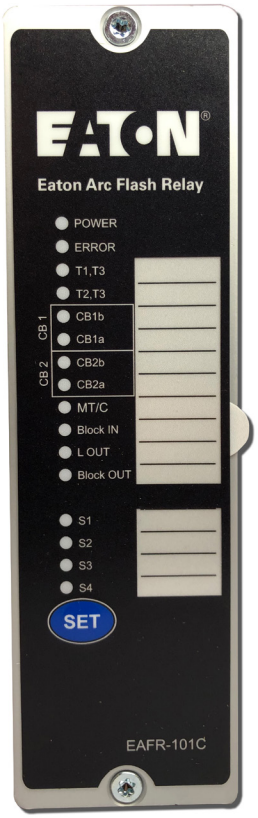
Instruction Booklet **IB0191002EN** Effective November 2019

EAFR-101C arc point sensor relay user manual



Contents

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⚠ CAUTION

ELECTRICAL EQUIPMENT SHOULD BE INSTALLED, OPERATED, SERVICED, AND MAINTAINED ONLY BY QUALIFIED PERSONNEL. LOCAL SAFETY REGULATIONS SHOULD BE FOLLOWED.

NO RESPONSIBILITY IS ASSUMED BY EATON FOR ANY CONSEQUENCES ARISING OUT OF THE USE OF THIS MATERIAL.

1 Introduction

Read these instructions carefully and inspect the equipment to become familiar with it before trying to install, operate, service, or maintain it.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. Local safety regulations should be followed. No responsibility is assumed by Eaton for any consequences arising out of the use of this material.

Eaton reserves right to changes without further notice.

1.1 Abbreviations

CB – Circuit breaker
CBFP – Circuit breaker failure protection
EMC – Electromagnetic compatibility
EPROM – Erasable programmable read only memory
HW – Hardware
LED – Light emitting diode
LV – Low voltage
ms – Millisecond
MV – Medium voltage
NC – Normally closed
NO – Normally open
PMSG – Permanent magnet synchronous generator
Rx – Receiver
SF – System failure
SW – Software
Tx – Transceiver
uP – Microprocessor

2 General

The Eaton arc flash relay 101C (EAFR-101C) is a sophisticated micro-processor based arc flash protection relay including complete self-supervision functionality. It is designed to minimize the damage caused by an arcing fault (arc flash) by sensing light from the point sensor and acting to trip the circuit breaker sourcing the fault current. The EAFR-101C complete system self-supervision function provides the highest level of dependability by continuously monitoring all internal system functions along with external connections.

The EAFR-101C is designed according to the latest protection relay standards and is therefore suitable for installations in rough environments, such as utility, traditional or renewable power plants, off shore, marine, oil and gas, mining, steel, or any other heavy industry applications. It is also well suited for commercial and institutional electrical systems. The EAFR-101C is suitable for either medium voltage or low voltage switchgear and motor control center applications in both new and retrofit installations.

2.1 EAFR-101C features

The EAFR-101C is a multipurpose arc flash protection relay that can receive light from four different channels of light point sensors and can be applied for variety of applications. The EAFR-101C can be used as a stand-alone relay or as part of a more complex arc protection system through the binary bus.

Main features of EAFR-101C:

- (110-220) Vac / (125-250) Vdc auxiliary power supply;
- (18-72) Vdc optional power supply;
- Four arc point sensor channels (S1, S2, S3, and S4);
- Six binary inputs (BI1, BI2, BI3, BI4, BI5, and BI6) nominal voltage of 24 Vdc;
- Three normally open trip relay outputs with direct trip circuit rated contacts (T1, T2, and T3);
- One normally open electronic lock-out trip relay with direct trip circuit rated contacts (T2);
- Two 24 Vdc binary outputs (BO1 and BO2);
- One system failure relay, form C output (SF);
- 16 indication LEDs; and
- One push-button (SET).

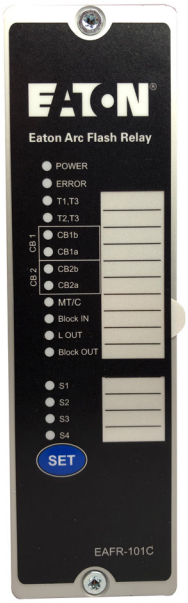

Figure 1. The EAFR-101C arc protection IO relay.

2.2 Simplified block diagram

The EAFR-101C simplified block diagram (see Figure 2) shows the main components of the EAFR-101C relay.

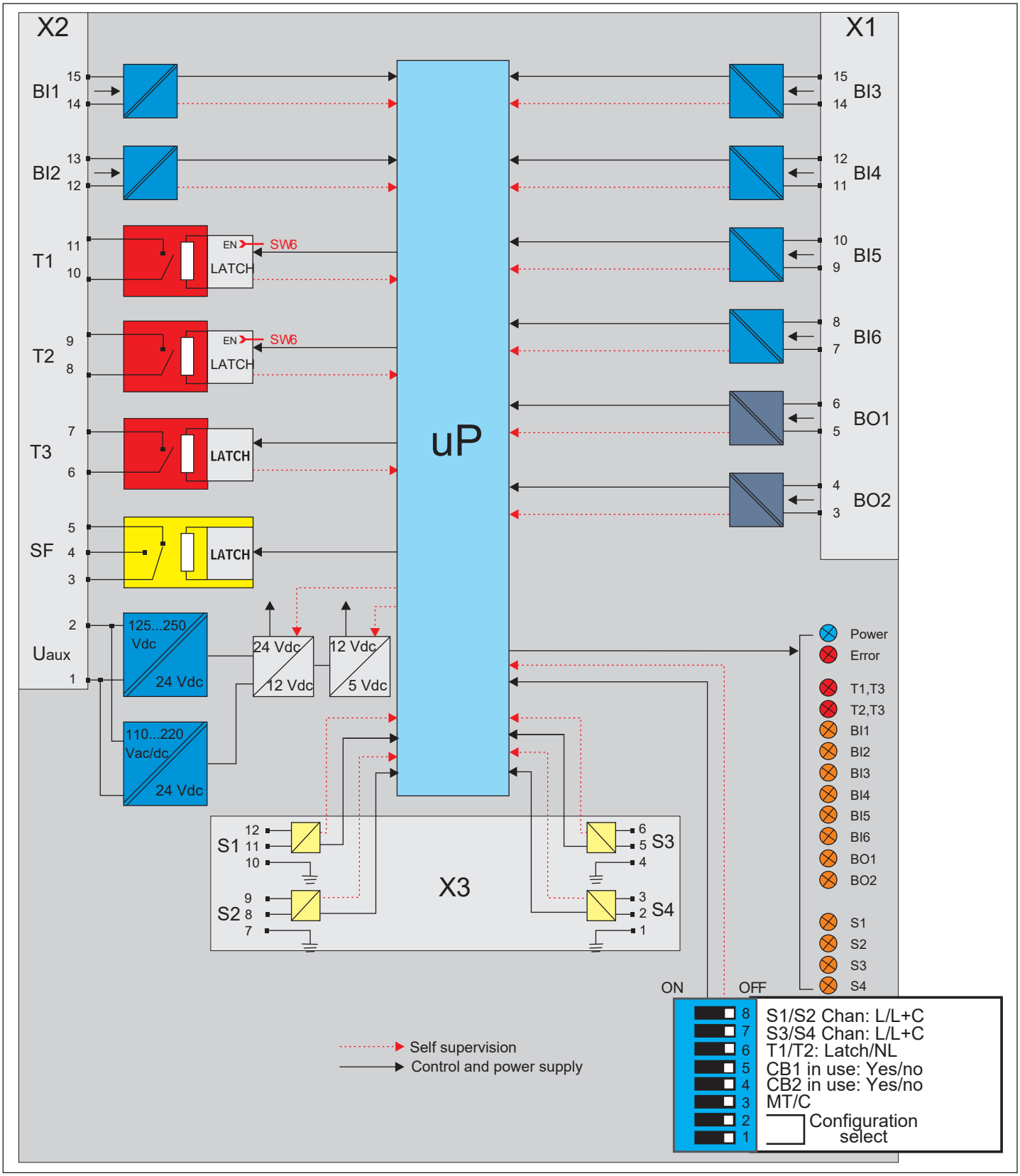

Figure 2. EAFR-101C simplified block diagram.

3 Operation and configuration

3.1 LED indicator functions

The EAFR-101C contains 16 indication LEDs. A user definable text pocket can be slid in under the label for identifying each LED function (except POWER and ERROR LEDs). LEDs are located at the front plate of the relay for clear viewing without a need for opening doors.

During power up, the relay performs an LED test. All LEDs are turned on for two seconds and then off. Only the blue POWER LED will remain on. After powered up, the relay goes into protection mode in 50 ms even while the LED test is being performed.

During normal operation, the blue power LED is ON, as are any CB open/close status LED's for connected CB's.

The sensor LEDs are off during the inactive condition. If a point arc sensor is activated, the corresponding sensor channel LED will turn on if the activation is longer than 1.5 ms. The sensor LED activation function is latched (steady light). To clear the LED, the "SET" button should be pressed.

In case of a loose sensor wire and binary input wires or configuration mismatch (new sensor attached without running auto-configuration system setup (see Section 3.3.1) situation, the corresponding LED for that sensor will start flashing and the ERROR LED will activate.

The Binary I/O LEDs indicate the I/O-line status. If any of the lines become active for more than 1.5 ms, the corresponding LED will turn on (latch).

In a trip situation, the corresponding trip LED will turn on. Trip outputs are controlled by the dipswitch settings (see Section 3.5).

All activation and trip indication LEDs are latched, even if the dipswitch setting is in the non-latched mode. They have to be cleared by pushing the "SET" button.

LED indications are stored in non-volatile EPROM memory for identifying the trip information in case the auxiliary power is lost. When re-powering the relay after power supply loss, the actual LED status can be visualized from the front of the relay.

3.2 LED operation quick guide

Table 1. LED operation quick guide.

LED	Off	Steady On	Blinking	Action if Abnormal
POWER - Blue	Auxiliary supply disconnected.	Auxiliary power connected.	N/A	Check the power source.
ERROR - Red	System healthy.	System failure.	Configuration mismatch. Protection partly operational.	Verify system condition. See Sections 11: Troubleshooting guide and 5: System self-supervision.
T1, and T3 - Red	Normal status.	Trip relays T1 and T3 activated.	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button.
T2, and T3 - Red	Normal status.	Trip relays T2 and T3 activated.	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button.
BI1 - Amber	CB open.	CB closed.	Loose connection/dipswitch mismatch.	Check the binary input wiring/dipswitch setting.
BI2 - Amber	CB closed.	CB open.	Loose connection/dipswitch mismatch.	Check the binary input wiring/dipswitch setting.
BI3 - Amber	CB open.	CB cLosed.	Loose connection/dipswitch mismatch.	Check the binary input wiring/dipswitch setting.
BI4 - Amber	CB closed.	CB open.	Loose connection/dipswitch mismatch.	Check the binary input wiring/dipswitch setting.
BI5 - Amber	Normal status.	Current/MT indication.	Binary input 5 has loose connection.	Check the binary input wiring.
BI6 - Amber	Normal status.	Blocking signal input..	Binary input 6 has loose connection.	Check the binary input wiring.
BO1 - Amber	Normal status.	Light > output.	N/A	N/A
BO2 - Amber	Normal status.	Blocking signal high.	N/A	N/A
S1 - Amber	Normal status.	Sensor channel 1 activated by light information	Sensor channel 1 has loose connection or the system set-up was not performed. Also activated by pressure information (if L+P sensors used).	Check why the sensor activated, check the sensor wire connection, or perform the system set-up (see Section 3.3.1: Auto-configuration (System setup).
S2 - Amber	Normal status.	Sensor channel 2 activated by light information.	Sensor channel 2 has loose connection or system set-up not performed. Also activated by pressure information (if L+P sensors used).	Check why the sensor activated, check the sensor wire connection, or perform system set-up (see Section 3.3.1: Auto-configuration (System setup).
S3 - Amber	Normal status.	Sensor channel 3 activated by light information.	Sensor channel 3 has loose connection or system set-up not performed. Also activated by pressure information (if L+P sensors used).	Check why the sensor activated, check the sensor wire connection, or perform system set-up (see Section 3.3.1: Auto-configuration (System setup).
S4 - Amber	Normal status.	Sensor channel 4 activated by light information	Sensor channel 4 has loose connection or system set-up not performed. Also activated by pressure information (if L+P sensors used).	Check why the sensor activated, check the sensor wire connection, or perform system set-up (see Section 3.3.1: Auto-configuration (System setup).

3.3 Push-button description

The EAFR-101C contains one single push-button (SET) that can be used for all operational functions of the relay. The push-button is used to initialize the auto-configuration of the system (see Section 3.3.1) and for resetting the indicators and latched output relays.

3.3.1 Auto configuration (System setup)

When all sensors and binary lines have been connected, an auto-configuration procedure must be executed. The initialization sequence is performed by pressing the "Set" button for two seconds. The EAFR-101C sensor LEDs and all binary LEDs start blinking. The relay scans these inputs to see if they are connected and when an input is detected, the corresponding LEDs are illuminated to mark that a connection was found. The inputs without connection continue blinking during the remaining three seconds. After five seconds, all LEDs are turned off. During this system setup, the dipswitch setting are also stored in non-volatile memory.

All sensor inputs will remain operational even when they are not auto-configured. The auto-configuration is only used for self-supervision purposes.

Note: To redo auto-configuration for a relay containing fewer connections (binary inputs/outputs or sensors) than in a previously memorized set-up, a dipswitch (any one) must be moved back and forth prior to performing auto-configuration. The timeout allowing a new configuration is one minute. Reconfiguration with more connections is allowed without moving a dipswitch.

3.4 Reset

All LED indications and latched trip relays are reset by pressing the "SET" button for one second. Otherwise, the latched trip relays will remain activated until auxiliary power is disconnected. All LED indications will remain active until reset is performed by the operator, even when auxiliary power supply is disconnected (see Section 3.6: Non-volatile memory).

3.5 Dipswitch settings

EAFR-101C functionality, such as tripping logic, is configured using dipswitch settings. Different trip configurations can be easily programmed by selecting the appropriate dipswitch positions. This gives users the flexibility to change settings dependent on the application. Tripping may be selected based on arc light only or arc light and current thresholds. Current threshold or other tripping criteria may be applied to binary input BI1 for blocking a trip caused by natural light sources. Dipswitches 1 and 2 are used as configuration selection. Dipswitch 3 is for configuring BI5 to operate as a Master Trip input or as a current information input. Dipswitch 4 and 5 are for setting binary input pairs 1-2 and 3-4 as active or inactive. If a circuit breaker is connected to a binary input pair, the respective dipswitch should be set to ON. Dipswitch 6 sets whether trip relay outputs T1 and T2 latch or activate momentarily. Dipswitches 7 and 8 set whether sensor channels 1/2 and 3/4, respectively, pick up on light only or on light and current.

Dipswitches are located at the back of the relay for easy access (see Figure 3: EAFR-101C Dipswitch SW1 and Table 2: EAFR-101C dipswitch setting selection for details of settings).

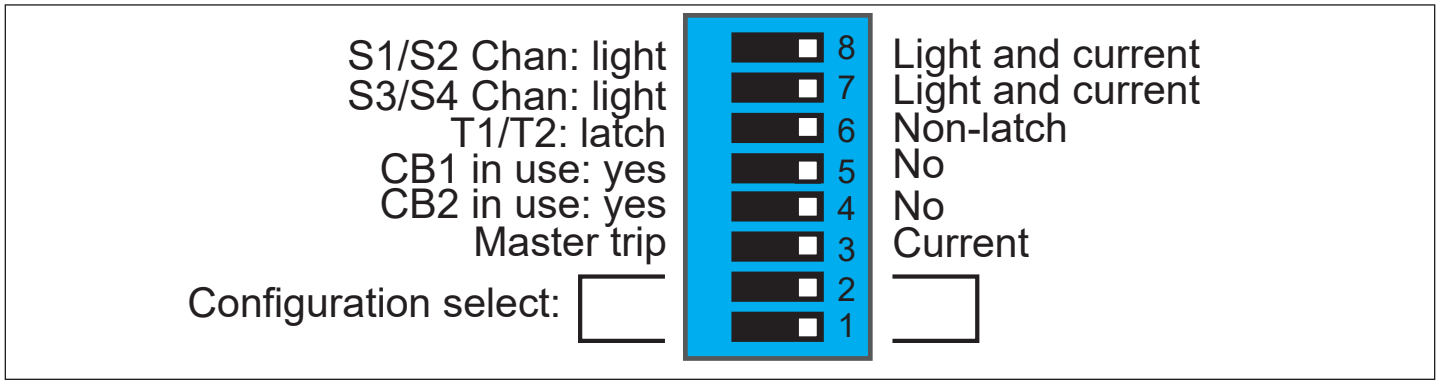

Figure 3. EAFR-101C dipswitch SW1.

Table 2. EAFR-101 dipswitch setting selection.

Dipswitch	Function selection	ON (left position)	OFF (right position)
8	Point sensor channels S1,S2 trip criteria.	Trip on light only. (L)	Trip on light and over-current. (L+C) Both signals are required simultaneously to trip.
7	Point sensor channel S3,S4 trip criteria.	Trip on light only. (L)	Trip on light and over-current. (L+C) Both signals are required simultaneously to trip.
6	Latch or non-latch for trip relays T1 and T2.	T1 and T2 operate as latched.	T1 and T2 operate as non-latched.
		Note: Trip relay T3 is always latched. Binary output BO1 (light out) function is always non-latched.	
5	Binary Input 1 & 2 activation. CB in use/ not in use.	CB in use.	CB not in use.
4	Binary Input 3&4 activation. CB in use/ not in use.	CB in use.	CB not in use.
3	Binary Input 5 function selection.	Master trip.	Current.
2	Configuration selection.		
1	Configuration selection.		

4 Arc sensors

The EAFR series provides the choice of different types of arc sensors to be utilized in different units and different switchgear types, according to the specific application requirements. Available sensor types are arc light point sensors and arc light fiber optic loop sensors.

Arc light point sensors are typically installed in metal enclosed compartments, providing quick accurate location of the faulted area. Arc light fiber loop sensors are installed typically to cover a wider protected area with one fiber when no need for more exact fault location exists. The EAFR-101C only accepts light point sensors.

4.1 Arc light point sensor EAFR-01

The EAFR-01 is an arc light point sensor with a light sensitive photodiode element activated by receiving arc light. The EAFR-01 arc sensors should be mounted in the switchgear cubicles in such a way that the light sensitive part can receive light from the protected area.

The fixed light sensitivity of the EAFR-01-A sensor is 8,000 Lux. The sensor does not require any user settings. The point sensor's light detection radius is 180 degrees. Other point sensors are available with different Lux sensitivities: EAFR-01-B at 25,000 Lux and EAFR-01-C at 50,000 Lux.

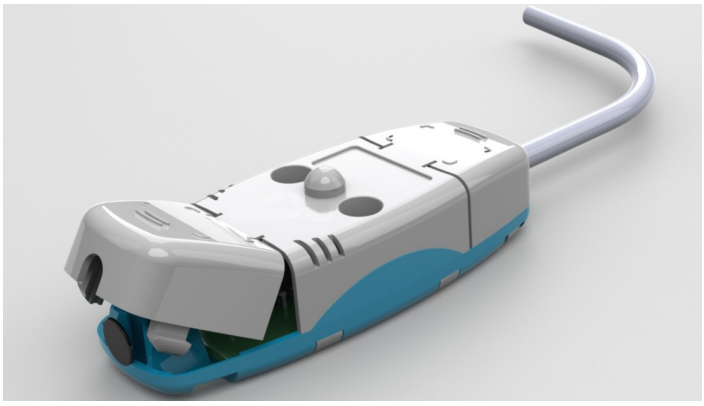

Figure 4. EAFR-01 arc light point sensor.

4.1.1 EAFR-01 installation and wiring

The EAFR-01 point sensor can be installed either on or through the compartment wall. An example of on the wall mounting is seen in Figure 55. The EAFR-01 is fixed against the wall using two screws. The same screw pattern is utilized in a through wall mounting arrangement. In this arrangement, the unit is turned around and the point of the eye of the photodiode sensor protrudes through a small hole cut in the wall. The point of the sensor now faces the compartment to be protected. This allows for the body of the sensor and cabling to be located outside the compartment. For both types of installation, two screws are attached from the back side of the sensor. No external mounting plates are needed.

The EAFR-01 cable connectors are located beneath the covers that can be conveniently detached for fastening the sensor wires. The cover will be attached after installing the wires. The cable connectors are located at both ends of the sensor for series connecting a maximum three sensors in one line.

Figure 5. EAFR-01 point sensor mounted to the compartment wall.

Table 3. 100 Ω Compatible.

Manufacturer	Part no.	Data AWG	Cable diameter mm (in.)	Temperature rating °C (°F)	Voltage rating
Belden	9154	20	5.03 (0.198)	-20/+80 (-4/+176)	300 V

4.1.2 EAFR-01 point sensor technical data

Table 4. EAFR-01 point sensors technical data.

Light intensity threshold	8,000 Lux/25,000 Lux/50,000 Lux
Detection radius	180 degrees
Mechanical protection	IP 64
Sensor wiring arrangement	Two wires and shield
Sensor cable specification	Shielded twisted pair 0.52 mm^2 (0.0008 $in.^2$)
Maximum sensor cable length per sensor channel	200 m (656 ft)
Operating temperature	-20 to 85°C (-4 to 185°F)

5 System self-supervision

The EAFR-101C includes an extensive self-supervision feature. Self-supervision includes both internal functions and external connections. The self-supervision module monitors power supply, hardware, and software malfunctions, and binary input connection and sensor problems. Dipswitch settings are also supervised by comparing the actual value with stored non-volatile memory data (see Section 3.3.1: Auto configuration [System setup]).

In a healthy condition, the POWER LED is on and the System Failure (SF) relay is energized. If the self-supervision function detects a faulty condition or the power supply fails, the self-supervision relay is released and the ERROR LED is illuminated.

If a sensor failure occurs, the relay will go into ERROR mode. The ERROR LED will illuminate, the SF relay will release, and the corresponding faulty SENSOR CHANNEL LED will start blinking. In this situation, the relay is still in the protection mode, but with the faulty sensor channel blocked. If the error is resolved, the ERROR LED will automatically clear the SF-status and failed SENSOR CHANNEL LED will remain in blinking status. This means that the SF relay will energize and the ERROR LED will turn off. If one or more of the sensors are disconnected, the healthy sensors remain in use and relay remains operational. The EAFR-101C will remain in error mode until the disconnected sensors are repaired.

If a dipswitch setting is changed after the auto-configuration function (see Section 3.3.1: Auto configuration [System setup]) has been executed, the relay will go into SF alarm mode. The configured (stored) setting is however still valid and the relay is still operational.

6 Application examples

The EAFR-101C may be applied to a variety of power switchgear layouts. Please refer to IB0191003EN, manual for standard arc configurations in low voltage switchgear.

7 Connections

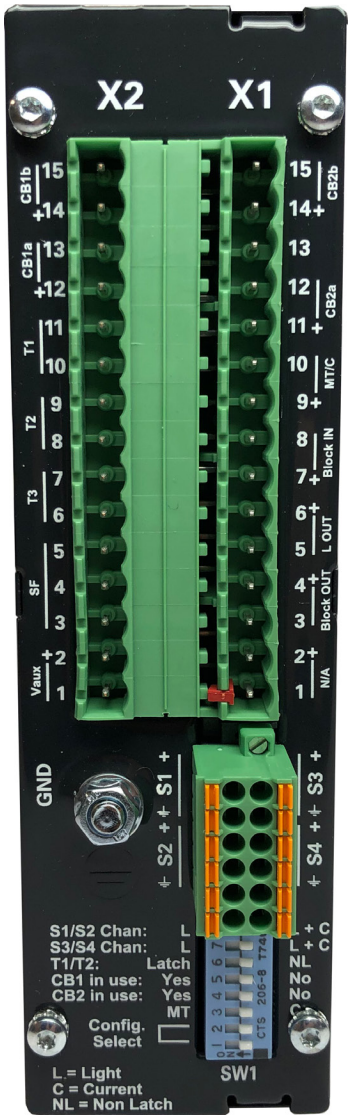

Figure 6. EAFR-101C terminals at the rear plate.

7.1 Outputs

7.1.1 Trip relays T1, T2, and T3

The EAFR-101C relay has integrated trip relays T1 and T2 for tripping of the circuit-breakers. T1 and T2 relays are normally open type (NO) relays.

Trip relay T3 is a (NO) trip relay that operates anytime the T1 or T2 relay operates and can be used either for tripping one more disconnecting device or for a trip alarm to local or remote monitoring and alarming system.

7.1.2 Binary output BO1, and BO2

Two binary outputs are available (+ 24 Vdc). BO1 is the light signal output to connected EAFR-110PLV relays. This output activates when light is received on one of the light sensor inputs. BO2 is the Block Out signal. This output activates when either of the connected circuit breakers opens. This sends the blocking signal to all other connected EAFR-110C relays. For more information on the blocking signal, see Section 7.2.2 Circuit breaker binary inputs BI1,BI2, BI3, and BI4.

Note: The binary output is polarity sensitive (see IB0191003EN).

7.1.3 System failure (SF) relay

The SF relay is a form C type (NO/NC) and is energized in the healthy condition. Whenever the EAFR-101C detects a system error or disconnection of the auxiliary power supply, the contact changes its state. The state of the SF relay remains the same until the EAFR-101C returns to a healthy condition and SF relay is again energized.

7.2 Inputs

7.2.1 Arc sensor channels S1, S2, S3, and S4

The EAFR-101C has four arc point sensor channels. A maximum of three arc point sensors (type EAFR-01) may be connected to each channel.

For details on sensors refer to Section 4: Arc sensors.

7.2.2 Circuit breaker binary inputs BI1, BI2, BI3, and BI4

The EAFR-101C contains six binary inputs. The inputs are activated by connecting a dc signal exceeding the specified nominal threshold level of the corresponding input. The nominal threshold level is 24 Vdc. The actual activation of the binary input occurs at 80% of the specified nominal threshold value (i.e. 16 Vdc).

BI1 and BI2 are reserved for the breaker open/close status information. When an air-insulated circuit breaker interrupts a fault, high current is present, as is light from the arc chutes on the circuit breaker, and the EAFR system may operate as if this event were an arc flash. If the CB has outputs that give indication of an opening operation before the primary contacts part, these outputs can be connected to BI1 + BI2 or BI3 + BI4. If an input is received on either of these two input pairs, the EAFR-101C restrains sending any light information out on BO1 for 50 ms. This gives the circuit breaker long enough time to clear the fault. Also at the time of input, the EAFR-101C outputs a blocking signal on BO2 to all other connected EAFR-101C relays. This communicates to the other relays in the system to also restrain passing light information out for 50 ms. After 50 ms, if any light is still present, the EAFR-101C will then give a light out signal on BO1. This blocking operation only occurs when a connected circuit breaker opens. A normally open (Form a) and normally closed (Form b) output is required from each connected circuit. This is for signal redundancy and error checking. If the input is the same on BI1 and BI2, or on BI3 and BI4, the self-supervision relay is released and the ERROR LED is illuminated. The corresponding LED's for the circuit breaker input will blink synchronously on the front of the EAFR-101C.

If a circuit breaker will be taken out of service for an extended period, it is advisable that the input for that circuit breaker be disabled. This is done via the dipswitches on the rear of the EAFR-101C. For details on dipswitch settings, refer to Section 3.5 Dipswitch settings.

7.2.3 Binary inputs BI5 and BI6

BI5 is the Master Trip/Current input. If set to Master Trip, upon receipt of this input the EAFR-101C will trip without other conditions being present. If set to Current, this input is permissive to tripping if any light signal is received on light sensor channels set to Light and Current (see section 3.5 Dipswitch settings).

BI6 is the Block In input. If a signal is received on this input, the EAFR-101C will restrain any light signal received for 50 ms. This input should be connected to the Block Out BO2 from all other connected EAFR-101C relays (refer to IB0191003EN).

7.3 Auxiliary voltage

The auxiliary power supply voltage is (110-220) Vac/(125-250) Vdc. After powering up the relay, protection is active and operational within 50 ms.

An optional 18-72 Vdc power supply is also available.

8 Dimensions and installation

The EAFR-101C is either door mounted or panel mounted in standard, 19 in. (482.6 mm) rack (height of 4U and 1/8 of a unit wide).

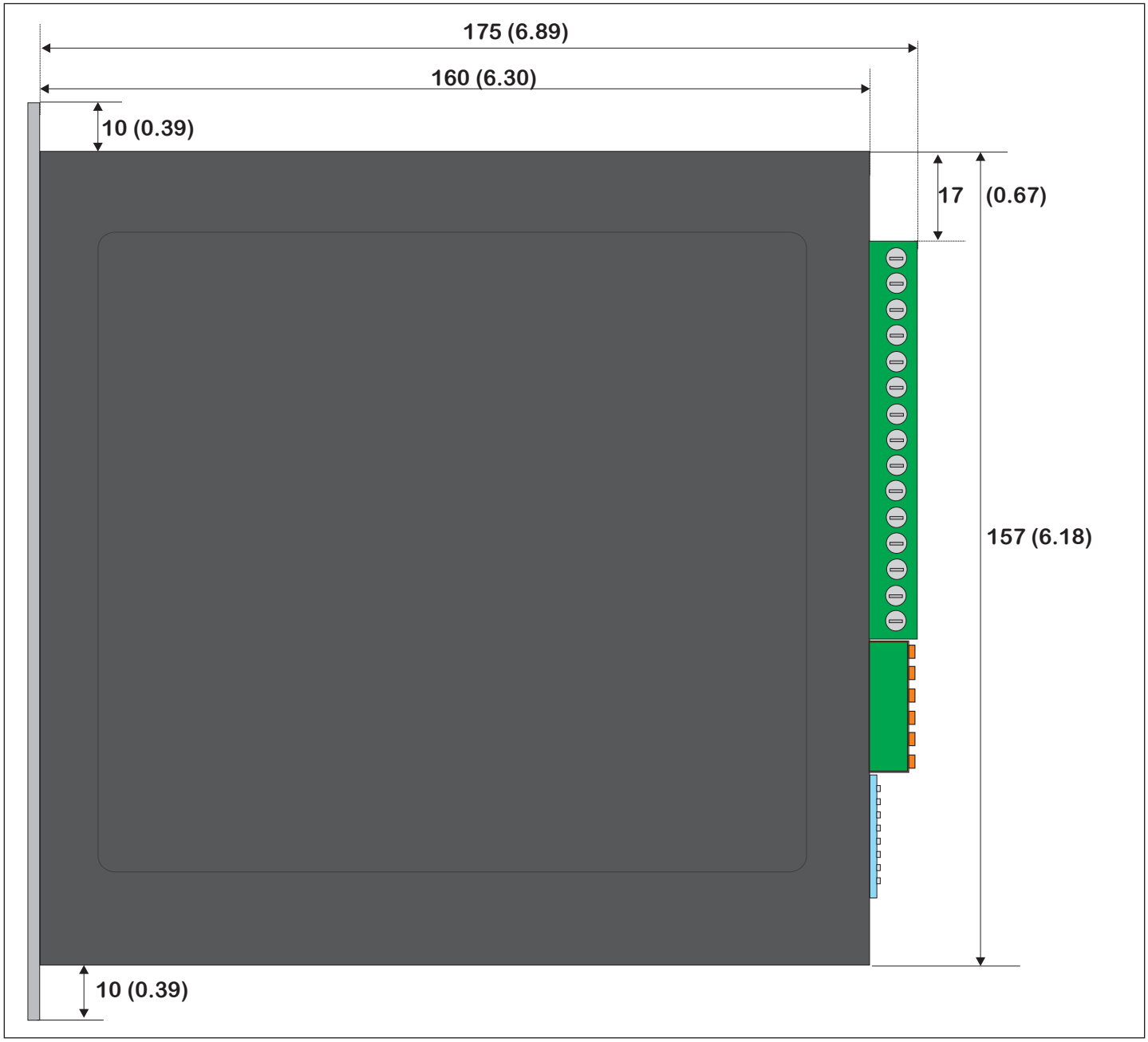

Figure 7. EAFR-101C dimensions in millimeters (in.) (side view).

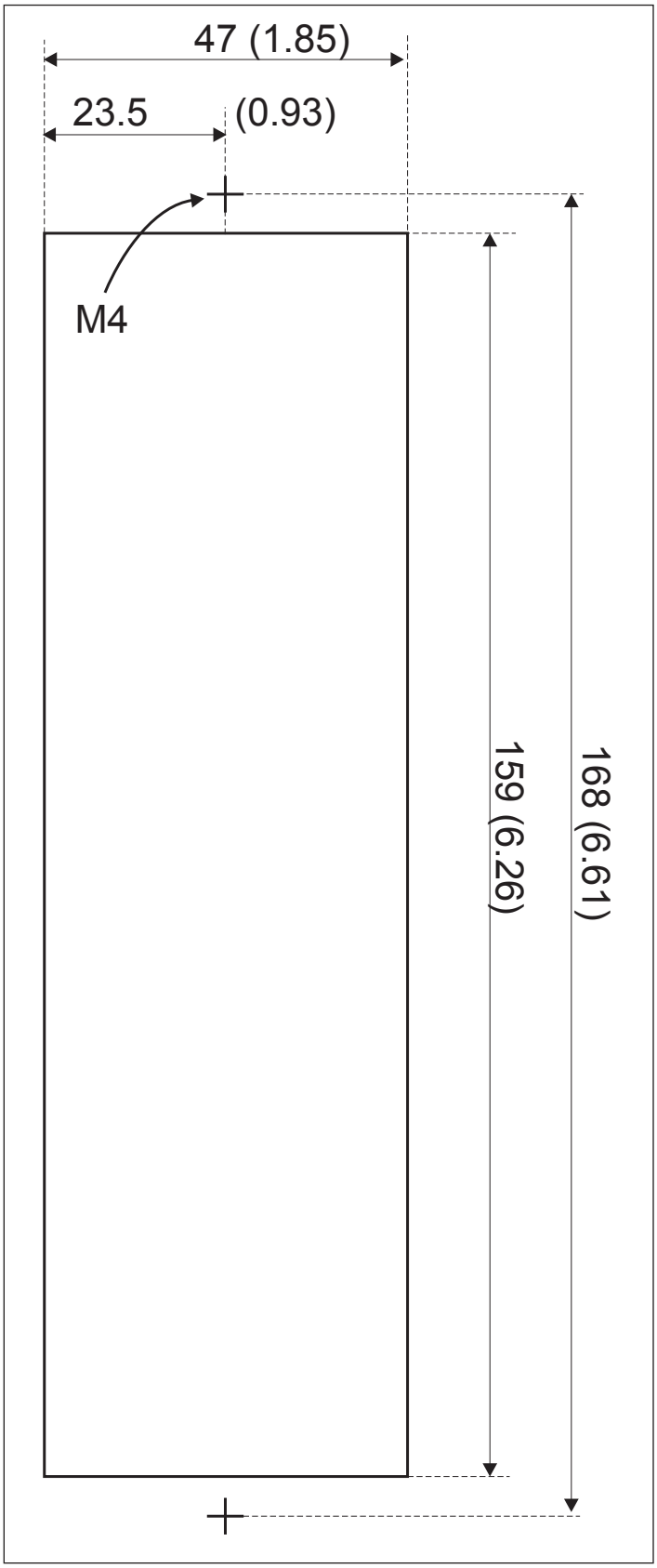

Figure 8. EAFR-101C cut out for panel mounting (mm [in.]).

9 Testing

It is recommended that the EAFR-101C relay be tested prior to substation energizing. Testing is carried out by simulating arc light to each sensor and verifying the tripping and LED indication. For arc light simulation, a suitable light source is provided as part of the Eaton AQS Tester kit. If an AQS Tester is not present, a camera flash can be used. A Canon Speedlite® 430EX or equivalent works well. Check that the light source has fully charged battery(ies) when testing.

9.1 Carrying out testing in the light only mode

1. Check that the dipswitch setting positions are in accordance to your application.
2. Activate the light source close to the EAFR-01 to be used.
3. Verify that the corresponding sensor channel indication LED status is changed to ON.
4. Verify the relay output(s) activation(s) by checking the circuit breaker status or by monitoring trip contact status. If a circuit breaker is connected to a trip output, the circuit breaker should open or contacts operate.

Note: A best practice is to operate the circuit breaker during testing.

5. Verify that the corresponding relay output(s) LED(s) indication status is changed to ON.
6. If the binary output (BO1) signal is utilized, verify the BO1 signal activation by the status change of the relevant input where the binary output signal is connected, or by measuring the signal output voltage.

Note: The BO1 signal is a non-latched type.

7. If a binary output signal is utilized, verify that the BO1 LED is illuminated.
8. Press the SET push-button to reset all indications and latches.

9.2 Carrying out testing in light and current mode

1. Check that the dipswitch setting positions are in accordance with your application.
2. Activate the light source close to the EAFR-01 to be used and simultaneously activate the binary input BI5 used for overcurrent condition. BI5 activation may be done by supplying current to a connected EAFR-110PLV (see AQS Tester Manual IB019011EN).
3. Verify that the sensor channel indication LED status is changed to ON.
4. Verify that the binary input indication LED status is changed to ON.
5. Verify the relay output(s) activation(s) by checking the circuit breaker status or by monitoring trip contact status.

Note: A best practice is to operate circuit breaker at testing. The circuit breaker should open or the contacts should operate.

6. Verify that the corresponding relay output(s) LED(s) indication status is changed to ON.
7. If a binary output (BO1 and BO2) signals are utilized, verify the BO signal activation by status change of relevant input where binary output signal is connected, or by measuring the signal output voltage.
8. Verify that the corresponding relay output(s) LED(s) indication status is changed to ON
9. Press the SET push-button to reset all indications and latches.

9.3 Test plan example

Date:_____

Substation:_____

Switchgear:_____

EAFR-101C serial number:_____

Preconditions	Light only	Light + current	Remarks
Sensor channels 1 and 2 setting			
Sensor channels 3 and 4 setting			

Object activated	LED indication	T1, T2, and T3 active	BO1 active	BO2 active
Sensor channel 1	Sensor 1			
	Sensor 2			
	Sensor 3			
Sensor channel 2	Sensor 1			
	Sensor 2			
	Sensor 3			
Sensor channel 3	Sensor 1			
	Sensor 2			
	Sensor 3			
Sensor channel 4	Sensor 1			
	Sensor 2			
	Sensor 3			
BIN 1				
BIN 2				
BIN 3				
BIN 4				
BIN 5				
BIN 6				

Tested by:	
Approved by:	

10 Troubleshooting guide

Table 5. Troubleshooting guide

Problem	Check	Cross Reference
Sensor does not activate when testing.	Sensor cable wiring	Section 4 of this manual
	Camera (or other test equipment) flash intensity	Section 10 of this manual
Trip relay(s) does not operate even if sensor is activated.	Dipswitch settings	Section 3.5 of this manual

11 Technical data

11.1 Protection

Trip time using mechanical trip relays.	7 ms*
Reset time (arc light stage).	2 ms
Protection operational after power up.	88 ms
* = Total trip time using arc light or phase/residual over-current from EAFR-110 and arc light.	

11.2 Auxiliary voltage

Vaux	(110-220) Vac / (125-250) Vdc ± 20%
Maximum interruption	100 ms
Maximum power consumption	5 W
Standby current	90 mA

11.3 Trip relays T1, T2, and T3

Number	3 NO
Rated voltage	250 Vac/dc
Continuous carry	5 A
Make and carry for 0.5 s	30 A
Make and carry for 3 s	16 A
Breaking capacity DC, when time constant L/R=40 ms	40 W; 0.36 A at 110 Vdc
Contact material	AgNi 90/10

11.4 Binary output BO1 and BO2

Rated voltage	+24 Vdc
Rated current	20 mA (max)
Number of outputs	23

11.5 Binary inputs BI1, BI2, BI3, BI4, BI5, and BI6

Rated voltage	+24 Vdc
Threshold pick up	≥ 16, 88, or 178 Vdc
Threshold drop off	≤ 15, 75, or 155 Vdc
Rated current	3 mA
Number of inputs	6

11.6 Disturbance tests

EMC test	CE approved and tested according to EN 50081-2, EN 50082-2
Emission - Conducted (EN 55011 Class A)	0.15 - 30 MHz
- Emitted (EN 55011 Class A)	30 - 1,000 MHz
Immunity - Static discharge (ESD) (according to IEC244-22-2 and EN61000-4-2, severity Class 4)	Air discharge 15 kV contact discharge 8 kV
- Fast transients (EFT) (according to EN61000-4-4, Class III and IEC801-4, Level 4)	Power supply input 4 kV, 5/50 ns Other inputs and outputs 4 kV, 5/50 ns
- Surge (according to EN61000-4-5 [09/96], Level 4)	Between wires 2 kV / 1.2/50 µs Between wire and earth 4 kV / 1.2/50 µs
- RF electromagnetic field test (according to EN 61000-4-3, Class III)	f = 80 ... 1,000 MHz 10 V/m
- Conducted RF field (according to EN 61000-4-6, Class III)	f = 150 kHz ... 80 MHz 10 V

11.7 Voltage tests

Insulation test voltage Acc - to IEC 60255-5	2 kV, 50 Hz, 1 min
Impulse test voltage Acc - to IEC 60255-5	5 kV, 1.2/50 us, 0.5 J

11.8 Mechanical tests

Vibration test	10 to 150 Hz, 0.07 mm (.003 in.), 0.5 gn (60 to 150 Hz) 10 to 150 Hz, 1 gn (10 to 150 Hz)
Shock/bump test acc. to IEC 60255-21-2	20 g, 1,000 bumps/dir.

11.10 Environmental conditions

Specified ambient service temp. range	-35 to 70°C (-31 to 158°F)
Transport and storage temp. range	-35 to 70°C (-31 to 158°F)
Relative humidity	Up to 97%

12 Ordering codes

Eaton catalog number	Eaton style number	Part number description
EAFR-110P	65C2010G01	Current, point sensor unit
EAFR-110F	65C2010G02	Current, fiber loop sensor unit
EAFR-101	65C2010G03	Point sensor unit
EAFR-101C	65C2010G18	Point sensor unit with circuit breaker inputs
EAFR-101D	65C2010G04	Point sensor unit, DIN rail mounted
EAFR-102	65C2010G06	Fiber loop sensor unit
EAFR-110PB	65C2010G07	Current, point sensor unit, NC trip relay
EAFR-110FB	65C2010G08	Current, fiber loop sensor unit, NC trip relay
EAFR-101B	65C2010G09	Point sensor unit, NC trip relay
EAFR-101DB	65C2010G10	Point sensor unit, DIN rail mounted, NC trip relay
EAFR-102B	65C2010G11	Fiber loop sensor unit, NC trip relay
EAFR-01-A	65C2011G01	Arc light point sensor - 8,000 Lux
EAFR-01-B	65C2011G02	Arc light point sensor - 25,000 Lux
EAFR-01-C	65C2011G03	Arc light point sensor - 50,000 Lux
EAFR-06-10	65C2013G01	Arc light plastic fiber sensor - 10 m (32.81 ft)
EAFR-06-15	65C2013G02	Arc light plastic fiber sensor - 15 m (49.21 ft)
EAFR-06-20	65C2013G03	Arc light plastic fiber sensor - 20 m (65.62 ft)
EAFR-06-25	65C2013G04	Arc light plastic fiber sensor - 25 m (82.02 ft)
EAFR-06-30	65C2013G05	Arc light plastic fiber sensor - 30 m (93.43 ft)
EAFR-06-35	65C2013G06	Arc light plastic fiber sensor - 35 m (114.83 ft)
EAFR-06-40	65C2013G07	Arc light plastic fiber sensor - 40 m (131.23 ft)
EAFR-07-10	65C2014G01	Arc light glass fiber sensor - 10 m (32.81 ft)
EAFR-07-15	65C2014G02	Arc light glass fiber sensor - 15 m (49.21 ft)
EAFR-07-20	65C2014G03	Arc light glass fiber sensor - 20 m (65.62 ft)
EAFR-07-25	65C2014G04	Arc light glass fiber sensor - 25 m (82.02 ft)
EAFR-07-30	65C2014G05	Arc light glass fiber sensor - 30 m (93.43 ft)
EAFR-07-35	65C2014G06	Arc light glass fiber sensor - 35 m (114.83 ft)
EAFR-07-40	65C2014G07	Arc light glass fiber sensor - 40 m (131.23 ft)
EAFR-07-45	65C2014G08	Arc light glass fiber sensor - 45 m (147.64 ft)
EAFR-07-50	65C2014G09	Arc light glass fiber sensor - 50 m (164.05 ft)
EAFR-08-10	65C2015G01	Arc light glass fiber sensor (high temperature) - 10 m (32.81 ft)
EAFR-08-15	65C2015G02	Arc light glass fiber sensor (high temperature) - 15 m (49.21 ft)
EAFR-08-20	65C2015G03	Arc light glass fiber sensor (high temperature) - 20 m (65.62 ft)
EAFR-08-25	65C2015G04	Arc light glass fiber sensor (high temperature) - 25 m (82.02 ft)
EAFR-08-30	65C2015G05	Arc light glass fiber sensor (high temperature) - 30 m (93.43ft)
EAFR-08-35	65C2015G06	Arc light glass fiber sensor (high temperature) - 35 m (114.83 ft)
EAFR-08-40	65C2015G07	Arc light glass fiber sensor (high temperature) - 40 m (131.23 ft)
EAFR-08-45	65C2015G08	Arc light glass fiber sensor (high temperature) - 45 m (147.64 ft)
EAFR-08-50	65C2015G09	Arc light glass fiber sensor (high temperature) - 50 m (164.05 ft)

Notes:

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1000 Eaton Boulevard
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Printed in USA
Publication No. IB0191002EN / TBG001479
November 2019

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