

CYBERHAWK EXPRESS INSTALLATION BULLETIN

	<h3>SAFETY INSTRUCTIONS</h3> <ul style="list-style-type: none">▪ <i>Follow all SAFETY requirements defined in NFPA 70E or CSA Z462 which includes, but not limited to, the use protective equipment (PPE: Clothing, Insulated Gloves, Safety Goggles, etc.). It is further recommended that all METALLIC OBJECTS (such as jewelry, watches, chains ETC.) be removed from their person.</i>▪ <i>This equipment to be installed and serviced only by qualified competent electrical personnel that have appropriate training on Electrical Systems</i>▪ <i>This device is to be installed in accordance with the prevailing local and National Electric Codes such as National Electric Code (NEC) in the USA or Canadian Electric Code in Canada which governs the requirements for electrical wiring and protection</i>
	<p>Failure to observe and follow these installation instructions and procedures could result in serious injury or even death</p>

RECEIVING

The Cyberhawk Express Power Meter is packaged for shipping in a cardboard packaging equipped with all user interface connectors. Accessories or ancillary equipment such as CTs, when specified at time of order, may be separately packed. Unpack and inspect equipment for damage that might have occurred during shipment. Also check the packing list to ensure all the equipment is accounted for.

Claims for damages should be made to the carrier immediately and also notify Powersmiths International of the details. Claims for shortages should be made to Powersmiths International at the earliest opportunity.

STORAGE

No special precautions are required in storing this device other than it should be protected from excessive humidity with storage temperatures in the limits of - 25 °C to + 50 °C.

OVERVIEW

Cyberhawk Express Power Meter series is a family of UL Listed 3-phase power meters based on a common transducer module that measures Voltages, Currents, Powers and Energies and are specifically designed for easy and rapid deployment directly into electrical system. The unit is available in a number of voltage ranges and in its standard configuration is powered directly from the voltage sensing leads requiring overcurrent protection at 15 Amps or less. Model specific configurations include various current sensors, communication and packaging options ranging from an open frame transducer to an outdoor rated enclosure. The family also includes various accessories to aid in application and deployment.

SCOPE OF THIS BULLETIN

This installation bulletin and guide is a condensed summary of the full instructions given in the manual and should be used in conjunction with it.

1 Installation

1.1 Safety Notes

For your personal safety and to prevent equipment damage, please carefully read the instructions in this manual and pay particular attention to the warnings and cautionary notes:



There is a potential risk of injury or death from **Electric Shock** and/or **ARC Flash Hazard** due to inadvertent contact or shorts when working on or around **live electrical systems**.

Ensure that power is proven disconnected prior to any work on the electrical system.



This equipment is designed for permanent installation to monitor electrical circuits up to 600VAC CAT III. Ensure that the specific model being installed is **rated for the system voltage** and the appropriate for the environmental category.



The devices described herein are intended to be used with **defined current sensors** of particular types which are model specific. Ensure that the appropriate current sensor is employed and note that 5 Amp output CTs are only used with integrated CT models (-10A, -40A or -120A).



The equipment is to be **installed in accordance** with the prevailing local and national electric codes such as **National Electric Code** (NEC, USA) or **Canadian Electric Code** (CEC, Canada), which governs the requirements for electrical wiring and protection and includes the requirement for **overcurrent protection** for all wiring.

1.2 Additional Hardware

The following additional hardware may be required to complete installation:

- Branch circuit protection for the voltage sense lines is required by National Electric codes, rated 15 Amps or less with a KAIC rating to match bus short circuit rating.
- CTs for sensing bus currents matching the *Cyberhawk-EX* model requirements
- CT Interface shorting Terminal Blocks if specified
- Thermistors for Temperature sensing if specified

Note that Powersmiths can provide both the above listed hardware and installation guidance as may be required by the installing contractor

1.3 Installation Considerations

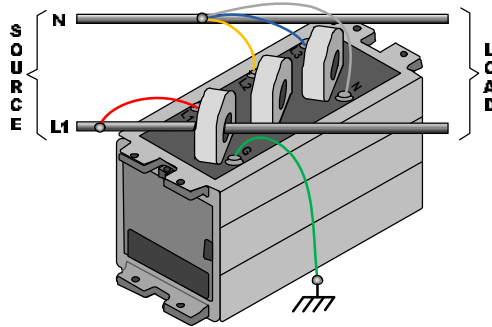
The following should also be considered prior to installation to ensure a trouble free installation:

- A wiring diagram should be available for connection of the meter to the system that matches the following connection diagrams
- Branch circuit protection is required as shown per national electric codes if the source breaker is rated greater than 15 Amps
Note that one device can supply a cluster of up to 12 meters fed by the same bus
- The input protection device must be marked as the disconnection device for the meter and it is further recommended that both be situated in close proximity to the meter
- Accessibility considerations regarding the physical location of the meters
- CT Types must match the Meter input requirements which are model specific
- Positioning of the CTs on the conductors
Note: The CTs should be cable tied to the power conductors and the output leads secured away from un-insulated buses
- Relative phasing of the voltage sense and CT phase are vital for a successful installation as is the CT direction
- Reference ancillary connection diagrams as required by the system
- Communication connections between meters and the building systems

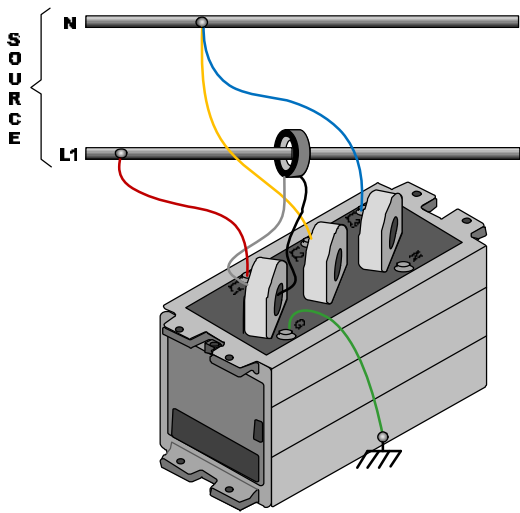
1.3.1 System Wiring Configurations

Refer to the following diagrams for wiring it in relation to the specific system configuration. Note that these diagrams are simplified illustrations for clarity; refer to the typical wiring diagram for more details.

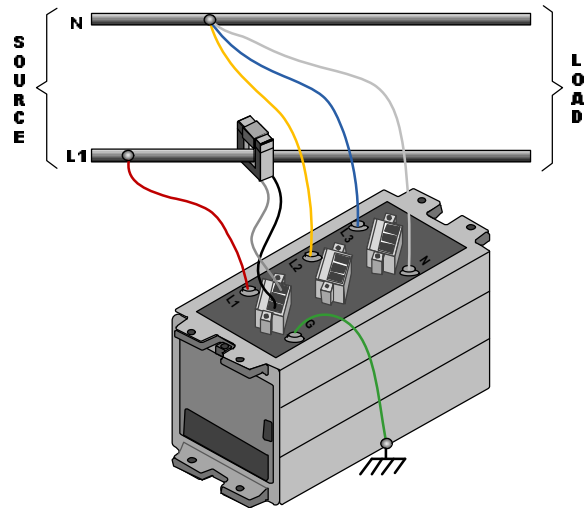
1.3.2 Wiring Single Phase (2-wire + ground) Systems



Measuring Current directly with 40 Amp and 120 Amp Models

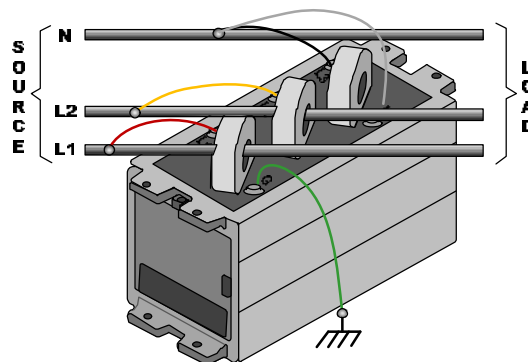


5A CTs with 10 Amp model

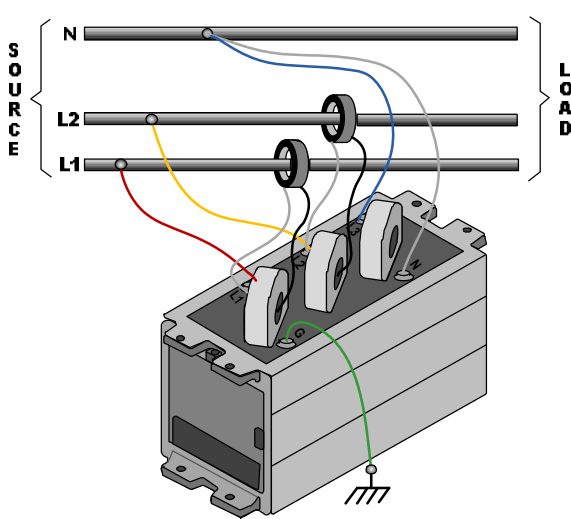


333mV CTs with 333mV model

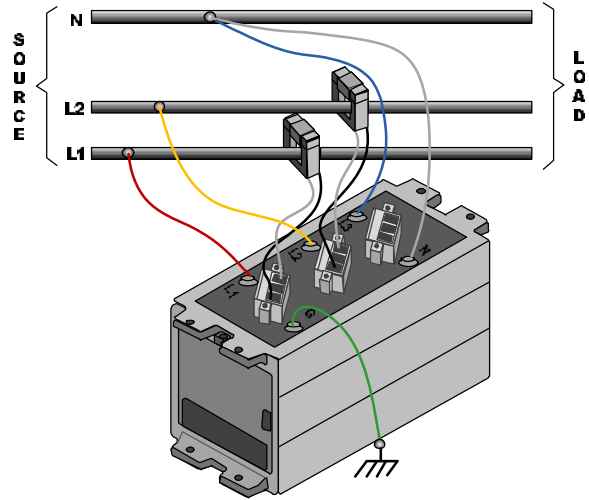
1.3.3 Wiring Split-Phase (3-wire + ground) or 2 x Single Phase



Measuring Current directly with 40 Amp and 120 Amp Models

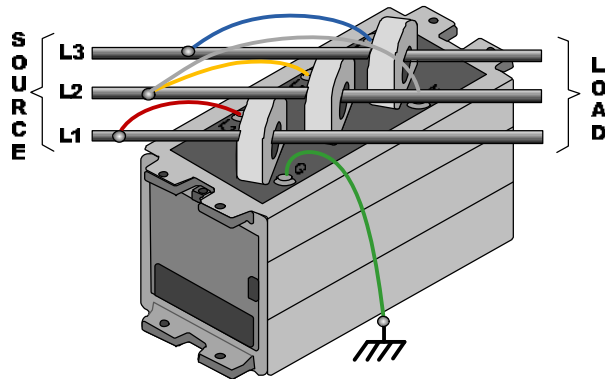


5A CTs with 10 Amp model

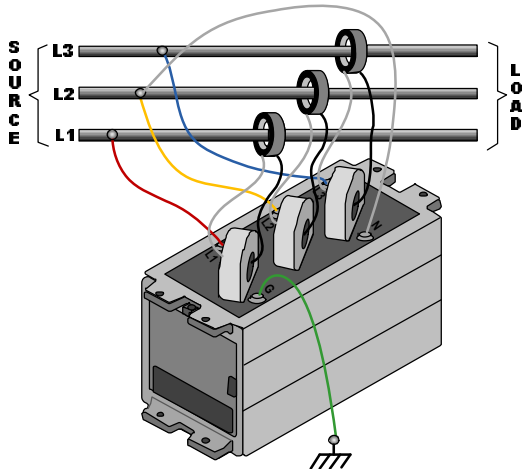


333mV CTs with 333V model

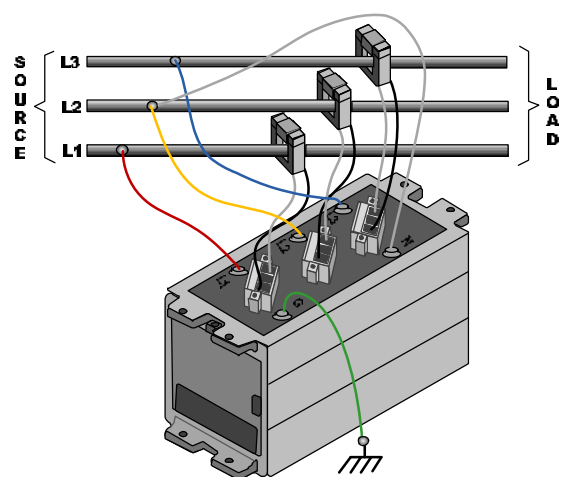
1.3.4 Wiring Three phase (3-wire + ground) Systems



Measuring Current directly with 40 Amp and 120 Amp Models

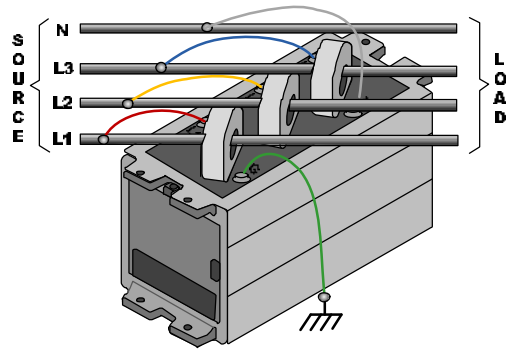


5A CTs with 10 Amp model

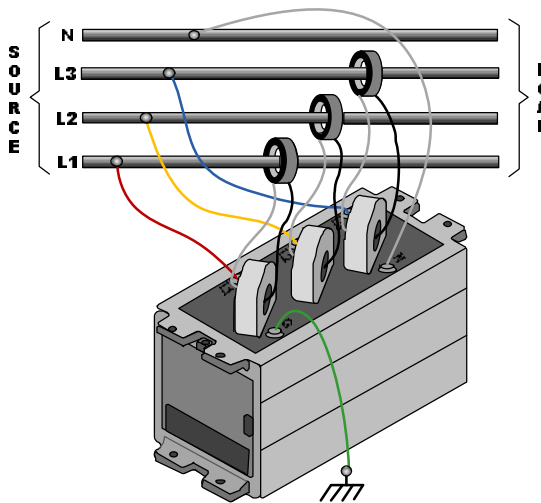


333mV CTs with 333V model

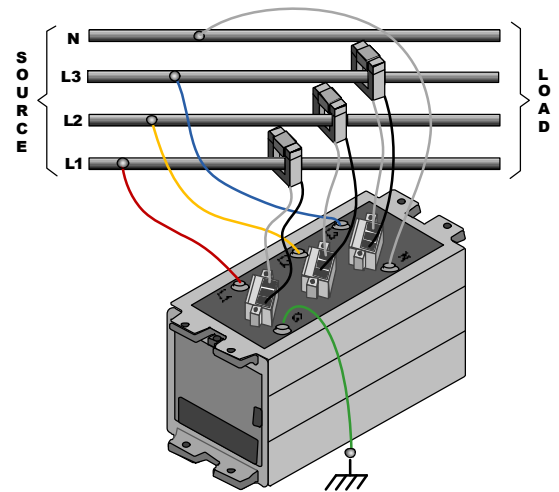
1.3.5 Three phase (4-wire + ground) and High-leg Systems



Measuring Current directly with 40 Amp and 120 Amp Models



5A CTs with 10 Amp model



333mV CTs with 333V model

1.4 Physical Installation and Mounting

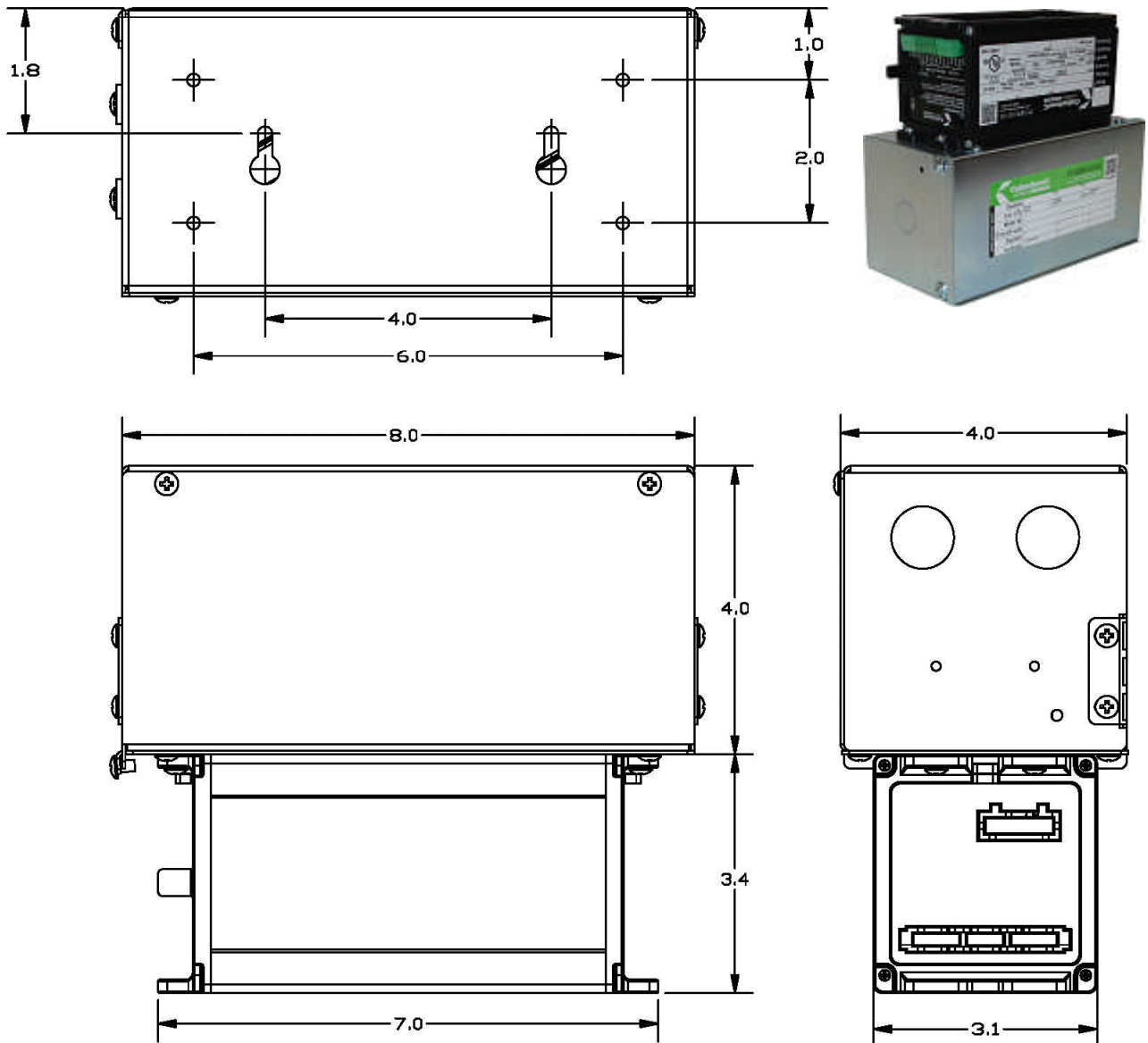
Mount unit with reference to the specific *Cyberhawk Express* model under the appropriate sub-heading. Additional considerations in mounting are:

- Location and accessibility
- Proximity to the power circuit to be monitored
- Meter overprotection and disconnect device to be in sight of the meter
- Environmental rating of the unit relative to location

1.4.1 *Cyberhawk-EX1* Installation

The *Cyberhawk-EX1* is an open type transducer with a conduit connection box for the voltage and current connections. It may be mounted in any orientation or flat against a bus duct.

Note: The auxiliary connections (if any) including communication connections to this device will be open and the installation location must be able to satisfy this limitation.

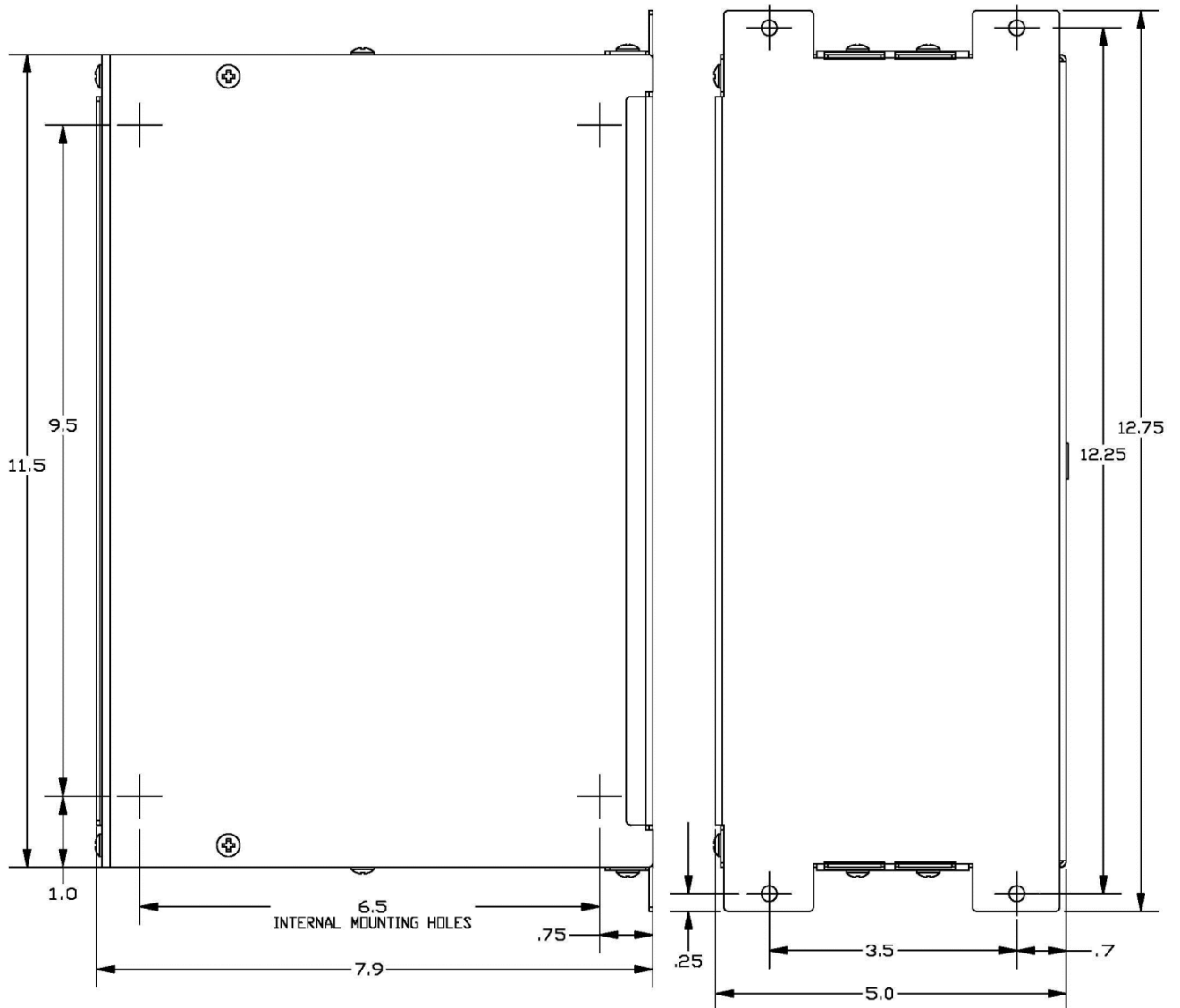


Cyberhawk-EX1 Outline with mounting dimensions

Note: Unit may be mounted in any orientation (Horizontal or horizontal)

1.4.2 Cyberhawk-EX2 Installation

The *Cyberhawk-EX2* is fully enclosed with direct external USB and Ethernet (-EM & -EB options) jacks for installation in a Type 1 environment. All connections to the unit can be conduit connected with a separate compartment for the voltage and current connections and the ancillary connections.

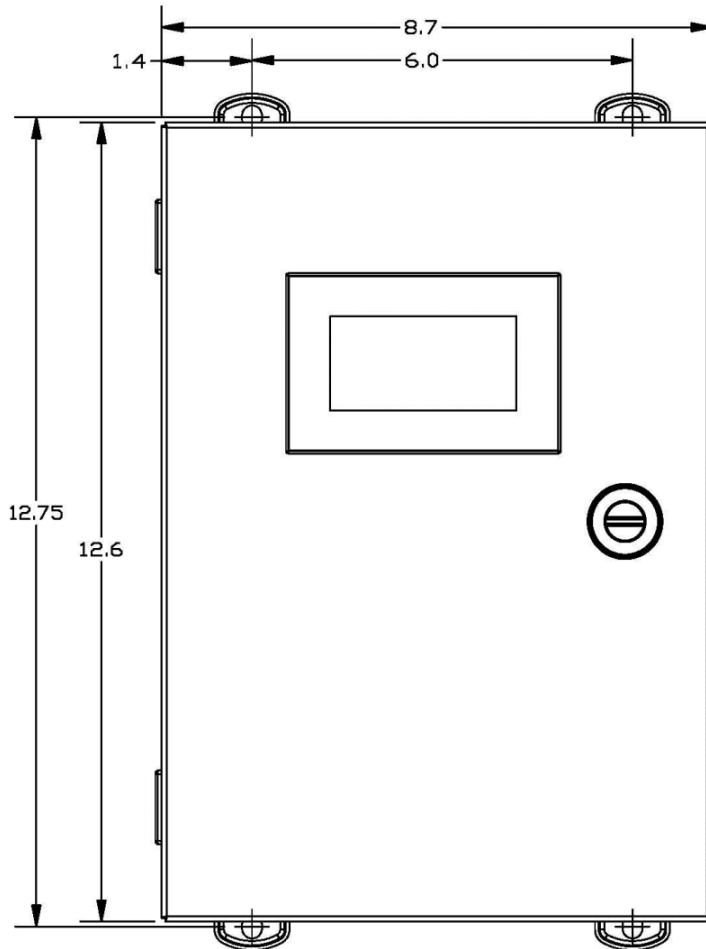


Cyberhawk-EX2 Outline with mounting dimensions

Note: Unit may be mounted in any orientation (Horizontal or horizontal)

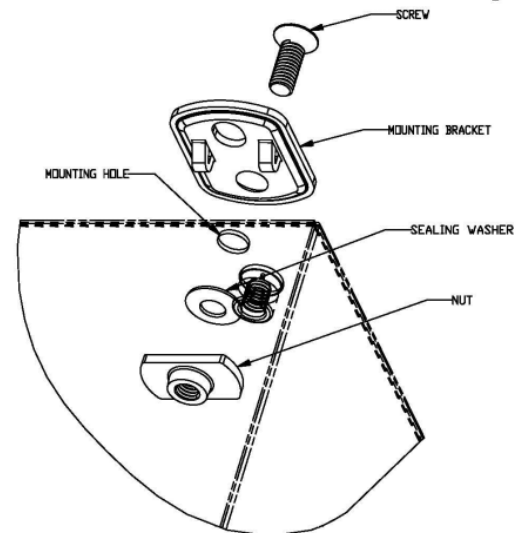
1.4.3 Cyberhawk-EX3 Installation

The Cyberhawk-EX3 is packaged for Type 3R or 4 environments (Type 2 environment with optional Display). Separate compartments are provided for the voltage and current connections and the auxiliary connections. The unit is also available with an optional internal Ethernet connectivity.



Cyberhawk-EX3 Outline with mounting dimensions

Note: The conduit fittings must be suitably rated for the environment to maintain the environmental ratings,. Failure to use the appropriate conduit could impair the degree of equipment protection.



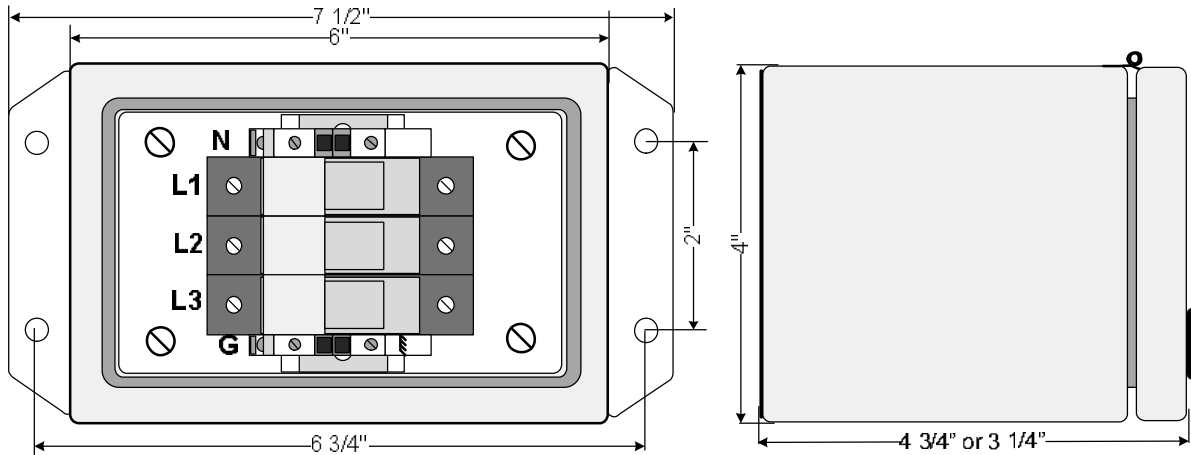
Wall Mounting Bracket Assembly

1.4.4 Cyberhawk Express Voltage Interface Installation

Table of Cyberhawk Express Voltage Terminal Characteristics

Terminal	Description
Lines (L1, L2, L3)	Wire range #8 to #14; Torque 14-15 inch/lbs
Neutral (N)	Wire Range #8 to #14; Torque 7 - 9 inch/lbs
Ground (G)	Wire Range #16 to # 10; Torque 6-7 inch/lbs max.

Note: It may be helpful to temporarily remove the inner assembly prior to attaching conduit connections.



Note: Height is 4 3/4" maximum but may be 1/2" less depending on enclosure supplied

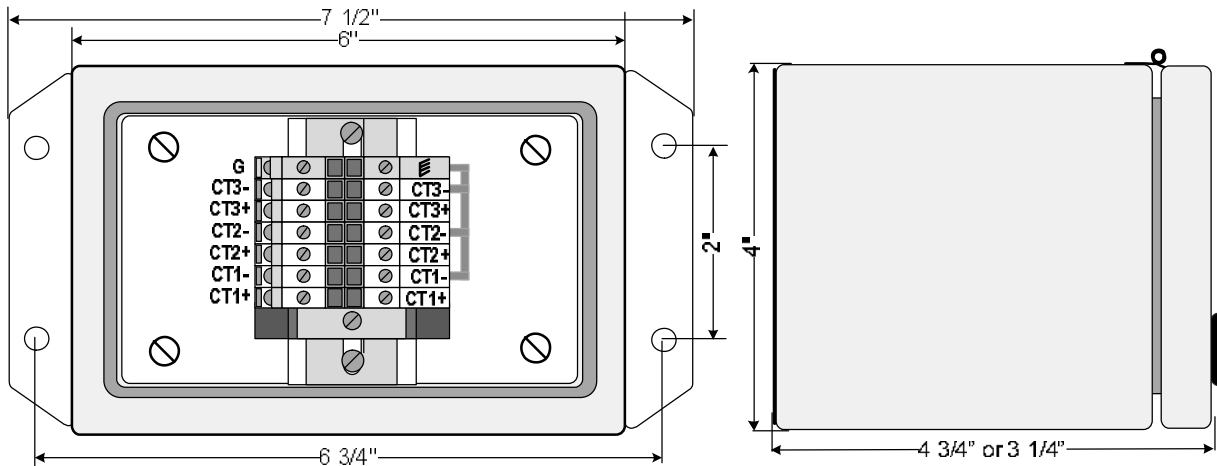
Cyberhawk Express Voltage Interface Outline



Note: The switch or circuit breaker must be marked as the disconnecting device for the power meter which should be mounted in an accessible location preferably close to the power meters it supplies

1.4.5 Cyberhawk Express CT Interface Installation

Wire range is #10 to #18 and Torques: 6 - 7 inch/lbs



Note: Height is 4 3/4" maximum but may be 3 1/4" depending on enclosure supplied

Note: It may be helpful to temporarily remove the inner assembly prior to attaching conduit connections.

1.5 Voltage Connections



FOR YOUR SAFETY, IT IS IMPERATIVE THAT THE POWER BE PROVEN DISCONNECTED BEFORE ANY WORK ON OR PHYSICAL CONTACT TO ELECTRICAL CIRCUITS IS ATTEMPTED: DO NOT ASSUME BUT CHECK ACROSS THE LINES AND TO GROUND WITH AN APPROVED VOLTAGE INDICATING DEVICE AND ENSURE THAT THE POWER SOURCE(S) DISCONNECTION DEVICES ARE LOCKED OUT.

The meter uses color coded wire lead outs that are terminated using standard wire nuts. For easy identification the leads are colored as follows:

- **Line 1 (L1): Red**
- **Line 2 (L2): Yellow**
- **Line 2 (L3): Blue**
- **Neutral (N): White**
- **Ground (G): Green**



Voltage connections require Branch Circuit Protection rated 15 Amps with 14 AWG min., 600 V wiring. The overcurrent protection device must be 3-pole handle tied for 3-phase, 2-pole handle tied for split-phase or 1-pole for single-phase.

1.5.1 Wiring Color Conventions

The following table lists the color code used in the *Cyberhawk-EX* family for phase identification and provides a guide to the color codes used in various countries. However note that this table is only a guide and the installer must check each installation carefully to avoid errors, though an incorrect phase connection will not damage the power meter.

Table 1-1: Cyberhawk-EX Color codes and International Color Code Guide

Conductors		1 Φ 120V 120/240V	3 Φ 120/208V		3 Φ 277/480V 347/600V		1 Φ 230V 240V	3 Φ 230/400 240/415	Cyberhawk Express Color Codes
Name	Labels	US & CA	US	CA	US	CA	EU		
Phase A	L1	Red or Black	Black	Red	Brown	Red	Brown	Brown	Red
Phase B	L2	Black or Red	Red	Black	Orange	Black		Black	Yellow
Phase C	L3		Blue	Blue	Yellow	Blue		Grey	Blue
Neutral	N	White	White		Grey	White	Blue		White
Ground	G, GND PG, PE	Bare, green or green-yellow					green-yellow		green

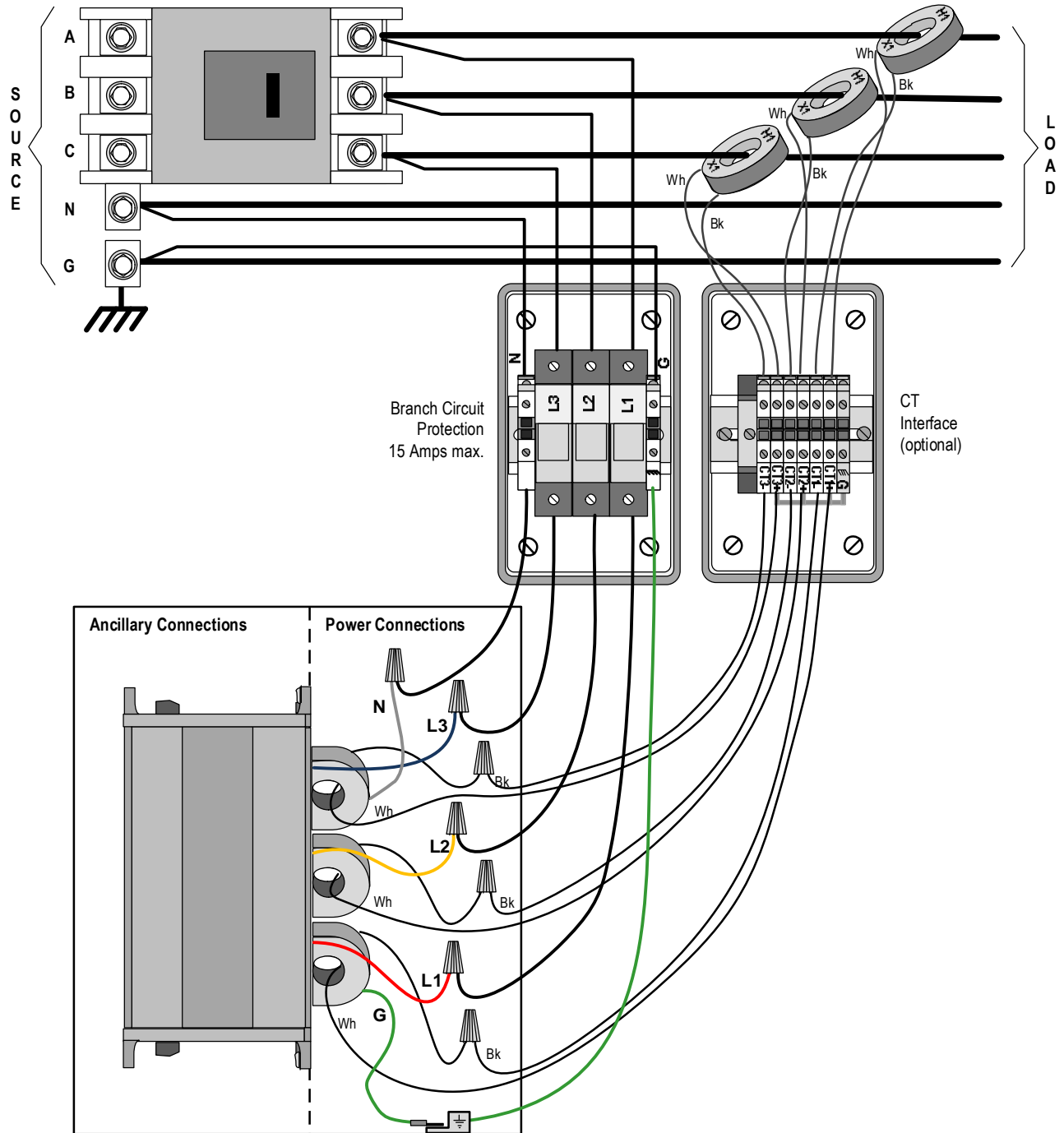
Note: This information is provided as a guide only and is neither definitive nor complete; the installer must check installation for compliance with prevailing local electric codes and practices

1.5.2 Wiring the Voltage Sense Leads



To reduce risk of electric shock, always open or disconnect the circuit from power-distribution system (or service) of building prior to any installation or service

Connect the voltage leads to system in series with the required overcurrent protection (Fuse or Breaker) rated 15 Amps or less or with the Powersmiths *Cyberhawk Express Voltage Interface* unit as illustrated in the following:



Typical system wiring connection

Note: It is very important to observe wiring polarity with regard to voltage phase and CT polarity.

1.6 CT Installation



To reduce risk of electric shock, always open or disconnect power circuit from power distribution system (or service of building) before installing or servicing current transformers.



Never leave the secondary leads of a 5 Amp output CT in a live circuit open-circuited as dangerous voltages may be produced and/or it may be damaged. The use of a shunting terminal block is recommended for 5 Amp CTs to facilitate service.

1.6.1 General CT Installation Considerations

CTs may be installed into an electrical system under the following conditions:

- CTs should be securely fastened such that they will not slide down to live terminals and the secondary wires are to be secured away from an live terminal or bus
- CT secondary splices are only permitted in a terminal box or auxiliary gutter and not within the enclosure where installed or in the conduit through which the secondary wires are run
- In accordance with NEC, installation of CTs installed in Panelboards or Gutters may not reduce the available space by more than 75% of its available volume.
- Observe polarity during installation and the CT must be sensing the same phase to which the voltage sensing leads are connected.

Note: A reversed CT may be electronically corrected at setup but not a cross wired phase

1.6.2 5A CT Wiring

The secondaries of the CTs are passed through the power meter integral CT and joined using an wire nut (suitable for size used) as illustrated in the figure below.

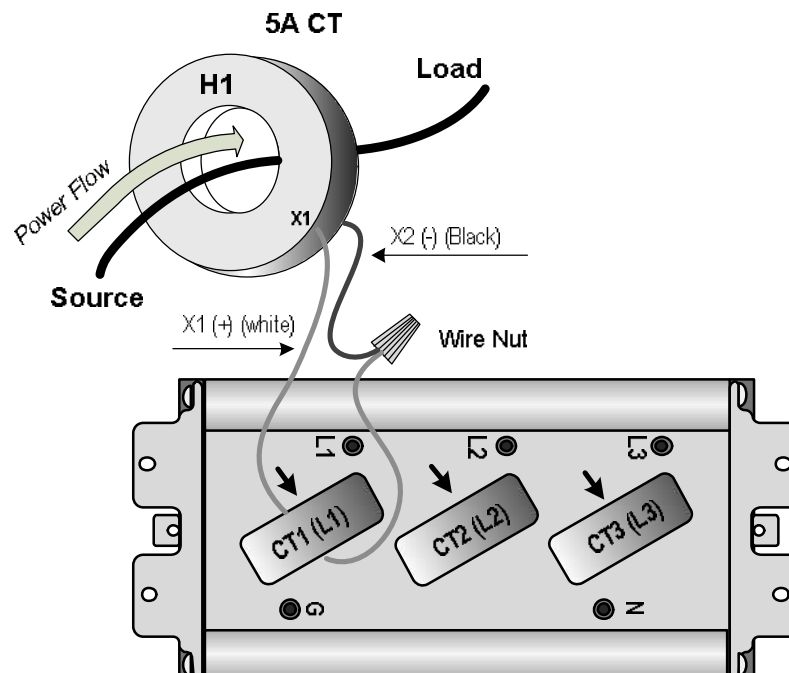


Figure 1-1: 5A CT connection to Cyberhawk-EXx-XXX -10A model

Note: Try to minimize the CT secondary lengths to within 50' for best accuracy otherwise see the note below on longer CT secondary runs.

Note: 1 Amp output CTs can be accommodated by passing the secondary wires through the Cyberhawk-EX CT window five (5) times.

Longer 5A CT Secondary Runs

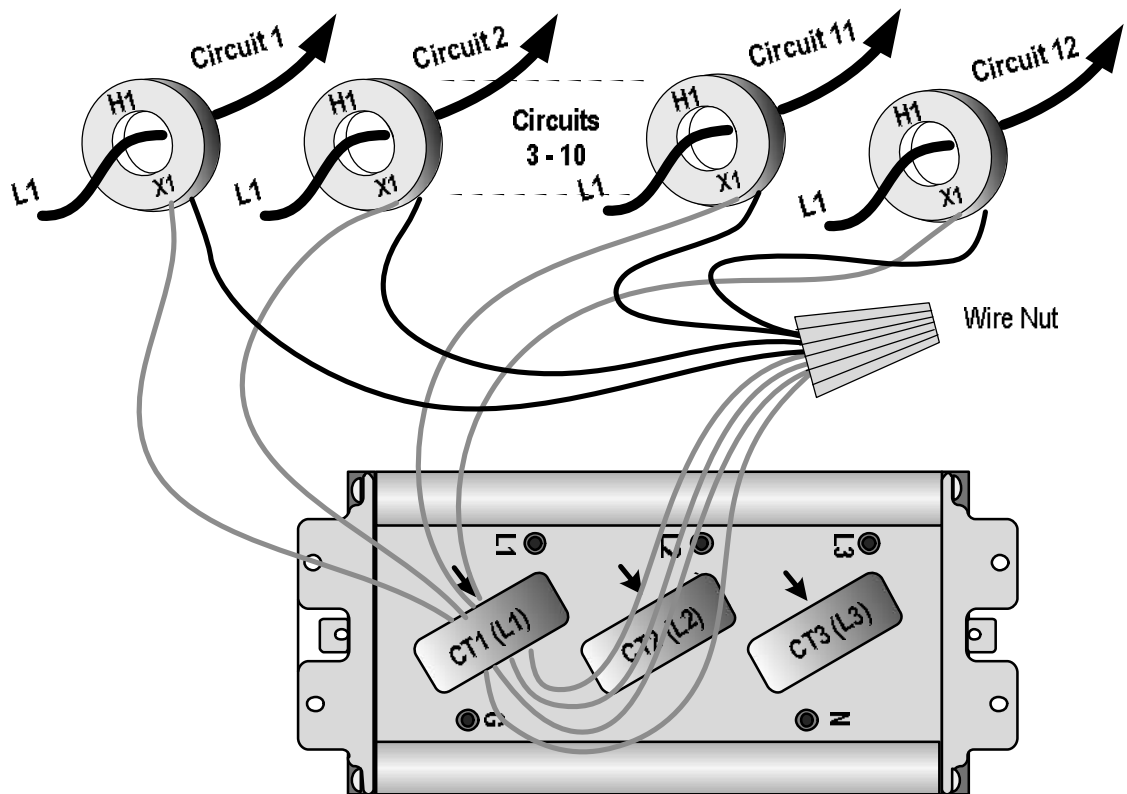
There is a limitation on the length of the secondary CT wiring based on the VA capability of the CT (i.e. Its ability to drive the VA developed on the wire). For runs longer than 50', calculate the resistance of the total wire run and multiply by 5² (25), then ensure that the selected CT can support the required VA. An alternative is to increase the gauge of the secondary wire run to reduce its resistance and hence the VA burden requirement.

1.6.3 Errorless Summation of Multiple Circuits

The *Cyberhawk Express -10A, -40A and -120A* models can be used for errorless summation of up to 12 multiple circuits on the same phase. This could be useful to use one meter to measure, for example, all lighting circuits and another meter for Plug loads. The recommended maximum circuits per meter are related to its CT current rating as follows:

- Model: -10A up to 2 circuits
- Model -40A up to 6 Circuits
- Model 120A up to 12 circuits

The wiring for summing the currents from a common phase is illustrated below and the other phases are similarly wired.



Summation of Currents on Multiple Circuits using 5 Amps CTs shown for one phase

Note: Summed currents work for same phase only

1.6.4 333mV CT Wiring

Connect the secondary wires to the pluggable plugs as shown in the diagram below. Torque CT terminal to 6-7 inch/lbs max.

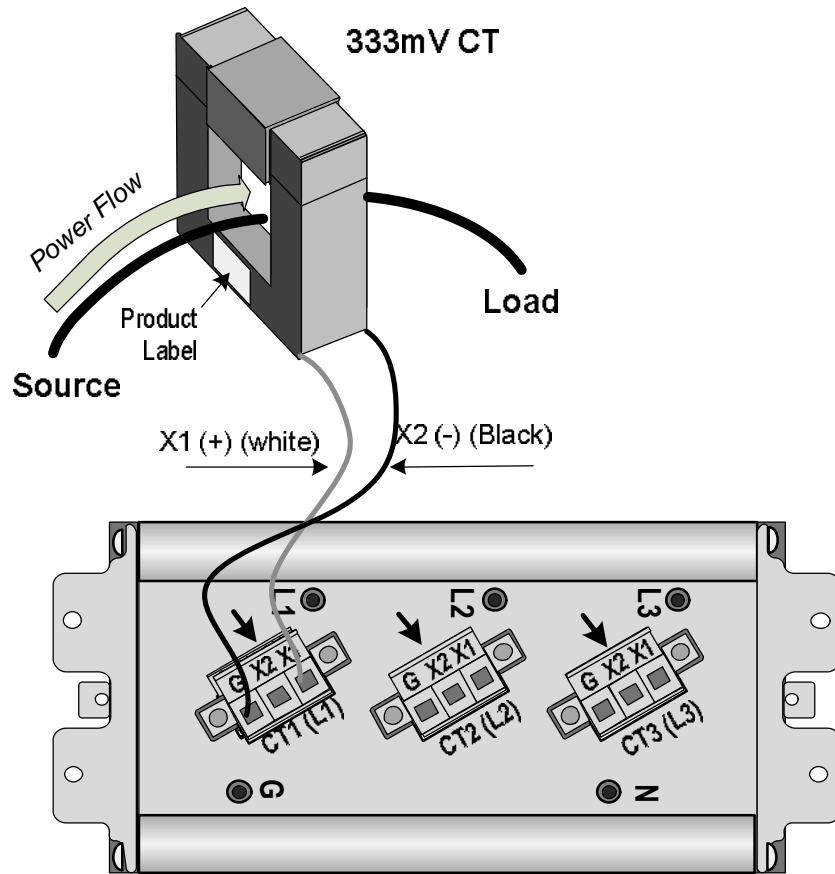


Figure 1-2: 333mV CT connection to Cyberhawk-EXx-XXX-333V

Note: Try to minimize the CT secondary lengths to within 50' for best accuracy.

Longer 333mV CT Secondary Runs

There is a limitation on the length of the secondary CT wiring because of the potential for induced noise in the high impedance circuit. For runs longer than 50', use a twisted pair per CT and run them together in a dedicated metal conduit separated at least 6" from any power wiring.

2 Communication Connections

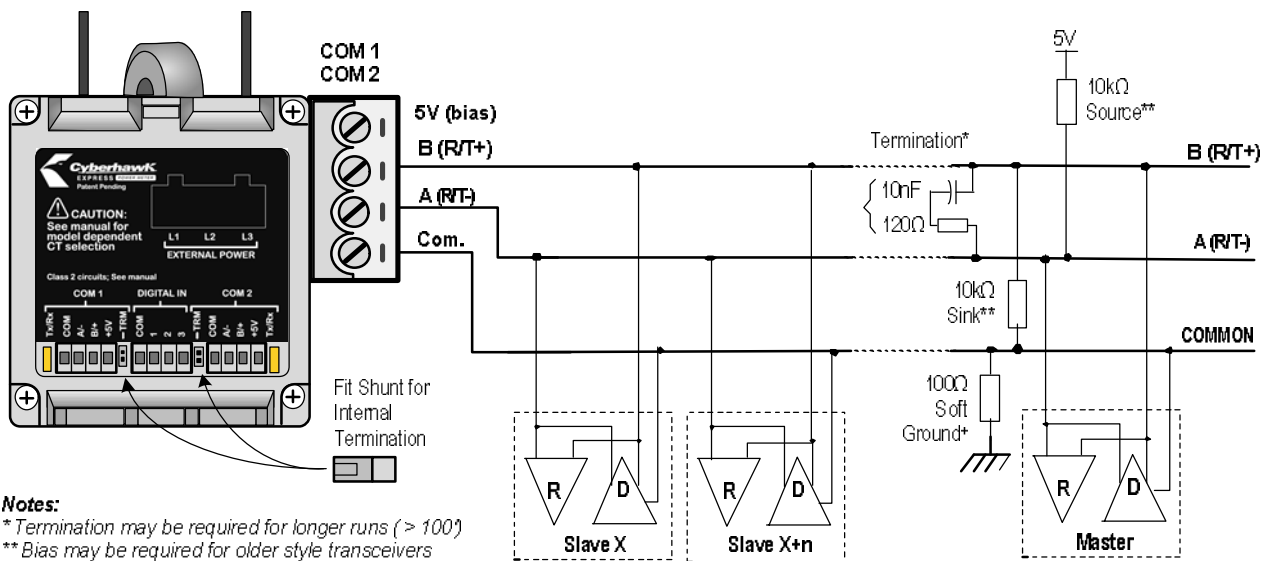
The *Cyberhawk Express* family of power meters is equipped with an integrated USB port and two (2) RS485 asynchronous ports supporting the Modbus RTU protocol. *Cyberhawk-EX2* and *-EX3* are available with Ethernet connectivity with WEB Server functionality and Modbus TCP plus optionally BAC/IP protocol.

Note that one Cyberhawk meter equipped with an Ethernet connection can support up to an additional 11 units (12 total) for a single point Ethernet connection; see Cyberhawk Express Clusters following.

2.1 RS485 Wiring

Wire the *Cyberhawk Express* RS485 terminals to the external RS485 Network by connecting the A (R/T-), B (R/T+) and Common (Com.) terminals. Terminate and ground as required per the Network configuration using the diagram provided below as a guide. Note that the maximum range of a RS485 network is typically 1,000 meters but baud rate may have to be reduced to $\leq 19,200$ baud.

2.1.1 Cyberhawk-EX1 RS485 Connection



Notes:

* Termination may be required for longer runs (> 100')

** Bias may be required for older style transceivers

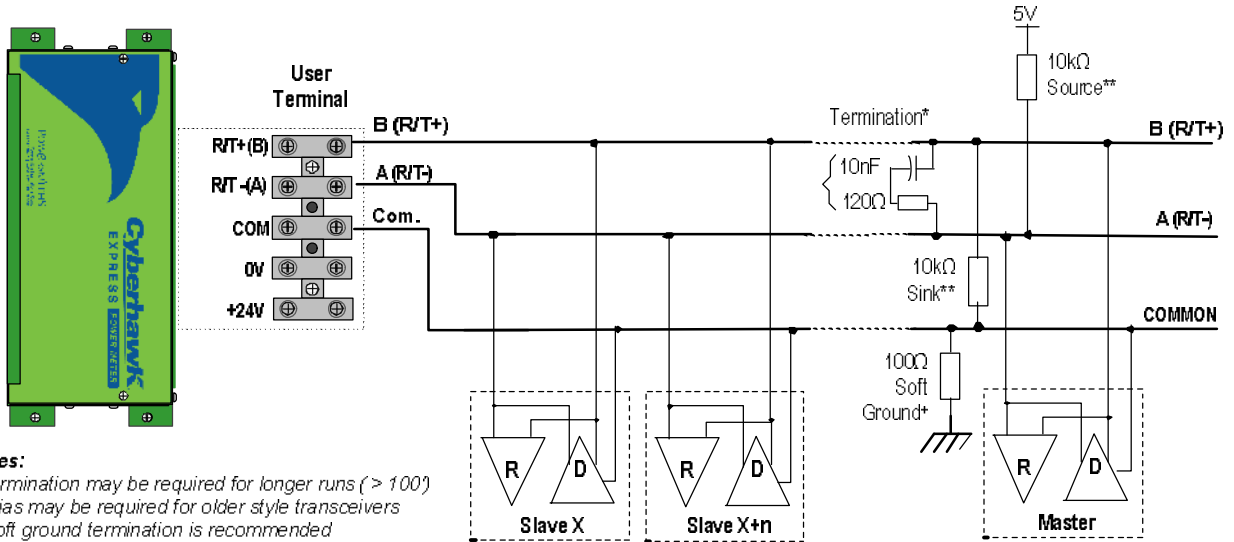
+ Soft ground termination is recommended

Typical RS485 Connection to Cyberhawk Express -EX1 models

Note: Termination of the RS485 network can be done on the Cyberhawk Express side by inserting shunt as shown for all models

2.1.2 Cyberhawk-EX2 and -EX3 RS485 Connection

Connection diagrams are illustrated following for the models: -EX2 and -EX3



Notes:
 * Termination may be required for longer runs (> 100)
 ** Bias may be required for older style transceivers
 + Soft ground termination is recommended

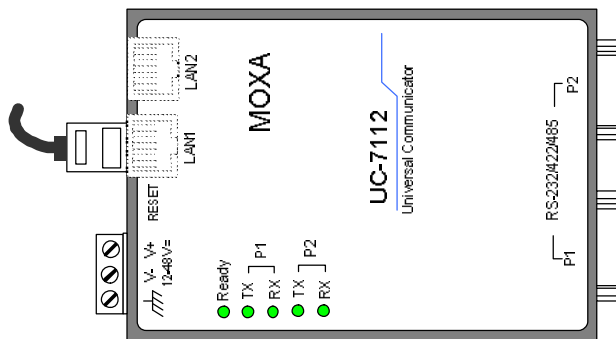
Typical RS485 Network connection to Cyberhawk-Express Models -EX2 and -EX3

2.2 Ethernet Connection

Cyberhawk Express models -EX2 or -EX3 may be optionally fitted with an Ethernet Port for Gateway and WEB Server capability. Connect the RJ45 terminated Ethernet cable internally to LAN 1 of the Ethernet WEB Server (MOXA UC-7112) shown in the table above. The network connection can be made externally on the Cyberhawk-EX2 model using the panel mount Ethernet Jack accessory (see accessories)

Note that when the Ethernet option is fitted, COM 1 is used for communication with the Ethernet device but COM 2 is still available for serial communication.

Ethernet WEB Server Connection



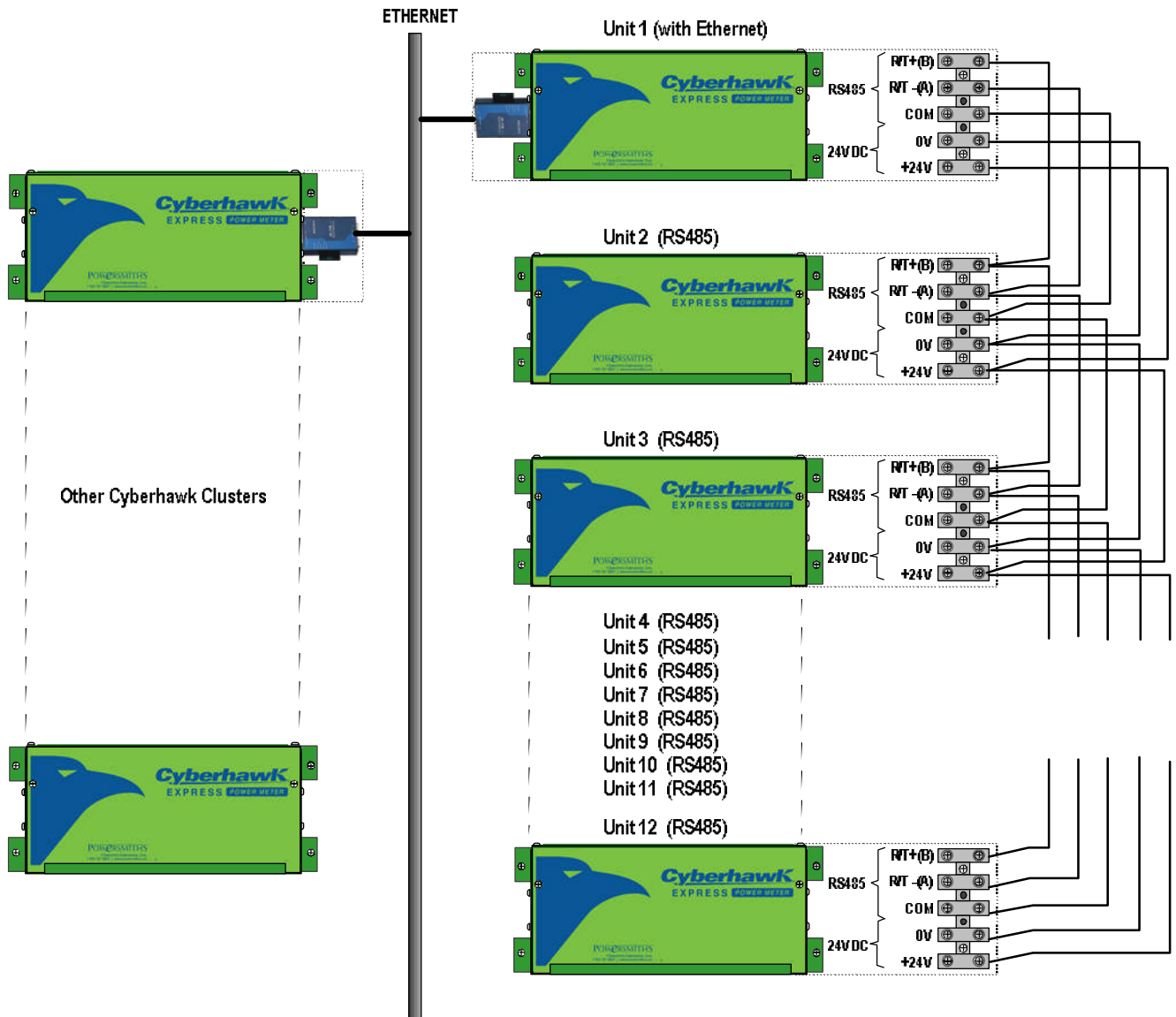
To mount the Ethernet Jack for external Ethernet pluggable capability, remove the knock out on the side of the unit and screw the panel mount jack in place using the hardware provided. Plug the RJ45 plug into LAN 1 of the Ethernet WEB Server.



Note: Prior to connection to the Intranet, it may be advisable to check with the local IT administrator for pre-assignment of Network IP addresses; to this end a crossover cable may be used with a local PC for local setup and is covered in the Manual in the section on communication setup.

2.2.1 Cyberhawk Express Cluster Wiring

A cluster of up to 12 Cyberhawk Express power meters can be RS485 connected together in a daisy chain to share a common Ethernet port equipped Cyberhawk Express (-EM or -EB option). This configuration is referred to as a Cyberhawk Express Cluster with the wiring is illustrated below.



Cyberhawk Express Cluster for sharing the Ethernet Equipped Port of one unit

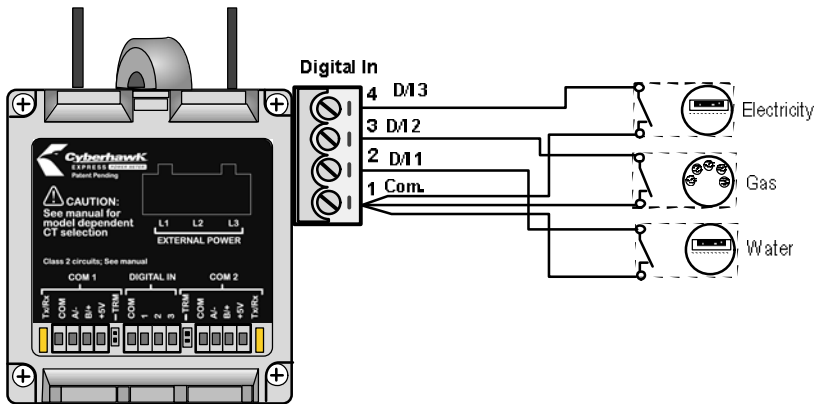
Note: 24VDC power is routed to all units in parallel so that any powered Cyberhawk Express can power the network device at unit 1.

3 Ancillary Connections

The following diagrams illustrate typical ancillary connections and reference both the terminal name and a reference number with Pin 1 always to the left of each connector.

3.1 Digital Inputs

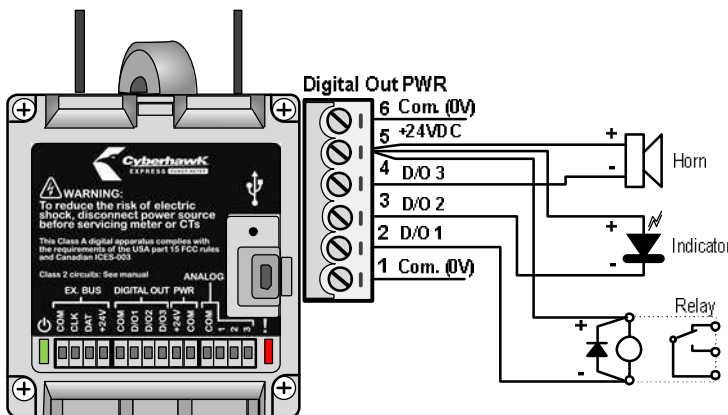
Connect the dry contacts to be monitored to the appropriate digital input (at 2, 3 or 4) with the common return at 1 as shown.



Typical Pulse Counting application

3.2 Digital Outputs and 24 VDC Power Output

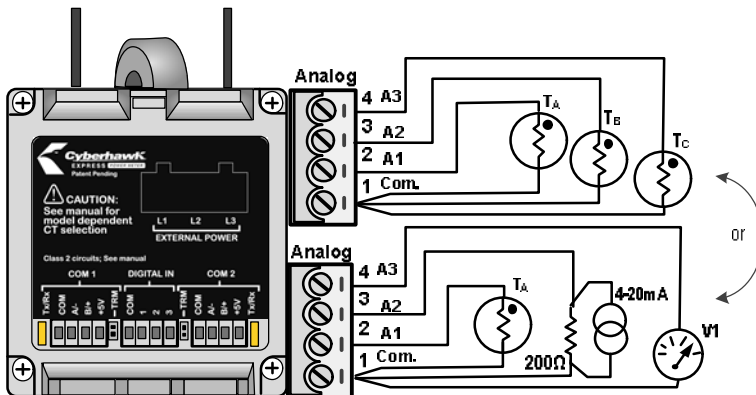
Connect the digital outputs (at 2, 3 or 4) to the appropriate output device with the common return at 1



Typical Digital Output Applications and 24 VDC Power

3.3 Analog Inputs

The diagrams below illustrate typical analog connections. Note that *Cyberhawk-EX2* is equipped with an integrated temperature sensor for ambient measurement.



Analog Inputs used for temperature sensing or other analog variables