

Solid-state automatic reclosing system for transmission line applications.

MRS

Transmission Line Reclosing System



Application

- Automatic transmission line breaker reclosing

Protection and Control

- Synchronism check function
- High-speed or time delay reclosing
- Single or two-shot reclosing
- Single-pole or three-pole reclosing

Features

- High reliability solid-state components
- Regulated DC-DC inverter P.S. module
- User selectable programs
- 19" rack mounting

DESCRIPTION

Using high-reliability solid-state components the MRS system provides an automatic reclosing system universally applicable for single/three-pole reclosing, single/two-shot and high speed time delay reclosing for transmission line applications in one package, suitable for rack or panel mounting.

The complete relaying system is contained in a modular package. The components are contained in drawout (plug-in) modules, including a highly reliable regulated DC-DC power supply module. The package contains test plugs to allow access to voltage input and contact output circuits for testing purposes. Additional test points are provided on the system component modules, which may be accessed by the use of a card extender.

High reliability, conservatively derated components are used to assure long life and stability.

APPLICATION

The MRS reclosing system can be applied for automatic reclosing of a transmission line breaker.

The versatile MRS reclosing system provides the user with application options to select programs with combinations of:

- single-pole and/or three-pole reclosing
- single-shot or two-shot reclosing
- high speed or time delay reclosing

The selection of a reclosing program depends on the power system arrangements for single-phase faults and/or multi-phase faults, acceptable

reclosing attempts and acceptable time for reclosing cycle.

The user can control functions with inputs for:

- blocking the recloser
- provide manual closing information of the breaker
- resetting the recloser

The reclosing system provides a pull back zone one extension output that may be used where a protective relay system has this requirement. The output operates after the first reclosing attempt or if the reclosing functions are turned off.

Synchronism check option is available.

The synchronism check function is normally applied at only one end of a transmission line, with the other end being closed first to energize the line. The synchronism check dead line voltage function permits the dead line end breaker to be closed, while the live line end breaker closing would require the synchronism check function.



MULTILIN

APPLICATION

The synchronism check function is intended primarily for application where the two parts of a system to be joined by the closure of a circuit breaker are interconnected at least at one other point in the system. Even though the voltages on either side of the open breaker are in synchronism, there may be an angular difference between them as a result of load flow throughout the interconnected system. It is usually desirable to close the breaker even though an angular difference exists, provided that this difference is not great enough to be detrimental to the system or to connected equipment. Each application should be checked to determine the maximum angular difference for which closing can be tolerated.

Closing the breaker is permitted when the input angle between the voltages across the open breaker remains in a fixed time period and when these are within the acceptable angle and time setting in the synchronism check function.

Usually, in conventional synchronism check relaying, a relatively long time measurement is used to ensure that the voltages are in synchronism. However, this long delay, which may be 10 or 20 sec, is undesirable if both ends of the line are being reclosed at high speed. If the time of measurement is shortened, a faster synchronism check measurement can be made, but this may result in reclosing for a non-synchronous condition with slip frequencies that are higher than desired for satisfactory reclosing.

Slip cut-off frequency functions can provide a high speed synchronism check determination when voltages are in synchronism without the risk of reclosing if high slip frequencies are actually present.

The synchronism check function will not provide an output to permit closing if there is no voltage on one side or both sides of the breaker. Therefore for applications where dead line and/or dead bus operation is required, the undervoltage detection functions can be used. Selection can be for one or more of the following supervision conditions of (1) live line and dead bus, (2) dead line and live bus, and (3) dead line and dead bus with adjustable voltage level settings for live and dead conditions.

RECLOSING FEATURES

The reclosing system can be used with protective relay schemes that trip only one breaker pole for single line-to-ground faults, and all three poles for all multi-phase faults. The reclosing system provides one or two reclosing operations with selection of different high speed reclose times for single-phase and multi-phase faults. The second reclose operation is always time-delayed. When a single-phase fault in the power system requires three-pole tripping, the protective relay scheme needs to use the reclosing function three-pole trip enable output to provide three-pole tripping instead of single-pole tripping.

Reclosing sequences are started by the reclose initiate contacts in the associated line relaying system. The reclosing function responds to single-pole/three-pole segregated reclose initiate contacts, that is one contact for single-phase and one contact for three-phase.

The reclosing sequence will reset after a successful reclosure or will lockout after last unsuccessful reclosure.

The combination of the described reclosing features provides various user selectable programs.

DESIGN FEATURES

Target Indicators

Target LED's are provided to indicate reclosing cycle is in progress, reclosing blocked by synchronism check and lock-out condition.

Contact Outputs

Three heavy duty contact outputs are provided for the reclosing function.

Auxiliary contact outputs are: one for zone extension, one for recloser lock out, one for three-pole trip enable and one for recloser out of service.

Contact Inputs

User's contact inputs for the selected control and protective functions are connected to contact converters in the reclosing system.

Power Supply

The MRS includes a highly-reliable DC-DC power supply capable of supplying all relay requirements. The power supply is single rated for 48 VDC, or 110/125 VDC, or 220/250 VDC. The power supply is selfprotected and is equipped with a switch for removing battery voltage from the input. An LED to indicate normal output voltage and an output alarm to indicate voltage outside of the rated limits are also provided.

TECHNICAL SPECIFICATIONS

RATINGS Rated Frequency: 50/60 Hz Rated Voltage: $V_n = 110 \text{ V (50 Hz)}$ $V_n = 120 \text{ V (60 Hz)}$ DC Control Voltage: 48 VDC 34-60 VDC 110/125 VDC 88/150 VDC 220/250 VDC 176-300 VDC Maximum Permissible AC Voltage: Continuous: 2.0 x rated One Minute: 3.5 x rated Ambient Temperature Range: Storage: -40° to +65°C Operation: The MRS has been designed for continuous operation between -20°C and +55°C per ANSI Standard C37.90. In addition, the MRS will not malfunction nor be damaged by operation at temperatures up to +65°C. Ambient Humidity: 95% without condensing Insulation Test Voltage: 2 kV 50/60 Hz, one min Impulse Voltage Withstand: 5 kV peak, 1.2/50 μsec , 0.5 J Interference Test Withstand: ANSI/IEEE C37.90 and IEC 255-5	BURDENS Voltage Circuits: 0.2 VA 49°, 60 Hz 0.24 VA 48°, 50 Hz DC Battery: Normal Tripped All Voltage Ratings: 13.5 W 17 W DC Battery (for contact converters): 1.9 mA each CONTACT DATA Heavy Duty Outputs (Reclose Breaker): Continuous rating = 3 A Make and carry for tripping duty (per ANSI C37.90) = 30 A Break 180 VA resistive at 125/250 VDC Break 60 VA inductive at 125/250 VDC Auxiliary Outputs (including Alarms): Continuous rating = 3 A Make and carry for 30 sec = 5 A Break 25 W inductive at 125/250 VDC Make and carry continuously = 50 W Maximum of 250 V or 0.5 A RECLOSE TIMERS Single and Three-Pole Reclose Timers: 0.01 to 2.55 sec in 0.01 sec step (each independently adjustable) Delayed Second Reclose: 1 to 255 sec in 1.0 sec steps (may be disabled) Dwell Time of Reclosing Contacts: 0.2 sec or 0.8 sec Reset Time: 1 to 255 sec in 1 sec steps	SYNCHRONISM CHECK Line and Bus Voltage Live: 65 to 110 % of rated in 5 % steps Line and Bus Voltage Dead: 10 to 70 % of rated in 5 % steps Rated Voltage: 57.7, 63.5, 66.4, 69 V phase-to-neutral Synchronism Angle: 1 to 99° in 1° steps Slip Cut-off Frequency: High 0.25 to 2.5 Hz in 0.25 Hz steps Low 0.01 to 0.1 Hz in 0.01 Hz steps, 0.1 to 1.0 Hz in 0.1 Hz steps PHYSICAL Weight (approximate): Net: 9 lbs (19.8 kg) Ship: 11 lbs (24.2 kg) TYPE TESTS AND STANDARDS Insulation Withstand: 2 kV 50/60 Hz, for one min, per IEC 255-5 Impulse: 5 kV peak 1.2/50 μsec , 0.5 J per IEC 255-4 Interference Test: 2.5 kV Longitudinal, 1 kV transversal, Class III, per IEC 255-22-1 Electrostatic Discharge: Per IEC 801-2, Class III Radio Interference: Per IEC 801-3, Class III Surge Withstand: Per IEC 801-4, Class III APPROVALS CE Compliant UL - UL listed for USA and Canada
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Specifications subject to change without notice.

ORDERING

The information required to provide a complete definition of a model appears in the tables. It is recommended that the model designation is accompanied with its characteristics:

MRS 200 * A * * 0 * 0 0 B

MRS200							Transmission line reclosing system
0							Without synchronism check
1							With synchronism check
	0						Without recloser counter
	1						With recloser counter
		0					Sync check at 50 Hz
		1					Synch check at 60 Hz
			A				48 VDC
			B				110/125 VDC
			C				220/250 VDC
				B			Revision level