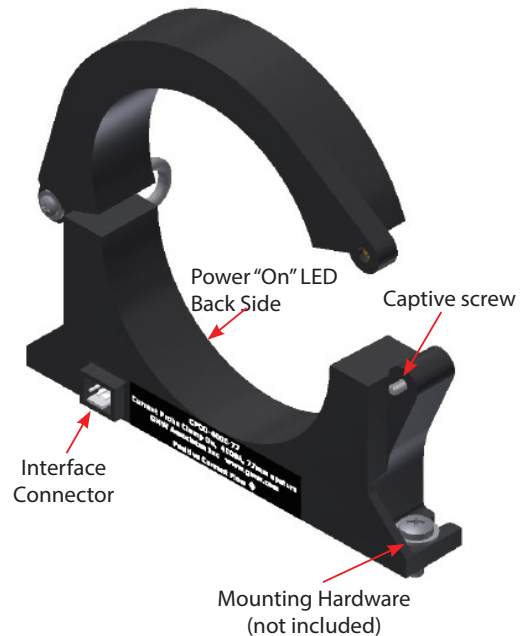


The CPCO Series (77mm) Current Probes are Clamp On current sensors capable of measuring ac and dc currents available in ranges of ±500A, ±1000A, ±2000, ±4000A, ±8000A or ±12000A with an accuracy of +/-1% and non-linearity of <+/-0.5%. The bandwidth is dc to 40kHz. The Probe splits along a diameter allowing 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 <120g
- 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: ±500, ±1000, ±2000, ±4000A, ±8000A, ±12000A
- 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)



### ORDERING INFORMATION

#### Part Number Format:

CPCO - Current Range - Aperture - Output Signal Type

#### CPCO

CPCO = Current Probe Clamp On

#### Current Range

500 = ± 500A  
1000 = ± 1000A  
2000 = ± 2000A  
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

#### Aperture

77mm

e.g. CPCO-4000-77-BP10

Current Probe Clamp On, 4000A, 77mm Diameter Aperture, Bi Polar ±10V Output Signal



**CPCO Series (77mm)**  
**DC-AC Current Probe, Clamp On**  
**±500A, ±1000A, ±2000 or ±4000A, ±8000 or ±12000A**

**TABLE 1: ELECTRICAL SPECIFICATIONS**

Specifications by Current Range								
Specification	Symbol	CPCO-500	CPCO-1000	CPCO-2000	CPCO-4000	CPCO-8000	CPCO-12000	
Primary Current, Nominal	$I_{PN}$	±500A	±1000A	±2000A	±4000A	±8000A	±12000A	
Primary Current, Max	$I_{PSAT}$	±625A	±1250A	±2500A	±5000A	±10000A	±15000A	
Primary Current, Overload	$I_{POL}$	No Limit						
Sensitivity Accuracy	SA	±1 % of FS						
Non Linearity	NL	< ±0.5% of $I_{PN}$ (Primary Current, Nominal)						
Sensitivity	SE Output	S	8mV/A	4mV/A	2mV/A	1mV/A	0.5mV/A	0.3mV/A
	BP5 Output		8mV/A	4mV/A	2mV/A	1mV/A	0.5mV/A	0.3mV/A
	BP10 Output		16mV/A	8mV/A	4mV/A	2mV/A	1mV/A	0.6mV/A
	RMS Output		8mV/Arms	4mV/Arms	2mV/Arms	1mV/Arms	0.5mV/Arms	0.3mV/Arms
	MA Output	S	0.016mA/A	0.008mA/A	0.004mA/A	0.002mA/A	0.001mA/A	0.0006mA/A
Bandwidth (-3dB)	BW	dc to 40kHz						
Hysteresis after ± $I_{PSAT}$	$V_{HYS}$ or $I_{HYS}$	<0.05 % of FS						
Noise (3Hz to 1kHz)	SE Output	$V_{NO}$	<2mVrms	<1mVrms	<0.5mVrms	<0.2mVrms	<0.2mVrms	<0.1mVrms
	BP5 Output		<2mVrms	<1mVrms	<0.5mVrms	<0.2mVrms	<0.2mVrms	<0.1mVrms
	BP10 Output		<4mVrms	<2mVrms	<1mVrms	<0.5mVrms	<0.5mVrms	<0.5mVrms
	RMS Output		<1mVrms	<0.5Vrms	<0.3Vrms	<0.05mVrms	<0.05mVrms	<0.02mVrms
	MA Output	$I_{NO}$	2 μArms	1 μArms	0.5 μArms	0.25 μArms	0.25 μArms	0.25 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	$V_{OUTSAT}$ or $I_{OUTSAT}$	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 $I_{OE}$	±10mV <sup>1</sup>	±10mV <sup>1</sup>	±20mV <sup>1</sup>	±20mV	±0.024mA	
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	Loop Load Resistance	
						100Ω	11-15V
						250Ω	11-20V
Power Supply Current, Max	$I_C$	<47mA	<47mA	<47mA	<47mA	<47mA + $I_{OUT}$	
Short Circuit Protection	$I_{SHORT}$	Continuous					<1 minute

<sup>1</sup> Except for CPCO-500 Series. For the CPCO-500 Series,  $V_{OE} = \pm 15mV$ .



**CPCO Series (77mm)**  
**DC-AC Current Probe, Clamp On**  
**±500A, ±1000A, ±2000 or ±4000A, ±8000 or ±12000A**

**TABLE 2: MECHANICAL SPECIFICATIONS**

Specification	
Aperture Diameter	77mm (3.0")
Overall Size	101mm x 127mm x 19mm (4" x 5" x 0.75")
Weight	120g (0.26lb)
Housing Material	Urethane Fire Retardant (UL 94 V-0)
Encapsulant Material	Polybutadiene Resin (UL 94 V-0)

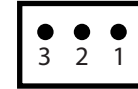
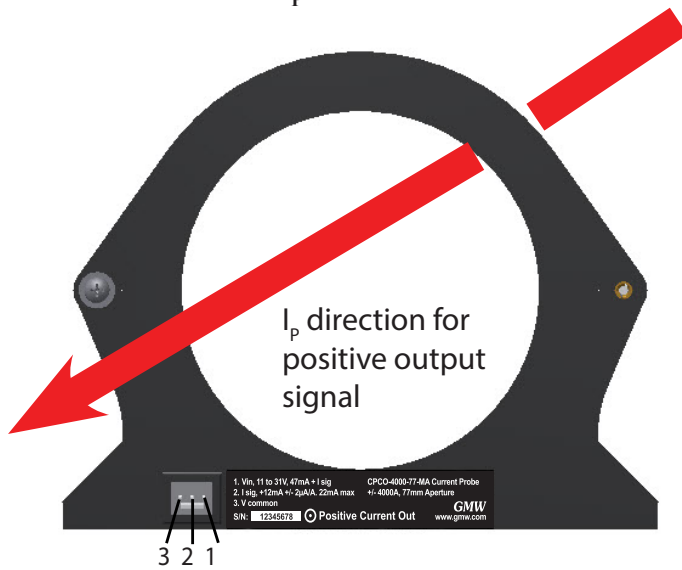
**TABLE 2: ENVIRONMENTAL SPECIFICATIONS**

Specification			
Temperature, Operating	-40 to 85°C		
Temperature, Storage	+15 to 85°C		
T <sub>c</sub> of Sensitivity	± 200ppm/°C		
T <sub>c</sub> of Zero	CPCO-500	± 0.2A/°C	
	CPCO-1000	± 0.2A/°C	
	CPCO-2000	± 0.4A/°C	
	CPCO-4000	± 0.8A/°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-500	20mT (200G)
		CPCO-1000	40mT (400G)
		CPCO-2000	60mT (600G)
		CPCO-4000	60mT (600G)
		CPCO-8000	120mT (600G)
		CPCO-12000	120mT (600G)
	Longitudinal or Axial	All Models	200mT (2000 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 <sub>PN</sub> )	< 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	< 0.2% of FS	

Revision Date: 23 July 2019

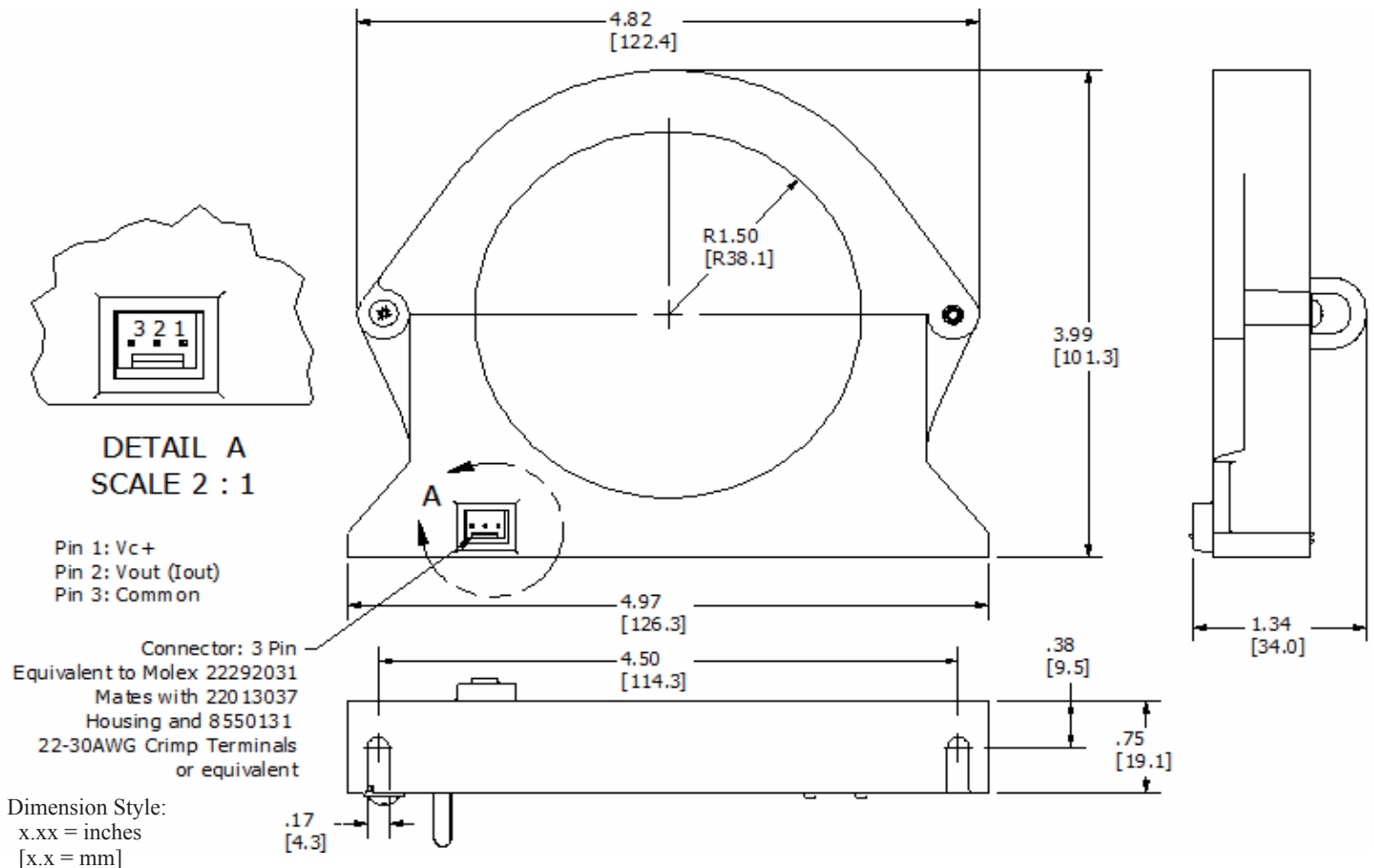
**DRAWING 1: PIN AND  $I_p$  ORIENTATION**

**DRAWING 2: CONNECTION DIAGRAM**



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

**DRAWING 3: OUTLINE DRAWING**

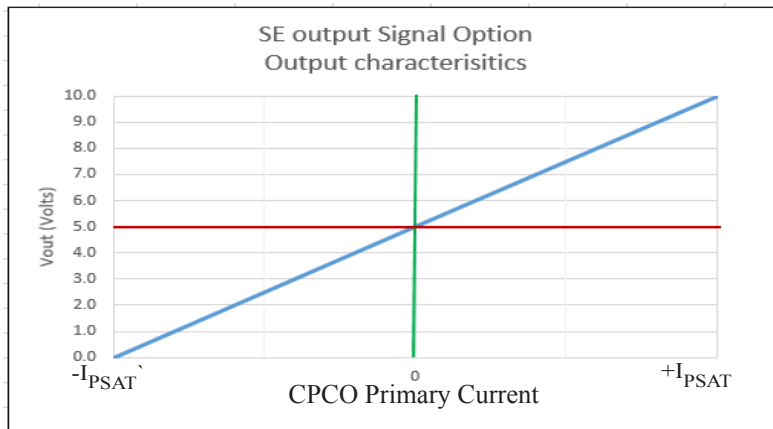


Revision Date: 23 July 2019

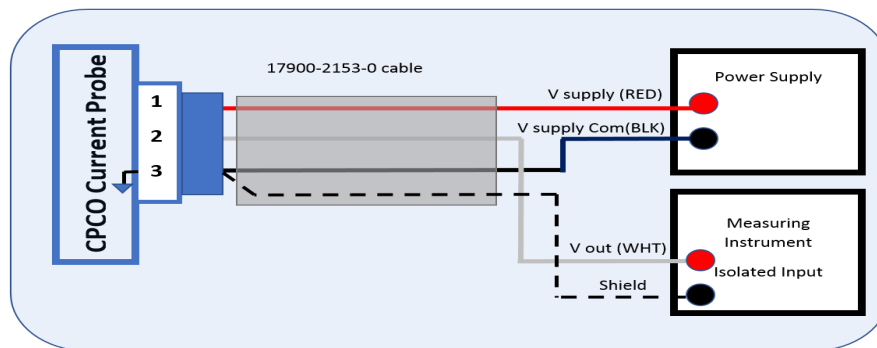
#### Signal Output Option Descriptions

**SE Option** - The SE stands for Single Ended and the output voltage from the CPCO will have a quiescent output voltage of 5.0V when there is no primary current ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output voltage will increase to the maximum level of 10.0V at  $I_p=+I_{PSAT}$ . When the primary current increases in the negative direction, the output voltage will decrease toward 0.0V at  $I_p=-I_{PSAT}$ . See below output characteristics.

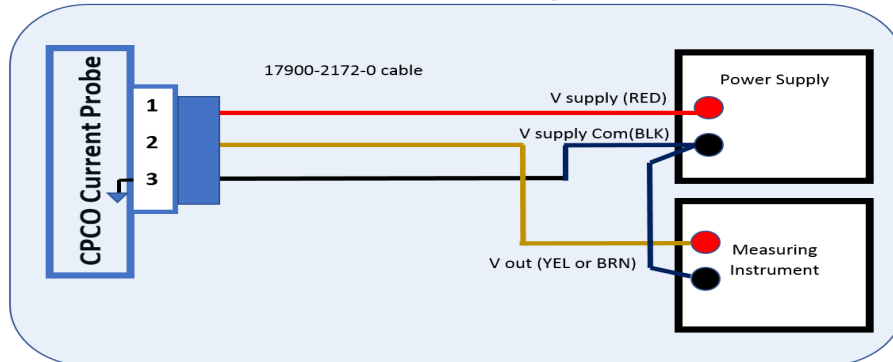
This option is useful for applications that drive circuitry that can only accommodate positive signal inputs voltages such as inputs to A/D's



#### Recommended Connection Diagram

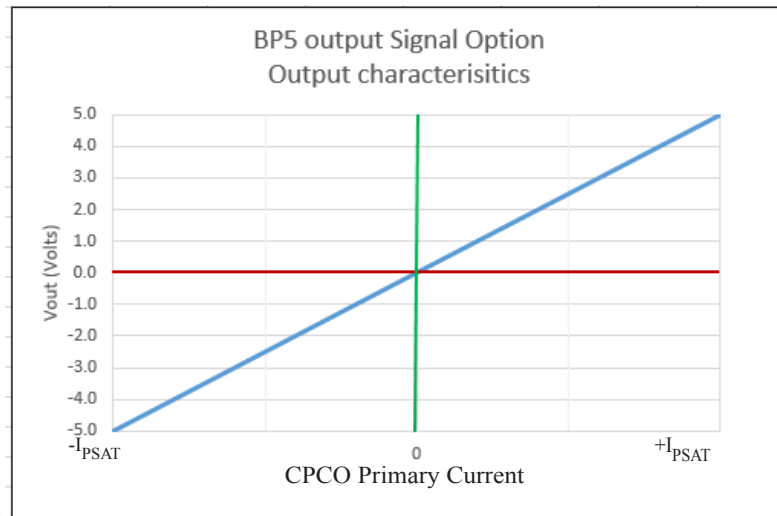


#### Alternate Connection Diagram

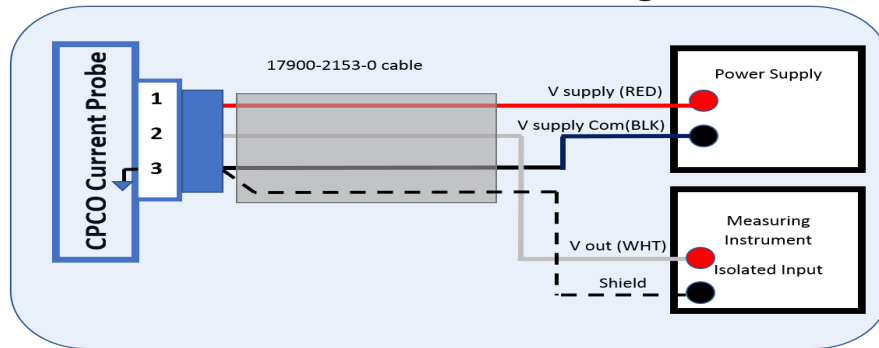


**BP5 Option** - The BP stands for Bi Polar and the output voltage from the CPCO will have a quiescent output voltage of 0.0V when there is no primary current ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output voltage will increase to the maximum level of 5.0V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

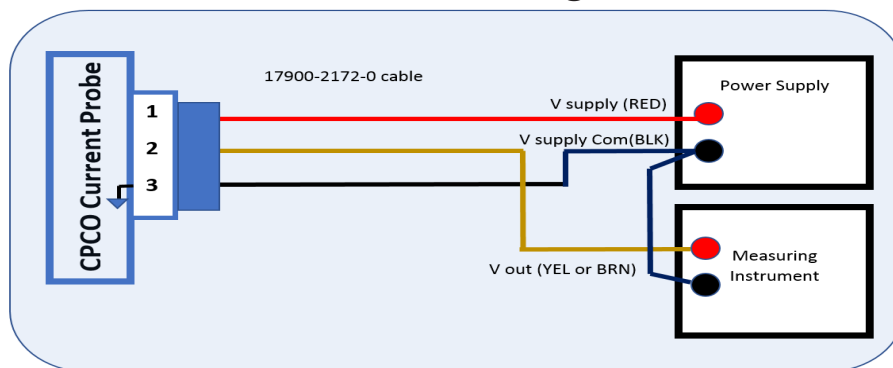
This option is useful for applications that drive circuitry that can accommodate Bi Polar signal inputs that swing around Com ( 0.0V) such as oscilloscopes, data loggers, multi-meters, etc.



### Recommended Connection Diagram



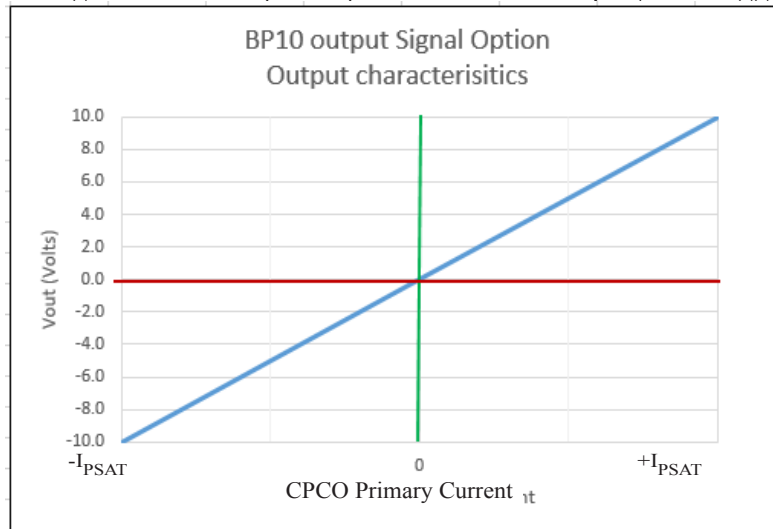
### Alternate Connection Diagram



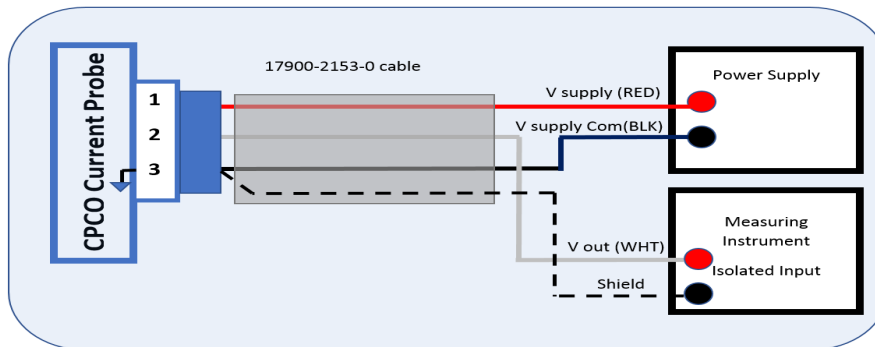
Revision Date: 23 July 2019

**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 ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output voltage will increase to the maximum level of 10.0V at  $I_p=+I_{PSAT}$ . When the primary current increases in the negative direction, the output voltage will decrease toward -10.0V at  $I_p=-I_{PSAT}$ . See below output characteristics.

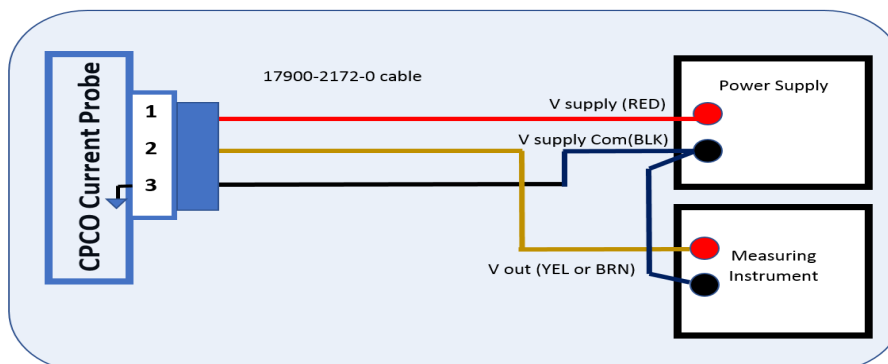
This option is useful for applications that drive circuitry that need higher voltages and can accommodate Bi Polar signal inputs that swing around Com ( 0.0V) such as oscilloscopes, data loggers, multi-meters, etc.



### Recommended Connection Diagram



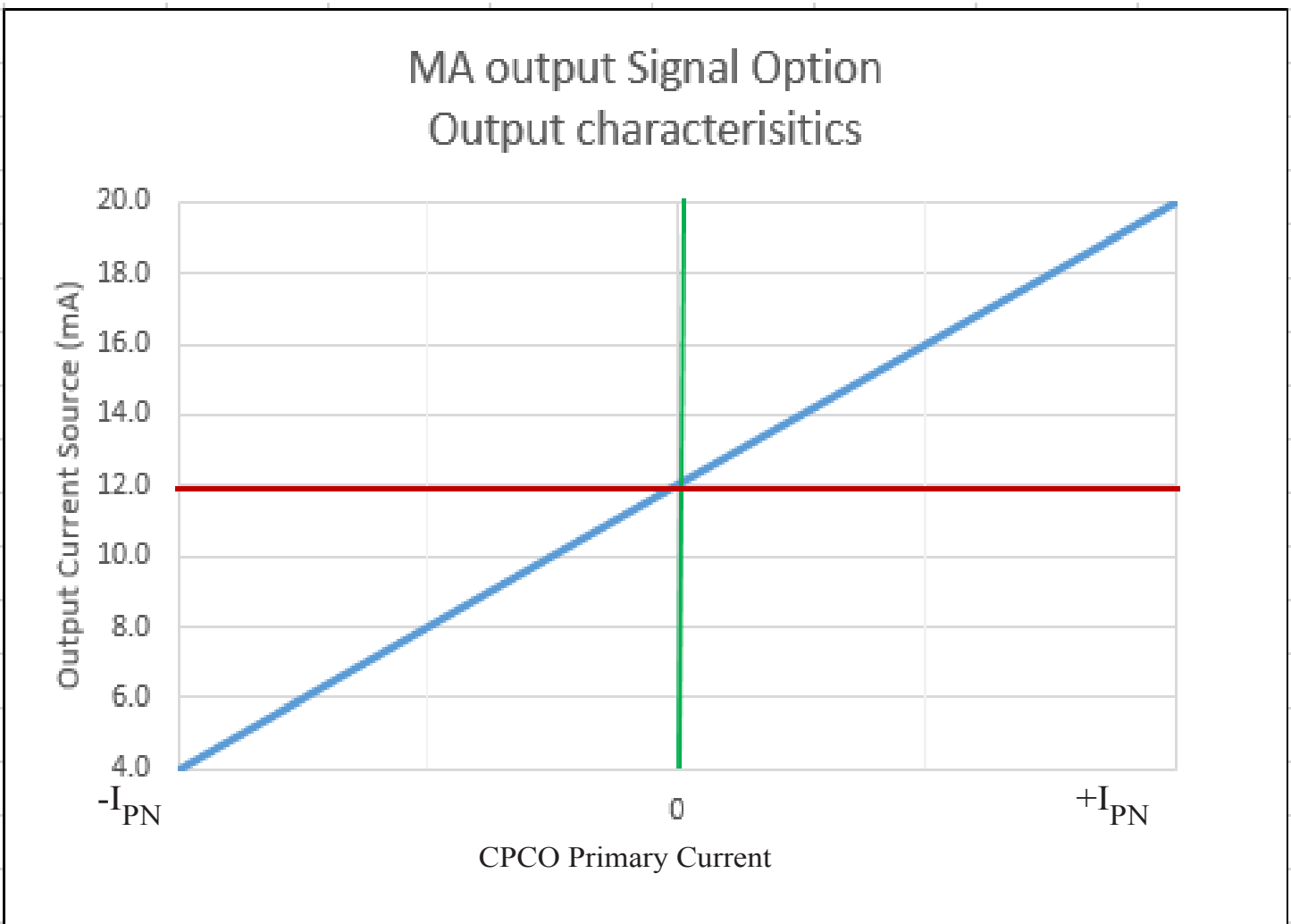
### Alternate Connection Diagram



Revision Date: 23 July 2019

**MA Option** - The MA stands for **Milli-Amp** 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 ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output current source will increase to the maximum level of 20.0mA at  $I_p=+I_{PSAT}$ . When the primary current increases in the negative direction, the output current source will decrease toward 4mA at  $I_p=-I_{PSAT}$ . The output current comes from the input power supply, therefore the CPCO power supply must be capable of providing the CPCO current 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 noisy environments with long cable runs. The 4-20mA current source output is common with PLC's. Offset errors that can result from long cables are eliminated with the MA version.





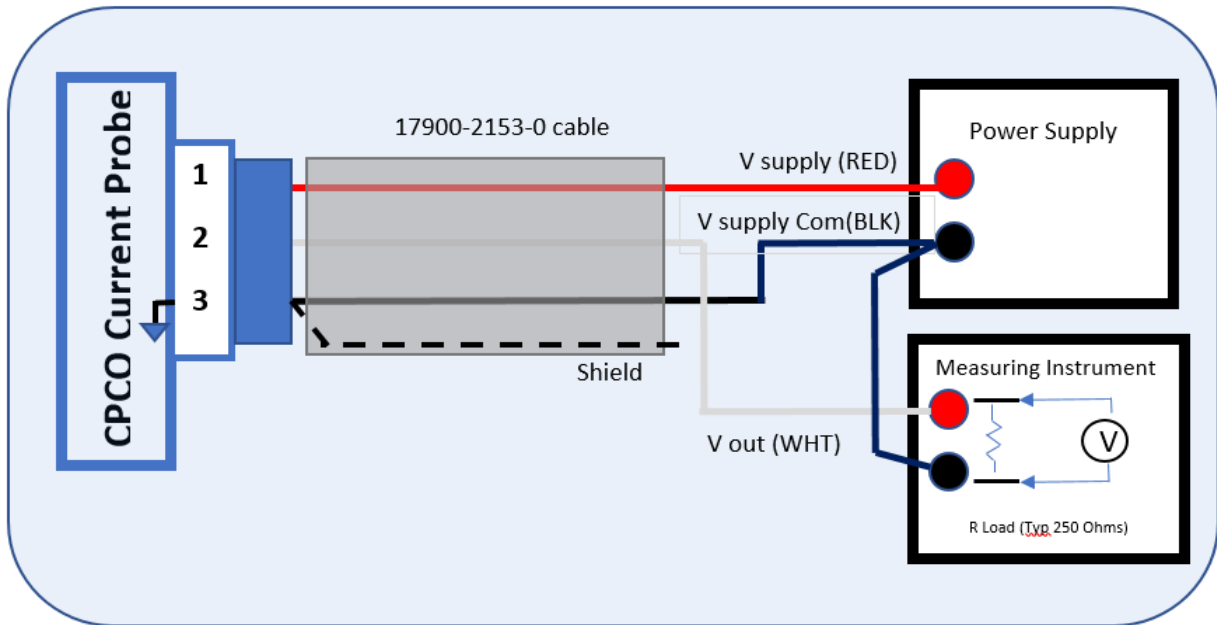
### Typical MA option circuit diagram.

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.

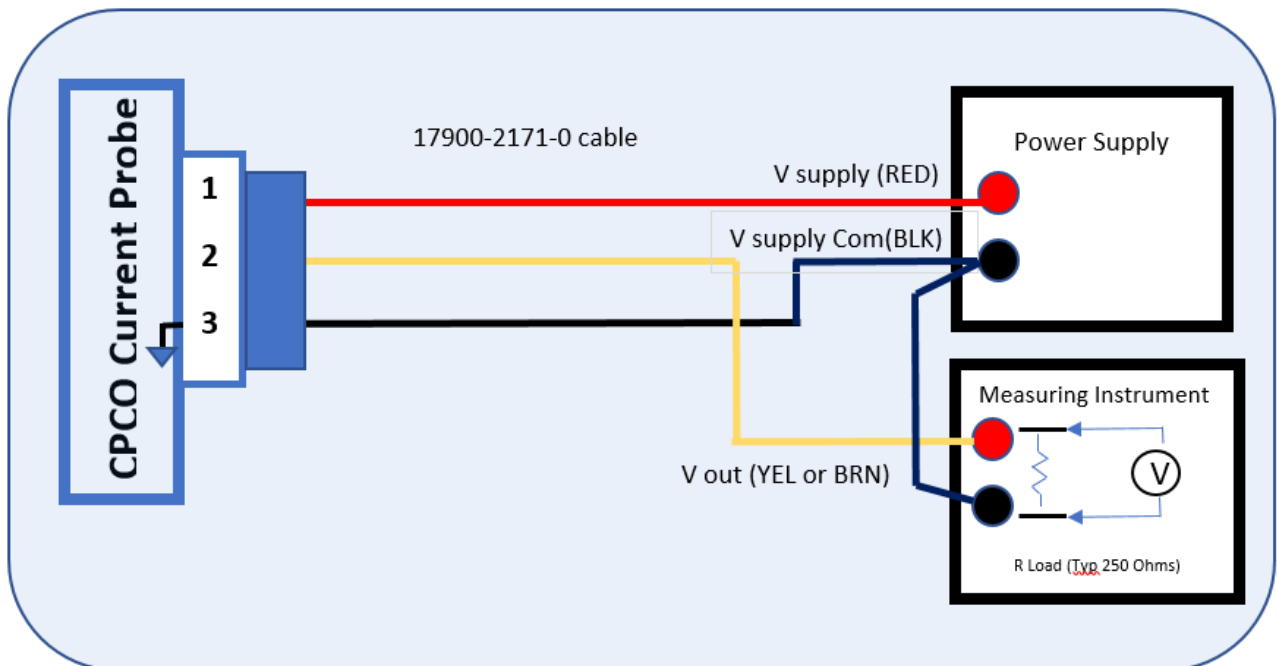
With a 250 ohm resistor, the voltage across the resistor will be :

$$V_{out} = I_{source} * R \text{ ( example: at 12mA the } V_{out} = 3.00V \text{)}$$

### Connection Diagram with 17900-2153-0 Cable



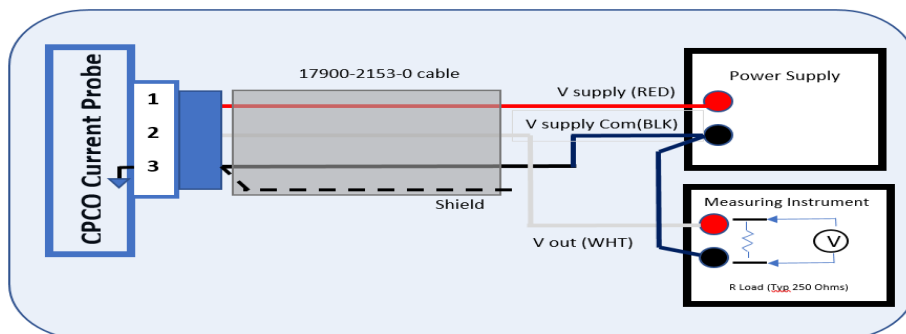
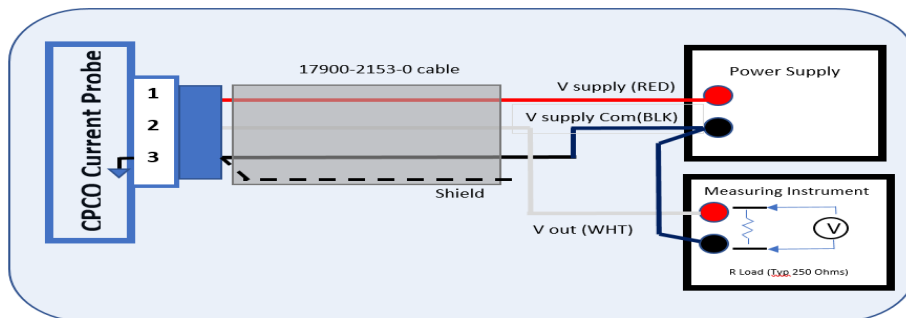
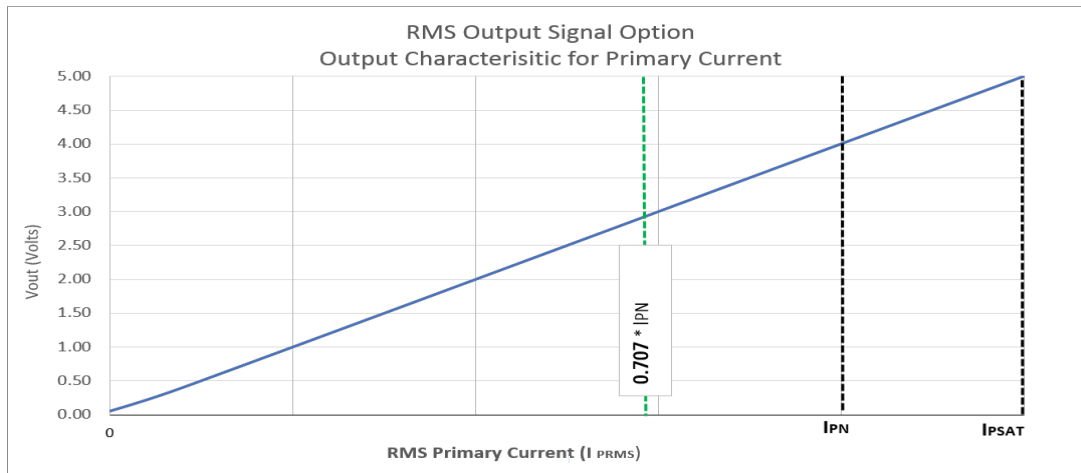
### Connection Diagram with 17900-2171-0 Cable



Revision Date: 23 July 2019

**RMS Option** - RMS stands for **Root Mean Square** and the output voltage from the CPCO has a quiescent output voltage in the range of 0.0V to 0.020V when there is no primary current ( $I_p=0A$ ). The output is an analog voltage that is proportional to the RMS value of the primary current over the complete dc to 50kHz (-3dB) bandwidth of the primary current. See the output characteristic below.

Accurate RMS measurements of a time varying primary current require that the peak current never exceeds  $\pm I_{PN}$  to ensure that the CPCO is operating within the linear electronic range to avoid limiting of the CPCO signal. For a sine wave primary current,  $I_{PRMS}$  is  $0.707 * I_{PN}$ . This implies that the maximum RMS primary sine current should be  $< 0.707 I_{PN}$  for the highest accuracy RMS output signal. For primary currents with occasional high current transients it is essential that the transients do not exceed  $I_{PSAT}$ . For this type of primary current waveform, the maximum allowed RMS current may be much less than  $0.707 I_{PN}$ .



Revision Date: 23 July 2019

#### Power Supply (Vs)

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, Vs. 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.

