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FP-e

MODBUS Slave RTU mode specifications

- Available from FP-e main unit Ver. 1.2 or later
- Available from Tool software FPWIN GR Ver. 2.3 or later
- Will be available from Tool software FPWIN Pro Ver. 5

Outline of FP-e MODBUS communication function specifications

- 1: The slave function and RTU mode (binary communication) is available with the COM port.
- 2: MODBUS slave communication function is selectable by system registers.
- 3: When no message is received for 4 to 5-character time, it is regarded as the completion of the reception, and the command operation will be executed.
- 5: The station numbers can be specified from the range of 1 to 99. (Same as before)
- 6: The capacity of transmit and receive buffer is 118 bytes.

MODBUS RTU command message frame

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
3.5-character time	8 bits	8 bits	n*8 bits	16 bits	3.5-character time

Name	Data length	Description
ADDRESS (Station number)	8 bits	0 to 99 (decimal) Note 1: 0=Broadcast address Note 2: Slave stations are 1 to 99 (decimal). Note 3: For MODBUS, 0 to 247 (decimal)
FUNCTION (Command)	8 bits	The detail is mentioned in the next page.
DATA	n*8 bits	The detail is mentioned in the next page.
CRC	16 bits	Communication error check

Response in normal status

The same message as a command is returned for single write command.
A part of a command message (6 bytes from the beginning) is returned for multiple write command.

Response in abnormal status

In case a parameter disabled to be processed is found in a command (except transmission error)

Slave address (station number)
Function code+80H
Error code
CRC

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Supported commands

Code (Decimal)	Name (MODBUS original)	Name for FP-e	Remarks (Reference No.)
01	Read Coil Status	Read Y and R Coils	0x
02	Read Input Status	Read X Input	1x
03	Read Holding Registers	Read DT	4x
05	Force Single Coil	Write Single Y and R	0x
06	Preset Single Register	Write DT 1 Word	4x
08	Diagnostics	Loopback Test	4x
15	Force Multiple Coils	Write Multiple Ys and Rs	0x
16	Preset Multiple Registers	Write DT Multiple Words	4x
22	Mask Write 4X Register	Write DT Mask	4x
23	Read/Write 4X Registers	Read/Write DT	4x

Table for MODBUS reference No. and FP-e device No.

Name of devices		Reference No.		
MODBUS	FP-e	MODBUS	FP-e (Decimal)	(Hexadecimal)
Coils	Y	000001 to 002048	0 to 207	0 to CF
	R	002049 to 009999	2048 to 3056	800 to BF0
Inputs	X	100001 to 109999	0 to 207	0 to CF
Holding registers	DT	400001 to 409999	0 to 1659	0 to 67B

No. of points and range of FP-e memory area (MEW standard)

External output Y	208 points (Y0 to Y12F)
Internal relay R	1008 points (R0 to R62F)
External input X	208 points (X0 to X12F)
Data registers	1660 words (DT0 to DT1659)

Command=01 Read Y and R Coils

Broadcast is not supported.

Command

Example for reading 20 bits of Y0 to Y13 in slave 17.

1	Slave address	11	K 17=H 11
2	Command (01H)	01	Command H 1
3	Starting No. of read (H)	00	H 0
4	Starting No. of read (L)	00	
5	Quantity to read (H)	00	K 20=H 14
6	Quantity to read (L)	14	
7	CRC16(H)	3E	
8	CRC16(L)	95	

Maximum No. of read = 904 (limited by the capacity of transmit and receive buffer)

Response in normal status

Examples of the responses to the above commands
(in case all points are ON)

1	Slave address	11	K 17=H 11
2	Command (01H)	01	Command H 1
3	Byte account of response data	03	3 bytes
4	Status 1	FF	Y0 to Y7 (bit 0 to bit 7)
:	:	FF	Y8 to YF (bit 0 to bit 7)
Status N		0F	Y10 to Y13 (bit 0 to bit 3) The high 4 bits return 0.
7	CRC16(H)	0F	
8	CRC16(L)	1A	

Response in abnormal status

1	Slave address
2	81H
3	Error code
4	CRC16(H)
5	CRC16(L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=02 Read Input Status

Broadcast is not supported.

Command

Example for reading 20 bits of X0 to X13 in slave 17.

1	Slave address	11	K 17=H 11
2	Command (02H)	02	Command H 2
3	Starting No. of read (H)	00	H 0
4	Starting No. of read (L)	00	
5	Quantity to read (H)	00	K 20=H 14
6	Quantity to read (L)	14	
7	CRC 16 (H)	7A	
8	CRC 16 (L)	95	

Maximum No. of read = 904 (limited by the capacity of transmit and receive buffer)

Response in normal status

Examples of the responses to the above commands
(in case all points are ON)

1	Slave address	11	K 17=H 11
2	Command (01H)	02	Command H 2
3	Byte count of response data	03	3 bytes
4	Status 1	FF	X0 to X7 (bit 0 to bit 7)
:	:	FF	X8 to XF (bit 0 to bit 7)
	Status N	0F	X10 to X13 (bit 0 to bit 3) The high 4 bits return 0.
7	CRC16(H)	4B	
8	CRC16(L)	1A	

Response in abnormal status

1	Slave address
2	82H
3	Error code
4	CRC16(H)
5	CRC16(H)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=03 Read DT

Broadcast is not supported.

Command

1	Slave address	11	K 17=H 11
2	Command (03H)	03	CommandH 3
3	Startind No. of read (H)	03	K 1000=H 3E8
4	Starting No. of read (L)	E8	
5	Quantity to read (H)	00	K 3=H 3
6	Quantity to read (L)	03	
7	CRC16 (H)	87	
8	CRC16 (L)	2B	

Maximum No. of read = 56 (limited by the capacity of transmit and receive buffer)

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (03H)	03	Command H 3
3	Byte count of response data	06	3 words = 6 bytes
4	Read data 1 (H)	11	DT1000=1100H
5	Read data 1 (L)	00	
	:	33	DT1001=3322H
	:	22	
6	Read data N (H)	55	DT1002=5544H
7	Read data N (L)	44	
8	CRC16 (H)	A0	
9	CRC16 (L)	A5	

Response in abnormal status

1	Slave address
2	83H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=05 Read Single Y and R

Broadcast is supported.
It is not "Forced set/reset function".

Command

For turning on R10 in slave 17.

1	Slave address	11	K 17=H 11
2	Command (05H)	05	Command H 5
3	Coil No. (H)	08	H 810
4	Coil No. (L)	10	
5	Setting status (H)	FF	Set On to FF00
6	Setting status (L)	00	
7	CRC16 (H)	8D	
8	CRC16 (L)	0F	

Setting status: Set FF00H for ON. Set 0000H for OFF.

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (05H)	05	Command H 5
3	Coil No. (H)	08	H 810
4	Coil No. (L)	10	
5	Setting status (H)	FF	Set ON to FF00
6	Setting status (L)	00	
7	CRC16 (H)	8D	
8	CRC16 (L)	0F	

Response in abnormal status

1	Slave address
2	85H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=06 Write DT 1 Word

Broadcast is supported.

Command

For writing 55AA in DT1000 of slave 17.

1	Slave address	11	K 17=H 11
2	Command (06H)	06	Command H 6
3	Starting No. of write (H)	03	K 1000=H 3E8
4	Starting No. of write (L)	E8	
5	Write data (H)	55	H 55AA
6	Write data (L)	AA	
7	CRC16 (H)	B4	
8	CRC16 (L)	05	

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (06H)	06	Command H 6
3	Starting No. of write (H)	03	K 1000=H 3E8
4	Starting No. of write (L)	E8	
5	Write data (H)	55	H 55AA
6	Write data (L)	AA	
7	CRC16 (H)	B4	
8	CRC16 (L)	05	

Response in abnormal status

1	Slave address
2	86H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=08 Loopback

Broadcast is not supported.

Command

For performing the loopback test for slave 17.

1	Slave address
2	Command (08H)
3	Test code (H)
4	Test code (L)
5	Data (H)
6	Data (L)
7	CRC16 (H)
8	CRC16 (L)

11	K 17=H 11
08	Command H 8
00	Always specify 00. If values other than 00
00	are specified, it becomes an error.
55	Data is arbitrary.
AA	
5D	
B4	

Response in normal status

Examples of the responses to the above commands.

1	Slave address
2	Command (08H)
3	Test code (H)
4	Test code (L)
5	Data (H)
6	Data (L)
7	CRC16 (H)
8	CRC16 (L)

11	K 17=H 11
08	Command H 8
00	Always specify 00. If values other than 00
00	are specified, it becomes an error.
55	Data is arbitrary.
AA	
5D	
B4	

Response in abnormal status

1	Slave address
2	88H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=15(0F hex) Write Multiple Ys and Rs

Broadcast is supported.
It is not "Forced set/reset function".

Command

For writing data for 20 bits from R100 for slave 17.

1	Slave address	11	K 17=H 11
2	Command (0FH)	0F	Command H F
3	Starting No. of status change (H)	08	H 8A0
4	Starting No. of status change (L)	A0	
5	Quantity of changed coils (H)	00	K 20=H 14
6	Quantity of changed coils (L)	14	
7	Byte count	03	3 bytes
8	Setting data 1	55	Data is arbitrary.
	:	AA	
	Setting data N	0F	
9	CRC16 (H)	DE	
10	CRC16 (L)	F8	

Maximum quantity of changed coils=872 (limited by the capacity of transmit and receive buffer)
Byte count: 8 coils = 1 data (1 byte)

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (0FH)	0F	Command H F
3	Starting No. of status change (H)	08	H 8A0
4	Starting No. of status change (L)	A0	
5	Quantity of changed coils (H)	00	K 20=H 14
6	Quantity of changed coils (L)	14	
7	CRC16 (H)	55	
8	CRC16 (L)	16	

Response in abnormal status

1	Slave address
2	8FH
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=16(10 hex) Write DT Multiple Data

Broadcast is supported.

Command

For writing 3 words from DT1000 in slave 17.

1	Slave address	11	K 17=H 11
2	Command (10H)	10	Command H 10
3	Starting No. of write (H)	03	K 1000=H 3E8
4	Starting No. of write (L)	E8	
5	No. of write registers (H)	00	3 words
6	No. of write registers (L)	03	
7	Byte count	06	6 bytes
8	Write data 1 (H)	11	Data is arbitrary.
9	Write data 1 (L)	00	
	:	33	Data is arbitrary.
	:	22	
10	Write data N (H)	55	Data is arbitrary.
11	Write data N (L)	44	
12	CRC16 (H)	C1	
13	CRC16 (L)	84	

Maximum No. of write registers=54 (limited by the capacity of transmit and receive buffer)

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (10H)	10	Command H 10
3	Starting No. fo write (H)	03	K 1000=H 3E8
4	Starting No. of write (L)	E8	
5	No. of write registers (H)	00	3 words
6	No. of write registers (L)	03	
7	CRC16 (H)	02	
8	CRC16 (L)	E8	

Response in normal status

1	Slave address
2	90H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=22(16 hex) Write DT Mask

Broadcast is not supported.

Command

For writing mask in DT1000 in slave 17.

1	Slave address	11	K 17=H 11
2	Command (16H)	16	Command K 22=H 16
3	Starting No. of write (H)	03	K 1000=H 3E3
4	Starting No. of write (L)	E8	
5	And_Mask (H)	00	Data is arbitrary.
6	And_Mask (L)	F2	
7	Or_Mask (H)	00	Data is arbitrary.
8	Or_Mask (L)	25	
9	CRC16 (H)	F6	
10	CRC16 (L)	BE	

The function's algorithm is:

Response in normal status

Examples of the responses to the above commands.

1	Slave address	11	K 17=H 11
2	Command (16H)	16	Command H 16
3	Starting No. of write (H)	03	K 1000=H 3E8
4	Starting No. of write (L)	E8	
5	And_Mask (H)	00	In this case, when the DT1000 is 12H, the result becomes 17H.
6	And_Mask (L)	F2	
7	Or_Mask (H)	00	
8	Or_Mask (L)	25	
9	CRC16 (H)	F6	
10	CRC16 (L)	BE	

If the Or_Mask data is zero, the result is simply the logical ANDing of the current contents and And_Mask.
If the And_Mask data is zero, the result is equal to the Or_Mask data.

Response in abnormal status

1	Slave address
2	96H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)

Command=23 (17 hex) Read/Write DT

Broadcast is not supported.

Command

For reading 3 words from DT1000 in slave 17 and clear it to 0 later.

1	Slave address	11	K 17=H 11
2	Command (17H)	17	Command K 23=H 17
3	Starting No. of read (H)	03	K 1000=H 3E8
4	Starting No. of read (L)	E8	
5	No. of read registers (H)	00	3 words
6	No. of read registers (L)	03	
7	Starting No. of write (H)	03	K 1000=H 3E8
8	Starting No. of write (L)	E8	
9	No. of write registers (H)	00	3 words
10	No. of write registers (L)	03	
11	Byte count of write data	06	3 words=6 bytes
12	Write data 1 (H)	00	H 0
	Write data 1 (L)	00	
	:	00	H 0
	:	00	
	Write data N (H)	00	H 0
	Write data N (L)	00	
13	CRC16 (H)	60	
14	CRC16 (L)	DB	

Maximum No. of read registers=56? (limited by the capacity of transmit and receive buffer)

Maximum No. of write registers=52? (limited by the capacity of transmit and receive buffer)

Response in normal status

1	Slave address	11	K 17=H 11
2	Command (17H)	17	K 23=H 17
3	Byte count of response data	06	3 words=6 bytes
4	Read data 1 (H)	AA	H AAAA
	Read data 1 (L)	AA	
	:	BB	H BBBB
	:	BB	
	Read data N (H)	CC	H CCCC
	Read data N (L)	CC	
7	CRC16 (H)	ED	
8	CRC16 (L)	CC	

Response in abnormal status

1	Slave address
2	97H
3	Error code
4	CRC16 (H)
5	CRC16 (L)

Error code contents

- 1: Function code error
- 2: Device number error (out of range)
- 3: Device quantity error (out of range)