnd2): NaN	2	bitfield32	RO
40234	Manufacturer-specific event code (EvtVnd3): NaN	2	bitfield32	RO
40236	Manufacturer-specific event code (EvtVnd4): NaN	2	bitfield32	RO

5.2.5 Table IC 120 (Inverter Controls Nameplate Ratings)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40238	Model ID (ID): 120 = SunSpec nameplate model	1	uint16	RO
40239	Number of the following Modbus registers in accordance with the PICS table (L): 26	1	uint16	RO
Fixed block:				
40240	DER type (DERTyp): 4 = PV device	1	enum16	RO
40241	Continuous active power capability (WRtg), in W^{WRtg_SF} (40242), (SMA: SGridNom*P_LIM_IF_Q).	1	uint16	RO
40242	Scale factor continuous active power capability (WRtg_SF): 3	1	sunssf	RO
40243	Continuous apparent power capability (VARtg) in VA^{VARtg_SF} (40244), (SMA: SGridNom).	1	uint16	RO
40244	Scale factor continuous apparent power capability (VARtg_SF): 3	1	sunssf	RO

40245	Continuous reactive power capability in quadrant 1 (VArRtgQ1), in var^{VArRtg_SF} (40249), (SMA: SGridNom).	1	int16	RO
40246	Continuous reactive power capability in quadrant 2 (VArRtgQ2), in var^{VArRtg_SF} (40249).	1	int16	RO
40247	Continuous reactive power capability in quadrant 3 (VArRtgQ3), in var^{VArRtg_SF} (40249).	1	int16	RO
40248	Continuous reactive power capability in quadrant 4 (VArRtgQ4), in var^{VArRtg_SF} (40249), (SMA: SGridNom).	1	int16	RO
40249	Scale factor continuous reactive power capability (VArRtg_SF): 3	1	sunssf	RO
40250	Continuous RMS current capability (ARtg), in A^{ARtg_SF} (40251), (SMA: SgridNom/(sqrt(3)*Unom_LL)).	1	uint16	RO
40251	Scale factor continuous RMS current capability (Artg_Rtg): 2	1	sunssf	RO
40252	Minimum displacement power factor capability in Q 1 ((PFRtgQ1)$^{PFRtg\_SF}$ (40256).	1	int16	RO
40253	Minimum displacement power factor capability in Q 2 ((PFRtgQ2)$^{PFRtg\_SF}$ (40256).	1	int16	RO
40254	Minimum displacement power factor capability in Q 3 ((PFRtgQ3)$^{PFRtg\_SF}$ (40256).	1	int16	RO
40255	Minimum displacement power factor capability in Q 4 ((PFRtgQ4)$^{PFRtg\_SF}$ (40256).	1	int16	RO
40256	Scale factor minimum displacement power factor capability (PFRtg_SF): -4	1	sunssf	RO
40257	Nominal capacity of the storage device (WHRtg), in Wh^{WHRtg_SF} (40258): NaN	1	uint16	RO
40258	Scale factor nominal capacity (WHRtg_SF): NaN	1	sunssf	RO
40259	Usable Ah capacity of the battery (AhrRtg), in Ah^{AhrRtg_SF} (40260) NaN	1	uint16	RO
40260	Scale factor usable Ah capacity (AhrRtg_SF): NaN	1	sunssf	RO

40261	Maximum energy transfer rate to the storage device (MaxChaRte), in $W^{MaxChaRte\_SF}$ (40262) NaN	1	uint16	RO
40262	Scale factor maximum energy transfer rate to the storage device (MaxChaRte_SF): NaN	1	sunssf	RO
40263	Maximum energy transfer rate from the storage device (MaxDisChaRte), in $W^{MaxDisChaRte\_SF}$ (40264): NaN	1	uint16	RO
40264	Scale factor maximum energy transfer rate from the storage device (MaxDisChaRte_SF): NaN	1	sunssf	RO
40265	Padding register	1	pad	RO

5.2.6 Table IC 121 (Inverter Controls Basic Settings)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40266	Model ID (ID): 121 = SunSpec basic settings model	1	uint16	RO
40267	Number of the following Modbus registers in accordance with the PICS table (L): 30	1	uint16	RO
Fixed block:				
40268	Setting for maximum output active power (WMax), in W^{WMax_SF} (40288), (SMA: SGridNom*P_LIM_IF_Q).	1	uint16	RO
40269	Voltage at the PCC (VRef), in V^{VRef_SF} (40289), (SMA: UNOM_LL).	1	uint16	RW
40270	Offset between PCC and inverter (VRefOfs), in $V^{VRefOfs\_SF}$ (40290), (SMA: UNOMOFFSET).	1	int16	RW
40271	Set value for maximum voltage (VMax), in $V^{VMinMax\_SF}$ (40291): NaN	1	uint16	RO
40272	Set value for minimum voltage (VMin), in $V^{VMinMax\_SF}$ (40291): NaN	1	uint16	RO

40273	Set value for maximum apparent power (VAMax), in VA^{VAMax_SF} (40292): NaN	1	uint16	RO
40274	Maximum reactive power in Q 1 (VArMaxQ1), in var^{VArMax_SF} (40293) : NaN	1	int16	RO
40275	Maximum reactive power in Q 2 (VArMaxQ2), in var^{VArMax_SF} (40293) : NaN	1	int16	RO
40276	Maximum reactive power in Q 3 (VArMaxQ3), in var^{VArMax_SF} (40293) : NaN	1	int16	RO
40277	Maximum reactive power in Q 4 (VArMaxQ4), in var^{VArMax_SF} (40293) : NaN	1	int16	RO
40278	Standard active power increase rate (WGra), in % of (WMax/min)$^{WGra\_SF}$ (40294) : NaN	1	uint16	RO
40279	Set value for minimum power factor in Q 1 (PFMinQ1) $^{PFMin\_SF}$ (40295) : NaN	1	int16	RO
40280	Set value for minimum power factor in Q 2 (PFMinQ2) $^{PFMin\_SF}$ (40295) : NaN	1	int16	RO
40281	Set value for minimum power factor in Q 3 (PFMinQ3) $^{PFMin\_SF}$ (40295) : NaN	1	int16	RO
40282	Set value for minimum power factor in Q 4 (PFMinQ4) $^{PFMin\_SF}$ (40295) : NaN	1	int16	RO
40283	VAr action when changing between charging and discharging (VArAct): NaN 1 = Change excitation type 2 = Do not change excitation type	1	enum16	RO
40284	Calculation method for total apparent power (ClcTotVA): NaN 1 = vectorial 2 = arithmetic	1	enum16	RO
40285	Relative maximum increase rate (MaxRmpRte), in % of WGra^{MaxRmpRte_SF} (40296): NaN	1	uint16	RO
40286	Set value for nominal frequency (ECPNomHz), in Hz^{ECPNomHz_SF} (40297): NaN	1	uint16	RO

40287	Identity of the line conductor in single-phase inverters (ConnPh): NaN 1 = Line conductor L1 2 = Line conductor L2 3 = Line conductor L3	1	enum16	RO
40288	Scale factor for output active power (WMax_SF): 3	1	sunssf	RO
40289	Scale factor reference voltage (VRef_SF): 2	1	sunssf	RO
40290	Scale factor for offset (VRefOfs_SF): 2	1	sunssf	RO
40291	Scale factor maximum and minimum voltage (VMinMax_SF): NaN	1	sunssf	RO
40292	Scale factor apparent power (VAMax_SF): NaN	1	sunssf	RO
40293	Scale factor reactive power (VArMax_SF): NaN	1	sunssf	RO
40294	Scale factor active power increase rate (WGra_SF): NaN	1	sunssf	RO
40295	Scale factor minimum power factor (PFMin_SF): NaN	1	sunssf	RO
40296	Scale factor maximum relative increase rate (MaxRmpRte_SF): NaN	1	sunssf	RO
40297	Scale factor nominal frequency (ECPNomHz_SF): NaN	1	sunssf	RO

5.2.7 Table IC 122 (Inverter Controls Extended Measurements)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40298	Model ID (ID): 122 = SunSpec measurements status model	1	uint16	RO
40299	Number of the following Modbus registers in accordance with the PICS table (L): 44	1	uint16	RO

Fixed block:				
40300	PV inverter availability status (PVConn): NaN Bit 0 = Connected Bit 1 = Available Bit 2 = In operation	1	bitfield16	RO
40301	Battery inverter availability status (StorConn): NaN Bit 0 = Connected Bit 1 = Available Bit 2 = In operation	1	bitfield16	RO
40302	ECP connection status (ECPConn): NaN Bit 0 = Connected	1	bitfield16	RO
40303	Total active power yield (ActWh), in Wh: NaN	4	acc64	RO
40307	Total apparent power yield (ActVAh), in VAh: NaN	4	acc64	RO
40311	Total reactive power yield in Q 1 (ActVArhQ1), in varh: NaN	4	acc64	RO
40315	Total reactive power yield in Q 2 (ActVArhQ2), in varh: NaN	4	acc64	RO
40319	Total reactive power yield in Q 3 (ActVArhQ3), in varh: NaN	4	acc64	RO
40323	Total reactive power yield in Q 4 (ActVArhQ4), in varh: NaN	4	acc64	RO
40327	Reactive power available independently of active power (VArAval), in var^{VArAval_SF} (40328): NaN	1	int16	RO
40328	Scale factor independently available reactive power (VArAval_SF): NaN	1	sunssf	RO
40329	Available reactive power (WAval), in var^{WrAval_SF} (40330): NaN	1	uint16	RO
40330	Scale factor available reactive power (WAval_SF): NaN	1	sunssf	RO

40331	Indicators for thresholds reached (StSetLimMsk): NaN 0 = WMax 1 = VAMax 2 = VArAval 3 = VArMaxQ1 4 = VArMaxQ2 5 = VArMaxQ3 6 = VArMaxQ4 7 = PFMinQ1 8 = PFMinQ2 9 = PFMinQ3 10 = PFMinQ4	2	bitfield32	RO
40333	Indicators for currently active inverter controls (StActCtl): NaN 0 = FixedW 1 = FixedVAR 2 = FixedPF 3 = Volt VAr 4 = Freq watt param 5 = Freq watt curve 6 = Dyn reactive current 7 = LVRT 8 = HVRT 9 = Watt PF 10 = Volt watt 12 = Scheduled 13 = LFRT 14 = HFRT	2	bitfield32	RO
40335	Used time synchronization source (TmSrc), as a URL: NaN	4	string	RO
40339	Seconds since 2000-01-01 00:00 UTC (Tms), in s. NaN	2	uint32	RO
40341	Indicator for currently active grid support procedure(s) (RtSt): NaN 0 = LVRT_ACTIVE 1 = HVRT_ACTIVE 2 = LFRT_ACTIVE 3 = HFRT_ACTIVE	1	bitfield16	RO
40342	Insulation resistance (Ris), in Ω^{Ris_SF} (40343): NaN	1	uint16	RO

40343	Scale factor insulation resistance (Ris_SF): NaN	1	sunssf	RO

5.2.8 Table IC 123 (Immediate Inverter Controls)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40344	Model ID (ID): 123 = SunSpec immediate controls model	1	uint16	RO
40345	Number of the following Modbus registers in accordance with the PICS table (L): 24	1	uint16	RO
Fixed block:				
40346	Time period for grid connection / disconnection (Conn_WinTms), in s: NaN	1	uint16	RO
40347	Interval for grid connection / disconnection (Conn_RvrtTms), in s: NaN	1	uint16	RO
40348	Status grid connection (Conn), (SMA: ReleaseToStart): 0 = Disconnect 1 = Connect	1	enum16	RW
40349	Set power to default value (WMaxLimPct), in % of WMax-$_{WMaxLimPct\_SF}$ (40367), (SMA: Pref).	1	uint16	RW
40350	Time period for change of the power limitation (WMaxLimPct_WinTms), in s: NaN	1	uint16	RO
40351	Permitted reaction time for change of the power limitation (WMaxLimPct_RvrtTms), in s: NaN	1	uint16	RO
40352	Ramp-up time for change from current to new set value (WMaxLimPct_RmpTms), in s: NaN	1	uint16	RO
40353	Limiting (WMaxLim_Ena): 0 = Deactivated 1 = Activated	1	enum16	RO

40354	Set power factor to a certain value (OutPFSet)$^{OutPFSet\_SF}$ (40368), (SMA: PF ref).	1	int16	RW
40355	Time period for change of the power factor (OutPF-Set_WinTms), in s: NaN	1	uint16	RO
40356	Permitted reaction time for change of the power factor (OutPF-Set_RvrtTms), in s: NaN	1	uint16	RO
40357	Ramp-up time for change from current to new set value (OutPF-Set_RmpTms), in s: NaN	1	uint16	RO
40358	Fixed power factor (OutPFSet_Ena), (SMA: Pfext): 0 = Deactivated 1 = Activated	1	enum16	RW
40359	Reactive power (VArWMaxPct), in % of WMax^{VArPct_SF} (40369), (SMA: Qref).	1	int16	RW
40360	Reactive power (VArMaxPct), in % of VarMax^{VArPct_SF} (40369): NaN	1	int16	RO
40361	Reactive power (VArAvalPct), in % of VArAval^{VArPct_SF} (40369): NaN	1	int16	RO
40362	Time period for change of the apparent power limitation (VArPct_WinTms), in s: NaN	1	uint16	RO
40363	Permitted reaction time for change of the apparent power limitation (VArPct_RvrtTms), in s: NaN	1	uint16	RO
40364	Ramp-up time for change from current to new set value (VArPct_RmpTms), in s: NaN	1	uint16	RO
40365	Mode of the percentile reactive power limitation (VArPct_Mod): 1 = in % of WMax	1	enum16	RO
40366	Control of the percentile reactive power limitation (VArPct_Ena), (SMA: Qext): 1 = activated	1	enum16	RW
40367	Scale factor power specification value (WMaxLimPct_SF): -2	1	sunssf	RO
40368	Scale factor power factor (OutPFSet_SF): -4	1	sunssf	RO
40369	Scale factor reactive power (VArPct_SF): -2	1	sunssf	RO

5.2.9 Table IC 124 (Basic Storage Controls)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40370	Model ID (ID): 124 = SunSpec Storage Model	1	uint16	RO
40371	Number of the following Modbus registers in accordance with the PICS table (L): 24	1	uint16	RO

IC 124 block was included for reasons of compatibility and only contains NaN values in the registers 40372 to 40395

5.2.10 Table IC 126 (Static Volt-VAR Arrays)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40396	Model ID (ID): 126 = SunSpec Static Volt-VAR Model	1	uint16	RO
40397	Number of the following Modbus registers in accordance with the PICS table (L): 64	1	uint16	RO

IC 126 block was included for reasons of compatibility and only contains NaN values in the registers 40398 to 40461

5.2.11 Table IC 127 (Parameterized Frequency-Watt)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40462	Model ID (ID): 127 = SunSpec Freq-Watt Param Model	1	uint16	RO
40463	Number of the following Modbus registers in accordance with the PICS table (L): 10	1	uint16	RO

IC 127 block was included for reasons of compatibility and only contains NaN values in the registers 40464 to 40473

5.2.12 Table IC 128 (Dynamic Reactive Current)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40474	Model ID (ID): 128 = SunSpec Dynamic Reactive Current Model	1	uint16	RO
40475	Number of the following Modbus registers in accordance with the PICS table (L): 14	1	uint16	RO

IC 128 block was included for reasons of compatibility and only contains NaN values in the registers 40476 to 40489

5.2.13 Table IC 131 (Watt-Power Factor)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40490	Model ID (ID): 131 = SunSpec Watt-PF Model	1	uint16	RO
40491	Number of the following Modbus registers in accordance with the PICS table (L): 64	1	uint16	RO

IC 131 block was included for reasons of compatibility and only contains NaN values in the registers 40492 to 40555

5.2.14 Table IC 132 (Volt watt)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40556	Model ID (ID): 132 = SunSpec Volt-Watt Model	1	uint16	RO
40557	Number of the following Modbus registers in accordance with the PICS table (L): 64	1	uint16	RO

IC 132 block was included for reasons of compatibility and only contains NaN values in the registers 40558 to 40621

5.2.15 Table I 160 (Multiple MPPT Inverter Extension)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40622	Model ID (ID): 160 = SunSpec Multiple MPPT Inverter Extension Model	1	uint16	RO
40623	Number of the following Modbus registers in accordance with the PICS table (L): 128	1	uint16	RO

IC 160 block was included for reasons of compatibility and only contains NaN values in the registers 40624 to 40750

5.2.16 Table IC 129 (LVRT Must Disconnect)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40752	Model ID (ID): 129 = SunSpec LVRTD Model	1	uint16	RO
40753	Number of the following Modbus registers in accordance with the PICS table (L): 60	1	uint16	RO

IC 129 block was included for reasons of compatibility and only contains NaN values in the registers 40754 to 40813

5.2.17 Table IC 130 (HVRT Must Disconnect)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40814	Model ID (ID): 130 = SunSpec HVRTD Model	1	uint16	RO
40815	Number of the following Modbus registers in accordance with the PICS table (L): 60	1	uint16	RO

IC 130 block was included for reasons of compatibility and only contains NaN values in the registers 40816 to 40875

5.2.18 Table E 307 (Base Meteorological Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40876	Model ID (ID): 307 = SunSpec Base Met Model	1	uint16	RO
40877	Number of the following Modbus registers in accordance with the PICS table (L): 11	1	uint16	RO
Fixed block:				
40878	Ambient Temperature (TmpAmb): values in degrees Celsius (°C)	1	int16	RO
40879	Relative Humidity (RH): NaN	1	int16	RO
40880	Barometric Pressure (Pres) : NaN	1	int16	RO
40881	Wind Speed (WndSpd): value in m/s	1	int16	RO
40882	Wind Direction (WndDir): value in degrees (°)	1	int16	RO

40883	Rainfall (Rain) : NaN	1	int16	RO
40884	Snow Depth (Snw) : NaN	1	int16	RO
40885	Precipitation Type (PPT) : NaN	1	int16	RO
40886	Electric Field (ElecFld) : NaN	1	int16	RO
40887	Surface Wetness (SurWet) : NaN	1	int16	RO
40888	Soil Wetness (SoilWet) : NaN	1	int16	RO

5.2.19 Table E 308 (Mini Met Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40889	Model ID (ID): 308 = SunSpec Mini Met Model	1	uint16	RO
40890	Number of the following Modbus registers in accordance with the PICS table (L): 4	1	uint16	RO
Fixed block:				
40891	Global Horizontal Irradiance (GHI): value in W/m^2	1	uint16	RO
40892	Back of Module Temperature (TmpBOM): value in degrees Celsius (°C)	1	int16	RO
40893	Ambient Temperature (TmpAmb): values in degrees Celsius (°C)	1	int16	RO
40894	Wind Speed (WndSpd): value in m/s	1	uint16	RO

5.3 SUNNY TRIPOWER 60 / SUNNY HIGHPOWER PEAK1 (Unit ID = 126 to 168)

You will find a summary of the SunSpec Modbus registers supported by the inverter as well as a brief description of the register data in the Technical Information "SunSpec Modbus Interface" at www.SMA-Solar.com.

5.3.1 Table C 001 (Common Model)

No. (DEC)	Description/Number Code(s)	CNT (WORD)	Type	Access
Header:				
40001	SunSpec ID (SID): 0x53756e53 = SunSpec Modbus Map	2	uint32	RO
40003	Model ID (ID): 1 = SunSpec common model	1	uint16	RO
40004	Number of the following Modbus registers in accordance with the PICS table (L): 66	1	uint16	RO
Fixed block:				
40005	Manufacturer (Mn): "SMA"	16	string	RO
40021	Model (Md): „STP60 / SHP75 / STPS“	16	string	RO
40037	Options (Opt): "Inverter name"	8	string	RO
40045	Version (Vr): Version number of the installed firmware.	8	string	RO
40053	Serial number (SN) of the device that uses the Modbus unit ID stored in the following register.	16	string	RO
40069	Modbus unit ID of the device (DA): 126 to 167, corresponding to STP60 / SHP75 / STPS 1 to 42	1	uint16	RO
40070	Padding register	1	pad	RO

5.3.2 Table NC011 (Ethernet Link Layer Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40071	Model ID (ID): 11 = SunSpec Ethernet link layer model	1	uint16	RO
40072	Number of the following Modbus registers in accordance with the PICS table (L): 13	1	uint16	RO

NC 011 block was included for reasons of compatibility and only contains NaN values in the registers 40073 to 40085

5.3.3 Table NC 012 (IPv4 Model)

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40086	Model ID (ID): 12 = SunSpec IPv4 model	1	uint16	RO
40087	Number of the following Modbus registers in accordance with the PICS table (L): 98	1	uint16	RO

NC 012 block was included for reasons of compatibility and only contains NaN values in the registers 40088 to 40185

5.3.4 Tables I 101, 102, 103 (Inverter Integer Map)

The following table is valid for each of the three connection models (Model ID). For the inverter, the table with ID = 103 is applicable.

Descriptions of the event IDs

For detailed descriptions of the operating status of the register 40225 as well as of the event IDs of the registers 40230 to 40236, refer to the inverter installation manual.

No. (DEC)	Description / Number code	CNT (WORD)	Type	Access
Header:				
40186	Model ID (ID): 101 = SunSpec inverter model (phsA, phsB, phsC) 102 = SunSpec inverter model (phsAB, phsAC, phsBC) 103 = SunSpec inverter model (phsABC)	1	uint16	RO
40187	Number of the following Modbus registers in accordance with the PICS table (L): 50	1	uint16	RO
Fixed block:				
40188	AC current (A), in A^{A_SF} (40192).	1	uint16	RO
40189	Current, line conductor L1 (AphA), in A^{A_SF} (40192).	1	uint16	RO
40190	Current, line conductor L2 (AphB), in A^{A_SF} (40192).	1	uint16	RO
40191	Current, line conductor L3 (AphC), in A^{A_SF} (40192).	1	uint16	RO
40192	Scale factor current (A_SF): -2	1	sunssf	RO
40193	Voltage, line conductor L1 to L2 (PPVphAB), in V^{V_SF} (40199).	1	uint16	RO
40194	Voltage, line conductor L2 to L3 (PPVphBC), in V^{V_SF} (40199).	1	uint16	RO
40195	Voltage, line conductor L3 to L1 (PPVphCA), in V^{V_SF} (40199).	1	uint16	RO
40196	Voltage, line conductor L1 to N (PhVphA), in V^{V_SF} (40199).	1	uint16	RO

40197	Voltage, line conductor L2 to N (PhVphB), in V^{V_SF} (40199).	1	uint16	RO
40198	Voltage, line conductor L3 to N (PhVphC), in V^{V_SF} (40199).	1	uint16	RO
40199	Scale factor voltage (V_SF): -1	1	sunssf	RO
40200	Active power (W), in W^{W_SF} (40201).	1	int16	RO
40201	Scale factor active power (W_SF): 1	1	sunssf	RO
40202	Power frequency (Hz), in Hz^{Hz_SF} (40203).	1	uint16	RO
40203	Scale factor power frequency (Hz_SF): -1	1	sunssf	RO
40204	Apparent power (VA), in VA^{VA_SF} (40205).	1	int16	RO
40205	Scale factor apparent power (VA_SF): 1	1	sunssf	RO
40206	Reactive power (VAr), in var^{VAr_SF} (40207).	1	int16	RO
40207	Scale factor reactive power (VAr_SF): 1	1	sunssf	RO
40208	Displacement power factor cos φ $(PF)^{PF\_SF}$ (40209).	1	int16	RO
40209	Scale factor displacement power factor (PF_SF): -1	1	sunssf	RO
40210	Total yield (WH), in Wh^{WH_SF} (40212).	2	acc32	RO
40212	Scale factor total yield (WH_SF): 0	1	sunssf	RO
40213	DC current (DCA), in A^{DCA_SF} (40214).	1	uint16	RO
40214	Scale factor DC current (DCA_SF): -2	1	sunssf	RO
40215	DC voltage (DCV), in A^{DCV_SF} (40216)	1	uint16	RO
40216	Scale factor DC voltage (DCV_SF): -1	1	sunssf	RO
40217	DC power (DCW), in W^{DCW_SF} (40218).	1	int16	RO
40218	Scale factor DC power (DCW_SF): 1	1	sunssf	RO
40219	Internal temperature (TmpCab), in $°C^{Tmp\_SF}$ (40223)	1	int16	RO
40220	Heat sink temperature (TmpSnk), in $°C^{Tmp\_SF}$ (40223)	1	int16	RO
40221	Transformer temperature (TmpTrns), in $°C^{Tmp\_SF}$ (40223): NaN	1	int16	RO
40222	Other temperature (TmpOt), in $°C^{Tmp\_SF}$ (40223): NaN	1	int16	RO

40223	Scale factor temperature (Tmp_SF): 0	1	sunssf	RO
40224	Operating status (St): NaN	1	enum16	RO

40225 — Manufacturer-specific status code (StVnd): — 1 — uint16 — RO

Status code (dec)	Description
0	Energy supply of the processor printed circuit board is defective.
10	The boot loader starts as soon as the device is supplied with energy again. The boot loader receives the application from the Inverter Manager when an update is necessary.
20	The SunSpec configuration model has been applied and remains in this status for a short period (a few ms). This status will be automatically switched to the next status.
30	Wait until all parameters and settings have been received from the Inverter Manager. When the Inverter Manager sends the START command, the start process will be set to the next status.
40	The Inverter Manager sends the active settings to the inverter. When the inverter has received all settings and is ready for operation, a message will be sent to the Inverter Manager and the start-up process is resumed.
50	The inverter starts the charging of the DC link and waits until the DC bus is charged.
51	The inverter performs a self test for utility grid connection before it connects to the utility grid. The self test includes the insulation resistance, the residual-current device, switch and relay.
52	The inverter monitors the utility grid for a certain time before it connects to the utility grid, depending on the selected country code. During this monitoring period, the utility grid should be free of errors. If an error occurs during this period the connection to the grid is postponed.

	53	The inverter waits until a short grid interruption is over, before it reconnects to the utility grid. If the error is not over during the waiting time, a repeat self test is necessary.		
	54	The inverter waits until an internal measured value returns to the permitted range (e.g. temperature too high), before it reconnects to the utility grid.		
	60	The inverter should run in this mode for the majority of the time: grid feed-in runs and the utility grid is free of errors.		
	70	The inverter is disconnected from the utility grid and stays in fail safe mode until powered off or rebooted.		
	80	If the inverter can not perform grid feed-in for a certain time (a few minutes), it switches to this status.		
40226	Event number (Evt1): NaN		2	bitfield32 RO
40228	Event number (Evt2): NaN		2	bitfield32 RO

40230 — 2 — bitfield32 — RO

Manufacturer-specific event code (EvtVnd1), (SMA: messages regarding the AC utility grid):

Event bit	Assigned event IDs
0	1, 2, 3 (events)
1	4, 5, 6 (events)
2	7, 8, 9 (events)
3	10, 11, 12 (events)
4	13, 14, 15 (events)
5	16, 17 (events)
6	18, 25, 26, 27, 28, 29, 30, 38, 39, 41, 42, 43, 44, 45, 48, 49, 50 (events)
7	19, 20, 21 (events)
8	22, 23, 24 (events)
9	51, 52, 53 (events)
10	31, 32, 33 (events)
11	54, 55, 56 (events)
12	34 (event)
13	35, 36, 37 (events)

	14	40 (event)			
	15	61 (event)			
	16	62 (event)			
	25	211 (warning)			
	26	278 (warning)			
40232	Manufacturer-specific event code (EvtVnd2), (SMA: messages regarding reliability):		2	bitfield32	RO
	Event bit	**Assigned event IDs**			
	0	225-240, 275			
	1	242, 243, 245, 274, 353, 356 to 361			
	2	264, 266			
	3	282			
	4	100			
	5	350, 351, 352, 366			
40234	Manufacturer-specific event code (EvtVnd3), bits 0 to 31, (SMA: messages regarding the DC grid):		2	bitfield32	RO
	Event bit	**Assigned event IDs**			
	0	103			
	1	115			
40236	Manufacturer-specific event code (EvtVnd4), (SMA: messages of the inverters):		2	bitfield32	RO
	Event bit	**Assigned event IDs**			
	0	201, 202, 203, 205, 207, 208 (events)			
	1	209, 210 (events)			
	2	258 (event)			
	3	216, 217, 218 (events)			
	4	219, 220, 221 (events)			
	5	252, 253, 254 (events)			
	6	213, 214, 215 (events)			
	7	263 (event)			
	8	279 (event)			
	9	280 (event)			
	10	281 (event)			
	11	283 (event)			

12	47 (event)
13	323 (event)
24	260 (warning)
25	272 (warning)
26	273 (warning)

5.4 Direct Marketer Interface (Unit ID = 200)

The individual registers are described in the following table.

5.4.1 Tabelle SMA.DM (Direct Marketing)

No. (DEC)	Description/Number Code(s)	CNT (WORD)	Type	Access
1	Specified output limitation through direct marketer. Percentage value regarding the maximum active power of system (Reg. 6) with two decimal places. A value of 10000 corresponds to 100%. A value of 0x8000 (NaN) shows that no value has been specified. Valid values from 0 to 10000.	1	uint16	RW
2	Manual output limitation that has been set via Sunspec Modbus. Percentage value regarding the maximum active power of system (Reg. 6) with two decimal places. A value of 10000 corresponds to 100%.	1	uint16	RO
3	Output limitation through the electric utility company that has been set via the IO box. Percentage value regarding the maximum active power of system (Reg. 6) with two decimal places. A value of 10000 corresponds to 100%. A value of 0x8000 (NaN) shows that no value has been specified.	1	uint16	RO
4	Minimum of all output limitations. The nominal PV system power is derated to this value. Percentage value regarding the maximum active power of the system with two decimal places. A value of 10000 corresponds to 100%.	1	uint16	RO

5	Currently, the active power of the system is shown in kW with one decimal place. A value of 600 corresponds to 60.0 kW.	1	uint16	RO
6	Maximum active power of the system without decimal place. A value of 60 corresponds to 60 kW.	1	uint16	RO
7	Meter for checking the connection (Watchdog). The meter is increased by one every 200 ms. After reaching 65535, the meter starts again with 0.	1	uint16	RO

5.5 Manual Restart (Unit ID = 201)

5.5.1 Tabelle SMA.MR (Manual Restart)

No. (DEC)	Description/Number Code(s)	CNT (WORD)	Type	Access
1	A value of 1 initiates the manual restart. Then the register is internally reset to 0 by automated means and the function is deactivated. 1 = Activated 0 = Deactivated	1	uint16	RW

6 Troubleshooting

Problem	Cause and corrective measures
The Inverter Manager cannot be accessed by the Modbus client.	The correct IP address for the Inverter Manager may not be set in the Modbus client. **Corrective measures:** • Read off the IP address of the Inverter Manager (see router manual). Ensure that the correct IP address for the Inverter Manager is set in the Modbus client (see the Modbus client manufacturer's manual).
	The firewall may not be set correctly. **Corrective measures:** • Enable port 502 in the firewall (see firewall manual).
The Inverter Manager does not send a reply within the reply time specified by the Modbus client.	The Modbus server in the Inverter Manager may be currently overloaded. **Corrective measures:** • Extend the response time set in the Modbus client successively by one second respectively.
A NaN value is reported in the Modbus client (see Section 3.6 "SunSpec Data Types and NaN Values", page 13).	You may be trying to read from a Modbus register that is not supported by the inverter. **Corrective measures:** • Contrast and compare the available measured values for your SMA device with the Modbus registers requested by this SMA device (see Section 5 "SunSpec Modbus Profile – Allocation Tablesn", page 15).
	You may be trying to read from a Modbus register that is not defined in the SunSpec Modbus profile. **Corrective measures:** • Remove the register address used from the data processing. • Install a newer version of the Modbus profile via a firmware update.

	The NaN value 255 is reported. You may be trying to read a configuration of a non-existent device. **Corrective measures:** • Set the Unit IDs = 125 to 167 in the Modbus client for the desired SMA device. • Check if the configuration read is supported by the device.
	You may be trying to read from a write-only Modbus register. **Corrective measures:** • Read off the access type of the affected register from the "Access" column of the corresponding assignment table and correct it in the Modbus client.
Modbus exception 1 "Illegal Function" is reported in the Modbus client.	You may be trying to write to a data block whose target address range has registers that are not writable. **Corrective measures:** • Check whether all registers to be written to are writable.
Modbus exception 2 "Illegal Data Address" is reported in the Modbus client.	You may be trying to write to a Modbus register that is not defined in the SunSpec Modbus profile. **Corrective measures:** • Check the Modbus address to be written to in the Modbus client for errors.
	You may be trying to read or write to a data block whose start or end address does not correspond with that of a register (alignment not correct). **Corrective measures:** • Check the start or end address of the data block. • Check the register at the start or end address of the data block to be read for consistency. It may be that one of the two registers is inconsistent.
	You may be trying to write to a data block and one of the registers to be written to are not supported by the device. **Corrective measures:** • Check that the register to be written to is provided by your SMA device (Technical Information SMA Modbus Interface at www.SMA-Solar.com).

Modbus exception 3 "Illegal Data Value" is reported in the Modbus client.	You may be trying to write to a data block (Modbus commands 0x10 and 0x17) and one of the values has a data type that is not permitted. **Corrective measures:** • Read off the data type of the register to be written to from the "Type" column of the corresponding assignment table and correct it in the Modbus client.
Modbus exception 4 "Slave Device Failure" is reported in the Modbus client.	You may be trying to read or write to a register of a device, but are using a unit ID that is not permitted. **Corrective measures:** • Set the Unit IDs = 125 to 167 in the Modbus client for the desired SMA device.
Other Modbus exceptions	**Corrective measures:** • For Modbus exceptions, see "Modbus Application Protocol Specification" at http://www.modbus.org/specs.php.
Other errors	**Corrective measures:** • For troubleshooting on the SMA devices, use the error code shown in the display or LCS tool. To decrypt the event messages of inverters, you require additional information (for event messages, see the inverter installation manual at www.SMA-Solar.com).

7 Technical data

7.1 Modbus Communication Ports

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

Network protocol	Communication port
TCP	502

Communication port not able to be changed

The communication port used for Modbus TCP - 502 - can not be changed.

7.2 Data Processing and Time Behavior

In this section, you will find typical data processing and reaction times of the Modbus interface.

Minimum read-write frequency

The minimum frequency with which data can be requested via the Modbus protocol from the Inverter Manager or written to the Inverter Manager is 1 Hz. This means that at most one Modbus command per second is permitted (for supported Modbus commands, see Section 3.5 "Reading and Writing of Data", page 12).

8 Contact

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

- Modbus 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 system.

Germany Austria Switzerland	SMA Solar Technology AG Niestetal Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (communication products): +49 561 9522-2499 Fuel Save Controller (PV Diesel Hybrid Systems): +49 561 9522-3199 Sunny Island, Sunny Boy Storage, Sunny Backup: +49 561 9522-399 Sunny Central, Sunny Central Storage: +49 561 9522-299 SMA Online Service Center: www.SMA-Service.com	Belgium Belgique België Luxemburg Luxembourg Netherlands	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730 SMA Online Service Center: www.SMA-Service.com
		Česko Magyarország Slovensko	SMA Service Partner TERMS a.s. +420 387 6 85 111 SMA Online Service Center: www.SMA-Service.com
		Türkiye	SMA Service Partner DEKOM Ltd. Şti. +90 24 22430605 SMA Online Service Center: www.SMA-Service.com

France	SMA France S.A.S. Lyon +33 472 22 97 00 SMA Online Service Center: www.SMA-Service.com	Ελλάδα Κύπρος	SMA Service Partner AKTOR FM. Αθήνα +30 210 8184550 SMA Online Service Center: www.SMA-Service.com
España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99 SMA Online Service Center: www.SMA-Service.com	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899 SMA Online Service Center: www.SMA-Service.com
Italia	SMA Italia S.r.l. Milano +39 02 8934-7299 SMA Online Service Center: www.SMA-Service.com	Australia	SMA Australia Pty. Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	SMA Solar (Thailand) Co., Ltd. กรุงเทพฯ +66 2 670 6999	□□□□	SMA Technology Korea Co., Ltd. □□ +82-2-520-2666

South Africa	SMA Solar Technology South Africa Pty Ltd. Cape Town 08600SUNNY (08600 78669) International: +27 (0)21 826 0600 SMA Online Service Center: www.SMA-Service.com	Argentina Brasil Chile Perú	SMA South America SPA Santiago de Chile +562 2820 2101
Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (+800 762 7378423) SMA Online Service Center: www.SMA-Service.com		

9 Index

H

I

L

M

N

O

P

R

S

T

U

V

W

SMA Solar Technology

www.SMA-Solar.com