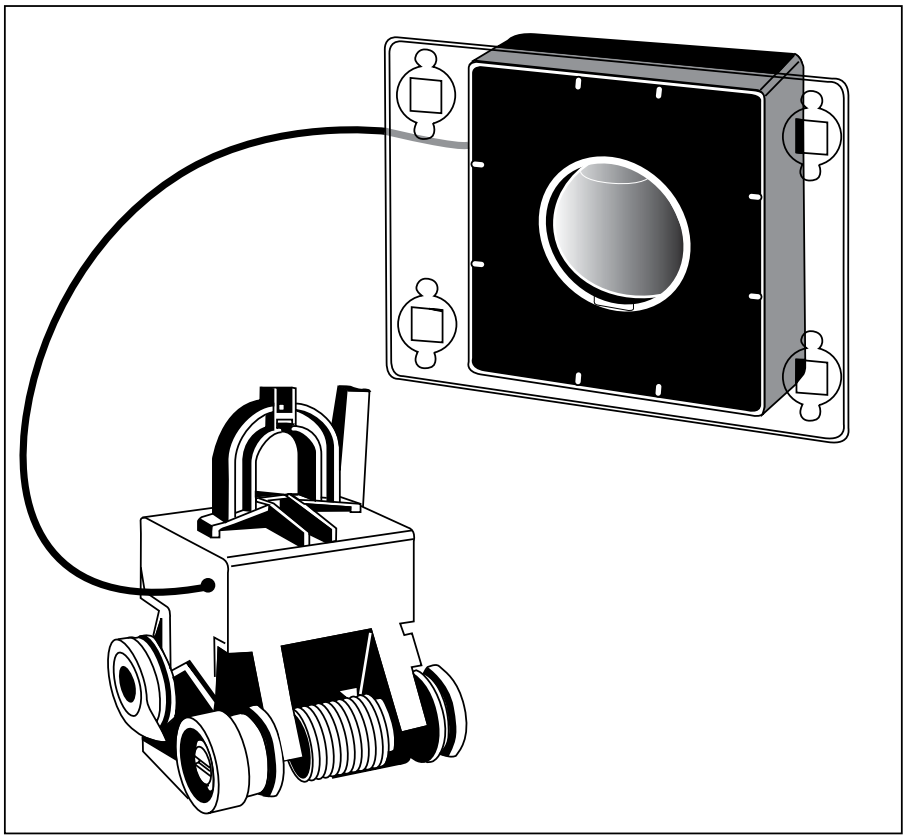
Effective March 2017
Supersedes December 2008 (S320-50-1)

S.T.A.R. type LVR faulted circuit indicator installation instructions



Powering Business Worldwide

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

The information, recommendations, descriptions and safety notations in this document are based on Eaton Corporation's ("Eaton") experience and judgment and may not cover all contingencies. If further information is required, an Eaton sales office should be consulted. Sale of the product shown in this literature is subject to the terms and conditions outlined in appropriate Eaton selling policies or other contractual agreement between Eaton and the purchaser.

THERE ARE NO UNDERSTANDINGS, AGREEMENTS, WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OTHER THAN THOSE SPECIFICALLY SET OUT IN ANY EXISTING CONTRACT BETWEEN THE PARTIES. ANY SUCH CONTRACT STATES THE ENTIRE OBLIGATION OF EATON. THE CONTENTS OF THIS DOCUMENT SHALL NOT BECOME PART OF OR MODIFY ANY CONTRACT BETWEEN THE PARTIES.

In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or other-wise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and descriptions contained herein. The information contained in this manual is subject to change without notice.

Contents

Safety for life

Eaton's Cooper Power series products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our "Safety For Life" mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result In death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and equipment damage.

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

⚠ WARNING

The Eaton Cooper Power series S.T.A.R. Type LVR Faulted Circuit Indicator is designed to be operated in accordance with normal safe operating procedures. These instructions are not intended to supersede or replace existing safety and operating procedures. Read all the instructions before installing the faulted circuit indicator.

Faulted circuit indicators should be installed and serviced only by personnel familiar with good safety practice and the handling of high-voltage electrical equipment. Improper operation, handling, or maintenance can result in death, severe personal injury, and equipment damage.

Product information

Introduction

The Eaton Cooper Power series S.T.A.R. Type LVR (Low Voltage Reset) Faulted Circuit Indicator (FCI) is cable mounted and indicates the passage of fault current by showing a "fault" flag in the window of the display. When the fault is cleared and the system is re-energized, the secondary voltage of the transformer will reset the FCI automatically. The FCI is weatherproof, submersible and meets or exceeds IEEE Std 495-1986™ standard Testing Guide. The flag will not change status as a result of mechanical shock or vibration.

The low-voltage reset faulted circuit indicator consists of two parts — the sensor (transmitter) and the display (receiver). The sensor clamps around the primary cable and the display mounts in the wall of the transformer cabinet. The sensor communicates with the display via a fiber optic cable. The display assembly includes a cable which is used to provide low-voltage (120 VAC, secondary for the standard LVR unit; 120, 208 or 277 for the LVR with universal power supply) power to the device.

The FCI is available with either a low or high trip rating. A low trip rating will trip at approximately 350 A on a 1.0" diameter cable and a high trip rating will trip at approximately 850 A on the same size cable. Refer to Figure 2 for trip values on other cable diameters.

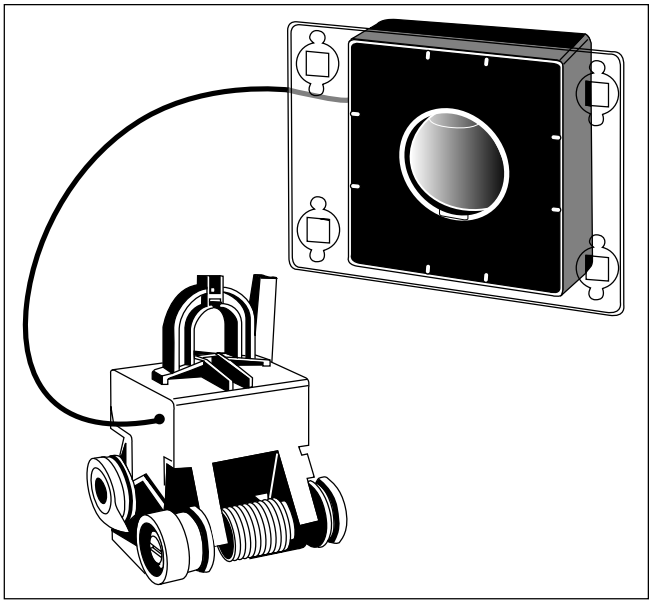


Figure 1. S.T.A.R. type LVR faulted circuit indicator

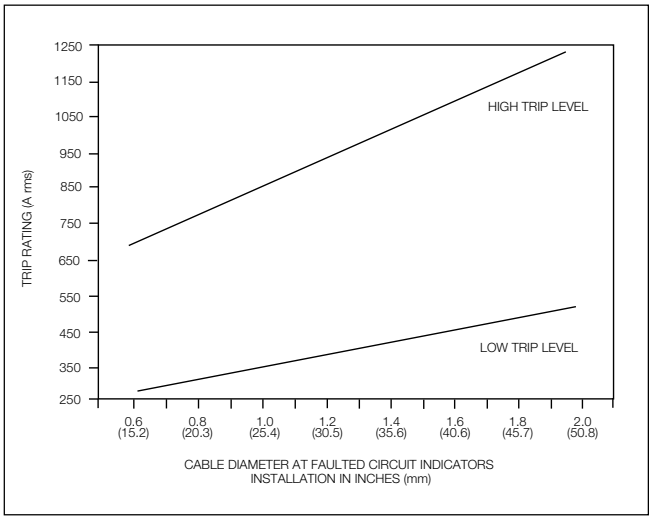


Figure 2. S.T.A.R. type LVR faulted circuit indicator cable diameter vs. trip value curves

⚠ Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your representative.

Acceptance and initial inspection

Each FCI is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the FCI and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling and storage

Be careful during handling and storage of the FCI to minimize the possibility of damage. If the FCI is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Standards

ISO 9001 Certified Quality Management System.

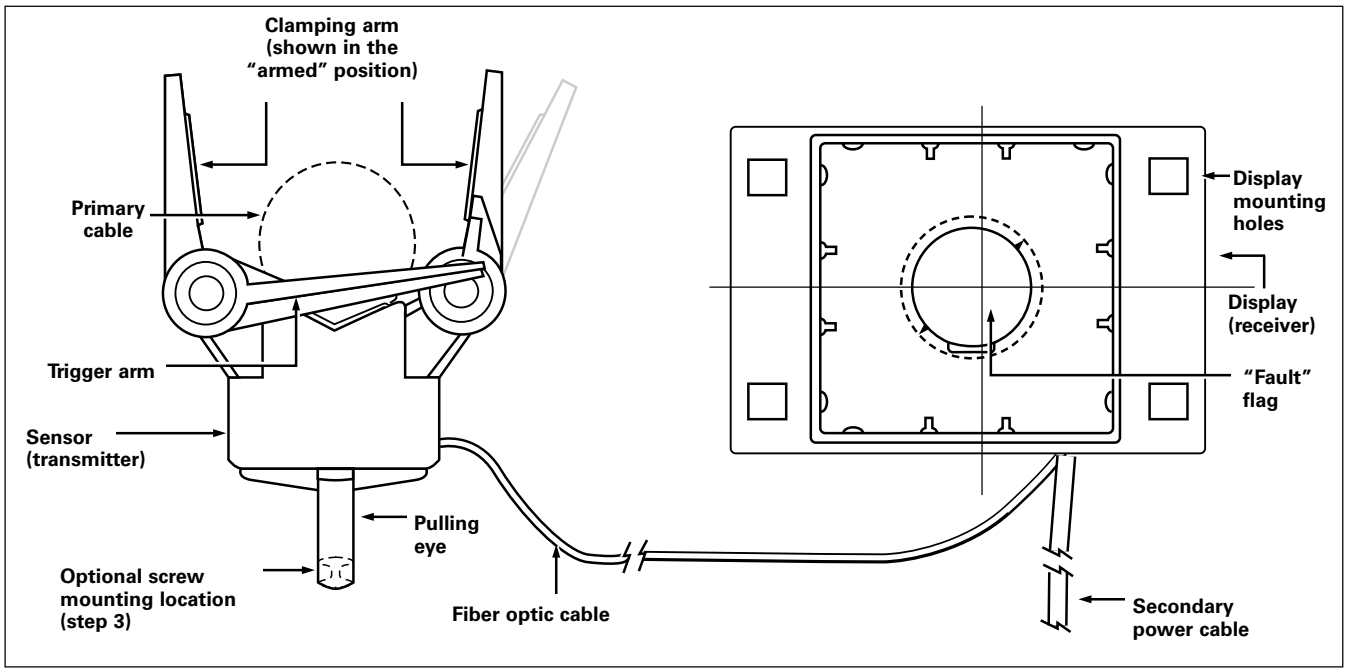


Figure 3. Line illustration of the S.T.A.R. type LVR faulted circuit indicator

Installation procedures

Primary cable preparation

Proper primary cable preparation is necessary for the low voltage reset faulted circuit indicator to work reliably. The FCI can be used on tape shield or drain wire cable. If the cable shielding does not provide the return path for the fault current, the FCI sensor can be installed directly to the cable. If the cable shielding provides the return path for the fault current, the sensor will not reliably detect a fault and will require the use of a tape shield or drain wire adapter. When used, the adapter must be installed approximately 3.5" below the elbow to allow space for mounting the FCI sensor on the cable.

One of the following four methods is preferred for installation on concentric neutral primary cable.

Method 1 (Refer to Figure 4-a)

1. **Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.**
2. **Terminate all of the remaining neutral wires approximately 6" below the elbow.**
3. **Pull the neutral wires straight up and terminate them again just below the elbow.** The wires should then be bent back down the cable which is commonly referred to as "double-back".
4. **Terminate and ground the wires approximately 6" below the elbow.**

Note: The sensor portion of the FCI is installed over the "double-back" neutral wires to cancel the effect of current in the neutral. The trip rating is dependent on the overall diameter, over the "double-back" neutral wires.

Method 2 (Refer to Figure 4-b)

1. **Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.**
2. **Terminate all of the remaining neutral wires just below the elbow.** The balance of the neutral wires should be gathered together and be "double-backed" down the cable and grounded.

Note: The sensor portion of the FCI is installed over the "double-back" neutral wires to cancel the effect of current in the neutral. The trip rating is dependent on the overall diameter, over the "double back" neutral wires.

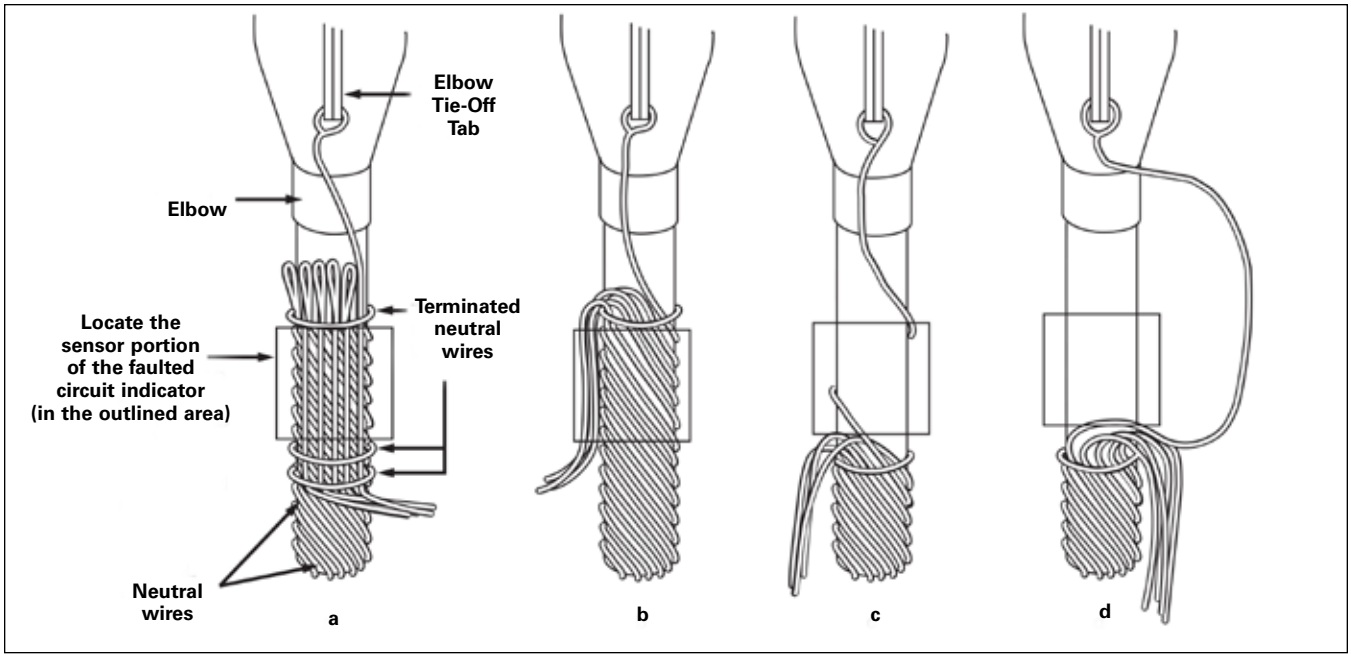
Method 3 (Refer to Figure 4-c)

1. **Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.**
2. **Terminate and ground all of the remaining neutral wires approximately 6" below the elbow.**

Method 4 (Refer to Figure 4-d)

1. **Arch one or two strands of the concentric neutral wrapped around the cable and attach it to the tie-off tab on the elbow.** The arch should be large enough to go around the outside of the sensor portion of the FCI when the sensor is installed.

Some installations of improper preparation of the primary cable will result in an inoperable FCI, shown in Figure 5 a and b. The magnetic field, due to current in the center conductor, will be cancelled by current in the concentric neutral wires. DO NOT PREPARE PRIMARY CABLE IN ACCORDANCE WITH METHODS SHOWN IN FIGURE 5.



a

Figure 4. Recommended methods of concentric neutral primary cable preparation

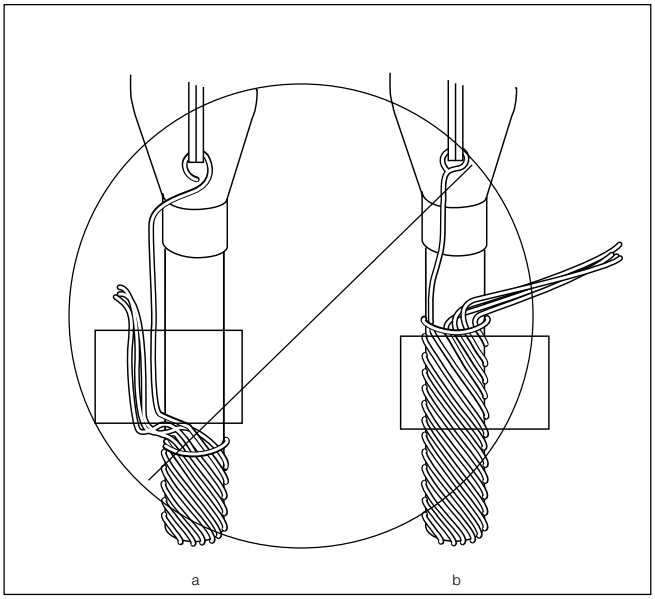


Figure 5. Incorrect methods of concentric neutral primary cable preparation

⚠ WARNING

DO NOT PREPARE PRIMARY CABLE IN ACCORDANCE WITH METHODS SHOWN IN FIGURE 5. (The magnetic field due to current in the center conductor will be cancelled by current in the concentric neutral wires).

Installation of the display

⚠ WARNING

The Eaton Cooper Power series S.T.A.R. Type LVR Faulted Circuit Indicator with remote display and/or auxiliary contact outputs are designed for installation at Ground Potential Only. Remote indicators and auxiliary contacts are not insulated for high voltage application. If high voltage is applied across the fault indicator, flashover may occur, possibly resulting in death, severe personal injury, and equipment damage.

Note: Complete mounting the display before mounting the sensor.

1. **Plan ahead!** Consider where the fault indicator cables will be routed and positioned when installed, and where the sensor and the display will be mounted before beginning.
2. **Prepare the secondary power cable by cutting back a sufficient amount of jacket material so that the conductors will reach both the secondary voltage source and the neutral.** This cable may be shortened. If necessary, crimp the two terminals provided to the ends of the power cable.
3. **If a knockout has been provided for the display in the sill or wall of the transformer cabinet, no further preparation is necessary.**
   A. If not, use the template provided and position it at the location where the display is to be mounted.
   B. Drill or cut out the five holes necessary to mount the display.
4. **Mount the display to the wall or the sill of the transformer cabinet using the four carriage bolts, washers and nuts provided.** (Refer to Figure 6.)
5. **Route the power cable to the secondary voltage source from the transformer's secondary bushings, routing the cable in a way that would prevent it from being pinched when closing the cabinet door(s).** Both secondary voltage and neutral are necessary, but there is no polarity requirement. Terminate per local practices and procedures.The FCI requires minimum of 105 VAC to reset.
6. **Route the fiber optic cable in a way that would prevent it from being pinched when closing the cabinet door(s).**
7. **The FCI is shipped with the flag in the faulted position.** If the transformer is energized, the "fault" flag will rotate to the unfaulted position after the installation of the sensor.

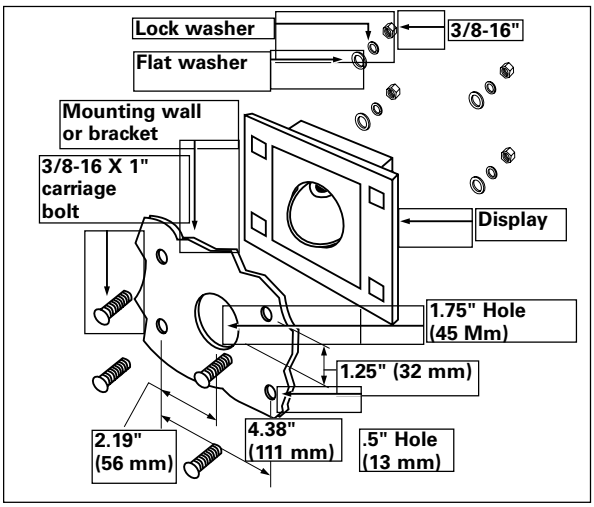


Figure 6. Installation of the FCI display on the mounting wall

Installation of the sensor

1. **Arm the sensor assembly by carefully grasping each clamping arm, pulling them apart until the trigger mechanism drops into place.** Stops have been built into the clamping arms such that they can be opened only to the point where the trigger will latch.
2. **Attach the sensor to a shotgun clamp stick using the pulling eye.**
3. **Push the sensor onto the cable below the elbow at a location shown in Figure 4 while holding the sensor shotgun stick horizontal.** The sensor triggering mechanism will release the clamping arms and securely attach the device to the cable.

⚠ WARNING

Care should be used when installing the sensor on a de-energized system without the use of a shotgun stick. When the clamping mechanism closes, the trigger arm swiftly swings toward the pulling eye and injury could occur if fingers or hands are in the trigger arm's path.

4. **Remove the shotgun stick.**
5. **If the shotgun stick interferes with a high sill, etc., and requires it to be held at an angle, a screw has been included with the FCI.** Mount the screw on the end of the pulling eye (Refer to Figure 7.)
6. **Attach the sensor to the shotgun stick using the pulling eye with the screw.**
7. **Push the sensor onto the cable below the elbow at a location shown in Figure 4 while holding the shotgun stick vertical.** The sensor triggering mechanism will release the clamping arms and securely attach the device to the cable.
8. **Remove the shotgun stick.**

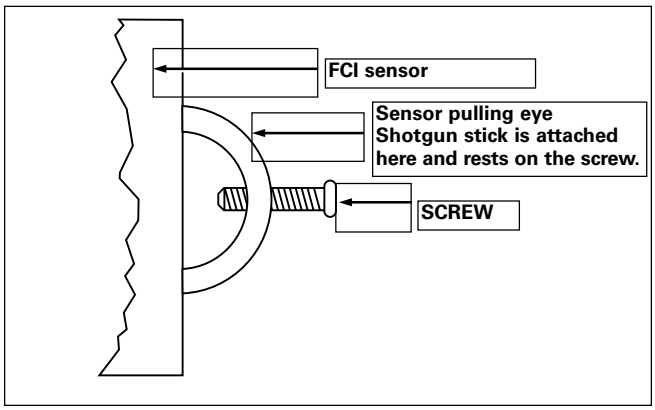


Figure 7. Installation of the screw on the fci sensor pulling eye

Installation of auxiliary contacts

⚠ WARNING

The Auxiliary Contact option is intended solely for use with faulted circuit indicators being installed on dead-front design equipment. DO NOT USE the auxiliary contact feature on fault indicators being applied to overhead conductors or live-front equipment. Exposed ends of the auxiliary contact cable may contact bare conductors or other energized equipment, and may result in electrocution hazard. The faulted circuit indicators should be installed and serviced only by personnel familiar with good safety practice and the handling of high-voltage electrical equipment.

Eaton's Cooper Power series S.T.A.R. Low Voltage Reset FCIs are available with auxiliary contacts as an option. The contact provides a means to monitor the status of the FCI remotely. The contact mirrors the status of the fault indicator. If the FCI is in the faulted position, the dry contacts will latch closed. If the FCI is in the reset position, the dry contacts will latch in the open position. A simple control diagram of the contacts is shown in Figure 8.

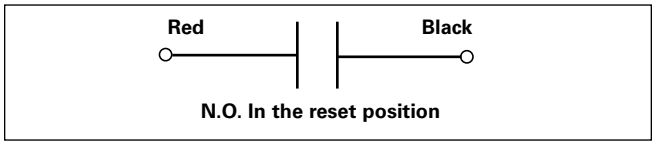


Figure 8. Control drawing of auxiliary contacts

This page intentionally left blank.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Power Systems Division
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries

Powering Business Worldwide

© 2017 Eaton
All Rights Reserved
Printed in USA
Publication No. MN320005EN REV00
March 2017

Eaton is a registered trademark.

All trademarks are property
of their respective owners.

For Eaton's Cooper Power series product information
call 1-877-277-4636 or visit:
www.eaton.com/cooperpowerseries.