Remote Reclosing Device with Insulation Control

MT51SD Series

User Manual

04/2025

matismart

AIoT Electric
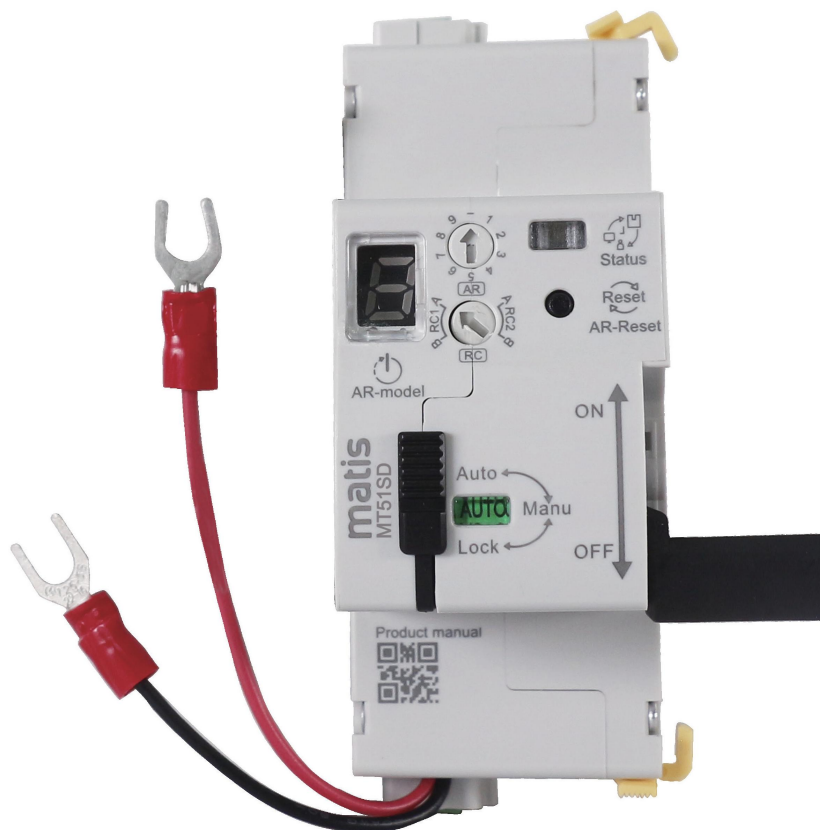
INDEX

1 Product Overview

1.1 Product Introduction

MT51SD is a remote control and automatic reclosing accessory with insulation detection function, suitable for MATIS series circuit breakers (MCB, RCCB, RCBO). The device automatically performs circuit insulation detection before reclosing or remote closing operation to ensure power safety.

1.2 Main Functions

- Perform insulation detection on MCB/RCCB/RCBO circuits after tripping, and close the circuit when conditions are met
- Multiple reclosing logic modes, programmable
- Local IO and RS485 dual control and status feedback interface
- Applicable to terminal power distribution systems to improve power supply continuity and system intelligence

1.3 Main Features

Parameter Name	Value/Description
Product Model	MT51SD
Rated Operating Voltage (Uc)	AC230V
Frequency	50/60Hz
Opening and Closing Action Time	≤0.5s (excluding reset time)
Impact Withstand Voltage	Uimp = 4kV
Power Frequency Withstand Voltage	2kV
Rated Insulation Voltage	Ui = 500V
Protection Class	IP20 (stand-alone) / IP40 (inside cabinet)
Mechanical Life	≥10,000 times
Operating Temperature Range	-25℃ ~ +70℃
Air Humidity	≤95% @ +25℃ (non-condensing)

Power Consumption	Standby power consumption <1.5VA, operating power consumption <20VA	
Installation Method	DIN rail mounting	2

2   Panel Introduction

2)Remote control working mode selection switch;

3)Working status indicator;

4)The screen displays the reclosing times;

5)Reset button

6)Automatic / manual control dial selection switch & padlock device;

7)Remote control device opening/closing handle

8)Insulation detection L/N line
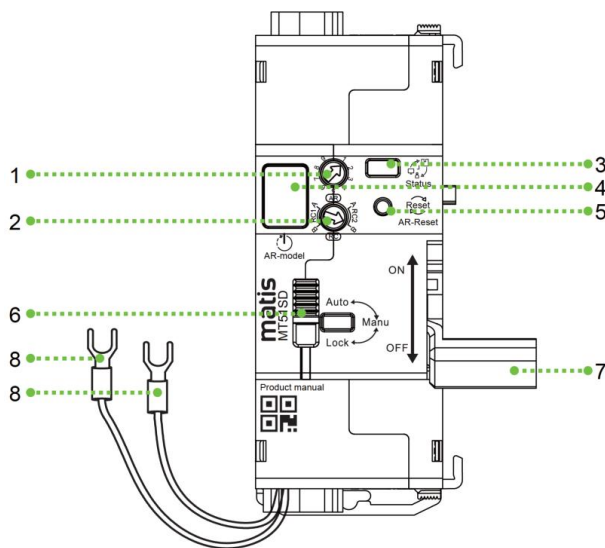
1)Reclosing program MR0-MR9 / ER0-ER9 selection switch;

1 — OUT-1	OUT-1 status output terminal block
2 — OUT-2	OUT-2 status output terminal block
3 — Com	Common terminal
4 — RS485-A	RS485-terminal A
5 — RS485-B	RS485-terminal B
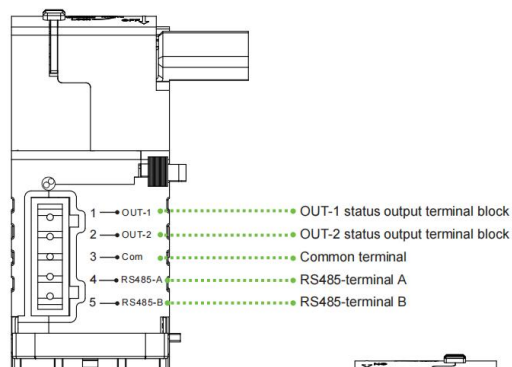
Lock closing terminal	6
Unlock closing terminal	7
C1 control input terminal block	C1 — 8
C2 control input terminal block	C2 — 9
230V AC power terminal L line	L — 10
230V AC power terminal N line	N — 11
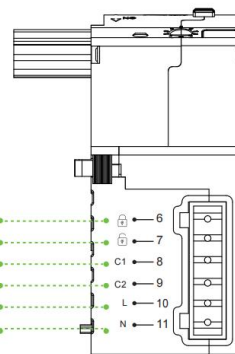
3   Indicator Description

Priority	Color and Pattern	Trigger Condition Description
1 (highest)	🔴 Steady red	- In OFF status
		- Pull out the safety lock to enter manual mode
		- The number of automatic reclosings reaches the upper limit, and the system enters the logic self-locking status.
2	🟡 Slow flashing yellow (cycle 2s: 1s on / 1s off)	- When the electrical lock input is valid:
		• Disable auto reclosing
		• Option to disable C1/C2 commands
		• Option to disable RS485 commands
3	🟢 Slow flashing green (cycle 2s: 1s on / 1s off)	- Unlock the first 3 seconds after the electrical locking signal is input
		- The first 10 seconds after the Reset button is pressed
4	🟡 Steady yellow	- Insulation test failed
5	🔴 Slow flashing red (cycle 2s: 1s on / 1s off)	- Waiting for automatic reclosing
6 (lowest)	🟢 Steady green	- The automatic reclosing function is enabled and in ON status.
		(xR0 mode, not in self-locking mode)

4　Wiring

4.1　Definition and Function of Upper Terminal

4.1.1　Electrical Locking and Unlocking Control Terminals

No.	Symbol	Function Description
Terminal 1	🔒 Electrical locking	- In reclosing mode (MR0-MR9 / ER0-ER9), used to control the program locking - The following locking functions can be configured via RS485 Modbus: 　☑ Remote locking automatic reclosing (required) 　☐ Locking C1/C2 ON/OFF commands (optional) 　☐ Locking RS485 control command (optional)
Terminal 2	🔓 Unlock	- To release the locked status, the input signal must last for ≥3 seconds - After unlocking, the remote control or reclosing process can be restored - ⚠ Before unlocking, the locking signal of terminal 1 must be disconnected, otherwise it will be invalid.

☑ The "remote lock auto reclosing" function is a mandatory option. If it is locked during the reclosing process, the subsequent actions will be interrupted.

4.1.2　Control Terminal (Knob 2 Set to RC1 or RC2)

4.1.2.1　Mode 1: RC1 (Remote Control Priority)

No.	Symbol	Function Description
Terminal 3	C1 Control 1	- Local continuous control signal 　ON → Close; OFF → Open
Terminal 4	C2 Control 2	- Local pulse control signal 　When receiving a pulse, the controller flips once

☑ Supports a final remote closing attempt after a reclosing failure

4.1.2.2   Mode 2: RC2 (Central Remote Control + Local Force)

No.	Symbol	Function Description
Terminal 3	C1 Control 1	- Local continuous control signal ON → Close; OFF → Open

Terminal 4	C2
	Control 2
		- Receive central control (RS485) commands
		   ON → Remote closing is allowed
		   OFF → Open or exit remote control

☑ Supports a final remote closing attempt after reclosing failure

4.1.3   Power Access Terminal

No.	Symbol	Function Description
Terminal 5	L	Power input: AC220V live line
Terminal 6	N	Power input: AC220V neutral line

4.2   Definition and Function of Lower Terminal

All outputs are passive dry contacts, and the status is determined by the register configuration: the default register value is 02;

Output Status	Description
1	Contact closed (ON)
0	Contact open (OFF)

4.2.1   Solution 1: Register Value = 01 (Multi-status Composite Output)

COM (3)	OUT2 (2)	OUT1 (1)	Status Function Description
✔	1	0	ON: Command closing / manual closing
✔	0	1	OFF: Command to open

| ✔ | 1 | 1 | TRIPPED / IM FAULT / END OF CYCLE
Fault trip (non-commanded) / insulation fault / reclosing failure |
| ✔ | 0 | 0 | 🔒 Electrical locking |

4.2.2   Solution 2: Register Value = 02 (ON/OFF Status + Insulation Detection + Reclosing Failure)

Output Terminal	Status	Status Function Description
OUT1 (1)	1	ON: Closing status (manual/command)
	0	OFF: Open status / fault trip (non-command)
OUT2 (2)	1	IM FAULT / END OF CYCLE (insulation fault / reclosing failure)
	0	Normal status
COM (3)	—	Output common terminal

4.2.3   Option 3: Register Value = 03 (ON/OFF Status + Insulation Fault)

Output Terminal	Status	Status Function Description
OUT1 (1)	1	ON: Closing status
	0	OFF: Open/fault open (non-command)
OUT2 (2)	1	IM FAULT (insulation fault)
	0	Normal status
COM (3)	—	Output common terminal

4.2.4   Solution 4: Register Value = 04 (Insulation Fault + Reclosing Failure)

Output Terminal	Status	Status Function Description
OUT1 (1)	1	IM FAULT (insulation fault)
	0	Normal status
OUT2 (2)	1	END OF CYCLE (reclosing failure)
	0	Normal status
COM (3)	—	Output common terminal

5   Knob Introduction

5.1   Knob 1 (AR): Reclosing Mode Selection

• Definition: Used to select the automatic reclosing strategy for the device;

• Reclosing list category can be selected via RS485 Modbus;

• The reclosing mode can be set by the physical dial of the knob;

• To match different types of bypass circuit breakers, MT51SD provides two types of reclosing programs:

Reclosing List	Applicable Type	Mode Range	Description
MR0~MR9	MCB / RCBO	MR0 ~ MR9	Applicable to short-circuit protection circuit breakers
ER0~ER9	RCCB / RCBO	ER0 ~ ER9	Applicable to leakage protection circuit breakers

5.2   Knob 2 (RC): Control Mode Selection

• Definition: Set the device control logic source priority

• Supports two control modes:

Mode Code	Mode Name	Function
RC1	Mainly local	Support local continuous signal and pulse control

	control	
RC2	Central control takes priority	Mainly controlled by RS485, retaining local forced control capability

5.3 Reset Button Description (Black Button on the Front Panel)

Items	Operation	Function Description
Reset reclosing logic	Press ≥ 3 seconds	Clear the current reclosing status and reset the timing logic
Restore factory settings	Press ≥ 10 seconds	All parameters are restored to factory default settings

5.4 Function Description of Dial Knob (Front Slide Button)

Toggle position	Mode	Function
Auto	Auto mode	Enables all functions, including:
		✔ Automatic reclosing
		✔ Remote control
		✔ Insulation monitoring
Manu	Manual mode	Disable remote control and reclosing, only keep insulation monitoring function
Lock	Lock mode	The slide button is pushed to the bottom and can be locked with a Φ4mm mechanical padlock.
		At this point, the device enters a completely locked status and cannot be controlled by electrical or local operation

6 Reclosing Function Description

6.1 Function Overview

The automatic reclosing function of MT51SD is used for automatic closing operation after non-command tripping of the circuit breaker (such as fault tripping) to ensure power

supply continuity.

The auto reclosing function will only be triggered if the following conditions are met:

• Currently in Auto mode

• No electrical locking status (🔒 not triggered)

• Insulation test passed

• Non-manual opening or remote command opening

6.2 Typical Flow Chart

1. Trip occurs

2. Delay RT seconds

3. Check whether the insulation status is qualified

4. If qualified → Wait for CT seconds → Close the circuit breaker

5. Closing failure or tripping again → Record a failure and continue to step 2 (maximum NR times)

6. After reaching the set number of failures → enter the "End of cycle" status (automatically exit the reclosing)

6.2.1 Applicable to MCB or RCBO
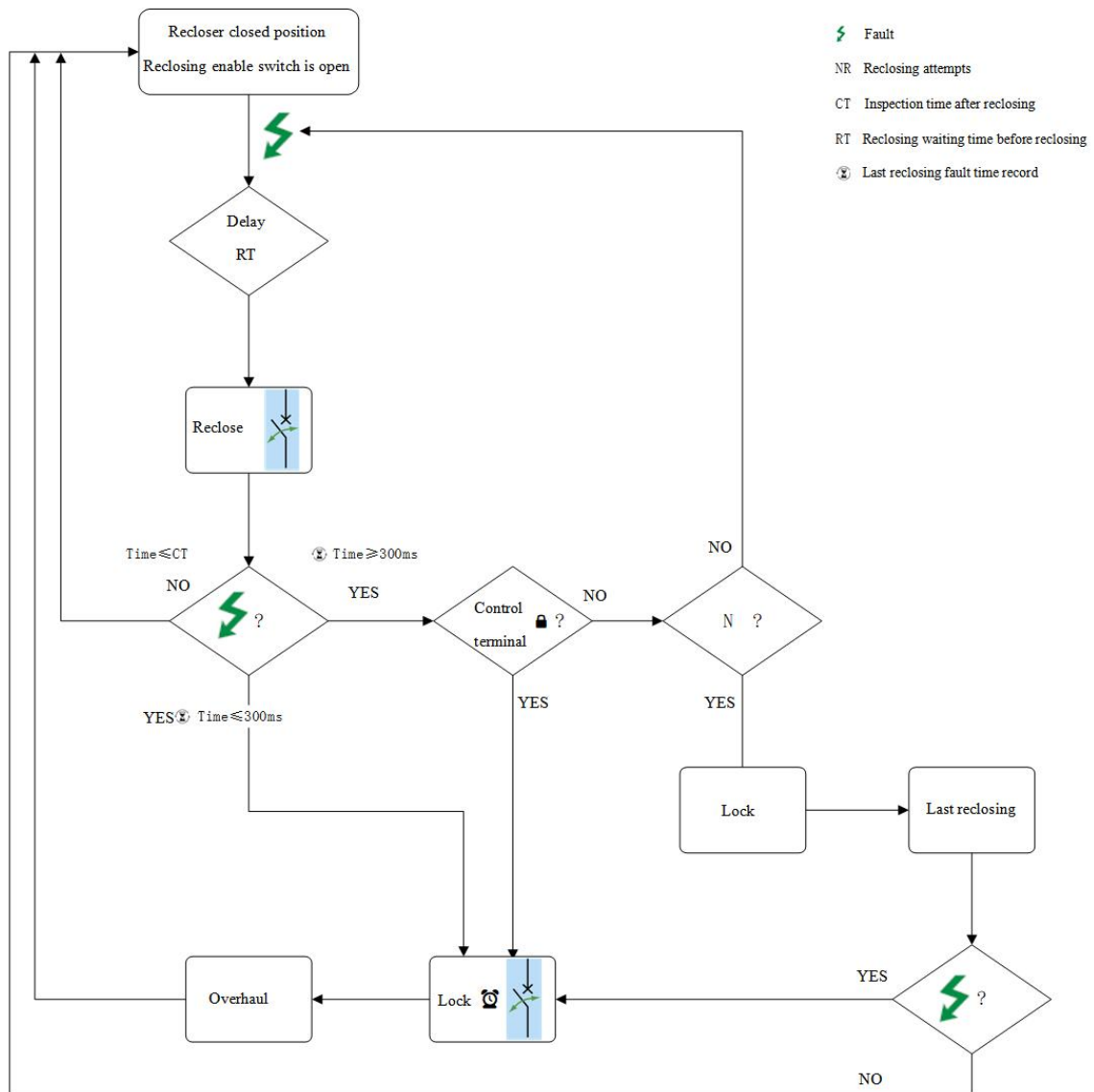
Applicable to MCB or RCBO

6.2.2 Applicable to RCCB or RCBO

Recloser closed position
Reclosing enable switch is open

Delay RT

Reclose

Time ≤ CT NO

? (Fault) YES

Control terminal 🔒 ? NO YES

N ? NO YES

Time ≤ 300ms
Time ≥ 300ms

Fault
NR Reclosing attempts
CT Inspection time after reclosing
RT Reclosing waiting time before reclosing
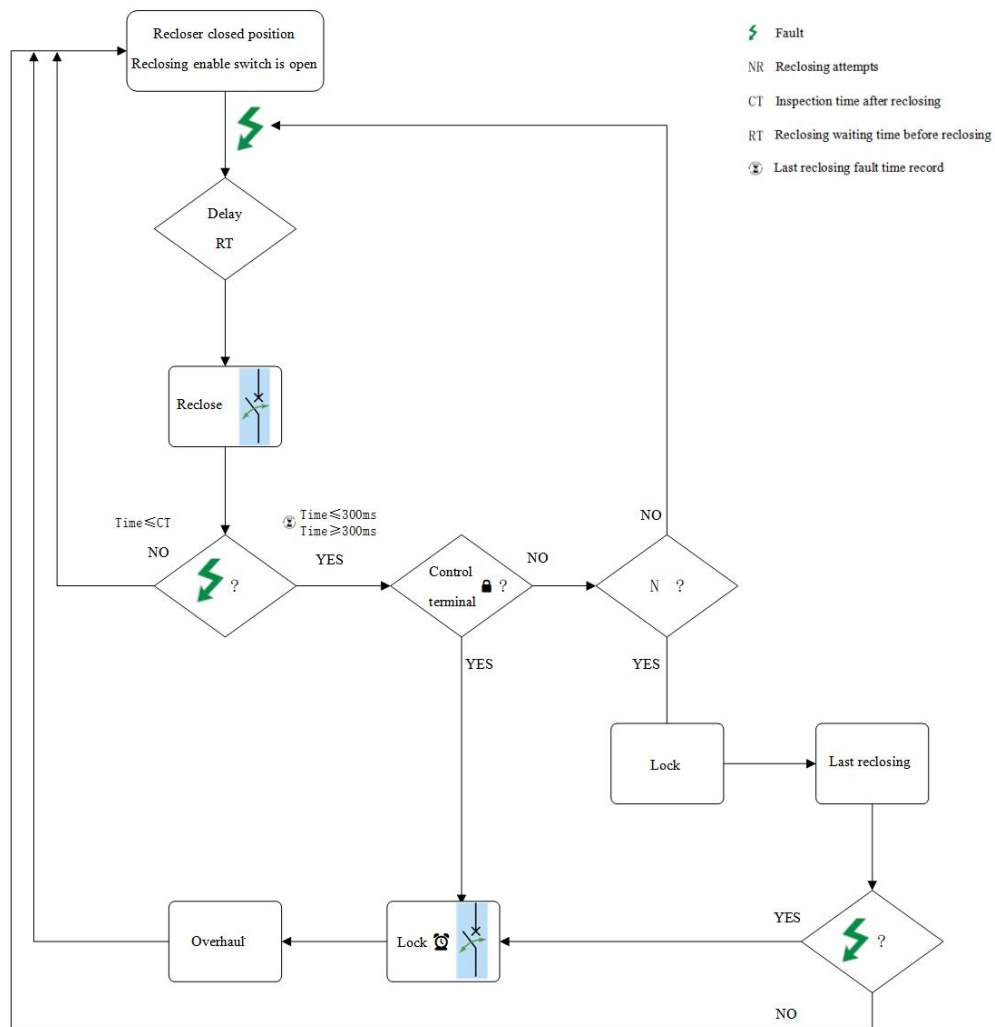Last reclosing fault time record

Lock

Last reclosing

? (Fault) YES NO

Overhaul

Lock ⏰

Applicable to RCCB or RCBO

6.3 Reclosing Mode List

6.3.1 Parameter Description

Parameter Abbreviation	Meaning	Description
RT	Reclosing waiting time	Delay before first insulation detection after tripping (seconds)
CT	Delay before closing	Delay time before closing after insulation detection is qualified (seconds)
NR	Maximum reclosing times	The maximum number of reclosing attempts allowed after each trip

6.3.2   Table 1: MRx Series Reclosing Procedure (Applicable to MCB / RCBO)

Mode No.	Number of reclosing attempts (NR)	Delay Before Each Reclosing (RT)	Detection Time Interval (CT)	The Last Closing Trigger Condition
MR0	None	None	None	No auto- reclosing function
MR1	1	30s	15min	Allowed after the recloser is locked
MR2	1	1min	30min	Same as above
MR3	2	1min,90s	15min	Same as above
MR4	2	90s,3min	30min	Same as above
MR5	2	2,4min	30min	Same as above
MR6	3	90s,3and6min	15min	Same as above
MR7	3	2,4and6min	30min	Same as above
MR8	3	2,4and8min	30min	Same as above
MR9	User defined	Programmable settings	Programmable settings	Programmable settings

Knob 1 sets the reclosing mode; Modbus configures the reclosing list selection.

6.3.3   Table 2: ERx Series Reclosing Procedure (Applicable to RCCB / RCBO)

Mode No.	Number of reclosing attempts (NR)	Delay Before Each Reclosing (RT)	Detection Time Interval (CT)	The Last Closing Trigger Condition
ER0	None	None	None	Auto reclosing disabled
ER1	3	2, 4 and 8min.	15 min.	Allowed after the recloser is locked
ER2	6	2, 4 and 8 min. The remaining is set to 8 minutes.	15min	Same as above

ER3	6	10, 20, 30, 60, 130 and 600s.	15min	Same as above
ER4	7	30s, 1, 2, 3, 4, 8 and 16min.	15min	Same as above
ER5	7	2, 4, 8, 16 and 32min. The remaining is set to 32 minutes.	15min	Same as above
ER6	8	30s, 1, 2, 3, 4, 5, 6, and 7min.	15min	Same as above
ER7	8	2, 4 and 6min. The remaining is set to 6 minutes.	15min	Same as above
ER8	10	90s. The remaining is set to 90s.	15min	Same as above
ER9	User defined	Programmable settings	Programmable settings	Programmable settings

Knob 1 sets the reclosing mode; Modbus configures the reclosing list selection.

7 Control Logic Priority Description

7.1 Function Description

MT51SD supports local control, central remote control (RS485) and automatic reclosing control at the same time. To avoid control conflicts, the system follows a clear priority determination mechanism.

7.2 Control Signal Source Classification

Control Source	Description
Local control	Continuous or pulse signal from C1/C2 terminal (depending on RC1 or RC2 mode)
Central control	From RS485 Modbus commands

Automatic control	From internal reclosing logic (based on MR/ER mode)

7.3　Behavior Differences in RC Mode

7.3.1　Working Mode

|	
	The remote control mode is set to RC1. Mode A: Authorized control after tripping.
	The remote control mode is set to RC1. Mode B: Control is prohibited after tripping.
	The remote control mode is set to RC2. Mode A: Authorized control after tripping.
	The remote control mode is set to RC2. Mode B: Control is prohibited after tripping.

7.3.2　Control Mode

Control Mode	Control Logic Features
RC1 mode	Local control is the main method:
	✔ C1 controls the continuous signal
	✔ C2 controls pulse flipping
	✔ RS485 controllable
RC2 mode	Central control + local enforcement:
	✔ RS485 command is the main control signal
	✔ When local signal exists, priority response (for example: manual override remote)

7.4 Timing Diagram

7.4.1 RC1 Mode
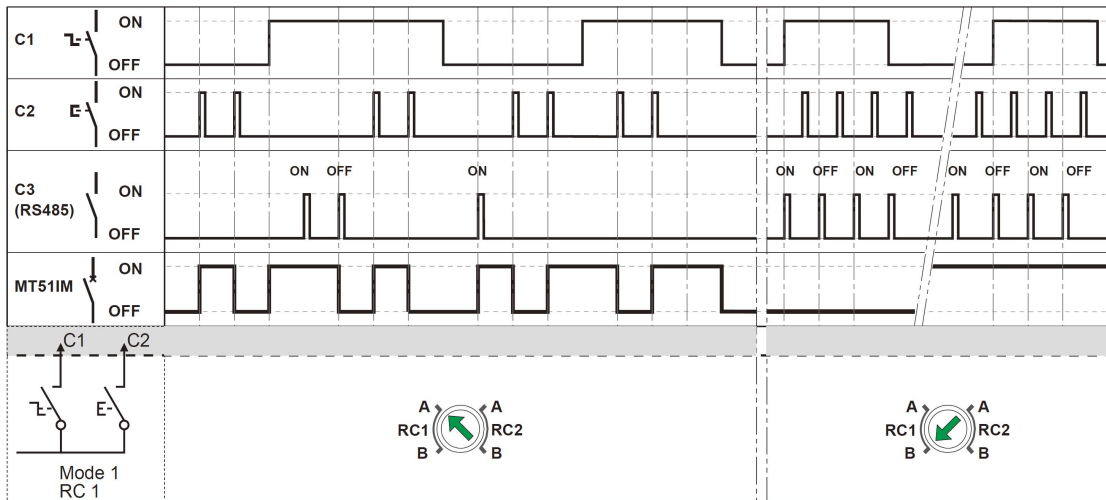
7.4.2 RC2 Mode
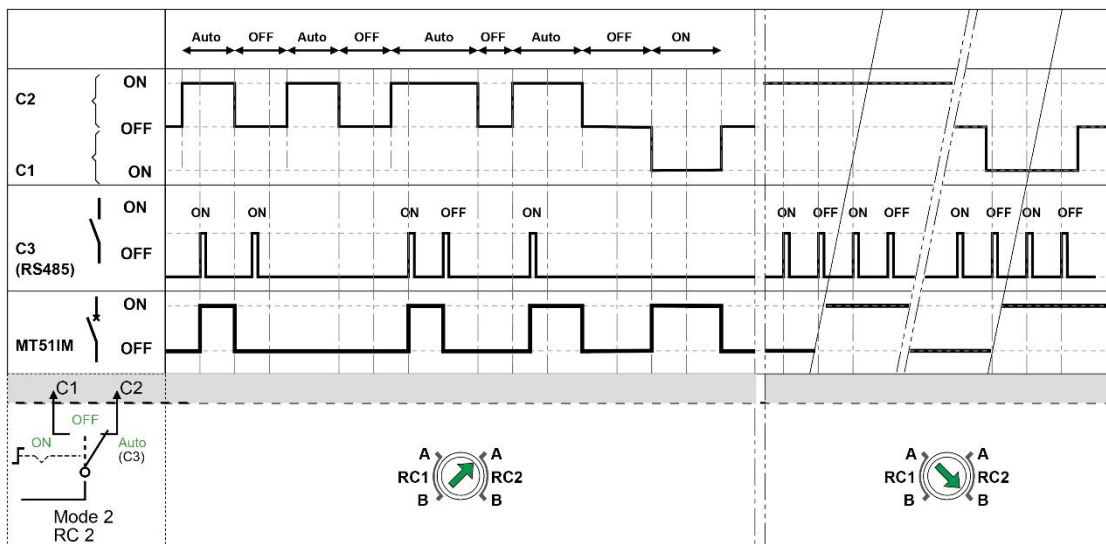
7.5 Control Signal Priority Strategy: Latecomers Coverage Mechanism

When the system receives multiple control signals (such as local control and remote commands) almost simultaneously, MT51SD follows the "last come first" strategy:

- The system will immediately execute the control command received first;

- If a second control signal is received within a short period of time, the later signal will override the previous control action and take priority;

- This mechanism prevents the device from entering an incorrect status due to command conflicts.

◇   Special Operating Status Processing Instructions

Status	System Response Description
Automatic reclosing in progress	If RS485 opening command or C1/C2 local disconnect signal is received → the system immediately terminates the current reclosing logic
The dial is in Lock mode	All electrical controls (local/remote/automatic) are disabled and can only be restored by mechanical unlocking.

⚠   It is recommended that the Lock mode be used during inspection and system maintenance, in conjunction with a Φ4mm industrial lock to achieve electrical + mechanical double locking.

8   Insulation Detection Function

8.1   Function Overview

Each time MT51SD executes automatic reclosing or receives a closing command (local/remote), it will detect the insulation status of the circuit to ensure good insulation conditions and prevent misclosing or safety accidents caused by hidden dangers such as line leakage and short circuit.

8.2   Detection Trigger Timing

Trigger Event	Whether to Perform Insulation Detection
Before automatic reclosing is executed	✔ Yes
Before RS485 remote closing command	✘ No
Before C1 C2 terminal control command closing	✘ No
Manual lever closing	✘ No
Power on the device	✘ No
No closing request in OFF status	✘ No

♀   If the last detection fails and is not reset, the system will prevent any closing action

until the user resets or the insulation is restored.

The insulation detection function can be turned on or off via Modbus commands;

8.3 Detection Execution Process

1.A closing request is received;

2.Start the insulation detection module and measure the load-to-ground resistance;

3.Determine the results and implement the corresponding strategy:

Detection Results	System Processing	Output Feedback
Qualified	Execute closing logic (including delay)	No exception
Unqualified	Prevent closing and record as a failure	OUT2 outputs "IM Fault" alarm

8.4 Insulation Detection Logic Diagram
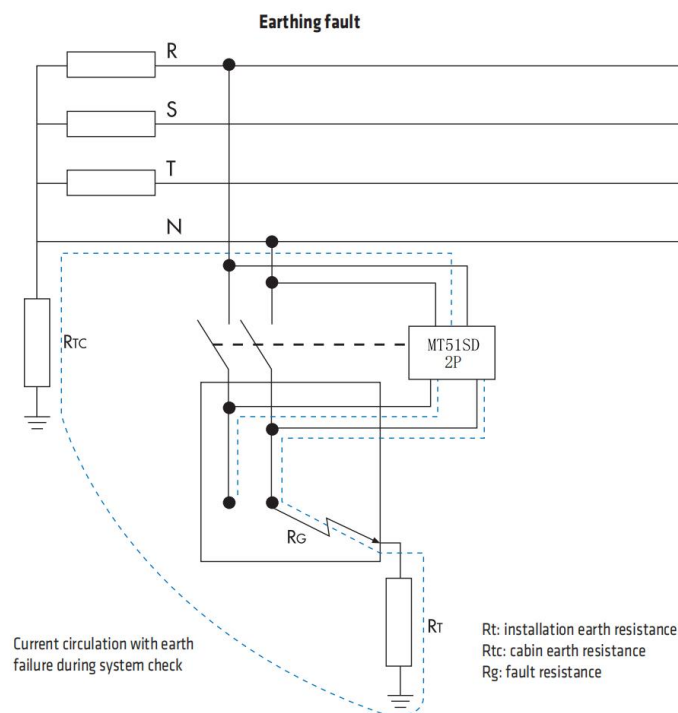
8.5 Insulation Detection Test Steps

1、Preparation

• Check whether the device is intact;

- Connect all terminals according to the terminal wiring instructions;

- Prepare the test resistor, resistance value (≤8kΩ or ≥ 16kΩ);

2、Electrical connection test

- Connect the "insulation detection L/N line" of MT51SD to the outgoing terminal below the circuit breaker;

- Lead out a wire from the "L-phase outgoing terminal" below the circuit breaker and connect it in series with the test resistor (Rg) to the "N-phase incoming terminal" above the circuit breaker. The insulation detection judgment logic is as follows:

When testing resistance (Rg ≤ 8kΩ): automatic reclosing is prohibited, the device indicator turns yellow, and the system outputs an IM Fault alarm;

When testing resistance (Rg ≥ 16kΩ): automatic reclosing is allowed, the device indicator flashes slowly in red, and the automatic reclosing delay status is entered or automatic reclosing is executed immediately;

8.6 Real-time Detection Mechanism

Condition	System Behavior Description
Rm ≤ 8kΩ for ≥5 seconds	If it is determined to be a **permanent fault**, an alarm will be given immediately and automatic reclosing will be prohibited.
Rm ≥ 16kΩ	Determined to be **good insulation**, and the reclosing logic process is allowed to resume normally.

8.7 Fault Recovery and Protection Strategies

Condition	System Response
The fault condition is resolved within 15 minutes	Automatically exit the fault status, restore the reclosing logic, and continue to execute the remaining closing process
The fault status lasts ≥15 minutes	Entering "permanent fault protection status", all remote and local control operations are prohibited
Manual troubleshooting method	Press the RESET key for ≥3 seconds to return to normal status.

8.8 Configurable Items (via RS485)

Function Items	Description
Insulation detection function switch	The insulation detection function can be turned on or off remotely
Fault status reading	Whether the remote read is in IM Fault status

9   Automatic Reclosing Failure Processing and Alarm Output

9.1   Function Overview

During the automatic reclosing process, if continuous reclosing attempts fail or abnormal conditions are triggered (such as insulation detection failure, lock signal existence, remote control interruption, etc.), the system will enter the failure protection status, terminate the current reclosing process, and provide an alarm signal through the output terminal.

9.2   Common Failure Trigger Conditions

Trigger Event	System Response Description
The maximum number of reclosings (NR) has been exhausted.	Stop reclosing and record the status as "End of Cycle"
Insulation detection failed (Rm < threshold)	Abort the reclosing process and mark it as an insulation fault
The electrical lockout signal (🔒) persists	Disable all automatic reclosings
External remote control active opening	Interrupt auto-reclose logic

9.3   End of Cycle Definition

• End of Cycle indicates that the current round of reclosing logic has been completed or failed and terminated, entering the static status;

• The system will no longer actively close the circuit breaker unless:

  • Remotely issue closing command

  • Insulation detection passed + Fault status released + Reclosing logic allowed

📌   The status code End of Cycle can be output through the OUT2 terminal for alarm indication or host computer identification.

9.4   Troubleshooting and Restart Process

Condition	System Behavior Description
The fault status is released within the set time	The system can automatically recover and continue to reclose according to the current logic

The fault lasts longer than the set time limit (e.g. 15 minutes)	Enters permanent fault protection status and requires manual reset
Manual reset (RESET button ≥ 3 seconds)	Clear the fault status and restart the detection and reclosing logic process