

FCTT
INPUT 8 CIRCUITS
COMMUNICATION SPECIFICATION
Modbus RTU

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1. Communication specification

(1) Specification

Item	Specification
Standard	TIA-485-A (2003)
Transmission system	Half-duplex two-wire system
Synchronous system	Asynchronous communication method
Modulation code	NRZ
Transmission character	Binary
Cable length	1000m (The total extension)
Error detection	CRC-16 ($X^{16}+X^{15}+X^2+1$)
Number of connections	Max. 32 units
Connection method	M3 screw connection (FW11 socket / Mounting base, FWBA)

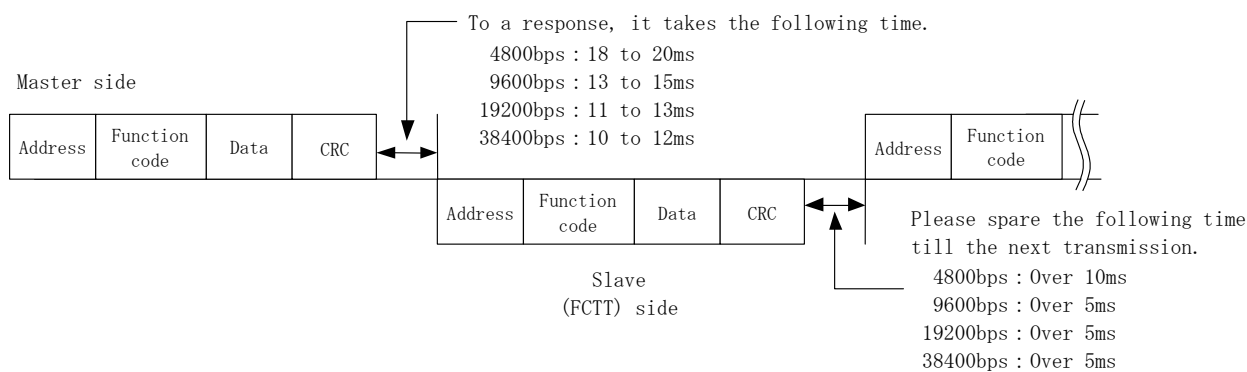
Transmission data are sent out from a bit 0.

(2) Communication setting

Item	Setting range	Factory setting
Bit rate	4800bps / 9600bps / 19200bps / 38400bps	9600bps
Start bit	1 bit (Fixed)	—
Data length	8 bit (Fixed)	—
Parity	NONE / Odd number / Even number	Even number
Stop bit	1 bit : Parity / 2 bits : Non parity	1 bit (Parity)
Communication address	01 to 99	00 (Communication unused)

2. Transmission and reception protocol

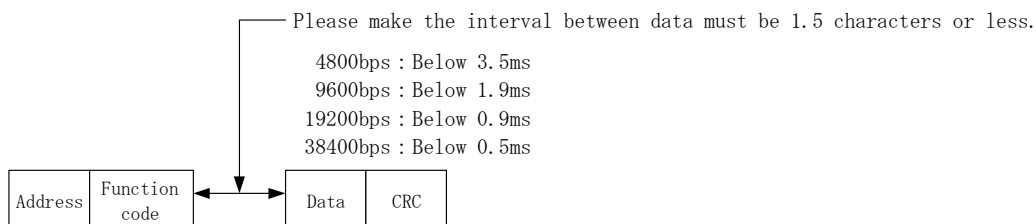
(1) Usual request (Query)



(2) The timeout between data

Please make the interval between data must be 1.5 characters or less.

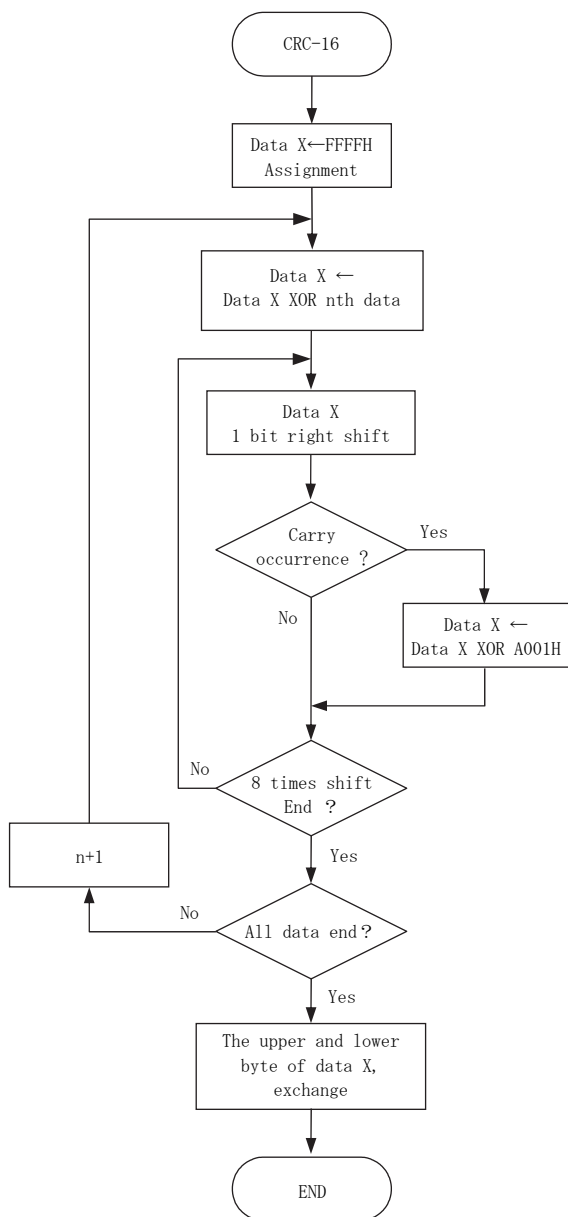
If there is an interval of 1.5 character hours or more, a timeout error will occur.



3. Calculation method of CRC-16

CRC-16 is adopted as error checking in Modbus RTU mode.

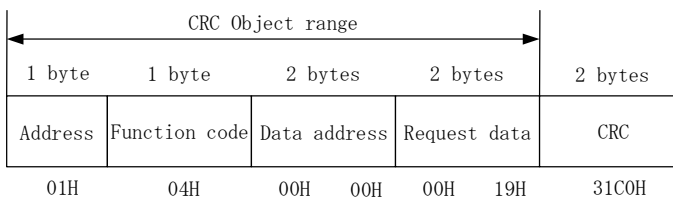
An address, a function code, and data are calculated by the following method.



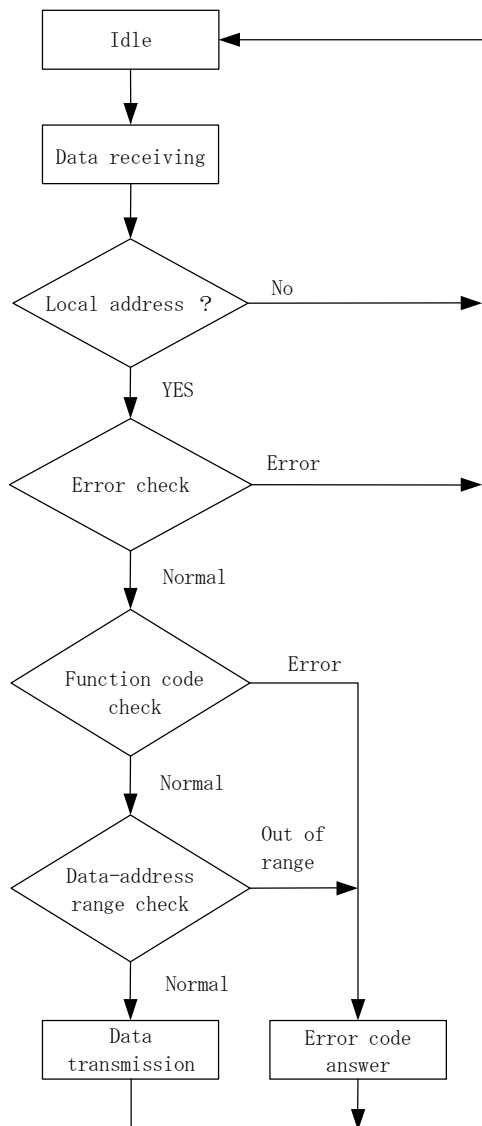
(1) Arithmetic process

- ① 2 bytes of data-area X is secured to a CRC calculation.
- ② FFFFH is substituted for ① as initial value.
- ③ XOR of data X and the nth data (n=1) is calculated. Assign it to data X.
- ④ The 1-bit right shift of the data X is done.
- ⑤ If carry occurs in operation of ④, data X and XOR of A001H are taken.
- ⑥ Operation of ④, ⑤ is repeated until it shifts 8 times.
- ⑦ The next data (n+1) and XOR of data X is calculated. Assign it to data X.
- ⑧ Operation of ④ to ⑦ is repeated until processing of all data is completed.
- ⑨ 1 byte of upper and 1 byte of lower of data-area X for a CRC calculation are exchanged.

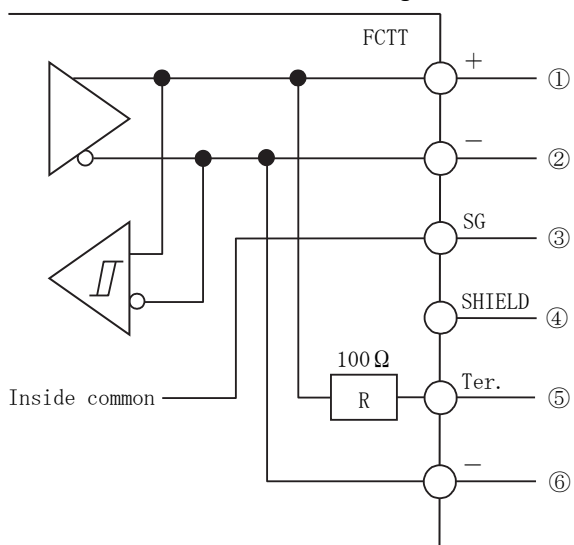
(2) Example of calculation



4. Communication process flow chart



5. FCTT communication terminal arrangement



Terminal arrangement

No.	Terminal symbol	Terminal No.	
		FW11	FWBA
①	+	1	1
②	-	3	2
③	SG	4	4
④	SHIELD	6	3
⑤	Ter.	2	7
⑥	-	5	8

- By short-circuiting the Ter. terminal and the negative terminal (⑤ and ⑥), a terminating resistance of 100Ω is connected.
- SHIELD terminal (④) is a relay terminal for the shielded wire of the communication cable. There is no connection with the internal circuit.
- The terminal arrangement is different between the FW11 socket and the mounting base FWBA. (Refer to the above terminal number)

6. Modbus protocol RTU mode

6.1 Function code

The next function code is supported with this product.

Function code	Name	Data address	Specifiable number of data	Master → FCTT		FCTT → Master	
				Command message [Unit : byte]		Response message [Unit : byte]	
				Min.	Max.	Min.	Max.
04H	Measurement range data	30001 to 30125	Max. 125 words	8	8	7	255
03H	Model information	40501 to 40503	Max. 3 words	8	8	7	11

6.2 Abnormal response

In case the message transmitted from the master is judged to be abnormal, this product does the next abnormal answer.

(1) In case it becomes a no answer

- ① : In case a message transmission error occurs. (Overrun, Framing, Parity error, CRC)
- ② : In case the data interval of a message exceeds a regulation value (1.5 characters).
- ③ : In case the message frame exceeding 8 bytes is received.

(2) In case as answered in an error code.

In the error that does not correspond to (1), the following abnormal response is returned.

At this case, the code that applied 80H to the code of a demand is returned to a function code.

And, the generated error code is returned as data.

1 byte	1 byte	1 byte	2 bytes
Address	function code (+80H)	Error code	CRC
01H	84H	02H	C2C1H

Error code list

Operation code	Function	Contents
01H	Undefined function code	Received a function code that the slave does not have. (Non-existent function code)
02H	Abnormal data address	A data address that is not defined for the slave was specified. (Outside the address range)
03H	Number of abnormal data	More data was requested than the number of data to be returned. Or, the number of reply data requested was 0 words.

6.3 Measurement value data request

Read the measurement value from this product. There is no broadcast. Function code is 04H.

(1) Data request (Query)

In case it performs setting value request, it is necessary to designate the start address of data to acquire. When sending a data address, specify a relative address (30001 is subtracted from the address in the data address table).

Please assign the word number of requested data as the number of data.

1	2	3	4	5	6	7	8
Address	Function code	Read start address (Relative address)		Number of data		CRC	
01H	04H	0000H		0008H		F1CCH	

Data address list

Function code	Relative address	Data address	Memory contents	Data type
04	0000H	30001	INPUT1 Measurement value data	WORD
	0001H	30002	INPUT2 Measurement value data	WORD
	0002H	30003	INPUT3 Measurement value data	WORD
	0003H	30004	INPUT4 Measurement value data	WORD
	0004H	30005	INPUT5 Measurement value data	WORD
	0005H	30006	INPUT6 Measurement value data	WORD
	0006H	30007	INPUT7 Measurement value data	WORD
	0007H	30008	INPUT8 Measurement value data	WORD

(2) Response

If measurement value requirements are performed normally, the following response will be returned from this product side.

Example) Read start address : 30001, Number of data : 8, Measurement value data (INPUT 1 to 8) : 10000

1	2	3	4	5	6	7	8	9	10	11
Address	Function code	Answer byte count	INPUT1 Measurement value data	INPUT2 Measurement value data	INPUT3 Measurement value data	INPUT4 Measurement value data	INPUT5 Measurement value data	INPUT6 Measurement value data	INPUT7 Measurement value data	INPUT8 Measurement value data
01H	04H	10H	2710H	2710H	2710H	2710H	2710H	2710H	2710H	2710H
12	13	14	15	16	17	18	19	20	21	
INPUT5 Measurement value data		INPUT6 Measurement value data		INPUT7 Measurement value data		INPUT8 Measurement value data		CRC		
2710H		2710H		2710H		2710H		DEDFH		

(3) Measurement value data format

Input	Transmission data (hexadecimal)	Transmission data (decimal)	Measurable range
DC4 to 20mA	0H to 2710H	0 to 10000	-25% to 125% of span (Transmission data -2500 to 12500)
DC1 to 5V			

6.4 Model information request

Used to read type code from this product.

There is no broadcast. Function code is 03H.

(1) Data request (Query)

In case it performs model information request, it is necessary to designate the start address of data to acquire.

When sending a data address, specify a relative address (40001 is subtracted from the address in the data address table).

Please assign the number of requested data as the number of data.

1	2	3	4	5	6	7	8
Address	Function code	Read start address (Relative address)		Number of data		CRC	
01H	03H	01F4H		0001H		C404H	

Data address list

Function code	Relative address	Data address	Memory contents
03H	01F4H	40501	Model information Type code
	01F5H	40502	Not used (0000H)
	01F6H	40503	Not used (0000H)

(2) Response

If model information request are performed normally, the following response will be returned from this product side.

1	2	3	4	5	6	7
Address	Function code	Answer byte count	Type code		CRC	
01H	03H	02H	0021H		785CH	

● Model information. Type code

Type	Communication data
FCTT (Input 8 circuit)	0021H

7. Communication monitor function

This function is valid only when using communication.

The communication status is determined by the lighting status of the RUN LED.

The communication monitor specifications are as follows.

Communication state	Definition	Communication monitor	
		RUN LED status	Priority
Normal	When there is communication addressed to the local station and the reply is normal. (Even if it recovers from the abnormal state, it is judged to be normal)	Always on	3
Not communicating	<ul style="list-style-type: none"> • No communication has been achieved after applying the auxiliary power supply. • Set to a communication address that is not used for communication 		
Abnormality	<ul style="list-style-type: none"> • Time out • Communication error (Parity error / Overrun error / Framing error), CRC error 	Blinking at 1 second cycle (0.5 second on, 0.5 second off)	1 (Top priority)
Others	Setting error <ul style="list-style-type: none"> • Change communication setting while applying power (Operates with the communication settings before the change) 	Blinking at 2 second cycle (1 second on, 1 second off)	2

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