

EXHIBIT 2

Technical Description



**Retlif Testing Laboratories**

REPORT No. R-3240N  
FCC ID: BWN-1548

## 1548 Radio Faulted Circuit Indicator Introduction and Technical Description

Fisher Pierce's radio Faulted Circuit Indicators are devices that are attached to the electric utilities distribution lines and when there is a fault, i.e., a downed power line will activate and begin transmitting a radio signal to indicate that an emergency exists and what phase A, B, C or TAP is affected. The transmitter will transmit a signal every 5 seconds for a period of four (4) hours when they will reset and stop transmitting. Some version will not reset until the line is restored and will operate during the pendency of the alarm condition. A 3.6 Volts battery powers the transmitter circuit. The utilities make a great effort to maintain their distribution systems; therefore this radio faulted circuit Indicator does not transmit very often, if ever.

There is single printed circuit board and copper shield board in the housing which are securely mounted in their respective locations. At final assembly the factory ultrasonically welds the housing with cover so that the unit cannot be accessed by the customers. One control board is included fault sensing and transmitter, the other board is copper shield board for hi voltage.

On the control board there are CMOS inverts U1,U3,U4 to provide current sensing and signal conditions, and 8 bits microcontroller U2 provide logical functions and data for transmitter circuit.

The microcontroller operates at 400 kHz, the encoder output of the microcontroller is a PWM series of 9 bits generator. The first 5 address bits are fixed and the last four will indicate the phase (A,B,C or TAP) in any case the worst case duty cycle is less than 40%.

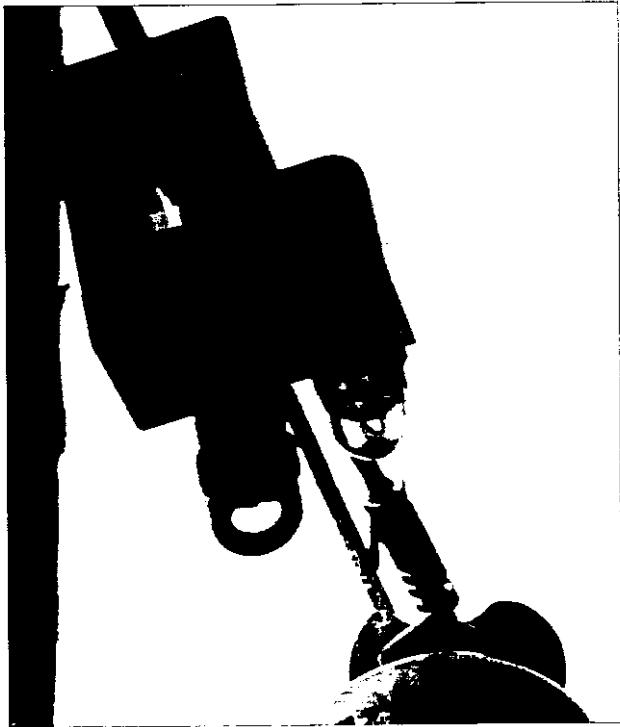
The oscillator of the microcontroller is shut off, because the microcontroller is put on the sleep mode. The only oscillator running and the transmitter operates when the faults on the distribution occurred.

The transmitter is a modified Colpits oscillator with its collector tank circuits turned to 312.0 MHz. It employs ON/OFF keying that turns the oscillator on and off. The frequency is a SAW device U6 with the frequency specification.

Center Frequency:	312.0 MHz $\pm$ 100 kHz
Temperature Stability:	FTC 0.032 ppm/ $^{\circ}$ C square
Frequency Aging:	$\leq$ 10 ppm/yr
Loaded Q:	2000

Please note that this device operates pursuant to FCC Rules section 15.231 (a)(4) which allows continuous transmission under emergency conditions. A power outage may be described as an emergency that may directly pose potential threats such as fire, security or safety of life.

### OVERHEAD FAULTED CIRCUIT INDICATORS UP TO 69kV



Strobe Display



LED or Radio and LED Indication

#### Application:

The Series 1548 Faulted Circuit Indicator is designed for single phase overhead applications. Standard features include replaceable lithium battery and improved C-Clamp hotstick mount with automatic torque limiting which guarantees proper mounting on conductors with diameters from .2 to 1.2 inches.

The 1548 incorporates choices of LED, Radio, Flag or Strobe Light Fault Indication, Standard, Inrush or "Adaptive Trip" Circuit Logic and both Time and Current Reset Options.

#### Mechanical Features:

- Replaceable Long-Life Lithium Battery (Flag Excluded).
- Hot Stick Mount (Torque Controlled).
- UV-Stable High Impact Plastic Housing.
- Viewable Indication from 360 Degrees (Strobe or LED).
- Reliable Operation in all Weather Conditions.

#### Conductor Size Calibration Selection:

- .5, .75 or 1 inch Cable Calibration Selections Available.

#### Electrical Features:

- "Adaptive" or Standard Current Trip with Logic Inrush Restraint Options.
- Adaptive Trip logic eliminates the need for trip rating selection.
- Load Current and/or Time Reset of Indicator.
- Manual Trip and Reset using Magnet Reset Tool.

#### Indication Options:

- Xenon Strobe, nominal 10 flashes per minute.
- High Intensity LED, nominal 30 flashes per minute.
- LED and Radio Signal, nominal 12 per minute.
- Flag

## Specifications

**Continuous Withstand Load:** 1000 amp max

**Operating Temperature:** -40° to +85°C

**Reset Time Accuracy:** +/- 10% @ 23°C

**Current Reset:** 3 amps minimum (strobe, radio, LED, Flag)

**Trip Current Level:** 50 to 1500A (Customer specified or Adaptive Trip)

**Trip Accuracy:** +/- 10% @ 23°C (Calibrated on selected cable diameter)

**Fault Withstand:** 25kA for 10 cycles (per ANSI/IEEE 495-1986)

**Battery:** Replaceable, 10+ yr Lithium Cell

(Flag model non-replaceable)

**Operating Life:** @ 23°C LED: 1000 operating hours

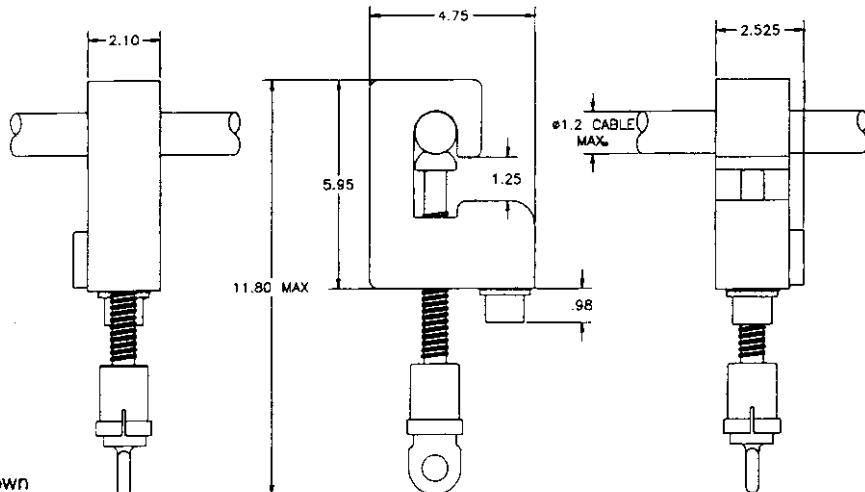
Strobe: 120 operating hours

Radio: 800 operating hours

**Housing:** Lexan 143, UV-stable polycarbonate

**Cable Diameter:** 0.2 to 1.2 inch

## Mechanical Data (All dimensions in inches.)



Indicator with LED shown

## Ordering Information

1548FH - C 2 C 3 - R - A - A  
 (1) (2) (3) (4) (5) (6) (7) (8)

Code	Basic Model
1548FH	Single Phase Faulted Circuit Indicator. Hotstick Mount. Up to 44KV System Voltage, Phase to Phase.
1548FX	Single Phase Faulted Circuit Indicator. Hotstick Mount. Up to 69 KV System Voltage, Phase to Phase. LED and/or Radio Indication Only.

Code	Trip Current
N	Adaptive Trip (3-800 amps)
0.5	50 Amp
1	100 Amp
2	200 Amp
3	300 Amp
4	400 Amp
5	500 Amp
6	600 Amp
8	800 Amp
10	1000 Amp
12	1200 Amp
15	1500 Amp

Code	Factory Code
A	Series 1548 As Released

Code	Transmitter Phase Encoder
A	Phase A
B	Phase B
C	Phase C
T	Tap
N	No transmitter available for code F, T, L of Section 6

Code	Indicator Options
L	Ultra Bright LED
T	Strobe Light (not available with 1548FX model)
R	Radio with LED
F	Flag (not available with 1548FX model)

Code	Cable Diameter Factory Calibration
1	.5 Inch Cable
2	.75 Inch Cable
3	1.0 Inch Cable (standard for all adaptive models)

For 2hr, 8hr or other customer specified time delay periods. Consult Factory.  
 Manual test and reset included as standard

Specifications are subject to change.



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