Technical Information

SMA Modbus® Interface

ennexOS

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1 Information on this Document

1.1 Validity

This document is valid for:

Product	Type
Sunny Boy Smart Energy	SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50 / SBSE8.0-50 / SBSE9.9-50
Sunny Boy Smart Energy-US	SBSE3.8-US / SBSE4.8-US / SBSE5.8-US / SBSE7.7-US / SBSE9.6-US / SBSE11.5-US
Sunny Tripower Hybrid X	STPH5-60 / STPH6-60 / STPH8-60 / STPH10-60 / STPH12-60 / STPH15-60 / STPH20-70 / STPH25-70 / STPH30-70
Sunny Tripower X 25	STP 12-50 / STP 15-50 / STP 20-50 / STP 25-50
Sunny Tripower X 30-US	STP 13-US (208V) / STP 20-US-50 / STP 25-US-50 / STP 30-US-50
Sunny Tripower X 60	STP 50-80 / STP 60-80
Sunny Tripower X 70-US	STP 27-US-80 / STP 50-US-80 / STP 62.5-US-80 / STP 70-US-80
Sunny Tripower Storage X	STPS 30-20 / STPS 50-20
Sunny Island X	SI30-20 / SI50-20
Sunny Island X-US	SI27US-10 (208V) / SI40US-10 / SI60US-10
Sunny Highpower Storage	SHPS 100-30 / SHPS 150-30 / SHPS 172-30 / SHPS 180-30
Sunny Highpower Storage-US	SHPS 125-US-30 / SHPS 150-US-30 / SHPS 172-US-30 / SHPS 180-US-30
SMA Data Manager M	EDMM-10 / EDMM-US-10 / EDMM-20
SMA Data Manager L	EDML-10
SMA eCharger	EVC22-3AC-20

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 Content and Structure of this Document

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 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#**

1.6 Additional Information

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

Title and information content	Type of information
"Direct Marketing Interface"	Technical Information
"SMA Modbus ®-interface - ennexOS" Information on the SMA Modbus interface	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 GRID GUARD 10.0 - Grid Management Services via Inverter and System Controller"	Technical Information
Modbus Application Protocol Specification	Modbus specification under https://modbus.org/modbus-specifications

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 selling
- Interface for direct selling Modbus TCP The Modbus interface can only be used via the Modbus TCP protocol.

The Modbus server function described is part of ennexOS-based System Manager products. For Modbus client interfaces, differing or additional information may apply.

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.

Alterations to the SMA products, e.g., changes or modifications, are only permitted with the express written permission of SMA Solar Technology AG. Unauthorized alterations as well as failure to observe the documentation will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

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.

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

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").

The setpoints for grid management services for controlling and limiting the 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").

NOTICE

Manipulation of system data in networks

You can connect the supported SMA products to the Internet. With an active Internet connection and router configuration, there is a risk that unauthorized users can access and manipulate the data of your system.

- Set up a firewall.
- Close unnecessary network ports.
- If absolutely necessary, only enable remote access via a virtual private network (VPN).
- Do not use the port forwarding feature. This also applies to the used Modbus ports.
- Disconnect system components from other network components (network segmentation).

Access to data points after activating the Modbus interface

The read-only access to data points is possible after activating the Modbus interface. The write-only access to all data points is possible without further input of a password via Modbus.

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

3 Product overview

3.1 Modbus Protocol

The Modbus Application Protocol is an industrial communication protocol that is currently used in the solar sector mainly for PV system communication. 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 product with Modbus server interface).

The SMA Modbus profile and SunSpec Modbus profile are used for SMA products. For SMA inverters, the SunSpec Modbus profile via Unit ID 126 is used as well.

3.2 SMA Modbus Profile

The SMA Modbus profile contains definitions for SMA products. All necessary data on SMA products were assigned to the corresponding Modbus registers for the definition. Not all SMA products support all Modbus registers of the SMA Modbus profile.

3.3 System Topology

An SMA product with Modbus interface is connected with the SCADA system of the electric utility company or the grid operator via Ethernet. The Modbus interface also enables communication via the Modbus protocol. From the perspective of the Modbus protocol, an SMA product with Modbus interface constitutes a Modbus server that supports the SMA Modbus profile.

3.4 Addressing and Data Transmission

3.4.1 Unit ID

The Unit ID is a superordinate addressing type in the Modbus protocol.

The following tables shows the Unit IDs supported by SMA products:

Unit ID	Explanation	SMA Inverters	Subordinate SMA device	SMA product as System Manager
1	This Unit ID is reserved for information on the SMA product.	✓	–	✓
2	This unit ID is reserved for the system parameters, measured values and setpoints.	✓	–	✓
3	This unit ID is reserved for the device parameters, measured values and setpoints.	✓	✓	✓

Unit ID	Explanation	SMA Inverters	Subordinate SMA device	SMA product as System Manager
10+	This unit ID refers to a device connected under unit ID 10 or higher whose data are assigned to this unit ID.	-	–	✓
126	This Unit ID represents the data model of the device via Modbus/SunSpec as long as the device supports this.	✓	-	-

3.4.2 Register Address, Register Width and Data Block

A Modbus register is 16 bits wide. For wider data items, connected Modbus registers are used and considered as data blocks. The address of the first Modbus register in a data block is the start address of the data block.

3.4.3 Data Transmission

In accordance with the Modbus specification, only a specific volume of data can be transported in a single data transmission in a simple protocol data unit (PDU). The data also contains function-dependent parameters such as the function code, start address or number of Modbus registers to be transmitted. The amount of data depends on the Modbus command used and has to be taken into account during data transmission (see Section 3.4.4 "Reading and Writing of Data", page 10).

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. This transmission convention also applies to larger data types (32 or 64 bits), for which the term "Big-Big" is usually used.

3.4.4 Reading and Writing of Data

The Modbus interface can only be used via the protocol Modbus TCP. Using Modbus TCP enables read and write access to the Modbus register. SMA products with Modbus interface use the Modbus TCP as standard. For client interfaces (e.g. to link further Modbus devices such as metering devices, sensors, I/O modules) Modbus/RTU can also be used provided an RS-485 interface is present.

Access type	Explanation
RO (Read-Only)	Read only
RW (Read-Write)	Read and write

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

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

3.4.4.1 Error messages on reading or writing individual Modbus registers

If a Modbus register is accessed, which is not contained in a 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.

3.4.4.2 Reading or writing of data blocks

To prevent inconsistencies, data blocks of associated Modbus registers or Modbus register ranges must be read or written consecutively. The 4 bytes of a 64-bit Modbus register must be read, for example, with an operation in a 64-bit SMA data type (Read Multiple Registers).

3.4.4.3 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 ("Not a Number") is used for their 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.

3.4.4.4 Error message on writing multiple Modbus registers as a data block

If multiple registers are written in the data block (Modbus command 0x10) and an error occurs when writing, the process continues with the next register in the data block. 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.

3.4.4.5 Modbus exceptions

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

3.4.5 SMA 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. The SMA data types describe the data widths of the assigned values:

Type	Explanation	NaN value decimal (hexadecimal)
S16	A signed word (16-bit)	32768 (0x8000)
S32	A signed double word (32-bit)	2147483648 (0x8000 0000)
STR32	32 byte data field, in UTF8 format.	0 (0)
U16	An unsigned word (16-bit)	65535 (0xFFFF)
U32	An unsigned double word (32-bit)	4294967295 (0xFFFF FFFF)
U32	Status values are usually transmitted as so-called tags	16777213 (0xFFFF FD)
U64	An unsigned quadruple word (64-bit)	18446744073709551615 (0xFFFF FFFF FFFF FFFF)

3.4.6 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
ENUM or TAGLIST	Coded numerical values. The breakdown of the possible codes can be found directly under the designation of the Modbus register in the assignment tables.
FIX0	Decimal number, commercially rounded, without decimal place.
FIX1	Decimal number, commercially rounded, one decimal place.
FIX2	Decimal number, commercially rounded, two decimal places.
FIX3	Decimal number, commercially rounded, three decimal places.
FIX4	Decimal number, commercially rounded, four decimal places.
FUNCTION_SEC	The date saved in the Modbus register will be transmitted in the event of a change to a function and starts this. After execution of the function, no status value is set. A security question must be executed in the client software prior to execution of the function.
FW	Firmware version (see Section 3.4.7 "SMA Firmware Data Formats", page 12)
HW	Hardware version (e.g. 24)
IP4	4-byte IP address (IPv4) of the form XXX.XXX.XXX.XXX.
RAW	Text or number. A RAW number has no decimal places and no thousand or other separation indicators.
TEMP	Temperature values are stored in special Modbus registers in degrees Celsius (°C), in degrees Fahrenheit (°F), or in Kelvin K. The values are commercially rounded, with one decimal place.
TM	UTC time, in seconds
UTF8	Data in UTF8 format.
DURATION	Time in seconds
DT or Date_Time	Date/time (Transmission in seconds since 1970-01-01)

3.4.7 SMA Firmware Data Formats

Four values are extracted from the delivered double word (DWORD) within the corresponding Modbus register. 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

Release type	Release-type coding	Explanation
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

If the firmware version of a product is specified, such as 1.05.10.R, the values consisting of a double word (DWORD) correspond to:

- Major: 1
- Minor: 05
- Build: 10
- Release type: 4 (Hex: 0x1 0x5 0xA 0x4)

3.5 Modbus Ports

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

Network protocol	Modbus port
TCP	502

Using free ports

Only use free ports when using another port than 502. 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 Modbus port

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

3.6 Data Processing and Time Behavior

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

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. Cyclical changing of these parameters leads to destruction of the flash memory of the SMA products. These parameters are marked with ⚠ (see Technical Information "Parameters and Measured Values").

Parameters for grid management services to control and limit the nominal PV system power are an exception. Such parameters can be changed cyclically. These parameters are marked with (see Technical Information "Parameters and Measured Values").

- Do not change device parameters cyclically.
- 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").

Processing time of setpoints

The signal runtime of the SMA product with Modbus interface is usually 150 ms. The signal runtime is the time required by the SMA product to process incoming Modbus setpoints.

Implementation time/reaction time of setpoints

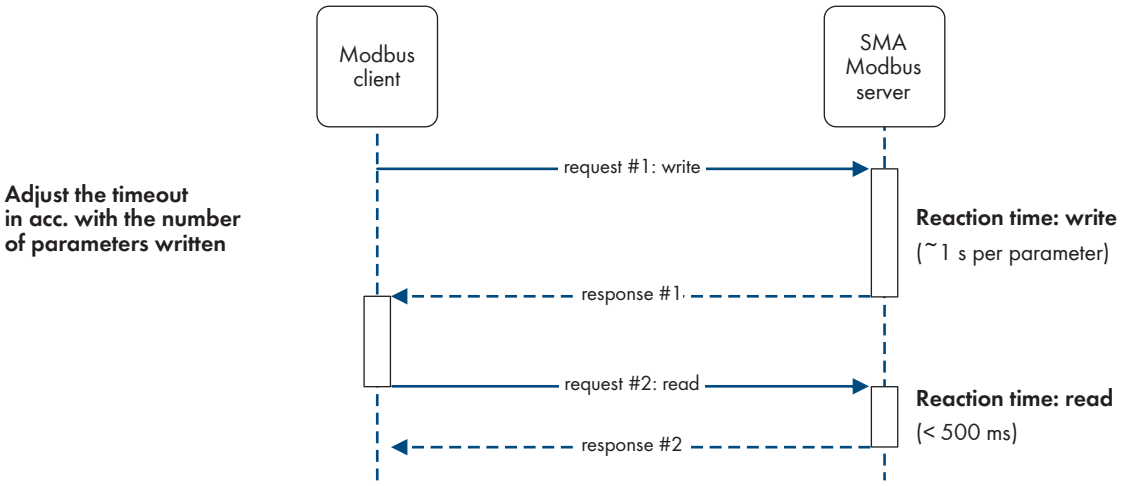
The physical reaction time of SMA products is normally approx. 1 second. The physical reaction time is the time between the changing of setpoints in a SMA product until their physical implementation. Such a change would be, for example, changing cos φ.

Data transfer interval via the Modbus protocol

For system stability reasons, the time period between data transfers via the Modbus protocol should be at least 1 second. No more than five parameters and measured values should be simultaneously transmitted. For larger, contiguous data ranges, it is best to use blockread functions.

Processing time of parameters

The response time is the time between a query and its answer. For write queries, this is around 1 second per parameter and for read queries around 500 ms. The response time between the write command via Modbus and the response via Modbus is up to 1 second. When reading back parameter changes, it is necessary to either wait for the response or take the response time into account.



3.7 Number codes of time zones

For products with up to 4 digital inputs, the following number codes are to be used. The 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 addition, take account of local regulations for summer/winter time.

City/Country	Code	Time zone
UTC-AUTO	9499	AUTO
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, Istanbul	9504	UTC+03:00
Baku	9508	UTC+04:00

City/Country	Code	Time zone
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

City/Country	Code	Time zone
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+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

City/Country	Code	Time zone
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, Lower 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

3.8 Frequently Used Number Codes

The following table contains number codes which, as function coding in data format ENUM, are frequently used in the SMA Modbus profile.

The event numbers of the SMA products are not decrypted with the number codes in this document.

The event numbers of the SMA products are device-specific and cannot be decrypted with the number codes in this document. To decrypt the event numbers of low or medium-power inverters, you require additional information such as operating parameters and measured values (see Technical Information with device-specific overview of all parameters and measured values and their setting options "Measured Values and Parameters" at www.SMA-Solar.com).

Code	Explanation	Code	Explanation
35	Errors	2055	Status digital inlet: DI1

Code	Explanation	Code	Explanation
51	Closed	2056	Status digital inlet: DI1, DI2
55	Communication impaired	2057	Status digital inlet: DI1, DI2, DI3
276	Instantaneous value	2058	Status digital inlet: DI1, DI2, DI3, DI4
295	MPP	2059	Status digital inlet: DI1, DI2, DI4
303	Off	2060	Status digital inlet: DI1, DI3
307	Ok	2061	Status digital inlet: DI1, DI3, DI4
308	On	2062	Status digital inlet: DI1, DI4
309	Operation	2063	Status digital inlet: DI2
311	Open	2064	Status digital inlet: DI2, DI3
336	Contact the manufacturer	2065	Status digital inlet: DI2, DI3, DI4
337	Contact the installer	2066	Status digital inlet: DI2, DI4
338	Invalid	2067	Status digital inlet: DI3
381	Stop	2068	Status digital inlet: DI3, DI4
455	Warning	2069	Status digital inlet: DI4
461	SMA (manufacturer specification)	3353	Modus: Control (open loop control)
1041	leading	3354	Modus: Control (closed loop control)
1042	lagging	4300	Fallback
1069	Reactive power / voltage characteristic curve Q(V)	4306	Single droop
1070	Reactive power Q, direct setpoint	4307	Droop with 4 supporting points and hysteresis
1071	Reactive power const. Q (kVAr)	4308	Droop with 6 supporting points
1072	Q specified by PV system control	4309	Droop with 8 supporting points
1073	Reactive power Q(P)	4316	Single droop with hysteresis
1074	cos φ, direct setpoint	4317	Droop with deadband
1075	cos φ, setpoint via system control	4318	Droop with deadband and hysteresis
1076	cos φ(P) characteristic curve	4354	Maximum active power output
1077	Active power limitation P (W)	4405	Maximum active power WMax
1078	Active power limitation P (%) of PMAX	4406	Maximum reactive power VArMax
1079	Active power limitation P via system control	4443	Current power
1387	Reactive power Q, setpoint via analog input	4444	Potential power
1388	cos φ, setpoint via analog input	4450	Q limitation

Code	Explanation	Code	Explanation
1389	Reactive power / voltage characteristic curve Q(U) with hysteresis and deadband	4520	Mean value of the phase voltages
1390	Active power limitation P via analog input	4521	Maximum phase voltage
1391	Active power limitation P via digital inputs	4562	cos φ(V) characteristic curve
1392	Errors	4623	Reactive power, analog input
1393	Wait for PV voltage	4624	Reactive power, Modbus
1394	Wait for valid AC grid	4626	Displacement power factor cos φ, analog input
1395	DC area	4627	Displacement power factor cos φ, Modbus
1396	AC grid	4714	Reactive power, digital input
1438	Automatic	4903	Voltage regulation, manually set in Volt
1455	Emergency stop	4904	Voltage regulation, manually set in p.u.
1466	Waiting	4905	Voltage regulation, external setpoint
1467	Starting	4921	No precipitation
1468	MPP search	4922	Liquid precipitation (e.g. rainfall)
1469	Shutdown	4923	Solid precipitation (e.g. snow)
1470	Disturbance	4924	Unspecified precipitation
1471	Warning/error e-mail OK	4925	freezing rain
1472	Warning/error e-mail not OK	4926	Sleet
1473	System info e-mail OK	4927	Hail
1474	System info e-mail not OK		
1475	Error e-mail OK		
1476	Error e-mail not OK		
1477	Warning e-mail OK		
1478	Warning e-mail not OK		
1479	Wait after grid interruption		
1480	Wait for electric utility company		

3.8.1 Numeric Codes for Digital Inputs

The following table shows the combination of digital inputs D4 to D1 along with the corresponding instantaneous values and numeric codes. The instantaneous values 0, 1, 2, 4, and 8 represent single signals that are typically used by ripple control receivers.

Instantaneous value display	Code	D4	D3	D2	D1
0	./.	0	0	0	0

Instantaneous value display	Code	D4	D3	D2	D1
1	2055	0	0	0	1
2	2063	0	0	1	0
3	2056	0	0	1	1
4	2067	0	1	0	0
5	2060	0	1	0	1
6	2064	0	1	1	0
7	2057	0	1	1	1
8	2069	1	0	0	0
9	2062	1	0	0	1
10	2066	1	0	1	0
11	2059	1	0	1	1
12	2068	1	1	0	0
13	2061	1	1	0	1
14	2065	1	1	1	0
15	2058	1	1	1	1

4 Configuration

In order to be able to use Modbus registers for grid management services, the grid management service must be configured on the SMA System Manager. In connection with an energy meter, an SMA System Manager takes over closed-loop control at the point of interconnection and can control or regulate subordinate SMA devices. SMA System Managers are certified according to VDE-AR-N-4105 and VDE-AR-N-4110 as power generation systems "EZA controllers". 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.

Requirements:

☐ 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).

Procedure:

1. Select the menu item **Grid management services** in the menu **Configuration**.
2. Select the button **Configuration and activation** in the **Active power method** and **Reactive power method** row.
3. Select the operating mode **Closed loop** or **Open loop**.
4. Select the signal source **Modbus**.
5. Make settings in accordance with the grid operator's specifications and confirm each step by clicking on [**Continue**].
6. Click on [**Save**].

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