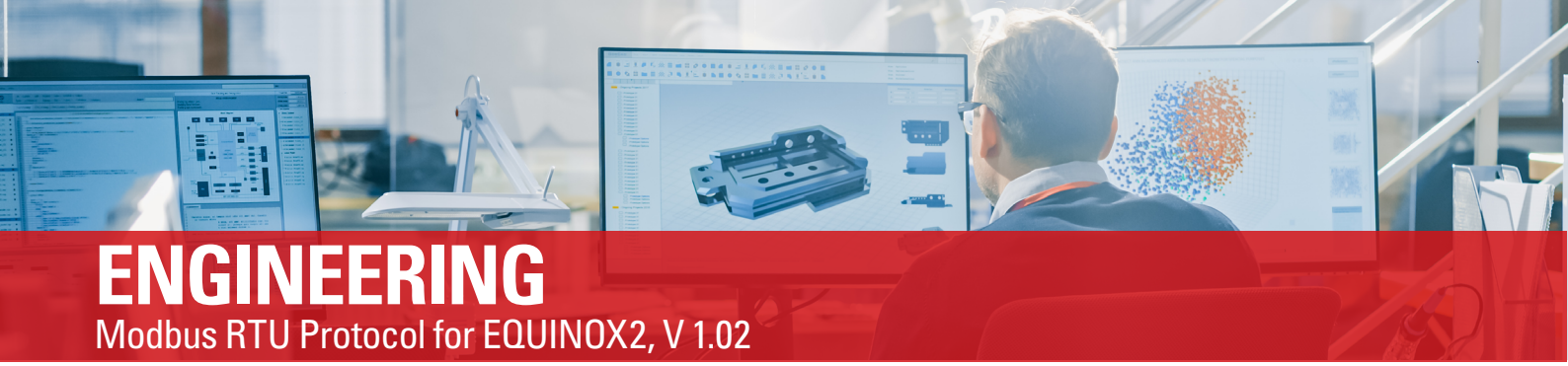

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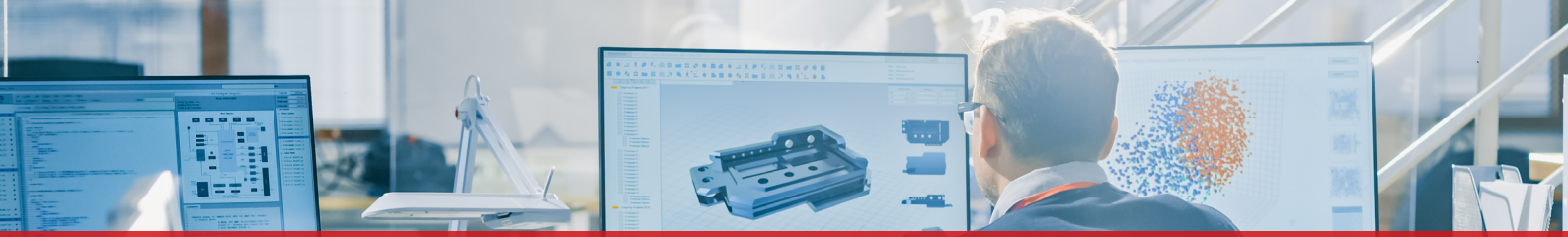
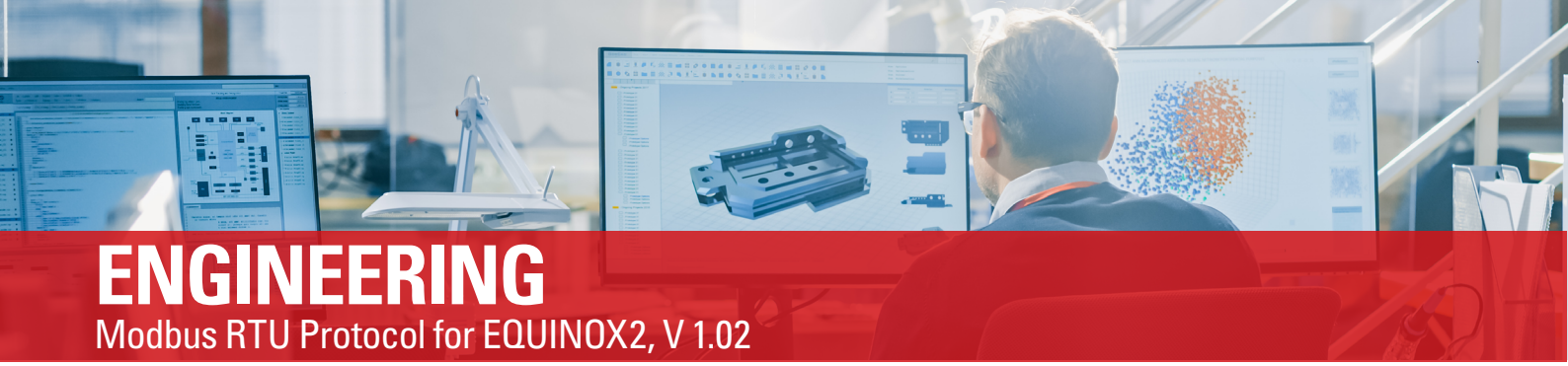
Modbus RTU Protocol for EQUINOX2, V 1.02

Indice general



DOCUMENT MANAGEMENT.

Date	Document Version	Author	Description
14/02/22	V 1.0	E. Sarrado	Initial release.
28/04/23	V 1.01	E. Sarrado	Equipment added.
27/09/23	V 1.02	E. Sarrado	Data corrections.



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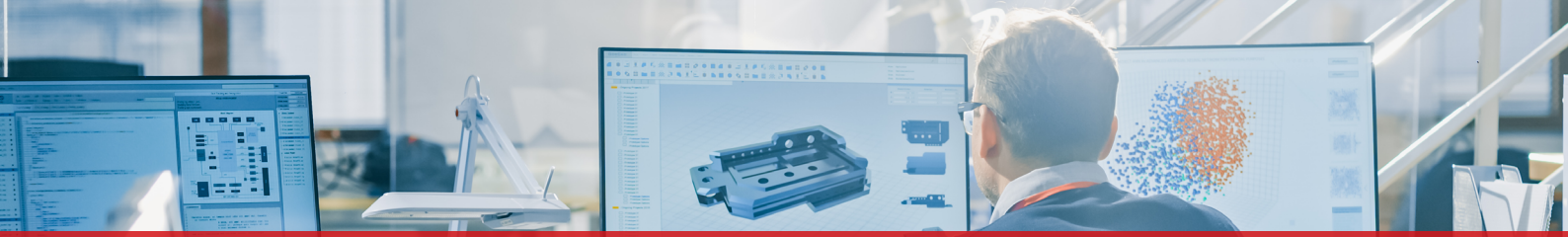
Modbus RTU Protocol for EQUINOX2, V 1.02

1. INTRODUCTION.

Modbus-RTU protocol is a widely used communication protocol in industry and is a common language used in electrical communication terminals. Through this protocol, inverters can communicate with each other via network (such as RS485 bus) and other devices. It has become a universal industry standard. With it, inverter equipment manufactured by different manufacturers can be connected into an industrial network for centralized monitoring. The protocol describes how the master and slave nodes are defined, how the master node accesses other devices by using various request methods, how the slave nodes respond to requests from other devices, and how both parties detect and record errors. It defines the message domain pattern and the data content in detail.

In this paper, the Modbus protocol of the SALICRU inverter is described and explained, which is used to standardize and constrain the subsequent third-party integration development and customization.



2. COMMUNICATION PROTOCOL SUMMARY.

Modbus communication protocol includes physical layer, data link layer and application layer.

2.1. PHYSICAL LAYER.

- Communicate with two - line RS-485 via serial port.
- The baud rate is 9600.
- Adopt RTU mode transmission, asynchronous mode.
- One starting bit.
- Eight data bits.
- No verification.
- 1 stop bit.

2.2. DLL.

2.2.1. Addressing Mode.

The protocol supports unicast and broadcast, and the address assignment rules are as follows:

Broadcast Address	Slave Node Address	Retain
0	1 ÷ 247	248 ÷ 255

2.2.2. Frame Structure.

Address	Function Code	Data	CRC Check Code
1 byte	1 byte	2*N bytes	2 bytes

Note:

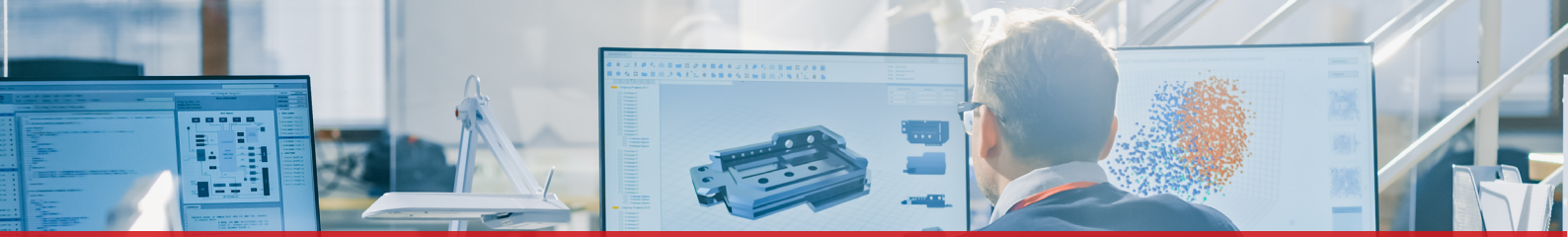
- The maximum frame length is no more than 256 bytes.
- CRC check code low byte before, high byte after.
- The definition of all frame structures in this paper contains only the function codes and data sections.

2.2.3. Data Coding.

Modbus uses a 'big-endian' to represent addresses and data items. This means that when sending more than one byte, the most significant bit is sent first, such as:

Register size	Value
16 bits	0xABCD

The first byte sent is 0xAB and the second byte is 0xCD.



2.2.4. Interactive Process.

In any case, the communication process is initiated by the master node and the slave node does not initiate the communication actively.

In unicast mode, the slave node responds to the master node's command in a question-and-answer manner. If the master node does not receive a reply from the slave node within 5s, the communication timeout is considered.

In broadcast mode, the slave node only receives commands issued by the master node and does not respond to command frames issued by the master node.

2.2.5. CRC Verify.

```
const INT8U auchCRCHi[256] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40
};
const INT8U auchCRCLo[256] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4, 0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F,
0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09, 0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE,
0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13, 0xD3, 0x11, 0xD1, 0xD0,
0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35, 0x34, 0xF4, 0x3C, 0xFC, 0xFD, 0x3D, 0xFF,
0x3F, 0x3E, 0xFE, 0xFA, 0x3A, 0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29, 0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E,
0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26, 0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20,
0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D,
0xAF, 0x6F, 0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE,
0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5, 0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71,
0x70, 0xB0, 0x50, 0x90, 0x91, 0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C, 0x5D,
0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98, 0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A,
0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C, 0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41,
0x81, 0x80, 0x40
};
```

```
INT16U CRC16(INT8U *puchMsg, INT16U usDataLen)
{
    INT8U uchCRCHi = 0xFF ;
    INT8U uchCRCLo = 0xFF ;
    INT8U uIndex=0 ;
    while (usDataLen--)
    {
        uIndex = uchCRCLo ^ *puchMsg++;
        uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex];
        uchCRCHi = auchCRCLo[uInddex];
    }
    return (((INT16U)uchCRCHi << 8) | (INT16U)uchCRCLo) ;
}
```

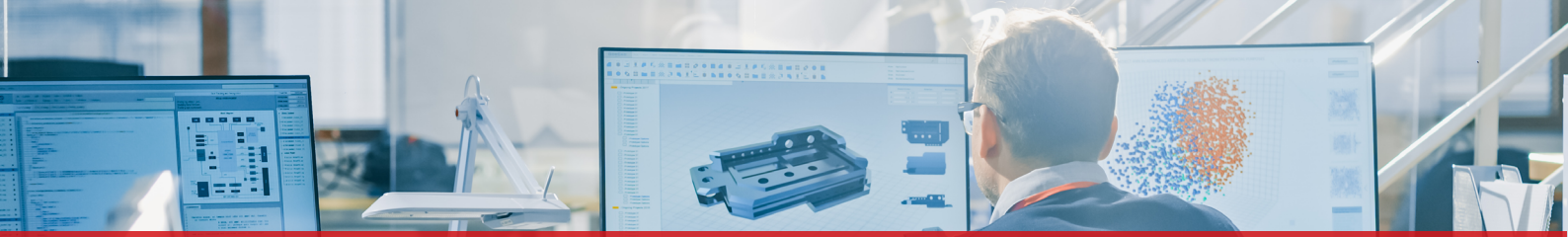
2.3. APPLICATION LAYER.

MODBUS has three types of function codes.

- Common function codes: They are well defined function codes that are guaranteed to be unique, modifiable by MODBUS organization, publicly proven, with available conformance tests, proven in MB IETF RFC, and contain defined common assigned function codes and unassigned reserved function codes for future use.
- User-defined function codes: There are two defined scopes of user-defined function codes, namely 65 to 72 and 100 to 110. Users can select and implement a function code without any approval from MODBUS organization, and the use of the selected function code cannot be guaranteed to be unique.
- Preserve function codes: Function codes that are commonly used by some companies for traditional products and that are not valid for public uses.

The common function codes used in this Agreement are as follows:

Function Code	Function Description
03 (0x03)	Read hold register values
06 (0x06)	Write Single Register
16 (0x10)	Write Multiple Registers



Abbreviations and terms are defined as follows:

Designation	Description
Register address	One address corresponds to one 2 Bytes data
U16	Unsigned 16-bit reshaping data
U32	Unsigned 32-bit reshaping data
I16	Signed 16-bit reshaping data
I32	Signed 32-bit reshaping data
STR	Character string
N/A	None

2.3.1. Function Code03(0x03).

The master node requests the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x03
Register start address	2	0x0000÷0xFFFF
Register number	2	1÷125
CRC	2	N/A

The slave node responds normally to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x03
Number of bytes	1	2*N
Register values	2*N	N/A
CRC	2	N/A

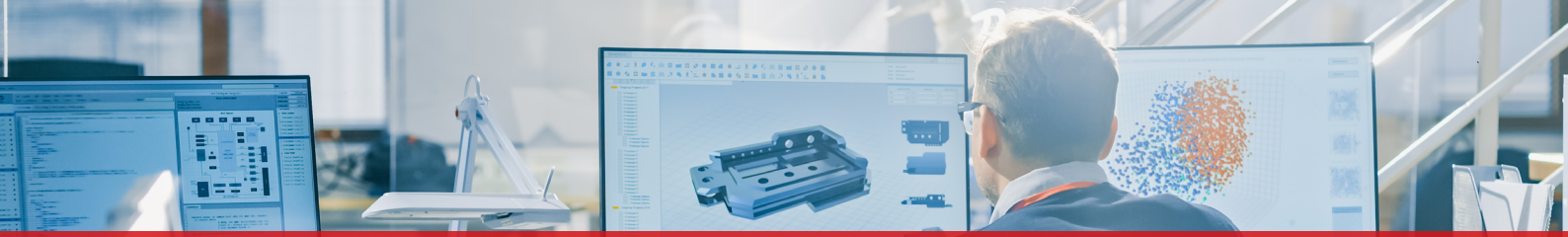
The slave node exception responds to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x83
Exception code	1	1/2/3
CRC	2	N/A

2.3.2. Function Code06(0x06).

The master node requests the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x06
Register address	2	0x0000÷0xFFFF
Register value	2	0x0000÷0xFFFF
CRC	2	N/A



The slave node responds normally to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x06
Register address	2	0x0000÷0xFFFF
Register value	2	0x0000÷0xFFFF
CRC	2	N/A

The slave node exception responds to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x86
Exception code	1	1/2/3
CRC	2	N/A

2.3.3. Function Code16(0x10).

The master node requests the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x10
Register address	2	0x0000÷0xFFFF
Number of registers	2	0x0000÷0x007b
Number of bytes	1	2*N
Register values	2*N	Value
CRC	2	N/A

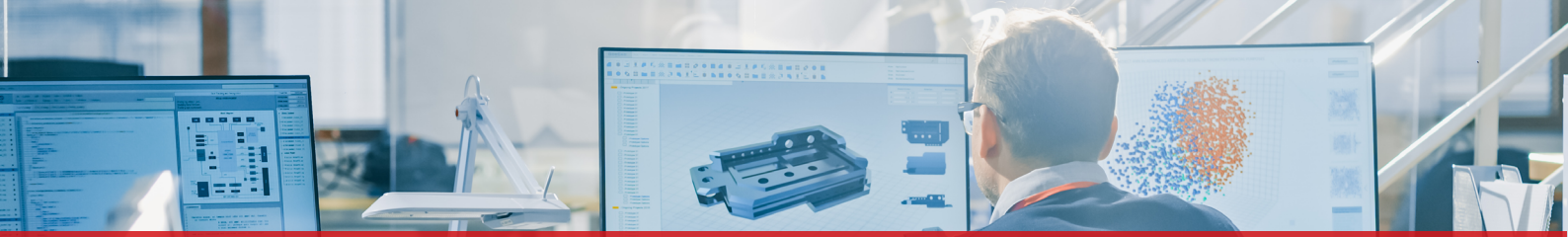
"N" is the number of registers(0x0000~0x007b)

The slave node responds normally to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x10
Register address	2	0x0000÷0xFFFF
Number of registers	2	0x0000÷0x007b
CRC	2	N/A

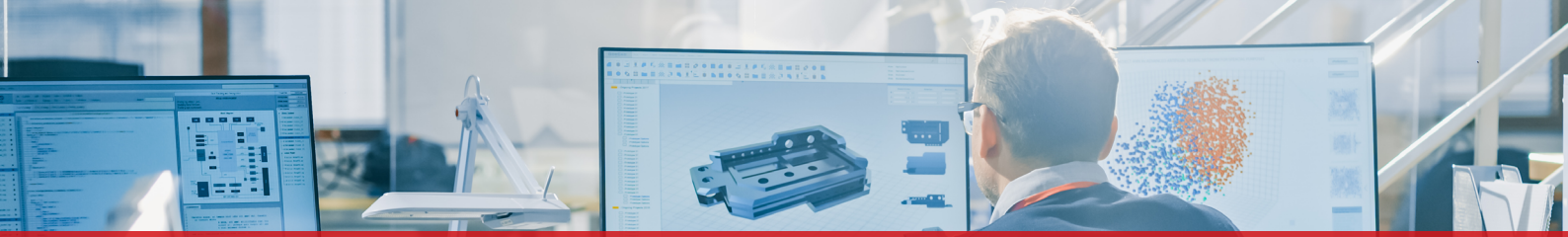
The slave node exception responds to the frame format:

Data domain	Length(byte)	Description
Slave node address	1	1÷247
Function code	1	0x90
Exception code	1	1/2/3
CRC	2	N/A



3. REGISTER TABLE.

Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
10000	8	Device Serial Number	RO	STR	N/A	1	Resolves to characters in high and low bytes // Read Bytes to string	ONGRID // HYB
10008	1	Model information	RO	U16	N/A	1	See table 3.2 for information resolution // Please refer to Table 3.4	ONGRID // HYB
10009	1	Output mode	RO	U16	N/A	1	0: three phase four-wire 1: three-phase three-wire	ONGRID
10010	1	Communication protocol version	RO	U16	N/A	1	Current version 0	ONGRID
10011	2	Firmware version number	RO	U32	N/A	1	Byte parsing // Byte parsing	ONGRID // HYB
10012								ONGRID // HYB
10100	1	Time: year/month	RO	U16	N/A	1		ONGRID // HYB
10101	1	Time: day/hour	RO	U16	N/A	1	The data is parsed in terms of high and low bytes //	ONGRID // HYB
10102	1	Time: minute/second	RO	U16	N/A	1		ONGRID // HYB
10104	1	Safety standard / Area code	RO	U16	N/A	1		ONGRID // HYB
10105	1	Working state of inverter	RO	U16	N/A	1	0: wait, Waiting for the grid 1: check, self-inspection 2: normal, generating 3: fault, device failure 4: flash, firmware update // 0:wait, wait for on-grid 1:check, self-check 2:On Grid 3:fault 4:flash, firmware update 5.Off Grid	ONGRID // HYB
10112	2	Fault FLAG1	RO	U32	N/A	1	The bitwise resolution is shown in Table 3.3 // Please refer to Table 3.5	ONGRID // HYB
10113								ONGRID // HYB
10114	2	Fault FLAG2	RO	U32	N/A	1		ONGRID // HYB
10115								ONGRID // HYB
10120	2	Fault FLAG3	RO	U32	N/A	1		ONGRID // HYB
10121								ONGRID // HYB
10994	2	Phase A Power on Meter	RO	I32	kW	1000		HYB
10995								HYB
10996	2	Phase B Power on Meter	RO	I32	kW	1000		HYB
10997								HYB
10998	2	Phase C Power on Meter	RO	I32	kW	1000		HYB
10999								HYB
11000	2	Total Power on Meter	RO	I32	kW	1000		HYB
11001								HYB
11002	2	Total Grid-Injection Energy on Meter	RO	U32	kWh	100		HYB
11003								HYB
11004	2	Total Purchasing Energy from Grid on Meter	RO	U32	kWh	100		HYB
11005								HYB
11006	1	Grid LINE AB voltage	RO	U16	V	10		ONGRID // HYB
11007	1	Grid LINE BC voltage	RO	U16	V	10		ONGRID // HYB
11008	1	Grid LINE CA voltage	RO	U16	V	10		ONGRID // HYB
11009	1	Grid A phase voltage	RO	U16	V	10		ONGRID // HYB



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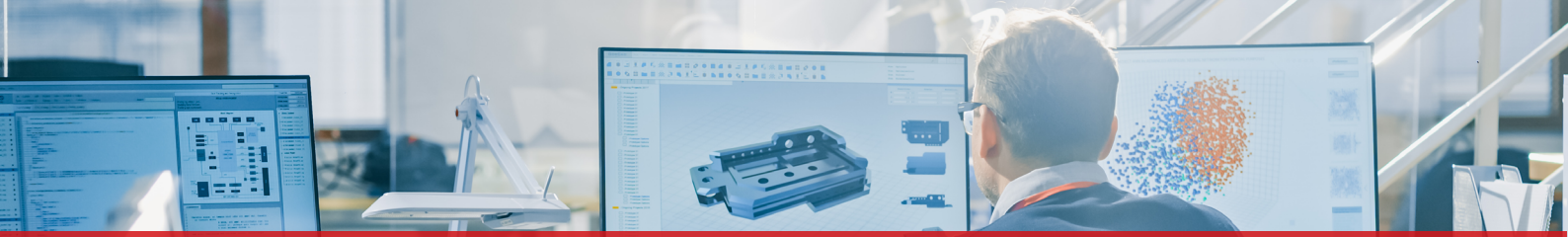
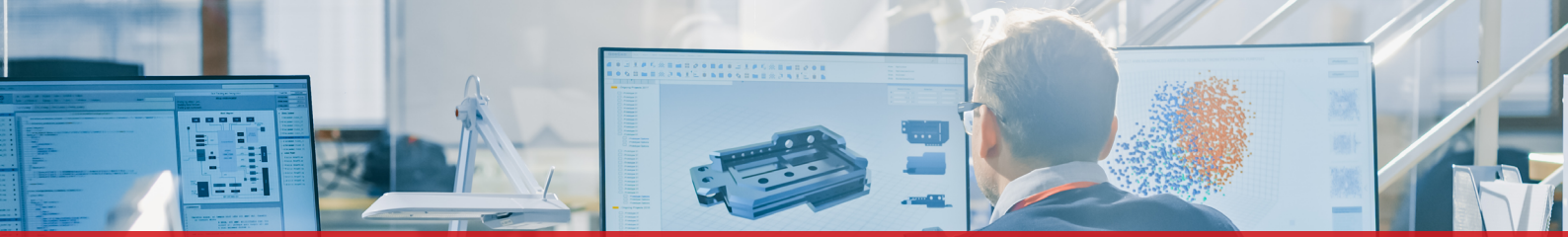
Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
11010	1	Grid A phase current	RO	U16	A	10		ONGRID // HYB
11011	1	Grid B phase voltage	RO	U16	V	10		ONGRID // HYB
11012	1	Grid B phase current	RO	U16	A	10		ONGRID // HYB
11013	1	Grid C phase voltage	RO	U16	V	10		ONGRID // HYB
11014	1	Grid C phase current	RO	U16	A	10		ONGRID // HYB
11015	1	Grid frequency	RO	U16	Hz	100		ONGRID // HYB
11016	2	P_AC	RO	U32	kW	1000		ONGRID // HYB
11017								ONGRID // HYB
11018	2	Daily generating capacity	RO	U32	kWh	10		ONGRID // HYB
11019								ONGRID // HYB
11020	2	Total generation PV	RO	U32	kWh	10		ONGRID // HYB
11021								ONGRID // HYB
11022	2	Total generating time	RO	U32	H	1		ONGRID // HYB
11023								ONGRID // HYB
11024	2	Output apparent power	RO	U32	kVar	1000		ONGRID
11025								ONGRID
11026	2	Output reactive power	RO	I32	kVar	1000		ONGRID
11027								ONGRID
11028	2	Total power input	RO	U32	kW	1000		ONGRID // HYB
11029								ONGRID // HYB
11030	1	Power factor	RO	I16	N/A	1000		ONGRID
11031	1	Efficiency	RO	U16	%	100		ONGRID
11032	1	Temperature 1	RO	I16	°C	10		ONGRID // HYB
11033	1	Temperature 2	RO	I16	°C	10		ONGRID // HYB
11034	1	Temperature 3	RO	I16	°C	10		ONGRID // HYB
11035	1	Temperature 4	RO	I16	°C	10		ONGRID // HYB
11036	1	BUS Voltage	RO	U16	V	10		ONGRID
11037	1	NBS Voltage	RO	U16	V	10		ONGRID
11038	1	PV1 voltage	RO	U16	V	10		ONGRID // HYB
11039	1	PV1 current	RO	U16	A	10		ONGRID // HYB
11040	1	PV2 voltage	RO	U16	V	10		ONGRID // HYB
11041	1	PV2 current	RO	U16	A	10		ONGRID // HYB
11042	1	PV3 voltage	RO	U16	V	10		ONGRID
11043	1	PV3 current	RO	U16	A	10		ONGRID
11044	1	PV4 voltage	RO	U16	V	10		ONGRID
11045	1	PV4 current	RO	U16	A	10		ONGRID
11046	1	PV5 voltage	RO	U16	V	10		ONGRID
11047	1	PV5 current	RO	U16	A	10		ONGRID
11048	1	PV6 voltage	RO	U16	V	10		ONGRID
11049	1	PV6 current	RO	U16	A	10		ONGRID
11050	1	String 1 current	RO	U16	A	10		ONGRID
11051	1	String 2 current	RO	U16	A	10		ONGRID
11052	1	String 3 current	RO	U16	A	10		ONGRID
11053	1	String 4 current	RO	U16	A	10		ONGRID
11054	1	String 5 current	RO	U16	A	10		ONGRID



Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
11055	1	String 6 current	RO	U16	A	10		ONGRID
11056	1	String 7 current	RO	U16	A	10		ONGRID
11057	1	String 8 current	RO	U16	A	10		ONGRID
11058	1	String 9 current	RO	U16	A	10		ONGRID
11059	1	String 10 current	RO	U16	A	10		ONGRID
11060	1	String 11 current	RO	U16	A	10		ONGRID
11061	1	String 12 current	RO	U16	A	10		ONGRID
11062	2	PV1 input power	RO	U32	kW	1000		ONGRID // HYB
11063								ONGRID // HYB
11064	2	PV2 input power	RO	U32	kW	1000		ONGRID // HYB
11065								ONGRID // HYB
11066	2	PV3 input power	RO	U32	kW	1000		ONGRID
11067								ONGRID
11068	2	PV4 input power	RO	U32	kW	1000		ONGRID
11069								ONGRID
11070	2	PV5 input power	RO	U32	kW	1000		ONGRID
11071								ONGRID
11072	2	PV6 input power	RO	U32	kW	1000		ONGRID
11073								ONGRID
11074	1	PV7 voltage	RO	U16	V	10		ONGRID
11075	1	PV7 current	RO	U16	A	10		ONGRID
11076	1	PV8 voltage	RO	U16	V	10		ONGRID
11077	1	PV8 current	RO	U16	A	10		ONGRID
11078	1	PV9 voltage	RO	U16	V	10		ONGRID
11079	1	PV9 current	RO	U16	A	10		ONGRID
11080	1	PV10 voltage	RO	U16	V	10		ONGRID
11081	1	PV10 current	RO	U16	V	10		ONGRID
11082	1	String 13 current	RO	U16	A	10		ONGRID
11083	1	String 14 current	RO	U16	A	10		ONGRID
11084	1	String 15 current	RO	U16	A	10		ONGRID
11085	1	String 16 current	RO	U16	A	10		ONGRID
11086	1	String 17 current	RO	U16	A	10		ONGRID
11087	1	String 18 current	RO	U16	A	10		ONGRID
11088	1	String 19 current	RO	U16	A	10		ONGRID
11089	1	String 20 current	RO	U16	A	10		ONGRID
11090	2	PV7 input power	RO	U32	kW	1000		ONGRID
11091								ONGRID
11092	2	PV8 input power	RO	U32	kW	1000		ONGRID
11093								ONGRID
11094	2	PV9 input power	RO	U32	kW	1000		ONGRID
11095								ONGRID
11096	2	PV10 input power	RO	U32	kW	1000		ONGRID
11097								ONGRID
18000	2	ARM Fault FLAG1	RO	U32	N/A	1	Please refer to Table 3.5	HYB
18001								HYB



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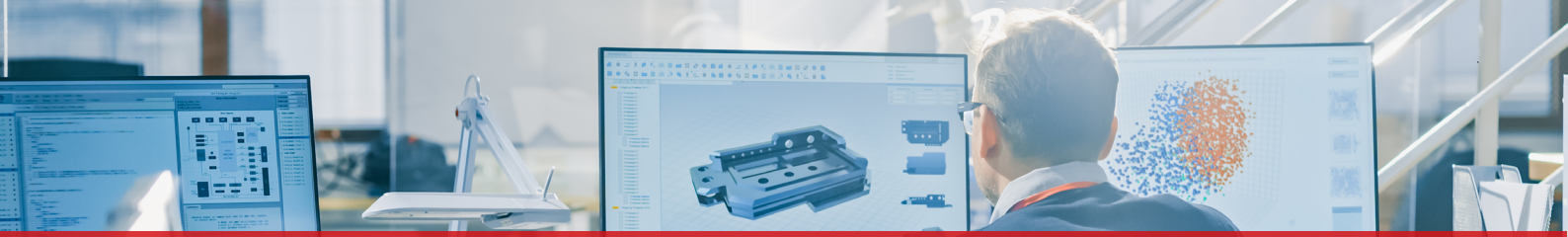
Modbus RTU Protocol for EQUINOX2, V 1.02

Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
20000	1	Device real-time clock time	RW	U16	N/A	1	Year Month // High Bit Year [19-99] Low Bit Month [1-12]	ONGRID // HYB
20001	1	Device real-time clock time	RW	U16	N/A	1	Day Hour // High Bit Day [1-31] Low Bit Hour [0-23]	ONGRID // HYB
20002	1	Device real-time clock time	RW	U16	N/A	1	Minute Second // High Bit Minute [0-59] Low Bit Second [0-59]	ONGRID // HYB
20011	1	Language Set	RW	U16	N/A	1	0: Chinese; 1: English; 2: Spanish; 3: Portuguese; 4: Polski; 5: Czech	ONGRID
25008	1	Switch on/off settings	R2	U16	N/A	1	BIT0: Set 1, turn on, Set 0, turn off BIT1: Set 1, restart;	ONGRID
25010	1	CT Ratio Set	RW	U16	N/A	1		ONGRID
25100	1	Export Limit Set	RW	U16	N/A	1	0: Off, 1: On // 0:Off; 1:ON	ONGRID // HYB
25101	2	Export Power Set	RW	U16	N/A	1	0-Pmax	ONGRID
25102								ONGRID
25103	1	Export Percent Set	RW	U16	N/A	1000	0-1000 // [0.0%-100.0%]	ONGRID // HYB
25104	1	Smart Meter COM. Status	WO	U16	N/A	1	0:Meter COM. Abnormal 1:Meter COM. Normal	HYB
25105	2	Phase A Power On Meter	WO	I32	W	1		HYB
25107	2	Phase B Power On Meter	WO	I32	W	1		HYB
25109	2	Phase C Power On Meter	WO	I32	W	1		HYB
25112	2	Active power limit	WO	U32	W	1		ONGRID
25113								ONGRID
25114	1	Active power limit percentage	WO	U16	N/A	1000	[0,1000]	ONGRID
25116	2	Reactive power limit	WO	I32	Var	1		ONGRID
25117								ONGRID
25118	1	Reactive power limit percentage	WO	I16	N/A	1000	[-600,+600]	ONGRID
25120	1	PF Settings	RW	I16	N/A	1000	(-1000,-800]U[800,1000]	ONGRID
28004	1	Under voltage 1	RW	U16	V	10		ONGRID
28005	1	Under voltage 1 Time	RW	U16	s	1		ONGRID
28006	1	Over voltage 1	RW	U16	V	10		ONGRID
28007	1	Over voltage 1 Time	RW	U16	s	1		ONGRID
28010	1	Over voltage 2	RW	U16	V	10		ONGRID
28011	1	Over voltage 2 Time	RW	U16	s	1		ONGRID
28012	1	Min frequency	RW	U16	Hz	100		ONGRID
28013	1	Min frequency Time	RW	U16	s	1		ONGRID
28014	1	Max frequency	RW	U16	Hz	100		ONGRID
28015	1	Max frequency Time	RW	U16	s	1		ONGRID
40200	1	Backup_A_V	RO	U16	V	10	AC Voltage	HYB
40201	1	Backup_A_I	RO	U16	A	10	AC Current	HYB
40202	1	Backup_A_F	RO	U16	Hz	100	Frequency	HYB
40204	2	Backup_A_P	RO	I32	kW	1000	AC Active Power	HYB
40205								HYB
40210	1	Backup_B_V	RO	U16	V	10	AC Voltage	HYB
40211	1	Backup_B_I	RO	U16	A	10	AC Current	HYB
40212	1	Backup_B_F	RO	U16	Hz	100	Frequency	HYB
40214	2	Backup_B_P	RO	I32	kW	1000	AC Active Power	HYB



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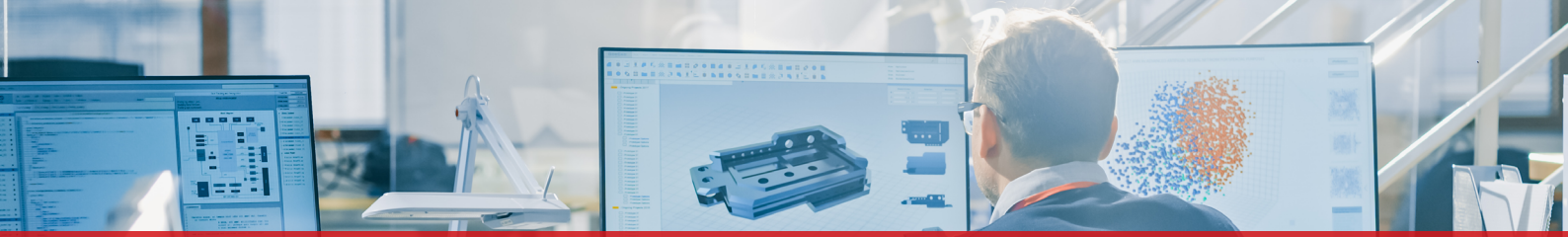
Modbus RTU Protocol for EQUINOX2, V 1.02

Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
40215								HYB
40220	1	Backup_C_V	RO	U16	V	10	AC Voltage	HYB
40221	1	Backup_C_I	RO	U16	A	10	AC Current	HYB
40222	1	Backup_C_F	RO	U16	Hz	100	Frequency	HYB
40224	2	Backup_C_P	RO	I32	kW	1000	AC Active Power	HYB
40225								HYB
40230	2	Total_Backup_P	RO	I32	kW	1000	AC Active Power	HYB
40231								HYB
40236	2	Invt_A_P	RO	I32	kW	1000	Phase A Active Power	HYB
40237								HYB
40242	2	Invt_B_P	RO	I32	kW	1000	Phase B Active Power	HYB
40243								HYB
40248	2	Invt_C_P	RO	I32	kW	1000	Phase C Active Power	HYB
40249								HYB
40254	1	Battery_V	RO	U16	V	10	DC Voltage	HYB
40255	1	Battery_I	RO	I16	A	10	DC Current	HYB
40256	1	Battery_Mode	RO	U16	N/A	1	0:discharge;1:charge	HYB
40258	2	Battery_P	RO	I32	kW	1000	Battery Power	HYB
40259								HYB
41000	1	Grid Injection Energy on that day[Meter]	RO	U16	kWh	10		HYB
41001	1	Grid Purchasing Energy on that day[Meter]	RO	U16	kWh	10		HYB
41002	1	Backup Output Energy on that day	RO	U16	kWh	10		HYB
41003	1	Battery Charge Energy on that day	RO	U16	kWh	10		HYB
41004	1	Battery Discharge Energy on that day	RO	U16	kWh	10		HYB
41005	1	PV Generation Energy on that day	RO	U16	kWh	10		HYB
41006	1	Loading Energy on that day	RO	U16	kWh	10		HYB
41008	1	Energy Purchased from Grid on that day	RO	U16	kWh	10		HYB
41102	2	Total Energy injected to grid	RO	U32	kWh	10		HYB
41103								HYB
41104	2	Total Energy Purchased from Grid from Meter	RO	U32	kWh	10		HYB
41105								HYB
41106	2	Total Output Energy on backup port	RO	U32	kWh	10		HYB
41107								HYB
41108	2	Total Energy Charged to Battery	RO	U32	kWh	10		HYB
41109								HYB
41110	2	Total Energy Discharged from Battery	RO	U32	kWh	10		HYB
41111								HYB
41112	2	Total PV Generation	RO	U32	kWh	10		HYB
41113								HYB
41114	2	Total Loading Energy consumed at grid side	RO	U32	kWh	10		HYB
41115								HYB
41118	2	Total Energy Purchased from Grid at inverter side	RO	U32	kWh	10		HYB
41119								HYB
42000	1	Battery Types	RO	U16	N/A	1		HYB



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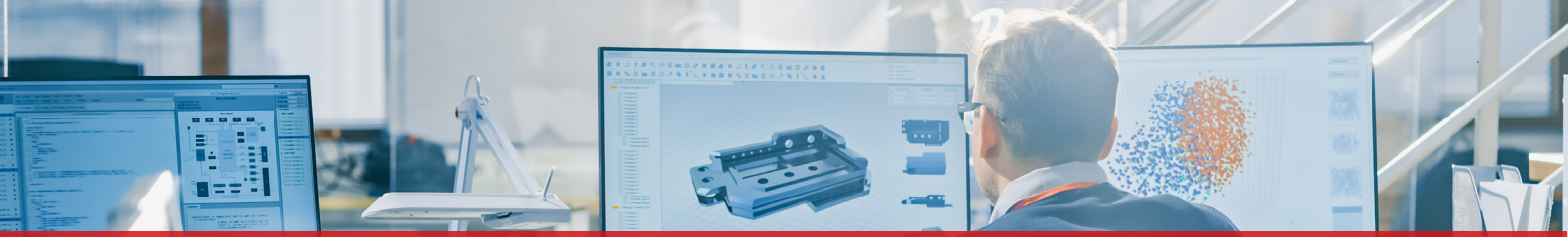
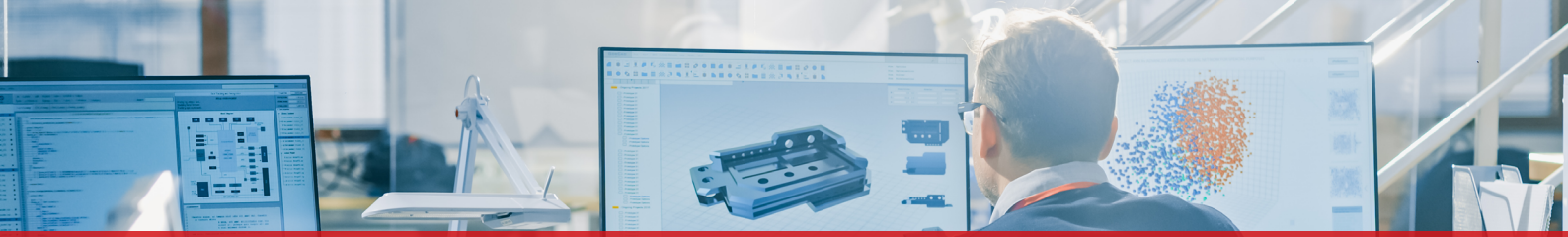
Modbus RTU Protocol for EQUINOX2, V 1.02

Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
42001	1	Battery strings	RO	U16	N/A	1		HYB
42002	1	Battery protocol	RO	U16	N/A	1		HYB
42003	1	Software Version	RO	U16	N/A	1		HYB
42004	1	Hardware Version	RO	U16	N/A	1		HYB
42005	1	BMS Charge Imax	RO	U16	A	10		HYB
42006	1	BMS Discharge Imax	RO	U16	A	10		HYB
43000	1	SOC	RO	U16	%	100		HYB
43001	1	SOH	RO	U16	%	100		HYB
43002	1	BMS Status	RO	U16	N/A	1		HYB
43003	1	BMS Pack Temperature	RO	U16	℃	10		HYB
43008	1	Max Cell Temperature ID	RO	U16	N/A	1		HYB
43009	1	Max Cell Temperature	RO	U16	℃	10		HYB
43010	1	Min Cell Temperature ID	RO	U16	N/A	1		HYB
43011	1	Min Cell Temperature	RO	U16	℃	10		HYB
43012	1	Max Cell Voltage ID	RO	U16	N/A	1		HYB
43013	1	Max Cell Voltage	RO	U16	V	1000		HYB
43014	1	Min Cell Voltage ID	RO	U16	N/A	1		HYB
43015	1	Min Cell Voltage	RO	U16	V	1000		HYB
43016	2	BMS ERROR CODE	RO	U32	N/A	1		HYB
43017								HYB
43018	2	BMS WARN CODE	RO	U32	N/A	1		HYB
43019								HYB
50000	1	Hybrid Inverter Working Mode Setting	RW	U16	N/A	1	Please refer to Table 3.6	HYB
50001	1	EPS/UPS function Switch	RW	U16	N/A	1	0:OFF 1:ON	HYB
50004	1	Off-grid Voltage Setting	RW	U16	V	10		HYB
50005	1	Off-grid Frequency Setting	RW	U16	Hz	100	[45.00-65.00]Hz	HYB
50006	1	Off-grid asymmetric output function switch	RW	U16	N/A	1	0:OFF 1:ON	HYB
50007	1	Peak Load Shifting Switch	RW	U16	N/A	1	0:OFF 1:ON	HYB
50009	1	Max. Grid Power Value Setting	RW	U16	kVA	10		HYB
50200	1	Off-grid function Switch	WO	U16	N/A	1	0:OFF 1:ON	HYB
50201	1	Clear Off-grid Over-loading Protection Flag	WO	U16	N/A	1	Write 1 to clear	HYB
50202	1	Inverter AC Power Setting	RW	U16	N/A	1	0:Off 1: Total Power Setting, Register: 50203 Setting, Registers: 50204- 50206 2: Power on each Phase	HYB
50203	1	Total AC Power Setting	RW	I16	kW	100	Full power programming settings	HYB
50204	1	Phase A Power Setting	RW	I16	kW	100	A Total power programming settings	HYB
50205	1	Phase B Power Setting	RW	I16	kW	100	B Phase power programming settings	HYB
50206	1	Power C Power Setting	RW	I16	kW	100	C Phase power programming settings	HYB
50207	1	Battery Power Setting	RW	I16	kW	100		HYB
50208	1	Max. AC Power Limit Setting	RW	I16	kW	100		HYB
50209	1	Min. AC Power Limit Setting	RW	I16	kW	100		HYB
50210	1	Priority Power Output Setting	RW	U16	NA	1	0 PV Output Priority 1 Battery Output Priority	HYB
50211	1	PV Power Setting	RW	U16	kW	100		HYB
52500	1	Battery Configuration	RW	U16	N/A	1	Please Refer to Table 3.7	HYB



Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
52502	1	On-grid Battery SOC Protection Switch	RW	U16	N/A	1	0:OFF 1:ON	HYB
52503	1	On-grid Battery DOD Switch	RW	U16	N/A	1000	[0.0%-100.0%]	HYB
52504	1	Off-grid Battery SOC Protection Switch	RW	U16	N/A	1	0:OFF 1:ON	HYB
52505	1	Off-grid Battery DOD	RW	U16	N/A	1000	[0.0%-100.0%]	HYB
53006	1	Scheduled Charge&Discharge	RW	U16	N/A	1	bit0- bit5 stands for period1-period6, bit7-bit15 0: disable Reserved; 1: enable See Table 3.10.	HYB
53007	1	Charge/Discharge Setting	RW	U16	N/A	1	Period1: 0:NONE 1:charge 2:discharge	HYB
53008	1	Battery Charge By	RW	U16	N/A	1	Period1: 0:PV 1:PV+GRID	HYB
53009	1	rsved	RW	U16	N/A	1	Period1: Reserved: 0xFF	HYB
53010	1	Power Limit	RW	U16	N/A	1000	Period1: [0.0-100.0%]	HYB
53011	1	rsved	RW	U16	N/A	1	Period1: Reserved: 0xFF	HYB
53012	1	Start Time	RW	U16	N/A	1	Period1: High 8bits(Hour):[0,23]	HYB
53013	1	Stop Time	RW	U16	N/A	1	Low 8bits(Mins):[0,59]	HYB
53014	1	Charge/Discharge	RW	U16	N/A	1	Period2 Same Period1	HYB
53015	1	Battery Charge By	RW	U16	N/A	1		HYB
53016	1	rsved	RW	U16	N/A	1		HYB
53017	1	Power Limit	RW	U16	N/A	1000		HYB
53018	1	rsved	RW	U16	N/A	1		HYB
53019	1	Start Time	RW	U16	N/A	1		HYB
53020	1	Stop Time	RW	U16	N/A	1		HYB
53021	1	Charge/Discharge	RW	U16	N/A	1	Period3 Same Period1	HYB
53022	1	Battery Charge By	RW	U16	N/A	1		HYB
53023	1	rsved	RW	U16	N/A	1		HYB
53024	1	Power Limit	RW	U16	N/A	1000		HYB
53025	1	rsved	RW	U16	N/A	1		HYB
53026	1	Start Time	RW	U16	N/A	1		HYB
53027	1	Stop Time	RW	U16	N/A	1		HYB
53028	1	Charge/Discharge	RW	U16	N/A	1	Period4 Same Period1	HYB
53029	1	Battery Charge By	RW	U16	N/A	1		HYB
53030	1	rsved	RW	U16	N/A	1		HYB
53031	1	Power Limit	RW	U16	N/A	1000		HYB
53032	1	rsved	RW	U16	N/A	1		HYB
53033	1	Start Time	RW	U16	N/A	1		HYB
53034	1	Stop Time	RW	U16	N/A	1		HYB
53035	1	Charge/Discharge	RW	U16	N/A	1	Period5 Same Period1	HYB
53036	1	Battery Charge By	RW	U16	N/A	1		HYB
53037	1	rsved	RW	U16	N/A	1		HYB
53038	1	Power Limit	RW	U16	N/A	1000		HYB
53039	1	rsved	RW	U16	N/A	1		HYB
53040	1	Start Time	RW	U16	N/A	1		HYB



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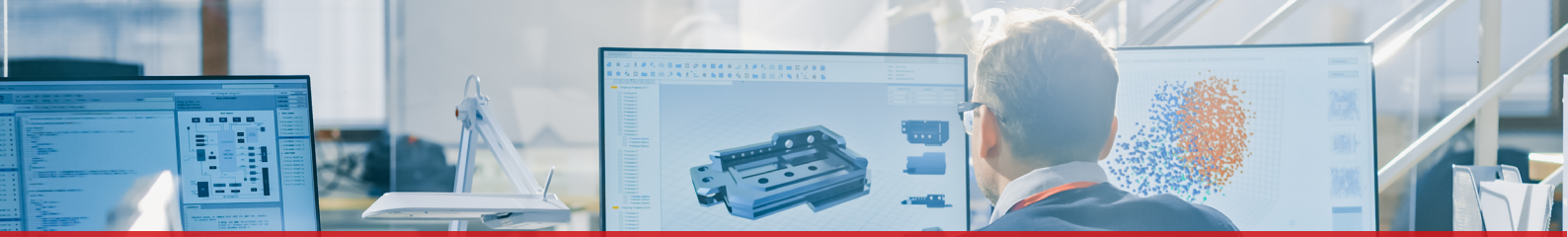
Modbus RTU Protocol for EQUINOX2, V 1.02

Register Adress	Words	Data Description	Read-write	Types	Units	Gain	Notes	Inverter Type
53041	1	Stop Time	RW	U16	N/A	1		HYB
53042	1	Charge/Discharge	RW	U16	N/A	1	Period6 Same Period1	HYB
53043	1	Battery Charge By	RW	U16	N/A	1		HYB
53044	1	rsved	RW	U16	N/A	1		HYB
53045	1	Power Limit	RW	U16	N/A	1000		HYB
53046	1	rsved	RW	U16	N/A	1		HYB
53047	1	Start Time	RW	U16	N/A	1		HYB
53048	1	Stop Time	RW	U16	N/A	1		HYB
53500	8	BMSVersion	WO	STR	N/A	1	Only for EMS	HYB
53508	1	BMS Status	WO	U16	N/A	1	Please refer to Table 3.8, only for EMS	HYB
53509	2	BMS ErrorCode	WO	U32	N/A	1	Please refer to Table 3.9, only for EMS	HYB
53511	2	BMS ProtectionCode	WO	U32	N/A	1	Please refer to Table 3.9, only for EMS	HYB
53513	2	BMS WarnCode	WO	U32	N/A	1	Please refer to Table 3.9, only for EMS	HYB
53515	1	BMSChargeVoltLi mit	WO	U16	V	10	Only for EMS	HYB
53516	1	BMSChargeCurrMax	WO	U16	A	10	Only for EMS	HYB
53517	1	BMSDishargeVoltLimit	WO	U16	V	10	Only for EMS	HYB
53518	1	BMSDishargeCurrMax	WO	U16	A	10	Only for EMS	HYB
53519	1	BMSBatSOC	WO	U16	%	100	Only for EMS	HYB
53520	1	BMSBatSOH	WO	U16	%	100	Only for EMS	HYB
53521	1	BMSBatVoltage	WO	U16	V	10	Only for EMS	HYB
53522	1	BMSBatCurrent	WO	I16	A	10	Only for EMS	HYB
53523	1	BMSBatTemp	WO	I16	℃	10	Only for EMS	HYB

Tab. 3.1.

Model information (10008 high type)		Single-phase Dual-MPPT PV inverter	Single-phase Single-MPPT PV inverter	Single-phase Dual-MPPT PV inverter	Three-phase Dual-MPPT PV inverter
		01	02	03	12
Rating information (10008 low byte)	0	EQX2 3002-S	N/A	EQX2 7002-SX	EQX2 6002-T
	1	EQX2 3602-S	EQX2 1001-S	EQX2 8002-SX	EQX2 8002-T
	2	EQX2 4002-S	EQX2 1501-S	EQX2 9002-SX	EQX2 10002-T
	3	N/A	EQX2 2001-S	EQX2 10002-SX	EQX2 12002-T
	4	EQX2 5002-S	EQX2 2501-S	N/A	EQX2 15002-T
	5	N/A	EQX2 3001-S	N/A	EQX2 17002-T
	6	N/A	N/A	N/A	EQX2 20002-T
	7	N/A	N/A	N/A	EQX2 25002-T
	8	N/A	N/A	N/A	EQX2 4002-T
	9	N/A	N/A	N/A	EQX2 5002-T

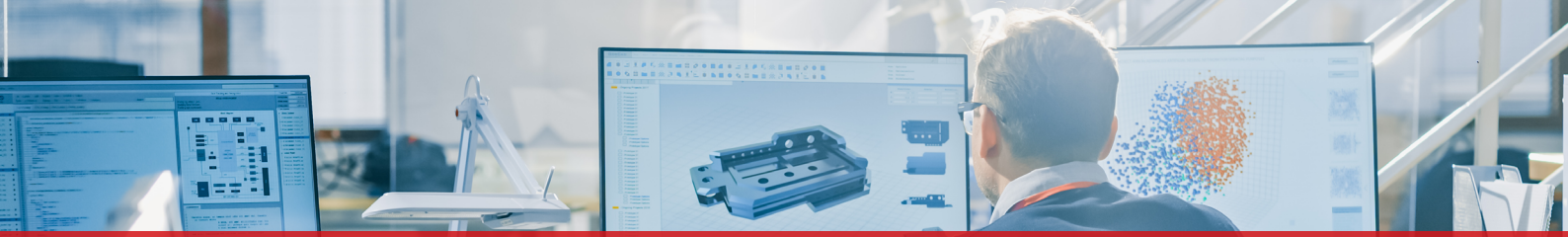


Model information (10008 high type)		Three-phase Four-MPPT PV inverter	Three-phase Six-MPPT PV inverter	Three-phase Ten-MPPT PV inverter	N/A
		16	20	21	N/A
Rating information (10008 low byte)	0	N/A	N/A	EQX2 80008-T	N/A
	1	N/A	N/A	N/A	N/A
	2	EQX2 33004-T	N/A	EQX2 100010-T	N/A
	3	N/A	N/A	N/A	N/A
	4	EQX2 40004-T	N/A	N/A	N/A
	5	N/A	N/A	N/A	N/A
	6	EQX2 50004-T	N/A	N/A	N/A
	7	EQX2 60004-T	N/A	N/A	N/A
	8	N/A	N/A	N/A	N/A
	9	N/A	N/A	N/A	N/A

Tab. 3.2.

Fault Code	Register Adress	Bit	Hexadecimal	Decimal	The Fault Name	English Display
1	10112 (Fault FLAG1)	BIT0	0x00000001	1	Grid loss	Mains Lost
2		BIT1	0x00000002	2	Grid voltage Fault	Grid Voltage Fault
3		BIT2	0x00000004	4	Grid Frequency Fault	Grid Frequency Fault
4		BIT3	0x00000008	8	DCI Fault	DCI Fault
5		BIT4	0x00000010	16	ISO Over Limitation	ISO Over Limitation
6		BIT5	0x00000020	32	GFCI Fault	GFCI Fault
7		BIT6	0x00000040	64	PV Over Voltage	PV Over Voltage
8		BIT7	0x00000080	128	Bus Voltage Fault	Bus Voltage Fault
9		BIT8	0x00000100	256	Inverter Over Temperature	Inverter Over Temperature
34	10112 (Fault FLAG2)	BIT1	0x00000002	2	SPI Fault	SPI Fault
35		BIT2	0x00000004	4	E2 Fault	E2 Fault
36		BIT3	0x00000008	8	GFCI Device Fault	GFCI Device Fault
37		BIT4	0x00000010	16	AC Transducer Fault	AC Transducer Fault
38		BIT5	0x00000020	32	Relay Check Fail	Relay Check Fail
39		BIT6	0x00000040	64	Internal Fan Fault	Internal Fan Fault
40		BIT7	0x00000080	128	External Fan Fault	External Fan Fault
65	10120 (Fault FLAG3)	BIT0	0x00000001	1	SCI Fault	SCI Fault
66		BIT1	0x00000002	2	FLASH Fault	FLASH Fault

Tab. 3.3.

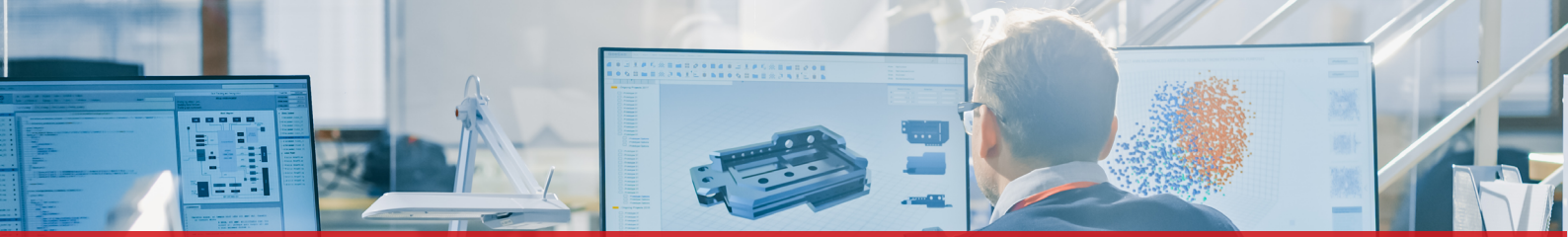


Inverter Type (10008 high bit)		Three Phase Hybrid	Single Phase Hybrid
		30	31
Model Info (10008 low bit)	0	EQX2 4002-HT	N/A
	1	EQX2 5002-HT	N/A
	2	EQX2 6002-HT	EQX2 4002-HSX
	3	EQX2 8002-HT	N/A
	4	EQX2 10002-HT	EQX2 5002-HSX
	5	EQX2 12002-HT	EQX2 6002-HSX
	6	N/A	N/A
	7	N/A	EQX2 8002-HSX
	8	N/A	EQX2 3001-HSX
	9	N/A	N/A

Tab. 3.4.

Fault Code	Registers	BIT	HEX	DEC	Fault Description
1	10112 (Fault FLAG1)	BIT0	0x00000001	1	Mains Lost
2		BIT1	0x00000002	2	Grid Voltage Fault
3		BIT2	0x00000004	4	Grid Frequency Fault
4		BIT3	0x00000008	8	DCI Fault
5		BIT4	0x00000010	16	ISO Over Limitation
6		BIT5	0x00000020	32	GFCI Fault
7		BIT6	0x00000040	64	PV Over Voltage
8		BIT7	0x00000080	128	Bus Voltage Fault
9		BIT8	0x00000100	256	Inverter Over Temperature
34	10112 (Fault FLAG2)	BIT1	0x00000002	2	SPI Fault
35		BIT2	0x00000004	4	E2 Fault
36		BIT3	0x00000008	8	GFCI Device Fault
37		BIT4	0x00000010	16	AC Transducer Fault
38		BIT5	0x00000020	32	Relay Check Fail
39		BIT6	0x00000040	64	Internal Fan Fault
40		BIT7	0x00000080	128	External Fan Fault
10001	18000 (ARM Fault FLAG1)	BIT0	0x00000001	1	SCI Fault
10002		BIT1	0x00000002	2	FLASH Fault
10003		BIT2	0x00000004	4	Meter Comm Fault

Tab. 3.5.



NO.	Hybrid Inverter Working Mode		Description	Note
	50000 high 8bits	50000 low 8bits		
1	1	1	General Mode	
2		2	Economic Mode	
3		3	UPS Mode	
4	2	N/A	Off Grid Mode	
5	3	1	EMS_ACCtrlMode	Valid Registers: 50202-50206
6		2	EMS_GeneralMode	
7		3	EMS_BattCtrlMode	Valid Registers: 50207-50211
8		4	EMS_OffGridMode	

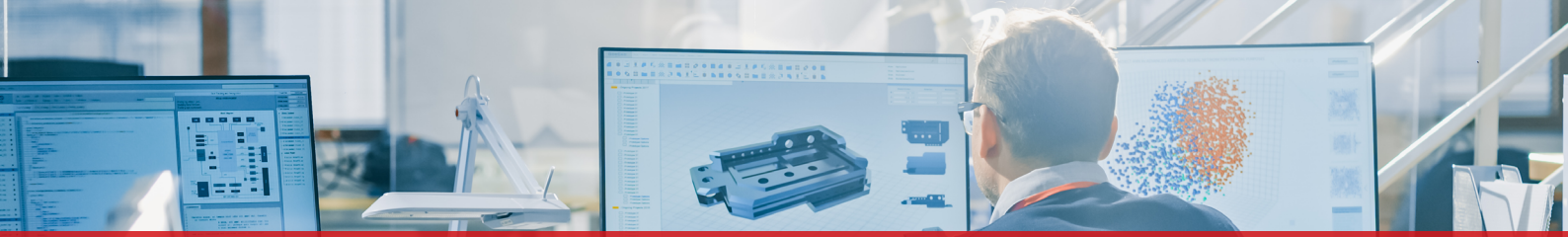
Tab. 3.6.

Battery Brand(52500)		Protocol Configuration (52501)	Note
2	EMS	N/A	Only for EMS
10	Li-HV		
14—	Rsved		

Tab. 3.7.

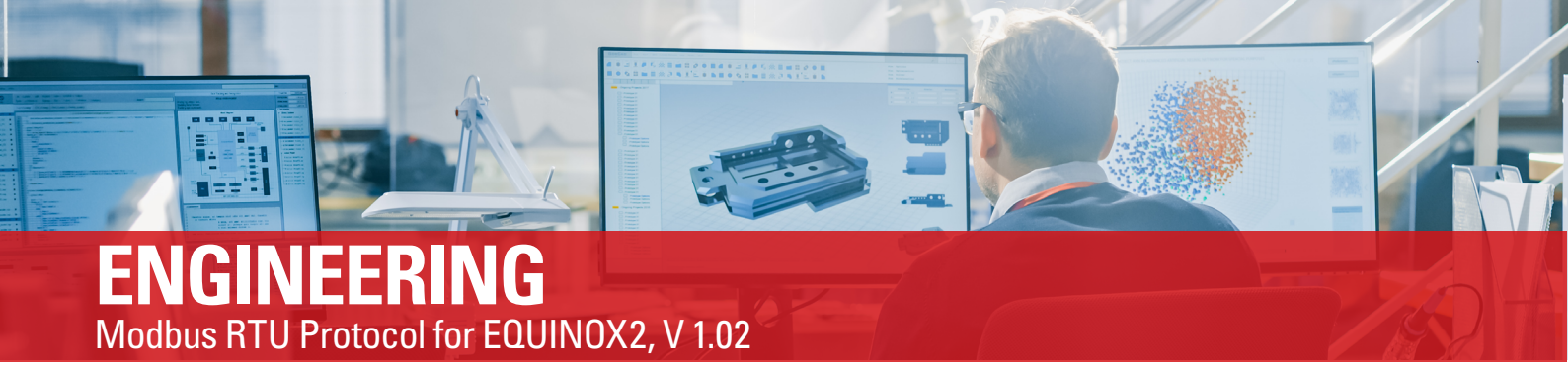
Registers(53508)	Bits	Function	Description
High 8 bits BMS Control Status	Bit15	Rsved	
	Bit14		
	Bit13		
	Bit12		
	Bit11	ForceCharge	1: ForceCharge Command (ChargeCommand Bit10 must write 1) 0: Invalid(Null)
	Bit10	ChargeCommand	1:Enable 0:Disable
	Bit9	Off-grid DischargeCommand	1:Enable 0:Disable
	Bit8	On-grid DischargeCommand	1:Enable 0:Disable
Low 8bits BMS Running Status	Bit0~Bit7	0:Sleep 1:Charge 2:Discharge 3:Standby 4:Fault	

Tab. 3.8.



Registers	Bits	Hex	Dec	Fault Description	Note
53509 (BMS Error Code)	BIT0	0x00000001	1	Internal COM Fault	
	BIT1	0x00000002	2	Voltage Sensor Fulat	
	BIT2	0x00000004	4	Temperature Sensor Fault	
	BIT3	0x00000008	8	Relay Fault	
	BIT4	0x00000010	16	Cells Damage Fault	
53511 (BMS Protection Code)	BIT0	0x00000001	1	Cells Low Voltage Protection	
	BIT1	0x00000002	2	Cells High Voltage Protection	
	BIT2	0x00000004	4	Battery Module Discharge Low Voltage Protection	
	BIT3	0x00000008	8	Battery Module Charge Over Voltage Protection	
	BIT4	0x00000010	16	Charge Low Temperature Protection	
	BIT5	0x00000020	32	Charge High Temperature Protection	
	BIT6	0x00000040	64	Discharge Low Temperature Protection	
	BIT7	0x00000080	128	Discharge High Temperature Protection	
	BIT8	0x00000100	256	Battery Module Charge Over-current Protection	
	BIT9	0x00000200	512	Battery Module Discharge Over-current Protection	
	BIT10	0x00000400	1024	Battery Module Low Voltage Protection	
	BIT11	0x00000800	2048	Battery Module Over Voltage Protection	
	BIT12	0x00001000	4096	Power Terminal Over Temperature Protection	
	BIT13	0x00002000	8192	Ambient Low Temperature Protection	
	BIT14	0x00004000	16384	Ambient High Temperature Protection	
	BIT15	0x00008000	32768	Leakage Current Protection	
53513 (BMS Alarm Code)	BIT0	0x00000001	1	Cells Low Voltage Warning	
	BIT1	0x00000002	2	Cells High Voltage Warning	
	BIT2	0x00000004	4	Battery Module Discharge Low Voltage Warning	
	BIT3	0x00000008	8	Battery Module Charge Over Voltage Warning	
	BIT4	0x00000010	16	Charge Low Temperature Warning	
	BIT5	0x00000020	32	Charge Over Temperature	
	BIT6	0x00000040	64	Discharge Low Temperature Warning	
	BIT7	0x00000080	128	Discharge Over Temperature Warning	
	BIT8	0x00000100	256	Battery Module Charge Over-current Warning	
	BIT9	0x00000200	512	Battery Module Discharge Over Current Warning	
	BIT10	0x00000400	1024	Battery Module Low Voltage Warning	
	BIT11	0x00000800	2048	Battery Module Over Voltage Warning	
	BIT12	0x00001000	4096	Power Terminal Over Temperature Warning	
	BIT13	0x00002000	8192	Ambient Low Temperature Warning	
	BIT14	0x00004000	16384	Ambient Over Temperature Warning	

Tab. 3.9.

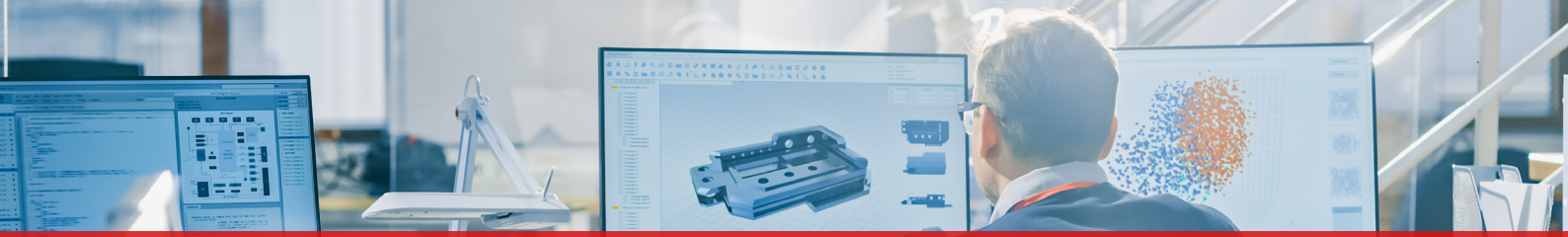


Base Register	End Register	Description	Notes
53006	53006	Numerical value based on active hourly periods.	
53007	53013	First hourly period vector. To activate it, add +1 to Register 53006.	To write values, the registers between 53007 and 53013 form a 7-byte set.
53014	53020	Second hourly period vector. To activate it, add +2 to Register 53006.	To write values, the registers between 53014 and 53020 form a 7-byte set.
53021	53027	Third hourly period vector. To activate it, add +4 to Register 53006.	To write values, the registers between 53021 and 53027 form a 7-byte set.
53028	53034	Fourth hourly period vector. To activate it, add +8 to Register 53006.	To write values, the registers between 53028 and 53034 form a 7-byte set.
53035	53041	Fifth hourly period vector. To activate it, add +16 to Register 53006.	To write values, the registers between 53035 and 53041 form a 7-byte set.
53042	53048	Sixth hourly period vector. To activate it, add +32 to Register 53006.	To write values, the registers between 53042 and 53048 form a 7-byte set.
530xx (53007 to 53042)	530xx + 6 (53013 to 53048)	4530xx -> charge = 1, discharge = 2	To write values, the registers between 530xx and 530xx + 6 form a 7-byte set.
		4530xx + 1 -> PV + Grid = 1, PV = 0	
		4530xx + 2 -> Undetermined	
		4530xx + 3 -> ‰ (charge or discharge)	
		4530xx + 4 -> Undetermined	
		4530xx + 5 -> Start time. See Table 3.11 for time encoding.	

Tab. 3.10.

Time example	Hour	Minute	Register value	Notes
0:00	0	0	0	Every hour adds 256 to the register value. The encoded hours range from 0 to 23. Every minute adds 1 to the register value. The encoded minutes range from 0 to 59.
0:59	0	59	59	
1:00	1	0	256	
12:30	12	30	3102	
23:00	23	0	5888	
23:59	23	59	5947	

Tab. 3.11.



4. EMS TABLE.

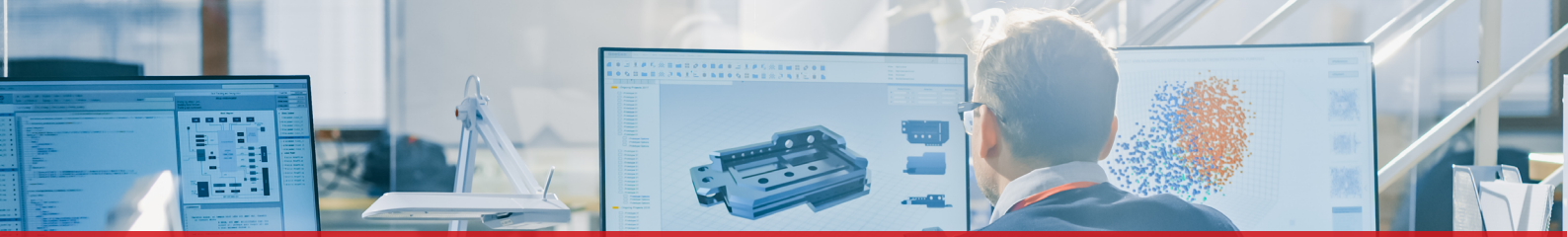
EMS_ACCtrlMode (EMS Applications) Application #1: AC Power Control						
AC Power Setting	Registers					Note
	Power Mode Seeting(50202)	Total Power Setting(50203)	Phase A Power Setting -50204	Power B Power Setting -50204	Phase C Power Setting -50204	
AC Total Power Setting	1	Set Power	--	--	--	
	Note: Set Power is to set the total input/output power of inverter Pinv(1) = Set Power Set; PowerA = PowerB = PowerC = Set Power /3					
AC Three Phases Independent Setting	2	--	Set PowerA	Set PowerB	Set PowerC	
	Note: Set PowerA, Set PowerB, Set PowerC is to set PhaseA/B/C power independently, which shall follow the rule as below Pinv = Set PowerA+ Set PowerB+ Set PowerC					

Tab. 4.1.

EMS_GeneralMode (EMS Applications) Application #2: General Mode						
Control Mode	Registers					Note
	--	--	--	--	--	
General Mode	Note: For maximum PV Self-consumption, shall follow the rule as below: Pload(2) = Ppv(3) + Pbat(4) - Pmeter(5)					

Tab. 4.2.

EMS_BattCtrlMode (EMS Applications) Application #3: Battery Charge/Discharge Control				
Battery charge/discharge control mode	Registers			
	Battery Power Setting(50207)	AC Top Limit Setting(50208)	AC Bottom Limit Setting(50209)	Supply Power Priority (50210)
Battery Charge	Set Pbat	Set PupLimit	Set PlowerLimit	0: PV Supply Priority
	E.g. Setting Map: Set Pbat = -1000W; Set PupLimit = 10000W; Set PlowerLimit = -500W; PV Supply with Priority; Target: Battery Charge: 1000W, Maximum Grid Injection: 10000W, Maximum Gird Purchasing: 500W 1. E.g. Ppv = 0W, battery charge power is 500W(Pbat = 500W), Inverter Grid Purchasing 500W(Pinv =-500W); 2. E.g. Ppv = 200W, battery charge power is 700W(Pbat = 700W), Inverter Grid Purchasing is 500W(Pinv = -500W); 3. E.g. Ppv = 2000W, battery charge power is 1000W(Pbat = 1000W), Inverter Grid Injection Power is 1000W (Pinv = 1000W)			
Battery Discharge	Set Pbat	Set PupLimit	Set PlowerLimit	0: PV Supply with Priority
	E.g. Setting Map: Set Pbat = 1000W; Set PupLimit = 2000W; Set PlowerLimit = -10000W; PV Supply with Priority Target: Battery Discharge: 1000W, Max. Grid Injection Power: 2000W, Max. Grid Purchasing Power: 10000W; 1. E.g. Ppv = 0W, Battery Discharge Power: 1000W(Pbat = 1000W), Inverter Grid Injection Power: 1000W(Pinv = 1000W) 2. E.g. Ppv = 500W, Battery Discharge Power: 1000W(Pbat = 1000W), Inverter Grid Injection Power: 1500W(Pinv = 1500W) 3. E.g. Ppv = 1500W, Battery Discharge Power: 500W(Pbat = 500W), Inverter Grid Injection Power 2000W(Pinv = 2000W);			



EMS_BattCtrlMode (EMS Applications) Application #3: Battery Charge/Discharge Control				
Battery Force Charge	Set Pbat	Set PupLimit	Set PlowerLimit	0: PV Supply with Priority
	E.g. Setting Map: Set Pbat = -1000W; Set PupLimit = 10000W; Set PlowerLimit = -500W; PV Supply with Priority Target: Battery Charge Power:1000W, Max. Grid Injection Power: 10000W, release inverter grid purchasing power limit and Set PlowerLimit = -Pn; 1. E.g. Ppv = 0W, battery charge power is 1000W(Pbat = -1000W), Inverter Grid Purchasing Power: 1000W(Pinv = -1000W); 2. E.g. Ppv = 200W, battery charge power is 1000W(Pbat = -1000W), Inverter Grid Purchasing Power: 800W(Pinv = -800W); 3. E.g. Ppv = 2000W, battery charge power is 1000W(Pbat = -1000W), Inverter Grid Injection Power:1000W(Pinv = -1000W)			
Battery Force Discharge	Set Pbat	Set PupLimit	Set PlowerLimit	1: Battery Supply with Priority
	E.g. Setting Map: Set Pbat = 1000; Set PupLimit = 2000; Set PlowerLimit = -10000; Battery Supply with Priority; Target: Battery Discharge Power:1000W, Max. Inverter Grid Injection Power: 2000W, Max. Grid Purchasing Power: 10000W; 1. E,g. Ppv=0W, Battery Discharge Power: 1000W(Pbat=1000W), Inverter Grid Injection Power:1000W(Pinv = 1000W); 2. E.g. Ppv=500W, Battery Discharge Power:1000W(Pbat=1000W), Inverter Grid Injection Power:1500W(Pinv =1500W); 3. E.g. Ppv =1500W(Limit Ppv<=1000W, battery supply with priority), Battery Discharge Power: 1000W(Pbat = 1000W), Inverter Grid Injection Power: 2000W(Pinv = 2000W);			

Tab. 4.3.

EMS_OffGridMode Application #4: Off-grid Mode						
Control Mode	Registers					Note
	PV Power Setting(50211)	--	--	--	--	
	Set Ppv					Note: 1. Hybrid Inverter AC Power 2. Total Loading Power(grid loading+backup loading) 3. PV Output Power 4. Battery Charge/Discharge Power 5. Gird Injection/Purchasing Power 6. Hybrid inverter backup loading Power
Off-grid Mode	No Ppv = Set Ppv te: Pbackup(6) = Pbat + Ppv					

Tab. 4.4.