Reclosing Relay

COOPER Power Systems

Electrical Apparatus

150-28

M-ARM513 Multiple Shot Reclosing Relay

The M-ARM513 Multi-Shot Reclosing relay is a member of Cooper Power Systems' **Edison**® Series of microprocessor based protective relays and provides comprehensive single and three phase reclosing functionality for circuit breakers. The M-ARM513 unit offers the following functions:

- Reclosing sequences up to four shots.
- Single or three phase reclosing.
- Adjustable reset time delay.
- Adjustable reclosing time for each shot.
- Automatic handling of evolving faults when in single phase reclose mode.
- Manual close signal input.
- Coordination with external synch-check relay.
- Skip Next Shot feature allows the next shot to be skipped as a result of a contact input.
- Programmable protection inhibit contact output.

The M-ARM513 also shares the following features common to all Edison Series relays:

- Simple five button human machine interface (HMI) allows access to all functions, settings, and stored data without the need for a computer.
- Bright electroluminescent display easily visible even in brightly lit environments.
- Draw-out design permits relay testing without disturbing connections to case.
- Modbus communication protocol and RS485 terminal on rear.
- Modular design allows the draw-out module to be fitted to a variety of space saving cabinet styles.
- Dedicated power supply/relay fail output contacts.
- Basic event records.

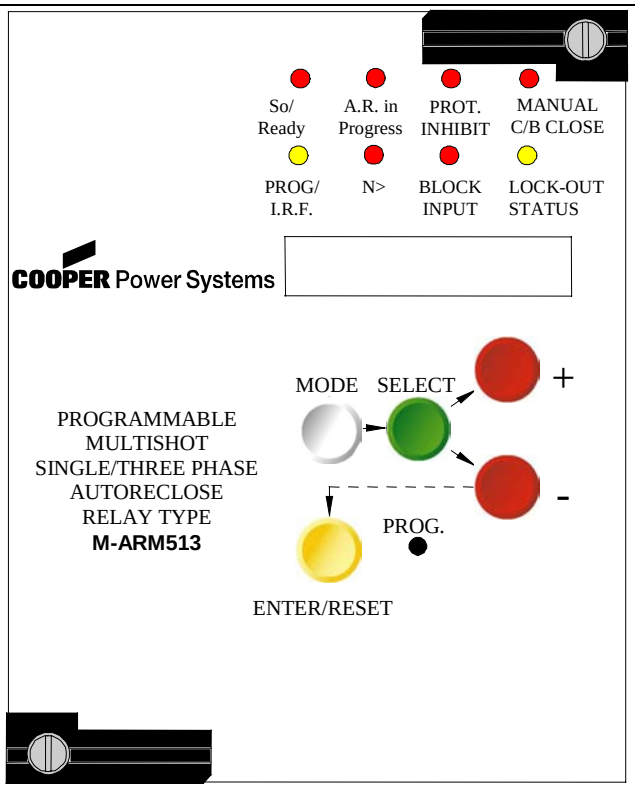

Figure 1: Front View of the M-ARM513 Reclosing Relay

- Cumulative trip counters.
- Auto-ranging power supplies.

APPLICATIONS

The M-ARM513 is ideally suited for any application requiring automatic single or three phase reclosing of a circuit breaker which has been tripped by external protective relays with up to 4-shots to lockout.

PROGRAMMABLE RECLOSE ELEMENT (79)

The following briefly describes the operating sequence of the M-ARM513 reclosing relay:

Assuming a steady state condition, the relay will initially be in a ready state.

An external protective relay is used to trip the circuit breaker. The trip signal is also brought in to the M-ARM513.

The M-ARM513 determines the fault type (for single-phase, three-phase or evolving faults) dduring the time window tA.

After the set time delay for the shot, the M-ARM513 issues a close command to the circuit breaker.

This process continues until no further protective trips are issued (after which the M-ARM513 will reset), or goes to lock-out by either reaching the maximum number of shots set, or by external Lockout command.

SINGLE OR THREE PHASE RECLOSING MODES

The M-ARM513 reclosing relay accepts both three single-phase TRIP indications and one three-phase TRIP indications from external protective relays. The relay may be set in single phase reclose

mode, three phase reclose mode, or single and three phase mode.

In single phase mode it is assumed that the protective relays are connected to trip the affected phase breaker directly. The M-ARM513 then provides the additional logic to issue a 3-phase trip command for the following two conditions:

- Any phase-phase or three phase fault is indicated.
- During a reclose sequence of a single line to ground fault, the fault evolves in to one involving additional phases.

In three-phase mode, all protective trip signals will result in a three phase trip. It is assumed that the protective relaying issues only one trip command, regardless of the fault type.

In single phase plus three phase tripping mode, the relay may be used with external protective relays that may issue single phase or three phase trip signals. The M-ARM513 will issue its own three phase trip signal in the event of a single-phase fault which develops to involve other phases.

LOCKOUT

The M-ARM513 will enter a lockout state for the following conditions:

- Circuit breaker trip after last shot of a reclose sequence.
- Fault type is not programmed for reclosing.
- Evolution of the initial fault.
- External blocking signal.
- Maximum cumulative number of allowed reclose operations exceeded.
- When the relay is in PROGRMAMMING mode.

ADJUSTABLE TIME DELAYS

The M-ARM513 includes adjustable time delays for the recloser reset time, the reclose time interval for each shot, the close pulse duration to the circuit breaker and for the fault determination time. The fault initiation time is useful for single phase relaying where the trip signals from the different phases may not arrive simultaneously. The fault discrimination for evolving faults is used to determine whether a reclose operation is permitted in the event of an evolving fault.

SYNCH-CHECK COORDINATION

A contact input from an external synch-check relay such as the Cooper Power Systems' SCM21 relay, may be connected to the M-ARM513 to ensure the reclose event does not take place if the two systems are not in synchronism.

NEXT SHOT SKIP

A contact input is provided that forces the M-ARM513 to advance to the next reclose shot count from that which it is currently at during a reclosing sequence.

MANUAL CLOSE

An contact input is provided that forces the M-ARM513 to issue a CLOSE command to the circuit breaker.

PROTECTION BLOCKING

An output contact may be programmed to close after an adjustable number of shots. This contact closure may be used to block the operation of various relays, load tap changer controls, etc.

BREAKER FAILURE

If the circuit breaker has not closed after the length of the close output contact pulse (programmable), the relay will automatically go to lockout.

TARGETS

Eight bright LED targets provide targeting to indicate the status of the reclose sequence as well as relay health.

EVENT RECORDS

For the most recent five protective element trips the M-ARM513 records the time of trip, shot number, reclose mode of the shot, total number of reclosures and the state of protection inhibit output contact.

MEASUREMENTS

The M-ARM513 displays the following quantities:

- Ready/Reclose in process status
- Counter of successful reclose shots
- Counter of failed reclose shots
- Counter of total number of circuit breaker operations
- Time and date

DIAGNOSTICS

Complete memory and circuit diagnostics are run upon powering the relay. The revision level of the firmware is displayed at this time.

The relay provides two manual test routines which may be run at any time. The first routine performs the same 15 minute test an in addition checks the target LEDs and the control circuitry to the output relays without operating the output relays.. The second test is identical but also operates the output relays.

During normal operation the relay suspends operation every 15 minutes for 7 msec and runs a comprehensive set of diagnostics that includes memory checksum, test of the A/D converters by injection of an internally generated reference voltage, and a check of the ALU.

Table 1: Functional Specifications

NUMBER OF SHOTS TO LOCKOUT	1, 2, 3 or 4
OPEN INTERVAL TIME (INDIVIDUALLY SETTABLE FOR EACH SHOT)	0.05 – 600 seconds
RECLOSE MODE (INDIVIDUALLY SETTABLE FOR EACH SHOT)	Single phase
	Three phase
	Single and three phase
RECLOSE LOGIC RESET TIME PERIOD	1 – 6000 seconds
SYNCH-CHECK ADVANCE TIME	0.01 – 99.99 seconds
DURATION OF CLOSE BREAKER CONTACT CLOSURE	0.01 – 9.99 seconds
FAULT DISCRIMINATION TIME TO DETECT EVOLVING FAULTS (tD)	0 – 9.00 seconds
FAULT INITIATION TIME WINDOW (tA)	1 – 500 msec

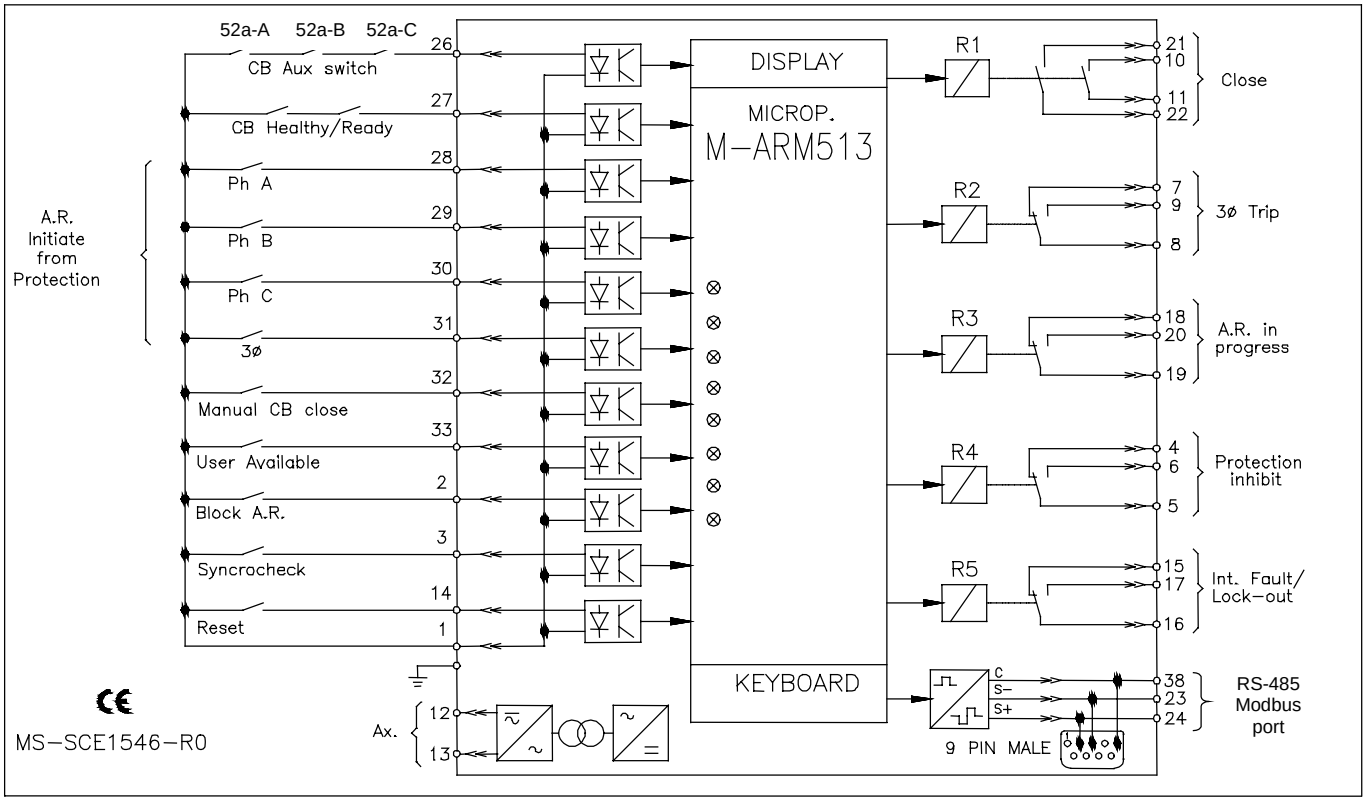

Figure 2: Wiring Diagram for the M-ARM513 Relay

ORDERING INFORMATION

Construct the catalog number from the following table:

Base Relay Model	Power Supply[1]		Rated CT Input		Case Style[2]	
	Code	Description	Code	Description	Code	Description
PRMARM513J	L	24-110V AC/DC	0	None	D	Draw-out relay only, no cabinet supplied
	H	90-220V AC/DC			S	Single case
					N	19” rack mount
					C2 C3 C4	Denotes mounting position in either a double case or 19” rack along with other relays ordered at the same time.

Example: PRMARM513JL0S is an M-ARM513 with low range power supply in a single relay case.

If ordering two or more relays to be fit in a common case, the first relay ordered should indicate the case style desired. This relay will be located in the leftmost bay of the case. Subsequent relays should use the C2, C3, or C4 suffixes to denote their position in the case using the leftmost bay as a “C1” reference.

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[1] The power supplies are user replaceable and interchangeable. See catalog section 150-99.

[2] The relay itself may be drawn out of any of the listed cases and plugged into any of the other case styles. The catalog number specified during ordering denotes the type of cabinet in which the relay will be shipped.