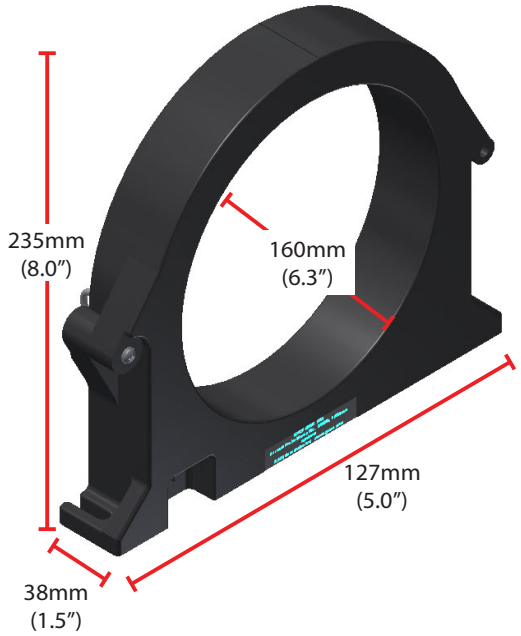
CPCO Series (160mm)
DC-AC Current Probe, Clamp On
±4000A, ±8000A, ±12000A,

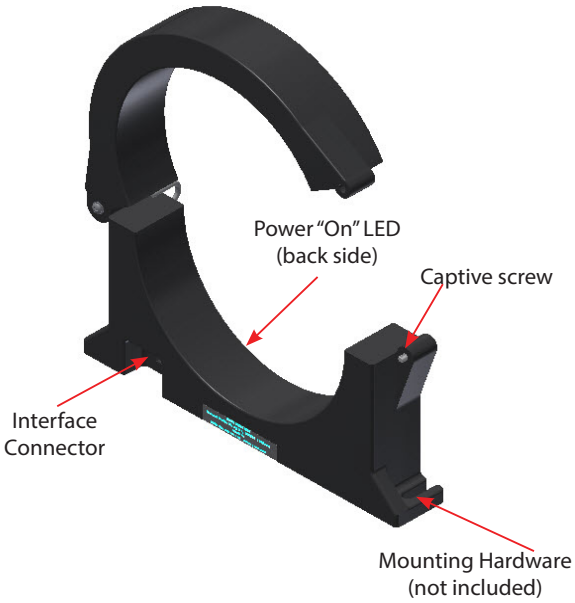
The CPCO Series (160mm) Current Probes are Clamp On current sensors capable of measuring ac and dc currents available in ranges of ±4000A ±8000A, ±12000A with an accuracy of +/-1% and non-linearity of <+/- 0.5%. The bandwidth is dc to 40kHz. Th Current Probe splits along a diameter allowing easy installation to existing cables without having to break the connection. A captive screw is used rather than a clip to ensure consistent closure under mechanical loading or vibration.

The Current Probes utilize Hall effect sensing technology with no magnetic core. This eliminates magnetic hysteresis and non-linearity effects present in conventional open loop sensors with magnetic cores.



FEATURES

- Clamp On
- Light Weight <500g
- Low Power <0.5W for Voltage Output Signal;
  <0.8W for 4-20mA Output Signal
- Operating Voltage: Single rail power supply for all versions
- Current Ranges: ±4000 ±8000, ±12000
- Accuracy: ±1%
- Non-Linearity: <±0.5%
- Wide Bandwidth: dc to 40kHz
- Output Signal Options: Single Ended 5V, Bi Polar 5V, Bi Polar 10V, 4-20mA and RMS
- Power ON LED indicator
- Low noise <0.1% of FS
- Reverse power supply voltage protected
- High rejection of external magnetic fields, e.g. from external conductors
- Output short circuit protection (except for 4-20mA version)
- Power ON LED



ORDERING INFORMATION

Part Number Format:

CPCO - *Current Range - Aperture - Output Signal Type*

CPCO
CPCO = Current Probe Clamp On

Aperture
160mm

Current Range

4000 = ± 4000A
8000 = ± 8000A
12000= ± 12000A

Output Signal Type
SE = Single Ended, 5.0V±5.0V
BP5 = Bi Polar, 0.0V ± 5.0V
BP10 = Bi Polar, 0.0V ±10V
RMS = RMS, 0-3V
MA = 4-20mA Source, 12mA±8mA.

e.g. CPCO-8000-160-BP10
Current Probe Clamp On, 8000A, 160mm Diameter Aperture, Bi Polar ±10V Output Signal

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TABLE 1: ELECTRICAL SPECIFICATIONS

Specifications by Current Range						
Specification		Symbol	CPCO-4000	CPCO-8000	CPCO-12000	
Primary Current, Nominal		I_{PN}	±4000A	±8000A	±12000A	
Primary Current, Max Note: 1		I_{PSAT}	±5000A	±10000A	±15000A	
Primary Current, Overload		I_{POL}	No Limit			
Sensitivity Accuracy		SA	±1 % of FS			
Non Linearity		NL	< ±0.5% of FS			
Sensitivity	SE Output	S	1mV/A	0.5mV/A	0.333mV/A	
	BP5 Output		1mV/A	0.5mV/A	0.333mV/A	
	BP10 Output		2mV/A	1mV/A	0.667mV/A	
	RMS Output		1.0mV/Arms	0.5mV/Arms	0.333mV/Arms	
	MA Output	S	0.002mA/A	0.001mA/A	0.000667mA/A	
Bandwidth (-3dB)		BW		dc to 40kHz		
Hysteresis after $\pm I_{PSAT}$		V_{HYS} or I_{HYS}		<0.05 % of FS		
Noise (3Hz to 1kHz)	SE Output	V_{NO}	<4mVrms	<2mVrms	<1mVrms	
	BP5 Output		<4mVrms	<2mVrms	<1mVrms	
	BP10 Output		<8mVrms	<4mVrms	<2mVrms	
	RMS Output		<2mVrms	<1mVrms	<0.5Vrms	
	MA Output	I_{NO}	4 µArms	2 µArms	1 µArms	
Resolution				Noise (1 / Sensitivity)		
Dielectric Withstanding between Aperture ID and Connector Pins		U_W		>5000V (60Hz, Dwell Time 1 min.)		

Specifications by Output Signal Type							
Specification	Symbol	SE (single ended)	BP5 (Bi Polar 5V)	BP10 (Bi Polar 10V)	RMS (RMS)	MA (4-20mA)	
Output Signal, Nominal	V_{OUT} or I_{OUT}	5.0 ± 4.0V	0.0V ± 4.0V	0.0 ± 8.0V	0.0 to 3.0V	12 ± 8mA	
Output Signal, Max	$V_{OUTMSAT}$ or $I_{OUTMSAT}$	5.0 ± 5.0V	0.0V ± 5.0V	0.0 ± 10.0V	0.0 to 4.0V	12 ± 10mA	
Output Signal Current, Absolute Max	I_{OUTM}	2mA	±2mA	±2mA	2mA	22mA	
Capacitive Load, Absolute Max	C_{OUTM}	10nF	10nF	10nF	10nF	100nF	
Output Source Impedance	R_S	10 to 15Ω	10 to 15Ω	10 to 15Ω	10 to 15Ω	>100KΩ	
Offset at $I_P = 0$	V_{OE} or I_{OE}	±5mV[1]	±5mV[1]	±10mV[1]	±3mV	±0.012mA	
Maximum Response Time	T_R	<10µs	<10µs	<10µs	1s	<10µs	
Power Supply Voltage	V_C	11 to 31V	11 to 31V	11 to 15.5V	11 to 31V	Suggested Loop Load Resistance	
						100Ω	11-15V
						250Ω	11-24V
						750Ω	21-30V
Power Supply Current, Max	I_C	<80mA	<80mA	<80mA	<80mA	<80mA +I_{OUT}	
Short Circuit Protection	I_{SHORT}	Continuous				<1 minute	

Note 1: For -MA output configurations, the "Primary Current, Max" is the same value as the "Primary Current, Nominal"

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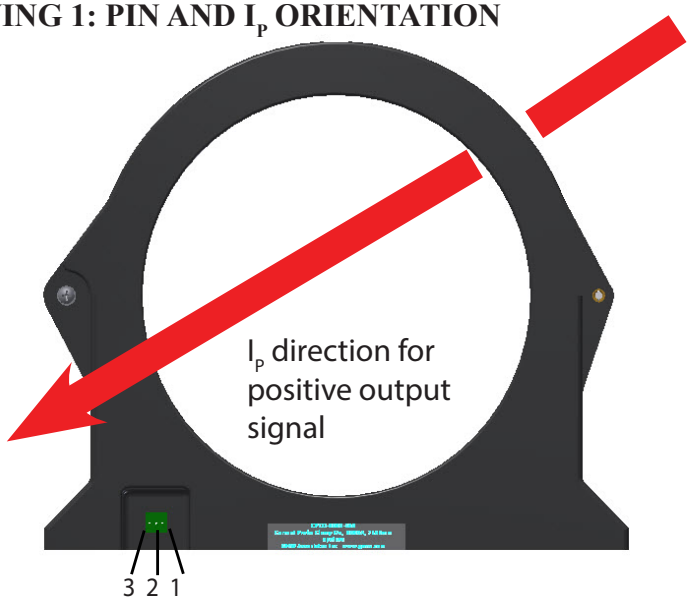
TABLE 2: MECHANICAL SPECIFICATIONS

Specification	
Aperture Diameter	160mm (6.3″)
Overall Size	101mm x 127mm x 19mm (4″ x 5″ x 0.75″)
Weight	120g (0.26lb)
Housing Material	ABS (UL 94 V-0)
Encapsulant Material	Polybutadiene Resin (UL 94 V-0)

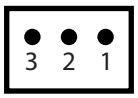
TABLE 2: ENVIRONMENTAL SPECIFICATIONS

Specification			
Temperature, Operating		-40 to 85°C	
Temperature, Storage		+15 to 85°C	
T_C of Sensitivity		± 200ppm/°C	
T_C of Zero		CPCO-4000	± 1.6A/°C
		CPCO-8000	± 1.6A/°C
		CPCO-12000	± 2.7A/°C
Sealed		NEMA 5 equivalent	
Humidity, Operating		0-90% RH	
Humidity, Storage		20-60% RH	
External Magnetic Field Component, <0.2% of FS Output Signal Shift	In Plane	CPCO-4000	60mT (600G)
		CPCO-8000	120mT (1200G)
		CPCO-12000	200mT (2000G)
	Longitudinal or Axial	All Models	400mT (4000 G)
Effect of Primary Conductor Position within Aperture (20mm diameter conductor)		< 0.5% of FS	
Effect of Another Conductor within 5mm of any outer surface of probe (20mm diameter conductor, I ≤ to I_{PN})		< 0.5% of FS	
Effect of Steel plate outside the Current Probe (200 x 200mm square plate)		In contact with any outer surface	< 0.5% of FS
		5mm from any outer surface	< 0.1% of FS

DRAWING 1: PIN AND I_P ORIENTATION

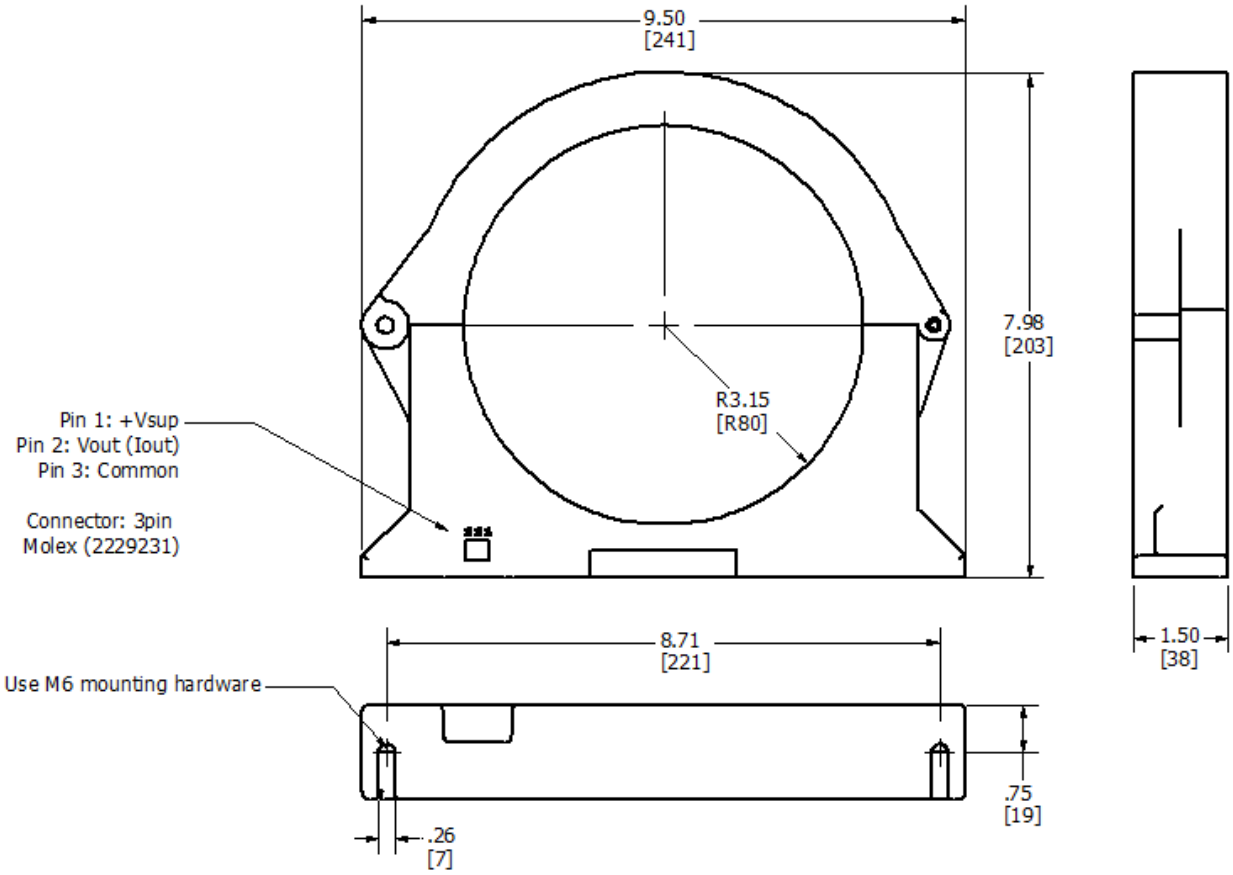


DRAWING 2: CONNECTION DIAGRAM



1. $+V_C$
2. V_{OUT} (I_{OUT})
3. Common

DRAWING 3: OUTLINE DRAWING



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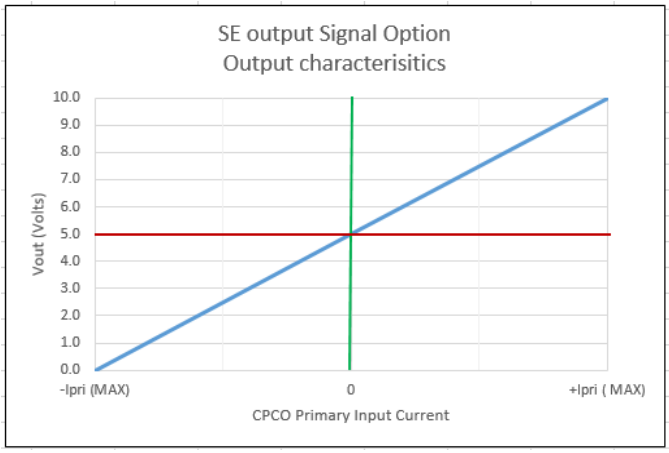
Signal Output Option Descriptions

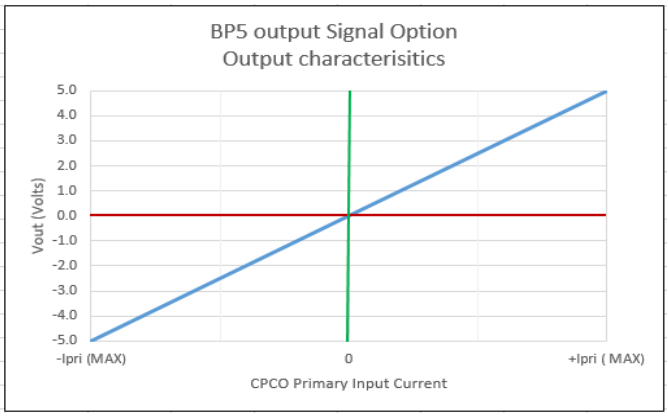
SE Option - The SE stands for **S**ingle **E**nded and the output voltage from the CPCO will have a quiescent output voltage of 5.0V when there is no primary current (Ipri=0A). As the primary current (Ipri) increases in a positive direction, the output voltage will increase to the maximum level of 10.0V at Ipri=Imax. When the primary current increases in the negative direction, the output voltage will decrease toward 0.0V at Ipri=-Imax. See below output characteristics.

This option is useful for applications that drive circuitry that can only accommodate positive signal inputs voltages such as inputs to A/D's



BP5 Option - The BP stands for Bi Polar and the output voltage from the CPCO will have a quiescent output voltage of 0.0V when there is no primary current (Ipri=0A). As the primary current (Ipri) increases in a positive direction, the output voltage will increase to the maximum level of 5.0V at Ipri=Imax. When the primary current increases in the negative direction, the output voltage will decrease toward -5.0V at Ipri=-Imax. See below output characteristics.

This option is useful for applications that drive circuitry that can accommodate Bi Polar signal inputs that swing around Com (0.0V) such as oscilloscopes, data loggers. multi-meters, etc.



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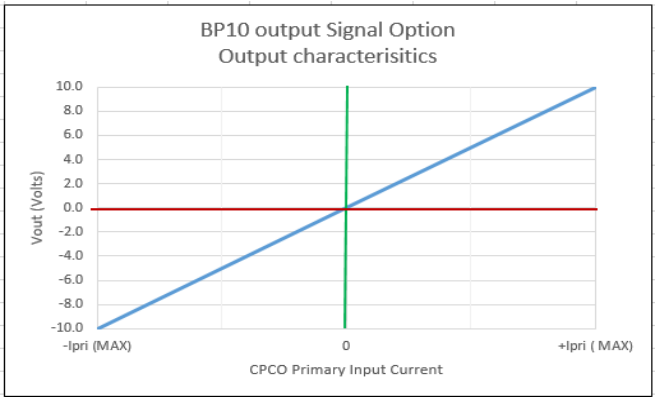
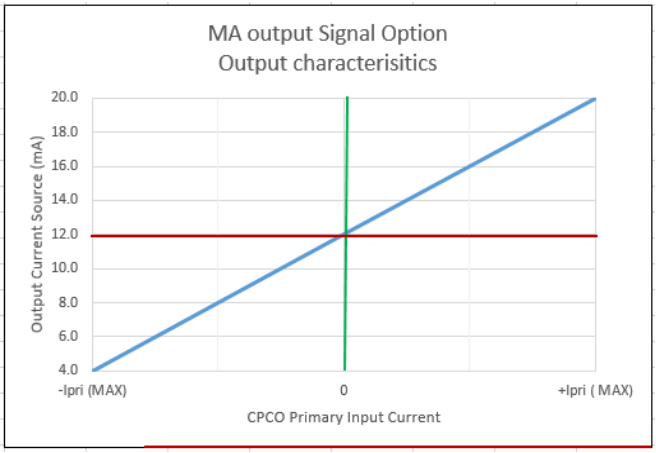
BP10 Option - The BP stands for Bi Polar and the output voltage from the CPCO will have a quiescent output voltage of 0.0V when there is no primary current (Ipri=0A). As the primary current (Ipri) increases in a positive direction, the output voltage will increase to the maximum level of 10.0V at Ipr=Imax. When the primary current increases in the negative direction, the output voltage will decrease toward -10.0V at Ipri=-Imax. See below output characteristics.

This option is useful for applications that drive circuitry that need higher voltages and can accommodate Bi Polar signal inputs that swing around Com (0.0V) such as oscilloscopes, data loggers. multi-meters, etc.



MA Option - The MA stands for **M**illi-**A**mp and the output from the CPCO will be a current source ranging from 4mA to 20mA. There is a quiescent output current source of 12mA when there is no primary current (Ipri=0A). As the primary current (Ipri) increases in a positive direction, the output current source will increase to the maximum level of 20.0mA at Ipri=Imax. When the primary current increases in the negative direction, the output current source will decrease toward 4mA at Ipri=-Imax. The output current comes from the input power supply, therefore the CPCO power supply must be capable of providing the CPCO circuit of approx 50mA plus the output source current of up to 20mA. See below output characteristics.

This option is applicable to standard 4-20mA circuit configurations and optimum in very noisy environments with long cable runs. The 4-20mA current source output is very common with PLC's. Offset errors that can result from long cables are eliminated with the MA version.



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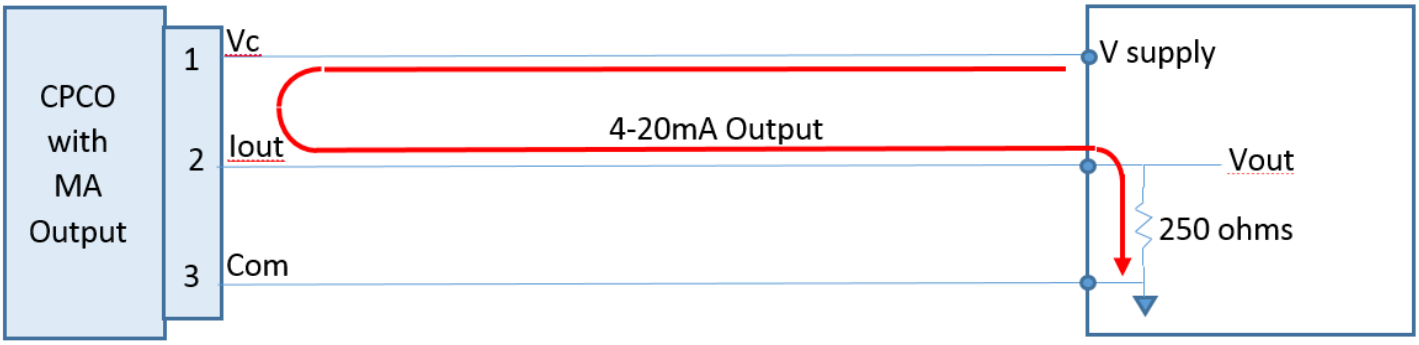
Typical MA option circuit diagram.

The 4-20mA current source flows from the PLC power supply, for example, to the CPCO and then back to the PLC, 4-20mA input. The typical PLC input load resistor is 250ohm.

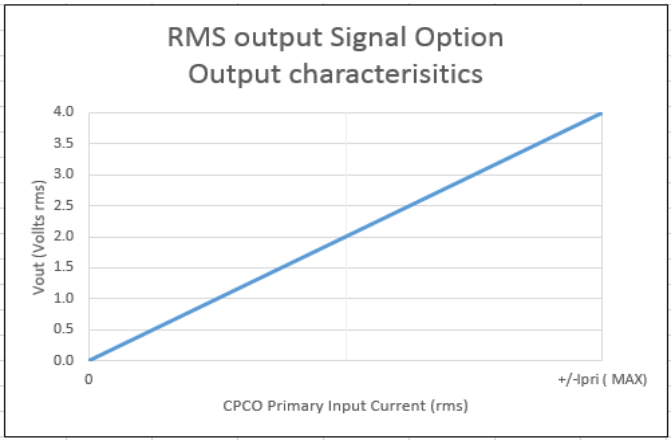
With a 250 ohm resistor, the voltage across the resistor will be :

Vout=I source * R (example: at 12mA the Vout =3.00V)



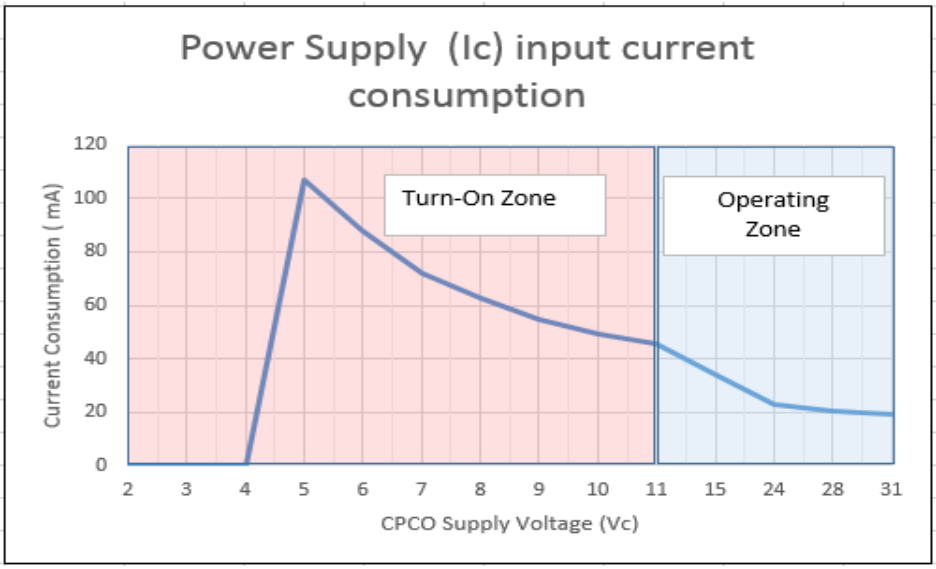
RMS Option - The RMS stands for **R**oot **M**ean **S**quare and the output voltage from the CPCO will have a quiescent output voltage of 0.0V when there is no primary current (Ipri=0A). As the primary current (Ipri) increases in a positive direction, the output voltage will increase to the maximum level of 4.00V at Ipr=Imax. When the primary current increases in the negative direction, the output voltage will increase toward 4.00V at Ipri=-Imax. The output is an analog voltage that is proportional to the RMS value of the primary current over the complete specified BW of the primary current. See below output characteristics.

This option is useful for applications that drive circuitry that need the RMS value only.



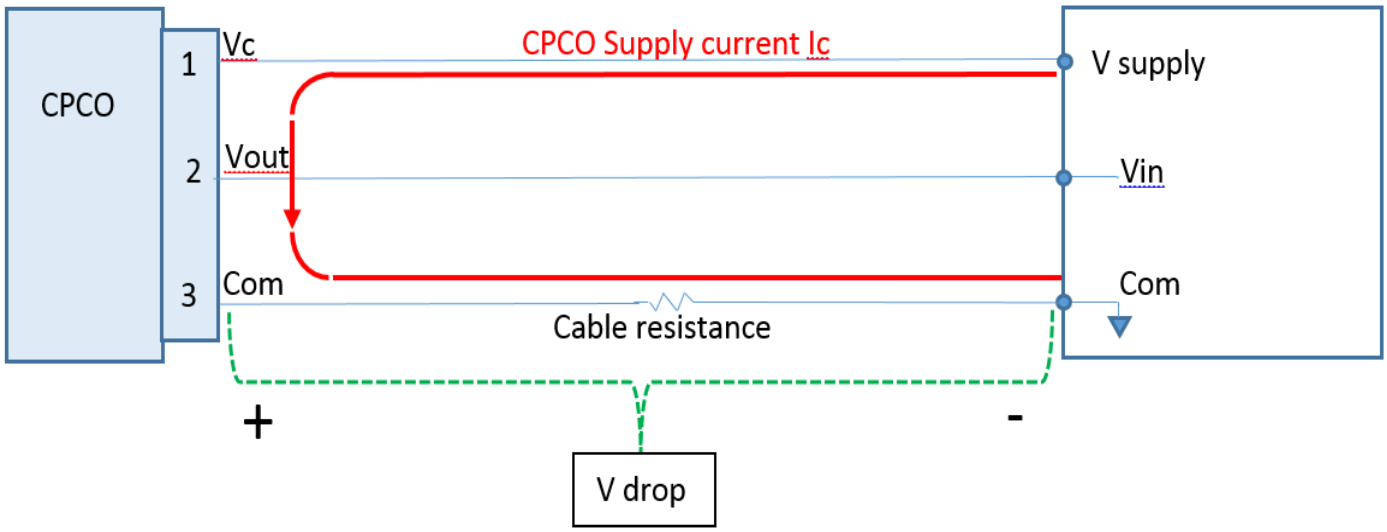
Power Supply (Vc)

The CPCO incorporates a switching power supply to convert the input power to the internal low voltage operating voltages and reduce the internal power dissipation. The power consumption is relatively constant, therefore the input current is inversely proportional to supply voltage, Vc. The max current is specified to be 47mA once the input voltage reaches the normal operating range of 11-31V, however during the turn-on the current required is higher . See the below graph for the power current required. The power supply used to operate the CPCO, must have at least 150mA capability otherwise the CPCO will not turn on.



Offset error caused by cable resistance/length.

The power supply return and signal return share a common wire, therefore any voltage drop caused by the supply current, Ic, will be added to the output signal voltage level. See below:



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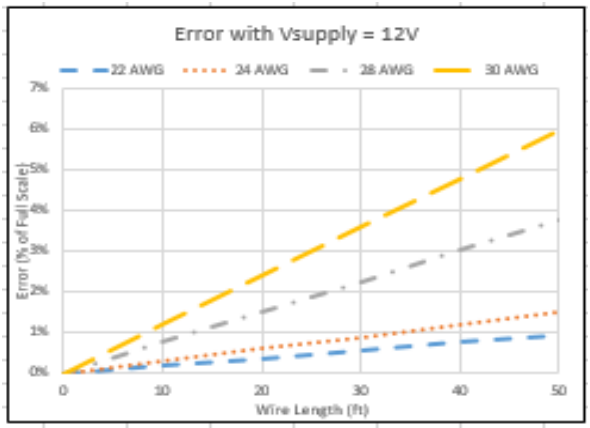
The amount of error voltage added to the offset voltage will be dependent on the cable length, wire gauge and operating voltage. The operating voltage affects the Ic current level.

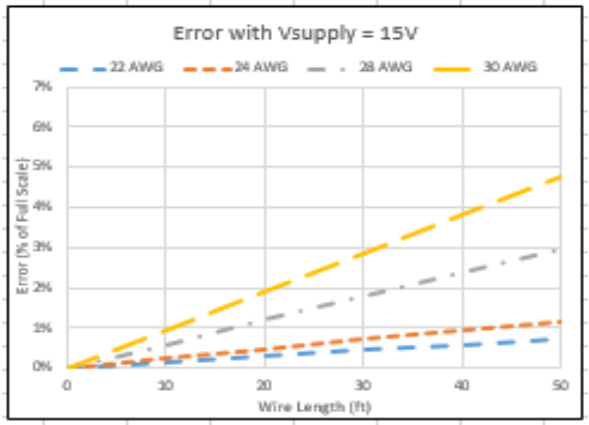
Offset voltage error (mV) = Ic (mA) * wire resistance (milli-ohms/ft) * cable length (ft)

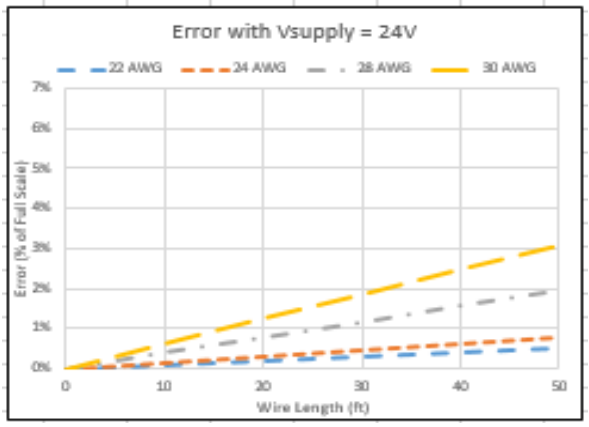
% Offset error = (OS voltage error/Full Scale output range (mV))*100%

The following graphs provide the % error for the various operating voltages, cable size and length for the various signal output options.

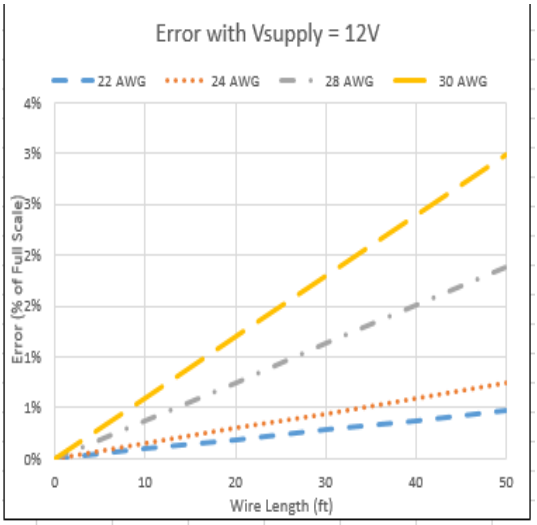
For the SE, BP5 and RMS output options

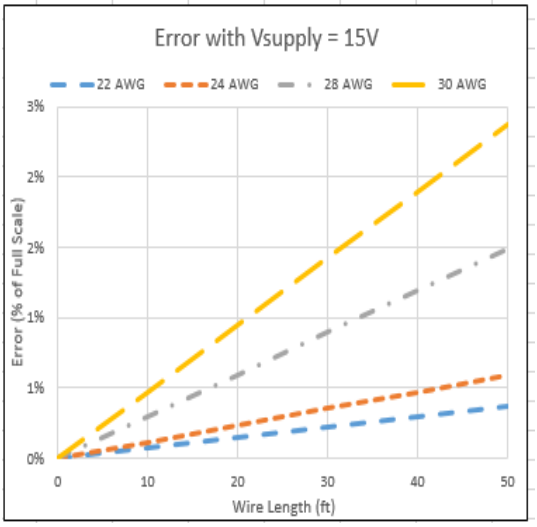






For the BP10 output option





For the MA output option.

The current source is independent of the wire size and return lead, therefore there is **NO** offset errors from the cable type or length.

Four Wire hookup with an isolated input instrument. The affect of error voltage on the cable return can be minimized by using a four wire connection and an isolated input instrument. The current flowing in the signal path (GREEN) is in the micro amps, therefore there is no voltage drop across the return lead. The cable accessory (1700-2153-0) has three leads plus a shield. With this cable, the shield can be used as the signal return line (GREEN) for isolated input as long is it in not connected to the power ground (COM).