

Models SC-IM9.. Interface Modules

Interface Modules for Use with the SC22-3 Safety Controller



Model SC-IM9C shown

Features

- Provides isolated safety output contacts for the SC22-3 Safety Controller, which has solid-state outputs and external device monitoring (EDM) capability.
- Designed specifically for use with one, two or three Safety Controller safety outputs (see Models table).
- Features three normally open redundant-output channels and one normally closed monitoring output channel for each safety output.
- Has contacts rated at 10 amps.
- Operates on 24V dc, supplied by the Safety Controller.
- Mounts to standard DIN rail.

Models

Model	Total Outputs	For SC22-3 Safety Output:			Contact Rating (All Contacts)	Supply Power
		SO1	SO2	SO3		
SC-IM9A	3 N.O., 1 N.C.	3 N.O., 1 N.C.	—	—	10 amps	24V dc
SC-IM9B	6 N.O., 2 N.C.	3 N.O., 1 N.C.	3 N.O., 1 N.C.	—		
SC-IM9C	9 N.O., 3 N.C.	3 N.O., 1 N.C.	3 N.O., 1 N.C.	3 N.O., 1 N.C.		

Overview

Interface Modules SC-IM9.. operate on 24V dc inputs and provide isolated redundant output channels for interfacing the Safety Controller's solid-state 24V dc outputs to ac safety circuits.

The normally open safety contacts of the Interface Module will follow the action of the safety outputs from the Safety Controller within 3 milliseconds when going from closed to open (for other response times, see Specifications). All Interface Module contacts are rated for up to 690V ac/dc at up to 10 amps.

The SC-IM9.. Interface Modules offer a series connection of normally closed contacts (labeled 21-22 on each contactor) for monitoring by the external device monitoring (EDM) function of the Safety Controller. These forced-guided (mechanically-linked) contacts allow the Safety Controller to detect failures of the SC-IM9.. Interface Module, and at a minimum, must be monitored in applications requiring Control Reliability per OSHA/ANSI or Category 3 or 4 per ISO13849-1.



WARNING . . . This Interface Module is not a point-of-operation guarding device, as defined by OSHA regulations. It is necessary to install point-of-operation guarding devices, such as safety light screens and/or hard guards, to protect personnel from hazardous machinery. Failure to install point-of-operation guards on hazardous machinery could lead to serious injury or death.



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⚠ Important ... read this before proceeding!

The user is responsible for satisfying all local, state, and national laws, rules, codes, and regulations relating to the use of this product and its application. Banner Engineering Corp. has made very effort to provide complete application, installation, operation, and maintenance instructions. Please direct any questions regarding the use or installation of this product to the factory applications department at the telephone numbers or address shown on the back cover.

The user is responsible for making sure that all machine operators, maintenance personnel, electricians, and supervisors are thoroughly familiar with and understand all instructions regarding the installation, maintenance, and use of this product, and with the machinery it controls. The user and any personnel involved with the installation and use of this product must be thoroughly familiar with all applicable standards, some of which are listed below. Banner Engineering Corp. makes no claim regarding a specific recommendation of any organization, the accuracy or effectiveness of any information provided, or the suitability of the provided information for a specific application.

Applicable U.S. Standards

ANSI B11 Standards for Machine Tools

Contact: Safety Director, AMT – The Associations for Manufacturing Technology,
7901 Westpark Drive, McLean, VA 22102, Tel: 703-893-2900

NFPA79 Electrical Standard for Industrial Machinery

Contact: National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101,
Quincy, MA 02269-9101, Tel: 800-344-3555

ANSI/RIA R15.06 Safety Requirements for Industrial Robots and Robot Systems

Contact: Robotic Industries Association, 900 Victors Way, P.O. Box 3724, Ann
Arbor, MI 48106, Tel: 734-994-6088

Applicable International Standards

ISO 12100-1 (EN292-1) Safety of Machinery – Basic Concepts, General Principles for Design, Part 1: Basic Terminology, Methodology

ISO 12100-2 (EN 292-2) Safety of Machinery – Basic Concepts, General Principles for Design, Part 2: Technical Principles and Specifications

IEC 60204-1 Electrical Equipment of Machines: Part 1: General Requirements. (Also request a type “C” standard for specific machinery.)

ISO 13849-1 (EN954-1) Safety of Machinery – Related Parts of Control Systems: Part 1 General Principles for Design

Contact: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, Tel: 800-854-7179

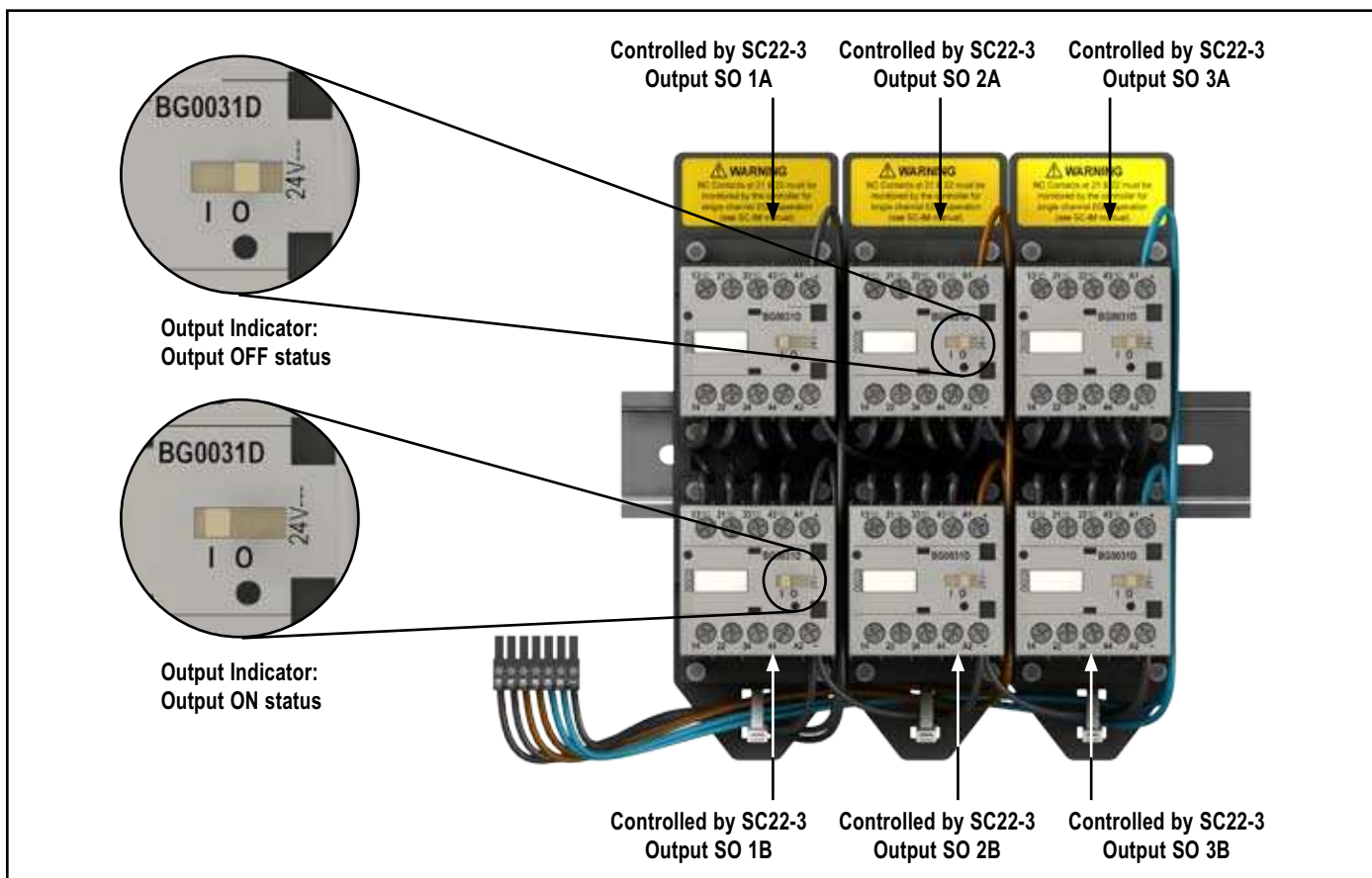


Figure 1. Features – model SC-IM9C shown

Models SC-IM9.. – Safety Controller Interface Modules

Primary Safety Device Requirements

These Interface Modules are driven by the safety output channels of the SC22-3 Safety Controller (model SC-IM9A by two safety output channels, SC-IM9B by four, and SC-IM9C by six). These Interface Modules must be used only with the SC22-3 Safety Controller and must be monitored via the Controller's EDM inputs (see Figure 2 and the Warning on page 5). Refer to the SC22-3 Safety Controller manual (p/n 133487), Section 3.6.1, for more information about the External Device Monitoring (EDM) function.

NOTE: Because the Safety Controller's output signal switching device (OSSD) solid-state outputs are pulsed, the Interface Module's relay coils may buzz; this will not affect its function.

Installation

Mechanical Installation

The SC-IM9.. Interface Modules must be installed inside an enclosure. They are not designed for exposed wiring. It is the user's responsibility to house the Interface Modules in an enclosure with NEMA 3 (IEC IP54) rating or better.

The Interface Modules are pre-wired to a terminal block that plugs into the Controller's safety outputs. Therefore, the Interface Module must be installed next to the Safety Controller (onto a 35 mm DIN rail).

Interface Module dimensions are shown in Figure 3.

For reliable operation, do not exceed the operating specifications. Verify that the enclosure provides adequate heat dissipation, so that the air closely surrounding the Module does not exceed its maximum operating temperature. Methods to reduce heat build-up include venting, forced airflow (e.g., exhaust fans), adequate enclosure exterior surface area, and spacing between modules and other sources of heat. (See Specifications.)

Electrical Installation

As the Interface Modules can interface to a multitude of machine control configurations, it is not possible to give exact wiring instructions for the output contacts. The following guidelines are general in nature.

Installation and wiring must be made by qualified personnel and must comply with the NEC (National Electrical Code), ANSI NFPA79 or IEC 60204-1, and all applicable local standards and codes.

Since the SC-IM9.. can switch high levels of energy, the user must consider and prevent the possibility of arc flash hazards. Arc flash can release dangerous amounts of heat and blast energy. When using low-voltage equipment (240V or less) being fed by small transformers (125kVA or less) the potential hazard is small, but the risk increases with higher voltage or larger transformers. The SC22-3 and the SC-IM9.. may be required to be located in such a manner that minimizes arc flash hazards. Refer to ANSI NFPA70E for more information.

Connection to the Machine To Be Controlled

The safety outputs of the Interface Module have no delay function by themselves. They will open within 3 milliseconds from the time that the Safety Controller's SO outputs turn OFF.

The hookup diagram in Figure 2 shows a generic connection to the machine primary control elements (MPCEs) from an SC-IM9C Interface Module. A machine primary control element is an electrically powered device, external to the interface module, which stops the machinery being controlled by immediately removing electrical power and (when necessary) applying a braking action. Refer to the SC22-3 Safety Controller manual (p/n 133487), Section 3.6, for more information.



WARNING . . . Shock Hazard

Always disconnect all power from the Interface Module, the Safety Controller, and the machine being controlled before making any wire connections. Electrical installation and wiring must be made by qualified personnel and must comply with the NEC (National Electrical Code) and ANSI NFPA70E, ANSI NFPA79 or IEC 60204-1, and all applicable local standards and codes.

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As the SC-IM9.. Module contacts are rated at 10 amps, they can be used as MPCEs to directly start and stop dangerous motion, or they may be used to power larger MPCE devices. **It is important to note that any MPCE element must be part of the EDM loop.**

To satisfy the requirements of Safety Category 3 or 4 of ISO 13849-1 (EN 954-1) and control reliability (OSHA/ANSI), all MPCEs must each offer at least one normally closed forced-guided monitor contact. One normally closed monitor contact from each MPCE is connected to the Safety Controller's monitoring contact feedback input, as shown in the hookups. (Each of the Safety Controller's 22 safety inputs—S1 through S22—can be configured as external device monitoring inputs. Refer to the SC22-3 manual and PCI software interface for more information.) Both single N.C. contacts (21–22) from each contactor are pre-wired in series in each contactor pair for single-channel EDM monitoring.

If the MPCEs are controlled by the SC-IM9.. Module, the normally closed contacts of both the Module and the MPCE can be switched in series to the same EDM input. In operation, if the MPCE fails in the energized condition, the associated monitor contact will remain open. As a result, the Safety Controller will detect the MPCE failure and prevent successive machine cycles. **It is the user's responsibility to monitor the contactors' N.C. contacts, to ensure that any single failure will not result in a hazardous condition and will prevent a successive machine cycle.**

Many types of mechanisms are used to arrest dangerous machine motion. Examples include mechanical braking systems, clutch mechanisms, and combinations of brakes and clutches. Additionally, control of the arresting scheme may be hydraulic or pneumatic. As a result, an MPCE may be one of several control types, including a wide variety of contactors and electromechanical valves. If your machine documentation leaves any doubt about the proper connection points for the Interface Module output contacts, do not make any connections. Contact the machine builder for clarification regarding connection to the MPCEs.



WARNING . . . Not for Use As a Stand-Alone Safety Module

- 1. DO NOT connect E-stop switches, 2-hand-control switches, safety interlock switches, or similar devices directly to this Interface Module.**
- 2. ALWAYS connect terminals 21–22 of this Interface Module to the monitoring input of the SC22-3 Safety Controller (see Figure 2).**

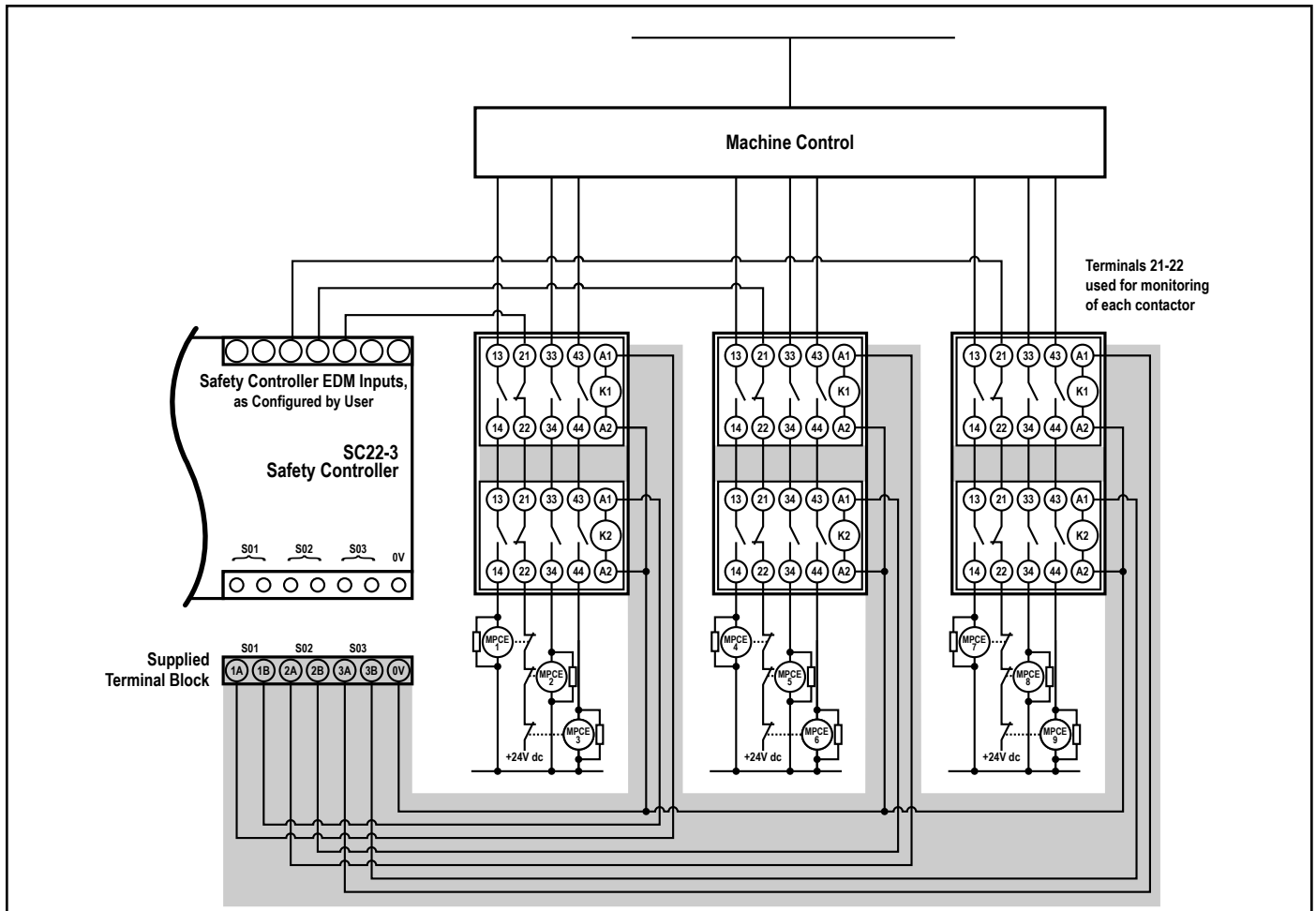
This Module does not have the circuitry required to perform a self-check. A single fault inside the unit can go undetected and create an unsafe condition. **Failure to properly connect this Module to the SC22-3 Safety Controller could result in serious injury or death.**

NOTICE Regarding MPCEs

To achieve control reliability, two machine primary control elements (MPCEs) are required to control each machine hazard. Each MPCE must be capable of immediately stopping the dangerous machine motion, irrespective of the state of the other. Some machines offer only one primary control element. For such machines, it is necessary to duplicate the circuit of the single MPCE to add a second MPCE.

MPCEs must offer at least one forced-guided auxiliary contact which is wired to the Safety Controller's monitoring contact feedback input (see hookup diagram).

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- NOTES:**
- Gray-shaded areas are pre-wired and require no further connections. The user is responsible for wiring SC-IM9.. Safety Outputs (13/14, 33/34, 43/44) and N.C. monitoring contacts (21/22).
 - Model SC-IM9C shown; hookup for models SC-IM9A and SC-IM9B is similar.

⚠ WARNING . . . Use of Arc Suppressors
 If arc suppressors are used, they **MUST** be installed across the actuator coil of the machine primary control elements (MPCE1, MPCE2, etc.). **NEVER** install suppressors directly across the output contacts of the Interface Module. It is possible for suppressors to fail as a short circuit. If installed directly across the output contacts of the Interface Module, a short-circuited suppressor will create an unsafe condition which could result in serious injury or death.

⚠ WARNING . . . MPCE Monitoring
 All machine control primary elements (MPCEs) must be of forced-guided (mechanically-linked) design to allow the EDM circuit to detect unsafe failures. This monitoring extends the safe switching point of the Safety Controller and the SC-IM9.. Interface Module to the MPCE elements. For this monitoring to be effective, a minimum of two redundant MPCEs are required to control each hazard. This is to detect the unsafe failure of one MPCE (e.g., a welded contact), while stopping the hazard and preventing a successive machine cycle with the second MPCE.
 If the MPCEs are the last electrically controlled device generating the hazard (i.e., not relays or contactors) and they do not have forced-guided, captive contacts to monitor (such as a solenoid), then the user must ensure that failure or fault of any single component of the MPCEs will prevent a successive machine cycle and will not result in a hazardous situation.

Figure 2. Generalized one-channel EDM-monitoring hookup of the SC-IM9C

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Initial Checkout Procedure

NOTE: *The Interface Module can be used safely only when it is connected to the Controller's safety output (according to the wiring diagrams in Figure 2) and monitored via the SC22-3 Safety Controller's EDM input.*

Checkout procedure:

1. Remove the power controlling (and switched by) the machine control elements (see Caution at right).
2. Verify that the Safety Controller that controls the Interface Module is operating correctly, according to its product documentation and configuration.
3. Confirm proper connection of the Interface Module to the Safety Controller, according to the wiring diagram.
4. Verify that all Interface Module output contacts follow exactly the operation of the safety outputs of the controlling Safety Controller, when it is operated according to its product documentation and manufacturer's recommendations.



CAUTION . . . Disconnect Power Prior to Checkout

Before performing the initial checkout procedure, make certain all power is disconnected from the machine to be controlled. Dangerous voltages may be present along the Module's wiring barriers whenever power to the machine control elements is ON. Exercise extreme caution whenever machine control power is or may be present.

Periodic Checkout

The checkout procedure described above should be performed according to the intervals specified by the product documentation of the Safety Controller controlling this Interface Module.

Repairs

NOTE: Do not attempt any repairs to this Interface Module. It contains no field-replaceable components. Return it to the factory for warranty repair or replacement.

If it becomes necessary to return an Interface Module to the factory:

1. Contact Banner at the address or the numbers listed on the back cover. A factory application engineer will attempt to troubleshoot the problem from your description or will issue a return merchandise authorization (RMA) number for your paperwork and provide the proper shipping address.
2. Pack the module carefully. Damage that occurs in return shipping is not covered by warranty.

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Specifications

Input Voltage and Current	24V dc, +/-15% no polarity, supplied by Safety Controller Operating voltage limits Pick-up: (0.7–1.15) x Un Drop-out: (0.1–0.2) x Un			
Average Consumption at 20° C (In-Rush Holding)	3.2 W			
Output Configuration		SC-IM9A	SC-IM9B	SC-IM9C
	Number of Redundant N.O. Contacts	1 x 3	2 x 3	3 x 3
	Number of N.C. Contacts	1 x 1	2 x 1	3 x 1
	Min. switching voltage: 1V ac/dc Min. switching current: 30 mA ac/dc Min. switching power: 50 mW (50 mVA) Mechanical life: 20,000,000 operations Electrical life (AC3): 500,000 cycles @ 10 A 3,800,000 cycles @ 2 A		Max. switching voltage: 575V Max. switching current: 10A ac/dc Max. switching power: 275 W (7200 VA)	
Conventional Free Air Thermal Current Ith (≤ 40° C)	10A			
Rated Insulation Voltage (Ui)	690V			
Frequency Limit	25–40 Hz (derating for use at 61–400 Hz)			
Terminal Tightening Torque Min/Max	0.8–1 Nm (0.59–0.74 lbft)			
Max Wire Gauge (for 1 or 2 Wires)	18–12 AWG Flexible w/o Ferrule: 0.75–2.5 mm ² Flexible w/Ferrule: 2 x 1 or 1 x 2.5 mm ²			
Output Response Time	N.O. contacts 13–14, 33–34, 43–44: 18–25 ms closing, 3 ms opening N.C. contacts 21–22: 3–5 ms closing, 17 ms opening			
Status Indicators	Output ON/OFF indicator on the front of each contactor; see Figure 1.			
Environmental Rating	Rated NEMA 1, IEC IP20. Interface Module must be installed inside an enclosure rated IEC IP54, or better.			
Mounting	Mounts to standard 35 mm DIN-rail track. Must mount adjacent to Safety Controller.			
Operating Conditions	Temperature: –40° to +60° C (–40° to 122° F) operating, –55° to +70° C (–40° to 122° F) storage Max. Relative Humidity: 90% @ 50° C (non-condensing)			
Application Notes	There are no adjustments and no user-serviceable parts.			

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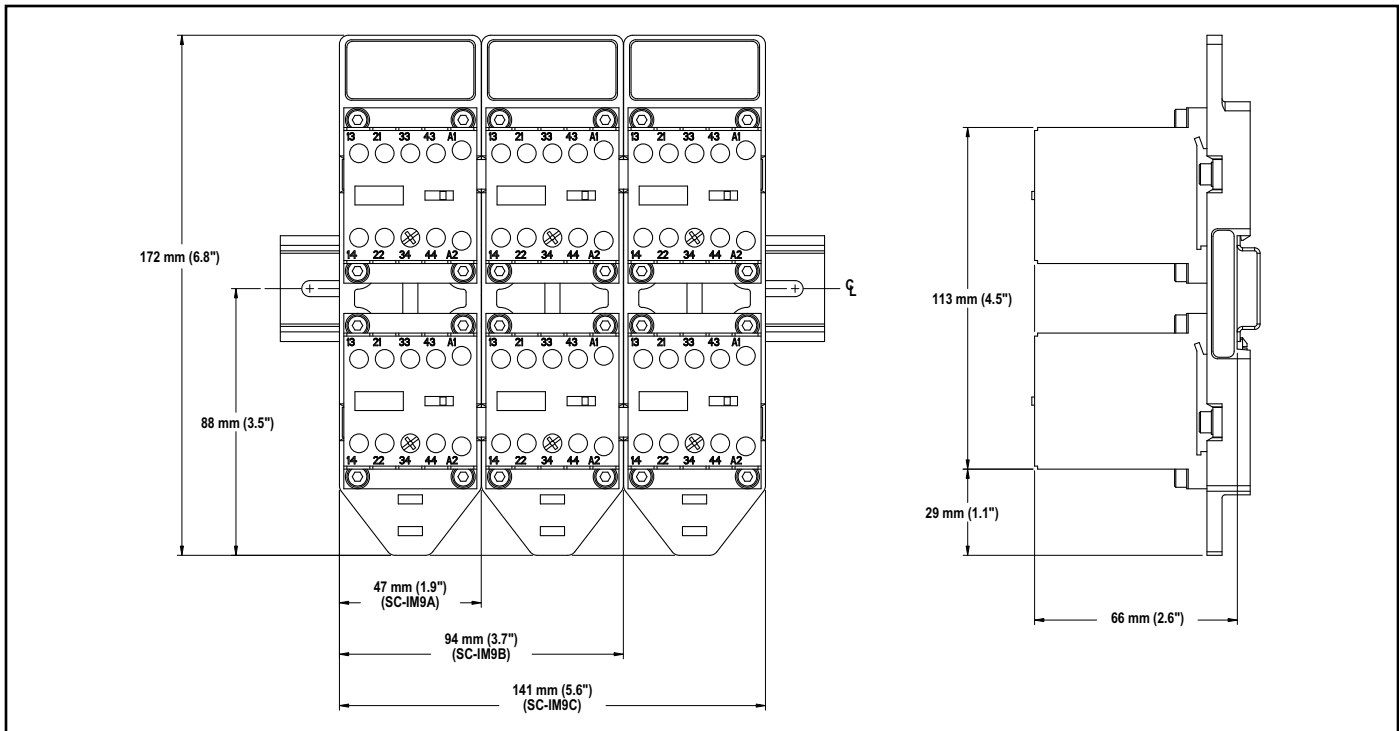




Figure 3. Dimensions

Accessories

Model	Description	Contacts	Positively Guided
 11-BGX10-40	Non-Safety Auxiliary Contacts: Adds normally open contacts to the primary contactor(s).	3 N.O.	No (Aux. only)

Model	Description	Voltage
 11-BGX77-048	Suppressor for Mechanically Linked Contactors: Extends the life of the actuating device—such as a light screen or control module—that uses a mechanically linked contactor. (Two required for each pair of relays.)	48V dc (max.)



WARRANTY: Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.

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