

# Nexus<sup>®</sup> 1262/1272

High Performance Utility Billing Meters



**User Manual**  
V.1.29  
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Nexus® 1262/1272 Meter Installation and Operation Manual Version 1.29

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Electro Industries/Gauge Tech  
1800 Shames Drive  
Westbury, NY 11590  
Attn: Customer Support

## Use of Product for Protection

Our products are not to be used for primary over-current protection. Any protection feature in our products is to be used for alarm or secondary protection only.

## Statement of Calibration

Our instruments are inspected and tested in accordance with specifications published by Electro Industries/GaugeTech. The accuracy and a calibration of our instruments are traceable to the National Institute of Standards and Technology through equipment that is calibrated at planned intervals by comparison to certified standards. For optimal performance, EIG recommends that any meter, including those manufactured by EIG, be verified for accuracy every five years using NIST traceable accuracy standards. In general, EIG metering devices should not require regular adjustments to maintain published accuracy. If the meter is to be used for revenue purposes, follow the verification and calibration guidelines adopted by your local utility.

## Disclaimer

The information presented in this publication has been carefully checked for reliability; however, no responsibility is assumed for inaccuracies. The information contained in this document is subject to change without notice.

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## Safety Symbols



In this manual, this symbol indicates that the operator must refer to an important WARNING or CAUTION in the operating instructions. Please see Chapter 11 for important safety information regarding installation and hookup of the meter.

Dans ce manuel, ce symbole indique que l'opérateur doit se référer à un important AVERTISSEMENT ou une MISE EN GARDE dans les instructions opérationnelles. Veuillez consulter le chapitre 4 pour des informations importantes relatives à l'installation et branchement du compteur.

The following safety symbols may be used on the meter itself:

Les symboles de sécurité suivante peuvent être utilisés sur le compteur même:



This symbol alerts you to the presence of high voltage, which can cause dangerous electrical shock.

Ce symbole vous indique la présence d'une haute tension qui peut provoquer une décharge électrique dangereuse.



This symbol indicates the field wiring terminal that must be connected to earth ground before operating the meter, which protects against electrical shock in case of a fault condition.

Ce symbole indique que la borne de pose des canalisations in-situ qui doit être branchée dans la mise à terre avant de faire fonctionner le compteur qui est protégé contre une décharge électrique ou un état défectueux.



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## **Our Focus at Electro Industries/GaugeTech (EIG)**

EIG exclusively delivers integrated energy and power quality monitoring solutions utilizing AI and deep industry expertise to improve reliability, efficiency, and sustainability. With over 50 years' experience in the electrical industry, EIG has developed extensive energy management and power quality expertise to help customers find ideal solutions to complex challenges. Our corporate culture promotes being cutting edge and investing in R&D to continually improve our customer experience.

Our solutions are designed to deliver results in days, not years. Known for our reputation as being a dependable provider and for exemplary service and support, EIG is committed to customer satisfaction.

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# 1: Three-Phase Power Measurement

This introduction to three-phase power and power measurement is intended to provide only a brief overview of the subject. The professional meter engineer or meter technician should refer to more advanced documents such as the EEI Handbook for Electricity Metering and the application standards for more in-depth and technical coverage of the subject.

## 1.1: Three-Phase System Configurations

Three-phase power is most commonly used in situations where large amounts of power will be used because it is a more effective way to transmit the power and because it provides a smoother delivery of power to the end load. There are two commonly used connections for three-phase power, a wye connection or a delta connection. Each connection has several different manifestations in actual use.

When attempting to determine the type of connection in use, it is a good practice to follow the circuit back to the transformer that is serving the circuit. It is often not possible to conclusively determine the correct circuit connection simply by counting the wires in the service or checking voltages. Checking the transformer connection will provide conclusive evidence of the circuit connection and the relationships between the phase voltages and ground.

### 1.1.1: Wye Connection

The wye connection is so called because when you look at the phase relationships and the winding relationships between the phases it looks like a Y. Figure 1.1 depicts the winding relationships for a wye-connected service. In a wye service the neutral (or center point of the wye) is typically grounded. This leads to common voltages of 208/120 and 480/277 (where the first number represents the phase-to-phase voltage and the second number represents the phase-to-ground voltage).



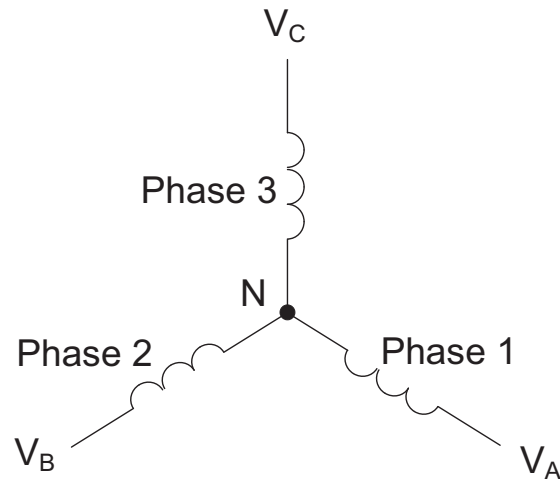


Figure 1.1: Three-phase Wye Winding

The three voltages are separated by  $120^\circ$  electrically. Under balanced load conditions the currents are also separated by  $120^\circ$ . However, unbalanced loads and other conditions can cause the currents to depart from the ideal  $120^\circ$  separation. Three-phase voltages and currents are usually represented with a phasor diagram. A phasor diagram for the typical connected voltages and currents is shown in Figure 1.2.

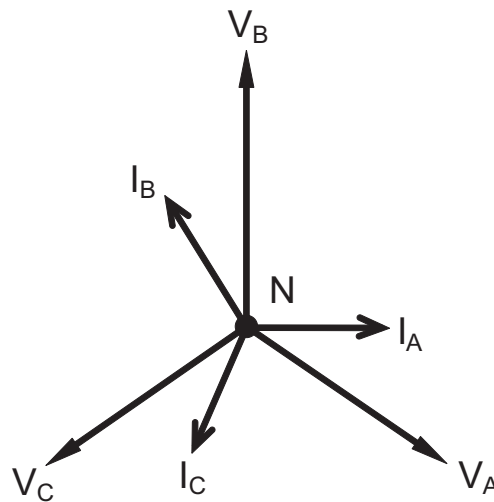


Figure 1.2: Phasor Diagram Showing Three-phase Voltages and Currents

The phasor diagram shows the  $120^\circ$  angular separation between the phase voltages. The phase-to-phase voltage in a balanced three-phase wye system is 1.732 times the phase-to-neutral voltage. The center point of the wye is tied together and is typically grounded. Table 1.1 shows the common voltages used in the United States for wye-connected systems.

| Phase to Ground Voltage | Phase to Phase Voltage |
|-------------------------|------------------------|
| 120 volts               | 208 volts              |
| 277 volts               | 480 volts              |
| 2,400 volts             | 4,160 volts            |
| 7,200 volts             | 12,470 volts           |
| 7,620 volts             | 13,200 volts           |

Table 1: Common Phase Voltages on Wye Services

Usually a wye-connected service will have four wires: three wires for the phases and one for the neutral. The three-phase wires connect to the three phases (as shown in Figure 1.1). The neutral wire is typically tied to the ground or center point of the wye.

In many industrial applications the facility will be fed with a four-wire wye service but only three wires will be run to individual loads. The load is then often referred to as a delta-connected load but the service to the facility is still a wye service; it contains four wires if you trace the circuit back to its source (usually a transformer). In this type of connection the phase to ground voltage will be the phase-to-ground voltage indicated in Table 1, even though a neutral or ground wire is not physically present at the load. The transformer is the best place to determine the circuit connection type because this is a location where the voltage reference to ground can be conclusively identified.

### 1.1.2: Delta Connection

Delta-connected services may be fed with either three wires or four wires. In a three-phase delta service the load windings are connected from phase-to-phase rather than from phase-to-ground. Figure 1.3 shows the physical load connections for a delta service.

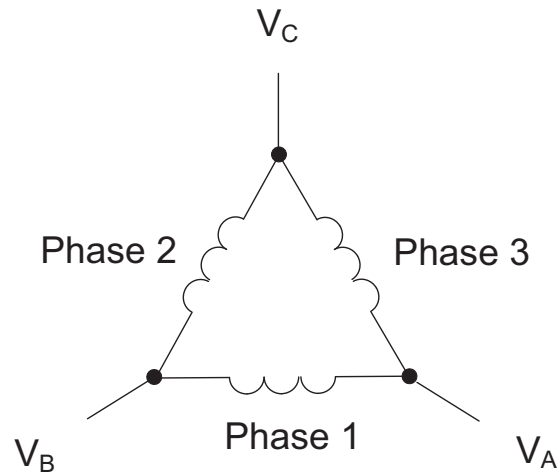


Figure 1.3: Three-phase Delta Winding Relationship

In this example of a delta service, three wires will transmit the power to the load. In a true delta service, the phase-to-ground voltage will usually not be balanced because the ground is not at the center of the delta.

Figure 1.4 shows the phasor relationships between voltage and current on a three-phase delta circuit.

In many delta services, one corner of the delta is grounded. This means the phase to ground voltage will be zero for one phase and will be full phase-to-phase voltage for the other two phases. This is done for protective purposes.

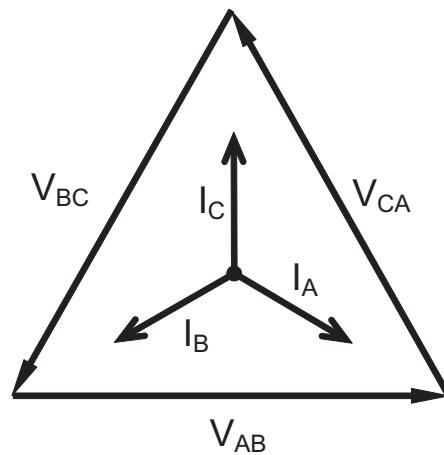


Figure 1.4: Phasor Diagram, Three-Phase Voltages and Currents, Delta-Connected

Another common delta connection is the four-wire, grounded delta used for lighting loads. In this connection the center point of one winding is grounded. On a 120/240 volt, four-wire, grounded delta service the phase-to-ground voltage would be 120 volts on two phases and 208 volts on the third phase. Figure 1.5 shows the phasor diagram for the voltages in a three-phase, four-wire delta system.

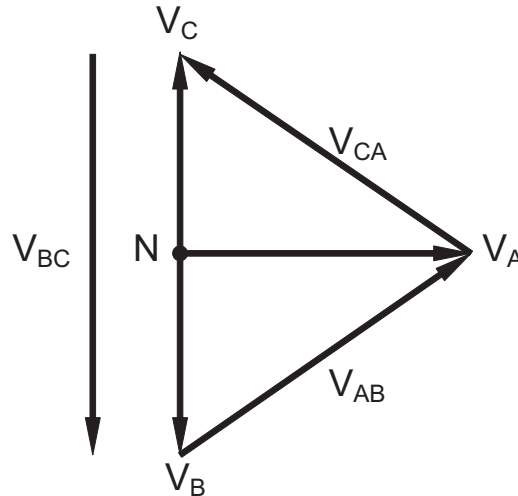


Figure 1.5: Phasor Diagram Showing Three-phase Four-Wire Delta-Connected System

### 1.1.3: Blondell's Theorem and Three Phase Measurement

In 1893 an engineer and mathematician named Andre E. Blondell set forth the first scientific basis for polyphase metering. His theorem states:

If energy is supplied to any system of conductors through N wires, the total power in the system is given by the algebraic sum of the readings of N wattmeters so arranged that each of the N wires contains one current coil, the corresponding potential coil being connected between that wire and some common point. If this common point is on one of the N wires, the measurement may be made by the use of N-1 wattmeters.

The theorem may be stated more simply, in modern language:

In a system of N conductors, N-1 meter elements will measure the power or energy taken provided that all the potential coils have a common tie to the conductor in which there is no current coil.

Three-phase power measurement is accomplished by measuring the three individual phases and adding them together to obtain the total three phase value. In older analog meters, this measurement was accomplished using up to three separate elements. Each element combined the single-phase voltage and current to produce a torque on the meter disk. All three elements were arranged around the disk so that the disk was subjected to the combined torque of the three elements. As a result the disk would turn at a higher speed and register power supplied by each of the three wires.

According to Blondell's Theorem, it was possible to reduce the number of elements under certain conditions. For example, a three-phase, three-wire delta system could be correctly measured with two elements (two potential coils and two current coils) if the potential coils were connected between the three phases with one phase in common.

In a three-phase, four-wire wye system it is necessary to use three elements. Three voltage coils are connected between the three phases and the common neutral conductor. A current coil is required in each of the three phases.

In modern digital meters, Blondell's Theorem is still applied to obtain proper metering. The difference in modern meters is that the digital meter measures each phase voltage and current and calculates the single-phase power for each phase. The meter then sums the three phase powers to a single three-phase reading.



Some digital meters calculate the individual phase power values one phase at a time. This means the meter samples the voltage and current on one phase and calculates a power value. Then it samples the second phase and calculates the power for the second phase. Finally, it samples the third phase and calculates that phase power. After sampling all three phases, the meter combines the three readings to create the equivalent three-phase power value. Using mathematical averaging techniques, this method can derive a quite accurate measurement of three-phase power.

More advanced meters actually sample all three phases of voltage and current simultaneously and calculate the individual phase and three-phase power values. The advantage of simultaneous sampling is the reduction of error introduced due to the difference in time when the samples were taken.

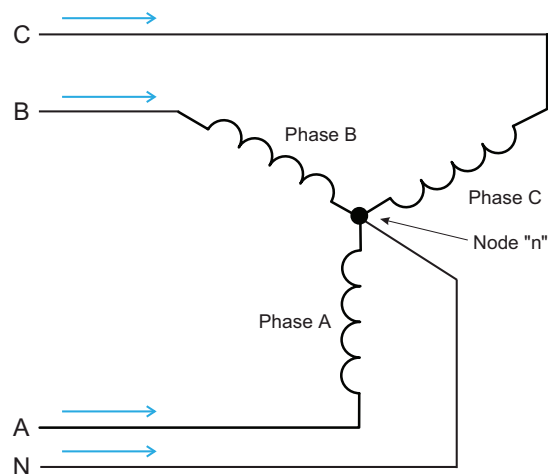


Figure 1.6: Three-Phase Wye Load Illustrating Kirchhoff's Law and Blondell's Theorem

Blondell's Theorem is a derivation that results from Kirchhoff's Law. Kirchhoff's Law states that the sum of the currents into a node is zero. Another way of stating the same thing is that the current into a node (connection point) must equal the current out of the node. The law can be applied to measuring three-phase loads. Figure 1.6 shows a typical connection of a three-phase load applied to a three-phase, four-wire service. Kirchhoff's Law holds that the sum of currents A, B, C and N must equal zero or that the sum of currents into Node "n" must equal zero.

If we measure the currents in wires A, B and C, we then know the current in wire N by Kirchhoff's Law and it is not necessary to measure it. This fact leads us to the conclusion of Blondell's Theorem- that we only need to measure the power in three of



the four wires if they are connected by a common node. In the circuit of Figure 1.6 we must measure the power flow in three wires. This will require three voltage coils and three current coils (a three-element meter). Similar figures and conclusions could be reached for other circuit configurations involving Delta-connected loads.

## 1.2: Power, Energy and Demand

It is quite common to exchange power, energy and demand without differentiating between the three. Because this practice can lead to confusion, the differences between these three measurements will be discussed.

Power is an instantaneous reading. The power reading provided by a meter is the present flow of watts. Power is measured immediately just like current. In many digital meters, the power value is actually measured and calculated over a one second interval because it takes some amount of time to calculate the RMS values of voltage and current. But this time interval is kept small to preserve the instantaneous nature of power.

Energy is always based on some time increment; it is the integration of power over a defined time increment. Energy is an important value because almost all electric bills are based, in part, on the amount of energy used.

Typically, electrical energy is measured in units of kilowatt-hours (kWh). A kilowatt-hour represents a constant load of one thousand watts (one kilowatt) for one hour. Stated another way, if the power delivered (instantaneous watts) is measured as 1,000 watts and the load was served for a one hour time interval then the load would have absorbed one kilowatt-hour of energy. A different load may have a constant power requirement of 4,000 watts. If the load were served for one hour it would absorb four kWh. If the load were served for 15 minutes it would absorb  $\frac{1}{4}$  of that total or one kWh.

Figure 1.7 shows a graph of power and the resulting energy that would be transmitted as a result of the illustrated power values. For this illustration, it is assumed that the power level is held constant for each minute when a measurement is taken. Each bar in the graph will represent the power load for the one-minute increment of time. In real life the power value moves almost constantly.

The data from Figure 1.7 is reproduced in Table 2 to illustrate the calculation of energy. Since the time increment of the measurement is one minute and since we

specified that the load is constant over that minute, we can convert the power reading to an equivalent consumed energy reading by multiplying the power reading times 1/60 (converting the time base from minutes to hours).

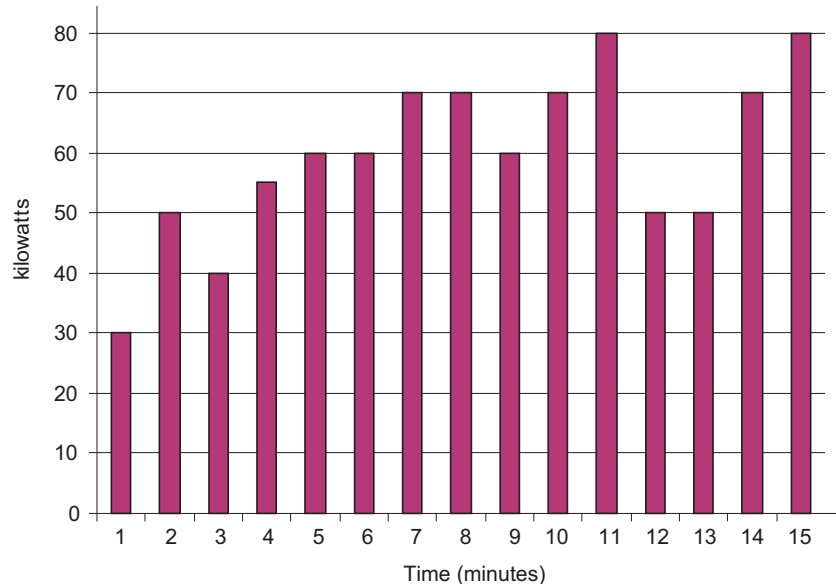


Figure 1.7: Power Use over Time

| Time Interval (minute) | Power (kW) | Energy (kWh) | Accumulated Energy (kWh) |
|------------------------|------------|--------------|--------------------------|
| 1                      | 30         | 0.50         | 0.50                     |
| 2                      | 50         | 0.83         | 1.33                     |
| 3                      | 40         | 0.67         | 2.00                     |
| 4                      | 55         | 0.92         | 2.92                     |
| 5                      | 60         | 1.00         | 3.92                     |
| 6                      | 60         | 1.00         | 4.92                     |
| 7                      | 70         | 1.17         | 6.09                     |
| 8                      | 70         | 1.17         | 7.26                     |
| 9                      | 60         | 1.00         | 8.26                     |
| 10                     | 70         | 1.17         | 9.43                     |
| 11                     | 80         | 1.33         | 10.76                    |
| 12                     | 50         | 0.83         | 12.42                    |
| 13                     | 50         | 0.83         | 12.42                    |
| 14                     | 70         | 1.17         | 13.59                    |
| 15                     | 80         | 1.33         | 14.92                    |

Table 1.2: Power and Energy Relationship over Time

As in Table 1.2, the accumulated energy for the power load profile of Figure 1.7 is 14.92 kWh.

Demand is also a time-based value. The demand is the average rate of energy use over time. The actual label for demand is kilowatt-hours/hour but this is normally reduced to kilowatts. This makes it easy to confuse demand with power, but demand is not an instantaneous value. To calculate demand it is necessary to accumulate the energy readings (as illustrated in Figure 1.7) and adjust the energy reading to an hourly value that constitutes the demand.

In the example, the accumulated energy is 14.92 kWh. But this measurement was made over a 15-minute interval. To convert the reading to a demand value, it must be normalized to a 60-minute interval. If the pattern were repeated for an additional three 15-minute intervals the total energy would be four times the measured value or

59.68 kWh. The same process is applied to calculate the 15-minute demand value. The demand value associated with the example load is 59.68 kWh/hr or 59.68 kWd. Note that the peak instantaneous value of power is 80 kW, significantly more than the demand value.

Figure 1.8 shows another example of energy and demand. In this case, each bar represents the energy consumed in a 15-minute interval. The energy use in each interval typically falls between 50 and 70 kWh. However, during two intervals the energy rises sharply and peaks at 100 kWh in interval number 7. This peak of usage will result in setting a high demand reading. For each interval shown the demand value would be four times the indicated energy reading. So interval 1 would have an associated demand of 240 kWh/hr. Interval 7 will have a demand value of 400 kWh/hr. In the data shown, this is the peak demand value and would be the number that would set the demand charge on the utility bill.

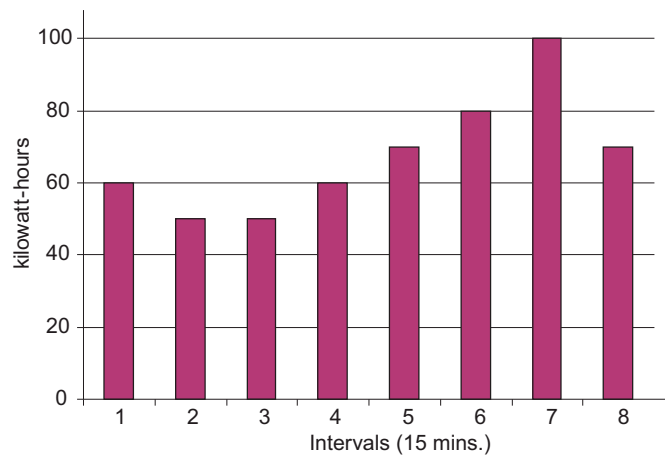


Figure 1.8: Energy Use and Demand

As can be seen from this example, it is important to recognize the relationships between power, energy and demand in order to control loads effectively or to monitor use correctly.

### 1.3: Reactive Energy and Power Factor

The real power and energy measurements discussed in the previous section relate to the quantities that are most used in electrical systems. But it is often not sufficient to only measure real power and energy. Reactive power is a critical component of the total power picture because almost all real-life applications have an impact on reactive power. Reactive power and power factor concepts relate to both load and generation applications. However, this discussion will be limited to analysis of reactive power and power factor as they relate to loads. To simplify the discussion, generation will not be considered.

Real power (and energy) is the component of power that is the combination of the voltage and the value of corresponding current that is directly in phase with the voltage. However, in actual practice the total current is almost never in phase with the voltage. Since the current is not in phase with the voltage, it is necessary to consider both the inphase component and the component that is at quadrature (angularly rotated  $90^\circ$  or perpendicular) to the voltage. Figure 1.9 shows a single-phase voltage and current and breaks the current into its in-phase and quadrature components.

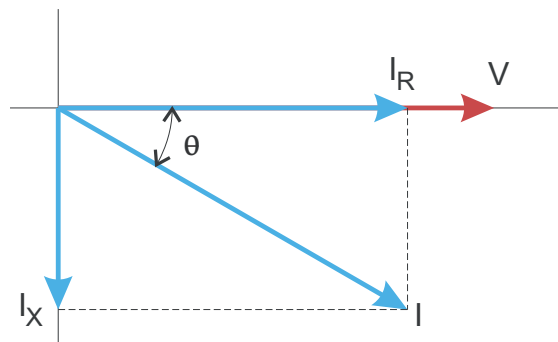


Figure 1.9: Voltage and Complex Current

The voltage ( $V$ ) and the total current ( $I$ ) can be combined to calculate the apparent power or VA. The voltage and the in-phase current ( $I_R$ ) are combined to produce the real power or watts. The voltage and the quadrature current ( $I_X$ ) are combined to calculate the reactive power.

The quadrature current may be lagging the voltage (as shown in Figure 1.9) or it may lead the voltage. When the quadrature current lags the voltage the load is requiring both real power (watts) and reactive power (VARs). When the quadrature current

leads the voltage the load is requiring real power (watts) but is delivering reactive power (VARs) back into the system; that is VARs are flowing in the opposite direction of the real power flow.

Reactive power (VARs) is required in all power systems. Any equipment that uses magnetization to operate requires VARs. Usually the magnitude of VARs is relatively low compared to the real power quantities. Utilities have an interest in maintaining VAR requirements at the customer to a low value in order to maximize the return on plant invested to deliver energy. When lines are carrying VARs, they cannot carry as many watts. So keeping the VAR content low allows a line to carry its full capacity of watts. In order to encourage customers to keep VAR requirements low, some utilities impose a penalty if the VAR content of the load rises above a specified value.

A common method of measuring reactive power requirements is power factor. Power factor can be defined in two different ways. The more common method of calculating power factor is the ratio of the real power to the apparent power. This relationship is expressed in the following formula:

$$\text{Total PF} = \text{real power} / \text{apparent power} = \text{watts/VA}$$

This formula calculates a power factor quantity known as Total Power Factor. It is called Total PF because it is based on the ratios of the power delivered. The delivered power quantities will include the impacts of any existing harmonic content. If the voltage or current includes high levels of harmonic distortion the power values will be affected. By calculating power factor from the power values, the power factor will include the impact of harmonic distortion. In many cases this is the preferred method of calculation because the entire impact of the actual voltage and current are included.

A second type of power factor is Displacement Power Factor. Displacement PF is based on the angular relationship between the voltage and current. Displacement power factor does not consider the magnitudes of voltage, current or power. It is solely based on the phase angle differences. As a result, it does not include the impact of harmonic distortion. Displacement power factor is calculated using the following equation:

$$\text{Displacement PF} = \cos\theta$$

where  $q$  is the angle between the voltage and the current (see Fig. 1.9).

In applications where the voltage and current are not distorted, the Total Power Factor will equal the Displacement Power Factor. But if harmonic distortion is present, the two power factors will not be equal.

#### 1.4: Harmonic Distortion

Harmonic distortion is primarily the result of high concentrations of non-linear loads. Devices such as computer power supplies, variable speed drives and fluorescent light ballasts make current demands that do not match the sinusoidal waveform of AC electricity. As a result, the current waveform feeding these loads is periodic but not sinusoidal. Figure 1.10 shows a normal, sinusoidal current waveform. This example has no distortion.

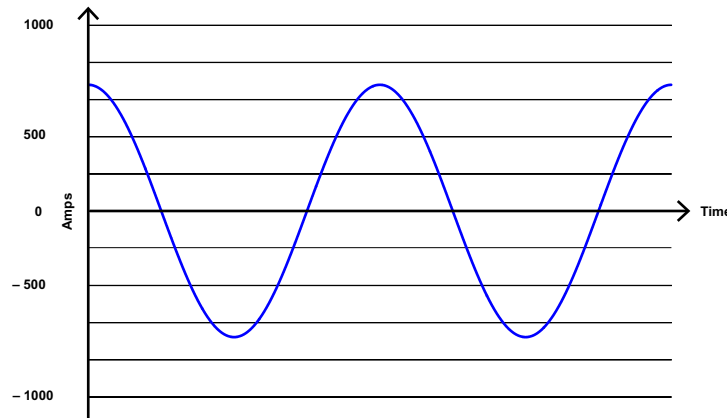


Figure 1.10: Nondistorted Current Waveform

Figure 1.11 shows a current waveform with a slight amount of harmonic distortion. The waveform is still periodic and is fluctuating at the normal 60 Hz frequency. However, the waveform is not a smooth sinusoidal form as seen in Figure 1.10.



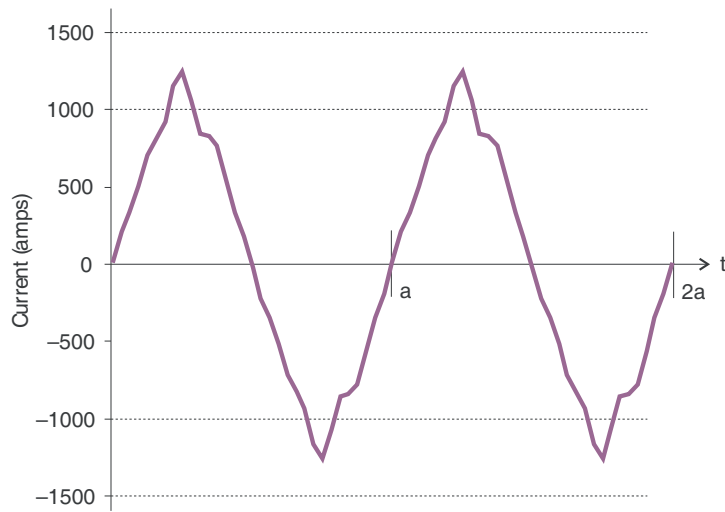


Figure 1.11: Distorted Current Waveform

The distortion observed in Figure 1.11 can be modeled as the sum of several sinusoidal waveforms of frequencies that are multiples of the fundamental 60 Hz frequency. This modeling is performed by mathematically disassembling the distorted waveform into a collection of higher frequency waveforms.

These higher frequency waveforms are referred to as harmonics. Figure 1.12 shows the content of the harmonic frequencies that make up the distortion portion of the waveform in Figure 1.11.

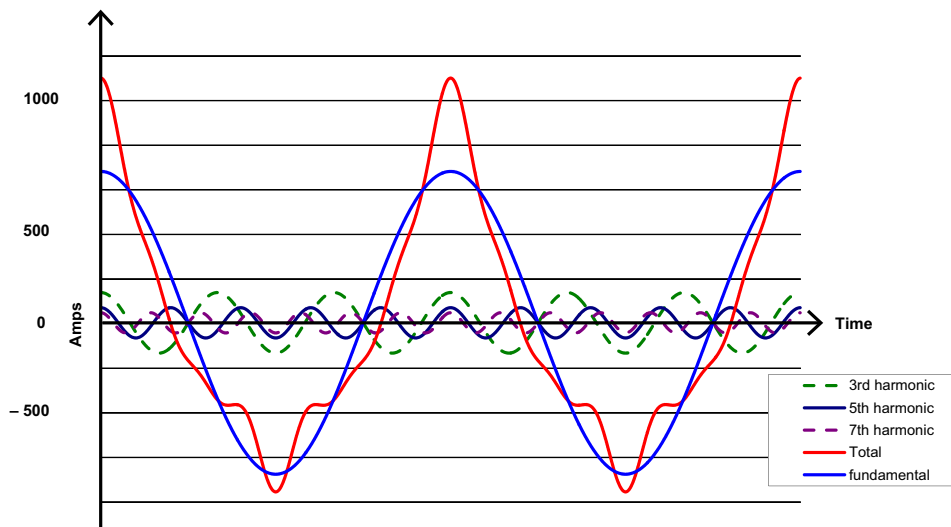


Figure 1.12: Waveforms of the Harmonics

The waveforms shown in Figure 1.12 are not smoothed but do provide an indication of the impact of combining multiple harmonic frequencies together.

When harmonics are present it is important to remember that these quantities are operating at higher frequencies. Therefore, they do not always respond in the same manner as 60 Hz values.

Inductive and capacitive impedance are present in all power systems. We are accustomed to thinking about these impedances as they perform at 60 Hz. However, these impedances are subject to frequency variation.

$$X_L = j\omega L \quad \text{and}$$

$$X_C = 1/j\omega C$$

At 60 Hz,  $\omega = 377$ ; but at 300 Hz (5th harmonic)  $\omega = 1,885$ . As frequency changes impedance changes and system impedance characteristics that are normal at 60 Hz may behave entirely differently in the presence of higher order harmonic waveforms.

Traditionally, the most common harmonics have been the low order, odd frequencies, such as the 3rd, 5th, 7th, and 9th. However newer, non-linear loads are introducing significant quantities of higher order harmonics.

Since much voltage monitoring and almost all current monitoring is performed using instrument transformers, the higher order harmonics are often not visible. Instrument transformers are designed to pass 60 Hz quantities with high accuracy. These devices, when designed for accuracy at low frequency, do not pass high frequencies with high accuracy; at frequencies above about 1200 Hz they pass almost no information. So when instrument transformers are used, they effectively filter out higher frequency harmonic distortion making it impossible to see.

However, when monitors can be connected directly to the measured circuit (such as direct connection to a 480 volt bus) the user may often see higher order harmonic distortion. An important rule in any harmonics study is to evaluate the type of equipment and connections before drawing a conclusion. Not being able to see harmonic distortion is not the same as not having harmonic distortion.

It is common in advanced meters to perform a function commonly referred to as waveform capture. Waveform capture is the ability of a meter to capture a present

picture of the voltage or current waveform for viewing and harmonic analysis. Typically a waveform capture will be one or two cycles in duration and can be viewed as the actual waveform, as a spectral view of the harmonic content, or a tabular view showing the magnitude and phase shift of each harmonic value. Data collected with waveform capture is typically not saved to memory. Waveform capture is a real-time data collection event.

Waveform capture should not be confused with waveform recording that is used to record multiple cycles of all voltage and current waveforms in response to a transient condition.

### **1.5: Power Quality**

Power quality can mean several different things. The terms "power quality" and "power quality problem" have been applied to all types of conditions. A simple definition of "power quality problem" is any voltage, current or frequency deviation that results in mis-operation or failure of customer equipment or systems. The causes of power quality problems vary widely and may originate in the customer equipment, in an adjacent customer facility or with the utility.

In his book *Power Quality Primer*, Barry Kennedy provided information on different types of power quality problems. Some of that information is summarized in Table 1.3.

| <b>Cause</b>                     | <b>Disturbance Type</b>  | <b>Source</b>   |
|----------------------------------|--|---|
| Impulse transient                | Transient voltage disturbance, sub-cycle duration              | Lightning<br>Electrostatic discharge<br>Load switching<br>Capacitor switching |
| Oscillatory transient with decay | Transient voltage, sub-cycle duration                          | Line/cable switching<br>Capacitor switching<br>Load switching                 |
| Sag/swell                        | RMS voltage, multiple cycle duration                           | Remote system faults  |
| Interruptions                    | RMS voltage, multiple seconds or longer duration               | System protection<br>Circuit breakers<br>Fuses<br>Maintenance                 |
| Under voltage/over voltage       | RMS voltage, steady state, multiple seconds or longer duration | Motor starting<br>Load variations<br>Load dropping                            |
| Voltage flicker                  | RMS voltage, steady state, repetitive condition                | Intermittent loads<br>Motor starting<br>Arc furnaces                          |
| Harmonic distortion              | Steady state current or voltage, long-term duration            | Non-linear loads<br>System resonance  |

Table 1.3: Typical Power Quality Problems and Sources

It is often assumed that power quality problems originate with the utility. While it is true that many power quality problems can originate with the utility system, many problems originate with customer equipment. Customer-caused problems may manifest themselves inside the customer location or they may be transported by the utility system to another adjacent customer. Often, equipment that is sensitive to power quality problems may in fact also be the cause of the problem.

If a power quality problem is suspected, it is generally wise to consult a power quality professional for assistance in defining the cause and possible solutions to the problem.

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## 2: Meter Overview

### 2.1: The Nexus® 1262/1272 Multi-parameter Revenue Meter

The Nexus® 1262/1272 transformer-rated, polyphase revenue meter is a unique collection of metering technologies designed to fulfill advanced metering requirements. It provides high-accuracy power and energy measurements of Voltage, current and all power values, data logging and power quality recording. The unit makes the data available through the programmable display, connected systems, and historic logs.

### 2.2: Accu-Measure™ Technology - Theory of Operation

The advanced metering capability of the Nexus® 1262/1272 device is a result of EIG's Accu-Measure™ Digital Sensing Technology. Accu-Measure™ technology is a combination of high-speed sampling, high-resolution measurement and high-speed calculation. All Voltage and current waveforms are sampled and RMS values calculated continuously every cycle. Values of Voltage, current and power are produced every three cycles and every second.

Figure 2.1 illustrates the key processes operating within the Nexus® 1262/1272 meter. The meter allows for four types of inputs and can provide outputs to an integrated display, pulse outputs and several communication ports.

#### **Nexus® 1262/1272 Meter Processing**

Voltage and current signals enter the meter and are sampled at up to 256 samples per cycle. Each sample is resolved to a digital value using 16-bit analog-to-digital converters. The Nexus® 1272 meter has two 16-bit A/D converters and the Nexus® 1262 meter has one. The first converter, which both meters have, is for the real-time measurements. The second converter, unique to the 1272, is for the waveform recorder. The use of two A/D converters ensures that both signals have maximum resolution, accuracy and integrity. The second converter also isolates energy sampling and calculations from the waveform fault recording requirements. This provides both advanced energy and advanced waveform analysis.

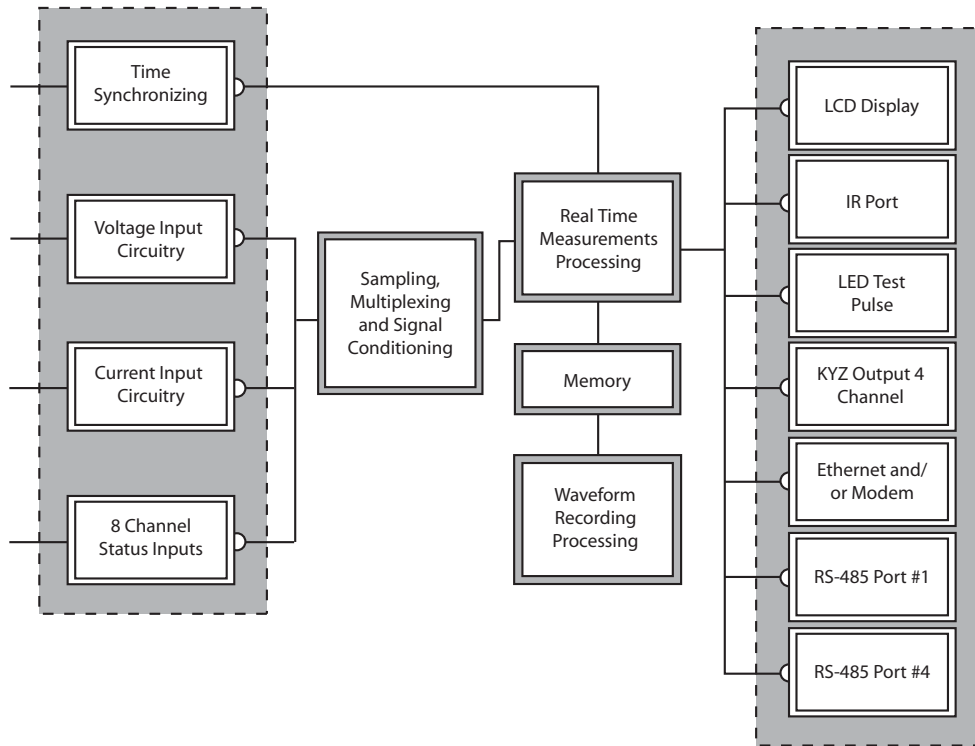


Figure 2.1: How the Nexus® 1262/1272 Meter Processes Inputs

The digitized signals are then passed to the appropriate processor. Real-time measurements are calculated in one processor and made available for meter readings and historical logs. A separate processor performs waveform recording. Calculated data and logs are stored in memory for delivery to displays, external systems and download processes.

The meter includes a time synchronizing input port that accepts an industry standard IRIG-B signal to synchronize meter time to standard universal time. If there is no IRIG-B signal, the meter uses an internal 20 ppm crystal or the primary power line frequency to keep meter time. The Line Frequency Clock Synchronization feature may be enabled or disabled. If it is not enabled, the internal clock crystal provides time synchronization. All readings and logs are time stamped to the nearest millisecond.

Eight status channels provide input of status or pulse signals. Status inputs are date/time stamped to the nearest millisecond and placed in the event log. Pulse inputs are multiplied by a user-supplied factor and accumulated in reading registers. These accumulated values can also be totalized. This feature makes the Nexus® 1262/1272 meter a good fit in universal metering applications. Additionally, any one input channel can be selected to accept an End of Interval pulse from another meter.

Meter set-up parameters and all historical log data are stored in nonvolatile RAM. The user has multiple log functionality. Data is made available through the onboard display. Display screens are described in Chapter 3. Several additional communication channels operate simultaneously, including the optional Ethernet/Modem Combo Card. External systems can be connected to either of the RS485 ports or the Ethernet/Modem port. Stored data can be downloaded through the RS485 ports, the Ethernet/Modem port or the Optical port.

## 2.3: Advanced Functionality

This section describes some of the advanced features of the meter.

### 2.3.1: Advanced Revenue Billing Capability

The Nexus® 1262/1272 device is a full four-quadrant power and energy meter with accuracy of within 0.06% of reading at full load unity PF. Energy measurements include: kWh Delivered & Received, kVARh Delivered & Received, kVAh, kVARh, kWh in each quadrant and Total kVAh. The meter measures instantaneous power and provides multiple, simultaneous demand measurements, including time-stamped maximum and minimum readings.

#### **Time of Use**

The Nexus® meter's Time of Use functionality offers the following standard capabilities:

- 8 TOU schedules
- Bidirectional consumption and Demand
- 4 seasons/year
- 20 year calendar
- Prior month and prior season readings for each schedule
- Present month and present season readings for each schedule
- Prior season may also be adjusted for a programmable freeze period
- Total-to-date readings for each month
- Total-to-date readings for each season
- Cumulative and continuous cumulative Demand

#### **Load Aggregation/Universal Metering**

Using standard pulse inputs, the Nexus® 1262/1272 meter can count pulses from external meters and accumulate usage. The pulse inputs can be used to totalize electrical usage and utility values, such as water or gas use data. Readings include:



- 8 pulse inputs
- Individual accumulating registers
- 4 totalizing registers
- Totalization with Nexus® meter kWh readings

### **Multiple Demand Windows**

The Nexus® 1262/1272 meter simultaneously monitors four demand structures. The unit offers:

- Block Window Demand
- Rolling Window Demand
- Thermal Demand
- Predictive Demand
- Interval length from 1 second to over one hour
- Up to 15 sub-intervals
- End of Interval Pulse Output (with optional 4IPO Internal KYZ capability)
- End of Interval Pulse Input

### **Time-Stamped Max/Min Demands**

The unit gathers Time-stamped Max/Min Demands for all power values. Each of the following values is date/time stamped:

- kW Demand, Delivered & Received, Max/Min
- kVAR Demand, Delivered & Received, Max/Min
- kVAR Coincident with kW Demand
- kVA Demand, Max/Min
- Amps Demand, Max/Min
- Voltage Demand Max/Min

### **Transformer Loss Compensation**

Transformer Loss Compensation adjusts for both copper and iron losses with a simple user setup.

### **2.3.2: Communications and I/O Capabilities**

The Nexus® 1262/1272 meter features advanced communication which utilizes multiple Com ports using open protocols. The meter's multi-port design allows multiple communication connections simultaneously. The Nexus® 1262/1272 system provides a direct digital link, allowing selected data to be gathered without affecting the meter or your data. All of the advanced features of the 1262/1272 are made available through industry-standard Modbus and DNP3 protocols. No proprietary or closed protocols are used.

#### **Standard Communications**

- ANSI Type 2 Optical port
- 2 RS485 serial ports
- Modbus RTU/ASCII protocol
- DNP3 Level 2 + protocol
- Speeds up to 115200 bps

#### **Optional Communications**

The Nexus® 1262/1272 meter allows you to select an additional port for one of the following uses:

- INP200: Internal Ethernet TCP/IP (10/100BaseT) with multiple sockets and Modbus TCP and DNP TCP
- INP202: Combination 56k Modem and Internal Ethernet TCP/IP (10/100BaseT)

### **Standard Internal I/O**

Extensive I/O capability is available in conjunction with all metering functions:

- IRIG-B Time Synchronizing to GPS to 1 millisecond resolution
- 8 High-Speed Status Inputs for status detect or of load aggregation/universal metering inputs
- Four KYZ pulse outputs which can be programmed to pulse for any accumulated reading. One of the pulse outputs can also be set for an End-of-Interval Sync Pulse.

### **Upgradeable External I/O**

The user can select from the following to connect multiple external I/O Modules for enhanced I/O capability:

- Analog Outputs
- Analog Inputs
- Additional Status Inputs
- KYZ Outputs
- Relay/ Alarm Outputs

### **Control Options**

ElectroLogic™ Relay Control provides user-definable control outputs:

- Action and/or alarm on abnormal condition
- Action on Boolean logic combinations of Inputs or electrical conditions

### 2.3.3: Programmable Display

The Nexus® 1262/1272 meter features a built-in graphical back-lit FSTN LCD display with extended temperature Voltage compensation. This allows you to view energy data and to gather circuit diagnostic data such as Voltage, current, harmonics and phasor information. The display is fully programmable. See Chapter 3 for details on the programmable display.

### 2.3.4: Additional Switches

The Nexus® 1262/1272 meter has additional switches & signals that help in using the unit (see Section 3.2 for more information):

- The Infrared Test Pulse can be set to pulse for +Watt-hour, -Watt-hour, +VAR-hour, -VAR-hour and VA-hour. The pulse uses time modulation, which allows the pulse to be accurate during short duration pulse tests. The pulse integration uses industry-accepted reference standards.
- The Mode Switch (magnetic reed switch) uses a magnet to switch operating modes.
- The Test button is used to access Test Mode.
- The Reset button is used to reset Demand.

### 2.3.5: Nexus® External I/O Modules

A variety of optional analog or digital I/O modules mount externally to the Nexus® 1262/1272 Socket meter. The Nexus® 1262/1272 unit does not supply power to I/O modules. Use a power supply, such as EIG's PSIO, to power optional I/O modules. See Chapter 10 for details on installation and use of the Nexus® External I/O modules.

## 2.4: Nexus® 1262/1272 Meter Forms

- The Nexus® 1262/1272 Socket meter offers three supported S-Based meter forms based on the rated Voltage and hookup required by the user. Below are the form specifications.

**Table 1: Nexus® 1262/1272 Meter Forms**

| Form | Hookup          |
|------|-----------------|
| 9S   | 3E Wye or Delta |
| 36S  | 2 1/2E Wye      |
| 45S  | 2E or 4W Delta  |

**NOTE:** See Section 2.6 for Rated Voltages.

- Form 9S can be ordered in an A-Base (Order Form 9A).
- Form 45S replaces Form 5S and may also be used in 4-wire Delta circuits.
- See Chapter 11 for corresponding Wiring diagrams and Appendix B for Blade configurations.
- **Switchboard:** The switchboard case meter gives you all the features of the socket meter, plus the benefits of EIG's new SWB3. The SWB3 is a superior direct replacement to the General Electric style relay case-mounted meters. The dimensions of the SWB3 are identical to the S1 relay case. Other features of the SWB3 are:
  - A draw out meter cradle for easy testing and replacement
  - Easy-remove hinged paddle for simple installation
  - NEMA 4X-rated cover for outdoor substation control panels
  - One button cover release for simpler installation and testing

**NOTE:** Older Nexus® 1262/1272 Switchboard meters offers two supported Z-Based forms, 9Z and 36Z. The legacy Switchboard meter comes in an S1 form relay case, but it has an optional retrofit panel that converts the meter to fit in an M1 form panel cutout (see Chapter 12 for details on the legacy Switchboard meter).

## 2.5: Nexus® 1262/1272 Meter Accuracy

**Table 2: Nexus® 1262/1272 Meter Accuracy**

| Value     | Accuracy |
|-----------|----------|
| Voltage   | 0.02%    |
| Current   | 0.05%    |
| Frequency | 0.001Hz  |
| W         | 0.06%    |
| Wh@1.0PF  | 0.06%    |
| Wh@0.5PF  | 0.10%    |
| VAR       | 0.10%    |
| VA        | 0.10%    |
| PF        | 0.10%    |

## 2.6: Nexus® 1262/1272 Meter Specifications Overview

### Sense Inputs

#### Current (AC)

- Transformer (CT) rated
- Two or three current inputs depending on Form (Ia, Ib, Ic)
- Class 2 - 1 A nominal, burden 0.000312 VA@2.5 A
- Class 10, 20 - 5 A nominal, burden 0.0125 VA@25 A
- 0.1% of nominal pick-up current
- 120% over-range of Meter Class
- Current surge withstand (at 23 °C): 100 A for 10 seconds, 300 A for 3 seconds, 500 A for 1 second



The current inputs are only to be connected to external current transformers.

### Voltage (AC)

- Blade powered unit, standard Voltage (Option S): 480 V max Phase to Reference (Va, Vb, Vc, to VRef), burden total 12 V max (including power supply); 600 V max Phase to Phase (Va to Vb, Vb to Vc, Vc to Va)
- Blade powered unit, low Voltage (Option LV): 69 V max Phase to Reference (Va, Vb, Vc, to VRef), burden total 12 V max (including power supply); 120 V between Va, Vb, Vc inputs
- Externally powered units (Options SE, DE): 480 V max Phase to Reference (Va, Vb, Vc, to VRef), burden 0.33 VA @ 576 V; 600 V max between Va, Vb, Vc inputs
- Input Impedance: 1 Mohm/phase
- 20% over range of rated Voltage
- 2 V pickup Voltage

### External Power Supply Options Nominal Ratings

- Standard external (Option SE): (102 to 270) V AC/DC @ 50/60 Hz, 12 VA max
- Low Voltage external (Option DE): (18 to 60) V DC, Burden 9 W max
- Separate power cord
- Switchboard meter is always separately powered (option SE or DE)

### Isolation

- All inputs and outputs isolated to 2500 V
- Com Ports isolated from each other to 1000 V

### Sensing

- Accu-Measure™ Technology
- 16-bit A/D Inputs
- True RMS

- 8-Channel Sample and Hold

#### Memory

- All meter setup parameters, measurements and logs contained in nonvolatile RAM

#### Standard Communications

- IR/ANSI port
- Two RS485 serial ports
- Modbus RTU, Modbus ASCII and DNP3 protocols
- Data Speeds of up to 115200 bps

#### Optional Communications

- INP200: Internal 10/100BaseT Ethernet with Total Web Solutions
- INP202: Ethernet / Modem Combo card
- Modbus TCP and DNP LAN/WAN

#### Internal 8-Channel Digital Inputs

- Type: Self-excited, for dry contacts only
- Wetting Voltage: 12 V DC typical

#### Internal 4-Channel KYZ Outputs

- Type: Form C contacts, pulse or transition based counts
- On Resistance: (23-35)  $\Omega$
- Peak Voltage: 350 V DC
- Continuous Load Current: 120 mA
- Peak Load Current: 350 mA (10ms)
- Off-State Leakage Current @ 350 V DC: 1: $\mu$ A



- Opto Isolation: 3750 V rms (60 Hz, 1 min)

### Clock Timing

- IRIG-B input for synchronizing to external GPS clock signal - accuracy better than 1 msec per month
- Line Frequency Clock Synchronization - accuracy better than 1 second per month
- Internal Clock Crystal - accuracy better than 2 minutes per month

### Environmental (Temperature Specifications to Indirect Light)

- Operating Temperature: (-40 to +85) °C
- Display Operating Temperature: (-20 to +60) °C
- Humidity: 95% non-condensing
- Storage Temperature: (-40 to +85) °C
- Raintight Lexan Cover, Outdoor Rated (Socket meter)

**NOTE:** At temperatures above 60 °C the display may turn black. The display should return to normal once the temperature has cooled. If the meter is exhibiting a heating issue that causes the display to turn black, try shielding the meter from direct sunlight or otherwise provide some cooling effect to the meter.

### Security

- A hardware lock secures meter settings.
- Two 10-character passwords are configurable: one password controls access to read meter digitally; a separate password controls access to meter programming.
- An additional 8 level password sequence is available by user configuration.

### Internal Battery

- Panasonic BR3032 3 V Lithium Battery (or equivalent) maintains NVRAM and time during outages.

### IRIG-B Port Impedance

- 1.8 mA @ 5 V

### Shipping Dimensions

- Socket Meter
  - Size: 13" W x 10" D x 11" H/33.02 cm x 25.40 cm x 28 cm
  - Weight: 10 lbs./4.54 kg
- Switchboard Meter (SWB3)
  - Size: 16" W x 14" D x 10 1/2" H/40.64 cm x 35.56 cm x 26.67 cm
  - Weight: 16 lbs./7.25 kg
- Legacy Switchboard Meter
  - Size: 16" W x 14" D x 11" H/ 40.64 cm x 35.56 cm x 28 cm
  - Weight: 16 lbs./7.25 kg

### Compliance

- ANSI C12.20 0.2 Accuracy Class and C12.1
- IEC 62053-22 2003 0.2S\*
- IEC 60687 (IEC 62053-22 and IEC 62053-23 0.2) KEMA Labs Certified\*
- IEC 62052-11 2003 (General Requirements; Mechanical Properties; Climactic Influences)\*
- IS IS 14697:1999, (Reaffirmed 2004)\*
- Measurement Canada Approved

\*Third party lab tested

## 2.7: Nexus® 1262/1272 Meter Logging Specifications

| Model | Historical Log 1* | Historical Log 2* | CBEMA/ITIC** | Event Log** | Waveform Log*** | Flicker Log** | Output Log** | Input Log** | System Events** |
|-------|-------------------|-------------------|--------------|-------------|-----------------|---------------|--------------|-------------|-----------------|
| 1272  | 555 Days          | 133 Days          | 512          | 1024        | 95              | 5120          | 256          | 1024        | 1024            |
| 1262  | 480 Days          | 133 Days          | N/A          | 512         | N/A             | N/A           | 512          | 1024        | 1024            |

\*Assumes logs store 4 scaled energy readings every 15 minutes.

\*\*Number of events recorded (assumes 14 parameters monitored).

\*\*\*Number of waveform records. Each record may be from 8 to 64 cycles in duration, depending upon meter setup.

## 2.8: DNP3 Level 2

Nexus® 1262 and 1272 meters support DNP3 Level 2

### DNP3 Level 2 Features

- Up to 104 measurements (64 Binary Inputs, 32 Binary Counters, 32 Analog Inputs) can be mapped to DNP Static Points (over 3000) in the customizable DNP Point Map.
- Up to 16 Relays and 8 Resets can be controlled through DNP Level 2.
- Report-by-Exception Processing (DNP Events) Deadbands can be set on a per-point basis.
- Available Freeze commands are Freeze, Freeze/No-Ack, Freeze with Time, and Freeze with Time/No-Ack.
- Freeze with Time commands enable the Nexus® meter to have internal time-driven Frozen and Frozen Event data. When the meter receives the time and interval, the data is created.

For complete details, download the appropriate DNP User Manual from our website at [www.electroind.com](http://www.electroind.com).

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## 3: Operating Instructions

### 3.1: Nameplate Information

The Nexus® 1262/1272 Socket meter has its operating information represented on the nameplate, which is located on the face of the meter (see figure below). Serial and Model numbers are on the Options label (see next page).

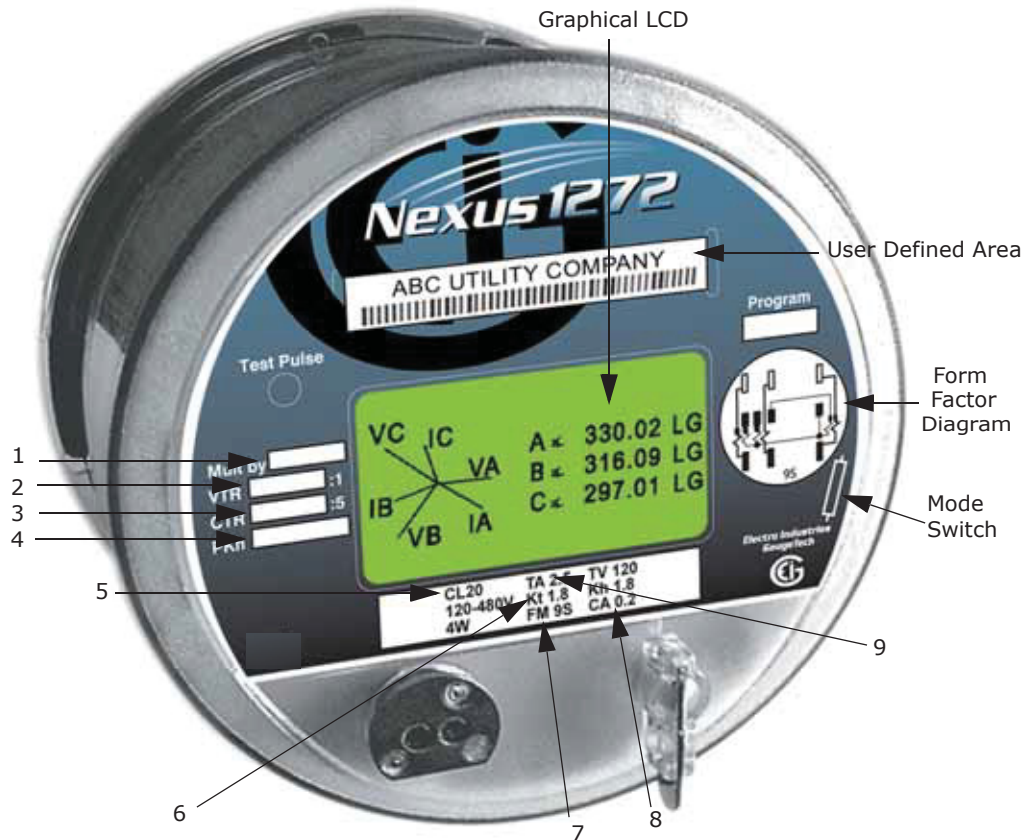


Figure 3.1: Meter Showing Faceplate Elements

The numbers in the figure represent:

1. Multiply by Constant
2. Voltage Transformer Ratio (PT Ratio)
3. Current Transformer Ratio (see Glossary)
4. Primary Watt-hour constant
5. Current class

- 6. Watt-hour test constant
- 7. ANSI C12.20 Form Number
- 8. ANSI C12.20 Accuracy Class
- 9. Test Amperes

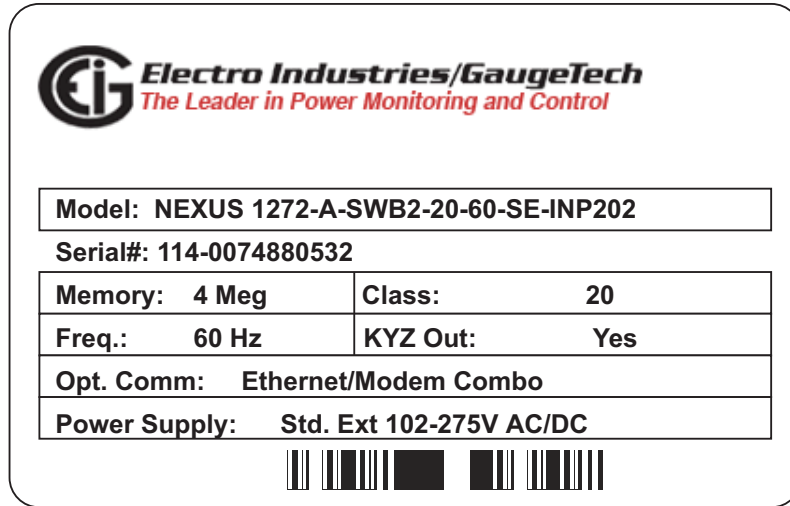


Figure 3.2: Meter Options Label

The Options Label is located on the outside of the internal shroud. It is printed specifically for each meter and shows the ordered options that are included in the meter. An example of a typical label is shown above. Below is a list of options available for the meter:

**Memory (1272):**

A (Advanced) 4M of RAM

**Memory (1262):**

A (Advanced) 2M of RAM

**Communication Options:**

INP2 - Dial Out Option

INP200 - Ethernet 10/100BaseT

INP202 - Ethernet/Modem Combination

**Case Style:**

SWB2 - Switchboard

45S, 9S, 36S - Socket meter Forms

9A - Socket meter in A-Base

**Power Supply:**

SE - Std. Ext (102-275) V AC/DC

S - Std. Blade Powered

DE - DC Ext (18-60) V DC

LV - 69 V AC Blade Powered

**EIG Number - Model Number plus Option Numbers** (Example below):

Model - Memory - Form - Freq - Power Supply - I/O - Communication

1272 - A - 9S - 60Hz - S - 4PO1 - INP200

## 3.2: Basic Operation

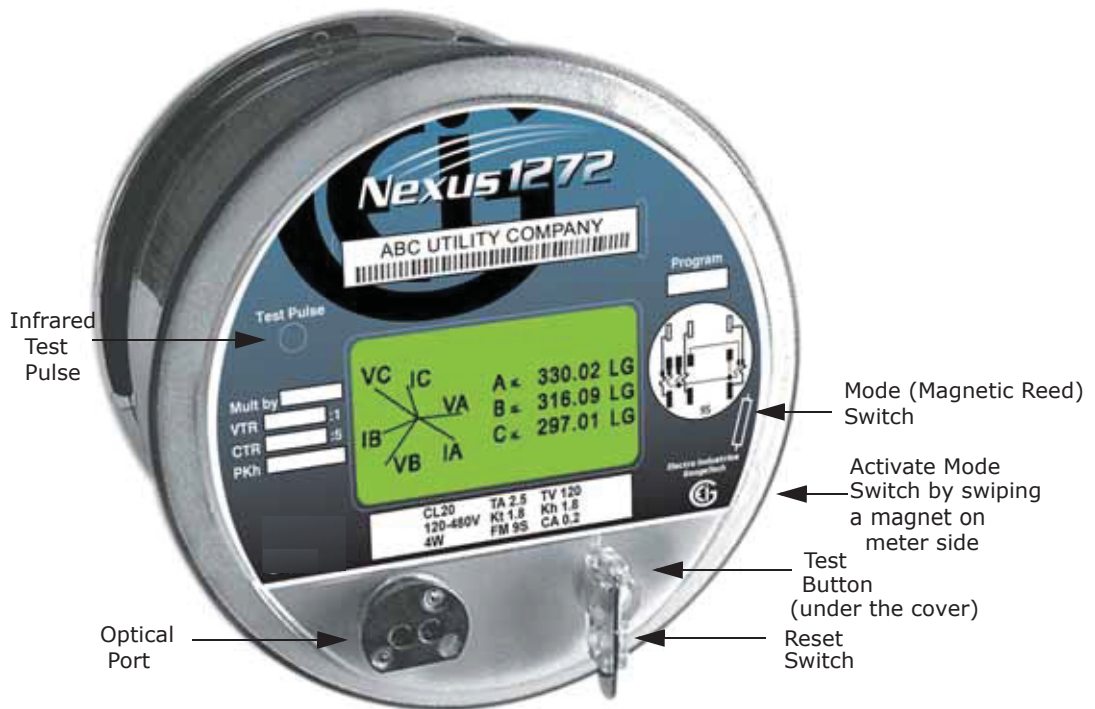


Figure 3.3: Meter Showing Switches and Indicators

### Switches and Indicators

- There are two switches accessible from outside the meter cover:
  1. The **Mode** Switch (also called a Magnetic Reed Switch) is used to switch from Normal Mode to Circuit Diagnostic Mode or Time of Use Mode.
  2. The **Reset** Switch is used to reset Demand.
- A third switch, the **Test** Button, is accessible only when the cover has been removed. The Test Button switches the meter from one of the operational modes to Test Mode and back to Normal Mode. The Test Button is also used to access Display Adjustments Mode during Power-up Mode.



### **Optical Port**

The Optical port is located on the lower left side of the meter face. With the Optical port you can program the meter with CommunicatorPQA software using a B10U Communication Interface (or other ANSI C12.13 Type II magnetic optical communications coupler).

### **Test Pulse**

An infrared Test pulse is located on the upper left side of the face. Energy pulsing applications can be configured using CommunicatorPQA software.

### **Phase Indicator**

A Phase indicator is located on the lower right side of the face. "ABC" stays illuminated if all three phases of voltage and current are present. The indicator blinks A, B or C if that phase has voltage but no current, and is blank if that phase has no voltage or current.

### 3.3: LCD Display Information

The Nexus® 1262/1272 meter has a graphical back-lit FSTN LCD programmable display with extended temperature Voltage compensation. The display lets you view Energy data and gather circuit diagnostic data such as Voltage, current, harmonics and phasor information.

You use CommunicatorPQA software to program the display. The display has three View modes to which you assign screens. This lets you determine what data is displayed and in what order. View mode 1 is the primary mode; the other modes automatically return to View mode 1 after a user-set amount of inactivity. Set the time through CommunicatorPQA (see Section 3.5 instructions for the Miscellaneous tab). There is also a Test mode and a Select Compensation screen.

#### Mode Details

- Access View mode 2 and View mode 3 by swiping the Mode Switch with a magnet (see Figure 3.3). Access Test mode by removing the cover (POWER MUST BE OFF), powering up the meter and pushing the Test Button at any time. See the Navigation map in Section 3.4 for display mode details.
- Test mode automatically returns to View mode 1 after an amount of time since the last user action with no energy accumulation (or) an amount of time since the last user action plus the Demand interval with energy accumulation. The values for the amount of time since the last user action are set through CommunicatorPQA (see Section 3.5 instructions for the Miscellaneous tab).

### **Display Configurator**

A Nexus® meter with the appropriate firmware (User Programmable LCD Display Run Time Firmware version 100, LCD Display Boot version 30, Base meter's COM Run Time 624; or higher - post-November, 2010) gives you the Display Configurator, which lets you assign up to 75 LCD display screens across the three View modes. These screens can be made of any combination of pre-defined screens (see Section 3.6.1), pre-defined screens with some customization, and fully customized screens with any of the meter's measured readings and numeric calculations, such as scaling. The Display Configurator's flexibility lets you match the display screens to any application needs you have. Refer to Section 3.5 for programming details.

### **Base Programmable Display**

Nexus® meters with an LCD Display Run Time Firmware version of less than 100 (pre-November, 2010) do not have the Display Configurator. For these meters you can assign up to 16 pre-defined screens per View mode. Refer to Section 3.6 for programming details.

**NOTE:** See Section 3.3.1 for instructions on finding your display's firmware version.

### **Low Battery**

Lo Batt - NVRam (Internal Battery) or Lo Batt - Modem (Modem Battery) flashes on the screen every 10-15 seconds when the Internal (or Modem) Battery is running low or when it is not "clicked" into place properly. See installation instructions in Section 6.2.

### **Test Mode**

- Wh Test - Same as kWh screen, except in Wh instead of kWh
- VARh Test - Same as kVAR screen, except in VARh (Quadrants)
- VAh Test - Same as kVAh screen, except in VAh (Quadrants)
- Watt Rolling Demand Test (Delivered and Received)
- Watt Block Demand Test (Delivered and Received)

### **Initial Display Screens**

The Nexus® 1262/1272 meter ships with initial display screens, which scroll on the display as soon as you power up the meter. The initial display screens are a sampling of the pre-defined screens. Typical initial display screens include:

- Meter Data, including Boot, Run, DSP Boot, DSP Run, Serial Number, Protect Enabled, Baud
- Wh Delivered
- Wh Received
- kVARh per Quadrant
- kVAh per Quadrant
- Rolling W Demand Delivered
- Rolling W Demand Received
- Block W Demand Delivered
- Block W Demand Received
- W Demand Last Reset
- Cumulative W Demand

### **Backlight**

The Backlight cannot be set to stay on indefinitely. It turns off after a programmed interval: one hour is the maximum setting. If the backlight times out and is off, swipe the Mode Switch once to turn the backlight on and redirect the screen.

### 3.3.1: Finding Your Display's Firmware Versions

To find your LCD display's firmware versions, follow these steps:

1. Connect to the meter through CommunicatorPQA software.
2. Click the **Profile** icon in the Title bar.
3. Click **Revenue and Energy Settings>Display Configuration** to open the Device Display Programmable Settings screen, shown below.

Device Display Programmable Settings

Display Modes    Power and Energy Display    Miscellaneous

Meter Display Mode Names    Screen Assignments

Enter Mode Label and Description for each mode

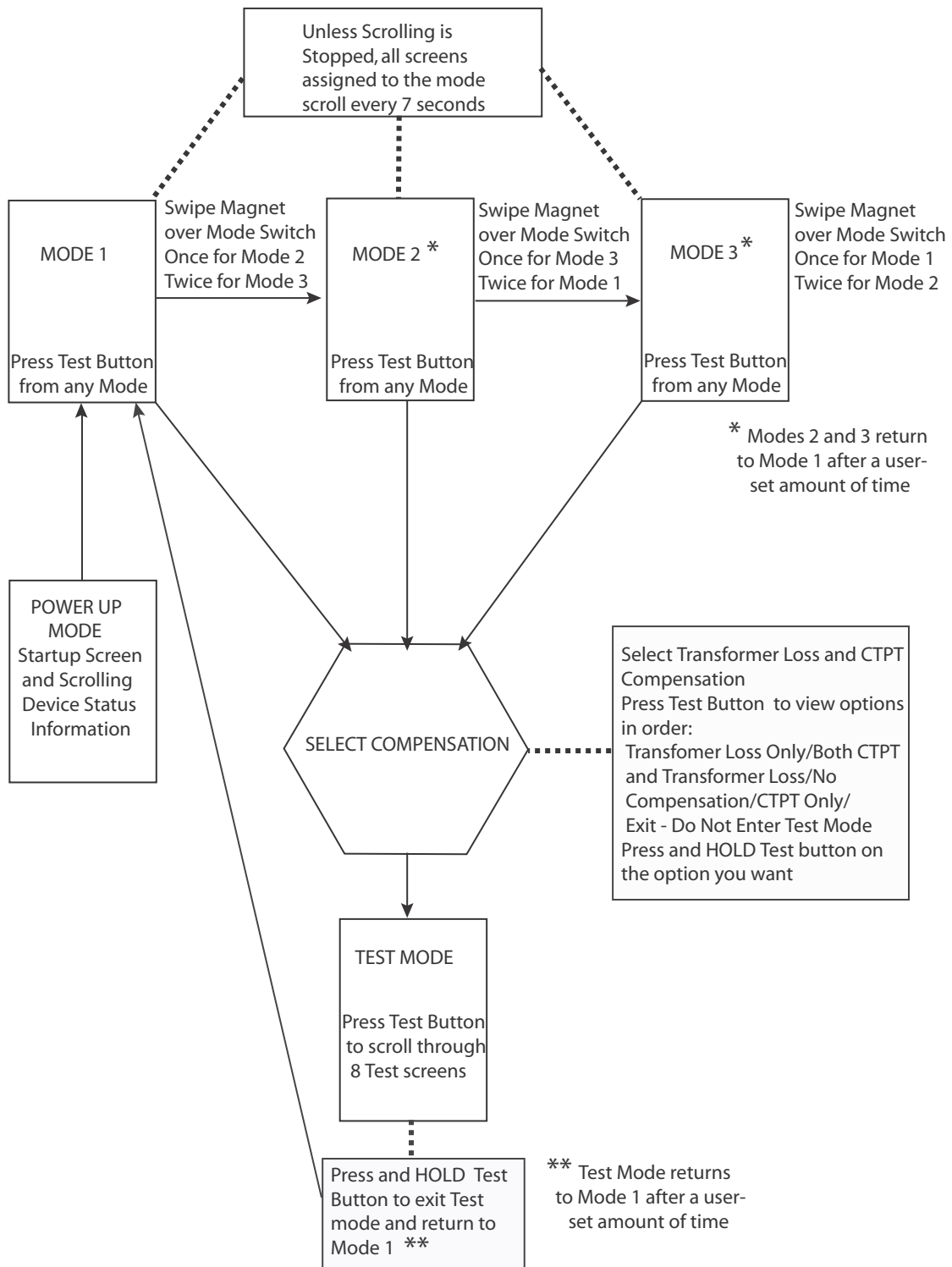
|             | Label | Line 1 Description | Line 2 Description |
|-------------|-------|--------------------|--------------------|
| View Mode 1 | Nrm   | Normal             |                    |
| View Mode 2 | Alt   | Alternat           |                    |
| View Mode 3 | Tst   | Test               |                    |

Firmware versions  
 Boot Version - 30  
 Run Version - 100

Update Display    Retrieve from Display    OK    Cancel    Save    Load    Help

4. The LCD display's firmware versions are shown in the bottom left portion of the screen. If the Boot version is 30 or higher and the Run version is 100 or higher, follow the instructions in Section 3.5. If the Boot and Run versions are less than 30/100, follow the instructions in Section 3.6.

### 3.4: Nexus 1262/1272 Programmable Display Navigation Map



### 3.5: Using the Display Configurator

The Nexus® 1262/1272 meter with appropriate firmware (User Programmable LCD Display Run Time Firmware version 100, LCD Display Boot version 30, Base meter's COM Run Time 624; or higher) gives you the Display Configurator. This feature lets you customize the meter's LCD screens to display any measured readings. The Display Configurator features three View modes (see Section 3.3) and has memory for up to 75 screens, distributed however you want among the three View modes.

The flexibility of the Display Configurator allows you to customize the LCD display for any application. Additional features of the Display Configurator are as follows:

- You can add screen numbers and/or labels (titles).
- You can add scaling and multiplier factors to the screen data.
- You can use the screens to view data from pulse inputs, such as water, gas, steam, etc.
- You can use a combination of pre-defined and customized displays. See Section 3.6.1 for a list of the pre-defined displays.

**IMPORTANT!** You use the Nexus® 1262/1272 meter's Modbus map to identify the data you want to display in a customized display screen. The Modbus map for the Nexus® 1262/1272 meter is contained in the *Modbus Protocol and Register Map for Nexus® 1252/1262/1272 Meters*. The manual can be downloaded from EIG's website.

#### To access the Display Configurator's programming screens

1. Connect to the meter through CommunicatorPQA.
2. Click the **Profile** icon to open the Device Profile screen.
3. Click the plus sign (+) next to Revenue and Energy Settings.

4. Double-click **Display Configuration**. You will see the screen show below. The first tab is Meter Display Mode Names, which lets you assign labels and descriptions to the three View modes.

| Enter Mode Label and Description for each mode |       |                    |                    |
|--|-------|--------------------|--------------------|
|  | Label | Line 1 Description | Line 2 Description |
| View Mode 1                                    | 1     | Mode_1             | 111                |
| View Mode 2                                    | 2     | Mode_2             | 222                |
| View Mode 3                                    | 3     | Mode_3             | 333                |

Firmware versions  
Boot Version - 25  
Run Version - 61

- Enter a three-letter label for each of the three View modes.
  - Enter a description for each mode using the Line 1 and Line 2 Description fields.
5. Click the Screen Assignments tab. You will see the screen shown on the next page.



**Device Display Programmable Settings**

Display Modes | Power and Energy Display | Miscellaneous

Meter Display Mode Names | Screen Assignments

Available Screens | View Mode 1 | View Mode 2 | View Mode 3

Buttons that let you: Create custom display screens, or Remove display screens from the available screens list

Buttons that let you: Change the order of display screens in a View mode, or Remove display screens from a View mode

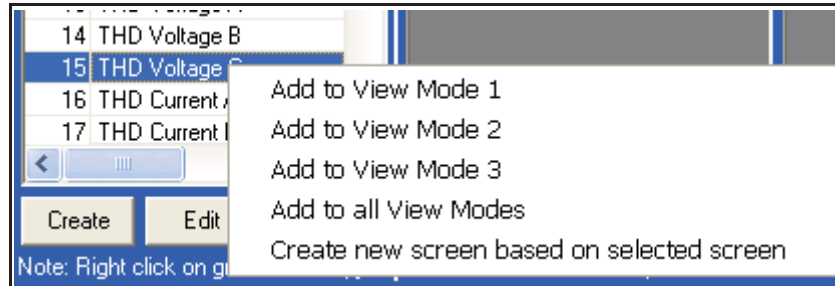
6. Using the buttons on the bottom of the screen you can:

- Retrieve display settings from the connected meter by clicking **Retrieve from Display**.
- Update the connected meter's display settings by clicking **Update Display**. The meter reboots and you see a message on the PC screen: Device LCD Display Programmable Settings Updated.
- Save any changes you have made to display settings by clicking **Save**.
- Load a previously saved LCD display file by clicking **Load** and select the file you want to load into this screen (it is a .nds2 file).
- Return to the previous screen without saving any changes by clicking **Cancel**.
- View online instructions for using this screen by clicking **Help**.

The leftmost column lists all of the Available display screens. Before you've used the Display Configurator, you will only see the pre-defined display screens in the list. Once you have created customized screens, you will see those in the list as well.

The other three columns list the display screens that are assigned to each of the three View modes. Use the scroll bars to display all of the items in the columns.

- a. To assign one of the screens to a View mode or to create a new screen based on it, click on the screen in the list and right-click. You will see the pop-up menu shown below.



- To add the screen to one of the modes, or to all modes, click on that item in the menu.
  - To create a new screen based on the screen, click on the last item in the menu (see Step e).
- b. To change the position of screens in one of the View modes, or to remove the screen from the mode, click on the screen in the View mode column and then either:
- Click **Move Up** or **Move Down** to change the position of the screen within that View mode. The position of the screens determines their scrolling order.
  - Click **Remove** to remove the screen from that View mode.
- c. To create a custom display screen, click **Create** in the Available Screens column. Continue to **“Creating a Custom Display Screen”** on the next page.
- NOTE:** to Edit a custom screen, click on the screen in the Available Screens list and then click **Edit**. Then use the instructions in **“Creating a Custom Display Screen”** on the next page to modify the screen.
- d. To edit a pre-defined screen, click on the screen in the Available Screens column list and then click **Edit**. Continue to **“Editing a Pre-defined Display Screen”** on page 3-22.

- e. To create a new screen based on an existing screen, highlight the screen in the Available Screens column list, right-click and select **Create New Screen Based on Selected Screen**. If you are making a custom screen, follow the instructions below. If you are just changing the screen number or label, follow the instructions in “**Editing a Pre-defined Display Screen**” on page 3-22.
- f. To remove a screen from the list of available screens, click on the screen in the Available Screens column list and then click **Remove**. The screen is no longer displayed in the list of available screens, and cannot be assigned to any View mode. It is also removed from any View modes it has already been assigned to.

#### Creating a Custom Display Screen

After you click the **Create** button in the Available screens list, you will see the LCD Screen Selection screen, shown below.

**LCD Screen Selection**

Screen Type

- Predefined
- Predefined with custom labeling
- User defined

User Screen Number: 26

Predefined Screens

| Group  | Item          |
|--------|---------------|
| Energy | kWh Delivered |

OK Cancel

1. Click the **User defined** button in the Screen Type box. The screen changes to allow you to set up the new Display screen.

The screenshot shows the 'LCD Screen Selection' dialog box. It is divided into several sections:

- Screen Type:** Includes radio buttons for 'Predefined', 'Predefined with custom labeling', and 'User defined' (which is selected).
- User Screen Number:** A text field containing '26'.
- Layout Arrangement:** Includes radio buttons for '1 Item', '2 Items', '3 Items', '4 Items', '5 Items', and '1 Demand, 1 Timestamp'.
- Screen Layout:** A grid of input fields. The first field contains '026', and a second field contains '0'. A note below states: 'Note: Click on Button of the row to edit the Modbus Address of the item for that row.'
- Screen's Modbus Registers' Data Interpretation:** Includes dropdown menus for 'Registers per item' (2), 'Register Contents are' (Binary), 'The data is' (Unsigned), and 'Divide Register Contents by' (1). It also has checkboxes for 'User Multiplier', 'PT Ratio', and 'CT Ratio'.
- Scaling Setup:** Includes dropdown menus for 'Data Format' (Number), 'Numerical Sign' (Auto), 'Show Sign' (No), 'Scale' (Auto), 'Total Digits' (9), and 'Digits to the right of the decimal place' (3).

Annotations with arrows point to various fields:

- 'You can change this number' points to the User Screen Number field.
- 'Select number of screen items OR 1 Demand, 1 Timestamp' points to the Layout Arrangement radio buttons.
- 'The fields in Screen Layout are determined by the number of items you select' points to the '026' field in the Screen Layout grid.
- 'These fields are for Modbus Information' points to the 'Registers per item', 'Register Contents are', and 'The data is' dropdowns.
- 'These fields are for multiplier setup' points to the 'Divide Register Contents by' dropdown and the 'User Multiplier', 'PT Ratio', and 'CT Ratio' checkboxes.
- 'These fields are for scaling setup' points to the 'Data Format', 'Numerical Sign', 'Show Sign', 'Scale', 'Total Digits', and 'Digits to the right of the decimal place' dropdowns.

2. You can change the number shown in the User Screen Number field. This field accepts any number up to three digits in length. Use numbers between 1 and 999 if you want the number to display on the LCD display screen; use numbers between 1000 and 1999 if you don't want the number to display. **NOTE:** The Harmonics, Phasors, and Line Segment screens never display their number on the LCD display screen.
3. Use the Layout Arrangement field to choose what fields you want the LCD screen to display. Choose either:
  - a. The number of items you want the LCD screen to display: click one of the **Item** buttons.
  - b. Display Demand and Timestamp fields: click the **1 Demand, 1 Timestamp** button.

After you make your selection, the left side of the screen changes to display entry fields for the Item(s) or Demand and Time Stamp information. See the example screens below.

**Custom Screen with 3 Item Fields**

**LCD Screen Selection**

Screen Type:  Predefined,  Predefined with custom labeling,  User defined

User Screen Number: 26

Layout Arrangement:  1 Item,  2 Items,  3 Items,  4 Items,  5 Items,  1 Demand, 1 Timestamp

Screen Layout:

|     |   |  |  |
|-----|---|--|--|
| 026 |   |  |  |
|     | 0 |  |  |
|     | 0 |  |  |
|     | 0 |  |  |

Screen's Modbus Registers' Data Interpretation:

Registers per item: 2  
 Register Contents are: Binary  
 The data is: Unsigned  
 Divide Register Contents by: 1

Multiply by:

Use Multiplier  
 PT Ratio  
 CT Ratio

Data Format: Number  
 Numerical Sign: Auto  
 Show Sign: No  
 Scale: Auto  
 Total Digits: 9  
 Digits to the right of the decimal place: 3

Note: Click on Button of the row to edit the Modbus Address of the item for that row.

Annotations:

- Display screen label fields (points to '026')
- Item entry fields click here to enter the Modbus Register containing the item (points to the '0' values in the table)
- The information for these fields comes from the meter's Modbus Register Map
- This is where you can specify a multiplier for your data
- These fields let you specify Scaling and data display

**Custom Screen with 1 Demand, 1 Timestamp Fields**

**LCD Screen Selection**

Screen Type:  Predefined,  Predefined with custom labeling,  User defined

User Screen Number: 26

Layout Arrangement:  1 Item,  2 Items,  3 Items,  4 Items,  5 Items,  1 Demand, 1 Timestamp

Screen Layout:

|     |                 |  |  |
|-----|-----------------|--|--|
| 026 |                 |  |  |
|     | 0               |  |  |
|     | MM/DD/YY HHMMSS |  |  |
|     | Status          |  |  |

Screen's Modbus Registers' Data Interpretation:

Registers per item: 2  
 Register Contents are: Binary  
 The data is: Unsigned  
 Divide Register Contents by: 1

Multiply by:

Use Multiplier  
 PT Ratio  
 CT Ratio

Data Format: Number  
 Numerical Sign: Auto  
 Show Sign: No  
 Scale: Auto  
 Total Digits: 9  
 Digits to the right of the decimal place: 3

Note: Click on Button of the row to edit the Modbus Address of the item for that row.

Annotations:

- Display screen label fields (points to '026')
- Demand field (points to '0')
- Timestamp (points to 'MM/DD/YY HHMMSS')
- Status field (does not display on the LCD screen) (points to 'Status')
- See screen above for explanation of the fields on the right side of the screen

The top field in the Screen Layout section is for the display screen label (Title). Depending on the number of items you select, you will have between 0 to 2 lines for a screen label:

- If you selected 1-3 items or 1 Demand, 1 Timestamp, you will have two entry lines.
- If you selected 4 items you will have one entry line.
- If you selected 5 items, you will not have any entry fields for a display screen label (there won't be room on the screen for a label).

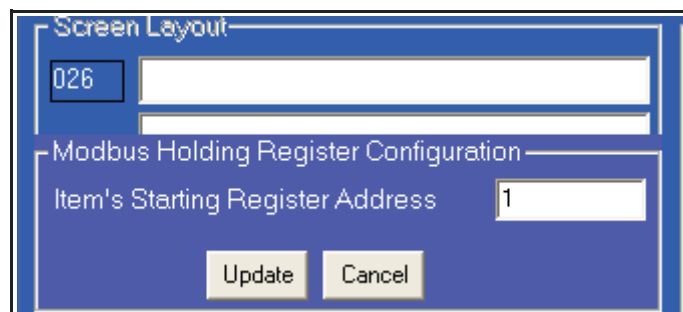
The Item entry fields allow you to specify the data you want to display on the LCD screen. You can also enter a prefix (optional) for each line item and a suffix (optional) for all of the items on the display screen.

**Example:** A screen containing phase to phase Voltages might have a single title (Volts P-P), 3 lines of data with prefixes (Vab, Vbc, Vca), and the same suffix (MV) on all 3 lines.

The 1 Demand, 1 Timestamp entry fields allow you to specify the Demand, the timestamp, and an optional status register. The status register is not displayed on the LCD screen.

4. To enter an item:

- a. Click on the Item label box. Fields that open underneath the item allow you to enter the starting value of the Modbus Register containing the data for the item. Use the Decimal value of the register. See the screen below. Refer to the *Nexus® 1252/1262/1272 Meter Modbus Manual* for the 1262/1272 meter's Modbus Register Map. The manual can be downloaded from EIG's website.



**IMPORTANT! All of the data items you select must be the same Modbus type**, for example F3. The Modbus type is listed in the Modbus map. See the Example below.

**Example:**

To select 1 Cycle Phase A-N Voltage, find the starting register for the field in the Modbus manual. See the figure below:

|             |    |   |    | 1 Cycle Block             |                        |                |    |   |  |
|-------------|----|---|----|---------------------------|------------------------|----------------|----|---|--|
| 00090-00093 | 9  | 0 | 50 | 1 cycle Block Time Stamp  | 12/31/9999 23:59:59.99 | 10 msec        | F3 | R |  |
| 00094-00095 | 10 |   |    | 1 cycle Phase A-N Voltage | +65536 V1 / P V'       | 1/65536 V' sec | F5 | R |  |

↑ Decimal Starting register is 00094      ↑ Item you are selecting      ↑ Modbus Type is F5

- b. Click **Update** to save the item's starting register address.
- c. Enter any additional items in the same way.
- d. When you finish entering items, use the entry fields in the right portion of the screen to enter details for the items' Modbus type, and to enter scaling, multiplier, and data display settings. The Modbus type information is found in Chapter 3 of the *Nexus® 1252/1262/1272 Meter Modbus Manual*. See the following example.

**Example:**

The item in the example above was Modbus type F5. Any additional items must be the same Modbus type. Type 5 is described in Chapter 3, page 3-3 of the 1262/1272 Meter's Modbus manual, as shown in the excerpt that follows.

Use the Modbus type information as shown below.

**3.5: Type F5 Secondary 1 Cycle RMS Voltage or Current**

- Length: 2 Registers (4 bytes)
- Range:  $+1,048,576 V^2 / 0 V^2$  or  $+65536 I^2 / 0 I^2$  (1262 or 1272)
- Unit:  $1/4906 V^2$  secondary or  $1/65536 A^2$  secondary (1262 or 1272)
- These registers together are a four-byte unsigned integer. Conversion into secondary voltage or current involves multiplying by the appropriate scale and taking the square root of that value.
- Depending on the unit and hardware, the range and unit of voltage reading differs. For a Nexus® 1262/72 meter, the range goes to  $+1,048,576 V^2$  with a unit of  $1/4096 V^2$ .

In the example above, you would find the number of registers per item, the fact that the data is unsigned, and scaling information from the Modbus type information.

The fields on the left, underneath the Multiply by fields, let you set up how the data will be displayed, for example, specifying if the data is a number or some other value; whether you want the sign to display for signed data; whether you want the data scaled, the number of digits and decimal places in the field. Click the pull-down menus to see alternate choices for the fields. The entries you make affect all of the items on the screen. The table that follows shows the fields and the valid entries for them.



| Entry fields                             | Possible entries  |
|--|---|
| Registers per item                       | 1 - 8   |
| Register contents                        | Binary, BCD, Text, Scaled Energy                                      |
| Data                                     | Signed, Unsigned  |
| Divide contents by                       | 1, 100, 65536   |
| Multiply by                              | User multiplier (enter in blank field), PT Ratio, CT Ratio            |
| Data format                              | Number, Text, Power factor, Time, Date, Time & Date, Status indicator |
| Numerical sign                           | Auto, Forced negative, Forced positive                                |
| Show sign                                | No, Yes   |
| Scale                                    | Auto, None, kilo (k), Mega (M), Giga (G)                              |
| Total digits                             | 1-10  |
| Digits to the right of the decimal place | 1-8   |

3. Once you finish making your entries, click **OK** to return to the Screen Assignments tab. The new screen is now listed in the left-most column. Click on it and then right-click to assign it to one or all of the View modes.
4. When you finish programming the LCD display, click:
  - **Save** to save the LCD Programmable Settings to a .nds2 file.
  - **Upload** to upload the LCD Programmable Settings to the connected 1262/1272 meter.
  - **Cancel** to exit the screen **without saving any changes**.

### Editing a Pre-defined Display Screen

You have the following options for editing pre-defined screens:

- You can edit the screen number.
- You can edit the screen label (title).
- You can create a new screen based on the pre-defined screen, but you will still only be able to change the screen number and/or label.

**NOTE:** Some of the pre-defined screens cannot be customized as described above. The table below lists these pre-defined screens and tells what can be changed in them.

| <b>Pre-defined LCD Screen Number (Default Value)</b> | <b>Description</b>    | <b>Editing Options</b> |
|--|-----------------------|------------------------|
| 18   | Phasors               | None                   |
| 20   | VAR, PF, & Frequency  | Title                  |
| 21 - 26  | Harmonics             | Title                  |
| 60   | Segment check         | None                   |
| 64   | Optical Port Settings | Title                  |
| 65   | Comm Ports            | Title                  |
| 66   | Nexus Status          | Title                  |
| 67   | Firmware Versions     | Title                  |
| 68   | Nexus Info            | Title                  |
| 76 - 77  | Rolling/Block Demand  | Title                  |
| 80 - 89  | TOU Energy            | Title                  |
| 90 - 93  | TOU Demand            | Title                  |
| 94-95  | TOU +/-VARh           | Title                  |

1. When you click **Edit** after selecting a pre-defined screen in the Available screens list (or right-click to select **Create a new screen based on selected screen**) you see the LCD Screen Selection screen. See the example screen that follows.

The screenshot shows a dialog box titled "LCD Screen Selection". It features three radio buttons for "Screen Type": "Predefined" (selected), "Predefined with custom labeling", and "User defined". A "User Screen Number" field contains the value "4". Below the "Predefined" option, there is a "Predefined Screens" section with two dropdown menus: "Group" (set to "Demands") and "Item" (set to "Block Watt Received"). "OK" and "Cancel" buttons are at the bottom.

2. The button at the top of the screen reflects the type of screen you are editing or copying: either Pre-defined or Pre-defined with custom labeling.
  - You can only change the screen number for a pre-defined screen (see example screen on the previous page), but if you are creating a new screen based on a pre-defined screen, you can select the pre-defined with custom labeling button to change the title as well as the number of the screen. Refer to the table on the previous page for editing limitations.
  - For a pre-defined screen with custom labeling, you can change the screen number and also the screen label. See the example screen that follows. Refer to the table on the previous page for editing limitations.

**NOTES:**

- The Screen number field is a three digit numeric field. Use numbers between 1 and 999 to display the number on the LCD display screen; use numbers between 1000 and 1999 to not display the number on the LCD display screen.

- The Harmonics, Phasors, and Line Segment screens never display their number on the LCD display screen.
- Depending on the pre-defined screen, you have between 0 - 3 lines for screen label entry. Screen labels can be up to 16 characters per line.

Below is an example of a Pre-defined with custom labeling screen.

**You can change the screen number**

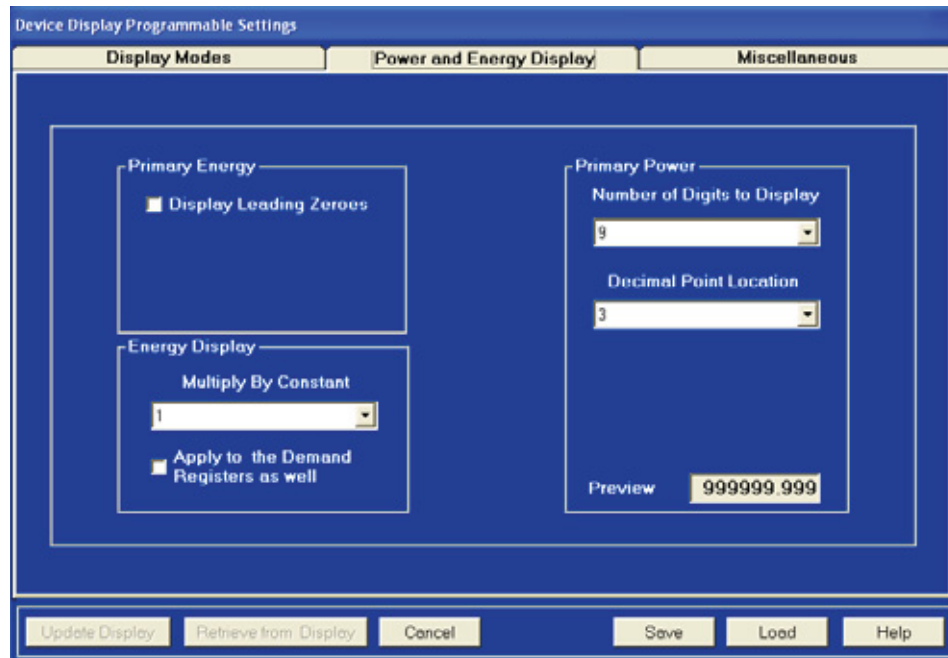
**You can enter a screen label**

Note: Click on Button of the row to edit the Modbus Address of the item for that row.

3. After you make your entries, click **OK**. You then return to the previous screen (Screen Assignments tab).
4. When you finish programming the LCD display, click:
  - **Save** to save the LCD Programmable Settings to a .nds2 file.
  - **Upload** to upload the LCD Programmable Settings to the connected meter.
  - **Cancel** to exit the screen **without saving any changes**.

## Power and Energy Display Tab

1. Click the Power and Energy Display tab. You will see the screen shown below.



2. Enter settings for Power and Energy display:

- Number of Digits: 4 - 9 (Primary Power)
- Decimal Point Location: 0 - 3 (Primary Power)
- Display Leading Zeroes: check if desired.
- Energy Display:
  - a. Select the Multiply by Constant value.
  - b. Click the checkbox next to "Apply to the Demand Registers as well" if applicable.

A preview appears at the bottom of the screen.

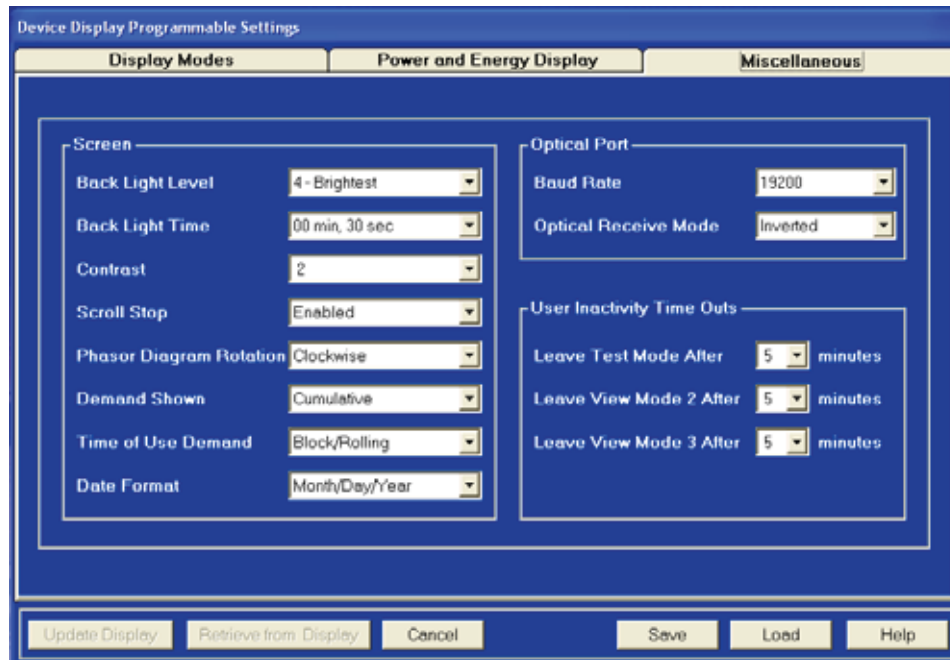
### NOTES:

- Settings on this screen control the display of Energy related numbers. Be careful to match the values on the display with those in the historical logs. These settings apply to VA-hours, Watt-hours(+/-), VAR-hours (+/-) and VAR-hours (each quadrant) in the meter.

- The Number of Digits setting controls the display and storage of all digits displayed on the screen, and it sets the Register Rollover for all Energy-type registers.

### Miscellaneous Tab

1. Click the Miscellaneous tab. You will see the screen shown below.



2. Enter settings in the Miscellaneous screen:

#### a. Screen Settings:

- Back Light Level: 0-Off to 4-Brightest
- Back Light Time (Back Light shuts off): 00min, 30sec - 60min, 00sec
- Contrast: 0 - Highest to 7 - Lowest
- Scroll Stop: Enabled or Disabled
- Phasor Rotation: Clockwise or Counterclockwise
- Demand Shown: Cumulative or Continuous Cumulative
- Time of Use Demand: Block/Rolling or Cumulative

- Date Format: Month/Day/Year or Day/Month/Year
- b. Optical Port settings:
- Baud Rate: 1200, 2400, 4800, 9600, 19200, 38400 or 57600
  - Optical Receive: Non-Inverted or Inverted
- c. User Inactivity Time Outs (number of minutes since last user action when Mode reverts to View Mode 1) (Settings are 5 to 60 minutes with 1 minute intervals.):
- Leave Test Mode After \_ Minutes
  - Leave View Mode 2 After \_ Minutes
  - Leave View Mode 3 After \_ Minutes

### **When you have finished programming the Device Display Programmable Settings Screen**

1. Use Buttons as described below:

- **Update Display:** Click to send the new settings to the display. (After settings have been updated, View Mode 1 is displayed.)
- **Retrieve from Display:** Click to retrieve existing settings.
- **Cancel:** Click to return to the CommunicatorPQA Main screen without updating or saving new settings.
- **Save:** Click to save new settings to a file.

2. When you finish making any changes, click **Update Display** to send the new settings to the display. Pop-up windows tell you that the changes have been made and then you return to the CommunicatorPQA Main screen.

### 3.6: Using the Base Programmable Display

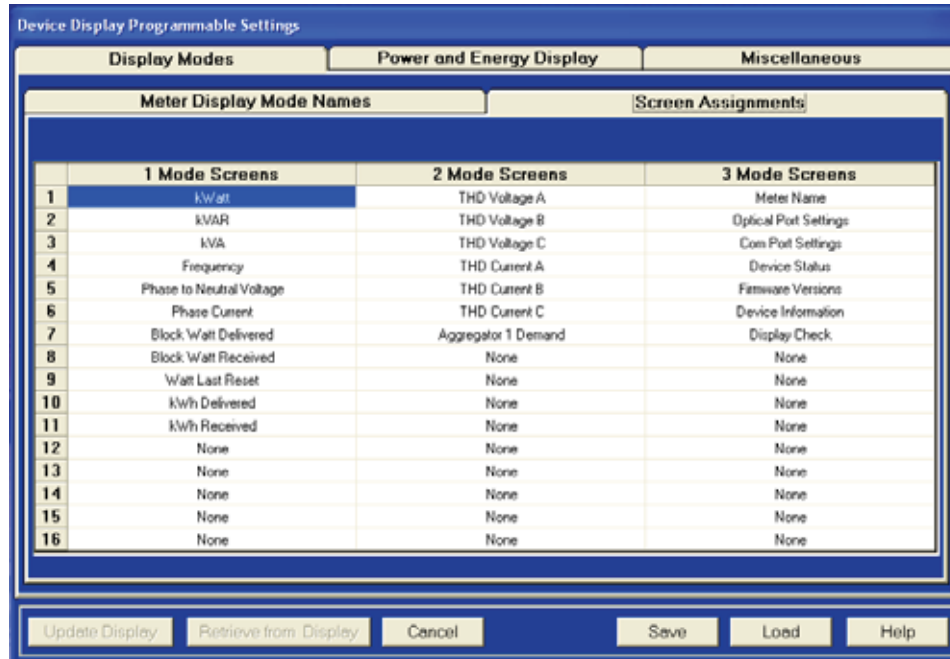
The Base Programmable Display (pre-November, 2010) has the same three configurable View modes as the Display Configurator, and the three modes are displayed in auto sequence in the same way. Using CommunicatorPQA, you can assign up to 16 of the pre-defined display screens to each mode: any of the available screens can be used in any mode. See Section 3.6.1 for a list of the pre-defined screens. You can also assign a three-digit label and description to the View modes, and configure the power and Energy display and screen time outs the same way as for the Display Configurator.

#### Programming the Base Programmable Display

1. Connect to the meter through Communicator EXT.
2. Click the **Profile** icon to open the Device Profile screen.
3. Click the plus sign (+) next to Revenue and Energy Settings.
4. Double-click **Display Configuration**. You will see the Meter Display Mode Names screen. For this screen and all of the screens in the Device Display Programmable Settings **except for** the Screen Assignments screen, follow the directions given in Section 3.5. For the Screen Assignments screen, follow the directions given here.

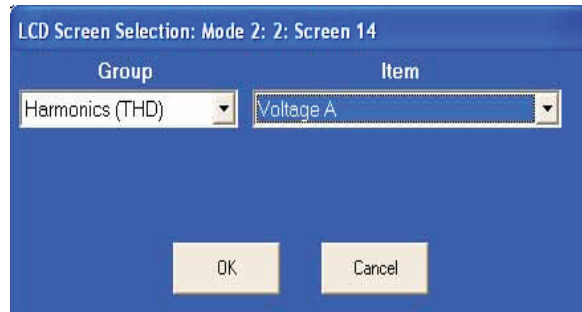


5. Click the Screen Assignments tab. You will see the screen shown below.



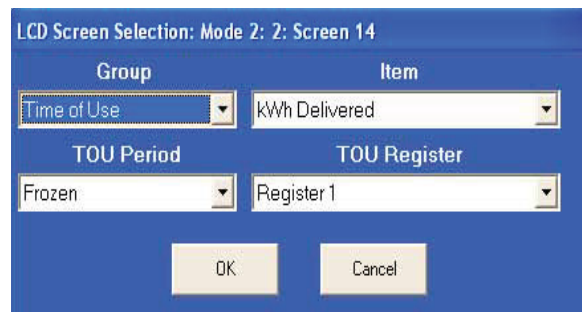
6. Your Label for each mode appears at the top of each column. Enter up to 16 screens for each View mode in the following way:

a. Double-click on one of the 48 settings on the screen. You will see the screen shown on the right.



b. Select Group and Item from the pull-down menus, and click **OK** to return to the Screen Assignments screen.

**NOTE:** If you select Time of Use as the Group, the screen changes to allow an Item selection and additional selections for TOU Period and TOU Register. See the screen on the right.



### 3.6.1: Pre-Defined Display Screens

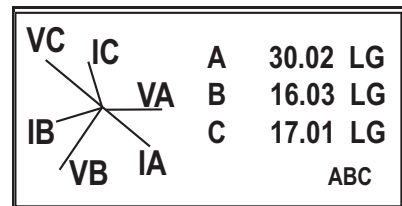
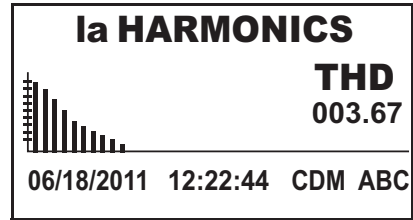
The Nexus® pre-defined display screens have features that make them very user friendly:

- Many of the screens have large digits (.56”).
- There are many screens to choose from.
- The Polling Indicator in the right corner of the Status Line provides two functions:
  1. A blinking indicator shows that the display is receiving data from the meter.
  2. Power Flow is displayed by different shaped icons.
    - a. When no power is flowing, a solid block is displayed.
    - b. An animated arrow pointing RIGHT indicates positive power flow.
    - c. An animated arrow pointing LEFT indicates negative power flow.

Below is a list of available screens with some example figures:

| Screen Number | Screen Name              |  |
|---------------|--------------------------|--|
| 1             | Wh Delivered             | <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>kWh</b></p> <p><b>DEL 43089263</b></p> <p><b>REC 71323159</b></p> <p>06/16/2011 3:50:44 Norm ABC</p> </div>                       |
| 2             | Wh Received              |  |
| 3             | +VARh                    |  |
| 4             | -VARh                    |  |
| 5             | VAh                      |  |
| 11            | Rolling W Demand Del     | <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>ROLLING</b></p> <p><b>W DEMAND</b></p> <p><b>DEL 502.3</b></p> <p>3:07:2003 2:07:09</p> <p>06/16/2011 3:50:44 Norm ABC</p> </div> |
| 12            | Rolling W Demand Rec     |  |
| 13            | Block W Demand Del       |  |
| 14            | Block W Demand Rec       |  |
| 15            | W Demand Last Reset      |  |
| 16            | Phase to Neutral Voltage |  |

- 17 Phase Current
- 18 Phasors
- 20 VAR, PF, Frequency
- 21 Va, Vab Harmonics
- 22 Vb, Vbc Harmonics
- 23 Vc/Vca Harmonics
- 24 Ia Harmonics
- 25 Ib Harmonics
- 26 Ic Harmonics
- 45 Totalizer 1
- 46 Totalizer 2
- 47 Totalizer 3
- 48 Totalizer 4
- 49 Totalizer 1 Demand
- 50 Totalizer 2 Demand
- 51 Totalizer 3 Demand
- 52 Totalizer 4 Demand
- 53 Cumulative Demand, Del & Rec
- 54 Phase to Phase Voltage
- 55 W
- 56 VAR
- 57 PF
- 58 VA



|    |                           |
|----|---------------------------|
| 59 | Frequency                 |
| 60 | Segment Check             |
| 61 | Q                         |
| 63 | Meter Name                |
| 64 | Optical Port              |
| 65 | Com Port Settings         |
| 66 | Nexus Status              |
| 67 | Firmware Versions         |
| 68 | Nexus Info                |
| 69 | Average PF Received       |
| 70 | Average PF Delivered      |
| 71 | VARh per Quadrant         |
| 72 | VAh per Quadrant          |
| 73 | Wh per Quadrant           |
| 74 | Qh                        |
| 75 | Cumulative Demand         |
| 76 | Rolling Window Demand     |
| 77 | Block Window Demand       |
| 78 | Power Factor per Phase    |
| 79 | Power Factor per Quadrant |
| 80 | TOU Wh, Rec               |
| 81 | TOU VAh, Q1               |
| 82 | TOU VARh, Q1              |

|    |                   |
|----|-------------------|
| 83 | TOU VAh, Q4       |
| 84 | TOU VARh, Q4      |
| 85 | TOU Wh, Del       |
| 86 | TOU VAh, Q2       |
| 87 | TOU VARh, Q2      |
| 88 | TOU VAh, Q3       |
| 89 | TOU VARh, Q3      |
| 90 | TOU W Demand, Rec |
| 91 | TOU W Demand, Del |
| 92 | TOU + VAR Demand  |
| 93 | TOU-VAR Demand    |

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## 4: Performing Meter Testing



The information contained within this chapter is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to install or remove meters from service. Any work on or near energized meters, meter sockets or other metering equipment presents the danger of electrical shock, personal injury or death. All work on these products must be performed by qualified industrial electricians and metering specialists **ONLY**. All work must be done in accordance with local utility safety practices and/or the procedures outlined in the current edition of the Handbook for Electricity Metering. The handbook is available from the Edison Electric Institute, 701 Pennsylvania Avenue N.W., Washington D.C. 20004-2696.

Les informations contenues dans ce chapitre sont destinées à assister au personnel de relevé qualifié. Il n'est pas destiné à remplacer la formation approfondie nécessaire pour installer ou retirer les compteurs de leur fonction. Toute intervention sur ou à proximité de compteurs sous tension, socles de compteur ou autres équipements de mesure présente un risque de choc électrique, de blessures ou la mort. Toute intervention avec ces produits doit être effectuée **UNIQUEMENT** par des électriciens industriels qualifiés et des spécialistes de relevé. Toute intervention doit être faite en conformité avec les pratiques de sécurité des services publics locaux et/ou les procédures décrites dans la présente édition du Manuel de relevé d'électricité. Le manuel est disponible à partir de la Edison Electric Institute, 701 Pennsylvania Avenue NW, Washington DC 20004-2696.

## 4.1: Testing Tools

The Nexus® 1262 and 1272 meters are equipped with a light-emitting diode (LED) for calibration and a liquid crystal display with test screens. These two standard features provide user interface and equipment interface points for meter testing.

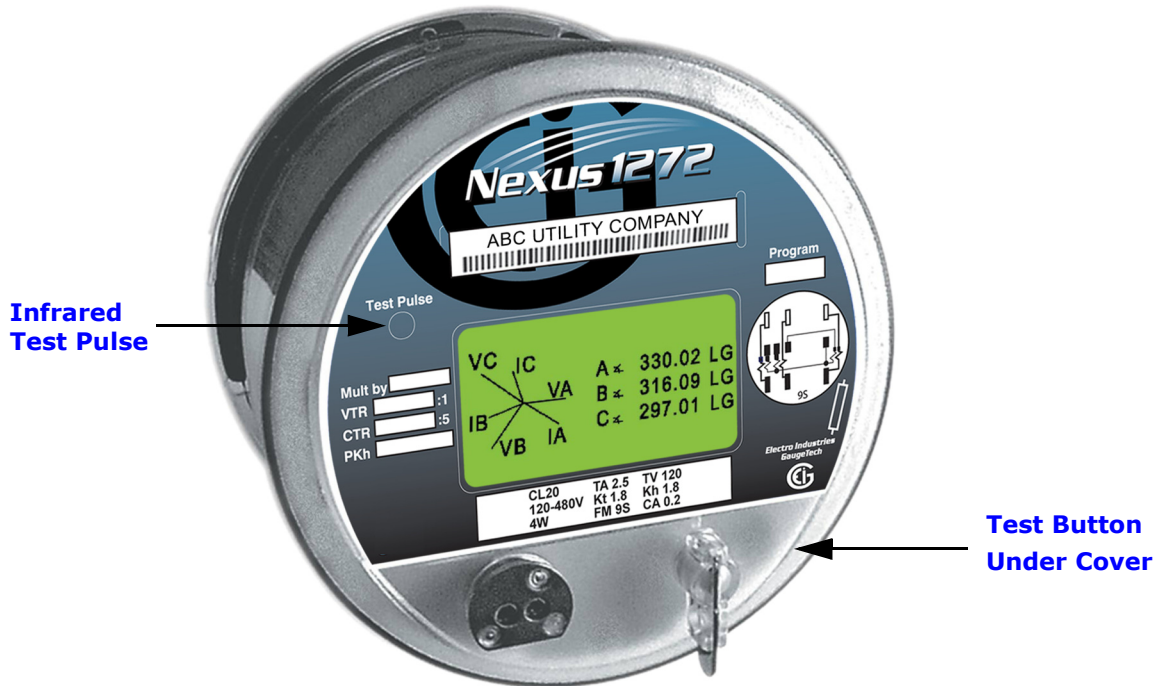


Figure 4.1: Meter Test Pulse and Test Button Location

### 4.1.1: Test Pulse LED

The Test Pulse LED is located in the upper left-hand portion of the meter face as shown in Figure 4.1. The Test Pulse LED continuously emits calibration pulses (infrared light). This LED can be used for a variety of pulses including individual quadrants for Watt-hour, VA-hour, VAR-hour and Watt Demand pulses. Each calibration pulse is equal to the value assigned to Kt (Watt-hours per pulse) in the meter's Device Profile. The millisecond duration of each output pulse is also programmable in the meter's Device Profile.

#### To program the Test Pulse LED:

1. From the Device Profile menu in the CommunicatorPQA® application, click **Revenue and Energy Settings>Internal KYZ** to configure the following settings:



- a. Assigned Channel - choose from settings.
  - b. Watt-hour per Pulse - enter the value in the secondary.
  - c. Pulse Width - set from 5ms to 635ms.
  - d. Mode - select to enable or disable.
  - e. Form - select between Form A and Form C.
2. Click **OK** and then click **Update Device** to send the new settings to the meter.

**NOTE:** The unit for the calibration pulses is watt hour. The initial value of each pulse (Kt) is 1.800 secondary watt hour per pulse.

### 4.1.2: LCD Display

In Test Mode, the LCD display provides user access to accumulated real, reactive and apparent energy as well as Block Demand for real power. There are eight screens in Test Mode: Wh - Del, Wh - Rec, VARh - Q1 & Q2, VARh - Q3 & Q4, VAh - Q1 & Q4, VAh - Q2 & Q3, Watt Demand Test Rolling and Watt Demand Test Block. See Section 4.2.2 for more detail.

The LCD display also includes three phase Voltage indicators. These indicators are labeled A, B and C to represent the presence of Voltage on the labeled phase.

If Voltage is not present on one phase, its indicator is not displayed. These indicators also show whether current is flowing on the phase. If no current is flowing on a phase, the indicator blinks; when current is flowing, the indicator shows a continuously illuminated digit. The indicator also shows phase sequence.

## 4.2: Test Mode

Test Mode allows the meter to be tested without disturbing billing data or setting a new maximum Demand. Test Mode performs the same function as setting the pointers back on an electromechanical meter after testing.

While operating in Test Mode, the meter uses the same measurement and calculation processes that are used in Normal Mode. The only difference is that the billing numbers stored in the meter are not updated with the real-time reading. This preserves the billing numbers while testing is performed.

### 4.2.1: Entering Test Mode

To enter Test Mode, you must bypass the meter's security system. In most instances, this requires you to remove power from the meter, break the meter seal and remove the Lexan cover, and then re-power the meter. If the meter is in a switchboard case, you'll first need to remove it from the case - see 6.2.1: Removing the Meter from the Switchboard Case/Reinstalling the Meter into the Switchboard Case on page 6-14.

### 4.2.2: Using Test Mode

The same selected measurement profile quantities (data accumulations) that are calculated during normal operation are calculated in Test Mode. Display quantities (Watt-hour, VAR-hour, Volt-Ampere-hour and Block Demand quantities) are displayed in units rather than kilo-units; i.e. the data is displayed as Wh, VARh, VAh and watts rather than kWh, kVARh, kVAh and kW. The same Demand values calculated during normal operation are also calculated in Test Mode. The display formats in Test Mode are changed to provide greater resolution during test operations.

The display does not scroll while in Test Mode. Each item remains displayed until the Test Button is pressed, which causes the next Test Mode screen to display.

The following table shows the display screens available in Test Mode, the data displayed on each screen and the pulse source for each screen.

| <b>Test Mode Displayed Data and Pulse Source</b> |  |                     |
|--|--|---------------------|
| <b>Test Mode</b>                                 | <b>Displayed Data</b>                    | <b>Pulse Source</b> |
| Wh - Del   | Delivered Wh Energy                      | kWh, Del            |
| Wh - Rec   | Received Wh Energy                       | kWh, Rec            |
| VARh - Q1 and Q2                                 | VARh in Quadrant 1<br>VARh in Quadrant 2 | kVARhr, Del         |
| VARh - Q 3 and Q4                                | VARh in Quadrant 3<br>VARh in Quadrant 4 | kVARhr, Rec         |
| VAh - Q1 and Q4                                  | VAh in Quadrant 1<br>VAh in Quadrant 4   | kVAhr, Q1           |
| VAh - Q2 and Q3                                  | VAh in Quadrant 2<br>VAh in Quadrant 3   | kVAhr, Q3           |
| Watt Demand Rolling                              | Watt Rolling Demand<br>Delivered         | kWH, Del            |

| <b>Test Mode Displayed Data and Pulse Source</b> |                                |                     |
|--|--------------------------------|---------------------|
| <b>Test Mode</b>                                 | <b>Displayed Data</b>          | <b>Pulse Source</b> |
| Watt Demand                                      | Watt Block Demand<br>Delivered | kWh, Del            |

### **Test Mode Details**

The Reset Button (R) is next to the Test Button (T). Initiate a Test Mode Reset by pressing and releasing the Reset Button while in Test Mode. A Test Mode Reset causes all test quantities to be reset to zero and a new block interval to be started. The item displayed when the reset occurred remains in the display but the value is initialized.

While in Test Mode, the Test Pulse LED pulses at the rate programmed for the meter. The value of the pulse is set in the meter's Device Profile (see Section 4.1.1). The meter quantity assigned to the Test Pulse LED changes as the user moves from one test screen to another. The assigned values are defined in the Pulse Source column of the table above.

Individual quadrant tests for VAR hours can be completed by proper test design. To test strictly VAR hours, limit the test parameters to one quadrant during testing.

In the event of a power outage, data for Test Mode Energy, Demand and Power Factor is not saved. Upon power up, the meter returns to Normal Mode. The test data is lost and all registers are restored to their pretest values.

While in Test Mode, the IR Port and Communications Port 1 are available for communication with the meter.

In Test Mode, you can preset the values of the energy readings that will be restored to the meter when Test Mode is exited, using CommunicatorPQA® software (see following section 4.2.3).

### **4.2.3: Test Mode Preset Accumulators**

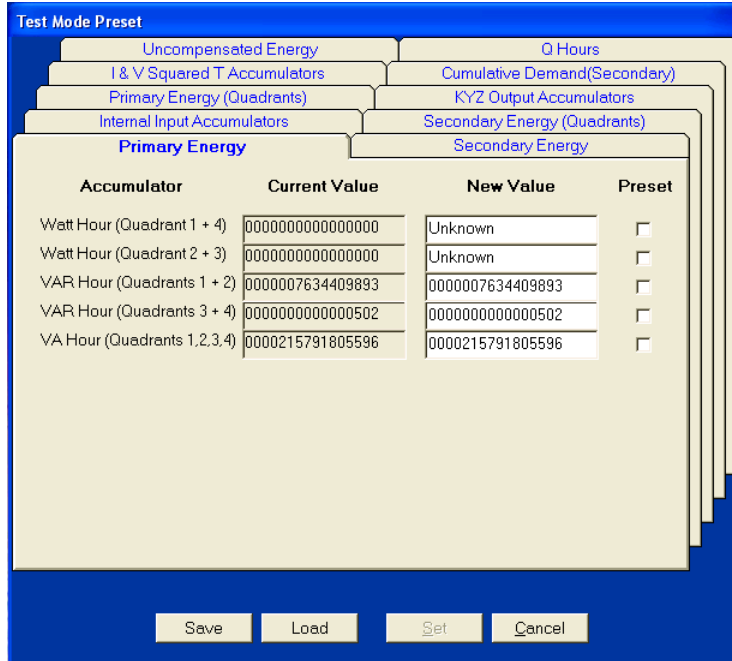
There are two reasons to use the Preset Accumulators screens:

1. A monitor in Test Mode is out of service and is therefore not monitoring accumulations. The New Value field can be used to adjust for the values not monitored while in Test Mode.

2. When replacing an old meter that has accumulations with a new meter that has no accumulations, the New Value field can be set to the value of the existing accumulations.

### Setting Test Mode Preset Accumulators

1. From the CommunicatorPQA® application’s Main screen, select **Tools>Test Mode>Preset Accumulators**. You will see the screen shown below.

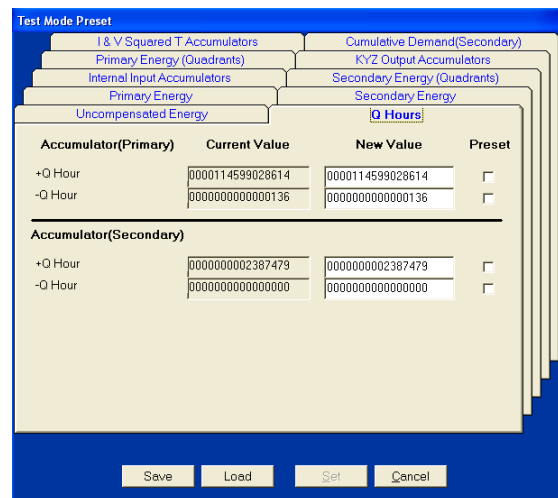


2. Click Tabs at the top of the screens to access the individual screens.

- Each screen has a Current Value, New Value and Preset Box for each accumulator.
- A new meter has zeros for Current Values.

3. Settings can be preset for the following sets of values:

- Primary Energy
- Secondary Energy
- Primary Energy (Quadrants)
- Secondary Energy (Quadrants)
- Internal Input Accumulators



- KYZ Output Accumulators
- Q Hours
- I & V Squared T Accumulators
- Cumulative Demand (Secondary)
- Uncompensated Energy

Examples of some of the screens are shown below.

4. Click the Preset Boxes for the values you want to set.
5. Click **Set** to save your entries or **Cancel** to exit the screen without saving any changes.

| Accumulator(Primary)        | Current Value    | New Value        | Preset                   |
|-----------------------------|------------------|------------------|--------------------------|
| Watt Hour (Quadrant 1 + 4)  | 0000215218632156 | 0000215218632156 | <input type="checkbox"/> |
| Watt Hour (Quadrant 2 + 3)  | 0000000000000098 | 0000000000000098 | <input type="checkbox"/> |
| VAR Hour (Quadrants 1 + 2)  | 0000008071015026 | 0000008071015026 | <input type="checkbox"/> |
| VAR Hour (Quadrants 3 + 4)  | 0000000000000373 | 0000000000000373 | <input type="checkbox"/> |
| VA Hour (Quadrants 1,2,3,4) | 0000215371401328 | 0000215371401328 | <input type="checkbox"/> |

| Accumulator(Secondary)      | Current Value    | New Value        | Preset                   |
|-----------------------------|------------------|------------------|--------------------------|
| Watt Hour (Quadrant 1 + 4)  | 000000004483721  | 000000004483721  | <input type="checkbox"/> |
| Watt Hour (Quadrant 2 + 3)  | 0000000000000000 | 0000000000000000 | <input type="checkbox"/> |
| VAR Hour (Quadrants 1 + 2)  | 000000000168146  | 000000000168146  | <input type="checkbox"/> |
| VAR Hour (Quadrants 3 + 4)  | 0000000000000000 | 0000000000000000 | <input type="checkbox"/> |
| VA Hour (Quadrants 1,2,3,4) | 000000004486904  | 000000004486904  | <input type="checkbox"/> |

| Accumulator          | Current Value | New Value | Preset                   |
|----------------------|---------------|-----------|--------------------------|
| Watt(Quadrant 1 + 4) | 000014992     | 000014992 | <input type="checkbox"/> |
| Watt(Quadrant 2 + 3) | 000000000     | 000000000 | <input type="checkbox"/> |

### 4.2.4: Exiting Test Mode

Exit Test Mode in one of the following three ways:

- Press and hold the Test Button for more than 3 seconds.
- Use the Test Mode Time-out Timer, if no load is present.
- Use the Extended Test Mode Time-out Timer, if load is present.

These options are explained further in the following sections.

#### **Exiting Test Mode Details:**

##### Test Mode Button

Pressing the Test Mode Button for more than three seconds ends Test Mode and returns the meter to Normal Mode.

##### Test Mode Time-out Timer

The Test Mode Time-out Timer has two modes of operation, depending on whether the meter sees measurable load.

If the meter does not recognize measurable load:

The meter watches for user interaction by monitoring activity on the Test Button and the Reset Button. If neither button is pushed within the programmed Exit Delay time, the meter exits Test Mode and returns to Normal Mode. Each time the Test or Reset Button is pressed, the meter starts the Exit Delay Timer again. The Exit Delay time is programmed in the meter's Device Profile in the Device Display Programmable Settings screen, Miscellaneous tab (see Section 3.6).

If the Meter recognizes measurable load:

The meter watches the Test and Reset Buttons for activity, using an extended time limit consisting of the Exit Delay time plus the programmed Block Interval Time. This insures that the meter completes a full block Demand test without interruption.

After exiting Test Mode:

All Test Mode data is lost when you exit Test Mode. Upon exiting Test Mode, a new (possibly partial) Demand interval and subinterval begin. The past subinterval as well as the current subinterval are zeroed. Upon returning to Normal operating mode, a TOU meter or Demand meter with load profiling completes the time remaining in the current partial subinterval so that subsequent subintervals are synchronized with the hourly boundary.

Maximum Demand values for each Demand integration type are not modified while in Test Mode. The previously recorded maximums are restored when you exit Test Mode. If you choose to reset Demand data during testing operations, you can complete this action when you exit Test Mode by pressing the Reset Button after the meter returns to Normal Mode.

**NOTE:** Normal billing and historical log data accumulation is suspended during Test Mode operation. Upon exiting Test Mode, accumulation of billing and historical log quantities does either of the following:

- Resumes from the values in place when Test Mode was entered
- Continues from the Test Mode Preset values (see Section 4.2.4)



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## 5: Serial Communication Wiring

### 5.1: Communication Overview

The figure below shows serial communication options.

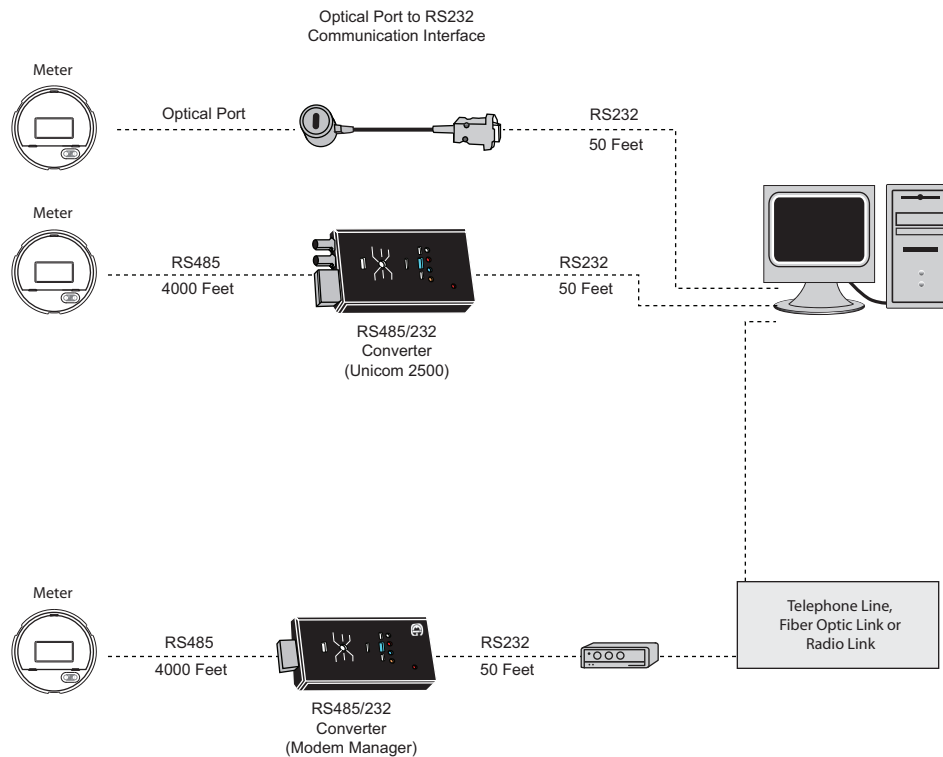


Figure 5.1: Serial Communication

RS232 communication is used to connect a single Nexus® 1262/1272 meter with another device, such as a computer, RTU or PLC. The link is viable for up to 50 feet (15.2 m) and is available only through the meter's Optical port with a communication interface (Optical port to RS232 converter); see figures 5.2 and 5.3.

RS485 communication allows multiple meters to communicate with another device at a local or remote site. The I/O modules and external displays use RS485 to communicate with the meter. All RS485 links are viable for up to 4000 feet (1220 m). The Nexus® Socket meter's Ports 1 and 4 are two-wire, RS485 connections (up to 115200 baud). Optional Communication Connections for INP200 (10/100BaseT connection) or INP202 (Combination Modem and Ethernet) are cables with appropriate connectors (see Chapter 6 and Figure 6.2).

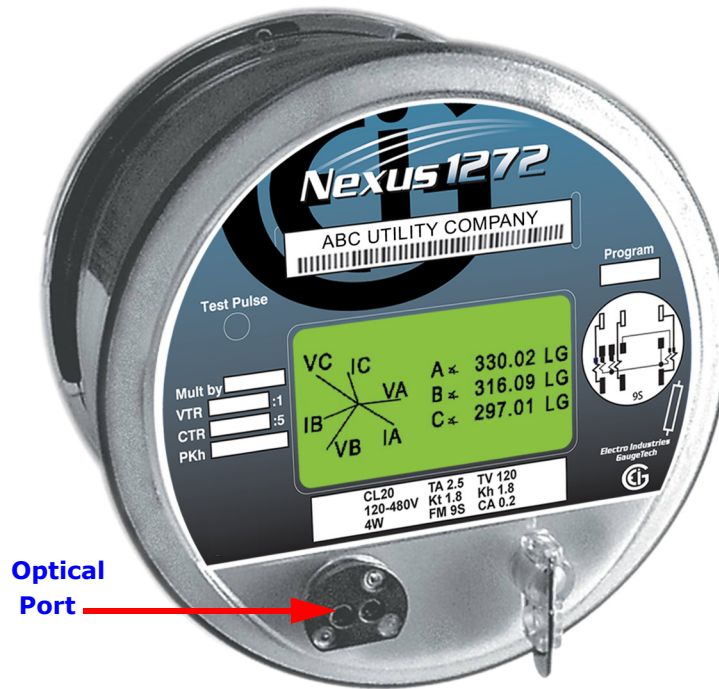


Figure 5.2: Optical Port Location

## 5.2: Communicating to the Meter through the ANSI Type II Optical Port

The Optical port allows the Nexus® 1262/1272 meter to communicate with one other device, e.g., a PC. Located on the left side of the meter's face, it provides communication with the meter through an ANSI C12.13 Type II Magnetic Optical Communications Coupler, such as the B10U Optical Probe, which connects to the USB port of the PC.

**NOTE:** You can order this device from EIG's webstore:

<https://www.electroind.com/product/b10u-ansi-optical-probe/>

You can then program the meter through the Optical port using CommunicatorPQA® software.



Figure 5.3: B10U Optical Probe

#### **B10U Instructions:**

Depending on your OS, you may need to download and install the driver for the B10U. From its webpage (above address), click Downloads>Tech Documents>USB Driver. When you download the driver file you will see a file that has installation instructions.

Note that the Nexus® 1500+ meter's optical port offers the standard inverted mode for communication, but can also be programmed in non-inverted mode using the CommunicatorPQA® software. Refer to Chapter 11 in the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for instructions (you can download the manual from <https://www.electroind.com/products/communicatorpqa-power-monitoring-software/> - click Downloads>Tech Documents>User Manual).

### 5.3: RS485 Serial Communication

RS485 communication allows multiple devices to communicate on a bus. The meter's Port 1 and Port 4 are RS485 terminals, viable for a distance of up to 4000 feet (1219 meters).

#### 5.3.1: RS485 Wiring Fundamentals - (Port 1 and Port 4)

Below is a detailed view of a 2-wire RS485 connection.

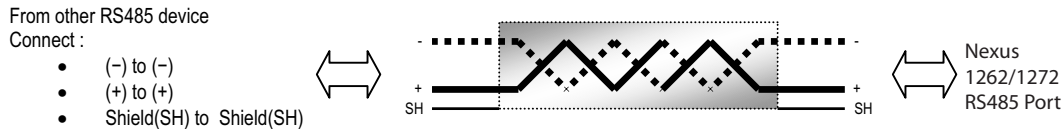


Figure 5.4: RS485 Connection Detail

- **S (Shield)**: This is not an earth-ground connection. You must also connect the shield to earth-ground at one point. Do not connect the shield to ground at multiple points; it will interfere with communication.
- **+/- (Two-wire, RS485 communication terminals)**: Connect the + terminal of the meter port to the + terminal of the device. Connect the - terminal of the meter port to the - terminal of the device.

#### NOTES on RS485 Connections:

- Use a shielded twisted pair cable 22 AWG (0.33 mm<sup>2</sup>) or larger, grounding the shield at one end only.
- Establish point-to-point configurations for each device on a RS485 bus: Connect (+) terminals to (+) terminals; connect (-) terminals to (-) terminals.
- Protect cables from sources of electrical noise.
- Avoid both "star" and "tee" connections (see Figure 5.6).
- No more than two cables should be connected at any one point on an RS485 network, whether the connections are for devices, converters or terminal strips.

- Include all segments when calculating the total cable length of a network. If you are not using an RS485 repeater, the maximum length for cable connecting all devices is 4000 feet (1219 meters).
- For an RS485 Daisy Chain connection, in which you link multiple devices in a series, connect shield to RS485 Master and individual devices as shown in Figure 5.5. You may also connect the shield to earth-ground at one point.
- The Nexus® 1262/1272 meter may be shipped with connectors on the ends of cables or they may be shipped as pigtails (no connectors). In this case, a generic terminal block is shipped with the meter. The terminal block has up to 12 connectors and can be cut into smaller sections with a utility knife. Please refer to the Cable Color Key on pages 6-5 to 6-7, if you are using pigtails or if you have any question about which connector is which.
- Termination Resistors ( $R_T$ ) are generally used on both ends of longer length transmission lines. The value of the Termination Resistors is determined by the electrical parameters of the cable. Termination Resistors are only needed with runs typically more than 500 feet, as the meter has some level of termination internally and usually resistors are not needed.
- For information on connecting the meter to a modem, see Section 5.3.10.

Figure 5.5 shows a representation of an RS485 Daisy Chain connection. You can connect up to 31 slaves in a Daisy Chain.

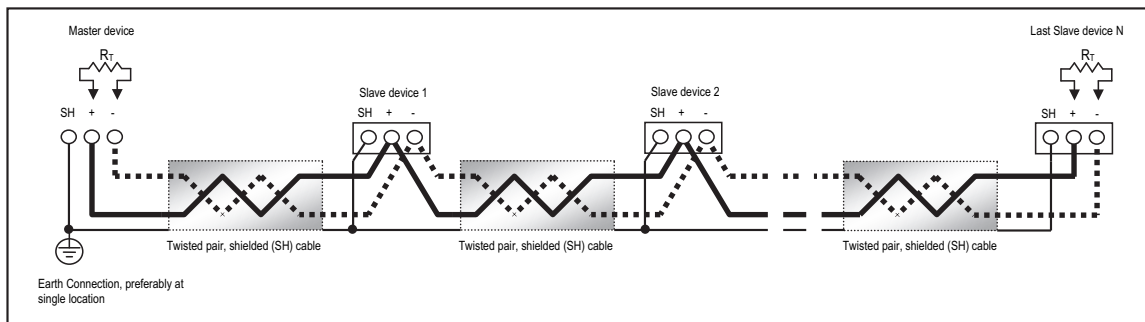


Figure 5.5: RS485 Daisy Chain Connection

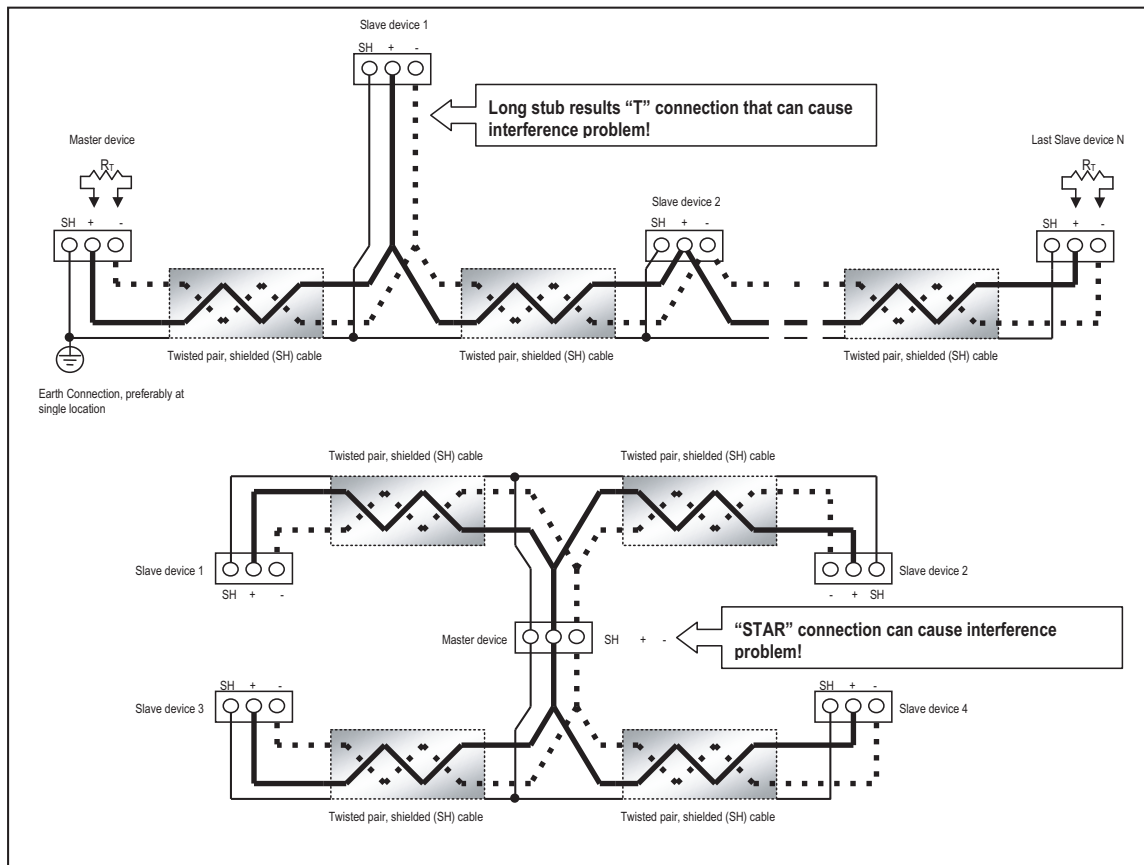


Figure 5.6: Incorrect "T" and "Star" Topologies

### 5.3.2: Using the Unicom 2500

The Unicom 2500 provides RS485/RS232 conversion. In doing so it allows the Nexus® meter to communicate with a PC or other device. See the *Unicom 2500 Installation and Operation Manual* for additional information. You can order the Unicom 2500 from EIG's webstore: [www.electroind.com/store](http://www.electroind.com/store). Select the Communications Products category from the left side of the webpage.

Figure 5.7 illustrates the Unicom 2500 connections for RS485.



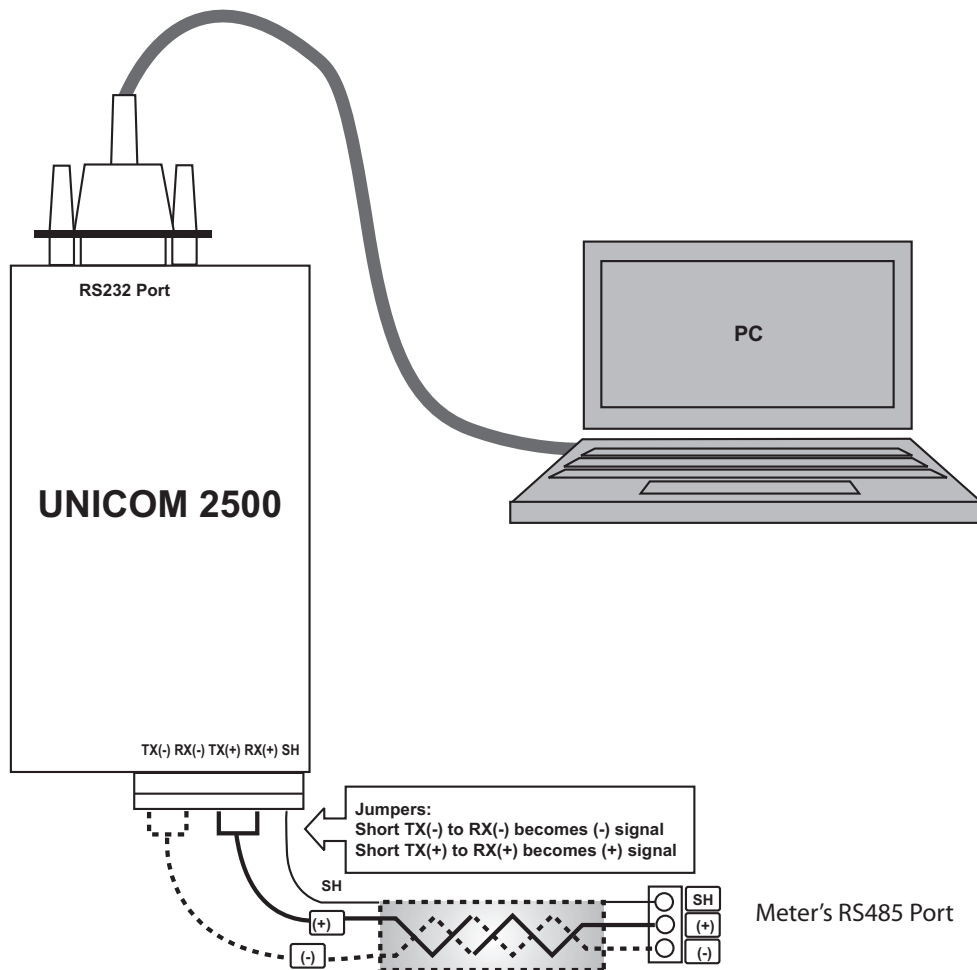


Figure 5.7: Meter Connected to a PC Using Unicom 2500

The Unicom 2500 can be configured for either 4-wire or 2-wire RS485 connections. Since the Nexus® meter uses a 2-wire connection, you need to add jumper wires to convert the Unicom 2500 to the 2-wire configuration.

As shown in Figure 5.7, you connect the "RX-" and "TX-" terminals with a jumper wire to make the "-" terminal, and connect the "RX+" and "TX+" terminals with a jumper wire to make the "+" terminal. See the figure on the right for the Unicom 2500's settings. The Unicom's Baud rate must match the Baud rate of the meter's RS485 port: you set the Baud rate by turning the screw to point at the rate you want.

### 5.3.3: RJ45 Connection—Meter with INP200 (10/100BaseT) Option

The INP200 Option conforms to the IEEE 802.3, 10/100BaseT specification using unshielded twisted pair (UTP) wiring. This allows you to use inexpensive RJ45

connectors and CAT 3 or better cabling. The RJ45 connector is supplied with the meter (Cable 6).

Using this LAN connection allows multiple PC's to access the meter concurrently. The RJ45 line is inserted into the RJ45 connector on Cable 6 coming from the bottom of a meter with the Ethernet Option. The connection using RJ45 into the meter connects the meter to a network using Modbus/TCP protocol over Ethernet.

For more information on a meter with the INP200 Onboard Ethernet (10/100BaseT), see Section 5.4.

### 5.3.4: Modem/Ethernet Connection—Meter with INP202 (Combo Card) Option

The INP202 is an extension of INP200. It has all the features of INP200 plus a built-in Modem. Modem and Ethernet capabilities can be used simultaneously.

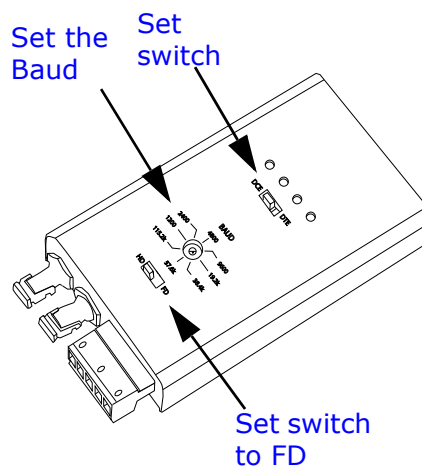
The communication protocol supported by the modem is Modbus ASCII. The Communication protocol supported by the RS485 Ethernet Modem Gateway is Modbus RTU. INP202 converts all incoming modem Modbus ASCII requests to Modbus RTU for internal and gateway communication. It then converts all response Modbus RTU messages into Modbus ASCII protocol before it sends the responses to the modem.

Some of the fixed parameters for the Ethernet Modem Gateway are: 8 Data Bits, Even Parity, 1 Stop Bit. The Ethernet/Modem's Gateway's Baud Rate and Delay Time are configurable.

For more information on a meter with the INP202 Modem/Ethernet Combo Card, see Section 5.5.

### 5.3.5: RS485 Connection - Meter to the P40N/P40N+/P41N+/P43N+ LED Display

Connect the communication wires of the supplied RS485 cable to the meter's Port 1 or Port 4. Set the port's Baud Rate to 9600, Address to 1, Protocol to Modbus RTU and Mode to Slave using the communication software. Insert the other end of the communication wires into the back of the first LED Display.



The Nexus® 1262/1272 meter's power supply does not supply power to external displays. You must use a power source, such as the EIG PB1 (12 V). (See Section 10.2.1 for PSIO details.)

RS485 communication is viable for up to 4000 feet (1219 meters). Be sure to do the following:

1. Connect the shield to the shield (S) terminal on the Display port. The (S) terminal on the meter is used to reference the meter's port to the same potential as the source. It is not an earth-ground connection. You may also connect the shield to earth-ground at one point.
2. Provide termination resistors at each end for longer runs (typically 500' or more), connected to the + and - lines.  $R_T$  is approximately 120 Ohms.

**NOTE:** The P40N+ and legacy P40N connect the same way, through the port on the back of the display. The only difference is in the port labeling.

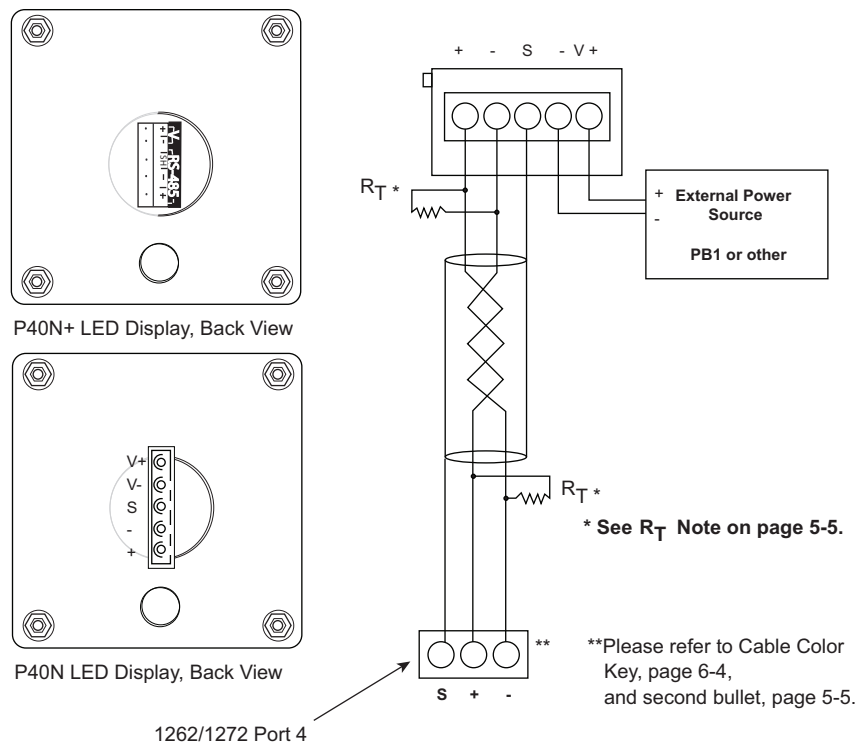


Figure 5.8: P41N+ and Legacy P40N External Display RS485 Connection

### 5.3.6: Communication Ports on the I/O Modules

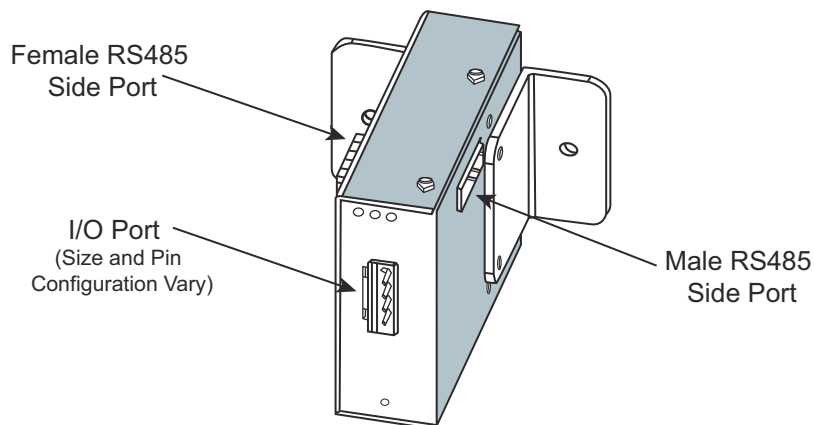


Figure 5.9: I/O Module Communication Ports

**Female RS485 Side Port:** use to connect to another module's male RS485 side port.

**Male RS485 Side Port:** use to connect to the meter's Port 4 (see following section) or to connect to another module's female RS485 side port (see Section 10.3.1).

**I/O Port:** use for functions specific to the type of module; size and pin configuration varies depending on type of module. For more detail, refer to Chapter 10.

### 5.3.7: RS485 Connection—Meter to I/O Modules

An RS485 cable harness is supplied with the purchase of MBIO (mounting brackets). Wire one end of the cable to the meter's Port 4.

Insert the other end of the cable into the communication pins of the I/O module's male RS485 side port (see Figure 5.9). See Section 10.3.1 for details on using multiple I/O modules.

The Nexus® 1262/1272 meter's power supply does not supply power to the I/O modules. You must use a power source, such as the EIG PSIO or PB1 (12 V). See Section 10.2.1 for PSIO details.

RS485 communication is viable for up to 4000 feet (1219 meters). Follow the wiring shown in Figure 5.10 and be sure to:

1. Connect the + and - terminals on the meter to the + and - terminals of the female RS485 port. Connect the shield to the shield (S) terminal. The (S) terminal on the meter is used to reference the meter's port to the same potential as the source. It is not an earth-ground connection. You may also connect the shield to earth-ground at one point.
2. Provide termination resistors at each end for longer runs (typically more than 500'), connected to the + and - lines. RT is approximately 120 Ohms.

**NOTES:**

- The meter has some level of termination internally and usually resistors are not needed.
- Refer to the Cable Color Key on pages 6-5 to 6-7.

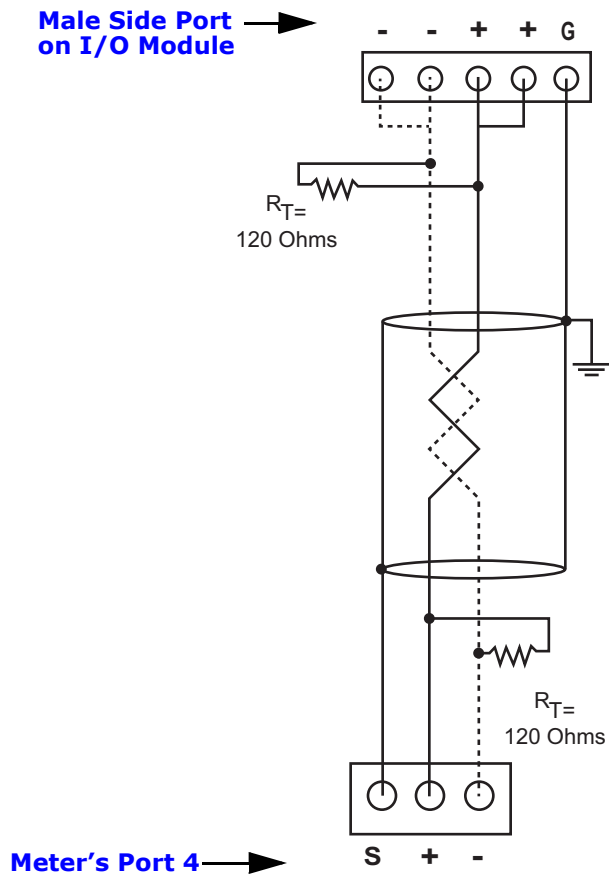


Figure 5.10: Meter and I/O Module Connections

### 5.3.8: Steps to Determine Power Needed

Since the Nexus® 1262/1272 meter's power supply does not supply power to the I/O modules, you need to use a power source, such as EIG's PSIO, which is designed for use with the I/O modules. Follow these steps to determine how many PSIO units you need.

1. All I/O modules are shipped pre-programmed with a baud rate of 57600 and individual addresses. Refer to the following table to determine the VA Ratings for the I/O modules.

| <b>I/O Module Factory Settings and VA Ratings</b> |                            |                |                  |
|---|----------------------------|----------------|------------------|
| <b>Model#</b>                                     | <b>Module</b>              | <b>Address</b> | <b>VA Rating</b> |
| 1mAON4  | 0-1 mA, 4 Analog Outputs   | 128            | 2.7 VA           |
| 1mAON8  | 0-1 mA, 8 Analog Outputs   | 128            | 3.2 VA           |
| 20mAON4   | 4-20 mA, 4 Analog Outputs  | 132            | 5.0 VA           |
| 20mAON8   | 4-20 mA, 8 Analog Outputs  | 132            | 8.5 VA           |
| 8AI1  | 0-1 mA, 8 Analog Inputs    | 136            | 2.3 VA           |
| 8AI2  | 0-20 mA, 8 Analog Inputs   | 140            | 2.3 VA           |
| 8AI3  | 0-5 V DC, 8 Analog Inputs  | 144            | 2.3 VA           |
| 8AI4  | 0-10 V DC, 8 Analog Inputs | 148            | 2.3 VA           |
| 4RO1  | 4 Latching Relay Outputs   | 156            | 2.7 VA           |
| 4PO1  | 4 KYZ Pulse Outputs        | 160            | 2.7 VA           |
| 8DI1  | 8 Status Inputs (Wet/Dry)  | 164            | 1.0 VA           |

2. Add together the VA Ratings for the I/O modules in use to determine total power needed.
3. Each PSIO supplies 12 VA @ 12 V DC. For details on the PSIO, see sections 10.2.1 and 10.3.

**NOTE:** For 24 or 48 V DC applications, EIG recommends the PB1 power supply.

**Example order number:** PB1-D-12VO (PB1)

If you are using a PSIO (for 125V AC/DC input) or PB1 your maximum VA is 12.

### 5.3.9: Remote Communication Over Telephone Line CommunicatorPQA®s Using the RS485 Port

Use modems (dedicated or dial-up) when devices are at great distances. EIG recommends using RS485 wiring with a Modem Manager.

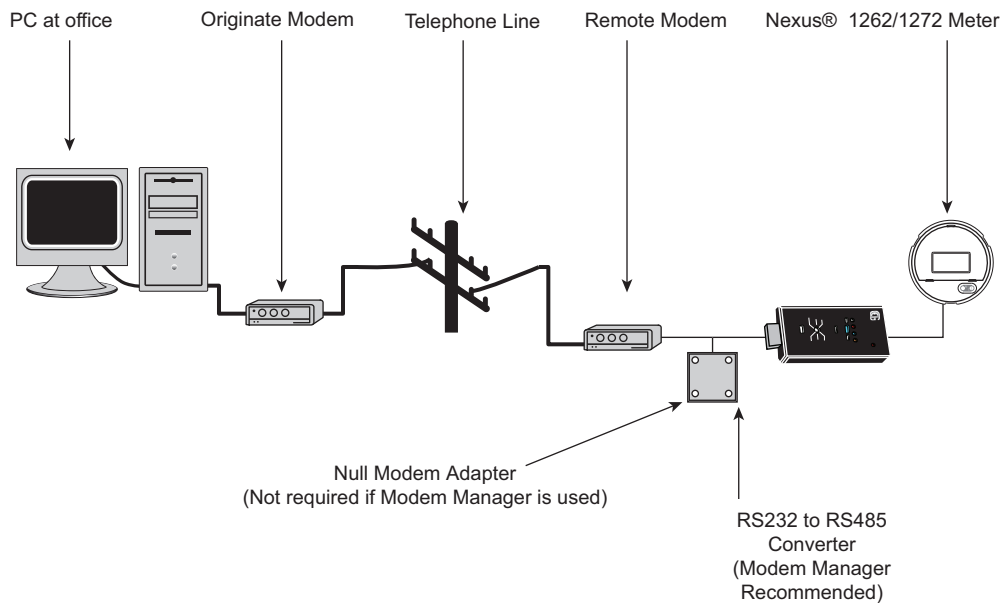


Figure 5.11: Remote RS485 Connections

Use Port 1 or Port 4 for RS485 communication. The link using RS485 is viable for up to 4000 feet (1219 meters).

Use CommunicatorPQA® software to set the port's baud rate to the appropriate speed for your hardware and/or network and enable Modbus ASCII protocol. See the *CommunicatorPQA®, MeterManagerPQA®, and EnergyPQA.com® Software User Manual* instructions. Remember, Modbus RTU will not function properly with modem communication. You **must** change the protocol to Modbus ASCII.

You must use an RS485 to RS232 converter and a Null Modem. EIG recommends using its Modem Manager. This converter has a built-in null modem and also provides line data buffering, making the telephone line communication reliable; most commer-



cial modems do not. For this reason, EIG recommends the Modem Manager to alleviate any communication line errors that might occur. Using the Modem Manager also eliminates the need to program default settings into the modem, which makes installation simpler.

### 5.3.10: Programming Modems for Remote Communication

You must program a modem before it can communicate properly with most RS485 or RS232-based devices. This task is often quite complicated because modems can be unpredictable when communicating with remote devices.

If you are not using EIG's Modem Manager, you must set the following strings to communicate with the remote Nexus® meter(s). Consult your modem's manual for the proper string settings or see Section 5.3.11 for a list of selected modem strings.

**NOTE:** Use a Modem Manager! The product was designed to make this task "plug and play." We highly recommend it for all serial modem solutions.

#### **Modem Connected to a Computer (the Originate Modem)**

- Restore modem to factory settings. This erases all previously programmed settings.
- Set modem to display Result Codes. The computer will use the result codes.
- Set modem to Verbal Result Codes. The computer will use the verbal result codes.
- Set modem to use DTR Signal. This is necessary for the computer to ensure connection with the originate modem.
- Set modem to enable Flow Control. This is necessary to communicate with the remote modem connected to the Nexus® meter.
- Instruct modem to write the new settings to activate profile. This places these settings into nonvolatile memory; the settings will take effect after the modem powers up.

#### **Modem Connected to the Nexus® Meter (the Remote Modem)**

- Restore modem to factory settings. This erases all previously programmed settings.
- Set modem to auto answer on  $n$  rings. This sets the remote modem to answer the call after  $n$  rings.

- Set modem to ignore DTR Signal. This is necessary for the Nexus® meter, to insure connection with the originate modem.
- Set modem to disable Flow Control. The Nexus® meter's RS232 communication does not support this feature.
- Instruct modem to write the new settings to activate profile. This places these settings into nonvolatile memory; the setting will take effect after the modem powers up.
- When programming the remote modem with a terminal program, make sure the baud rate of the terminal program matches the Nexus® meter's baud rate.

### 5.3.11: Selected Modem Strings

| Modem  | String/Setting   |
|--|--|
| Cardinal modem   | AT&FE0F8&K0N0S37=9   |
| Zoom/Faxmodem VFX<br>V.32BIS(14.4K)                          | AT&F0&K0S0=1&W0&Y0   |
| Zoom/Faxmodem 56Kx<br>Dual Mode:                             | AT&F0&K0&C0S0=1&W0&<br>Y0  |
| USRobotics Sportster<br>33.6 Faxmodem:<br>DIP switch setting | AT&F0&N6&W0Y0 (for<br>9600 baud)<br>Up Up Down Down Up Up<br>Up Down |
| USRobotics Sportster 56K<br>Faxmodem:<br>DIP switch setting  | AT&F0&W0Y0<br>Up Up Down Down Up Up<br>Up Down                       |

### 5.3.12: High Speed Inputs Connection

The Nexus® 1262/1272 meter's built-in High Speed Inputs can be used in two ways:

- Attaching status contacts from relays, breakers or other devices for status or wave-form initiation
- Attaching the KYZ pulse outputs from other meters for pulse counting and totalizing

Even though these inputs are capable of being used as high speed digital fault recording inputs, they serve a dual purpose as KYZ counters and totalizers. The function in

use is programmable in the meter and is configured via CommunicatorPQA® software. Refer to the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for instructions on programming these features.

The High Speed Inputs can be used to sense dry contact closures only. The meter internally generates the wetting Voltage for the contacts. The wetting Voltage is 12 V DC, +/-20%.

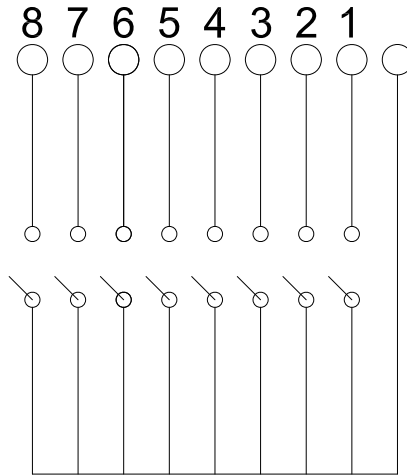


Figure 5.12: High Speed Inputs Connection

### 5.3.13: IRIG-B Connections

IRIG-B is a standard time code format that synchronizes event time-stamping to within 1 millisecond. An IRIG-B signal-generating device connected to the GPS satellite system synchronizes Nexus® 1262/1272 meters located at different geographic locations. Nexus® meters use an un-modulated signal from a satellite-controlled clock (such as Arbiter 1093B). For details on installation, refer to the User's Manual for the satellite-controlled clock in use. Below are installation steps and tips that will help you.

#### Connection:

Connect the (+) terminal of the Nexus® meter to the (+) terminal of the signal generating device; connect the (-) terminal of the Nexus® meter to the (-) terminal of the signal generating device.

**Installation:**

Set Time Settings for the meter being installed.

1. From the CommunicatorPQA® software's Device Profile menu:
  - a. Click **General Settings>Time Settings>one of the Time Settings lines**, to open the Time Settings screen.
  - b. Set the Time Zone and Daylight Savings (Select **AutoDST** or **Enable** and set dates).
  - c. Click **Update Device Profile** to save the new settings. (See Chapter 4 of the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details.)
2. Before connection, check that the date on the meter clock is correct (or, within 2 Months of the actual date). This provides the right year for the clock (GPS does not supply the year).
3. Connect the (+) terminal of the Nexus® meter to the (+) terminal of the signal generating device; connect the (-) terminal of the Nexus® meter to the (-) terminal of the signal generating device.

**Troubleshooting Tip:**

The most common source of problems is a reversal of the two wires. If you have a problem, try reversing the wires.

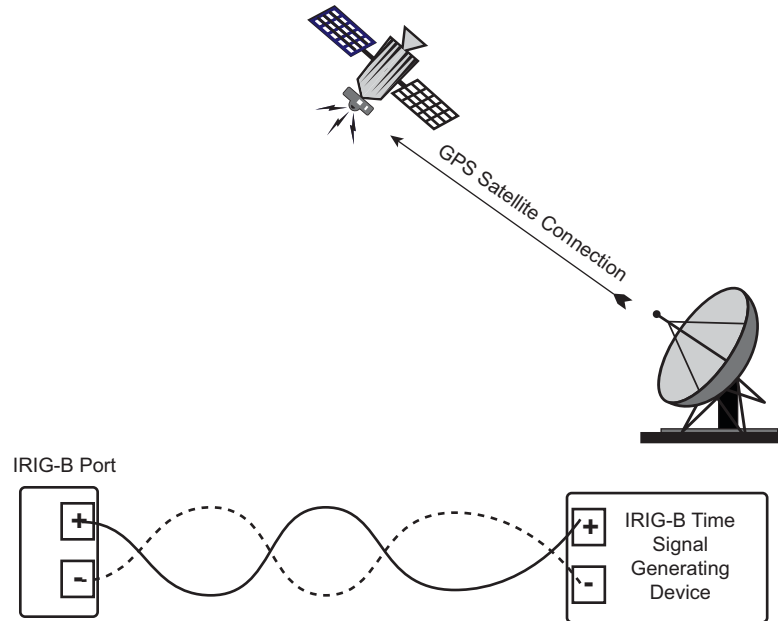


Figure 5.13: IRIG-B Communication

**NOTE:** Please make sure that the selected clock can drive the amount of wired loads.

### 5.3.14: Time Synchronization Alternatives

(See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details.)

#### IRIG-B

- All Nexus® 1262/1272 meters are equipped to use IRIG-B for time synchronization.
- If IRIG-B is connected, this form of time synchronization takes precedence over the internal clock. If the GPS Signal is lost, the internal clock takes over time keeping at the precise moment the signal is lost.

#### Line Frequency Clock Synchronization

- All Nexus® meters are equipped with Line Frequency Clock Synchronization, which may be enabled or disabled for use instead of IRIG-B. If Line Frequency Clock Synchronization is enabled and power is lost, the internal clock takes over at the precise moment power is lost.

#### Internal Clock Crystal

- All Nexus® meters are equipped with internal clocks crystals which are accurate to 20ppm, and which can be used if IRIG-B is not connected and/or Line Frequency Clock Synchronization is not enabled.

#### DNP Time Synchronization

- Using CommunicatorPQA® software, you can set the meter to request time synchronization from the DNP Master. Requests can be made from once per minute to once per day. See the *Nexus® 1252/1262/1272/1450/1500+ DNP User Manual* for instructions. You can download the manual from EIG's website:  
[www.electroind.com/pdf](http://www.electroind.com/pdf)

#### Other Time Setting Tools

- **Tools>Set Device Time:** For manual or PC time setting
- **Script & Scheduler:** Time stamps retrieved logs and data

- **MV90:** Can synchronize time on retrievals in the form of a time stamp. Refer to the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* (HHF Converter instructions) for more MV90 details.

## 5.4: INP200 Onboard Ethernet

The 10/100BaseT Ethernet option -INP200 - is a fully customizable web server that uses XML to provide access to real-time data via the Internet. EIG's name for this dynamic system is Total Web Solutions. The system incorporates a highly programmable network card with built-in memory that is installed in meters with the INP200 option. Each card can be programmed to perform extensive monitoring functions. The 100BaseT option is much faster than the 10BaseT option, which does not offer Total Web Solutions.

### 5.4.1: Hardware Overview

A Nexus® 1262/1272 meter with the 10/100BaseT Ethernet Option (INP200) has all the components of the standard Nexus® meter plus the capability of connection to a network through an Ethernet LAN or through the Internet via Modbus TCP, DNP3 WAN/LAN, HTTP, SMTP, FTP, and/or DHCP.

The Internal Network Option of the Nexus® meter is an extremely versatile communication tool. It:

- Adheres to IEEE 802.3 Ethernet standard using TCP/IP
- Utilizes simple and inexpensive 100BaseT wiring and connections
- Plugs right into your network using the built-in RJ45 jack
- Is programmable to any IP address, subnet mask, and gateway requirements
- Communicates using the industry standard Modbus/TCP protocol or DNP3 WAN/LAN

### 5.4.2: Hardware Connection

Use standard RJ45 10/100BaseT cable to connect with the Nexus® meter. The RJ45 line is inserted into the RJ45 port coming from the back of the meter with the INP200 Ethernet Option (see Figure 6.2).

**Configure the Network settings using the following steps:**

1. Using Port 1, Port 4 (RS485 connection), or the optical port, connect a PC to the meter. An RS232/RS485 converter may be required (e.g., Electro Industries Unicom 2500).
2. Double-click on CommunicatorPQA Software to open it.
3. Click the **Quick Connect** or **Connection Manager** icon in the icon tool bar.
4. Click the **Serial Port** button. Make sure data matches the meter, then click **Connect**.

**Set the Network using the following steps:**

1. From the Device Profile menu, click **General Settings>Communications>** and then click on one of the listed ports.



2. You will see the Device Profile Communications Settings screen.

**Device Profile: Communications Settings**

**Port 1**

Address: 63

Baud Rate: 57600

Data Bits: 8

Parity: None

Stop Bits: 1

Tx Delay: 0ms

Protocol: Modbus RTU

**Port 4(Ext Devices)**

Address: 113

Baud Rate: 38400

Data Bits: 8

Parity: None

Stop Bits: 1

Tx Delay: 0ms

Protocol: Modbus ASCII

Mode: Slave

**Network Settings (If Network Option was purchased)**

IP Address: 172 20 167 73 [Advanced Settings]

Subnet Mask: 255 255 248 0

Default Gateway: 172 20 161 23

**Internal Modem Settings (If Internal Modem Option was purchased)**

Answer Phone on: 3 Rings

Modem Gateway Baud Rate: 9600 [Dial Out Profile]

OK Cancel Help

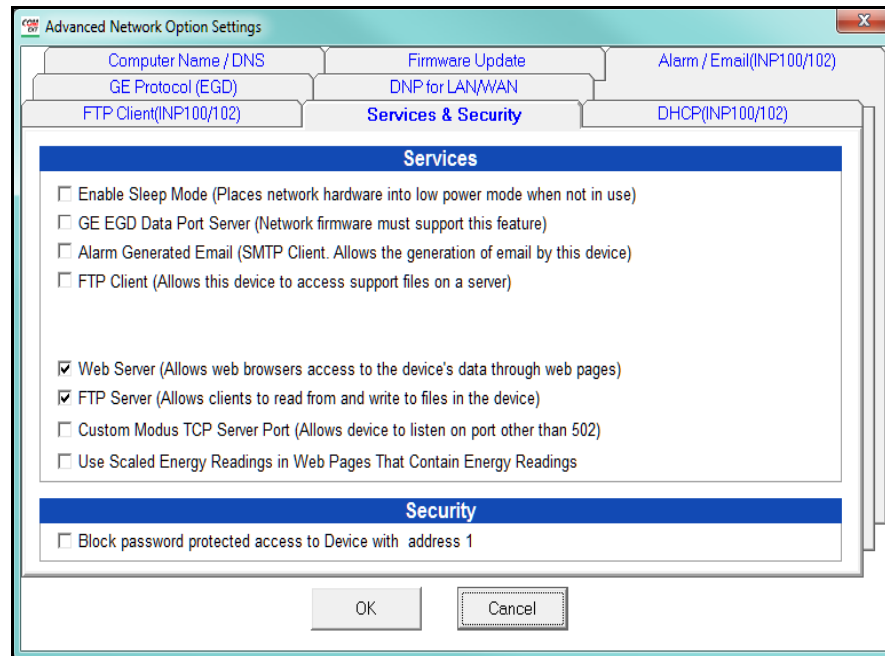
In the Network Settings section (middle of the screen), enter the following data provided by your Systems Administrator:

IP Address: 10.0.0.1 (Example)

Subnet Mask: 255.255.255.0 (Example)

Default Gateway: 0.0.0.0 (Example)

3. Click the **Advanced Settings** button to further configure the Network connection.  
The Advanced Network Option Settings screen opens.



The tabs at the top of the screen let you navigate between settings. Depending on your meter's configuration, you may not need to program all of the settings shown here.

- c. The first tab is **Services & Security**, shown above. Click the options to enable them for the Network option, e.g., to enable the Web server, click the box next to that option.
- d. Click any of the other tabs to configure more options (see Chapter 21 in the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for detailed instructions):

- FTP Client: configure the FTP server settings
- GE Protocol (EGD): configure GE's EGD protocol (if the meter's firmware supports this)
- Alarm/Email: configure the alarm email notification settings
- Computer Name/DNS: set a name/DNS servers
- DHCP: enable DHCP functionality

- Firmware Update: update the Network card's firmware
  - DNP for LAN/WAN: configure the settings for DNP3 LAN/WAN (DNP over the Ethernet)
- e. Click **OK** to save your settings and close the Advanced Network Option Settings screen.
4. Click **OK** to save your communication settings and close the Communications Settings screen.
5. Click **Update Device** to send the new profile to the meter.

After the Network parameters are set, CommunicatorPQA® software connects to the meter via the Network using a Device Address of "1" and the assigned IP Address.

Follow these steps:

1. Double-click on the CommunicatorPQA® icon to open the software.
2. Click the **Connect** icon in the icon tool bar.
3. You will see the Connect screen. Click the **Network** button at the top of the screen. The screen will change to one requesting the following information:

Device Address: 1

Host: IP Address (per your network administrator).

Example: 10.0.0.1

Network Port: 502

Protocol: Modbus TCP

**NOTE:** See Section 5.7 for the factory settings.

4. Click the **Connect** button at the bottom of the screen. CommunicatorPQA® software connects to the meter via the Network.

**NOTES:**

- CommunicatorPQA® software always communicates via Modbus TCP for Ethernet communication, which is the default protocol for Nexus® meters.

- See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for more details on the Network option and the Web server (Total Web Solutions).

## 5.5: INP202 Ethernet/Modem Combination

The INP202 Option is an extension of INP200. It has all the features of INP200 plus a built-in modem. The communication protocol supported by the modem is Modbus ASCII. The communication protocol supported by the RS485 Ethernet/Modem Gateway is Modbus RTU.

INP202 converts all incoming Modem Modbus ASCII requests to Modbus RTU for internal and gateway communication. It then converts all response Modbus RTU messages into Modbus ASCII and sends the responses to the modem.

### 5.5.1: Hardware Overview

The Nexus® 1262/1272 meter with the INP202 Option has all the components of an INP200 Nexus® meter plus a built-in modem. It has the capability of connecting to a network through an Ethernet LAN and with other devices via modem.

### 5.5.2: Hardware Connection

There are three cables to connect for the INP202 Option. An RS485 Gateway cable, an RJ45 Ethernet cable and an RJ11 Modem cable are inserted into the cables coming from the back of the Nexus® meter with the INP202 Ethernet/Modem Option. Refer to Figure 6.2 for details on cables.

#### **Make the software connection using the following steps:**

1. Using Port 1 or Port 4 (RS485 connection), connect a PC to the meter. An RS232/RS485 converter may be required (e.g., Electro Industries' Unicom 2500).
2. Double-click on CommunicatorPQA® Software to open it.
3. Click the **Quick Connect** or the **Connection Manager** icon in the icon tool bar.
4. Click the **Serial Port** button. Make sure data matches the meter, then click **Connect**.

#### **Set the Network using the following steps:**

(Refer to Section 4.3.5 of the *CommunicatorPQA®*, *MeterManagerPQA®*, and *Ener-gyPQA.com® Software User Manual* for more details).

1. From the Device Profile menu, click **General Settings>Communications>** and then click on one of the listed ports.
2. You will see the Device Profile Communications Settings screen. In the Network Settings section, enter data provided by your systems manager:

IP Address: 10.0.0.1 (Example)

Subnet Mask: 255.255.255.0 (Example)

Default Gateway: 0.0.0.0 (Example)

Computer Name: NETWORK (Example)

After the Network parameters are set, CommunicatorPQA® software connects to the meter via the Network using a Device Address of "1" and the assigned IP Address. Follow these steps:

1. Double-click on the CommunicatorPQA® icon to open the software.
2. Click the **Connect** icon in the icon tool bar.
3. You will see the Connect screen. Click the **Network** button at the top of the screen. The screen will change to one requesting the following information:

Device Address: 1

Host: IP Address (per your network administrator).

Example: 10.0.0.1

Network Port: 502

Protocol: Modbus TCP

**NOTE:** See Section 5.7 for the factory settings.

4. Click the **Connect** button at the bottom of the screen. CommunicatorPQA® software connects to the meter via the Network.

5. For the Modem connection, a standard telephone RJ11 plug connects the meter to a standard PSTN (Public Switched Telephone Network). The phone jack is the override of the modem function when the phone is in use: the modem operates at up to 56k baud.

## 5.6: Factory Settings

You can use CommunicatorPQA® software to connect to a meter with the INP200/INP202 option for the first time, or at any time until the settings are changed, using the following factory settings:

Device Address: 1

IP Address: 10.0.0.1

Network Port: 502

Protocol: Modbus TCP

## 6: Hardware Installation

This chapter outlines the installation of the Socket meter, Switchboard meter, battery, external display, and external I/O modules. For instructions regarding the legacy Switchboard meter (non-SWB3), see Chapter 11: Legacy Switchboard Meter (non-SWB3), on page 11-1.

### 6.1: Socket Meter Installation

The Nexus® 1262/1272 Socket meter is designed to mount into a standard meter socket. Follow the Installation Summary below or follow the installation instructions on the meter socket to ensure that the unit is installed securely. See dimension figures below and on the following pages.

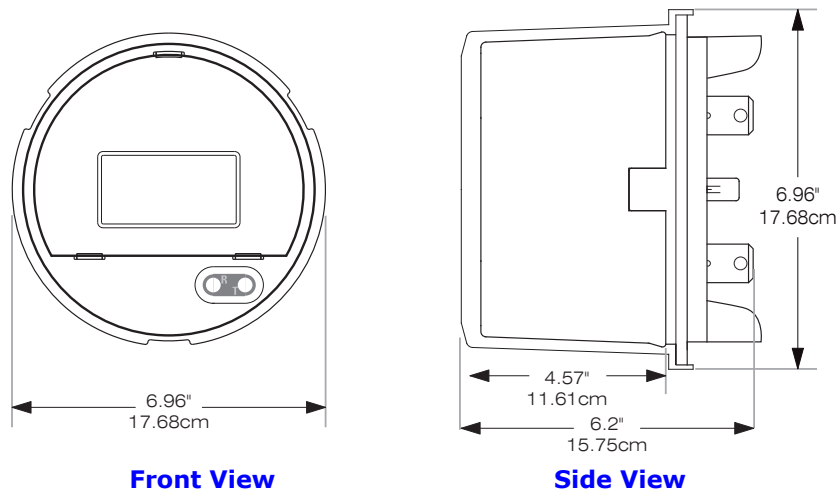


Figure 6.1: Socket Meter Mounting Dimensions

#### Installation Summary

- Examine the labels to verify that the meter you are installing is, in fact, the correct form factor and service type. Make sure that the socket and meter current class ratings are compatible.
- Make sure that all communication and auxiliary power wiring is accessible in case disconnection is required for any reason.

- Before applying power to the meter, install battery if not installed at the factory and check the connections if they are installed. The meter has one or two batteries: it has an Internal battery which is used to maintain non-volatile readings and the real-time clock; and older meters may have the Dial-out Modem battery, which is used by a meter with the INP2 legacy option to dial out on an outage.

**WARNING! POWER MUST BE OFF TO INSTALL THE INTERNAL BATTERY!**  
**AVERTISSEMENT! POUR INSTALLER LA BATTERIE DE LA BORNE, IL FAUT ÉTENDRE L'ALIMENTATION ÉLECTRIQUE!**

- To install the Internal Battery, remove the Internal Shroud and place the battery into the battery compartment with the + facing UP. Replace the Internal Shroud. See Section 6.2.
  - To install the Modem Battery, with the Outer Shroud on the meter, locate the battery cable at the back of the meter and insert the cable connector into the cable. Use the velcro (peel and stick) to attach the battery somewhere outside of the meter.
- Measure the enclosure to make sure it accommodates the meter. (If it is standard size, that won't be necessary.)
  - Make sure that any communications wiring from the back of the meter is fed through the appropriate openings in your socket to allow for clean connections with external devices.
  - Insert the meter into the socket, making sure that the unit blades are firmly within the jaws of the socket.
  - Connect external devices to the appropriate communications wiring. See following Figure 6.2. RJ11 and RJ45 connectors are supplied.



- Make sure the meter is functioning properly by running it through a test circuit.
- The Nexus® Socket meter has its own display built into the face of the meter. However, you may want to install additional displays in remote locations. See Section 6.3 for installation procedures for the Nexus® P40N/P40N+/P41N+/P43N+ displays. The displays are connected to the meter via the RS485 cable supplied with the 1262/1272 (see Figure 6.2, below). See Chapter 5 for detailed wiring instructions.

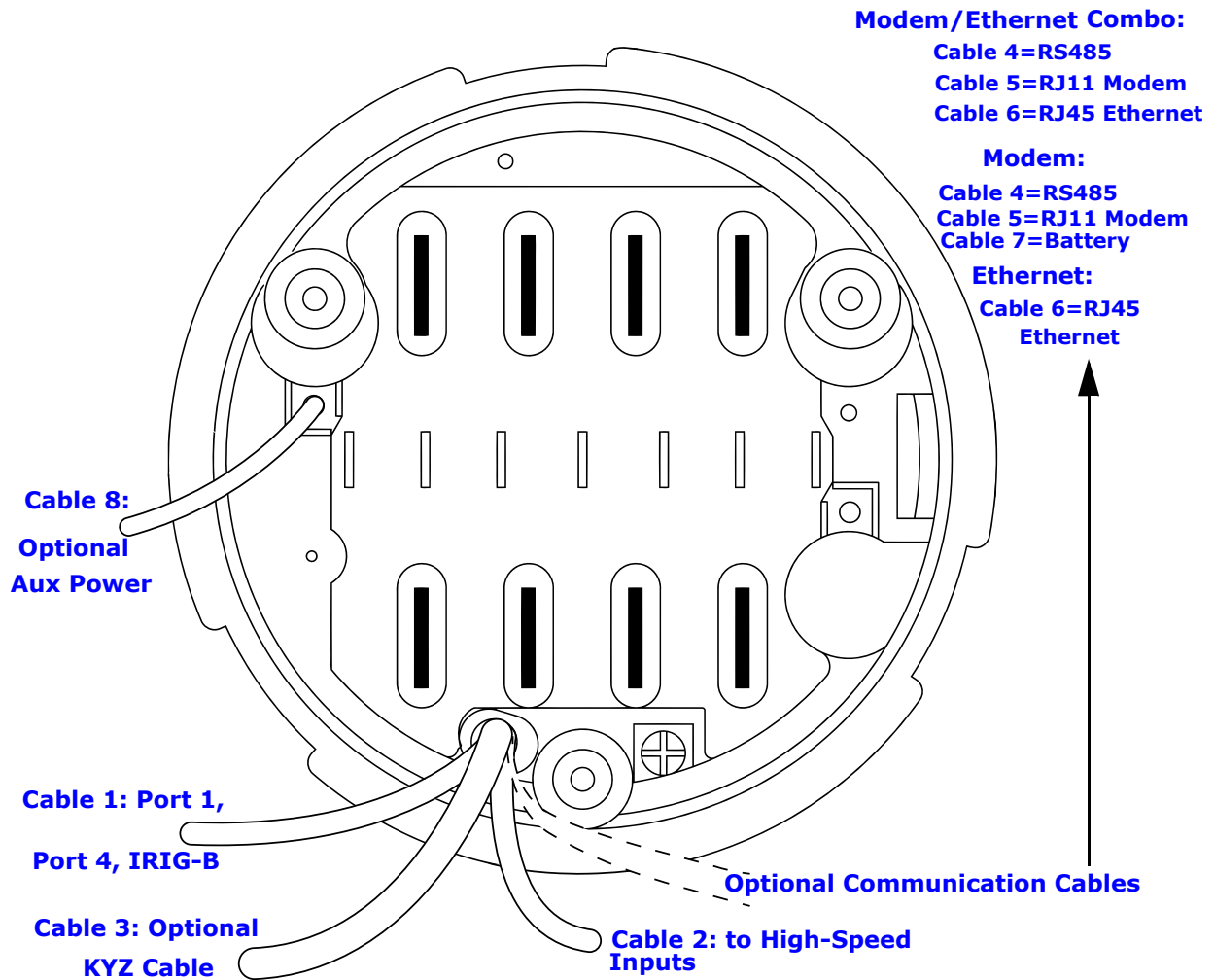


Figure 6.2: Socket Meter Rear View Showing Cables

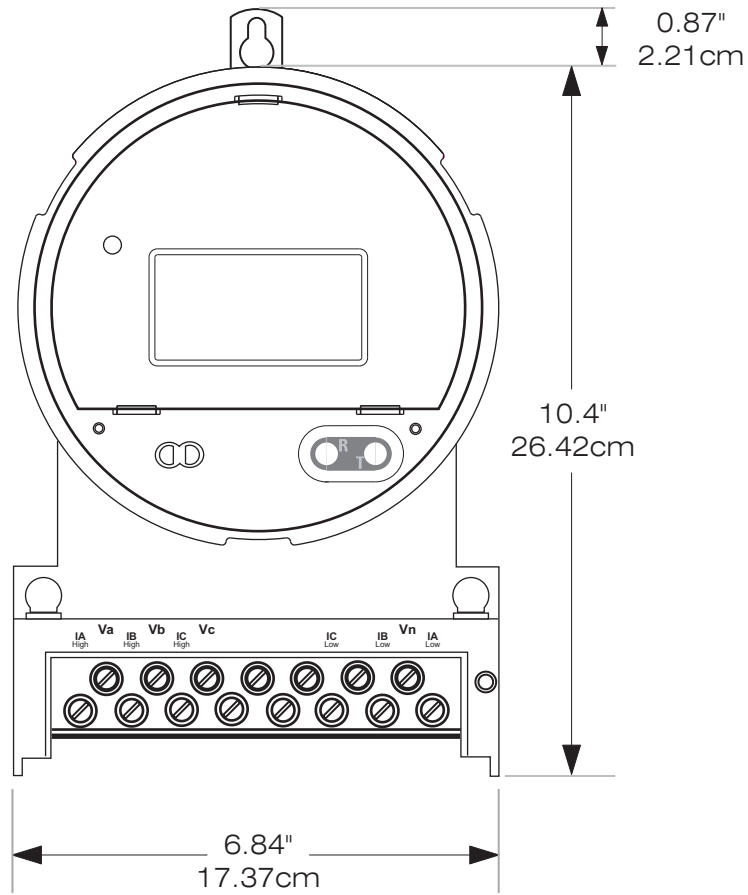


Figure 6.3: Socket Meter Mounted in A-Base Front View

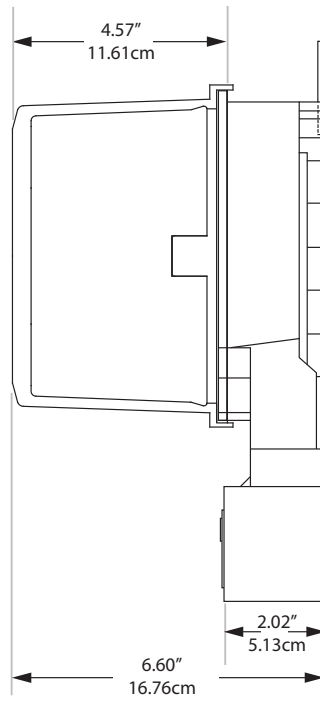


Figure 6.4: Socket Meter in A-Base Side View

## 6.2: Switchboard Meter Installation

| Cable          | Signal Name                  | Color  |
|----------------|------------------------------|--------|
| <b>Cable 1</b> | <b>Port 1 Wiring (RS485)</b> |        |
|                | SHIELD                       | Black  |
|                | Tx/Rx+                       | Brown  |
|                | Tx/Rx-                       | Red    |
|                | <b>Port 4 Wiring (RS485)</b> |        |
|                | SHIELD                       | Orange |
|                | Tx/Rx+                       | Yellow |
|                | Tx/Rx-                       | Green  |
|                | <b>IRIG-B</b>                |        |
|                | +                            | Blue   |
|                | -                            | Purple |
| <b>Cable 2</b> | <b>High-Speed Inputs</b>     |        |
|                | Input 8                      | Black  |
|                | Input 7                      | Brown  |
|                | Input 6                      | Red    |
|                | Input 5                      | Orange |
|                | Input 4                      | Yellow |
|                | Input 3                      | Green  |
|                | Input 2                      | Blue   |
|                | Input 1                      | Gray   |
|                | Common                       | Purple |

| <b>Cable</b>   | <b>Signal Name</b>         | <b>Color</b> |
|----------------|----------------------------|--------------|
| <b>Cable 3</b> | <b>Optional KYZ Output</b> |              |
|                | Normally Closed 1          | Black        |
|                | Common                     | Brown        |
|                | Normally Open 1            | Red          |
|                | Normally Closed 2          | Orange       |
|                | Common                     | Yellow       |
|                | Normally Open 2            | Green        |
|                | Normally Closed 3          | Blue         |
|                | Common                     | Purple       |
|                | Normally Open 3            | Gray         |
|                | Normally Closed 4          | Light Green  |
|                | Common                     | Pink         |
|                | Normally Open 4            | White        |
|                | <b>Cable 4</b>             | <b>RS485</b> |
| SHIELD         |                            | Blue         |
| Tx/Rx+         |                            | Green        |
| Tx/Rx-         |                            | Red          |
| <b>Cable 5</b> | <b>RJ11 Modem</b>          |              |
|                | Label Attached             | Blue         |
| <b>Cable 6</b> | <b>RJ45 Ethernet</b>       |              |
|                | Label Attached             | Blue         |
| <b>Cable 7</b> | <b>Battery</b>             |              |
|                | Label Attached             | Black        |
| <b>Cable 8</b> | <b>Aux Power - DE</b>      |              |
|                | Positive                   | Red          |
|                | Neutral/Negative           | Black        |
|                | <b>Aux Power - SE</b>      |              |
|                | Std. Ext.                  | Black        |
|                | Std. Ext.                  | Black        |

The following figures show the switchboard case meter dimensions.

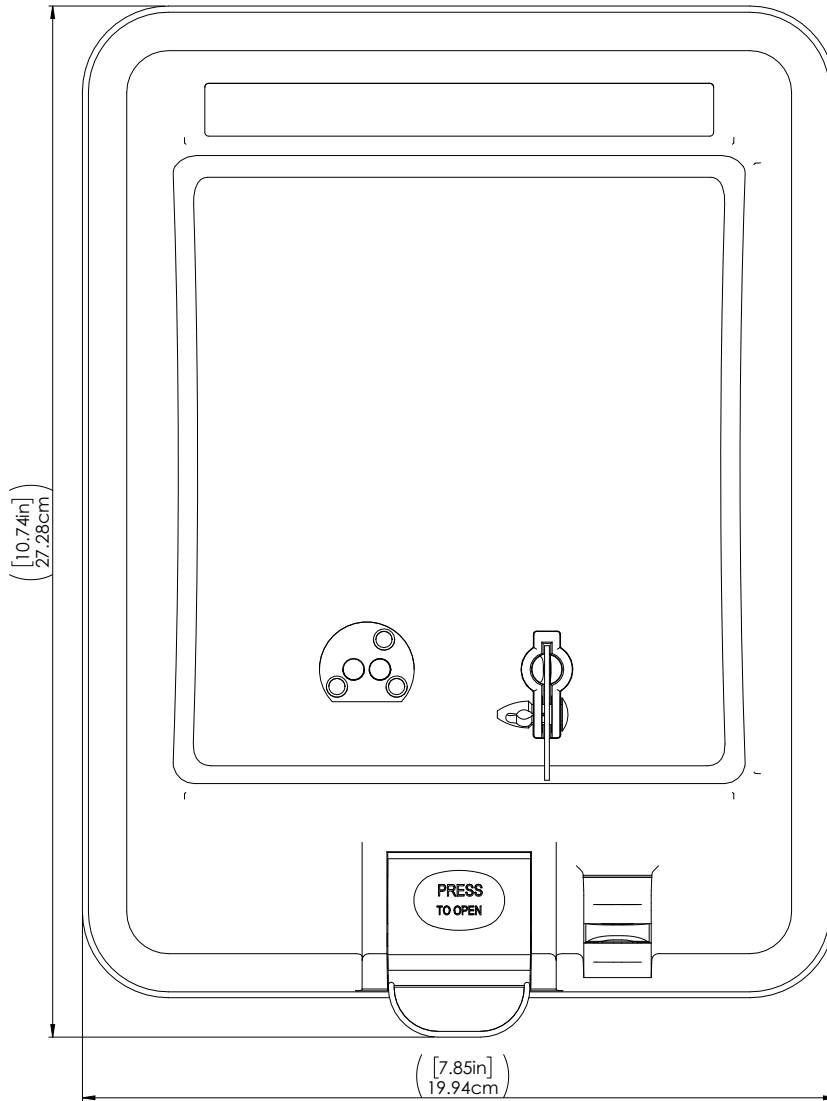


Figure 6.5: Switchboard Case Meter Front Dimensions (SWB3)

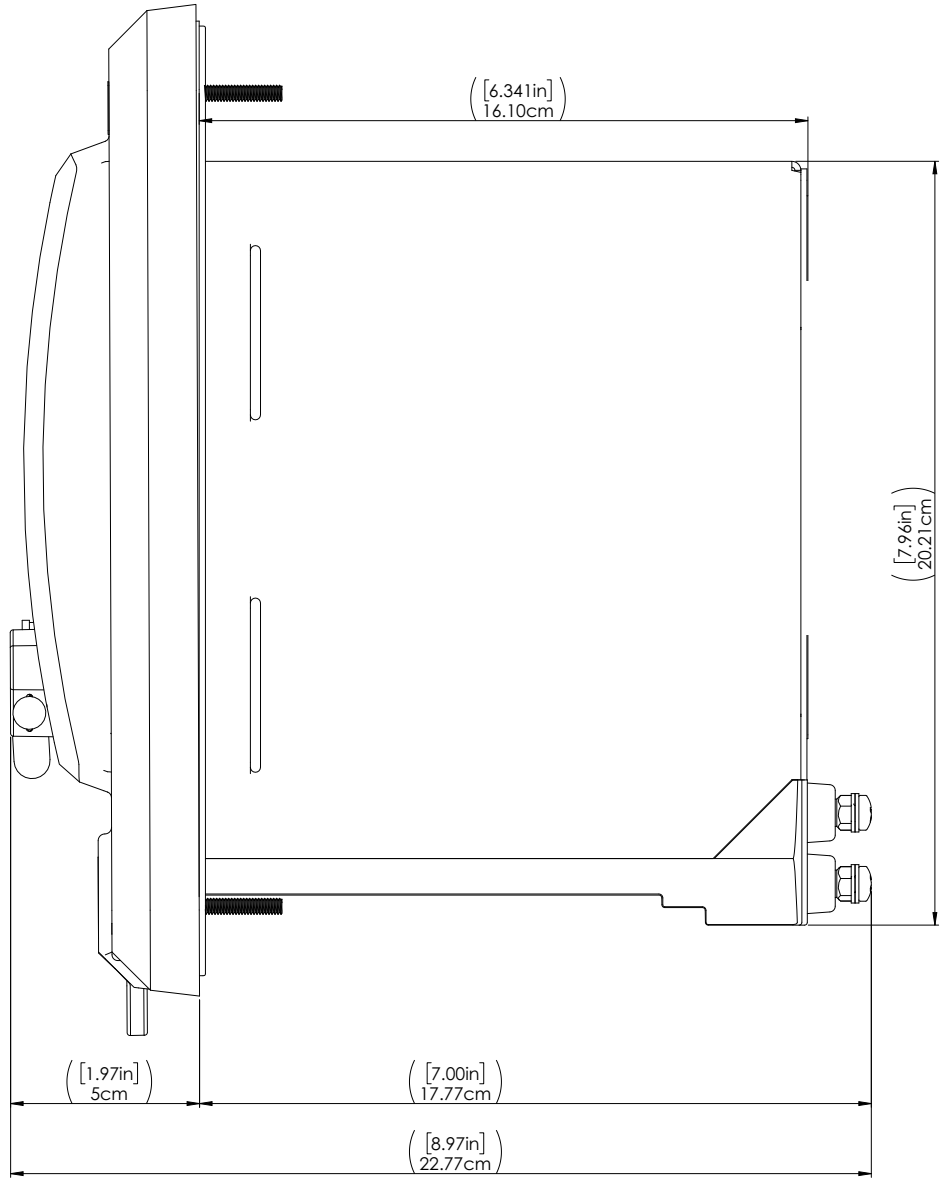


Figure 6.6: Switchboard Meter Side Dimensions (SWB3)

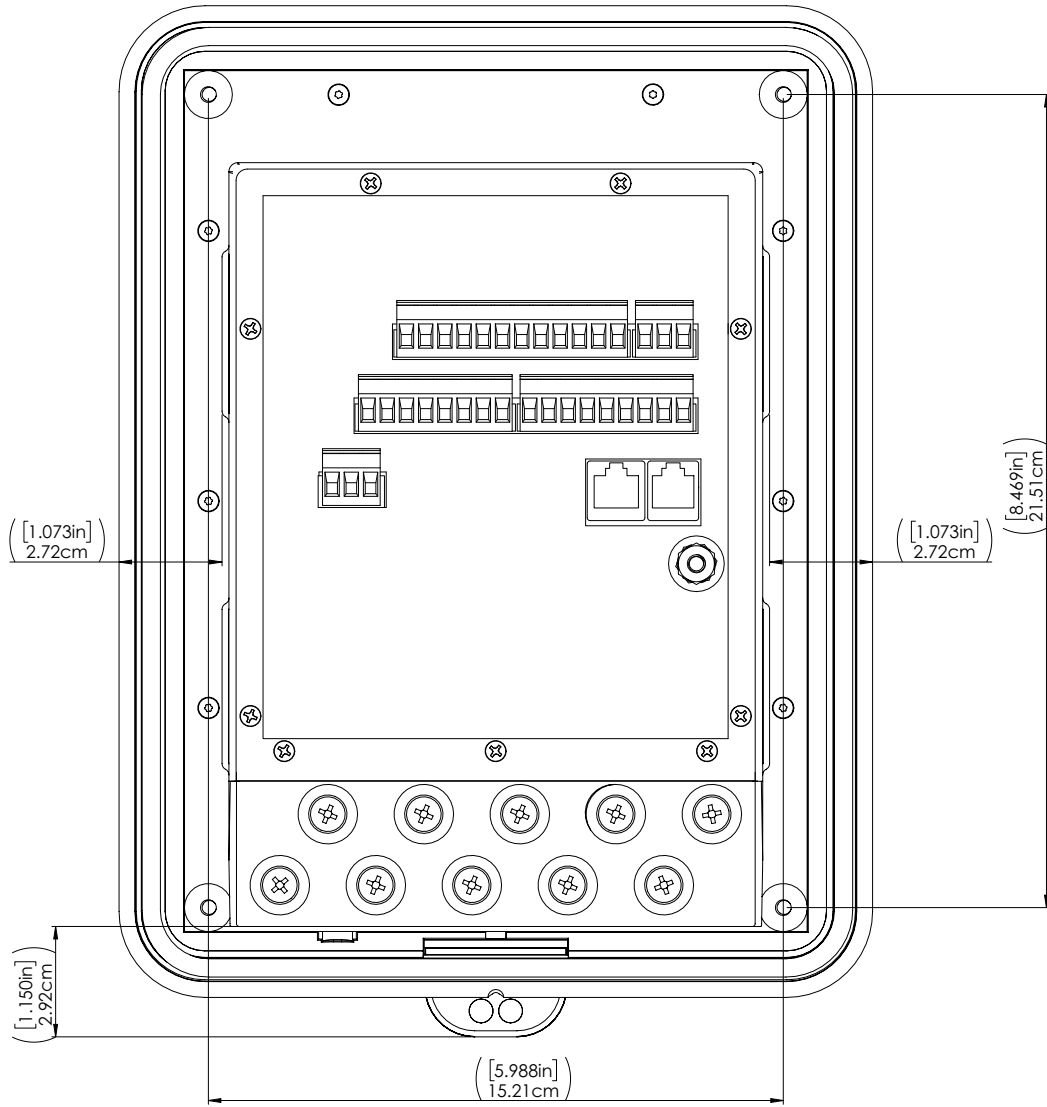


Figure 6.7: Switchboard Case Back Dimensions (SWB3)



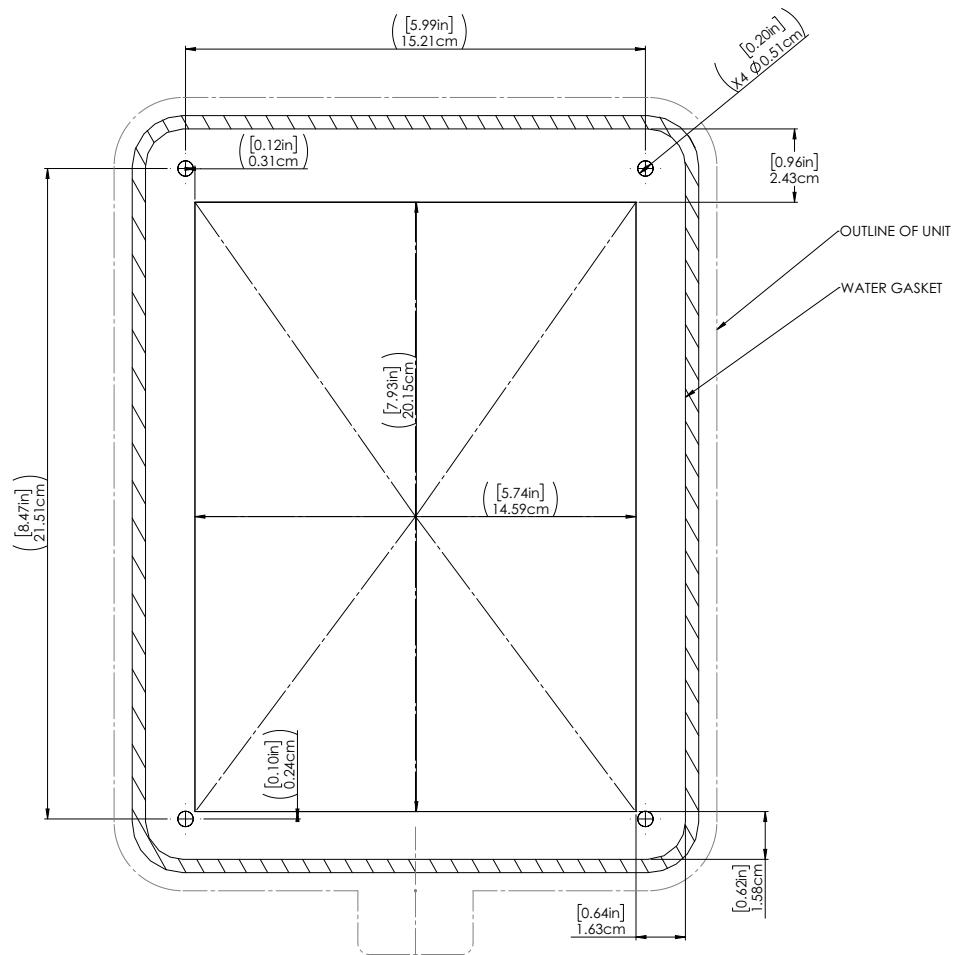


Figure 6.8: Switchboard Case Meter Cutout Dimensions

The cutout has standard GE S1 relay case dimensions. If you are replacing an existing meter using this connection, the meter should fit in the same cutout. See the figure on the next page. Tools needed are a #2 Phillips screwdriver and an 11/32 nut driver. For new installations, see page 13.

If you want to remove the meter from the switchboard case before installing the case, see [6.2.1: Removing the Meter from the Switchboard Case/Reinstalling the Meter into the Switchboard Case](#), on page 6-14, for instructions.

**When replacing an existing installation:**



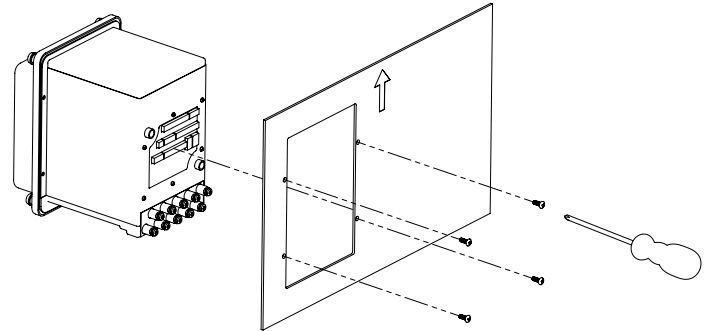
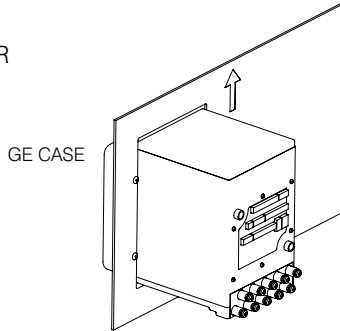
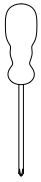
**IMPORTANT!** Please note that the mounting hole locations are different from the GE S1 case. For quick retrofit, use the four mounting brackets to firmly secure the enclosure in the cutout, as shown in the figure below.

1. LOCATE UNIT TO BE CHANGED.

2. REMOVE 4 SCREWS HOLDING CASE TO PANEL.

TOOLS NEEDED

#2 PHILIPS SCREWDRIVER



3. INSERT AND INSTALL SHARK 270 SWB3 UNIT INTO PANEL CUT OUT USING INCLUDED MOUNTING CLIPS.

4. INSERT MOUNTING CLIPS INTO SIDE SLOTS.

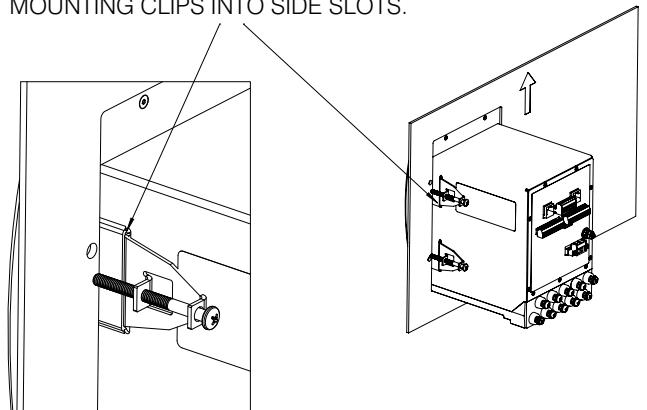
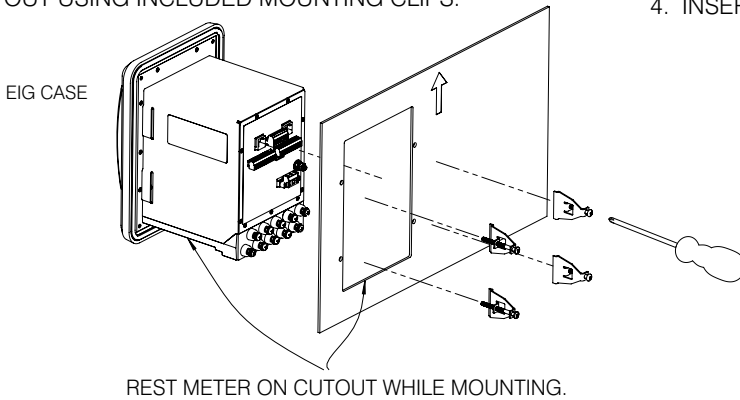
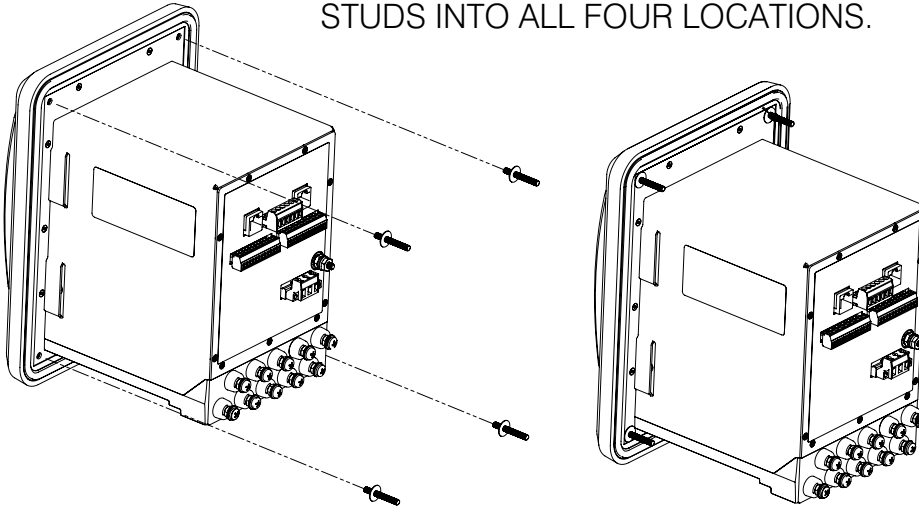


Figure 6.9: Switchboard Case Installation for Existing/Retrofit Installations

**When making a new installation:**

Use the four mounting studs with nuts and washers, located in the accessories bag to attach the meter to the panel, as shown in the figure below.

1. USING INCLUDED WASHER AND STUDS, SCREW STUDS INTO ALL FOUR LOCATIONS.



3. INSTALL FLAT WASHER, SPLIT WASHER, AND NUT FROM BAG.

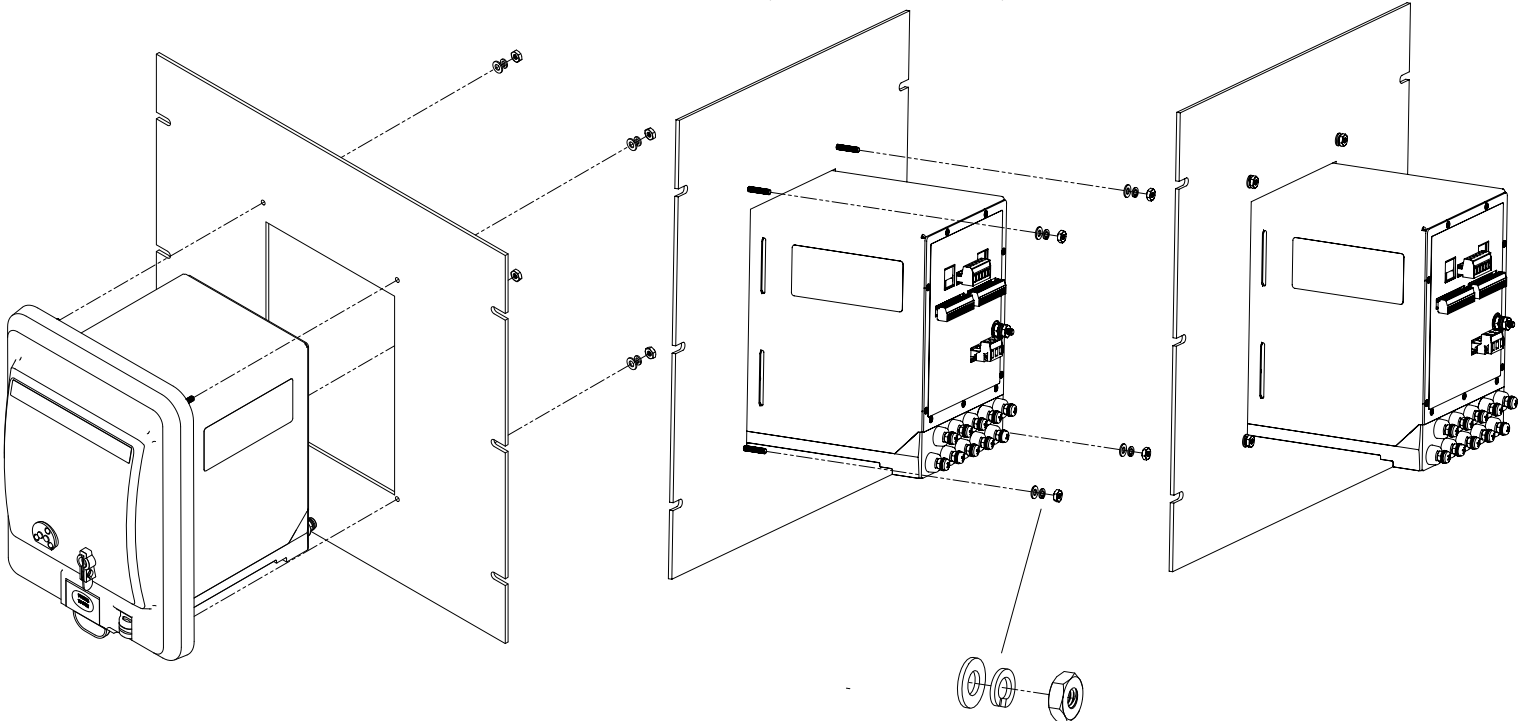


Figure 6.10: Switchboard Case Installation for New Installations

**NOTE:** Alternatively, you can use the mounting brackets for new installations - see the instructions on the previous page.

### 6.2.1: Removing the Meter from the Switchboard Case/Reinstalling the Meter into the Switchboard Case

You may want to remove the meter from the switchboard case for calibration or maintenance tasks. Follow these instructions:

1. Lift the latch and remove the front bezel.

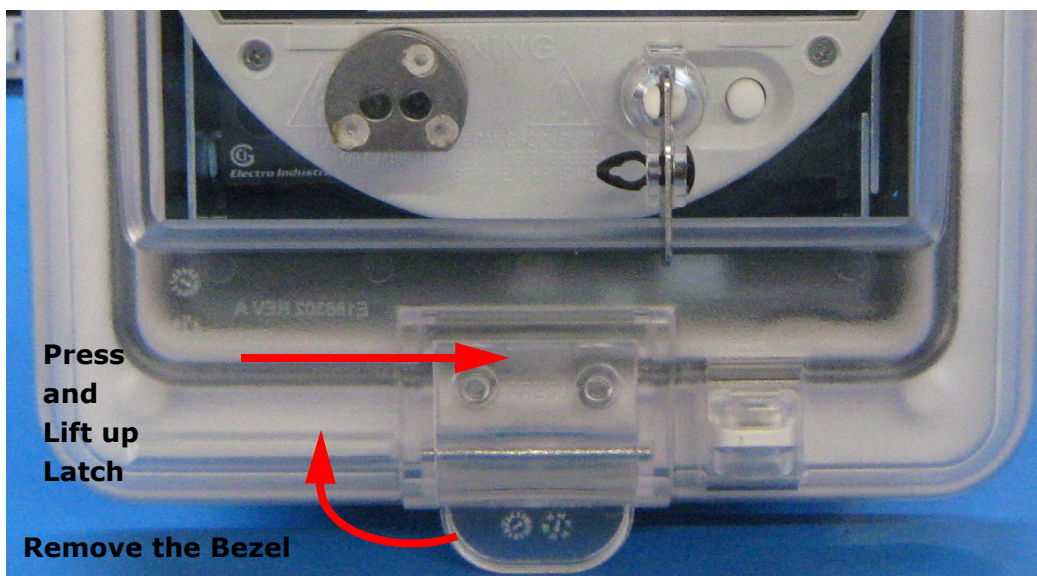


Figure 6.11: Removing the Front Bezel

2. Pull out the paddle board.



Figure 6.12: Removing the Paddle Board





3. Move the top lever to the right (a) and move the bottom lever to the left (b).



Figure 6.13: Unlocking the Cradle

4. Holding onto the meter, gently pull the meter cradle toward you. You can use the top lever to pull the cradle all the way out.



Figure 6.14: Removing the Meter Cradle



5. Put the cradle with the meter in a safe location.

To re-install the meter in the switchboard case:

1. Make sure the top lever is in the open position and use it to reinsert the cradle into the switchboard case.



Figure 6.15: Reinserting the Meter Cradle

2. Lock the meter cradle into the switchboard case by moving the upper lever to the left (a), and the lower lever to the right (b).

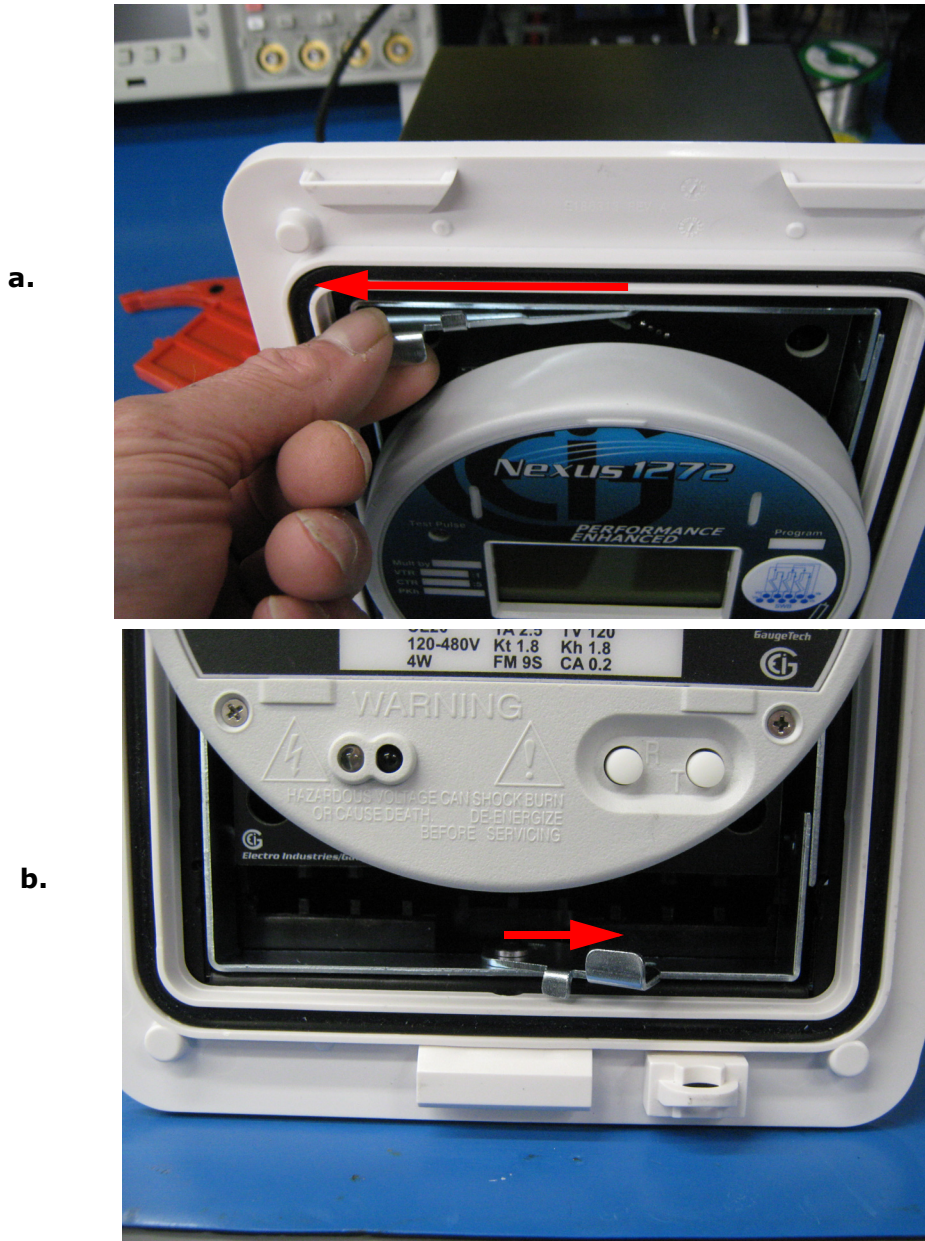


Figure 6.16: Locking the Cradle



3. Re-insert the paddle board between the bottom of the cradle and the switchboard case, and continue to push the paddle board inward until it is fully installed. Note that some effort will be needed to fully install the paddle board.



Inserting the Paddle Board



Paddle Board Completely Installed

Figure 6.17: Reinserting the Paddle Board

4. Re-install the assembly: On the inside of the upper lip there are two self-locating tabs that will guide the bezel into its proper position. Once the bezel hangs freely, push the bottom of the bezel firmly against the case, and then press the latch until it snaps into place.



Figure 6.18: Reinstalling the Bezel

### 6.3: Internal Battery Installation and Maintenance

**CAUTION! - BATTERY INSTALLATION OR REPLACEMENT MUST BE DONE WITH POWER OFF!**

**ATTENTION! - L'INSTALLATION OU LE REMPLACEMENT DE LA PILE DOIT ÊTRE FAIT SANS ALIMENTATION!**

Depending on its age, the Nexus® 1262/1272 meter could be equipped with either of two types of batteries:

- Older meters are equipped with 3 V Lithium cell BR2032.
- Meters shipped after February, 2010 are equipped with 3 V Lithium cell Panasonic BR3032.

Examine the specific meter and be sure to install the correct battery.

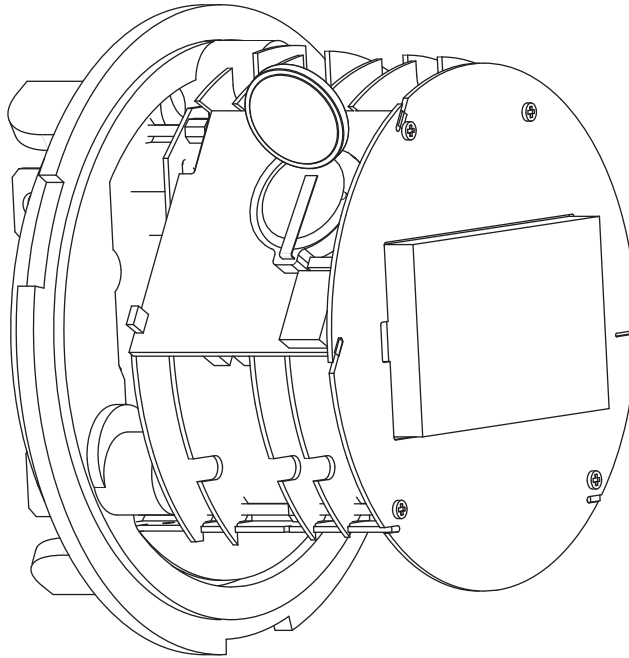


Figure 6.20: Meter without Internal Shroud

The Internal battery maintains NVRAM and time during outages. It is located on one of the vertical panels inside the Internal Shroud (see Figure 6.5). Under normal conditions, the battery should provide in excess of 10 years of service during storage conditions (disconnected from terminals) or when properly installed in an energized meter. The battery should provide more than one year of service during outage

conditions (time on battery backup). A LOW BATTERY indicator on the display screen tells you when replacement is needed.

**Follow these steps to install the battery:**

1. Before replacing the battery, download all memory files to your computer, as data may be lost.
2. Remove power from the meter.
3. Remove the external meter cover and the internal shroud. If the meter is in a switchboard case, lift the locking latch and remove the switchboard case's front bezel. If the meter was in a socket form, remove the outer, clear cover by rotating it counter-clockwise.
4. Remove the old battery with a screwdriver or similar tool.
5. Place the new battery in the battery holder.

**IMPORTANT!** You must insert the replacement battery into the holder correctly. Otherwise proper contact will not be achieved and the meter may lose log memory and time functions.

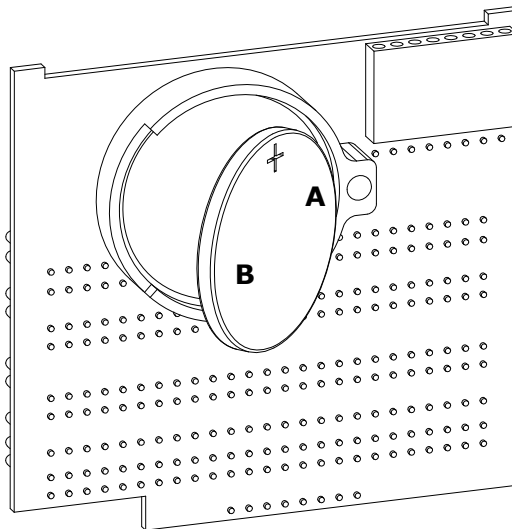


Figure 6.21: Battery Holder Detail

- a. Make sure the + on the battery is facing UP and toward you.



- b. Insert the RIGHT SIDE of the battery UNDER the 2 clips on the right side of the holder while gently pushing the battery against the INSIDE RIGHT WALL of the battery holder (Side A in Figure 6.21).
  - c. Gently push the LEFT SIDE of the battery in until it snaps into place (Side B in Figure 6.21).
4. Replace the internal shroud and the external meter cover. For the switchboard case meter, re-install the front bezel assembly in this way: On the inside of the upper lip there are two self-locating tabs that will guide the bezel into its proper position. Once the bezel hangs freely, push the bottom of the bezel firmly against the case, and then press the latch until it snaps into place. For the socket meter, install the clear cover and turn it clockwise until it locks into place.
5. Power up the meter.
6. Reset meter time using CommunicatorPQA® software, unless IRIG-B is connected. (If IRIG-B is connected, time is synchronized automatically.)

### **6.3.1: Battery Safety and Disposal**

Dispose of batteries in accordance with local, state and federal hazardous waste regulations. For disposal outside the United States, follow your country's disposal guidelines.

### **6.4: Mounting the Optional External Displays**

The Nexus® 1262/1272 meter has its own LCD Display on the meter face. The optional Nexus® LED Displays: P40N+, P41N+ and P43N+ (as well as the legacy P40N) may be used where additional displays are desired. The dimensions of the P40N and P40N+ are different - see the figures on the next page. The display mounts using a standard ANSI C39.1 drill plan. Secure the four mounting studs to the back of the panel with the supplied hardware. See Chapter 9 for details on the external displays.

Six feet of RS485 communication/power cable harness is supplied. Allow for at least a 1.25 inch (3.17 cm) diameter hole in the mounting panel for the cable harness. See Chapter 5 for wiring details.

The display is powered by an external power source, such as the PSIO, which supplies 12 V DC.

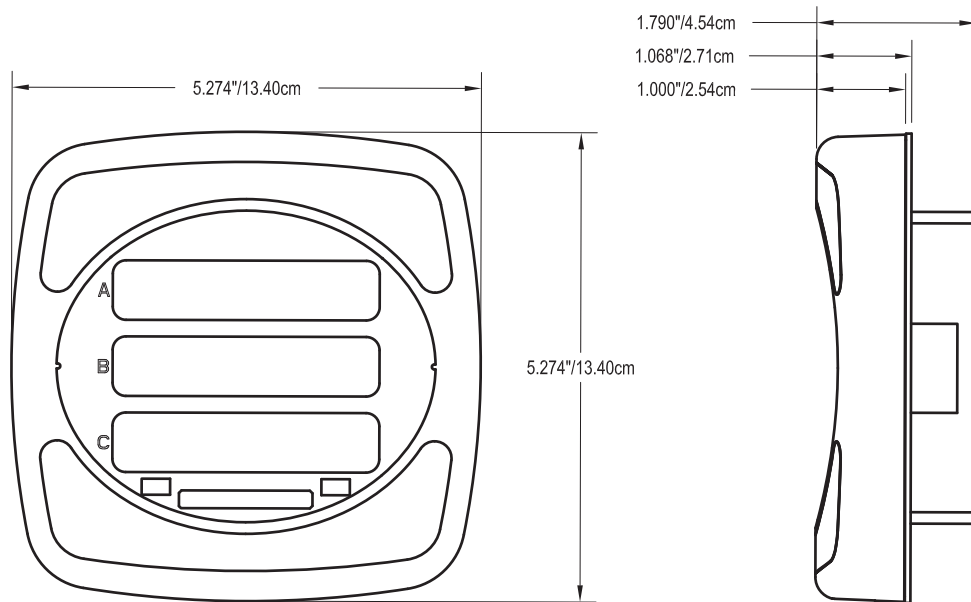


Figure 6.22: P40N+ Front and Side Dimensions

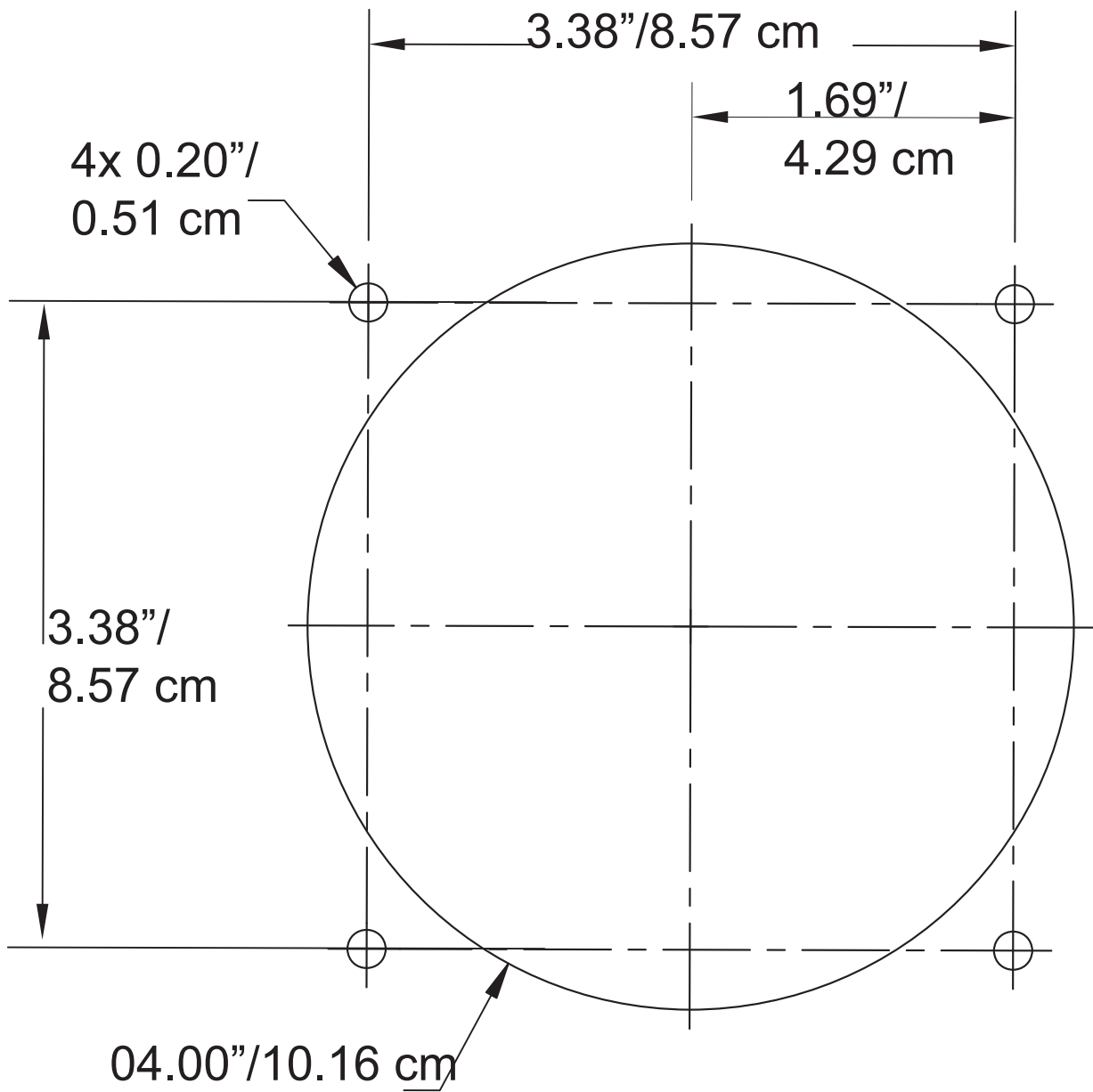


Figure 6.23: P40N+ ANSI Mounting

## 6.5: Mounting the Nexus® External I/O Modules

Connect multiple I/O modules by inserting male RS485 side ports into female side ports, then screw each module into the next, using a flathead screwdriver. Work from left to right.

Secure the mounting brackets to both ends of a group of I/O modules or both sides of an individual module, using the screws supplied (#440 pan-head screws). Next, secure the brackets to a flat surface using a #8 screw with a lock washer.

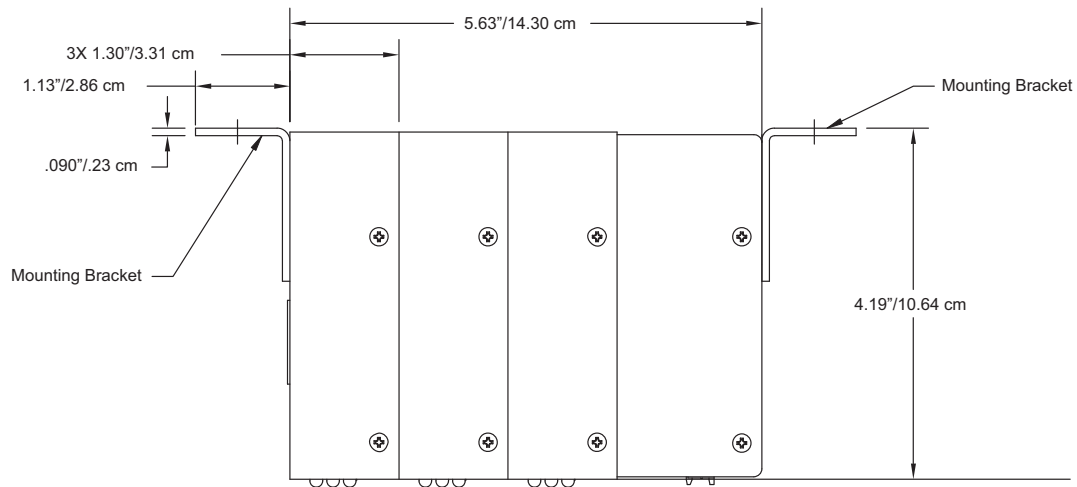


Figure 6.24: I/O Modules Mounting Diagram, Overhead View



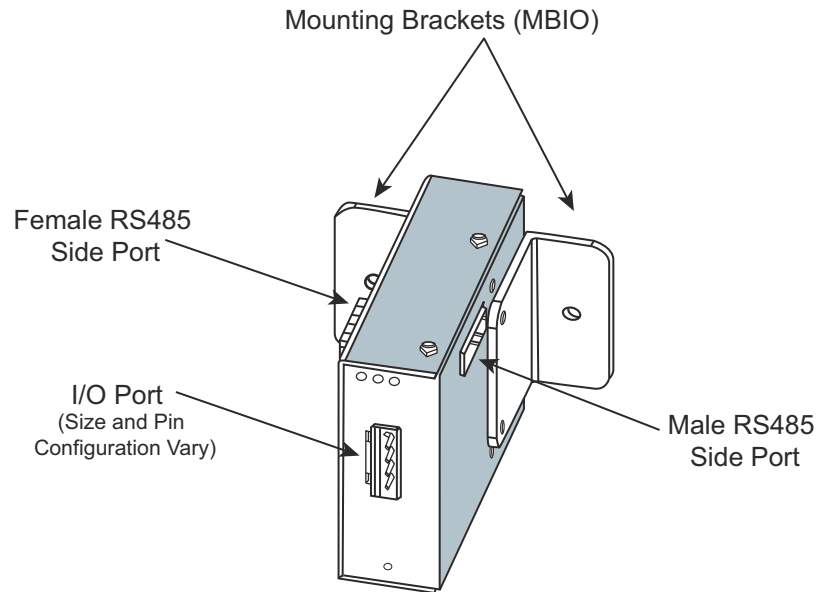


Figure 6.25: Single I/O Module with Mounting Brackets

**IMPORTANT!** The Nexus® 1262/1272 meter does not supply power to the I/O modules. You must use an external power supply, such as the EIG PSIO (12 V Output). Figure 6.26 shows mounting with the PSIO.

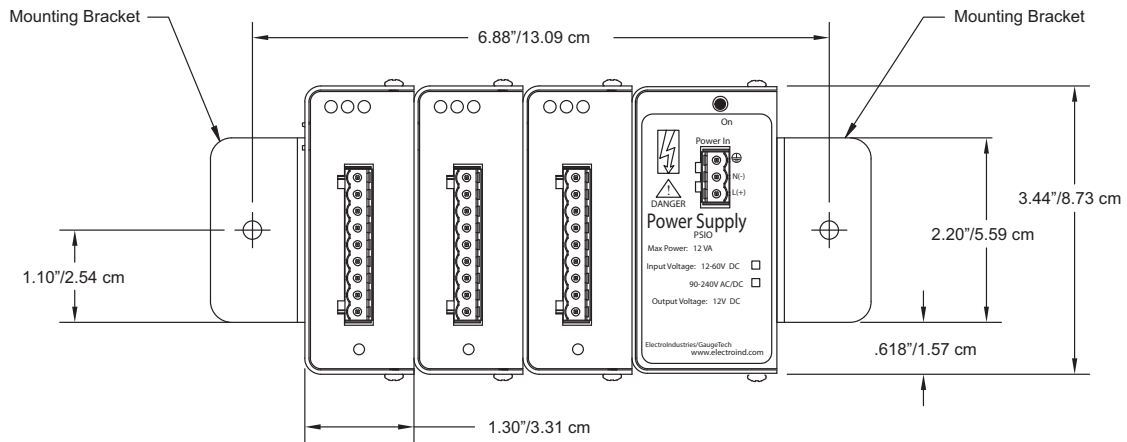


Figure 6.26: I/O Modules Mounting Dimensions, Front View

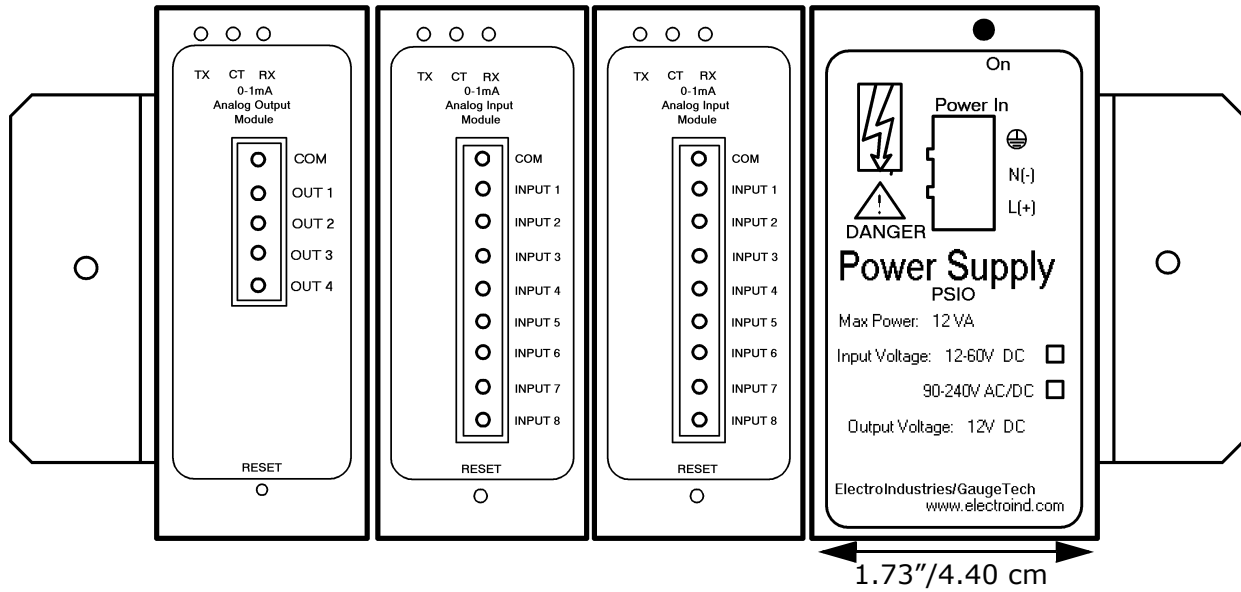


Figure 6.27: I/O Modules with PSIO Power Supply

Refer to Figure 6.28 and Section 5.3.8 for PSIO and I/O Module wiring instructions.

Auxiliary Power (PSIO) is supplied through pins 3 and 4

Connection though SHIELD, + and - to meter's Port 4

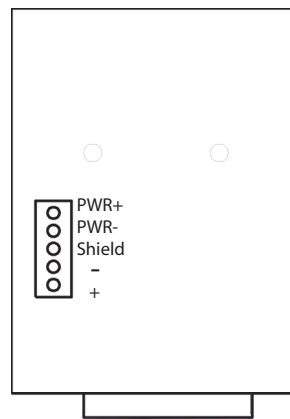


Figure 6.28: I/O Module Wiring Detail

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## 7: Time of Use Function

### 7.1: Introduction

A Time of Use (TOU) usage structure takes into account the quantity of energy used and the time at which it was consumed. The Nexus® 1262/1272 meter's TOU function, available with the CommunicatorPQA® software, is designed to accommodate a variety of programmable rate structures. The TOU function accumulates data based on the time-scheme programmed into the Nexus® meter.

See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details on programming the Nexus® 1262/1272 meter's TOU calendar and retrieving TOU data.

### 7.2: The Nexus® Meter's TOU Calendar

A Nexus® meter's TOU calendar sets the parameters for TOU data accumulation. You may store up to twenty calendars in the Nexus® Meter and an unlimited amount of calendar files on your computer.

The TOU calendar profile allows you to assign a programmable usage schedule—eg, “Weekday,” “Weekend,” “Holiday”—to each day of the calendar year. You may create up to 16 different TOU schedules.

Each TOU schedule divides the 24 hour day into fifteen-minute intervals from 00:00:00 to 23:59:59. You may apply one of eight different programmable registers—e.g., “Peak,” “Off Peak,” “Shoulder Peak”—to each fifteen-minute interval.

The Nexus® meter stores:

- Accumulations on a seasonal basis, up to four seasons per year
- Accumulations on a monthly basis

Seasonal and monthly accumulations may span one year into the next. Each season and month is defined by a programmable start/billing date, which is also the end-date of the prior season or month.

A season ends at midnight of the day before the start of the next season.

A month ends at midnight of the month's billing day.

If the year ends and there is no new calendar, TOU accumulations will stop. If a calendar is present for the following year, TOU accumulations continue until the next monthly bill date or next start-of-season is reached. Accumulation can span into the following year.

If no following year is present, the last accumulation for the year will end on 12:31:23:59:59.

### **7.3: TOU Frozen and Active Registers**

The Nexus® meter stores accumulations for the prior time periods. When the end of a billing period is reached, the Active period of time becomes stored as Frozen. The registers are then cleared and accumulations resume, using the next set of TOU schedules and register assignments from the stored calendar.

Frozen and Active Accumulations are always available.

### **7.4: Updating, Retrieving and Replacing TOU Calendars**

CommunicatorPQA® software retrieves TOU calendars from the Nexus® meter or from the computer's hard drive for review and edit.

Up to a maximum of twenty yearly calendars can be stored in the Nexus® meter at any given time. You may retrieve them one at a time; a new calendar can be stored while a current calendar is in use.

Accumulations do not stop during calendar updates. If a calendar is replaced while in use, the accumulations for the current period will continue until the set end date. At that point, the current time will become the new start time and the settings of the new calendar will be used.

Reset the current accumulations, if you replace a calendar in use. A reset clears only the current accumulation registers. This causes the current accumulations to use the present date as the start and accumulate to the next new end date, which will be taken from the new calendar. Once stored, prior accumulations are always available and cannot be reset. See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergypQA.com® Software User Manual* for instructions on resetting TOU accumulations.

At the end of a defined period, current accumulations are stored, the registers are cleared and accumulations for the next period begin. When the year boundary is crossed, the second calendar, if present, is used. To retain continuity, you have up to one year to replace the old calendar with one for the following year.

## 7.5: Daylight Savings and Demand

To use Daylight Savings Time, you must enable it in the Nexus® meter's Device Profile, Time Settings. Click Auto DST, which sets Daylight Savings Time automatically (for the United States ONLY). You can also select User Defined and enter the desired dates for Daylight Savings Time. See Chapter 4 in the *CommunicatorPQA®*, *Meter-ManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details.

- To set Demand Intervals, from the Device Profile select **Revenue & Energy Settings > Demand Integration Intervals** and set the desired intervals. Click **OK**.
- To set Cumulative Demand Type, from the Device Profile click **Revenue & Energy Settings > Cumulative Demand Type** and select Block or Rolling Window. Click **OK**.

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## 8: Transformer Loss Compensation

### 8.1: Introduction

The Edison Electric Institute's Handbook for Electricity Metering, Ninth Edition defines Loss Compensation as:

A means for correcting the reading of a meter when the metering point and point of service are physically separated, resulting in measurable losses including  $I^2R$  losses in conductors and transformers and iron-core losses. These losses may be added to or subtracted from the meter registration.

Loss compensation may be used in any instance where the physical location of the meter does not match the electrical location where change of ownership occurs. Most often this appears when meters are connected on the low Voltage side of power transformers when the actual ownership change occurs on the high side of the transformer. This condition is illustrated in Figure 8.1.

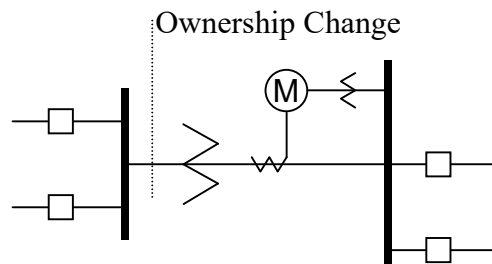


Figure 8.1: Low Voltage Metering Installation Requiring Loss Compensation

It is generally less expensive to install metering equipment on the low Voltage side of a transformer and in some conditions other limitations may also impose the requirement of low-side metering even though the actual ownership change occurs on the high Voltage side.

The need for loss compensated metering may also exist when the ownership changes several miles along a transmission line where it is simply impractical to install metering equipment. Ownership may change at the midway point of a transmission line where there are no substation facilities. In this case, power metering must again be compensated. This condition is shown in Figure 8.2.

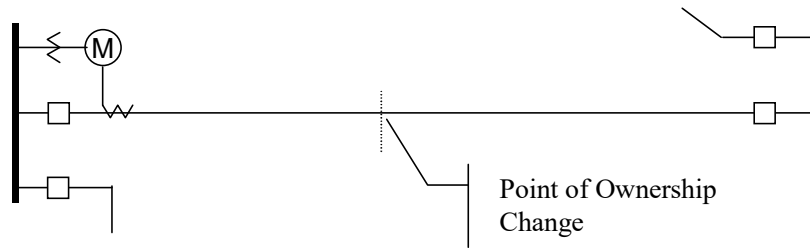


Figure 8.2: Joint Ownership Line Meeting Requiring Loss Compensation

A single meter cannot measure the losses in a transformer or transmission line directly. It can, however, include computational corrections to calculate the losses and add or subtract those losses to the power flow measured at the meter location. This is the method used for loss compensation in the Nexus® meter. Refer to Appendix A in this manual and Appendix B of the *CommunicatorPQA®*, *MeterManager-PQA®*, and *EnergyPQA.com® Software User Manual* for detailed explanation and instructions for using the Transformer Line Loss Compensation feature of the Nexus® 1262/1272 meter.

The computational corrections used for transformer and transmission line loss compensation are similar. In both cases, no-load losses and full-load losses are evaluated and a correction factor for each loss level is calculated. However, the calculation of the correction factors that must be programmed into the meter differ for the two different applications. For this reason, the two methodologies will be treated separately in this chapter.

In the Nexus® meter, Loss Compensation is a technique that computationally accounts for active and reactive power losses. The meter calculations are based on the formulas below. These equations describe the amount of active (Watts) and reactive (VARs) power lost due to both iron and copper effects (reflected to the secondary of the instrument transformers).

Total Secondary Watt Loss =

$$W_{TotalTransformerLoss} = VA_{TransformerFullScale} \times \left[ \%LFWE \times \left( \frac{V_{measured}}{V_{nominal}} \right)^2 + \%LWCU \times \left( \frac{I_{measured}}{I_{nominal}} \right)^2 \right]$$



Total Secondary VAR Loss =

$$VAR_{TotalTransformerLoss} = VA_{TransformerFullScale} \times \left[ \%LVFE \times \left( \frac{V_{measured}}{V_{nominal}} \right)^4 + \%LVCU \times \left( \frac{I_{measured}}{I_{nominal}} \right)^2 \right]$$

The Values for %LVFE, %LVCU, %LVFE, and %LVCU are derived from the transformer and meter information, as demonstrated in the following sections.

The calculated loss compensation values are added to or subtracted from the measured Watts and VARs. The selection of adding or subtracting losses is made through the meter's profile when programming the meter (see the following section for instructions). The meter uses the combination of the add/subtract setting and the directional definition of power flow (also in the profile) to determine how to handle the losses. Losses will be "added to" or "subtracted from" (depending on whether add or subtract is selected) the Received Power flow. For example, if losses are set to "Add to" and received power equals 2000 kW and losses are equal to 20kW then the total metered value with loss compensation would be 2020 kW; for these same settings if the meter measured 2000 kW of delivered power the total metered value with loss compensation would be 1980 kW.

Since transformer loss compensation is the more common loss compensation method, the meter has been designed for this application. Line loss compensation is calculated in the meter using the same terms but the percent values are calculated by a different methodology.

Nexus® meter transformer loss compensation:

- Performs calculations on each phase of the meter for every measurement taken; unbalanced loads are handled accurately.
- Calculates numerically, eliminating the environmental effects that cause inaccuracies in electromechanical compensators.
- Performs bidirectional loss compensation.
- Requires no additional wiring; the compensation occurs internally.
- Imposes no additional electrical burden when performing loss compensation.

Loss Compensation is applied to 1 second per phase Watt/VAR readings and, because of that, affects all subsequent readings based on 1 second per phase Watt/VAR readings. This method results in loss compensation being applied to the following quantities:

- Total Power
- Demands, per phase and total (Thermal, Block (Fixed) Window, Rolling (Sliding) Window and Predictive Window)
- Maximum and minimum Demands
- Energy accumulations
- KYZ output of Energy accumulations

**NOTE:** Loss Compensation is disabled when the meter is placed in Test Mode.

## 8.2: Nexus® 1262/1272 Meter's Transformer Loss Compensation

The Nexus® meter provides compensation for active and reactive power quantities by performing numerical calculations. The factors used in these calculations are derived by figuring the values from the worksheet shown here and in Appendix B of the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual*.

You enter the derived values into the CommunicatorPQA® software through the Device Profile Transformer and Line Loss Compensation screen.

The CommunicatorPQA® software allows you to enable transformer loss compensation for losses due to copper and iron, individually or simultaneously. Losses can either be added to or subtracted from measured readings. Refer to Appendix B in the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for instructions.

Loss compensation values must be calculated based on the meter installation. As a result, transformer loss values must be normalized to the meter by converting the base Voltage and current and taking into account the number of elements used in the metering installation. For three-element meters, the installation must be normalized to the phase-to-neutral Voltage and the phase current; in two-element meters the

installation must be normalized to the phase-to-phase Voltage and the phase current. This process is described in the following sections.

### **8.2.1: Loss Compensation in Three Element Installations**

Loss compensation is based on the loss and impedance values provided on the transformer manufacturer's test report. A typical test report will include at least the following information:

- Manufacturer
- Unit serial number
- Transformer MVA rating (Self-Cooled)
- Test Voltage
- No load loss watts
- Load loss watts (or full load loss watts)
- % Exciting current @ 100% Voltage
- % Impedance

The transformer MVA rating is generally the lowest MVA rating (the self-cooled or OA rating) of the transformer winding. The test Voltage is generally the nominal Voltage of the secondary or low Voltage winding. For three-phase transformers these values will typically be the three-phase rating and the phase-to-phase Voltage. All of the test measurements are based on these two numbers. Part of the process of calculating the loss compensation percentages is converting the transformer loss values based on the transformer ratings to the base used by the meter.

Correct calculation of loss compensation also requires knowledge of the meter installation. In order to calculate the loss compensation settings you will need the following information regarding the meter and the installation:

- Number of meter elements
- Potential transformer ratio (PTR)

- Current transformer ratio (CTR)
- Meter base Voltage
- Meter base current

This section is limited to application of Nexus® meters to three-element metering installations. As a result, we know that:

- Number of metering elements = 3
- Meter base Voltage = 120 Volts
- Meter base current = 5 Amps

### 8.2.1.1: Three-Element Loss Compensation Worksheet

|                |  |                |  |
|----------------|--|----------------|--|
| Company        |  | Station Name   |  |
| Date           |  | Trf. Bank No.  |  |
| Trf Manf       |  | Trf Serial No. |  |
| Calculation by |  |                |  |

Transformer Data (from Transformer Manufacturer's Test Sheet)

| Winding       | Voltage | MVA | Connection  |
|---------------|---------|-----|-------------|
| HV - High     |         |     | $\Delta$ -Y |
| XV - Low      |         |     | $\Delta$ -Y |
| YV - Tertiary |         |     | $\Delta$ -Y |

| Value        | Watts Loss |         |            |
|--------------|------------|---------|------------|
|              | 3-Phase    | 1-Phase | 1-Phase kW |
| No-Load Loss |            |         |            |
| Load Loss    |            |         |            |

Enter 3-Phase or 1-Phase values. If 3-Phase values are entered, calculate 1-Phase values by dividing 3-Phase values by three. Convert 1-Phase Loss Watts to 1-Phase kW by dividing 1-Phase Loss Watts by 1000.

| Value              | 3-Phase MVA | 1-Phase MVA | 1-Phase kVA |
|--------------------|-------------|-------------|-------------|
| Self-Cooled Rating |             |             |             |

Enter 3-Phase or 1-Phase values. If 3-Phase values are entered, calculate 1-Phase values by dividing 3-Phase values by three. Convert 1-Phase Self-Cooled MVA to 1-Phase kVA by multiplying by 1000.

|                    |  |
|--------------------|--|
| % Exciting Current |  |
| % Impedance        |  |

| Value                    | Phase-to-Phase | Phase-to-Neutral |
|--------------------------|----------------|------------------|
| Test Voltage (Volts)     |                |                  |
| Full Load Current (Amps) |                |                  |

Test Voltage is generally Phase-to-Phase for three-phase transformers. Calculate Phase-to-Neutral Voltage by dividing Phase-to-Phase Voltage by the square root of 3. Calculate Full Load Current by dividing the (1-Phase kW Self-Cooled Rating) by the (Phase-to-Neutral Voltage) and multiplying by 1000.

**Meter/Installation Data**

|  |           |             |            |
|--|-----------|-------------|------------|
| Instrument Transformers                              | Numerator | Denominator | Multiplier |
| Potential Transformers                               |           |             |            |
| Current Transformers                                 |           |             |            |
| Power Multiplier [(PT Multiplier) x (CT Multiplier)] |           |             |            |

Enter the Numerator and Denominator for each instrument transformer. For example, a PT with a ratio of 7200/120 has a numerator or 7200, a denominator or 120 and a multiplier of 60 ( $7200/120 = 60/1$ ).

|                                 |     |
|---------------------------------|-----|
| Meter Secondary Voltage (Volts) | 120 |
| Meter Secondary Current (Amps)  | 5   |

**Base Conversion Factors**

| Quantity | Trans-<br>former | Multiplier | Trf IT Sec | Meter Base | Meter/Trf |
|----------|------------------|------------|------------|------------|-----------|
| Voltage  |                  |            |            | 120        |           |
| Current  |                  |            |            | 5          |           |

For Transformer Voltage, enter the Phase-to-Neutral value of Test Voltage previously calculated. For Transformer Current, enter the Full-Load Current previously calculated. For Multipliers, enter the PT and CT multipliers previously calculated.

TrfIT Secondary is the Base Value of Voltage and Current at the Instrument Transformer Secondary of the Power Transformer. These numbers are obtained by dividing the Transformer Voltage and Current by their respective Multipliers. The Meter/Trf values for Voltage and Current are obtained by dividing the Meter Base values by the TrfIT Secondary values.

Load Loss at Transformer

**No-Load Loss Watts (kW)** = 1-Phase kW No-Load Loss = \_\_\_\_\_

**No-Load Loss VA (kVA)** = (%Exciting Current) \* (1-Phase kVA Self-Cooled Rating)  
/ 100 = (\_\_\_\_\_) \* (\_\_\_\_\_) / 100

= \_\_\_\_\_ kVA

**No-Load Loss VAR (kVAR)** = SQRT((No-Load Loss kVA)<sup>2</sup> - (No-Load Loss kW)<sup>2</sup>) =  
SQRT((\_\_\_\_\_)<sup>2</sup> - (\_\_\_\_\_)<sup>2</sup>)

= SQRT((\_\_\_\_\_) - (\_\_\_\_\_) )

= SQRT (\_\_\_\_\_) = \_\_\_\_\_

**Full-Load Loss Watts (kW)** = 1-Phase Kw Load Loss = \_\_\_\_\_

**Full-Load Loss VA (kVA)** = (%Impedance) \* (1-Phase kVA Self-Cooled Rating) /  
100 = (\_\_\_\_\_) \* (\_\_\_\_\_) / 100

= \_\_\_\_\_ kVA

**Full-Load Loss VAR (kVAR)** = SQRT((Full-Load Loss kVA)<sup>2</sup> - (Full-Load Loss kW)<sup>2</sup>)  
= SQRT((\_\_\_\_\_)<sup>2</sup> - (\_\_\_\_\_)<sup>2</sup>)

= SQRT((\_\_\_\_\_) - (\_\_\_\_\_) )

= SQRT (\_\_\_\_\_) = \_\_\_\_\_

---

 Normalize Losses to Meter Base

| Quantity          | Value at Trf Base | M/T Factor | M/T Factor Value | Exp        | M/T Factor w/Exp | Value at Meter Base |
|-------------------|-------------------|------------|------------------|------------|------------------|---------------------|
| No-Load Loss kW   |                   | V          |                  | $\wedge 2$ |                  |                     |
| No-Load Loss kVAR |                   | V          |                  | $\wedge 4$ |                  |                     |
| Load Loss kW      |                   | 1          |                  | $\wedge 2$ |                  |                     |
| Load Loss kVAR    |                   | 1          |                  | $\wedge 2$ |                  |                     |

Enter Value at Transformer Base for each quantity from calculations above. Enter Meter/Trf Factor value from Base Conversion Factor calculations above. Calculate M/T Factor with Exponent by raising the M/T Factor to the power indicated in the "Exp" (or Exponent) column.

Calculate the "Value at Meter Base" by multiplying the (M/T Factor w/ Exp) times the (Value at Trf Base).

Loss Watts Percentage Values

$$\text{Meter Base kVA} = 600 * (\text{PT Multiplier}) * (\text{CT Multiplier}) / 1000$$

$$= 600 * (\text{_____}) * (\text{_____}) / 1000$$

$$= \text{_____}$$



## Calculate Load Loss Values

| Quantity          | Value at Meter Base | Meter Base kVA | % Loss at Meter Base | Quantity        |
|-------------------|---------------------|----------------|----------------------|-----------------|
| No-Load Loss kW   |                     |                |                      | % Loss Watts FE |
| No-Load Loss kVAR |                     |                |                      | % Loss VARs FE  |
| Load Loss kW      |                     |                |                      | % Loss Watts CU |
| Load Loss kVAR    |                     |                |                      | % Loss VARs CU  |

Enter "Value at Meter Base" from Normalize Losses section. Enter "Meter Base kVA" from previous calculation. Calculate "% Loss at Meter Base" by dividing (Value at Meter Base) by (Meter Base kVA) and multiplying by 100.

Enter calculated % Loss Watts values into the Nexus® meter using CommunicatorPQA® software. Refer to Appendix B of the *CommunicatorPQA®*, *MeterManager-PQA®*, and *EnergyPQA.com® Software User Manual* for instructions.

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## 9: External I/O Modules

### 9.1: Hardware Overview

All Nexus® External I/O modules have the following components:

- Female RS485 Side Port: use to connect to another module's male RS485 side port.
- Male RS485 Side Port: use to connect to the Nexus® 1250/1252 Meter's Port 3 or 4 or to another module's female RS485 side port. See Section 5.3.8 for wiring detail.
- I/O Port: used for functions specific to the type of module; size and pin configuration vary depending on type of module.
- Reset Button: Press and hold for three seconds to reset the module's baud rate to 57600 and its address to 247 for 30 seconds.
- LEDs: when flashing, signal that the module is functioning.
- Mounting Brackets (MBIO): used to secure one or more modules to a flat surface. Comes with 2 DIN rail mounting clips.

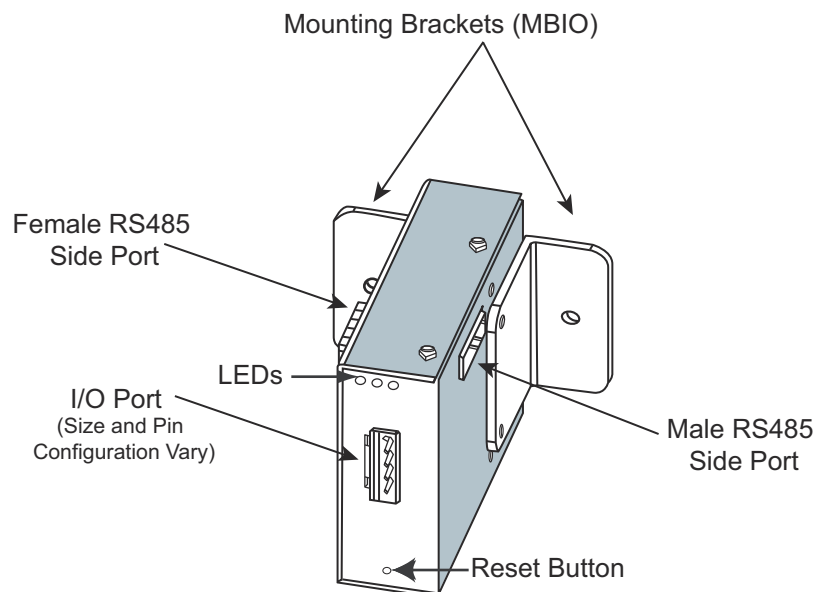
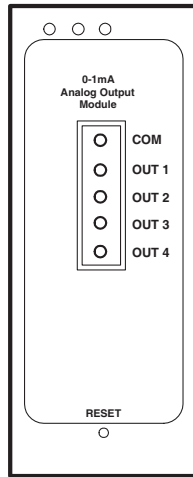


Figure 9.1: I/O Module Components

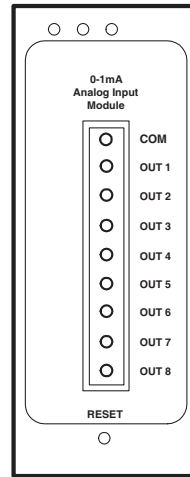
### 9.1.1: Port Overview

All Electro Industries I/O Modules have ports through which they interface with other devices. The port configurations are variations of the four types shown below.

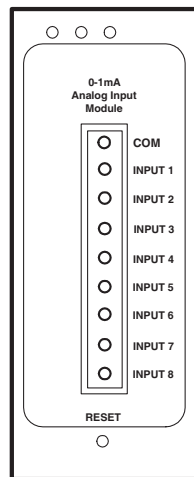
**Four Analog Outputs  
(0-1mA and 4-20mA)**



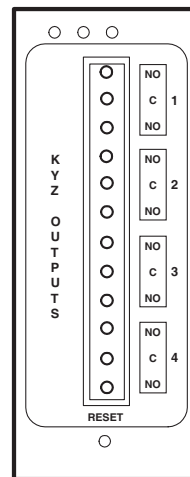
**Eight Analog Outputs  
(0-1mA and 4-20mA)**



**Eight Analog Inputs  
(0-1mA, 0-20mA,  
0-5Vdc, 0-10Vdc) or  
Eight Status Inputs**



**Four Relay Outputs or  
Four KYZ Pulse Outputs**



## 9.2: I/O Module Installation

See Section 5.3.8 for wiring instructions for the external I/O Modules, and Section 6.4 for hardware installation instructions.

### 9.2.1: Power Source for I/O Modules

The Nexus® 1262/1272 does not supply power to the I/O Modules. You must use an external power source, such as the EIG PSIO (12 V). Refer to Section 5.3.9 to determine power needed.

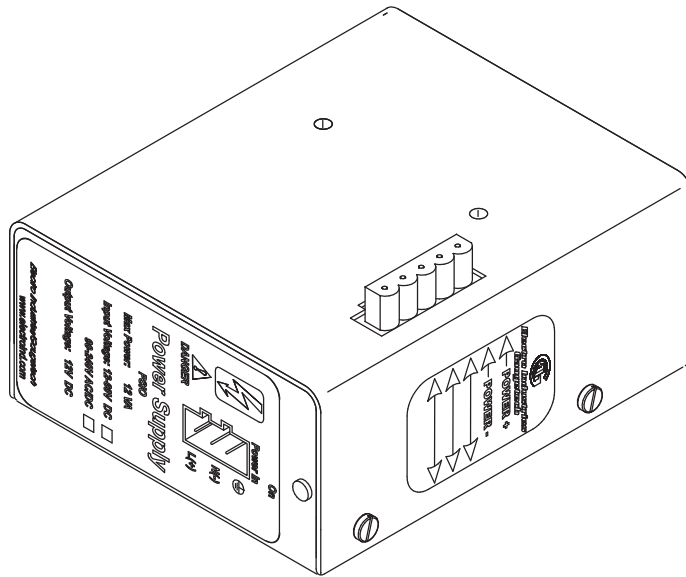


Figure 9.2: PSIO Power Supply Side View, Showing Male RS485 Port

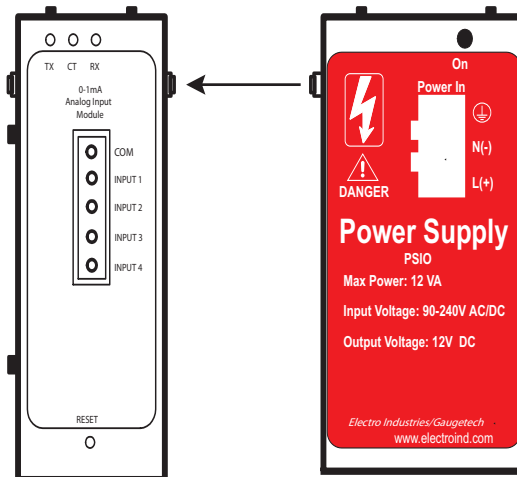


Figure 9.3: Power Flow from PSIO to I/O Module

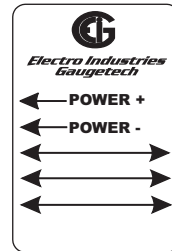
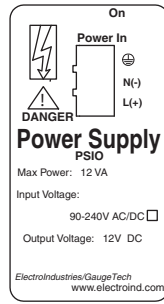


Figure 9.4: PSIO Side and Top Labels (Labels are Red and White)

### 9.3: Using the PSIO with Multiple I/O Modules

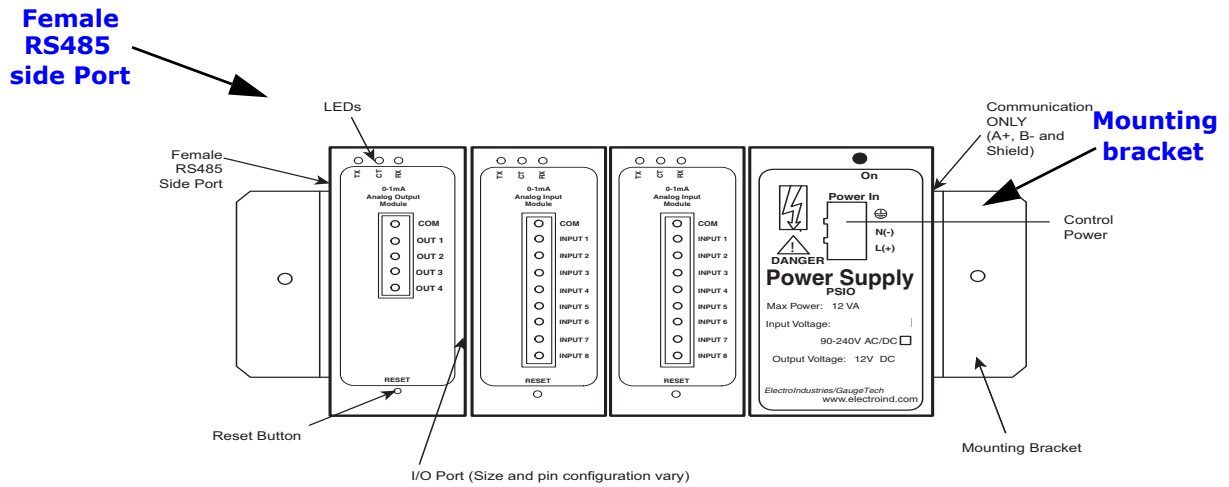


Figure 9.5: PSIO Used with Multiple I/O Modules

**NOTE:** As shown, the PSIO must be to the right of I/O Modules when viewing the side label.

### 9.3.1: Steps for Attaching Multiple I/O Modules

1. Each I/O module in a group must be assigned a unique address. See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details on configuring and programming the I/O Modules.
2. Determine how many power sources (such as the PSIO) are needed for the number of modules in use. See Sections 5.3.9 for details.
3. I/O modules can be mounted using either of two methods. The first method is using the mounting brackets provided, to attach directly to a panel. The second method is to attach the Din Rail clips to the mounting brackets to connect the I/O modules to a DIN rail mounting system.
4. Starting with the left module and using a slotted screwdriver, fasten the first I/O module to the left mounting bracket of the MBIO mounting brackets kit. The left mounting bracket is the one with the PEM. Fasten the internal screw tightly into the left mounting bracket.
5. Slide the female RS485 port into the male RS485 side port to connect the next I/O module to the left module. Fasten together enough to grab but do not tighten, yet.
6. Combine the modules together, one by one.
7. Attach the PSIO (power supply) to the right of the group of I/O Modules it is supplying with power.

**NOTE:** The PB1 can also be used as a Low Voltage Power Supply. It must be mounted separately. The PB1 should be ordered with a 12 V output for this application.

8. Once you have combined all the I/O modules and power supplies together for the group, fasten tightly. This final tightening will lock the whole group together as a unit.
9. Attach the right Mounting Bracket to the right side of the group using the small Phillips head screws provided.

10. If not mounting on a DIN rail, mount the group of modules on a secure, flat surface. This procedure will insure that all modules stay connected securely.
11. The MBIO mounting brackets kit comes with 2 DIN rail mounting clips and an 8mm screw and lock washer for each clip. The clips let you easily mount the connected I/O modules (or a single I/O module between two brackets) on a DIN rail. See the figure below.

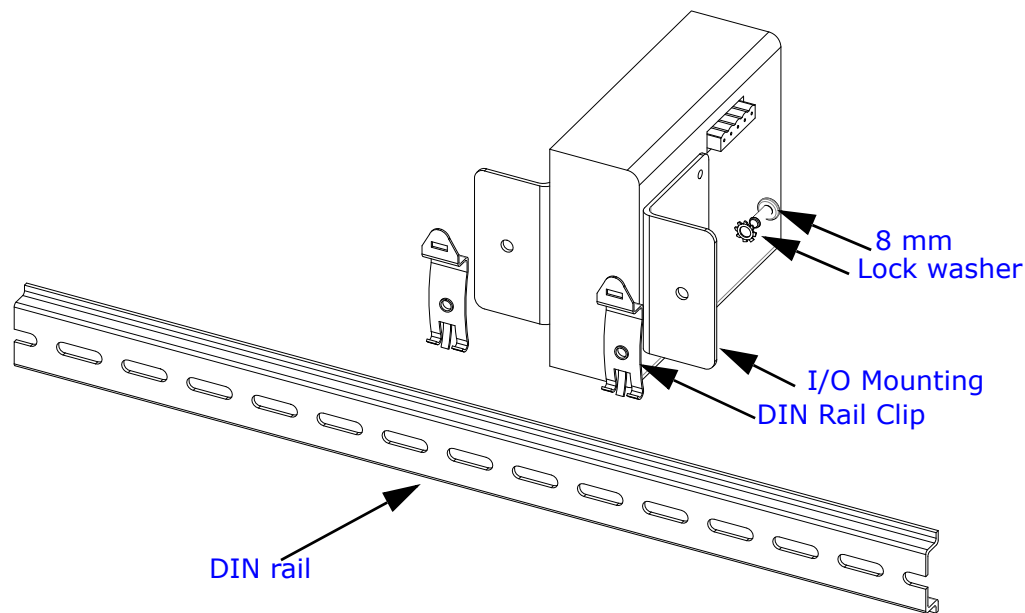


Figure 9.6: Mounting the Brackets on a DIN Rail

To use the DIN rail mounting clips:

- a. From the front of either bracket, insert the screw into the lock washer and through the hole, and screw it into the clip using an appropriate screwdriver. Note that the clip should be positioned as shown above, with the indented side facing the back.
- b. Repeat step a for the second bracket.



- c. Hook the bottom of the clips around the bottom of the DIN rail and then push the top of the clips forward so that they fit over the top of the DIN rail. See the figure below.

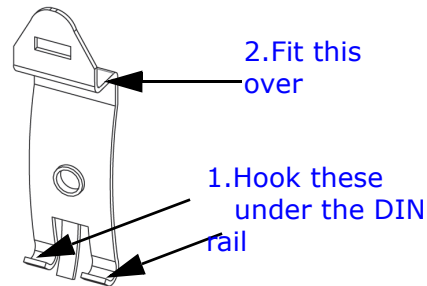


Figure 9.7: Detail of DIN Rail Mounting Clip

## 9.4: Factory Settings and Reset Button

### Factory Settings:

All Nexus® I/O Modules are shipped with a preset address and a baud rate of 57600. See following sections for I/O Module addresses.

### Reset Button:

If there is a communication problem or if you are unsure of a module's address and baud rate, press and hold the RESET button for 3 seconds; the module will reset to a default address of 247 at 57600 baud rate for 30-seconds. This enables you to interrogate the I/O using the CommunicatorPQA® software; see the *Modbus Communicating I/O Modules User Manual*.

## 9.5: Analog Transducer Signal Output Modules

| <b>Analog Transducer Signal Output Module Specifications</b> |  |
|--|--|
| Model Numbers  | 1mAON4: 4-channel analog output $0\pm 1$ mA                          |
|  | 1mAON8: 8-channel analog output $0\pm 1$ mA                          |
|  | 20mAON4: 4-channel analog output (4-20) mA                           |
|  | 20mAON8: 8-channel analog output (4-20) mA                           |
| Accuracy   | 0.1% of Full Scale   |
| Scaling  | Programmable   |
| Communication  | RS485, Modbus RTU  |
|  | Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600             |
| Power Requirement  | (12-20) V DC @ (50-200) mA   |
| Operating Temperature  | (-20 to +70) ° C / (-4 to +158) ° F                                  |
| Maximum Load Impedance                                       | $0\pm 1$ mA: 10k Ohms; 4-20mA: 500 Ohms                              |
| Factory Settings   | Modbus Address: 1mAON4: 128; 1mAON8: 128; 20mAON4: 132; 20mAON8: 132 |
|  | Baud Rate: 57600   |
|  | Transmit Delay Time: 0   |
| Default Settings (Reset Button)                              | Modbus Address: 247  |
|  | Baud Rate: 57600   |
|  | Transmit Delay Time: 20 ms   |

### 9.5.1: Overview

The Analog Transducer Signal Output Modules ( $0\pm 1$  mA or (4–20) mA) are available in either a 4- or 8-channel configuration. Maximum registers per request, read or write, is 17 registers.

All outputs share a single common point. This is also an isolated connection (from ground).

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

### 9.5.2: Normal Mode

Normal Mode is the same for the 0-1mA and the 4-20mA Analog Output Modules except for the number of processes performed by the modules.

Both devices:

1. Accept new values through communication.
2. Output current loops scaled from previously accepted values.

The 0-1mA module includes one more process in its Normal Mode:

3. Read and average the A/D and adjust values for Process 2 above.

The device will operate with the following default parameters:

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 ms

Normal Operation is prevented by a number of occurrences. See Section 9.4 for details.

## 9.6: Analog Input Modules

| <b>Analog Input Module Specifications</b> |  |
|---|--|
| Model Numbers                             | 8AI1: 8-channel analog input 0±1 mA                        |
|   | 8AI2: 8-channel analog input 0±20 mA                       |
|   | 8AI3: 8-channel analog input 0±5 V DC                      |
|   | 8AI4: 8-channel analog input 0±10 V DC                     |
| Accuracy                                  | 0.25% of Full Scale  |
| Scaling                                   | Programmable   |
| Communication                             | RS485, Modbus RTU  |
|   | Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600   |
| Power Requirement                         | (12-20) V DC @ (50-200) mA                                 |
| Operating Temperature                     | (-20 to +70) ° C/(-4 to +158) ° F                          |
| Maximum Load Impedance                    | 0±1 mA: 10k Ohms; 4-20 mA: 500 Ohms                        |
| Factory Settings                          | Modbus Address: 8AI1: 136; 8AI2: 140; 8AI3: 144; 8AI4: 148 |
|   | Baud Rate: 57600   |
|   | Transmit Delay Time: 0                                     |
| Default Settings (Reset Button)           | Modbus Address: 247  |
|   | Baud Rate: 57600   |
|   | Transmit Delay Time: 20 ms                                 |

### 9.6.1: Overview

The Analog Input Modules (0±1 mA, 0±20 mA, 0±5 V DC and 0±10 V DC) are available in 8-channel format. Maximum registers per request, read or write, is 17 registers.

All inputs share a single common point. This is also an isolated connection (from ground).

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

### 9.6.2: Normal Mode

In Normal Mode, the Input Module:

1. Reads and averages the A/D and adjusts values for process 2.
2. Calculates the percentage of Input Value.

**NOTE:** The percentage value of the Input is stored in Input Value Registers (Registers 04097-04104).

The device will operate with the following default parameters:

|                      |            |
|----------------------|------------|
| Address:             | 247 (F7H)  |
| Baud Rate:           | 57600 Baud |
| Transmit Delay Time: | 20 ms      |

Normal Operation is prevented by a number of occurrences. See Section 9.4 for details.

## 9.7: Digital Dry Contact Relay Output (Form C) Module

| Digital Dry Contact Relay Output Module Specifications |  |
|--|--|
| Model Number   | 4RO1: 4 latching relay outputs                           |
| Contact Type   | Changeover (SPDT)  |
| Relay Type   | Mechanically latching                                    |
| Communication  | RS485, Modbus RTU  |
|  | Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600 |
| Power Requirement                                      | 2.0 W max @ (12-20) V DC                                 |
| Operating Temperature                                  | (-20 to +70) ° C / (-4 to +158) ° F                      |
| Switching Voltage                                      | AC 250 V / DC 30 V                                       |
| Switching Power  | 1250 VA / 150 W  |
| Switching Current                                      | 5 A  |
| Mechanical Life  | 5 x 10 <sup>7</sup> switching operations                 |
| Electrical Life  | 10 <sup>5</sup> switching operations at rated current    |
| Factory Settings                                       | Modbus Address: 156                                      |
|  | Baud Rate: 57600   |
|  | Transmit Delay Time: 0                                   |
| Default Settings (Reset Button)                        | Modbus Address: 247                                      |
|  | Baud Rate: 57600   |
|  | Transmit Delay Time: 20ms                                |

### 9.7.1: Overview

The Relay Output Module consists of four Latching Relay Outputs. In Normal Mode, the device accepts commands to control the relays. Relay output modules are triggered by limits programmed with the CommunicatorPQA® software. See the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for details on programming limits.

The Modbus Map for the Analog Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

Each latching relay will hold its state in the event of a power loss.

### 9.7.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following default parameters:

Address: 247 (F7H)

Baud Rate: 57600 Baud

Transmit Delay Time: 20 ms

Some situations will cause the device to operate with the above Default Parameters. See Section 9.4 for details of Default Mode.

### 9.7.3: Normal Mode

Normal Mode consists of one process: the device accepts new commands to control the relays.

## 9.8: Digital Solid State Pulse Output (KYZ) Module

| <b>Digital Solid State Pulse Output Module Specifications</b> |   |
|---|---|
| Model Number  | 4PO1  |
| Communication   | RS485, Modbus RTU   |
|   | Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600                        |
| Power Requirement   | (12-20) V DC @ (50-200) mA  |
| Operating Temperature   | (-20 to +70) ° C/(-4 to +158) ° F   |
| Voltage Rating  | Up to 300 V DC  |
| Commands Accepted   | Read and Write with at least 4 registers of data per command                    |
| Memory  | 256 Byte IC EEPROM for storage of programmable settings and non-volatile memory |
| Factory Settings  | Modbus Address: 160   |
|   | Baud Rate: 57600  |
|   | Transmit Delay Time: 0  |
| Default Settings (Reset Button)                               | Modbus Address: 247   |
|   | Baud Rate: 57600  |
|   | Transmit Delay Time: 20ms   |

### 9.8.1: Overview

The KYZ Pulse Output Modules have 4 KYZ Pulse Outputs and accept Read and Write Commands with at least 4 registers of data per command. Digital Solid State Pulse Output (KYZ) Modules are user programmed to reflect VAR-hours, WATT-hours, or VA-hours. See the *Modbus Communicating I/O Modules User Manual* for details on programming the module.

The Modbus Map for the KYZ Pulse Output Module (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

NC = Normally Closed; NO = Normally Open; C = Common.



### 9.8.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following Default Mode Parameters. See Section 9.4 for details.

|                      |            |
|----------------------|------------|
| Address:             | 247 (F7H)  |
| Baud Rate:           | 57600 Baud |
| Transmit Delay Time: | 20 ms      |

### 9.8.3: Normal Mode

Energy readings are given to the device frequently. The device generates a pulse at each channel after a certain energy increase.

Normal Operation consists of three processes:

1. The first process accepts writes to registers 04097 - 04112. Writes can be up to four registers long and should end on the fourth register of a group (register 04100, or registers 04103-04112 or registers 04109-04112). These writes can be interpreted as two-byte, four-byte, six-byte or eight-byte energy readings. The reception of the first value for a given channel provides the initial value for that channel. Subsequent writes will increment the Residual for that channel by the difference of the old value and the new value. The previous value is then replaced with the new value. Attempting to write a value greater than the programmed Roll-over Value for a given channel is completely ignored and no registers are modified. If the difference is greater than half of the programmed Rollover Value for a given channel, the write does not increment the Residual but does update the Last Value. Overflow of the Residual is not prevented.
2. The second process occurs in the main loop and attempts to decrement the Residual by the Programmed Energy/Pulse Value. If the Residual is greater than the Programmed Energy/Pulse Value and the Pending Pulses Value for that channel has not reached the maximum limit, then Residual is decremented appropriately and the Pending Pulses is increased by two, signifying two more transitions and one more pulse.

3. The third process runs from a timer which counts off pulse widths from the Programmable Minimum Pulse Width Values. If there are Pulses Pending for a channel and the delay has passed, then the Pulses Pending is decremented for that channel and the Output Relay is toggled.

Operation Indicator (0000H = OK, 1000H = Problem):

Bit 1:1 = EEPROM Failure

Bit 2:1 = Checksum for Communications Settings bad

Bit 3:1 = Checksum for Programmable Settings bad

Bit 4:1 = 1 or more Communications Settings are invalid

Bit 5:1 = 1 or more Programmable Settings are invalid

Bit 6:1 = 1 or more Programmable Settings have been modified

Bit 7:1 = Forced Default by Reset Value

Bit 15:1 = Normal Operation of the device is disabled

## 9.9: Digital Status Input Module

| <b>Digital Status Input Module Specifications</b> |   |
|---|---|
| Model Number                                      | 8DI1  |
| Communication                                     | RS485, Modbus RTU   |
|   | Programmable Baud Rates: 4800, 9600, 19200, 38400, 57600                                      |
| Power Requirement                                 | (12-20) V DC @ (50-200) mA  |
| Operating Temperature                             | (-20 to +70) ° C/(-4 to +158) ° F   |
| Voltage Rating                                    | Up to 300 V DC  |
| Detection   | Wet/Dry, Auto-detect  |
| Memory  | 256 Byte I <sup>2</sup> C EEPROM for storage of programmable settings and non-volatile memory |
| Factory Settings                                  | Modbus Address: 164   |
|   | Baud Rate: 57600  |
|   | Transmit Delay Time: 0  |
| Default Settings (Reset Button)                   | Modbus Address: 247   |
|   | Baud Rate: 57600  |
|   | Transmit Delay Time: 20ms   |

### 9.9.1: Overview

The Digital Status Input Module is used either for additional status detect or for accumulating pulses from external equipment, such as power meters, water meters, etc.

### 9.9.2: Communication

Maximum registers per request, read or write, is 4 registers.

The device will operate with the following Default Mode Parameters. See Section 9.4 for details.

|                      |            |
|----------------------|------------|
| Address:             | 247 (F7H)  |
| Baud Rate:           | 57600 Baud |
| Transmit Delay Time: | 20 ms      |

### 9.9.3: Normal Mode

The device polls the inputs at 100Hz (once every 10 ms), debouncing the inputs and incrementing the Transition Accumulators for each channel as appropriate.

The inputs are represented by Channel 1 in the LSB through Channel 8 in the MSB of the low order byte of the register.

The Modbus Map for the Digital Status Input Modules (and operating details) can be found in the *Modbus Communicating I/O Modules Manual*.

# 10: Electrical Installation

The Nexus® 1262/1272 meter supported forms and their wiring configurations are shown in this chapter. The forms are based on the rated Voltage and hookup required for your application. (Custom forms and configurations are also available from EIG.) Socket meter wiring diagrams are shown in 10.3: Socket Meter Wiring Diagrams, page 10-6 and SWB Switchboard wiring diagrams are shown in 10.5: SWB3 Switchboard Meter Wiring Diagrams, page 10-25.

## 10.1: Considerations When Installing Meters



Installation of the Nexus® 1262/1272 meter must be performed only by qualified personnel who follow standard safety precautions during all procedures. Those personnel should have appropriate training and experience with high voltage devices. Appropriate safety gloves, safety glasses and protective clothing are recommended.

During normal operation of the Nexus® meter, dangerous voltages flow through many parts of the unit, including: Terminals and any connected CTs (Current Transformers) and PTs (Potential Transformers), all I/O Modules and their circuits. **All Primary and Secondary circuits can, at times, produce lethal voltages and currents. Avoid contact with any current-carrying surfaces.**

**Do not use the meter or any I/O device for primary protection or in an energy-limiting capacity. The meter can only be used as secondary protection.**

Do not use the meter for applications where failure of the meter may cause harm or death.

Do not use the meter for any application where there may be a risk of fire.

All meter terminals should be inaccessible after installation.

Do not apply more than the maximum voltage the meter or any attached device can withstand. Refer to meter and/or device labels and to the Specifications for all devices before applying voltages. Do not HIPOT/Dielectric test any Outputs, Inputs or Communications terminals.

EIG requires the use of Fuses for voltage leads and power supply, and shorting blocks to prevent hazardous voltage conditions or damage to CTs, if the meter needs to be removed from service (see 10.1.1: Voltage Fuses, page 10-4, for fuse specifications). One side of the CT must be grounded.

**NOTE:** The current inputs are only to be connected to external current transformers provided by the installer. The CTs shall be Approved or Certified and rated for the current of the meter used.



**NOTE: IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.**

**NOTE:** THERE IS NO REQUIRED PREVENTIVE MAINTENANCE OR INSPECTION NECESSARY FOR SAFETY. HOWEVER, ANY REPAIR OR MAINTENANCE SHOULD BE PERFORMED BY THE FACTORY.



**DISCONNECT DEVICE: The following part is considered the equipment disconnect device.**

A SWITCH OR CIRCUIT-BREAKER SHALL BE INCLUDED IN THE END-USE EQUIPMENT OR BUILDING INSTALLATION. THE SWITCH SHALL BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH SHALL BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT.



L'installation des compteurs de Nexus 1262/1272 doit être effectuée seulement par un personnel qualifié qui suit les normes relatives aux précautions de sécurité pendant toute la procédure. Le personnel doit avoir la formation appropriée et l'expérience avec les appareils de haute tension. Des gants de sécurité, des verres et des vêtements de protection appropriés sont recommandés.

**AVERTISSEMENT!** Pendant le fonctionnement normal du compteur Nexus 1262/1272 des tensions dangereuses suivant de nombreuses pièces, notamment, les bornes et tous les transformateurs de courant branchés, les transformateurs de ten-

sion, toutes les sorties, les entrées et leurs circuits. **Tous les circuits secondaires et primaires peuvent parfois produire des tensions de léta et des courants. Évitez le contact avec les surfaces sous tensions. Avant de faire un travail dans le compteur, assurez-vous d'éteindre l'alimentation et de mettre tous les circuits branchés hors tension.**

**Ne pas utiliser les compteurs ou sorties d'appareil pour une protection primaire ou capacité de limite d'énergie. Le compteur peut seulement être utilisé comme une protection secondaire.**

Ne pas utiliser le compteur pour application dans laquelle une panne de compteur peut causer la mort ou des blessures graves.

Ne pas utiliser le compteur ou pour toute application dans laquelle un risque d'incendie est susceptible.

Toutes les bornes de compteur doivent être inaccessibles après l'installation.

Ne pas appliquer plus que la tension maximale que le compteur ou appareil relatif peut résister. Référez-vous au compteur ou aux étiquettes de l'appareil et les spécifications de tous les appareils avant d'appliquer les tensions. Ne pas faire de test HIPOT/diélectrique, une sortie, une entrée ou un terminal de réseau.

EIG nécessite l'utilisation de les fusibles pour les fils de tension et alimentations électriques, ainsi que des coupe-circuits pour prévenir les tensions dangereuses ou endommagements de transformateur de courant si l'unité Nexus 1262/1272 doit être enlevée du service (voir 10.1.1: Voltage Fuses, page 10-4, pour les spécifications des fusibles). Un côté du transformateur de courant doit être mis à terre.

**NOTE:** Les entrées actuelles doivent seulement être branchées dans le transformateur externe actuel par l'installateur. Le transformateur de courant doit être approuvé ou certifié et déterminé pour le compteur actuel utilisé.



**IMPORTANT! SI L'ÉQUIPEMENT EST UTILISÉ D'UNE FAÇON NON SPÉCIFIÉE PAR LE FABRICANT, LA PROTECTION FOURNIE PAR L'ÉQUIPEMENT PEUT ÊTRE ENDOMMAGÉE.**

**NOTE:** IL N'Y A AUCUNE MAINTENANCE REQUISE POUR LA PRÉVENTION OU INSPECTION NÉCESSAIRE POUR LA SÉCURITÉ. CEPENDANT, TOUTE RÉPARATION OU MAINTENANCE DEVRAIT ÊTRE RÉALISÉE PAR LE FABRICANT.



DÉBRANCHEMENT DE L'APPAREIL : la partie suivante est considérée l'appareil de débranchement de l'équipement. UN INTERRUPTEUR OU UN DISJONCTEUR DEVRAIT ÊTRE INCLUS DANS L'UTILISATION FINALE DE L'ÉQUIPEMENT OU L'INSTALLATION. L'INTERRUPTEUR DOIT ÊTRE DANS UNE PROXIMITÉ PROCHE DE L'ÉQUIPEMENT ET A LA PORTÉE DE L'OPÉRATEUR. L'INTERRUPTEUR DOIT AVOIR LA MENTION DÉBRANCHEMENT DE L'APPAREIL POUR L'ÉQUIPEMENT.

### 10.1.1: Voltage Fuses

EIG requires the use of fuses on each of the sense voltages and on the control power.

- For a meter with the external power supply connection (-SE option):
  - Use a 0.1 A fuse on each voltage input.
  - Use a 3 A Slow Blow fuse on the power supply.
- For a meter with the internal (blade) power supply connection (-S option):
  - Use a 3 A fuse on each voltage input.

EIG offers the EI-CP Panel meter protective fuse kit, which can be ordered from EIG's webstore: [www.electroind.com/store](http://www.electroind.com/store). Select Fuse Kits from the list on the left side of the webpage.



## 10.2: Blade Configuration for Forms 9S, 36S, and 45S

Detailed drawings of the Blade configurations are shown below and on the next page. There are two configurations because the 9S and the 36S are the same.

**NOTE:** The forms referred to in this chapter comply with ANSI forms 9S, 36S and 45S.

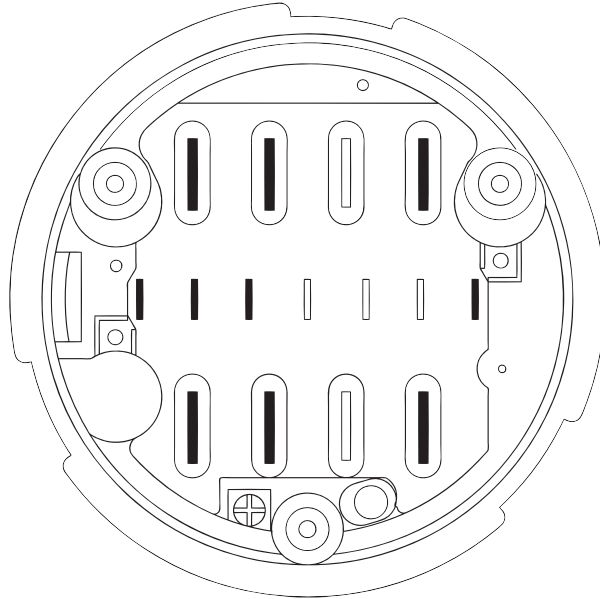


Figure 10.1: Form 9S & 36S Base with Knock Out Holes

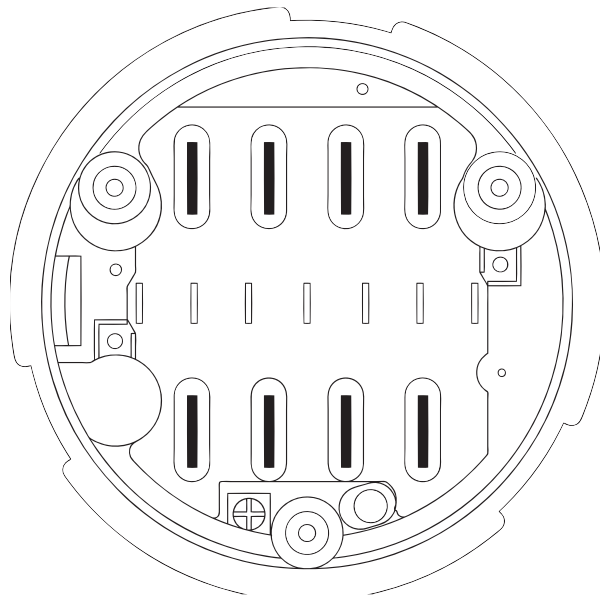


Figure 10.2: Form 45S Base with Knock Out Holes

### 10.3: Socket Meter Wiring Diagrams

Choose from the supported meter forms based on the rated Voltage and hookup required for your application. Corresponding wiring diagrams appear on the following pages. If the connection diagram you need is not listed, contact EIG for a custom connection diagram. Form 9S mounted in an A/S Adapter is shown in Figure 10.19.

**NOTE:** Form 45S replaces Form 5S and may also be used in 4-wire circuits.

| Form      | Description   | Figure# |
|-----------|---|---------|
| 9S        | Wye, no PTs, 3 CTs                                  | 10.3    |
|           | Wye, 3 PTs, 3 CTs                                   | 10.4    |
|           | 4-Wire Delta, no PTs, 3 CTs                         | 10.5    |
|           | 4-Wire Delta, 3 PTs, 3 CTs                          | 10.6    |
|           | 4-Wire Delta, no PTs, 2 CTs                         | 10.7    |
|           | 4-Wire Delta, 2 PTs, 2 CTs                          | 10.8    |
|           | 3-Wire Delta, no PTs, 2 CTs                         | 10.9    |
|           | 3-Wire Delta, 2 PTs, 2 CTs                          | 10.10   |
| 36S       | 2.5 EL Wye, no PTs, 3 CTs                           | 10.11   |
|           | 2.5 EL Wye, 2 PTs, 3 CTs                            | 10.12   |
| 45S       | Wye, no PTs, 3 CTs                                  | 10.13   |
|           | Wye, 2 PTs, 3 CTs                                   | 10.14   |
|           | 3-wire Delta, no PTs, 2 CTs                         | 10.15   |
|           | 3-wire Delta, 2 PTs, 2 CTs                          | 10.16   |
|           | 4-wire Delta, no PTs, 2 CTs                         | 10.17   |
|           | 4-wire Delta, 2 PTs, 2 CTs                          | 10.18   |
| 9S in S/A | Form 9S Mounted in S/A Adapter (showing connectors) | 10.19   |

Table 10.1: Nexus® 1262/1272 Socket Meter Forms and Wiring Diagrams

#### REMARQUE pour Tous les schémas de câblage:

- Les connexions de garde pour les transformateurs sont omises dans les schémas et ne sont pas nécessaires afin que le compteur fonctionne correctement. Toutefois, nous vous recommandons fortement ces connexions pour réduire les risques de choc.

- Les commutateurs de court-circuit (blocs) pour le côté secondaire des transformateurs de courant ne sont également pas représentés. Pour éviter les chocs électriques, nous vous recommandons d'utiliser ces commutateurs de court-circuit (blocs). Assurez-vous que les côtés secondaires des transformateurs de courant sont court-circuités avant de les déconnecter des bornes d'entrée de courant du compteur.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**NO PTs, 3 CTs**

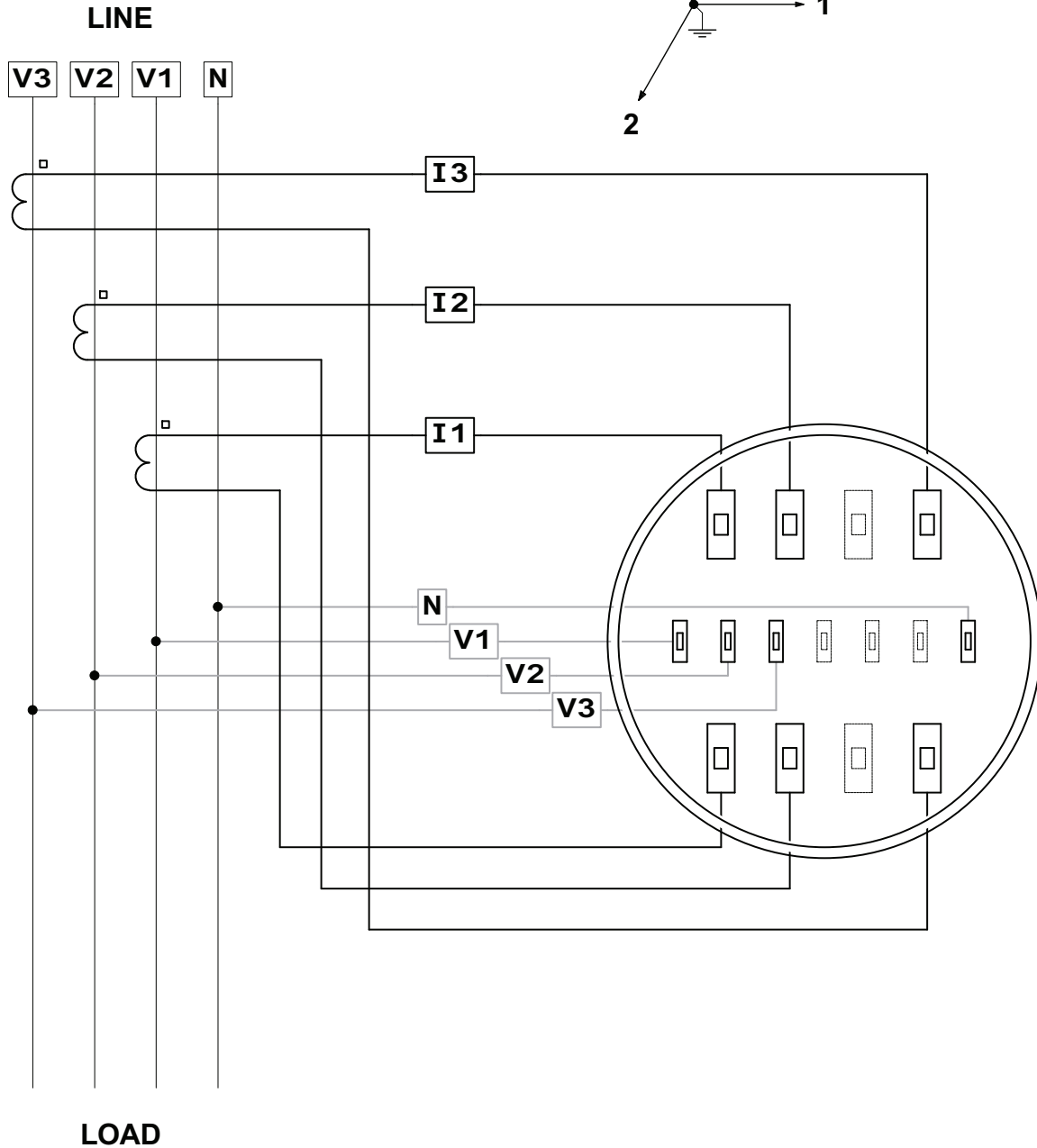


Figure 10.3: Form 9S Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**3 PTs, 3 CTs**

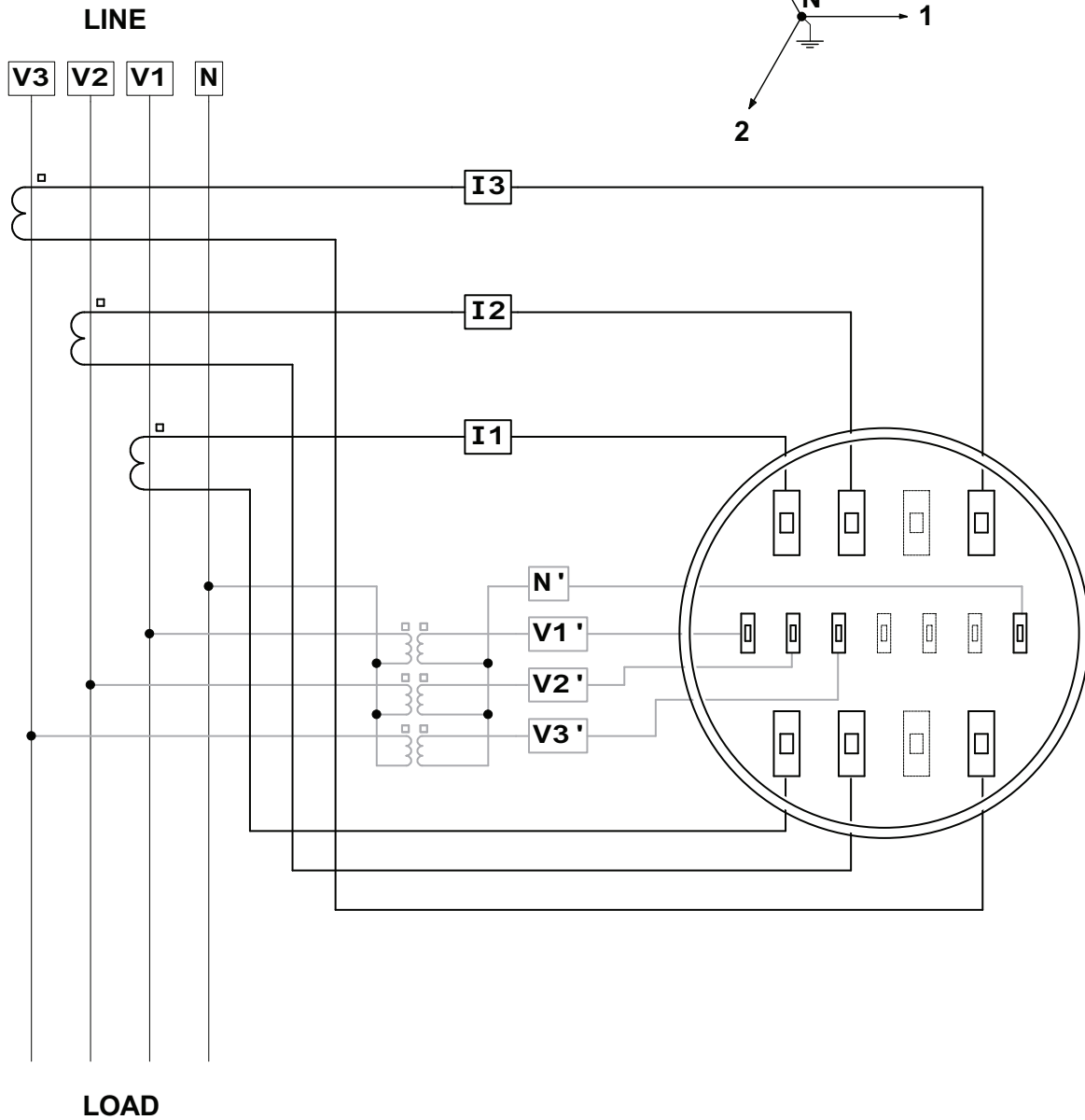


Figure 10.4: Form 9S Wye, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**NO PTs, 3 CTs**

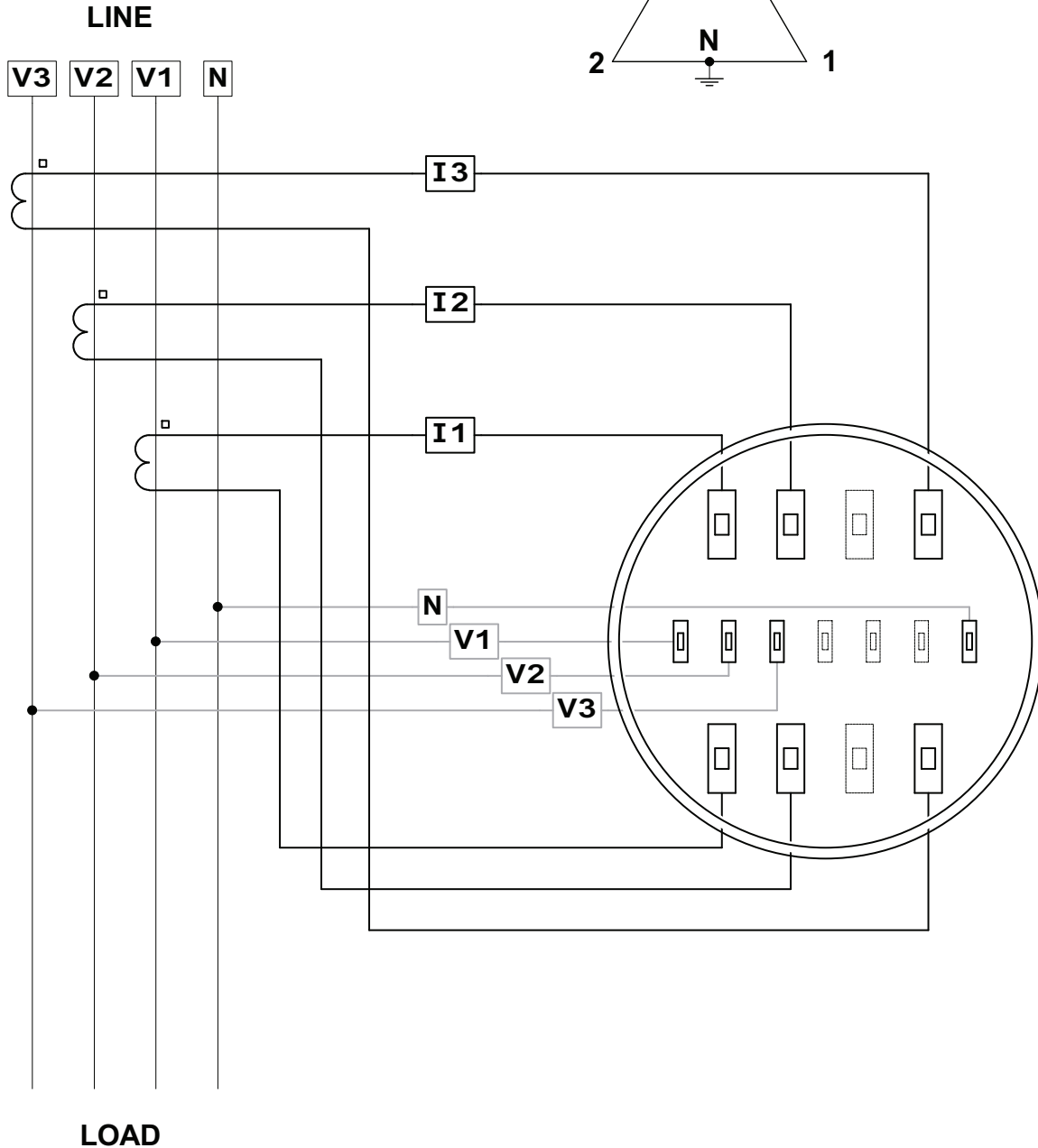


Figure 10.5: Form 9S 4-Wire Delta, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**3 PTs, 3 CTs**

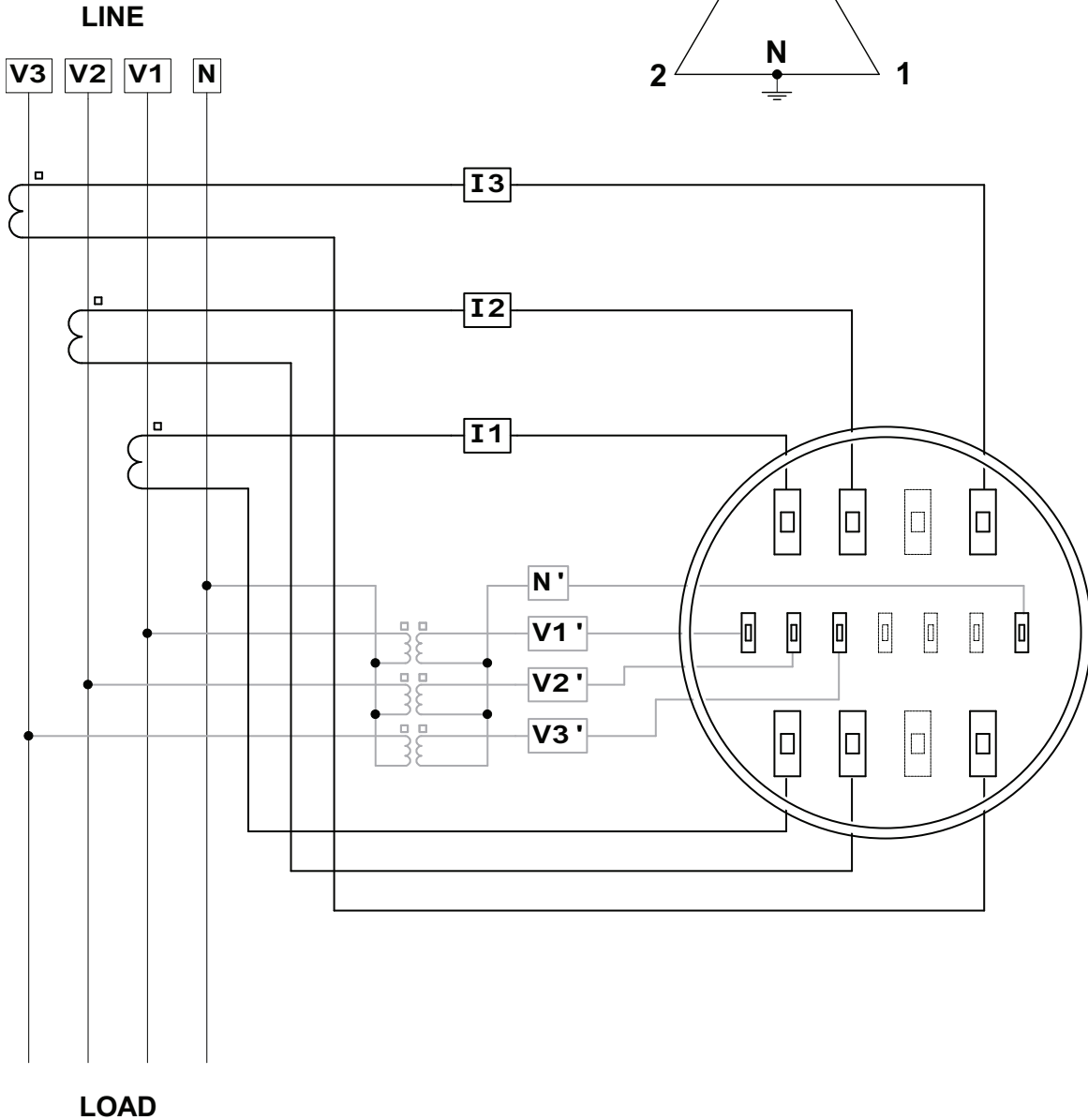


Figure 10.6: Form 9S 4-Wire Delta, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**NO PTs, 2 CTs**

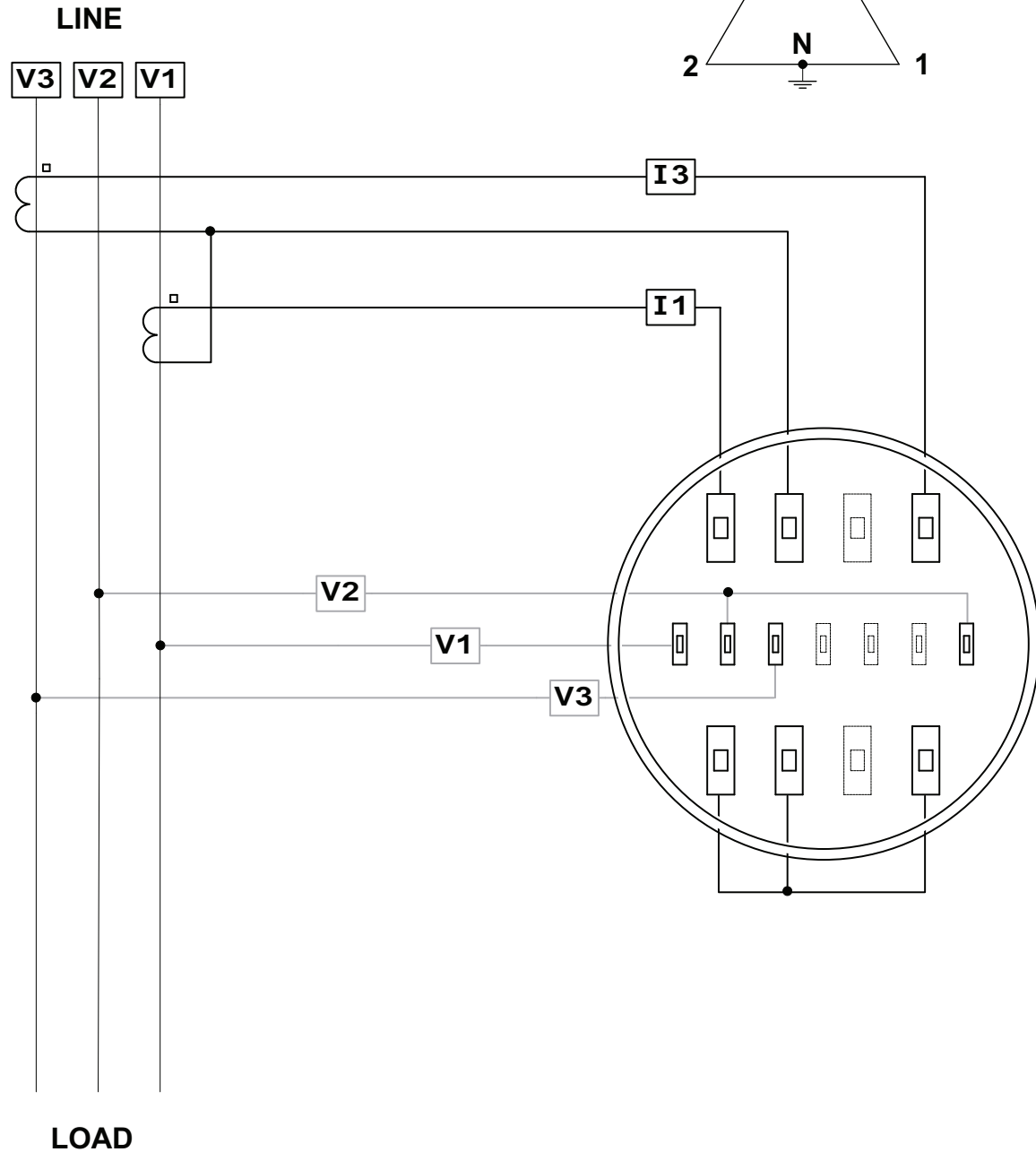


Figure 10.7: Form 9S 4-Wire Delta no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**2 PTs, 2 CTs**

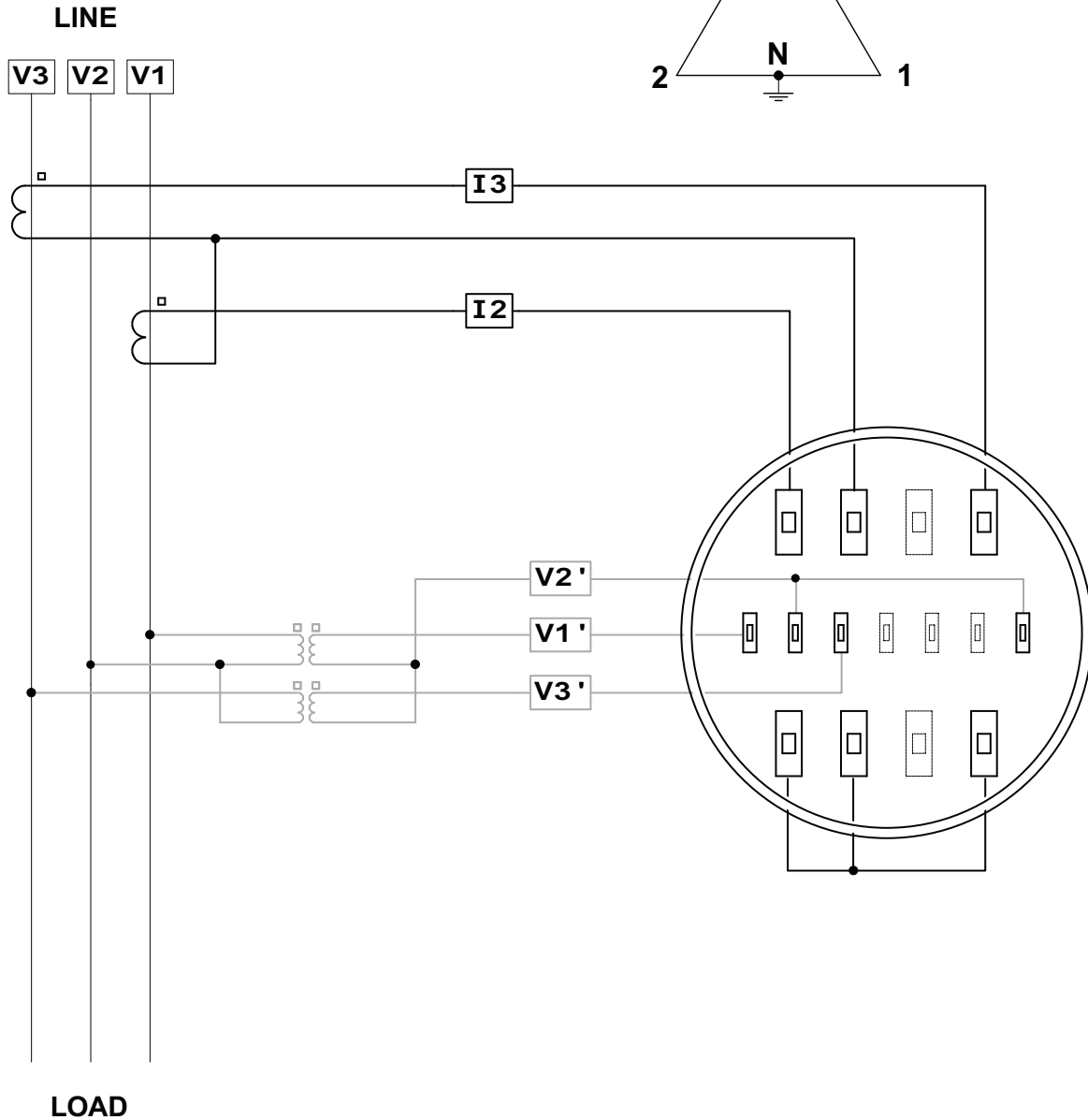


Figure 10.8: Form 9S 4-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 3WIRE**  
**NO PTs, 2 CTs**

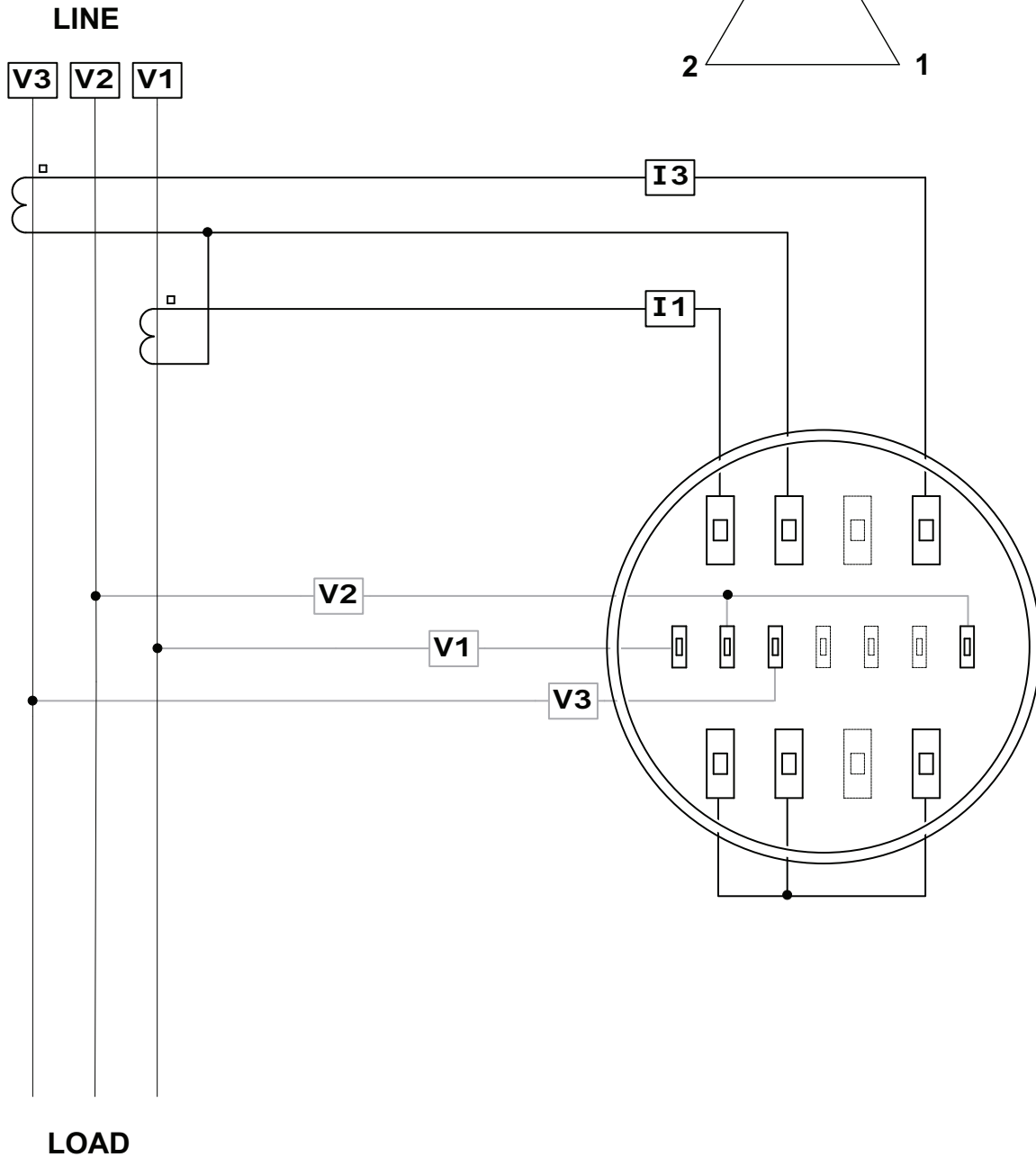


Figure 10.9: Form 9S 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 9S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 3WIRE**  
**2 PTs, 2 CTs**

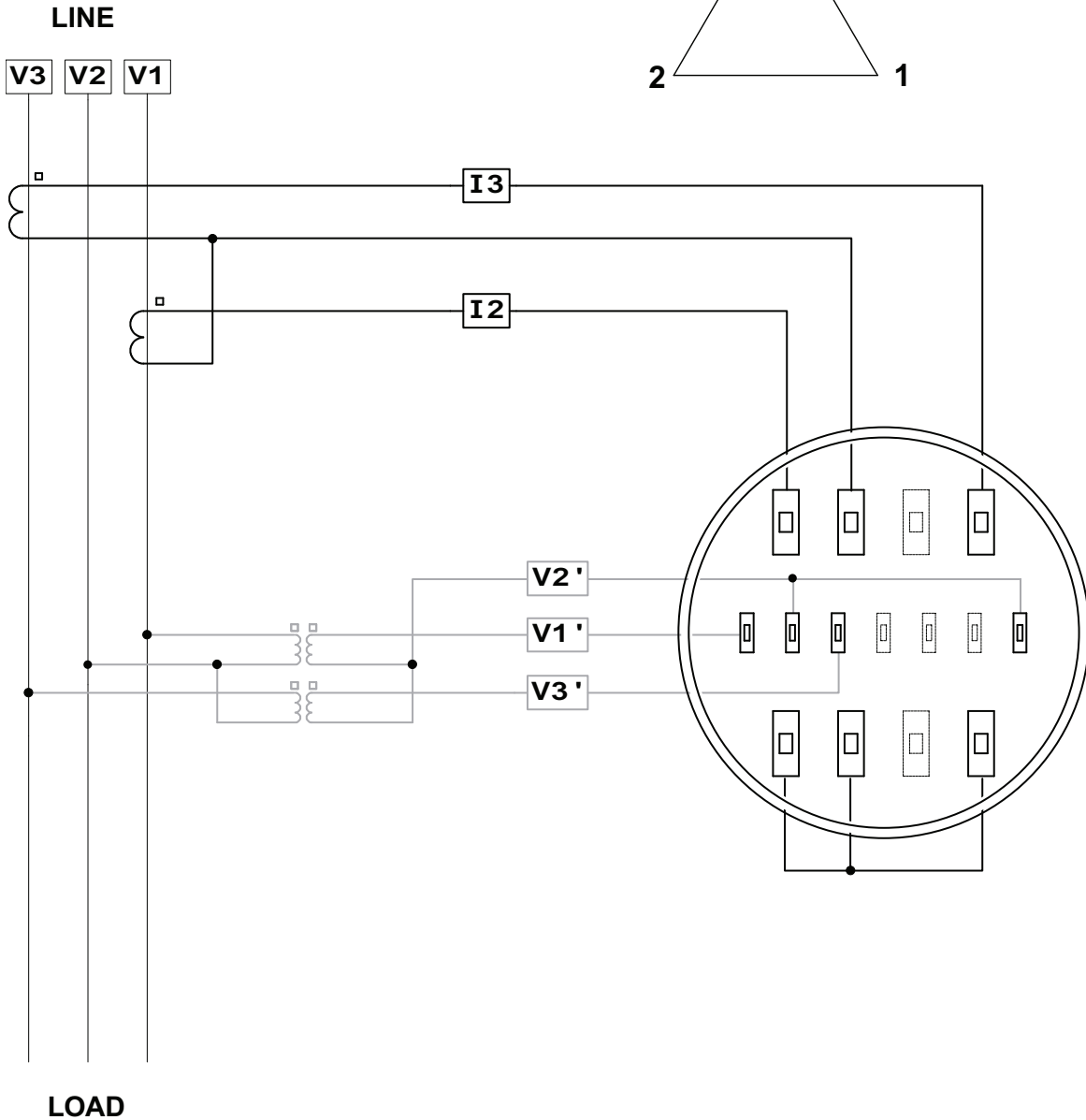


Figure 10.10: Form 9S 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 36S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**NO PTs, 3 CTs**

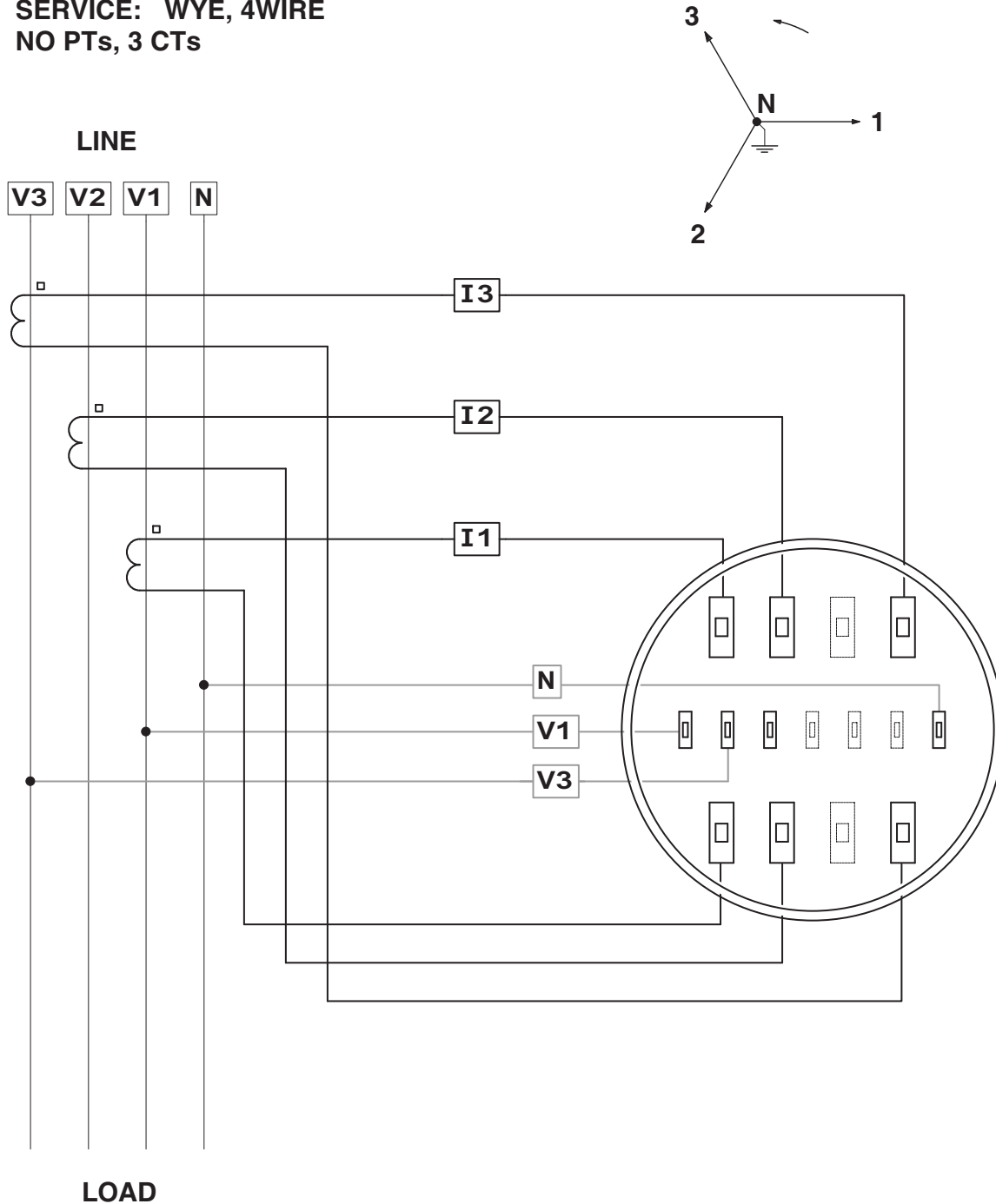


Figure 10.11: Form 36S 2.5 Element Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 36S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**2 PTs, 3 CTs**

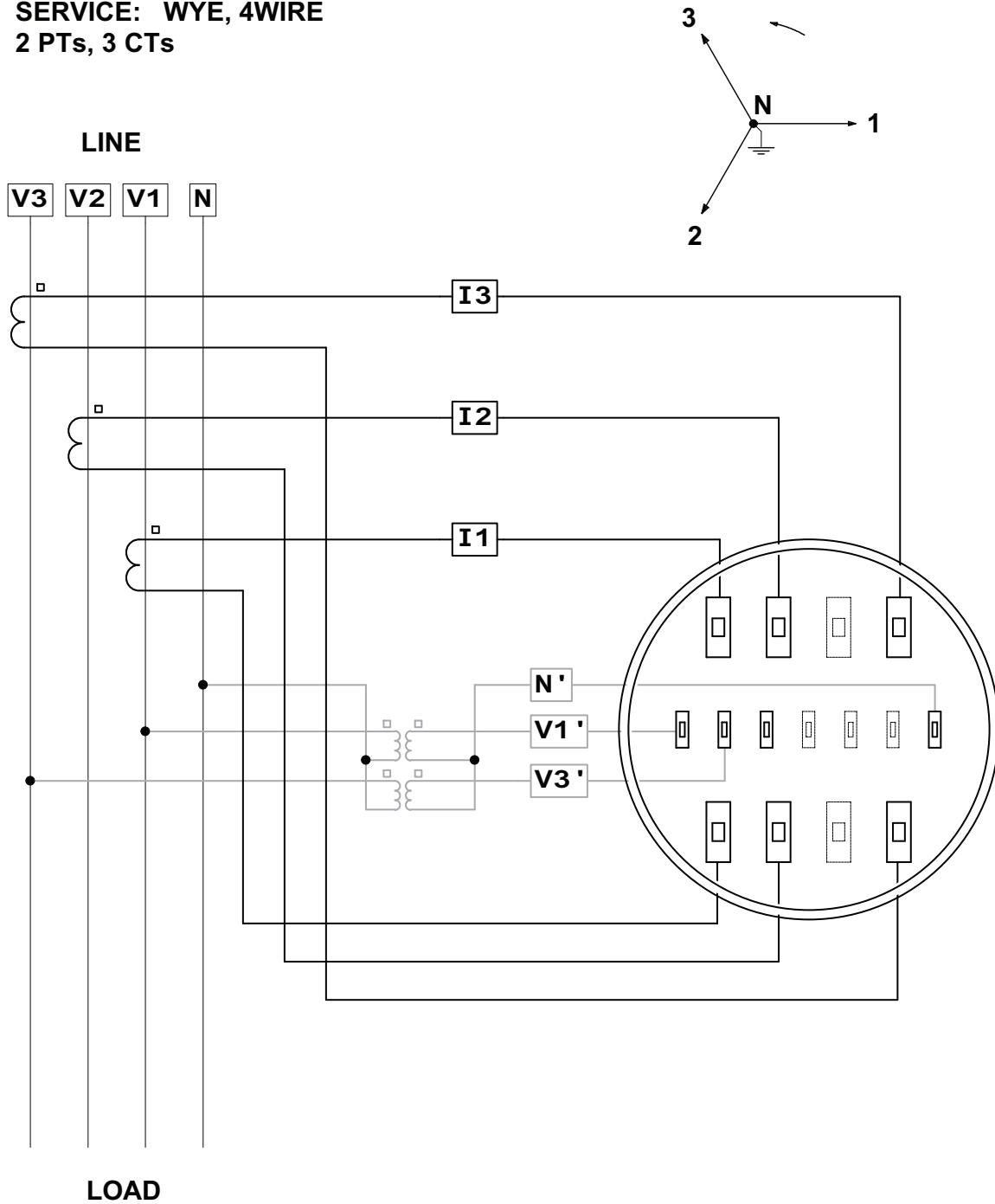


Figure 10.12: Form 36S 2.5 Element Wye, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**NO PTs, 3 CTs**

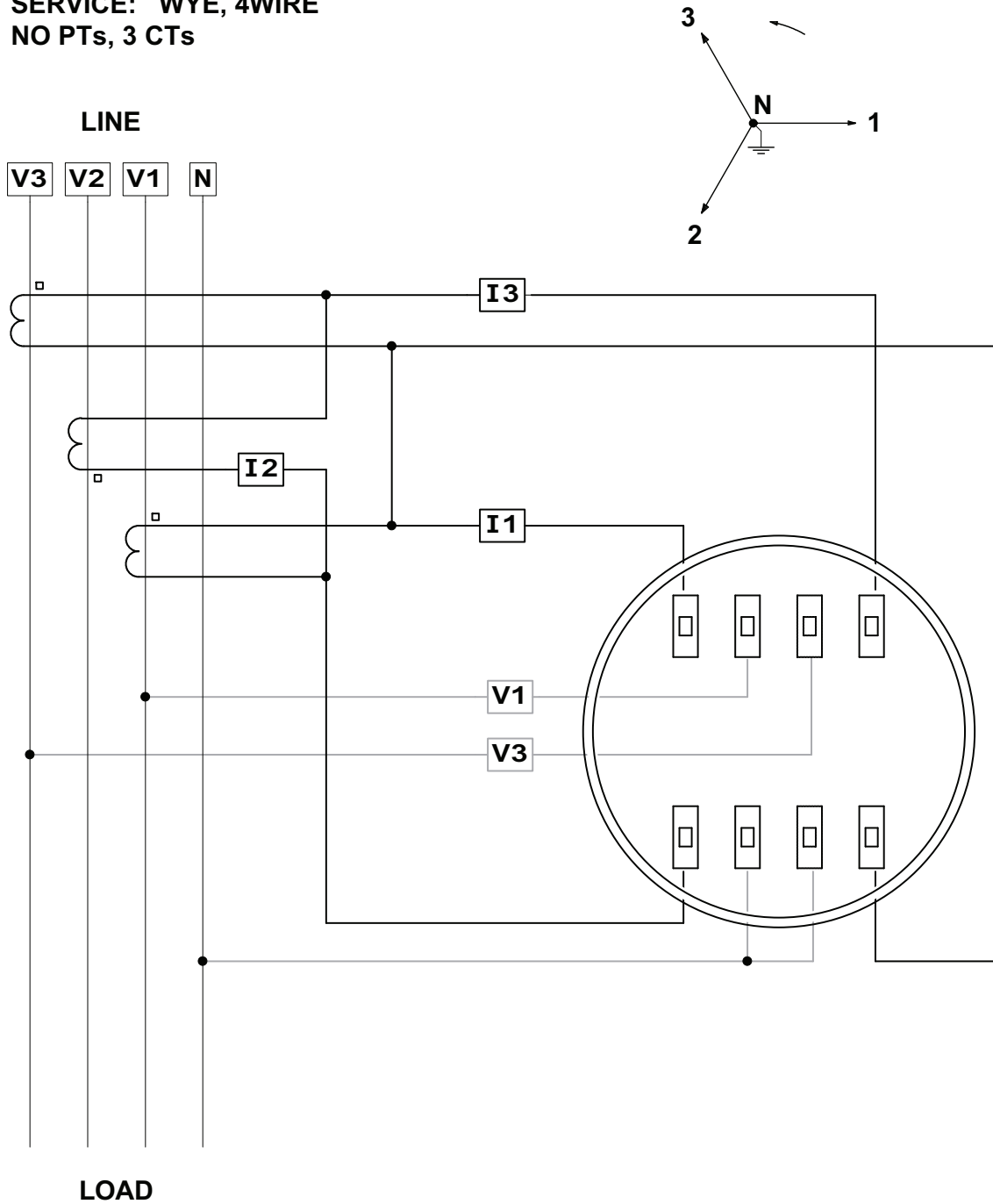


Figure 10.13: Form 45S Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: WYE, 4WIRE**  
**2 PTs, 3 CTs**

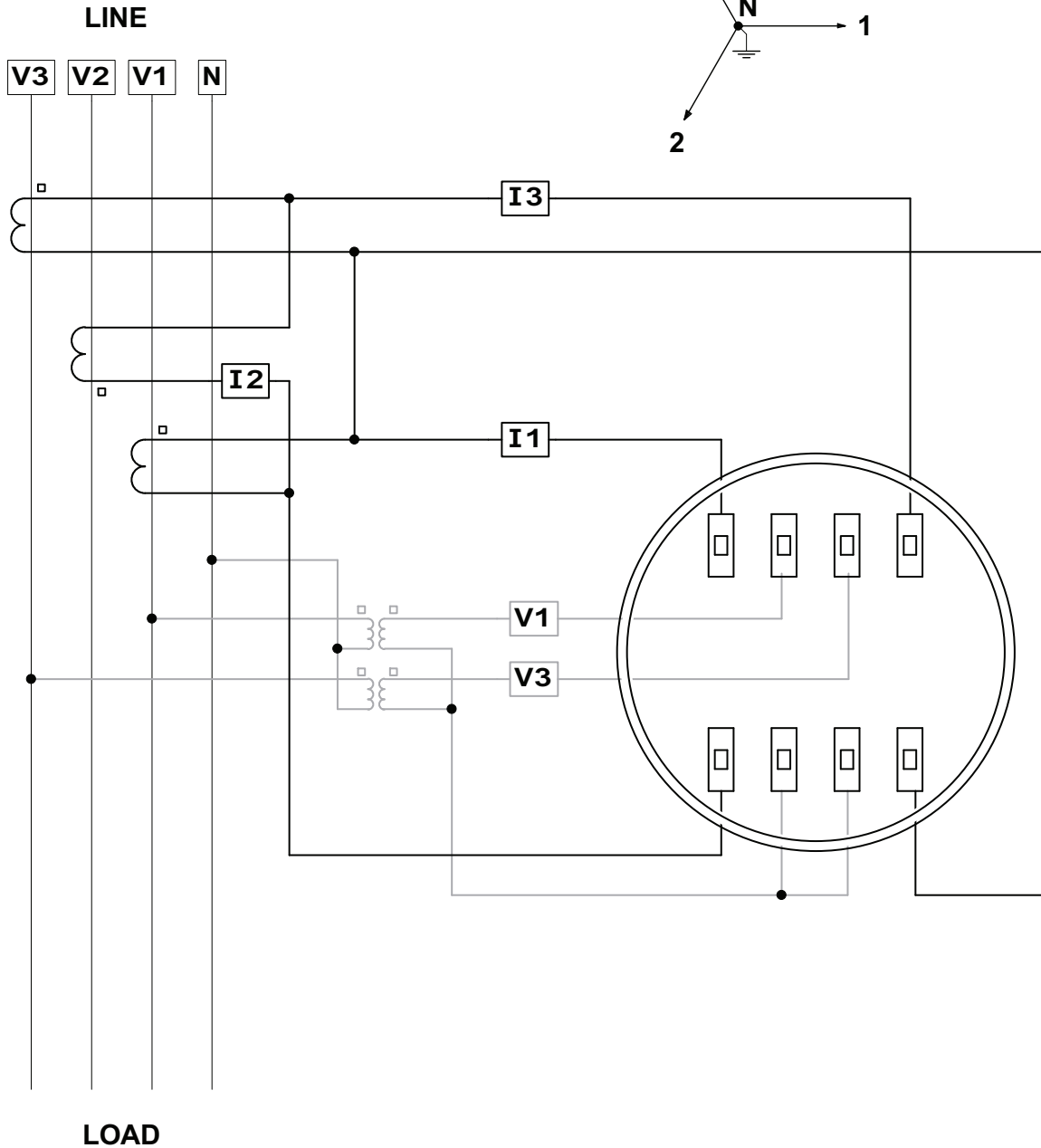


Figure 10.14: Form 45S Wye, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 3WIRE**  
**NO PTs, 2 CTs**

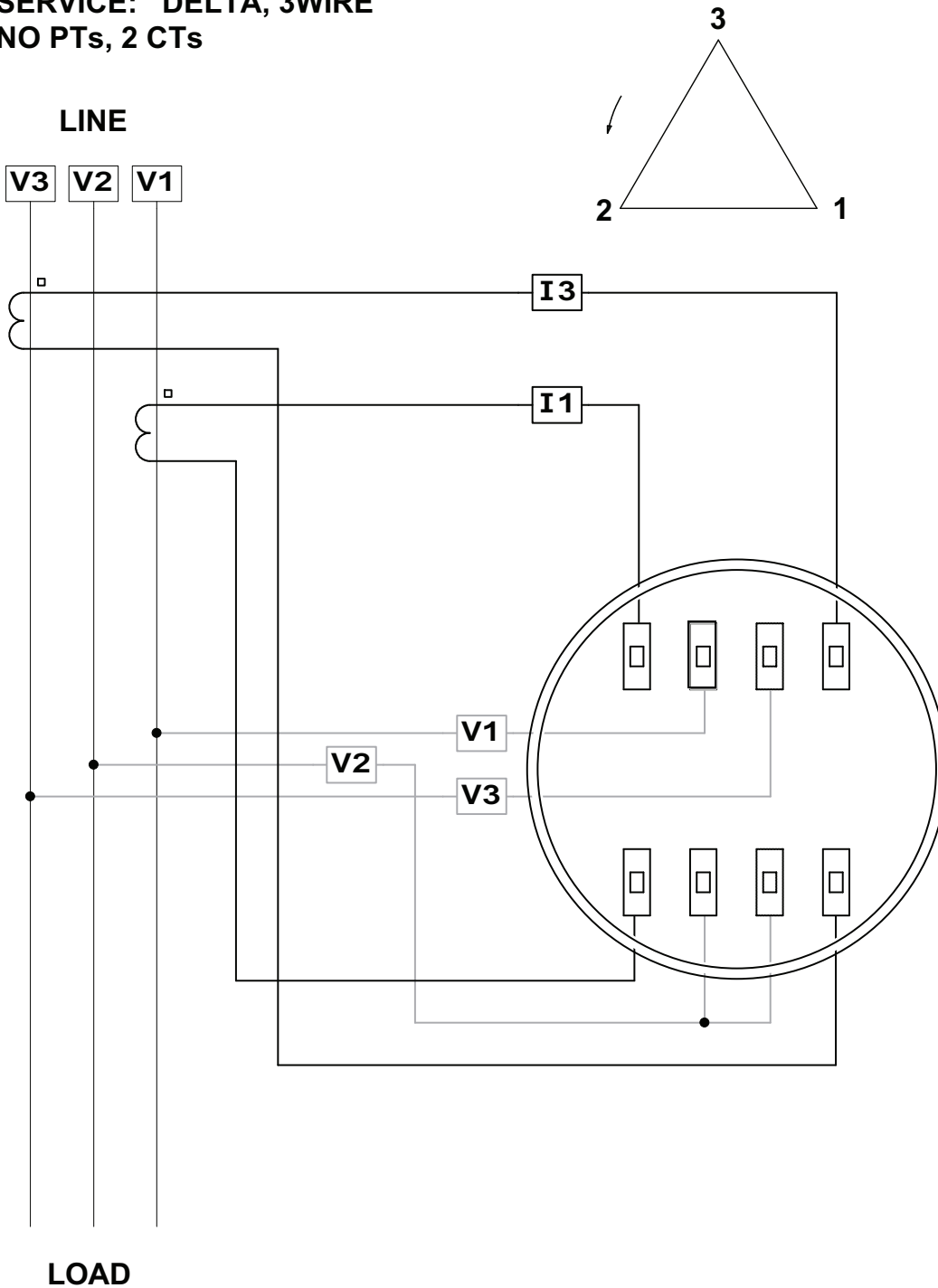


Figure 10.15: Form 45S 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 3WIRE**  
**2 PTs, 2 CTs**

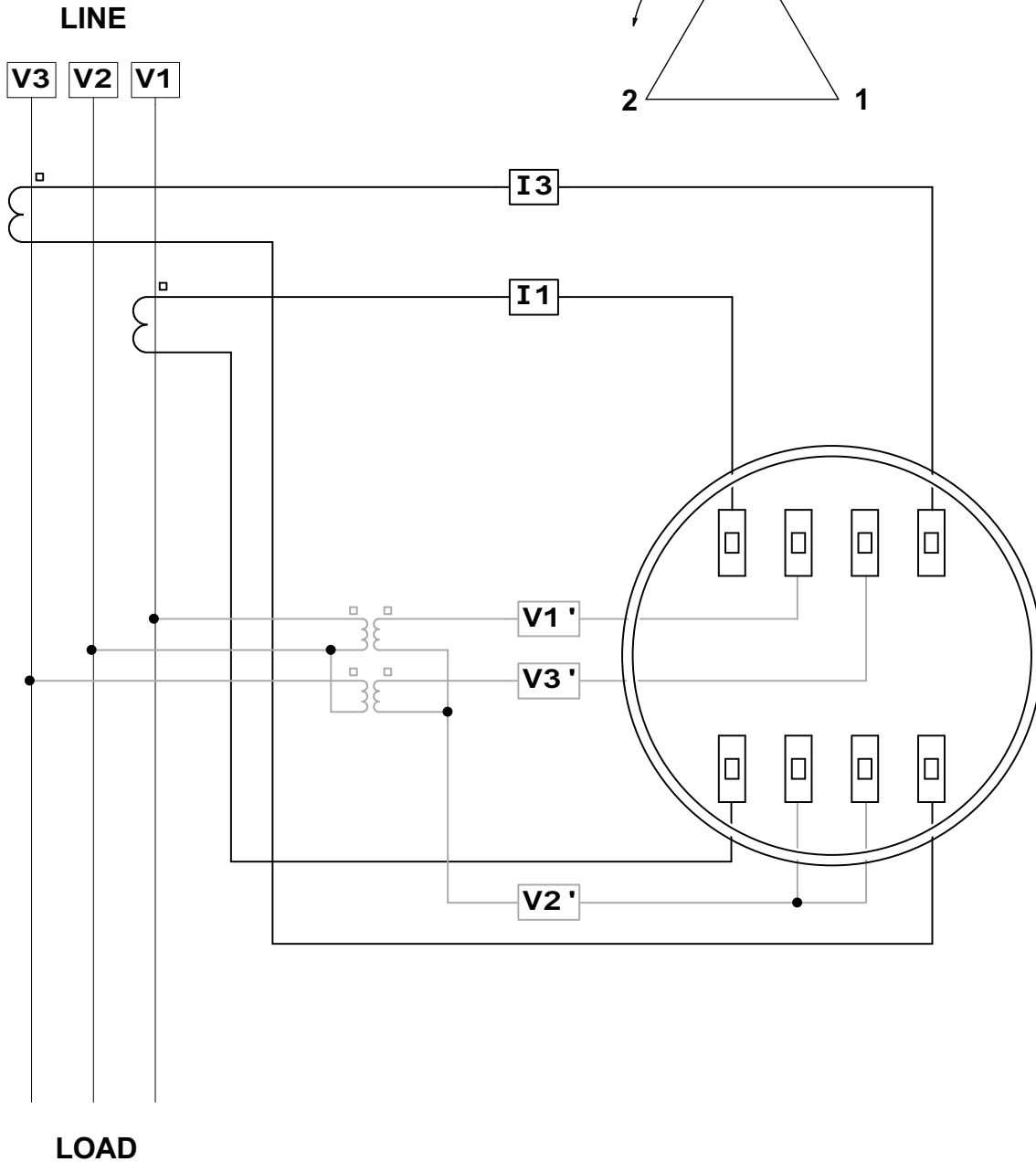


Figure 10.16: Form 45S 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**NO PTs, 2 CTs**

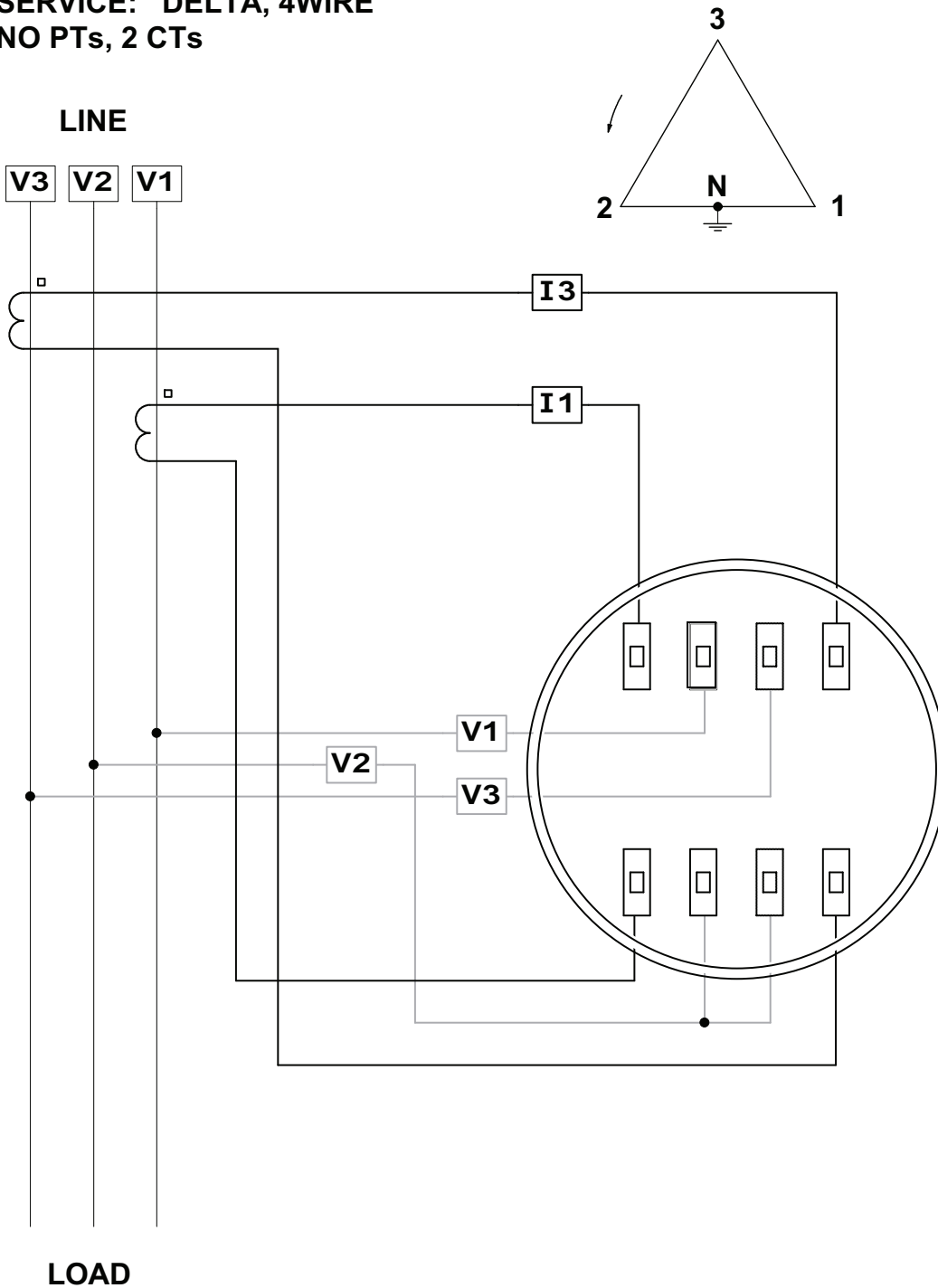


Figure 10.17: Form 45S 4-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

**FORM: 45S (TRANSFORMER RATED)**  
**SERVICE: DELTA, 4WIRE**  
**2 PTs, 2 CTs**

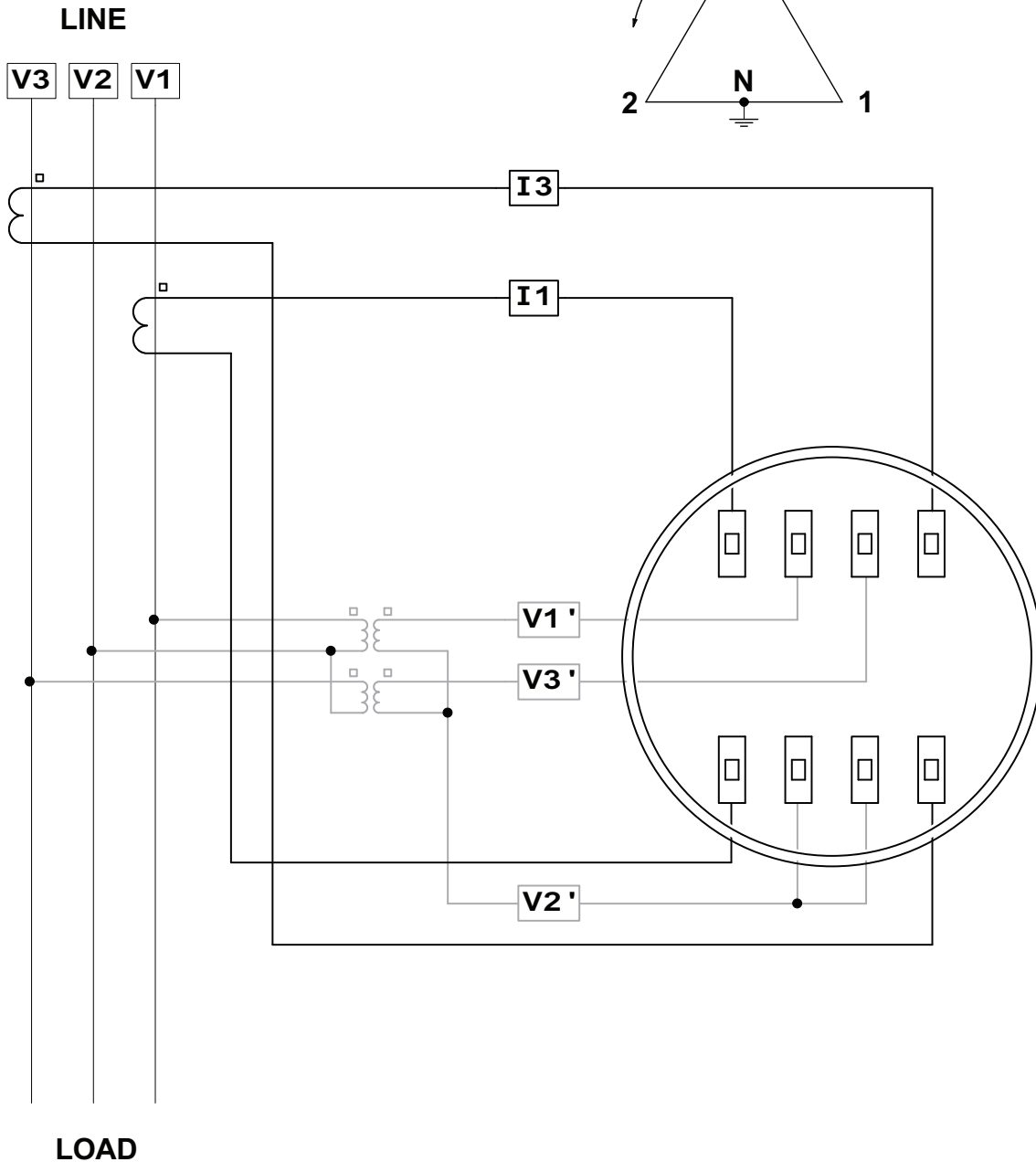


Figure 10.18: Form 45S 4-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

## 10.4: 9S Meter Mounted in S/A Adapter

Any of the 9S Forms can be mounted in an S/A Adapter, such as the one shown below. The socket meter is "pushed" into the S/A Adapter until the meter "snaps" into place. The blades on the back of the socket meter make the proper connection. See Figures 10.1 to 10.8 for the 9S wiring diagrams.

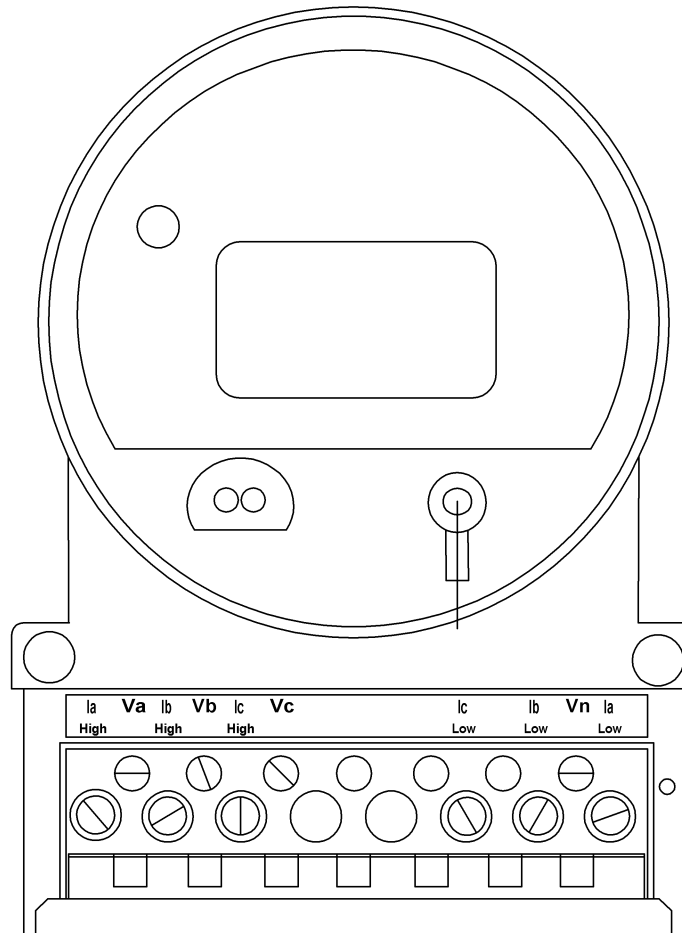


Figure 10.19: Form 9S mounted in an S/A Adapter (front removed)

## 10.5: SWB3 Switchboard Meter Wiring Diagrams

The wiring of the Switchboard meter is similar to that of the Socket meter.

| Form       | Description                 | Figure# |
|------------|-----------------------------|---------|
| <b>9Z</b>  | Wye, no PTs, 3 CTs          | 10.20   |
|            | Wye, 3 PTs, 3 CTs           | 10.21   |
|            | 4-Wire Delta, no PTs, 3 CTs | 10.22   |
|            | 4-Wire Delta, 3 PTs, 3 CTs  | 10.23   |
|            | 3-Wire Delta, no PTs, 2 CTs | 10.24   |
|            | 3-Wire Delta, 2 PTs, 2 CTs  | 10.25   |
|            | 3-Wire Delta, no PTs, 2 CTs | 10.26   |
|            | 3-Wire Delta, 2 PTs, 2 CTs  | 10.27   |
|            | 3-Wire Delta, 2 PTs, 3 CTs  | 10.28   |
|            | 3-Wire Delta, no PTs, 3 CTs | 10.29   |
| <b>36Z</b> | 2.5 EL Wye, no PTs, 3 CTs   | 10.30   |
|            | 2.5 EL Wye, 2 PTs, 3 CTs    | 10.31   |

Table 10.2: SWB3 Switchboard Meter Configurations and Wiring Diagrams

All input and output connections are made automatically as the meter is installed.

**NOTE:** For special requirements, contact our service department.

**CAUTION!** All wiring should be done by a licensed professional. Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards. **See Section 10.1 for important safety considerations.**

**ATTENTION!** Tout travail de câblage doit être effectué par un professionnel agréé. Les procédures, matériaux, équipements et connexions d'installation actuels doivent être conformes aux codes et aux normes applicables. **Pour voir d'importantes exigences de sécurité, vous référer à Section 10.1.**

**REMARQUE pour Tous les schémas de câblage:**

- Les connexions de garde pour les transformateurs sont omises dans les schémas et ne sont pas nécessaires afin que le compteur fonctionne correctement. Toutefois,

nous vous recommandons fortement ces connexions pour réduire les risques de choc.

- Les commutateurs de court-circuit (blocs) pour le côté secondaire des transformateurs de courant ne sont également pas représentés. Pour éviter les chocs électriques, nous vous recommandons d'utiliser ces commutateurs de court-circuit (blocs). Assurez-vous que les côtés secondaires des transformateurs de courant sont court-circuités avant de les déconnecter des bornes d'entrée de courant du compteur.

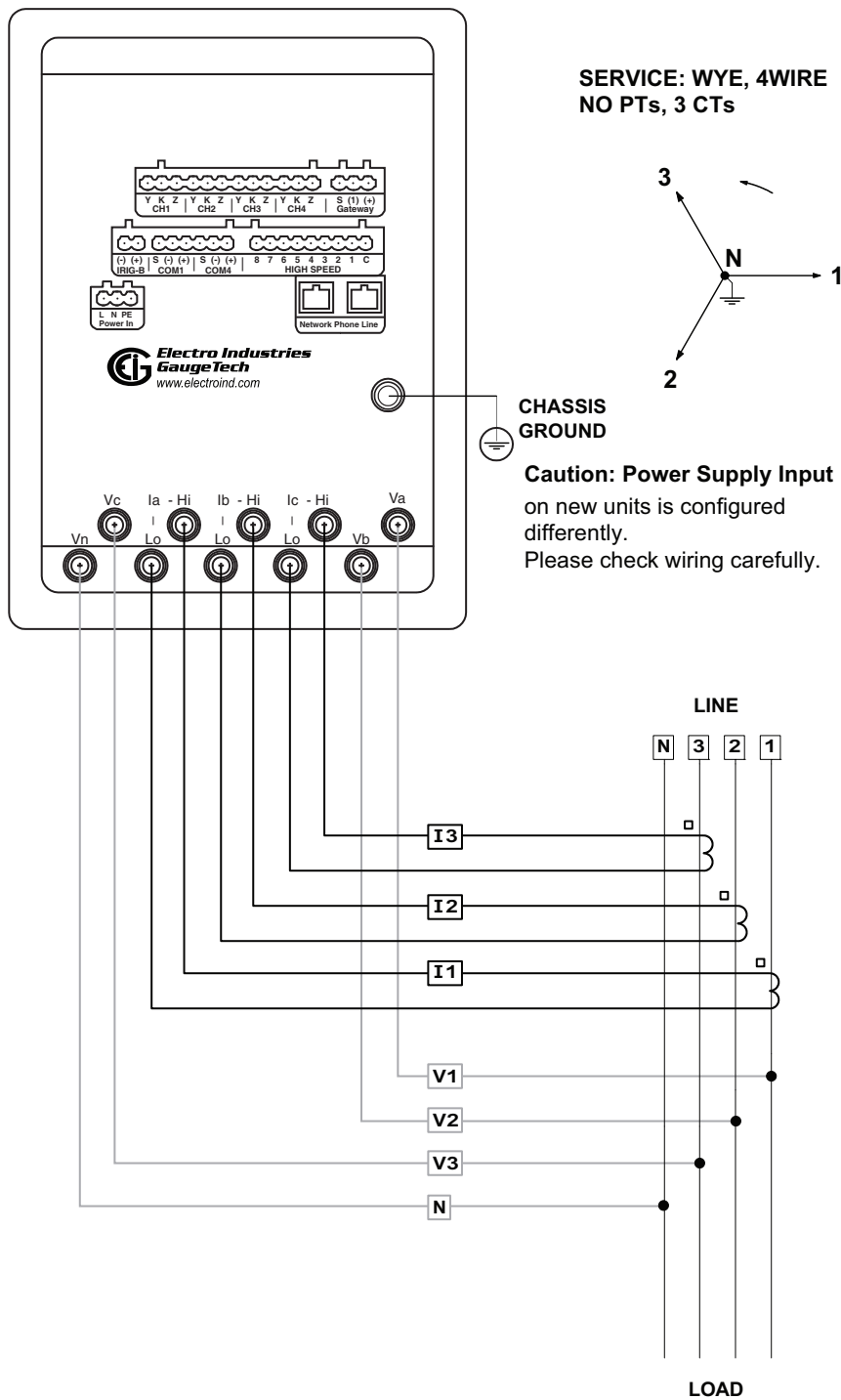


Figure 11.20: 9Z Transformer Rated Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

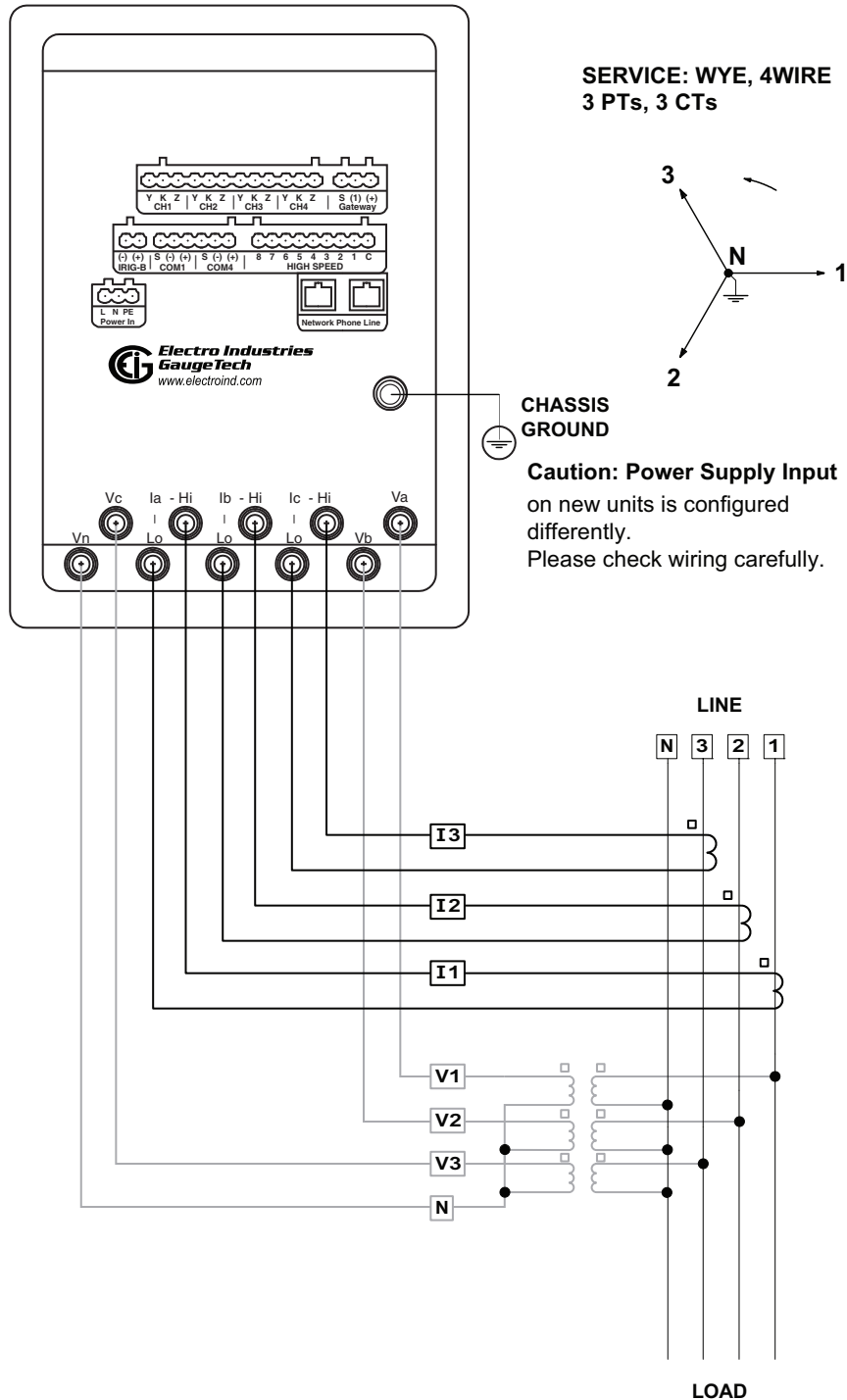


Figure 11.21: 9Z Transformer Rated Wye, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



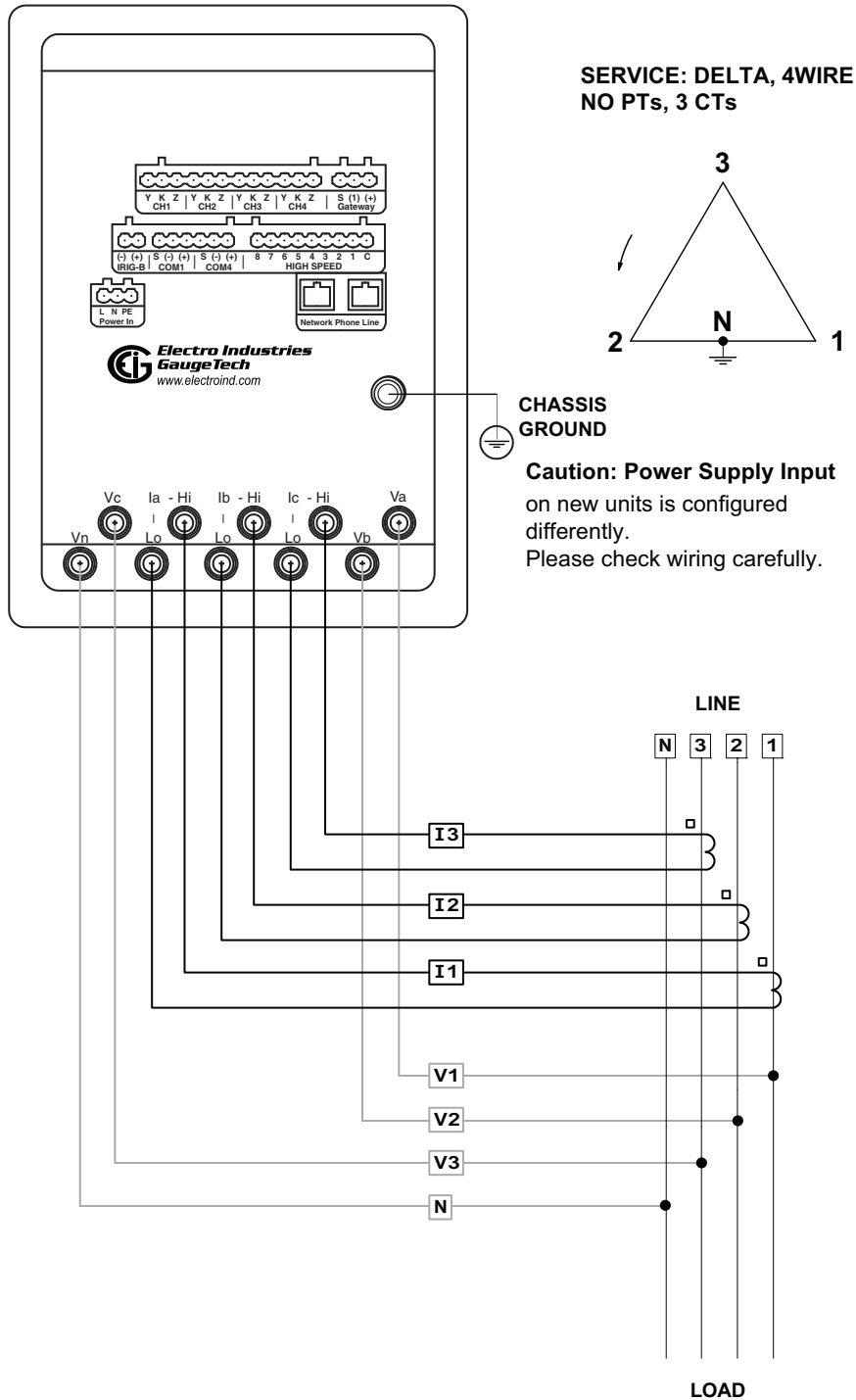


Figure 11.22: 9Z Transformer Rated 4-Wire Delta, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

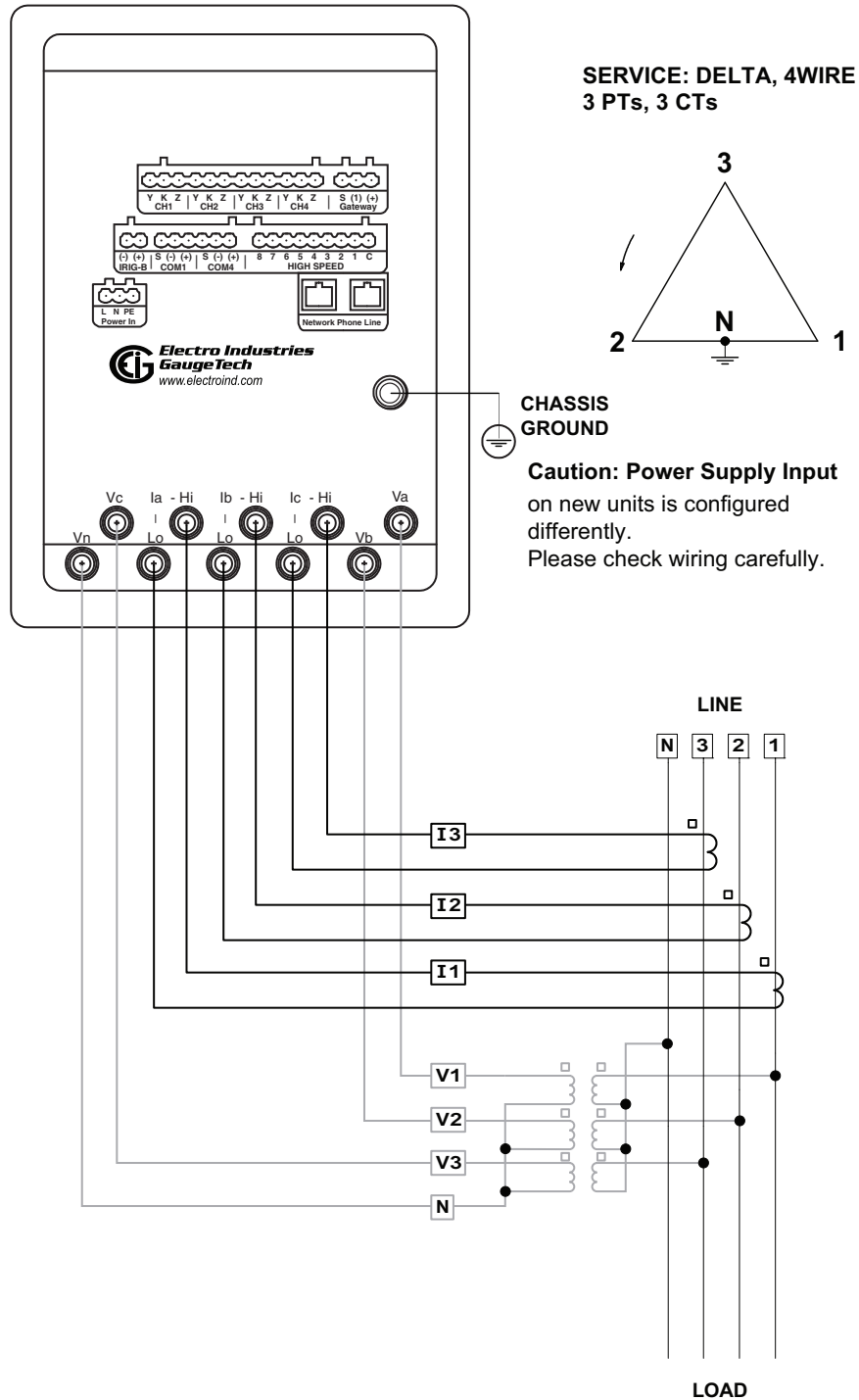


Figure 11.23: 9Z Transformer Rated 4-Wire Delta, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

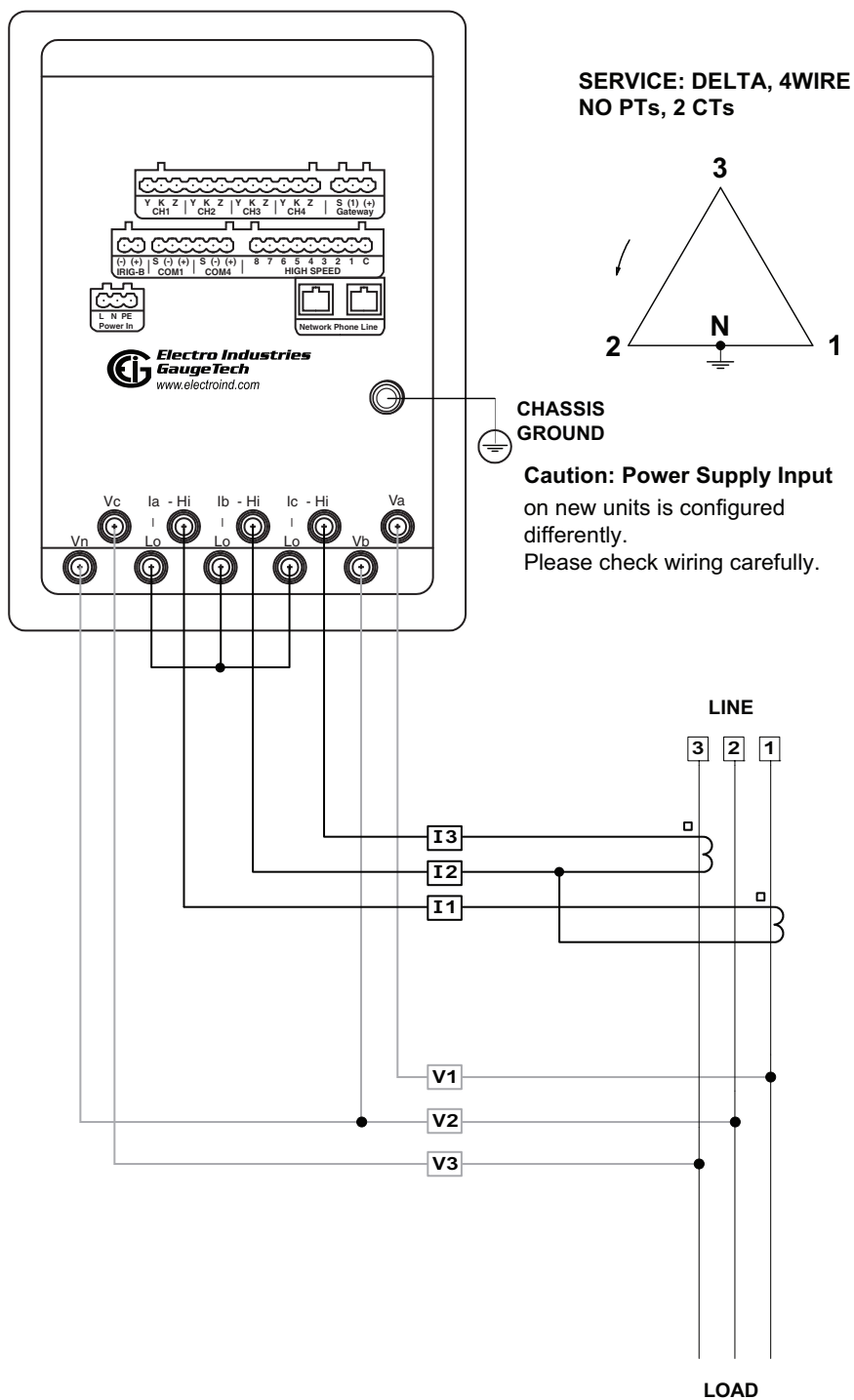


Figure 11.24: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

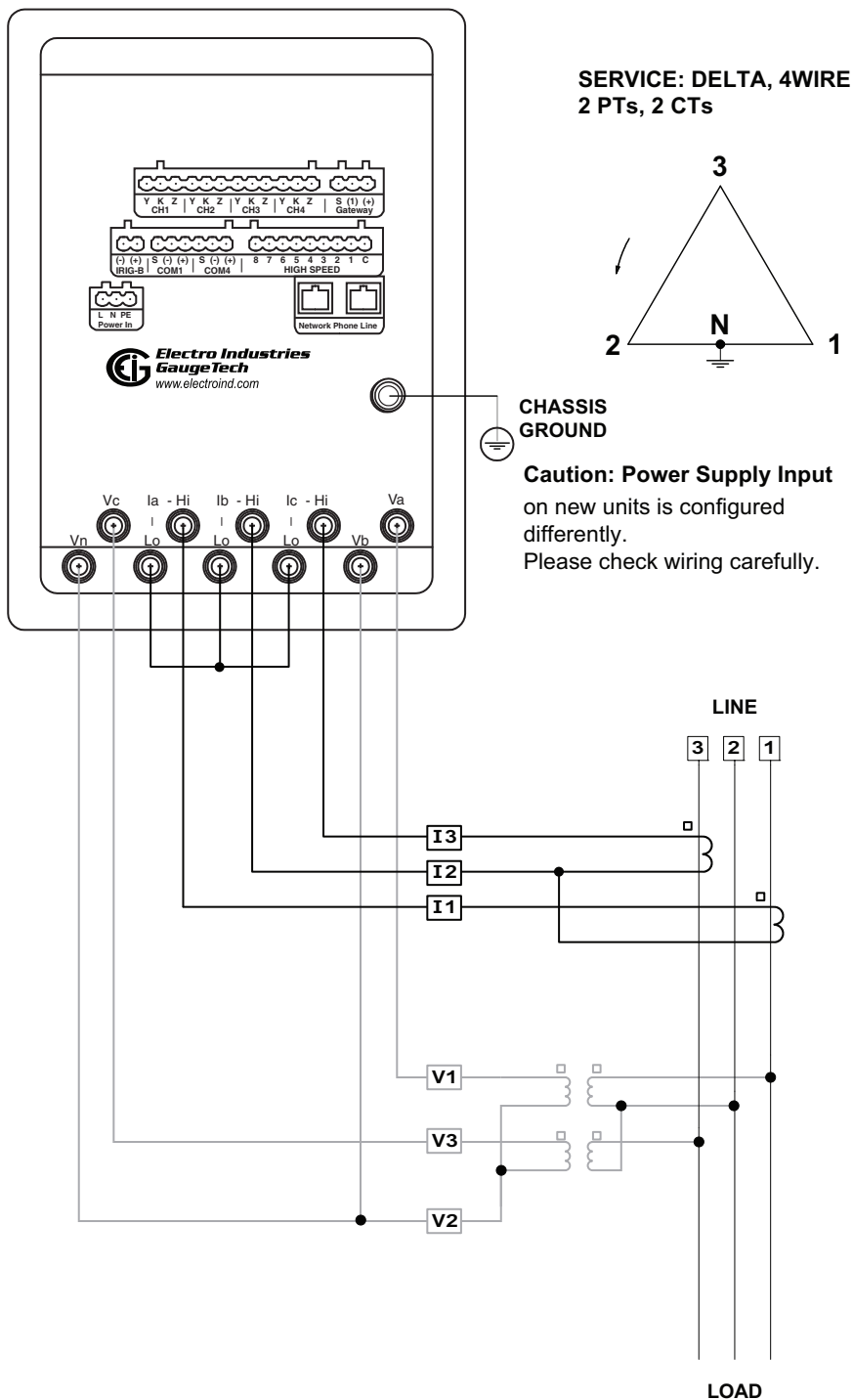


Figure 11.25: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

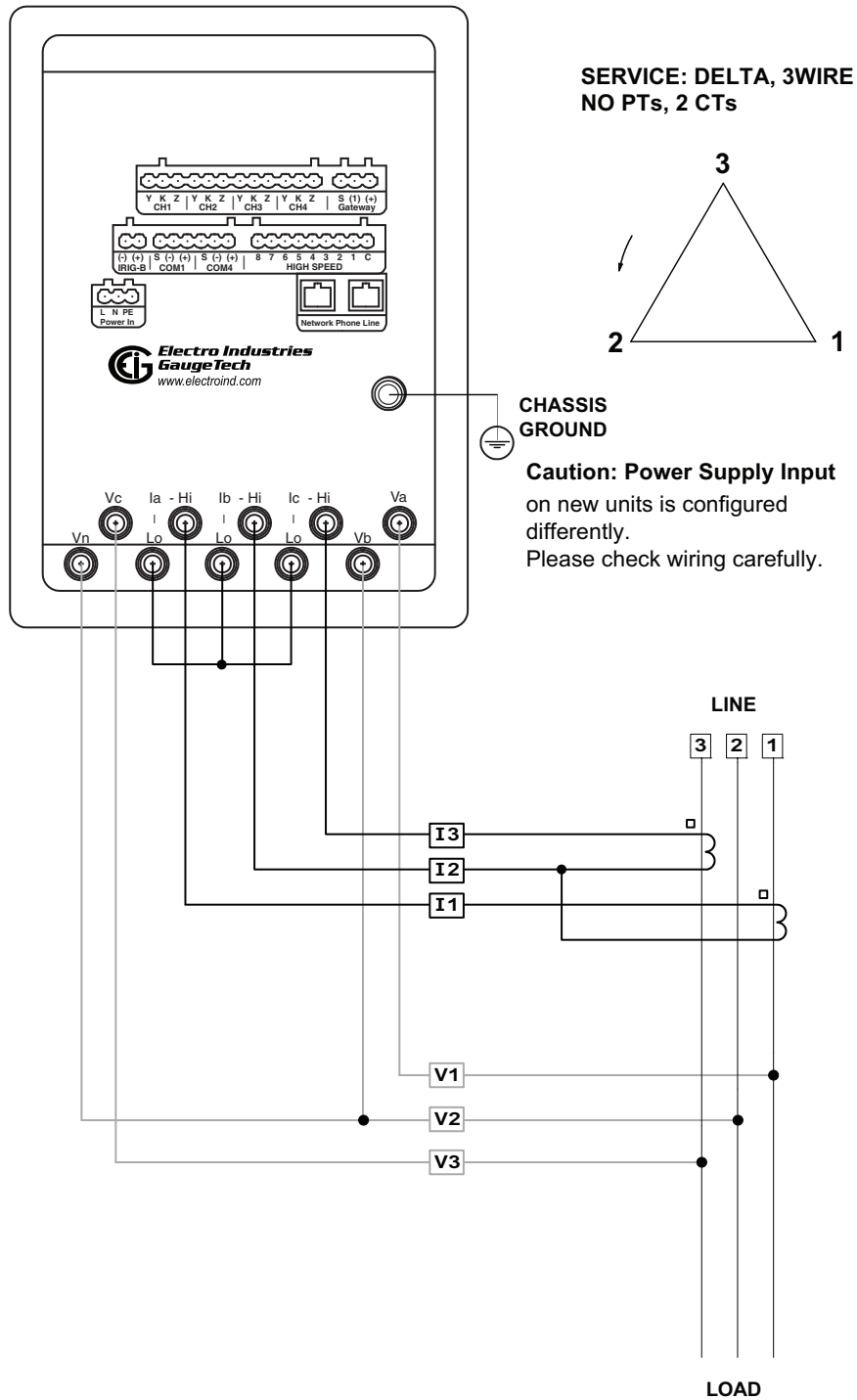


Figure 11.26: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

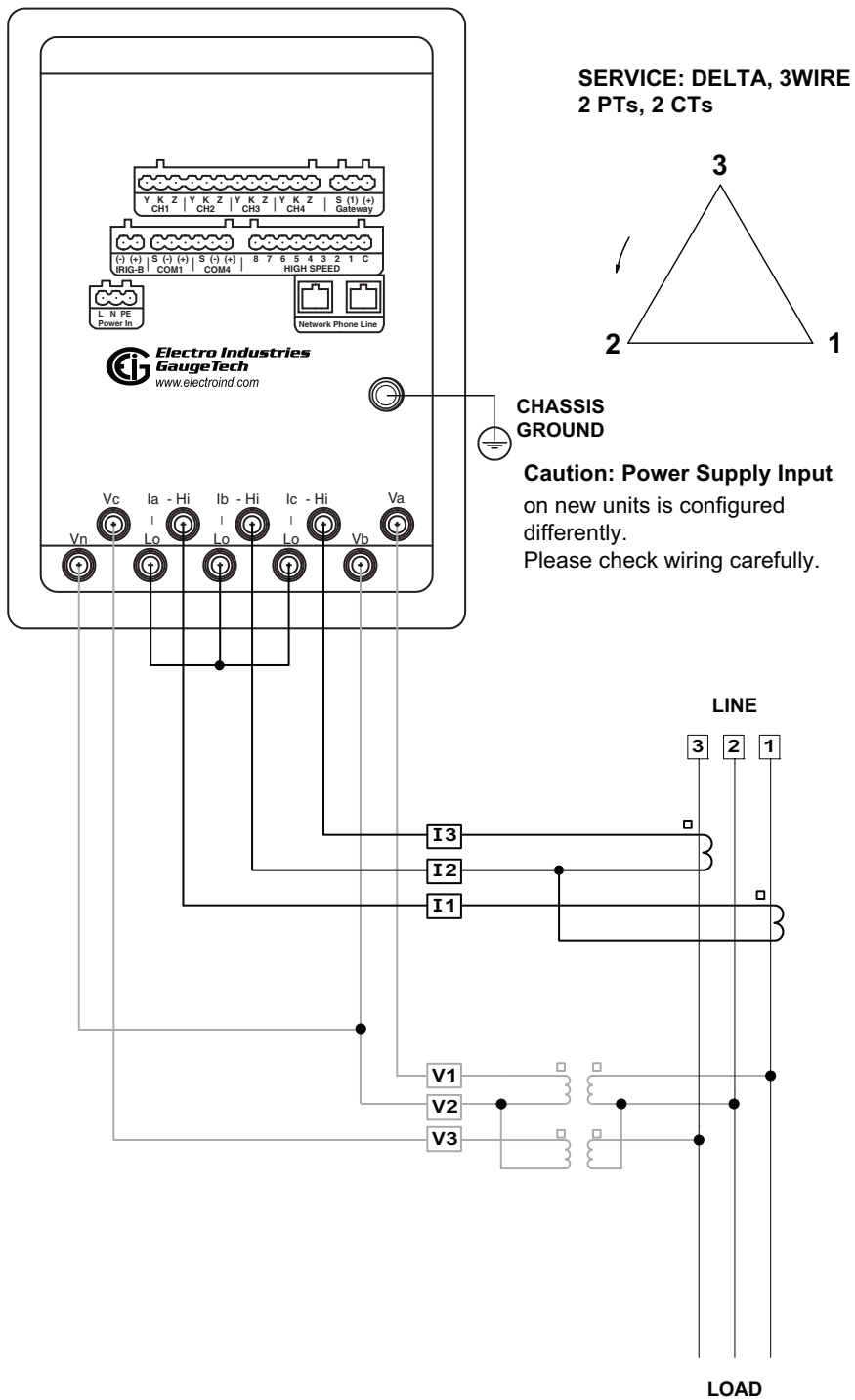


Figure 11.27: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

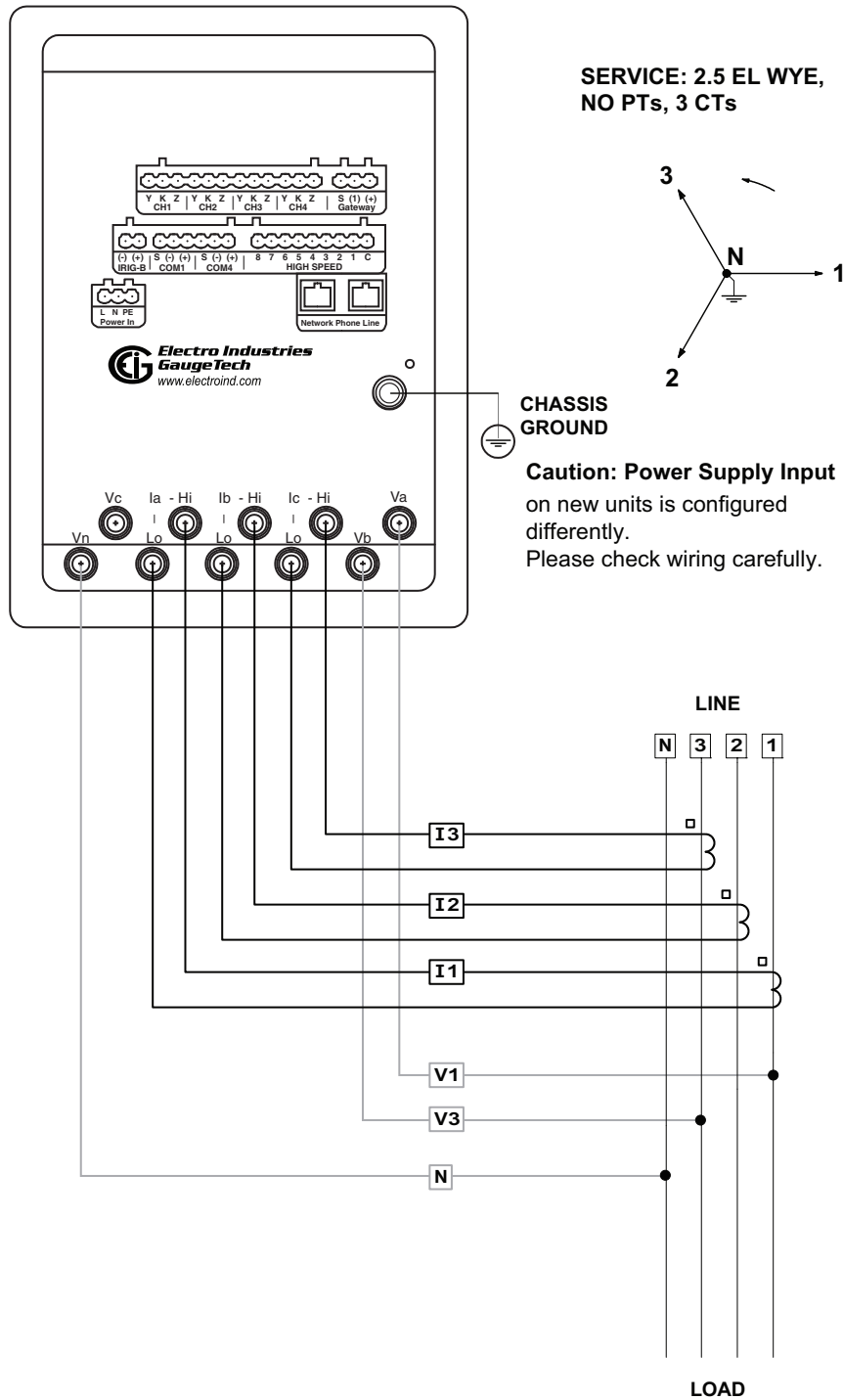


Figure 11.28: 36Z 2.5 Element Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

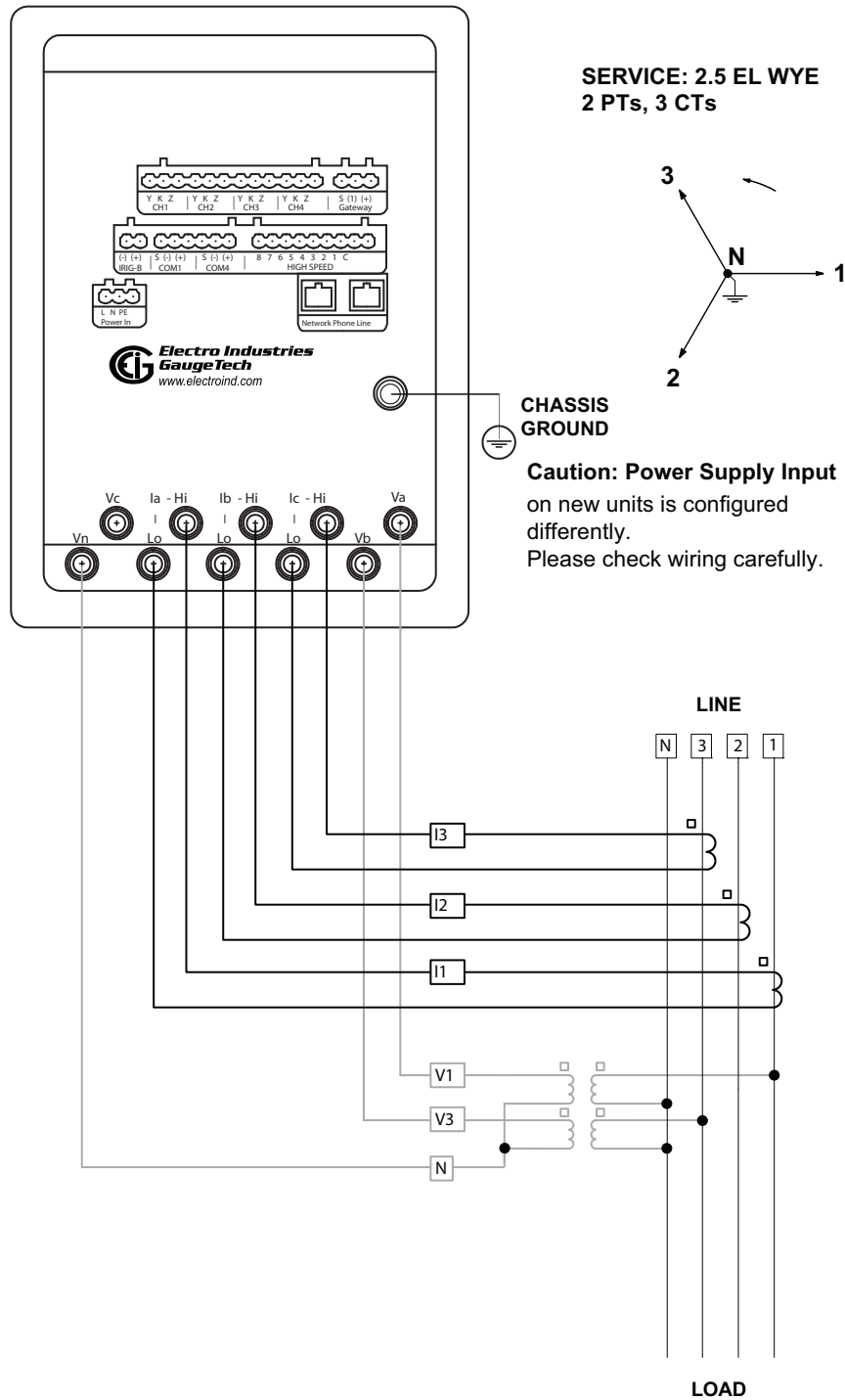


Figure 11.29: 36Z 2.5 Element Wye, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



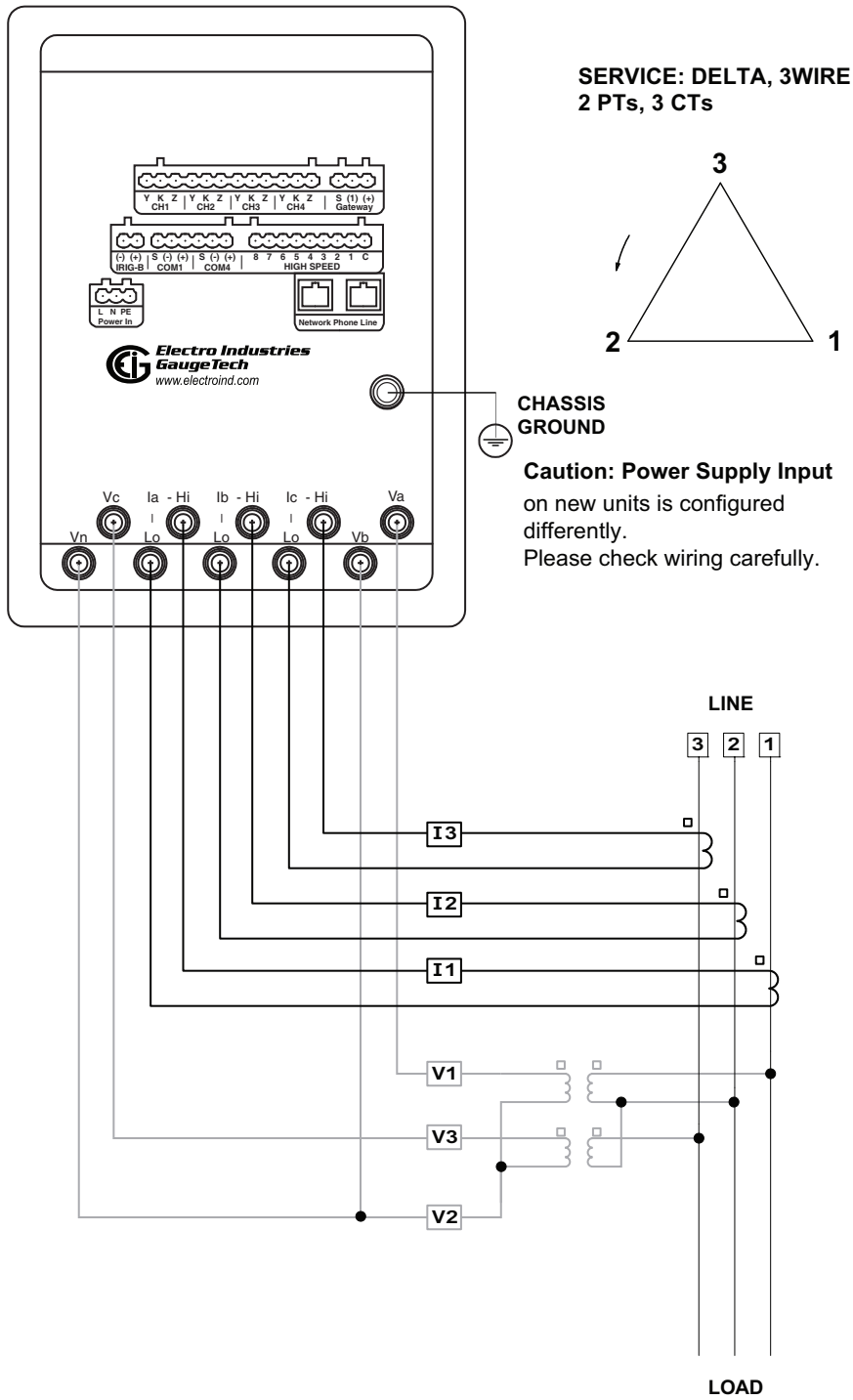


Figure 11.30: Delta, 3-Wire, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

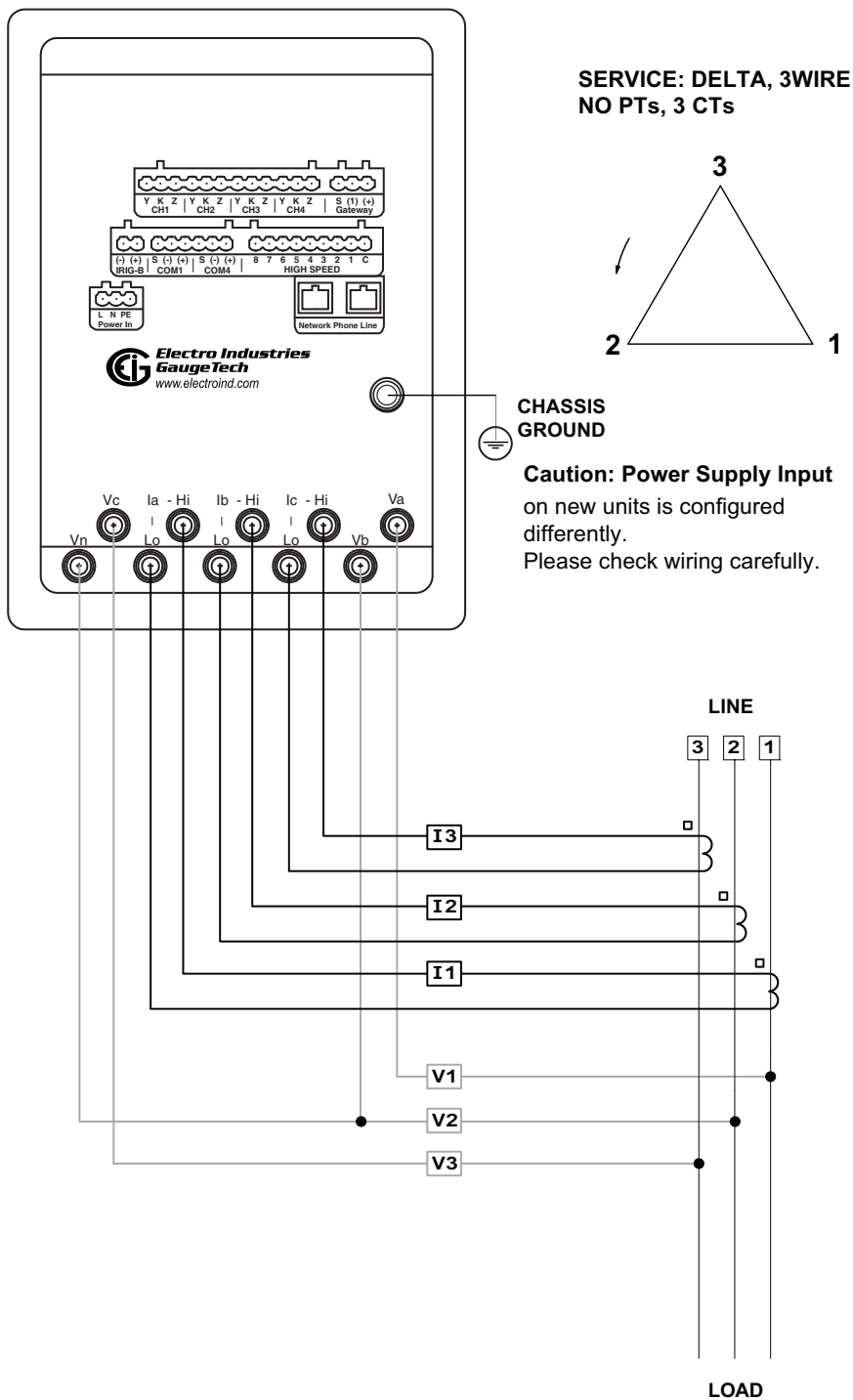


Figure 11.31: Delta, 3-wire, No PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

# 11: Legacy Switchboard Meter (non-SWB3)

## 11.1: Introduction

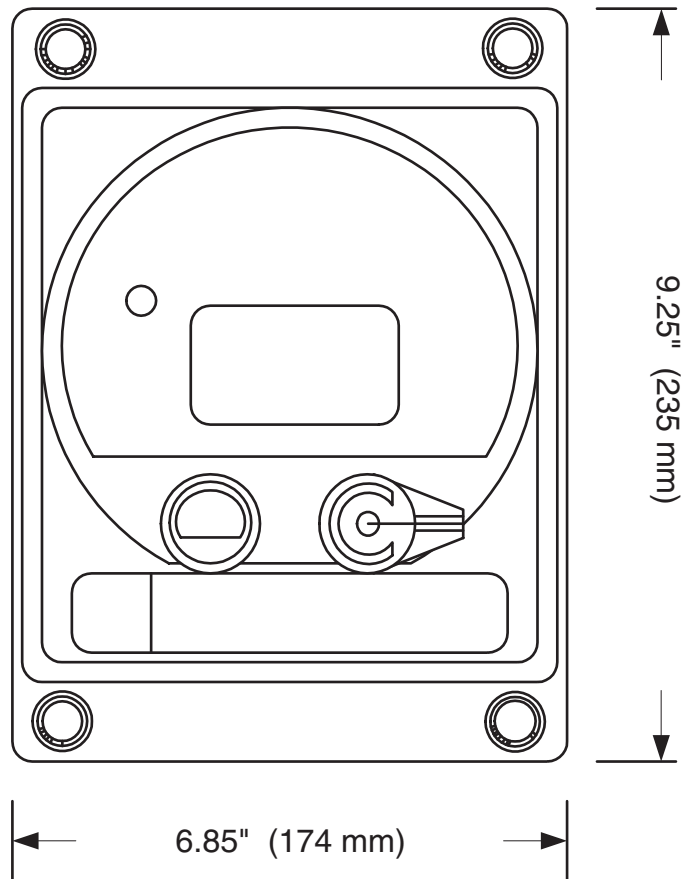


Figure 11.1: Switchboard Meter Dimensions, Front

This chapter gives you a brief overview of the Nexus® 1262/1272 legacy Switchboard option (not SWB3). See Chapter 6 for instructions on the newer SWB3 Switchboard meter and Chapter 11 for its wiring. The legacy Switchboard meter gives you all the features of the Socket meter in a compact case. Easy installation or disconnection is the primary benefit of choosing this option. The Switchboard system lets you install or “rack out” the meter in two easy steps. Minimal manual wiring is required to connect or disconnect the meter.

The Switchboard meter comes in an S1 form relay case, but it has an optional retrofit panel that converts the meter to fit in an M1 form panel cutout. See Section 11.6 for details.

The Switchboard meter operates in the same way as the Socket meter.

There are a few differences between the two meter options:

- The labels on the face and the shroud of the meter will be slightly different, depending on options selected (see Section 11.2 for label detail)
- The wiring Forms are 9Z and 36Z and the wiring is different (see Section 11.5)
- Dimensions are different (see Section 11.3)
- Installation is different (and even easier!) (see Section 11.4)

**CAUTION! The Power Supply Input on the Switchboard unit is configured differently. Please check wiring carefully.**

**ATTENTION! L'entrée d'alimentation de l'unité du tableau est configurée différemment. Veuillez vérifier le câblage avec soin.**

## 11.2: Labels

The labels on the Switchboard meter are similar to those on the Socket meter. Forms are 9Z and 36Z and there may be some additional items, depending upon the options selected. See Chapter 3 for a description of the components on the front and shroud labels.



Figure 11.2: Switchboard Meter, Front View

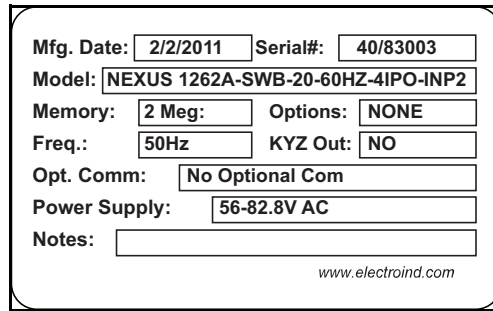


Figure 11.3: Sample of Switchboard Options Label

### 11.3: Specifications and Dimensions

The Switchboard meter specifications are the same as those of the Socket meter, except for meter dimensions. The Switchboard meter is essentially the Socket meter in an oblong case. The dimensions are given in figures 11.1 (Front View), 11.4 (Back View) and 11.5 (Side View). See Chapter 2 for meter specifications.

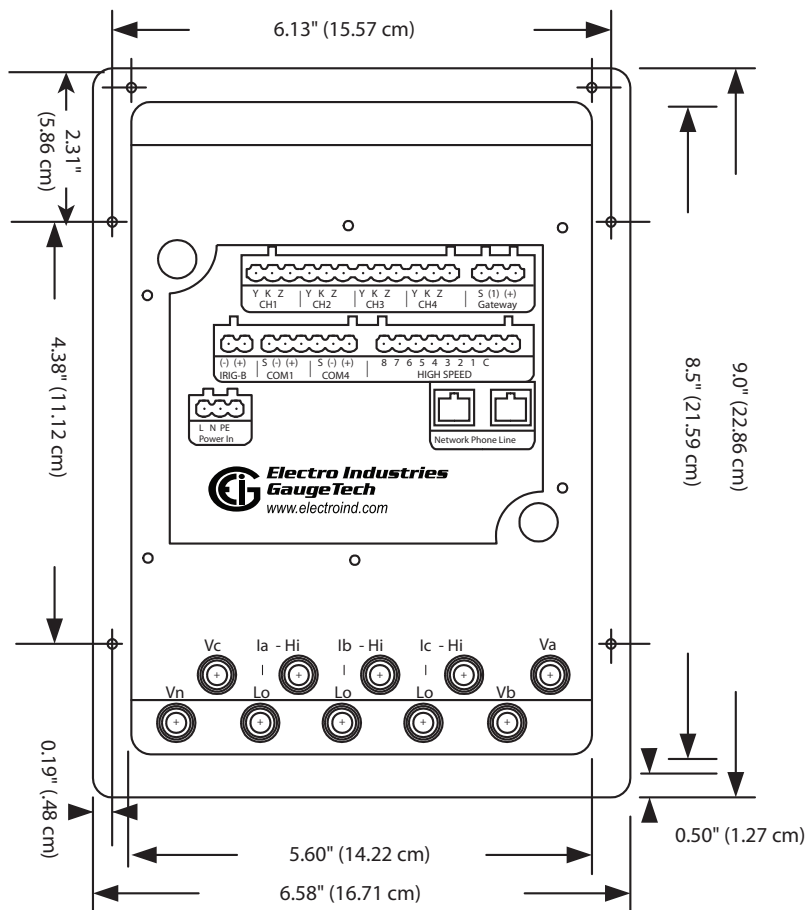


Figure 11.4: Switchboard Meter Dimensions, Back

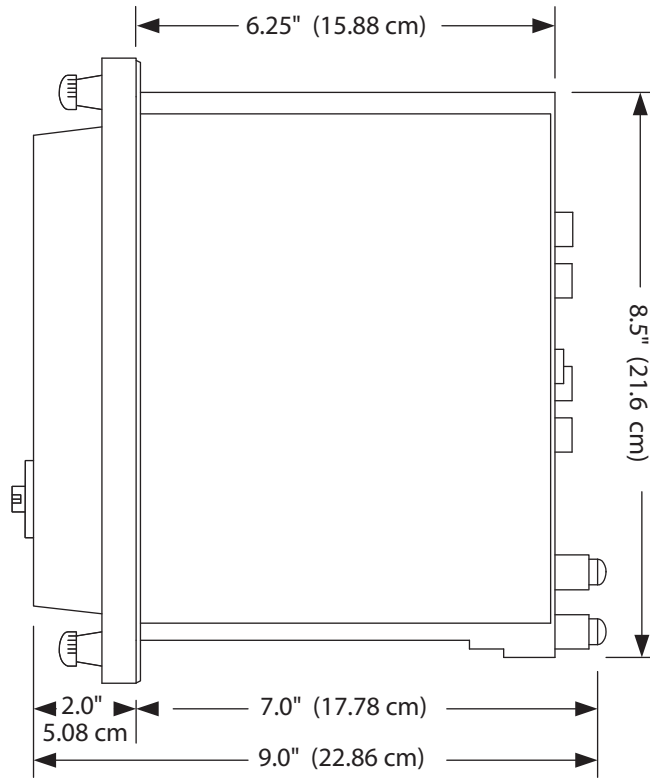


Figure 11.5: Switchboard Meter Dimensions, Side

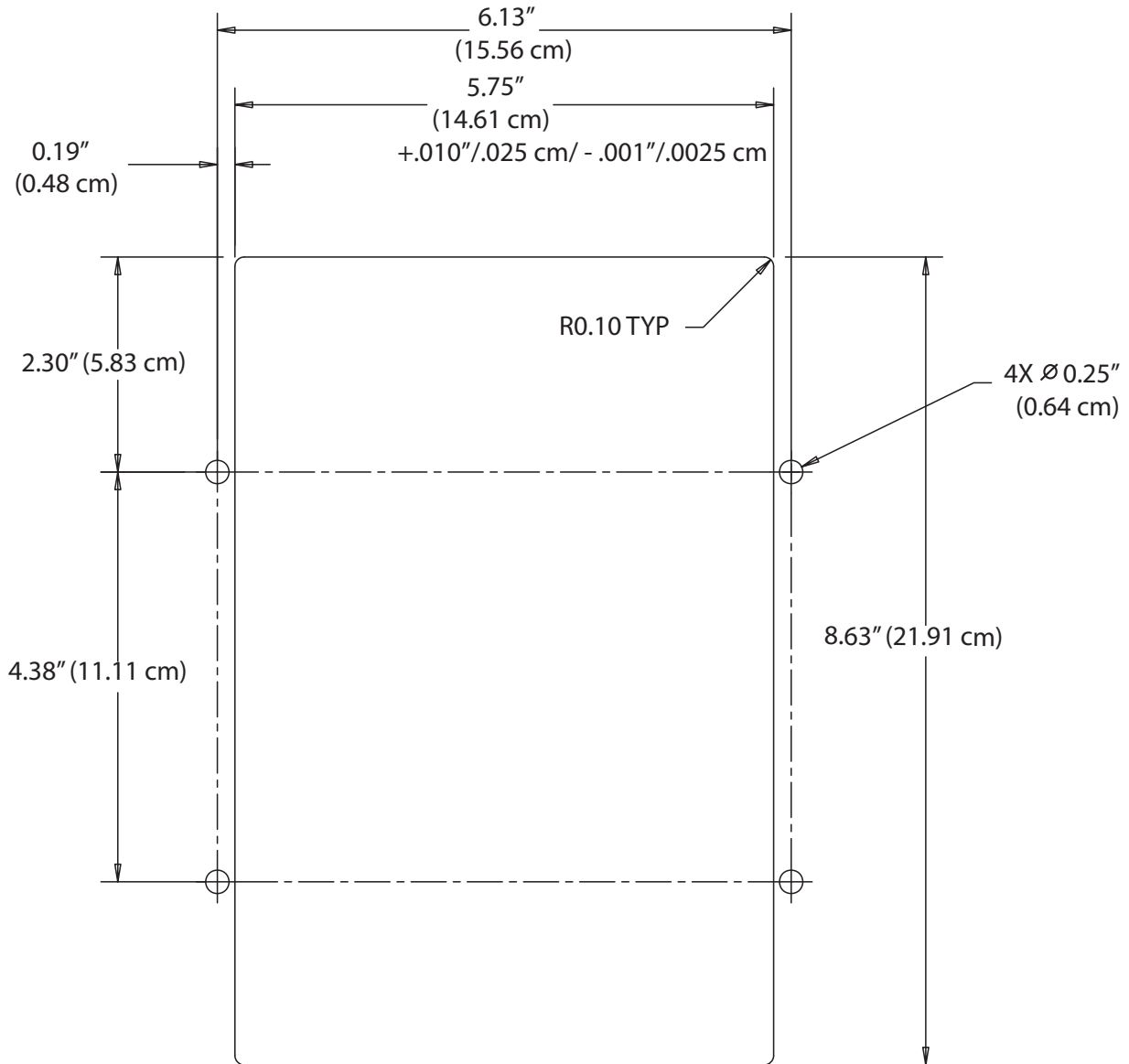


Figure 11.6: Switchboard Meter Cutout

**IMPORTANT!** Check drill holes for the mounting screw you are using, to insure that the mounting screw fits the box tightly enough to hold the box in place. You can use a washer for a slightly smaller mounting screw.

## 11.4: Installation

The Switchboard meter provides easy installation and removal from installation.

**IMPORTANT!** Before installing the meter, check the battery connections (see Sections 6.2 and 5.4.4).

1. Insert the case into a prepared mounting hole. Secure with mounting screws.
2. Slide the meter into the case and secure it by sliding the chassis levers until they snap into place. Connectors for the following are located on the back of the meter. The connectors automatically plug into the available connectors on the mounting board (see Figure 11.8).
  - Pulse Outputs - Four Channels
  - Status Inputs
  - Phone
  - Line/Network
  - Power In
  - COM4, COM1
  - IRIG-B
  - Modem Gateway RS485
3. Position the Switchboard case front against the four screw holes and secure it by turning the four built-in screws in each of the corners. See Figure 11.7.



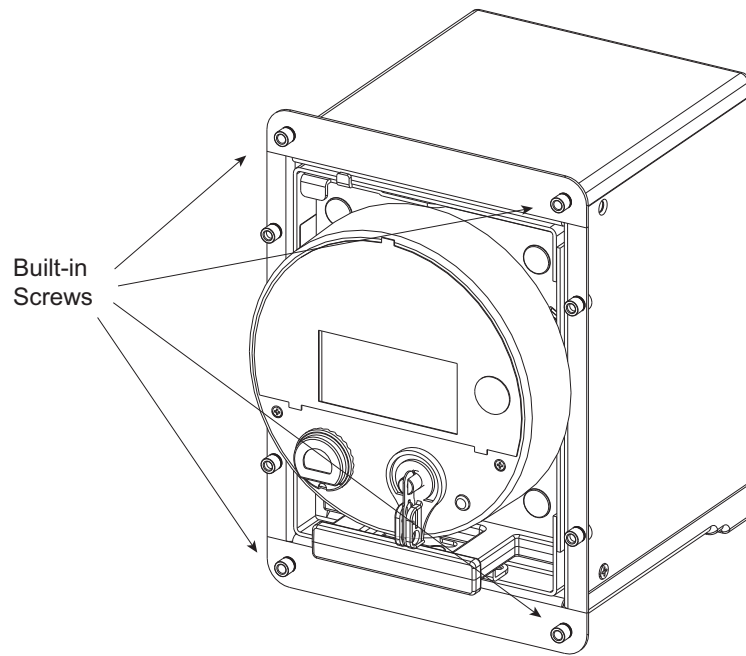


Figure 11.7: Switchboard Case Front Showing 4 Screw Holes

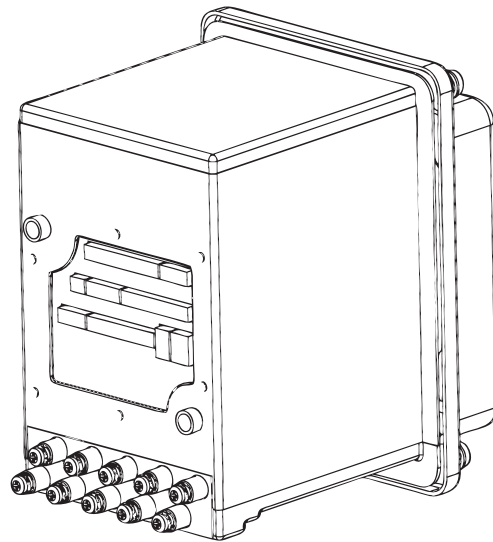


Figure 11.8: Switchboard Meter Back Showing Connectors

## 11.5: Wiring Diagrams

The wiring of the Switchboard meter is similar to that of the Socket meter.

| Form       | Description                 | Figure# |
|------------|-----------------------------|---------|
| <b>9Z</b>  | Wye, no PTs, 3 CTs          | 11.9    |
|            | Wye, 3 PTs, 3 CTs           | 11.10   |
|            | 4-Wire Delta, no PTs, 3 CTs | 11.11   |
|            | 4-Wire Delta, 3 PTs, 3 CTs  | 11.12   |
|            | 3-Wire Delta, no PTs, 2 CTs | 11.13   |
|            | 3-Wire Delta, 2 PTs, 2 CTs  | 11.14   |
|            | 3-Wire Delta, no PTs, 2 CTs | 11.15   |
|            | 3-Wire Delta, 2 PTs, 2 CTs  | 11.16   |
|            | 3-Wire Delta, 2 PTs, 3 CTs  | 11.19   |
|            | 3-Wire Delta, no PTs, 3 CTs | 11.20   |
| <b>36Z</b> | 2.5 EL Wye, no PTs, 3 CTs   | 11.17   |
|            | 2.5 EL Wye, 2 PTs, 3 CTs    | 11.18   |

Table 11.1: Switchboard Meter Configurations

The meter snaps into place and is secured with levers and screws. All input and output connections are made automatically as the meter is installed. (Refer to Section 11.4 and Figure 11.8.)

Wiring options are shown in Figures 11.9 through 11.20.

**NOTE:** For special requirements, contact our service department.

**CAUTION!** All wiring should be done by a licensed professional. Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards. **See Section 11.1 for important safety considerations.**

**ATTENTION!** Tout travail de câblage doit être effectué par un professionnel agréé. Les procédures, matériaux, équipements et connexions d'installation actuels doivent être conformes aux codes et aux normes applicables. **Pour voir d'importantes exigences de sécurité, vous référer à Section 11.1.**

**REMARQUE pour Tous les schémas de câblage:**

- Les connexions de garde pour les transformateurs sont omises dans les schémas et ne sont pas nécessaires afin que le compteur fonctionne correctement. Toutefois, nous vous recommandons fortement ces connexions pour réduire les risques de choc.
- Les commutateurs de court-circuit (blocs) pour le côté secondaire des transformateurs de courant ne sont également pas représentés. Pour éviter les chocs électriques, nous vous recommandons d'utiliser ces commutateurs de court-circuit (blocs). Assurez-vous que les côtés secondaires des transformateurs de courant sont court-circuités avant de les déconnecter des bornes d'entrée de courant du compteur.

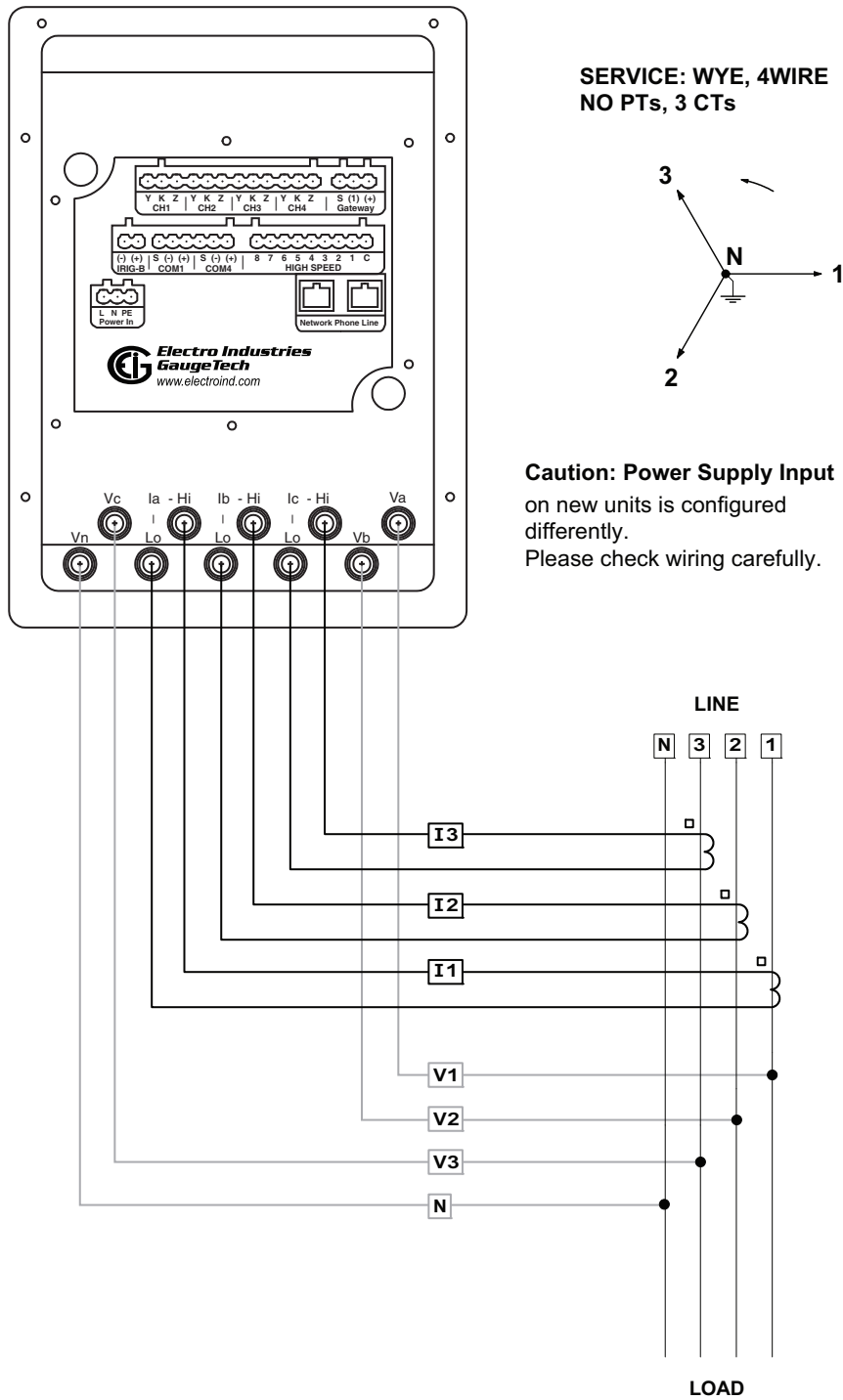


Figure 11.9: 9Z Transformer Rated Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

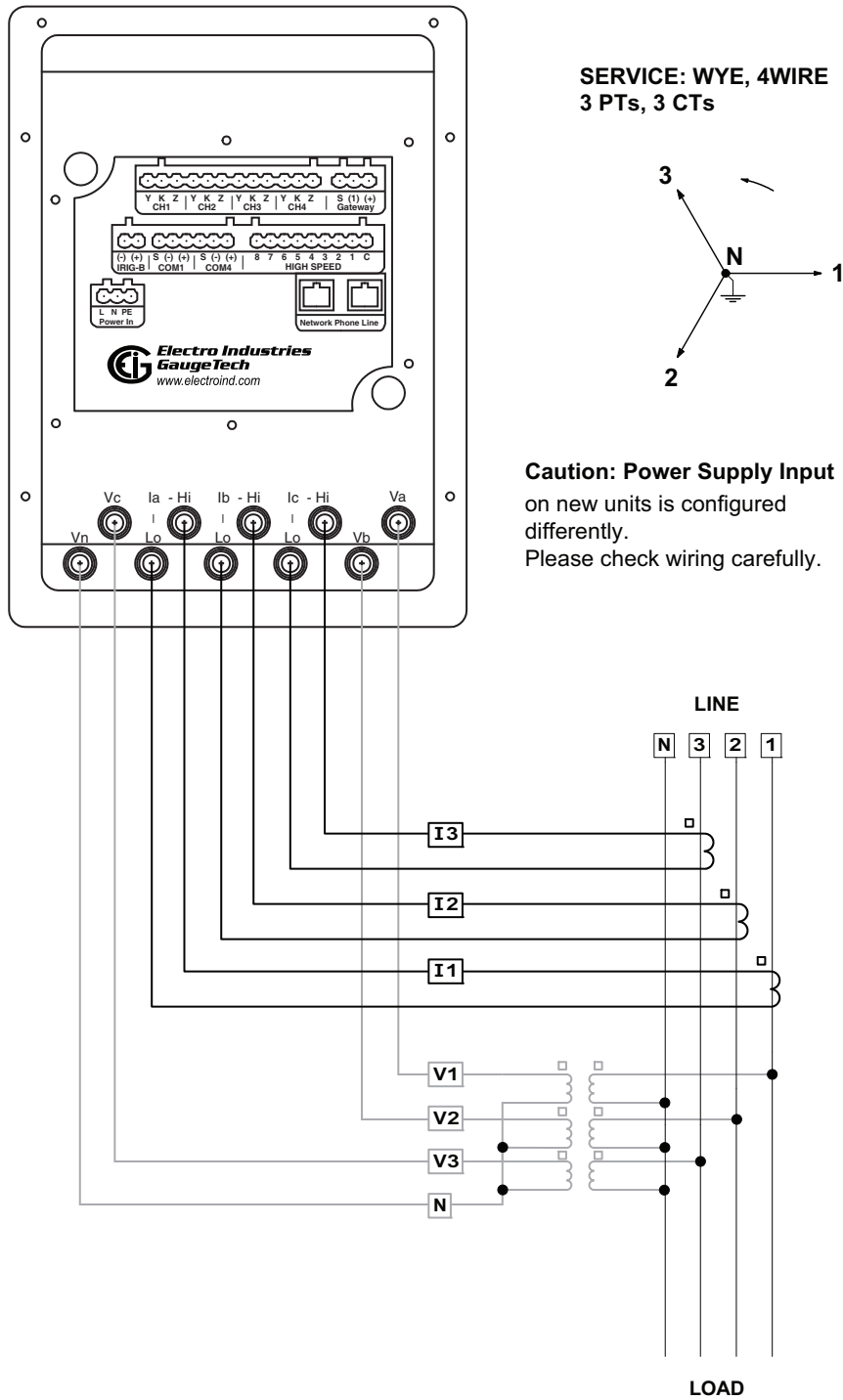


Figure 11.10: 9Z Transformer Rated Wye, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

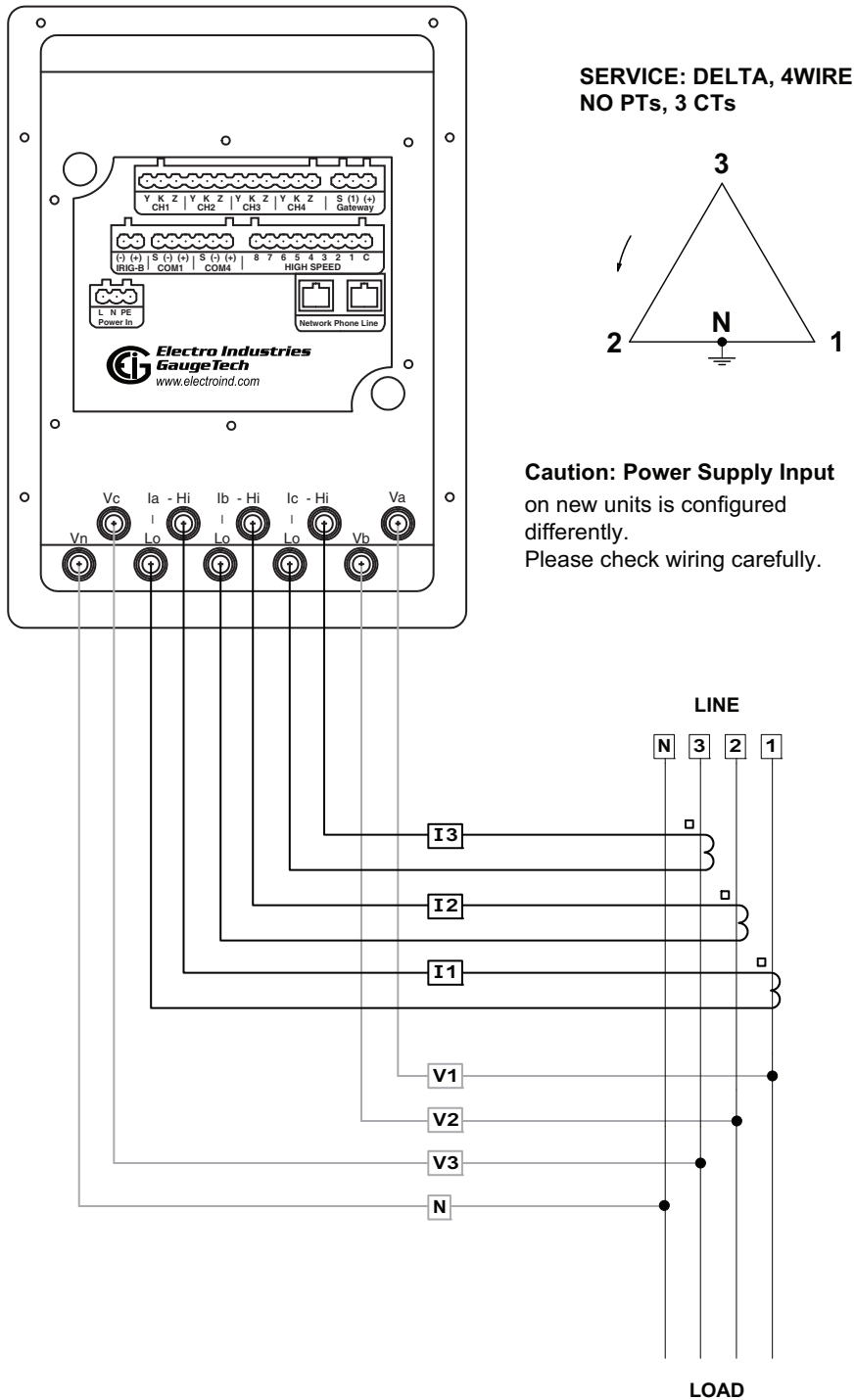
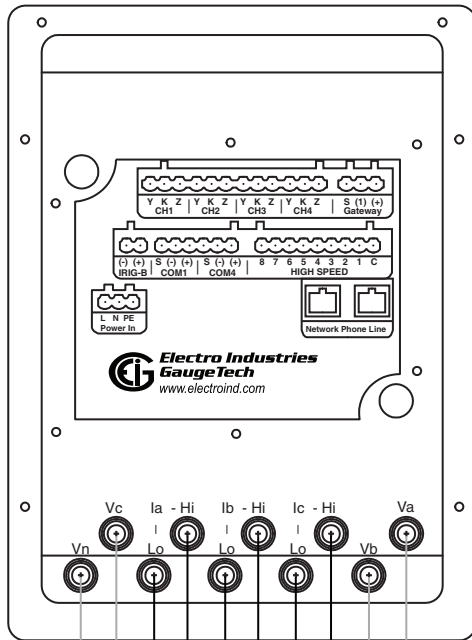


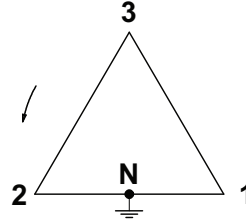
Figure 11.11: 9Z Transformer Rated 4-Wire Delta, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



**SERVICE: DELTA, 4WIRE**  
**3 PTs, 3 CTs**



**Caution: Power Supply Input**  
 on new units is configured differently.  
 Please check wiring carefully.

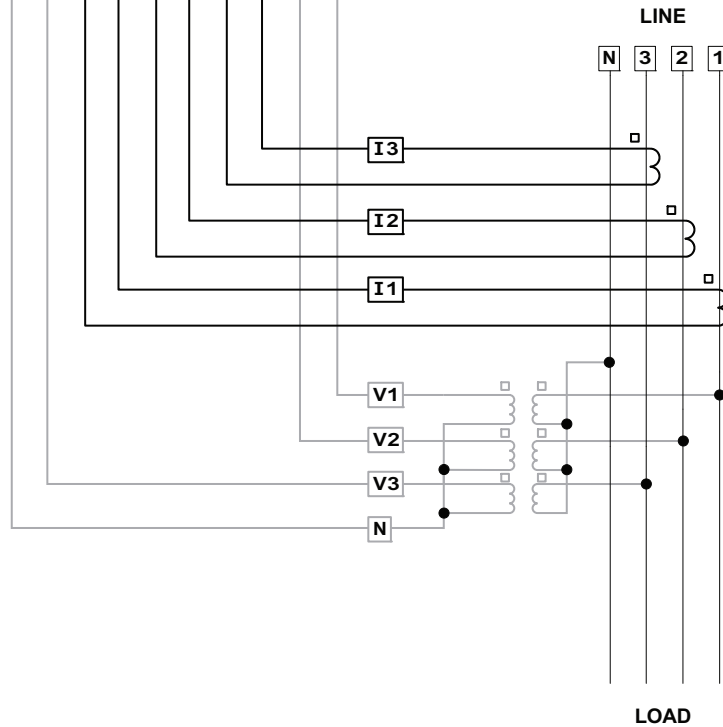


Figure 11.12: 9Z Transformer Rated 4-Wire Delta, 3 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

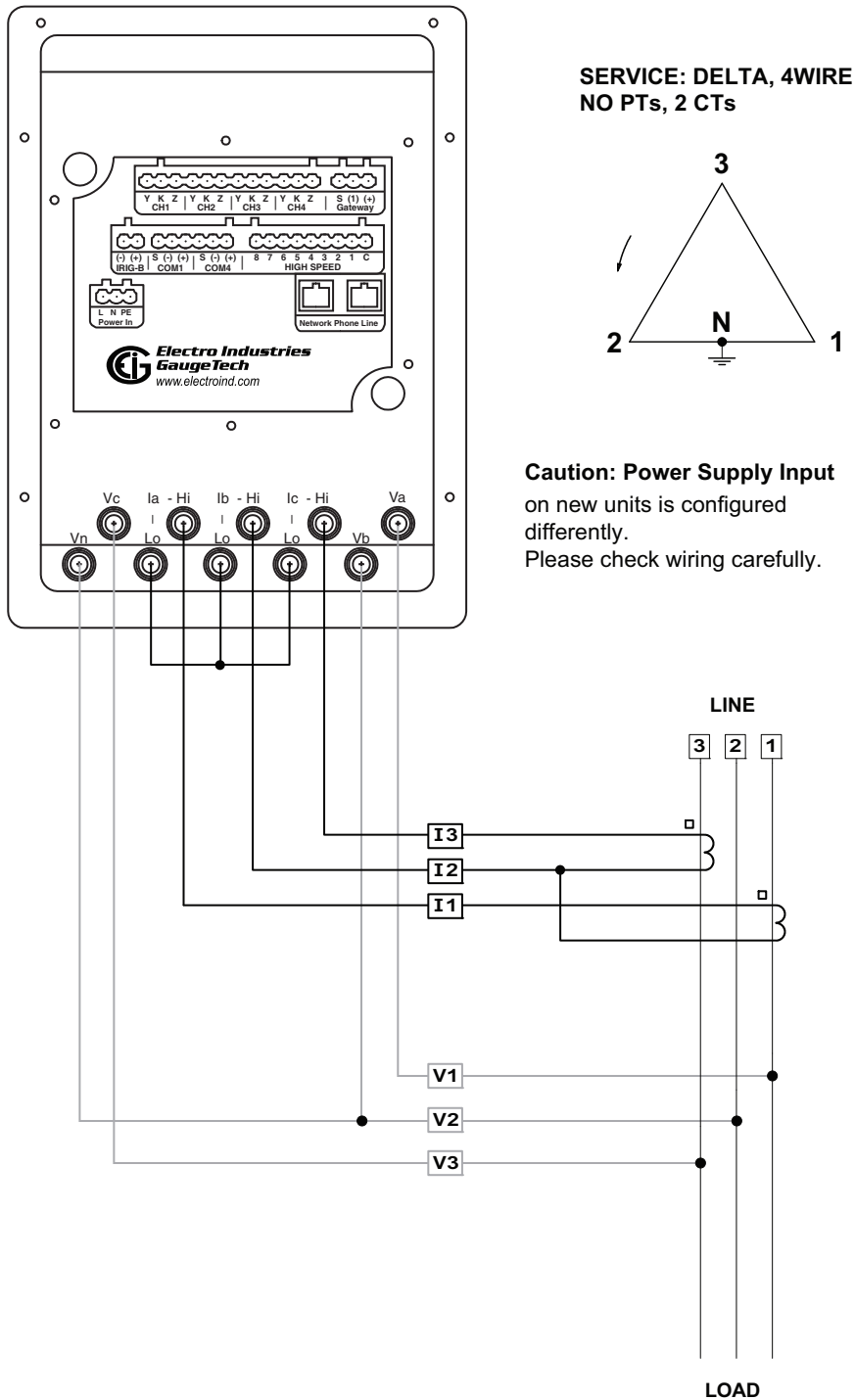


Figure 11.13: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



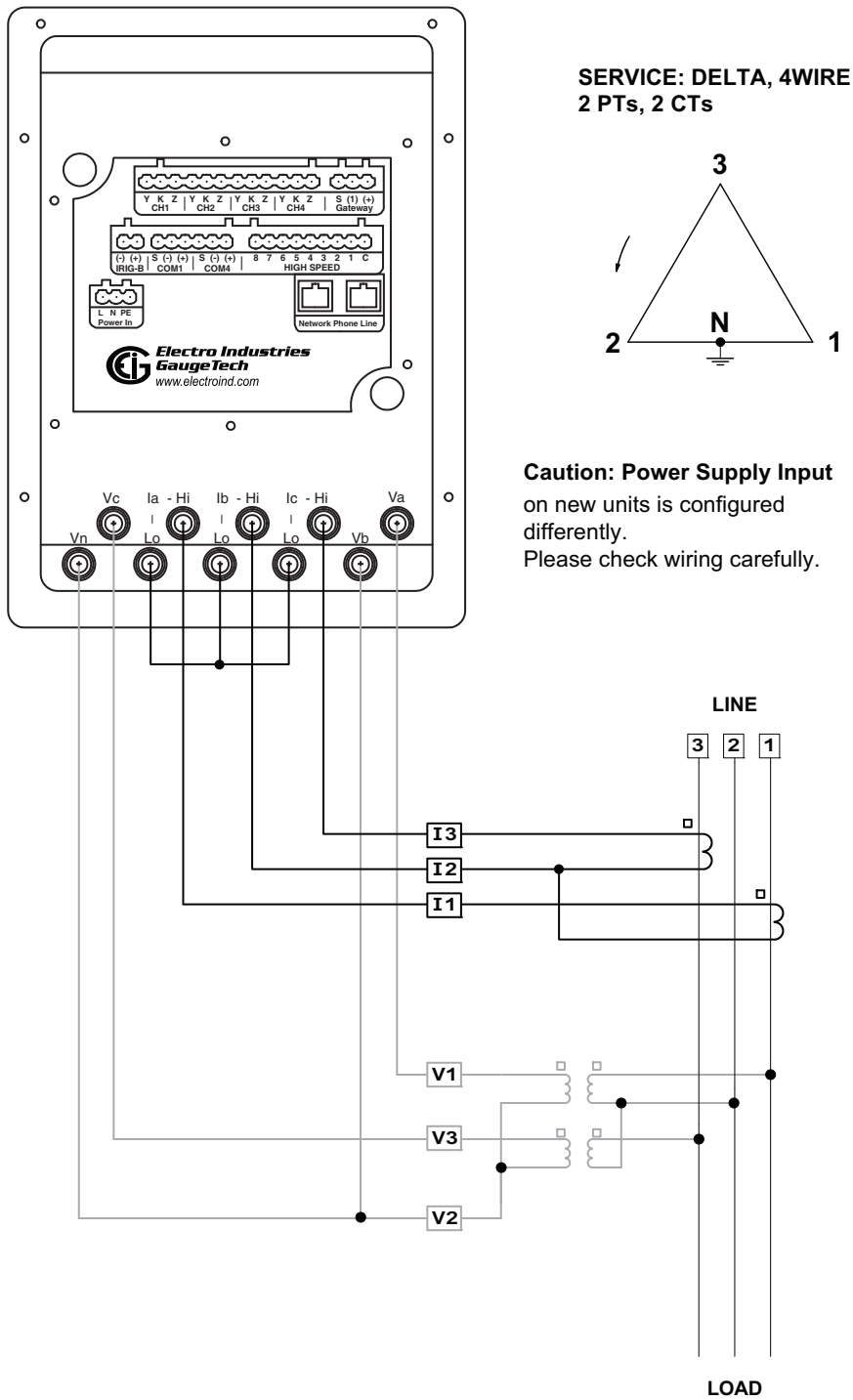


Figure 11.14: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

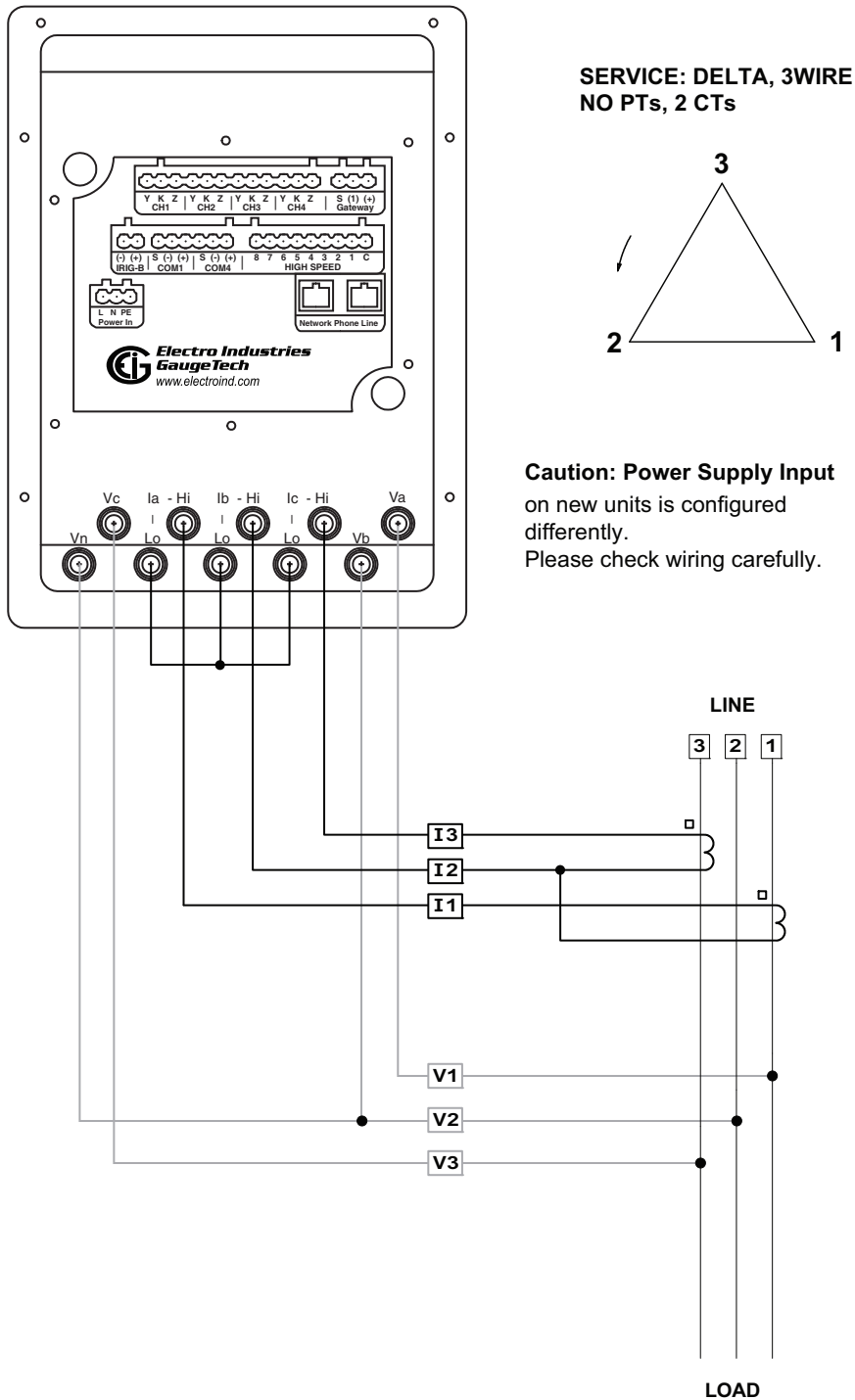


Figure 11.15: 9Z Transformer Rated 3-Wire Delta, no PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

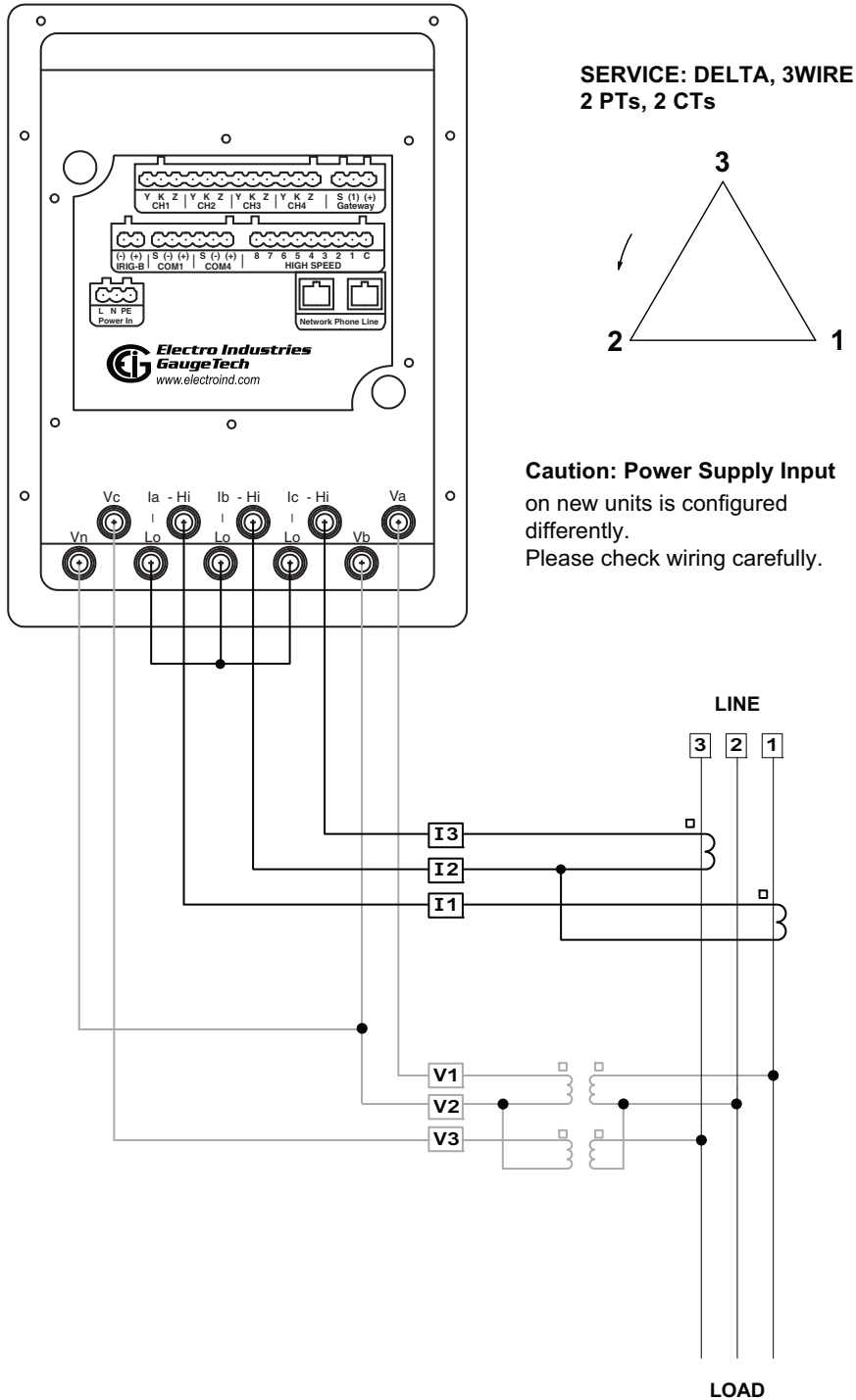


Figure 11.16: 9Z Transformer Rated 3-Wire Delta, 2 PTs, 2 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

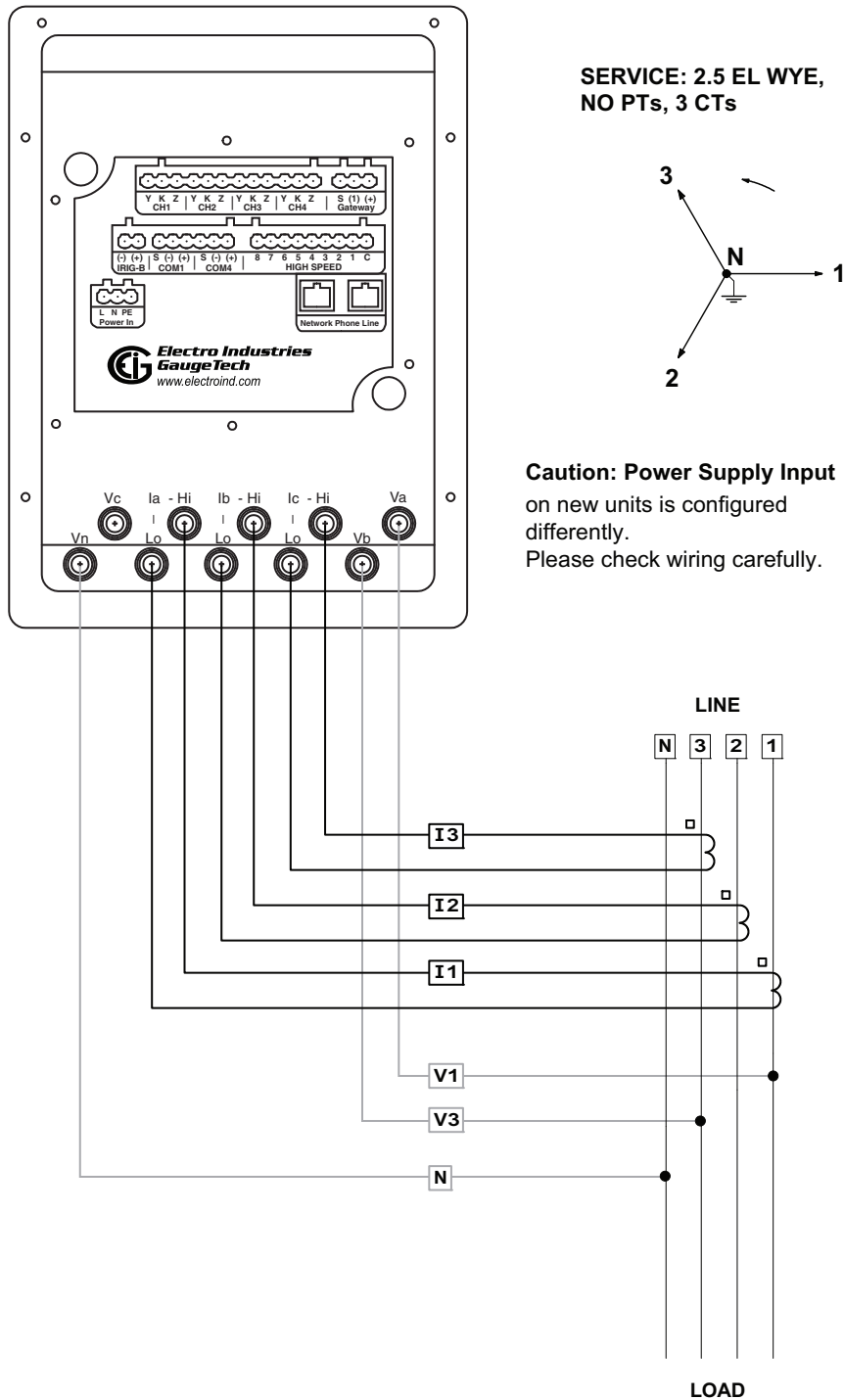


Figure 11.17: 36Z 2.5 Element Wye, no PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

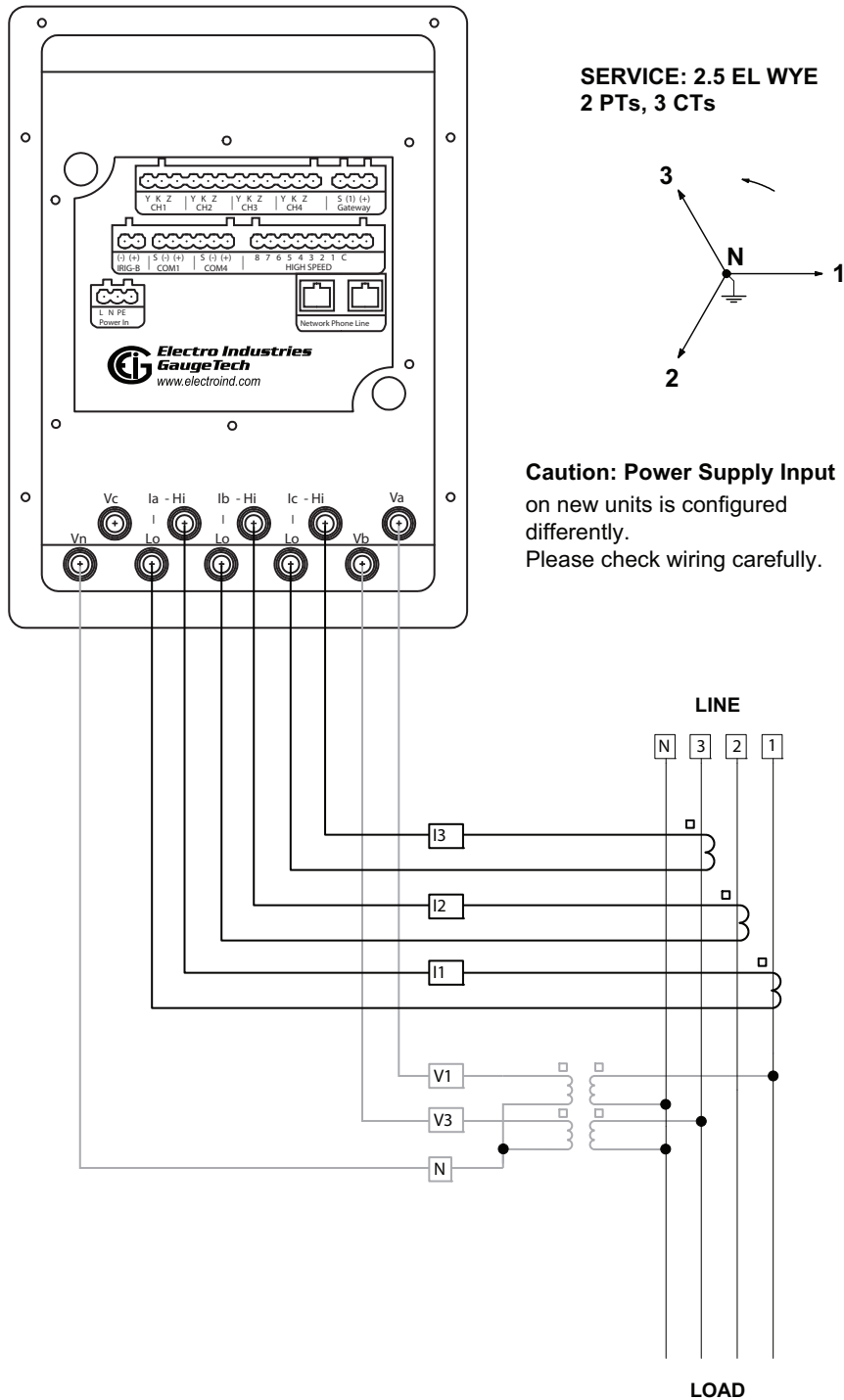
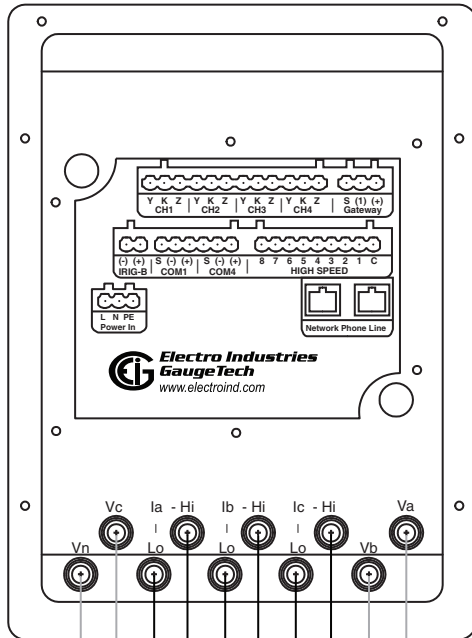


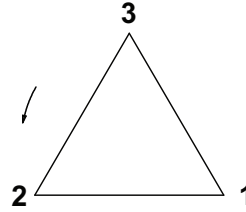
Figure 11.18: 36Z 2.5 Element Wye, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.



**SERVICE: DELTA, 3WIRE**  
**2 PTs, 3 CTs**



**Caution: Power Supply Input**  
 on new units is configured differently.  
 Please check wiring carefully.

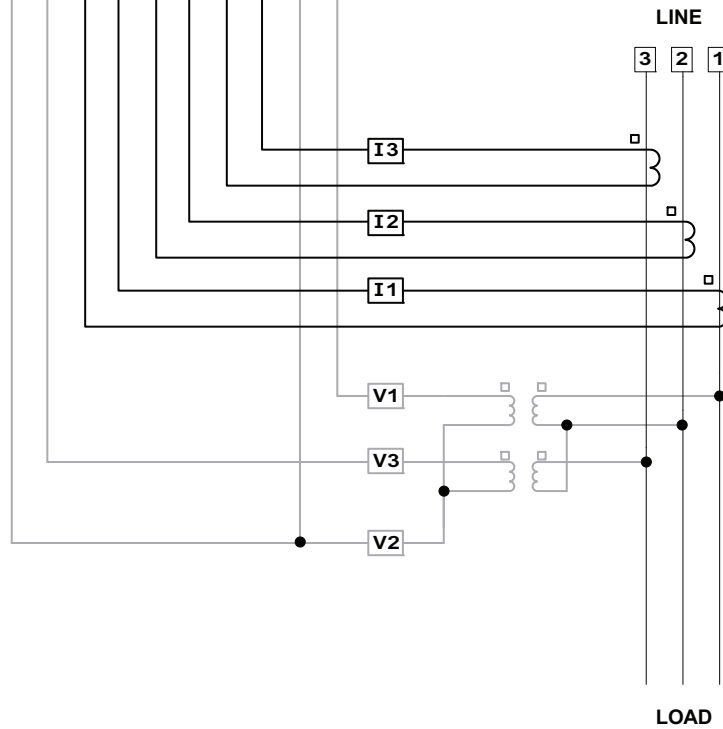


Figure 11.19: Delta, 3-Wire, 2 PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

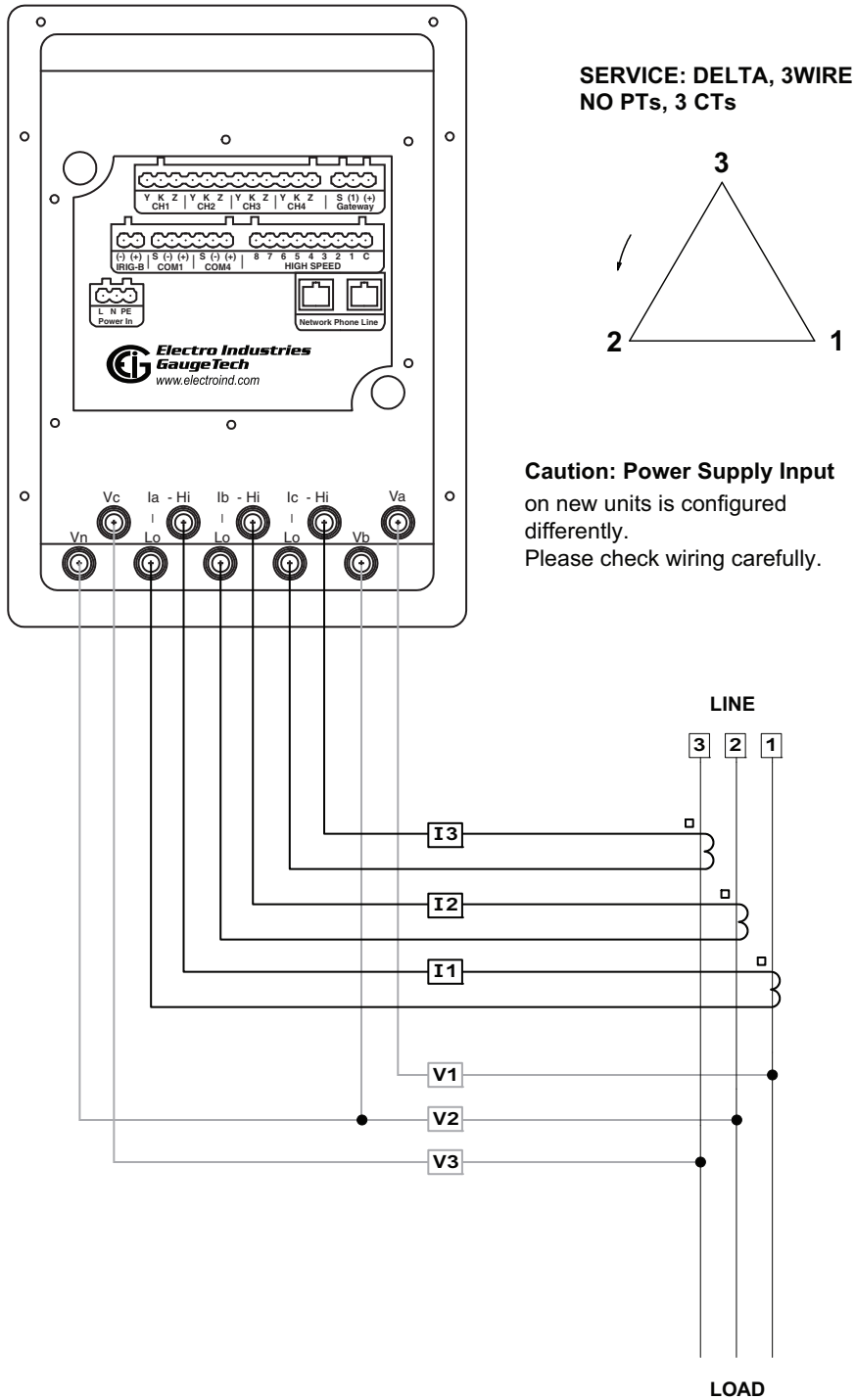


Figure 11.20: Delta, 3-wire, No PTs, 3 CTs



- The protective ground connections for the transformers are omitted in the diagrams and are not required for the meter to work properly. However, we strongly recommend those connections to reduce shock hazard.
- Shorting switches (blocks) for the current transformers' secondary side are also not shown. To prevent electrical shock we recommended you use such shorting switches (blocks). Make sure the CTs' secondary are shorted before disconnecting them from the meter's current input terminals.

## 11.6: E137370 Retrofit Panel - S1 to M1 Case Retrofit

The E137370 M1 retrofit panel will convert any S1 (GE) relay case meter (or relay) to fit in the dimensions of a large case M1 format. Using this conversion panel, a user can mount a Nexus® 1262/1272 S1 form switchboard meter to fill the cutout of an existing M1 case.

The E137370 can be ordered as an accessory option.

To use the panel:

1. Attach the switchboard meter to the retrofit panel, using the built-in switchboard screws (see Figure 11.7).
2. Place the switchboard meter with retrofit panel into the space for the M1 case and attach the retrofit panel using screws in all four corner holes.

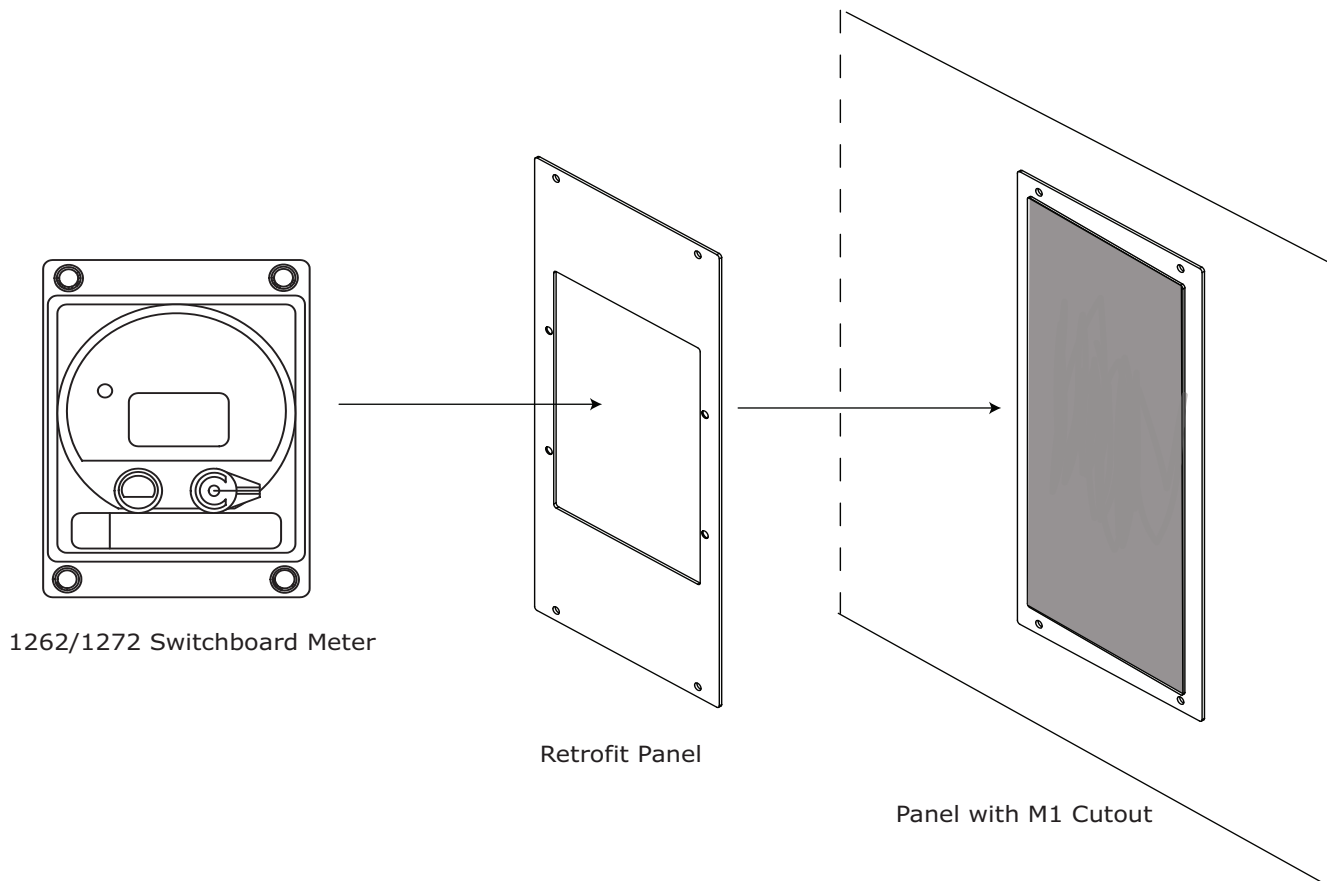
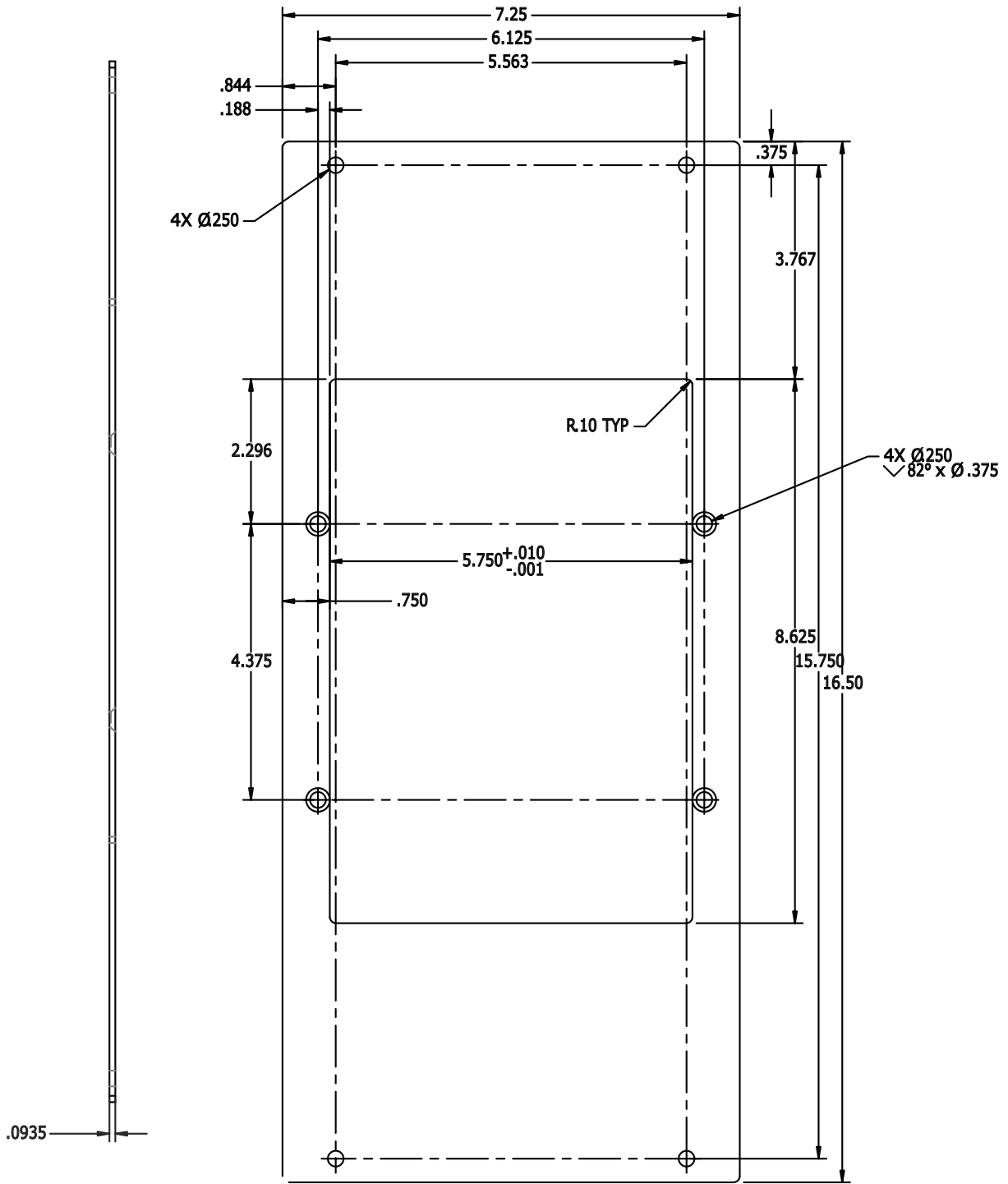


Figure 11.21: Attaching the Panel and Inserting the Meter





Side Dimensions

Front Dimensions

(in inches)

11. 22: E137370 Retrofit Panel Dimensions

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# 12: Meter Calculations

## 12.1: Measurements and Calculations

The Nexus® 1262/1272 Meter measures many different power parameters. Following is a list of the formulas used to perform calculations with samples for Wye and Delta services.

Samples for Wye:  $v_a, v_b, v_c, i_a, i_b, i_c, i_n$

Samples for Delta:  $v_{ab}, v_{bc}, v_{ca}, i_a, i_b, i_c$

Root Mean Square (RMS) of Phase Voltages:  $N =$  number of samples

For Wye:  $x = a, b, c$

$$V_{RMS_x} = \sqrt{\frac{\sum_{t=1}^N v_{x(t)}^2}{N}}$$

Root Mean Square (RMS) of Line Currents:  $N =$  number of samples

For Wye:  $x = a, b, c, n$

For Delta:  $x = a, b, c$

$$I_{RMS_x} = \sqrt{\frac{\sum_{t=1}^N i_{x(t)}^2}{N}}$$

Root Mean Square (RMS) of Line Voltages: N = number of samples

For Wye: x, y = a,b or b,c or c,a

$$V_{RMS_{xy}} = \sqrt{\frac{\sum_{t=1}^N (v_{x(t)} - v_{y(t)})^2}{N}}$$

For Delta: xy = ab, bc, ca

$$V_{RMS_{xy}} = \sqrt{\frac{\sum_{t=1}^N v_{xy(t)}^2}{N}}$$

Power (Watts) per phase: N = number of samples

For Wye: x = a, b, c

$$W_x = \frac{\sum_{t=1}^N v_{x(t)} \cdot i_{x(t)}}{N}$$

Apparent Power (VA) per phase:

For Wye: x = a, b, c

$$VA_x = V_{RMS_x} \cdot I_{RMS_x}$$

Reactive Power (VAR) per phase:

For Wye:  $x = a, b, c$

$$VAR_x = \sqrt{VA_x^2 - W_x^2}$$

Q per Phase:

For Wye:  $x = a, b, c$

$$Q_x = \frac{\sqrt{3}VAR_x + W_x}{2}$$

Active Power (Watts) Total:  $N = \text{number of samples}$

For Wye:

$$W_T = W_a + W_b + W_c$$

For Delta:

$$W_T = \frac{\sum_{t=1}^N (v_{ab(t)} \cdot i_{a(t)} - v_{bc(t)} \cdot i_{c(t)})}{N}$$

Reactive Power (VAR) Total:  $N = \text{number of samples}$

For Wye:

$$VAR_T = VAR_a + VAR_b + VAR_c$$

For Delta:

$$VAR_T = \sqrt{\left(V_{RMS_{ab}} \cdot I_{RMS_a}\right)^2 - \left[\frac{\sum_{t=1}^N v_{ab(t)} \cdot i_{a(t)}}{N}\right]^2} + \sqrt{\left(V_{RMS_{bc}} \cdot I_{RMS_c}\right)^2 - \left[\frac{\sum_{t=1}^N v_{bc(t)} \cdot i_{c(t)}}{N}\right]^2}$$

Apparent Power (VA) Total:

For Wye:

$$VA_T = VA_a + VA_b + VA_c$$

For Delta:

$$VA_T = \sqrt{W_T^2 + VAR_T^2}$$

Total Q:

For Wye:

$$Q_T = Q_a + Q_b + Q_c$$

For Delta:

$$Q_T = \frac{\sqrt{3VAR_T + W_T}}{2}$$

**Total Energies:**

$x, y = W_T, Wh_T$  or  $VAR_T, VARh_T$  or  $VA_T, VAh_T$  or  $Q_T, Qh_T$

$$y = \frac{\sum x}{3600 \text{ sec.}}$$

**Power Factor (PF):**

For Wye:  $x = a, b, c, T$

For Delta:  $x = T$

$$PF_x = \frac{W_x}{VA_x}$$

**Total Average Power Factor:**

$x =$  Quadrants 1 & 4 (positive Wh), Quadrants 2 & 3 (negative Wh)

$$PF_{T\_Avg_x} = \frac{Wh_x}{VAh_x}$$

**Phase Angles:**

$x = a, b, c$

$$\angle_x = \cos^{-1}(PF_x)$$

% Total Harmonic Distortion (%THD):

For Wye:  $x = v_a, v_b, v_c, i_a, i_b, i_c$

For Delta:  $x = i_a, i_b, i_c, v_{ab}, v_{bc}, v_{ca}$

$$THD = \frac{\sqrt{\sum_{h=2}^{127} (RMS_{x_h})^2}}{RMS_{x_1}}$$

K Factor:

$x = i_a, i_b, i_c$

$$KFactor = \frac{\sum_{h=1}^{127} (h \cdot RMS_{x_h})^2}{\sum_{h=1}^{127} (RMS_{x_h})^2}$$

Voltage Imbalance: N = number of samples

$$Imb_v = \frac{\sqrt{\frac{\sum (v_a + v_b + v_c)^2}{N}}}{RMS_{v_a} + RMS_{v_b} + RMS_{v_c}}$$

Current Imbalance:

$$Imb_i = \frac{RMS_{I_{Calc}}}{RMS_{I_A} + RMS_{I_B} + RMS_{I_C}}$$



## 12.2: Demand Integrators

Power utilities take into account both energy consumption and peak demand when billing customers. Peak demand, expressed in kilowatts (kW), is the highest level of demand recorded during a set period of time, called the interval. The Nexus® 1262/1272 supports the following most popular conventions for averaging demand and peak demand: Block Window Demand, Rolling Window Demand, Thermal Demand, and Predictive Window Demand. You can program and access all conventions concurrently with the CommunicatorPQA® software (see the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual*).

### **Block (Fixed) Window Demand:**

This convention records the average (arithmetic mean) demand for consecutive time intervals (usually 15 minutes).

Example: A typical setting of 15 minutes produces an average value every 15 minutes (at 12:00, 12:15, 12:30, etc.) for power reading over the previous fifteen minute interval (11:45-12:00, 12:00-12:15, 12:15-12:30, etc.).

### **Rolling (Sliding) Window Demand:**

Rolling Window Demand functions like multiple overlapping Block Window Demands. The programmable settings provided are the number and length of demand subintervals. At every subinterval, an average (arithmetic mean) of power readings over the subinterval is internally calculated. This new subinterval average is then averaged (arithmetic mean), with as many previous subinterval averages as programmed, to produce the Rolling Window Demand.

Example: With settings of 3 five-minute subintervals, subinterval averages are computed every 5 minutes (12:00, 12:05, 12:10, etc.) for power readings over the previous five-minute interval (11:55-12:00, 12:00-12:05, 12:05-12:10, 12:10-12:15, etc.). Further, every 5 minutes, the subinterval averages are averaged in groups of 3 (12:00, 12:05, 12:10, 12:15, etc.) to produce a fifteen (5x3) minute average every 5 minutes (rolling (sliding) every 5 minutes) (11:55-12:10, 12:00-12:15, etc.).

**Thermal Demand:**

Traditional analog Watt-hour (Wh) meters use heat-sensitive elements to measure temperature rises produced by an increase in current flowing through the meter. A pointer moves in proportion to the temperature change, providing a record of demand. The pointer remains at peak level until a subsequent increase in demand moves it again, or until it is manually reset. The Nexus® 1262/1272 mimics traditional meters to provide Thermal Demand readings.

Each second, as a new power level is computed, a recurrence relation formula is applied. This formula recomputes the thermal demand by averaging a small portion of the new power value with a large portion of the previous thermal demand value. The proportioning of new to previous is programmable, set by an averaging interval. The averaging interval represents a 90% change in thermal demand to a step change in power.

**Predictive Window Demand:**

Predictive Window Demand enables the user to forecast average demand for future time intervals. The Nexus® uses the delta rate of change of a Rolling Window Demand interval to predict average demand for an approaching time period. The user can set a relay or alarm to signal when the Predictive Window reaches a specific level, thereby avoiding unacceptable demand levels. The Nexus® 1250/1252 calculates Predictive Window Demand using the following formula:

Example: Using the previous settings of 3 five-minute intervals and a new setting of 120% prediction factor, the working of the Predictive Window Demand could be described as follows:

At 12:10, we have the average of the subintervals from 11:55-12:00, 12:00-12:05 and 12:05-12:10. In five minutes (12:15), we will have an average of the subintervals 12:00-12:05 and 12:05-12:10 (which we know) and 12:10-12:15 (which we do not yet know). As a guess, we will use the last subinterval (12:05-12:10) as an approximation for the next subinterval (12:10-12:15). As a further refinement, we will assume that the next subinterval might have a higher average (120%) than the last subinterval. As we progress into the subinterval, (for example, up to 12:11), the Predictive Window Demand will be the average of the first two subintervals (12:00-12:05, 12:05-12:10), the actual values of the current subinterval (12:10-12:11) and

the prediction for the remainder of the subinterval, 4/5 of the 120% of the 12:05-12:10 subinterval.

# of Subintervals = n

Subinterval Length = Len

Partial Subinterval Length = Cnt

Prediction Factor = Pct

|                  |  |                  |                  |         |         |
|------------------|--|------------------|------------------|---------|---------|
| Sub <sub>n</sub> |  | Sub <sub>1</sub> | Sub <sub>0</sub> | Partial | Predict |
| Len              |  | Len              | Len              | Cnt     | Len     |

$$Sub = \frac{\sum_{i=0}^{Len-1} Value_i}{Len}$$

$$Partial = \frac{\sum_{i=0}^{Cnt-1} Value_i}{Cnt}$$

$$\left[ Partial + \frac{\sum_{i=0}^{n-2} Value_i}{n} \right] \times \left[ 1 - \left[ \frac{Len - Cnt}{Len} \right] \times Pct \right]$$

---

$$+ \left[ \frac{\sum_{i=0}^{n-2} Sub_i}{n-1} + \frac{Sub_0 - Sub_{n-1}}{2x(n-1)} \right] \times \left[ \left[ \frac{Len - Cnt}{Len} \right] \times Pct \right]$$

# 13: EN 50160/IEC 61000-4-15 Flicker

## 13.1: Overview

Flicker is the sensation experienced by the human visual system when subjected to changes in the illumination intensity of light sources. The primary effects of Flicker are headaches and irritability; sometimes Flicker can trigger epileptic fits.

IEC 61000-4-15 and former IEC868 describe the methods used to determine Flicker severity. Since this phenomenon is strictly related to the sensitivity and reaction of individuals, it can only be studied on a statistical basis, by setting up suitable experiments among people.

## 13.2: Theory of Operation

Flicker can be caused by voltage variations which, in turn, are caused by variable loads, such as arc furnaces, laser printers and microwave ovens. In order to model the eye brain change, which is a complex physiological process, the signal from the power network has to be processed while conforming with Figure 13.1, shown on page 13-4.

- Block 1 consists of scaling circuitry and an automatic gain control function that normalizes input Voltages to Blocks 2, 3 and 4. For the specified 50 Hz operation, the Voltage standard is 230 V RMS.
- Block 2 recovers the Voltage fluctuation by squaring the input Voltage scaled to the reference level. This simulates the behavior of a lamp.
- Block 3 is composed of a cascade of two filters and a measuring range selector. In this implementation, a log classifier covers the full scale in use so the gain selection is automatic and not shown here. The first filter eliminates the DC component and the double mains frequency components of the demodulated output. The configuration consists of a .05 Hz Low High Pass filter and a 6 Pole Butterworth Low Pass filter located at 35 Hz. The second filter is a weighting filter that simulates the response of the human visual system to sinusoidal Voltage fluctuations of a coiled filament, gas-filled lamp (60 W - 230 V). The filter implementation of this function is as specified in IEC 61000-4-15.

- Block 4 is composed of a squaring multiplier and a Low Pass filter. The Human Flicker Sensation via lamp, eye and brain is simulated by the combined non-linear response of Blocks 2, 3 and 4.
- Block 5 performs an online statistical cumulative probability analysis of the flicker level. Block 5 allows direct calculation of the evaluation parameters Pst and Plt.

Flicker is computed using the three phase-to-neutral Voltages in Wye configurations and the three phase-to-phase Voltages when in Delta. Evaluation occurs in the following forms: Instantaneous, Short Term or Long Term.

- Instantaneous Flicker Evaluation: An output of 1.00 from Block 4 corresponds to the Reference Human Flicker Perceptibility Threshold for 50% of the population. This value is measured in Perceptibility Units (PU) and is labeled Pinst. This is a real time value and it is continuously updated.
- Short Term Flicker Evaluation: An output of 1.00 from Block 5 (corresponding to the Pst value) corresponds to the conventional threshold of irritability per IEC 1000-3-3. In order to evaluate flicker severity, two parameters have been defined: one for the short term called Pst (defined in this section) and one for the long term called Plt (defined in the next section).

The standard measurement time for Pst is 10 minutes. Pst is derived from the time at level statistics obtained from the level classifier in Block 5 of the flicker meter.

The following formula is used:

$$P_{st} = \sqrt{0.0314P_{0.1s} + 0.0525P_{1s} + 0.0657P_{3s} + 0.28P_{10s} + 0.08P_{50s}}$$

,where the percentiles P(0.1), P(1), P(3), P(10), P(50) are the flicker levels exceeded for 0.1, 1, 2, 20 and 50% of the time during the observation period. The suffix S in the formula indicates that the smoothed value should be used. The smoothed values are obtained using the following formulas:

$$P(1s) = (P(.7) + P(1) + P(1.5))/3$$

$$P(3s) = (P(2.2) + P(3) + P(4))/3$$

$$P(10s) = (P(6) + P(8) + P(10) + P(13) + P(17))/5$$

$$P(50s) = (P(30) + P(50) + P(80))/3$$

The .3-second memory time constant in the flicker meter ensures that P(0.1) cannot change abruptly and no smoothing is needed for this percentile.

- Long Term Flicker Evaluation: The 10-minute period on which the short-term flicker severity is based is suitable for short duty cycle disturbances. For flicker sources with long and variable duty cycles (e.g. arc furnaces) it is necessary to provide criteria for long-term assessment. For this purpose, the long-term Plt is derived from the short-term values over an appropriate period. By definition, this is 12 short-term values of 10 minutes each over a period of 2 hours. The following formula is used:

$$P_{lt} = \sqrt[3]{\frac{\sum_{i=1}^N P_{sti}^3}{N}}$$

,where Psti (i = 1, 2, 3...) are consecutive readings of the short-term severity Pst.

### 13.2.1: Summary

**Flicker** = Changes in the illumination of light sources due to cyclical Voltage variations.

**Pinst** = Instantaneous flicker values in Perceptibility Units (PU).

**Pst** = Value based on 10-minute analysis.

**Plt** = Value based on 12 Pst values.

#### Measurement Procedure:

1. Original Signal with amplitude variations.
2. Square demodulator.
3. Weighted filter.
4. Low pass filter 1st order.
5. Statistical computing.

**Data available:**

- Pst, Pst Max, Pst Min values for long term recording
- Plt, Plt Max, Plt Min values for long term recording

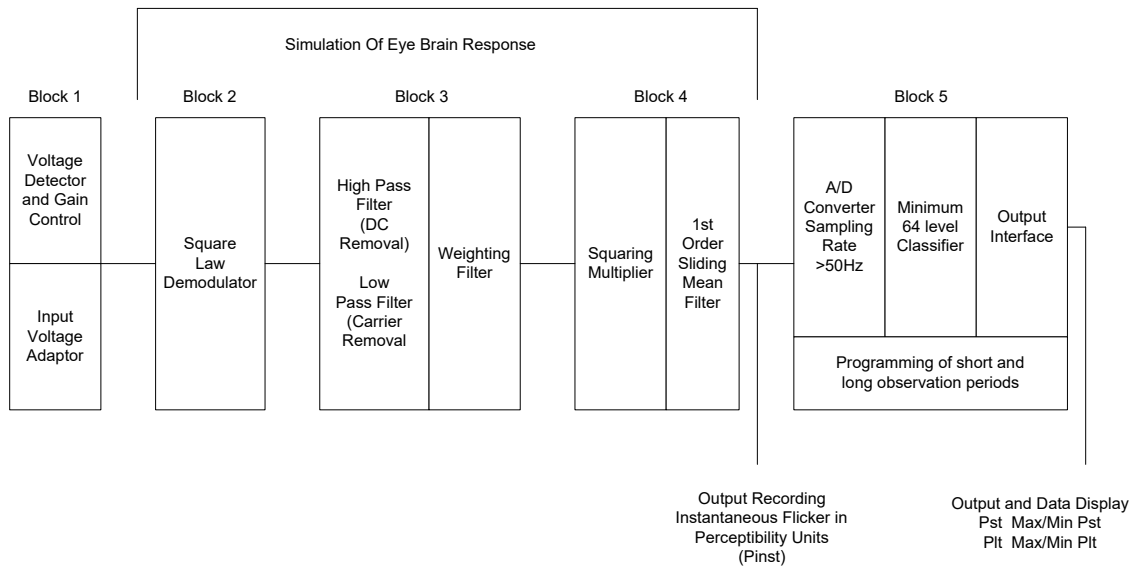


Figure 13.1: Simulation of Eye Brain Response

**13.3: Flicker Setup**

You must set up several parameters to properly configure Flicker.

1. Select the **Profile** icon from CommunicatorPQA® software's Icon bar.
2. From the Device Profile screen, double-click **Power Quality and Alarm Settings>EN 50160/IEC 61000-4-30 Flicker**. You will see the screen shown below.

The screenshot shows the 'EN50160 / IEC 61000-4-30 Flicker' configuration window with the following settings:

- Frequency:** 60 Hz
- Short term test time (PST):** 10 Minutes
- Long term test time (PLT):** 240 Minutes

Buttons: OK, Cancel, Help



- Select the Frequency of operation. 50 Hz is the approved frequency according to Flicker standards. A 60 Hz implementation is available and can be selected. Remember the Voltage is normalized. For 50 Hz, the normalized Voltage is 230 V and for 60 Hz, the normalized Voltage is 120 V.
- Select a Short Term Test Time (PST) time range from 1 to 10 minutes. The standard measurement period is nominally 10 minutes.
- Select a Long Term Test Time (PLT) time range from 1 to 240 minutes. The standard measurement is nominally 12 Pst periods (120 minutes). Plt time must always be equal to or great than and a multiple of Pst time. This is reflected in the available selections.

3. Click **OK** when you are finished.

### 13.4: Flicker Polling Screen

1. From the CommunicatorPQA® Title bar, select **Real-Time Poll>Power Quality and Alarms>Flicker**. You will see the screen shown below.

| Time               |                     | Instantaneous          |       | Short Term      | Long Term |
|--------------------|---------------------|------------------------|-------|-----------------|-----------|
| Start/Reset        | 10/17/2007 11:43:35 | PINST                  |       | Voltage Reading |           |
| Stop               | 00:00/0000 00:00:00 | Volts A                | 0.052 | 120.198V        |           |
| Current            | 01/29/2015 17:29:12 | Volts B                | 0.043 | 119.219V        |           |
| Next PST           | 0 min, 50 sec       | Volts C                | 0.026 | 120.142V        |           |
| Next PLT           | 150 min, 50 sec     |                        |       |                 |           |
| Status             |                     | Active                 |       |                 |           |
| Frequency          |                     |                        |       |                 |           |
| Base               | 60 Hz               |                        |       |                 |           |
| Current            | 60.077 Hz           |                        |       |                 |           |
| Base Voltage       | 120 Volts           |                        |       |                 |           |
| Flicker Monitoring |                     | Polling Flicker Status |       |                 |           |
| Start              | Stop                | Reset                  | OK    | Help            | Print     |

#### Main screen:

This section describes the Main Screen functions. These functions are found on the left side of the screen.

---

### Time:

- Start/Reset is the time when Flicker was started or reset. A Reset of Flicker causes the Max/Min values to be cleared and restarts the Flicker Pst and Plt timers. A Start of Flicker is also equivalent to a Reset in that the PST and PLT are restarted and the Max/Min Values are cleared.
- Stop corresponds to the time when Flicker is turned off.
- Current is the current clock time.
- Next Pst is the countdown time to when the next Pst value is available.
- Next Plt is the countdown time to when the next Plt value is available.

### Status:

- Indicates the current status: Active = On; Stopped = Off.

### Frequency:

- Base is the operating frequency (50 or 60 Hz) selected in the EN 50160 Flicker screen (see Section 13.3).
- Current is the real-time frequency measurement of the applied Voltage.

### Base Voltage:

- The normalized Voltage for the selected frequency (230 V for 50 Hz or 120 V for 60 Hz).

### Flicker Monitoring:

- Clicking on **Stop** causes Flicker to stop being processed and freezes all the current values. Stop Time is recorded and the current Max/Min values are cleared.
- Clicking on **Start** starts Flicker processing. Start Time is recorded.
- Clicking on **Reset** causes the Max/Min values to be cleared and restarts the Flicker Pst and Plt timers.

Use the tabs at the top of the screen to navigate to the Instantaneous, Short Term, and Long Term Readings views, shown on the right side of the screen.

### Instantaneous Readings:

**NOTE:** The Instantaneous view is the default of this screen. (See the screen pictured on the previous page.) If you are in the Short or Long Term views, click on the Instantaneous tab to display this view.

- The PU values, Pinst for Voltage Inputs Va, Vb and Vc are displayed here and are continuously updated. The corresponding Current Voltage values for each channel are displayed for reference.

### Short Term Readings:

Click on the Short Term tab to access a screen containing three groups of Pst readings (shown below).

| Time                           |                     | Instantaneous | Short Term | Long Term |
|--------------------------------|---------------------|---------------|------------|-----------|
| Start/Reset                    | 10/17/2007 11:43:35 |               |            |           |
| Stop                           | 00/00/0000 00:00:00 |               |            |           |
| Current                        | 01/29/2015 17:32:14 |               |            |           |
| Next PST                       | 7 min, 46 sec       |               |            |           |
| Next PLT                       | 147 min, 46 sec     |               |            |           |
| <b>Status</b>                  |                     |               |            |           |
| Active                         |                     |               |            |           |
| <b>Frequency</b>               |                     |               |            |           |
| Base                           | 60 Hz               |               |            |           |
| Current                        | 60.077 Hz           |               |            |           |
| Base Voltage 120 Volts         |                     |               |            |           |
| <b>Flicker Monitoring</b>      |                     |               |            |           |
| Polling Voltage and Frequency  |                     |               |            |           |
| Start Stop Reset OK Help Print |                     |               |            |           |

|             | PST    | Time                   |
|-------------|--------|------------------------|
| Volts A     | 0.252  | 01/29/2015 17:30:00.13 |
| Volts B     | 0.211  | 01/29/2015 17:30:00.13 |
| Volts C     | 0.169  | 01/29/2015 17:30:00.13 |
| Max Volts A | 42.985 | 07/30/2007 09:00:00.22 |
| Max Volts B | 43.007 | 07/30/2007 09:00:00.22 |
| Max Volts C | 42.848 | 07/30/2007 09:00:00.22 |
| Min Volts A | 0.023  | 08/01/2007 10:30:00.55 |
| Min Volts B | 0.023  | 08/01/2007 10:30:00.55 |
| Min Volts C | 0.023  | 08/01/2007 10:30:00.55 |

Pst Readings Displayed:

- Current Pst values for Va, Vb and Vc and the time of computation.
- Current Pst Max values for Va, Vb and Vc since the last reset and the time of the last reset.

- Current Pst Min values for Va, Vb and Vc since the last reset and the time of the last reset.

### Long Term Readings:

1. Click on the Long Term tab to access a screen containing three groups of Plt readings (shown below).

The screenshot shows the 'EN50160 / IEC 61000-4-30 Flicker' software interface. The 'Long Term' tab is selected, displaying a table of PLT readings. The table has two columns: 'PLT' and 'Time'. The rows show current PLT values and their corresponding times for Volts A, B, and C, as well as maximum and minimum values and their times.

| PLT         | Time   |
|-------------|--------|
| Volts A     | 0.256  |
| Volts B     | 0.222  |
| Volts C     | 0.175  |
| Max Volts A | 39.942 |
| Max Volts B | 39.986 |
| Max Volts C | 39.965 |
| Min Volts A | 0.023  |
| Min Volts B | 0.023  |
| Min Volts C | 0.023  |

Other visible data in the interface includes:

- Time:** Start/Reset: 10/17/2007 11:43:35; Stop: 00/00/0000 00:00:00; Current: 01/29/2015 17:32:59; Next PST: 7 min, 2 sec; Next PLT: 147 min, 2 sec.
- Status:** Active
- Frequency:** Base: 60 Hz; Current: 60.077 Hz
- Base Voltage:** 120 Volts
- Flicker Monitoring:** Start, Stop, Reset buttons.
- Buttons:** OK, Help, Print.

### Plt Readings Displayed:

- Current Plt values for Va, Vb and Vc and the time of computation.
  - Current Plt Max values for Va, Vb and Vc since the last reset and the time of the last reset.
  - Current Plt Min values for Va, Vb and Vc since the last reset and the time of the last reset.
2. Click **OK** to exit the EN 50160/IEC 61000-4-30 Flicker Polling screen; click **Print** to print all of the Readings views.

### 13.5: Logging

The Nexus® 1262/1272 meter is capable of logging Flicker values in an independent log. When Flicker is on, entries are made into the log in accordance with the times that associated values occur. Pst, Pst Max, Pst Min, Plt, Plt Max, Plt Min, Start/Reset and Stop times are all recorded. All values can be downloaded to the Log Viewer where they are available for graphing or export to another program, such as Excel. All Flicker values are pre-defined and cannot be changed. Refer to Chapter 8 of the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for additional instructions concerning the Flicker log.

### 13.6: Polling through a Communication Port

The Pinst, Pst, Pst Max, Pst Min, Plt, Plt Max, Plt Min values can be polled through the Communications Port. Refer to the Nexus® 1262/1272 meters' Modbus and DNP Mapping manuals for register assignments and data definitions.

### 13.7: Log Viewer

1. Open Log Viewer by selecting the **Open Logs** icon from CommunicatorPQA® software's Icon bar.
2. Using the menus at the top of the screen, select a meter, time ranges and values to access.
3. Click the **Flicker** icon.

The values and the associated time stamps (when the values occurred) are displayed in a grid box. Use the buttons at the bottom of the screen to create a graph or export the data to another program.

- Graphed values include Pst and Plt Va, Vb and Vc.
- Displayed values include Pst and Plt Max and Min for Va, Vb and Vc.

**NOTE:** Max and Min values are only displayed; they cannot be graphed. However, Max and Min values are available for export.

## 13.8: Performance Notes

Pst and Plt average time are synchronized to the clock (e.g. for a 10 minute average, the times will occur at 0, 10, 20, etc.). The actual time of the first average can be less than the selected period to allow for initial clock synchronization.

If the wrong frequency is chosen (e.g. 50 Hz selection for a system operating at 60 Hz), Flicker will still operate but the computed values will not be valid. Therefore, you should select the frequency setting with care.

User settings are stored. If Flicker is on and power is removed from the meter, Flicker will still be on when power returns. This can cause gaps in the logged data.

The Max and Min values are stored, and are not lost if the unit is powered down.

Flicker is defined using the requirements of IEC 61000-4-15 and former IEC 868 and is designed for survey purposes only. Refer to those specifications for more details, if needed. Meters with the Flicker option also are designed to the requirements for the IEC 61000-4-30 standards for Flicker for survey purposes only. Refer to chapters 16 and 17 in the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for additional information.

Operation is at 230 V for 50 Hz and 120 V for 60 Hz as per specification. If the input Voltage is different, the system will normalize it to 230 V or 120 V for computational purposes.

---

# A: Transformer Loss Compensation Spreadsheet and Examples

## A.1: Calculating Values

Transformer Loss Compensation is discussed in Chapter 8. Values for three element installations can be calculated in two ways:

### Through an Excel Spreadsheet:

1. Click the **TLC Calculator** button on the Transformer Loss screen of the meter's Device Profile. The TLC Calculator button activates an Excel Spreadsheet, but ONLY if you have MS Excel installed on your computer. A copy of the Excel Spreadsheet is shown on the following pages with example numbers.
2. Enter the required data into the Excel Spreadsheet. The Excel program will calculate the values needed for the Transformer Loss screen of the Device Profile.
3. Enter the values into the Device Profile.

### Manually:

1. Use the worksheet found in Chapter 8, "Three Element Loss Compensation Worksheet" to calculate the values by hand. Refer to the Notes under each section.
2. Enter values based on the transformer manufacturer's test report. The worksheet is progressive and notes under each section will guide you to the next section.
3. Enter the values into the Device Profile.

## A.2: Excel Spreadsheet with Example Numbers

If you have MS Excel installed in your computer, use the **TLC Calculator** button on the Transformer Loss screen of the Device Profile. Refer to the spreadsheet copies with example numbers, found on the following pages.

**IMPORTANT!** Refer to Appendix B of the *CommunicatorPQA®*, *MeterManagerPQA®*, and *EnergyPQA.com® Software User Manual* for additional instructions and information on the Transformer Line Loss application.

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**System Losses Summary** *EIG Loss Compensation Calculator*

Meter Correction Factors from this sheet are manually entered into EIG Communicator Software

Note: Begin Data Entry by Going to Xfmr Loss Sheet

|          |                                  |          |  |
|----------|----------------------------------|----------|--|
| Company: | Example 2 - EEI Handbook Example | Project  |  |
| Name:    |                                  | Location |  |
| Date:    |                                  |          |  |

Comments:

|   |
|---|
| Example of Loss Calculation that includes Transformer Losses, but no Substation or Line Losses. |
|   |

| Meter Correction Factors for Communicator Software |       | Loss Factors |        |   |
|--|-------|--------------|--------|---|
|  |       | Calc         | Used   |   |
| % No-Load Loss Watts                               | %LWFE | 2.16780      | 2.168  | Enter These Values in Communicator Software |
| % Full-Load Loss Watts                             | %LWCU | 0.02471      | 0.025  |   |
| % No-Load Loss VARs                                | %LVFE | 58.45983     | 58.460 |   |
| % Full-Load Loss VARs                              | %LVCU | 0.35639      | 0.356  |   |

| Losses Shifted to IT Primary |                         | per element | Total     | Unit |
|------------------------------|-------------------------|-------------|-----------|------|
| LWFE                         | Core-Loss Watts         | 78.04       | 234.12    | kW   |
| LVFE                         | Core-Loss VARs          | 2,104.55    | 6,313.65  | kVAr |
| LWCU                         | Watts Loss due to Cu    | 0.89        | 2.67      | kW   |
| LVCU                         | VA Rated Loss due to Cu | 12.83       | 38.49     | kVAr |
| VA <sub>nom</sub>            | Nominal Meter VA Rating |             | 10,800.00 | kVA  |

| Total System Losses |                          |  |              |            |               |
|---------------------|--------------------------|--|--------------|------------|---------------|
| total losses        |                          | Note: If no data entered in Line or Substation Loss sheets contribution to total is zero |              |            |               |
| Type                | Source                   |  | kWatts Loss  |            | kVAr Losses   |
| No-Load Losses      | Transformer Core         | NLW  | 28.68        | NLV        | 94.74         |
| Load Losses         | Transformer Windings     | FLW  | 56.03        | FLV        | 807.98        |
|                     | Transmission Line        | LLW  | 0.00         | LLV        | 0.00          |
|                     | Substation Conductors    | CLW  | 0.00         | CLV        | 0.00          |
|                     | <b>Total Load Losses</b> | <b>TLW</b>   | <b>56.03</b> | <b>TLV</b> | <b>807.98</b> |

| per element losses |                          |            |              |            |               |
|--------------------|--------------------------|------------|--------------|------------|---------------|
| Type               | Source                   |            | kWatts Loss  |            | kVAr Losses   |
| No-Load Losses     | Transformer Core         | NLW        | 9.56         | NLV        | 31.58         |
| Load Losses        | Transformer Windings     | FLW        | 18.68        | FLV        | 269.33        |
|                    | Transmission Line        | LLW        | 0.00         | LLV        | 0.00          |
|                    | Substation Conductors    | CLW        | 0.00         | CLV        | 0.00          |
|                    | <b>Total Load Losses</b> | <b>TLW</b> | <b>18.68</b> | <b>TLV</b> | <b>269.33</b> |

Comments:

|  |
|--|
|  |
|  |
|  |

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**Legend**

|                       |  |
|-----------------------|--|
| Information Only      |  |
| Required Data         |  |
| Calculated Value      |  |
| Data from other Sheet |  |
| Enter this Data       |  |
| Comments              |  |



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### Transformer Losses

### EIG Loss Compensation Calculator

|            |                          |                |  |
|------------|--------------------------|----------------|--|
| Company:   | Example 2 - EEI Handbook | Substation:    |  |
| Name:      |                          | Xmfr Bank No.: |  |
| Date:      |                          | Xmfr S/N:      |  |
| Xmfr Manf: |                          | Company Number |  |
| Winding    |                          |                |  |
| HV - High  |                          |                |  |
| XV - Low   |                          |                |  |
| YV - Tert. |                          |                |  |
| Comments:  |                          |                |  |
|            |                          |                |  |

#### Legend

- Information Only
- Required Data
- Calculated Value
- Data from other Sheet
- Enter this Data
- Comments

| Transformer Losses   |      | Losses      |          |      |
|----------------------|------|-------------|----------|------|
|                      |      | per Element | Total    | Unit |
| No Load VA           | NLVA | 32.9967     | 98.9901  | kVA  |
| No Load Watts        | NLW  | 9.5600      | 28.6800  | kW   |
| No-Load Loss VARs    | NLV  | 31.5815     | 94.7444  | kVAr |
| Full Load VA         | FLVA | 269.9730    | 809.9190 | kVA  |
| Full-Load Loss Watts | FLW  | 18.6757     | 56.0270  | kW   |
| Full-Load Loss VARs  | FLV  | 269.3263    | 807.9788 | kVAr |

| Power Transformer Data  |           | Watts Loss |             |            |       |
|-------------------------|-----------|------------|-------------|------------|-------|
| Value                   |           | Total      | per element | Calculated | kVA   |
| No Load Loss Watts      | LWFe      | 28,680.00  |             | 9,560.00   | 9.56  |
| Full Load Loss Watts    | LWCu      | 56,027.00  |             | 18,675.67  | 18.68 |
| % Exciting Current      | %Ix       | 0.99       |             |            |       |
| % Impedance             | %Z        | 8.1        |             |            |       |
| Transformer kVA Rating  | kVA Rated | 9,999.00   |             | 3,333.00   |       |
| Rated Primary L_L Volts | Vp        | 115,000    |             |            |       |

| Power Transformer - 3 Transformer bank |         | Line-to-Line |    | Line-to-Neut. |  |
|--|---------|--------------|----|---------------|--|
| V Secondary Side of Xmfr               | Vs      | 2520         | Vr | 1455          |  |
| Rated Transformer Current              | I Rated | 2291         |    |               |  |
| Wye or Delta Connection                |         | Wye          |    |               |  |

| Meter / Installation Data |             |            |            | Three Element Meter with 3 PT's and 3 CT's |  |
|---------------------------|-------------|------------|------------|--|--|
| Instrument Transformers   | Primary     | Secondary  | Multiplier |  |  |
| Voltage Xmfr              | 7200        | 120        | 60         |  |  |
| Current Xmfr              | 500         | 5          | 100        |  |  |
| Transformer Factor        | TF          | 6000       |            |  |  |
| Meter Voltage Rating      | VM          | 120        |            | 120 volts for Nexus                        |  |
| Meter Test Amps           | TA          | 2.5        |            | 2.5 amps for Nexus                         |  |
| Meter Class               | CL          | 20         |            | Nexus CL20                                 |  |
| Meter Form                | Fm          |            |            |  |  |
| <b>Nominal Current</b>    | <b>Inom</b> | <b>2.5</b> |            | <b>Typically .5 Class(10) or TA(2.5)</b>   |  |

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## Line Losses

### EIG Loss Compensation Calculator

Three Element Meter with 3 PT's and 3 CT's

Note: Leave Data Entry Cells Blank if not including Line Losses

|          |                          |                   |  |
|----------|--------------------------|-------------------|--|
| Company: | Example 2 - EEI Handbook | Substation:       |  |
| Name:    |                          | Stn Trf Bank No.: |  |
| Date:    |                          |                   |  |

|                            |  |
|----------------------------|--|
| Metering Point Information |  |
|                            |  |

| Line Losses       |     | Losses    |         | Unit |
|-------------------|-----|-----------|---------|------|
| Value             |     | per phase | Total   |      |
| Total Line Length |     |           | 0.0000  | Mile |
| Line Current      | Ip  |           | 50.1994 | Amp  |
| Line Loss Watts   | LLW | 0.0000    | 0.0000  | kW   |
| Line Loss VARs    | LLV | 0.0000    | 0.0000  | kVA  |

| Transmission Line Impedance Data |            |          |        |      |
|----------------------------------|------------|----------|--------|------|
| Value                            |            | per Unit | Total  | Unit |
| Resistance                       | R/unit     | 0.0000   |        | Ohms |
| Inductive Reactance              | XL/unit    | 0.0000   |        | Ohms |
| Length of Line                   | LL - Units | 0.0000   |        |      |
| Length Unit                      | U          | Mile     |        |      |
| Resistive Losses                 |            |          | 0.0000 | kW   |
| Inductive Losses                 |            |          | 0.0000 | kars |

Note: Please make sure data entered uses a consistent unit of length

| Adjustment for Line Charging Current |         |          |        |       |
|--------------------------------------|---------|----------|--------|-------|
| Value                                |         | per Unit | Total  | Unit  |
| Capacitive Reactance                 | XC-unit | 0.0000   | #REF!  | Ohms  |
| Charging Current per line            | Amps    |          | 0.0000 | Amps  |
| Capacitive Losses                    | kvar    |          | 0.0000 | kvars |

| Line Losses reflected to Secondary of PT |            | Losses    |        | Unit |
|--|------------|-----------|--------|------|
| Value                                    |            | per phase | Total  |      |
| Nominal Pri kVA Rating                   | VA mom-pri |           | 5.4783 | kVA  |
| Nominal Sec kVA Rating                   | VA mom-sec |           | 5.4783 | kVA  |
| Line Loss Watts                          | LLW        | #REF!     | #REF!  | kW   |
| Line Loss VARs                           | LLV        | 0.0000    | 0.0000 | kVA  |

| Transformer Data from Xmfr Loss Sheet |       |           |            |       |
|---------------------------------------|-------|-----------|------------|-------|
| Value                                 |       | per phase | Total      | Unit  |
| Transformer kVA Rating                | kvars | 3333.0000 | 9,999.00   | kvars |
| Rated Primary L_L Volts               | Vp    |           | 115,000.00 | Volts |

Note: This Data must be entered on Transformer Loss Sheet before completing Line Loss Calculation

|        |  |
|--------|--|
| Notes: |  |
|        |  |
|        |  |
|        |  |

**Legend**

|                       |  |
|-----------------------|--|
| Information Only      |  |
| Required Data         |  |
| Calculated Value      |  |
| Data from other Sheet |  |
| Enter this Data       |  |
| Comments              |  |

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### Substation Losses

### EIG Loss Compensation Calculator

Three Element Meter with 3 PT's and 3 CT's

Note: Leave Data Entry Cells Blank if not including Line Losses

|          |                          |                   |  |
|----------|--------------------------|-------------------|--|
| Company: | Example 2 - EEI Handbook | Substation:       |  |
| Name:    |                          | Stn Trf Bank No.: |  |
| Date:    |                          |                   |  |

|                        |   |
|------------------------|---|
| Substation Information | Example of Loss Calculation that includes Transformer, Substation, and Line Losses. |
|------------------------|---|

| Line Losses                |     | Losses   |             | Unit |
|----------------------------|-----|----------|-------------|------|
|                            |     | Total    | per Element |      |
| Total Conductor Length     |     | 0.00     |             | FT   |
| Secondary Current @ Rating | Ir  | 2290.843 |             | Amp  |
| Conductor Loss Watts       | CLW | 0.000    | 0.000       | kW   |
| Conductor Loss VArS        | CLV | 0.000    | 0.000       | kVA  |

| Transmission Line Impedance Data |    |          |
|----------------------------------|----|----------|
| Value                            |    | per Unit |
| Resistance                       |    | 0.000000 |
| Inductive Reactance              | x  | 0.000000 |
| Length of Conductor              | CL | 0.00     |
| Length Unit                      | U  | FT       |

**Legend**

- Information Only
- Required Data
- Calculated Value
- Data from other Sheet
- Enter this Data
- Comments

Note: This Data must be entered on Transformer Loss Sheet before completing Substation Loss Calculation

| Transformer Data from Xmfr Loss Sheet |      |       |           |
|---------------------------------------|------|-------|-----------|
| Value                                 |      |       |           |
| Transformer kVA Rating                | kVAr | 9,999 | 3333.0000 |
| Rated Secondary L <sub>N</sub> Volts  | Vr   | 1,455 |           |

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# Glossary

|                                      |   |
|--------------------------------------|---|
| 0.2 Second Values:                   | These values are the RMS values of the indicated quantity as calculated after approximately 200 milliseconds (3 cycles) of sampling.  |
| 1 Second Values:                     | These values are the RMS values of the indicated quantity as calculated after one second (60 cycles) of sampling.   |
| Alarm:                               | An event or condition in a meter that can cause a trigger or call-back to occur.  |
| Annunciator:                         | A short label that identifies particular quantities or values displayed, for example kWh.   |
| Average (Current):                   | <p>When applied to current values (amperes) the average is a calculated value that corresponds to the thermal average over a specified time interval.</p> <p>The interval is specified by the user in the meter profile. The interval is typically 15 minutes.</p> <p>So, Average amperes is the thermal average of amperes over the previous 15 minute interval.</p> <p>The thermal average rises to 90% of the actual value in each time interval. For example, if a constant 100 A load is applied, the thermal average will indicate 90 A after one time interval, 99 A after two time intervals and 99.9 A after three time intervals.</p> |
| Average (Input Pulse Accumulations): | When applied to Input Pulse Accumulations, the "Average" refers to the block (fixed) window average value of the input pulses.  |

|                              |  |
|------------------------------|--|
| Average (Power):             | <p>When applied to power values (watts, VARs, VA), the average is a calculated value that corresponds to the thermal average over a specified time interval.</p> <p>The interval is specified by the user in the meter profile. The interval is typically 15 minutes. So, the Average watts is the thermal average of watts over the previous 15 minute interval. The thermal average rises to 90% of the actual value in each time interval. For example, if a constant 100 kW load is applied, the thermal average will indicate 90 kW after one time interval, 99 kW after two time intervals and 99.9k W after three time intervals.</p> |
| Bit:                         | <p>A unit of computer information equivalent to the result of a choice between two alternatives (Yes/No, On/Off, for example).</p> <p>Or, the physical representation of a bit by an electrical pulse whose presence or absence indicates data.</p>  |
| Binary:                      | <p>Relating to a system of numbers having 2 as its base (digits 0 and 1).</p>  |
| Block Window Avg<br>(Power): | <p>The Block (Fixed) Window Average is the average power calculated over a user-set time interval, typically 15 minutes. This calculated average corresponds to the demand calculations performed by most electric utilities in monitoring user power demand. (See Rolling Window Average.)</p>  |

|                     |   |
|---------------------|---|
| Byte:               | A group of 8 binary digits processed as a unit by a computer (or device) and used especially to represent an alphanumeric character.  |
| CBEMA Curve:        | A Voltage quality curve established originally by the Computer Business Equipment Manufacturers Association. The CBEMA Curve defines Voltage disturbances that could cause malfunction or damage in microprocessor devices. The curve is characterized by Voltage magnitude and the duration which the Voltage is outside of tolerance. (See ITIC Curve.) |
| Channel:            | The storage of a single value in each interval in a load profile.   |
| Cold Load Pickup    | This value is the delay from the time control power is restored to the time when the user wants to resume demand accumulation.  |
| CRC Field:          | Cyclic Redundancy Check Field (Modbus communication) is an error checksum calculation that enables a Slave device to determine if a request packet from a Master device has been corrupted during transmission. If the calculated value does not match the value in the request packet, the Slave ignores the request.                                    |
| CT (Current) Ratio: | A Current Transformer Ratio is used to scale the value of the current from a secondary value up to the primary side of an instrument transformer.   |

|                    |  |
|--------------------|--|
| Cumulative Demand: | The sum of the previous billing period maximum demand readings at the time of billing period reset. The maximum demand for the most recent billing period is added to the previously accumulated total of the maximum demands. |
| Demand:            | The average value of power or a similar quantity over a specified period of time.  |
| Demand Interval:   | A specified time over which demand is calculated.  |
| Display:           | User-configurable visual indication of data in a meter.  |
| DNP3:              | A robust, non-proprietary protocol based on existing open standards. DNP3 is used to operate between various systems in electric and other utility industries and SCADA networks.  |
| EEPROM:            | Nonvolatile memory; Electrically Erasable Programmable Read Only Memory that retains its data during a power outage without need for a battery. Also refers to meter's FLASH memory.   |
| Energy Register:   | Programmable record that monitors any energy quantity. Example: watt hours, VAR hours, VA hours.   |



|                   |  |
|-------------------|--|
| Ethernet:         | A type of LAN network connection that connects two or more devices on a common communications backbone. An Ethernet LAN consists of at least one hub device (the network backbone) with multiple devices connected to it in a star configuration. The most common versions of Ethernet in use are 10BaseT and 100BaseT as defined in IEEE 802.3 standards. However, several other versions of Ethernet are also available. |
| Flicker:          | Flicker is the sensation that is experienced by the human visual system when it is subjected to changes occurring in the illumination intensity of light sources. IEC 61000-4-15 and former IEC 868 describe the methods used to determine Flicker severity.   |
| Harmonics:        | Measuring values of the fundamental current and Voltage and percent of the fundamental.  |
| I2T Threshold:    | Data will not accumulate until current reaches programmed level.   |
| Integer:          | Any of the natural numbers, the negatives of those numbers, or zero.   |
| Internal Modem:   | An optional modem within the meter's enclosure that connects to the RJ11 telephone connector.  |
| Invalid Register: | In the Nexus® meter's Modbus Map there are gaps between Registers. For example, the next Register after 08320 is 34817. Any unmapped Register stores no information and is said to be invalid.   |

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| ITIC Curve:     | An updated version of the CBEMA Curve that reflects further study into the performance of microprocessor devices. The curve consists of a series of steps but still defines combinations of Voltage magnitude and duration that will cause malfunction or damage.                                    |
| Ke:             | kWh per pulse; i.e. the energy.  |
| kWh:            | Kilowatt hours; kW x demand interval in hours.   |
| KYZ Output:     | Output where the rate of changes between 1 and 0 reflects the magnitude of a metered quantity.   |
| LCD:            | Liquid Crystal Display.  |
| LED:            | Light Emitting Diode.  |
| Maximum Demand: | The largest demand calculated during any interval over a billing period.   |
| Modbus ASCII:   | Alternate version of the Modbus protocol that utilizes a different data transfer format. This version is not dependent upon strict timing, as is the RTU version. This is the best choice for telecommunications applications (via modems).  |
| Modbus RTU:     | The most common form of Modbus protocol. Modbus RTU is an open protocol spoken by many field devices to enable devices from multiple vendors to communicate in a common language. Data is transmitted in a timed binary format, providing increased throughput and therefore, increased performance. |

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| Network:      | A communications connection between two or more devices to enable those devices to send to and receive data from one another. In most applications, the network is either a serial type or a LAN type.  |
| NVRAM:        | Nonvolatile Random Access Memory: able to keep the stored values in memory even during the loss of circuit or control power. High speed NVRAM is used in the Nexus® meter to gather measured information and to insure that no information is lost. |
| Optical Port: | A port that facilitates infrared communication with a meter. Using an ANSI C12.13 Type II magnetic optical communications coupler and an RS232 cable from the coupler to a PC, the meter can be programmed with CommunicatorPQA® software.          |
| Packet:       | A short fixed-length section of data that is transmitted as a unit. Example: a serial string of 8-bit bytes.  |
| Percent THD:  | Percent Total Harmonic Distortion. (See THD.)   |
| Protocol:     | A language that is spoken between two or more devices connected on a network.   |
| PT Ratio:     | Potential Transformer Ratio used to scale the value of the Voltage to the primary side of an instrument transformer. Also referred to as VT Ratio.  |

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| Pulse:   | The closing and opening of the circuit of a two-wire pulse system or the alternate closing and opening of one side and then the other of a three wire system (which is equal to two pulses).   |
| Q Readings:  | Q is the quantity obtained by lagging the applied voltage to a wattmeter by 60 degrees. Values are displayed on the Uncompensated Power and Q Readings screen.   |
| Quadrant<br>(Programmable Values and<br>Factors on the Nexus <sup>®</sup><br>meter:) | <p>Watt and VAR flow is typically represented using an X-Y coordinate system. The four corners of the X-Y plane are referred to as quadrants. Most power applications label the right hand corner as the first quadrant and number the remaining quadrants in a counter-clockwise rotation. Following are the positions of the quadrants:</p> <p>1st - upper right, 2nd - upper left, 3rd - lower left and 4th - lower right.</p> <p>Power flow is generally positive in quadrants 1 and 4.</p> <p>VAR flow is positive in quadrants 1 and 2.</p> <p>The most common load conditions are:</p> <p>Quadrant 1 - power flow positive, VAR flow positive, inductive load, lagging or positive power factor;</p> <p>Quadrant 2 - power flow negative, VAR flow positive, capacitive load, leading or negative power factor.</p> |
| Register:  | An entry or record that stores a small amount of data.   |

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| Register Rollover:              | A point at which a register reaches its maximum value and rolls over to zero.   |
| Reset:                          | Logs are cleared or new (or default) values are sent to counters or timers.   |
| Rolling Window Average (Power): | The Rolling (Sliding) Window Average is the average power calculated over a user-set time interval that is derived from a specified number of sub-intervals, each of a specified time. For example, the average is calculated over a 15 minute interval by calculating the sum of the average of three consecutive 5 minute intervals. This demand calculation methodology has been adopted by several utilities to prevent customer manipulation of kW demand by simply spreading peak demand across two intervals.                            |
| RS232:                          | <p>A type of serial network connection that connects two devices to enable communication between the devices. An RS232 connection connects only two points. Distance between devices is typically limited to fairly short runs.</p> <p>Current standards recommend a maximum of 50 feet but some users have had success with runs up to 100 feet.</p> <p>Communications speed is typically in the range of 1200 bits per second to 57,600 bits per second. RS232 connection can be accomplished using Port 1 of the Nexus® 1250/1252 meter.</p> |
| RS485:                          | A type of serial network connection that connects two or more devices to enable communication between the devices. An RS485 connection allows multi-drop communication from one to many points.   |

Distance between devices is typically limited to around 2,000 to 3,000 wire feet.

Communications speed is typically in the range of 120 bits per second to 115,000 bits per second.

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| Sag:             | A Voltage quality event during which the RMS Voltage is lower than normal for a period of time, typically from 1/2 cycle to 1 minute.  |
| Secondary Rated: | Any Register or pulse output that does not use any CT or PT(VT) Ratio.   |
| Serial Port:     | The type of port used to directly interface with a device using the RS232 standard.  |
| Swell:           | A Voltage quality event during which the RMS Voltage is higher than normal for a period of time, typically from 1/2 cycle to 1 minute.   |
| TDD:             | <p>The Total Demand Distortion of the current waveform. The ratio of the root-sum-square value of the harmonic current to the maximum demand load current. (See equation below.)</p> <p><b>NOTE:</b> The TDD displayed in the Harmonics screen is calculated by CommunicatorPQA® software, using the Max Average Demand.</p> |

$$1TDD = \sqrt{\frac{I_2^2 + I_3^2 + I_4^2 + I_5^2 + \dots \times 100\%}{I_L}}$$

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| THD:                 | Total Harmonic Distortion is the combined effect of all harmonics measured in a Voltage or current. The THD number is expressed as a percent of the fundamental. For example, a 3% THD indicates that the magnitude of all harmonic distortion measured equals 3% of the magnitude of the fundamental 60 Hz quantity. The THD displayed is calculated by your Nexus® meter. |
| Time Stamp:          | A stored representation of the time of an event. Time Stamp can include year, month, day, hour, minute, second and Daylight Savings Time indication.  |
| TOU:                 | Time of Use.  |
| Uncompensated Power: | VA, Watt and VAR readings not adjusted by Transformer Loss Compensation.  |
| V2T Threshold:       | Data will stop accumulating when Voltage falls below programmed level.  |
| Voltage, Vab:        | Vab, Vbc, Vca are all Phase-to-Phase Voltage measurements. These Voltages are measured between the three phase Voltage inputs to the meter.   |
| Voltage, Van:        | Van, Vbn, Vcn are all Phase-to-Neutral Voltages applied to the monitor. These Voltages are measured between the phase Voltage inputs and Vn input to the meter. Technologically, these Voltages can be "measured" even when the meter is in a Delta configuration and there is no connec-   |

tion to the Vn input. However, in this configuration, these Voltages have limited meaning and are typically not reported.

Voltage Imbalance/Unbalance: As defined by National Equipment Manufacturer's Association (NEMA), the formula for voltage unbalance is:

$$\text{VoltageUnbalance} = \frac{\text{Maximum deviation from the mean of } V_{ab}, V_{bc}, V_{ca}}{\text{Mean of } V_{ab}, V_{ac}, V_{ca}}$$

Voltage Quality Event: An instance of abnormal Voltage on a phase. The events the meter tracks include sags, swells, interruptions and imbalances.

VT Ratio: The Voltage Transformer Ratio is used to scale the value of the Voltage to the primary side of an instrument transformer. Also referred to as PT Ratio.

Voltage, Vaux This is the fourth Voltage input measured from between the Vaux and Vref inputs. This input can be scaled to any value. However, the actual input Voltage to the meter should be of the same magnitude as the Voltages applied to the Va, Vb and Vc terminals.