Smart Recloser-MT53RS

---- Modbus RTU Communication Protocol

Date	Version	Event	Operator
20260526	V1.6	Reorganized / Restructured	Panzy
20210623	V1.3	New Version Design	Tang Qi
20201023	V1.2	Modified Register Definitions	Tang Qi
20201016	V1.1	Modified Functions	Tang Qi
20200521	V1.0	Initial Release	Tang Qi

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1. Protocol Description

This communication protocol is the Modbus protocol for the Smart Recloser, designed to facilitate users in reading and writing device parameters using Modbus commands. In this protocol, all transmitted data and returned values are in hexadecimal (Hex) format, unless otherwise specified.

2. Frame Format Introduction

Table 1: Modbus Frame Format

Address Code	Function Code	Data Field	Check Code

1、Address Code

- Occupies 1 byte.
- Each device terminal corresponds to a unique address code. The valid address range is 1 to 247 (0x01 to 0xF7). 0 is designated as the broadcast address, which can be used to broadcast and read certain configuration data, such as the slave communication address.

2、Function Code

- Occupies 1 byte.
- Based on the standard Modbus protocol function code definitions, two commonly used basic function codes are selected as the read and write function codes for this protocol.

Table 2 Function Code Definitions

Function Code	Description
0x03	Read Holding Registers
0x06	Write Single Register

3、Data Field

- The format of the data field is determined by the function code.
- Read Registers (0x03)
- When reading registers, the starting address and the number of registers must be specified. Therefore, the data field consists of the Starting Address and the Quantity of Registers. The data field of

the returned response frame consists of the Byte Count and the Register Data within the corresponding range.

- Table 3 0x03 Read Registers Frame Format

Request Frame			Response Frame		
Frame Format	**Value / Range**	**Bytes**	**Frame Format**	**Value / Range**	**Bytes**
Address Code	0～247	1	Address Code	0～247	1
Function Code	0x03	1	Function Code	0x03	1
Register Starting Address	0～0xFFFF	2	Return data length	2*N	1
Quantity of Registers N	1～125	2	Return data	2～250	2*N
CRC Check		2	CRC Check		2

For all fields containing 2 bytes (except for the CRC check), the high byte is transmitted first, followed by the low byte, which follows the Big-endian format.

- Write Single Register (0x06)

Writing to a single holding register is primarily used for configuring parameters. The total length is 8 bytes. The response frame is identical to the request frame, and the register value is the value being written.

Table 4 0x06 Write Single Register Frame Format

Request Frame			Response Frame		
Frame Format	**Value / Range**	**Bytes**	**Frame Format**	**Value / Range**	**Bytes**
Address Code	0～247	1	Address Code	0～247	1
Function Code	0x06	1	Function Code	0x06	1
Register Address	0～0xFFFF	2	Register Address	0～0xFFFF	2
Register Value	0～0xFFFF	2	Register Value	0～0xFFFF	2
CRC Check		2	CRC Check		2

4、Check Code

The check code is calculated using CRC-16 (with the generator polynomial 0xA001). The transmission sequence is **low byte first, followed by high byte**.

5、MODBUS Exception Response Frame

When the device receives a request frame from the master station and successfully processes the requested data, it returns a normal response frame to the master station.

When the device fails to successfully receive a request frame from the master station, it performs no action and returns no response. The master station can configure a timeout duration to serve as the basis for diagnosing device failures.

When the device receives a request frame from the master station, but the function code or register in the request frame does not comply with the data definition requirements, the device cannot execute the data processing. In this case, the device must return an exception response frame to the master station. The format of the exception response frame is shown in Table 6 below:

Table 6 MODBUS Exception Response Frame Format

Exception Response Frame		
Frame Format	**Value / Range**	**Bytes**
Address Code	0～247	1
Function Code	0x80 + Requested Function Code	1
Exception Code	01/02/03	1
CRC Check		2

The function code is generated by setting the highest bit (MSB) of the received request frame's function code to 1, indicating that this frame is an exception response frame.

The definitions of the exception codes are shown in Table 7 below:

Table 7 MODBUS Exception Code Definitions

Exception Code	Name	Description
01	Illegal Function Code	The function code in the request frame is not defined.
02	Illegal Register	The register address in the request frame is not defined.
03	Illegal Register Value	The register value or register length (quantity) in the request frame does not conform to the defined format.

3. Register Definitions

Hex Address	Data Item	R/W Attribute	Value Range	Default Value	Data Type	Length	Unit
0000	Communication Address	R/W	1~247; Takes effect immediately after modification; Saved on power-off	1	UInt16	1	/
0001	Baud Rate	R/W	0: 9600; 1: 2400 2: 4800 3: 9600 Takes effect immediately after modification; Saved on power-off	3	UInt16	1	bits/s
0002	Parity	R/W	1: None 2: Even 3: Odd Takes effect after reboot; Saved on power-off	1	UInt16	1	/
0003	Stop Bits	R/W	1: 1bit 2: 2bit	1	UInt16	1	/
0004	System Status Control	R/W	Input 2020 to reset and reboot	/	UInt16	1	/
0005	System Upgrade Control	R/W	Input 2025 to enter upgrade mode	/	UInt16	1	/

0006	System Clock (High Word)	R		/	UInt16	1	H
0007	System Clock (Low Word)	R		/	UInt16	1	S
0008	Hardware ID	R		/	UInt16	1	/
0009	Firmware Version	R		/	UInt16	1	/
0x0A (10)	Auto-Reclose Enable	R/W	For versions with auto reclosing: 0: Disabled 1: Enabled Saved on power-off; For versions without auto reclosing: Configuration is invalid and NOT saved on power-off.	1	UInt16	1	/
0x0B	Auto-Reclose Countdown	R	/	/	UInt16	1	S
0x0C (12)	Display Status	R	1: Red LED solid on 2: Green LED solid on 3: Yellow LED solid on 4: Red LED flashing 5: Green LED flashing 6: Yellow LED flashing 7: Red LED rapid flashing 8: Green LED rapid flashing 9: Yellow LED rapid flashing 10: Red/Green alternating flash	/	UInt16	1	/
0x0D (13)	AUX Output Status	R	0: No output (AUX disconnected) 1: Output active (AUX conducting)	0	UInt16	1	/
0x0E	Padlock /	R	0: Automatic	/	UInt16	1	/

(14)	Lockout Status		1: Manual				
0x0F (15)	Position Hall (Active/Triggered when 1)	R	For each bit, 1 indicates present or sensed, 0 indicates absent or not sensed; Bit-0: Opening Hall Bit-1: Reset Hall Bit-2: Closing Hall Bit-3: Motor Fault	/	UInt16	1	/
0x10 (16)	Recloser Status	R	For each bit, 1 indicates Present/Yes, 0 indicates Absent/No; bit0 (1): Fault bit1 (2): Command Opening bit2 (4): Command Closing bit3 (8): Command Lockout / Lock bit4 (16): Command Reset bit5 (32): Initialization Opening bit6 (64): Auto-Reclosing or Initialization Closing bit7 (128): Reserved bit8 (256): Reserved bit9 (512): Reserved bit10 (1024): Manual Closing bit11 (2048): External Opening (includes manual closing and tripping)	/	UInt16	1	/
0x11 (17)	Control Opening/ Closing	R/W	Read value is always 0; Write value: 1: Control Opening 2: Control Closing	/	UInt16	1	/
0x12	RS485 Control Opening/	R/W	1-2: Enable RS485 Control	1	UInt16	1	/

	Closing Enable		Opening/Closing 3: Disabled				
0x13	Allowed Number of Reclosings	R	For versions with auto reclosing: 0: Disabled 1: once 2: twice ... Max 10: 10 times; For versions without auto reclosing: Configuration is invalid and NOT saved on power-off.	3	UInt16	1	/
0x14	Closing Motor Operation Compensation Time	R/W	1~300 Factory calibrated, use with caution;	30/45/60/70	UInt16	1	ms
0x15	Opening Motor Operation Compensation Time	R/W	1~300 Factory calibrated, use with caution;	0	UInt16	1	ms
0x16	Closing Reset Motor Operation Compensation Time	R/W	1~300 Factory calibrated, use with caution;	30	UInt16	1	ms
0x17	Opening Reset Motor Operation Compensation Time	R/W	1~300 Factory calibrated, use with caution;	20	UInt16	1	ms
0x18	Closing Motor Operation Time	R	1~3600	/	UInt16	1	ms
0x19	Opening Motor Operation Time	R	1~3600	/	UInt16	1	ms
0x1A	Closing Reset Motor Operation Time	R	1~3600	/	UInt16	1	ms
0x1B	Opening Reset Motor Operation Time	R	1~3600	/	UInt16	1	ms

0x1C	Locking Motor Operation Time	R	1~3600	/	UInt16	1	ms
0x1D	Unlocking Motor Operation Time	R	1~3600	/	UInt16	1	ms
0x1E~0x30	Reserved	R	/	/	UInt16	...	/
0x31	Current Cycled Tripping Count	R	Reset to zero upon initialization closing, manual closing, RS485 control closing, or after closing stabilization; otherwise, increments by 1 for each trip.	/	UInt16	1	Times
0x32	1st Auto-Reclose Wait Time	R/W	1~3600	10	UInt16	1	S
0x33	2nd Auto-Reclose Wait Time	R/W	1~3600	60	UInt16	1	S
0x34	3rd Auto-Reclose Wait Time	R/W	1~3600	300	UInt16	1	S
0x35	4th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x36	5th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x37	6th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x38	7th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x39	8th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x3A	9th Auto-Reclose Wait Time	R/W	1~3600	900	UInt16	1	S
0x3B	10th	R/W	1~3600	900	UInt16	1	S

	Auto-Reclose Wait Time						
0x3C	1st Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x3D	2nd Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x3E	3rd Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x3F	4th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x40	5th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x41	6th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x42	7th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x43	8th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x44	9th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x45	10th Auto-Reclose Stabilization Time	R/W	1~3600	900	UInt16	1	S
0x46~0x	Chip UID	R	Product Unique	/	HEX	6	/

4B			Identifier				

Table 7 MODBUS Registers

Additional Features:

1、 In the Padlock / Lockout status, the device responds to the broadcast address 0x00 to read and write the communication address register 0x0000. In the Non-Lockout status, the device will not respond to commands sent to the broadcast address 0x00.

2、

Broadcast Address Acquisition (The safety lock must be pulled out in advance, and only one device on the same communication bus may have its lock pulled at a time to prevent signal interference):

[TX] - 00 03 00 00 00 01 85 DB

[RX] - 01 03 02 00 01 79 84

Broadcast Address Modification:

[TX] - 00 06 00 00 00 02 09 DA

[RX] - 02 06 00 00 00 02 08 38

Read Multiple Registers:

[TX] - 01 03 00 00 00 1E C5 C2 (Default Address: 1)

[RX] - 01 03 3C 00 01 00 04 00 01 00 02 00 00 00 00 00 00 01 2E 00 00 03 E2 00 01 00 00 00 01 00 01 00 00 00 03 00 00 00 00 00 00 00 00 03 20 00 0A 00 2D 00 05 00 10 00 10 00 00 00 00 00 04 00 05 34 4E

Read Multiple Registers:

[Tx]01 03 00 00 00 4C 44 3F (Response command omitted);