Plant Monitoring

SUNNY WEBBOX MODBUS-Interface

User Manual

Interface description &

Assignment Tables

Explanation of Symbols Used

To ensure the best use of this document and the safe deployment of the assembly during commissioning, operation and maintenance, please note the following explanations of the symbols used in this document.

This symbol identifies a fact that is important for the optimal operation of your product. For this reason, please read these sections carefully.

This symbol identifies an issue which, if ignored, could result in damage to components or personal hazard. Please read these sections very carefully.

This symbol indicates an example.

Table of Contents

1 Introduction

The MODBUS Application Protocol (MBAP) is an industrial communication protocol that is currently in the solar sector mainly used for plant communications in PV power stations in the USA. It supports the protocol variants MODBUS TCP/IP, MODBUS RTU as well as MODBUS ASCII. The MODBUS RTU protocol is for example used for series communication via RS485. MODBUS TCP/IP is respectively used for communication via Ethernet.

The MODBUS protocol has been developed for reading data from or writing data to clearly defined data areas. It is not prescribed what data is within which data area; this information must be defined specifically for a device. The fixed definition for a device is the MODBUS Profile of the device. With knowledge of the MODBUS Profile a MODBUS Master (Client) can access the data of the MODBUS Slave (Server). This document describes the MODBUS Profile for SMA devices, the SMA MODBUS Profile.

The SMA MODBUS Profile applies to all SMA devices which can be connected via MODBUS (see section "System Requirements", page 6). The implementation of particular SMA devices is individually defined in the SMA MODBUS Profile. An SMU (String Monitoring Unit) for example only gives the information on the string currents, whereas an inverter for example provides the opportunity to call up power and voltage.

It is not intended to provide every SMA device with a physical MODBUS interface. In order to enable access to data of an SMA device that is not MODBUS capable, a special gateway is required. To this end the functional range of the Sunny WebBox has been extended, so that it serves as both hardware and software interface.

The SMA MODBUS Profile allows for a simple configuration of the gateway and therefore access to the connected SMA devices.

1.1 Acronyms and Abbreviations

NaN	Not a Number; no useable value has been returned
RO	Read Only; value can only be read
RW	Read / Write; value can be read and written
MBAP	MODBUS Application Protocol; protocol for the Modbus of the "Modbus Organization, Inc." company
Device ID	SMA device ID; numerical value, which identifies a certain SMA device type, e.g. 155 = Sunny Central 250 US version, 156 = Sunny Central 500 US version, 47 = Sunny WebBox 1.0
DT, FW, RAW, FIXn	SMA data formats; see section SMA Data formats, page 14
ADR [DEZ]	MODBUS start address as decimal value
CNT [2 Bytes]	Object length (number of MODBUS registers). One register contains 2 bytes.
Hex	Hexadecimal number

1.2 Referenced Documents and Sources

[MODBUS TCP/IP]	MODBUS Messaging on TCP/IP Implementation Guide V1.0b, Modbus Organization, Inc. PO Box 628 Hopkinton, MA 01748, October 2006
[MBAP]	MODBUS Application Protocol Specification V1.1b, Modbus Organization, Inc. PO Box 628 Hopkinton, MA 01748, December 2006
[Sunny WebBox]	Plant monitoring, Sunny WebBox, technical description, scope of validity as of firmware version 1.51, SMA Solar Technology AG, Sonnenallee 1, D-34266 Niestetal, http://www.sma.de/de/products/monitoring-systems/sunny-webbox.html

1.3 System Requirements

Requirements WebBox:

Firmware version 1.51, or higher

Supported devices:

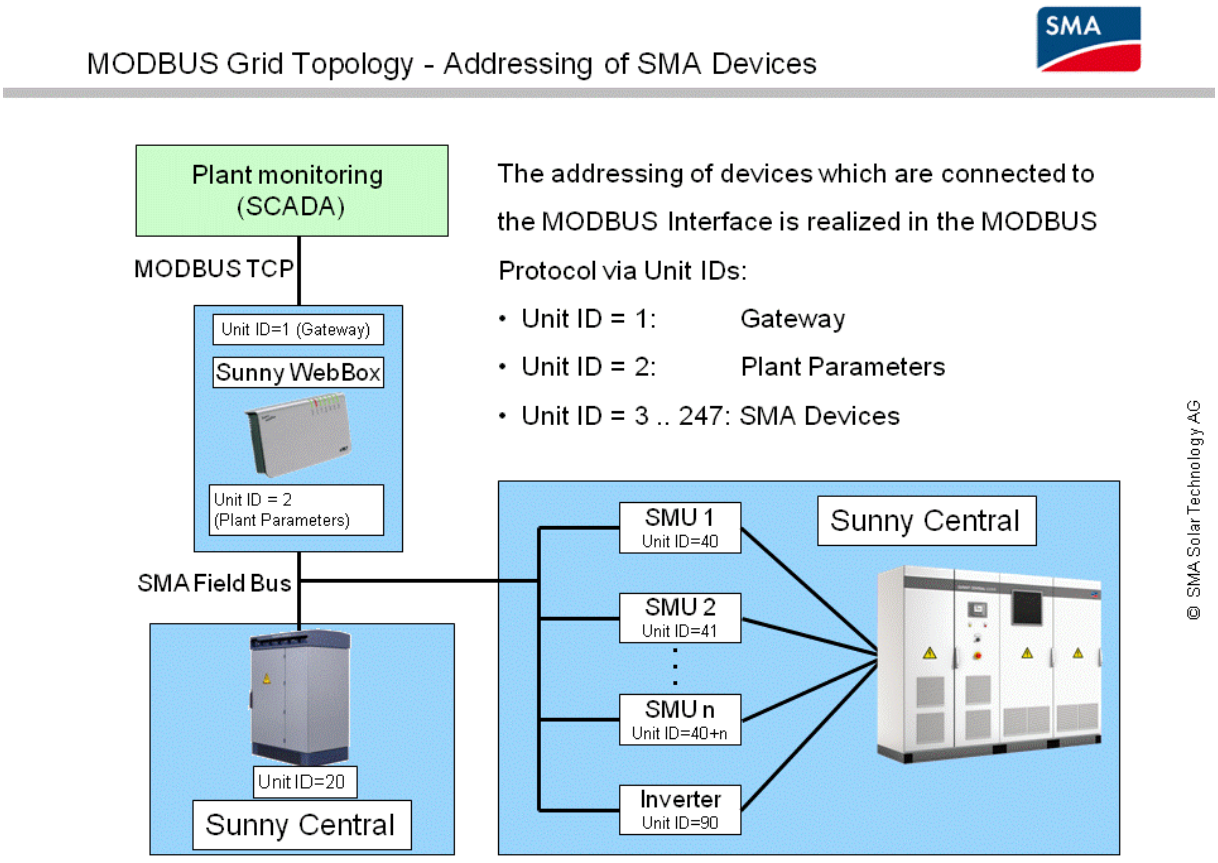
- Sunny Central 800CP (firmware version 1.004), device ID = 158
- Sunny Central 630CP (firmware version 1.004), device ID = 159
- Sunny Central 500CP (firmware version 1.004), device ID = 160
- Sunny Central 250U (firmware version 1.030), device ID = 155
- Sunny Central 500U (firmware version 1.030), device ID = 156
- Sunny Central 500HEUS (firmware version 1.030), device ID = 157

Modbus TCP:

Preset port: 502

1.4 Grid Topology

The SMA MODBUS Profile has been designed for a complex plant structure. In this structure there is an SMA device that has the capability to control the other SMA devices in the plant or to detect the data of other SMA devices. This special SMA device is fitted with a MODBUS TCP/IP interface. In the following diagram this special SMA device is a Sunny WebBox which has been expanded by an interface for MODBUS TCP/IP.



* SMU = SUNNY String-Monitor

From the view of MODBUS the SMA MODBUS Master (in this example Sunny WebBox) presents a gateway to subordinate SMA devices. The subordinate SMA devices can be accessed via an addressing (Unit ID in MODBUS TCP/IP).

Excursus - MODBUS Application Protocol – Header

The following table illustrates the header of the "MODBUS Application Protocol" for TCP/IP (MODBUS TCP/IP) and shows where the Unit ID is to be found there.

Field	Length	Description	Client	Server
Transaction ID	2 Bytes	Identification of a MODBUS request / response transaction	Initialized through the client	Return copied through the server of the received request
Protocol ID	2 Bytes	0 = MODBUS Protocol	Initialized through the client	Return copied through the server of the received request
Length	2 Bytes	Quantity of the subsequent bytes	Initialized through a client (Request)	Initialized as response from the server
Unit ID	1 Byte	Identification of a slave, which is connected in series or otherwise	Initialized through the client	Return copied through the server from the received request

(Source: MODBUS TCP/IP)

Translated to the SMA MODBUS Profile, the gateway (Sunny WebBox) represents the server and the subordinate SMA devices, such as individual inverters, represent the slaves.

1.5 Unit ID - SMA Devices

During the initial plant recording the MODBUS master (Gateway of the Sunny WebBox) requests the individual SMA device addresses (Device ID and serial number) from every SMA device and automatically assigns each of these devices with a Unit ID. This assignment is recorded in the configuration area of the gateway (assignment table).

The individual Unit IDs of the SMA devices can (after the initial recording) be read from the assignment table and changed via the MODBUS interface. To change the Unit ID this must be written in the respective address area.

MODBUS TCP/IP allows for an addressing of a maximum of 247 devices via the Unit ID. Since the SMA MODBUS Profile is valid for all SMA devices, the addressing of individual SMA devices (inverters) is realized via the ID (3...247). The gateway has the unit ID = 1 (predefined and fixed), the plant parameters can be addressed via the unit ID = 2 (predefined and fixed).

Via the Unit ID an addressing of a maximum of 245 SMA devices is possible.

The assignment of the Unit IDs 3 - 247 are saved in the MODBUS registers from address 42109 (see section "Gateway (UNIT ID = 1)", page 16).

During configuration it must be ensured that no Unit ID is assigned twice. If Unit IDs are assigned twice, the data of the Unit ID with the lower MODBUS address will be read off during a MODBUS request.

SMA devices added subsequently or device replacements

With a repeated plant recording additional devices are assigned with the Unit ID = NaN (255) and can therefore not be accessed. Such assignments must be changed manually.

The following table shows an example assignment. An inverter "Sunny Central 500CP" device ID = 160 = A0 [Hex]) with the serial number 1134365300, added subsequently, has been recorded as second device in the plant (MODBUS address 42113). The Unit ID of this device was set to 186:

MODBUS Address		After Recording	Modified
42113	Device ID	0xA0	0xA0
42114	Serial number H	11343	11343
	Serial number L	65300	65300
42116	Unit ID	255 (NaN)	186

1.6 SMA Device Data

It is not possible to assign all values saved in SMA devices (data) one to one to the MODBUS data area. Therefore it was sensible to conduct a reduction of the available data such as overall and daily energy, current output, voltages and currents and assign the remaining data to the respective MODBUS registers. This reduction and assignment between SMA device data and MODBUS addresses is illustrated in an assignment table (see section "SMA MODBUS Profile", page 16).

The address range 0-0xFFFF is available for the addressing of MODBUS registers (65536 addresses). One register is 16 bits wide. For larger data values connected registers are used. Once the assignment of data value to MODBUS address has been defined, it should not be changed. For additions, spaces in the address area are left open.

The MODBUS register address forms the start address of a data block. A data block equates to one SMA data set or an individual date and is always made up of several MODBUS registers. The quantity of required MODBUS registers is given in the assignment table.

In order to avoid inconsistencies, data blocks must always be read or written completely. The MODBUS functions "Read Holding Registers", "Read Input Registers" und "Write Multiple Registers" support this.

According to the MODBUS specification a maximum of 253 bytes can be transmitted to reference data during a data transfer (message). Function dependent parameters (e.g. Function Code, Start Address, and Quantity of Registers) also count as reference data. Thus a maximum of 125 MODBUS registers can be transmitted in one message. This must be taken into consideration during the request.

2 Interface Definition

2.1 SMA Data Types vs. MODBUS Registers

The following sections define the data types used by SMA, which are 16, 32 and 64 bits wide. The width of a MODBUS register is 16 bits. The registers are transmitted in Motorola format (Big-endian) - this means firstly the high byte and then the low byte is transmitted.

Background to the following interface descriptions is that n MODBUS registers must be read and written to or from one SMA data type in one step. If for example two 16 bit MODBUS registers are read into a 32 bit SMA data type, the 4 bytes of both registers must be read in with a read operation.

2.1.1 Reading and Writing MODBUS Registers

The following MODBUS commands are supported for the mapping of MODBUS registers to SMA data types:

Reading in of MODBUS registers in SMA data types:	Read Holding Registers (0x03)
	Read Input Registers (0x04)
Writing of SMA data types in MODBUS register:	Write Multiple Registers (0x10)

MODBUS addresses not mapped to the SMA MODBUS Profile return 0xFFFF.

2.2 SMA Data Types and NaN Values

2.2.1 Supported Data Types

Name	Description	
	The following data types are supported by the SMA MODBUS Profile	**Possible NaN values**
U16	A word (16 bit) in the local processor format	0xFFFF
U32	A double word (32 bit) in the local processor format	0xFFFFFFFF
S32	Signed double-word (32 bit)in the local processor format	0x80000000
U64	A quad word (64 bit)in the local processor format	0xFFFFFFFFFFFFFFFF

2.2.2 16 Bit Integer Values

16 bit integers are saved in a register in Big-endian sorting.

MODBUS registers	1	
Byte	0	1
Bits	8 ... 15	0 ... 7

U16: 0 ... 65535 Not implemented: 0xFFFF

Example: 32.000 (U16) = 01111101 00000000

2.2.3 32 Bit Integer Values

32 bit integers are saved in two registers in Big-endian sorting.

MODBUS registers	1		2	
Byte	0	1	2	3
Bits	24 ... 31	16 ... 23	8 ... 15	0 ... 7

U32: 0 ... 4294967294 Not implemented: 0xFFFFFFFF

S32: -2147483647 ... 2147483647 Not implemented: 0x80000000

Example: 136.534.944 (U32) = 00001000 00100011 01011011 10100000

2.2.4 64 Bit Integer Values

64 bit integers are saved in four registers in Big-endian sorting.

MODBUS registers	1		2	
Byte	0	1	2	3
Bits	56 ... 63	48 ... 55	40 ... 47	32 ... 39
MODBUS registers	**3**		**4**	
Byte	4	5	6	7
Bits	24 ... 31	16 ... 23	8 ... 15	0 ... 7

U64: 0 ... 18446744073709551614 Not implemented: 0xFFFFFFFFFFFFFFFF

2.3 SMA Data Formats

The following data formats are used in the assignment table, in the display column. They describe how the integer values have to be interpreted:

Format	Meaning	Comment
Duration	Time period	In seconds
DT	Date / Time	Output of data / time, in accordance with country setting. Transmission as UTC (without daylight saving time) in seconds since 1970-01-01.
FIX0	Factor 1	Output as decimal number, commercially rounded, no decimal places.
FIX1	Factor 0.1	Output as decimal number, commercially rounded, one decimal place.
FIX2	Factor 0.01	Output as decimal number, commercially rounded, two decimal places.
FIX3	Factor 0.001	Output as decimal number, commercially rounded, three decimal places.
FW		Firmware version e.g. 1.12.0.R, see below
RAW		Output as text or number, depending on data format of the value. Numbers without decimal places and without thousand or other separation indicators.
ENUM		A parameter of this format can provide various status values. The parameters are returned as code. You will find the breakdown of the code in the appropriate section of the SMA MODBUS Profile - parameter lists.
TEMP	Temperature	The values are given in degrees Celsius. The output is given commercially rounded with one decimal place (FIX1).

FW: Firmware Version. Four values are extracted from the delivered DWORD. The values Major and Minor are contained BCD coded in bytes 1 and 2. Byte 3 contains the Build value (not BCD coded). The release type in accordance with the following table is contained in the 4th byte:

Value	Edition	Meaning
0	N	NOREV
1	E	EXPERIMENTAL
2	A	ALPHA
3	B	BETA
4	R	RELEASE
5	S	SPECIAL
> 5	As number	No special interpretation

For the output all four values will be hanged in a string one after another (in the order Major.Minor.Build.Release, each separated by a point). The values Major, Minor and Build are given as two digits, missing positions are filled out with 0 (zero). The Release value is translated into a single letter in accordance with the above table as long as it is less than or equal to 5. Values greater than 5 are given as unchanged numbers.

Example:

Values from DWORD: Major: 1, Minor: 5, Build: 10, Release Type: 3
[0x1 0x5 0xA 0x3]

Output: 01.05.10.B

3 SMA MODBUS Profile - Assignment Tables

3.1 Gateway (Unit ID = 1)

In this section you will find a summary of the parameters supported by the Gateway (Sunny WebBox):

ADR [DEC]	Description / return value	CNT [2 Bytes]	Format	Type	Display	Access
30001	Version number of the SMA Profile (predefined section)	2	U32	Scalar	RAW	RO
30003	Device address - device ID (Sunny WebBox Gateway)	2	U32	Scalar	RAW	RO
30005	Device address - serial number (Sunny WebBox Gateway)	2	U32	Scalar	RAW	RO
30007	MODBUS data change: counter value will increase if data in the Profile has changed (overrun).	2	U32	Scalar	RAW	RO
	Assigment Unit ID - SMA devices: See section "Assignment Unit ID - SMA Devices", page 8.					
42109	Device 1: Device ID	1	U16	Scalar	ENUM	RO
42110	Device 1: Serial number	2	U32	Scalar	RAW	RO
42112	Device 1: Unit ID (e.g. 3)	1	U16	Scalar	RAW	RW
42113	Device 2: Device ID	1	U16	Scalar	ENUM	RO
42114	Device 2: Serial number	2	U32	Scalar	RAW	RO
42116	Device 2: Unit ID (e.g. 4)	1	U16	Scalar	RAW	RW
...	...	...	...	...	...	...
43089	Device 245: Device ID	1	U16	Scalar	ENUM	RO
43090	Device 245: Serial number	2	U32	Scalar	RAW	RO
43092	Device 245: Unit ID (e.g. 247)	1	U16	Scalar	RAW	RW

3.2 Plant Parameters (Unit ID = 2)

In this section you will find a summary of the plant parameters (Sunny WebBox):

ADR [DEC]	Description / return value	CNT [2 Bytes]	Format	Type	Display	Access
30001	Version number of the SMA Profile (predefined section)	2	U32	Scalar	RAW	RO
30003	Device address - device ID (Sunny WebBox)	2	U32	Scalar	RAW	RO
30005	Device address - serial number (Sunny WebBox)	2	U32	Scalar	RAW	RO
30007	MODBUS data change: counter value will increase if data in the Profile has changed (overrun).	2	U32	Scalar	RAW	RO
30061	Firmware 1 (device dependent)	2	U32	Scalar	FW	RO
30063	Firmware 2 (device dependent)	2	U32	Scalar	FW	RO
30065	Firmware 3 (device dependent)	2	U32	Scalar	FW	RO
30193	Reading of the plant time (UTC)	2	U32	Scalar	DT	RO
40001	Setting of the plant time (UTC)	2	U32	Scalar	DT	RW
40003	Selected time zone for the presentation in the user interface. Return codes, see section "Return Codes - Time Zones", page 23.	2	U32	Status	ENUM	RW

3.3 SMA Devices (Unit ID 3 - 247)

In this section you will find a summary of the parameters supported by the SMA devices (see section System Requirements, Page 6):

ADR [DEC]	Description / return value	CNT [2 Bytes]	Format	Type	Display	Access
30193	Reading of the device time (UTC)	2	U32	Scalar	DT	RO
30195	Reading of the time zone (UTC) Return codes, see section "Return Codes - Time Zones", page 23.	2	U32	Scalar	ENUM	RO
30197	Consecutive number of cumulative events (number of posts is limited by the device)	2	U32	Scalar	FIX0	RO
30199	Time until grid connection attempt (s)	2	U32	Scalar	Duration	RO
30211	Recommended Action 336 = Contact manufacturer Service 337 = Contact installer 973 = No recommendation	2	U32	Status	ENUM	RO
30213	Current event message 973 = no message NNNN = see section "Return Codes - Event Messages", page 24	2	U32	Status	ENUM	RO
30215	Recommended error correction measures 973 = no recommendation NNNN = see section "Return Codes - Event Messages", page 24	2	U32	Status	ENUM	RO
30217	Grid contactor 51 = contactor closed 311 = contactor open	2	U32	Status	ENUM	RO
30219	Temperature derating 802 = Temperature derating 803 = no derating	2	U32	Status	ENUM	RO
30225	Insulation resistance (ohms)	2	U32	Scalar	FIX0	RO

30241	Operational status: 309 = Operation 381 = Stop 455 = Warning 973 = Unknown 1392 = Error 1393 = Waiting for PV voltage 1394 = Waiting for AC grid	2	U32	Status	ENUM	RO
30243	Error: 267 = Inverter 973 = Unknown 1395 = DC area 1396 = AC grid	2	U32	Status	ENUM	RO
30257	DC switch in cabinet 51 = closed 311 = open	2	U32	Status	ENUM	RO
30261	AC switch 1 in cabinet 51 = closed 311 = open	2	U32	Status	ENUM	RO
30265	AC load circuit breaker in cabinet 303 = off 308 = on	2	U32	Status	ENUM	RO
30513	Total AC energy fed in on all phases (Wh)	4	U64	Scalar	FIX0	RO
30517	Energy fed in on the current day on all phases (Wh)	4	U64	Scalar	FIX0	RO
30521	Operating hours (s)	4	U64	Scalar	Duration	RO
30525	Feed-in hours (s)	4	U64	Scalar	Duration	RO
30769	DC current input (A)	2	S32	Scalar	FIX3	RO
30771	DC voltage input (V)	2	S32	Scalar	FIX2	RO
30773	DC power input (W)	2	S32	Scalar	FIX0	RO
30775	AC active power across all phases (W)	2	S32	Scalar	FIX0	RO
30783	Voltage AC L1 [V]	2	U32	Scalar	FIX2	RO
30785	Voltage AC L2 [V]	2	U32	Scalar	FIX2	RO
30787	Voltage AC L3 [V]	2	U32	Scalar	FIX2	RO
30795	AC current (A)	2	U32	Scalar	FIX3	RO
30797	AC current L1(A)	2	U32	Scalar	FIX3	RO
30799	AC current L2(A)	2	U32	Scalar	FIX3	RO

30801	AC current L3(A)	2	U32	Scalar	FIX3	RO
30803	Grid frequency (Hz)	2	U32	Scalar	FIX2	RO
30805	Reactive power (VAr)	2	S32	Scalar	FIX2	RO
30813	Apparent power (VA)	2	S32	Scalar	FIX0	RO
30821	Current, average shift factor from active and reactive power, across all phases.	2	U32	Scalar	FIX2	RO
30823	Excitation type of cos(Phi) 973 = Not set 1041 = overexcited 1042 = underexcited	2	U32	Status	ENUM	RO
30825	Operating mode of the reactive power regulation. 303 = off 1069 = Reactive power- / voltage characteristic curve Q(U) 1070 = Reactive power Q, direct default setting 1071 = Reactive power const. Q in kVAr 1072 = Reactive power Q, default setting via plant control 1073 = Reactive power Q(P) 1074 = cos(Phi), direct default setting 1075 = cos(Phi), default setting via plant control 1076 = cos(Phi)(P) - characteristic curve 1387 = Reactive power Q, default setting via analog input 1388 = cosPhi, default setting via analog input 1389 = Reactive-/Current characteristic curve Q(U) with hysteresis and dead band	2	U32	Status	ENUM	RO
30827	Reactive power setpoint (VAr)	2	S32	Scalar	FIX0	RO
30829	Reactive power setpoint (%)	2	S32	Scalar	FIX1	RO
30831	cos(Phi) set point	2	S32	Scalar	FIX2	RO

30833	Setpoint excitation type of cos(Phi) 973 = not set 1041 = overexcited 1042 = underexcited	2	U32	Status	ENUM	RO
30835	Operating mode of the reactive power limitation 303 = off 1077 = Reactive power limitation P in W 1078 = Reactive power limitation P in % Pmax 1079 = Reactive power limitation P via plant control 1390 = Reactive power limitation P via analog input 1391 = Reactive power limitation P via digital inputs	2	U32	Status	ENUM	RO
30837	Active power set point (W)	2	U32	Scalar	FIX0	RO
30839	Active power set point (%)	2	U32	Scalar	FIX0	RO
34097	Operating hours interior fan 1 (s)	4	U64	Scalar	Duration	RO
34105	Operating hours heat sink fan (s)	4	U64	Scalar	Duration	RO
34109	Heat sink temperature 1 (°C)	2	S32	Scalar	TEMP	RO
34113	Interior temperature 1 (°C)	2	S32	Scalar	TEMP	RO
34117	Interior temperature 3 (°C)	2	S32	Scalar	TEMP	RO
34125	External temperature 1 (supply air) (°C)	2	S32	Scalar	TEMP	RO
34141	Operating hours interior heater 2 (h)	4	U64	Scalar	Duration	RO
34145	Temperature of the sinusoidal filter choke (°C)	2	S32	Scalar	TEMP	RO
40001	Setting of the plant time (UTC)	2	U32	Scalar	DT	RW
40003	Selected time zone for the presentation in the user interface. Return codes see section "Return Codes - Time Zones", page 23.	2	U32	Status	ENUM	RW

40013	Device languages (only readable) 777 = DE 778 = EN 779 = IT 780 = ES 781 = FR 782 = EL 783 = KO 784 = CS 785 = PT 786 = NL 796 = SL 797 = BG 798 = PL	2	U32	Status	ENUM	RO

3.4 Return Codes - Time Zones

The following table is used for identifying the time zones. In the tables of section "SMA MODBUS Profile - Assignment Tables", from page 16, the return codes of the time zones are provided by various addresses of the SMA MODBUS Profile.

9500	(UTC+04:30) Kabul
9501	(UTC-09:00) Alaska
9502	(UTC+03:00) Kuwait, Er Riad
9503	(UTC+04:00) Abu Dhabi, Muscat
9504	(UTC+03:00) Baghdad
9505	(UTC-04:00) Atlantic (Canada)
9506	(UTC+09:30) Darwin
9507	(UTC+10:00) Canberra, Melbourne, Sydney
9508	(UTC+04:00) Baku
9509	(UTC-01:00) Azores
9510	(UTC-06:00) Saskatchewan
9511	(UTC-01:00) Cape Verde Islands
9512	(UTC+04:00) Erivan
9513	(UTC+09:30) Adelaide
9515	(UTC+06:00) Astana, Dhaka
9516	(UTC-04:00) Manaus
9517	(UTC+01:00) Belgrade, Bratislava, Budapest, Ljubljana, Prague
9518	(UTC+01:00) Sarajevo, Skopje, Warsaw, Zagreb
9519	(UTC+11:00) Magadan, Solomon Is, New Caledonia
9520	(UTC-06:00) Central America
9521	(UTC-06:00) Guadalajara, Mexico-City, Monterrey - old
9522	(UTC+08:00) Peking, Chongqing, Hong Kong, Ürümchi
9523	(UTC-12:00) International Date Line (West)
9524	(UTC+03:00) Nairobi
9525	(UTC+10:00) Brisbane
9526	(UTC+02:00) Minsk
9527	(UTC-03:00) Brasilia
9528	(UTC-05:00) New York, Miami, Atlanta, Detroit, Toronto
9529	(UTC+02:00) Cairo
9530	(UTC+05:00) Yekaterinburg
9531	(UTC+12:00) Fiji, Marshall Islands
9532	(UTC+02:00) Helsinki, Kiev, Riga, Sofia, Tallinn, Vilnius
9534	(UTC) Dublin, Edinburgh, Lisbon, London
9535	(UTC-03:00) Greenland
9536	(UTC) Monrovia, Reykjavík
9537	(UTC+02:00) Athens, Bucharest, Istanbul
9538	(UTC-10:00) Hawaii
9539	(UTC+05:30) Chennai, Kolkata, Mumbai, New-Delhi
9540	(UTC+03:30) Tehran
9541	(UTC+02:00) Jerusalem
9542	(UTC+02:00) Amman
9543	(UTC+09:00) Seoul
9544	(UTC+08:00) Kuala Lumpur, Singapore
9545	(UTC-02:00) Mid Atlantic
9546	(UTC+02:00) Beirut
9547	(UTC-07:00) Denver, Salt Lake City, Calgary
9548	(UTC-07:00) Chihuahua, La Paz, Mazatlan - old
9549	(UTC+06:30) Yangon (Rangun)
9550	(UTC+06:00) Nowosibirsk
9551	(UTC+02:00) Windhoek
9552	(UTC+05:45) Katmandu
9553	(UTC+12:00) Auckland, Wellington
9554	(UTC-03:30) Newfoundland
9555	(UTC+08:00) Irkutsk
9556	(UTC+07:00) Krasnoyarsk
9557	(UTC-04:00) Santiago
9558	(UTC-08:00) Pacific (USA, Canada)
9559	(UTC-08:00) Tijuana, Lower California (Mexico)
9560	(UTC+01:00) Brussels, Copenhagen, Madrid, Paris
9561	(UTC+03:00) Moscow, St. Petersburg, Volgograd
9562	(UTC-03:00) Buenos Aires
9563	(UTC-05:00) Bogotá, Lima, Quito
9565	(UTC-11:00) Midway Islands, Samoa
9566	(UTC+07:00) Bangkok, Hanoi, Jakarta
9567	(UTC+02:00) Harare, Pretoria
9568	(UTC+05:30) Sri Jayawardenepura
9569	(UTC+08:00) Taipei
9570	(UTC+10:00) Hobart
9571	(UTC+09:00) Osaka, Sapporo, Tokyo
9572	(UTC+13:00) Nuku'alofa
9573	(UTC-05:00) Indiana (east)
9574	(UTC-07:00) Arizona
9575	(UTC+10:00) Vladivostok
9576	(UTC+08:00) Perth
9577	(UTC+01:00) West-Central Africa
9578	(UTC+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
9579	(UTC+05:00) Islamabad, Karachi
9580	(UTC+10:00) Guam, Port Moresby
9581	(UTC+09:00) Jakutsk
9582	(UTC+04:00) Caucasian Standard Time
9583	(UTC-06:00) Chicago, Dallas, Kansas City, Winnipeg
9584	(UTC-06:00) Guadalajara, Mexico City, Monterrey - new
9585	(UTC) Casablanca
9587	(UTC-07:00) Chihuahua, La Paz, Mazatlan - neu
9588	(UTC-03:00) Montevideo
9589	(UTC+05:00) Tashkent
9591	(UTC-04:00) Georgetown, La Paz, San Juan

3.5 Return Codes - Event Messages

The following table is used for identifying the event messages. In the section "SMA Devices (Unit ID 3 - 247)" from page 18, the return codes of events are provided by various addresses of the SMA MODBUS Profile.

Return value	Event
100	Grid overvoltage
200	Grid undervoltage
300	Voltage rise protection
301	Voltage rise protection (the effective value of the grid voltage is for a prescribed time (country parameter, e.g. 10 minutes) above a permissible threshold (country parameter, e.g. 253V).
500	Grid frequency disturbance
600	DC grid feed-in
700	Grid frequency not permitted
800	Grid Failure
900	PE connection missing
1000	L / N swapped
1100	Installation fault
1201	The automatic grid type recognition has failed. Used in the USA for 208 V / 240 V / 277 V grids
1300	Installation failure grid connection
1400	Grid voltage failure
3300	Unstable operation
3400	DC overvoltage
3401	The input voltage on String A is above a prescribed maximum value. The 10 ms mean value of the input voltage is above 570 V.)
3402	The input voltage on String B is above a prescribed maximum value. The 10 ms mean value of the input voltage is above 570 V.)
3403	PV overvoltage (SW)
3500	Insulation failure
3501	Insulation failure. The measured value of the active RISO measurement is below a specified limit. As long as the failure is present, the inverter will not feed in. Only measured 1 x per day, or after a discharge current or overcurrent failure.
3502	GFDI Fuse Open (PV is not the same as ground)
3503	Too much current in the GFDI/Ground current - current measurement
3600	High discharge current
3700	Residual current
3800	DC overcurrent
3900	DC start conditions
3901	PV output not sufficient to pre-charge or maintain the intermediate circuit. Active test during pre-charging or maintaining before grid connection. Continuous operational monitoring during grid parallel operation.
3902	Generator voltage too low. Running operational monitoring (currently 100ms). Both strings not active (active: U > 150 V, inactive U < 100 V) after a defined time (approx. 60 min).
4000	String defective

4200	Grounding error
6000	Memory error
6001	EEPROM Restore. Operational data changed is saved in two data sets (redundancy). A check sum/data set of one of the following data sets is faulty: parameter data set, device data set, operational data, and disturbance data set.
6002	EEPROM. Operational data changed is saved in two data sets (redundancy). Both check sums/data sets of one of the following data sets are faulty: parameter data set, device data set, operational data, and disturbance data set.
6003	Via SPI, data is incorrectly read or written During communication with the BFS-EEPROM SPI errors occur!
6004	Saving error in RAM. A faulty storage location has been identified.
6005	Saving error in ROM. A faulty storage location has been identified.
6006	CPU self test HP. EFSK self test during start up failed.
6007	Checking of the CPLD and assembly version. Version of the CPLD or assembly not compatible with HP version status.
6008	The SPI communication to the CPLD is disturbed.
6009	Data inconsistency (check of redundantly saved data, possibly caused by software).
6100	Firmware error
6101	24h Watchdog Test. The cyclic test (back reading of the relay control cable) failed. HP initiates WD test (vital signs modified) and awaits reaction from relay control cable on the DSP.
6102	Program run (Start-up). EFSK exe check failed during start up. Not all safety relevant functions have been performed.
6103	Program run (test hardware). EFSK exe check failed during Test Hardware. Not all safety relevant functions have been performed.
6104	Program run (cold start). EFSK exe check failed during cold start. Not all safety relevant functions have been performed.
6105	Program run (operation). EFSK exe check failed during operation. Not all safety relevant functions have been performed.
6106	Program run (mail traffic). Operating system could not send or receive mail on a task. Not enough memory for mail delivery. Receipt failure of a mail.
6107	Program run (status machine). Maximum permissible time for an operational state exceeded.
6108	Program run (task init). Operating system could not initialize a task. Not enough memory for task.
6109	General BSP error. Board support error which does not fit into any other category (just in case).
6110	General OSL error. Operation System Layer error which does not fit into any other category (just in case).
6111	Program run (shared memory). Data in a shared memory area has not been consumed. Error in timing, which leads to unread data to be overwritten.
6112	Program run (Watchdog). The Watchdog (software and hardware) triggers. A task has not triggered the Software Watchdog.
6200	DI converter
6300	Measurement sequence

6301	Grid current sensor shows an offset that is too large. Offset of the grid current sensor is balanced before grid connection. Disturbance, if the comparison value exceeds a determined limit of a calculated 10% of the measurement range end value (here 4.2 A).
6304	Grid voltage sensor shows an offset that is too large. (see comment below)
6305	The grid voltage measurements ACVtg and ACVtgPhRly deviate from one another. The effective value of the grid voltage measurement ACVtg deviates by more than 3% from the effective value of the grid voltage measurement ACVtgPhRly.
6306	DC voltage measurements DCVtgA, DCVtgB and DclVtg deviate strongly from one another which is not permitted.
6307	Disturbance, if during a grid current shutdown (hardware monitoring) an AD value of the grid current is measured that is too small.
6313	DC current measuring is probably defective, e.g. DC string current measurements deviate from step-up converter measurements. See comment below.
6400	Hardware fault
6401	Sensors for the measurement of the insulation resistance are defective. Active test before grid connection in "cold start".
6402	Relay for the measurement of the insulation resistance is defective. Active test before the grid connection in "cold start".
6403	HW threshold overvoltage grid. Analog measurement value ACVtg exceeds preset hardware threshold.
6404	HW threshold overcurrent grid. Analog measurement value exceeds preset hardware threshold.
6405	HW threshold intermediate circuit voltage. Analog measurement value DclVtg exceeds preset hardware threshold.
6406	HW threshold overcurrent input (DCCurA > 22 A).
6407	HW threshold overcurrent input (DCCurB > 22 A).
6408	HW threshold UCE monitoring on V2 and V4.
6437	Capacitor voltages in the intermediate circuit deviate from one another.
6500	Overtemperature
6501	The interior temperature exceeds a permissible maximum value.
6502	The converter temperature (HL module) exceeds a permissible maximum value.
6505	Overtemperature power unit 2 (option)
6506	Overtemperature transformer area
6600	SW thresholds
6603	Overcurrent grid (SW)
6604	Overvoltage intermediate circuit (SW)
6700	Error communication processor (SW)
6800	String A
6801	Input current sensors of String A record an Offset that is too high.
6802	Step-up converter A is defective
6900	String B
6901	Input current sensors of String B record an Offset that is too high.
6902	Step-up converter B is defective
7000	Temperature sensors
7200	Data logger (communication)
7300	Update failed
7400	Varistor defective

7500	Fan fault
7501	Interior fan 1
7502	Interior fan 2
7600	Communication error
7700	Contactor error
7800	Overvoltage protector
7900	Reverse current
8000	Derating occurred
8100	Error communications processor (HW)
8200	Short circuit
8300	Overvoltage protection
8401	HP has sent overtemperature error to PVS. Reaction: both inputs switch to idling cycle.
8500	String C
8501	Input current sensors of String C record an Offset that is too high.
8502	Step-up converter C is defective

4 Contact

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

- Operating system of your computer
- Sunny WebBox software version
- Sunny WebBox serial number and hardware version
- Type of communication interface between Sunny WebBox and the inverters
- Type and serial numbers of the inverters connected to the system
- Please plug out the SD card in case you have to send your Sunny WebBox to us

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