HSQT2-500

COMMUNICATION SPECIFICATION

(MODBUS RTU mode communication protocol)

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Content

1. Communication specification

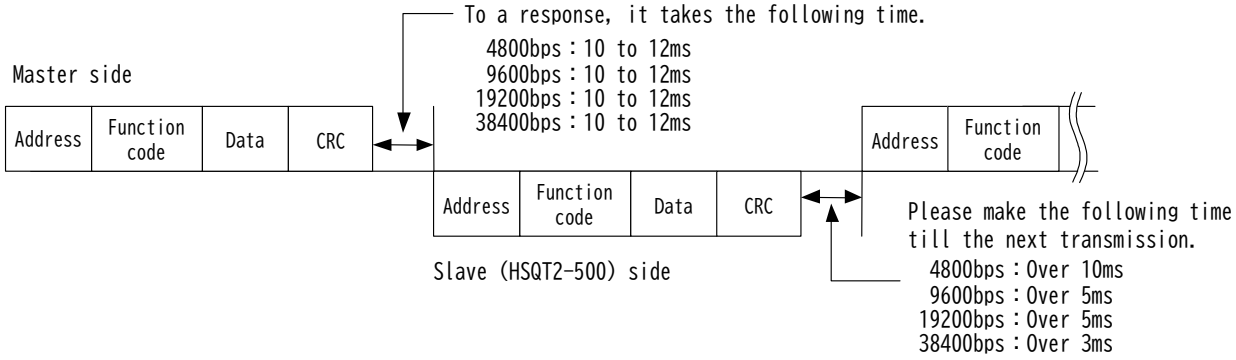
Item	Specification	Default setting
Standard	TIA RS-485-A (2003)	—
Protocol	MODBUS RTU mode	—
	Use function code : 03H, 04H, 08H	
Transmission system	Half-duplex two-wire system	—
Synchronous system	Asynchronous communication method	—
Bit rate (1)	4800bps / 9600bps / 19200bps / 38400bps	9600bps
Modulation code	NRZ	—
Start bit	1 bit	—
Data length	8 bits	—
Parity (1)	NONE / Even number / Odd number	Even number
Stop bit (1)	1 bit / 2 bits	1 bit
Cable length	1000m (The total extension)	—
Address (1)	1 to 247 (Connection is possible to 31 sets.)	1
Error detection	CRC-16 ($X^{16}+X^{15}+X^{2}+1$)	—
Transmission character	Binary	—

Transmission data are sent out from a bit 0.

Note(1) Settings can be changed.

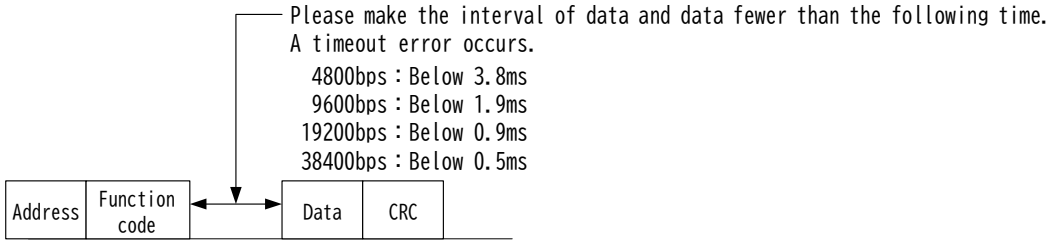
2. Transmission and reception protocol

(1) Usual request (Query)



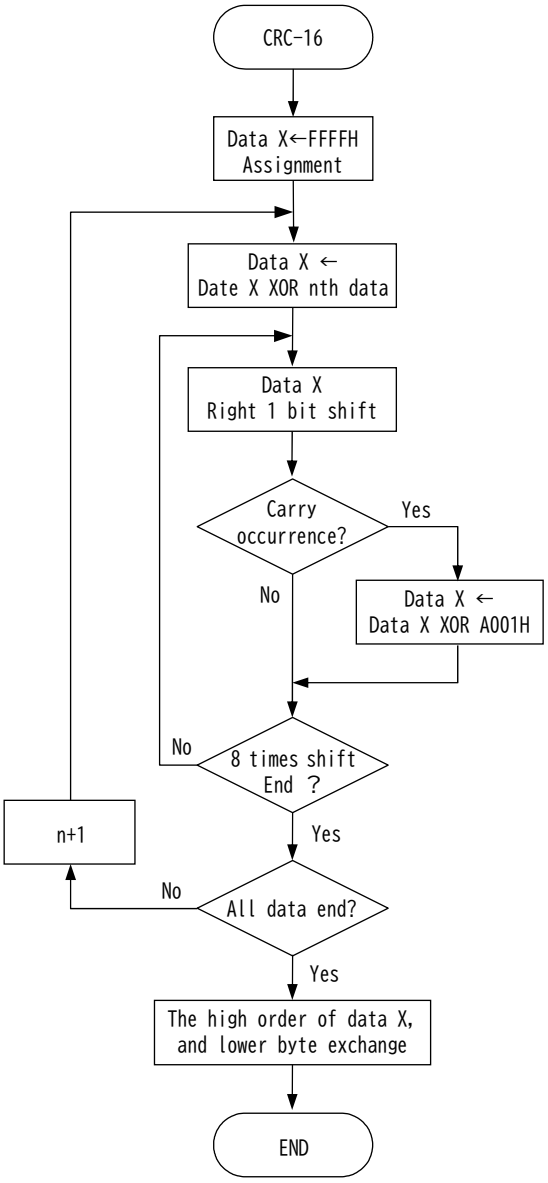
(2) Time-out of between data

The interval between data and data must be 1.5 characters or less.



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 shift right 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 XOR of the next data (n+1) and Data X is calculated. Assign it to data X.

⑧ Operation of ④ - ⑦ is repeated until processing of all data is completed.

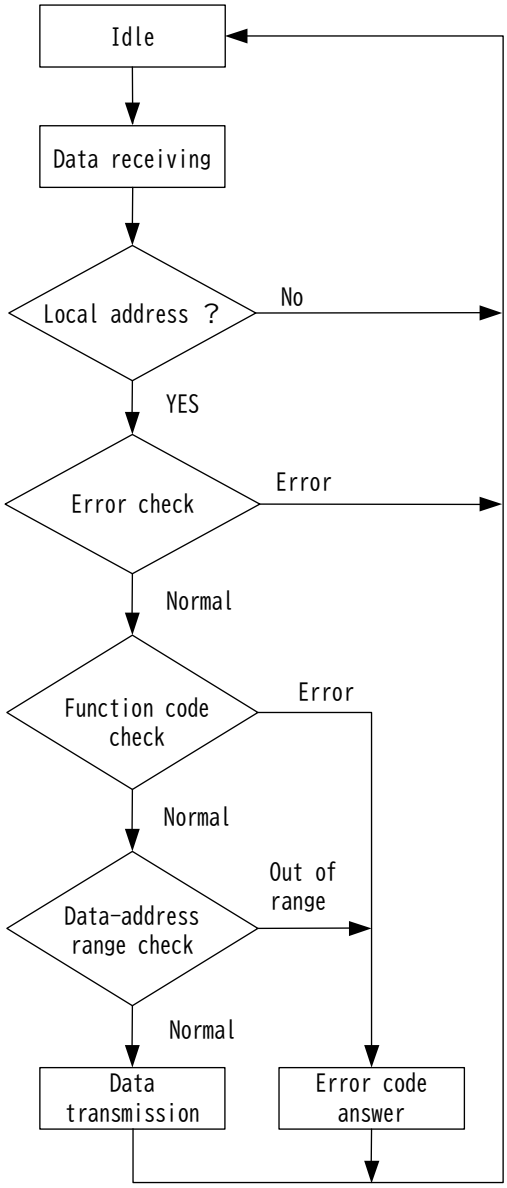
⑨ 1 byte of upper and 1 byte of lower of data-area X for a CRC calculation are replaced.

(2) Example of calculation

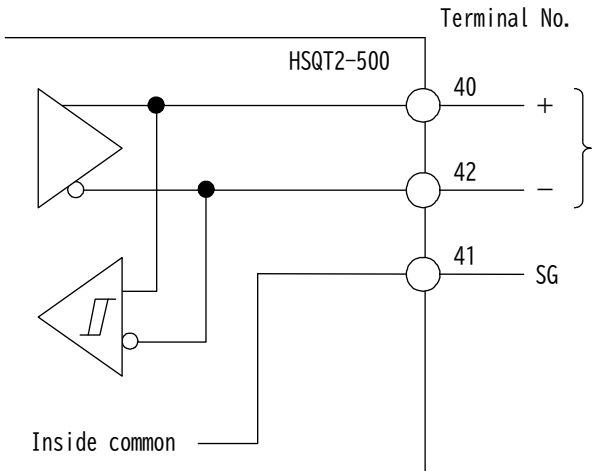
CRC Object range

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Address	Function code	Data address	Number of request data	CRC
01H	04H	00H 00H	00H 19H	31C0H

4. Communication process flow chart



5. HSQT2-500 communication specification terminal arrangement



Please connect the terminating resistor (accessories) to the terminating equipment on the connection form.
Connection terminal: Between 40 (+) and 42 (-)

6. MODBUS RTU mode

6.1 Function code

The next function code is supported with this product.

Code	Name	Data address	Contents	MODBUS original function
03	Setting value request	40001 to	Readout of setting (VT ratio, CT ratio, Electric energy count value)	Read holding registers
	Model information request	40501 to	Readout of model information (Type code, phase wire)	
04	Measurement value request	30001 to	Readout of general measurement value 1.	Read input registers
		30501 to	Readout of general measurement value 2.	
08	Loopback test	—	Communication test of master and slave is performed.	Diagnostic

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 added 80H to the code of a request is returned to a function code.
And the generated error code is returned as data.

Error code list

Error code	Contents
01H	Function code besides regulation is received.
02H	Data address is out of range.
03H	Request data that exceeds the number of data to reply. Out of setting range.

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

6.3 Setting value request

Read the setting value from this product. There is no broadcast. Function code designates 03H.

(1) Data request (Query)

In case it performs a setting values request, it is necessary to designate the data address of data to acquire. When a data address is transmitted, please subtract 40001 from the address of a data-address list. The number of data should designate the tale of the data to request.

1	2	3	4	5	6	7	8
Address	Function code	Data address		Number of data		CRC	
01H	03H	0000H		0002H		C40BH	

Data address list

Function code	Data address	Communication data
03H	40001	VT ratio
	40002	CT ratio
	40003	0000H (Fixed)
	40004	0000H (Fixed)
	40005	0000H (Fixed)
	40006	Electric energy count value

(2) Response

If data request is performed normally, the following response will be returned from this product side.

Example) Data address : 40001, Number of data : 2.

1	2	3	4	5	6	7	8	9
Address	Function code	Answer byte count	VT ratio		CT ratio		CRC	

- VT ratio

VT ratio data = Primary rated value ÷110 V

Primary rated (V)	Setting value data	Primary rated (V)	Setting value data
110 V	0001H (1)	16.5 kV	0096H (150)
220 V (2)	0002H (2)	18.4 kV (3)	00A7H (167)
440 V (2)	0004H (4)	22 kV	00C8H (200)
880 V	0008H (8)	33 kV	012CH (300)
1100 V	000AH (10)	66 kV	0258H (600)
1650 V	000FH (15)	77 kV	02BCH (700)
2200 V	0014H (20)	110 kV	03E8H (1000)
3300 V	001EH (30)	132 kV	04B0H (1200)
6600 V	003CH (60)	154 kV	0578H (1400)
11 kV	0064H (100)	187 kV	06A4H (1700)
13.2 kV	0078H (120)	220 kV	07D0H (2000)
13.8 kV (3)	007DH (125)		

Numbers in parentheses indicate decimal number data.

Note(2) Even for 220 V, 440 V input specifications, VT ratio data = primary rated value ÷ 110 V is output.
Note(3) Dividing by 110 V generate fraction values, so it will be unique set value data.

- CT ratio

  CT ratio data = Primary rated value ÷ 5 A × 10 (4)

Primary rating (A)	Setting value data	Primary rating (A)	Setting value data
5 A	000AH (10)	600 A	04B0H (1200)
6 A	000CH (12)	750 A	05DCH (1500)
7.5 A	000FH (15)	800 A	0640H (1600)
8 A	0010H (16)	900 A	0708H (1800)
10 A	0014H (20)	1000 A	07D0H (2000)
12 A	0018H (24)	1200 A	0960H (2400)
15 A	001EH (30)	1500 A	0BB8H (3000)
20 A	0028H (40)	1600 A	0C80H (3200)
25 A	0032H (50)	1800 A	0E10H (3600)
30 A	003CH (60)	2000 A	0FA0H (4000)
40 A	0050H (80)	2500 A	1388H (5000)
50 A	0064H (100)	3000 A	1770H (6000)
60 A	0078H (120)	4000 A	1F40H (8000)
75 A	0096H (150)	5000 A	2710H (10000)
80 A	00A0H (160)	6000 A	2EE0H (12000)
100 A	00C8H (200)	7500 A	3A98H (15000)
120 A	00F0H (240)	8000 A	3E80H (16000)
150 A	012CH (300)	9000 A	4650H (18000)
200 A	0190H (400)	10000 A	4E20H (20000)
250 A	01F4H (500)	12000 A	5DC0H (24000)
300 A	0258H (600)	15000 A	7530H (30000)
400 A	0320H (800)	20000 A	9C40H (40000)
500 A	03E8H (1000)	30000 A	EA60H (60000)

Numbers in parentheses indicate decimal number data.

Note(4) In case of 1 A input specification, they output it as CT ratio data = Primary rated value ÷ 5 A ×10.

- Electric energy count value (Magnification of active energy data)

Electric energy count value	Communication data
×0.00001	FFFBH (-5)
×0.0001	FFFCH (-4)
×0.001	FFFDH (-3)
×0.01	FFFEH (-2)
×0.1	FFFFH (-1)
×1	0000H (0)
×10	0001H (1)
×100	0002H (2)
×1000	0003H (3)

Numbers in parentheses indicate decimal number data.

6.4 Model information request

Read the model information and phase wire from this product. There is no broadcast.
Function code designates 03H.

(1) Data request (Query)

In case it performs a model information request, it is necessary to designate the data address of data to acquire. When a data address is transmitted, please subtract 40001 from the address of a data-address list. The number of data should designate the tale of the data to request.

1	2	3	4	5	6	7	8
Address	Function code	Data address		Number of data		CRC	
01H	03H	01F4H		0002H		8405H	

Data address list

Function code	Data address	Model			
		3P3W	1P3W	1P2W	3P4W
03H	40501	Model information. Type			
	40502	Model information. Phase wire			

(2) Response

If data request is performed normally, the following response will be returned from this product side.

Example) Data address : 40501, Number of data : 2.

1	2	3	4	5	6	7	8	9
Address	Function code	Answer byte count	Type		Phase wire		CRC	

- Model information, Type

Type	Communication data
HSQT2-500	0031H

- Model information, Phase wire

Phase wire	Communication data
3P3W [3-phase 3-wire] (2VT2CT)	0001H
1P3W [1-phase 3-wire]	0002H
1P2W [1-phase 2-wire]	0005H
3P4W [3-phase 4-wire] (3VT3CT)	0006H
3P3W [3-phase 3-wire] (2VT3CT)	0007H
3P4W [3-phase 4-wire] (2VT3CT)	0008H

6.5 Measurement value request

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

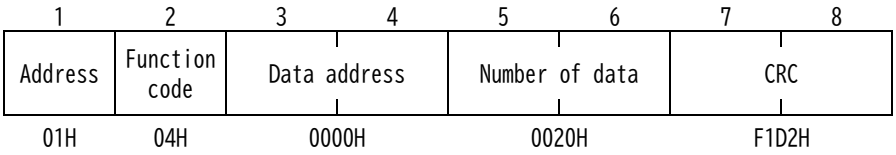
(1) Data request (Query)

In case it performs setting value request, it is necessary to designate the start address of data to acquire.
If a data address is transmitted, please subtract 30001 from the address of a data-address list.
The number of data should designate the tale of the data to request.

< Note > Active / reactive energy (Wh, varh) consists of 2 words (4 bytes), please set the number of data to 2. Also, depending on the phase wire, treat the part where measurement value does not exist (data 0000H fixed) as 1 data.

< Note > As for a general measurement value 1 and general measurement value 2, addresses are different. Therefore, it cannot read by data request once. Please perform a data request individually.

< Note > Data addresses 30034 to 30074, 30101 to 30160, 30301 to 30360, and 30601 to 30625 are 0000H (fixed).



Data-address list : General measurement value 1

Function code	Data address	3P3W	1P3W	1P2W	3P4W
04	30001	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Voltage (L1N)
04	30002	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Voltage (L2N)
04	30003	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Voltage (L3N)
04	30004	Voltage (L12)	Voltage (L1N)	Voltage	Voltage (L12)
04	30005	Voltage (L23)	Voltage (L3N)	0000H (Fixation)	Voltage (L23)
04	30006	Voltage (L31)	Voltage (L13)	0000H (Fixation)	Voltage (L31)
04	30007	Current (L1)	Current (L1)	Current	Current (L1)
04	30008	Current (L2)	Current (N)	0000H (Fixation)	Current (L2)
04	30009	Current (L3)	Current (L3)	0000H (Fixation)	Current (L3)
04	30010	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Current (N)
04	30011	Fundamental voltage (L12)	Fundamental voltage (L1N)	Fundamental voltage	Fundamental voltage (L1N)
04	30012	Fundamental voltage (L23)	0000H (Fixation)	0000H (Fixation)	Fundamental voltage (L2N)
04	30013	Fundamental voltage (L31)	Fundamental voltage (L3N)	0000H (Fixation)	Fundamental voltage (L3N)
04	30014	Fundamental voltage (Average)	0000H (Fixation)	0000H (Fixation)	Fundamental voltage (Average)
04	30015	Active power (5)	Active power (5)	Active power (5)	Active power (5)
04	30016	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)

Function code	Data address	3P3W	1P3W	1P2W	3P4W
04	30017	Wh (Incoming) upper	Wh (Incoming) upper	Wh (Incoming) upper	Wh (Incoming) upper
04	30018	Wh (Incoming) lower	Wh (Incoming) lower	Wh (Incoming) lower	Wh (Incoming) lower
04	30019	Wh (Outgoing) upper	Wh (Outgoing) upper	Wh (Outgoing) upper	Wh (Outgoing) upper
04	30020	Wh (Outgoing) lower	Wh (Outgoing) lower	Wh (Outgoing) lower	Wh (Outgoing) lower
04	30021	Reactive power	Reactive power	Reactive power	Reactive power
04	30022	varh (Incoming LAG) upper	varh (Incoming LAG) upper	varh (Incoming LAG) upper	varh (Incoming LAG) upper
04	30023	varh (Incoming LAG) lower	varh (Incoming LAG) lower	varh (Incoming LAG) lower	varh (Incoming LAG) lower
04	30024	varh (Incoming LEAD) upper	varh (Incoming LEAD) upper	varh (Incoming LEAD) upper	varh (Incoming LEAD) upper
04	30025	varh (Incoming LEAD) lower	varh (Incoming LEAD) lower	varh (Incoming LEAD) lower	varh (Incoming LEAD) lower
04	30026	varh (Outgoing LAG) upper	varh (Outgoing LAG) upper	varh (Outgoing LAG) upper	varh (Outgoing LAG) upper
04	30027	varh (Outgoing LAG) lower	varh (Outgoing LAG) lower	varh (Outgoing LAG) lower	varh (Outgoing LAG) lower
04	30028	varh(Outgoing LEAD) upper	varh(Outgoing LEAD) upper	varh(Outgoing LEAD) upper	varh(Outgoing LEAD) upper
04	30029	varh(Outgoing LEAD) lower	varh(Outgoing LEAD) lower	varh(Outgoing LEAD) lower	varh(Outgoing LEAD) lower
04	30030	Apparent power	Apparent power	Apparent power	Apparent power
04	30031	Power factor	Power factor	Power factor	Power factor
04	30032	Frequency	Frequency	Frequency	Frequency
04	30033	Active power (5)	Active power (5)	Active power (5)	Active power (5)

Note(5) The active power of data addresses 30015 and 30033 will be the same data.

Data-address list : General measurement value 2

Function code	Data address	3P3W	1P3W	1P2W	3P4W
04	30501	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Phase voltage (Average)
04	30502	Line voltage (Average)	0000H (Fixation)	0000H (Fixation)	Line voltage (Average)
04	30503	Current (Average)	0000H (Fixation)	0000H (Fixation)	Current (Average)
04	30504	Current (Power flow) (L1)	Current (Power flow) (L1)	Current (Power flow)	Current (Power flow) (L1)
04	30505	Current (Power flow) (L2)	Current (Power flow) (LN)	0000H (Fixation)	Current (Power flow) (L2)
04	30506	Current (Power flow) (L3)	Current (Power flow) (L3)	0000H (Fixation)	Current (Power flow) (L3)
04	30507	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)
04	30508	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)

Function code	Data address	3P3W	1P3W	1P2W	3P4W
04	30509	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Active power (L1)
04	30510	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Active power (L2)
04	30511	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Active power (L3)
04	30512	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)
04	30513	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)
04	30514	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)
04	30515	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (L1)
04	30516	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (L2)
04	30517	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (L3)
04	30518	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (Power flow) (L1)
04	30519	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (Power flow) (L2)
04	30520	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Reactive power (Power flow) (L3)
04	30521	Reactive power (Power flow)	Reactive power (Power flow)	Reactive power (Power flow)	Reactive power (Power flow)
04	30522	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Apparent power (L1)
04	30523	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Apparent power (L2)
04	30524	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Apparent power (L3)
04	30525	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (L1)
04	30526	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (L2)
04	30527	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (L3)
04	30528	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (power flow) (L1)
04	30529	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (power flow) (L2)
04	30530	0000H (Fixation)	0000H (Fixation)	0000H (Fixation)	Power factor (power flow) (L3)
04	30531	Power factor (power flow)	Power factor (power flow)	Power factor (power flow)	Power factor (power flow)

(2) Response

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

Example) Data address : 30001, Number of data : 32 (3P3W)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Address	Function code	Answer byte count	00	00	00	00	00	00	Voltage (L12)		Voltage (L23)		Voltage (L31)	

16	17	18	19	20	21	22	23	24	25	26	27	28	29
Current (L1)		Current (L2)		Current (L3)		00	00	Fundamental voltage (L12)		Fundamental voltage (L23)		Fundamental voltage (L31)	

30	31	32	33	34	35	36	37	38	39	40	41	42	43
Fundamental voltage (Average)		Active power		00	00	Wh (Incoming) Upper		Wh (Incoming) Lower		Wh (Outgoing) Upper		Wh (Outgoing) Lower	

44	45	46	47	48	49	50	51	52	53	54	55	56	57
Reactive power		varh (Incoming LAG) Upper		varh (Incoming LAG) Lower		varh (Incoming LEAD) Upper		varh (Incoming LEAD) Lower		varh (Outgoing LAG) Upper		varh (Outgoing LAG) Lower	

58	59	60	61	62	63	64	65	66	67	68	69
varh (Outgoing LEAD) Upper		varh (Outgoing LEAD) Lower		Apparent power		Power factor		Frequency		CRC	

Transmission scaling (1/2)

Item		Input			Communication data	Intrinsic error
Voltage	3P3W 1P2W 3P4W	AC0 to 150V, AC0 to 300V, AC0 to 600V (Line)			0000H to 2710H (0 to 10000)	±0.2%
		AC0 to 150/√3V, AC0 to 300/√3V, AC0 to 600/√3V (Phase)			0000H to 168EH (0 to 5774)	
	1P3W	AC0 to 300V, AC0 to 600V (Line)			0000H to 2710H (0 to 10000)	
		AC0 to 150V, AC0 to 300V (Phase)	Phase voltage full-scale 150V, 300V		0000H to 2710H (0 to 10000)	
			Phase voltage full-scale 300V, 600V		0000H to 1388H (0 to 5000)	
Current		AC0 to 5A			0000H to 2710H (0 to 10000)	±0.2%
		AC0 to 1A				±0.5%
Current (power flow)		Outgoing AC5A to Incoming AC5A			D8F0H to 0000H to 2710H (-10000 to 0 to 10000)	±0.2%
		Outgoing AC1A to Incoming AC1A				±0.5%
Active power	3P3W 1P3W 3P4W	5A	110V	-1kW to 0 to +1kW	D8F0H to 0000H to 2710H (-10000 to 0 to 10000)	±0.3%
			220V	-2kW to 0 to +2kW		
			440V	-4kW to 0 to +4kW		
		1A	110V	-200W to 0 to +200W		±0.5%
			220V	-400W to 0 to +400W		
			440V	-800W to 0 to +800W		
	1P2W	5A	110V	-500W to 0 to +500W	EC78H to 0000H to 1388H (-5000 to 0 to 5000)	±0.3%
			220V	-1kW to 0 to +1kW		
			440V	-2kW to 0 to +2kW		
		1A	110V	-100W to 0 to +100W		±0.5%
			220V	-200W to 0 to +200W		
			440V	-400W to 0 to +400W		
Reactive power Reactive power (power flow)	3P3W 1P3W 3P4W	5A	110V	LEAD1kvar to 0 to LAG1kvar	D8F0H to 0000H to 2710H (-10000 to 0 to 10000)	±0.3%
			220V	LEAD2kvar to 0 to LAG2kvar		
			440V	LEAD4kvar to 0 to LAG4kvar		
		1A	110V	LEAD200var to 0 to LAG200var		±0.5%
			220V	LEAD400var to 0 to LAG400var		
			440V	LEAD800var to 0 to LAG800var		
	1P2W	5A	110V	LEAD500var to 0 to LAG500var	EC78H to 0000H to 1388H (-5000 to 0 to 5000)	±0.3%
			220V	LEAD1kvar to 0 to LAG1kvar		
			440V	LEAD2kvar to 0 to LAG2kvar		
		1A	110V	LEAD100var to 0 to LAG100var		±0.5%
			220V	LEAD200var to 0 to LAG200var		
			440V	LEAD400var to 0 to LAG400var		
Apparent power	3P3W 1P3W 3P4W	5A	110V	0 to 1kVA	0000H to 2710H (0 to 10000)	±0.3%
			220V	0 to 2kVA		
			440V	0 to 4kVA		
		1A	110V	0 to 200VA		±0.5%
			220V	0 to 400VA		
			440V	0 to 800VA		
	1P2W	5A	110V	0 to 500VA	0000H to 1388H (0 to 5000)	±0.3%
			220V	0 to 1kVA		
			440V	0 to 2kVA		
		1A	110V	0 to 100VA		±0.5%
			220V	0 to 200VA		
			440V	0 to 400VA		
Power factor Power factor (power flow)		5A	LEAD 0 to 1 to LAG 0		0000H to 1388H to 2710H (0 to 5000 to 10000)	±1.0%
		1A				±1.5%
Frequency		45 to 55Hz			1194H to 157CH (4500 to 5500)	±0.2%
		55 to 65Hz			157CH to 1964H (5500 to 6500)	
		45 to 65Hz			1194H to 1964H (4500 to 6500)	

Transmission scaling (2/2)

Item		Input		Communication data	Intrinsic error
Fundamental voltage	3P3W 1P2W	AC0 to 150V, AC0 to 300V, AC0 to 600V		0000H to 2710H (0 to 10000)	±0.3%
	3P4W	AC0 to 150/√3V, AC0 to 300/√3V, AC0 to 600/√3V (Phase)		0000H to 168EH (0 to 5774)	
	1P3W	AC0 to 150V, AC0 to 300V (Phase)	Phase voltage full-scale 150V, 300V	0000H to 2710H (0 to 10000)	
			Phase voltage full-scale 300V, 600V	0000H to 1388H (0 to 5000)	
Active energy (Incoming / Outgoing)	5A	0 to 999999999		00000000H to 3B9AC9FFH (0 to 999999999) (6)	±1.0%
	1A				±2.0%
Reactive energy (Incoming / Outgoing, LAG/LEAD)	5A	0 to 999999999		00000000H to 3B9AC9FFH (0 to 999999999) (6)	±2.0%
	1A				

Note(6) By multiplying the active / reactive energy data by the electric energy count value, it becomes actual electric energy (kWh / kvarh).

Example) Electric energy (kWh) = Electric energy data × Electric energy count value
= 123456789 kWh × 100 = 12345678900 kWh

Measurement data upper limit and lower limit, and low input cut (1/2)

Item		Input			Upper and lower limiter	Low input cut
Voltage	3P3W 1P2W 3P4W	AC0 to 150V, AC0 to 300V, AC0 to 600V (Line)			120% of full scale (12000)	Less than 1% of full scale (100)
		AC0 to 150/√3V, AC0 to 300/√3V, AC0 to 600/√3V (Phase)			120% of full scale (6928)	Less than 1% of full scale (58)
	1P3W	AC0 to 300V, AC0 to 600V (Line)			120% of full scale (12000)	Less than 1% of full scale (100)
		AC0 to 150V, AC0 to 300V (Phase)	Phase voltage full-scale 150V, 300V		120% of full scale (12000)	
			Phase voltage full-scale 300V, 600V		120% of full scale (6000)	Less than 1% of full scale (50)
Current		AC0 to 5A			120% of rated (12000)	Less than 0.2% of rated (20) (7)
		AC0 to 1A				Less than 0.5% of rated (50) (7)
Current (Power flow)		Outgoing AC5A to Incoming AC5A			120% of rated (±12000)	Less than 0.2% of rated (±20) (7)
		Outgoing AC1A to Incoming AC1A				Less than 0.5% of rated (±50) (7)
Active power	3P3W 1P3W 3P4W	5A	110V	-1kW to 0 to +1kW	120% of rated (±12000)	Less than 0.3% of rated (±30)
			220V	-2kW to 0 to +2kW		
			440V	-4kW to 0 to +4kW		
		1A	110V	-200W to 0 to +200W		Less than 0.5% of rated (±50)
			220V	-400W to 0 to +400W		
			440V	-800W to 0 to +800W		
	1P2W	5A	110V	-500W to 0 to +500W	120% of rated (±6000)	Less than 0.3% of rated (±15)
			220V	-1kW to 0 to +1kW		
			440V	-2kW to 0 to +2kW		
		1A	110V	-100W to 0 to +100W		Less than 0.5% of rated (±25)
			220V	-200W to 0 to +200W		
			440V	-400W to 0 to +400W		

Note(7) When 3P4W and 1P3W, the low input cutting value of N phase is double.

Measurement data upper limit and lower limit, and low input cut (2/2)

Item		Input			Upper and lower limiter	Low input cut
Reactive power Reactive power (power flow)	3P3W 1P3W 3P4W	5A	110V	LEAD1kvar to 0 to LAG1kvar	120% of rated (±12000)	Less than 0.3% of rated (±30)
			220V	LEAD2kvar to 0 to LAG2kvar		
			440V	LEAD4kvar to 0 to LAG4kvar		
		1A	110V	LEAD200var to 0 to LAG200var		Less than 0.5% of rated (±50)
			220V	LEAD400var to 0 to LAG400var		
			440V	LEAD800var to 0 to LAG800var		
	1P2W	5A	110V	LEAD500var to 0 to LAG500var	120% of rated (±6000)	Less than 0.3% of rated (±15)
			220V	LEAD1kvar to 0 to LAG1kvar		
			440V	LEAD2kvar to 0 to LAG2kvar		
		1A	110V	LEAD100var to 0 to LAG100var		Less than 0.5% of rated (±25)
			220V	LEAD200var to 0 to LAG200var		
			440V	LEAD400var to 0 to LAG400var		
Apparent power	3P3W 1P3W 3P4W	5A	110V	0 to 1kVA	120% of rated (12000)	Less than 0.3% of rated (30)
			220V	0 to 2kVA		
			440V	0 to 4kVA		
		1A	110V	0 to 200VA		Less than 0.5% of rated (50)
			220V	0 to 400VA		
			440V	0 to 800VA		
	1P2W	5A	110V	0 to 500VA	120% of rated (6000)	Less than 0.3% of rated (15)
			220V	0 to 1kVA		
			440V	0 to 2kVA		
		1A	110V	0 to 100VA		Less than 0.5% of rated (25)
			220V	0 to 200VA		
			440V	0 to 400VA		
Power factor Power factor (power flow)		5A	LEAD 0 to 1 to LAG 0		0 to 5000 to 10000 (LEAD 0 to 1 to LAG 0 fixed)	Less than 20% of voltage full scale or less than 2% of rated current
		1A				
Frequency		45 to 65Hz			10 to 180Hz (1000 to 18000)	Less than 20% of voltage full scale
Fundamental voltage	3P3W 1P2W	AC0 to 150V, AC0 to 300V, AC0 to 600V			120% of full scale (12000)	Less than 1% of full scale (100)
	3P4W	AC0 to 150/√3V, AC0 to 300/√3V AC0 to 600/√3V (Phase)			120% of full scale (6928)	Less than 1% of full scale (58)
	1P3W	AC0 to 150V, AC0 to 300V (Phase)		Phase voltage full-scale 150V, 300V	120% of full scale (12000)	Less than 1% of full scale (100)
				Phase voltage full-scale 300V, 600V	120% of full scale (6000)	Less than 1% of full scale (50)

6.6 Loopback test

The loopback test is the function that tests communication of a master and a slave (HSQT2-500).
Arbitrary data is answered as it is. There is no broadcast. Function code designates 08H.

(1) Request of loopback (Query)

In case it performs a loopback test, it is necessary to transmit the data used for a diagnostic code and diagnostic. Diagnostic code should designate 0000H.
For diagnostic data, specify an arbitrary value from 0000H to FFFFH.

1	2	3	4	5	6	7	8
Address	Function code	Diagnostic code		Diagnostic data		CRC	
01H	08H	0000H		04D2H		6296H	

(2) Response

If loopback request is performed normally, the following response will be returned from this product side.

1	2	3	4	5	6	7	8
Address	Function code	Diagnostic code		Diagnostic data		CRC	

The same data as the master transmitted by (1) is returned to diagnostic code and diagnostic data.

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