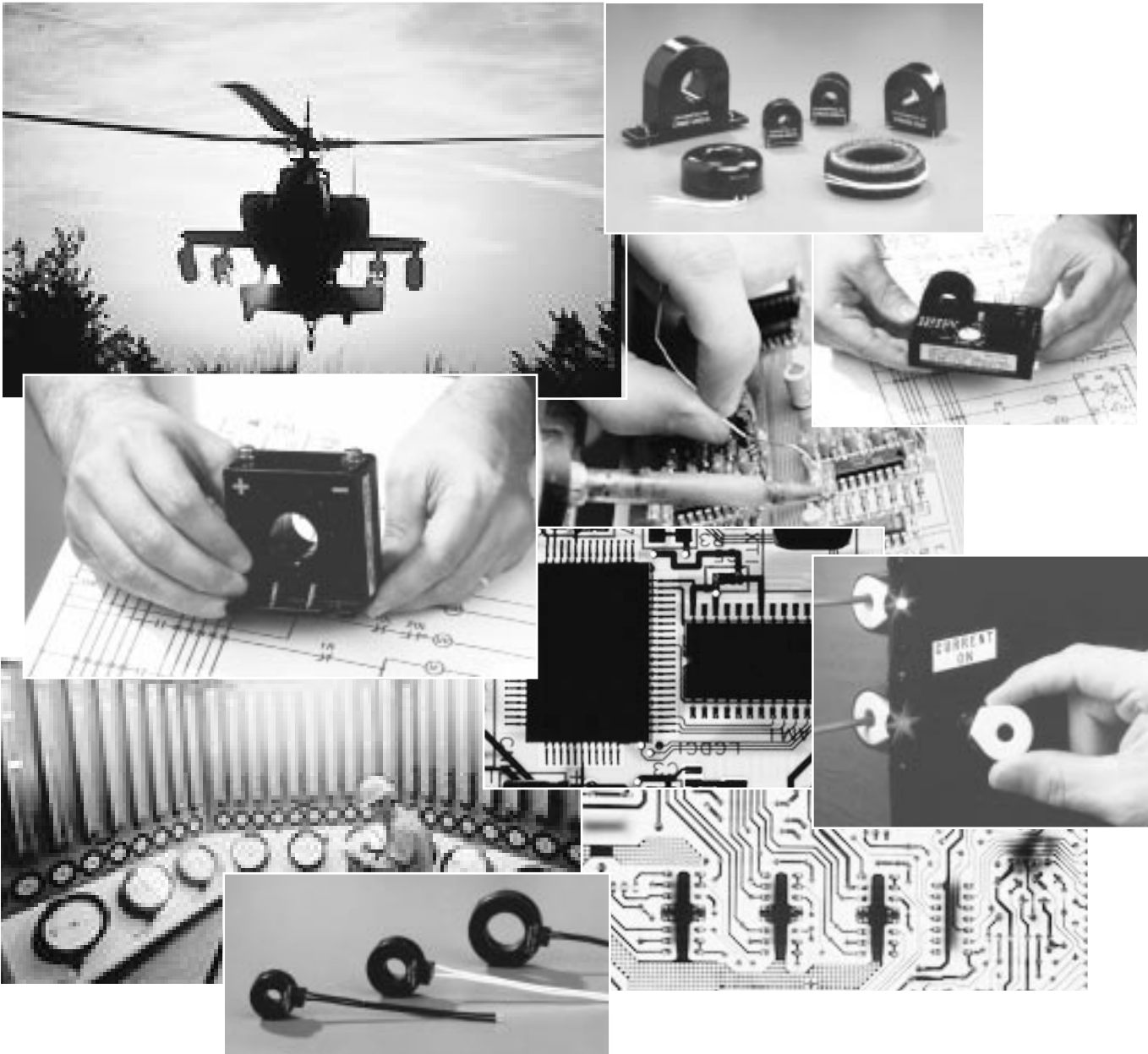
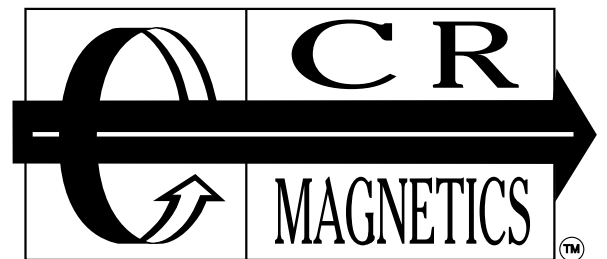


# CURRENT MONITORING HANDBOOK

Performance Applications For All Industries



**Transducers • Relays • Transformers • Indicators**





# Specialist in Electrical Current Monitoring


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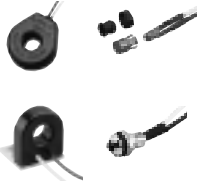



## TRANSDUCERS and RELAYS

	Transducers				Relays	
						
Part Number	CR431	CR4320	CR4340	CR473	CR4395	CR9321
Description	AC Current to Voltage	2-Wire AC Current to 4-20	4-Wire AC Current to 4-20	Voltage to 4-20 mA	Current Relay	Current Switch
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	60/400 Hz	50/400Hz
Input Range	5 thru 200 Aac	5 thru 400 Aac	5 thru 600 Aac	90-150 Vac 360-600 Vac	.01-to 100 Aac	0.350 Aac
Output	5/10 Volts DC	4-20 mA	4-20 mA	4-20 mA	Dry Contacts Transistor Triac	Solid State
Accuracy	0.5 thru 1.0% F.S.	0.5% F.S.	0.5% F.S.	0.5% F.S.	—	—
Dimensions (H)x(W)x(D)	2.75x2.69x2.36 (69.9x68.3x59.9)	2.75x2.69x2.36 (69.9x68.3x60)	4.50x2.68x2.37 (114.3x68x60.1)	3.63x4.19x4.38 (92.2x106.4x111.3)	2.13 x 3.50 x 2.5 (54.1x88.9x63.5)	1.50x1.0x.75 (38.1x25.4x19.1)
Power Source	Self-Powered	Loop-Powered	120 Vac	Loop-Powered	120 Vac 240 Vac 24 Vdc	Self Powered
Agency Approval	UL	UL	UL	UL	—	—
Page Number	6	8	10	12	14	16

## CURRENT TRANSFORMERS

Current Transformers						
						
17,18, 19	CR8300	CR8400	CR8750			
Wire Lead	Vertical Mount	Wire Lead	Horizontal Mount	Commercial & ANSI Class	Split Core	Medium Voltage
50-400 Hz	50-400 Hz	—	50-400 Hz	50-400 Hz	50-400 Hz	50-400 Hz
Up to 60 Aac	Up to 100 Aac	—	Up to 60 Aac	Up to 4,000 Aac	Up to 10,000 Aac	Up to 3,000 Aac
—	—	—	—	5.0, 1.0 0.2, 0.1 AAC	5.0 Aac & High Ratios	5.0 Aac
—	—	—	—	Up to 0.3%	Up to 0.3%	Up to 0.3%
.29 & .55 (7.4 & 14.0)	.272 to .772 (6.9 to 19.6)	.232 to .610 (5.8 & 15.5)	.250 (6.4)	See Catalog	See Catalog	See Catalog
—	—	—	—	—	—	—
—	—	—	—	UL/CSA	UL/CSA	UL
18	20	22	25	26	Request Catalog Sec 5	Request Catalog Sec 13

# CURRENT INDICATORS AND VOLTAGE TRANSFORMERS

	Indicators			Voltage Transformers	
					
<b>Part Number</b>	<b>CR45</b>	<b>Model 18 &amp; 19</b>	<b>CR2550</b>		
<b>Description</b>	Wire Mounted Current Indicator	Remote Current Indicator	Remote Current Indicator	Low Voltage V/T	Medium Voltage V/T
<b>Frequency</b>	50/60 Hz	50/60 Hz	50/400 Hz	60 Hz	60 Hz
<b>Input Range</b>	2 thru 100 Aac	2 thru 100 Aac	2 thru 100 Aac	Up to 600 Vac	Up to 34.5 kV
<b>Output</b>	Visual	Visual	Visual	120 Vac	120 Vac
<b>Accuracy</b>	—	—	—	Up to 0.3%	Up to 0.3%
<b>Dimensions (H)x(W)x(D)</b>	1.04x.95x.46 (26.4x24.1x11.7)	See Page 32	See Page 34	See Catalog	See Catalog
<b>Power Source</b>	Self-Powered	Self-Powered	Self-Powered	—	---
<b>Agency Approval</b>	—	—	—	UL/CSA	UL/CSA
<b>Page Number</b>	32	34	36	Request Catalog Sec 11	Request Catalog Sec 15

# Current Transformer Ratios

## Changing Current Transformer Ratios

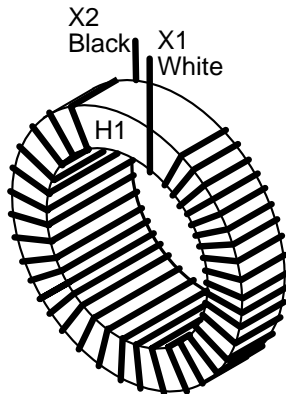
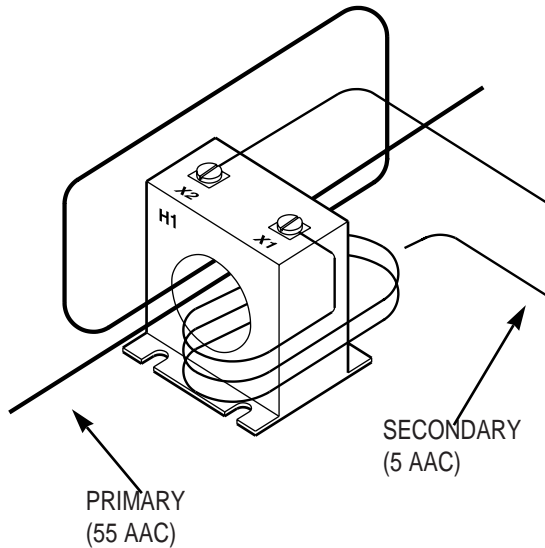
The actual current ratio may be changed from the nameplate ratio by wrapping the primary and/or secondary leads through the window opening.

$$\text{ACTUAL TURNS RATIO} = \frac{\text{NAMEPLATE RATIO} \pm \text{NUMBER OF SECONDARY TURNS THROUGH WINDOW OPENING}}{\text{NUMBER OF PRIMARY TURNS THROUGH WINDOW OPENING}}$$

- Wire from X1 terminal is routed through the H1 side
- + Wire from X1 terminal is routed through the side opposite the H1 side (H2 side)

## Examples

This illustration shows how a current transformer with a nameplate turns ratio of 125:5 can be rescaled to operate as a non-standard 55:5 ratio transformer.



### WHERE:

Nameplate ratio = 125 (125/5)

Number of secondary turns through window = - 3

Use -3 because the secondary wire is routed from the X1 terminal first through the H1 side.

Use + if the wire was routed first through the side opposite the H1 side.

Number of primary turns through window = 2

$$\frac{\frac{125}{5} - 3}{2} = 11$$

TURNS RATIO = 11:1

CURRENT RATIO = 55:5

This illustration shows the internal construction of a current transformer. The outside face of the transformer is identified as H1. The opposite face is identified as H2. The secondary leads are identified as X1 and X2.

Current flowing out of terminal X1 will have the same polarity as current flowing into terminal H1.

### Internet Resources <http://www.crmagnetics.com/>

- Transducer Selection Guide: [transducer.html](#)
- Application Sheet: [pdf/ancrct-1.pdf](#)  
[error.html](#)  
[appguide.html](#)



# Precision, AC Current to Voltage Transducer

The **CR431** series, Current-to-Voltage Transducer produces a 0-5 Vdc or 0-10 Vdc output signal that is directly proportional to the input AC current. The output signal is average-sensing, calibrated for RMS.

This transducer is used with process control and industrial instrumentation equipment. The DC output signal can be connected directly to a high impedance analog input of a computer or PLC without additional signal conditioning.

The series will measure up to 200% of full scale on a short time basis (1 minute or less) and 150% on a continuous basis at its rated accuracy.

To protect external circuits from damage caused by short circuits or motor inrush currents.



## Features

- Permanently calibrated
- Output overload protected
- Fully isolated
- 10 different ranges
- Self-powered, requires no external power source



## Specifications

### Accuracy:

Depends on the range and load resistance, see Part Numbers table

### Ripple:

1% Max. peak ripple on output

### Calibrated Signal Out:

0-5 Vdc for CR4310

0-10 Vdc for CR4311

### Response Time:

250 ms max., 10-90% FS

### Max. Signal Out:

16 Vdc for CR4310

33 Vdc for CR4311

### Frequency:

50/60 Hz

### Continuous Thermal Current Rating Factor:

2.50 @ 30°C

### Short Time Thermal Current Rating Factor:

60 x Full Scale (For 1 Second)

### Insulation Class:

600 V, BIL 10 kV Full Wave

### Operating Temperature Range:

-30°C to +60°C

### Storage Temperature Range:

-55°C to +85 °C

### Shipping Weight:

1.5 pounds (.68 kg.)

## Part Numbers

### CR431 - CURRENT TO VOLTAGE TRANSDUCER

	Range in AC Amps	Accuracy % FS *
5	0-5	1.0
10	0-10	0.75
15	0-15	0.75
20	0-20	0.5
30	0-30	0.5
50	0-50	0.5
75	0-75	0.5
100	0-100	0.5
150	0-150	0.5
200	0-200	0.5

0	0-5 Vdc Out
1	0-10 Vdc Out

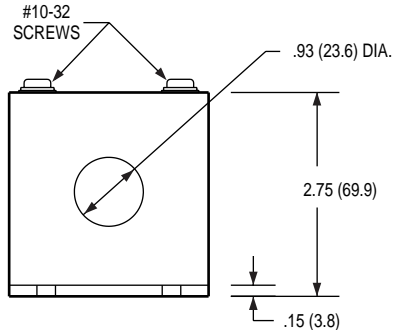
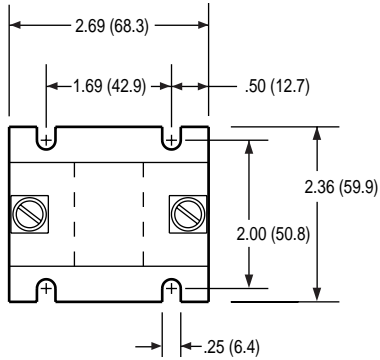
\* For total load resistance of:  
1.0 megohm or higher for CR4310  
150 K ohm or higher for CR4311

## Internet Resources <http://www.crmagnetics.com/>

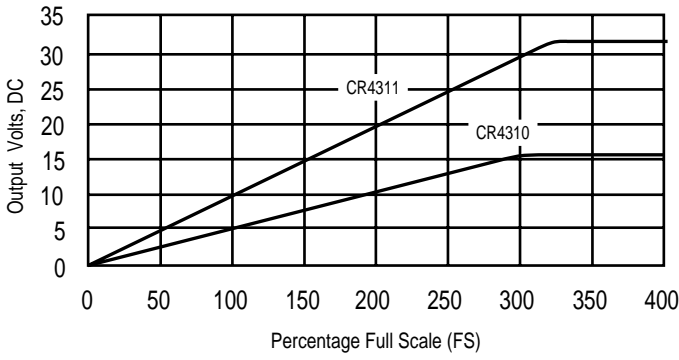
- Transducer Selection Guide: [transducer.html](#)
- Application Sheet: [pdf/ancr4310.pdf](#), [pdf/ancr4310-2](#)
- Pricing: [pricing/4310.html](#)
- External Current Transformers: [cts.html](#)

# Precision, AC Current to Voltage Transducer

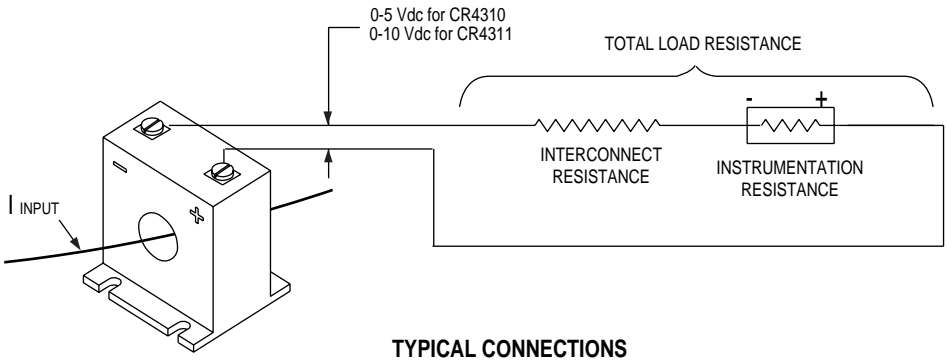
## Application Notes



OUTLINE DRAWING



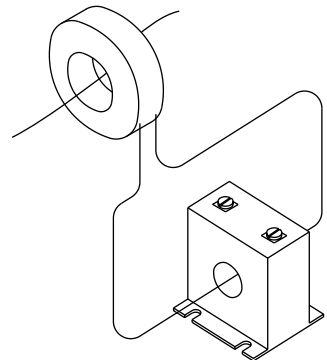
CONTROL VOLTAGE OUT vs FULL-SCALE INPUT CURRENT



TYPICAL CONNECTIONS

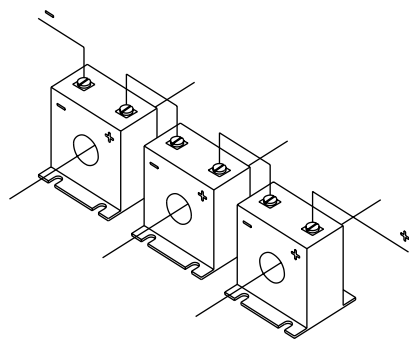
in (mm)

## Typical Applications



EXTERNAL CURRENT TRANSFORMER

An external current transformer may be used with the transducer by routing the secondary leads through the window opening. Use the CR4310-5 or CR4311-5 current transducer with a 5 Amp secondary instrument grade current transformer. For additional details on current transformers, see page 25.



3-PHASE SYSTEMS

Three-phase systems may be monitored by attaching three transducers in series. The total output voltage will be the sum of each individual transducer. If each transducer is sized for the full-scale current, the output voltage will be 0-15 Vdc for the CR4310 Series (0-30 Vdc for the CR4311 Series) at 0 to 100% full-scale. As an alternate, each transducer may be sized for three times the full-scale current, then the output voltage for the CR4310 will be 0-5 Vdc for 0 to 100% full-scale.



# 2-Wire Current Transmitter, 4-20 mA Output

The **CR4320** series, loop-powered, 2-Wire Current Transmitter produces a calibrated 4-20 mA. DC output current directly proportional to the average RMS value of the input alternating current. The controlled current output is unaffected by variations in supply voltage, interconnect and load impedance (within specification limits) to provide a highly accurate means for monitoring alternating current over long distances.

## Features

- Permanently calibrated
- Loop-powered
- Fully isolated
- 12 different ranges
- 2 case styles, .93" (23.6 mm) and 1.25" (31.8 mm) window opening
- Output overload protected



Case Style 1

Case Style 2

## Specifications

### Accuracy:

±0.5% Full-Scale (FS)

### Repeatability:

Less than 0.1%

### Ripple & Noise:

1% Max., peak to peak

### Calibrated Signal Out:

4-20 mA DC

### Response Time:

200 ms max., 10-90% FS

### Max. Signal Out:

30 mA DC

### Temperature Coefficient:

± 0.04%/°C

### Supply Voltage:

24 Vdc ±10%

### Frequency:

50/60 Hz

### Continuous Thermal Current Rating Factor:

1.33 @ 30°C

### Short Time Thermal Current

### Rating Factor (For 30 Seconds):

6.0 x Full Scale for AC ranges up to 200 Amp.

4.0 x Full Scale for ranges 300 and 400 Amp.

### Output Load:

0 to 600 ohms

### Insulation Class:

600 V, BIL 10 kV Full Wave

### Reverse Polarity Protection:

Yes

### Operating Temperature Range:

-30°C to +60°C

### Storage Temperature Range:

-55°C to +85°C

### Approximate Weight:

1.5 pounds (.68 kg)

## Part Numbers

CR4320 -    4-20 MA CURRENT TRANSMITTER

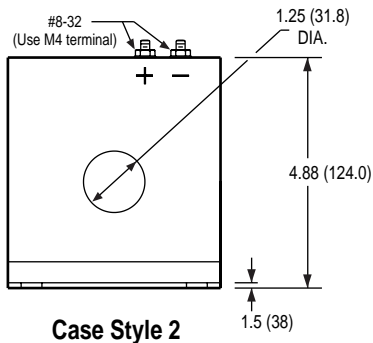
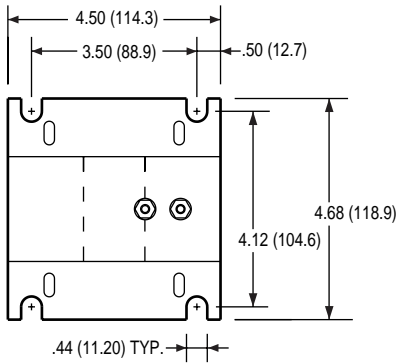
	Full-Scale (FS) Range in AC Amps	Case Style
<b>5</b>	0-5	1
<b>10</b>	0-10	1
<b>15</b>	0-15	1
<b>20</b>	0-20	1
<b>30</b>	0-30	1
<b>50</b>	0-50	1
<b>75</b>	0-75	1
<b>100</b>	0-100	1
<b>150</b>	0-150	1
<b>200</b>	0-200	1
<b>300</b>	0-300	2
<b>400</b>	0-400	2

Internet Resources <http://www.crmagnetics.com/>

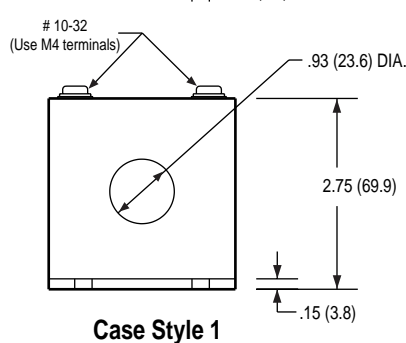
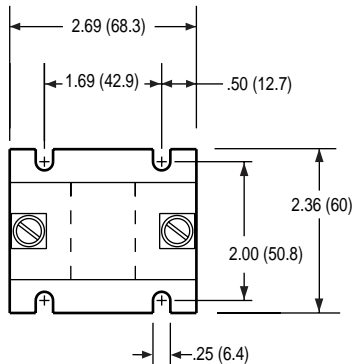
- Transducer Selection Guide: [transducer.html](#)
- Application Sheet: [pdf/ancr4320-1.pdf](#)
- Pricing: [pricing/4320.html](#)
- Motor Loads: [mot\\_ld\\_a.pdf](#)

# 2-Wire Current Transmitter 4-20 mA Output

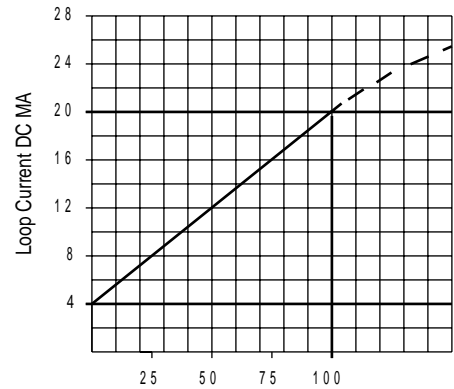
## Application Notes



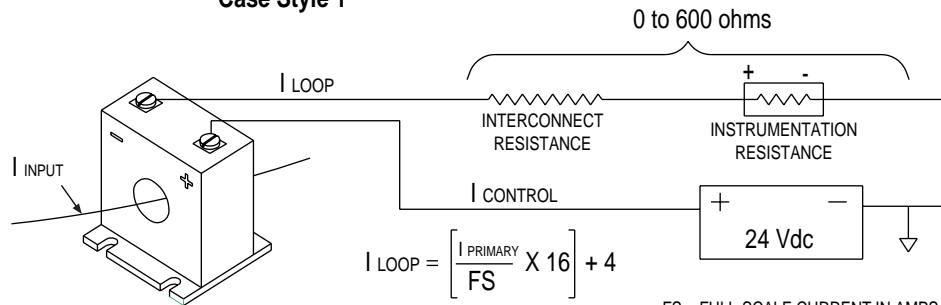
**Case Style 2**



**Case Style 1**



**LOOP CURRENT OUT  
VS  
FULL-SCALE INPUT CURRENT**

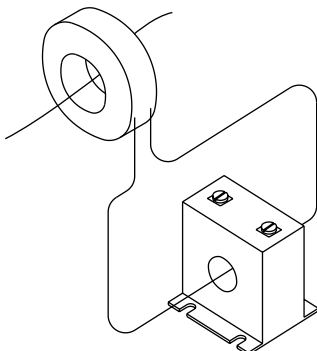


$$I_{LOOP} = \left[ \frac{I_{PRIMARY}}{FS} \times 16 \right] + 4$$

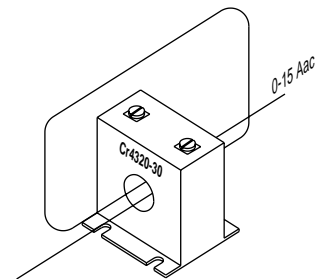
FS = FULL-SCALE CURRENT IN AMPS RMS  
I PRIMARY = MONITORED CURRENT IN AMPS RMS  
I LOOP = LOOP CURRENT IN mA dc

in (mm)

## Typical Applications



An external current transformer may be used with the transmitter by routing the secondary leads through the window opening. Use the CR4320-5 current transmitter when using a 5 Amp secondary instrument grade current transformer. For additional details on current transformers, see page 25.



The scaling factor may be changed by threading the primary current-carrying wire several times through the window opening. The "actual" measurement range will be the name plate range divided by the number of wire passes. For example, the CR4320-30 has the name plate range of 0-30 Aac. Two passes of the wire through the window opening will then provide an effective range of 0-15 Aac (30÷2).



# 4-Wire Current Transmitter 4-20 mA Output

The **CR4340** series, 4-Wire Current Transmitter produces a calibrated 4-20 mA DC signal proportional to the average RMS value of the input alternating current. The output signal is produced by an internal current generator powered from an external 120 Vac supply. The output signal is unaffected by variations in interconnect and load impedance (within specification limits) thus providing a highly accurate means for monitoring alternating current over long distances.

The 4-wire transmitter allows for direct attachment to instrumentation. There is no need for external DC power as required with 2-wire transmitters.

## Features

- Permanently calibrated
- Fully isolated
- Output overload protected
- 13 different ranges - 6 field selectable
- Internal current generator
- 2 case styles, .94" (23.9) and 2.13" (54.1) window opening
- Monitors over long distances

## Specifications

### Accuracy:

±0.5% Full-Scale (FS)

### Ripple & Noise:

1% Max., peak to peak

### Calibrated Signal Out:

4-20 mA DC

### Response Time:

150 ms max., 10-90% FS

### Max. Signal Out:

30 mA DC

### Temperature Coefficient:

± 0.02%/°C

### Supply Voltage:

120 ±10% Vac

### Frequency:

50/60 Hz

### Continuous Thermal Current Rating Factor:

1.50 @ 30°C for ranges-All Ranges up to 75 Amp.

1.33 @ 30°C for ranges 100 Amp. and over

### Short Time Thermal Current

### Rating Factor (For 30 Seconds):

15.0 x Full Scale for AC ranges up to 75 Amp.

4.0 x Full Scale for ranges 400 Amp. and over

### Output Load:

0-1000 ohms

### Insulation Class:

600 V, BIL 10 kV Full Wave

### Operating Temperature Range:

-30°C to +60°C

### Storage Temperature Range:

-55°C to +85°C



Case Style 2

Case Style 1

## Part Numbers

### CR4340 - 4-WIRE CURRENT TRANSMITTER

	Full-Scale (FS) Range in AC Amps	Case Style
5	0-5	1
	0-10*	1
	0-15*	
	0-20*	
20	0-25*	1
	0-50*	
	0-75*	
75	0-100	2
100	0-150	2
150	0-200	2
200	0-300	2
300	0-400	2
400	0-600	2
600		

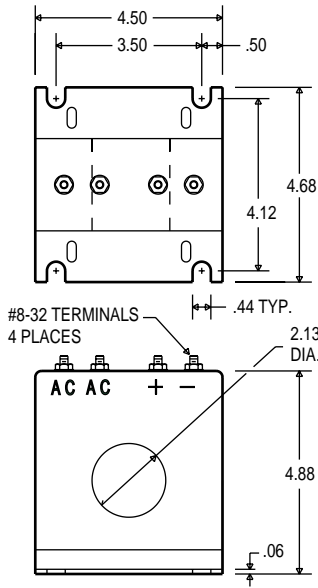
\* RANGE SET WITH FIELD SELECTABLE SWITCH

Internet Resources <http://www.crmagnetics.com/>

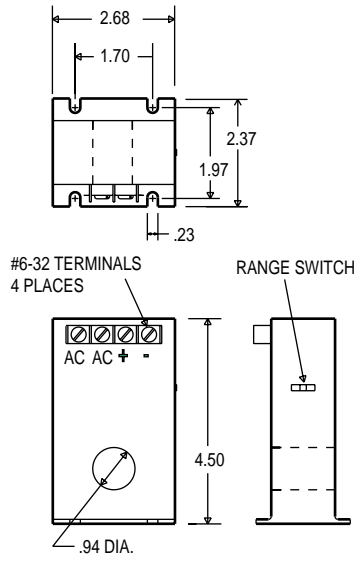
- Transducer Selection Guide: [transducer.html](#)
- Application Sheet: [pdf/ancr4340-1.pdf](#)
- Pricing: [pricing/4340.html](#)

# 4-Wire Current Transmitter 4-20 mA Output

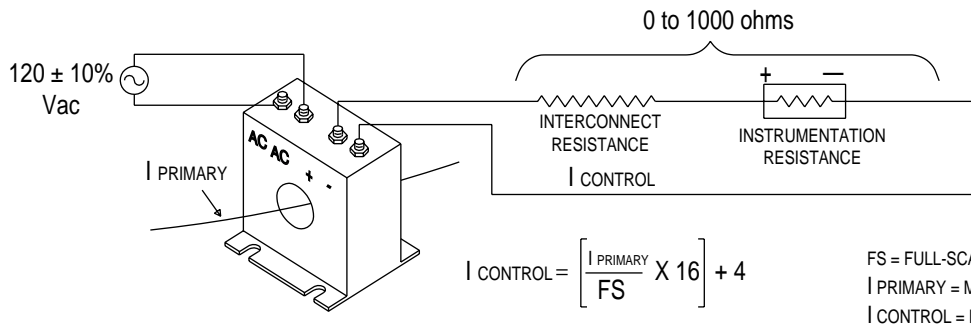
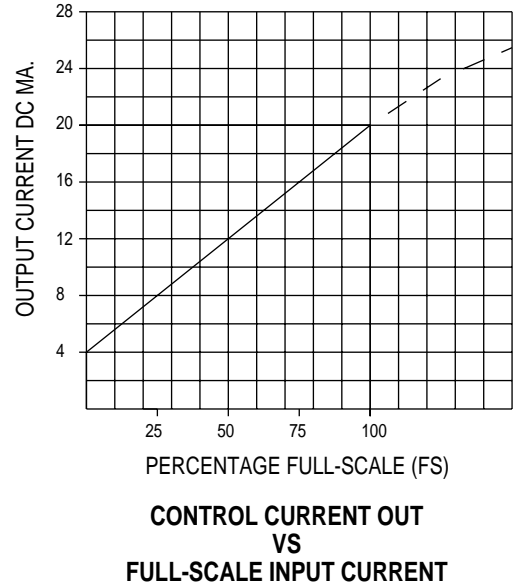
## Application Notes



Case Style 2



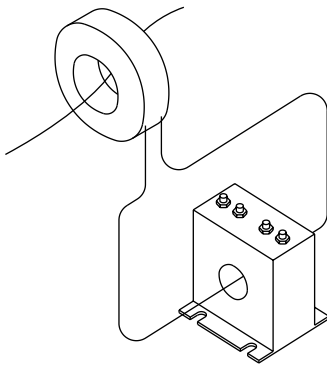
Case Style 1



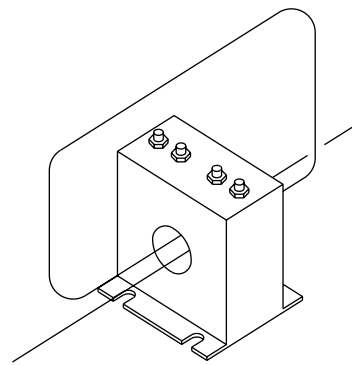
FS = FULL-SCALE CURRENT IN AMPS RMS  
 I PRIMARY = MONITORED CURRENT IN AMPS RMS  
 I CONTROL = LOOP CURRENT IN mA dc

in (mm)

## Typical Applications



An external current transformer may be used with the transmitter by routing the secondary leads through the window opening. Use the CR4340-5 current transmitter when using 5-Amp secondary instrument grade current transformer. For additional details on current transformers, see page 22.



The scaling factor may be changed by threading the primary current-carrying wire several times through the window opening. The "actual" measurement range will be the name plate range divided by the number of wire passes. For example, the CR4340-30 has the name plate range of 0-30 ACA. Two passes of the wire through the window opening will then provide an effective range of 0-15 ACA (30÷2).



# 3-Phase Voltage Transmitter 4-20 mA Output

The **CR473** series, Voltage Transmitters are expanded scale instruments designed to accurately measure three-phase voltages. Each model produces three discrete 4-20 mA signals which are proportional (across the selected input voltage range) to the three-phase input voltage. The output is a true constant current driver which is unaffected by resistance variations in the output loop of 0-600 ohms. The CR4730 is designed to measure line-to-line voltages and the CR4731 to measure line-to-neutral. Both are average-reading, calibrated to read RMS.

## Features

- Permanently calibrated
- Fully isolated
- ANSI/ISO 50.1 Class L3

**Internet Resources** <http://www.crmagnetics.com/>

- Transducer Selection Guide: [transducer.html](#)
- Application Sheet: [pdf/ancr4730-1.pdf](#)
- Pricing: [pricing/4730.html](#)



E154235

## Specifications

### Nominal Input Voltages:

120, 240, 277 & 480 Vac

### Accuracy:

±0.5% Full-Scale (FS)

### Ripple On Output:

Less than 1%

### Calibrated Signal Out:

4-20 mA DC

### Response Time:

1.50 sec. max., 10-90% FS

### Temperature Coefficient:

± 0.03%/°C

### Supply Voltage:

24 Vdc ± 10%

### Load Resistance:

0-600 ohms

### Frequency:

50/60 Hz

### Max. Continuous Input Voltage:

600 V

### Operating Temperature Range:

-30°C to +60°C

### Storage Temperature Range:

-50°C to +85°C

### Shipping Weight:

Approx. 1.3 Pounds (.59 kg)

### Reverse Polarity Protection:

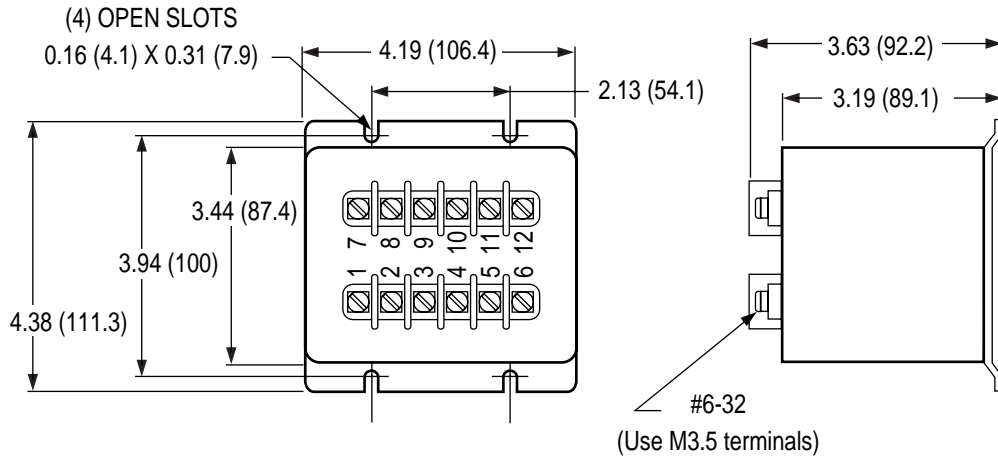
Yes

PART NUMBERS	APPLICATION	NOMINAL VOLTAGE RANGE	INPUT VOLTAGE RANGE	INPUT BURDEN (MAX)	TRANSFER FUNCTION I <sub>LOOP</sub> MA DC
CR4730-120	Line-to-line	120 V	90 V to 150 V	0.1 VA @ 240 V	$\frac{E_{IN} - 75}{3.75}$
CR4730-480 (Dual Range)	Line-to-line	240 V	180 V to 300 V	0.1 VA @ 265 V	$\frac{E_{IN} - 150}{7.5}$
		480 V	360 V to 600 V	0.1 VA @ 530 V	$\frac{E_{IN} - 300}{15}$
CR4731-120	Phase-to-neutral	120 V	90 V to 150 V	0.1 VA @ 150 V	$\frac{E_{IN} - 75}{3.75}$
CR4731-277	Phase-to-neutral	277 V	180 V to 300 V	0.1 VA @ 300 V	$\frac{E_{IN} - 150}{7.5}$

E<sub>in</sub>=Volts RMS

# 3-Phase Voltage Transmitter 4-20 mA Output

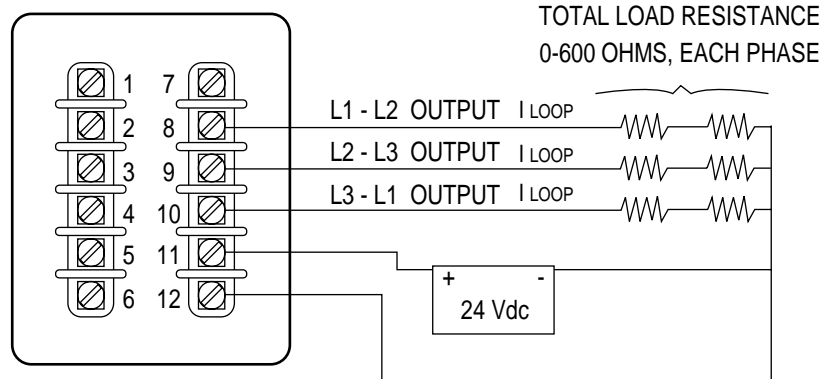
## Outline Drawings



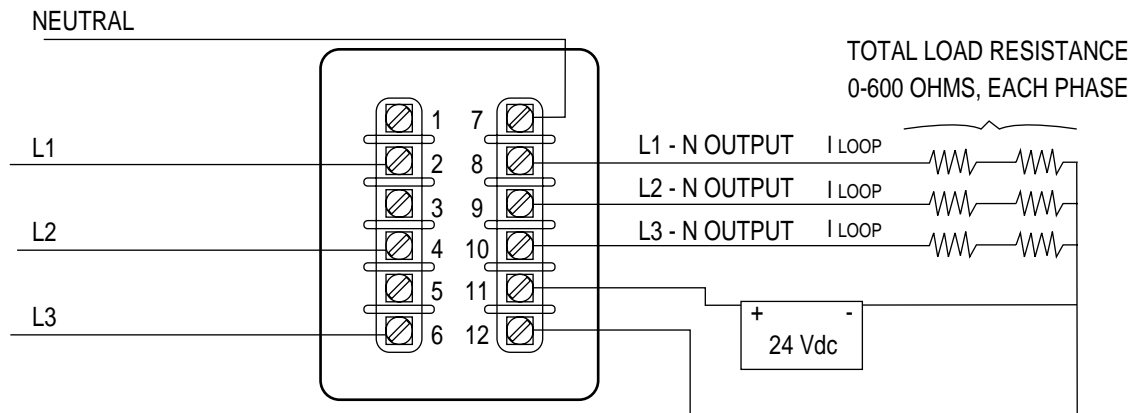
in (mm)

## Typical Connection Diagrams

MODEL	RANGE IN VOLTS	CONNECTIONS L1 - L2 - L3
CR4730-480	360 TO 600	1 - 3 - 5
	180 TO 300	2 - 4 - 6
CR4730-120	90 TO 150	2 - 4 - 6



CR4730-120 AND CR4730-480  
LINE-TO-LINE



CR4731-120 AND CR4731-277  
PHASE-TO-NEUTRAL



# Current Sensing Relay

The **CR4395** series, Current Sensing Relay provides an effective and highly stable method for monitoring electrical current. The current-carrying wire is routed through the opening extending from the top of the case. When current reaches the level set by the trip point adjustment, the relay trips and starts the adjustable timer. After the timer cycles the electro-mechanical relay is energized. A precision voltage reference circuit ensures a highly repeatable trip point.



Calibrated Dial  
Option Shown

## Applications

- Monitor electrical heater elements
- Sense motor over/under loads
- Detect lamp burn-out
- Indicate phase loss

## Features

- Variable trip point and time delay
- Monitors currents from 10 mA to 100 AC Amps
- Electrical isolation between circuits
- Output relay rated up to 20 Amps
- LED trip status indicator
- Dead band prevents relay chatter
- Calibrated dial option available
- External current transformers available

## Specifications \*

### Mounting:

3/16" dia. clearance holes on 1 15/16" by 2 15/16" centers

### Environmental:

Operating Temperature: -30°C to +60°C  
Storage Temperature: -55°C to +85°C

**Power-On Delay:** 100 ms max

**Hysteresis:** 5% Max.

### Input Supply Power:

Terminals: 2 - 1/4" Male Q C

### Sensed Current:

Max. Continuous: 200% Full Scale  
Frequency: 60-400 Hz

**Internet Resources** <http://www.crmagnetics.com/>

- Relay Selection Guide: relays.html
- Application Sheets : pdf/ancr4395-1.pdf, pdf/ancr4395-2.pdf, pdf/ancr4395-3
- Pricing: pricing/4395.html
- External Current Transformers: cts.html

## Output Options

The Relay is available with three different output configurations, electromechanical relay, optoisolated NPN transistor or optoisolated triac. Specify desired selection in part number.

### Relay

Arrangement: 1 Form C (SPDT)

Contact Material: Silver-cadmium oxide

Terminals: 3 - 1/4" Male Q C

Mechanical Life: 10 million operations, typ. @ rated load

Electrical Life: 100,000 operations, typ. @ rated load

Initial Contact resistance:

50 milliohms max. @ 500 mA, 12 Vdc

Contact Rating: UL508/873 & CSA

VOLTAGE	LOAD TYPE	N.O. CONTACT	N.C. CONTACT
240 Vac	Resistive	20A	10A
240 Vac	Motor	2HP	1/2HP
125 Vac	Motor	1HP	1/4HP
28 Vdc	Resistive	20A	10A

### DC Switching (-NPN)

**Vce (full off):** 30 Vdc max.

**Isink (full on):** 120 mAdc max. @ rated full-on

**Vce (full on):** 1.5 Vdc @ 120 mAdc Isink

**Off state leakage current:** 5ua @ 30 Vdc (typical)

### AC Switching (-AAC)

**Off state voltage:** 240 Vac RMS max.

**Minimum switch voltage:** 24 Vac RMS

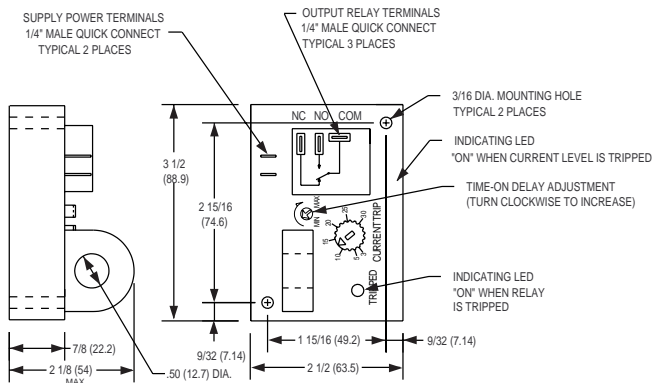
**On state current:** 0.5 Aac RMS max. continuous

**Switching mode:** Zero crossing

**Off state leakage:** 60 ua @ 240 Vac max.

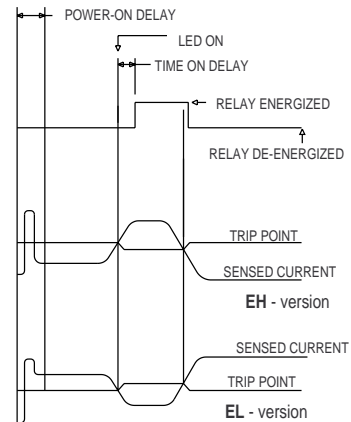
\*All specifications for operation at 60 Hz only

## Outline Drawing



**CALIBRATED DIAL OPTION SHOWN (-CD)**

## Timing Drawing



## Part Numbers

**CR4395** - □□ - □□□ - □□□ - □ - □□ - □□□

**SUPPLY VOLTAGE**  
**AC**  
 120 - 120 Vac  
 240 - 240 Vac  
**DC**  
 24D - 24 Vdc  
 All supply voltage tolerances are ± 10 %

**TIME ON DELAY**  
**A** - .5 to 6 Sec.  
**B** - 2 to 25 Sec.  
**X** - none  
 Time-on delay is the time from when the relay trips to when the output energizes. The ranges are guaranteed minimum, actual range may be slightly greater.

**OUTPUT OPTIONS**  
**ELR** - Electromechanical Relay  
**NPN** - Optoisolated NPN Transistor  
**TRC** - Optoisolated Triac., zero crossing

- ELR      - NPN  
 - TRC

**TRIP STATUS**  
**EH** - Energized on High, trips when sense current is above trip point and returns to non-trip status when sense current is below the trip point.  
**EL** - Energized on Low, trips when sense current is below trip point and returns to non-trip status when sense current is above trip point.  
**LH** - Latch on High, trips when sense current is above trip point and remains tripped until supply power is removed.  
**LL** - Latch on Low, trips when sense current is below trip point and remains tripped until supply power is removed.

**TRIP RANGE**  
 .01.1 - .01 to 0.1 AAC  
 .11 - 0.1 to 1.0 AAC  
 110 - 1.0 to 10 AAC  
 330 - 3.0 to 30 AAC  
 660 - 6.0 to 60 AAC  
 101 - 10 to 100 AAC  
 The trip ranges shown are for one wire pass through the window opening. The trip range may be proportionally lowered with additional wire passes through the window.

**TRIP POINT DIAL**  
**NC** - Non-calibrated Dial  
**CD** - Calibrated Dial  
**FP** - Fixed Trip Point (Specify value of fixed trip point with order)

- NC      - CD      - FP  
 -330 trip range shown



# Low Cost Current Switch

The **CR9321-LC** series is a low cost, self powered, fixed set-point Current Switch designed for applications that require an on-off indication of current flow.

Current levels above the guaranteed full-on level will turn the output to full on. The Current Switch is recommended only for applications where the continuous operating current is above the rated full on level of 350 mA. Operation below this point will not drive the output device full-on and derate the output ratings.

The unit is available with a NPN or PNP output transistor for switching DC and a SCR output for switching AC. Connections can be made directly to items such as a PLC or electromechanical relay. Note that connections made directly to an inductive device such as an electromechanical relay will require a customer supplied clamping diode for DC operation or a snubber network for AC operation.



## Specifications \*

**Rated full-on:** 0.350 Aac RMS

**Turn-on time:**  
100 ms max. @ rated full-on

**Turn-off time:**  
250 ms. max. to 80% of Vce

**Maximum sense current:**  
Continuous: 100 Aac  
1 Second: 500 Aac

**Frequency: \***  
50 to 400 Hz

**Operating Temperature:**  
-30 °C to +60 °C

**Storage Temperature:**  
-55 °C to +85 °C

## DC Switching (-NPN or -PNP)

**Vce (full off):** 30 Vdc max.

**Isink (full on):** 120 mA dc max. @ rated full-on

**Vce (reverse polarity voltage):** 1.2 Vdc @ 100 mA dc

**Vce (full on):** 1.5 Vdc @ 120 mA dc Isink

**Off state leakage current:** 5ua @ 30 Vdc (typical)

## AC Switching (-ACA)

**Off state voltage:** 240 Vac RMS max.

**Minimum switch voltage:** 24 Vac RMS

**On state current:** 1.0 Aac RMS max. continuous

**Off state leakage:** 50 ua @ 240 Vac max.

**Peak Non-Repetitive Surge Current:**  
8 Aac RMS (1 cycle, 60 Hz.)

\*All specifications for operation at 60 Hz only

## Part Number

**CR9321-LC - [ ] [ ] CURRENT SWITCH**

**NPN** - Transistor output

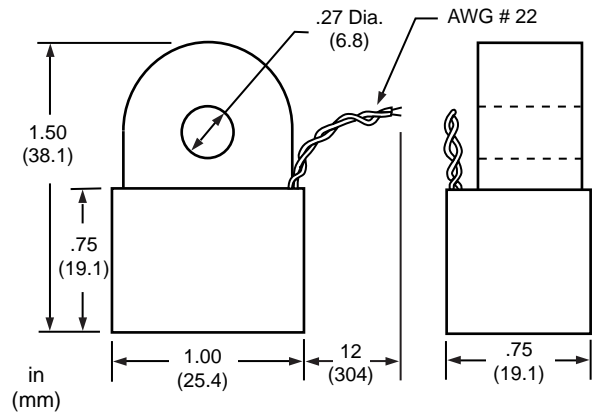
**PNP** - Transistor output

**ACA** - AC Output

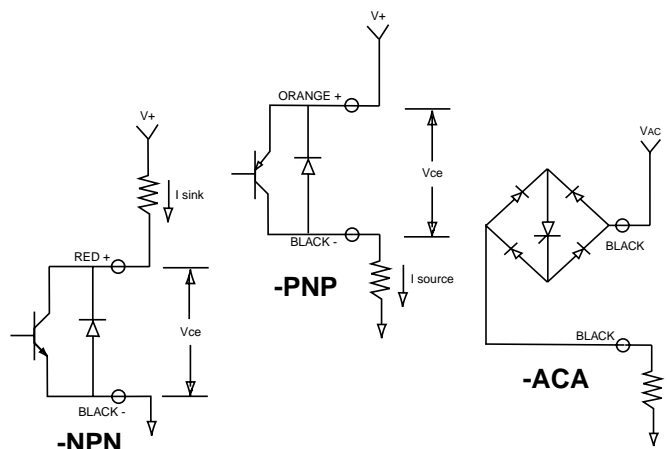
## Features

- Low cost
- Low fixed trip point
- Fully isolated
- Reverse output polarity protected
- Self-powered

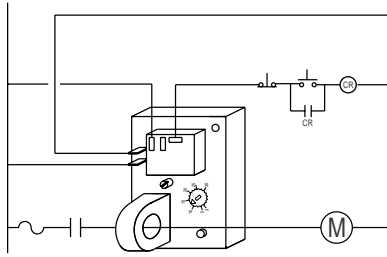
## Outline Drawing



## Electrical Connections

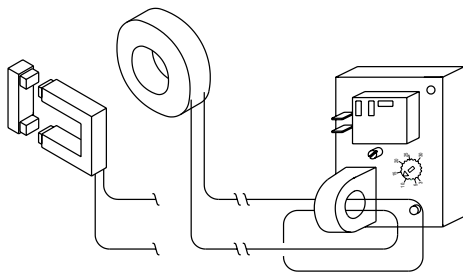


## Typical Relay Applications



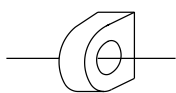
### MOTOR OVER / UNDER MONITOR

The relay may be used to monitor the operational load of a motor. One leg of the motor wiring is routed through the window opening. With the "EH" (Energized on High) option, when the motor current draw exceeds the trip point, the relay will energize and open the motor starter. The time delay would be set long enough to inhibit tripping during high inrush starting current. Note that an electrical fuse and other overload devices will still be required for complete motor protection.

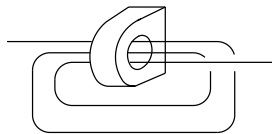


### EXTERNAL CURRENT TRANSFORMERS

The relay may be used with an external split or solid-core current transformer. The external transformer can be used to access remote loads or where the current-carrying wire is too large to fit through the window opening in the relay. A standard, 5 Amp secondary, commercial grade current transformer (see page 25) would be attached with the secondary leads threaded twice through the window opening, as illustrated. The trip range option "110" (1.0 to 10 ACA) would then provide full-scale adjustment for the transformer.

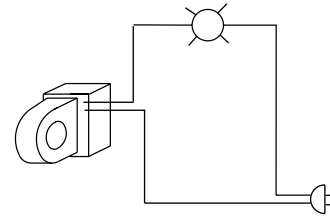


ONE-WIRE PASS



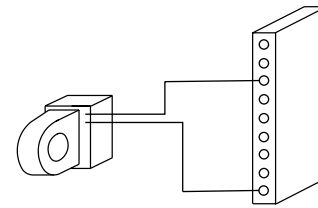
THREE-WIRE PASS

The trip ranges shown on page 15 represent one wire pass through the window opening. The trip range may be changed by threading the current-carrying wire through the window opening several times, as shown above. The "actual" trip range would be the relay name plate range divided by the number of wire passes through the opening. For example, a name plate range of 6.0 to 60 ACA with three wire passes would provide an actual range of 2.0 to 20 ACA ( $6 \div 3 = 2.0$  &  $60 \div 3 = 20$ ).



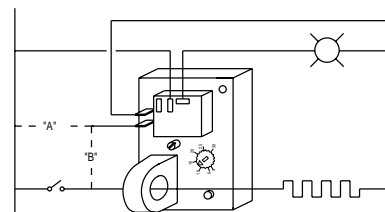
### CONNECTION TO INDICATOR LAMP

The current switch may be used to drive directly an indicating lamp. When using the AC output version, either of the two black leads may be attached to the power source. A snubber network is required when connecting to an inductive device such as an electromechanical relay.



### CONNECTION TO PLC

The current switch may be connected directly to a PLC. Supply power may be provided from the PLC, as shown, or from an external power source. When using a transistor output, the negative or black lead from the switch is attached to the negative side of the supply.



### OPEN HEATER / LAMP DETECTOR

The relay may be used to provide an alarm signal to indicate an open heater element. The current-carrying wire is routed through the window opening. With the "EL" (Energized on Low current) option, when the heater element draws current above the trip point, the relay remains de-energized. If the element becomes open, the current level will be reduced, causing the relay to become energized. Supply power is constantly supplied to the relay with the "A" connection and the relay will cycle every time the temperature controller cycles. Using the alternate connection with line "B", power is provided to the relay only when the temperature controller is cycled on. With this connection, the relay will energize only when the element is open.



# Wire Lead Current Transformers

CR Magnetics offers a versatile line of rugged wire lead current transformers. Installed around a current-carrying wire, the sensor provides a current output relative to the AC input current (within specification limits). With the output connected across a resistive load (burden), the voltage developed is proportional to the input current.

## Applications

- Remote monitoring of electrical loads
- Input to electrical control system
- Detect open heater elements
- Indicate phase loss
- Monitor motor operation

## Features

- Low cost
- Non-contact, isolated current measurement
- Surface mounting bracket available for Model 17 and Model 18
- 2 case sizes, 3 different standard ratios

## Specifications

**Frequency:** 50-60 Hz

**Working Class:** 600 Vac

**Case Material:** Black thermoplastic

## Part Numbers

<b>Model 17-2000</b>	Current Transformer with wire leads, .55 dia. opening, 2000 turns
<b>Model 17-1000</b>	Current Transformer with wire leads, .55 dia. opening, 1000 turns
<b>Model 18-600</b>	Current Transformer with wire leads, .55 dia. opening, 600 turns
<b>MB-18</b>	Surface Mounting Bracket for Model 17 or Model 18
<b>Model 19</b>	Current Transformer with .29 dia. opening, 230 turns



**Model 19**



**Model 17 & 18**

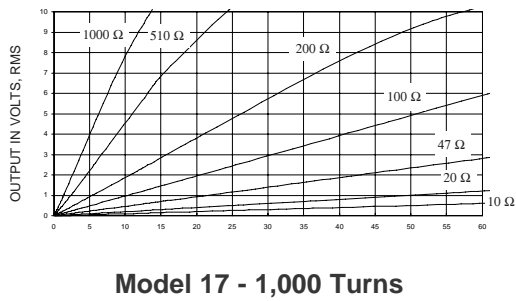
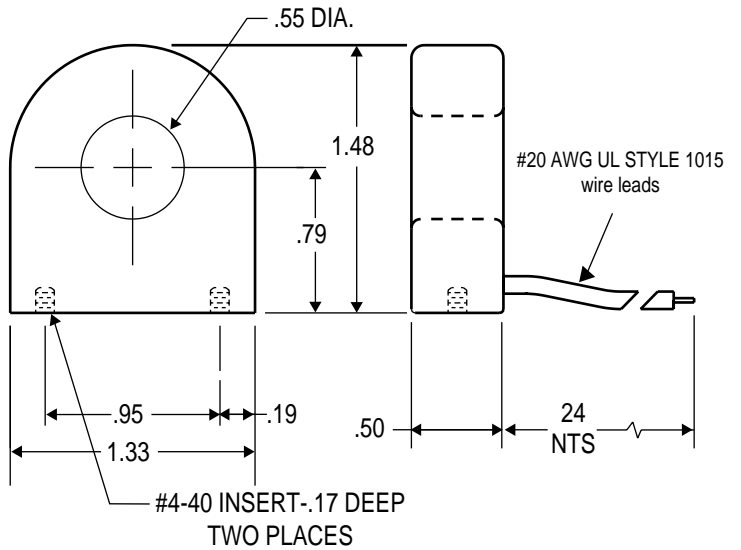
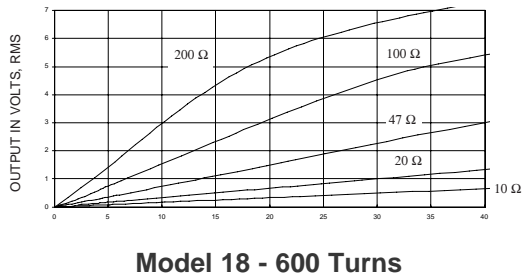
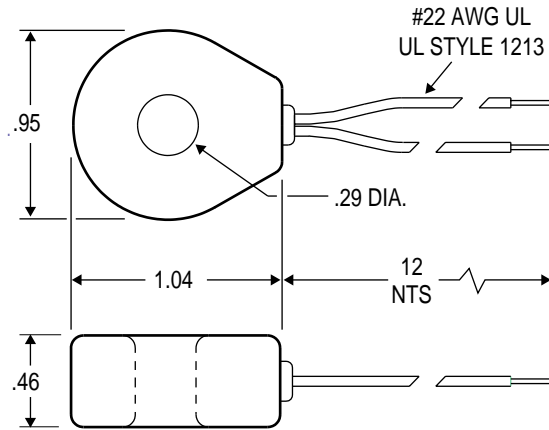
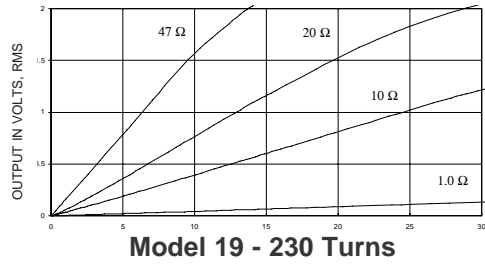
Shown with optional mounting bracket **MB-18**

**Internet Resources** <http://www.crmagnetics.com/>

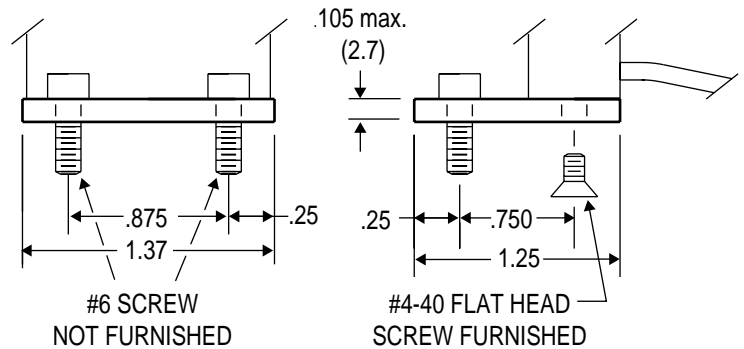
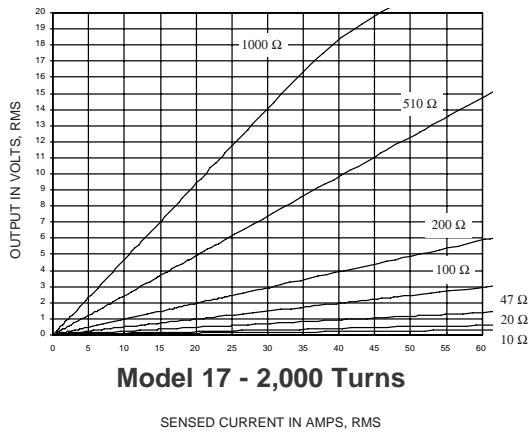
- Transformer Selection Guide: pcb.html

# Wire Lead Current Transformers

## Outline Drawings



**Model 17 & 18: Current Sensing Transformers**  
Also available with PCB pins





# Vertical Mounting, PCB Current Transformers - Series 8300

## Features

- Low cost
- 4 standard sizes
- Non-symmetrical mounting pattern
- Silicon Steel & Nickel Alloy cores available

## Applications

- **Silicon Steel** cores provide moderate accuracy and lower cost for applications such as current measurement and current relaying.
- **Nickel Alloy** cores are for applications that require highest accuracy with minimal phase angle error and are higher in cost. Applications would include power and energy monitoring devices.

## Specifications

**Case Material:** Polypropylene Resin

**Construction:** Epoxy Encapsulated

**Operating Temperature:** -25°C to +66°C

**Insulation Resistance:** 100 M ohm @ 500 Vdc

**High Potential:** 1500 volts x 1 minute

**Frequency:** 50 to 400 Hz



## Outline Dimensions

PART NUMBERS	A	B	C	D	E	F	G	H	I	J	K	L	M	Fig.
	min.	max.	max.	± .04 (±1.0)	max.									
CR8348-xxxx	.265 (6.7)	.925 (23.5)	.433 (11)	.118 (3)	.984 (25)	.040 (1.0)	.075 (1.905)	.60 (15.24)	.75 (19.05)	.374 (9.5)				1
CR8349-xxxx	.354 (9)	1.024 (26)	.669 (17)	.118 (3)	1.102 (28)	.040 (1.0)	.075 (1.905)	.60 (15.24)	.75 (19.05)	.60 (15.24)				1
CR8350-xxxx	.504 (12.8)	1.476 (37.5)	.551 (14)	.118 (3)	1.535 (39)	.040 (1.0)	.15 (3.81)	1.00 (25.4)	1.30 (33.02)	.50 (12.7)				1
CR8351-xxxx	.772 (19.6)	1.969 (50)	.748 (19)	.137 (3.5)	2.204 (56)	.059 (1.5)	.591 (15)	1.181 (30)	2.362 (60)	.394 (10)	.059 (1.5)	3.15 (80)	.040 (1.0)	2

## Part Numbers

CR □ □ □ □ - □ □ □ □ - □ □ □ □

Number of Secondary Turns

**8348** - .272 Window Opening  
**8349** - .354 Window Opening  
**8350** - .504 Window Opening  
**8351** - .772 Window Opening

Leave blank for Silicon Steel Core  
**N 0.2** - Nickel Alloy Core, 0.2 Accuracy Class  
**N 0.1** - Nickel Alloy Core, 0.1 Accuracy Class

**Internet Resources** <http://www.crmagnetics.com/>

- Transformer Selection Guide: [pcb.html](#)
- Pricing: [pricing/8300.html](#)

## Standard Configurations

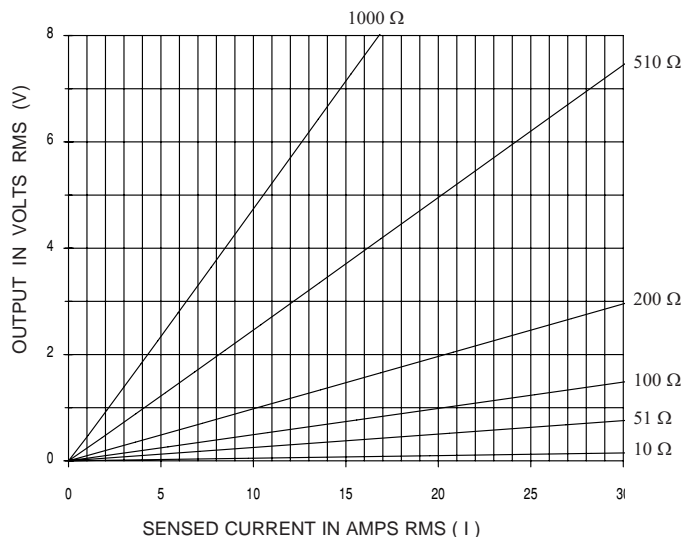
The following are standard configurations that are stocked.

- CR8348-2000
- CR8348-2500-N-0.2
- CR8349-1500
- CR8349-2500-N-0.2
- CR8350-2000
- CR8350-2500-N-0.2
- CR8351-2000-N-0.2

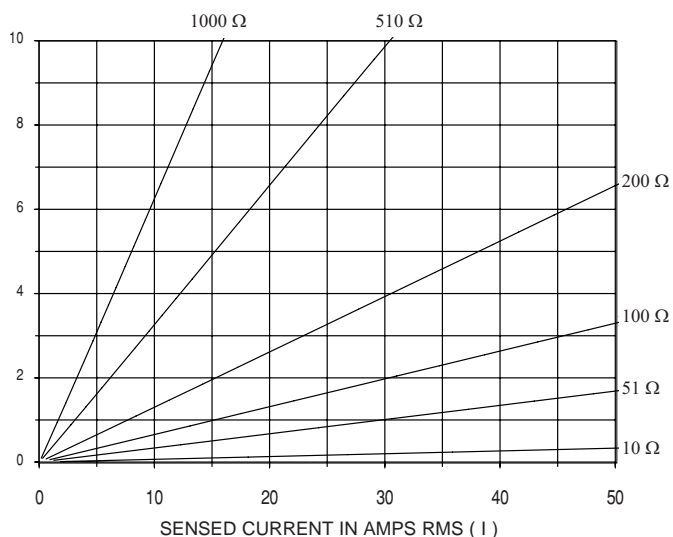
**CONTACT FACTORY FOR ADDITIONAL ELECTRICAL SPECIFICATIONS**

## Output Voltage vs Sensed Current for Different Values Of Burden Resistance (R)

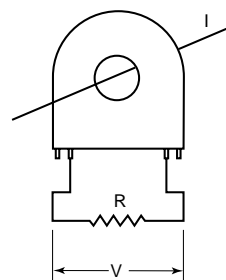
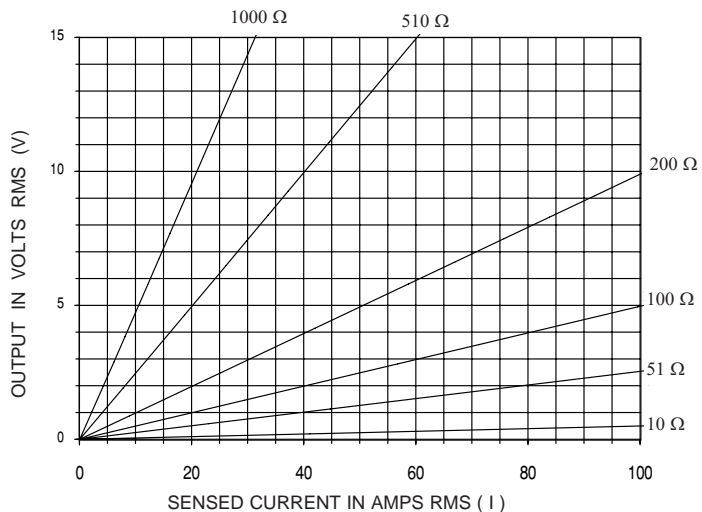
**CR8348-2000 (.272 WINDOW)**



**CR8349-1500 (.354 WINDOW)**



**CR8350-20000 (.504 WINDOW)**



# Wire Lead Current Transformers Series 8400



## Features

- Low cost
- 5 standard sizes
- Non-contact, isolated measurement

## Applications

- Over/under current sensing
- Ground Faults
- Current measurements
- Power monitoring

## Specifications

**Case Material:** Polypropylene Resin  
**Construction:** Epoxy Encapsulated  
**Operating Temperature:** -25°C to +66°C  
**Insulation Resistance:** 100 M ohm @ 500 Vdc  
**High Potential:** 1500 volts x 1 minute  
**Frequency:** 50 to 400 Hz



CR8459



CR8460



CR8401

CR8410

CR8420

## Part Numbers And Outline Dimensions

PART NUMBERS	A	B	C	D	E	Fig.	NOTES
	min.	max.	max.	$\pm .12$ ( $\pm 3.0$ )	max.		
CR8401-xxxx	.232 (5.9)	.827 (21.0)	.315 (8.0)	2.75 (70.0)	.709 (18.0)	3	NICKEL ALLOY CORE WITH MAGNETIC SHIELDS FOR GROUND FAULT APPLICATIONS
CR8410-xxxx	.350 (8.9)	.984 (25.0)	.355 (9.0)	2.87 (73.0)	.866 (22.0)	3	SILICON STEEL CORE FOR GENERAL PURPOSE CURRENT MONITORING
CR8420-xxxx	.610 (15.5)	1.299 (33.0)	.355 (9.0)	2.75 (70.0)	1.181 (30.0)	3	NICKEL ALLOY CORE WITH MAGNETIC SHIELDS FOR GROUND FAULT APPLICATIONS
CR8459-xxxx-N	.760 (19.3)	1.862 (47.3)	.748 (19)			4	NICKEL ALLOY CORE FOR POWER MONITORING APPLICATIONS
CR8460-xxxx-N	1.181 (30)	2.401 (61)	.826 (21)	3.464 (88)		5	NICKEL ALLOY CORE FOR POWER MONITORING APPLICATIONS

## Part Numbers

CR □ □ □ □ - □ □ □ □

Number of  
Secondary Turns

**8401** - .232 Window Opening  
**8310** - .350 Window Opening  
**8420** - .610 Window Opening  
**8459** - .760 Window Opening  
**8460** - 1.181 Window Opening

**CONTACT FACTORY FOR ADDITIONAL ELECTRICAL SPECIFICATIONS**

CR Magnetics, Inc. 544 Axminister Dr. Fenton MO USA 63026 V: 636.343.8518 F: 636.343.5119  
 Web: <http://www.crmagnetics.com> Email: [sales@crmagnetics.com](mailto:sales@crmagnetics.com)

**Internet Resources** <http://www.crmagnetics.com/>

- Transformer Selection Guide: [pcb.html](#)
- Pricing: [pricing/8400.html](#)

## Standard Configurations

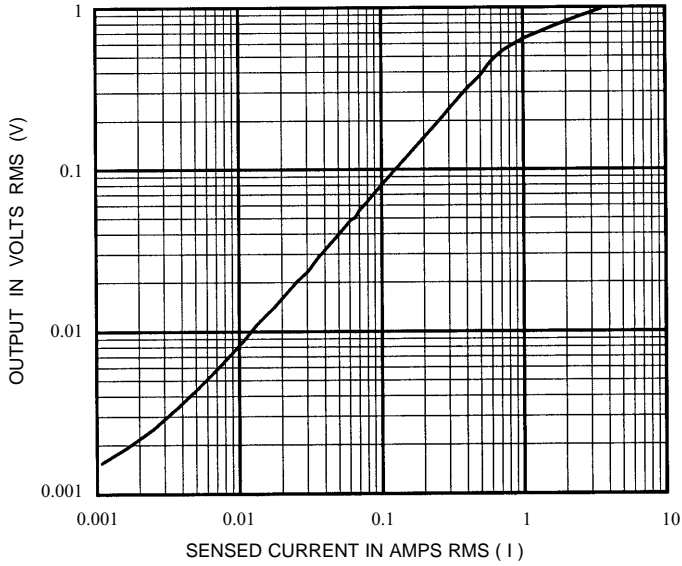
The following are standard configurations that are normally stocked.

CR8401-1000  
 CR8410-1000  
 CR8420-1000  
 CR8459-2000-N

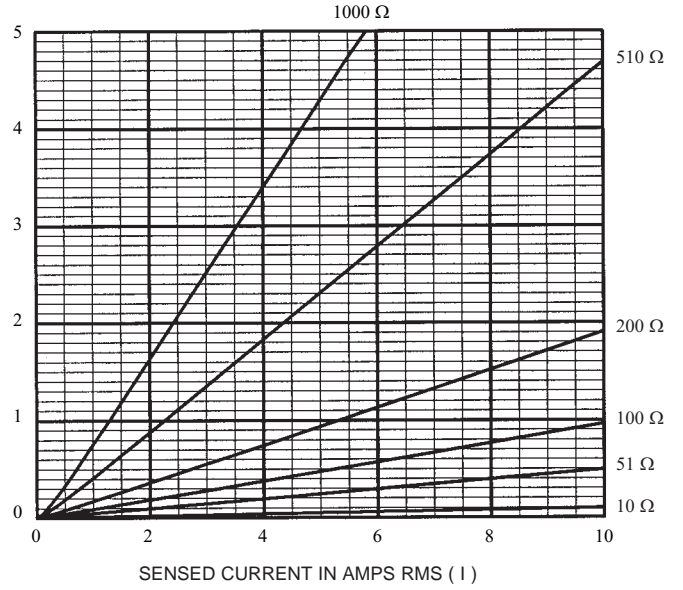
# Wire Lead Current Transformers Series 8400

## Output Voltage vs Sensed Current for Different Values Of Burden Resistance (R)

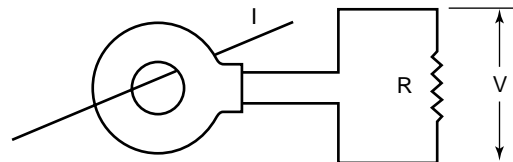
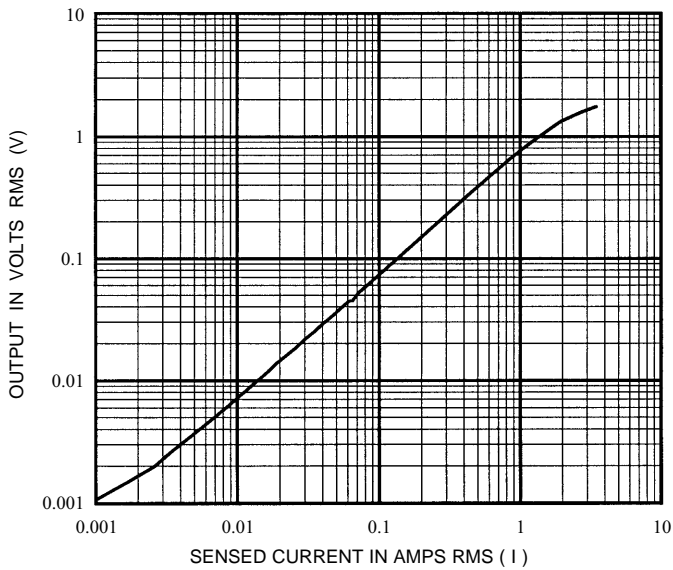
**CR8401-1000 (.232 WINDOW)**  
R=1,000 ohms



**CR8410-1000 (.350 WINDOW)**



**CR8420-1000 (.610 WINDOW)**  
R=1,000 ohms



# Series 8300 and 8400 Current Transformers

## Outline Drawings

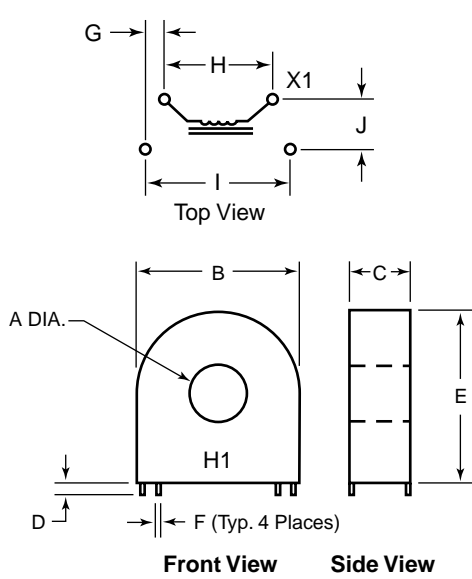


Figure 1

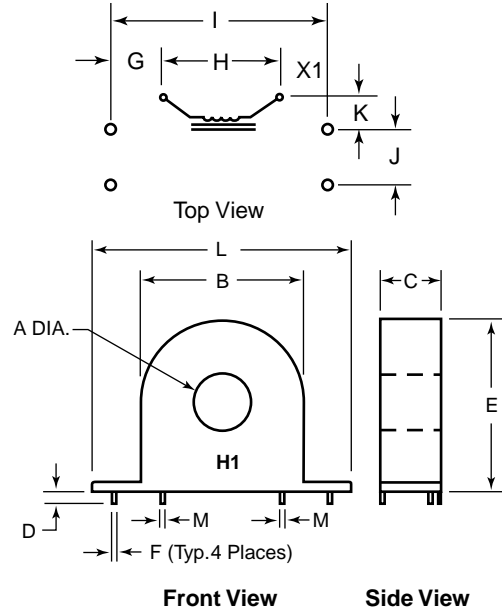


Figure 2

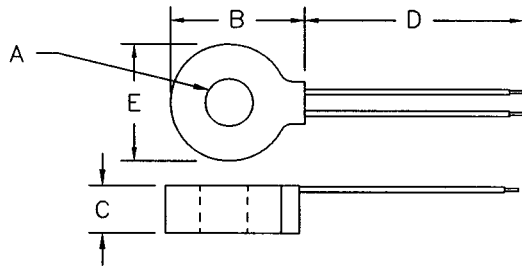


Figure 3

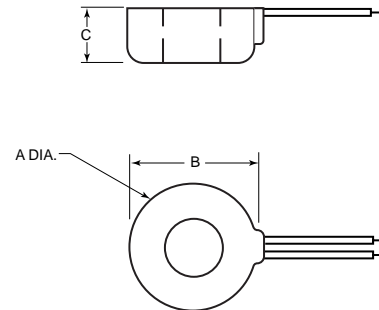


Figure 4

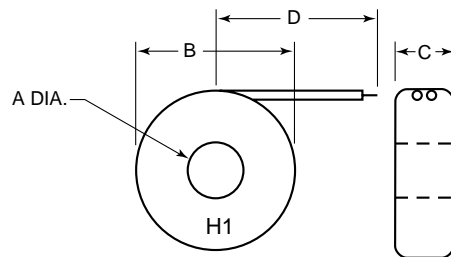


Figure 5



# Horizontal Mounting, PCB Current Transformer

The **CR8750** series, PCB Current Transformer provides a low cost method for monitoring electrical current. The transformer is intended to be mounted on a Printed Circuit Board with the current-carrying wire routed through the center window opening. A five-pin, non-symmetrical mounting pattern ensures correct orientation on the PCB. Two different winding ratios are available to accommodate various applications. The graph below illustrates how different values of burden resistors attached to the output terminal will provide a number of different output voltage ranges.



## Specifications

**Frequency:** 60-400 Hz  
**Insulation Level:** 600 V

**Internet Resources** <http://www.crmagnetics.com/>

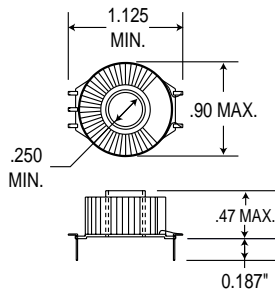
- Transformer Selection Guide: pcb.html
- Pricing: pricing/8750.html

## Part Numbers

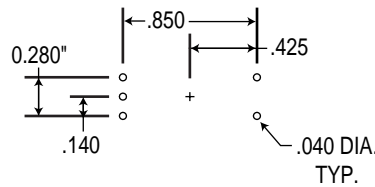
**CR8750-□□□□ PCB CURRENT TRANSFORMER**

**0230 TURNS**  
**1000 TURNS**

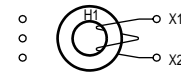
## Application Notes



**Outline Drawing**

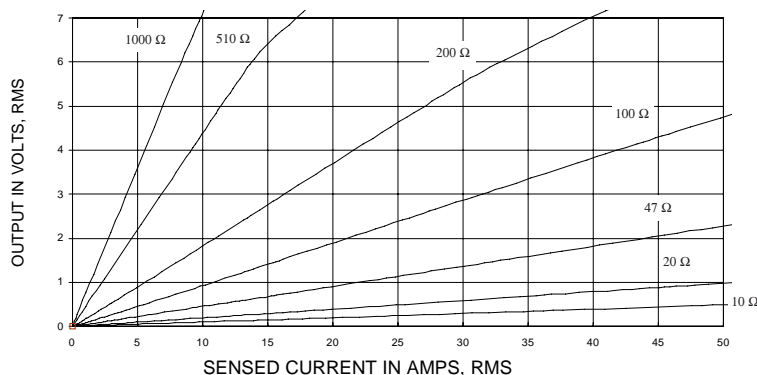


**Recommended Mounting Hole Pattern (Top View)**



**Window Polarity (Top View)**

## Typical Response



**CR8750-1000**



# Commercial & Metering Class Current Transformers

The CR Magnetics line of Instrumentation Grade Electrical Current Transformers are available in either Commercial or ANSI Metering Class. The commercial class transformers are lower cost and well-suited for current monitoring applications. The ANSI metering class transformers are higher-cost units intended for power monitoring applications where high accuracy and minimum phase angle error are required. Twelve different window openings and eight different mounting styles along with numerous secondary ratios are available to meet most applications. This short form catalog shows an overview of our most popular 5 amp secondary transformers. Contact factory for different sizes or unique electrical requirements.

## Applications

- Ammeters
- Energy Management
- Watt/VAR/Watthour Transducers,
- Current Sensing Relays, see pages 14 & 16



Internet Resources <http://www.crmagnetics.com/>

- Application Sheet: pdf/ancrct-2.pdf
- Transformer Selection Guides: transformer.html  
cts.html

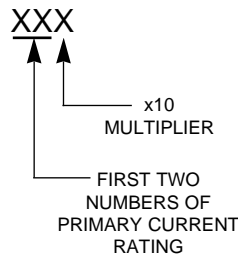
## Part Numbers

□ □ □ □ - □ □ □ - □ □ □

### MOUNTING STYLES

- RL** Round with leads
- SFT** Square with feet & terminals
- SFL** Square with feet & leads
- SHT** Square without feet & with terminals
- SHL** Square without feet & with leads
- RT** Round with terminals
- RBT** Round with bracket & terminals
- RBL** Round with bracket & leads

SERIES	WINDOW DIAMETER
CR1A	0.64 (16.2)
CR2	1.13 (28.7)
CR2DA	1.00 (35.4)
CR5	1.56 (39.6)
CR5A	1.56 (39.6)
CR6A	2.06 (52.3)
CR7	2.50 (63.5)
CR7A	2.50 (63.5)
CR8	3.25 (72.5)
CR56	2.06 (52.3)
CR76	3.00 (76.2)
CR170	4.25 (107.9)



\*Example: 50 AMP primary current rating would read 500, 300 AMP would read 301 and 4000 AMP would read 402.



RL



SFT



SFL



SHT



SHL



RT



RBT



RBL

## Specifications

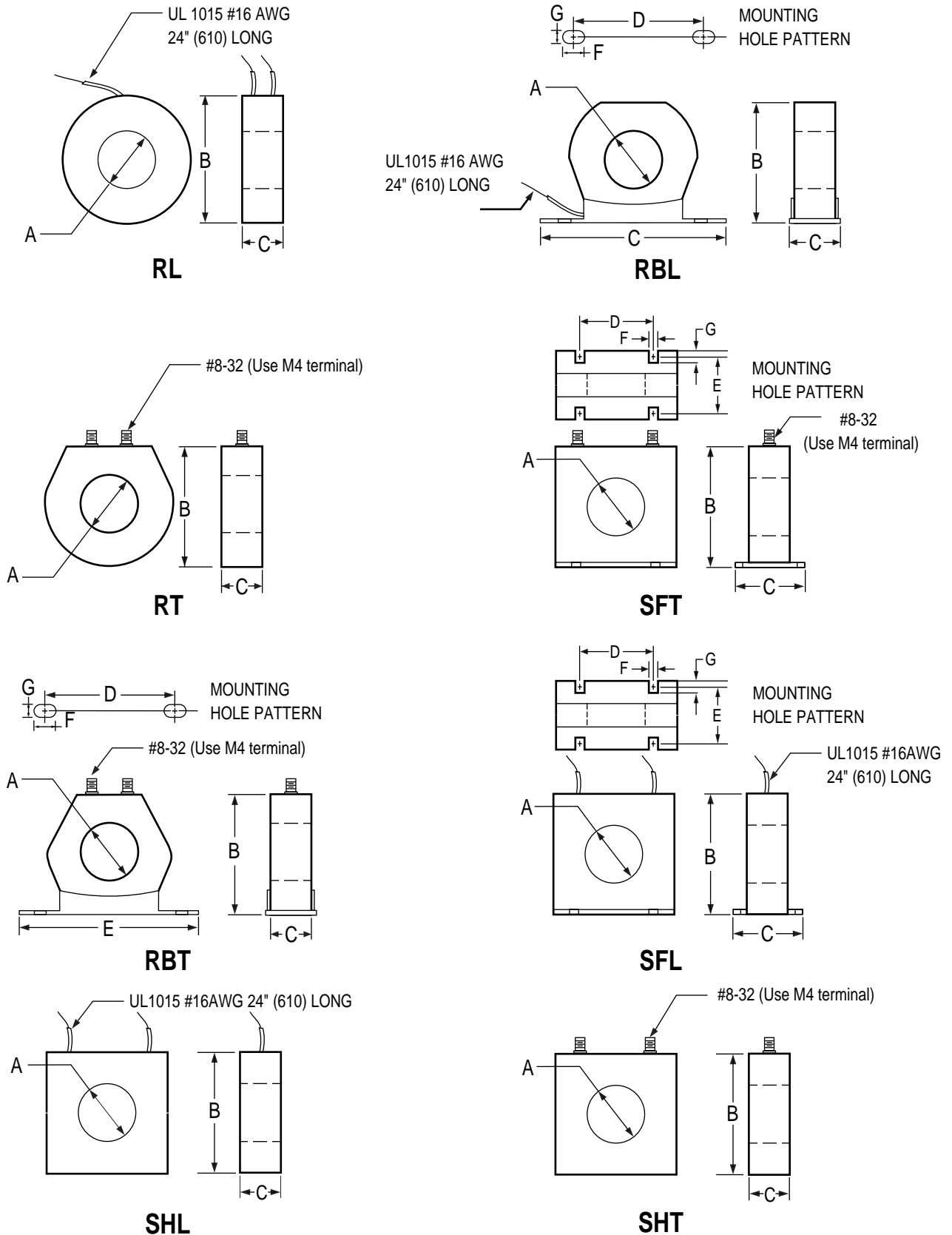
Frequency: 50-400 Hz  
Insulation: .6 kV, BIL 10 kV Full Wave

## Specials

- Ultra low frequency to 20 Hz
- Water Proof
- High volume, low cost styles
- 1.0, 0.2 & 0.1 AAC secondary ratios available

# Commercial & ANSI Metering Class Current Transformers

## Outline Drawings



## Commercial Class Current Transformers

WINDOW OPENING DIMENSION A	SERIES	MOUNTING STYLE	DIMENSIONS						CURRENT RATIO	ACCURACY AT 60 Hz	BURDEN VA AT 60 Hz								
			B	C	D	E	F	G											
1.13 (28.7)	CR2	RL	2.46 (62.5)	1.05 (26.7)					50:5	±3%	2.0								
		SFT							60:5	±2%	2.0								
		SFL							75:5	±2%	2.0								
		SHT							80:5	±2%	2.0								
		SHL							100:5	±1%	2.0								
									120:5	±1%	2.5								
									125:5	±1%	2.5								
									150:5	±1%	4.0								
									200:5	±1%	4.0								
									250:5	±1%	6.0								
	300:5	±1%	8.0																
1.56 (39.6)	CR5	RL	3.56 (90.4)	1.10 (27.9)					50:5	±2%	1.0								
		SFT							75:5	±2%	1.5								
		SFL							100:5	±2%	2.0								
		SHT							150:5	±1%	5.0								
		SHL							200:5	±1%	5.0								
		RT							250:5	±1%	10.0								
		RBT *							300:5	±1%	12.5								
		RBL *							400:5	±1%	12.5								
									500:5	±1%	20.0								
									600:5	±1%	25.0								
									750:5	±1%	25.0								
									800:5	±1%	25.0								
									1000:5	±1%	25.0								
									1200:5	±1%	30.0								
		2.50 (63.5)							CR7	RL	4.70 (919.4)	1.10 (27.4)					100:5	±2%	2.5
SFT	150:5		±1%	5.0															
SFL	200:5		±1%	5.0															
SHT	250:5		±1%	5.0															
SHL	300:5		±1%	12.0															
RT	400:5		±1%	15.0															
RBT	500:5		±1%	25.0															
RBL	600:5		±1%	30.0															
	750:5		±1%	30.0															
	800:5		±1%	35.0															
	1000:5		±1%	30.0															
	1200:5		±1%	35.0															
	1500:5		±1%	40.0															
	1600:5		±1%	45.0															
2.06 (52.3)	CR56		RL	3.50 (88.9)	1.09 (27.7)												50:5	±3%	0.5
		SFT	75:5						±1%		0.5								
		SFL	100:5						±1%		1.0								
		RT	150:5						±1%		2.5								
		RBT	200:5						±1%		4.0								
		RBL	250:5						±1%		6.0								
			300:5						±1%		7.5								
			400:5						±1%		10.0								
			500:5						±1%		12.5								
			600:5						±1%		15.0								
			750:5						±1%		7.0								
			800:5						±1%		8.0								
			1000:5						±1%		10.0								
			1200:5						±1%		12.5								
		3.00 (76.2)	CR76						RL		4.50 (114.3)	1.09 (27.7)					200:5	±1%	5.0
SFT	250:5			±1%	5.0														
SFL	300:5			±1%	6.0														
RT	400:5			±1%	10.0														
RBT	500:5			±1%	10.0														
RBL	600:5			±1%	10.0														
	750:5			±1%	10.0														
	800:5			±1%	12.5														
	1000:5			±1%	10.0														
	1200:5			±1%	10.0														
	1500:5			±1%	12.5														
	1600:5			±1%	12.5														
	2000:5			±1%	15.0														
.64 (16.3)	CR1A			RL	1.99 (50.5)	1.25 (31.8)											50:5	±2%	1.0
																	60:5	±1%	2.0
			75:5	±1%							2.0								
			80:5	±1%							2.0								
			100:5	±1%							2.5								
			120:5	±1%							3.0								
			125:5	±1%							3.0								
			150:5	±1%							4.0								
			200:5	±1%							5.0								
			250:5	±1%							7.5								

\* RBT and RBL mounting styles in the CR5 series are not available in current ratios of 750:5 thru 1200:5

## ANSI Metering Class Current Transformers

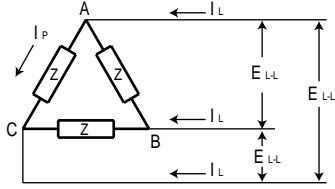
WINDOW OPENING DIMENSION A	SERIES	MOUNTING STYLE	DIMENSIONS					CURRENT RATIO	ANSI METERING CLASS @ 60 Hz					
			B	C	D	E	F		G	B0.1	B0.2	B0.5	B0.9	B1.8
1.0 (25.4)	CR2DA	RL	2.47 (62.7)	1.75 (44.5)					50:5	2.4	-	-	-	-
									60:5	2.4	-	-	-	-
									75:5	2.4	2.4	-	-	-
									80:5	1.2	2.4	-	-	-
									100:5	1.2	1.2	-	-	-
									120:5	1.2	1.2	-	-	-
									125:5	0.6	1.2	-	-	-
									150:5	0.6	1.2	2.4	-	-
									200:5	0.3	0.6	1.2	-	-
									250:5	0.3	0.6	1.2	-	-
300:5	0.3	0.3	0.6	1.2	-									
1.56 (39.6)	CR5A	RL SFT SFL SHT SHL	3.56 (90.4)	1.10 (27.9)					100:5	1.2	-	-	-	-
									150:5	1.2	1.2	-	-	-
									200:5	0.6	0.6	-	-	-
									250:5	0.6	0.6	1.2	-	-
									300:5	0.3	0.3	1.2	-	-
									400:5	0.3	0.3	0.6	1.2	-
									500:5	0.3	0.3	0.6	1.2	-
									600:5	0.3	0.3	0.6	0.6	1.2
									750:5	0.3	0.3	0.6	0.6	-
									800:5	0.3	0.3	0.6	0.6	-
									1000:5	0.3	0.3	0.3	0.6	-
1200:5	0.3	0.3	0.3	0.3	0.6									
2.06 (52.3)	CR6A	RL SFT SFL SHT SHL	4.08 (103.6)	1.10 (27.9)					100:5	2.4	-	-	-	-
									150:5	1.2	1.2	-	-	-
									200:5	0.6	1.2	-	-	-
									250:5	0.3	0.6	2.4	-	-
									300:5	0.3	0.6	1.2	2.4	-
									400:5	0.3	0.3	0.6	1.2	-
									500:5	0.3	0.3	0.6	1.2	-
									600:5	0.3	0.3	0.6	0.6	1.2
									750:5	0.3	0.3	0.6	0.6	-
									800:5	0.3	0.3	0.6	0.6	-
									1000:5	0.3	0.3	0.3	0.6	-
1200:5	0.3	0.3	0.3	0.3	0.6									
1500:5	0.3	0.3	0.3	0.3	0.6									
2.50 (63.5)	CR7A	RL SFT SFL SHT SHL	4.70 (119.4)	1.10 (27.9)					100:5	2.4	-	-	-	-
									150:5	1.2	2.4	-	-	-
									200:5	0.6	1.2	-	-	-
									250:5	0.6	1.2	1.2	-	-
									300:5	0.6	0.6	1.2	2.4	-
									400:5	0.3	0.3	0.6	1.2	-
									500:5	0.3	0.3	0.6	1.2	-
									600:5	0.3	0.3	0.6	0.6	1.2
									750:5	0.3	0.3	0.6	0.6	1.2
									800:5	0.3	0.3	0.6	0.6	1.2
									1000:5	0.3	0.3	0.3	0.6	1.2
									1200:5	0.3	0.3	0.3	0.3	0.6
1500:5	0.3	0.3	0.3	0.3	0.6									
1600:5	0.3	0.3	0.3	0.3	0.6									

## ANSI Metering Class Current Transformers

WINDOW OPENING DIMENSION A	SERIES	MOUNTING STYLE	DIMENSIONS						CURRENT RATIO	ANSI METERING CLASS @ 60 Hz				
			B	C	D	E	F	G		B0.1	B0.2	B0.5	B0.9	B1.8
3.25 (82.6)	CR8	RL SHT SHL	5.73 (145.5)	1.15 (29.2)					200:5	1.2	1.2	-	-	-
									250:5	0.6	1.2	2.4	-	-
									300:5	0.6	0.6	1.2	2.4	-
									400:5	0.3	0.6	1.2	1.2	-
									500:5	0.3	0.3	0.6	1.2	2.4
									600:5	0.3	0.3	0.6	1.2	1.2
									750:5	0.3	0.3	0.3	0.6	1.2
									800:5	0.3	0.3	0.3	0.6	1.2
									1000:5	0.3	0.3	0.3	0.6	0.6
									1200:5	0.3	0.3	0.3	0.6	0.6
									1500:5	0.3	0.3	0.3	0.6	0.6
									1600:5	0.3	0.3	0.3	0.6	0.6
									2000:5	0.3	0.3	0.3	0.3	0.3
									2500:5	0.3	0.3	0.3	0.3	-
									3000:5	0.3	0.3	0.3	0.3	-
3200:5	0.3	0.3	0.3	0.3	-									
4000:5	0.3	0.3	0.3	0.3	-									
4.25 (108)	CR170	RL SHT SHL	6.73 (170.9)	1.25 (31.8)					200:5	1.2	1.2	-	-	-
									250:5	1.2	1.2	-	-	-
									300:5	0.6	0.6	1.2	2.4	-
									400:5	0.6	0.6	1.2	1.2	2.4
									500:5	0.3	0.3	0.6	1.2	2.4
									600:5	0.3	0.3	0.6	0.6	1.2
									750:5	0.3	0.3	0.3	0.3	0.6
									800:5	0.3	0.3	0.3	0.3	0.6
									1000:5	0.3	0.3	0.3	0.3	0.6
									1200:5	0.3	0.3	0.3	0.3	0.6
									1500:5	0.3	0.3	0.3	0.6	0.6
									1600:5	0.3	0.3	0.3	0.6	0.6
									2000:5	0.3	0.3	0.3	0.3	0.3
									2500:5	0.3	0.3	0.3	0.3	0.3
									3000:5	0.3	0.3	0.3	0.3	0.3
3500:5	0.3	0.3	0.3	0.3	0.3									
4000:5	0.3	0.3	0.3	0.3	0.3									

## 3-Phase Balanced Circuits

### 3-Phase Delta



$$P = 1.73 E_{L-L} I_P \cos \theta = \frac{3(E_{L-L})^2}{Z}$$

$$Z = \frac{1.73 E_{L-L}}{I_L}$$

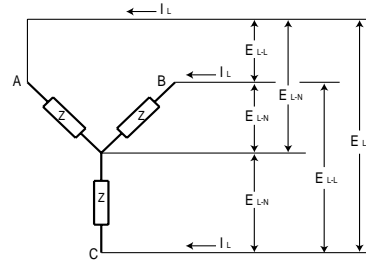
$$I_P = \frac{I_L}{1.73}$$

- The current in each element is equal to the line current  $I_L$  divided by  $\sqrt{3}$ .
- The voltage across each element is equal to the line voltage  $E_{L-L}$ .
- The impedance of each element is equal to  $\sqrt{3}$  times the voltage across each element divided by the line current.
- The voltage across the elements are  $120^\circ$  out of phase.
- The currents in the elements are  $120^\circ$  out of phase.
- The power is equal to  $\sqrt{3}$  times voltage across each element times the current  $I_L$  times  $\cos \theta$ .

$P$  = power in watts

$\theta$  = phase angle in degrees

### 3-Phase WYE



$$P = 3 E_{L-N} I_L \cos \theta = 1.73 E_{L-L} I_L \cos \theta$$

$$I_L = \frac{E_{L-N}}{Z} = \frac{E_{L-L}}{1.73 Z}$$

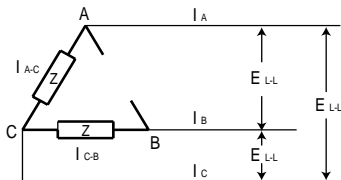
$$E_{L-N} = \frac{E_{L-L}}{1.73}$$

$$Z = \frac{E_{L-L}}{1.73 I_P}$$

- The current in each element is equal to the line current  $I_L$ .
- The voltage across each element  $E_{L-N}$  is equal to the line voltage  $E_{L-L}$  divided by  $\sqrt{3}$ .
- The impedance of each element is equal to line voltage  $E_{L-L}$  divided by  $\sqrt{3}$  times the line current.
- The voltages across the elements are  $120^\circ$  out of phase.
- The currents in the elements are  $120^\circ$  out of phase.
- The power is equal to 3 times line voltage  $E_{L-N}$  times line current times  $\cos \theta$ .
- For a balanced load the current in the neutral is equal to zero.

## 3-Phase Open Leg

### 3-Phase Delta



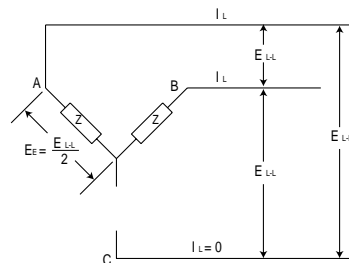
$$P = \frac{2(E_{L-L})^2}{Z}$$

$$I_{A-C} = I_{C-B} = I_A = I_B = \frac{E_{L-L}}{Z}$$

$$I_C = 1.73 I_A = 1.73 I_B$$

- The current in each non-open element is equal.
- The current in the connecting leg of the non-open elements is  $\sqrt{3}$  times the current in any other leg.

### 3-Phase WYE (No neutral)



$$P = E_{L-L} I_L \cos \theta$$

$$I_L = \frac{E_{L-L}}{2 Z}$$

- The current in each non-open element is equal to the line current.
- The voltage across each non-open element is equal to the line voltage divided by 2.
- The power is equal to the line voltage times the line current times  $\cos \theta$ .



# Wire-Mounted Current Indicator

The **CR-45** series, Wire-Mounted Electrical Current Indicators provides an effective method of monitoring electrical current. The indicator is attached directly to a current-carrying wire. When the current exceeds the turn-on point, the LED will illuminate to indicate the presence of current.



**CR-45** Current Indicators  
(Shown Approx. Full Size)

## Applications

- Monitor status of heater elements
- Observe remote loads
- Indicate phase loss
- Monitor motor operation

## Features

- Self powered
- Red or green indicator
- Easy to install
- Supplied with plastic tie
- Bright yellow case for easy identification
- Panel mounting bracket available



**MB-45** Panel Mounting Bracket  
(Shown Approx. Full Size)

## Specifications

### Min. Turn-on Point

2 Amps for CR-45-R  
2.5 Amps for CR-45-G

### Indicating Range:

2 to 100 Amps (for CR-45-R)  
2.5 to 100 Amps (for CR-45-G)

### Max. Continuous Current:

100 Amps

### LED Type:

T 1<sup>3</sup>/<sub>4</sub> Diffused

### LED Color:

Red or Green

### Case Material:

Thermoplastic

### Case Color:

Bright Safety Yellow

### Weight:

.5 oz. (14.2 g)

### Frequency:

50-60 Hz

### Mounting Bracket Material:

Non-Magnetic Aluminum

WIRE PASSES	TURN-ON POINT		MAX. WIRE DIAMETER
	RED	GREEN	
<b>1</b>	2	2.5	.29
<b>2</b>	1	1.25	.14
<b>3</b>	.66	.83	.13
<b>4</b>	.5	.62	.12
<b>N</b>	2÷N	2.5÷N	

**Internet Resources** <http://www.crmagnetics.com/>

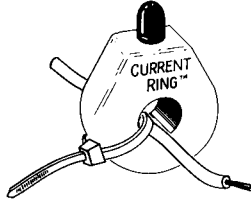
- Indicator Selection Guide: ind.html
- Application Sheet: pdf/ancr450-1.pdf
- Pricing: pricing/cr45.html

## Part Numbers

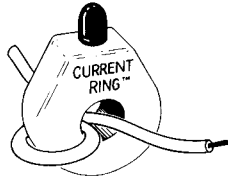
- CR45** -  Current Indicator with (Red or Green) LED  
            R-Red Indicator  
            G-Green Indicator  
**MB-45** Panel Mounting Bracket for CR-45

# Wire-Mounted Current Indicator

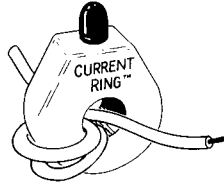
## Typical Installation



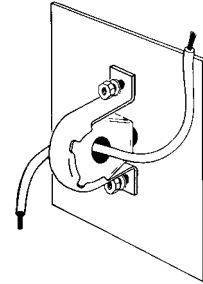
One-Wire Pass



Two-Wire Passes

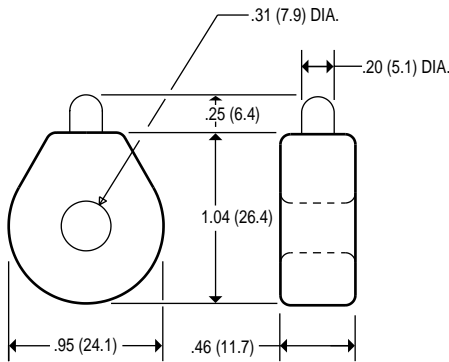


Three-Wire Passes

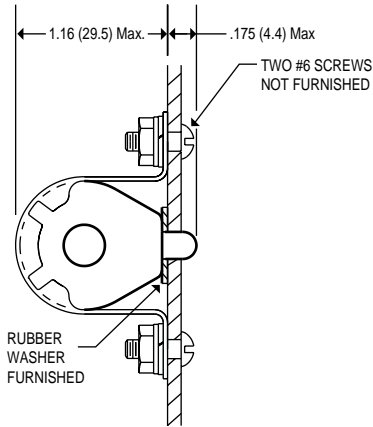


MB-45 with CR-45

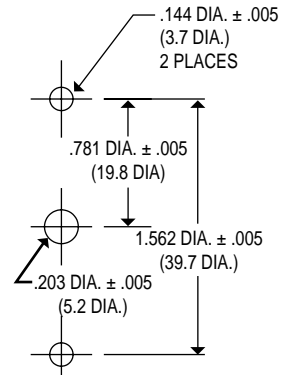
## Outline Drawings



CR-45

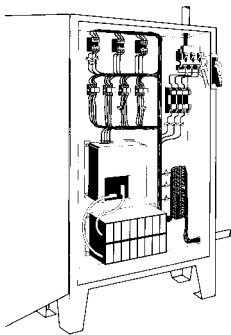


MB-45

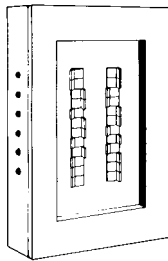


Recommended Mounting Hole Pattern

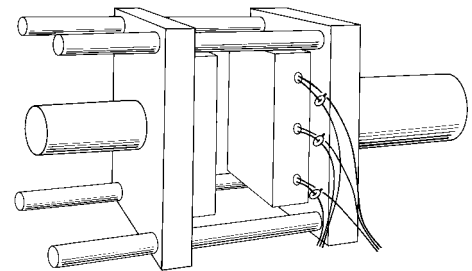
## Typical Application



Load Center



Control Panel



Process Heating



# Remote Current Indicators

The CR Magnetics line of Remote Electrical Current Indicators provides an effective method for remote monitoring of electrical current. The remote current sensing transformer is installed around the current-carrying wire and is connected directly to the LED panel indicator. When the current exceeds the turn-on point of the sensing transformer, the LED illuminates to indicate the presence of current. Two sizes of remote current sensing transformers are available for use with either one of two types of LED indicators. The panel indicators are available with either red or green LED.

## Applications

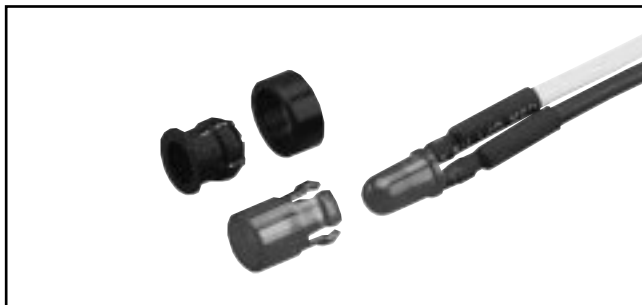
- Indicate open heater elements
- Observe remote loads
- Indicate phase loss
- Monitor motor operation



### Model 19 Remote Current Transformer

(Connect directly to either PH-25 or PH-31 LED indicator)  
 Indicating Range: 2 to 100 Amps (1-Wire Pass)  
 Minimum turn-on point: 2 Amps  
 Max. Cont. Current: 100 Amps  
 Max. Transient Current: 150 Amps for 5 Sec.  
 Working Class: 600 Volts, 50-60 Hz

WIRE PASSES	TURN-ON POINT	MAX. WIRE DIAMETER
1	2	.29 (7.4)
2	1	.14 (3.6)
3	.66	.13 (3.3)
N	$2 \div N$	



### PH-25 Press-In LED Panel Indicator

(Supplied with two types of mounting hardware)  
 LED type: T-1<sup>3</sup>/<sub>4</sub>, Bi-Polar, Red or Green  
 Mounting Hole: .250 (6.4) ± .002" Dia.  
 Mounting Hardware: Use either one-piece press-in red lens or two-piece mounting clip



### Model 18-600 Remote Current Transformer

(Connect directly to either PH-25 or PH-31 LED indicator)  
**SHOWN WITH MB-18, SURFACE MOUNTING BRACKET**  
 Indicating Range: 2.5 to 100 Amps (1-Wire Pass)  
 Minimum turn-on point: 2.5 Amps  
 Max. Cont. Current: 100 Amps  
 Max. Transient Current: 150 Amps for 5 Sec.  
 Working Class: 600 Volts, 50-60 Hz

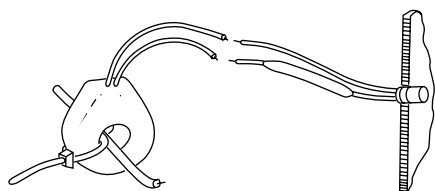
WIRE PASSES	TURN-ON POINT	MAX. WIRE DIAMETER
1	2.5	.55 (14)
2	1.25	.27 (6.9)
3	.83	.25 (6.4)
N	$2.5 \div N$	



### PH-31 Splash-Proof LED Panel Indicator

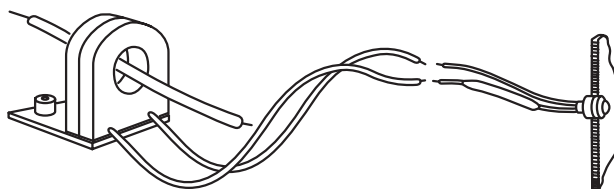
(Supplied with rubber sealing washer)  
 LED type: T-1<sup>3</sup>/<sub>4</sub>, Bi-Polar, Red or Green  
 Housing Material: Chrome Plated Brass  
 Mounting Hole: .312 ± .005" (7.9) Dia.

## Outline Drawings



**Model 19**

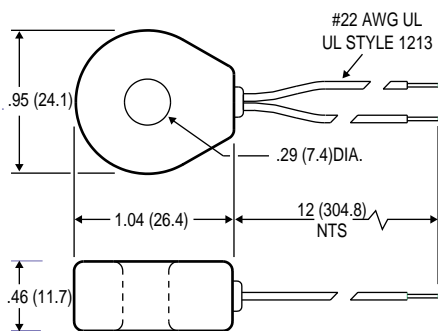
**PH-25**



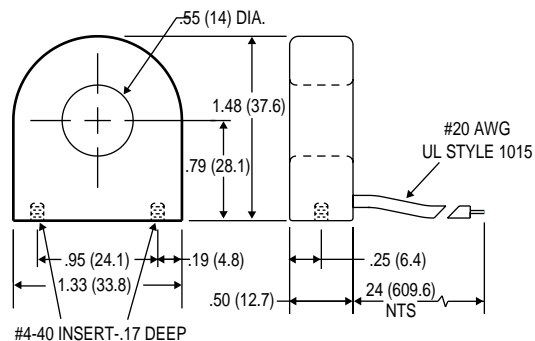
**Model 18  
with MB-18**

**PH-31**

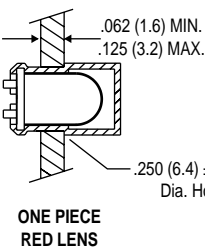
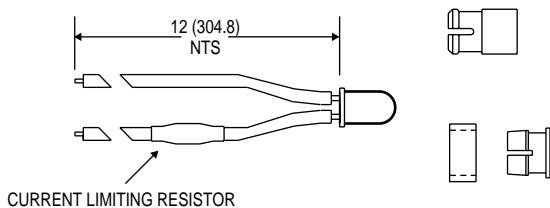
## Typical Applications



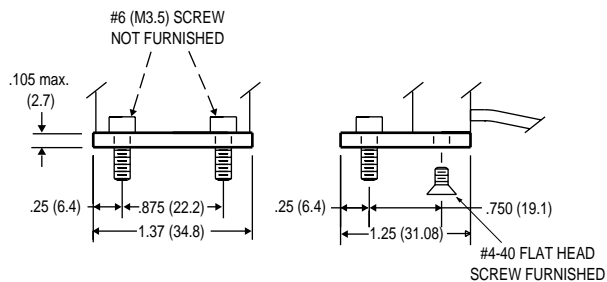
**Model 19: Remote Current Transformer**



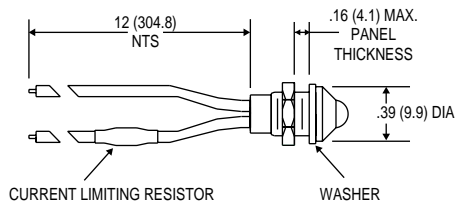
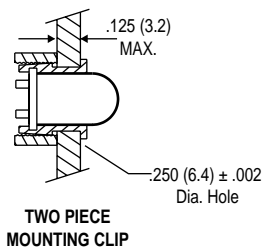
**Model 18: Remote Current Transformer**



**PH-25: Press-In LED Panel Indicator**



**MB 18: Surface Mounting Bracket**



**PH-31: Splash-Proof LED Panel Indicator**

**Internet Resources** <http://www.crmagnetics.com/>

- Indicator Selection Guide: ind.html
- Application Sheet: pdf/ancr2550-1.pdf
- Pricing: pricing/remote.html

## Part Numbers

<b>Model 19</b>	Current Transformer with .29 dia. opening
<b>Model 18-600</b>	Current Transformer with .55 dia. opening
<b>MB-18</b>	Surface Mounting Bracket for Model 18
<b>PH-25-R</b>	Press-In Panel Indicator with red LED
<b>PH-25-G</b>	Press-In Panel Indicator with green LED
<b>PH-31-R</b>	Splash Proof Panel Indicator with red LED
<b>PH-31-G</b>	Splash-Proof Panel Indicator with green LED



# Low Cost Remote Current Indicator

The **CR2550** series Remote Current Indicators are designed as a low cost method for providing a visual indication of electrical current flow. The current-carrying wire is routed through the window opening in the current sensing transformer. Attached to the transformer is a high efficiency, bi-polar LED that illuminates when the current is above the turn-on point. The indicator is available as standard with an 11 inch long lead and a red or green LED indicator.

## Features

- Low cost for high volume OEM installations
- Low fixed trip point
- Fully isolated
- Easy to install
- Self-powered

## Specifications

**Turn-on point:** 0.75 Aac RMS for Red LED  
1.5 Aac RMS for Green LED

**Maximum Continuous Rating:**  
20 Aac RMS

**Frequency:**  
50 to 400 HZ

**Operating Temperature:**  
-30 °C to +60 °C

**Storage Temperature:**  
-55 °C to +85 °C

**LED Indicator type:**  
T-13/4, Bipolar, Red/Red or Green/Green Diffused, Indicator is supplied with LED attached to current sensing transformer

**LED Mounting Hardware:**  
Supplied with both one-piece press-in lens and two-piece mounting clip



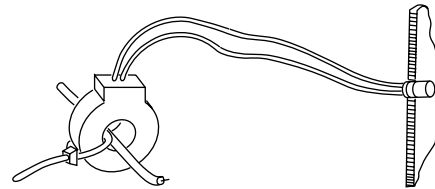
## Applications

- Indicate open heater element
- Observe remote loads
- Indicate phase loss
- Monitor motor operation

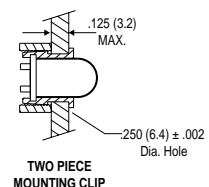
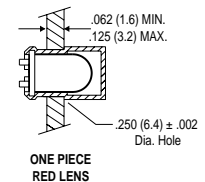
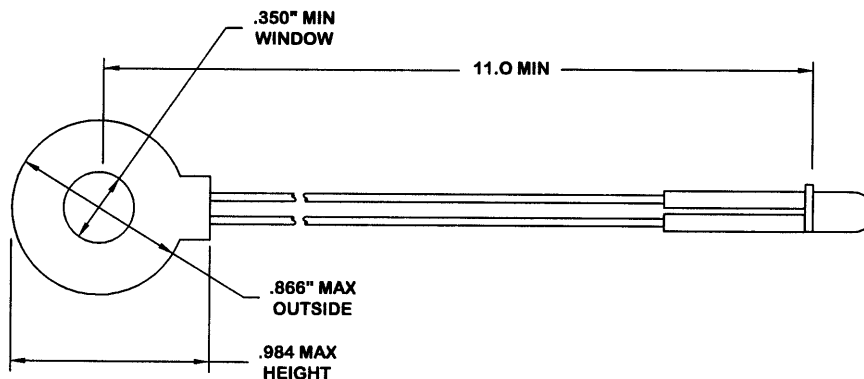
## Part Numbers

- CR2550-11-.75 R** CURRENT INDICATOR WITH RED LED  
**CR2550-11-1.5 G** CURRENT INDICATOR WITH GREEN LED

## Installation



## Outline Drawing



# AC Motor Loads & U.S. Standard Voltages

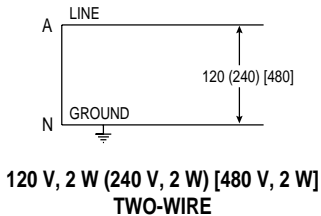
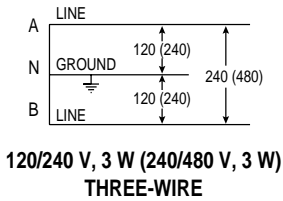
## A C Motor Loads \*

HP	MOTOR FULL LOAD CURRENTS								MAXIMUM LOCKED ROTOR CURRENTS						
	SINGLE PHASE		3-PHASE A.C. INDUCTION						3-PHASE A.C. INDUCTION						
	115 V	230 V	115 V	200 V	230 V	460 V	575 V	2300 V	4160 V	200 V	220/230 V	440/460 V	550/575 V	2300 V	4160 V
1/2	9.8	4.9	4	2.3	2	1	.8			23	20	10	8		
3/4	13.8	6.9	5.6	3.2	2.8	1.4	1.1			29	25	12.5	10		
1	16	8	7.2	4.15	3.6	1.8	1.4			34.5	30	15	12		
1 1/2	20	10	10.4	6	5.2	2.6	2.1			46	40	20	16		
2	24	12	13.6	7.8	6.8	3.4	2.7			57.5	50	25	20		
3	34	17		11	9.6	4.8	3.9			73.5	64	32	25		
5	56	28		17.5	15.2	7.6	6.1			106	92	46	37		
7 1/2	80	40		25	22	11	9			146	127	63	51		
10	100	50		32	28	14	11			186	162	81	65		
15				48	42	21	17			267	232	116	93		
20				62	54	27	22			334	290	145	116		
25				78	68	34	27			420	365	182	146	35	19
30				92	80	40	32			500	435	217	174	41	23
40				120	104	52	41			667	580	290	232	55	30
50				150	130	65	52			834	725	362	290	69	38
60				177	154	77	62	16	8.9	1000	870	435	348	83	46
75				221	192	96	77	20	11	1250	1085	592	435	104	57
100				285	248	124	99	26	14.4	1670	1450	725	580	139	76
125				358	312	156	125	31	17	2085	1815	907	726	173	96
150				415	360	180	144	37	20.5	2500	2170	1085	870	208	115
200				550	480	240	192	49	27	3340	2900	1450	1160	278	153
OVER 200HP APPROX. AMPS/HP			2.75	2.40	1.20	.96	.24	.133							

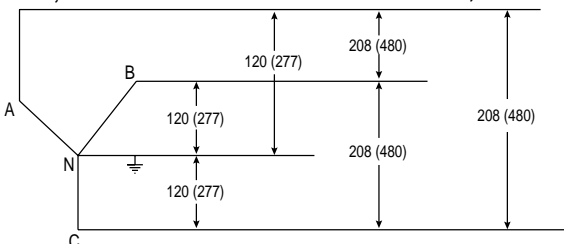
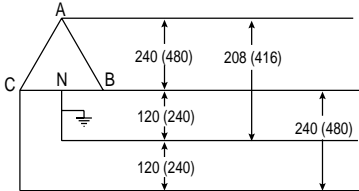
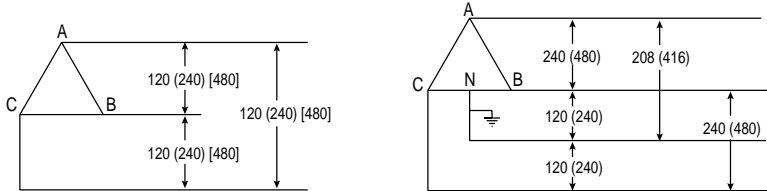
\*This information provided as reference only. Consult motor manufacturer and related standards for additional information.

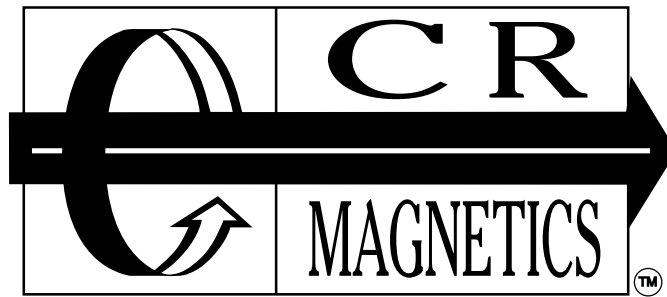
## U.S. STANDARD VOLTAGES

### SINGLE-PHASE



### POLYPHASE





**Manufacturers & Designers Of Electrical Current Monitoring Products  
For Industrial Market Applications Throughout The World**

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