

Series TUF Modbus Communication Variables Table

I. Communication protocol parameters

1	Communication protocol	Modbus	
2	Communication cable	2-core shielded double-twisted wire	Shield needs to be grounded
3	Hardware interface	RS-485	
4	Baud rate	Default: 9600 bps	It can be modified according customer's requirements
5	Byte format	Default: 1 start bit,8 data bits,1 even parity bit,1 stop bit	It can be modified according customer's requirements
6	Transmission mode	RTU mode	
7	MDU Address	1~247	
8	Function codes (hexadecimal)	02H 03H 06H 10H	
9	Error Checking Methods	CRC-16	

II. Modbus RTU communication register table

02H: Read Input Status [Address range: 0x1000-0x17D0]				
Function code	Register address	Discrete input	Description	Remarks
02H	1000H	Input 1	Valve Open	0: Normal 1: Open
02H	1001H	Input 2	Valve Close	0: Normal 1: Close
02H	1002H	Input 3	Valve Abnormal	0: Normal 1: Abnormal
02H	1003H	Input 4	Fan status	0: Run 1: Stop
02H	1004H	Input 5	Fan in low speed	0: OFF 1: ON
02H	1005H	Input 6	Fan in medial speed	0: OFF 1: ON
02H	1006H	Input 7	Fan in high speed	0: OFF 1: ON
02H	1007H	Input 8	Status of the second valve	0: OFF 1: ON
02H	1008H	Input 9	Battery under-	0: Normal

			voltage alarm	1: Under-voltage
02H	1009H	Input 10	EEPROM alarm	0: Normal 1: Abnormal
02H	100AH	Input 11	RAM alarm	0: Normal 1: Abnormal
02H	100BH	Input 12	Communication status of output module	0: Normal 1: Failure
02H	100CH	Input 13	Undefined	0
02H	100DH	Input 14	Undefined	0
02H	100EH	Input 15	Undefined	0
02H	100FH	Input 16	Undefined	0
02H	1010H	Input 17	Platinum resistance of water inflow in short circuit	0: Normal 1: Alarm
02H	1011H	Input 18	Platinum resistance of water inflow in open circuit	0: Normal 1: Alarm
02H	1012H	Input 19	Platinum resistance of water outflow in short circuit	0: Normal 1: Alarm
02H	1013H	Input 20	Platinum resistance of water outflow in open circuit	0: Normal 1: Alarm
02H	1014H	Input 21	Short circuit	0: Normal 1: Alarm
02H	1015H	Input 22	Open circuit	0: Normal 1: Alarm
02H	1016H	Input 23	Strong magnetic	0: Normal 1: Alarm
02H	1017H	Input 24	Hall	0: Normal 1: Alarm
02H	1018H	Input 25	Gas leakage	0: Normal 1: Alarm
02H	1019H	Input 26	Emergency input	0: Normal 1: Alarm
02H	101AH	Input 27	Alarm against	0: Normal

			burglary	1: Alarm
02H	101BH	Input 28	Overload alarm	0: Normal 1: Alarm
02H	101CH	Input 29	Undefined	0
02H	101DH	Input 30	Undefined	0
02H	101EH	Input 31	Undefined	0
02H	101FH	Input 32	Undefined	0

03H: Read Holding Registers 06H: Preset Single Register 10H: Preset Multiple Registers [Address range: 0x4000-0x4FFF]			
Function code	Register address	Description	Remarks
03H/06H/10H	4000H	Week	0000H Range (0~6) 0 indicates Sunday, 1 indicates Monday, ...
	4001H	Year (High byte)	0014H Range (20)
	4002H	Year (Low byte)	000BH Range (0~99)
	4003H	Month	0008H Range (1~12)
	4004H	Date	001DH Range (1~31)
	4005H	Hour	000DH Range (0~23)
	4006H	Minute	002EH Range (0~59)
	4007H	Second	0005H Range (0~59)
It indicates the time: 46 minutes and 05 seconds past 13 o'clock on 29 August 2011, Thursday. The time is the time collected from the current calibration, the deviation with the actual time of the meter is 0~4 T [Note 2]			
06H	4010H	Valve control	Open (0055H), Close (0099H)
03H/06H	4011H	Date of backup (BCD code)	0012H(12) Range(1~31)
03H/06H	4014H	Mode	Cold(004BH) or Heat(004CH)
03H	4020H	Forward flow temperature (Temp. forward)	Enlarge 10times /enlarge 100 times, operating method [Note 9]
03H	4021H	Return flow temperature (Temp. return)	Enlarge 10times /enlarge 100 times, operating method [Note 9]
Register 4000H~402FH can read continuously. Writing to other registers not listed in variables table is not allowed, otherwise the normal operation of meter will be affected			
03H	4114H	Accumulative flow(2 low bytes)	Enlarge 100 times (4 Bytes)
	4115H	Accumulative flow(2 high bytes)	
03H	4116H	Total cold quantity(2 low bytes)	Enlarge 100 times (4 Bytes)
	4117H	Total cold quantity(2 high bytes)	

03H	4118H	Total heat quantity(2 low bytes)	Enlarge 100 times (4 Bytes)
	4119H	Total heat quantity(2 high bytes)	
03H	4128H	Flow rate(2 low bytes)	Enlarge 100 times (4 Bytes)
	4129H	Flow rate(2 high bytes)	
03H	412AH	Power(2 low bytes)	Enlarge 100 times (4 Bytes)
	412BH	Power(2 high bytes)	
03H	412CH	Status(2 low bytes)	(4 Bytes)
	412DH	Status(2 high bytes)	
03H	412EH	Meter ID(2 low bytes)	(4 Bytes)
	412FH	Meter ID(2 high bytes)	
03H	414AH	Flow rate(2 low bytes)	Enlarge 1, 000 times (4 Bytes)
	414BH	Flow rate(2 high bytes)	
03H	414EH	Software version and Hardware version	High-byte: Software version of Meter Low-byte: Hardware version of Meter
	414FH	Protocol version and Reset times	High-byte: Protocol version of Meter Low-byte: the number of Restart
03H	4150H	Software version and Hardware version	High-byte: Software version of MDU Low-byte: Hardware version of MDU
	4151H	Protocol version and Reset times	High-byte: Protocol version of MDU Low-byte: the number of Restart
03H	4155H	Operation result of command of writing	0000H: write failure, FFFFH: write success
Register 4114H~4155H can read continuously. Writing to other registers not listed in variables table is not allowed, otherwise the normal operation of Meter will be affected			

Note:

1. TUF indicates the Series TUF thermal energy meter
2. T indicates the interval of visit to TUF from communication. If ultrasonic heat meter requires time calibration, it is feasible to continuously enter the current time to communication.
3. Two flow rates exist in variables table, one is that has been enlarged by 100 times and the other is that has been enlarged by 1,000 times. The one that has been enlarged by 1,000 times are mainly applied in ultrasonic heat meter. The one that has been enlarged by 100 times are mainly applied in ACM meter;
4. The flow valve value in the instruction of ultrasonic heat meter is the same variable of the minimum flow in the variables table;
5. In discrete reading input status, variables related to ultrasonic heat meter include: 1000H~1002H valve status, 1008H battery under-voltage alarm, 100BH is mainly applied to indicate whether the meter communicate normally and 1010H~1015H is mainly applied to indicate platinum resistance status of the meter;
6. Some parameters in the variables table are the configuration parameters of ultrasonic heat meter, which are mainly intended for maintenance and commissioning by professionals. The users shall never causally modify them. Otherwise, the ultrasonic heat meter may fail to work normally. If the parameters are required to be modified, please contact the working personnel of our company;

7. The cold and heat mode of ultrasonic heat meter shall be set according to actual situation, for when it is in cold, only the cold quantity shall be updated. When it is in heat, only the heat quantity shall be updated.
8. The valve control of ultrasonic heat meter shall be matched with valve module. Therefore, valve control in variables table is the reserved function;
9. The temperature schemes are available: one is one decimal transmission and the other is two decimal transmission; when one decimal transmission is available, if the read-out data is 0x0123, then, it indicates the temperature is 29.1 °C; if the highest order of the data transmitted is 1, then, it indicates the temperature is two decimals, for example 0x8B5F, then, the temperature is 29.11 °C, the digit on the highest order indicates the decimal of the transmitted data is of one decimal or two decimals.

III. Exception codes

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was iTUFed, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowed address for the slave.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave.
04	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	ACKNOWLEDGE	The slave has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master. The master can next iTUFe a Poll Program Complete message to determine if processing is completed.
06	SLAVE DEVICE BUSY	The slave is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.
07	NEGATIVE ACKNOWLEDGE	The slave cannot perform the program function received in the query. This code is returned for an unsuccessful programming request using function code 13 or 14 decimal. The master should request diagnostic or error information from the slave.
08	MEMORY PARITY ERROR	The slave attempted to read extended memory, but detected a parity error in the memory. The master can retry the request, but service may be required on the slave device.

IV. Communication example

1 .Read single register or Read multiple registers:

QUERY:

Slave address + Function code (03H) + Starting Address Hi + Starting Address Lo + No. of Points Hi +
No. of Points Lo + Error Check(CRC)

RESPONSE:

Slave address + Function code (03H) + Btyle Count + Data Hi + Data Lo + Data Hi + Data Lo +
Data Hi+ Data Lo + Error Check(CRC)

EXCEPTION RESPONSE:

Slave address + 83H + Exception code + Error Check(CRC)

EXAMPLE:

1.1 Visit data of 16 Bit:

Transmit: 01 03 40 00 00 02 D1 CB

Correct Receive: 01 03 04 00 01 00 14 AB FC

It visits two registers: Register 4000H, Data 0x0001; Register 4001H, Data 0x0014

1.2 Visit data of 32 Bit:

Transmit: 01 03 41 15 00 02 C1 F3

Correct Receive: 01 03 04 C3 50 00 00 C6 66

The data visited is data of 4 bytes: The value of the data is 0x0000C350;

Note: The data of 32 bit is dislocated and regrouped. This is because application of dislocated regrouping in PLC is abundant. Therefore, the data transmission shall also adopt this method, high byte is in high address register and low byte is in low address register;

2. Write single register:

QUERY:

Slave address + Function code (06H) + Register Address Hi + Register Address Lo + Preset Data Hi +
Preset Data Lo + Error Check(CRC)

RESPONSE:

Slave address + Function code (06H) + Register Address Hi + Register Address Lo + Preset Data Hi +
Preset Data Lo + Error Check(CRC)

EXCEPTION RESPONSE:

Slave address + 86H + Exception code + Error Check(CRC)

EXAMPLE:

Transmit: 01 06 40 97 00 01 EC 26

Correct Receive: 01 06 40 97 00 01 EC 26

Error Receive: 01 86 03 FD 9E

Correct return indicates correct operation and error return indicates data error;

3. Write multiple registers

QUERY:

Slave address + Function code (10H) + Starting Address Hi + Starting Address Lo + No. of Registers Hi
+ No. of Registers Lo + Byte Count + Data Hi + Data Lo + Data Hi + Data Lo + Error Check(CRC)

RESPONSE:

Slave address + Function code (10H) + Starting Address Hi + Starting Address Lo + No. of Registers Hi
+ No. of Registers Lo + Error Check(CRC)

EXCEPTION RESPONSE:

Slave address + 90H + Exception code + Error Check(CRC)

EXAMPLE:

Transmit: 01 10 40 01 00 0A 14 00 14 00 0B 00 0A 00 18 00 0D 00 0B 00 10 00 00 00 00 00 00
CB FD

Receive: 01 90 05 73 FC

Returned data indicates the unit correctly receives data sent by upper computer, however, the operation shall be executed for long time;

If the unit is executing the writing, the upper computer will continue to communicate and will return the command of subordinate equipment busy;

The current unit still has not finished the writing and the upper computer sends command to read the data

Transmit: 01 03 41 15 00 02 C1 F3

Receive: 01 83 06 C1 32