Reliable Power Meters

InSite Power Recorder Installation Guide

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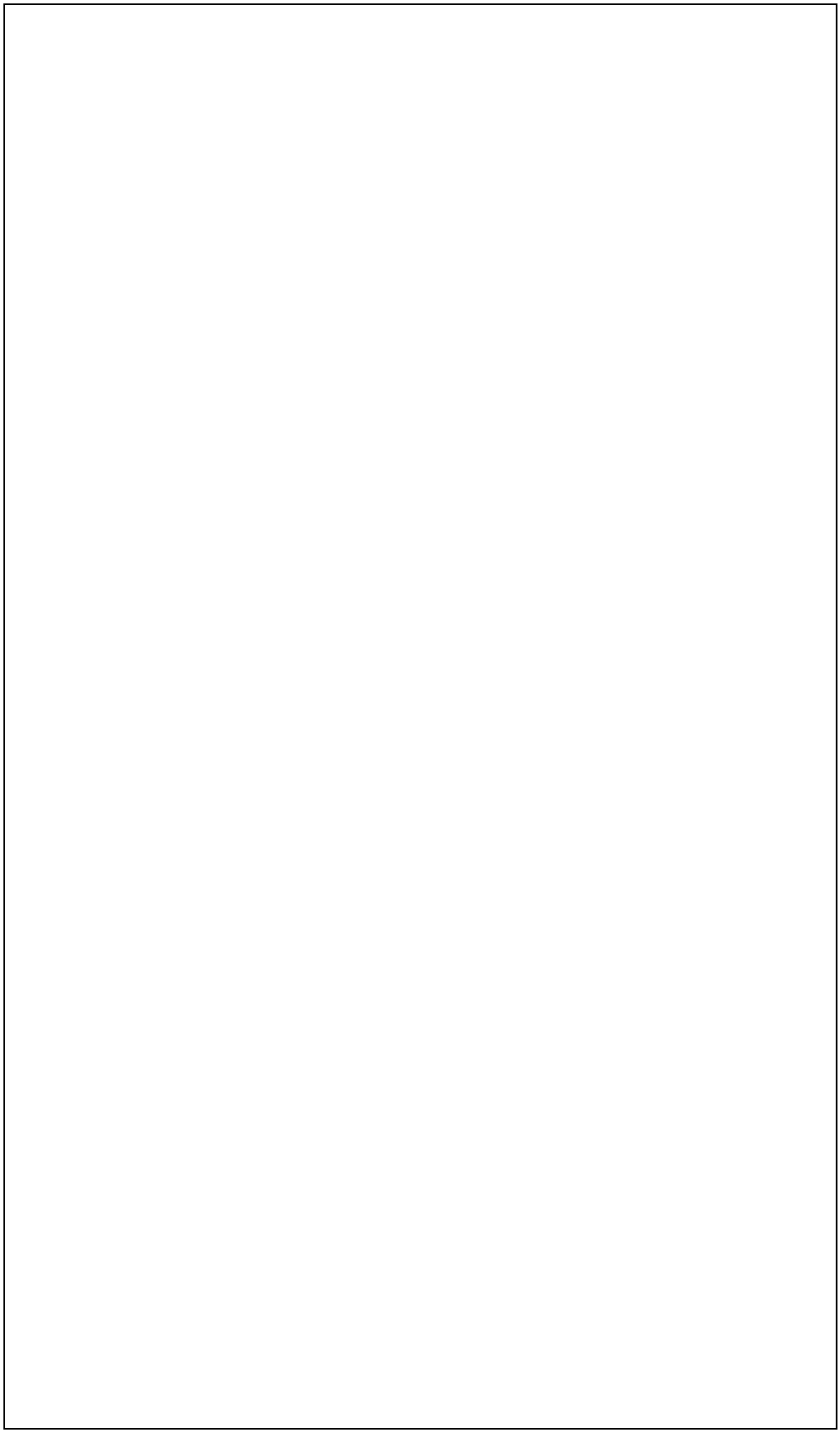

WARNING	The InSite Power Recorder is for use by qualified personnel only. **Do not install the InSite on a power line unless you are qualified to do so.** High voltages that can cause burns and lethal shocks are present during power monitoring. **To assure operator safety:** When making connections to power lines, always start by connecting the safety earth ground. Use standard high-voltage, high-current safety precautions. Workers who open energized power panels are required to abide by the instructions of ANSI/NFPA 70E-1988 [B2] concerning appropriate protective equipment, as well as government regulations codified in ASHA CFR 1910 [B3] and 1926 [B4], and in ANSI C2-1990 [B1].

CAUTION	Communications and digital data connections to the InSite Power Recorder must be made with shielded computer data cables and compatible components must be used.

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Technical Support

Reliable Power Meters is ready to assist you. For technical support or sales, contact Reliable Power Meters at:

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Web site	http://www.reliablemeters.com

Table of Contents

Preface

This guide describes the InSite Power Recorder and tells you how to install it and connect it to power.

After installation, you will need to connect it to a computer running the Scenario or Power Recorder System Software and then configure the InSite unit. Configuration tells the InSite unit the specific type of power to be monitored at the installation location, sets the initial monitoring intervals, and specifies other settings. For details about configuring the InSite Power Recorder, see the *Power Recorder System User Guide* or the *Scenario User Guide*.

Warning Symbols on the InSite Power Recorder

Two warning symbols appear on the InSite Power Recorder.

When you see this symbol	It means
	**There is a risk of electric shock.** This symbol appears adjacent to the voltage and current measuring terminals and the instrument power terminals.
	**Attention—consult accompanying documents** (this *InSite Power Recorder Installation Guide*) for information. This symbol appears adjacent: Instrument power terminals (pages 10 - 11) Voltage measuring terminals (pages 12 - 13) Current measuring terminals (pages 14 - 15) Communication ports (page 16)

Introducing the InSite Power Recorder

The InSite Power Recorder is a power monitor for permanent installations that allows for continuous monitoring of three phase or single-phase voltages and currents in a non-hostile environment.

Lethal voltages are present. In order to ensure safety, the InSite Power Recorder must be installed in a protective enclosure that limits access to the electrical connections of the device and requires a tool or key for such access. InSite Power Recorders are not weatherproof. If you need a weatherproof unit, contact Reliable Power Meters about obtaining a Power Recorder with a Hostile Environment Enclosure.

Features include[1]

- Small (10.3" x8.7") rugged die-cast metal enclosure, weighing only 7.5 pounds.
- Full-disclosure technology, providing complete information on power quality events such as sags, swells, transients, and interruptions.
- Measurement of harmonics to the 63rd harmonic on all four voltage and all five current channels.
- Recording of power consumption parameters such as Watts, VA, VAR, PF, demand and KWh.
- Sampling frequency of 128 samples per cycle minimum(6400 samples/sec @ 50 Hz, - 7680 samples/sec @60 Hz, each channel)
- Twenty-bit analog-to-digital converters and solid-state memory.

[1] For complete details about the InSite Power Recorder, see the specifications in Appendix A.

- Terminal strips for voltage and current connections.
- Built-in current transformers for monitoring low amperage metering circuits found in substations and switch-gear.

Communications

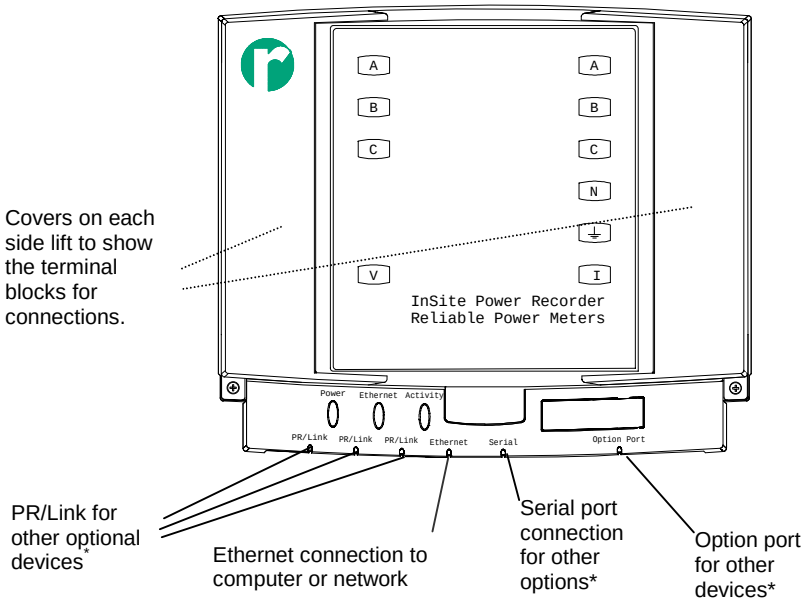
The InSite Power Recorder Includes an Ethernet RJ45 port and can be easily configured for TCP/IP communications. One InSite can be networked to others by Ethernet, Intranets or the Internet. A user can also connect to InSite units by dial-up phone lines using the communications software built into Microsoft Windows. Many communication options are available. If you need assistance, contact Technical Support at Reliable Power Meters.

Future Expansion:

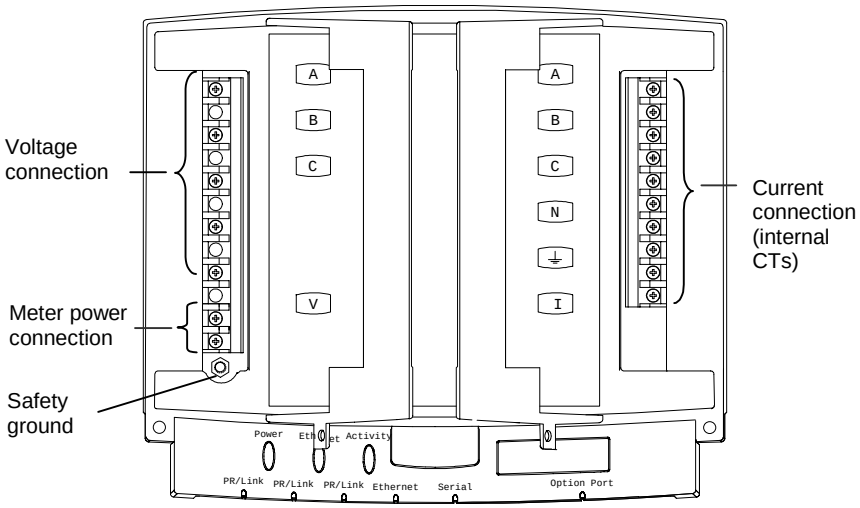
The InSite provides two paths for future expansion and enhanced capabilities:

- The PR/Link port is a high-speed communications link that offers communications to other InSite Power Recorders at speeds of 400 megabits/sec.
- The Option port is available for future modules that RPM has in development.

InSite Power Recorder Front View, Covers Closed

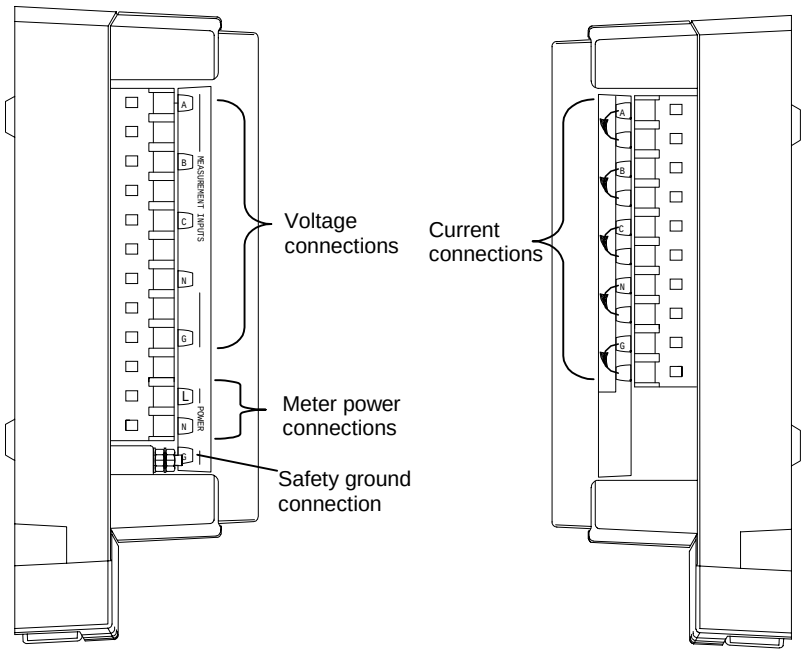


InSite Power Recorder Front View, Covers Open



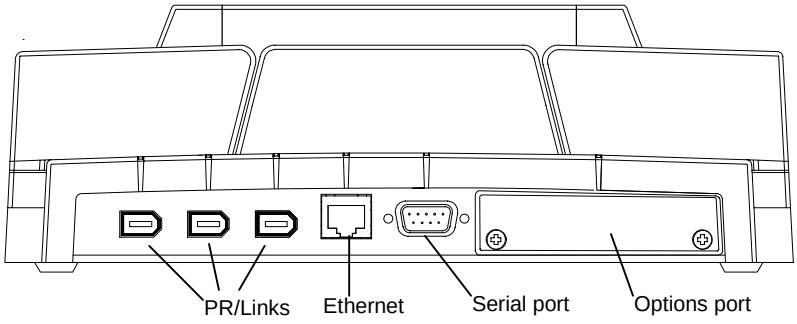
* These ports are for other options, available from Reliable Power Meters. Refer to the manual for your specific option for information on its use.

InSite Power Recorder Side Views



Left Side

Right Side



Bottom of Unit

Before You Install

Installation Considerations

Before installing your InSite Power Recorder, be sure to consider the following:

1. **Location:** The InSite Power Recorder must be installed according to applicable electrical codes. When choosing an installation location, keep in mind that you may need to supply a suitable enclosure, conduit, and other materials.
2. **Instrument Power:** The InSite Power Recorder requires single-phase instrument power in addition to the measurement connections.
3. **Location Accessibility:** Make sure that you locate the recorder where connections can be safely made.
4. **Power Type:** You will need to know the power type in order to make proper connections.
5. **Communications Availability:** The InSite Power Recorder requires an Ethernet connection.

Tools and Supplies Provided

- InSite Power Recorder
- Installation Template
- This booklet (*InSite Power Recorder Installation Guide*)

Additional Tools and Supplies Needed

- Mounting hardware [4 #10 (M6) screws, minimum]
- Screwdriver
- Category 5 Ethernet cable (or a crossover cable, if connecting directly to a PC)
- Suitable wire for connecting to instrument power, voltage, and current, according to applicable electrical codes
- Safety gear
- Tamper seals, if required

Installing the InSite Power Recorder

Overview of the Installation Process

To install the InSite Power Recorder, follow the process described below. Each of the steps in this process is described in detail on the next pages.

1. **De-energize relevant power -** Make sure that all equipment, wiring, and connections are de-energized. (See page 8.)
2. **Mount the InSite Power Recorder** - Put the InSite Power Recorder in place, mounting it to a panel adequate to support its weight. (See page 8.)
3. **Connect the Safety ground.** (See page 9.)
4. **Connect instrument power** - Connect the InSite Unit to the meter power source. (See page 10.)
5. **Connect monitored voltage(s) -** Connect the InSite Unit to the voltage to be monitored. (See page 2.) You'll find diagrams of the wiring for various power configurations in Appendix B.
6. **Connect monitored current(s)** - Connect the InSite Unit to the current to be monitored. (See page 14.)
7. **Connect the Ethernet communications** -Connect the InSite Unit to Ethernet. (See page 16.)
8. **Check the connections**. (See pages 17.)
9. **Restore power**. (See page 18.)
10. **Finish up.** (See page 19.)

Note: Mounting hardware and connection wires are not included.

BEFORE YOU CAN USE AN INSTALLED INSITE POWER RECORDER	In addition to being physically installed at a facility, the InSite Power Recorder also needs to be ***configured*** to measure and store data about a particular site and location. For more information, see "Configuring the Power Recorder" in the *Power Recorder System User Guide* or in the *Scenario User Guide*.

De-energizing Relevant Power

▶ **Safety First:** Make sure that all equipment, wiring, and connections are de-energized.

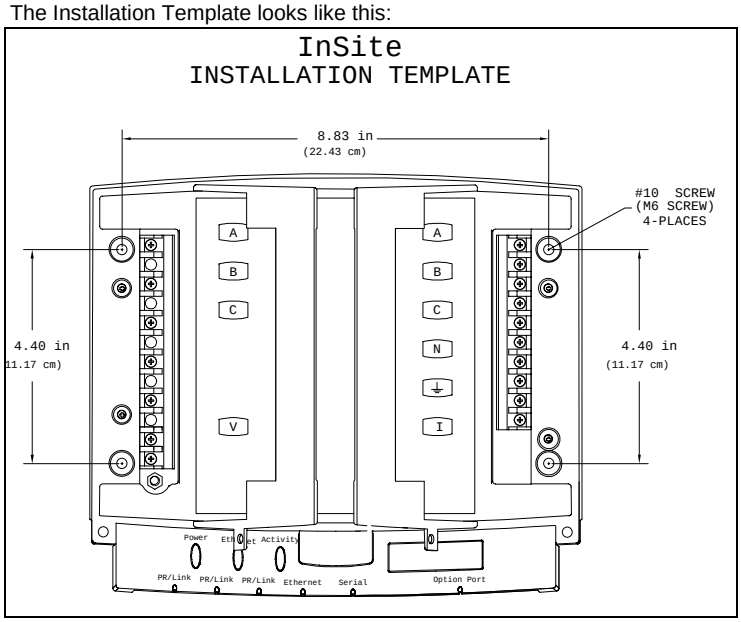
> **Warning:** Before connecting the InSite Power Recorder to AC power, potential transformers, or current transformers, be sure these circuits are de-energized.

Mounting the InSite Power Recorder in Place

The InSite Power Recorder must be mounted to a support panel adequate to support its weight (7.5 pounds / 3.4 kg).

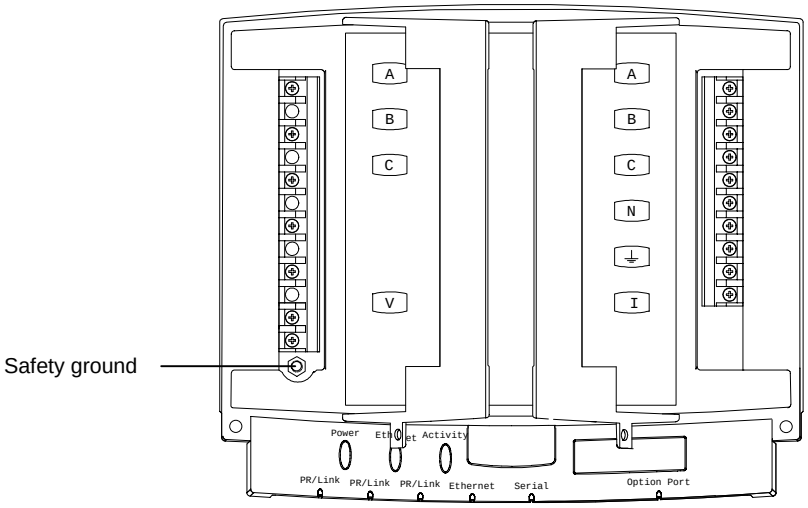
1. Use the InSite Installation Template included in the package to mark where you need to drill holes on the support panel.
2. Drill the four holes, as marked.
3. Secure the InSite Power Recorder to the support panel (mounting hardware not included).

The Installation Template looks like this:



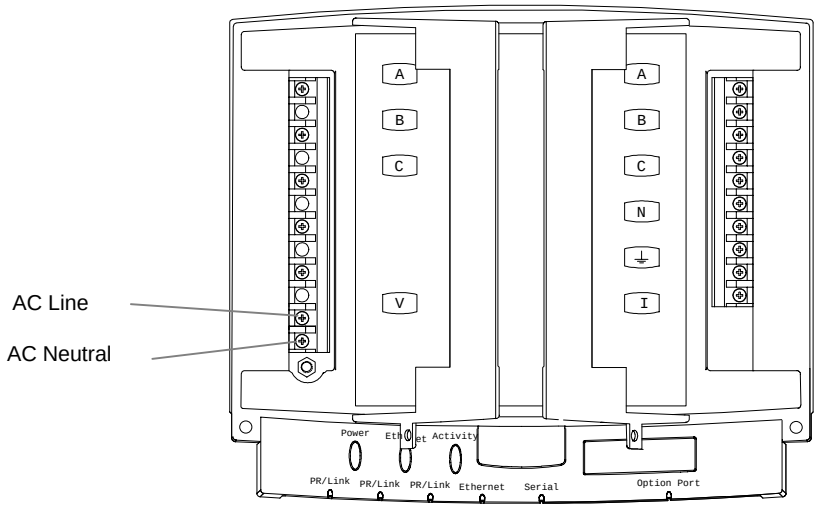
Connecting the Safety Ground

▶ Connect the ground first.



Connecting Instrument Power to the Meter Power Source ⚠

You connect to the InSite meter power using AC. The meter power requires 90-264 volts AC, 47-63 Hz.

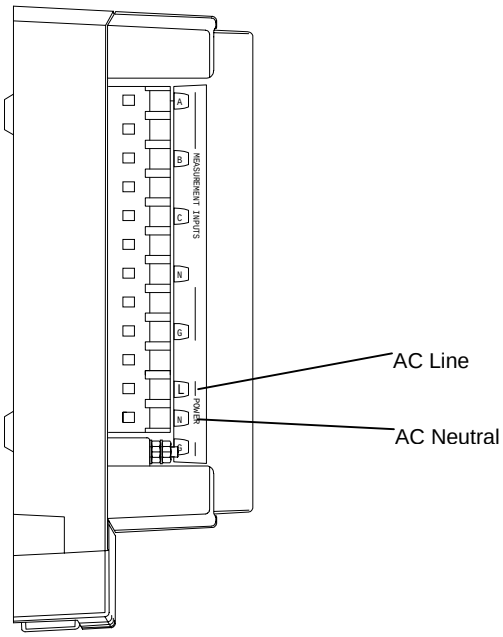


Front View

To hook up power to the InSite Power Recorder

▶ After the safety ground is connected, make the connection between the power source and the meter power terminal strip on the InSite Power Recorder.

Connect line and neutral as labeled.



Side View

Note: Power must be provided through an appropriate circuit protection device (fuse or circuit breaker).

Connecting to Voltage ⚠

WARNING: Make sure that all equipment, wiring, and connections are de-energized before proceeding.

Note: All connections should be wired in accordance with local electrical codes.

1. Starting at the InSite unit, attach the voltage wires to the voltage measurement terminal strip.

   Gauge 20-8 AWG / 6 mm^2

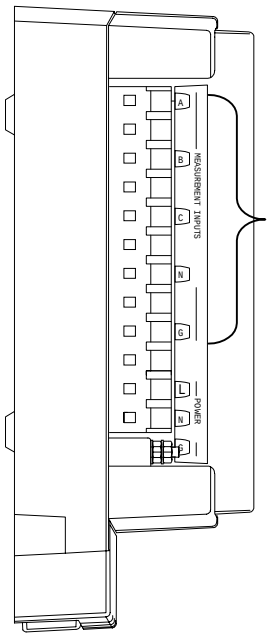
   Stripping length .28" / 7mm

2. Screw down the wires.

3. Attach the wires to the voltage source being monitored.

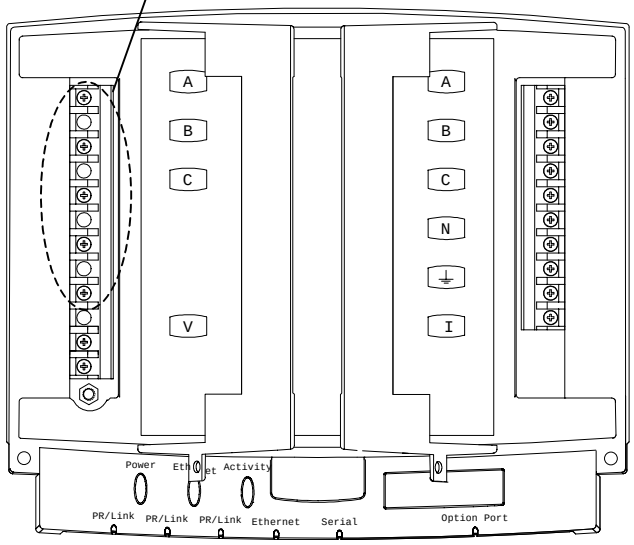
Table 1. Wire Color Codes

Phase	US Color Code	European Color Code	U.K. Color Code	Single-phase	Split Single-phase	3-phase Wye	3-phase Delta
A	Black	Black	Red	X	X	X	X
B	Red	Red	Yellow		X	X	X
C	Blue	White	Blue			X	X
Neutral	White	Blue	Black	X	X	X	
Ground	Green	Yellow and green stripe	Yellow and green stripe	X	X	X	X



Attach the voltage wires to the voltage measurement terminals. (Phase A, B, C, Neutral, Ground, as appropriate.)

Side View



Front View

Connecting to Current ⚠

1. If necessary, mount your external metering CTs on the busbar or current source, as required.

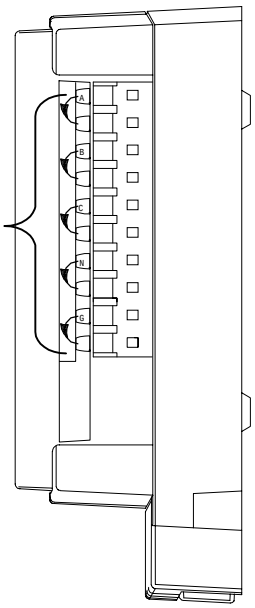
WARNING: To avoid potential injury or equipment damage, the secondary must never be left open-circuited. You may need to provide an external means to short the CT secondary while making connections to the InSite Power Recorder.

2. Hook up the secondary of the external metering CTs to the current measurement terminal strip on the InSite Power Recorder.

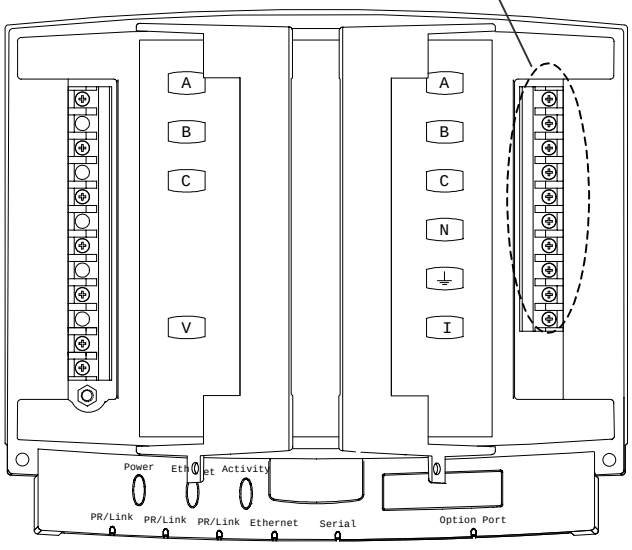
   Gauge 20-8 AWG / 0.5 to 6mm^2

   Stripping length .28" / 7 mm

Attach the current wires of the external metering CT secondaries to the current measurement terminal strip. (Phase A, B, C, Neutral, Ground, as appropriate.)



Side View



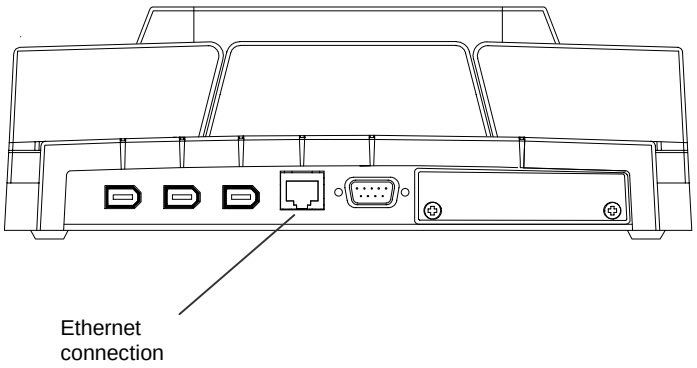
Front View

Wiring Diagrams

Appendix B contains wiring illustrations for some standard power configurations.

Connecting Ethernet ⚠

1. If you're connecting the InSite to a local area network (LAN), plug a standard Category 5 RJ45 terminated Ethernet patch cable into the Ethernet port on the InSite Power Recorder.



2. Connect the other end of the Ethernet cable into a 10-Base T network hub.

   Tip: If you're connecting the InSite directly to a computer, use a cross-over cable. Plug one end of it into the Ethernet port on the InSite Power Recorder and the other end into your computer.

   An Ethernet wiring diagram is provided in Appendix C. If you need additional information about proper wiring of Ethernet, consult your network administrator.

Checking Connections Before Restoring Power

Before you restore power, check all the connections:

1. Make sure terminals are tight.
2. Make sure current and voltage wires are paired correctly.

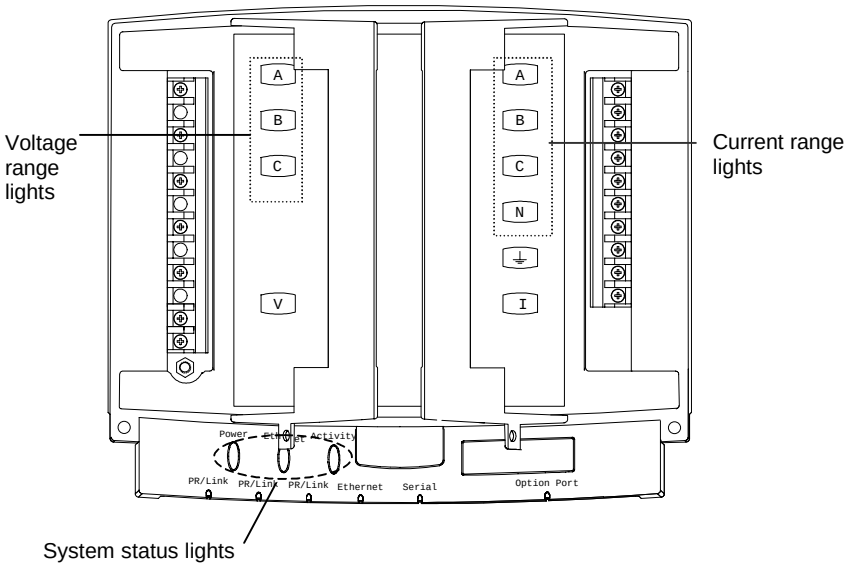
Restoring Power

> **WARNING:** To avoid potential injury or equipment damage, carefully check your wiring before restoring power to your system.

You can restore power after connecting voltage, current, and Ethernet to the InSite Power Recorder.

When you restore power, the InSite Power Recorder automatically turns itself on; however this process takes a minute or two.

- Notice the power-on sequence of lights as the unit performs a self-test.
  - All lights blink on, then off, and then follow an LED test sequence.
  - Finally, the lights remain on or off in accordance with the amount of voltage and current applied. (See Table 2 on page 19.)



Confirming Connections and Finishing Up

After connecting the InSite Power Recorder:

- Check the range lights to be sure that the unit is registering both current and voltage.
- Check to be sure the voltage and current are paired correctly.

Table 2. Range Indicator Lights

LED	Color	Meaning
VA, B, C	Green	Voltage is greater than approximately 49 volts RMS. LED flashes if voltage is over range (707) V_{RMS}
IA, B, C, N	Green	Applied current (RMS) is greater than approximately 7 % of probe nominal. LED flashes if current is greater than approximately 105% of probe nominal.
IG	Red	Applied current (RMS) is greater than 1.5% of probe nominal. LED flashes if current is greater than approximately 105% of probe nominal.
Power	Green	Power on
	Orange	Configuration in progress ("booting up") **Note:** In normal operation, when power is applied, the LED looks orange as the machine configures itself, and then begins flashing green/orange, indicating that it is ready to go.
Ethernet	Green	Ethernet link integrity
	Red	Ethernet reverse polarity **Note:** These let you know if you have wired up the Ethernet to the hub or computer correctly. Green means the connection is good; red indicates an error in the Ethernet wiring.
Activity	Green	Ethernet packet is being received. Ethernet packet is being sent.

Table 2. Range Indicator Lights

LED	Color	Meaning
	Orange	Ethernet collision
	Red	**Note:** The green will blink on and off as packets are passed. The red will light occasionally during normal use on a busy network, and can be an indication of an overloaded network.

Check the Range Lights (LEDs) for Current

The InSite Power Recorder contains range lights for each current connection. When you connect to power, the range lights indicate whether current is being drawn (see Table 2, above).

If the current range lights are steady ON, you know the current through the CT to which you've connected is presently within the normal range of the measured current.

If the current range lights are blinking, the current may be beyond the range.

If the current range lights are OFF, it may indicate that either there is no current in the circuit or the CT is not connected correctly.

WARNING: Unburdened output from a CT is extremely dangerous. Ensure that the panel is de-energized or use a shorting block prior to making any changes.

Check the Range Light (LEDs) for Each Voltage Phase

The InSite Power Recorder contains range lights that indicate when a connection is established for each wired voltage phase, A, B, or C.

When the light is ON, you know that the connection is secure and that voltage is present.

When the light is OFF, check to make sure the InSite Power Recorder has power. Next check the connection between the lead and the line to make sure it is secure. If the LED still does not light, there may be no voltage in the line. Use a voltmeter to check for voltage.

Make Sure Voltage Phases and Current Phases are Paired Correctly

Measurements are made in pairs and cannot be changed after data is recorded. The voltage and current phases must be properly associated. Each voltage must be associated with its corresponding current.

You can use either the Power Recorder System Software or the Scenario software to confirm whether the voltage and current are paired correctly. Details about how to do this in the Power Recorder System Software are described below. For details about doing this through Scenario, see the *Scenario User Guide*.

Checking Connections Through Software

In order to confirm that connections have been made properly, you need to check some settings in the Power Recorder System Software.

If you don't have access to a computer running the Power Recorder System Software, contact someone on the network and ask them to perform these steps for you. You will need to provide them with the serial number of the unit.

1. Go to a computer that is connected to the network and has the Power Recorder System Software installed.

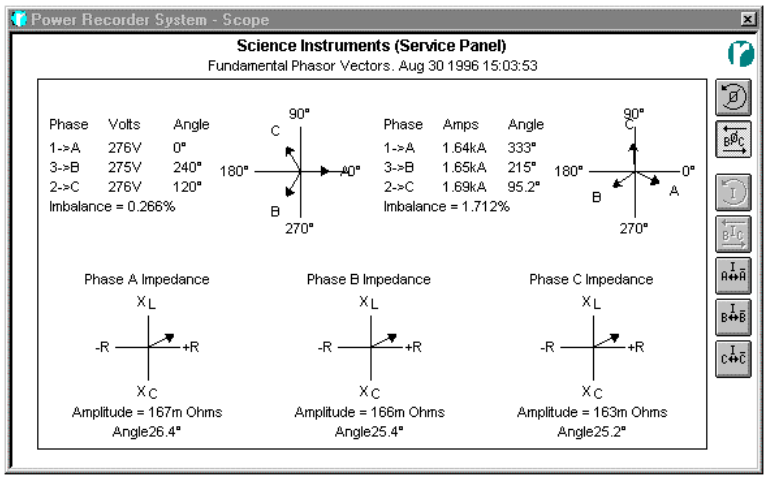
2. Link to the InSite Power Recorder from the Power Recorder System Software.

3. If the InSite Power Recorder has not yet been configured, use the configuration settings to designate the correct power type.

4. Open the Scope view.

Using Phase Diagrams to Check Voltage and Current Pairing

1. Open the Scope | Phasor window.

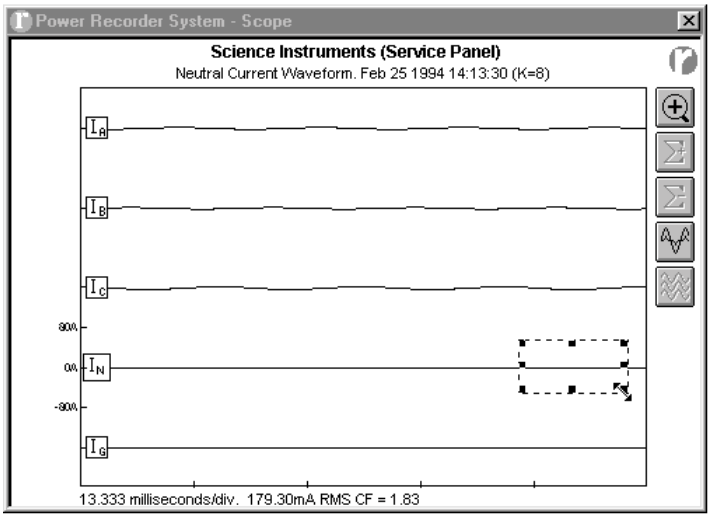


2. Verify the correct pairing and rotation of the currents and voltages.

   If the pairing or rotation is incorrect, use the tools in the window to swap connections and change polarity, or change polarity by physically swapping the input. For more information, see "Using the Phasors Tool to Verify Connections" in the *Power Recorder System User Guide*.

Tip: You can also use the Waveforms tool in the Power Recorder System Software to look at current in the ground and neutral channels.

1. Open the Amps window in the Waveforms view.
2. Select the ground or neutral current trace.
3. Draw a small selection rectangle around the trace.



4. Click the Magnify tool to zoom in and inspect the current trace.

Tip: You can also change the Full Scale settings from the Option menu.

Configuring the InSite Power Recorder

While you are linked to the InSite Power Recorder, you can configure it, to set power type and other parameters.

For complete information about Configuring an InSite or other Power Recorder, see the *Power Recorder System User Guide* or the *Scenario User Guide*.

Finishing Up

Before you finalize the installation, do a final check:

1. Make sure that all wires are neatly routed and secured.
2. Check to see whether voltage and current wires are paired correctly. If they are not, you can make changes through the Power Analysis System Software or through Scenario.
3. Confirm that the range light indicators (LEDs) are appropriate. (See Table 2 on page 19.)
4. Make sure the installation meets all applicable safety codes.

What Next?

See the *Power Recorder System User Guide* or the *Scenario User Guide* for information about how to perform many of the tasks you may want to do next, including:

- Configure the InSite Power Recorder.
- Observe and check the connections.
- Examine initial conditions.
- Set monitoring intervals.

Appendix A. InSite Power Recorder Specifications

Measurement Parameters

Voltage

Four (4) Channels:

Input:	1000 Volts peak (707 V_{RMS} max., for use on services up to 600 volts)
Accuracy:	± 1% of reading (typically 0.5%)
Impedance:	< 30 pF, >2MΦ
Frequency:	60/50 Hz ± 5 Hz

Current

Five (5) Channels

Input:	Current Transformer (CT) 5 A_{RMS} nominal, 20 A_{RMS} maximum
Frequency Response:	2.5 kHz
Dielectric withstand to ground:	4 kV_{RMS}
Insertion Impedance:	<0.003 Ohms at 60 Hz
Accuracy:	1% of reading or better, ± 1°

Sampling

Voltage and current wave-forms are sampled with a 20 bit analog to digital converter at a rate providing 128 sampled points per cycle at 50 and 60 Hz.

Power Requirements

90 - 264 V_{RMS}, 47 - 63 Hz

25 VA Max.

Dimensions

Size: 10.3"x8.7x3.4" (26 cm x 22 cm x 9 cm)

Weight: 7.5 pounds (3.4 kg)

Environmental Requirements

For use indoors or in a suitable, protective enclosure outdoors.

Maximum Altitude: 2000 meters (6561.7 feet)

Operating: 0° C to 50° C

Humidity: less than 90% non-condensing

Storage: -20° C to 60° C

Installation category: II

Pollution degree: 2

Calibration

The InSite Power Recorder should be calibrated every two years to maintain specified accuracy. For assistance, contact Reliable Power Meters.

Batteries

The InSite Power Recorder utilizes two sets of batteries on board. These batteries are not operator replaceable. The clock/calendar uses a lithium battery with a life span of ten years. A nickel metal hydride (NiMH) battery pack is used to power the instrument in the event of a power failure. This battery allows the instrument to monitor for five minutes before performing an orderly shutdown. The battery is charged when power is applied to the instrument. This rechargeable battery pack can only be obtained from Reliable Power Meters. If the battery fails to charge, return the instrument to RPM for repair.

Cleaning Instructions

After removing power from unit, a damp cloth may be used to remove dust particles that may have accumulated on the surface of the instrument.

Fuses Used In the Product

There are no operator accessible fuses in the InSite Power Recorder.

Resolution vs Recording Time

The InSite Power Recorder has a user selectable recording period. Based on the period selected, the InSite Power Recorder will provide a predetermined resolution of RMS, power, and harmonic data as follows:

Recording Period	Resolution
15 Minute	15 cycle
30 Minute	0.5 second
1 hour	1 second
3 hours	3 seconds
6 hours	6 seconds
12 hours	15 seconds
24 hours	30 seconds
48 hours	1 minute
5 days	3 minutes
1 week	5 minutes
2 weeks	10 minutes
4 weeks	15 minutes
1 month	15 minutes
90 days	1 hour
1 year	4 hours

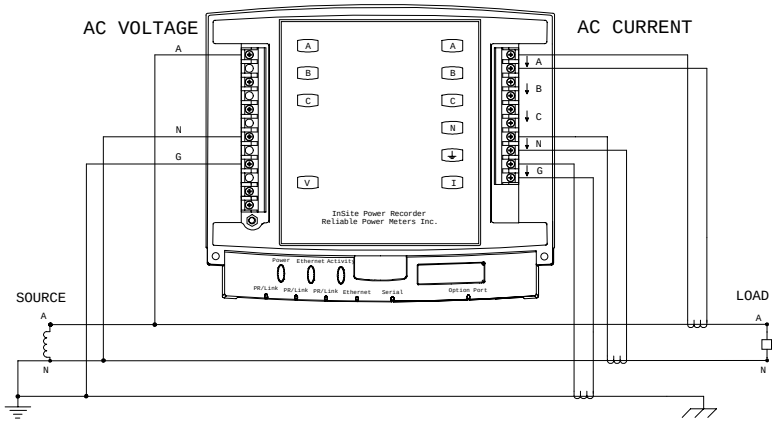
All recordings are performed via the digital signal processor and are done on a cycle by cycle basis. Regardless of the recording period or the resolution the minimum and maximum values in summary graphs have a one cycle response.

Note: Harmonic trending data is only available for recording periods of one hour or greater.

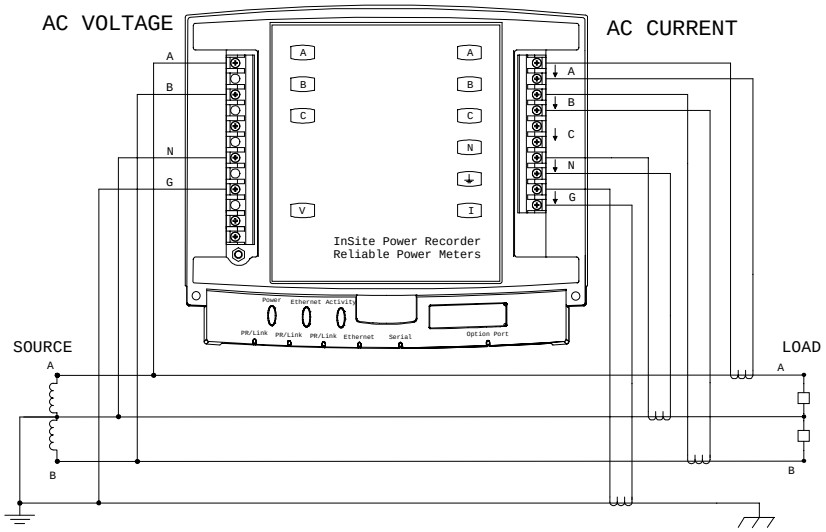
If you should have any further questions please contact Reliable Power Meters Technical Support.

Appendix B. Wiring Diagrams

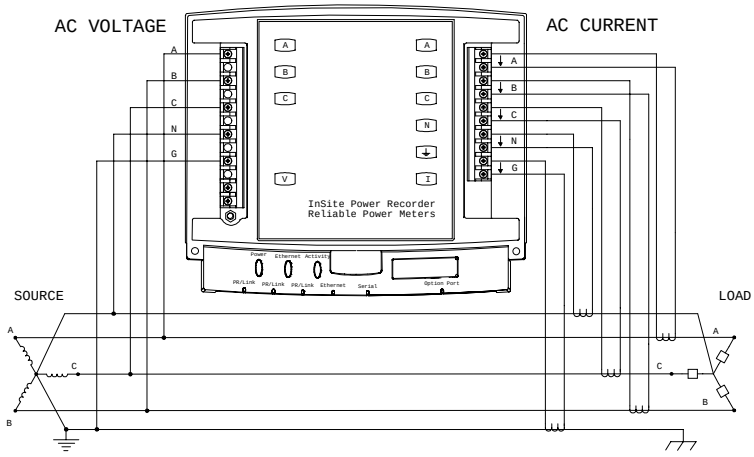
Single-Phase



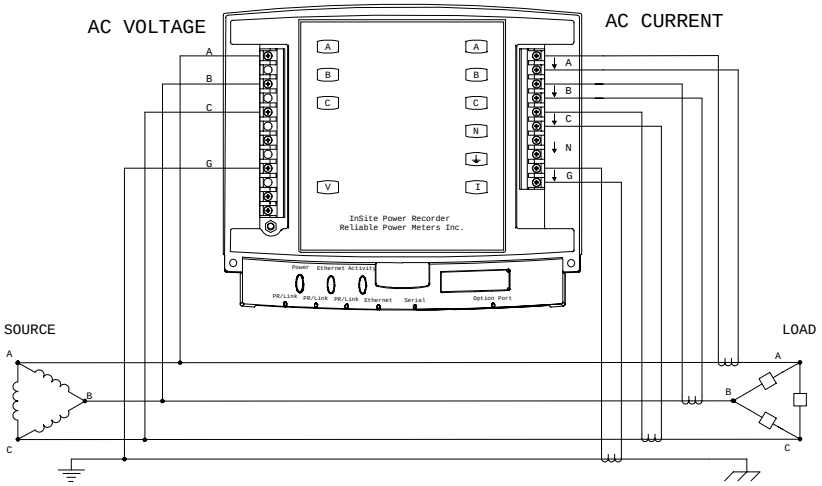
Split Single-Phase



4 Wire Wye (3-Phase Wye with ground)

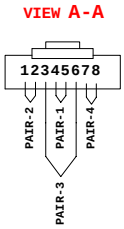


3-Phase Delta



Appendix C. Ethernet Wiring

CAUTION: Networking is a specialized field. The information provided below is a wiring snapshot only and is not intended to provide complete instructions. If you are creating your own cables, make sure you understand how to make them correctly. **If you are uncertain about any aspect of creating networking cables, use a network cable installation contractor or expert, or contact your network administrator.**



T-568B PATCH CABLE WIRING DIAGRAM

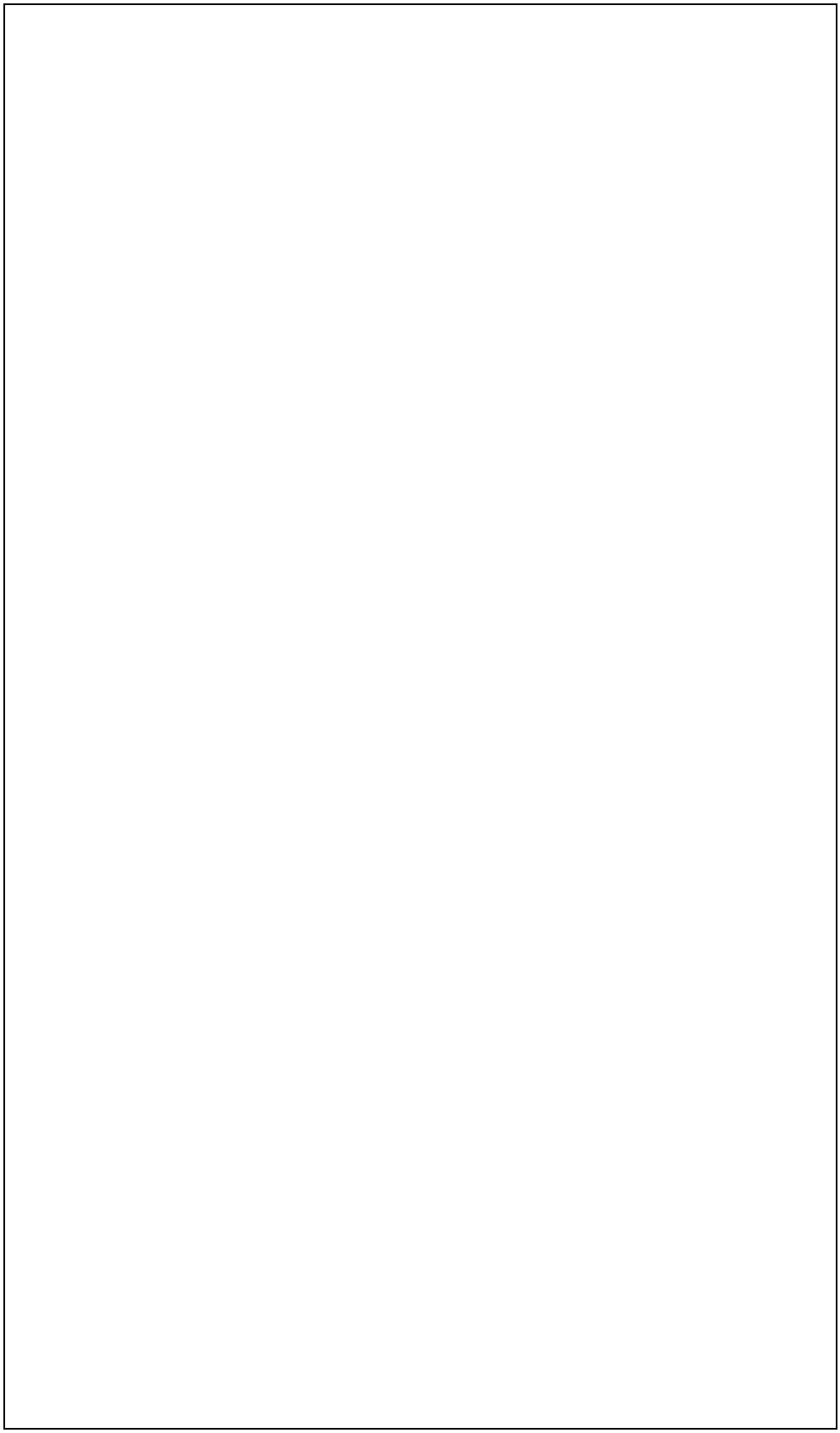
COLOR CODE	Pin	SIGNAL/PAIR	
brown	8	UNUSED	PAIR-4
white/brown	7	UNUSED	
green	6	Data Receive (-)	PAIR-3
white/blue	5	UNUSED	PAIR-1
blue	4	UNUSED	
white/green	3	Data Receive (+)	PAIR-3
orange	2	Data Transmit (-)	PAIR-2
white/orange	1	Data Transmit (+)	PAIR-2

Notes:

Important: Standard telephone cable will not work.

1. 10Base-T wiring specifies an 8-position jack. All 8 wires need to be installed correctly, even though only pairs 2 and 3 of the EIA/TIA-568 scheme are used. Pair 1 is not used because that position is used in conventional telephone service and carries voltage when the telephone rings. The 100Base-T standard uses all four pairs.
2. The wire must conform to EIA/TIA category-5 wire specifications and follow the EIA/TIA-568 wire scheme.

   A common description of this wiring is *CAT5 4-pair twisted Ethernet cable*.



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