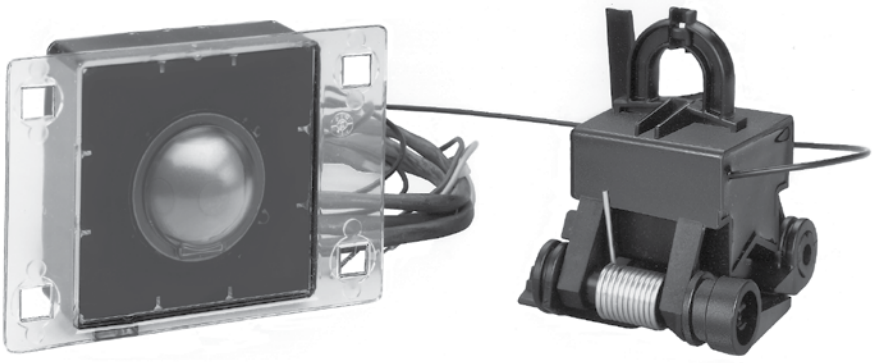
Faulted Circuit Indicators
Catalog Data
**CA320004EN**

Effective February 2015
Supersedes 320-50 January 1999

COOPER POWER SERIES

# S.T.A.R.™ low voltage reset faulted circuit indicators



## Description

Eaton designs its Cooper Power™ series S.T.A.R.™ low voltage reset (LVR) faulted circuit indicators to quickly and easily locate faulted sections of underground cable systems. These faulted circuit indicators (FCIs) can be installed on pad-mounted distribution transformers or wherever a secondary voltage source is available. The secondary voltage source deriving power from the monitored circuit will provide a known reliable source for operating and resetting the low voltage reset FCI, as compared to current reset devices which are subject to system loading variations. Low voltage reset faulted circuit indicators provide a reliable means of fault location and isolation. They also eliminate fault chasing methods which are costly, time consuming, and very stressful on the system components exposed to the fault currents.

## Construction

The low voltage reset indicator consists of two parts – the sensor (transmitter) and the display (receiver). The sensor is designed to minimize the proximity effect described as the sensitivity of FCIs to fault currents on other phases of a three-phase transformer. Eaton provides a 180° visual indication of FCI operation with its Cooper Power series patented FISHEYE™ display. This unique orange reflective target designates a fault and a black target designates a normal condition. The sensor is attached to the primary cable and the display is mounted in the cabinet wall so that it is visible from the outside at a glance. The polycarbonate display housing is made of a Lexan® material providing the exposed target window tamperproof and scratch-resistant protection. A six foot fiber optic cable connects the sensor to the display, thereby eliminating any electrical or metallic connection between the primary side and the secondary side of the transformer. A six foot low voltage cable from the display attaches to the secondary bushing(s).

## Trip rating

The S.T.A.R. FCI is available with either a low trip rating or a high trip rating. The very same FCI can be used on all cables ranging in size from 0.7 to 2.0 inches (17 to 51 mm).

Therefore, it is not necessary to specify a cable diameter when placing an order. (See Figure 2 in *Service Information S320-50-1 S.T.A.R. LVR Faulted Circuit Indicator Installation Instructions*.)

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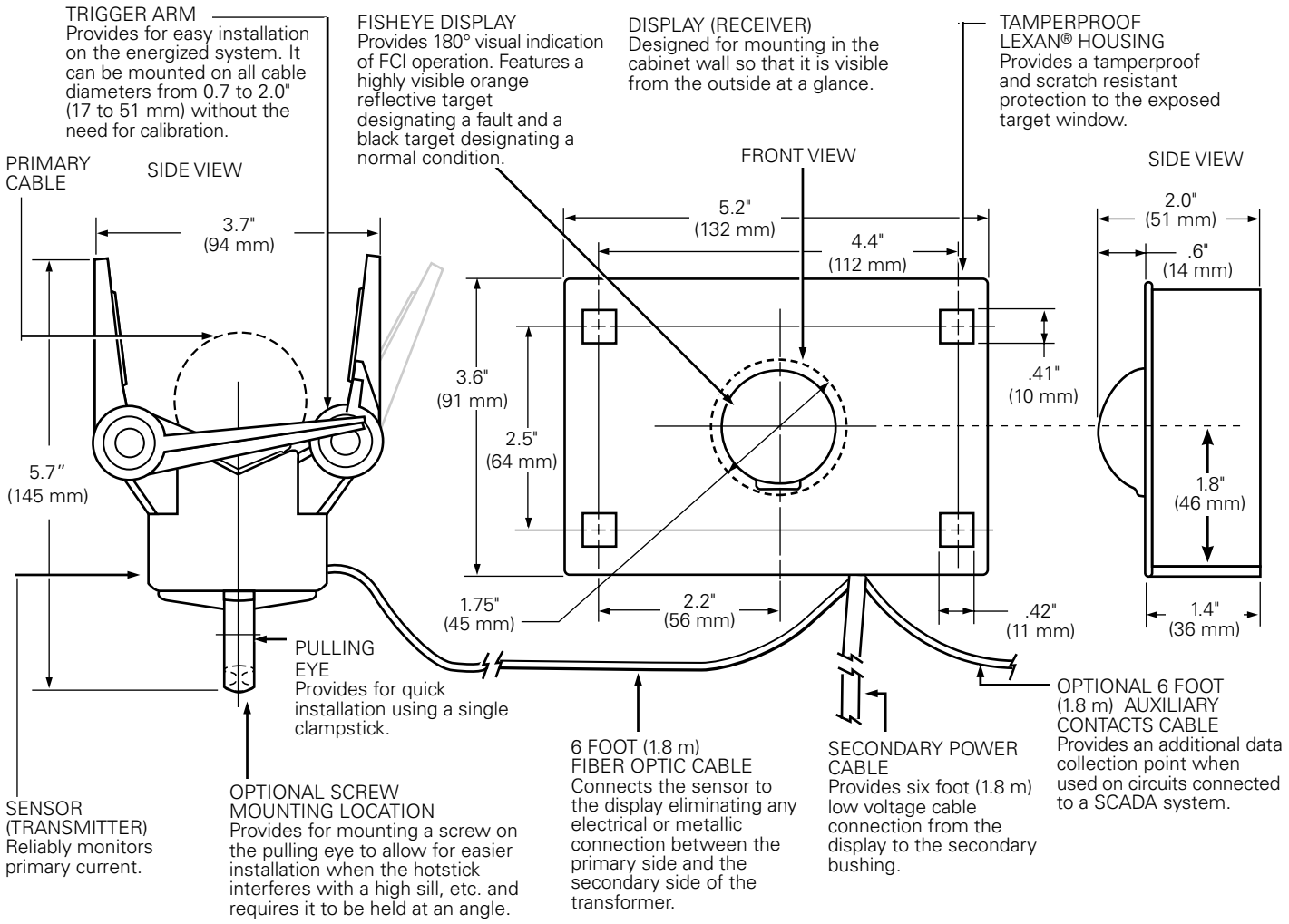



**Figure 1. Features and dimensions of a LVR faulted circuit indicator (shown in the "armed" position).**

## Design features

An inrush restraint feature eliminates false tripping and is standard on all units. The S.T.A.R. faulted circuit indicator will ignore inrush currents caused by reclosing operations of protective devices on the system. A dead time of 200 rms will activate the inrush restraint feature.

A low pass filter, also a standard feature, will prevent the S.T.A.R. faulted circuit indicator from tripping on high frequency transients like those caused by cable capacitive discharges.

Another standard feature is the reset restraint circuit. It prevents the premature resetting of faulted circuit indicators caused by feedback voltages of less than 90 Vac.

In addition, the S.T.A.R. faulted circuit indicator is equipped with temperature compensation circuitry to assure accurate, reliable performance over the entire specified temperature range.

The quick response time of the low voltage reset S.T.A.R. faulted circuit indicator allows easy coordination with current-limiting fuses (see Figure 3).

The unit is insensitive to primary line voltage and will operate on any cable system. This unique combination of standard features makes the S.T.A.R. faulted circuit indicator extremely reliable.

## Testing

S.T.A.R. faulted circuit indicators are made of corrosion resistant materials and meet or exceed ANSI/IEEE Std 495™-1986 standard "Guide for Testing Faulted Circuit Indicators".

100% automated production testing verifies the trip rating, the reset voltage, the inrush restraint feature, and the reset restraint feature.

The electronic components are completely encapsulated to prevent any environmental damage.

## Installation

All units are shipped to the customer in the tripped position. The status of the display cannot be changed mechanically in handling. After the unit is installed, the energized system will reset the reflective target from the tripped position to the normal position.

Installation is quick and easy. No special tools are required. The patented clamping mechanism of the sensor provides for easy installation on an energized system using a single clampstick. The display is mounted in a transformer cabinet using four carriage bolts.

All installation hardware is supplied including a drilling template for those transformers without an FCI knockout. Refer to *Service Information S320-50-1 S.T.A.R. LVR Faulted Circuit Indicator Installation Instructions* for detailed instructions.

**Table 1. Electrical Ratings and Characteristics**

| Description | Ratings and Characteristics |
|---|---|
| Power Requirements | 105 Vac, 15 mA @ 120 Vac (Standard LVR):<br>40 mA @ 120 Vac (LVR with Universal Power Supply |
| Reset Requirements | 90 VAC minimum (Standard LVR):<br>60% of nominal (120, 208 or 277 Vac - LVR with Universal Power Supply) |
| Reset Time | 6 to 9 seconds |
| Trip Current | Factory Preset, High and Low |
| Trip Accuracy | +/- 10% |
| Trip Response Speed | Response Curve, Figure 3 |
| Maximum Continuous Load Current | 600 A |
| Fault Withstand Capability | 25 kA for 10 cycles per ANSI/IEEE Std 495™-1986 standard |
| Cable Size | #2 to 1000 MCM, Insulated |
| Temperature Range | -40 ˚C to +85 ˚C |
| Materials | Corrosion resistant & submersible per ANSI/IEEE Std 495™-1986 standard |
| Weight | 26.7 ounces (0.76 kg) |
| Auxiliary Contact Ratings | 1 A 30 Vdc |
| | 0.5 A 125 Vac |
| | 0.3 A 110 Vac |

**Table 2 Standard Cable Diameters in Inches (Millimeters)**

| | 175 MIL* | 220 MIL* | 260 MIL* | 345 MIL* |
|---|---|---|---|---|
| **Cable Size** | **15 kV** | **15 kV** | **25 kV** | **35 kV** |
| #2 | .700 (17.8) | .790 (20.1) | .870 (22.1) | – |
| #1 | .740 (18.8) | .830 (21.1) | .910 (23.1) | – |
| 1/0 | .785 (19.9) | .875 (22.2) | .955 (24.3) | 1.125 (28.6) |
| 2/0 | .830 (21.1) | .920 (23.4) | 1.000 (25.4) | 1.170 (29.7) |
| 3/0 | .880 (22.4) | .970 (24.6) | 1.050 (26.7) | 1.220 (31.0) |
| 4/0 | .940 (23.9) | 1.030 (26.2) | 1.110 (28.2) | 1.280 (32.5) |
| 250 MCM | .995 (25.3) | 1.085 (27.6) | 1.175 (29.8) | 1.350 (34.3) |
| 350 MCM | 1.100 (27.9) | 1.190 (30.2) | 1.280 (32.5) | 1.455 (37.0) |
| 500 MCM | 1.235 (31.4) | 1.325 (33.7) | 1.415 (35.9) | 1.590 (40.4) |
| 600 MCM | 1.325 (33.7) | 1.415 (35.9) | 1.505 (38.2) | 1.680 (42.7) |
| 750 MCM | 1.430 (36.3) | 1.525 (38.7) | 1.610 (40.9) | 1.785 (45.3) |
| 1000 MCM | 1.580 (40.1) | 1.680 (42.7) | 1.760 (44.7) | 1.935 (49.1) |

* Insulation thickness

## Options

### Auxiliary contacts

Auxiliary contacts can be added to the standard unit and would provide an additional data collection point when used on circuits connected to a SCADA system. The magnetic latching circuit that operates the auxiliary contact ensures reliable indication.

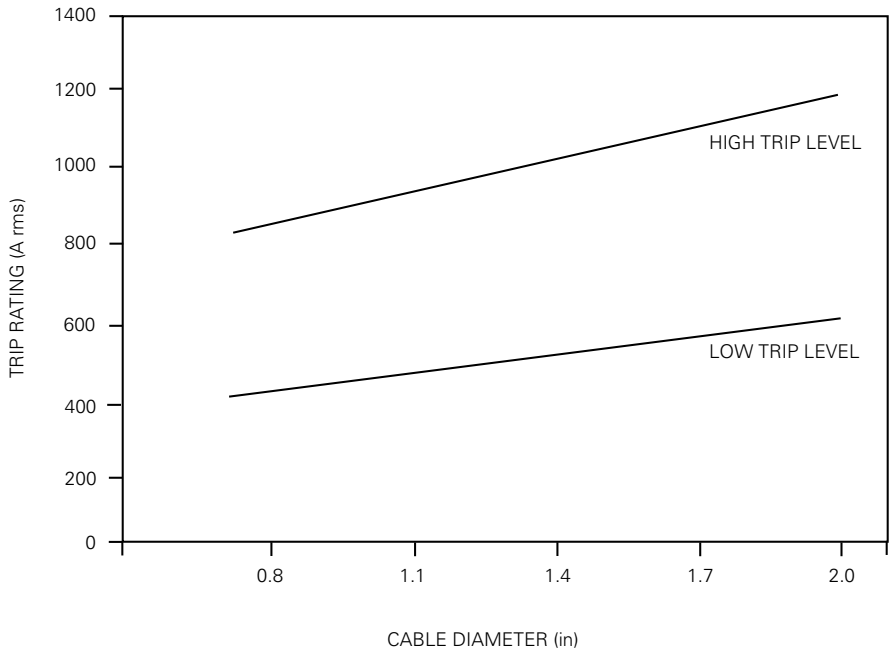



**Figure 2. S.T.A.R. LVR faulted circuit indicator cable diameter vs trip value curves.**

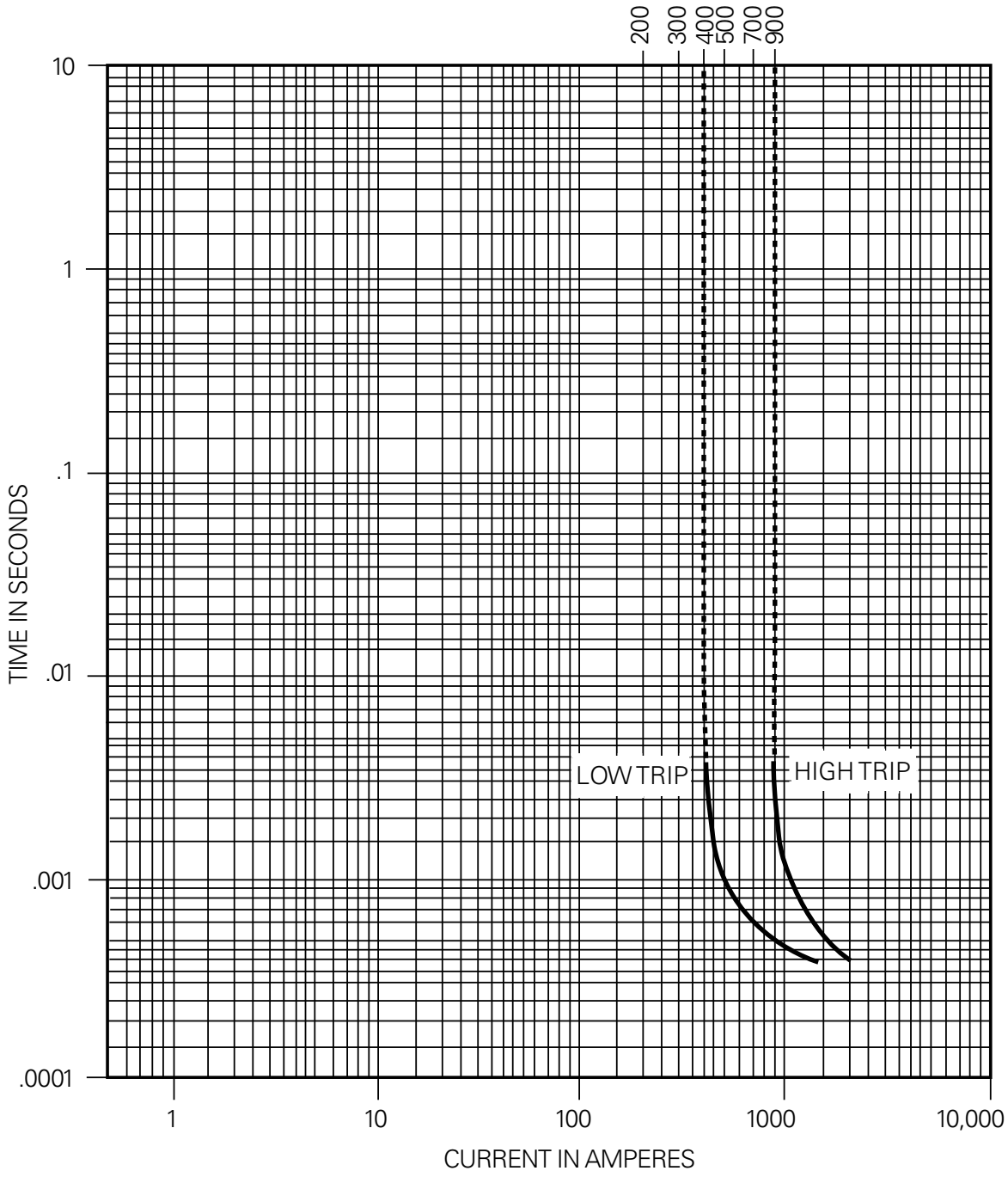



**Figure 3. LVR faulted circuit indicator response curve* developed on a 1.2 inch (30.5 mm) cable.**

* Per Figure 3, for a 1.2 inch diameter cable the low trip rating is 400 A and the high trip rating is 900 A. The curves will shift for various cable diameters.

## Ordering information

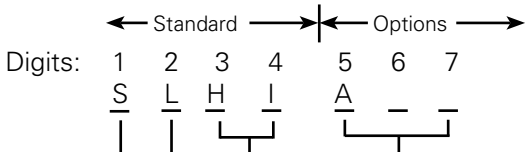
To order a S.T.A.R. low voltage reset faulted circuit indicator specify the catalog number from Table 3 by selecting the appropriate codes.

Contact your Eaton representative for additional information.

**Table 1. S.T.A.R. Faulted Circuit Indicator Ordering Information**

**Catalog Number**[1, 2]

Example: A Low Voltage Reset FCI with a high trip rating and standard 6 ft. auxiliary contacts would have a catalog number SLHIA (as shown below).




S.T.A.R. FCI Line

FCI Type

| Digit 2 | Type |
|---|---|
| L | Low Voltage Reset |

**Trip Rating**

| Digits | | |
|---|---|---|
| 3 | 4 | Trip Rating |
| L | O | Low |
| H | I | High |

**Options**

| Digits | | | Description |
|---|---|---|---|
| 5 | 6 | 7 | |
| A | | | Standard indicator with auxiliary contacts |
| U | | | Universal Power Supply (120, 208, or 277 Vac power connection) |
| A | U | | Auxiliary contacts and universal power supply |

**Notes:**

1. The S.T.A.R. FCI catalog number may vary in length from 4 digits to 7 digits.
2. The standard S.T.A.R. FCI catalog number may be truncated after entering digits 1-4. Options may be selected be adding the appropriate design code to digits 5, 6 and/or 7.

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Printed in USA
Publication No. CA320004EN



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