

# Installation Instructions

Original Instructions



## Back EMF Monitoring Relay Module

Catalog Numbers 440R-S35011, 440R-S35012, 440R-S35013, 440R-S35014, 440R-S35015, 440R-S35016

**IMPORTANT** Save these instructions for future use.

### Description

The Allen-Bradley Guardmaster® MSR55P back EMF modules are suitable to monitor the standstill of all electric motors that generate a remanence voltage while coasting to stop.

The MSR55P standstill module is connected to the motor terminals and measures the induced back EMF voltage. Two redundant measuring channels are used (L2-L1 and L3-L1). If the back EMF voltage drops to 0V simultaneously in both channels, it indicates standstill and the output relay is energized.

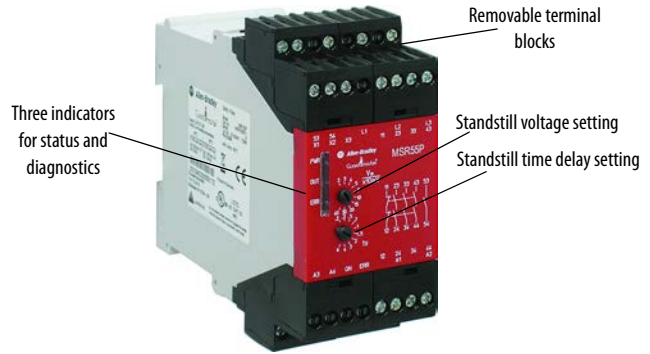
The voltage threshold that indicates a standstill on the MSR55P module is adjustable. This standstill allows the unit to work with different types of motors in various applications. The standstill time  $T_s$  (time delay between detection and energizing of the relay) is also adjustable.

The MSR55P standstill module detects a broken wire on the measuring inputs L1/L2/L3. If a broken wire is detected, the relay outputs go into safe state (as with running motor).

### Features

- Safe standstill detection on three-phase and single-phase motors
- Performance Level is PLe
- Category 4 to EN ISO13849-1: 2008
- Safety integrity level (SIL) 3 to IEC/EN 61508
- SIL Claim Limit (SIL CL) 3 to IEC/EN 62061
- No external sensors necessary
- Standstill detection independent of direction
- Broken wire detection
- Three N.O. redundant voltage-free safety contacts and one redundant N.C. monitoring contact for up to 250V AC
- Two semiconductor status outputs
- Monitors motor voltage up to 690V AC
- Adjustable voltage setting
- Adjustable standstill time delay
- LED indicators for standstill, event of line breakage and operation voltage
- Suitable for operation with inverters
- Removable screw terminals

Figure 1 - Overview of Key Features



### DIN Rail Mounting and Removal

MSR55P standstill module safety relays mount onto 35 mm (1.4 in.) DIN rails.

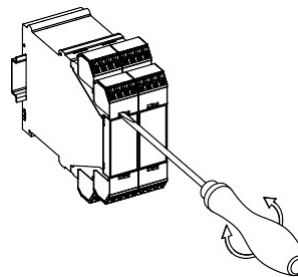
### Spacing

MSR55P standstill module safety relays can be mounted directly next to other MSR and GSR safety relays.

Maintain a space of 50.8 mm (2 in.) above, below, and in front of the relay for adequate ventilation or provide forced (fan) cooling.

### Removable Terminals

MSR55P standstill module safety relays have removable terminals to ease wiring and replacement.



1. Insert the tip of a small screwdriver into the slot near the terminal screws.
2. To unlock the terminal block, rotate the screwdriver.

## Excessive Heat Prevention

For most applications, normal convective cooling keeps the relay within the specified operating range. Verify that the specified temperature range is maintained. Usually, proper spacing of components within an enclosure is sufficient for heat dissipation.

Additional provisions are necessary to cool equipment when high ambient temperatures are encountered. Do not bring in unfiltered outside air. Place the MSR55P standstill module in an enclosure to help protect it from a corrosive atmosphere. Harmful contaminants or dirt could damage components or cause improper operation. In extreme cases, air conditioning helps protect against heat buildup within the enclosure.

## Wiring Requirements and Recommendation



**ATTENTION:** Before you install and wire any device, disconnect power to the system.

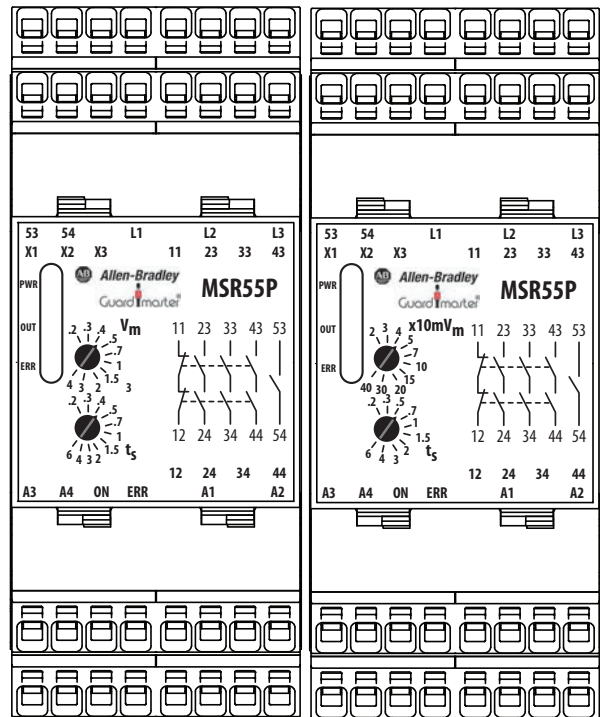
Calculate the maximum possible current in each power and common wire. Observe all electrical codes that dictate the maximum current allowable for each wire size. Current above the maximum rating causes wiring to overheat, which can cause damage.

- Allow for at least 50 mm (2 in.) between I/O wire ducts or terminal strips and the relay.
- Route incoming power to the relay by a path separate from the device wiring. Where paths must cross, their intersection must be perpendicular.
- Do not run signal or communications wiring and power wiring in the same conduit. Route wires with different signal characteristics by separate paths.
- Separate wiring by signal type. Bundle wiring with similar electrical characteristics together.
- Separate input wiring from output wiring.
- Label wiring to all devices in the system. Use tape, shrink-tubing, or other more dependable means to label wire. Use colored insulation as well to identify wiring by signal characteristics. For example, use blue for DC wiring and red for AC wiring.

## Enclosure Requirements

Install the MSR55P standstill module in an enclosure that meets the environmental requirements of Pollution Degree 2, where only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

## Relay Face and Terminal Identification



**Table 1 - Terminal Assignments and Functions**

Terminal	Function
A1(+)...A2(-)	Power supply
L1/L2/L3	Motor connections
11/12	Voltage-free redundant monitoring (non-safety) contacts (N.C.)
23/24, 33/34, 43/44	Voltage-free redundant safety contacts (N.O.)
53/54	Voltage-free monitoring (auxiliary) contact (N.O.)
X1/X2	Connection for feedback circuit
X3/X2	Reset for fault conditions.
A3(+)...A4(-)	Power supply for semiconductor outputs
ON	Non-safety semiconductor output indicates that safety outputs are ON.
ERR	Non-safety semiconductor output indicates fault condition.



**ATTENTION:** The outputs 53...54, ON and ERR are only monitoring outputs and must not be used in safety circuits.

## Connect Power Supply

Power for the MSR55P standstill module safety relay depends on the model. The primary power supply is connected to terminals A1 and A2. An auxiliary (12...30V DC only) supply voltage can be connected to terminals A3/A4 to provide semiconductor diagnostics.

Depending on the model, the primary supply can be 24V DC, 115V AC, or 230V AC. When an AC supply is used, both 50 Hz and 60 Hz are acceptable.

When powering with 24V DC in the European Union, the DC supply must have a Protective Extra-Low Voltage (PELV) rating. When powering with 24V DC in the United States, the DC supply must have both a PELV rating as well as an NEC Class 2 rating. Many of our Bulletin 1606 power supplies are PELV and Class 2 compliant.

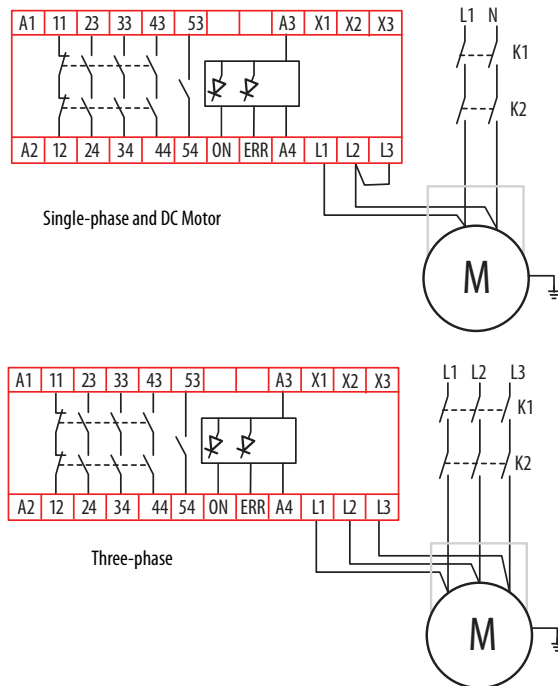
Power to A1/A2 is required to operate the MSR55P standstill module safety relay. Power to A3/A4 is only necessary if the solid-state auxiliary status signals (ON and ERR) are used.

## Motor Winding Inputs

The motor windings are connected to terminals L1, L2, and L3. The connections must be made directly at the motor with no electrical devices (like transformers and contactors) between the motor and the MSR55P safety relay. [Figure 3](#) shows wiring for a single-phase, DC, and a three-phase motor.

**IMPORTANT** The three connections create two safety monitor channels. L1 is common to the two channels, which are L2 and L3.

**Figure 2 - Motor Connections**



## Surge Suppressors

Because of the potentially high current surges that occur when switching inductive load devices, such as motor starters and solenoids, the use of surge suppression is required. Adding a suppression device prolongs the life of the relay outputs and reduces the effects of voltage transients and electrical noise from radiating into adjacent systems.

Since this is a safety-related system, the surge suppression device must be connected across the load device. The surge suppression device must not be connected across the MSR55P safety relay contacts.

For outputs that use 24V DC, we recommend 1N4001 (50V reverse voltage) to 1N4007 (1000V reverse voltage) diodes for surge suppression. The diode must be connected as close as possible to the load coil.

For outputs that use 120V AC or 240V AC, we recommend metal oxide varistors.

## Configuration

The configuration of MSR55P safety relays is accomplished by adjusting the two switches on the front face. Each switch control knob rotates two potentiometers. The recommended practice is to set the switches to the minimum setting initially, and then adjust them as necessary to reduce nuisance tripping while maintaining a safe application.

## V<sub>m</sub> - Monitoring Voltage

The trip voltage of the back EMF is adjusted by the 10-position V<sub>m</sub> potentiometer. When the back EMF drops below the voltage level, the MSR55P standstill module safety relay begins the delay timer. After the timer expires, the outputs are de-energized. [Table 2](#) shows the settings of each of the catalog numbers.

**Table 2 - V<sub>m</sub> - Monitoring Voltage Settings**

Position	440R-S35014, 440R-S35015, 440R-S35016 [Volts]	440R-S35011, 440R-S35012, 440R-S35013 [x10mV]
1	0.2	2
2	0.3	3
3	0.4	4
4	0.5	5
5	0.7	7
6	1.0	10
7	1.5	15
8	2	20
9	3	30
10	4	40

## t<sub>s</sub> - Time Delay

When the back EMF of the motor drops below the V<sub>m</sub> voltage setting, the standstill delay timer starts. The delay time is set by the 10-position t<sub>s</sub> potentiometer. During the timing cycle, the OUT indicator flashes. [Table 3 on page 4](#) shows the delay time for each setting. After the delay expires, the outputs are energized.

**Table 3 - T<sub>s</sub> Delay Time Settings**

Position	Delay Time [seconds]
1	0.2
2	0.3
3	0.5
4	0.7
5	1.0
6	1.5
7	2.0
8	3.0
9	4.0
10	6.0

## Status Indicators and Diagnostics

Three indicators on the front provide the operating status of the MSR55P standstill module safety relay. [Table 4](#) describes the state of each indicator.

**Table 4 - Status Indicators**

Indicator	State	Description
PWR	Off	No power to A1
	Green	Normal operation
	Red	Internal Fault
OUT	Green	Safety outputs are energized
	Flashing green	In timing cycle
	Flashing orange	Intermittent crossing of the V <sub>m</sub> trip point
	Orange	Safety outputs are de-energized
	Off	Code 1 or code 5 error is present
ERR	Off	No faults exist; normal operation
	Flashing red	Fault is present (see <a href="#">Figure 3</a> )

MSR55P standstill module safety relays include a number of facilities to detect faults that could influence the safety function of the module. Checks are conducted on power-up of the unit and in cycles during normal operation. If a fault occurs, the output relays switch off. The fault state is indicated with the ERR indicator, the PWR indicator, and the semiconductor output ERR.

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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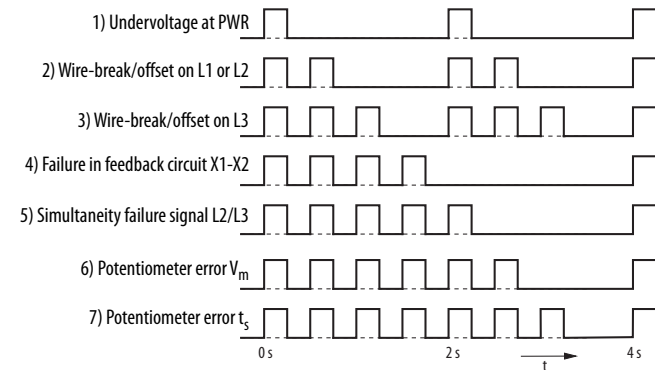
Supersedes Publication 440R-IN081A-EN-P - June 2019

With safety relevant failures, your MSR55P standstill module safety relay differentiates between external failures (broken wire/offset, simultaneity failure, or feedback circuit failure) and internal failures.

Broken wire/offset failures and feedback circuit failures can be restored by using manual reset. They can also be reset automatically after removing the fault by placing a jumper from terminal X2 to X3.

The number of times the ERR status indicator blinks communicates diagnostics. When multiple faults exist simultaneously, the ERR indicator shows the highest priority. After the highest priority fault is corrected, the ERR shows the next highest priority fault.

**Figure 3 - ERR Flashing Codes**



Flashing codes of the ERR indicator in sequence of priority

## Rockwell Automation Support

For technical support, visit <http://www.rockwellautomation.com/support/overview.page>.

## Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

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