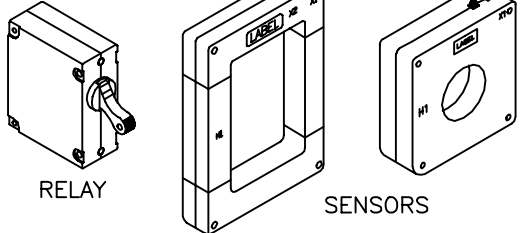
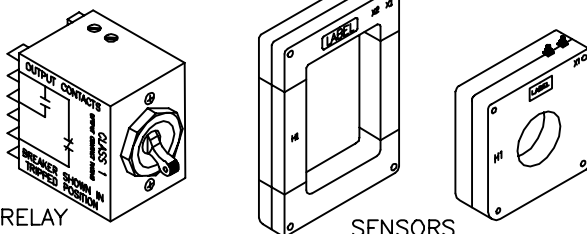
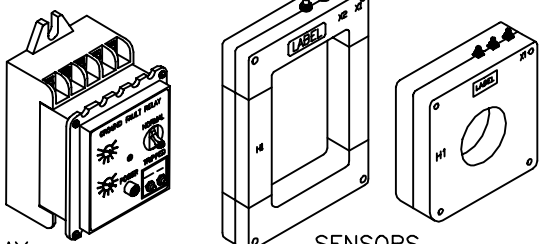
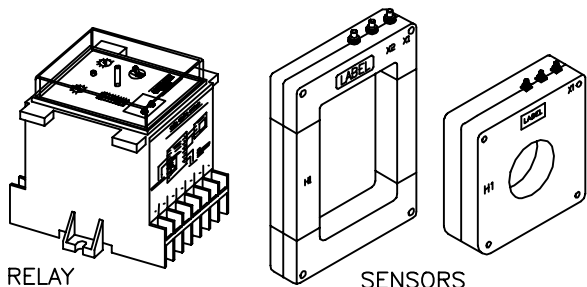
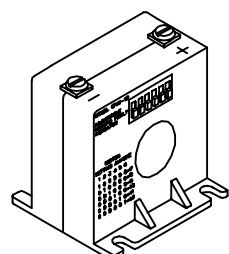
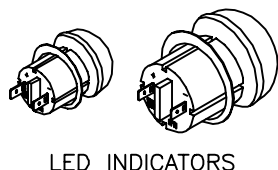


# ELECTRONIC PRODUCTS

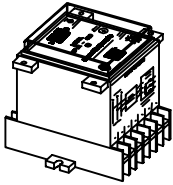
## Ground Fault Systems

GROUND FAULT SYSTEMS				
<b>MODEL GFA</b>	 <p>RELAY</p> <p>SENSORS</p>	<b>TRIP CURRENTS</b> 10, 15, 20, 75A	<b>APPLICATION</b> GENERAL DUTY	<b>5-6</b>
<b>MODEL GFM</b>	 <p>RELAY</p> <p>SENSORS</p>	<b>TRIP RANGES</b> 2.0-8.5A THROUGH 15-65A	<b>APPLICATION</b> MOTOR CONTROL	<b>7-8</b>
<b>MODEL BGFL</b>	 <p>RELAY</p> <p>SENSORS</p>	<b>TRIP RANGES</b> 5-60A 30-360A 100-1200A	<b>APPLICATION</b> SERVICE ENTRANCE	<b>9-10</b>
<b>MODEL MGFL</b>	 <p>RELAY</p> <p>SENSORS</p>	<b>TRIP RANGES</b> 0.5-6A 1-12A 5-60A 30-360A 100-1200A	<b>APPLICATION</b> SERVICE ENTRANCE	<b>11-12</b>
<b>GROUND FAULT INDICATOR</b>				
	 <p>LED INDICATORS</p>	<b>MODELS</b> GFAI-6 GFAI-12	<b>APPLICATION</b> MOTOR CONTROL	<b>13-14</b>
				<b>15-17</b>
				<b>18-19</b>

# ELECTRONIC PRODUCTS

*Voltage Relays – Voltage Transducers – Blown Fuse Indicator*

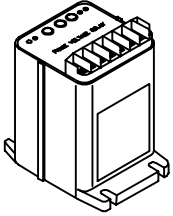
## THREE PHASE VOLTAGE MONITORING



**MODEL**  
SPVR

**PROTECTION**  
PHASE LOSS  
PHASE UNBALANCE  
PHASE SEQUENCE  
UNDERVOLTAGE  
OVERVOLTAGE

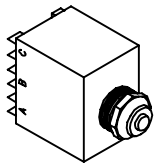
**20-22**



**MODEL**  
LPVR

**PROTECTION**  
PHASE LOSS  
PHASE UNBALANCE  
PHASE SEQUENCE  
UNDERVOLTAGE

**23-24**

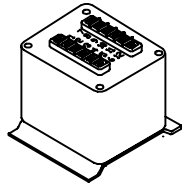


**MODEL**  
APVR

**PROTECTION**  
PHASE LOSS  
PHASE UNBALANCE  
PHASE SEQUENCE

**25-26**

## VOLTAGE TRANSDUCERS



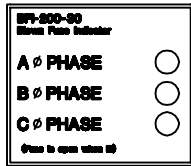
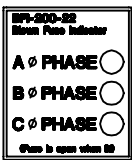
**MODEL**  
LLV  
PNV

**INPUT**  
120,240–480V ac  
120,277V ac

**OUTPUT**  
4–20 mA dc  
4–20 mA dc

**27-28**

## BLOWN FUSE INDICATOR



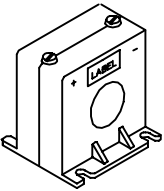
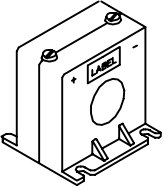
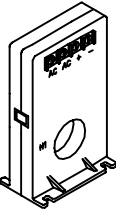
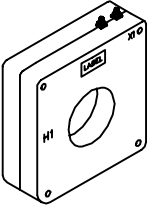
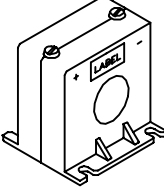
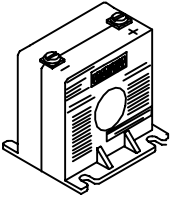

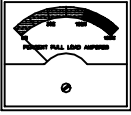
**MODELS**  
BFI-200  
BFI-400  
BFI-600

**APPLICATION**  
MOTOR CONTROL

**29**

# ELECTRONIC PRODUCTS

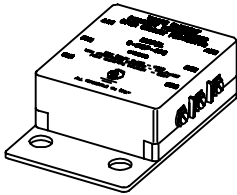
## Current Transducers – Adjustable Metering Current Transformers

<b>CURRENT TRANSDUCERS</b>					
	<b>MODEL</b> ACV	<b>INPUT RANGES</b> 0 – 200A ac	<b>OUTPUT</b> 5V dc	<b>30</b>	
	<b>MODEL</b> 10ACV	<b>INPUT RANGES</b> 0 – 200A ac	<b>OUTPUT</b> 10V dc	<b>31</b>	
	<b>MODEL</b> PCL	<b>INPUT RANGES</b> 0–5A ac 0 – 20A ac 0 – 75A ac	<b>OUTPUT</b> 4–20 mA dc	<b>32</b>	
	<b>MODEL</b> PCL	<b>INPUT RANGES</b> 0 – 600A ac	<b>OUTPUT</b> 4–20 mA dc	<b>33</b>	
	<b>MODEL</b> PCM	<b>INPUT RANGES</b> 0 – 300A ac	<b>OUTPUT</b> 4–20 mA dc	<b>34-35</b>	
<b>METERING CURRENT TRANSFORMER</b>					
			<b>MODELS</b> AMCT-14 AMCT-54 AMCT-130	<b>APPLICATION</b> MOTOR CONTROL	<b>36-37</b>
	METERS				

# ELECTRONIC PRODUCTS

## Open Circuit Protectors – Capacitor Trip Devices

### OPEN CIRCUIT PROTECTORS

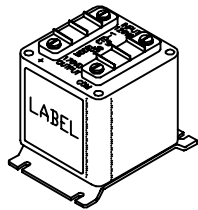


**MODEL**  
OCP

**APPLICATION**  
VOLTAGE SENSING

**38-39**

### CAPACITOR TRIP DEVICE

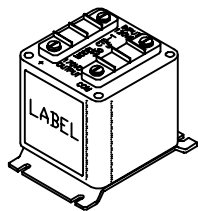


**MODEL**  
CTD-1 & 2

**CAPACITANCE**  
330  $\mu$ F/1500  $\mu$ F

**APPLICATION**  
ENERGY SOURCE  
FOR BREAKER &  
SWITCH TRIP COILS  
DURING LOSS OF  
CONTROL POWER

**40**

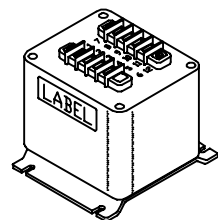


**MODEL**  
CTD-3

**CAPACITANCE**  
330  $\mu$ F

**APPLICATION**  
ENERGY SOURCE  
FOR BREAKER &  
SWITCH TRIP COILS  
DURING LOSS OF  
CONTROL POWER

**41**

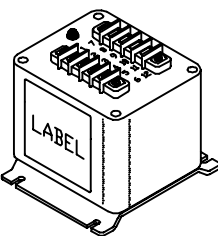


**MODEL**  
CTD-4

**CAPACITANCE**  
4500  $\mu$ F/990  $\mu$ F

**APPLICATION**  
ENERGY SOURCE  
FOR BREAKER &  
SWITCH TRIP COILS  
DURING LOSS OF  
CONTROL POWER

**42-43**



**MODEL**  
CTD-5

**CAPACITANCE**  
4500  $\mu$ F/990  $\mu$ F

**APPLICATION**  
ENERGY SOURCE  
FOR BREAKER &  
SWITCH TRIP COILS  
DURING LOSS OF  
CONTROL POWER

**44-45**

# GROUND FAULT CURRENT DETECTION SYSTEMS

## Model GFA (Relay)

10 to 75 Amp Trip Currents

REGULATORY AGENCY APPROVALS



### OPERATING RANGE:

Trip currents of 10,15,20 & 75 Amps.  
Time delay from 0.01 to 20 seconds.

### INPUT POWER:

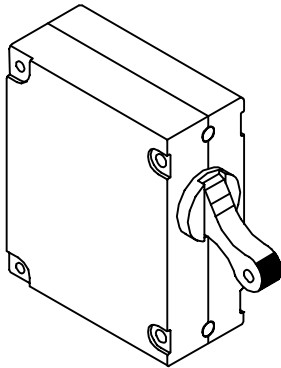
Self powered.

### FREQUENCY:

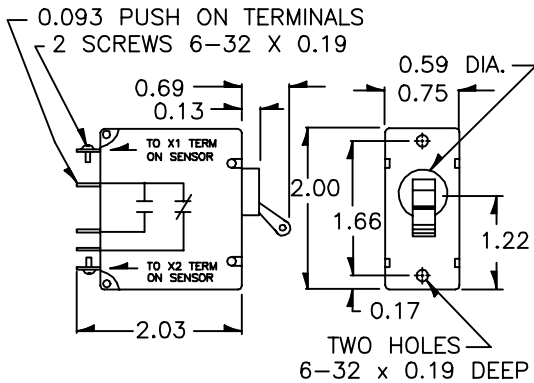
50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

-30°C. to +60°C.

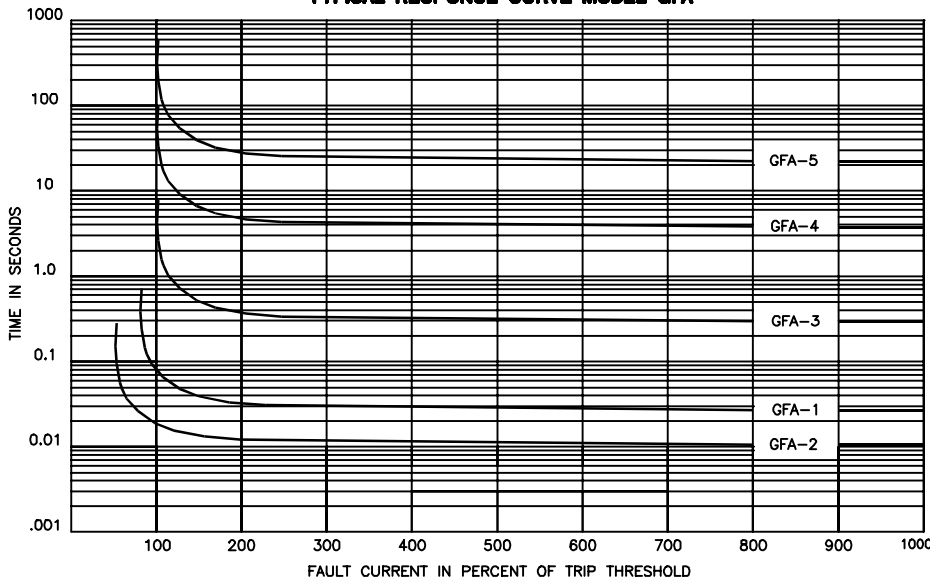


- SPDT contacts: Form C, rated 10 Amps at 250 Volts ac, 1/4 H.P., 125 Vac.
- Contacts shown with the relay in the tripped position.
- Dielectric strength: GFA protectors withstand 1500 Volts, 60 Hz for 60 seconds between all electrically isolated terminals.
- Insulation Resistance: Insulation resistance of GFA Protectors exceeds 100 megohms when tested at 500 Vdc.
- Only for use with GFA sensors.



RELAY MODEL NUMBER	HANDLE COLOR	DELAY TYPE
GFA-1	WHITE	INSTANTANEOUS
GFA-2	RED	INSTANTANEOUS
GFA-3	YELLOW	SHORT DELAY
GFA-4	BLUE	MEDIUM DELAY
GFA-5	GREEN	LONG DELAY

TYPICAL RESPONSE CURVE MODEL GFA



# Model GFA (Sensor)

10 to 75 Amp Trip Currents

## OPERATING RANGE:

Trip currents of 10,15,20 & 75 Amps.  
Trip current tolerance is  $\pm 15$  percent.

## FREQUENCY:

50/60 Hz.

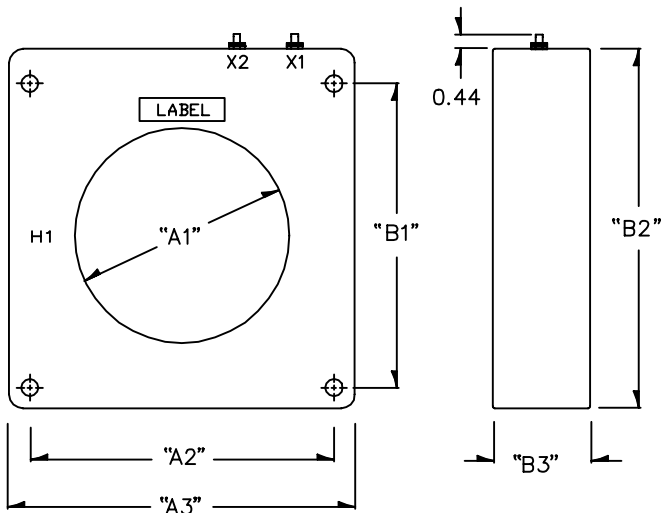
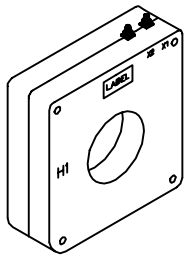
## INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

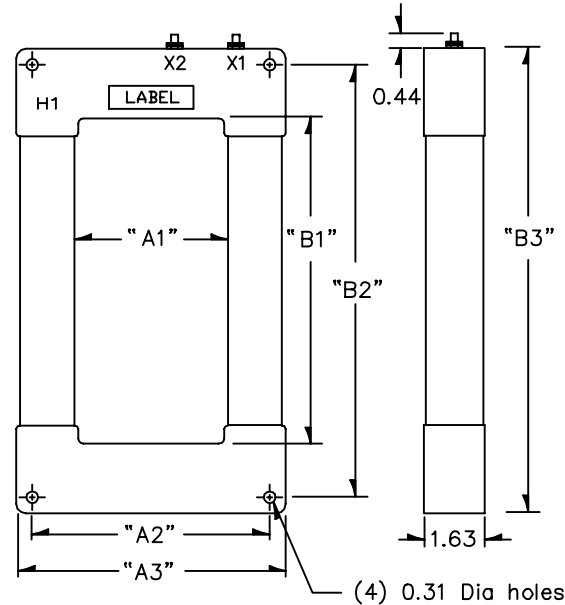
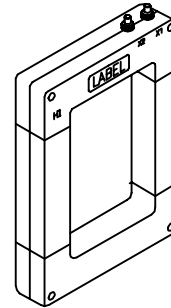
- Terminals are brass studs No. 8–32 UNC with one flatwasher, lockwasher & regular nut.
- Only for use with GFA relay.

The combination of any of the sensors below and the GFA relay offers low cost ground fault protection in a self-powered, reliable system. When ordering specify sensor model number and relay part number.

### TOROIDAL SENSORS



### RECTANGULAR SENSORS



TRIP CURRENT	MODEL NUMBER	"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
10 AMP	GFA 200	2.00	3.75	4.63	N/A	5.10	3.00
15 AMP	GFA 400	4.00	5.62	7.00	5.62	7.00	2.17
20 AMP	GFA 156	1.56	N/A	4.08	N/A	4.59	2.10
20 AMP	GFA 213	2.13	3.50	4.50	N/A	4.88	2.19
20 AMP	GFA 425	4.25	5.44	6.73	5.43	6.73	1.28

TRIP CURRENT	MODEL NUMBER	"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
75 AMP	GFA 041 X 071	4.1	6.4	7.3	7.1	10.0	10.9
75 AMP	GFA 051 X 071	5.1	7.2	8.3	7.1	10.0	10.9
75 AMP	GFA 058 X 071	5.8	7.0	9.0	7.1	10.0	10.9
75 AMP	GFA 080 X 071	8.0	9.5	11.1	7.1	10.0	10.9

Model	Bracket Kit
GFA 200	0221B00541
GFA 400	0221B00185
GFA 213	0221B00777
GFA 425	0221B00187

Mounting bracket kits are available for all toroidal sensors except the Model GFA 156 which has molded mounting feet.

# GROUND FAULT CURRENT DETECTION SYSTEMS

## Model GFM (Relay)

1.5 to 65 Amp Trip Currents



11 0395



LR80793

### ADJUSTABLE OPERATING RANGE:

Trip currents from 1.5 to 65 Amperes, depending on sensor. Time delay from instantaneous to 36 cycles.

### INPUT POWER:

Self powered.

### FREQUENCY:

50/60 Hz.

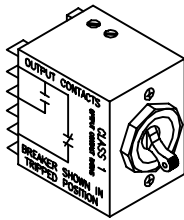
### AMBIENT TEMPERATURE RANGE:

-30°C. to +60°C.

- Positive "ON" (Green) and "OFF" (Red) condition indication, manual reset.
- SPDT contacts: Form C, rated 10 Amps continuous, 23 Amps inrush, 250 volts ac.
- Only for use with GFM sensors.

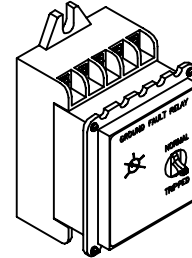
These Class 1 Model GFM Ground Fault protection systems are designed to minimize damage or loss to equipment caused by destructive arcing ground faults. This GFM system is designed for all polyphase applications and is ideally suited for motor control, motor control centers, and high voltage starters. Systems can be wye or delta, grounded or resistance grounded. When the ground fault current exceeds a pre-selected condition (current and time settings) the relay trips.

The relay contacts can be connected in the control circuit of a motor starter, to the shunt trip of a circuit breaker or similar disconnecting or alarm devices. The system has an inverse time characteristic to prevent nuisance tripping. The relay tripping current value is field adjustable over the trip current range of the sensor. The adjustable trip time delay relay is field settable up to 36 cycles.



### MODELS GFM-252 AND 262

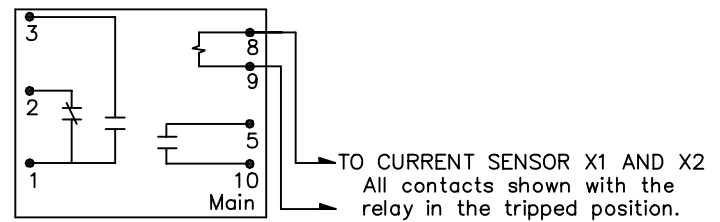
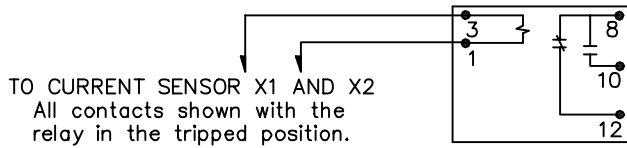
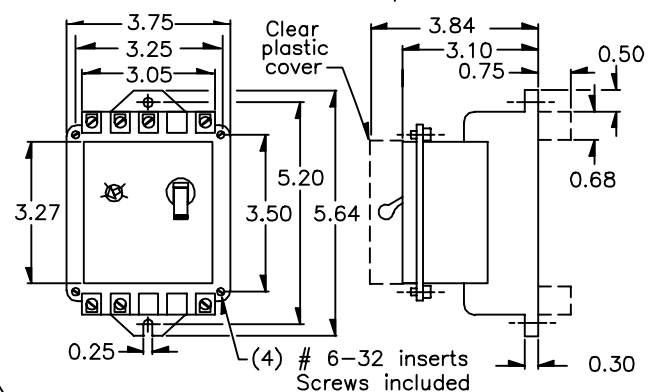
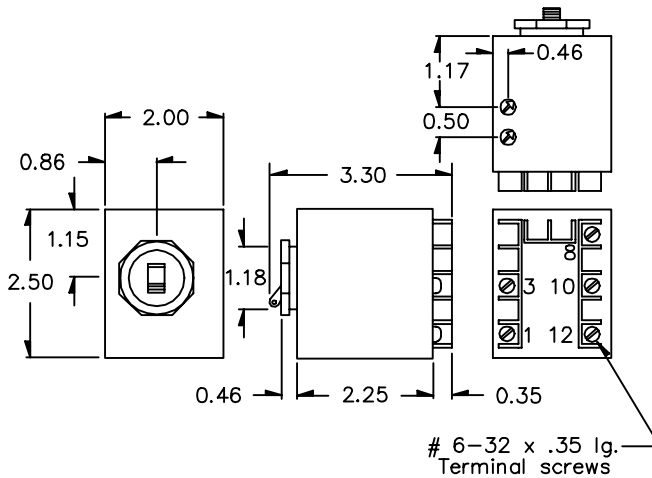
Push Button (P.B.) Style: door mount.



### MODELS GFM-353, 363, 453, AND 463.

Rear terminal kit and clear plastic cover standard with door mounting.

Main contact rated 30 Amps, 277 Volts.



### HOW TO ORDER RELAYS

CASE STYLE	WEIGHT:
2- P.B. Style-Door mtg.	6 oz.
3- Panel mount	14 oz.
4- Door mount	16 oz.

GFM	X	X	X
TIME DELAY			
5- Instantaneous			
6- Adjustable time delay, up to 36 cycles.			

OUTPUT CONTACTS
2- 10A form C contacts (case style 2 only)
3- 10A form C contacts plus 30A N.O. contacts (on case styles 3 & 4 only)

# Model GFM (Sensor)

1.5 to 65 Amp Trip Currents



110395



LR80793

## OPERATING RANGE:

Trip ranges from 1.5–7.5 to 15–65 Amps.  
Trip current tolerance is  $\pm 15$  percent.

## FREQUENCY:

50/60 Hz.

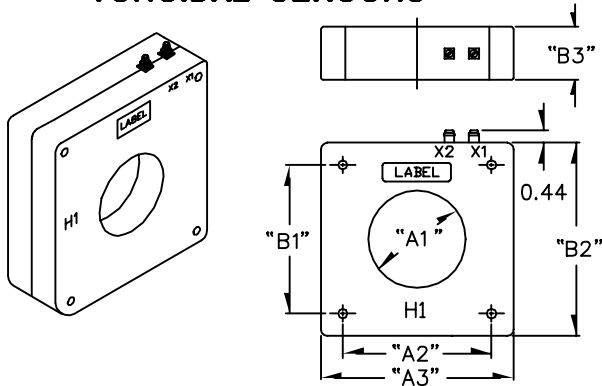
## INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

- Terminals are brass studs No 8–32 UNC with one flatwasher, lockwasher & regular nut
- Only for use with GFM relays.

Ground Fault Current Sensors, type GFM, are available in three different case styles, a variety of sizes and trip current ranges – to match the GFM Relay. The physical size of the sensor window should be carefully determined by the physical size and configuration of the power conductors. The Ground Fault Sensor will respond only to ground faults which occur between the position of the sensor and the load.

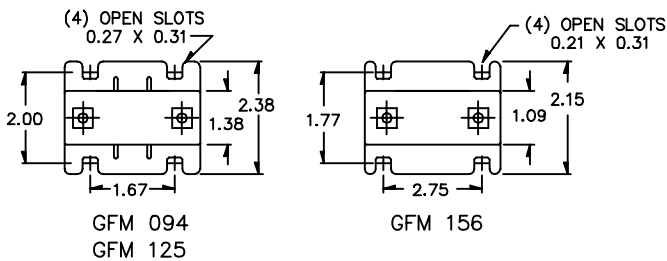
## TOROIDAL SENSORS



MODEL NUMBER	TRIP CURRENT	SENSOR DIMENSIONS					
		"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
GFM 094	2.0 TO 8.5	0.94	N/A	2.67	N/A	2.75	2.38
GFM 125	2.7 TO 14	1.25	N/A	2.67	N/A	2.75	2.38
GFM 156	3.8 TO 18	1.56	N/A	3.53	N/A	3.77	2.15
GFM 200	3.5 TO 14.5	2.00	3.19	4.00	N/A	4.00	1.75
GFM 250	3.5 TO 11	2.50	3.75	4.63	N/A	5.10	3.00
GFM 375	4 TO 12	3.75	4.75	5.96	4.75	6.31	3.00
GFM 375D	*	3.75	4.75	5.96	4.75	6.31	3.00
GFM 425	5 TO 18	4.25	5.44	6.73	5.43	6.73	1.28
GFM 462	4 TO 12	4.62	5.75	7.00	5.75	7.12	4.00
GFM 813	4 TO 20	8.13	8.50	11.10	8.50	11.47	3.00

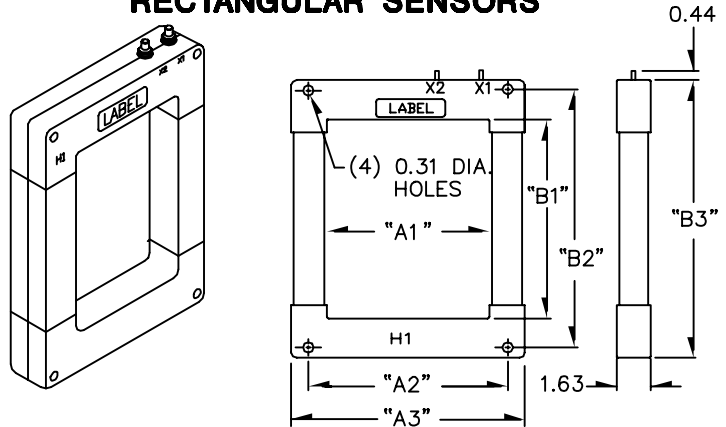
\* Dual trip current ranges: 3.5 to 11 and 10 to 36.

Mounting bracket kits are available for all toroidal sensors except the Models GFM 094, GFM 125, and GFM 156, which have molded mounting feet.



Model Number	Bracket Kit
GFM 200	0221B01976
GFM 250	0221B00541
GFM 375	0221B00259
GFM 375D	0221B00259
GFM 425	0221B00187
GFM 462	0221B01525
GFM 813	0221B00259

## RECTANGULAR SENSORS



MODEL NUMBER	TRIP CURRENT	SENSOR DIMENSIONS					
		"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
GFM 041 X 071	6 TO 30	4.1	6.4	7.3	7.1	10.0	10.9
* GFM 080 X 117SC	15 TO 65	8.0	9.5	11.1	11.7	14.5	15.4
GFM 080 X 141	9 TO 39	8.0	9.5	11.1	14.1	17.0	17.9

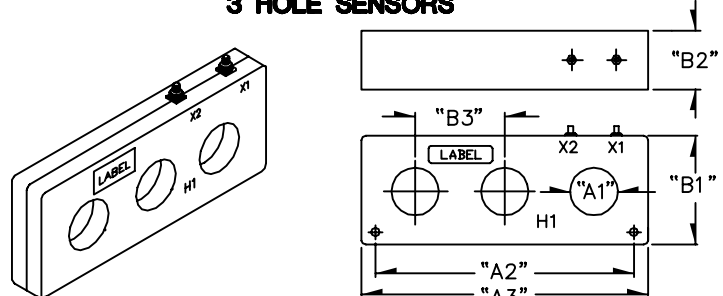
\* The Model GFM 080 X 117SC is a split core (take-apart style) for assembly to existing electrical installations without the need for dismantling the primary bus or cables.

### CAUTION:

Proper safety precautions must be followed during installation by a trained electrician. It is recommended that the incoming power be de-energized before installation.

The sensor must have its secondary terminals short circuited or the relay connected, before energizing the primary circuit.

## 3 HOLE SENSORS



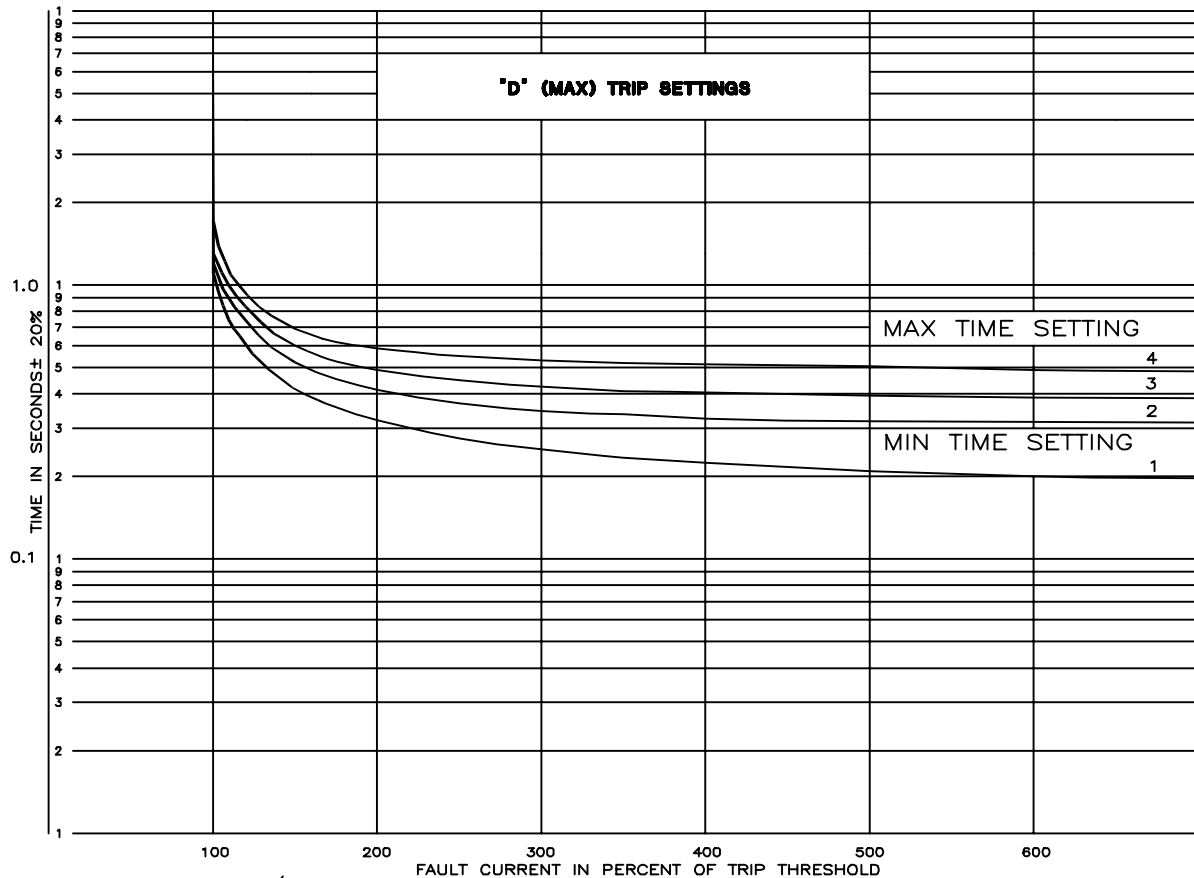
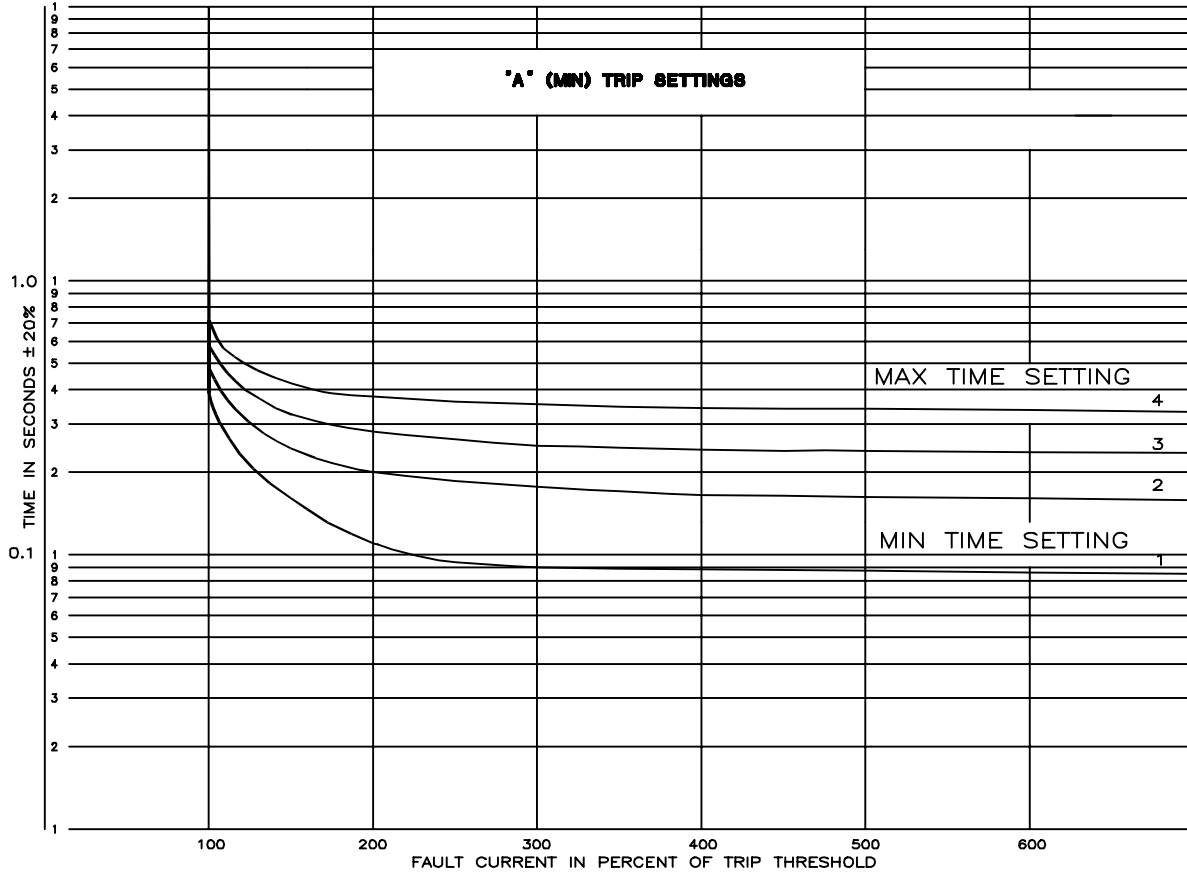
MODEL NUMBER	TRIP CURRENT	SENSOR DIMENSIONS					
		"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
GFM 3P205 X 050	4.5 TO 16	*	7.60	8.50	3.70	2.00	2.75
GFM 3P208	5 TO 20	2.08	8.24	9.00	3.94	2.00	2.75
GFM 3P212	7 TO 25	2.12	11.72	12.80	4.87	2.63	4.00

\* The Model GFM 3P205 X 050 has a rectangular window 2.05" X 0.50"



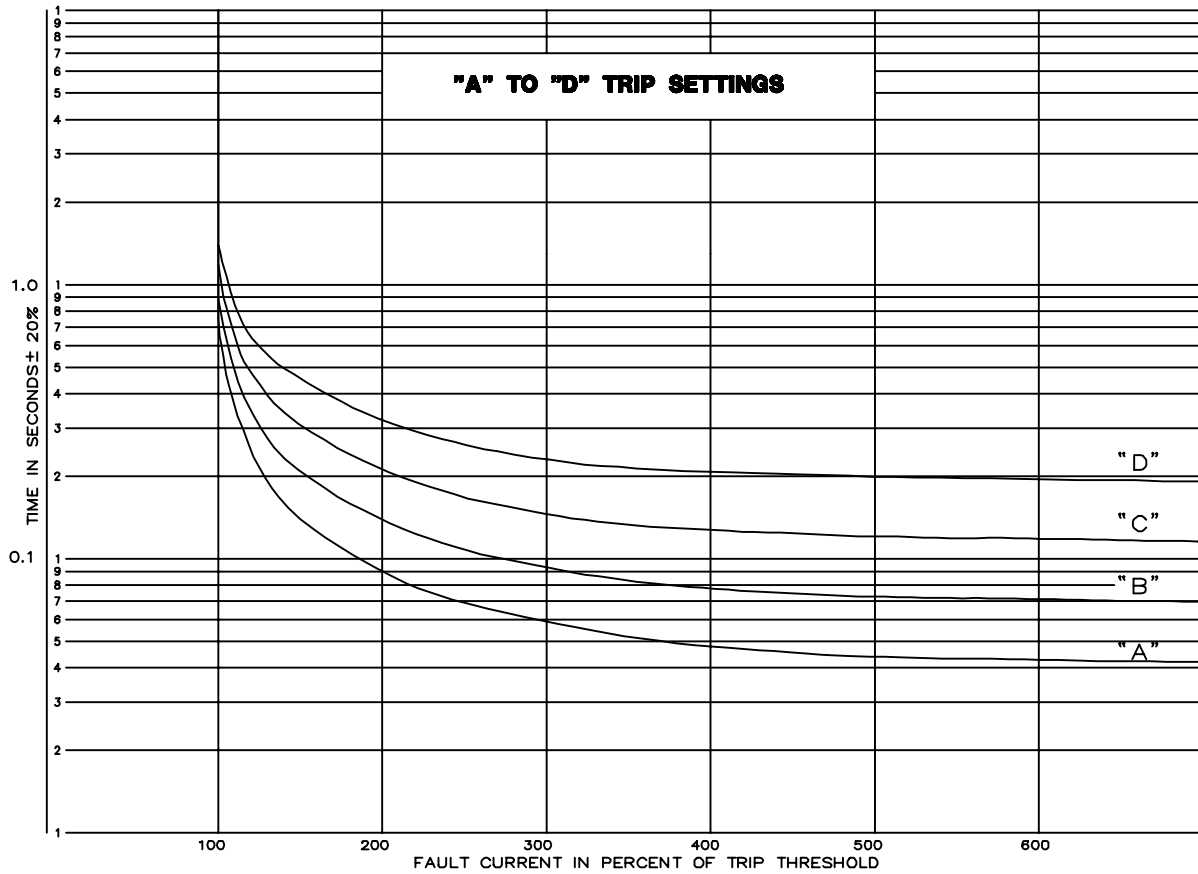
# ADJUSTABLE DELAY TYPES

## TYPICAL RESPONSE CURVES MODEL GFM

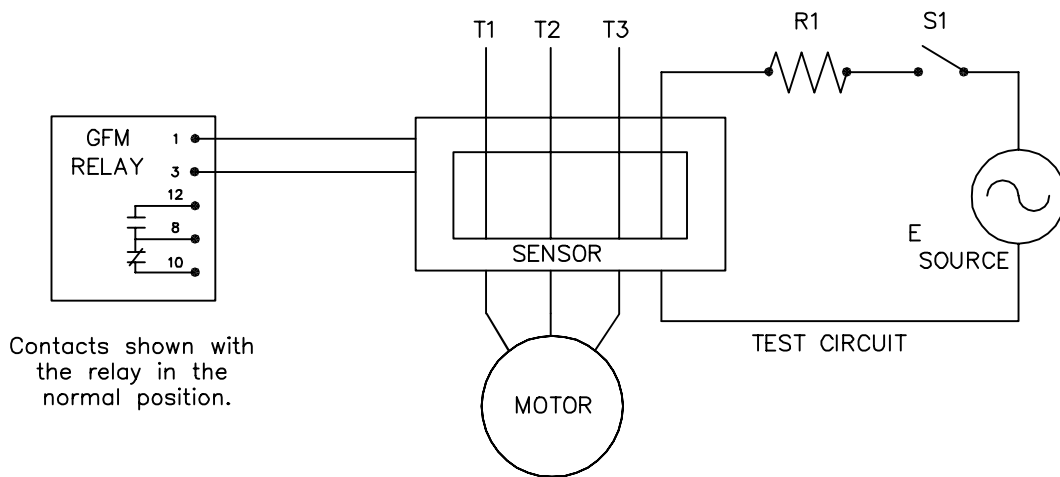


# FIXED DELAY TYPES

## TYPICAL RESPONSE CURVES MODEL GFM



### GFM TEST PROCEDURE



A simulated fault current can be applied by the above test circuit. An appropriate value of R1 should be selected to apply a minimum of 1.5 times the maximum trip rating of the sensor.

1. Assure that the GFM relay is in "NORMAL" (reset) position.
2. Close switch S1 and check for relay response. Relay handle will move to the tripped position.
3. Open S1, reset the relay and remove the test circuit from the system. System is now back to normal.

THE ABOVE TEST PROCEDURES SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

# GROUND FAULT CURRENT DETECTION SYSTEMS

## Model BGFL (Relay)

*Trip Currents*

*5-60, 30-360, or 100-1200A*



110395



LR80793

### OPERATING RANGE:

Trip currents of 5-60, 30-360, or 100-1200A.  
Time delay from 0.10 to 1 second. (Adjustable)

### INPUT POWER:

2 VA plus shunt coil requirements.  
Rated @ 120 Vac.

### INPUT WITHSTAND:

200,000 Amperes RMS for 3 cycles, 50/60 Hz.

### NOMINAL INPUT VOLTAGES:

120 Volts ac, 125 Volts dc, 24 Volts dc, 48 Volts dc.

### FREQUENCY:

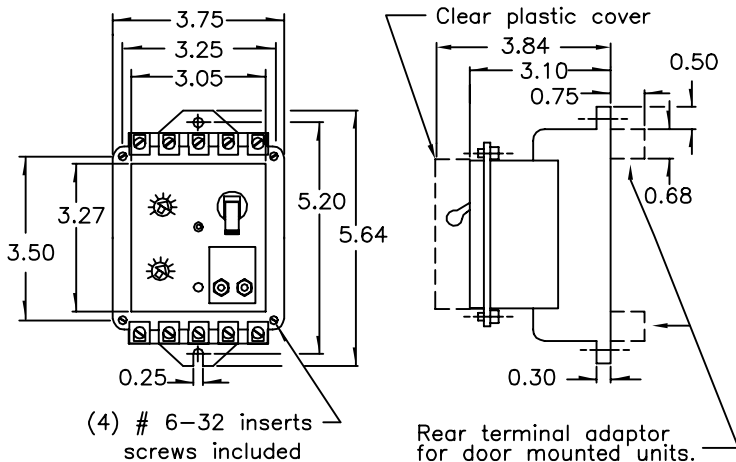
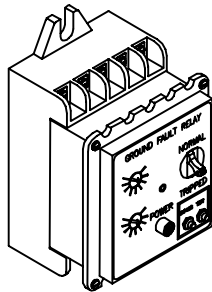
50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

-30°C. to +60°C.

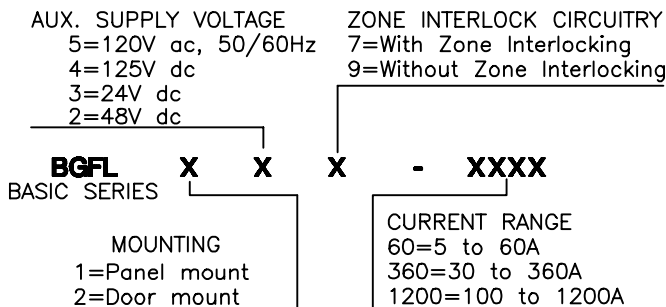
- Only for use with GFL sensors.
- Approximate Weight: 1.5 lb.

These Class 1 Model BGFL Ground Fault Relays and Sensors are designed to form a system for detecting a ground fault current on a grounded ac power system. When a ground fault exceeds a pre-selected Current level and Time Delay setting, the relay initiates a trip signal for a shunt trip disconnect device to open and clear the fault. This BGFL system is designed to provide protection for electrical equipment, not protection for personnel.



- Available in two basic styles, "Standard" or "Zone Interlocking" for coordination of single or multiple ground fault devices in a system.
- Integral test panel with "Push To Test" and "Shunt Trip Bypass" pushbuttons for ease in proper operational testing of the system, with or without tripping the protective device.
- "Power on" LED indicator in cover.
- Positive visual trip indicator, manual reset.
- Infinitely adjustable Time Delay.
- Discrete current threshold adjustment.
- Panel or door mounting.
- Rear terminal kit and clear plastic cover standard with door mounting.
- Electromechanical relay output, positive "ON" and "OFF".
- Operates with molded case and power circuit breakers, bolted pressure switches, or fusible disconnect switches.
- Meets NEC service entrance equipment standards.

### HOW TO ORDER RELAYS



CONTACT RATINGS		
DEVICE INPUT POWER	INRUSH	CONT.
120 Volts ac	10 A	3 A
125 Volts dc	1 A	1 A
48 Volts dc	4 A	4 A
24 Volts dc	8 A	8 A

# Model GFL (Sensor)

## Trip Currents

5-60, 30-360, or 100-1200A  
0.5-6\*\*\*, or 1-12A\*\*\*



110395



LR80793

### OPERATING RANGE:

Trip currents of 5-60, 30-360, or 100-1200A.  
Trip current tolerance  $\pm 15$  percent.

### FREQUENCY:

50/60 Hz.

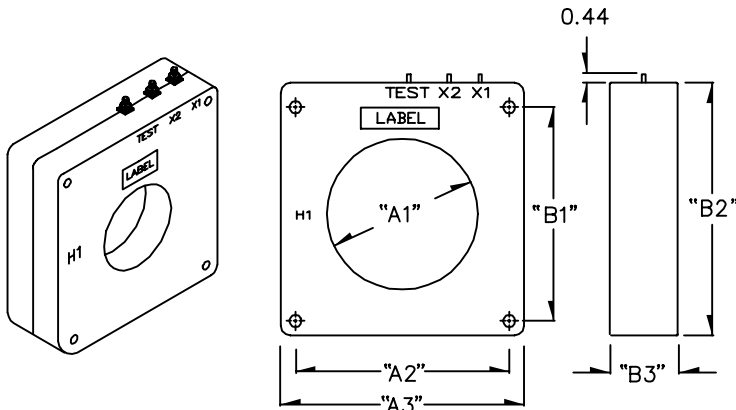
### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

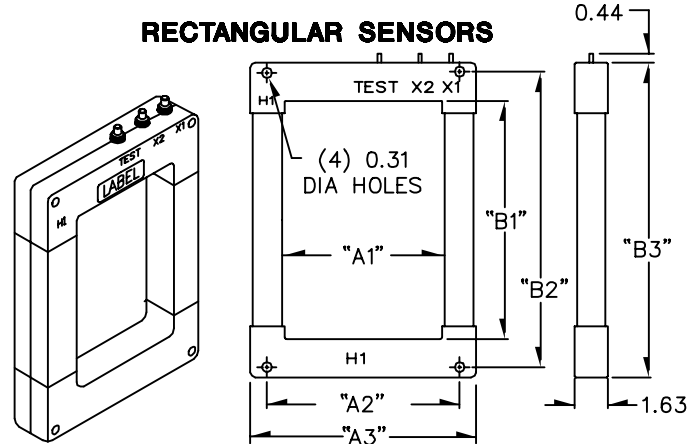
- Terminals are brass studs No. 8-32 UNC with one flatwasher, lockwasher & regular nut
- Only for use with BGFL or MGFL relays.

Ground Fault Current Sensors, type GFL, are available in three different styles, a variety of sizes and current ranges - to match the BGFL or MGFL relay ranges. The physical size of the sensor window should be carefully determined by the physical size and configuration of the power conductors. The Ground Fault Sensor will respond only to ground faults which occur between the position of the sensor and the load. Each sensor has two sets of windings one for test and one for normal operation.

### TOROIDAL SENSORS



### RECTANGULAR SENSORS



MODEL NUMBER	SENSOR DIMENSIONS					
	"A1"	"A2"	"A3"	"B1"	"B2"	"B3"

#### TRIP CURRENT 5-60 AMPS

GFL156T-1	1.56	*	3.53	*	3.77	2.15
GFL250T-1	2.50	*	4.56	*	4.71	2.13
GFL325T-1	3.25	4.70	5.73	4.70	5.73	1.15
GFL425T-1	4.25	4.86	5.92	**	6.17	1.15
GFL631T-1	6.31	6.75	8.50	6.75	8.50	1.28
GFL825T-1	8.25	8.50	10.48	8.50	10.48	1.53

#### TRIP CURRENT 0.5-6\*\*\*, 1-12\*\*\*, 30-360 AMPS

GFL156T-3	1.56	*	3.53	*	3.77	2.15
GFL250T-3	2.50	*	4.56	*	4.71	2.13
GFL325T-3	3.25	4.70	5.73	4.70	5.73	1.15
GFL425T-3	4.25	4.86	5.92	**	6.17	1.15
GFL631T-3	6.31	6.75	8.50	6.75	8.50	1.28
GFL825T-3	8.25	8.50	10.48	8.50	10.48	1.53

#### TRIP CURRENT 100-1200 AMPS

GFL325T-2	3.25	4.70	5.73	4.70	5.73	1.15
GFL425T-2	4.25	4.86	5.92	**	6.17	1.15
GFL631T-2	6.31	6.75	8.50	6.75	8.50	1.28
GFL825T-2	8.25	8.50	10.48	8.50	10.48	1.53

\* The Models GFL156T-1, GFL156T-3, GFL250T-1, and GFL250T-3 have molded mounting feet.

\*\* The Models GFL425T-1, GFL425T-2, and GFL425T-3 have no top mounting holes. Order the following mounting bracket kits:

\*\*\* Only for MGFL relay use.

Model Number	Bracket kit
GFL 325T-1, -2 and -3	0221B00183
GFL 425T-1, -2 and -3	0221B00183
GFL 631T-1, -2 and -3	0221B00231
GFL 825T-1, -2 and -3	0221B01529

#### RECTANGULAR SENSOR SIZES

"A1"	"A2"	"A3"	"B1"	"B2"	"B3"
4.1	6.4	7.3	7.1	10.0	10.9
5.1	7.2	8.3	11.7	14.5	15.4
5.8	7.0	9.0	14.1	17.0	17.9
8.0	9.5	11.1	18.1	21.0	21.9
10.1	11.6	13.2	24.0	27.0	27.9
-	-	-	30.1	33.0	33.9
-	-	-	36.0	38.9	39.8

Rectangular sensors are available for the following trip currents: 5-60A, 30-360A and 100-1200A.

The table above lists the available sensor sizes. Any window width (A1) may be combined with any window length.(B1)

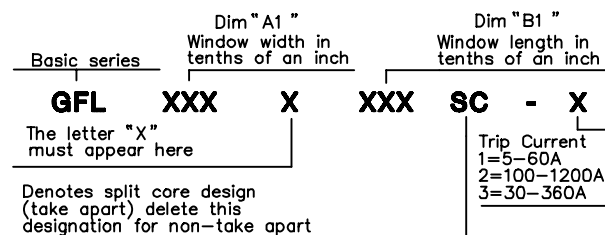
Rectangular sensors are also available as a split core (take-apart) style for assembly to existing electrical installations without the need for dismantling the primary bus or cables.

#### CAUTION:

Proper safety precautions must be followed during installation by a trained electrician. It is recommended that the incoming power be de-energized before installation.

The sensor must have its secondary terminals short circuited or the relay connected, before energizing the primary circuit.

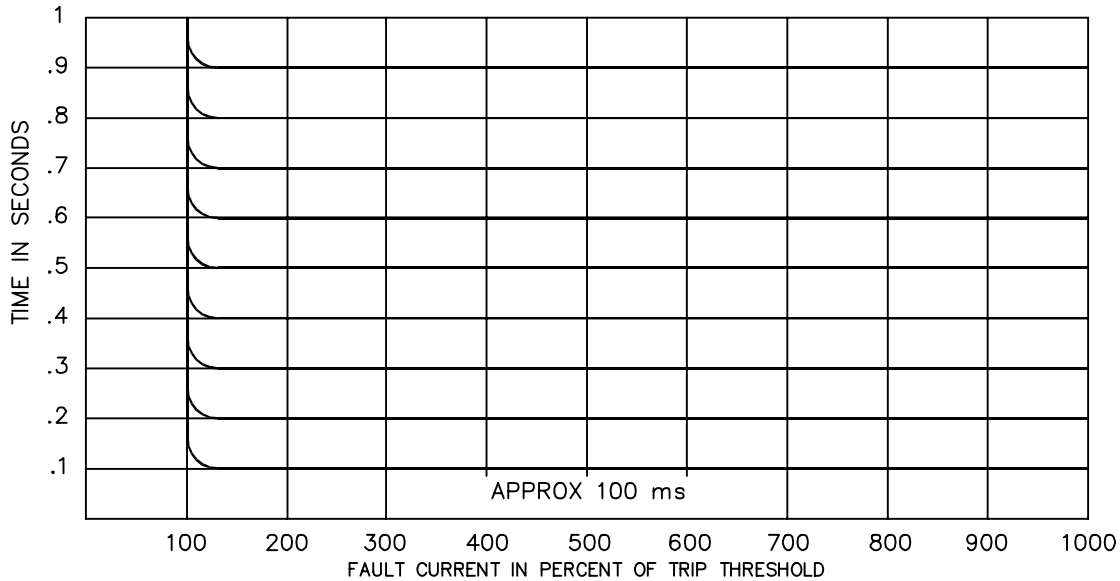
### HOW TO ORDER RECTANGULAR SENSORS



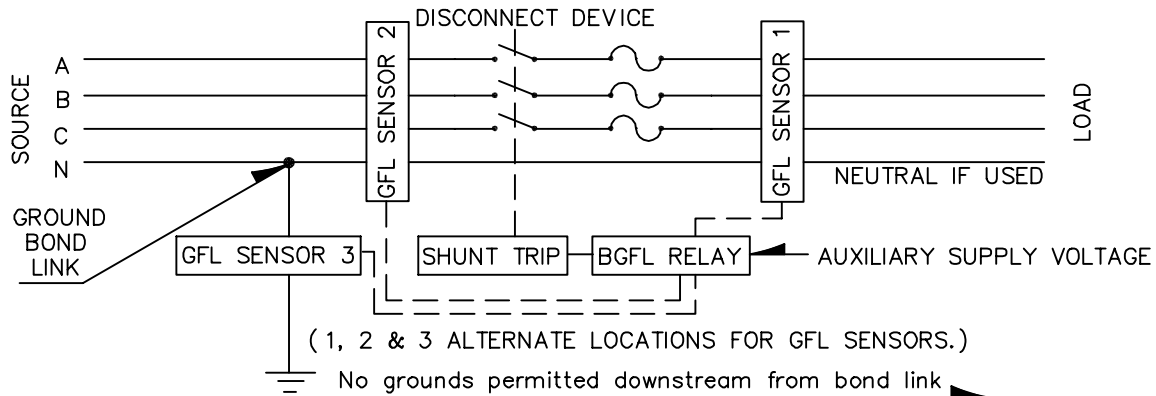
Example: To order a rectangular sensor with a 4.1 x 7.1 window and a 5-60A trip current, the catalog number would be GFL 041 X 071-1.

# TYPICAL RESPONSE CURVES MODEL BGFL

Cardinal points are shown for clarity only. The actual time delay adjustment is continuously variable between instantaneous and 1 second. The time delay tolerance is  $\pm 10\%$  of setting.



## BGFL TEST PROCEDURE



To determine if the neutral is grounded in only one place at the service entrance (in accordance with The National Electrical Code);

1. Disconnect power.
2. Remove ground bond link.
3. With a "megger", measure the resistance of each phase and neutral to ground. The resistance should be 1 megohm in accordance with NEC requirements. Readings as low as 100 ohms will pass a minimal current so as not to affect BGFL calibration on the 100 - 1200A relay. The 5-60A and 30-360A relay calibration will be affected if set at the lowest setting.
4. Reconnect bond link, reconnect power and check power LED for illumination.

To test the entire system including the disconnect device;

1. Check for control power, the LED should be illuminated.
2. Press the "Push To Test" switch on the relay. The trip indicator will go to the tripped position and the disconnect device will open.
3. Reset the relay and the disconnect device. System is now back to normal.

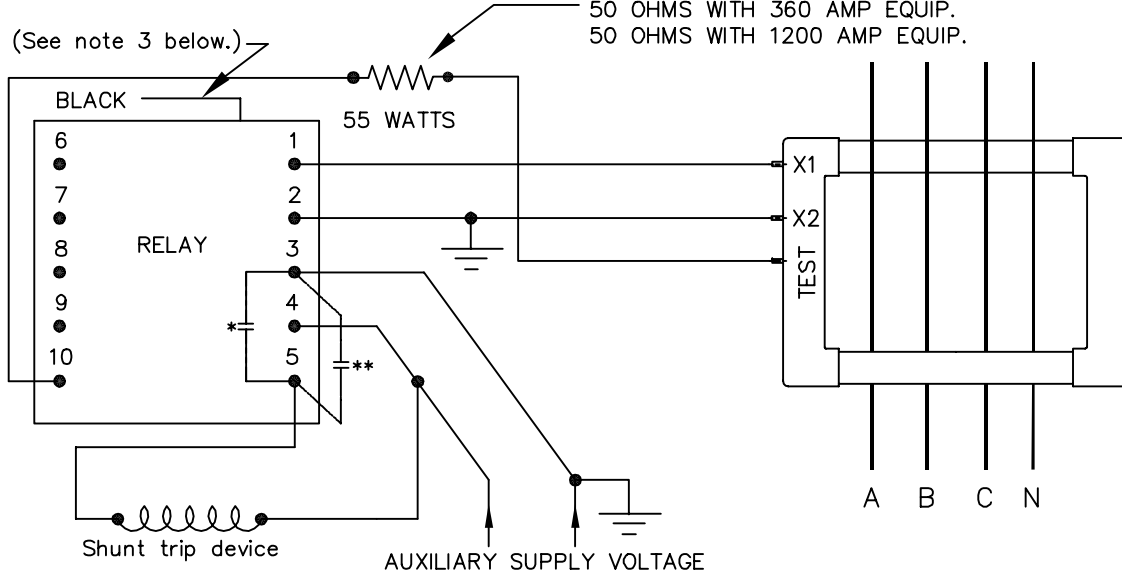
To test the Ground Fault Relay and Sensor only (The sensor will trip the relay in this test).

1. Check for control power, the LED should be illuminated.
2. Press and HOLD the "Shunt Trip Bypass" switch on the relay.
3. Press the "Push To Test" switch. The Ground Fault Relay will trip.
4. Reset the relay, then release the "Shunt Trip Bypass" switch. System is now back to normal.

THE ABOVE TEST PROCEDURES SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

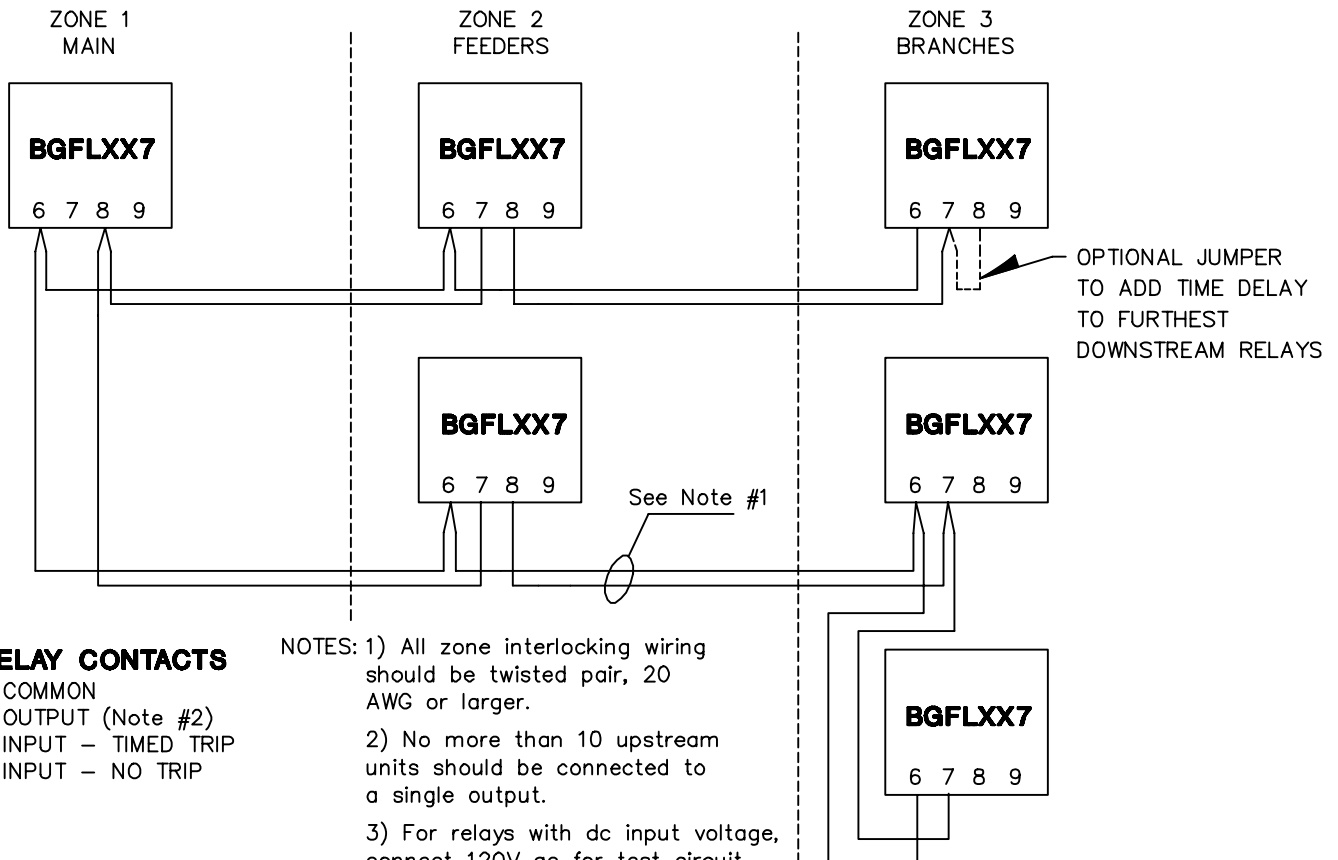
# BGFL TYPICAL WIRING DIAGRAM

TEST RESISTOR: (SEPARATELY MOUNTED)\*\*\*  
 75 OHMS WITH 60 AMP EQUIP.  
 50 OHMS WITH 360 AMP EQUIP.  
 50 OHMS WITH 1200 AMP EQUIP.



- \* Internal BGFL Relay Contact
  - \*\* Additional Protective Device. "NO" isolated contacts can be connected in parallel across terminals 3 and 5.
  - \*\*\* Mounting provision on rectangular GFL sensors with 11.1" & 13.2" widths.
- 120V ac 60 Hz  
 125V dc  
 24V dc  
 48V dc

## TYPICAL WIRING DIAGRAM ZONE SELECTIVE INTERLOCKING



**RELAY CONTACTS**  
 6 COMMON  
 7 OUTPUT (Note #2)  
 8 INPUT - TIMED TRIP  
 9 INPUT - NO TRIP

- NOTES: 1) All zone interlocking wiring should be twisted pair, 20 AWG or larger.  
 2) No more than 10 upstream units should be connected to a single output.  
 3) For relays with dc input voltage, connect 120V ac for test circuit to black lead and terminal #2.

# GROUND FAULT CURRENT DETECTION SYSTEMS

## Model MGFL (Relay)

*Trip Currents*

*0.5-6, 1-12, 5-60,  
30-360, or 100-1200A*



110395



LR80793

### OPERATING RANGE:

Trip currents of 0.5-6, 1-12, 5-60, 30-360, or 100-1200A. Time delay from 0.10 to 1 second. (Adjustable)

### INPUT POWER:

3 VA plus shunt coil requirements.  
Rated @ 120 Vac.

### INPUT WITHSTAND:

200,000 Amperes RMS for 3 cycles, 50/60 Hz.

### NOMINAL INPUT VOLTAGE:

120 Volts ac, 50/60 Hz

### FREQUENCY:

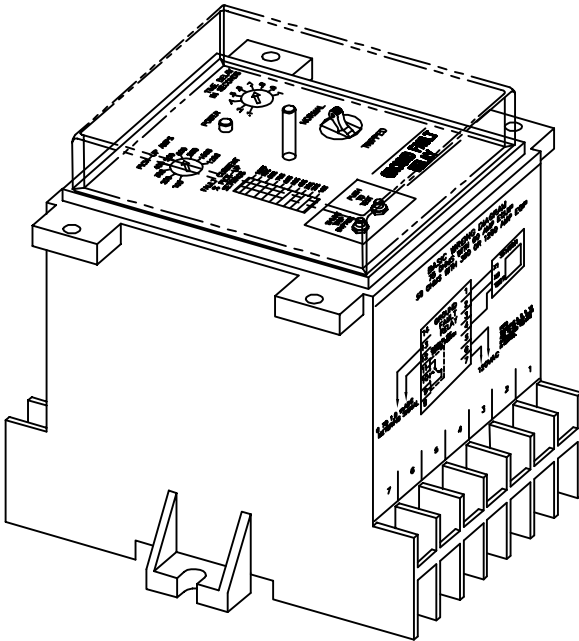
50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

-30°C. to +60°C.

- Only for use with GFL sensors.
- Approximate Weight: 1.5 lb.

These Class 1 Model MGFL Ground Fault Relays and Sensors are designed to form a system for detecting and displaying a ground fault current on a grounded ac power system. When a ground fault exceeds a pre-selected current level and delay setting, the relay initiates a trip signal for a shunt trip disconnect device to open and clear the fault. This MGFL system is designed to provide protection for electrical equipment not protection for personnel. The integral bar type LED meter indicates actual ground current detected from 10% to 100% of selected trip current.



- Available in two basic styles, "Standard" or "Zone Interlocking" for coordination of single or multiple ground fault devices in a system.
- Integral test panel with "Push To Test" and "Shunt Trip Bypass" pushbuttons for ease in proper operational testing of the system, with or without tripping the protective device.
- "Power on" LED indicator in cover.
- Positive visual trip indicator, manual reset.
- Infinitely adjustable Time Delay.
- Discrete current threshold adjustment.
- Panel or door mounting.
- Dust cover kit standard with door mounting.
- Electromechanical relay output, positive "ON" and "OFF".
- Operates with molded case and power circuit breakers, bolted pressure switches, or fusible disconnect switches.
- Meets NEC service entrance equipment standards.
- Light emitting diode (LED) meter is 10 segments tall for 10% to 100% of trip current setting indication.

### HOW TO ORDER RELAYS

#### ADDITIONAL CIRCUITRY

- 3 = 0 to 1.0 mA ground fault current signal and zone selective interlocking
- 5 = 0 to 1.0 mA ground fault current signal
- 7 = Zone selective interlocking
- 9 = No additional circuitry

**MGFL**  
BASIC SERIES

**X**

MOUNTING  
1=Panel mount  
2=Door mount

**5**

**X**

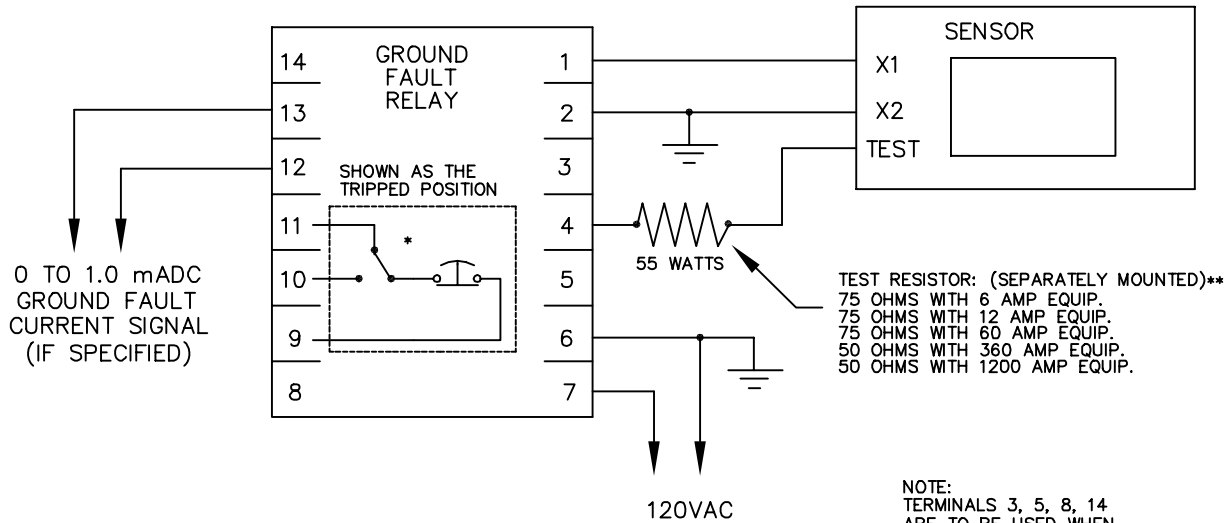
**- XXXX**

CURRENT RANGE  
6=0.5 to 6A  
12=1 to 12A  
60=5 to 60A  
360=30 to 360A  
1200=100 to 1200A

#### CONTACT RATINGS

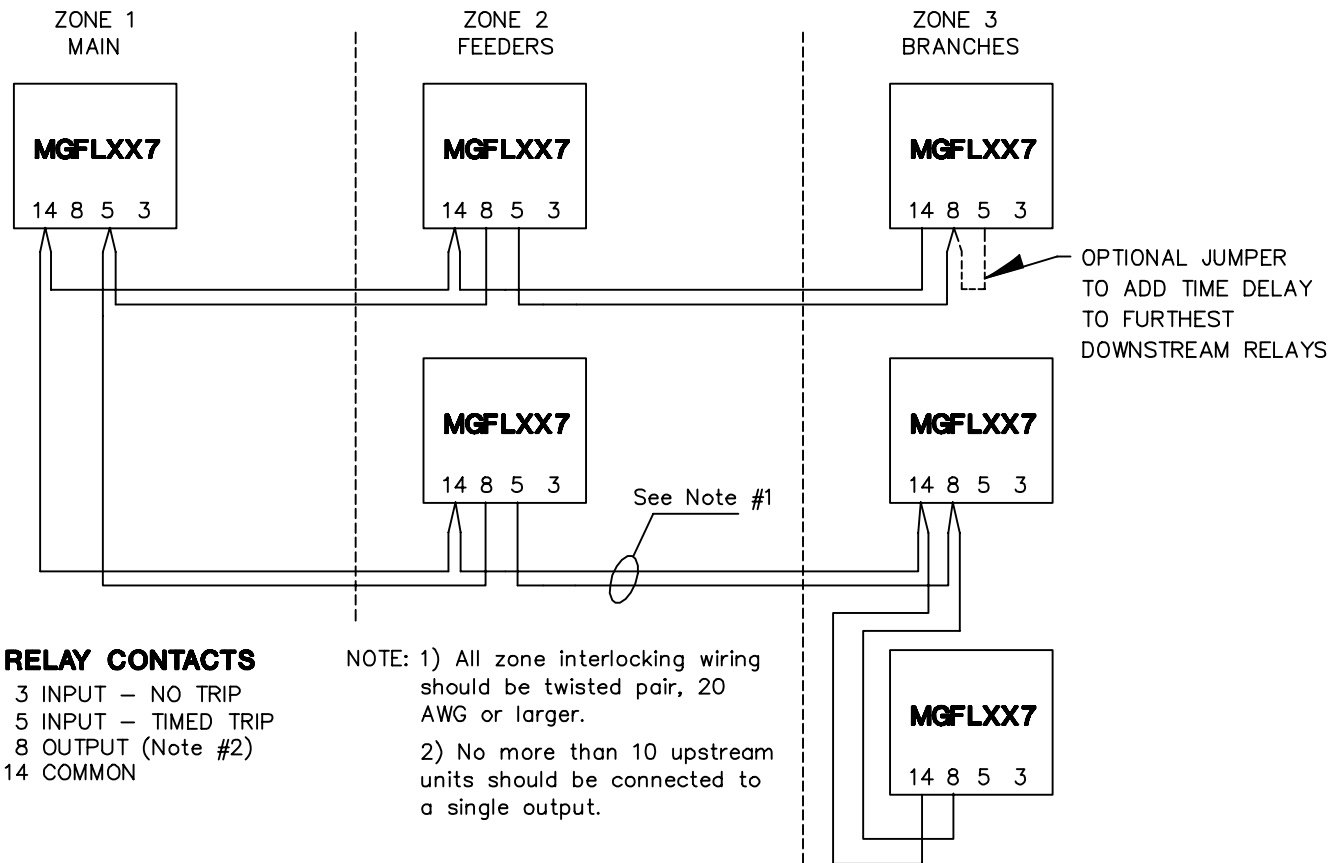
DEVICE INPUT POWER	INRUSH	CONT.
120 Volts ac	10 A	3 A
125 Volts dc	1 A	1 A
48 Volts dc	4 A	4 A
24 Volts dc	8 A	8 A

# MGFL TYPICAL WIRING DIAGRAM



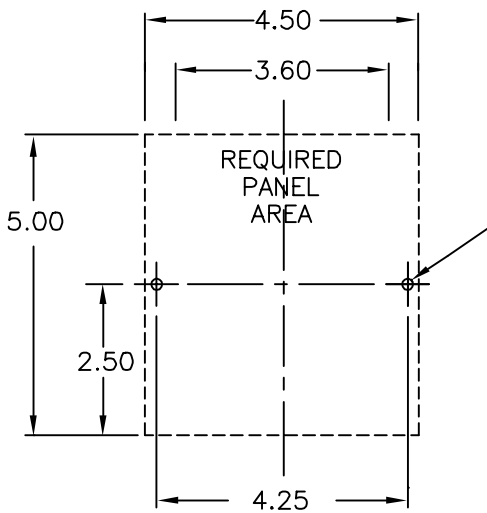
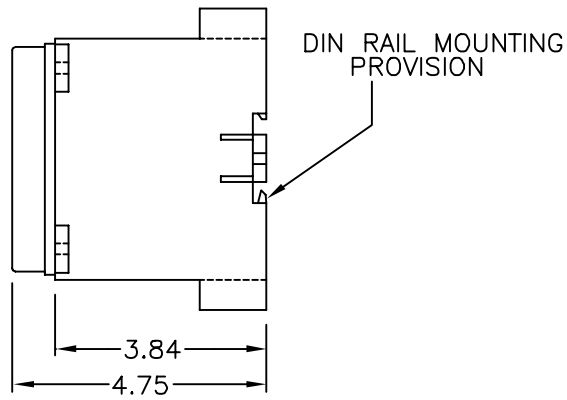
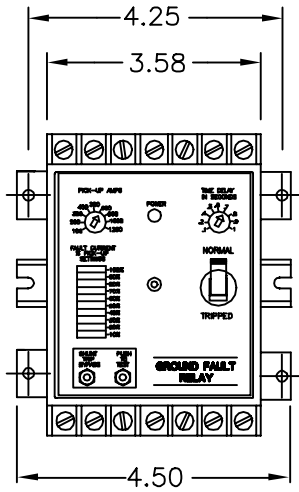
- \* Internal MGFL Relay Contact
- \*\* Mounting provision on rectangular GFL sensors with 11.1" & 13.2" widths.

## TYPICAL WIRING DIAGRAM ZONE SELECTIVE INTERLOCKING



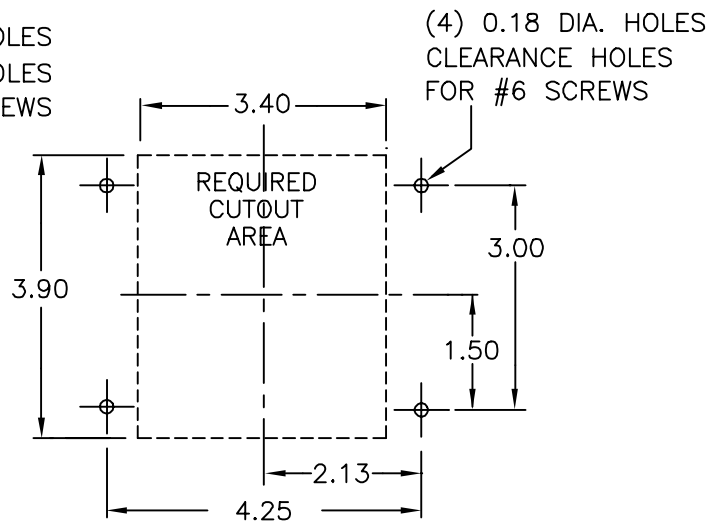


# MGFL DIMENSIONS



PANEL MOUNTING LAYOUT

(2) 0.24 DIA. HOLES  
CLEARANCE HOLES  
FOR #12 SCREWS



DOOR MOUNTING LAYOUT

(4) 0.18 DIA. HOLES  
CLEARANCE HOLES  
FOR #6 SCREWS

# GROUND FAULT ADJUSTABLE INDICATOR

**Models GFAI-6  
GFAI-12**



**INPUT:**  
130 amps max. cont.  
Peak surge current  
10,000 amps, 1/2 cycle

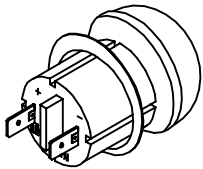
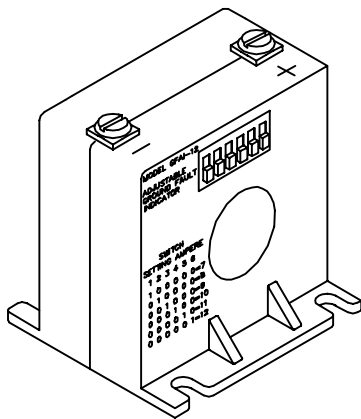
**ADJUSTABLE  
PICK-UP RANGES:**  
1 – 6 amperes AC or  
7 – 12 amperes AC

**FREQUENCY:**  
50/60 Hz.

**INSULATION LEVEL:**  
600 Volt, 10 kV BIL full wave.

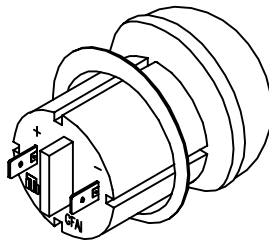
**AMBIENT TEMPERATURE RANGE:**  
–30°C. to +70°C.

- Pick-up accuracy is  $\pm 15\%$ .
- Sensor terminals are brass screws No. 8–32. Indicator terminals are 1/4" quick connect type.
- Self powered.
- Internally protected from overloads.
- Recommended use on NEMA 00–4 and IEC A–N size motor loads.
- Approximate weight: 1.5 lbs.

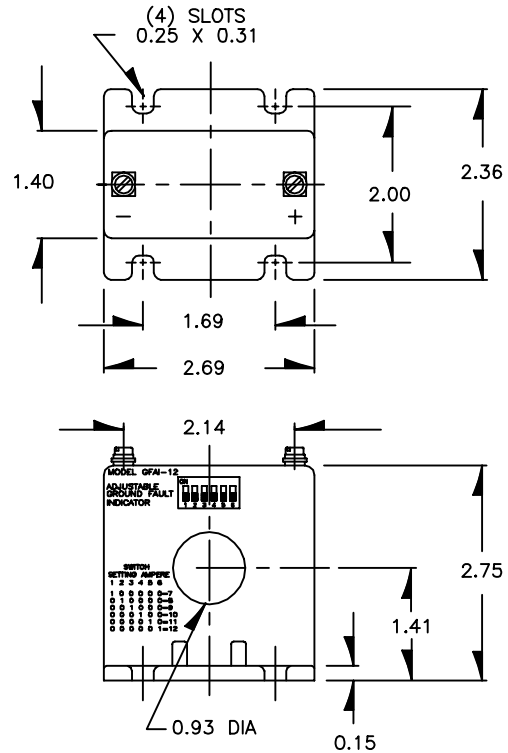


FOR 22.5mm HOLE

LED INDICATORS:



FOR 30mm HOLE



## Description:

Each GFAI system includes one adjustable current sensor and one red LED panel mount indicator. The ground fault indicator works by illuminating the remote mounted light emitting diode (LED) when a preset ground fault level is reached. (Zero sequence method)

The GFAI–6 model features an adjustable current range of 1 to 6 amperes in 1 amp increments. The GFAI–12 model features an adjustable current range of 7 to 12 amperes in 1 ampere increments. Both models incorporate a multi–circuit DIP switch on the front of the current sensor.

The red LED indicator is suitable for use with Type 1 and Type 12 enclosures.

## Application:

The model GFAI Ground Fault Indicator is intended for use in downstream branch motor circuits for locating and indicating low level ground faults.

NOTE: The GFAI is an indicating device only. It is not intended for ground fault protection or remote signaling to other protection or alarm devices. The GFAI unit is designed to withstand a maximum of 130 amps ground fault current continuously.

## HOW TO ORDER INDICATORS GFAI-XX-XX

PICK-UP RANGE 6 = 1 to 6 amps 12 = 7 to 12 amps	INDICATOR MOUNTING * 22 = 22.5 millimeters 30 = 30 millimeters
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\* INCLUDES MOUNTING HARDWARE.

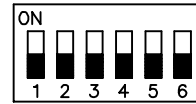
# GFAI CALIBRATION & LOCATION

## GFAI-6-XX

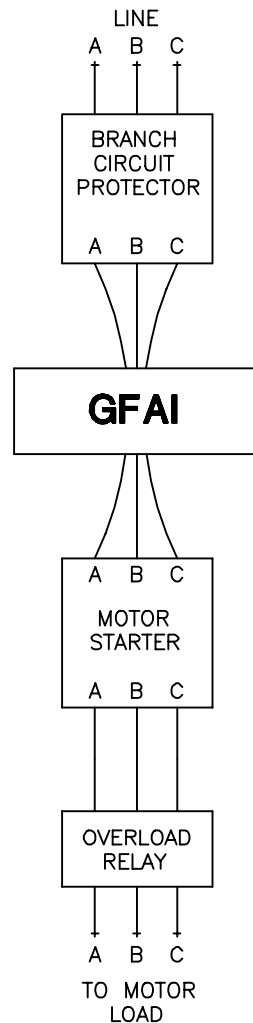


- 1 0 0 0 0 0 = 1 Amp
- 0 1 0 0 0 0 = 2 Amp
- 0 0 1 0 0 0 = 3 Amp
- 0 0 0 1 0 0 = 4 Amp
- 0 0 0 0 1 0 = 5 Amp
- 0 0 0 0 0 1 = 6 Amp

## GFAI-12-XX



- 1 0 0 0 0 0 = 7 Amp
- 0 1 0 0 0 0 = 8 Amp
- 0 0 1 0 0 0 = 9 Amp
- 0 0 0 1 0 0 = 10 Amp
- 0 0 0 0 1 0 = 11 Amp
- 0 0 0 0 0 1 = 12 Amp



ELECTROMECHANICAL, SOLID STATE  
AND/OR VFD  
TYPICAL MOTOR CIRCUIT  
LOCATION FOR GFAI.  
PASS ALL CURRENT CARRYING  
LEADS THROUGH CT WINDOW.

# THREE PHASE VOLTAGE MONITOR

## Model SPVR



### APPLICATION:

Protection of three phase electrical equipment sensitive to damage from a phase loss or phase unbalance. Phase reversal, phase sequence, undervoltage & overvoltage protection are available as options.

### AMBIENT TEMPERATURE RANGE:

Operation:  $-30^{\circ}\text{C}$ . to  $+60^{\circ}\text{C}$ .  
Storage:  $-40^{\circ}\text{C}$ . to  $+85^{\circ}\text{C}$ .

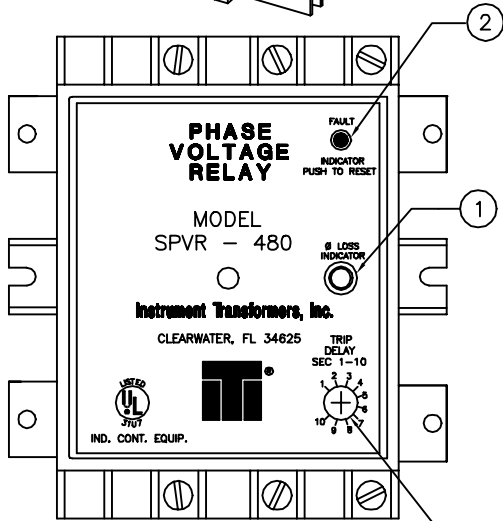
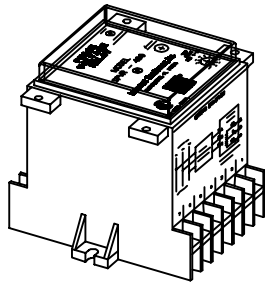
- Terminal screws are #6-32 nickel plated brass.

### NORMAL INPUT VOLTAGES:

120 to 600Vac – 60Hz,  
380 to 415Vac – 50Hz

- Shipping Weight: 3.0 lbs.

The Model SPVR Voltage Sensing Relay is designed to protect against phase loss and phase unbalance in a power system. The output contacts change their normal state only when a phase loss or unbalance occurs for longer than the preset trip delay. A total power loss or de-energization of the SPVR relay will not change the output contacts position. Recommended for manually reset switches and breaker applications.



### STANDARD FEATURES:

- Phase Unbalance: 8%
- Phase Loss Protection
- Adjustable Trip Delay: 1 to 10 seconds after failure occurs: prevents nuisance operations.
- Output Relay: normally de-energized: Form C contacts for easy circuit configuration.
- Automatic Reset to Normal: upon removal of fault conditions.
- Electro-Mechanical Indicator: retains memory of fault until manually reset.
- Door or panel mounting.
- Status Indicator: bi-colored LED
  - Green: Output Relay De-energized (Normal Condition).
  - Red: Output Relay Energized (Fault Condition).
  - Dark: Output Relay De-energized (Input Power Off).

### OPTIONAL FEATURES:

- Phase Reversal Protection: Operates the output relay instantaneously. LED diagnostic indicator.
- Phase Sequence Protection: operates the output relay instantaneously. LED diagnostic indicator.
- Overvoltage and Undervoltage Protection: Operates when voltage exceeds 115% or goes below 80% for a preset time. LED diagnostic indicator.
- Manual Reset: operates from a remote or local pushbutton in the cover. A long life Lithium battery assures the circuit operation and has an LED Low Battery Status indicator.
- Phase Unbalance Protection: 6% unbalance for motor applications.

- BI-COLORED LED INDICATOR:
  - Power system condition. Normal (green). Trip (red).
- ELECTROMECHANICAL DIAGNOSTIC INDICATOR:
  - Phase loss.
- ADJUSTABLE SYSTEM DELAY:
  - Phase loss.
  - Phase unbalance.

#### AVAILABLE MODELS

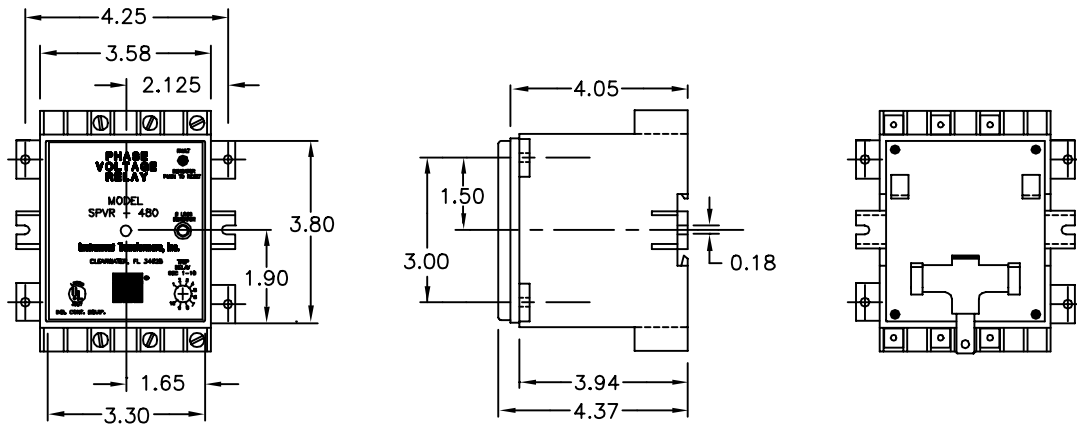
MODEL No.	NOMINAL Vac	Vac Range	FREQ.
SPVR 120	120	96 – 138	60
SPVR 208	208	166 – 238	60
SPVR 240	240	192 – 276	60
SPVR 480	480	384 – 552	60
SPVR 575	575	460 – 661	60
SPVR 380	380	304 – 437	50
SPVR 415	415	332 – 477	50

#### OUTPUT CONTACT RATINGS

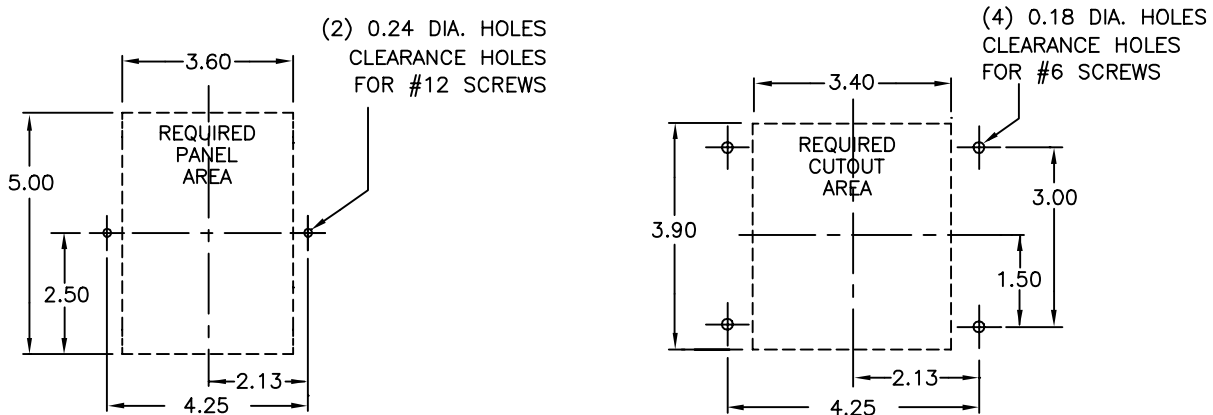
VOLTAGE	CONTINUOUS	MAKE	BREAK
120 Vac	10 A	3160 VA	316 VA
240 Vac	10 A	4800 VA	480 VA
380 Vac	10 A	4800 VA	480 VA
600 Vac	10 A	4800 VA	480 VA

10A, 28Vdc/120Vac/240Vac, 0.8pf  
3A, 480Vac/600Vac, 0.8pf

## SPVR DIMENSIONS



DOOR LAYOUT



PANEL MOUNTING LAYOUT

DOOR MOUNTING LAYOUT

## STANDARD SPVR OPERATION

When installed in a power system and conditions are normal, the output relay contacts will be in the de-energized state. At this time a bi-colored LED ("Power") on the face of the unit will be green. If a "phase loss" or "phase unbalance" occurs for longer than the user selected (1 Sec. to 10 Sec.) time delay, the output relay contacts change state and the LED changes to red indicating that a fault condition exists and the output relay is in the energized state.

All indicators, adjustments, and LED's are easily accessible on the face of the relay. An electromechanical pop-up device physically maintains a "phase loss" fault indication until reset.

The output relay has a single Form C contact and is rated for up to 600 volts AC, 28 volts DC. For additional contacts or higher current and voltage ratings, an external relay is used.

The SPVR relay is packaged in a high impact thermoplastic enclosure which can be either panel or door mounted. A clear Lexan cover is provided to prevent accidental adjustment and indicator condition changes.

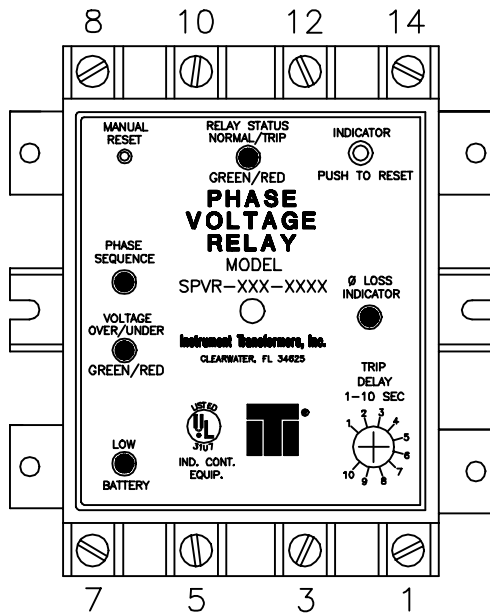
## ORDERING INFORMATION

**SPVR - XXX - XXXX**

Input Voltage:  
120/208/240/480 or 600Vac, (60Hz)  
380 or 415V ac, (50Hz)

Optional Features: (Select any or all)  
M - Manual Reset with local Push-Button  
O - Over and Undervoltage Protection  
R - Phase Reversal/Sequence Protection  
U - Phase Unbalance 6%

## SPVR OPTIONS



- Phase Sequence Protection: Operates the output relay instantaneously. LED diagnostic indicator.
- Phase Reversal Protection: Operates the output relay instantaneously. LED diagnostic indicator.
- Over and Undervoltage Protection: Operates when the voltage dips below 80% or exceeds 115% after a preset time delay. Automatically resets when the voltage level reaches 90% or 107%. LED diagnostic indicator.
- Manual Reset: A standard manual reset button in the cover and terminals for remote button.
- Electro-Mechanical fault indicator.
- Bi-Color LED indicates Relay Status.

## SPVR OPERATION WITH OPTIONS

A correctly installed SPVR Voltage Sensing Relay will protect a power system against damage due to "phase loss" and "phase unbalance". When operating under normal power conditions, the bi-colored LED ("Relay Status") will be green indicating the de-energized state of the output relay.

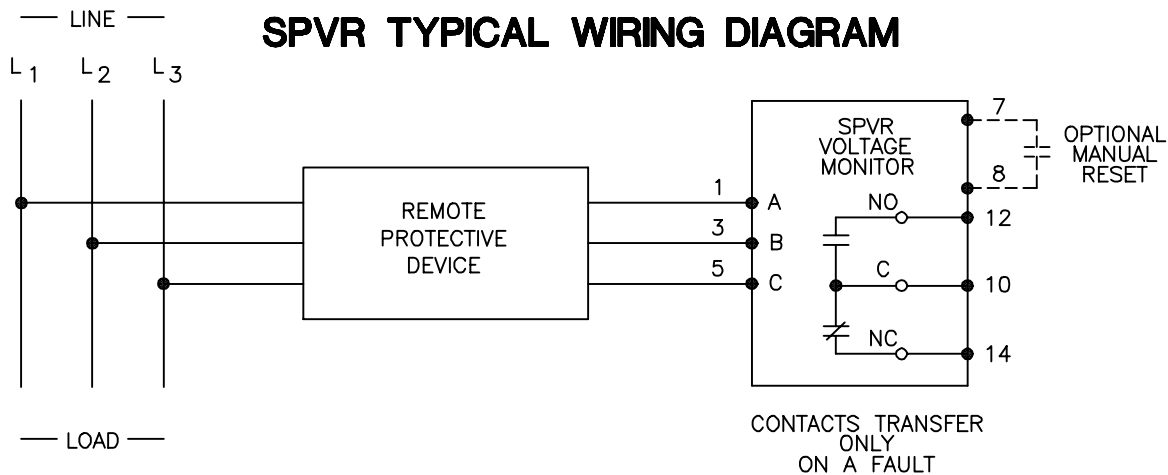
Optional protection is offered for phase sequence, phase reversal, and under or overvoltage. If a phase sequence or phase reversal condition occurs, the output relay changes state instantaneously. If a phase loss or phase unbalance of 8% (optional 6%) occurs for longer than the preselected time delay of 1 to 10 seconds, the output relay is energized and changes state. An LED diagnostic indicator lights on a phase loss condition. If the voltage level dips below 80% but is above 60% after the preselected time, or if the voltage exceeds 115% for a preselected time the output relay changes state. This output relay returns to its normal energized state when the the undervoltage returns to 90% or the overvoltage reduces to 107%.

With the manual reset option, a local reset push-button is provided on the front of the relay. Two terminals provided can be used for a normally open remote reset button. The SPVR relay can be reset with or without main incoming power. When the main power is restored, the output relay is energized immediately if a reset button has not been operated. This circuit includes a "long life" lithium battery with an LED to indicate low battery voltage.

The output relay has a single Form C contact and is rated for up to 600 volts AC, 28 volts DC. For additional contacts or higher current and voltage ratings an external relay is used.

The SPVR relay is packaged in a high impact thermoplastic enclosure which can be either panel or door mounted. The terminal hardware is set for panel mounting but is easily reversed for door mounting. A clear Lexan cover is provided to prevent accidental indicator changes.

## SPVR TYPICAL WIRING DIAGRAM



# THREE PHASE VOLTAGE MONITOR

## Model LPVR



### APPLICATION:

Protection of three phase electrical equipment sensitive to damage due to loss of phase, improper phase sequence, or undervoltage.

### NOMINAL INPUT VOLTAGES:

120V, 240V, 380V, 480V, 575V

### FREQUENCY:

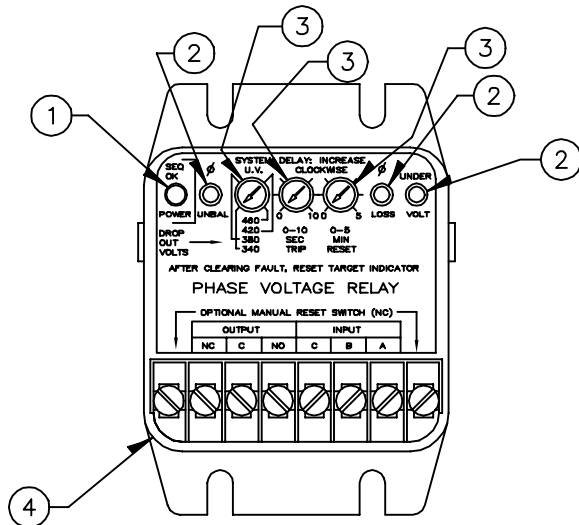
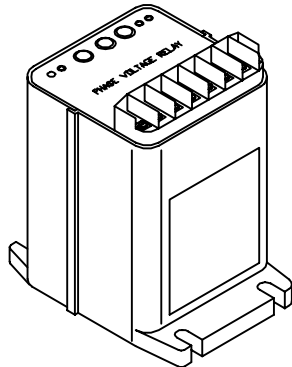
50 Hz, 60 Hz

### AMBIENT TEMPERATURE RANGE:

Operation: -30°C. to +60°C.

Storage: -55°C. to +85°C.

These Model LPVR Three Phase Voltage Monitors are designed to protect against phase loss, phase unbalance, phase reversal and undervoltage conditions in a power system. Electromechanical, manual reset diagnostic indicators show trip condition due to phase unbalance, phase loss or undervoltage. A green LED indicates that the power system has no fault present.



- ① GREEN LED INDICATOR:
  - Power system condition.
- ② ELECTROMECHANICAL DIAGNOSTIC INDICATORS:
  - Phase unbalance.
  - Phase loss.
  - Undervoltage.
- ③ ADJUSTABLE SYSTEM DELAYS:
  - Undervoltage trip point.
  - .05 - 10 second trip delay.
  - 1 sec.-5 minute reset delay.
- ④ TERMINAL BLOCK:
  - Automatic or manual reset.
  - Input Voltage - 120 to 575 Volts.
  - Output Contacts - Form C, 1 NO & 1 NC.

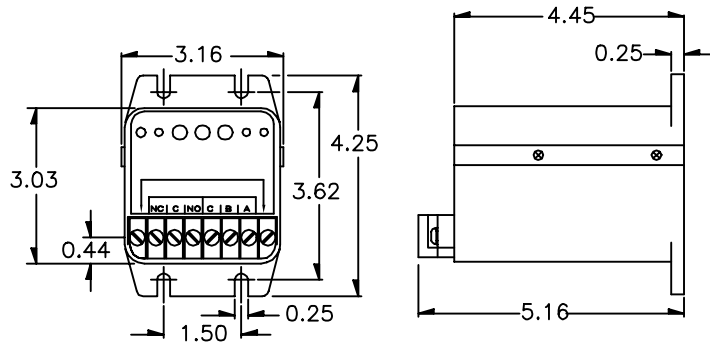
- Provides pre-start and running protection.
- Fully rated 600 Volt contacts.
- Diagnostic indicators continue to show cause of trip after voltage is removed.
- Adjustable undervoltage trip point settable from 75% to 95% of nominal.
- Adjustable trip delay from 50 milliseconds to 10 seconds.
- Adjustable reset delay from 1 second to 5 minutes.
- Operates at 6% phase unbalance, optional 10%.
- Operates with a 12.5% phase voltage loss.
- Automatic or manual reset, local or remote.
- Operational green LED indicator.
- Fail-safe: Trip free contacts will not operate if a fault is present.
- Isolated Form "C" output contacts.
- Terminal screws are #6-32 nickel plated brass.
- Shipping Weight: 2.1 lbs.

AVAILABLE WITH THE FOLLOWING 3 PHASE VOLTAGES

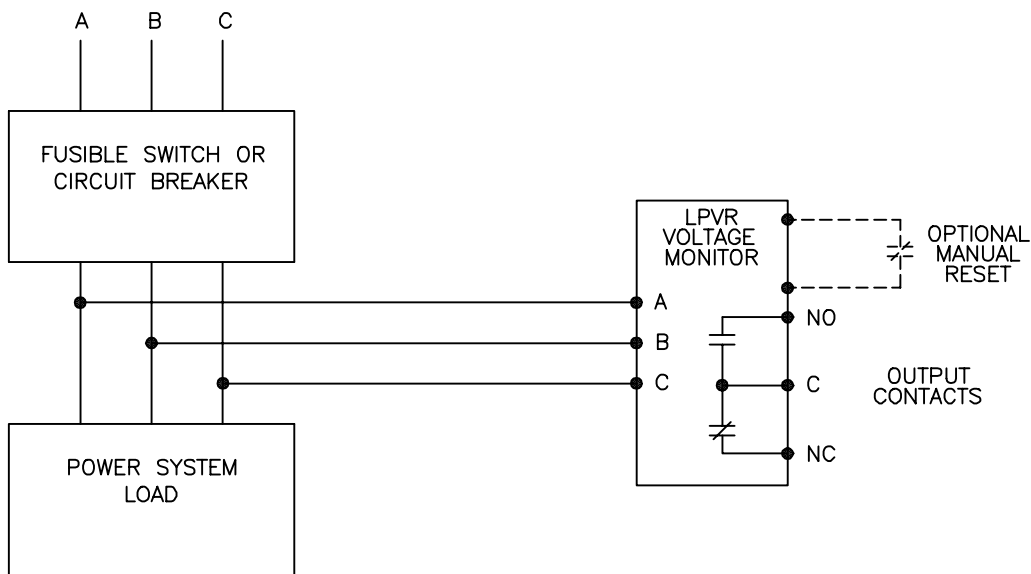
MODEL NUMBER	NOMINAL RATING	VOLTAGE RANGE	FREQ.
LPVR 120	120	90 - 125	60 Hz
LPVR 240	240	180 - 250	60 Hz
LPVR 480	480	360 - 500	60 Hz
LPVR 575	575	430 - 600	60 Hz
LPVR 400	380	285 - 400	50 Hz

OUTPUT CONTACT RATINGS			
VOLTAGE	CONTINUOUS CURRENT	MAKE RATING	BREAK RATING
120V ac	10A	3160 VA	316 VA
240V ac	10A	4800 VA	480 VA
380V ac	10A	4800 VA	480 VA
480V ac	10A	4800 VA	480 VA
575V ac	3A	4800 VA	480 VA

## LPVR DIMENSIONS



## LPVR TYPICAL WIRING DIAGRAM



## LPVR OPERATION

The LED will light when there is no fault present and the output relay contacts have been transferred. The operator should be aware that the LED will not light until after any reset time delay has been satisfied and the output contacts transfer. Under a fault condition the LED will be off and one of the electromechanical indicators will be extended. The tripped indicator will show which fault caused the output relay to drop out. The indicator can be manually reset at any time without affecting the operation of the relay. However, the fault must be corrected before the output relay will re-energize. An additional fault will not cause an additional indicator to trip.

The unit allows the operator an adjustable trip delay that is effective on all faults once the device has been energized. The operator can also adjust the reset delay. The full delay will become effective after the device has been energized for more than 50 seconds. If a fault occurs in less than 50 seconds after power is applied the reset time delay will be proportionally shorter. This delay takes precedence over manual reset.

The device is shipped from the factory in the automatic reset configuration. For manual reset the operator must connect a normally closed set of contacts to the indicated terminals on the LPVR. After the selected reset time delay has been satisfied and any fault has been corrected the device can be reset by momentarily opening the contacts.

If a fault is present when the power circuit is closed the output contacts will not be energized. This is true for all fault conditions and any combination of operator selected time delays.

This device can be mounted inside a cabinet and will retain the shutdown fault indication after the power disconnect is operated to permit safe entry into the cabinet. These electromechanical fault indicators must be manually reset. Other similar devices use LED fault indicators which lose intelligence when the power is disconnected to open the cabinet door.



# PHASE LOSS PHASE SEQUENCE DETECTION SYSTEM

## Model APVR



### APPLICATION:

Protection of three phase electrical equipment sensitive to damage due to loss of phase, phase unbalance or improper phase sequence.

### NOMINAL INPUT VOLTAGES:

120V, 208V, 240V, 380V, 415V, 480V, 575V

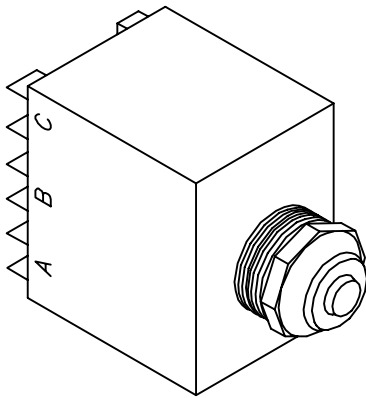
### FREQUENCY:

50 Hz, 60 Hz

### AMBIENT TEMPERATURE RANGE:

Operation: -30°C to +60°C  
Storage: -55°C to +85°C

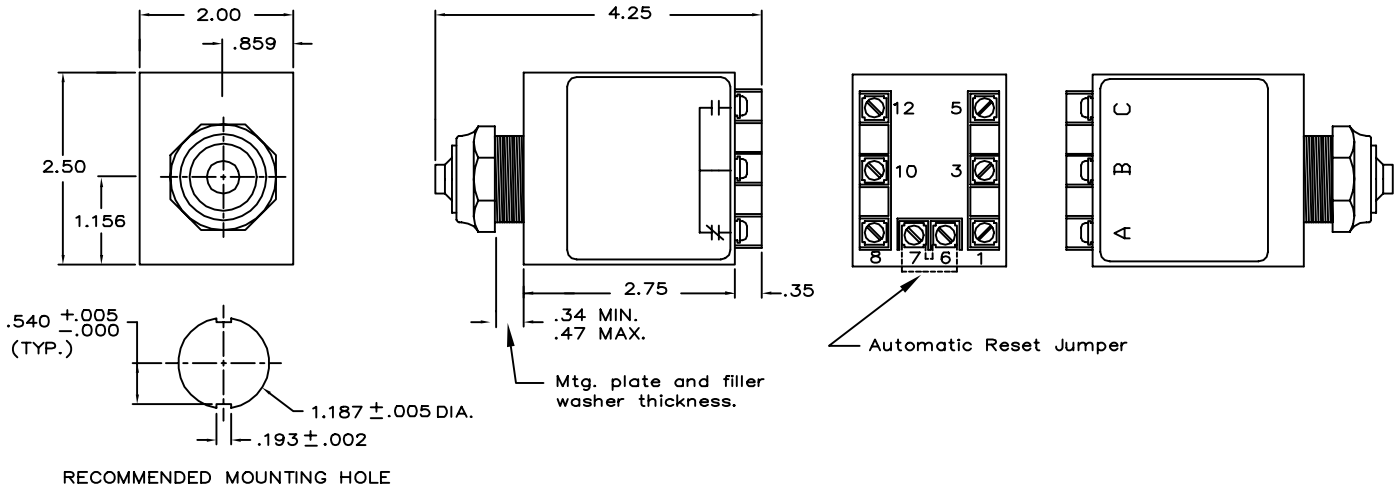
### SPECIFICATIONS



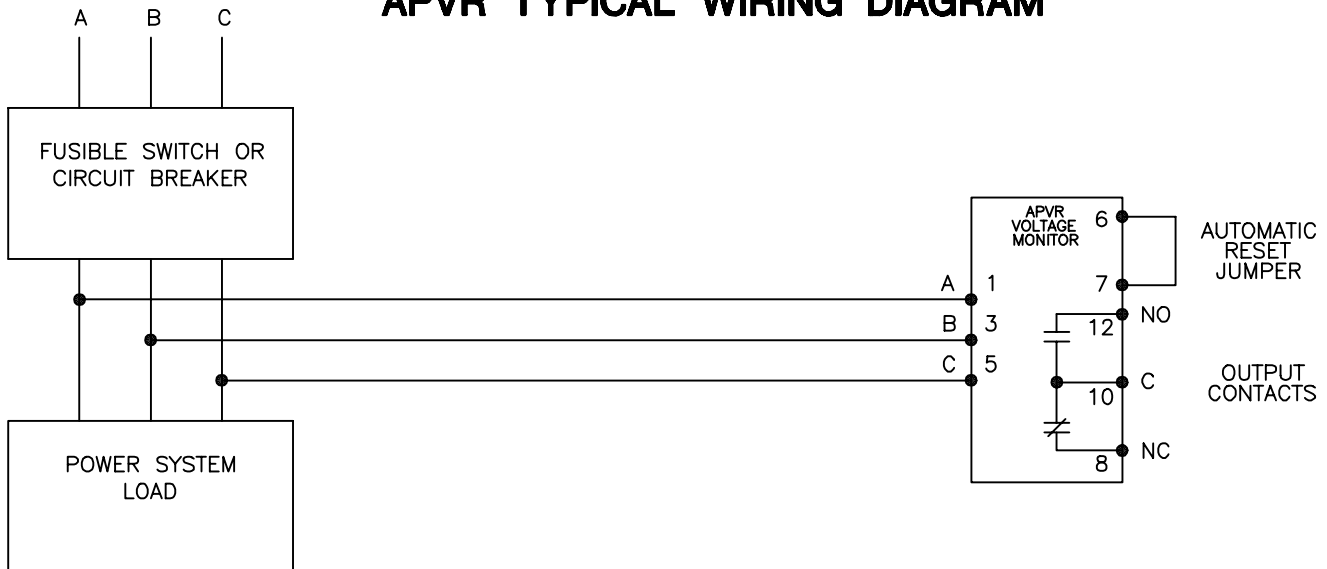
- Failsafe: Trip free contacts will not operate if a fault is present.
- Automatic reset. (Configurable to manual reset, See application notes.)
- Fixed undervoltage trip point: approx. 90% pickup, 80% dropout.
- Operates at 6% phase unbalance.
- Operational green LED indicator.
- Isolated Form "C" output contacts.
- Output contact rating: 250V ac, 5 amps, (general use).
- Input voltages up to 575V ac.
- Terminal screws are # 6-32 nickel plated brass.
- 3 second drop-out delay to avoid nuisance tripping.
- Shipping Weight: 0.6 lbs.

AVAILABLE FOR THE FOLLOWING 3 PHASE VOLTAGES

MODEL NUMBER	NOMINAL	VOLTAGE RANGE	FREQUENCY
APVR 120	120V	95 - 135	60Hz
APVR 208	208V	165 - 234	60Hz
APVR 240	240V	190 - 270	60Hz
APVR 480	480V	380 - 530	60Hz
APVR 575	575V	455 - 600	60Hz
APVR 380	380V	300 - 425	50Hz
APVR 415	415V	328 - 466	50Hz



## APVR TYPICAL WIRING DIAGRAM



## UNBALANCE CALCULATION

$$\frac{\text{MAX DEVIATION FROM AVERAGE}}{\text{AVERAGE}} \times 100 = \% \text{ UNBALANCE}$$

EXAMPLE:

$\phi A - \phi B = 240V$ ;  $\phi B - \phi C = 220V$ ;  $\phi C - \phi A = 215V$ ; AVERAGE = 225V

MAX DEVIATION FROM AVERAGE =  $240 - 225 = 15V$

$$\% \text{ UNBALANCE} = \frac{15}{225} \times 100 = 6.67\%$$

## APPLICATION NOTES

If the power conditions are normal, 3 seconds after power is supplied to the APVR the contacts will transfer, permitting operation. In normal applications, this power will already be applied to the APVR and there is no time delay in operating.

The correct phase sequence must be established upon initial installation for proper operation of the relay. Any subsequent change in phase sequence will cause the relay to trip. If the relay is re-energized and the phase sequence is incorrect the relay will not operate.

The device is shipped from the factory in the automatic reset mode with a jumper on terminals 6 & 7. Operation can be changed from automatic reset to manual reset by removing the external jumper. Automatic reset means that upon fault removal the device resets automatically to perform its monitoring function. For manual reset simply remove the jumper and connect a normally open pushbutton across terminals 6 and 7.

Upon application of power the green LED indicator will illuminate. If a fault exists the green LED will remain illuminated for three seconds and then go out. This is normal and indicates that line power is present but a fault condition has been detected. The output contacts will remain in their de-energized failsafe state.

If no fault exists upon application of power the green LED indicator illuminates and three seconds later the relay contacts transfer. Upon detection of a fault, the green indicator light will go out and three seconds later the relay contacts revert to their de-energized state. This three second delay prevents nuisance tripping of the APVR.

In service the line voltage to the device may be interrupted on various occasions. In the automatic reset mode the device will resume its monitoring function approximately three seconds after power is restored. In the manual reset mode the reset pushbutton must be pressed.

"Failsafe" operation is achieved by the following features:

- 1) The relay is energized and the output contacts are transferred under "normal" conditions only.
- 2) Should the output relay itself fail or in the event of internal circuit failure, the relay will revert to the de-energized position.

# VOLTAGE TRANSDUCERS

## Models LLV & PNV

**APPLICATION:**  
3 Phase voltage measurement.

**NOMINAL INPUT VOLTAGES:**  
120V, 240V, 277V, 480V

**FREQUENCY:**  
50/60Hz

**ACCURACY:**  
±0.5% Full scale.

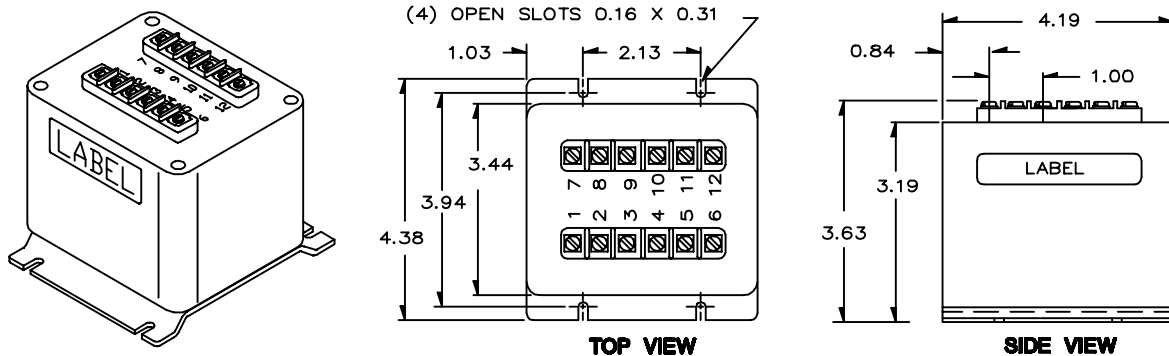
**AMBIENT TEMPERATURE RANGE:**

- Effect on accuracy : ±0.03%/°C.
- Operating : -30°C to +60°C.
- Storage : -55°C to +85°C.

- Power supply: 24 V dc ± 10%
- Max. continuous input voltage: 600V
- Output:
  - Load range: 0-600 ohms.
  - Operating range: 4 to 20mA dc.
  - Ripple: < 1%.
  - Response time: < 1.5 sec. (10% to 90%)
- Approx. shipping weight: 1.3 lbs.



The Model LLV and PNV series of voltage transducers are expanded scale instruments which are designed to accurately measure voltages on three phase systems. The LLV series is designed to meter line-to-line voltages and the PNV series is designed to meter phase-to-neutral voltages. The transducers provide three discrete 4 to 20mA outputs that are proportional to the three phase input voltages. The input voltage scale does not meter down to zero Volts, instead it is limited to the normal useful range of input voltages for a particular system. For example: The model PNV-120 has an input signal range from 90 to 150 V ac and will yield an output of 4 to 20 mA dc for that range. The output is a true constant current driver and is unaffected by resistance variations from 0-600 ohms in the output loop. An external 24V dc supply is needed to provide power for the internal solid state circuitry. The power supply input has reverse polarity protection to prevent damage from an accidental miswire. The high accuracy solid state circuitry is average responding calibrated to read RMS. This device is an ANSI/ISO 50.1 Class L3 Transmitter.



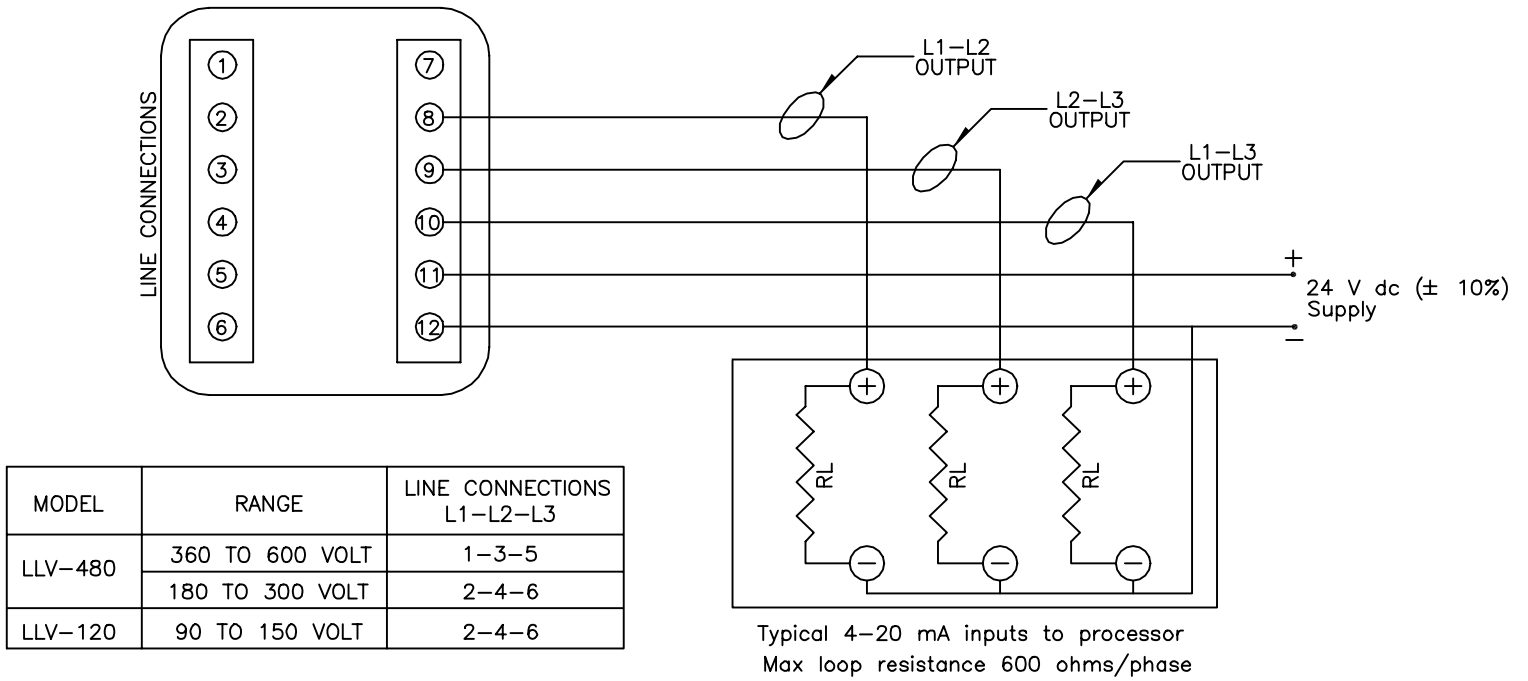
	LINE-TO-LINE VOLTAGE			PHASE-TO-NEUTRAL VOLTAGE	
	LLV	LLV (Dual Range)		PNV	
Nominal Input Voltage	120V	240V	480V	120V	277V
Voltage Input Range	90V to 150V	180V to 300V	360V to 600V	90V to 150V	180V to 300V
Burden (Max.)	0.1VA at 120V	0.1VA at 265V	0.1VA at 530V	0.1VA at 150V	0.1VA at 300V
Ripple On Output	250 $\mu$ A ac				
Dielectric Test (1 Min)	1300 Volts	1600 Volts	2200 Volts	1300 Volts	1600 Volts
Transfer function: $E_{in} =$	(3.75)(mA out)+75	(7.5)(mA out)+150	(15)(mA out)+300	(3.75)(mA out)+75	(7.5)(mA out)+150

**ORDERING INFORMATION**

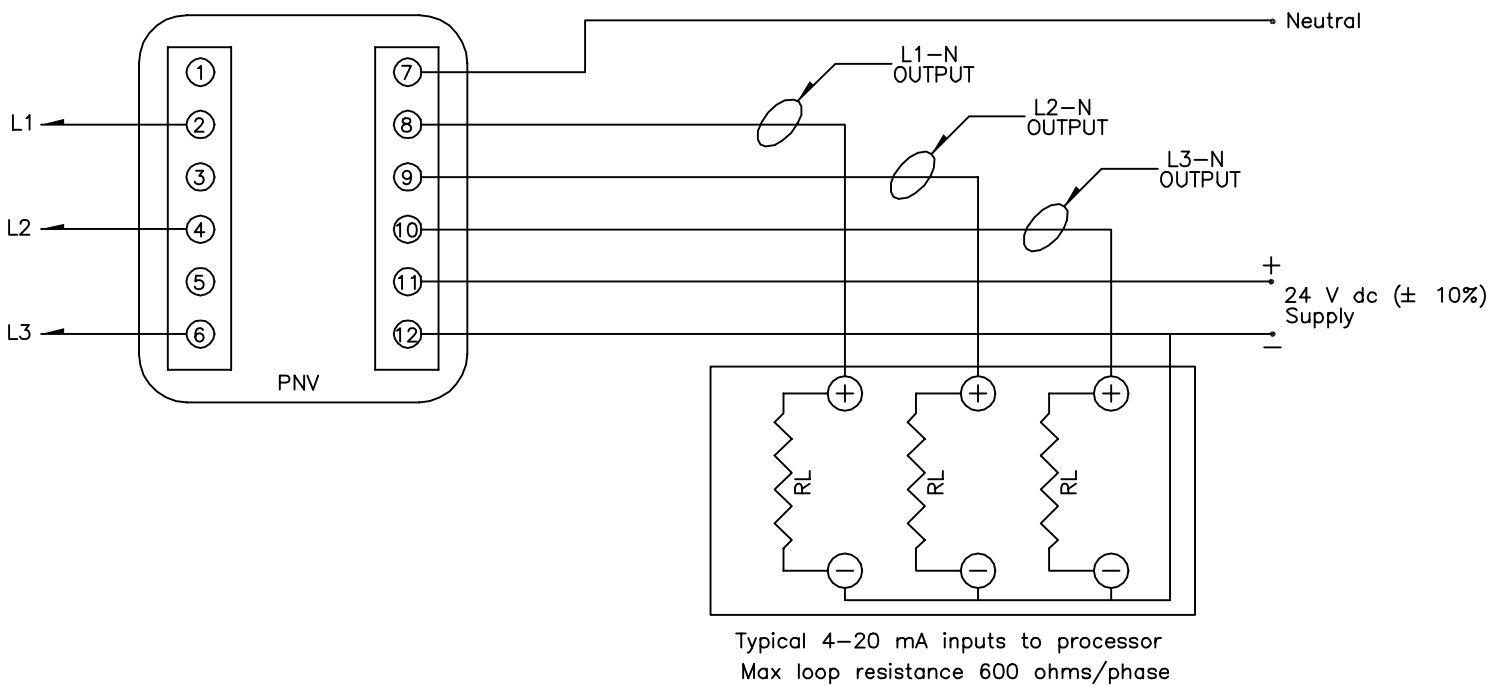
MODEL  $\rightarrow$  XXX-XXX  $\leftarrow$  NOMINAL INPUT VOLTAGE

LLV	120
PNV	277 [PNV Model only]
	480 [LLV (Dual Range) Model only]

## LLV (LINE-TO-LINE) CONNECTION DIAGRAM



## PNV (PHASE-TO-NEUTRAL) CONNECTION DIAGRAM



It is recommended that the installation conform to the NEC and any local codes.

# BLOWN FUSE INDICATOR

**Models BFI-200  
BFI-400  
BFI-600**

## APPLICATION:

For use with Power Correction Capacitor Fuses and Main Fuse Motor Control Circuits rated up to 600vac.

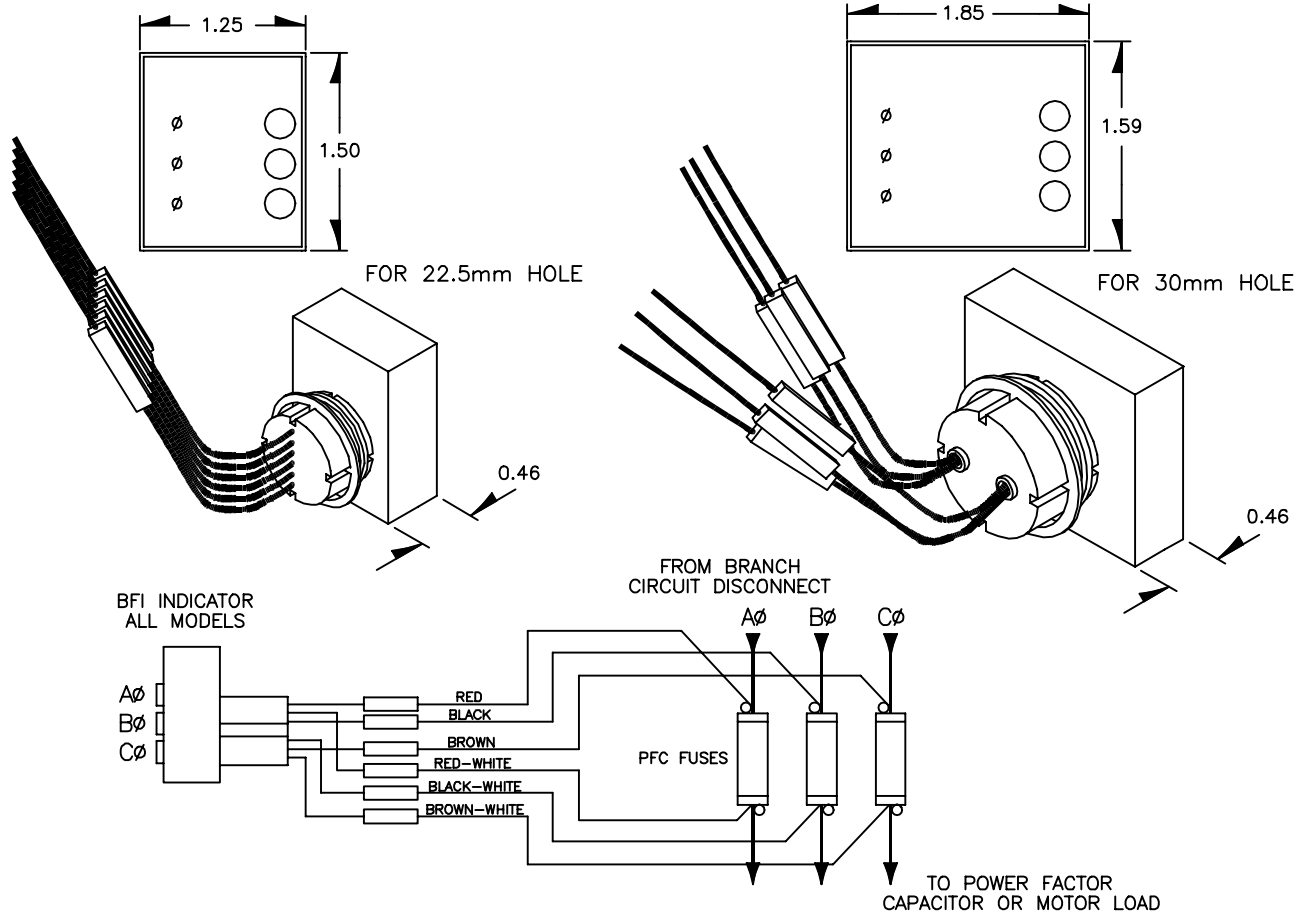
## MAX INPUTS:

277, 415, 600 VAC, 50/60 Hz. based on model.

## AMBIENT TEMPERATURE RANGE:

-30°C to +70°C

- 36 inch wire leads, 20 gauge copper, 600vac, 105°C rated with in-line voltage/current limiting networks.
- Available in 22.5mm and 30mm keyed mounting designs.
- Color-coded phase cables.
- Miniature neon lamp indicators.
- Approximate weight: 0.5 lbs.



The BFI system includes three individual phase neon lamps for indicating pfc or main fused motor status. Under normal conditions all lamps are off. Should a monitored fuse open for any reason the associated BFI phase circuit lamp will illuminate.

Each BFI model comes with six, 36 inch color coded phase leads. They can be butt spliced for additional length or terminated to suit each individual application. A variety of crimp-on quick connect voltage clips are available for use with industry standard fuse blocks. Please consult vendor for availability.

The BFI indicator is available in 22.5mm and 30mm keyed mounting. Both types are suitable for use with Type 1 and Type 12 enclosures.

The model BFI Blown Fuse Indicator is intended for use on power factor correction capacitors and motor circuits rated up to 600vac, 50/60 Hz with individual phase protection fuses.

NOTE: When applied properly, the BFI provides local fuse status for pfc and motor circuits. It is not intended for use in local or remote relay protection, alarm or trip circuits. When applied in main fused motor circuits, proper fuse loss will be indicated after motor shut down.

## HOW TO ORDER INDICATORS

**BFI - XXX - XX**

VOLTAGE RANGE  
200 = 200 to 277vac  
400 = 346 to 415vac  
600 = 440 to 600vac

INDICATOR \*  
22 = 22.5 millimeters  
30 = 30 millimeters

\* INCLUDES MOUNTING HARDWARE

# AC CURRENT TRANSDUCER

## Model ACV

0-200 Amps to produce

0-5 Volts dc



### OPERATING RANGES:

Primary : 5 to 200 Amps ac.  
Secondary : 0 to 5 Volts dc.

### FREQUENCY:

50/60 Hz.

### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

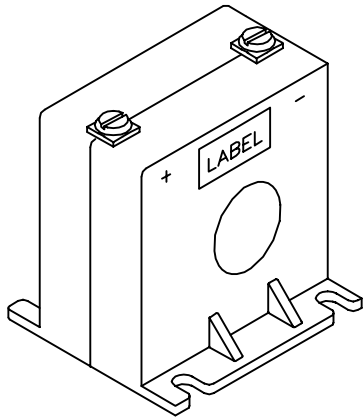
### RESPONSE TIME:

0.25 Seconds.

### AMBIENT TEMPERATURE RANGE:

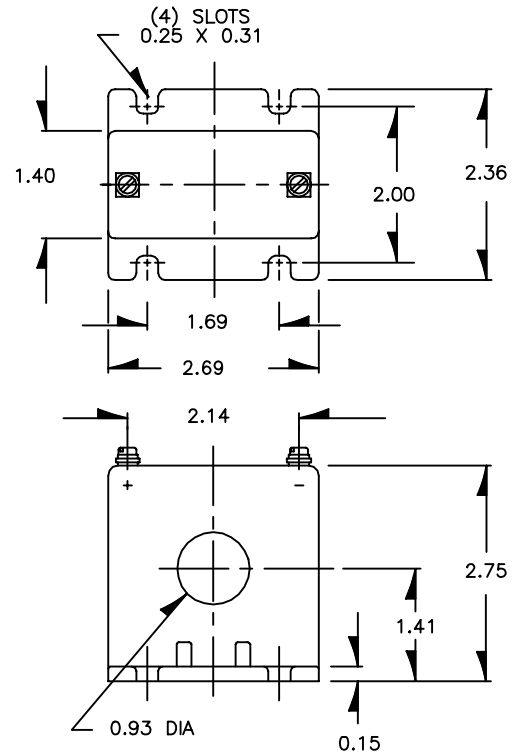
-30°C. to +60°C.

- 1% max. peak ripple on output at 1 megohm or greater.
- Secondary terminals are brass screws No. 8-32 with one flatwasher and lockwasher.
- Approximate weight: 1.5 lbs.



MODEL NUMBER	PRIMARY AMPS	ACCURACY % F.S.*
ACV - 5	0-5	1.0
ACV - 10	0-10	0.75
ACV - 15	0-15	0.75
ACV - 20	0-20	0.5
ACV - 30	0-30	0.5
ACV - 50	0-50	0.5
ACV - 75	0-75	0.5
ACV - 100	0-100	0.5
ACV - 150	0-150	0.5
ACV - 200	0-200	0.5

\* FOR LOADS GREATER THAN 1 MEGOHM.



## Description:

The Model ACV series of current transducers will produce a 0-5V dc output signal that is directly proportional to the input current. The transducer's internal circuitry is average sensing, calibrated for RMS.

## Application:

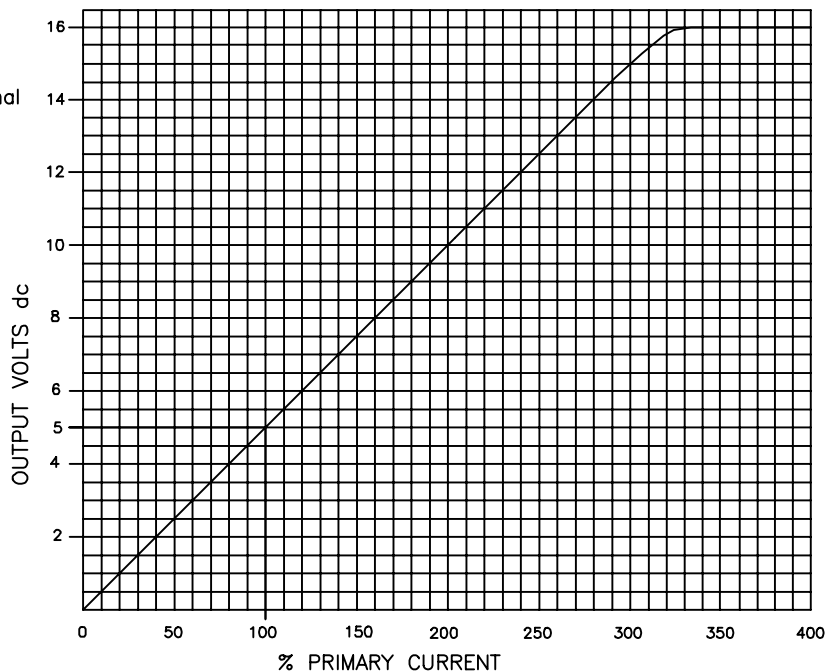
These transducers are intended for use with process control or industrial measuring equipment. The D.C. output signal can be connected directly to a high impedance A/D input of a computer without any additional signal conditioning components.

These transducers can accurately measure up to 200% of full scale on a short time basis (1 min. or less), and 150% on a continuous basis.

To protect external circuits from damage caused by a short circuit or motor inrush current the output is limited to approx. 16V. If it is necessary to accurately measure motor overload currents then a model must be selected so that the expected overload will fall within the transducer's 200% accuracy range.

EXAMPLE: Motor FLA of 6A.

During lock rotor condition the current could rise to 36A. In order to accurately measure the 36A inrush current a model ACV-20 should be used. The ACV-20 will accurately measure up to and including 40 Amps.



# AC CURRENT TRANSDUCER

## Model 10ACV

0-200 Amps to produce  
0-10 Volts dc

### OPERATING RANGES:

Primary : 5 to 200 Amps ac.  
Secondary : 0 to 10 Volts dc.

### FREQUENCY:

50/60 Hz.

### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

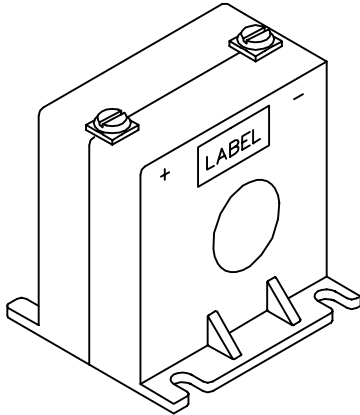
### RESPONSE TIME:

0.25 Seconds.

### AMBIENT TEMPERATURE RANGE:

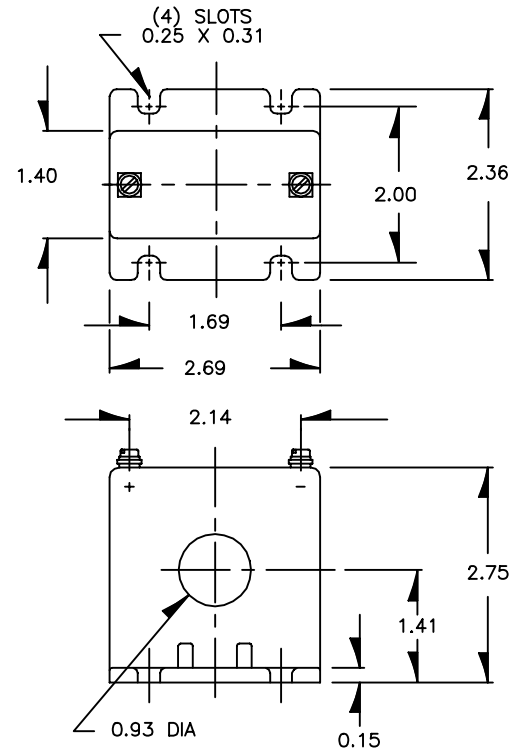
-30°C. to +60°C.

- 1% max. peak ripple on output at 150 K ohms or greater.
- Secondary terminals are brass screws No. 8-32 with one flatwasher and lockwasher.
- Approximate weight: 1.5 lbs.



MODEL NUMBER	PRIMARY AMPS	ACCURACY % F.S.*
10ACV - 5	0-5	1.0
10ACV - 10	0-10	0.75
10ACV - 15	0-15	0.75
10ACV - 20	0-20	0.5
10ACV - 30	0-30	0.5
10ACV - 50	0-50	0.5
10ACV - 75	0-75	0.5
10ACV - 100	0-100	0.5
10ACV - 150	0-150	0.5
10ACV - 200	0-200	0.5

\* FOR LOADS GREATER THAN 150 K OHMS.



## Description:

The Model 10ACV series of current transducers will produce a 0-10V dc output signal that is directly proportional to the input current. The transducer's internal circuitry is average sensing, calibrated for RMS.

## Application:

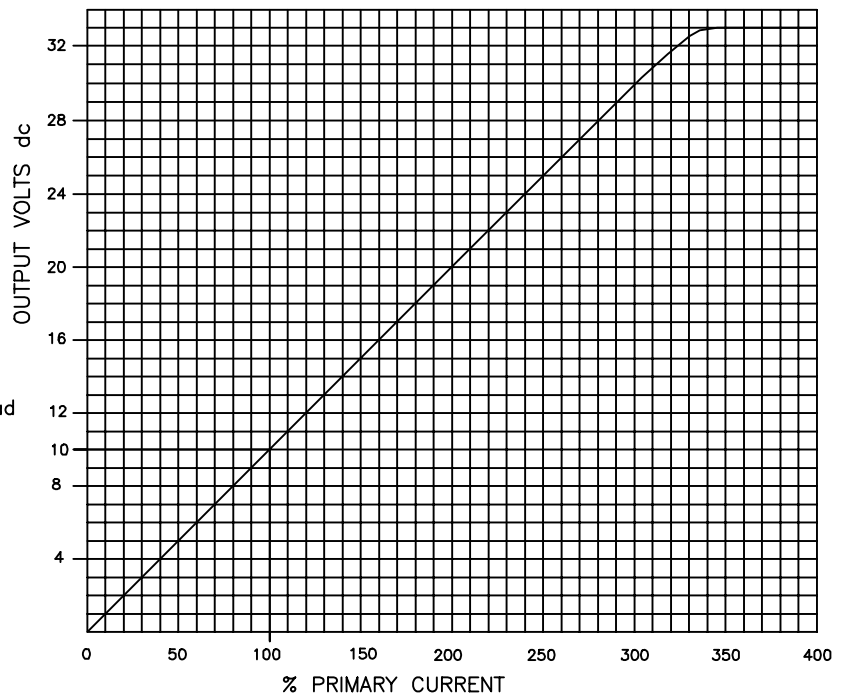
These transducers are intended for use with process control or industrial measuring equipment. The D.C. output signal can be connected directly to a high impedance A/D input of a computer without any additional signal conditioning components.

These transducers can accurately measure up to 200% of full scale on a short time basis (1 min. or less), and 150% on a continuous basis.

To protect external circuits from damage caused by a short circuit or motor inrush current the output is limited to approx. 33V. If it is necessary to accurately measure motor overload currents then a model must be selected so that the expected overload will fall within the transducer's 200% accuracy range.

EXAMPLE: Motor FLA of 6A.

During lock rotor condition the current could rise to 36A. In order to accurately measure the 36A inrush current a model 10ACV-20 should be used. The 10ACV-20 will accurately measure up to and including 40 Amps.



# AC CURRENT TRANSUDCER

## Model PCL

0-75 Amps ac to produce 4-20 mA dc

### OPERATING RANGE:

Input: 0 to 5 thru 75 Amps ac.  
Output: 4 - 20 mA dc.

### FREQUENCY:

50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

- Effect on accuracy:  $\pm 0.02\%/^{\circ}\text{C}$
- Operating:  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$
- Storage:  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

### ACCURACY:

$\pm 0.5\%$  F.S. maximum.  
1% max. peak ripple on output.

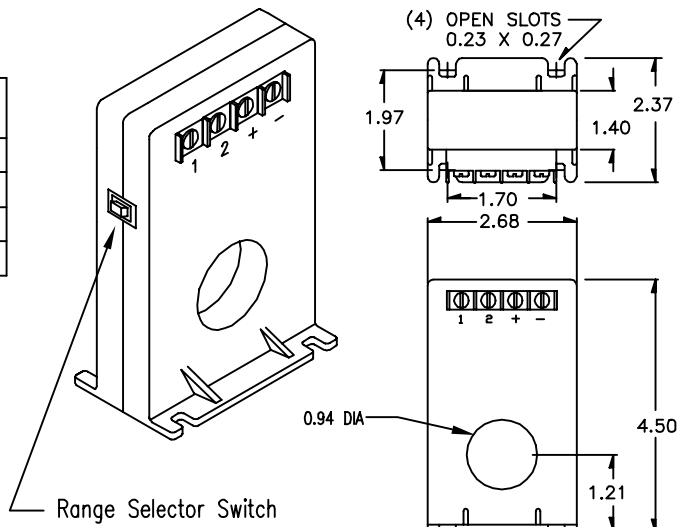
- Response Time:  $< 150\text{ms}$  (10% to 90%)
- Output load ( $R_L$ ): 0 to 1000 ohms.
- Maximum output: 30 mA dc.
- Supply Voltage Range: 120 Vac  $\pm 10\%$ .
- Terminals are No. 10-32 brass screws.
- Approximate weight: 1.0 lb.



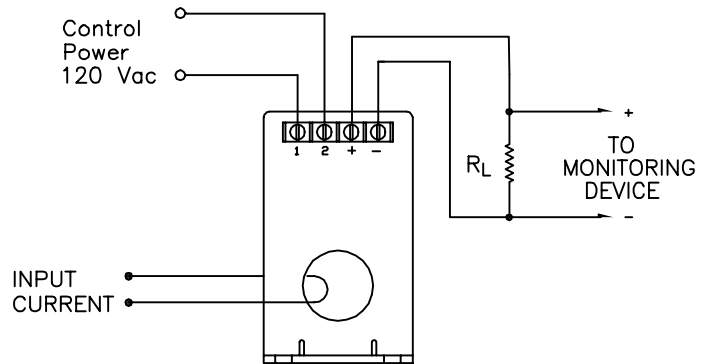
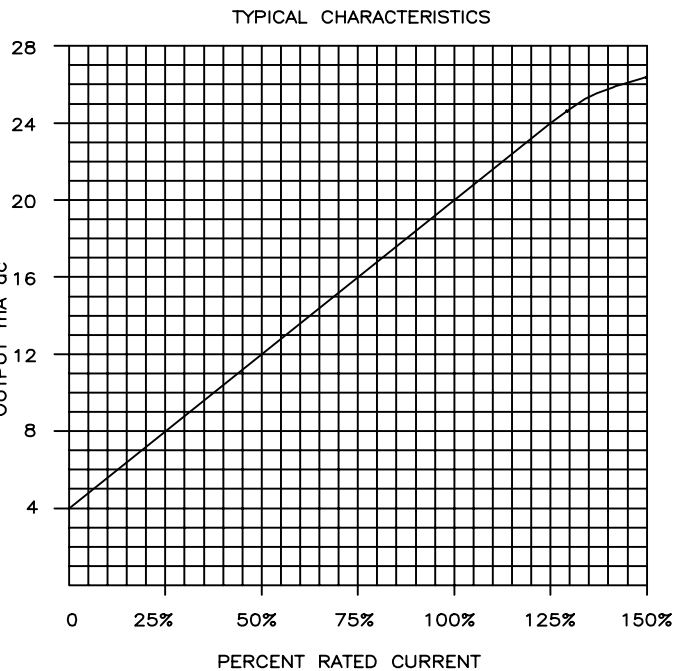
The PCL transducer accurately converts a sinusoidal ac input current to a proportional dc output current. The high performance integrated circuits achieve a constant current output, insensitive to a variable impedance load. This allows the PCL to be easily applied to remote instrumentation, motor control and energy management installations. The output signal (4 to 20mA dc) can be transmitted over long distances with no loss in accuracy. Model numbers PCL 20 and PCL 75 have been provided with a range selector switch for customer selectable current ranges. The input circuit is average responding. The output is calibrated to read true RMS for a pure sinusoidal waveform.

MODEL NUMBER	INPUT CURRENT RANGE
PCL 5	0 - 5
* PCL 20	0 - 10, 0 - 15, 0 - 20
* PCL 75	0 - 25, 0 - 50, 0 - 75
See Page 33 for 0-100 thru 0-600	

\* Switch selectable current ranges.



## TYPICAL CONNECTION DIAGRAM



## APPLICATION

Calculating:  $I_m = \text{ac Amps measured}$   
 $I_o = \text{mA dc out of PCL}$   
 Rated Input = CT Primary Rating (when monitoring a CT)  
 Rated Input = PCL Primary Rating (when monitoring direct)

Where:  $I_m = \text{Rated Input} \times \left( \frac{I_o - 4}{16} \right)$



# AC CURRENT TRANSUDCER

## Model PCL

0-600 Amps ac to produce 4-20 mA dc



### OPERATING RANGES:

Input: 0 to 100 thru 600 Amps ac.  
Output: 4 - 20 mA dc.

### FREQUENCY:

50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

- Effect on accuracy:  $\pm 0.02\%/^{\circ}\text{C}$
- Operating:  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$
- Storage:  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

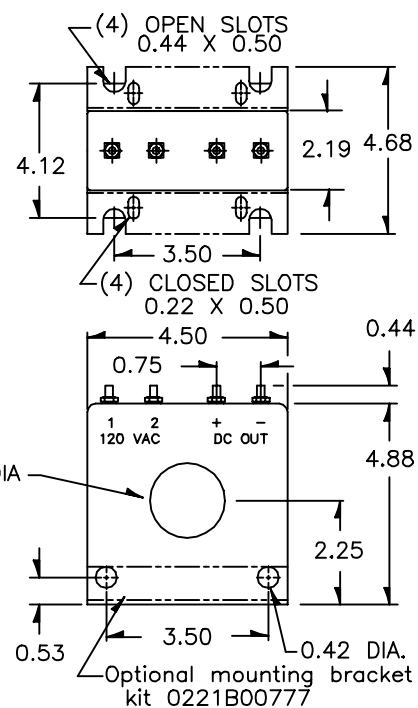
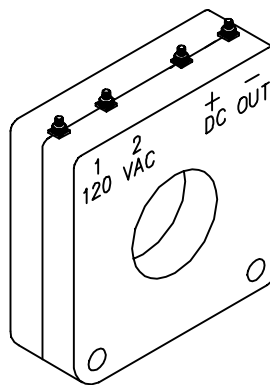
### ACCURACY:

$\pm 0.5\%$  F.S. maximum.  
1% max. peak ripple on output.

- Response Time:  $< 150\text{ms}$  (10% to 90%)
- Output load ( $R_L$ ): 0 to 1000 ohms.
- Maximum output: 30 mA dc.
- Supply Voltage Range:  $120\text{ Vac} \pm 10\%$ .
- Terminals are brass studs No. 8-32 with one flatwasher, lockwasher and regular nut.
- Approximate weight: 3.0 lbs.

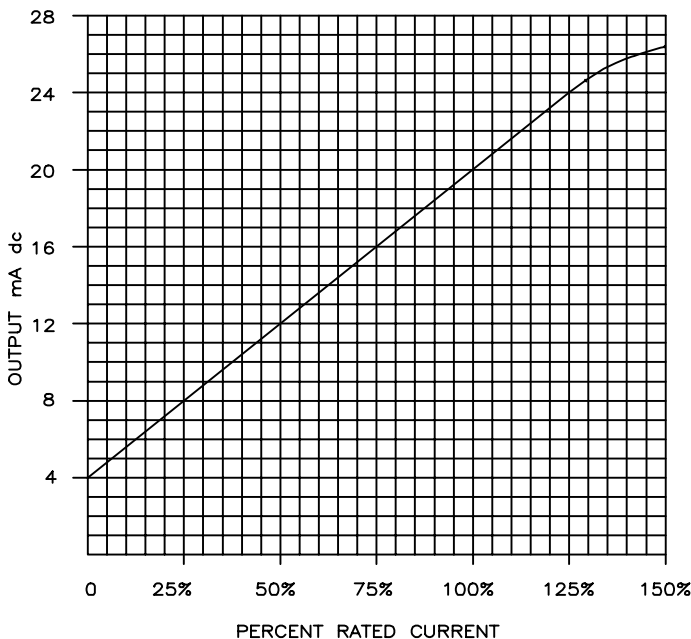
The PCL transducer accurately converts a sinusoidal ac input current to a proportional dc output current. The high performance integrated circuit amplifiers achieve a constant current output, insensitive to a variable impedance load. This allows the PCL to be easily applied to remote instrumentation, motor control and energy management installations. The output signal (4 to 20mA dc) can be transmitted over long distances with no loss in accuracy.

MODEL NUMBER	INPUT CURRENT RANGE
See Page 32 for 0-5 thru 0-75	
PCL 100	0 - 100
PCL 150	0 - 150
PCL 200	0 - 200
PCL 300	0 - 300
PCL 400	0 - 400
PCL 600	0 - 600
0221B00777	Mtg. Bracket Kit

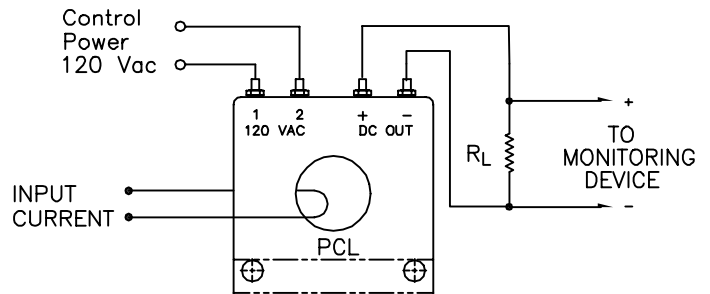


For load currents which are greater than 600A the PCL-5 may be used in conjunction with separate higher ratio C.T.'s having a rated 5A secondary.

TYPICAL CHARACTERISTICS



## TYPICAL CONNECTION DIAGRAM



## APPLICATION

Calculating:  $I_m$  = ac Amps measured  
 $I_o$  = mA dc out of PCL  
Rated Input = CT Primary Rating (when monitoring a CT)  
Rated Input = PCL Primary Rating (when monitoring direct)

Where:  $I_m = \text{Rated Input} \times \left( \frac{I_o - 4}{16} \right)$

# AC CURRENT TRANSDUCER

## Model PCM

*0-300 Amps ac to produce 4-20 mA dc*

### OPERATING RANGE:

Input: 0 - 5 thru 0 - 300 Amps ac.  
Output: 4 - 20 mA dc.

### FREQUENCY:

50/60 Hz.

### AMBIENT TEMPERATURE RANGE:

- Effect on accuracy:  $\pm 0.04\%/^{\circ}\text{C}$
- Operating:  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$
- Storage:  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### CONTINUOUS THERMAL CURRENT RATING FACTOR:

1.33 at  $30^{\circ}\text{C}$  ambient \*

\* 6.00 times rated current for 30 seconds

### INSULATION LEVEL:

600 Volt, 10 kV BIL full wave.

### ACCURACY:

$\pm 0.5\%$  F.S. maximum.  
1% maximum peak to peak ripple on dc output.

- Output load ( $R_L$ ): 0 to 600 ohms.
- Maximum output: 30 mA dc.
- Supply Voltage Range: 24V dc  $\pm 10\%$ .
- Response time:  $< 200\text{ms}$  (10%-90%)
- Repeatability:  $< 0.1\%$
- PCM 5-200 terminals are brass screws No. 10-32 with one flatwasher and lockwasher.
- PCM 300 terminals are brass studs No. 8-32 with one flatwasher, lockwasher and nut.
- Approximate weight: 1.5 lbs.

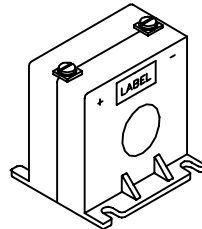
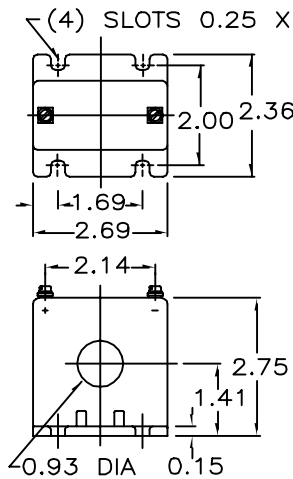


The PCM transducer accurately converts a sinusoidal ac input current to a proportional dc output current. The high performance integrated circuit amplifiers achieve a constant current output, insensitive to a variable impedance load. This allows the PCM to be easily applied to remote instrumentation, motor control, and energy management installations. The input circuit is average responding.

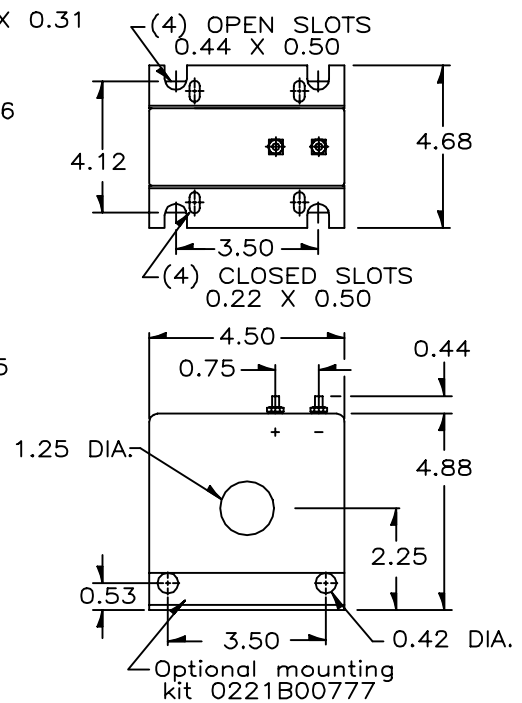
MODEL NUMBER	INPUT CURRENT RANGE
PCM 5	0 - 5
PCM 10	0 - 10
PCM 20	0 - 20
PCM 30	0 - 30
PCM 50	0 - 50
PCM 75	0 - 75
PCM 100	0 - 100
PCM 150	0 - 150
PCM 200	0 - 200
PCM 300	0 - 300

For primary currents which are greater than 300A, the 5A unit may be used in conjunction with higher ratio C.T.'s having a rated 5A secondary.

### PCM 5-200



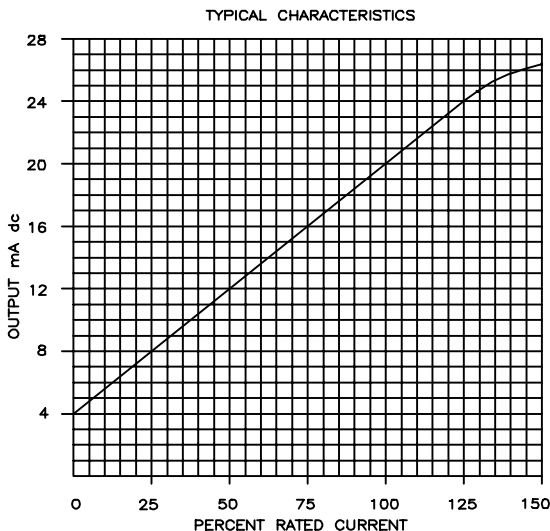
### PCM 300



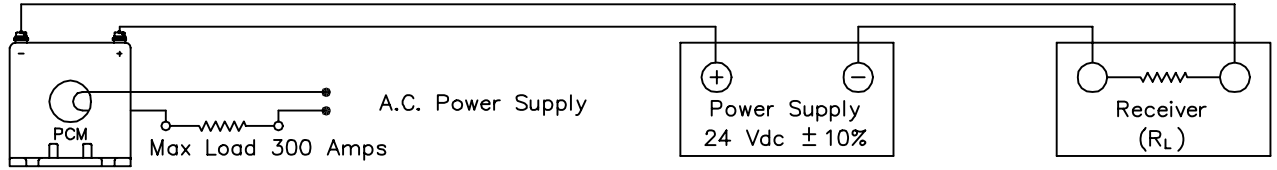
The output requires 24V dc to be applied between the (+) terminal and ground. The output load may be inserted in either the (-) line for a negative ground system or the (+) line for a positive ground system. Power supply polarity is critical for correct operation, but an accidental reverse polarity connection will not damage the output. Several transducers can be operated from a single power supply with the only limitation being the maximum current available from the supply itself. (Example: a one Amp supply will support 50 transducers operating at 20mA dc output.) The maximum output is limited to 30mA dc to prevent damage to external components.

### CAUTION:

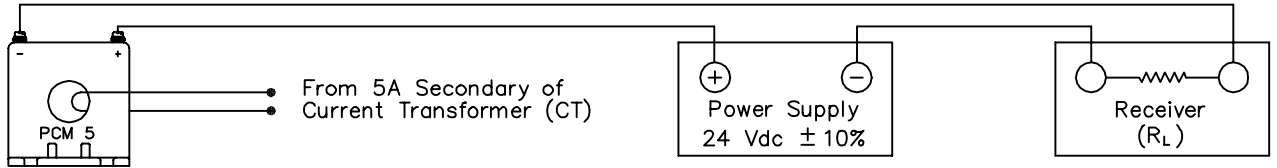
Some consideration should be given to the ripple content of the external power supply. Any extra ripple introduced by the power supply will appear at the load resistor.



## APPLICATION #1 Monitoring Loads 300 Amps or Less



## APPLICATION #2 Monitoring Loads from a Current Transformer Secondary

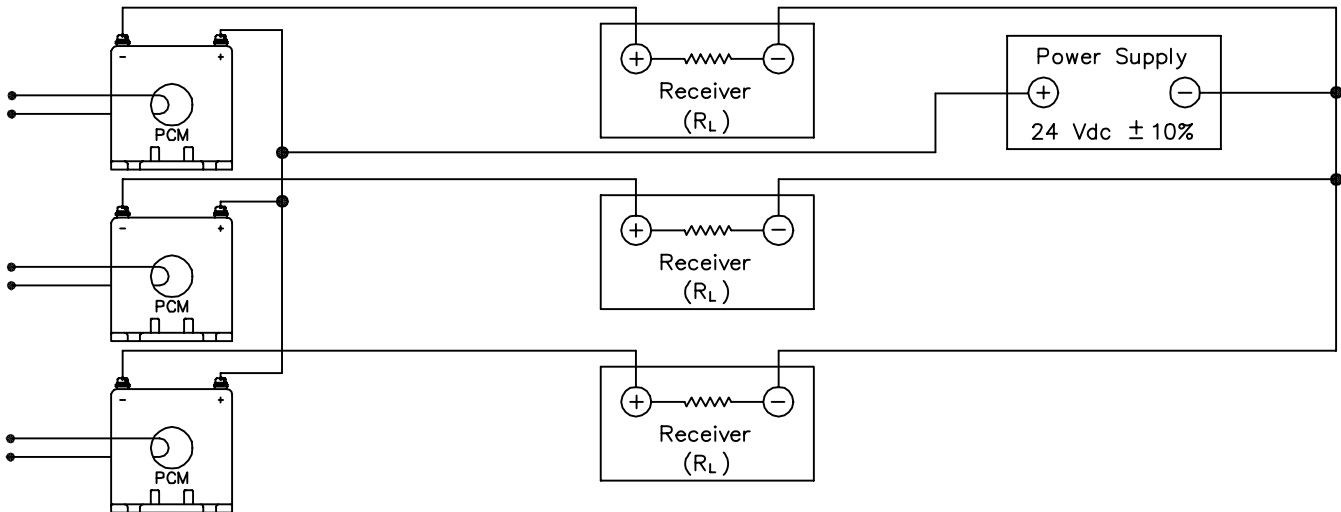


$$\text{When used with a 2000:5 CT } I_{in} = 2000 \times \left( \frac{I_o - 4}{16} \right)$$

### EXAMPLE

$$\text{If } I_o = 10\text{mA then } I_{in} = 2000 \times \left( \frac{10 - 4}{16} \right) = 750 \text{ amps}$$

## APPLICATION #3 Energizing multiple transducers from a single power supply



## APPLICATION NOTES

Calculating:  $I_{in}$  = ac Amps input  
 $I_o$  = mA dc output  
 Rated Input = CT Primary Rating (when monitoring a CT)  
 Rated Input = PCM Primary Rating (when monitoring direct)

$$\text{Therefore: } I_{in} = \text{Rated Input} \times \left( \frac{I_o - 4}{16} \right)$$

NOTE: Output current of each PCM is limited to 30mA max. From this the required output capacity of the D.C. supply can be calculated by multiplying the total number of PCM's times 0.03A to find the maximum required total output current from the supply.

It is possible to achieve an output close to full scale and increase output resolution by using multiple turns through the window of the PCM. The following equation would apply:

$$I_{in} = \frac{\text{Rated Input Amps}}{\text{No. of Turns}} \times \left( \frac{I_o - 4}{16} \right)$$

**EXAMPLE:** A PCM 5 is used with two turns and is monitoring a 2A load.

$$\text{If } I_o = 16.8 \text{ mA then } I_{in} = \frac{5}{2} \times \left( \frac{16.8 - 4}{16} \right) = 2 \text{ Amps}$$

# ADJUSTABLE METERING CURRENT TRANSFORMER

**Models AMCT 14  
AMCT 54  
AMCT 130**

**INPUT:**  
2 to 130 amps max cont.  
peak surge current  
10,000 amps 1/2 cycle

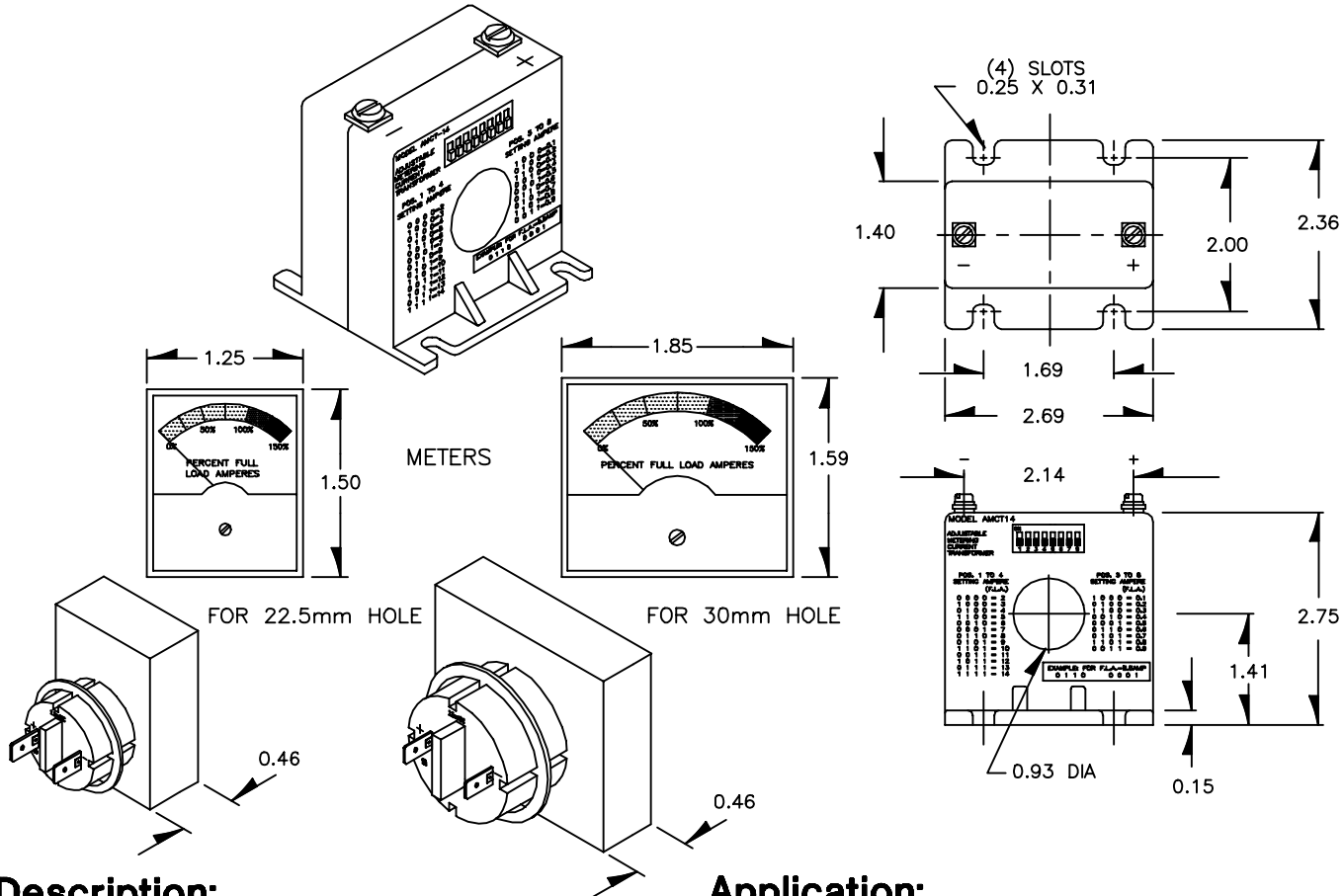
**ADJUSTABLE MOTOR  
LOAD RANGES:**  
2-14, 6-54 or  
10-130 amperes AC

**FREQUENCY:**  
50/60 Hz.

**INSULATION LEVEL:**  
600 Volt, 10kV BIL full wave

**AMBIENT TEMPERATURE RANGE:**  
-30°C to +70°C

- Meter accuracy is  $\pm 15\%$ .
- Secondary terminals are brass screws No. 8-32. Load meter terminals are 1/4" quick connect type.
- Self powered.
- Internally protected for overloads.
- Recommended use on NEMA 00-4 and IEC A-N size motor loads.
- Approximate weight: 1.5 lbs.



## Description:

Each AMCT system includes one adjustable current sensor and one percent full load ampere meter. The percent full load ampere system works by sensing one leg of the downstream motor circuit. The percentage load current is displayed based on the 8 point DIP switch setting.

The AMCT-14 offers an adjustable range of 2 to 14 amperes in 1 ampere increments. The AMCT-54 offers an adjustable range of 6 to 54 amperes in 4 ampere increments. The AMCT-130 offers an adjustable range of 10 to 130 amperes in 10 ampere increments.

The meters are available in 22.5mm & 30mm keyed mounting cases. Both are suitable for use with TYPE 1 and TYPE 12 enclosures.

## Application:

The model AMCT percent full load ampere meter is intended for use in downstream branch motor circuits for visual indication of motor load.

NOTE: The AMCT series is intended for indication only. It is not intended for use as a motor overload protection device, remote signaling or alarm device. The AMCT unit is designed to withstand a maximum of 14 amps, 54 amps or 130 amps continuously based on model.

### HOW TO ORDER AMCT LOAD METERS

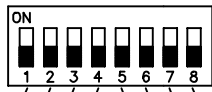
**AMCT - XXX - XX**

LOAD RANGE	METER MOUNTING *
14 = 2 to 14 amps	22 = 22.5 millimeters
54 = 6 to 54 amps	30 = 30 millimeters
130 = 10 to 130 amps	

\* INCLUDES MOUNTING HARDWARE

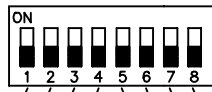
# AMCT CALIBRATION & LOCATION

## AMCT-14-XX



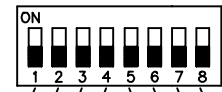
2 Amp = 0 0 0 0	1 0 0 0 = 0.1 Amp
3 Amp = 1 0 0 0	0 1 0 0 = 0.2 Amp
4 Amp = 0 1 0 0	1 1 0 0 = 0.3 Amp
5 Amp = 1 1 0 0	0 0 1 0 = 0.4 Amp
6 Amp = 0 0 1 0	0 0 0 1 = 0.5 Amp
7 Amp = 0 0 0 1	0 1 1 0 = 0.6 Amp
8 Amp = 0 1 1 0	0 1 0 1 = 0.7 Amp
9 Amp = 0 1 0 1	1 1 0 1 = 0.8 Amp
10 Amp = 1 1 0 1	0 0 1 1 = 0.9 Amp
11 Amp = 0 0 1 1	
12 Amp = 1 0 1 1	
13 Amp = 0 1 1 1	
14 Amp = 1 1 1 1	

## AMCT-54-XX



6 Amp = 0 0 0 0	1 0 0 0 = 0.4 Amp
10 Amp = 1 0 0 0	0 1 0 0 = 0.6 Amp
14 Amp = 0 1 0 0	0 0 1 0 = 1.2 Amp
18 Amp = 0 0 1 0	1 0 1 0 = 1.6 Amp
22 Amp = 1 0 1 0	0 1 1 0 = 2.0 Amp
26 Amp = 0 1 1 0	0 0 0 1 = 2.4 Amp
30 Amp = 0 0 0 1	1 0 0 1 = 2.8 Amp
34 Amp = 1 0 0 1	0 1 0 1 = 3.2 Amp
38 Amp = 0 1 0 1	0 0 1 1 = 3.6 Amp
42 Amp = 0 0 1 1	1 0 1 1 = 4.0 Amp
46 Amp = 1 0 1 1	
50 Amp = 0 1 1 1	
54 Amp = 1 1 1 1	

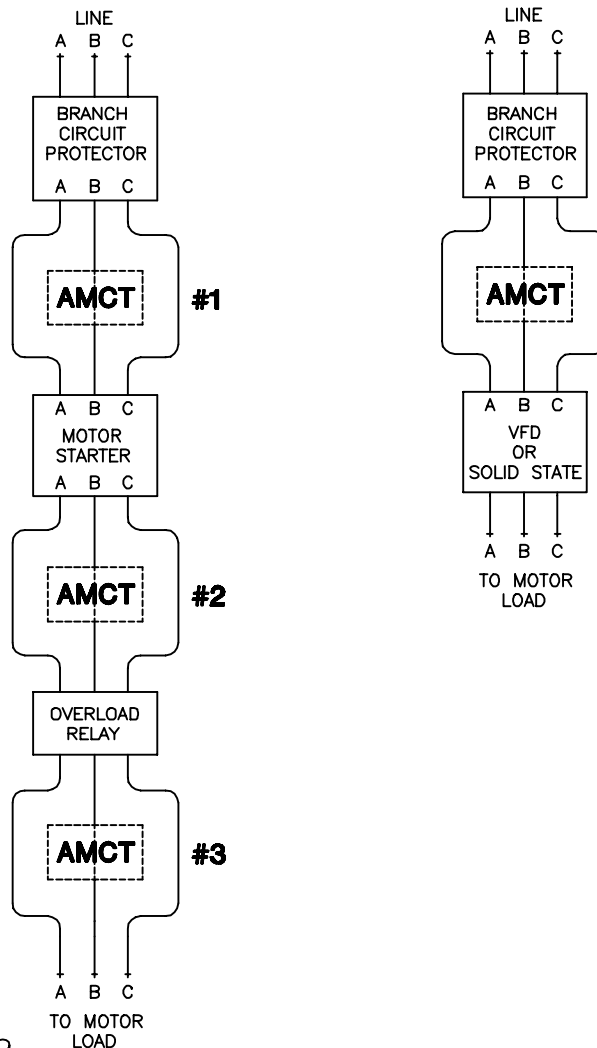
## AMCT-130-XX



10 Amp = 0 0 0 0	1 0 0 0 = 1 Amp
20 Amp = 1 0 0 0	0 1 0 0 = 2 Amp
30 Amp = 0 1 0 0	1 1 0 0 = 3 Amp
40 Amp = 1 1 0 0	0 0 1 0 = 4 Amp
50 Amp = 0 0 1 0	0 0 0 1 = 5 Amp
60 Amp = 0 0 0 1	1 0 0 1 = 6 Amp
70 Amp = 1 0 0 1	0 1 0 1 = 7 Amp
80 Amp = 0 1 0 1	1 1 0 1 = 8 Amp
90 Amp = 1 1 0 1	0 0 1 1 = 9 Amp
100 Amp = 0 0 1 1	1 0 1 1 = 10 Amp
110 Amp = 1 0 1 1	
120 Amp = 0 1 1 1	
130 Amp = 1 1 1 1	

NOTE: SWITCH POSITIONS 1 TO 4 VALUE PLUS SWITCH POSITIONS 5 TO 8 VALUE EQUAL TOTAL FLA CALIBRATED VALUE

THREE TYPICAL LOCATIONS FOR AMCT USE IN 1 LEG OF ELECTROMECHANICAL MOTOR CONTROLLERS



RECOMMENDED LOCATION FOR AMCT USE IN 1 LEG OF VFD OR SOLID STATE MOTOR CONTROLLER

# OPEN CIRCUIT PROTECTORS

## Model OCP



### APPLICATION:

Open circuit protection for relay classes through C800 and all metering classes.

### FREQUENCY:

50-400 Hz.

### AMBIENT TEMPERATURE RANGE:

-30° C. to +55° C.

### NORMAL SECONDARY CURRENT:

5 Amps ac.

### SHORT TIME OVERCURRENT:

100 Amps for 2 Sec.

### MAX. CONTINUOUS CURRENT:

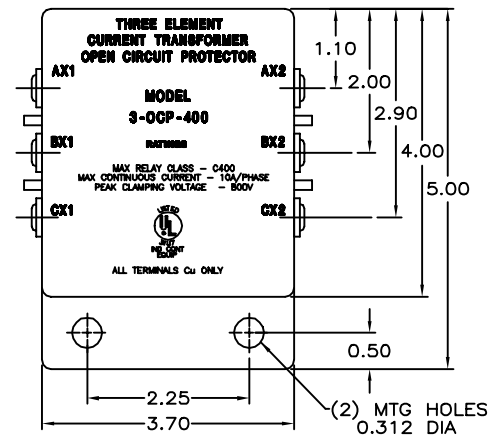
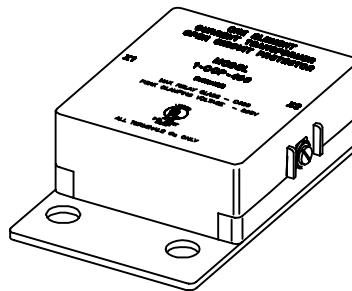
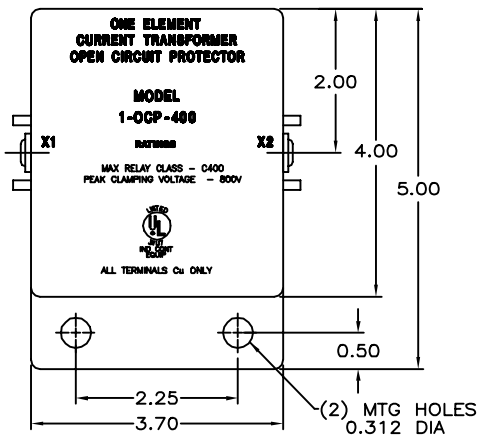
10 Amps through one element or 7.5 Amps through all three independent elements.

### TERMINALS:

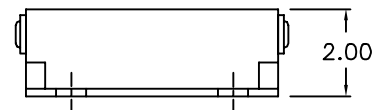
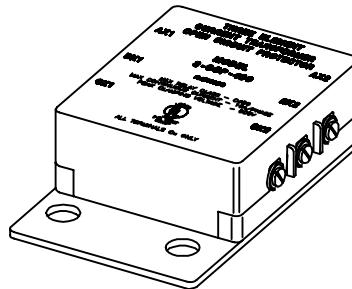
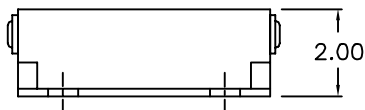
Copper with brass slotted pan head screws, #8-32 X 1/4, with cupped washers

### WEIGHT:

1.2 lbs.



DIMENSIONS ARE TYPICAL FOR ALL MODELS



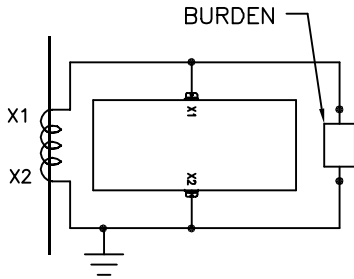
1 ELEMENT OPEN CIRCUIT PROTECTOR			
MODEL NUMBER	RECOMMENDED CT RELAYING CLASS	CLAMPING PEAK VOLTAGE LIMIT (V peak nom)	STANDARD BURDEN (OHM)
1-OCP-100	THRU C100	200	1
1-OCP-200	C200	400	2
1-OCP-400	C400	800	4
* 1-OCP-800	C800	1500	8

\* NOT U.L. LISTED, SINGLE ELEMENT ONLY

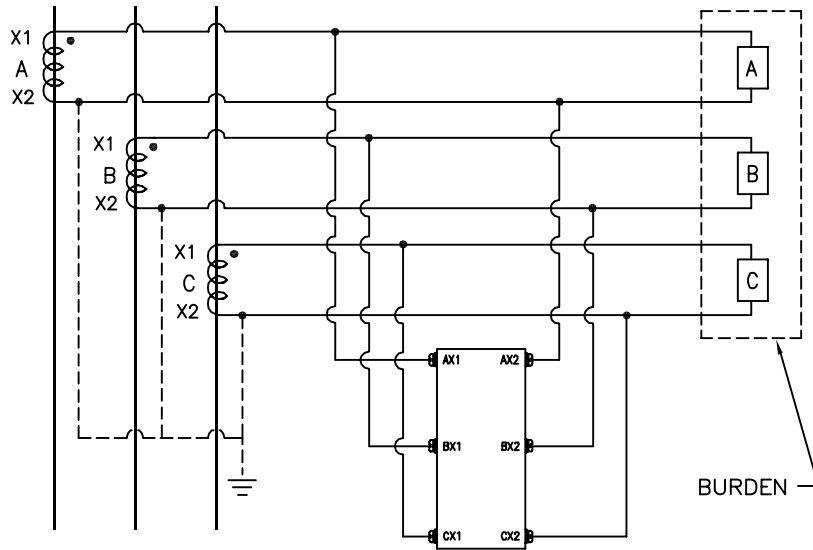
3 ELEMENT OPEN CIRCUIT PROTECTOR			
MODEL NUMBER	RECOMMENDED CT RELAYING CLASS	CLAMPING PEAK VOLTAGE LIMIT (V peak nom)	STANDARD BURDEN (OHM)
3-OCP-100	THRU C100	200	1
3-OCP-200	C200	400	2
3-OCP-400	C400	800	4

# OPEN CIRCUIT PROTECTORS

## Model OCP



TYPICAL  
1 ELEMENT CONNECTION DIAGRAM  
1-OCP-XXX



TYPICAL  
3 ELEMENT CONNECTION DIAGRAM  
3-OCP-XXX

A Current Transformer secondary should never be open circuited while the Current Transformer primary circuit is energized. If this situation should occur there is a possibility of developing extremely high voltages which could be dangerous to personnel or cause an insulation breakdown.

The OCP series of Open Circuit Protectors are voltage sensing devices using high speed shorting SCR switches. When the secondary peak voltage exceeds the clamping voltage value, the SCR operates, shorting the C.T. secondary and reducing the voltage to about 2 volts in less than 1/4 cycle. This process repeats each current polarity reversal. The protection is activated each half cycle.

The three element Open Circuit Protector is provided with six terminals for connection across the secondary of the C.T.'s and in parallel with the burden. It can also be connected across the current terminals of a protective relay, meter, or other current operated device without affecting the operation of the device. Secondary polarity of the C.T.'s is not critical to the OCP.

The OCP also provides protection against high secondary voltage transients, which may damage the burden or secondary winding. If the transient voltage exceeds the voltage clamping limit, the Open Circuit Protector will trigger. After triggering, the voltage will fall to about 2 volts and remain there until the next zero crossing of the current waveform at which time the device resets and the cycle repeats as necessary. In the transient mode of protection, triggering will occur only on the half cycle where the transient appears. The leakage current of the OCP is insignificant and will not cause a ratio or phase angle error in the Current Transformer accuracy.

Metering class C.T.'s with a rating factor of 2 could operate up to 10 amps on a continuous basis. Relaying class C.T.'s are designed to withstand short time overloads up to 20 times normal (100 amps RMS) for 2 seconds. The OCP is designed to tolerate both of these conditions if the burden accidentally opens.

### ORDERING INFORMATION

## X - OCP - XXX

Elements:

- 1 = One Element
- 3 = Three Elements

Product Group:

Relay Class Protection:

- 100 = C10 Thru C100
- 200 = C100 Thru C200
- 400 = C200 Thru C400
- 800 = C400 Thru C800 (One Element Only)

# CAPACITOR TRIP DEVICE

Models CTD-1 and CTD-2



## APPLICATION:

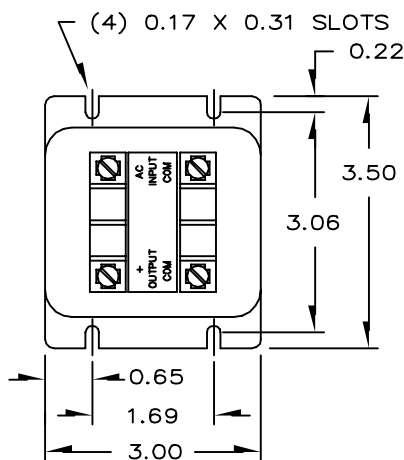
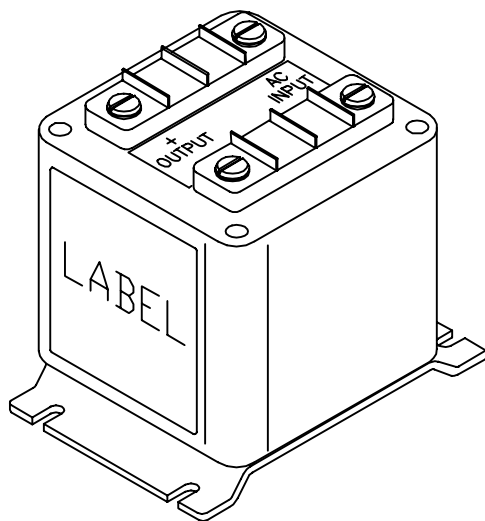
Provides a source of energy for circuit breaker and switch trip coil operation during a loss of AC control voltage.

## NOMINAL INPUT:

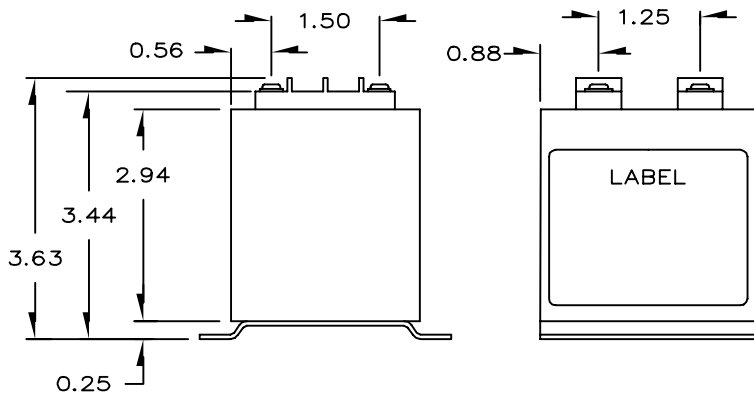
120 Volts ac, 125 Volts dc

## FREQUENCY:

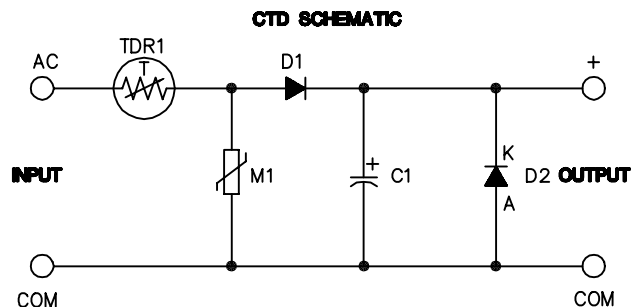
DC to 400Hz



SPECIFICATIONS	
Max. input voltage . . .	140 Vac, 125 Vdc surge protected
Capacitance . . . . .	330 $\mu$ F, CTD-1 $\pm 20\%$ @ 25°C. 1500 $\mu$ F, CTD-2 $\pm 20\%$ @ 25°C.
Available Energy (**)	4.72 joules, CTD-1 $\pm 20\%$ @ 25°C. 21.5 joules, CTD-2 $\pm 20\%$ @ 25°C.
Normal output . . . . . voltage (**)	170 Vdc (120 Vac input) 125 Vdc (125 Vdc input)
Normal charge time (*)	170 mSec. CTD-1 440 mSec. CTD-2
Operating temperature . . range	-30°C to 60°C
Storage temp range . . .	-50°C to 80°C
Short circuit protection .	Continuous
Mounting . . . . .	Vertical or horizontal
Input surge protection . .	MOV protected to 65 joules single pulse surge



\* Charge time from full discharge to 90% of max. capacitor voltage at 25°C.  
\*\* Trip capacitor fully charged at nominal ac input voltage.



These devices are protected against inadvertent output short circuits, inductive kickback from the trip coil, and input line voltage surges.

Nominal 120 Volts ac, or 125 Volts dc is applied between the 'AC' and 'COM' terminals. This voltage is half wave rectified and applied across the trip capacitor, giving an output trip voltage. The charge stored in this capacitor (330  $\mu$ F or 1500  $\mu$ F) is available between the '+' and 'COM' terminals for breaker trip coil operation. The half wave rectification circuitry provides the advantage of maintaining a common neutral connection from input to output while still maintaining the charge in the trip capacitor after control power is lost.

The capacitor is continuously charged when control power is available, providing energy for normal trip coil operation. Because mechanical relays are not involved, energy for the trip coil operation is immediately available with the loss of control power. When the control power returns, the capacitor automatically charges to supply energy for the next trip coil operation.



# CAPACITOR TRIP DEVICE

Model CTD-3



## APPLICATION:

Provides a source of energy for circuit breaker and switch trip coil operation during a loss of AC control voltage.

## NOMINAL INPUT:

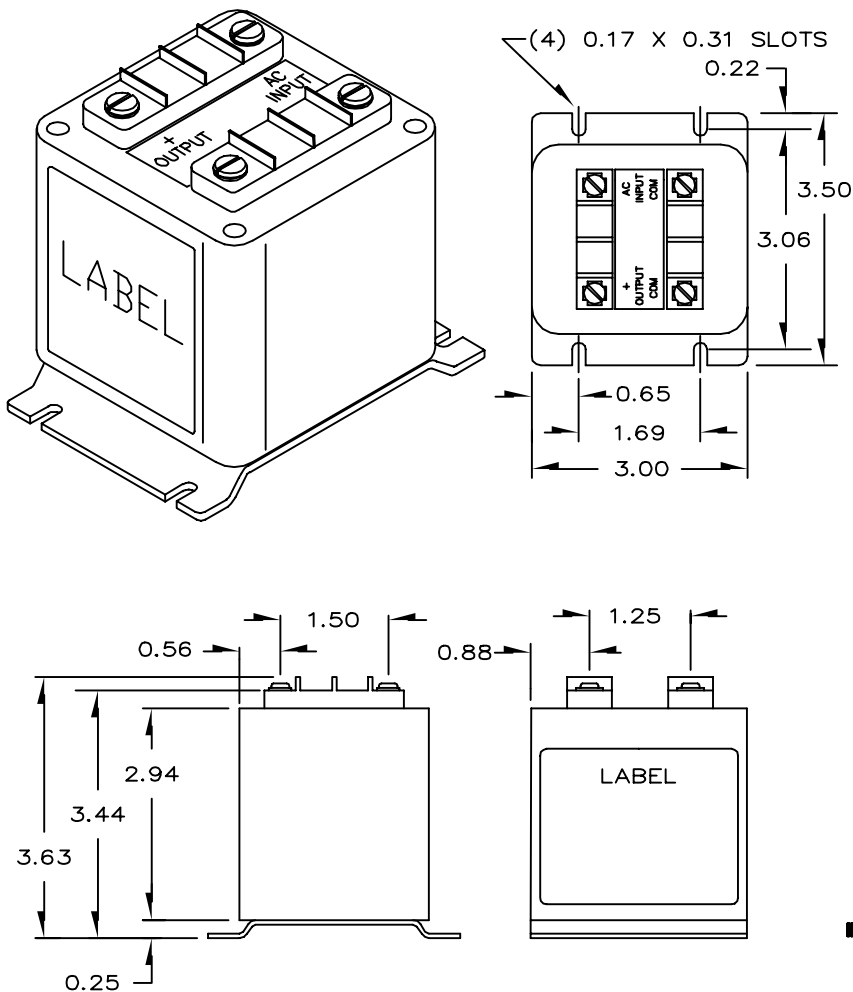
240 Volts ac

## AMBIENT TEMPERATURE RANGE:

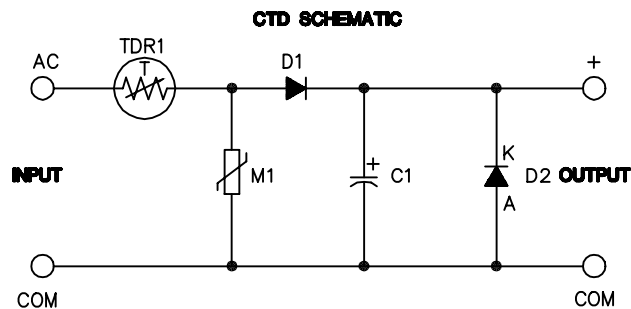
-30°C to +60°C

## FREQUENCY:

DC to 400Hz



SPECIFICATIONS	
Normal input voltage . . . . .	240 V
Max. input voltage . . . . .	280 Vac
Available energy . . . . .	19 joules
Trip capacitor fully charged at normal input voltage.	+20% @ 25°C.
Normal output voltage . . . . .	338 Volts DC
Approx charge time to 90% . . . . . at 60Hz / 25°C.	350mS
Capacitance . . . . .	330 $\mu$ F $\pm$ 20% @ 25°C.
Temp. influence on cap. . . . .	-10% @ -30°C / +5% @ +60°C.
Ambient operating temperature.	-30°C to 60°C
Ambient storage temperature . . . . .	-50°C to 80°C
Short circuit protection . . . . .	Continuous
Mounting . . . . .	Vertical or horizontal
Input transient protection . . . . .	Mov protected to 65 joules single pulse transient.



These devices are protected against inadvertent output short circuits, inductive kickback from the trip coil, and input line voltage surges.

Nominal 240 Volts ac is applied between the 'AC' and 'COM' terminals. This voltage is half wave rectified and applied across the trip capacitor, giving an output trip voltage. The charge stored in this capacitor is available between the '+' and 'COM' terminals for breaker trip coil operation. The half wave rectification circuitry provides the advantage of maintaining a common neutral connection from input to output while still maintaining the charge in the trip capacitor after control power is lost.

The capacitor is continuously charged when control power is available, providing energy for normal trip coil operation. Because mechanical relays are not involved, energy for the trip coil operation is immediately available with the loss of control power. When the control power returns, the capacitor automatically charges to supply energy for the next trip coil operation.

# CAPACITOR TRIP DEVICE

## Model CTD-4



### APPLICATION:

Provides a source of energy for circuit breaker and switch trip coil operation during a loss of AC control voltage.

### NOMINAL INPUT:

120 VAC or 240 VAC

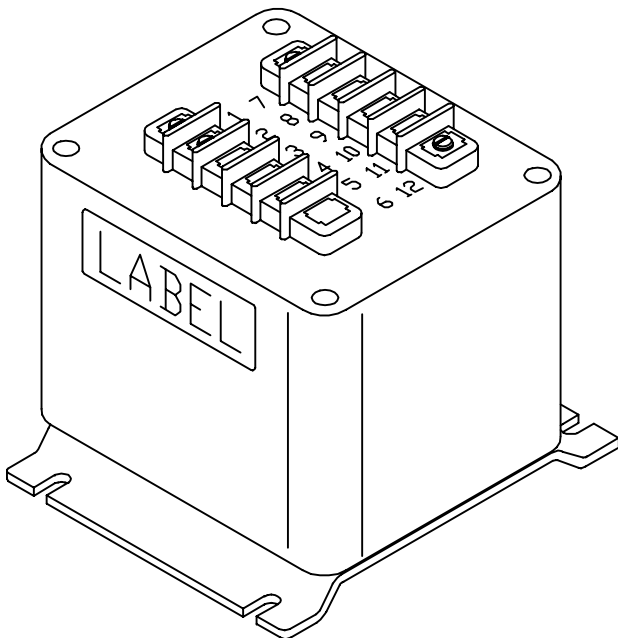
### FREQUENCY:

DC to 400Hz

These devices are protected against inadvertent output short circuits, inductive kickback from the trip coil, and input line voltage surges.

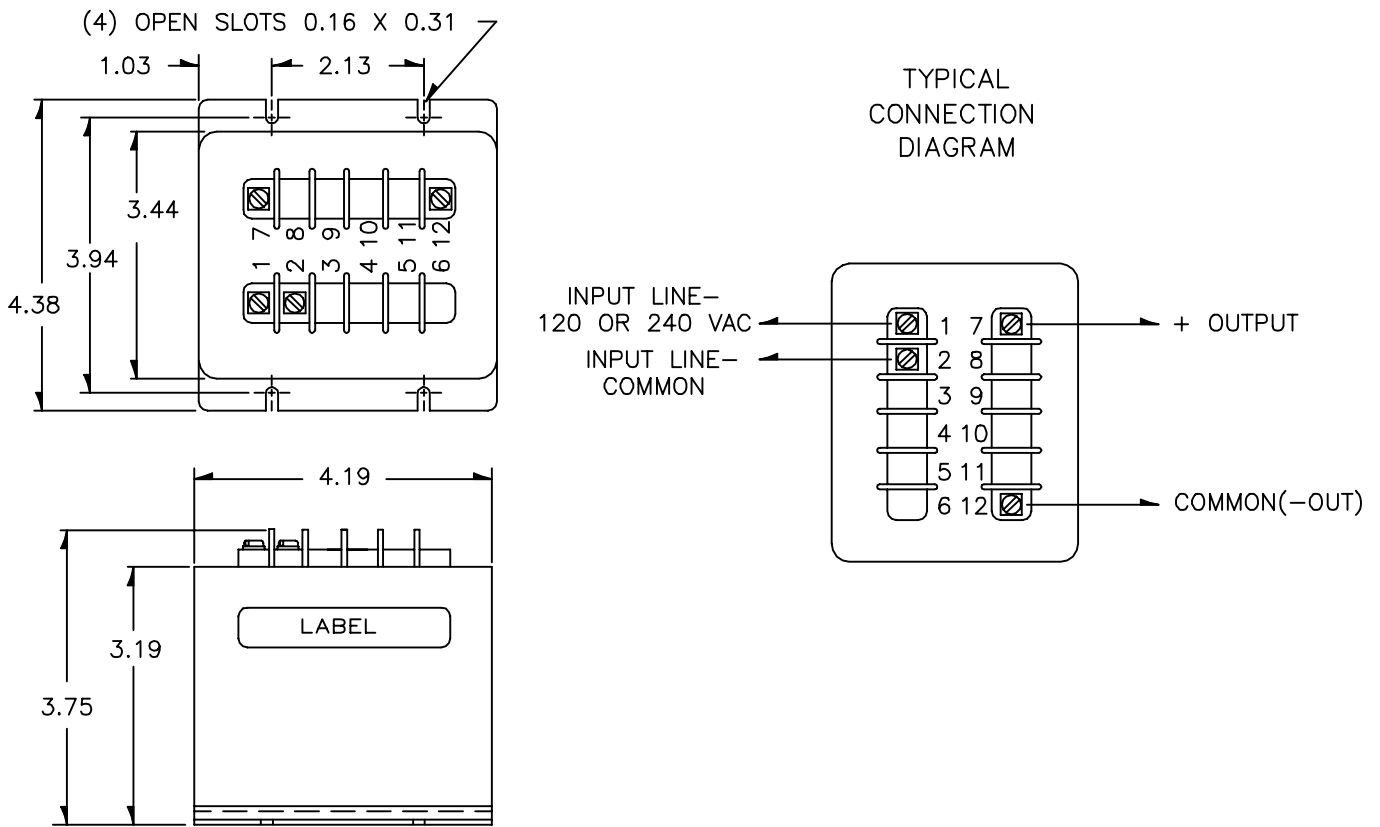
Nominal 120 Volts ac, or 240 Volts ac is applied between the "INPUT" and "COMMON" terminals. This voltage is half wave rectified and applied across the trip capacitors, yielding an output trip voltage. The charge stored in these capacitors is available between the "+" and "COMMON" terminals for breaker trip coil operation. The half wave rectification circuitry provides the advantage of maintaining a common neutral connection from input to output while still maintaining the charge in the trip capacitor after control power is lost.

The capacitor is continuously charged when control power is available, providing energy for normal trip coil operation. Because mechanical relays are not involved, energy for the trip coil operation is immediately available with the loss of control power. When the control power returns, the capacitor automatically charges to supply energy for the next trip coil operation.

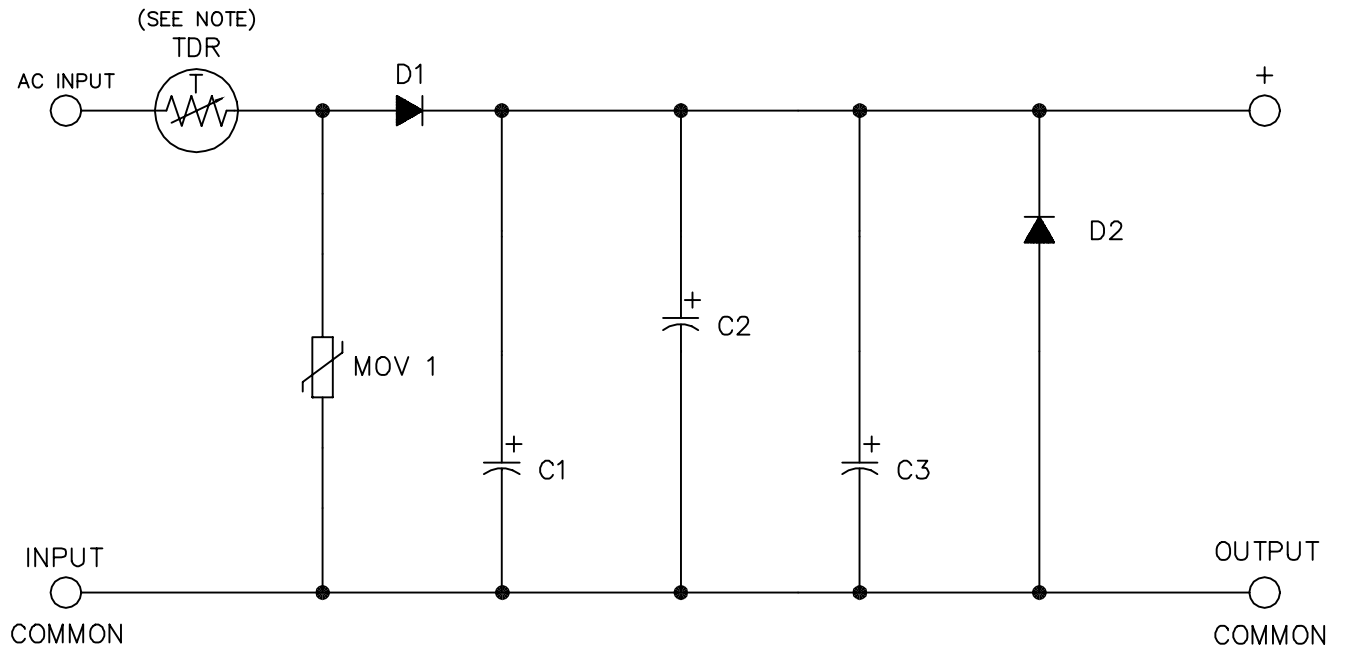


SPECIFICATIONS	CTD-4-120	CTD-4-240
Normal input voltage . . . . .	120 V	240 V
Max. input voltage . . . . .	140 Vac	280 Vac
Available Energy . . . . . Trip capacitor fully charged at normal input voltage.	64 joules ±20% @ 25°C.	57 joules ±20% @ 25°C.
Normal output voltage . . . . .	169 Volts DC	338 Volts DC
Approx charge time to 90% . . at 25°C.	1.4S	570mS
Capacitance . . . . .	4500 µF ±20% @ 25°C.	990 µF ±20% @ 25°C.
Temp. influence on cap. . . . .	-10% @ -30°C/ +5% @ +60°C.	
Ambient operating temperature	-30°C to 60°C	
Ambient storage temperature .	-50°C to 80°C	
Short circuit protection . . . . .	Continuous	
Mounting . . . . .	Vertical or horizontal	
Input transient protection . . .	MOV protected to 65 joules single pulse transient.	

## CTD-4 DIMENSIONS



## CTD SCHEMATIC (Fig. 1)



NOTE:  
TDR is temperature dependent resistor.

# CAPACITOR TRIP DEVICE

Model CTD-5



**APPLICATION:**

Provides a source of energy for circuit breaker and switch trip coil operation during a loss of AC control voltage.

**INPUT:**

120/240 Volts ac

**FREQUENCY:**

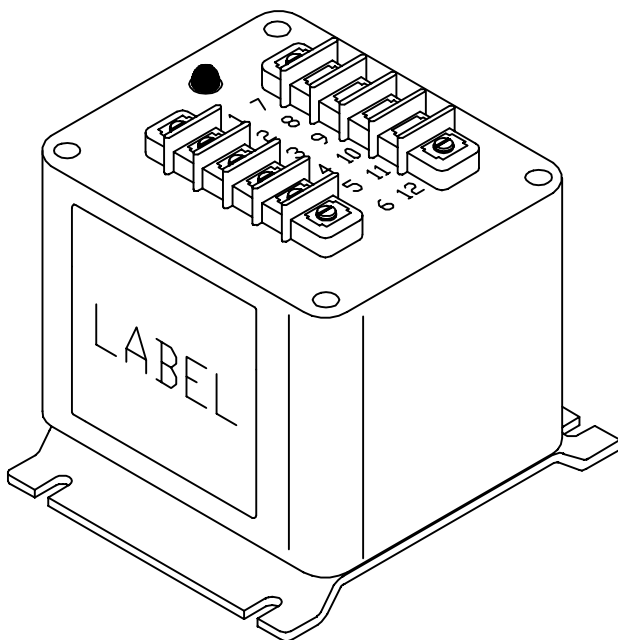
DC-400Hz

These devices are protected against inadvertent output short circuits, inductive kickback from the trip coil, and input line voltage surges.

Nominal 120 or 240 Volts ac is applied between the "INPUT" terminals. This voltage is half wave rectified and applied across the trip capacitors, giving an output trip voltage. The charge stored in these capacitors is available between the "+" and "COMMON" terminals for breaker trip coil operation. The half wave rectification circuitry provides the advantage of maintaining a common neutral connection from input to output while still maintaining the charge in the trip capacitor after control power is lost.

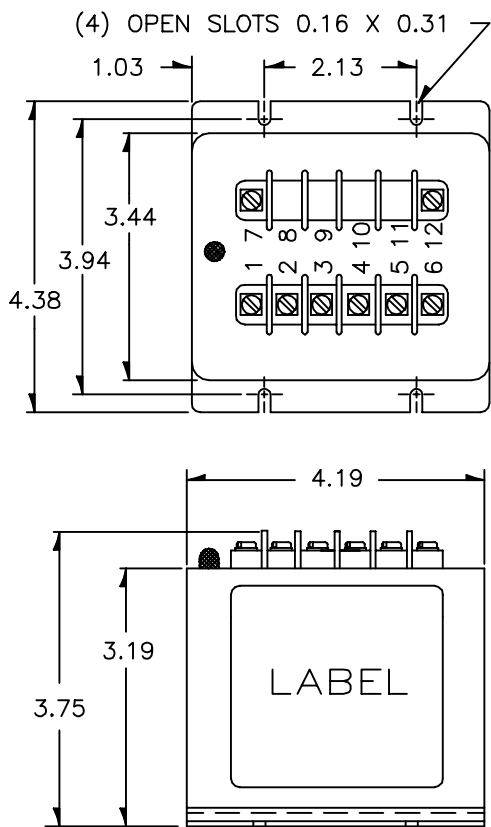
The capacitor is continuously charged when control power is available, providing energy for normal trip coil operation. Energy for the trip coil operation is immediately available with the loss of control power. When the control power returns, the capacitor automatically charges to supply energy for the next trip coil operation.

An alarm relay is incorporated to continuously monitor the input and output condition of the device. The relay is normally energized when both input and output voltage are present. If either the input voltage is lost or the output voltage falls below 85% of the normal output level the output alarm contacts transfer to their de-energized state. An LED indicates normal operation. The LED goes out when the alarm contacts transfer to their de-energized state.

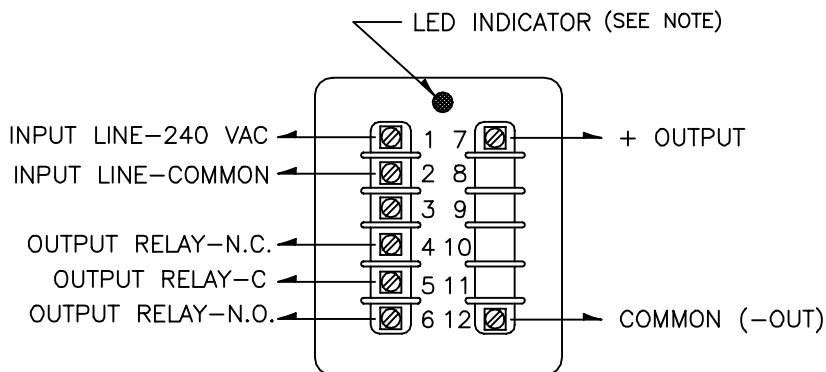


SPECIFICATIONS	CTD-5-120	CTD-5-240
Normal input voltage . . . . .	120 Vac	240 Vac
Max. input voltage . . . . .	132 Vac	264 Vac
Available Energy . . . . .	64 joules	57 joules
Trip capacitor fully charged at normal input voltage.		
Normal output voltage. . . . .	169 Volts DC	338 Volts DC
Approx charge time to 90% . . . at 25°C.	1.4S	570mS
Capacitance . . . . .	4500 µF ± 20% @ 25°C.	990 µF ± 20% @ 25°C.
Temp. influence on cap. . . . .	-10% @ -30°C/+5% @ +55°C.	
Ambient operating temperature.	-30°C to +60°C	
Ambient storage temperature. .	-50°C to 80°C	
Short circuit protection . . . . .	Continuous	
Mounting . . . . .	Vertical or horizontal	
Input transient protection . . .	MOV protected to 65 joules single pulse transient.	
Output contact ratings . . . . .	Resistive: 5A, 250VAC 5A, 30VDC  Inductive: 2A, 250VAC 3A, 30VDC 1/6HP, 120VAC, 1/3HP, 240VAC	

## CTD-5 DIMENSIONS



TYPICAL  
CONNECTION  
DIAGRAM



**NOTES:**

1. The output contacts are shown in the de-energized condition. Contacts will pick up when input and output voltage is present. If the output DC voltage drops below 85% of the expected operating level or the input voltage is lost, then the contacts will change state and the LED indicator will no longer illuminate.

2. TDR is temperature dependent resistor.

## CTD FUNCTIONAL DIAGRAM

