i-SENSE®

Voltage Sag Detector

Owner's Guide

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Save this Guide! It provides important safety and setup information.

Important Safety Information

Use this product only as specified by the manufacturer. Do not perform any unauthorized modifications or repairs to the product. Return the product to SoftSwitching Technologies for repair to ensure that safety features are maintained—see Returned Material Authorization (RMA) instructions.

Safety Notices and Symbols:

A **<u>WARNING</u>** notice denotes a hazard. It calls attention to an operating or installation procedure or practice that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

A **<u>CAUTION</u>** notice denotes a hazard. It calls attention to an operating or installation procedure or practice that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Messages of particular importance are indicated by the following symbol.

⚠ **WARNING**: risk of danger (refer to the manual for specific Warning or Caution information)

Messages d'avertissement en français:

<u>AVERTISSEMENT</u>: Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entrainer des blessures graves voir mortelles.

<u>MISE EN GARDE</u>: Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures ou modérées. Également utilisé pour signaler une situation ou une utilisation qui pourrait gravement endommager l'appareil mais qui n'entrainera pas de blessures.

Des messages d'importance particulière sont indiqués par le symbole suivant.

⚠ **AVERTISSEMENT** Référez-vous a ce manuel pour éviter tout risque de blessure pour l'utilisateur et/ou pour protéger l'appareil d'eventuels dommages.

⚠ **WARNING**—Do not apply power to the i-Sense until configuration and wiring are completed. The following steps are required for safe and successful installation.

See sections 3 and 4 for more detail. Online support pages are at http://www.i-grid.com .

⚠ **AVERTISSEMENT**— Ne mettez pas sous tension le i-Sense avant que la configuration et le câblage soient accomplis. Referez vous aux instructions suivantes pour une installation correcte et securisée de l'appareil.
Voir les sections 3 et 4 pour plus de détails. Référez-vous à http://www.i-grid.com .

1.0 Quick-Start Installation Guide

Welcome to the Grid Alert™ system, powered by the i-Grid® network of i-Sense® voltage detectors. Follow this guide to configure and install the i-Sense. ***Do not apply power until configuration is complete***.

1) Inspect for shipping damage. If any damage is seen, contact the shipper.

2) Record the i-Sense **Serial Number**:

   _____ - _____ - _____

   The S/N label is located above the battery cover; it will be needed to register and use this i-Sense.

3) **Register** the i-Sense:
   a. Go to http://www.i-grid.com
   b. Login, or follow the online instructions to register as an i-Grid user
   c. Follow the online instructions to register your new i-Sense.

4) Configure the i-Sense hardware to match your nominal voltage:
   a. Find your **Nominal Voltage** in Table 1 (on page 9) and record Voltage Settings here:

   > Voltage: ☐ 480V   ☐ 120V   ☐ Other _____
   >
   > Wiring: ☐ LL   ☐ LN   ☐ S1:Single-Phase   ☐ S2:Split-Phase
   >
   > Power Supply Plug JP1: ☐ White (<250V)   ☐ Red (>250V)

   b. Remove the right-side cover (two Phillips-head screws, top and bottom)
   c. Verify that plug JP1 is installed correctly for your voltage (see Table 1, p. 9)
   d. Verify that INPUT jumper wires are installed according to your wiring diagram (see Table 2, p. 10)

5) **Configure** the i-Sense software and communications according to Section 3. This step may be performed either before or after installation.
   a. Needed supplies:
      i. A supply of power for the i-Sense: either (A) the [optional] external power supply, plugged into the 9Vdc jack ⊝–⊙–⊝ or (B) AC mains power, after installation. In normal operation, the i-Sense is powered by the mains connection at INPUT_1.
      ii. A laptop PC or workstation with Ethernet network card and Web browser.
      iii. Ethernet cross-over cable (for direct connection to a laptop PC) or standard Cat.-5e Ethernet cable connected to your Local Area Network (LAN).
      iv. Phillips-head screwdriver.
      v. Information from your IT department (for Ethernet communications).
   b. Follow the configuration instructions in Section 3.

6) **Install** the i-Sense according to Section 4 of this Owner's Guide.
   a. Electrical installation must be performed by a qualified electrician or technician in an appropriate environment (see technical specifications, Section 6).
   b. Choose a communications method: either Ethernet LAN or analog (PSTN) telephone line.
   c. Follow the installation instructions in Section 4.

7) Perform step 5), if skipped earlier.

8) **Verify** communications.
   Push the ♡ button to generate a Heartbeat event. Verify that the event is logged at www.i-grid.com.

2.0 Introduction

The i-Sense® Voltage Sag Detector captures and records voltage disturbances on the electric power service, as well as long-term voltage trends. Voltage disturbances are the most common power quality problems and may include voltage sags (dips), swells, or interruptions and outages. Many different mains voltages are utilized internationally and the i-Sense can be easily configured to operate with most of them.

The i-Sense detector is an integral part of the i-Grid voltage monitoring network that enables the GridAlert reporting and alerting service. Operation of the i-Sense requires daily communication with the i-Grid servers via the Internet. Instructions for setting up an Internet connection are included in this Guide.

The most up-to-date setup and support information is always available at www.i-grid.com .

3.0 Configuration

The i-Sense performs simultaneous measurements on three (or six) voltage channels. Typically, these will be the three Line-to-Line (LL) or three Line-to-Neutral (LN) voltages of the three-phase AC mains. The i-Sense can also measure single-phase or split single-phase systems. A few settings must be performed to assure safe operation and to properly record the measurements.

3.1 Configure for your Nominal Voltage

Select your voltage and 3-wire or 4-wire settings, then configure as shown in Table 1 on p. 10. If your voltage is not shown, contact i-Grid support. All i-Sense channels will be configured for the same nominal voltage. Remove the right-side cover to access the AC input terminals (two Phillips-head screws, top and bottom). For 6-channel i-Sense models, the INPUT_1 and INPUT_2 terminal blocks must be configured identically.

It is important that the power supply jumper JP1 and the INPUT jumper wires be connected correctly. Follow the instructions in Table 1 and Table 2 exactly (see pages 9-10).

Finally, connect to the *i-Sense Management Console*, as explained in Section 3.2, to set your nominal voltage level. As-shipped, the i-Sense is configured for 480V LL nominal voltage.

In the U.S., common nominal service voltages are 480V and 208V 3-wire (LL) three-phase, 277Y/480V and 120Y/208V 4-wire (LN) three-phase, and 120V single-phase or 120/240V split-phase. If a Neutral (4th wire) is available, it should be used.   As shipped, the i-Sense is configured for 480V LL, 3-wire.

3.2 Configure Communications Settings

The i-Sense is pre-configured for Ethernet-based communications; even so, network settings must be entered to make connection to the Internet. Additionally, if a telephone modem connection is desired, the Ethernet port is initially used to enable that option (see Section 3.2.2).

An on-board Web server, the *i-Sense Management Console* is the interface for quick configuration using your Web browser (Internet Explorer, Firefox, Safari, etc.) application. To get started, either (**1**) connect directly from a computer (PC) to the i-Sense using an Ethernet cross-over cable (or regular Ethernet cable if the PC's Network Interface Card supports Gigabit Ethernet), or (**2**) connect the i-Sense to a Local Area Network (LAN), as described in Section 3.2.1.2.

If the phone modem is to be used for connection to the Internet, the Ethernet port may remain connected to an internal LAN so that status checks and configuration changes can be easily made.

3.2.1   Ethernet Communications Setup

There are several ways to configure the i-Sense for networking. Contact your IT department or System Administrator to discuss the optimal configuration method for your network.

3.2.1.1 Network Security and Firewall Requirements—Ethernet-to-Internet

The i-Sense sends measurement data to the i-Grid servers over the Internet on port 80 via the HTTP protocol. The site firewall must allow outbound HTTP traffic from the IP address assigned to the i-Sense. This is the same requirement needed to open a PC's Web browser and access www.i-grid.com. There are no additional firewall requirements. If a PC with an assigned IP address can access www.i-grid.com, then the i-Sense can use that IP address as well.

The i-Sense always initiates the (outbound) connection to the i-Grid servers via Ethernet or modem to exchange configuration information and upload voltage event data. The i-Grid servers cannot initiate communication to the i-Sense monitor.

3.2.1.2 Default Auto-Sensing Configuration—Ethernet

The i-Sense requires an IP address and related information (see the next Section for details). The process of assigning an IP address is simplified by an Auto-Sensing process: The i-Sense will first attempt to contact a DHCP server for an IP address. If a DHCP server responds with networking settings, the i-Sense will use those settings. If no DHCP server responds after one minute, the i-Sense will fall-back to the last-used manual (static) networking settings. Once the desired networking settings are entered, the auto-sensing feature can be disabled.

Even when the network settings will be manually entered (see Section 3.2.1.3), the i-Sense can be temporarily connected to a network that supports DHCP to more easily acquire those settings. The desired static IP address can then be entered prior to installation.

To connect your Web browser to the *i-Sense Management Console* over the local network, the i-Sense IP address must be known. And if you are using DHCP, the IP address might not be evident. The *i-Sense Discovery Utility* (available for download at www.i-grid.com) will display the IP address and serial numbers of all active i-Senses on the local (same subnet) network and provides double-click access to launch a browser window into the *i-Sense Management Console*. An example Discovery Utility window is shown in Figure 1.
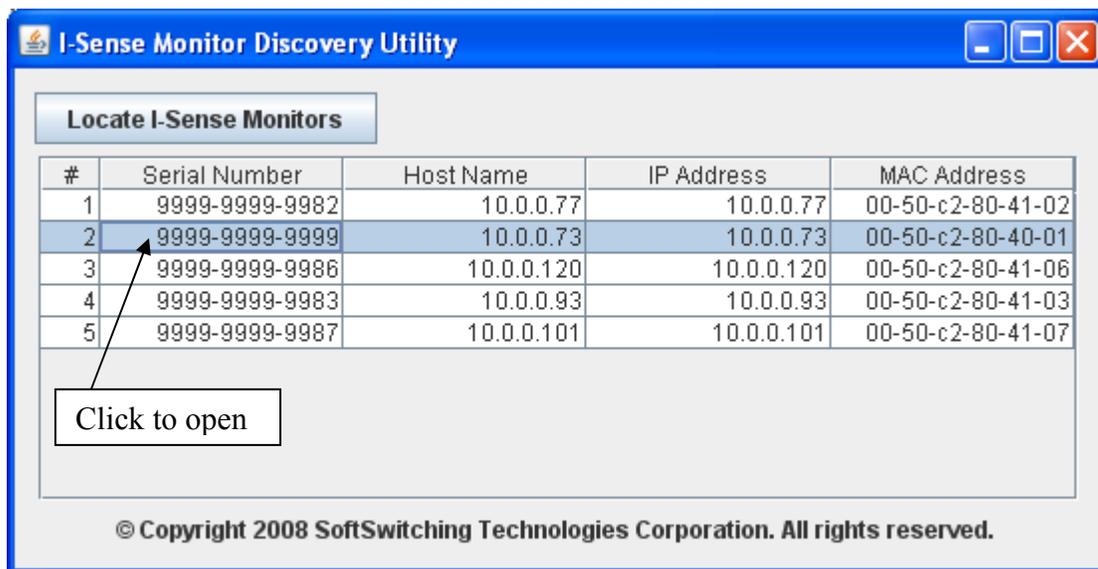
#	Serial Number	Host Name	IP Address	MAC Address
1	9999-9999-9982	10.0.0.77	10.0.0.77	00-50-c2-80-41-02
2	9999-9999-9999	10.0.0.73	10.0.0.73	00-50-c2-80-40-01
3	9999-9999-9986	10.0.0.120	10.0.0.120	00-50-c2-80-41-06
4	9999-9999-9983	10.0.0.93	10.0.0.93	00-50-c2-80-41-03
5	9999-9999-9987	10.0.0.101	10.0.0.101	00-50-c2-80-41-07

I-Sense Monitor Discovery Utility

Locate I-Sense Monitors

Click to open

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Figure 1. Example *i-Sense Discovery Utility* window

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3.2.1.3 Manual Configuration—Ethernet or direct connection to a PC

To manually configure the i-Sense with a static IP address: The following network information is needed. When the i-Sense initially powers up, it will attempt DHCP configuration, then default to these values:

i-Sense Network Setting	Default Value
Static IP Address	192.168.1.200
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
Primary DNS Server	192.168.1.201
Secondary DNS Server	192.168.1.200

An Ethernet cross-over cable may be required for static IP address configuration via direct connection to a PC (a standard Ethernet cable is adequate if the PC's Network Interface Card supports Gigabit Ethernet).

To communicate with the i-Sense in the default mode, the networking settings on the PC must be changed temporarily to the following values:

Computer Network Setting	Value
IP Address	192.168.1.201
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
Preferred DNS Server	192.168.1.201
Alternate DNS Server	192.168.1.200

The Windows XP Internet Protocol (TCP/IP) Properties configuration window below is typical.
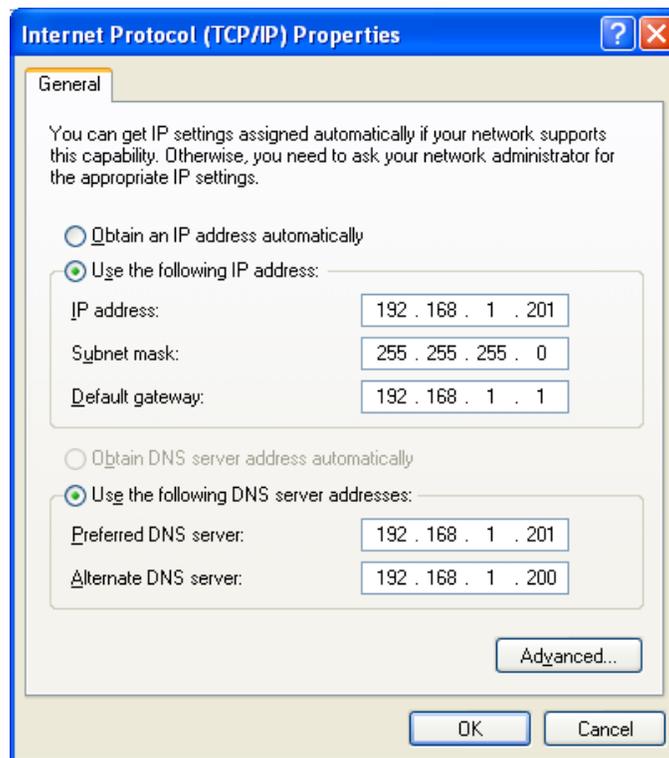

Figure 2. Typical Windows XP Internet Protocol (TCP/IP) Properties window

If the PC was already set to "Use the following IP address:" then those settings should be recorded for later restoration.

When the PC is configured and connected to the i-Sense, enter the Web address http://192.168.1.200 to access the i-Sense management pages.

3.2.1.4 The *i-Sense Management Console*

Connect to the i-Sense by typing http://192.168.1.200 (replace with the actual IP address) into the Web browser address bar. The *i-Sense management console* will prompt for a valid username and password. The factory-default user credentials are:

> **Username:** admin
> **Password:** password

Change the username and password from the default values during initial setup. Click on the "Configuration" menu item to change the default values.

If the username or password is lost, contact i-Grid product support to reset the user credentials to the factory default values. If the i-Sense is not able to communicate with the i-Grid website, you will need to reset the user credentials and networking options back to their default values using the push-buttons. See the Resetting to Factory Defaults section for more details.

3.2.1.4.1 Management: Select Communications Method—Ethernet or Telephone modem

To send data to the i-Grid servers over Ethernet, select the "Send PQ data to the i-Grid via Ethernet" check box on the Ethernet Settings page.

To send data to the i-Grid servers via the modem, select the "Send PQ data to i-Grid via modem" check box on the Modem Settings page. See the "Modem Configuration" section for modem configuration instructions.

Test the connection to i-Grid servers initially and whenever any of the networking or communication settings have changed. This will ensure that voltage data will be uploaded and preserved. For Ethernet, press the "Test Connection to i-Grid" button on the Ethernet Settings page. Any connection errors will be displayed on the page. For PSTN modem connections, the button is on the Modem Settings page.

3.2.1.4.2 Management: Ethernet

After connecting to the i-Sense, click on the "Communication" top menu item and select the "Ethernet" left menu item. The top section of the page displays the active Ethernet settings. The following settings are displayed:

- **Configuration Mode** shows how the Ethernet settings were last configured:

Configuration Mode	Description
Auto-Sense: Automatic (DHCP)	configured by DHCP (auto-sensing was enabled)
Auto-Sense: Manual (static)	No DHCP server was found; Previous static IP address is used (auto-sensing was enabled).
Automatic (DHCP)	configured by DHCP (auto-sensing was disabled)
Manual (static)	Manually configured (auto-sensing was disabled).

- **Active Networking Settings**: IP Address**,** Subnet Mask**,** Default Gateway**,** Preferred DNS Server**,** Alternate DNS Server**,** MAC Address

- **Settings.** The "auto-sensing" feature is initially enabled to simplify the configuration process. Auto-sensing can be disabled, in which case selection must be made either to always use DHCP or to use static settings.
    - **DHCP Configuration**
    Select "Obtain an IP address automatically" to use automatic configuration via a DHCP server. To override the DHCP server-assigned DNS addresses, select "Use the following DNS server addresses".
    - **Manual (Static) Configuration**
    Select "Use the following IP address" to configure with static settings. Update the IP Address, subnet mask, default gateway, preferred DNS server and alternate DNS server with the values provided by your IT department or System Administrator.

Click the "Restart Ethernet" button to use the new Ethernet settings. If the IP address has changed, update the IP address in the browser's address bar to reconnect to the i-Sense. If needed, use the *i-Sense Discovery Utility* to find the new IP address.

3.2.1.4.3 Management: Reset to factory defaults

Press both **RESET** and ♡ push-buttons for 10 seconds to reset the networking and security username and password to the default values. Both LEDs (green and red) will blink rapidly for 2 seconds when the settings are reset. The Ethernet interface will be restarted after a few seconds.

3.2.2   Telephone Modem Communications Setup

If the modem is the desired method of i-Grid communication, this option must be selected and configured appropriately. First, connect to the *i-Sense Management Console* (see Section 3.2.1). The modem configuration values can be found on the "Modem Settings" page. The Ethernet port must be used to access the *i-Sense Management Console* where the modem settings can be configured.

3.2.2.1 Required Modem Configuration Settings

The following configuration information must be entered:

Country

Select your country from the drop-down list of supported countries. Contact i-Grid support if your country is not present in the list.

I-Grid Communication Method

Select the "Send PQ data to i-Grid via the modem" checkbox.

Phone Numbers

Enter the phone numbers needed to contact the ISP (Internet Service Provider). Unless an alternate ISP is used, look up available local phone numbers on the i-Grid phone number lookup page.

3.2.2.2 Optional Modem Configuration Settings

These optional settings are also available:

Dialing Prefix

Set the desired dialing prefix (e.g. if 9 or 8 prefix is needed to access an outside line). The comma (,) character inserts a pause.

Blind Dialing

If the i-Sense reports that it cannot find a dial-tone even though the line has been tested, it is possible to enable blind dialing to skip the dial-tone detection phase of the dialing process. This should only be enabled on a dedicated phone line, otherwise other devices or users may be interrupted while using the phone line.

Alternate Internet Service Provider (ISP)

Depending on the availability of local phone numbers from the i-Grid phone number lookup page, it may be desirable to use an alternate ISP. Enter the username and password for the ISP.

Extra Modem Initialization String

In rare cases it may be necessary to change the modem default initialization settings. Unless instructed by i-Grid Support, leave the modem initialization string blank.

TABLE 1. Nominal Voltage Configurations. Default as-shipped is 480V L-L

Your Voltage	Nominal Volts per Channel	Channels	Mains Wires	Wiring Diagram (See Table 2)	Power Supply Jumper JP1
Any single-phase voltage ≤ 240V	nominal	1	2	S1	White wires
100 (L-N for 100/200V split-phase)	100	2	3	S2	White wires
105 (L-N for 105/210V split-phase)	105	2	3	S2	White wires
110 (L-N for 190Y/110V 3-phase)	110	3	4	LN	White wires
115 (L-N for 200Y/115V 3-phase)	115	3	4	LN	White wires
115 (L-N for 115/230V split-phase)	115	2	3	S2	White wires
120 (L-N for 208Y/120V 3-phase)	**120**	**3**	**4**	**LN**	**White wires**
120 (L-N for 120/240V split-phase)	120	2	3	S2	White wires
125 (L-N for 216Y/125V 3-phase)	125	3	4	LN	White wires
127 (L-N for 220Y/127V 3-phase)	127	3	4	LN	White wires
133 (L-N for 230Y/133V 3-phase)	133	3	4	LN	White wires
139 (L-N for 240Y/139 3-phase)	139	3	4	LN	White wires
190 (L-L for 190Y/110V 3-phase)	190	3	3	LL	White wires
200 (L-L for 100/200V split-phase)	200	1	2	S1	White wires
208 (L-L for 208Y/120V 3-phase)	208	3	3	LL	White wires
210 (L-L for 105/210V split-phase)	210	1	2	S1	White wires
216 (L-L for 216Y/125V 3-phase)	216	3	3	LL	White wires
220 (L-L for 380Y/220V 3-phase)	220	3	3	LL	White wires
230 (L-L for 230Y/133V 3-phase)	230	3	3	LL	White wires
230 (L-N for 400Y/230V 3-phase)	230	3	4	LN	White wires
240 (L-L for 120/240V split-phase)	240	3	3	LL	White wires
240 (L-N for 415Y/240 3-phase)	240	3	4	LN	White wires
254* (L-N for 440Y/254 3-phase)	254	3	4	LN	RED wires*
277 (L-N for 480Y/277V 3-phase)	277	3	4	LN	RED wires
346 (L-N for 600Y/346V 3-phase)	346	3	4	LN	RED wires
346 (L-L for 346Y/200V 3-phase)	346	3	3	LL	RED wires
380 (L-L for 380Y/220V 3-phase)	380	3	3	LL	RED wires
400 (L-L for 400Y/230V 3-phase)	400	3	3	LL	RED wires
400 (L-N for 690Y/400V 3-phase)	400	3	4	LN	RED wires
415 (L-L for 415Y/240V 3-phase)	415	3	3	LL	RED wires
440 (L-L for 440Y/254V 3-phase)	440	3	3	LL	RED wires
440 (L-L for 220/440V split-phase)	440	3	3	LL	RED wires
460 (L-L, at point of use)	460	3	3	LL	RED wires
480 (L-L for 480Y/277V 3-phase)	**480**	**3**	**3**	**LL**	**RED wires**
600 (L-L 3-phase) not allowed**	NO!	NO!	NO!	NO!	NO!

*Nominal 254V source must operate normally at >240V (95% of nominal).

**Maximum 480V per channel. 575Y/332V and 600Y/346V systems must use the 346 (L-N) configuration.

TABLE 2. Wiring Diagrams

Use the appropriate wiring diagram and jumper wire positions. **There should be no more than one wire installed at each terminal block position.** The i-Sense is shipped with jumper wires in the LL configuration. The LL and LN diagrams are also shown inside the i-Sense cover. Move or remove jumper wires as needed:

Source type	Wiring Diagram	
S1 Single phase	L1 (N or L2) GND 1 2 3 4 5 6 7 8 9	1 channel sensing 2 wires + ground required No jumper wires Use AWG 14-22, 600 VAC conductors Tighten screws to 12-13 in-lb (1.4 N-m) Tighten ground stud nut to 30 in-lb (3.4 N-m)
S2 Split-phase	L1 N L2 GND 1 2 3 4 5 6 7 8 9	2 channel sensing 3 wires + ground required Jumper pins 3-5 Use AWG 14-22, 600 VAC conductors Tighten screws to 12-13 in-lb (1.4 N-m) Tighten ground stud nut to 30 in-lb (3.4 N-m)
LN 3-Phase 4-wire	L1 N L2 L3 GND 1 2 3 4 5 6 7 8 9	3 channel sensing 4 wires + ground required Jumper pins 3-5 & 6-8 Use AWG 14-22, 600 VAC conductors Tighten screws to 12-13 in-lb (1.4 N-m) Tighten ground stud nut to 30 in-lb (3.4 N-m)
LL 3-Phase 3-wire	L1 L2 L3 GND 1 2 3 4 5 6 7 8 9	3-channel sensing 3 wires + ground required Jumper pins 1-6 & 3-7 & 4-9 Use AWG 14-22, 600 VAC conductors Tighten screws to 12-13 in-lb (1.4 N-m) Tighten ground stud nut to 30 in-lb (3.4 N-m)

The ground stud is #10-32.

IMPORTANT: Use the *i-Sense Management Console* to set your nominal voltage. See Section 3.1.

4.0 Installation

4.1 Pre-installation:

1) Inspect for shipping damage
2) Record the i-Sense serial number (see Section 1.0)
3) Register the i-Sense at www.i-grid.com (see Section 1.0)
4) Configure the i-Sense hardware for the service voltage (see Section 1.0)
5) Configure communications software using the Ethernet port. (this can be done after installation and power-up)

⚠ **WARNING**—Do not apply power to the i-Sense until the configuration and wiring are completed. Installation must be performed by an electrician, in accordance with all local and national codes.

⚠ **AVERTISSEMENT**—Ne mettez pas sous tension le i-Sense avant que la configuration et le câblage soient accomplis. L'installation doit être effectuée par un electricien en accord avec les lois en vigueur du pays

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4.2 Environmental Conditions

The i-Sense is rated for installation in the following environment:

- Indoor use only, no conductive pollution.
- Altitude up to 2000 m (6500 ft)
- Temperature range 0 °C to 40 °C (32 °F to 104 °F)
- Maximum relative humidity 95%, non-condensing.

4.3 Mounting

- Provide 10 inches (250mm) clearance around the i-Sense for cooling and access.
- Remove the left and right covers (four Phillips-head screws, two top and two bottom)
- Mount the i-Sense to a vertical surface using the four mounting holes. Two of the four mounting screws should penetrate into studs at least 1 in. (25mm). Mounting screws 1.5 in. (38mm) long are recommended.

4.4 Electrical connections

- Branch protection: upstream fuse or circuit breaker protection rated 20A or less is required.
- Conduit entry: top or bottom.
- Connect the Ground (Earth) wire to the #10-32 stud near the bottom knock-out.
- Connect mains line to the INPUT_1 terminal block, according to the proper wiring diagram from Table 2 on p. 10.
- If the INPUT_2 terminal block is present, wire the second 3-phase set using the same wiring diagram.
- Verify that the JP1 plug is properly configured, per Table 1 on p. 9: The plug with RED wires must be installed if the channel voltage is greater than 250 VAC.
- CAUTION: This unit is not rated for 600VAC L-L installations. 600Y/346V installations require the 4-wire L-N wiring method. The Neutral must be connected as shown.
- Replace the right-side cover and two screws.

4.5 Communications Connections

- Remove left side cover (two Phillips-head screws, top and bottom)
- Conduit entry: top or bottom.
- Install appropriate communications cable(s) (see Section 3):

  🖧 8P8C (RJ45) modular Ethernet cable. Pass the Ethernet cable through the included RF filter core, and close the core securely, as shown in Figure 3. Failure to install the cable filter may result in RF emissions beyond the standards of the EU's EMC Directive.
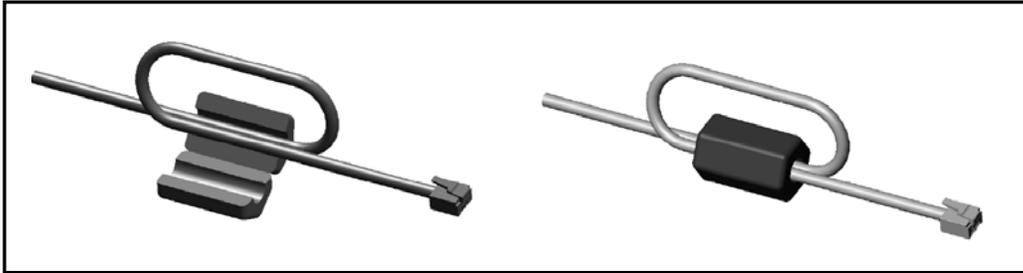
  ⌇ RJ11 telephone line (analog PSTN)

Figure 3. Ethernet cable filter installation. The clip-on filter core is supplied with the i-Sense.

4.6 Final Check

- Check all connections
- Replace left and right side covers

4.7 External power supply

The optional external 9Vdc power supply is used only during configuration; it should not be used in normal operation. Remove the left-side cover to access the 9Vdc jack ⊙─⊙─⊙

4.8 Initial battery charge time.

The rechargeable batteries may become discharged after some time on the shelf. Allow 30 minutes charge time after power-up before the i-Sense is ready to record voltage interruption events.

5.0 Operation, Maintenance and Troubleshooting

> ⚠ **WARNING**—**Risk of Electric Shock**—do not remove the right-side cover while mains voltage is applied. The middle cover should never be removed—there are no user-serviceable parts inside.

> ⚠ **AVERTISSEMENT**—**Risque d'electrocution**—ne pas retirer la protection de droite tant que la machine est sous tension. La protection centrale ne doit jamais être retirée. Rien à l'interieur ne doit être modifier par l'utilisateur.

The left-side cover may be removed at any time to access the communications ports.

5.1 User controls and indicators

These user controls and indicators are available:

- The *i-Sense Management Console* (requires Ethernet or cross-over cable connection to i-Sense)
- The www.i-grid.com website (available from any Web browser)
- Red and Green LED indicators (see Table 3 and Table 4 below)
- **RESET** pushbutton (located inside left cover)
- Heartbeat ♡ pushbutton (located inside left cover)

5.1.1 LED indicators

The LEDs will flash to indicate status; the flash codes are listed in the tables below. Additional status information is available by connecting to the *i-Sense Management Console* via the Ethernet port.

Startup/Confirmation Blink

At power-up and to confirm a push-button operation, both LEDs will blink rapidly for a few seconds.

TABLE 3. Green NORMAL LED flash codes

Flash Rate	Meaning
Off	No power
1	OK
2	Voltage events captured, waiting to transmit.
3	Voltage deviation event detected, voltage has not yet returned to normal (PQ event in progress).
4	Establishing connection to the i-Grid servers.
5	Connected to the i-Grid servers, uploading PQ event data.
Constant	Not operating properly. Push RESET button.

TABLE 4. Red ERROR LED flash codes

Flash Rate	Meaning
Off	OK
1	There was a communication error on the last attempt to contact the i-Grid servers. Will retry the connection after a period of time.
2	Ethernet interface is not configured and connected to a network. Also displayed while Ethernet interface is initializing or if the network cable is unplugged.
3	Voltage is low. The i-Sense has not detected an AC signal above 90% nominal on each of the enabled voltage channels.
4	Both Ethernet and event detection are not initialized yet (combination of status 2 and 3).
Constant	Not operating properly. Push RESET button.

5.1.2 Reset Communications

If Ethernet port communications fail, the i-Sense's assigned IP address may be incompatible with your current LAN. Reset the i-Sense IP address to the default value by simultaneously pressing the **RESET** and Heartbeat ♡ buttons for 10 seconds. This will also reset the security username and password to their default values. The Ethernet connection will restart after 5 seconds. Then follow Section 3 to assign a new IP address.

5.1.3 Hard Reset

If the i-Sense fails to respond, press and hold the **RESET** buttons for 4 seconds to perform a hard reset. This has will not erase stored event data, but will cause a "power up" event to be recorded.

5.1.4 Planned shutdown

The i-Sense will normally record an "interruption" event whenever mains power is disconnected. It is often preferable to exclude maintenance shutdowns from your site's power data record. To shut down the i-Sense without recording an interruption event, push and hold the Heartbeat ♡ button for 10 seconds, until the LED blinks rapidly. The i-Sense will automatically restart the next time power is cycled, or when the button is held for another 10 seconds.

5.2 Battery Replacement

The i-Sense uses rechargeable batteries to allow continued operation during power interruptions. The batteries will last for several years in normal operation, but will need to be replaced at some point. Battery health is monitored by the i-Sense and battery problems will be reported to the registered user via email. Battery health is also shown on the *i-Sense Management Console*.

The battery cover is located on the bottom surface of the i-Sense. Battery replacement may be safely performed while mains power is applied. To replace or check batteries:

- Loosen two Phillips-head screws and remove the battery cover to access the battery holder
- Carefully disconnect the battery plug and pull the battery holder straight out.
- Replace or check batteries. Use only the same type rechargeable battery: Nickel-metal-hydride (NiMH), 1.2V AA-size, rated 2000mAh to 3000mAh. Do not use any other battery type.
- Important: be sure that battery polarity matches the markings on the battery holder (+ and -)
- Be certain leads are not pinched. Replace cover. Tighten screws.

Waste batteries should be separated from the normal municipal waste stream and collected separately for local recycling.

⚠ **WARNING**—to reduce risk of explosion or fire, replace only with same battery type: Rechargeable NiMH, size AA, 1.2V, 2000-to-3000mAh. Obey polarity markings (+ / -).

⚠ **AVERTISSEMENT**—pour réduire le risque d'explosion ou de feu, remplacez seulement par le même type de batterie : Rechargeable NiMH, taille AA, 1.2V, 2000 to-3000mAh. Prenez garde de bien respecter les inscriptions de polarité (+/-)

6.0 Technical Specifications

Specifications are typical and are subject to change without notice.

Electrical

Nominal Voltage	User-selectable, 100V-480Vrms, 1-Phase or 3-Phase Immune to voltage fluctuation up to ±10% of nominal and transient over voltages typically present on mains supply (impulse withstand Category II of IEC 60364-4-443)
Frequency	45-65 Hz, auto-sensing
Measurement inputs	1 to 3 channels (V3 models) Up to 6 channels (V6 models)
RMS voltage measurement accuracy	±0.2% typical, ±2% maximum (of full-scale) True rms
Sample rate	5760 sample/second
Waveform capture rate	32 samples/cycle
Time Stamp	±0.1 seconds, typical. Real-time clock synchronized to UTC (NIST standard) daily, via i-Grid and SNTP protocol.
Voltage Deviation Event detection trigger	½-cycle rms voltage $\leq$ 87% or $\geq$ 115% of set nominal Adaptive waveform deviation detection of transient events.
Voltage Deviation Event Storage	8 cycles waveform data (-1 to +3 cycles at event start and -3 to +1 cycles at event end) Continuous rms voltage trend, up to 2 minutes.
Data Storage	Non-volatile event storage > 300 events. Memory cleared after automatic upload to i-Grid.
Periodic (PRMS) Data Logging	Minimum, Maximum, and Average rms voltage recorded for each 10-minute period. Min./Max. are lowest/highest sliding ½-cycle rms in the period.
Power supply and battery backup	Powered from Channel 1 (L1-L2 or L1-N), < 25VA load. Optional 9VDC external power supply (for configuration only). Rechargeable batteries enable measurement & communications during power interruptions for up to 2 minutes.

Mechanical & Environmental

Enclosure	NEMA 1 (IP20).
	   Indoor use only.
	   Only non-conducting pollution (pollution degree II)
	Dimensions: 11.4"H x 9.7"W x 3.0"D
	      291mm H x 247mm W x 75mm D

Weight	8.5 lb (3.6 kg)
Operating Temperature	0°–40°C (32°–104°F)
Storage Temperature	-40°–75°C (-40°–167 °F)
Relative Humidity	0 to 95%, non-condensing
Altitude	2000 m (6,562 ft) at 40°C

Communications

Internet communications	Over port 80 via HTTP protocol. Outgoing only.
Ethernet	IEEE 802.3 10Base-T (10 Mb/s), 8P8C (RJ45) modular connector
Modem (Optional)	PSTN (analog telephone) RJ11 modular connector. Global phone systems supported.
Indicators	Red and green front-panel LEDs
Relay I/O (Optional)	Input: trigger capture Output: event indication (user-selectable thresholds)
i-Sense Management Console	On-board Web server for configuration and status, password protected.
Setup utility (available for download)	*i-Sense Discovery Utility* (Java based) shows all i-Sense units connected to the local area network.

7.0 Compliance Information

- cTUVus (OSHA NRTL) listed
- tested to UL and CSA safety standards
- CE mark (Safety and EMC) (pending)
- RoHS compliant
- FCC part 68   (Telephone Equipment)
- FCC part 15   (Emissions)
- Industry Canada CS-03 (Telephone Equipment)
- European Union CTR21(Telephone Equipment)

7.1   FCC PART 68

- This equipment complies with Part 68 of the FCC rules and the requirements adapted by the ACTA. On the bottom-side of this equipment is a label that contains, among other information, a product identifier in the format US: 3A4MM00BTM. If requested, this information must be provided to the telephone company.
- This equipment uses the USOC jacks: RJ11C.
- A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. See installation instructions for details.
- The REN is used to determine the number of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area. The REN for this product is part of the product identifier that has the format US:AAAEQ##TXXXX. The digits represented by ## are the REN without a decimal point (e.g., 00 is a REN of 0.0).
- If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.
- The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.
- If trouble is experienced with this equipment, please contact SoftSwitching Technologies customer service at www.i-grid.com for repair or warranty information. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.
- The following repairs can be done by the customer: Battery replacement.
- Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.
- If your home has specially wired alarm equipment connected to the telephone line, ensure the installation of this i-Sense does not disable your alarm equipment. If you have questions about what will disable alarm equipment, consult your telephone company or a qualified installer.
- Advisory notice: It is suggested that the customer use a surge arrestor on the AC power lines to which this device is connected. Telephone companies report that electrical surges, typically lightning transients, are very destructive to customer terminal equipment connected to AC power sources. This has been identified as a major nationwide problem.

7.2   Industry Canada NOTICE:

- This product meets the applicable Industry Canada technical specifications. This is confirmed by the registration number. The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.
- Le présent materiel est conforme aux specifications techniques applicables d'Industrie Canada.
- The Ringer Equivalence Number (REN) for this terminal equipment is 0.0. The REN assigned to each terminal equipment provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five.
- L'indice d'équivalence de la sonnerie (IES) sert à indiquer le nombre maximal de terminaux qui peuvent être raccordés à une interface téléphonique. La terminaison d'une interface peut consister en une combinaison quelconque de dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'excède pas 5.

7.3   FCC Part 15 Class A Digital Equipment

- Operation of this device is subject to the following two conditions:
    - o   This device must not cause harmful interference.
    - o   This device must accept any interference received including interference that may cause undesired operation.
- NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- Any changes made by the user not approved by SoftSwitching Technologies can void the user's authority to operate the equipment.

7.4   CTR21 Statement:

- This equipment has been approved for pan-European single terminal connection to the Public Switched Telephone Network (PSTN).
- Due to differences between the individual PSTN's provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN termination point.
- In the event of a problem, you should contact your equipment supplier in the first instance.

SOFT SWITCHING TECHNOLOGIES CORPORATION
STANDARD LIMITED WARRANTY

1. Soft Switching Technologies Corporation ("Seller") warrants that its product conforms to Seller's published specifications and is free from defects in material or workmanship.

2. The duration of the warranty is 12 months from the date the product ships from Seller's Middleton facilities to Buyer (the "Warranty Period").

3. The warranty is applicable only to Buyer, or to the end-user if Buyer is an authorized reseller, for whom the SoftSwitching product is originally installed for use. This warranty is not transferable or assignable.

4. If Buyer discovers within the Warranty Period a failure of the product to conform to specifications or a defect in material or workmanship, Buyer must promptly notify Seller in writing with 10 days after it discovers such failure <u>and</u> before the expiration of the Warranty Period. <u>Any such notification received by Seller after the expiration of the Warranty Period shall be null, void and ineffective.</u> Within a reasonable time after Buyer's notification, Seller will confirm whether a breach of warranty has occurred, and if so will repair the product to correct any failure of the product to conform to specifications or any defect in material or workmanship.

5. Buyer shall ship at Buyer's cost the defective product to Seller for repair. Buyer assumes the risk of loss while product is in transit. Upon repair of the product, shipment back to Buyer shall be at Buyer's sole expense. Seller will arrange with Buyer shipment of the repaired product back to Buyer. If Buyer requires warranty service on-site and Seller agrees, in its sole discretion, to provide such service, then labor costs for on-site field repair and all associated travel and living expenses, shall be the responsibility of Buyer. If Buyer requests expedited warranty service and Seller can accommodate such request as determined in Seller's sole discretion, such service shall be at Buyer's expense.

6. If Seller is unable to repair the product Seller will provide to Buyer, at Seller's sole option, one of the following: (1) a replacement product, or (2) a full refund of the purchase price. <u>These remedies are Buyer's exclusive remedies for breach of warranty</u>.

7. Replacement parts shall be warranted for 90 days or for the remainder of the original Warranty Period, whichever is longer.

8. Seller does not warrant (1) defects caused by failure to provide a suitable installation environment for the product, (2) damage caused by use of the product in applications or for purposes other than it was designed for, (3) damage caused by wrong or inadequate electrical connections of field wiring, (4) damage caused by weather or other natural causes, (5) damage caused by unauthorized attachment or modification, (6) damage during shipment, (7) damage due to ordinary wear and tear, or (8) any other abuse, misapplication, neglect or misuse by Buyer.

9. **DISCLAIMER OF WARRANTY**: THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER ARISING UNDER ANY STATUTE OR LAW, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

10. **Limitation of Liability**. SELLER DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH HEREIN, INCLUDING BUT NOT LIMITED TO ANY LIABILITY FOR PRODUCT NOT BEING AVAILABLE FOR USE, LOST PROFITS, OR LOSS OF BUSINESS. EXCEPT AS EXPRESSLY PROVIDED HEREIN, SELLER WILL NOT BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INDIRECT, OR PUNITIVE DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY THIRD PARTY. BUYER AGREES THAT FOR ANY LIABILITY RELATED TO THE PURCHASE OF PRODUCT, SELLER IS NOT LIABLE OR RESPONSIBLE FOR ANY AMOUNT OF DAMAGES ABOVE THE AMOUNT INVOICED FOR THE APPLICABLE PRODUCT. THE REMEDIES SET FORTH IN THIS WARRANTY SHALL APPLY EVEN IF SUCH REMEDIES FAIL THEIR ESSENTIAL PURPOSE

11. Any action by Seller against Buyer for Buyer's breach of the terms and conditions of this warranty must be commenced within 12 months following the date of such breach.

12. **WARRANTY OF TITLE, PATENTS, AND COPYRIGHTS**: In addition to the warranty set forth in Paragraph 1 above, Seller warrants that it has good title to its products free of any encumbrance, and that the product shall be delivered free from the rightful claim of any third person for infringement of patent or copyright. Seller will defend Buyer against any claim of infringement and will pay resulting costs, damages, and attorney fees finally awarded, provided that, (1) Buyer promptly notifies Seller in writing of any claim within 10 days after Buyer becomes aware of any such claim or potential claim, and (2) Seller has sole control of the defense and all related settlement negotiations. If a claim arises, Buyer will allow Seller, at Seller's option and expense, to procure the right for Buyer to continue using the product, to replace or modify it so that it becomes non-infringing, or to grant Buyer a refund of the purchase price in exchange for return of the infringing product

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