Instruction Manual

Supplementary Manual for SKX-400-S (RS-485/Modbus_RTU)

Version 1.0 (Aug, 2022)

CAUTION!

This controller is intended to control equipment under normal operating conditions. If failure or malfunction of it could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory) intended to warn of or protect against failure or malfunction of the controller must be incorporated into and maintained as part of the control system.

1. Introductory

This controller is using RS485 Modebus_RTU (Remote Terminal Unit) mode for the data transfer. Up to 255 meters can be connected at same time. The format for each byte in RTU mode is:

Coding system:
8-bit binary, hexadecimal 0-9, A-F
Two hexadecimal characters contained in each 8-bit field of the message

Bits per Bytes:
Baud rate (bps): 1200, 2400, 4800 and 9600
Stop bit: 1 bit
Data length: 8 bits
Parity check: None
Error Check Field: Modbus Cyclical Redundancy Check (CRC-16)

Other spec when use third party PLC/comm software
Timeout interval: 300ms.
Retries: >2 times

2. RTU Message Frame:

A typical message frame is shown below.

Table 2.1 RTU data frame.

Target Address	Function	Data	CRC-16
8 Bits	8 Bits	n x Bits	16 Bit

Target address field: This field contains 8-bit data (RTU). Its range is 0 - 255 decimal. Address 0 is for broadcasting data to all receiving devices. To contact a PID controller, the sender unit/computer/PLC will put the address of that PID controller in the address field of the message. When that PID controller replies, it will put its address in the address field of the message as well.

Function field: This field contains 8-bit data. Its range is 1 - 64 decimal. This function field will tell what operations are requested for this data frame. For example, updating the value for set temperature, fetching the current reading temperature, etc.

Data field: This field contains multiple 8-bit data. It contains all the additional information, which is needed to complete the requested function. Such as the target parameter address, or the new set temperature.

CRC: 16-bit or two 8-bit bytes for error checking. Cyclical Redundancy Check (CRC) value is appended to the end of this data frame. Low-order byte will be sent in prior to the high-order byte. For example, if the data frame is 010310010001, and its CRC16 is D10A. So its complete data frame is 010310010001**D10A**.

Note: RTU message is in hexadecimal format.

3. Parameter set

Table 3.1 System Parameters

Code	Description	Data Type*	Register Absolute Address (Hex)	Holding Register Address (Dec)
PV	Reading Value For Channel 1 ~ 4	Decimal	1001 ~ 1004	44098 ~ 44101
System Parameters (first layer of menu)				
LoCK	Parameter Lock	Integral	0000	40001
ES	Input Type	Integral	0001	40002
PE	Cycle Time	Integral	0003	40004
dP	Decimal Point Position	Integral	0004	40005
PS-H	Display High Limit	Integral	0005	40006
PS-L	Display Low Limit	Integral	0006	40007
CF	Display Unit	Integral	0007	40008
Addr	Comm. Address	Integral	0008	40009
bAud	Comm. Baud Rate	Integral	0009	40010
Parameters for Each Channels (second layer of menu)				
SP	Set Value (Channel 1 ~ 4)	Decimal	000A, 0013, 001C, 0025	40011, 40020, 40029, 40038
Pb	Input Offset (Channel 1 ~ 4)	Decimal	000C, 0015, 001E, 0027	40013, 40022, 40031, 40040
VP	Proportional Constant (Channel 1 ~ 4)	Integral	000D, 0016, 001F, 0028	40014, 40023, 40032, 40041
VL	Integral Time (Channel 1 ~ 4)	Integral	000E, 0017, 0020, 0029	40015, 40024, 40033, 40042
Vd	Derivative Time (Channel 1 ~ 4)	Integral	000F, 0018, 0021, 002A	40016, 40025, 40034, 40043
HY	Hysteresis Band (Channel 1 ~ 4)	Decimal	0010, 0019, 0022, 002B	40017, 40026, 40035, 40044
AE	Auto-tuning (Channel 1 ~ 4)	Integral	0011, 001A, 0023, 002C	40018, 40027, 40036, 40045
CoL	Control Mode (Channel 1 ~ 4)	Integral	0012, 001B, 0024, 002D	40019, 40028, 40037, 40046

Table 3.3 Response data from status parameters (read only, two 8-bit bytes)

Register Absolute Address (Hex)	Bit 15 ~ 8	Bit 7 ~ 0
1101	Channel 1 output percentage	00
1102	Channel 2 output percentage	00
1103	Channel 3 output percentage	00
1104	Channel 4 output percentage	00

Note*: Parameter Data Type

Some parameters in this controller may display in decimal number (number with one decimal digit) rather than integral number. For example, your display temperature can be 20.1 degree (decimal number) and your step 2 ramp timer is 10 minutes (integral number). For decimal number, its actual stored value in controller's memory will be 10 times larger than its display value. For example, if your display temperature is 20.1, it will be stored as 201 (Decimal) or C9 (Hex) in its register. For integral number, its actual stored value in the controller's memory will be the same as its display value.

This controller uses signed 16-bit number and it cannot read floating point numbers.

Note: Input Sensor Type**
This PID controller can read the following 9 different temperature sensor types. Please find the table below. Sn code is the Sn value used in its software. Sn symbol is the display value on the PID controller.

Table 3.4 Value table for input sensor type

Sn Code	Sn Symbol	Definition
0	Cu50	Cu50 (RTD)
1	Pt2	Pt100 (RTD), -200~600C
2	K	K (thermocouple)
3	E	E (thermocouple)
4	J	J (thermocouple)
5	t	T (thermocouple)
6	S	S (thermocouple)

4. Function code examples

Note: Two function codes are available for this controller: 03 (0x03) and 06 (0x06). Function code 03 (read holding registers) and 06 (present single register/write register). For details, please check ModBus Protocol.

4.1. Function code 03: Read parameter value from the controller

Function code 03 is used to read the parameter value from the controller.

Example #1: Read the current PV value from the channel 1
Data sent by host (query): 01 03 10 01 00 01 D1 0A
Data received from PID (response): 01 03 02 01 0D 78 11

Table 4.1 Example for function code 03

Query Message				
Target Address	Function	Parameter Address	Number of words	CRC16
01	03	1001	0001	D10A
Response Message				
Target Address	Function	Data Length	Data	CRC16
01	03	02	010D	7811

By the response message, the channel 1 PV value was 010D (hex) or 269 (decimal). So the actual display temperature is 26.9 degree.

Example #2: Read the status register from the channel 1
Data sent by host (query): 01 03 11 01 00 01 D0 F6
Data received from PID (response): 01 03 02 64 00 92 84

Table 4.2 Example for function code 03

Query Message				
Target Address	Function	Parameter Address	Number of words	CRC16
01	03	1101	0001	D0F6
Response Message				
Target Address	Function	Data Length	Data	CRC16

01	03	02	6400	9284

By the response message, the status parameter data is 6400, which means the channel 1 output percentage is 64H (hex), or 100 (decimal).

4.2. Function code 06: Write new parameter value to the controller

Function code 06 is used to write new parameter value to the controller. After the controller received the query message correctly, controller will reply the exact same message to the host.

Example: Write 550.5 degree as the new set temperature for channel 1 (SP1), which is in decimal format, so the stored value is 5505 (decimal) or 1581 (hex). The replied data will be the same as sent data.

Data sent by host (query): 01 06 00 0A 15 81 67 38
Data received from PID (response): 01 06 00 0A 15 81 67 38

Table 4.3 Example for function code 06

Query Message				
Target Address	Function	Parameter Address	Number of words	CRC16
01	06	000A	1581	6738
Response Message				
Target Address	Function	Parameter Address	Number of words	CRC16
01	06	000A	1581	6738

5. Common Error

Q: Why I get no response from this controller?
A: 1). Please check the controller's address in the query message is correct, CRC code for message is correct and data frame format is correct.
2). Every command can only read one resistor at one time. User cannot read multiple registers at same time.
3). Please check the time interval between query messages is over 300ms.

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