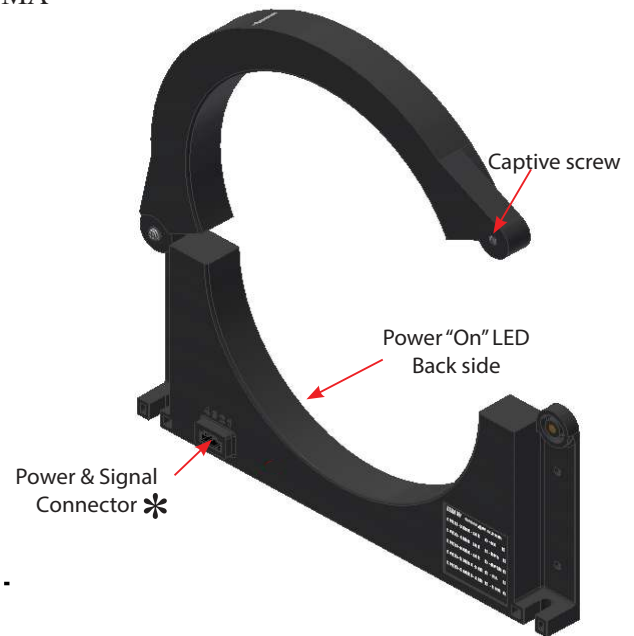
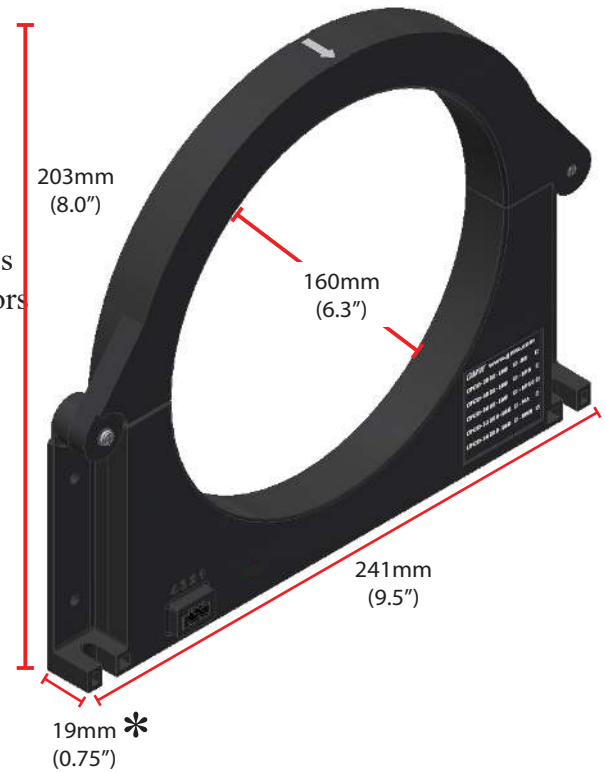


The CPCO Series (160mm aperture) Current Probes are Clamp On current sensors capable of measuring ac and dc currents. The Current Probe splits along a diameter allowing easy installation to existing cables without having to break the connection. A captive screw is used rather than a clip to ensure consistent closure under mechanical loading or vibration.

The Current Probes do not exhibit the magnetic hysteresis and non-linearity effects present in conventional open loop sensors with magnetic cores.

### FEATURES

- Clamp On
- Operating Temperature: -40C to +85C
- Light Weight <300g ( 0.66 lb)
- Low Power <0.5W for Voltage Output Signal; <0.8W for 4-20mA Output Signal
- Operating Voltage: 11-31V single rail power supply
- Current Ranges:  $\pm 1000A$   $\pm 2000A$   $\pm 4000A$   $\pm 8000A$   $\pm 12000A$ ,  $\pm 16000A$
- Accuracy: +/-1%
- Wide bandwidth: dc to 50kHz (-3db).
- Output Signal Options: SE, BP5, BP10, MA, RMS and RMS-MA (See below)
- Power ON LED indicator
- Reverse power supply voltage protected
- High rejection of external magnetic fields, e.g. from external conductors or steel cabinet plates
- Output short circuit protection (except for 4-20mA version)
- Mating cables available, 1m and 10m ( see page 5)



### ORDERING INFORMATION

#### Part Number Format:

CPCO - Current Range - Aperture - Output Signal Option

CPCO = Current Probe Clamp On

| <u>Current Range</u> | <u>Aperture=160mm</u>                    |
|----------------------|--|
| 1000 = $\pm 1000A$   | <u>Output Signal Option ( max range)</u> |
| 2000 = $\pm 2000A$   | SE = Single Ended, (5.0 $\pm$ 5.0V)      |
| 4000 = $\pm 4000A$   | BP5 = Bi-Polar, (0.0V $\pm$ 5.0V)        |
| 8000 = $\pm 8000A$   | BP10 = Bi-Polar, (0.0V $\pm$ 10.0V)      |
| 12000 = $\pm 12000A$ | MA = Current Source, (12mA $\pm$ 10mA)   |
| 16000 = $\pm 16000A$ | RMS = RMS, (0.0V +4.0V)                  |

e.g. CPCO-8000-160-BP10

\* Current Probe Clamp On,  $\pm 8000A$ , 160mm Diameter Aperture, Bi Polar  $\pm 10V$  Output Signal

*From December 1, 2017 the CPCO is updated to include : 4-pin rather than 3-pin Power & Signal Connector; axial thickness reduced to 19mm from 38mm; and additional Supply Voltage transient protection*

U.S. PATENT 9,952,257

Revision Date: 08-MAR-2021



# CPCO Series DC-AC Current Probe, Clamp On, 160mm, ±1000A ±2000A ±4000A ±8000A ±12000A, ±16000A

**TABLE 1: ELECTRICAL SPECIFICATIONS**

| Specifications by Current Range                                      |                        |  |              |              |             |              |              |             |
|--|------------------------|--|--------------|--------------|-------------|--------------|--------------|-------------|
| Specification  | Symbol                 | CPCO-1000                              | CPCO-2000    | CPCO-4000    | CPCO-8000   | CPCO-12000   | CPCO-16000   |             |
| Primary Current, Nominal   | $I_{PN}$               | ±1000A                                 | ±2000A       | ±4000A       | ±8000A      | ±12000A      | ±16000A      |             |
| Primary Current, Max   | $I_{PSAT}$             | ±1250A                                 | ±2500A       | ±5000A       | ±10000A     | ±15000A      | ±20000A      |             |
| Primary Current, Overload  | $I_{POL}$              | No Limit                               |              |              |             |              |              |             |
| Sensitivity  | SE Output              | S                                      | 4.00mV/A     | 2.00mV/A     | 1.00mV/A    | 0.50mV/A     | 0.300mV/A    | 0.25mV/A    |
|  | BP5 Output             |  | 4.00mV/A     | 2.00mV/A     | 1.00mV/A    | 0.50mV/A     | 0.300mV/A    | 0.25mV/A    |
|  | BP10 Output            |  | 8.00mV/A     | 4.00mV/A     | 2.00mV/A    | 1.00mV/A     | 0.600mV/A    | 0.50mV/A    |
|  | RMS Output             |  | 4.00mV/Arms  | 2.00mV/Arms  | 1.00mV/Arms | 0.50mV/Arms  | 0.30mV/Arms  | 0.25mV/Arms |
|  | MA Output              |  | 0.008mA/A    | 0.004mA/A    | 0.002mA/A   | 0.001mA/A    | 0.0006mA/A   | 0.0005mA/A  |
|  | RMS-MA Output          |  | 0.016mA/A    | 0.008mA/A    | 0.004mA/A   | 0.002mA/A    | 0.0013mA/A   | 0.001mA/A   |
| Sensitivity Accuracy   | SA                     | ±1 %                                   |              |              |             |              |              |             |
| Non Linearity  | NL                     | < ±0.5% of FS                          |              |              |             |              |              |             |
| Bandwidth (-3dB)   | BW                     | dc to 50kHz                            |              |              |             |              |              |             |
| Hysteresis after ± $I_{PSAT}$  | $V_{HYS}$ or $I_{HYS}$ | <0.5 % of FS                           | <0.5 % of FS | <0.5 % of FS | <0.5% of FS | <0.5 % of FS | <0.5 % of FS |             |
| Noise<br>(3Hz to 1kHz)   | SE Output              | $V_{NO}$                               | <8mVrms      | <8mVrms      | <4mVrms     | <2mVrms      | <1mVrms      | <1mVrms     |
|  | BP5 Output             |  | <8mVrms      | <8mVrms      | <4mVrms     | <2mVrms      | <1mVrms      | <1mVrms     |
|  | BP10 Output            |  | <16mVrms     | <16mVrms     | <8mVrms     | <4mVrm       | <2mVrms      | <2mVrms     |
|  | RMS Output             |  | <4mVrms      | <4mVrms      | <2Vrms      | <1mVrms      | <0.5Vrms     | <0.5Vrms    |
|  | MA Output              |  | $I_{NO}$     | 8 μArms      | 8 μArms     | 4 μArms      | 2 μArms      | 1 μArms     |
| Resolution   |                        | Noise / Sensitivity                    |              |              |             |              |              |             |
| Dielectric Withstanding<br>between Aperture ID and<br>Connector Pins | $U_W$                  | >5000Vac (60Hz, Dwell Time 1min, <2ma) |              |              |             |              |              |             |

| Specifications by Output Signal Type |                              |                      |                      |                        |              |                    |
|--------------------------------------|------------------------------|----------------------|----------------------|------------------------|--------------|--------------------|
| Specification                        | Symbol                       | SE<br>(single ended) | BP5<br>(Bi Polar 5V) | BP10<br>(Bi Polar 10V) | RMS<br>(RMS) | MA<br>(4-20mA)     |
| Output Signal, Nominal               | $V_{OUTN}$ or $I_{OUTN}$     | 5.0 ± 4.0V           | 0.0V ± 4.0V          | 0.0 ± 8.0V             | 0.0 to 4.0V  | 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 5V    | 12 ± 10mA          |
| Output Signal Current, Absolute Max  | $I_{OUTM}$                   | 2mA                  | ±2mA                 | ±2mA                   | 2mA          | 22mA               |
| Capacitive Load, Absolute Max        | $C_{OUTM}$                   | 10nF                 | 10nF                 | 10nF                   | 10nF         | 10nF               |
| Output Source Impedance              | $R_S$                        | 10 to 15Ω            | 10 to 15Ω            | 10 to 15Ω              | 10 to 15Ω    | >100kΩ             |
| Offset at $I_p = 0$ , CPCO-1000      | $V_{OE}$ or $I_{OE}$         | ±30mV                | ±30mV                | ±50mV                  | 0 to +20mV   | ±0.100mA           |
| Offset at $I_p = 0$ , CPCO-2000      | $V_{OE}$ or $I_{OE}$         | ±20mV                | ±20mV                | ±25mV                  | 0 to +20mV   | ±0.050mA           |
| Offset at $I_p = 0$ ( Range >2000)   | $V_{OE}$ or $I_{OE}$         | ±5mV                 | ±5mV                 | ±10mV                  | 0 to +20mV   | ±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 31V              | 11 to 31V    | 11-26V             |
| Power Supply Current, Max            | $I_C$                        | <80mA                | <80mA                | <80mA                  | <80mA        | <80mA + $I_{OUTN}$ |

**U.S. PATENT 9,952,257**

Revision Date: 08-MAR-2021

**GMW Associates: 955 Industrial Road, San Carlos, CA 94070, USA. www.gmw.com. +1 (650) 802-8292**



**CPCO Series DC-AC Current Probe, Clamp On, 160mm,  
±1000A ±2000A ±4000A ±8000A ±12000A, ±16000A**

**TABLE 2: MECHANICAL SPECIFICATIONS**

| Specification        |  |
|----------------------|--|
| Aperture Diameter    | 160mm (6.3")                             |
| Overall Size         | 203mm x 241mm x 19mm (8" x 9.5" x 0.75") |
| Weight               | 300g (0.66lb)                            |
| Housing Material     | Nylon 66 (UL 94 V-0)                     |
| Encapsulant Material | Polybutadiene Resin (UL 94 V-0)          |

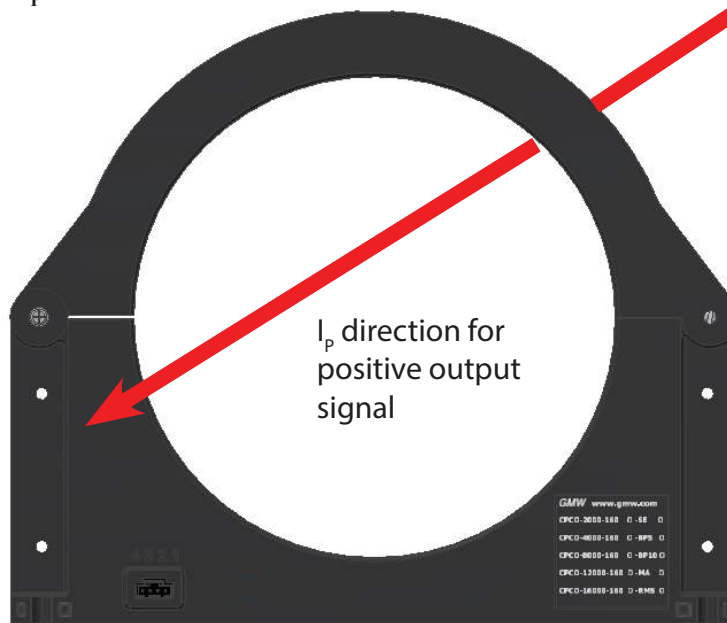
**TABLE 2: ENVIRONMENTAL SPECIFICATIONS**

| Specification   |                       |                                   |                |
|---|-----------------------|-----------------------------------|----------------|
| Temperature, Operating  |                       | -40 to 85C                        |                |
| Temperature, Storage  |                       | -40 to 100C                       |                |
| T <sub>c</sub> of Sensitivity   |                       | ± 200ppm/C                        |                |
| T <sub>c</sub> of Zero (referred to I <sub>p</sub> )  |                       | ± 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-1000                         | 18mT (180G)    |
|   |                       | CPCO-2000                         | 33mT (330G)    |
|   |                       | CPCO-4000                         | 67mT (670G)    |
|   |                       | CPCO-8000                         | 133mT (1330G)  |
|   |                       | CPCO-12000                        | 200mT (2000G)  |
|   |                       | CPCO-16000                        | 267mT (2670G)  |
|   | Longitudinal or Axial | All Models                        | 400mT (4000 G) |
| Effect of Primary Conductor Position within Aperture (20mm diameter conductor)  |                       | < 1.0% of FS                      |                |
| Effect of Another Conductor within 5mm of any outer surface of probe (20mm diameter conductor, I ≤ to I <sub>PN</sub> ) |                       | <1.0% of FS                       |                |
| Effect of Steel plate outside the Current Probe (200 x 200mm square plate)  |                       | In contact with any outer surface | < 1.0% of FS   |
|   |                       | 5mm from any outer surface        | < 1.0% of FS   |

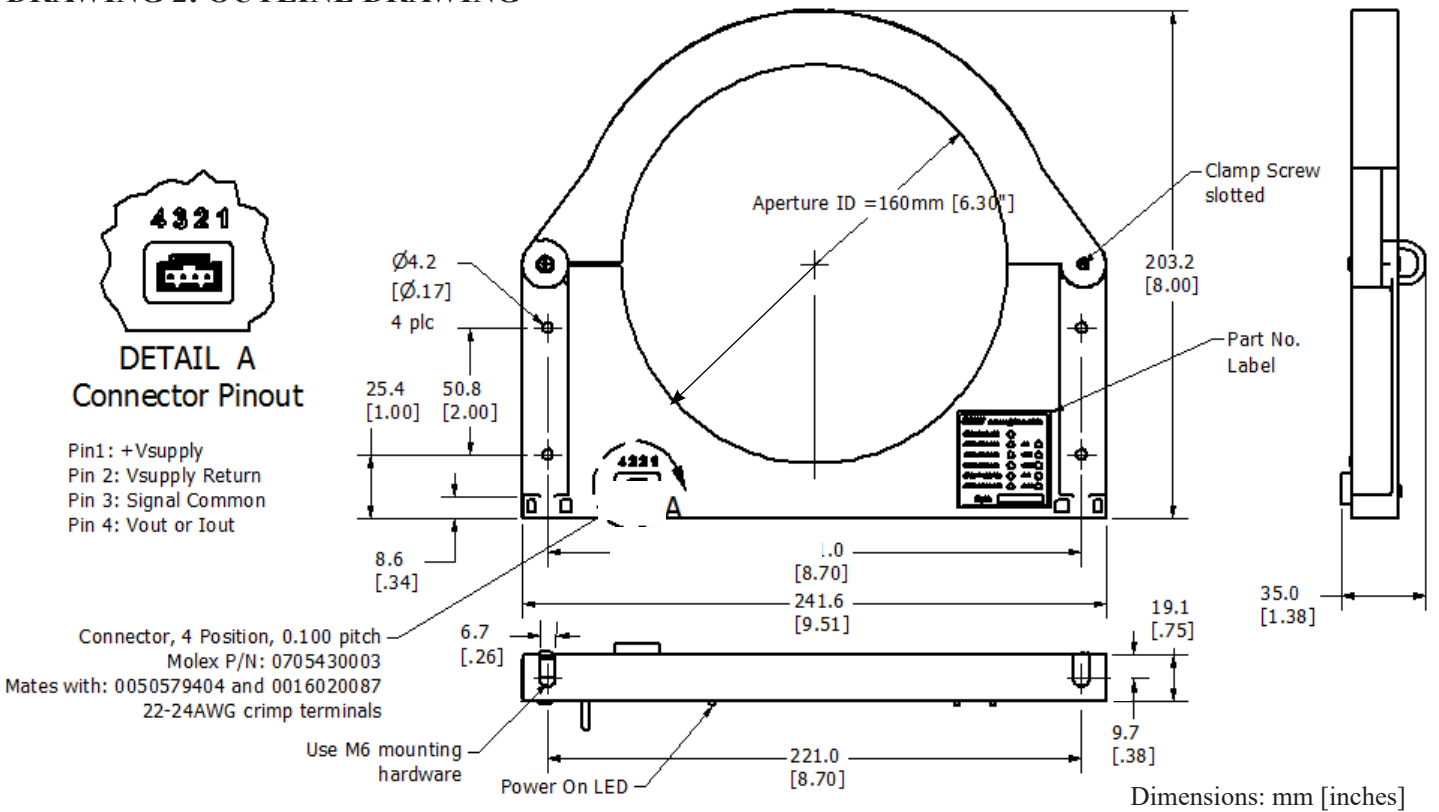


# CPCO Series DC-AC Current Probe, Clamp On, 160mm, $\pm 1000A$ $\pm 2000A$ $\pm 4000A$ $\pm 8000A$ $\pm 12000A$ , $\pm 16000A$

## DRAWING 1: PIN AND $I_p$ ORIENTATION



## DRAWING 2: OUTLINE DRAWING



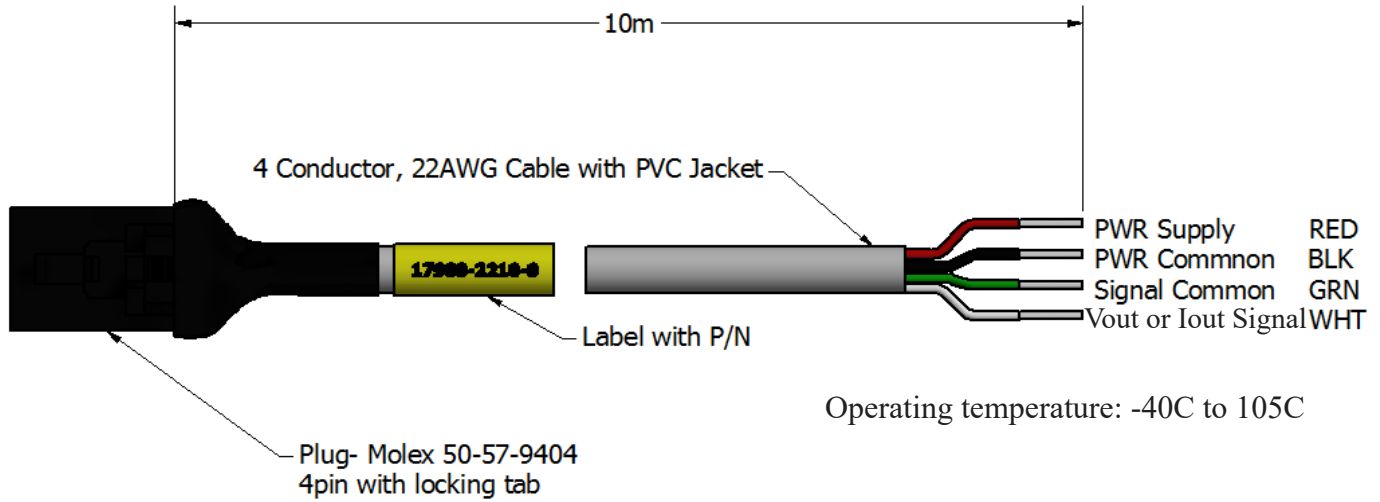


# CPCO Series DC-AC Current Probe, Clamp On, 160mm, ±1000A ±2000A ±4000A ±8000A ±12000A, ±16000A

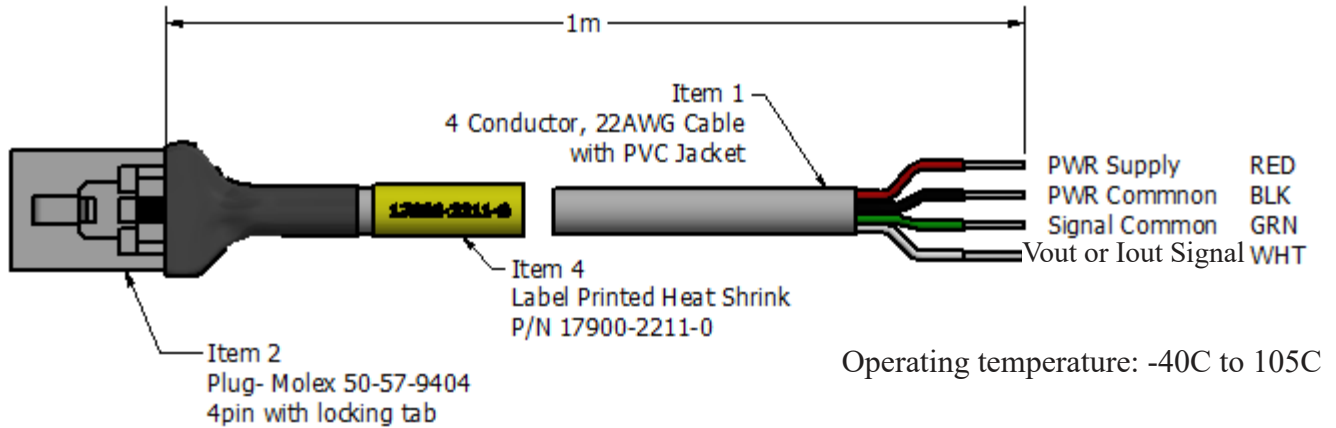
## ACCESSORIES

### Mating cables

**17900-2210-0** Cable, Pigtail, Signal and Power, 22AWG, 4pin Molex Plug, Locking tab and Unterminated, PVC Jacket,



\*\*\*\*\*  
**17900-2211-0** Cable, Pigtail, Signal and Power, 22AWG, 4pin Molex Plug, Locking tab and Unterminated, PVC Jacket, 1m



\*\*\*\*\*  
**17900-2213-0** Connector and Pins, Set of 5 ( Molex 50-57-9404 Housing, 16-02-0103 pins)



5 ea



20 ea



*Suggested hand crimping tool: Molex Part Number 0640160201*

**U.S. PATENT 9,952,257**

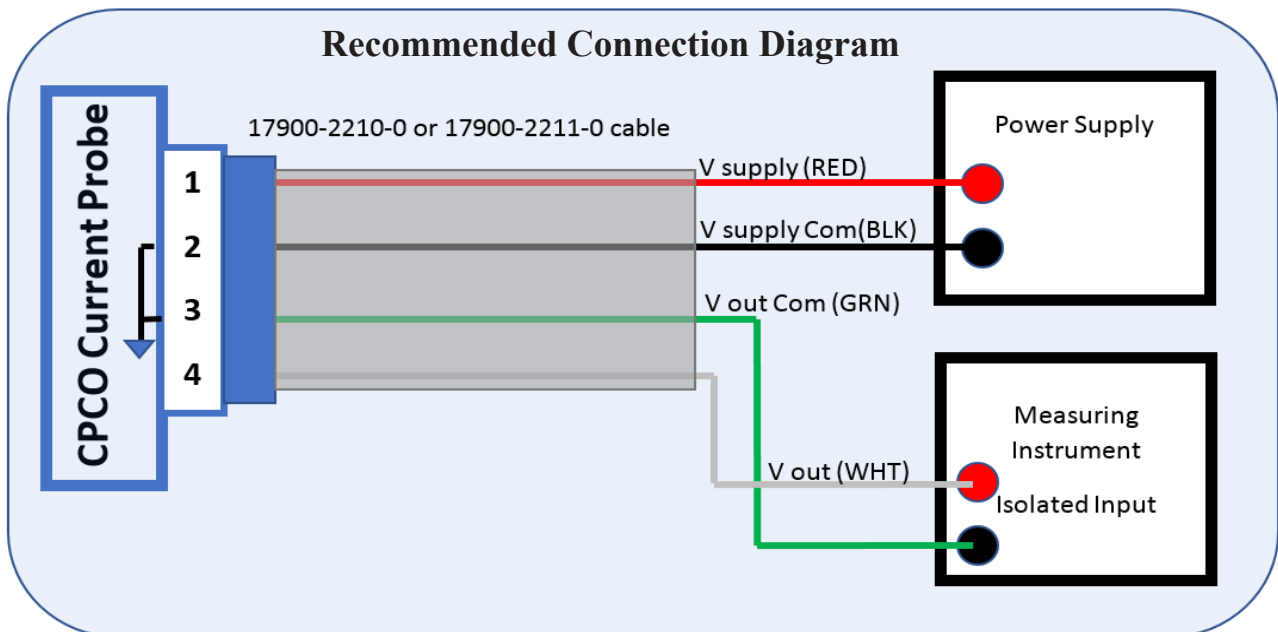
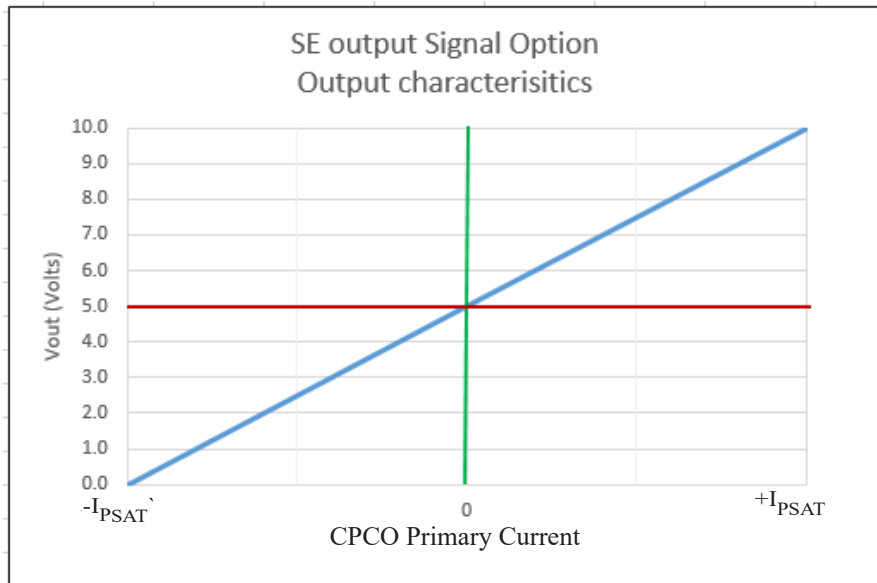
Revision Date: 08-MAR-2021

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### Signal Output Option Descriptions

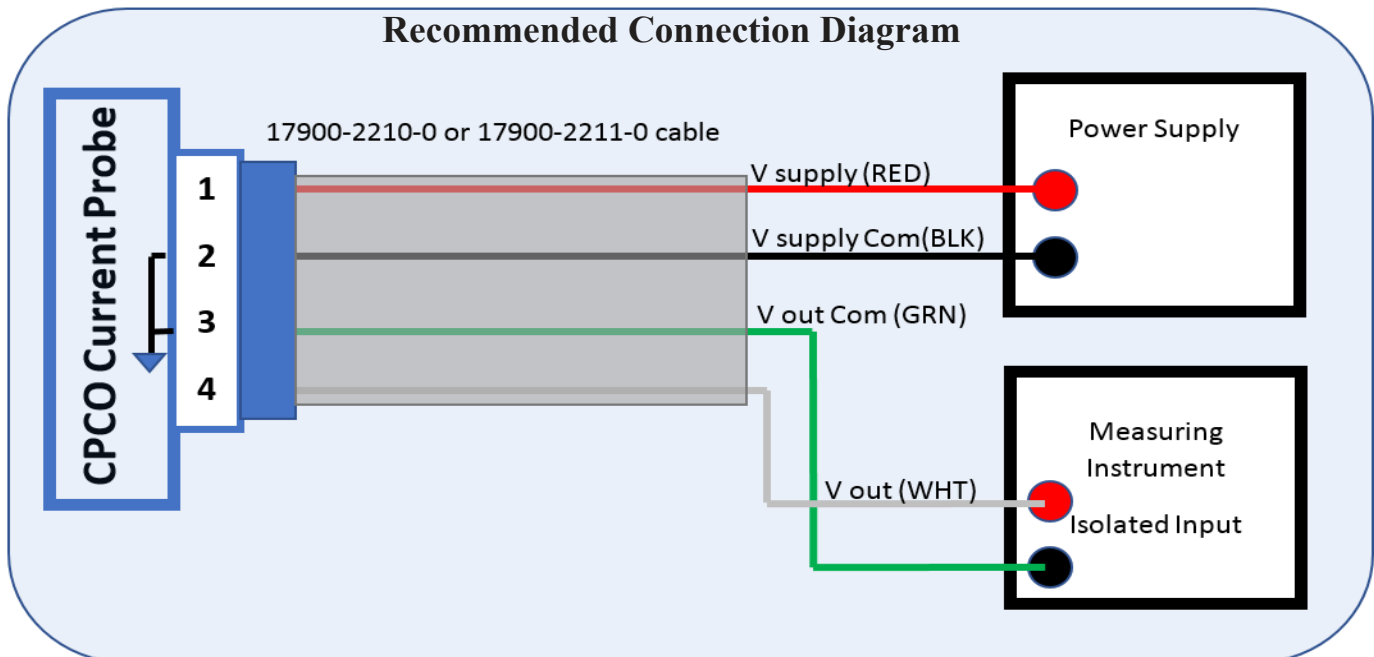
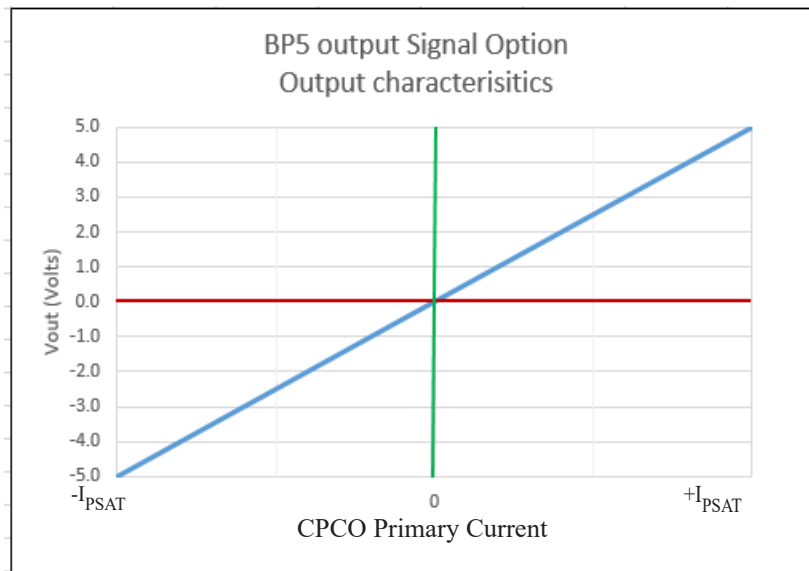
**SE Option** - The SE stands for **Single Ended** and the output voltage from the CPCO will have a quiescent output voltage of 5.0V when there is no primary current ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output voltage will increase to the maximum level 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



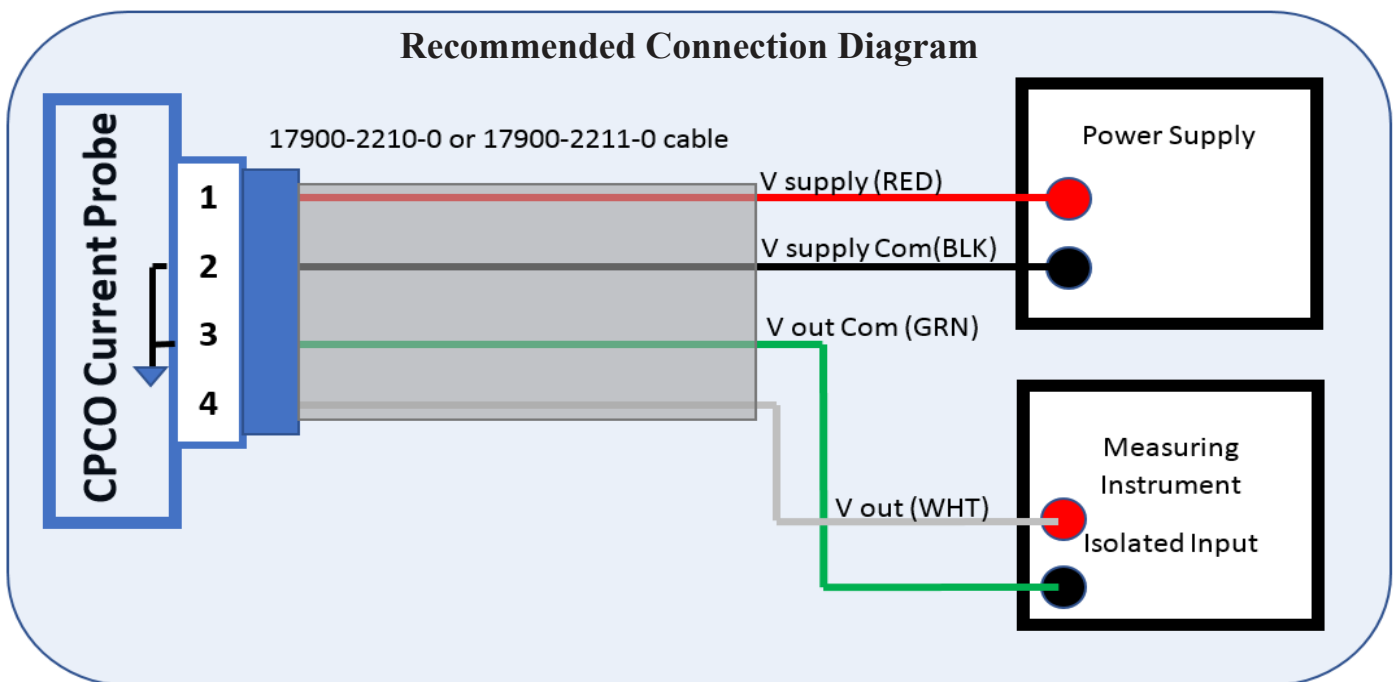
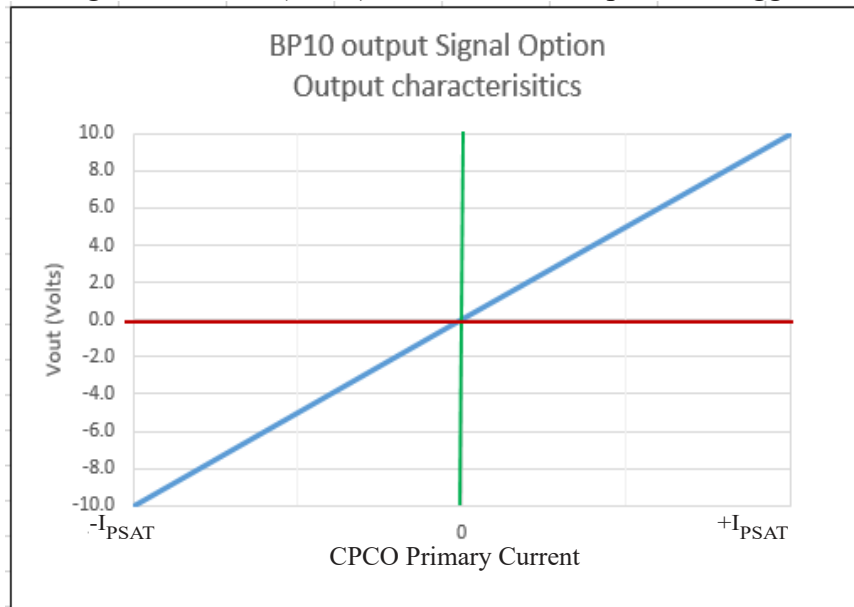
**BP5 Option** - The BP stands for Bi Polar and the output voltage from the CPCO will have a quiescent output voltage of 0.0V when there is no primary current ( $I_p=0A$ ). As the primary current ( $I_p$ ) increases in a positive direction, the output voltage will increase to the maximum level of 5.0V 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.



**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.

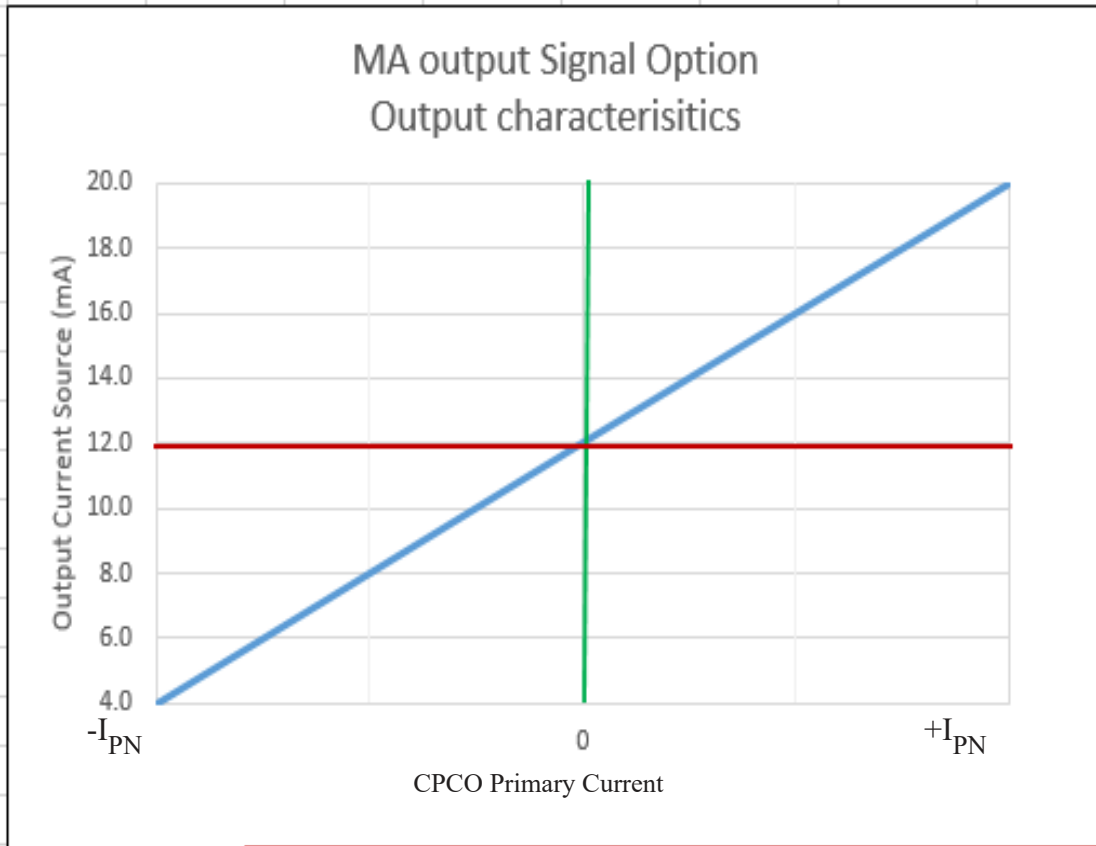
This option is useful for applications that drive circuitry that need higher voltages and can accommodate Bi Polar signal inputs that swing around Com ( 0.0V) such as oscilloscopes, data loggers, multi-meters, etc.





**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.

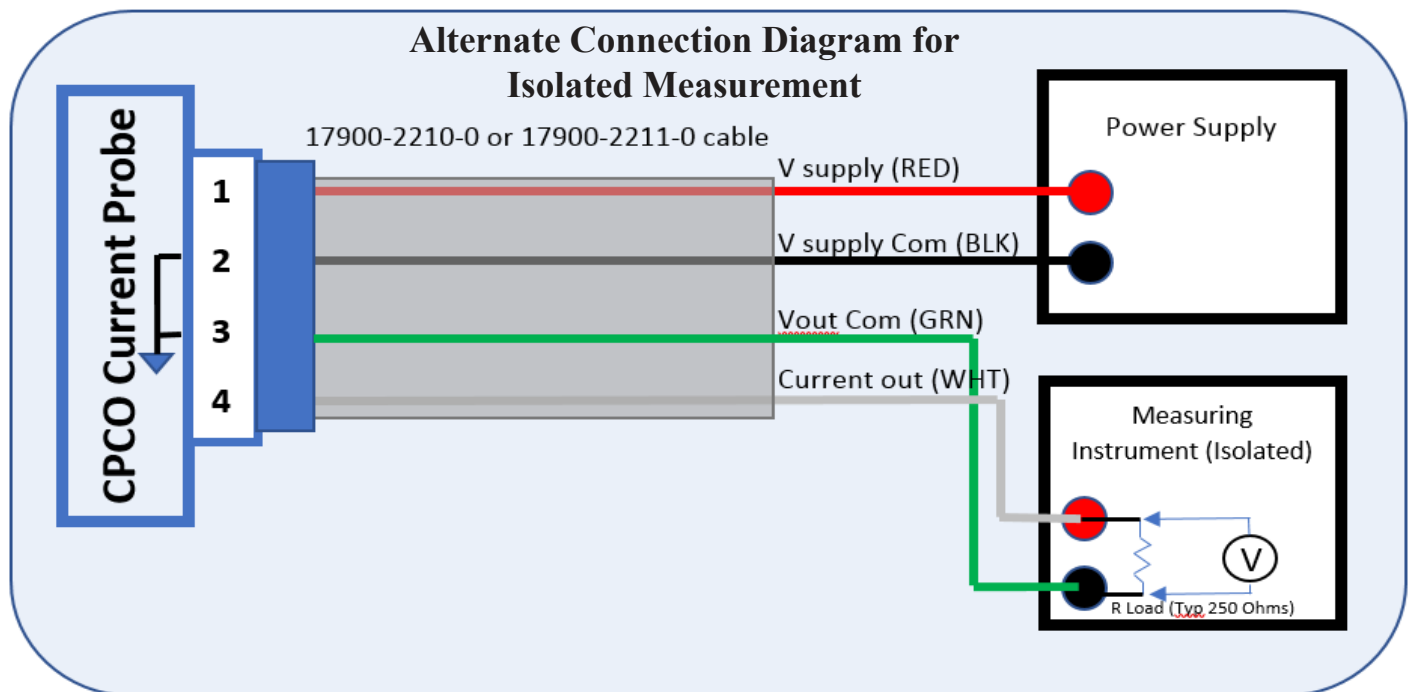
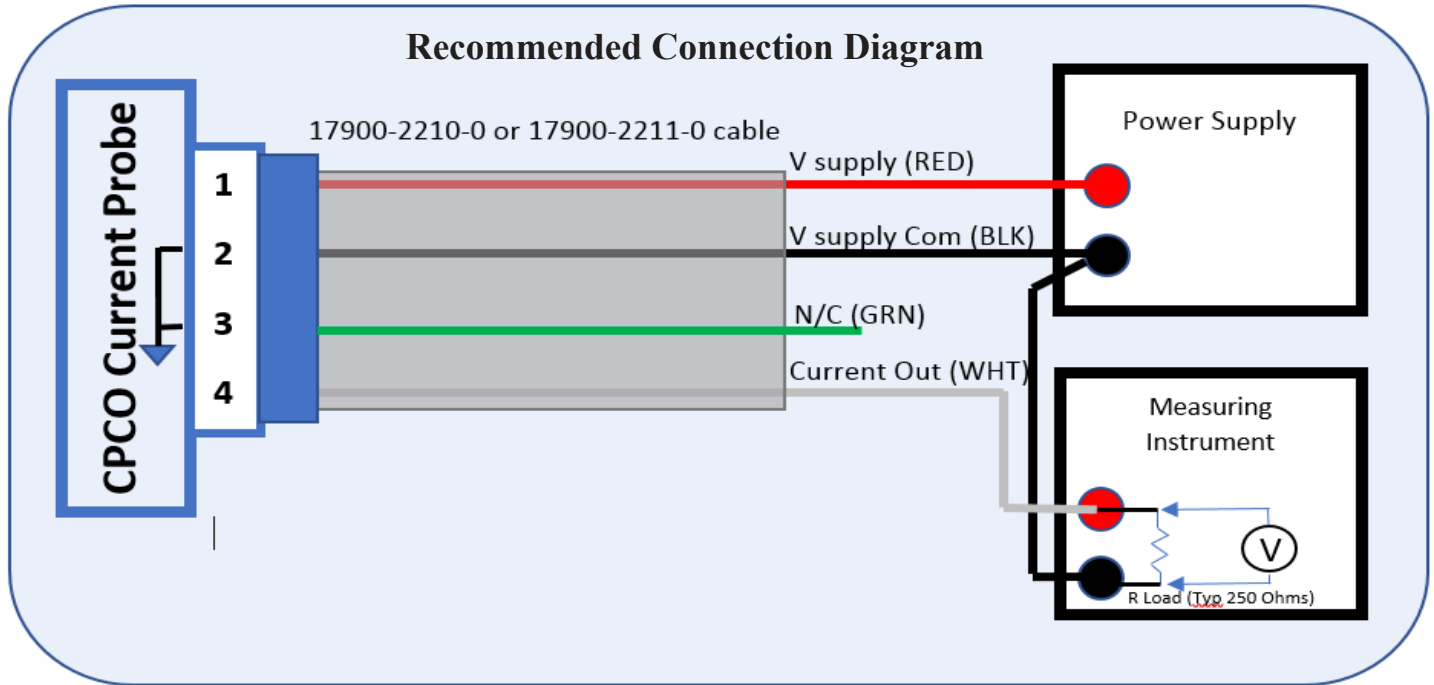


### Typical MA option circuit diagram.

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.

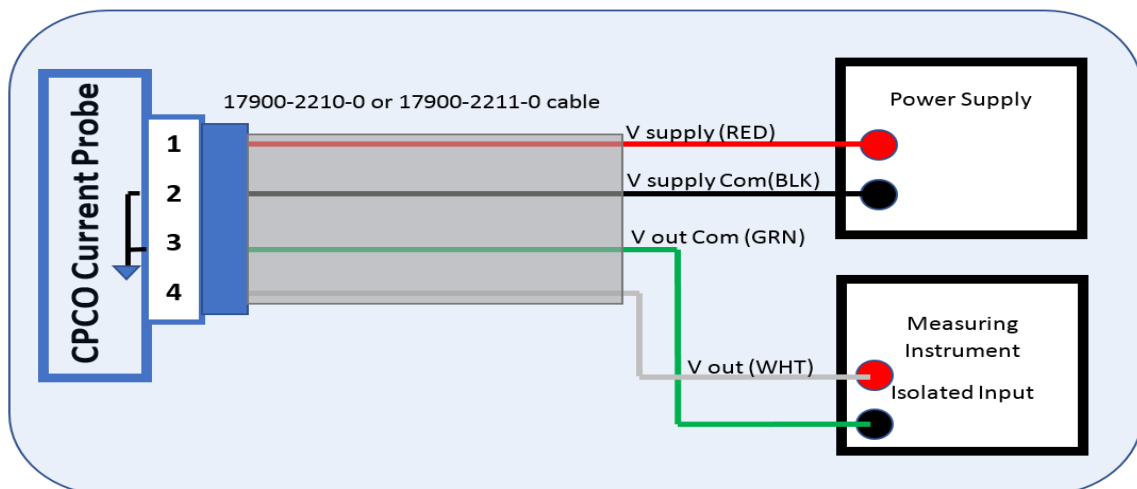
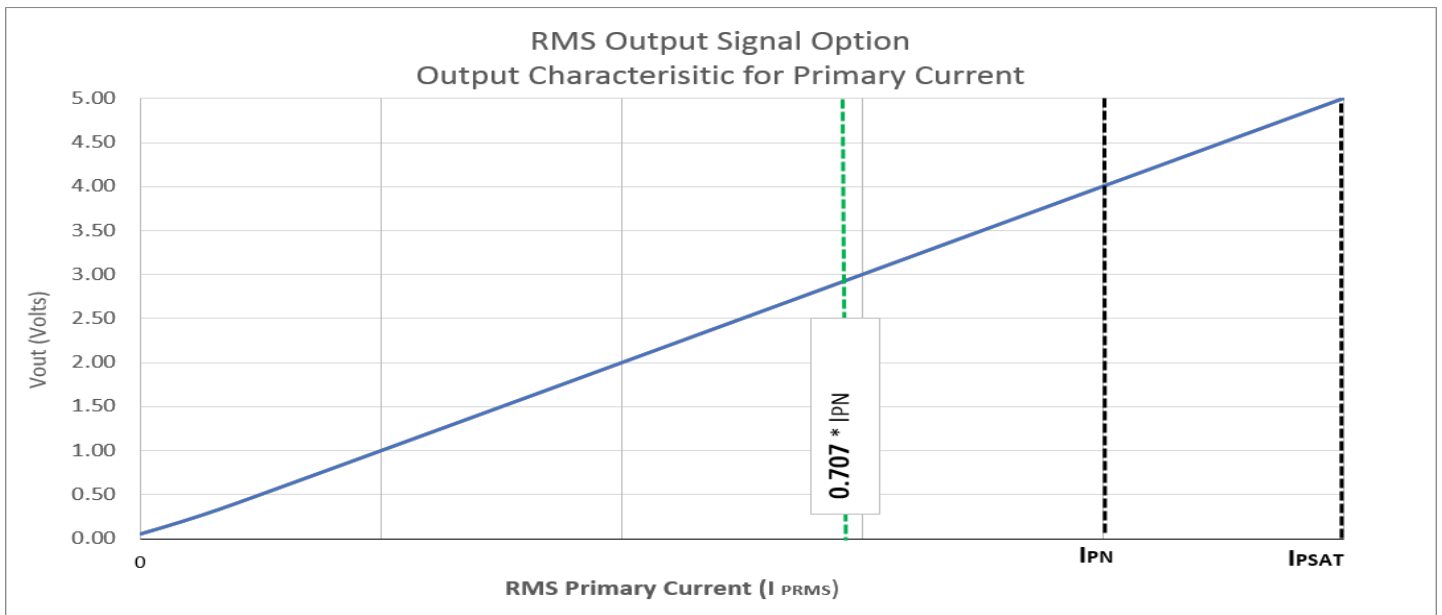
With a 250 ohm resistor, the voltage across the resistor will be :

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



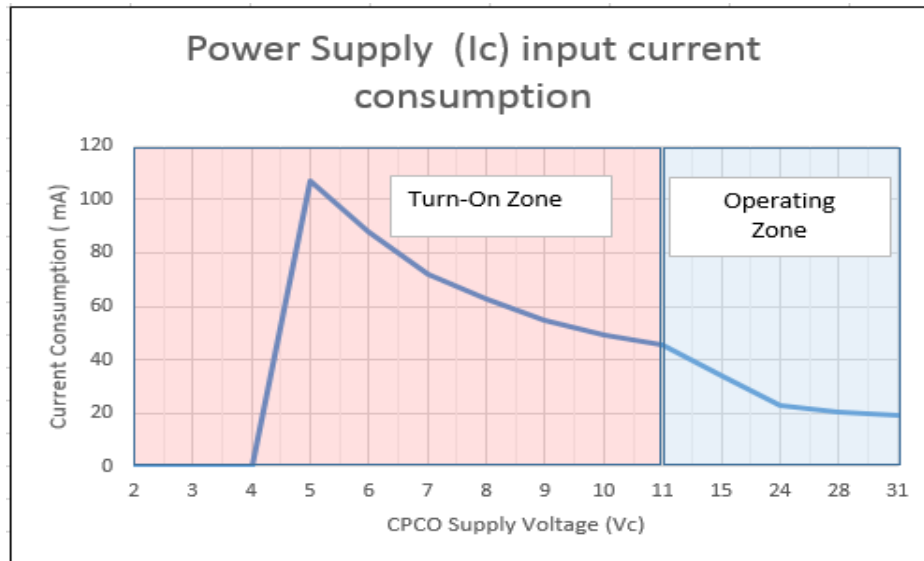
**RMS Option** - RMS stands for **Root Mean Square** and the output voltage from the CPCO has a quiescent output voltage in the range of 0.0V to 0.020V when there is no primary current ( $I_p=0A$ ). The output is an analog voltage that is proportional to the RMS value of the primary current over the 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  $0.707 I_{PN}$ .



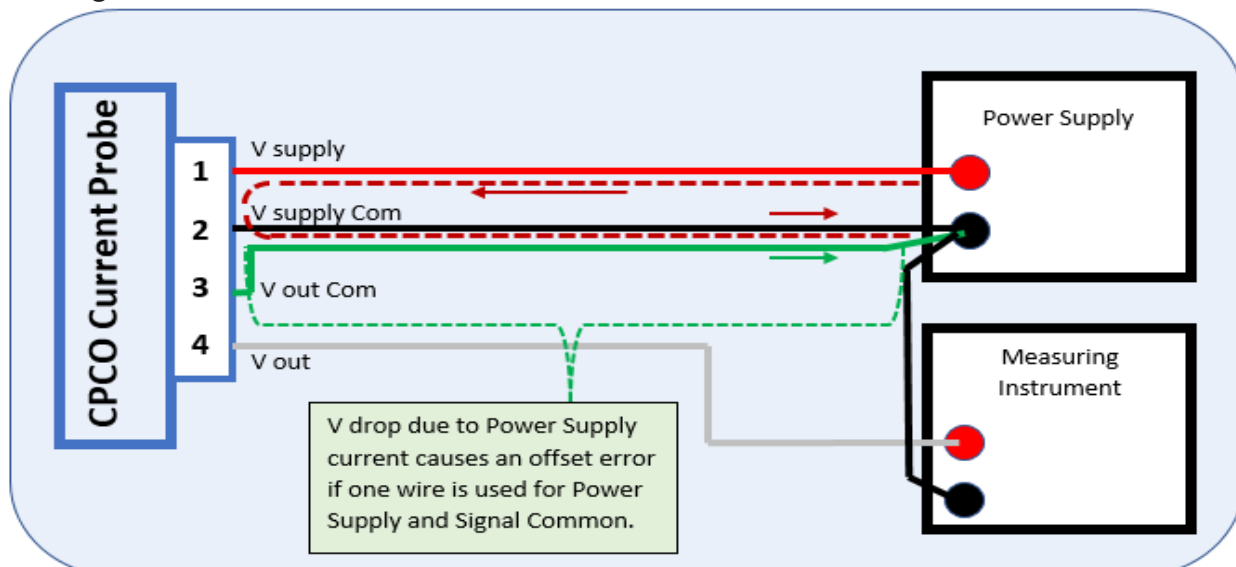
### Power Supply (Vs)

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.



### Offset error caused by connecting the common returns together

It is recommended the Vout Common and V supply return be isolated from each other to avoid Offset error in the measurement of Vout. The CPCO will work if the returns are tied together, however the Offset voltage at the measuring instrument will change due to the voltage drop caused by the supply current and resistance of the wire. See diagram below:





**CPCO Series DC-AC Current Probe, Clamp On, 160mm,  
±1000A ±2000A ±4000A ±8000A ±12000A, ±16000A**

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Revision Status:

3-MAR-2021. Page 2. Changed Sensitivity Accuracy from “±1 % of Sensitivity specification” to “+/-1% “.