Modbus_RTU communication description

Version: Version 1.0, September 2021

Modbus_RTU communication description Communication Data Format Frame Format Device register address fault code table warning code description CRC calibration algorithm

Communication data format

- During communication, the data is returned in the form of words (WORD-2 bytes). In each word returned, the high byte is in front and the low bytes is back. If two words are sent back continuously (e. g., long plastic surgery), the high word is before and the low word is back.
-

data type	Number of registers	Bytes	explain
Hollerith type	1	1	Send back two characters at a time, less than two are supplemented with 0
integer	1	2	Send back once, high bytes in front, low bytes back
long	2	4	In two words back, high words in the front, low words in the back

-

---

frame format

- Register content query (function code 03H)

- The start and end address of the query must be the start and end address of a complete data block, otherwise the data returned is incorrect.For example, if the register starting address of the device serial number is 186 and the length is 12, the starting address cannot be between 186 and 198, and the same end address (start address + number of registers read) cannot fall in this range.
- Frame format sent by the upper bit computer
Byte order	code	instance	explain
0	device address	01H	Equipment Address (1~247)
1	03H	03H	FC
2	Start register address High-byte	00H	Register address is 8 bits higher
3	The Start register address is low in bytes	10H	Register address is 8 bits lower
4	Register number of high bytes	00H	The number of registers is 8 bits higher
5	Number of registers is low in bytes	02H	The number of registers is 8 bits lower
6	CRC16 Check the high bytes	C0H	CRC16 checks 8 bits
7	CRC16 Check the low bytes	CBH	CRC16 check for low 8 bits
- The next bit machine successfully resolved the return frame format
-

Byte order	code	explain
0	device address	Equipment Address (1~247)
1	03H	FC
2	Return Data Bytes (N)	N = The number of registers requested, * 2
3	First register data high byte	
4	The 1st register data is a low byte	
.....	.....	
.....	.....	
	The N register data high byte	
	The N register data low byte	
N+3	CRC16 Check the high bytes	
N+4	CRC16 Check the low bytes	

- The next parresolves error return frame format

-

Byte order	code	explain
0	device address	Equipment Address (1~247)
1	03H	FC
2	Return Data Bytes (N)	N = The number of registers requested, * 2
3	The first 0	Total total of N 0
4	The second 0	
.....	.....	
.....	.....	

Byte order	code	explain
	N-10	
	N, 0	
N+3	CRC16 Check the high bytes	
N+4	CRC16 Check the low bytes	

- Register Read example:
- Read the data of the effective value (start register 202) to the average municipal power, where the municipal voltage returns to 220.0v, the municipal power frequency returns to 50.0Hz, and the average municipal power returns to 1200w
- Upper position computer: 01 03 00 CA 00 03 25 F5
- Lower machine: 01 03 06 08 FC 13 88 04 B0 F7 F3
- ---
-
-
-

Register Content Settings (function code 10H)

- Frame format sent by the upper bit computer
-

Byte order	code	instance	explain
0	device address	01H	Equipment Address (1~247)
1	10H	10H	FC

Byte order	code	instance	explain
2	Start register address High-byte	01H	Register address is 8 bits higher
3	The Start register address is low in bytes	10H	Register address is 8 bits lower
4	Register number of high bytes	00H	Number of registers is 8 bits high (constant to 0)
5	Number of registers is low in bytes	02H	The number of registers is 8 bits lower
6	Number of bytes to be written to (N)		N = Number of registers * 2
7	First register data high byte		
8	The 1st register data is a low byte		
.....	.....		
.....	.....		
	The N register data high byte		
	The N register data low byte		
N+7	CRC16 Check the high bytes		CRC16 checks 8 bits
N+8	CRC16 Check the low bytes		CRC16 check for low 8 bits

- **The next bit machine successfully resolved the return frame format**
-

Byte order	code	instance	explain
0	device address	01H	Equipment Address (1~247)
1	10H	10H	FC
2	Start register address High-byte	01H	Register address is 8 bits hig
3	The Start register address is low in bytes	10H	Register address is 8 bits low
4	Register number of high bytes	00H	Number of registers is 8 bits (constant to 0)
5	Number of registers is low in bytes	02H	The number of registers is 8 b lower
6	CRC16 Check the high bytes	41H	CRC16 checks 8 bits
7	CRC16 Check the low bytes	F1H	CRC16 check for low 8 bits

- The next parresolves error return frame format

Byte order	code	explain
0	device address	Equipment Address (1~247)
1	90H	FC
2	error code	error code
3	CRC16 Check the high bytes	CRC16 checks 8 bits
4	CRC16 Check the low bytes	CRC16 check for low 8 bits

- Error code description

code	explain
01H	The Read-only register was operated
03H	Write to the data beyond the acceptable range

code	explain
07H	The current working mode does not allow for modified registers

- Register Write example:
- Set the output voltage (start register 320) to 220v
- Upper: 01 10 01 40 00 01 08 98 BE 3A
- Lower machine: 01 10 01 40 00 01 01 E1

Device register address

- R: means readable support for the 03 H command.W: Support for 10 H command.
-
- Int: whole type; Long: long integer type; UInt: no integer type; ULong: no character length integer type; ASC: ASCII code
-
- Max: Take the maximum value; Min: Take the minimum value
-
- The addresses in the following table are shown as decimal systems
-

data name	unit	data format	start address	Number of registers	read-write	remarks
Device fault code		ULong	100	2	R	The 32-bit fault code, each bit corresponds to a fault code, see the fault code table, fault code 1 corresponds to bit1, fault code 2 corresponds to bit2, and so on
obligate			102	2		Leave an address
obligate			104	2		Leave an address
obligate			106	2		Leave an address
Get the warning code		ULong	108	2	R/W	See the 32-bit warning code description
obligate			110	61		Leave an address
obligate			171	1	R	Leave an address
obligate			172	12		Leave an address

data name	unit	data format	start address	Number of registers	read-write	remarks
DNA		UInt	184	1	R	internal command
obligate			185	1		Leave an address
Device serial number		ASC	186	12	R	
obligate			198	2		Leave an address
DNA		UInt	200	1		internal command
work pattern		UInt	201	1	R	0: boot mode 1: standby mode 2: Market power mode 3: Off-grid mode 4: bypass mode 5: Charging mode 6: fault-pattern
Effective value of municipal electric voltage	0.1v	Int	202	1	R	
power frequency	0.01Hz	Int	203	1	R	

data name	unit	data format	start address	Number of registers	read-write	remarks
Average municipal electric power	1w	Int	204	1	R	
Inverse voltage active value	0.1v	Int	205	1	R	
Effective value of the inverter current	0.1A	Int	206	1	R	
Inverse frequency	0.01Hz	Int	207	1	R	
Inverse power average value	1w	Int	208	1	R	Positive number indicates the inverse output, and negative number indicates the inverse input
Inverse charging power	1w	Int	209	1	R	
Output voltage effective value	0.1v	Int	210	1	R	
Output current valid value	0.1A	Int	211	1	R	

data name	unit	data format	start address	Number of registers	read-write	remarks
output frequency	0.01Hz	Int	212	1	R	
Output active power	1w	Int	213	1	R	
The output is viewed in power	1VA	Int	214	1	R	
Battery voltage average value	0.1v	Int	215	1	R	
Battery current average value	0.1A	Int	216	1	R	
Battery power average value	1w	Int	217	1	R	
DNA			218	1		internal command
The PV voltage is average value	0.1v	Int	219	1	R	
PV current average	0.1A	Int	220	1	R	

data name	unit	data format	start address	Number of registers	read-write	remarks
obligate			221	2		Leave an address
PV power average value	1w	Int	223	1	R	
PV charging power average value	1w	Int	224	1	R	
load percentage	1%	Int	225	1	R	
DCDC temperature	1℃	Int	226	1	R	
Inverse temperature	1℃	Int	227	1	R	
obligate			228	1		Leave an address
Percentage of batteries	1%	UInt	229	1	R	
DNA			230	1		internal command
obligate			231	1		Leave an address
Battery current filtering is the average value	0.1A	Int	232	1	R	Positive number indicates charging, negative

data name	unit	data format	start address	Number of registers	read-write	remarks
						indicates discharge
Inverse charging current average value	0.1A	Int	233	1	R	
PV charging current average	0.1A	Int	234	1	R	
DNA			235	1		internal command
DNA			236	1		internal command
obligate			237	63		Leave an address
Output mode		Uint	300	1	R/W	0: light engine; 1: parallel operation; 2: Three-phase combination
output priority		Uint	301	1	R/W	0: Municipal Electricity-PV-Battery; 1: PV-MSC-Battery; 2: PV-Battery-MMC

data name	unit	data format	start address	Number of registers	read-write	remarks
input voltage range		Uint	302	1	R/W	0: Wide range; 1: narrow range;
The buzzer mode		Uint	303	1	R/W	0: Mute in all cases; 1: The input source has a transformation or a specific warning or fault to ring; 2: Sound with a specific warning or fault; 3: Sound during the fault;
obligate			304	1	R/W	Leave an address
LCD be in a poor light		Uint	305	1	R/W	0: Time-time shut-off; 1: Chang Liang;
The LCD automatically returns to the home page		Uint	306	1	R/W	0: Not automatically returned; Return automatically after 1:1 minutes;

data name	unit	data format	start address	Number of registers	read-write	remarks
Energy saving mode switch		Uint	307	1	R/W	0: Energy-saving mode is off; 1: Energy-saving mode is open;
overload automatically restarts		Uint	308	1	R/W	0: Overload fault does not restart; 1: Automatic restart of the overload fault;
Overtemperature automatic restart		Uint	309	1	R/W	0: Over-temperature failure does not restart; 1: Automatic restart of overtemperature fault;
Overload turn bypass enables		Uint	310	1	R/W	0: prohibit; 1: enable;
obligate			311	2		Leave an address
Battery Eq mode enables the		Uint	313	1	R/W	0: prohibit; 1: enable;
obligate			314	2		Leave an address

data name	unit	data format	start address	Number of registers	read-write	remarks
obligate			316	1		Leave an address
obligate			317	3		Leave an address
output voltage	0.1v	Uint	320	1	R/W	
output frequency	0.01Hz	Uint	321	1	R/W	
obligate			322	1		Leave an address
Battery overvoltage protection point	0.1v	Uint	323	1	R/W	
Maximum charging voltage	0.1v	Uint	324	1	R/W	
Floating charging voltage	0.1v	Uint	325	1	R/W	
Municipal power mode battery discharge recovery point	0.1v	Uint	326	1	R/W	
Municipal electric	0.1v	Uint	327	1	R/W	

data name	unit	data format	start address	Number of registers	read-write	remarks
mode battery low-voltage protection point						
obligate			328	1		Leave an address
Offline grid mode battery low-voltage protection point	0.1v	Uint	329	1	R/W	
obligate			330	1		Leave an address
Battery charging priority		Uint	331	1	R/W	0: Municipal power is priority; 1:PV take precedence; 2: PV and the municipal electricity; 3: Only PV charging is allowed
Maximum charging current	0.1A	Uint	332	1	R/W	
Maximum municipal electric	0.1A	Uint	333	1	R/W	

data name	unit	data format	start address	Number of registers	read-write	remarks
charging current						
Eq charging voltage	0.1v	Uint	334	1	R/W	
bat_eq_time	min	Uint	335	1	R/W	Range: 0 ~ 900
Eq timeout exit	min	Uint	336	1	R/W	Range: 0 ~ 900
Two Eq charging intervals	day	Uint	337	1	R/W	Scope: 1 ~ 90
obligate			338	1		Leave an address
obligate			339	65		Leave an address
DNA			404	1		internal command
obligate			405	1		Leave an address
boot way		Uint	406	1	R/W	0: It can be turned on either locally or remotely 1: Only start on locally 2: You can only start it on remotely

data name	unit	data format	start address	Number of registers	read-write	remarks
obligate			407	13		Leave an address
Remote switch		Uint	420	1	R/W	0: Remote shutdown 1: Remote boot
DNA			421	1		internal command
obligate			422	3		Leave an address
obligate			425			Leave an address
Exit the fault lock status		Uint	426		W	1: Exit fault lock status (only the machine enters failure mode)
DNA			427	1		internal command
obligate			428	22		Leave an address
DNA			450	7		internal command
obligate			457	3		Leave an address
obligate			460	1		Leave an address

data name	unit	data format	start address	Number of registers	read-write	remarks
obligate			461	1		Leave an address
DNA			462	6		internal command
obligate			468	32		Leave an address
DNA			500	34		internal command
obligate			534	66		Leave an address
DNA			600	34		internal command
obligate			634	7		Leave an address
obligate			641	2		Leave an address
power rating	w	UInt	643	1	R	
obligate			644	1		Leave an address
obligate			645	55		Leave an address
obligate			700	2		Leave an address
obligate			702	1		Leave an address

data name	unit	data format	start address	Number of registers	read-write	remarks
obligate			703	26		Leave an address
obligate			729	16		Leave an address
obligate			745	5		Leave an address

Fault code table

fault code	explain
1	continue to have
2	Too warm
3	Battery overpressure
4	continue to have
5	Output short circuit
6	Reverse overpressure
7	Output overload
8	Bus overpressure
9	The bus is soft and timed out
10	PV overcurrent
11	PV overvoltage

fault code	explain
12	Battery overflow
13	Inverse transition over flow
14	Bus low voltage
15	continue to have
16	Inverse DC component is too high
17	continue to have
18	The output current is zero bias too large
19	The inverter current with zero bias is too large
20	Battery current zero bias is too large
21	The PV current with zero bias is too large
22	Inverse transformer low voltage
23	Negative power protection of inverter
24	Combined system host is lost
25	The parallel system synchronization signal is abnormal
26	continue to have
27	The parallel version is incompatible

Warning code description

The system warning is a 32-bit unsigned long integer type, each bit corresponding to a warning, each bit can also be blocked by the warning mask I, after shielding the corresponding warning will not be read in the LCD or by command.

- Warning code table
-

Warning code	explain
bit 0	City electricity zero loss
bit 1	The market power waveform is abnormal
bit 2	Municipal power overpressure
bit 3	City electricity owe pressure
bit 4	Market electricity overfrequency
bit 5	City electricity owed frequency
bit 6	PV undervoltage
bit 7	Too warm
bit 8	The battery voltage is low
bit 9	The battery is not connected
bit 10	overload
bit 11	Battery Eq charge
bit 12	Battery discharge is low and not charged back to the recov point
bit 13	Output power reduction
bit 14	Fan blocking
bit 15	The PV energy is too low to use
bit 16	The grid communication is interrupted
bit 17	Single single output mode is inconsistent
bit 18	The voltage difference of the parallel machine battery is large
bit 19~31	continue to have

CRC calibration algorithm

Parametric model: CRC-16 / MODBUS X16 + X15 + X2 + 1

C language code

```
const  char  auchCRCHi [] = {
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  char  auchCRCLo [] = {
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
} ;

unsigned  short  sModbusCrc16(INT8U  *chMsg , INT16U  dataLen )
{
unsigned  char  ubCRCHi  = 0xFF ;
unsigned  char  ubCRCLo  = 0xFF ;
unsigned  char  duwIndex ;
while  (dataLen  --)
{
duwIndex  = 0xff &(ubCRCHi  ^ *chMsg ++);
ubCRCHi  = 0xff &(ubCRCLo  ^ auchCRCHi [duwIndex ]);
ubCRCLo  = auchCRCLo [duwIndex ];
}
return  (ubCRCHi  << 8 | ubCRCLo );
}
```