User Manual

FUTURA + SERIES

- Installation
- Operation
- Programming

Multifunction Digital Power Monitor

Electro Industries/GaugeTech
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Installation, Operation
and Faceplate Programming Manual
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Table of Contents

PART I: INSTALLATION & OPERATION

Chapter 1 AC Power Measurement 1

1.1 Single Phase System 1
1.2 Three-Phase System 2
1.3 Consumption, Demand and Poor Power Factor 3
1.4 Waveform and Harmonics 4

Chapter 2 Mechanical Installation 5

2.1 Explanation of Symbols 5
2.2: Mechanical Installation 5

Chapter 3 Electrical Installation 9

3.1: Important Considerations When Installing Meters 9
3.2 Connecting the Current Circuit 10
3.3 CT Hookup 10
3.4 Connecting the Voltage Circuit 11
3.5 Selecting the Voltage Fuses 11
3.6 Connection to the Main Power Supply 12
3.7 Electrical Connection Installation 12
3.8 Helpful Debugging Tools 16

Chapter 4 Communication Installation 17

4.1 RS232C 17
4.2 RS485 17
4.3 Network of Instruments and Long Distance Communication 23
4.4 Compatible Software (Optional) 23
4.5 Connection Diagram for Modem to EI Device 24

PART II: DISPLAY MODULES

Chapter 5 P14 and P15 Optional Display Overview 27

5.1 Accessing KW, KWD, KWH or KVAR, KVARD, KVARH 27
5.2 Resetting KWD/KWH or KVARD/KVARH 28
5.3 Accessing LM1/LM2 Set Limits for KW/KVAR 29
5.4 LED Test 29

Chapter 6 P31 and P32 Optional Display Overview 31

6.1 Accessing Max/Min Values 31
6.2 Resetting Max/Min Values 32
6.3 Firmware Version/LED Test 33

Chapter 7 P33 Optional Display Overview 35

7.1 Accessing Max/Min Values 35
7.2 Resetting Max/Min Values 36
7.3 Firmware Version/LED Test 37

Chapter 8 P34 Optional Display Overview 39

8.1 Accessing the Power Functions 39
8.2 Accessing Voltage and Current Phases 40
8.3 Accessing %THD Functions 40
8.4 Accessing Max/Min Values 41
8.5 Resetting Values 41

8.6 Accessing the LM1/LM2 Set Limits 44
8.7 Voltage Phase Reversal and Imbalance 44
8.8 Access Modes 45
8.9 Print Operating Data 45
8.10 Print Programming Data 46
8.11 Firmware Version/LED Test 47

PART III: FACEPLATE PROGRAMMING THE P34 DISPLAY

Chapter 9 Faceplate Programming Overview 49
9.1 General Procedure 49
9.2 Password Entry 50
9.3 Selecting Groups and Functions 51
9.4 Data Entry 52
9.5 Checksum Error—Protective Mechanism 52
9.6 Exiting Programming Mode 53

Chapter 10 Programming Group 0—Global Meter Setup 55
10.1 Group 0, Function 0—Integration Interval 55
10.2 Group 0, Function 1—Meter Address 56
10.3 Group 0, Function 2—Baud Rate 57
10.4 Group 0, Function 3—System Configuration 58
10.4.A Open Delta System Installation Programming 59
10.4.B Switch Communication Protocols 59
10.4.C Printing Option 60
10.5 Group 0, Function 7—Number of Phases 61

Chapter 11 Programming Group 1—Volt, Amp and WATT Full Scale Settings 63
11.1 Group 1, Function 0—Voltage Full Scale 63
11.2 Group 1, Function 1—Amperage Full Scale 65
11.3 Group 1, Function 2—WATTS Scale and Decimal Placement 67

Chapter 12 Programming Group 2—Meter Calibration 69
12.1 Calibration Requirements 69
12.2 Group 2, Functions 0–8—High End Calibration of Voltage Channels, High and Low End Calibration of Amperage Channels 70

PART IV: OPTIONAL MODULES

Chapter 13 1mA0 and 20mA Analog Output Modules 73
13.1 0–1mA Analog Output Module 73
13.2 4–20mA Analog Output Module 74
13.3 Standard Factory Setup 74
13.4 DC-Output Chart 75
13.5 DC-Output Programming and Calibration 76
13.6 Formulas for DC Output 76

Chapter 14 Relay and Input-Sensing Using the L-100 I/O Module 81
14.1 Input Status Contacts 81
14.2 Internal Relay Activation 83

Chapter 15 Relay and Input-Sensing Using the L-200/L-200 KYZ I/O Modules 85
15.1 Outputs 86
15.2 Sense Inputs 86

Part I: Installation & Operation

CHAPTER 1
AC POWER MEASUREMENT

The economics of electric power distribution networking dictate several configurations of AC power transmission. The number of phases and voltage levels characterize these configurations.

1.1: Single Phase System

A **single phase system** is a basic two-wire system used in low power distribution applications, such as residential communities or offices. Typically, the voltage is 120V AC. For higher power requirements, such as small commercial facilities, the typical power configuration is two lines of 120V AC opposite in phase (see **Figure 1.1 B,** below).

This system produces 120 volts from line to neutral for lighting and small appliance use. The line-to-line voltage is 240V AC, used for higher loads such as water heaters, electric dryers, ranges and machinery.

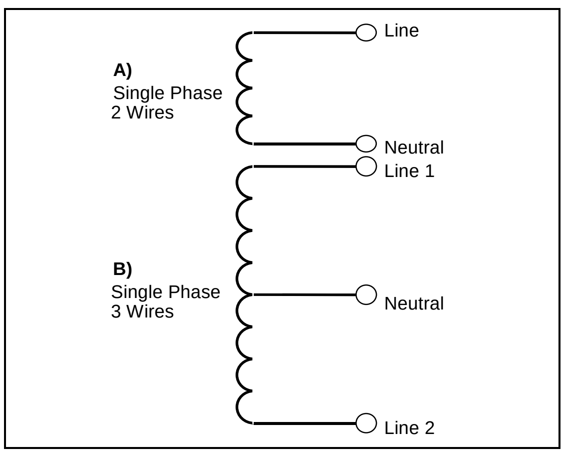


Figure 1.1: Single Phase System: (A) Two-Wire, (B) Three-Wire

The power (**W**) in a single phase system is: $W = E \bullet I \bullet \cos\Theta$
E = potential, **I** = current, and **cosΘ** = phase difference between the potential and the current.

Power in a 120/240V AC system is: $W = (E_{Line1} \bullet I_{Line1} \bullet \cos\Theta) + (E_{Line2} \bullet I_{Line2} \bullet \cos\Theta)$

Phase differential between the potential and the current results from a non-resistive load, either reactive or capacitive.

Reactive power (VAR): The additional power consumed that does not produce any work but must be delivered to the load: $VAR = E \cdot I \cdot sin\Theta$. This is a measure of the inefficiency of the electrical system.

Apparent power (VA): The total power delivered to the load, and the vector sum of real power and reactive power.

Power Factor (PF): The ratio between real power and apparent power: $PF = \frac{W}{VA} = \frac{W}{\sqrt{W^2 + VAR^2}}$

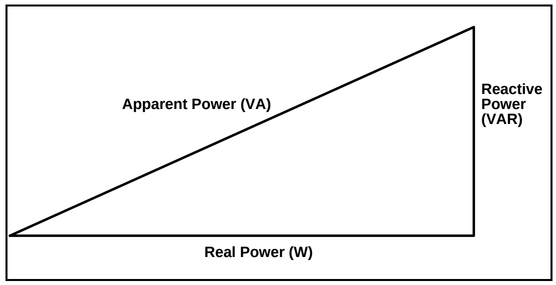


Figure 1.2: Apparent, Real and Reactive power.

Ideal power distribution should have a PF of 1. This condition can be met only if no reactive power loads exist. In real life applications, many loads are inductive loads. Often, corrective capacitors are installed to correct Poor Power Factor (see Section 1.3).

1.2: Three-Phase System

A **three-phase system** delivers higher levels of power for industrial and commercial applications; the three phases correspond to three potential lines. A 120° phase shift exists between the three potential lines.

A typical configuration has either a Delta connection or a Wye connection (see **Figure 1.3,** below).

In a three-phase system, the voltage levels between the phases and the neutral are uniform and defined by:

$$E_{an} = E_{bn} = E_{cn} = \frac{E_{ab}}{\sqrt{3}} = \frac{E_{bc}}{\sqrt{3}} = \frac{E_{ac}}{\sqrt{3}}$$

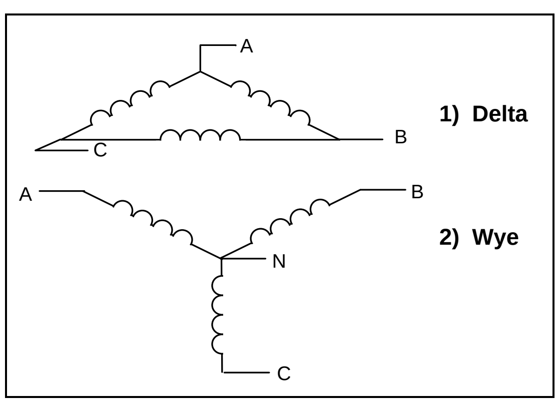


Figure 1.3: Three-Phase System: (1) Delta, (2) Wye

Voltages between the phases vary depending on loading factors and the quality of distribution transformers. The three-phase system is distributed in different voltage levels: 208V AC, 480V AC, 2400V AC, 4160V AC, 6900V AC, 13800V AC, and so on.

Power measurement in a poly phase system is governed by **Blondel's Theorem**. Blondel's Theorem states that in a power distribution network which has N conductors, the number of measurement elements required to determine power is N-1. A typical configuration of poly phase system has either a Delta connection or a Wye connection (see **Figure 1.4**, below).

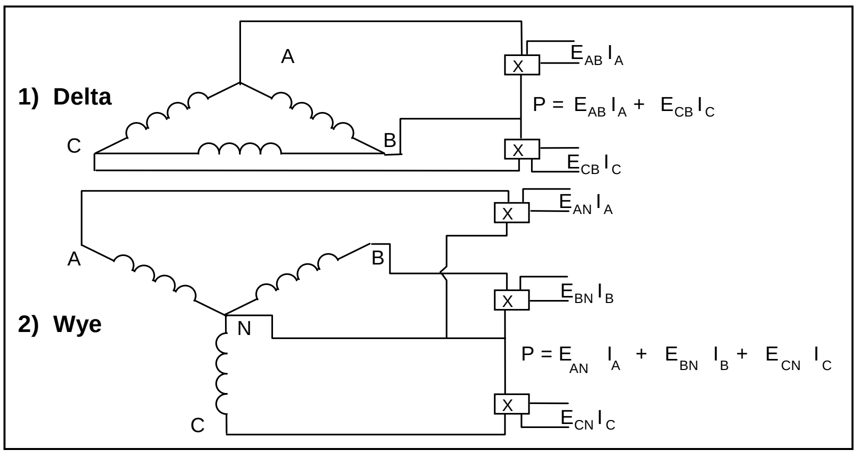


Figure 1.4: Poly Phase System: (1) Delta, (2) Wye

1.3: Consumption, Demand and Poor Power Factor

CONSUMPTION: $WH = W \times T$ **W** = instantaneous power **T** = time in hours
The total electric energy usage over a time period is the consumption of WH.

Typically, the unit in which consumption is specified is the **kilowatt-hour** (KWH): one thousand watts consumed over one hour. Utilities use the **WH** equation to determine the overall consumption in a billing period.

DEMAND: Average energy consumed over a specified time interval. The interval is determined by the utility, typically 15 or 30 minutes. The utility measures the maximum demand over a billing period. This measurement exhibits a deviation from average consumption causing the utility to provide generating capacity to satisfy a high maximum consumption demand. The highest average demand is retained in the metering system until the demand level is reset.

POOR POWER FACTOR: Results in reactive power consumption. Transferring reactive power over a distribution network causes energy loss. To force consumers to correct their Power Factor, utilities monitor reactive power consumption and penalize the user for Poor Power Factor.

1.4: Waveform and Harmonics

Ideal power distribution has sinusoidal waveforms on voltages and currents. In real-life applications, where inverters, computers, and motor controls are used, distorted waveforms are generated. These distortions consist of harmonics of the fundamental frequency.

SINUSOIDAL WAVEFORM: $A \bullet \sin(\omega \cdot t)$

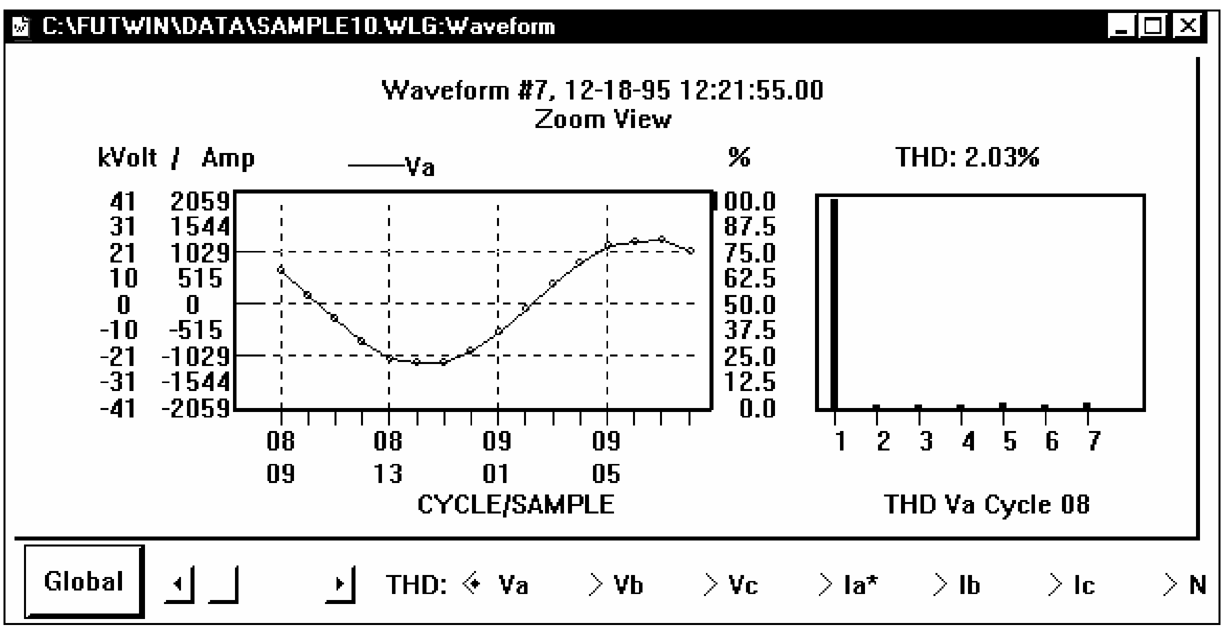
DISTORTED WAVEFORM: $A \bullet \sin(\omega \bullet t) + A_1 \bullet \sin(\omega_1 \bullet t) + A_2 \bullet \sin(\omega_2 \bullet t) + A_3 \bullet \sin(\omega_3 \bullet t) + \cdots$

TOTAL HARMONIC DISTORTION (THD):

$$\%\ \text{of THD} = \frac{\text{RMS of Total Harmonic Distortion Signal}}{\text{RMS of the Fundamental Signal}} \times 100$$

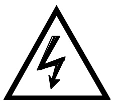
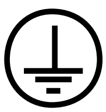
HARMONIC DISTORTION: A destructive force in power distribution systems. It creates safety problems, shortens the life span of distribution transformers, and interferes with the operation of electronic devices. The Futura+ monitors the harmonic distortion to the 31st harmonic. A waveform capture of distorted waveform is also available.

% THD GRAPH



CHAPTER 2
MECHANICAL INSTALLATION

2.1: Explanation of Symbols:

	CAUTION, RISK OF DANGER. DOCUMENTATION MUST BE CONSULTED IN ALL CASES WHERE THIS SYMBOL IS MARKED.
	CAUTION, RISK OF ELECTRIC SHOCK.
	PROTECTIVE CONDUCTOR TERMINAL.
~	ALTERNATING CURRENT.
≃	BOTH DIRECT AND ALTERNATING CURRENT.
⎓	DIRECT CURRENT.

2.2: Mechanical Installation

METER NOTES:

- To clean the meter, wipe it with a clean, dry cloth.
- Meter's environmental conditions:
  - Operating Temperature: -20°C to +70°C/-4.0°F to +158°F
  - Storage Temperature: -30°C to +80°C/-22°F to +176°F
  - Relative Humidity: 90% non-condensing
  - Ventilation requirement: Natural convection cooling is adequate. Allow unobstructed airflow around the unit and monitor for a rise in temperature when the meter is installed in an enclosed cabinet.
  - The meter has no specific protection against ingress of water.
  - The rating of this meter requires all input and output terminals to be connected permanently: modification and maintenance of any kind should be performed **only** by qualified personnel.
  - Rated Altitude: 2,000 meters maximum

<u>Note</u>*: *Figures in this chapter are not to scale.

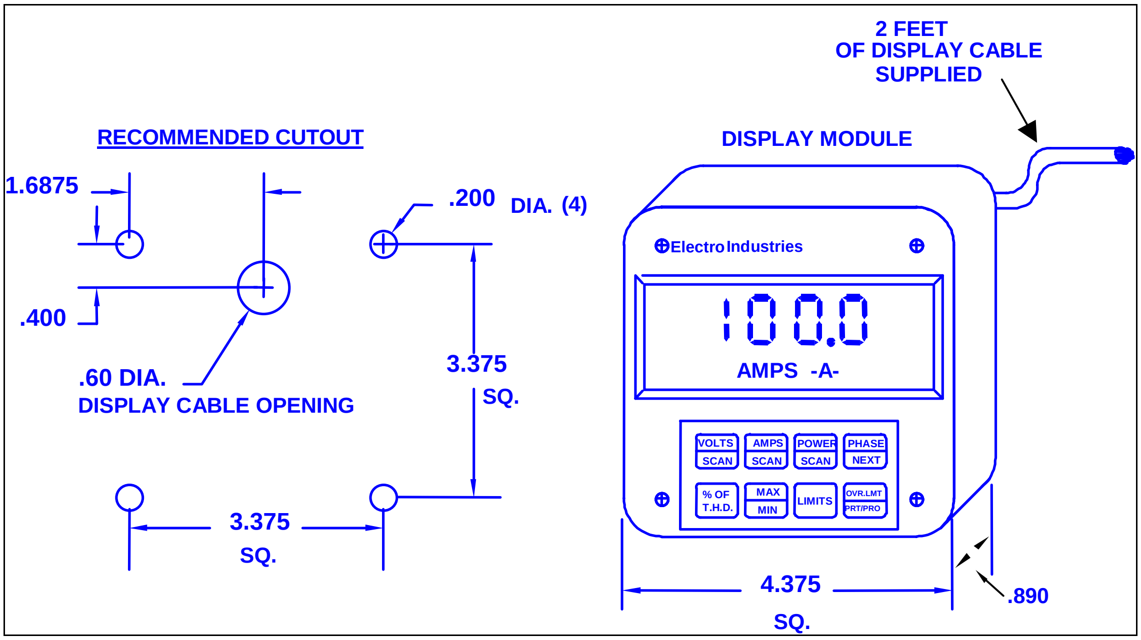
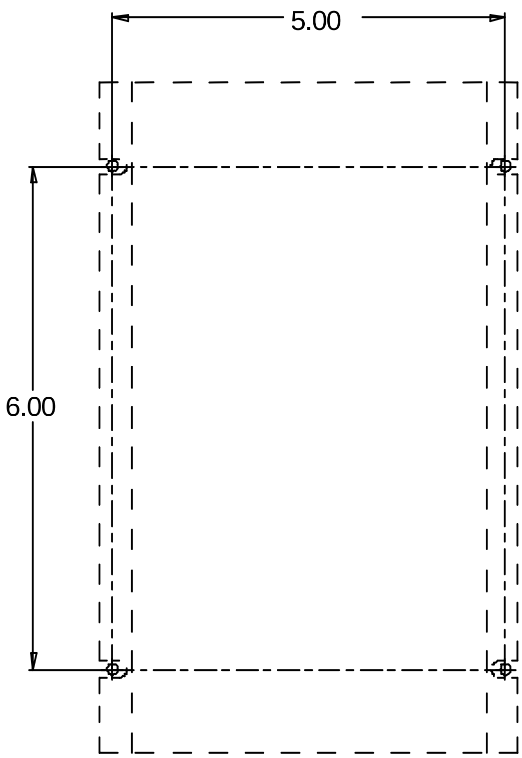


Diagram 2.1A: Recommended cutout for CPU-1000 display module—measurements in inches



- Recommended mounting screw size is #8.
- Extra deep slots permit use of existing screw locations if upgrading from an earlier slot base.

Diagram 2.1B: Recommended cutout for the CPU-1000 transducer module

<u>Installation of RS232C/485 Communication Converter or DC Output</u>

- Use the two screws as guides and insert them into the respective holes.
- Slowly lower the converter.
- The eight pins (on the converter) mount into the socket.

***Note**: When mounting the communication converter, be careful—the pins bend easily.*

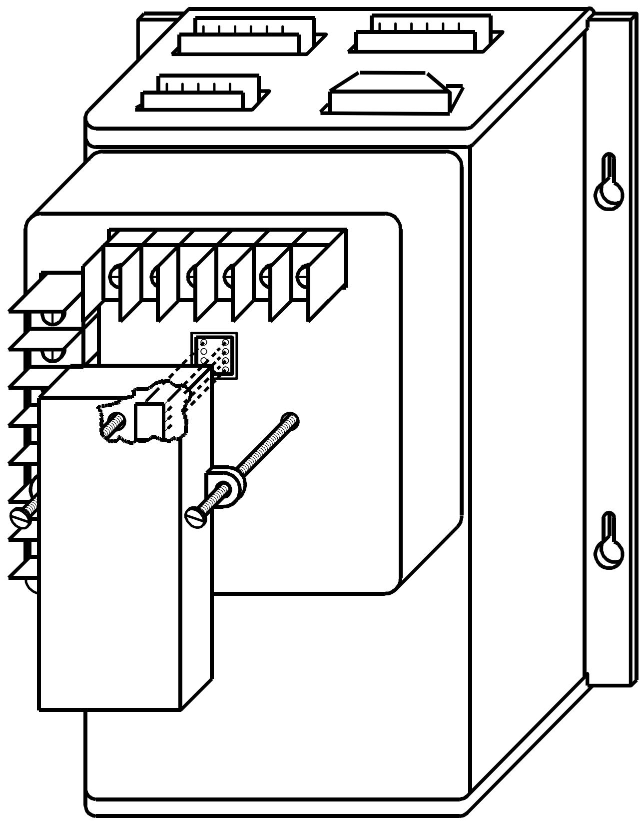


Diagram 2.2: RS232C/485 Communication Converter or DC Output Installation (both are optional)

<u>Installation of CPU-1000</u>

(This installation is usually performed at the factory. It is included here in case the input module is upgraded.)

- Connect the input module to the transducer base unit.
- Follow the instructions for installing the communication converter (if this option was ordered).
- For an extension, use the electrical extension converter (EEC) that accommodates several remote displays or a single display.

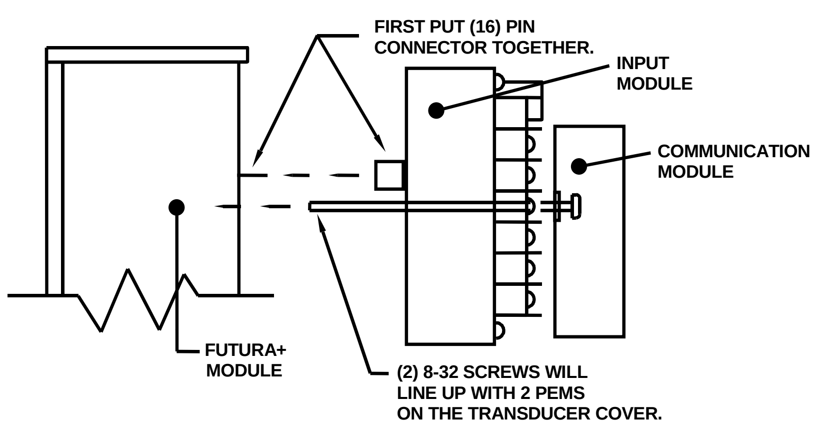


Diagram 2.3: Standard Installation of the CPU-1000

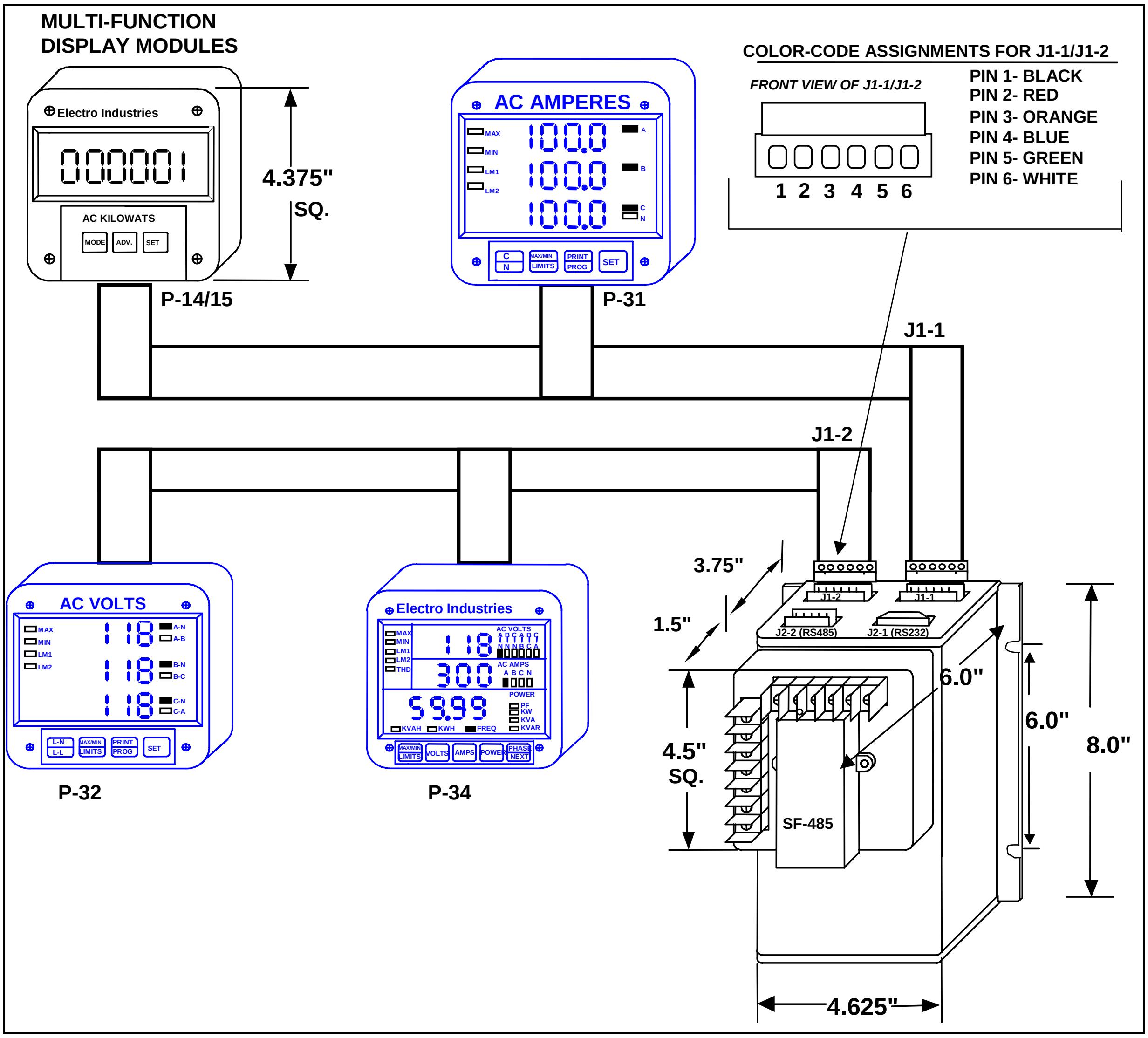


Diagram 2.4: Standard Installation with electrical extension connector. Displays are optional.

<u>Note</u>: A maximum of 4 displays connect to either J1-1 or J1-2 or both <u>without</u> external power supply. A maximum of 16 displays connect <u>with</u> external power supply (optional). The displays are powered by a 4-wire RS485 with a power and ground wire. For longer distances, the wires should be shielded and grounded at one point only.

CHAPTER 3

ELECTRICAL INSTALLATION

3.1: Important Considerations When Installing Meters

Please read the following sections carefully for important safety information regarding installation and hookup of the meter.

- This meter is rated as “permanently installed equipment” and must be installed in non-accessible areas only, e.g. control panels, switchgear enclosures, etc.

- Installation of the 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 meter, dangerous voltages flow through many parts of the meter, including: Terminals and any connected CTs (Current Transformers) and PTs (Potential Transformers), all I/O Modules (Inputs and Outputs) 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 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 recommends the use of Shorting Blocks and Fuses for voltage leads and power supply to prevent hazardous voltage conditions or damage to CTs, if the meter needs to be removed from service. CT grounding is optional.

- The UL Measurement Category of the meter is Category III, Pollution Degree II.

- Refer to additional safety notes on the next page.

NOTES:

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

- 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 DISCONNECTING 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 THEEQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH SHALLBE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT.

3.1.1: Measurement Inputs Rating:

UL Classification: Measurement Category III, Pollution Degree II.

Current Inputs: 10A max.

Voltage Inputs[1]: 150V L-N, 300V L-L

Frequency: (45 to 75) Hz

[1] Suffix - G extends the maximum direct voltage to 300V phase to neutral, 600 volt phase to phase. Models with suffix - G are not UL rated.

3.2: Connecting the Current Circuit

Install the cable for the current at 600V AC minimum. The cable connector should be rated at 6 Amps or greater and have a cross-sectional area of 16 AWG.

Mount the current transformers (CTs) as close as possible to the meter. The table below illustrates the maximum recommended distances for various CT sizes, assuming the connection is via 16 AWG cable.

CT Size (VA)	Maximum Distance (CT to CPU1000)
2.5 VA	10 FEET
5.0 VA	15 FEET
7.5 VA	30 FEET
10.0 VA	40 FEET
15.0 VA	60 FEET
30.0 VA	120 FEET

WARNING: ***DO NOT leave the secondary of the CT open when primary current is flowing. This may cause high voltage, which will overheat the CT. If the CT is not connected, provide a shorting block on the secondary of the CT.***

3.3: CT Connection

If the CPU-1000 is connected directly, maintain the exact connection to avoid incorrect polarity.

It is important to maintain the correct CT polarities when using CTs to connect the CPU-1000. CT polarities are dependent upon correct connections of CT leads and the direction the CTs are facing when clamped around conductors. The dot on the CT must face the line side and the corresponding secondary connection must connect to the appropriate pin. Failure to connect CTs properly results in incorrect Watt readings.

3.4: Connecting the Voltage Circuit

For proper meter operation, the voltage connection *must* be maintained. The voltage must correspond to the correct terminal.

The cable required to terminate the voltage sense circuit should have an insulation rating greater than 600V AC and a current rating greater than 0.1 A.

3.5: Selecting the Voltage Fuses

We recommend using fuses, although the connection diagrams on the following pages do not show them. Use a 1 Amp fuse on each voltage input.

3.5: Connection to the Main Power Supply

The CPU-1000 requires a separate power supply. Listed below are the four power supply options and their corresponding suffixes. The maximum power consumption is 12VA or 9W. AC unit's frequency rating is 50/60Hz.

CONTROL POWER	OPTION SUFFIX
115V AC	115A
230V AC/DC	230A
24-48V DC	D
125V AC/DC (UNIVERSAL)	D2

***Note**: Do not ground the unit through the negative of the DC supply. Separate grounding is required.*

***Note**: Externally fuse power supply with a slow-blow 3 Amp fuse.*

3.6: Electrical Connection Installation

Choose the diagram that best suits your application and maintain the polarity. Follow the outlined procedure to verify correct connection.

Connection Diagrams

—If the connection diagram you need is not listed, contact EIG for a custom connection diagram.

I. Three-Phase, Three-Wire System Delta with Direct Voltage and CTs

II. Three-Phase, Three-Wire Open Delta with two CTs and two PTs
—Open Delta System Installation should only be used if the electrical system is a 3-wire OPEN DELTA. (The P-34 display can enable or disable Open Delta in the faceplate programming mode: Group 0, Function 3, Pack 1, Switch D; see Chapter 10.)

III. Three-Phase, Three-Wire Open Delta with three CTs and two PTs
—Open Delta System Installation should only be used if the electrical system is a 3-wire OPEN DELTA. (The P-34 display can enable or disable Open Delta in the faceplate programming mode: Group 0, Function 3, Pack 1, Switch D; see Chapter 10.)

IV. Three-Phase, Four-Wire System Wye with Direct Voltage and CTs

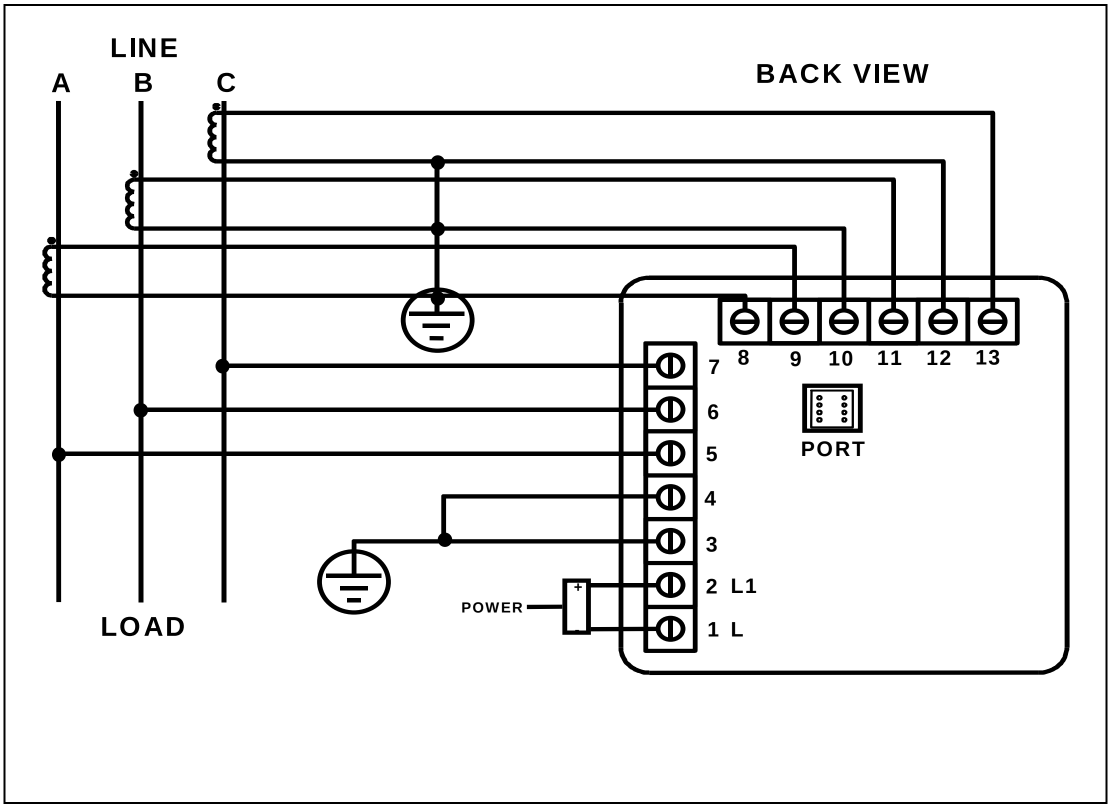
V. Three-Phase, Four-Wire System Wye with CTs and PTs

VI. Broken Delta System

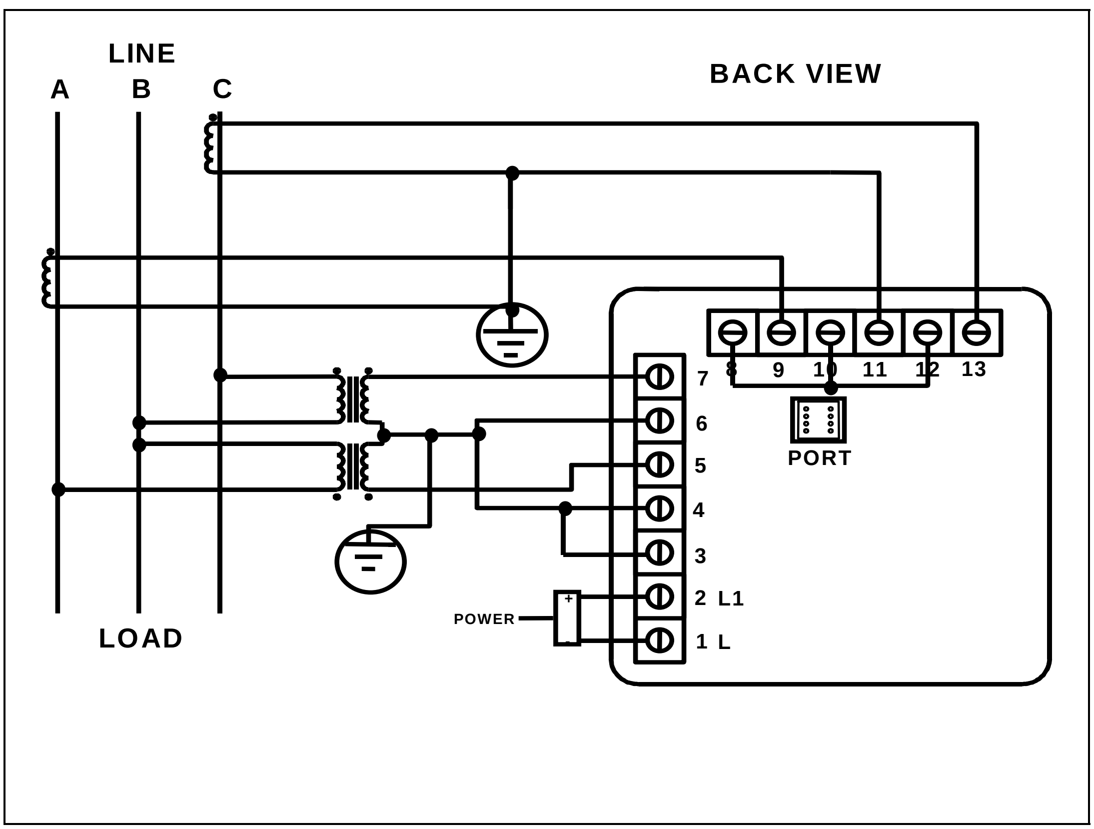
VII. Three-Phase, Four-Wire Wye with 2.5 Element

***Note**: For P-34 display—see phase reversal (Chapter 8) if a message of CBA appears after installation.*

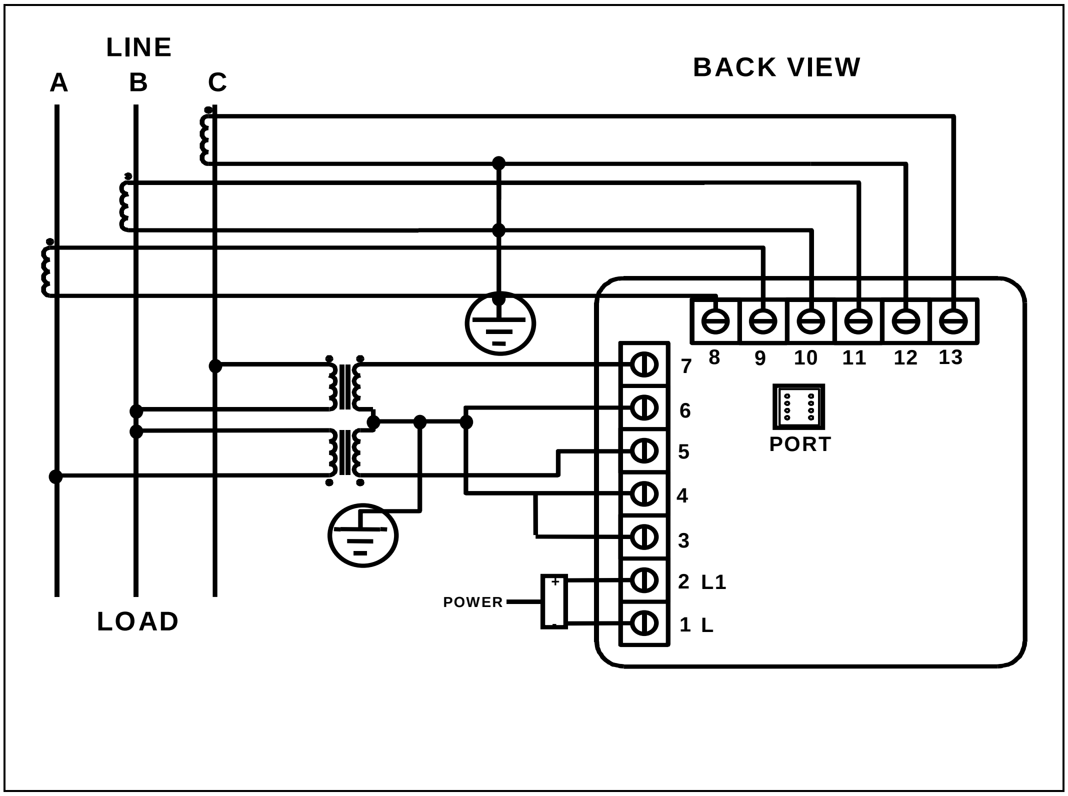
***Note**: Control power polarity indications only apply if DC control power was ordered.*



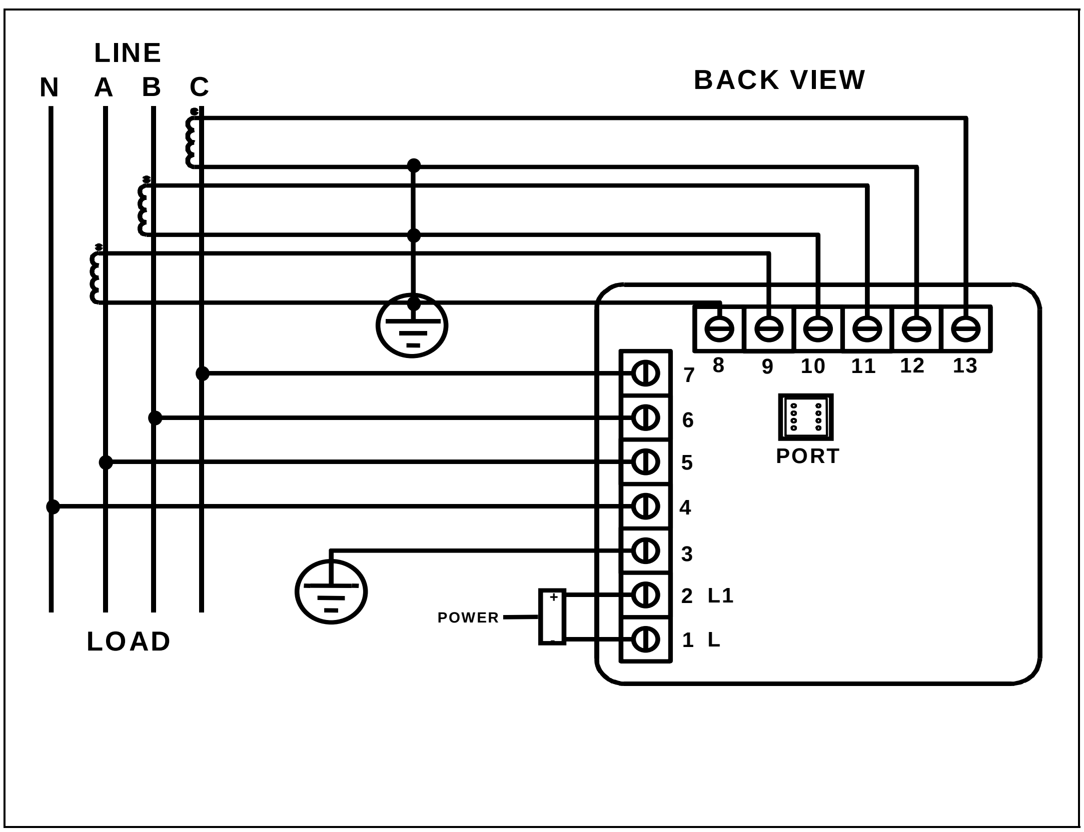
I. Three-Phase, Three-Wire System Delta with Direct Voltage and CTs



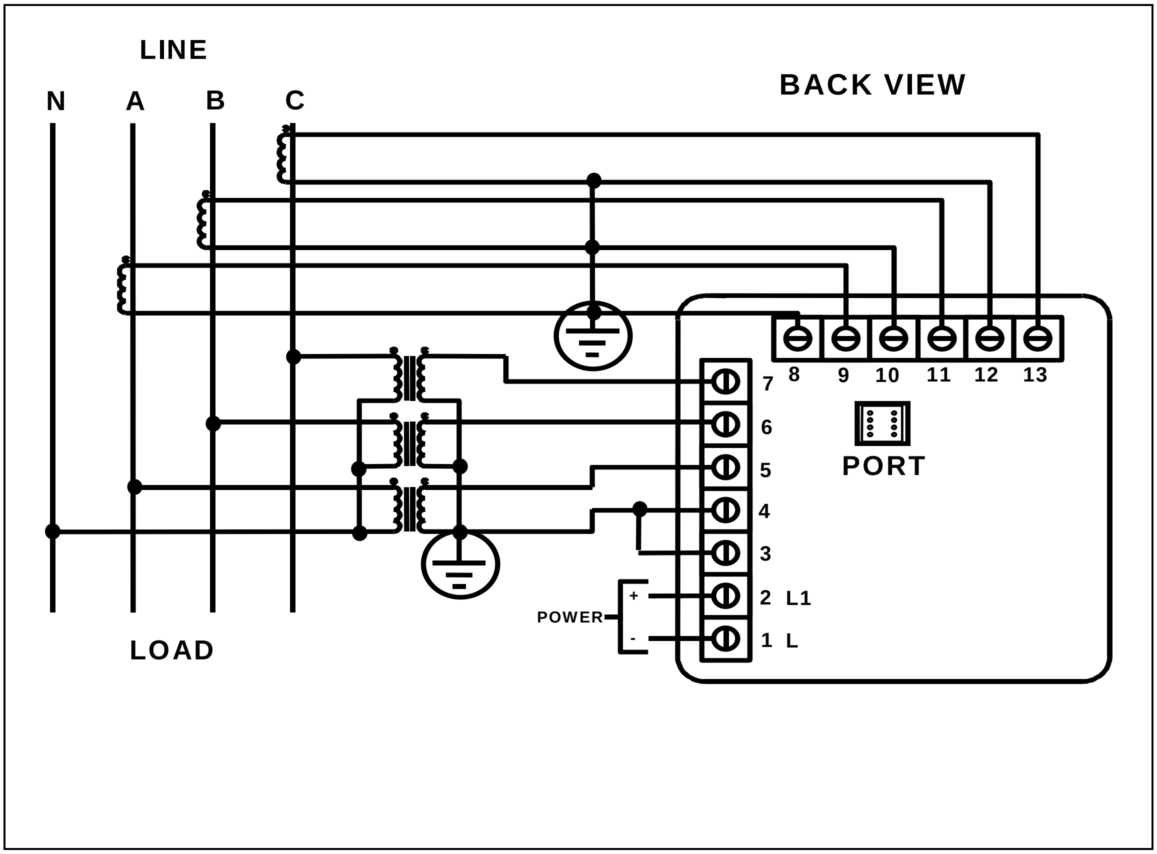
II. Three-Phase, Three-Wire Open Delta with two CTs and two PTs
—Special programming required: see note, page 9



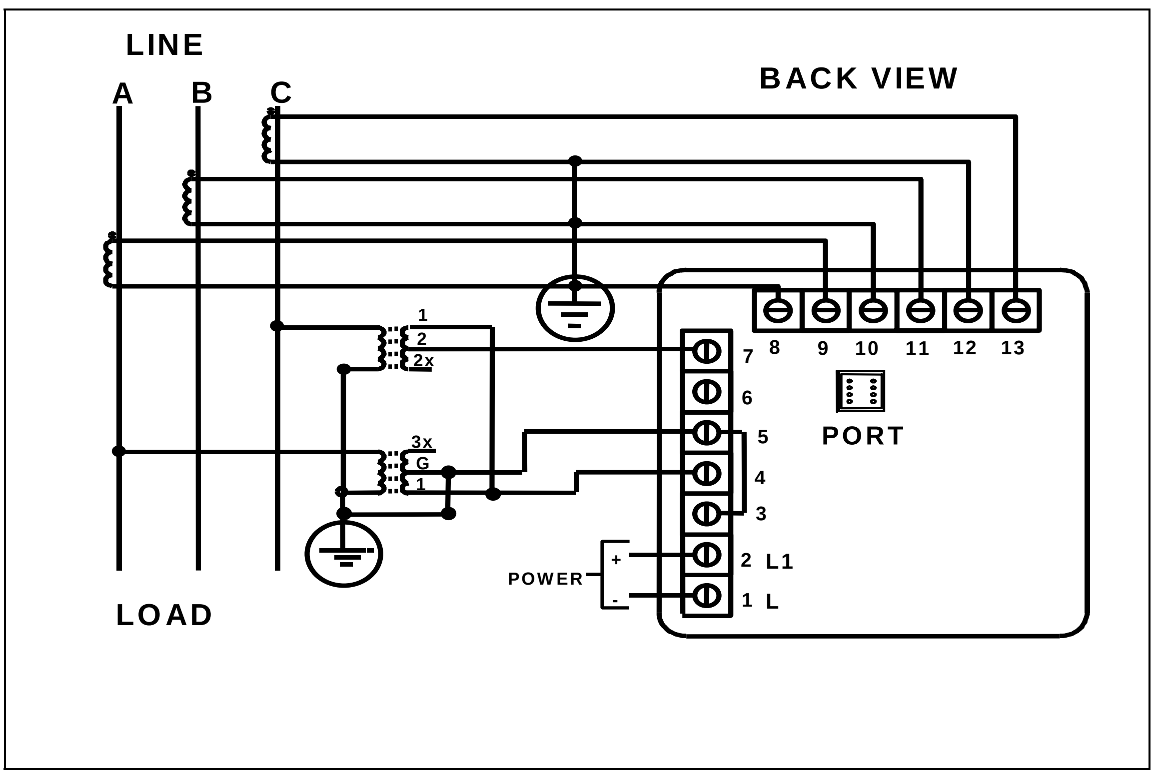
III. Three-Phase, Three-Wire Open Delta with three CTs and two PTs
—Special programming required, see note page 9



IV. Three-Phase, Four-Wire Wye with Direct Voltage and CTs

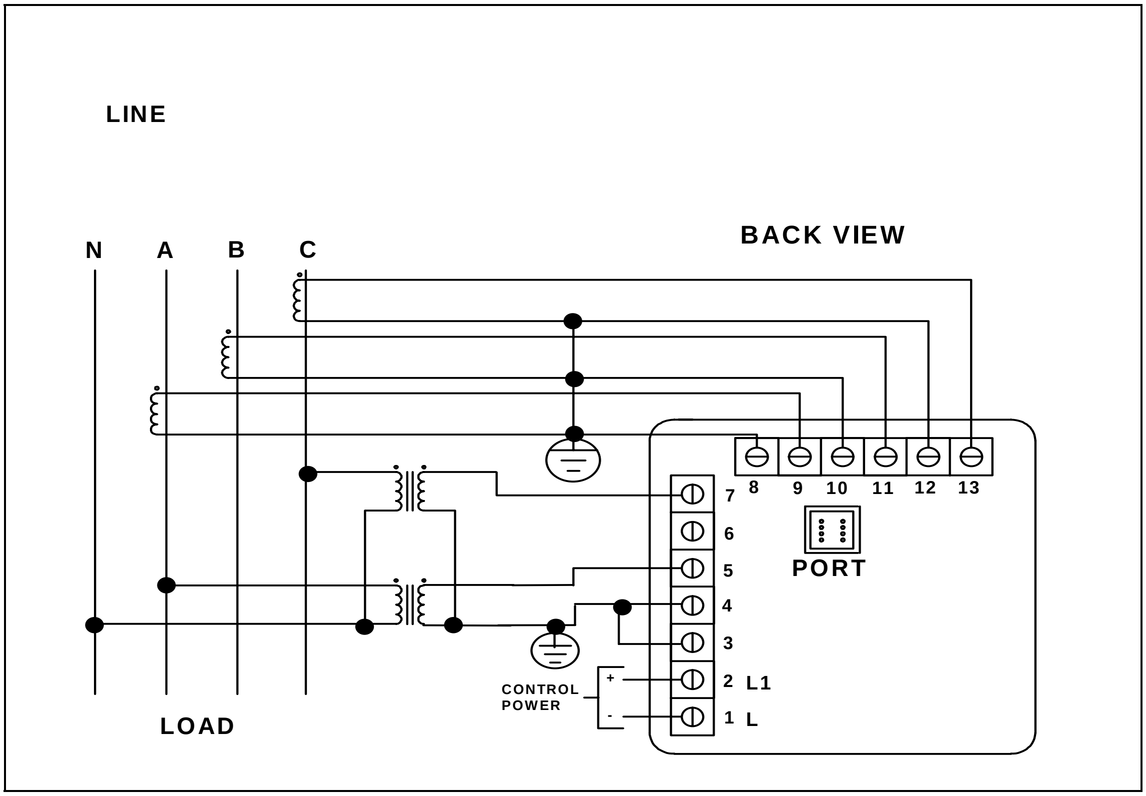


V. Three-Phase, Four-Wire System WYE with CTs and PTs



VI. Broken Delta System with CTs and PTs, Option E

Note: This option must be custom ordered from the factory.



VII. Three-Phase Four-Wire WYE with 2.5 Element
Note: This option must be ordered from the factory.

3.7: Helpful Debugging Tools

Isolating a CT Connection Reversal

1. Remove potential connections to terminals 6 and 7. Observe the KW reading. It should be positive. If negative, reverse the CT wires on terminals 8 and 9.

2. Connect terminal number 6 potential. If KW decreases to about zero, reverse CT wires on terminals 10 and 11.

3. Connect terminal number 7 potential. If KW is one-third of the expected reading, reverse CT wires to terminals 12 and 13.

CHAPTER 4
COMMUNICATION INSTALLATION

All CPU-1000 instruments can be equipped with the RS232C or the RS485.

- Use the Top Port for MODBUS, DNP, RTU and ASCII protocols (see Figure 4.1, below).
- Use the Main Port for Futura+ Communicator protocols (see Figure 4.1, below).

4.1: RS232C

RS232C communication is used to link a single CPU-1000 instrument with a computer or device such as RTU or PLC. The link is capable for a distance up to 100 feet. A standard 9-pin female serial port allows direct connection to a computer with a 9-pin cable.

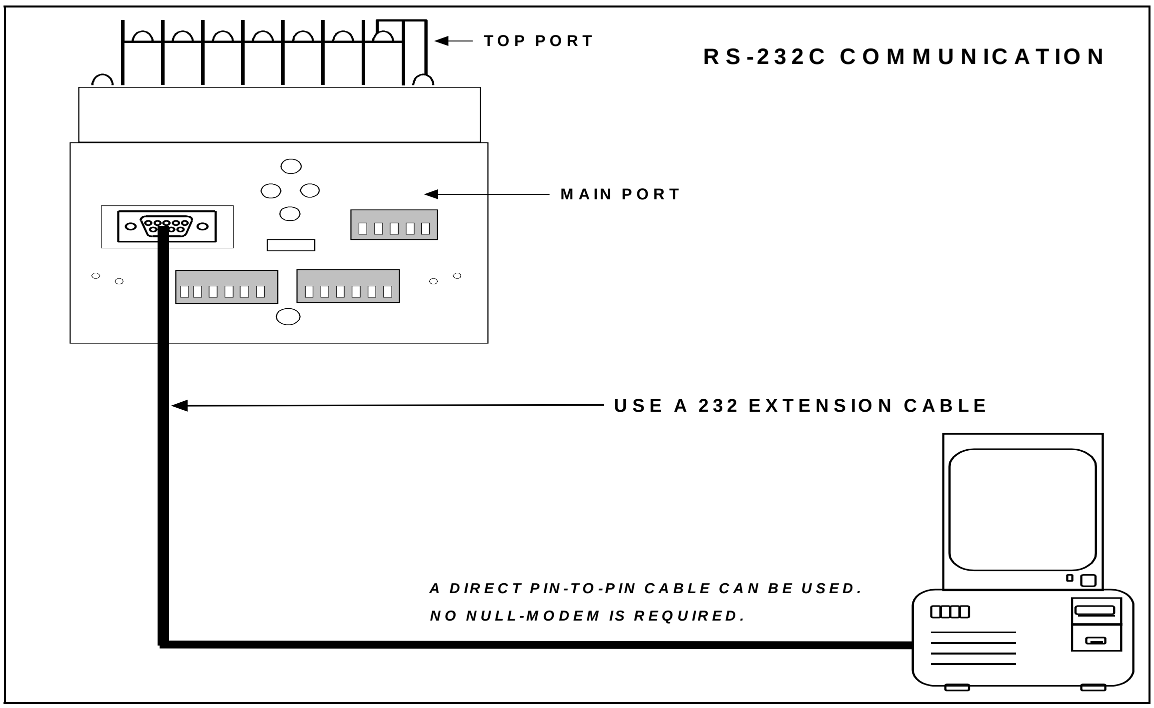


Figure 4.1: RS232C Communication Connection Installation

4.2: RS485

RS485 parallels multiple instruments on the same link. Its operating capability is up to 4000 feet. When using only 2 wires (on the RS485), the link can include up to 15 instruments (see Figure 4.5). When using all 4 wires, the link can include up to 31 instruments (see Figure 4.2).

Each CPU-1000 instrument has a unique address up to four digits long. This allows the user to communicate with up to 10,000 instruments. Available standard baud rates are 1200, 2400, 4800, and 9600. To select the proper baud rate, apply the following rules:

- *The Top port should always be operated at 9600 baud max.*
- *Maximum baud rate is 38400 for the Main port.*
- *For a smaller number of instruments over a long distance, use a lower baud rate.*
- *Optimal recommended baud rate is 1200 baud if noisy conditions exist.*

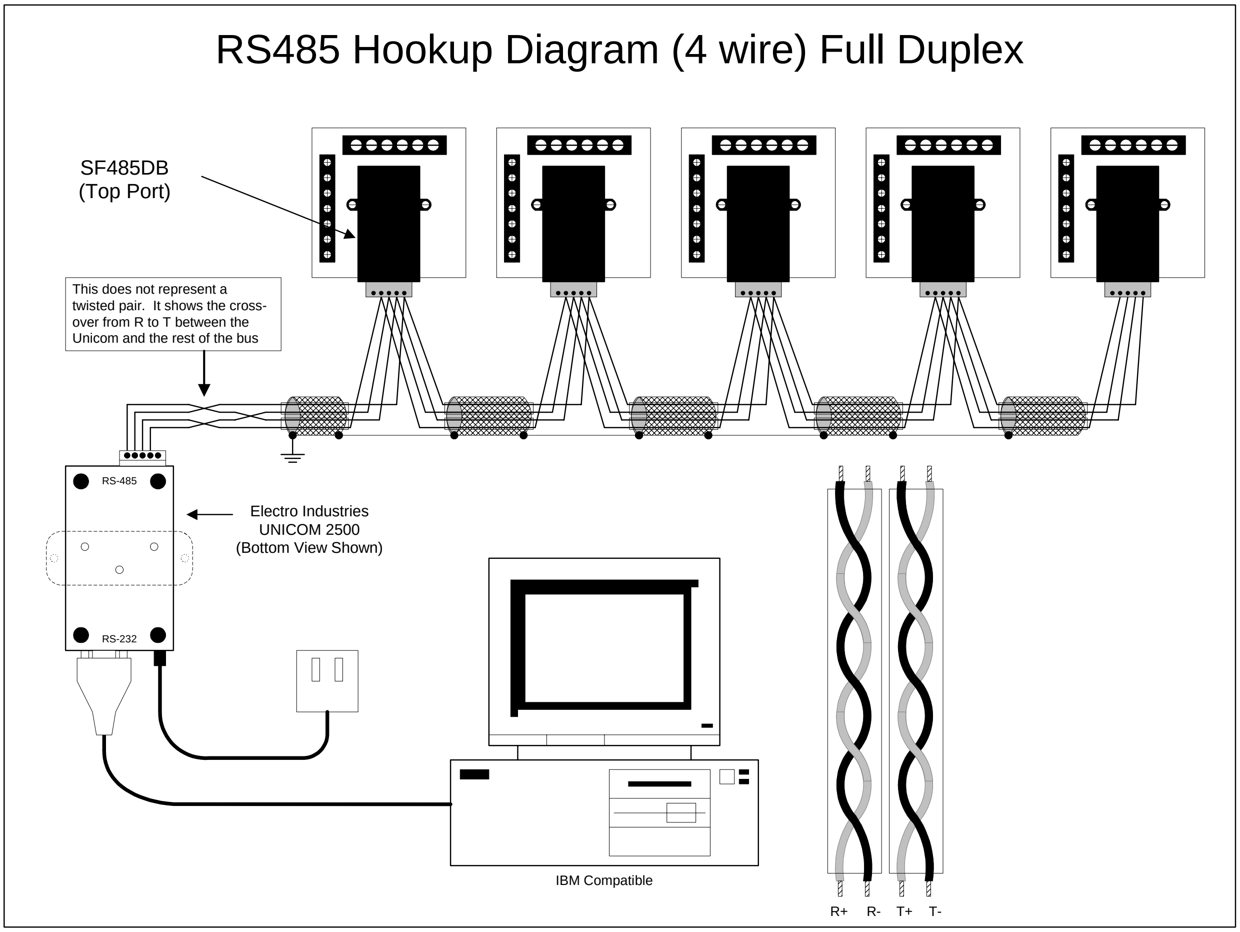


Figure 4.2: 4-Wire RS485 Communication Connection Installation Full Duplex
—Detail View next page

***Note**: 4-wire RS485 is strongly recommended because it provides cleaner communication and is less susceptible to noise interference. It is important to shield the communication wire and ground it at one end. Grounding at both ends causes a ground loop and results in noise problems.*

Connecting 4-Wire bus to RS485 Port:

- Connect the T- wire of the Unicom 2500 to the R- on the RS485 port
- Connect the R- wire of the Unicom 2500 to the T- on the RS485 port
- Connect the T+ wire of the Unicom 2500 to the R+ on the RS485 port
- Connect the R+ wire of the Unicom 2500 to the T+ on the RS485 port

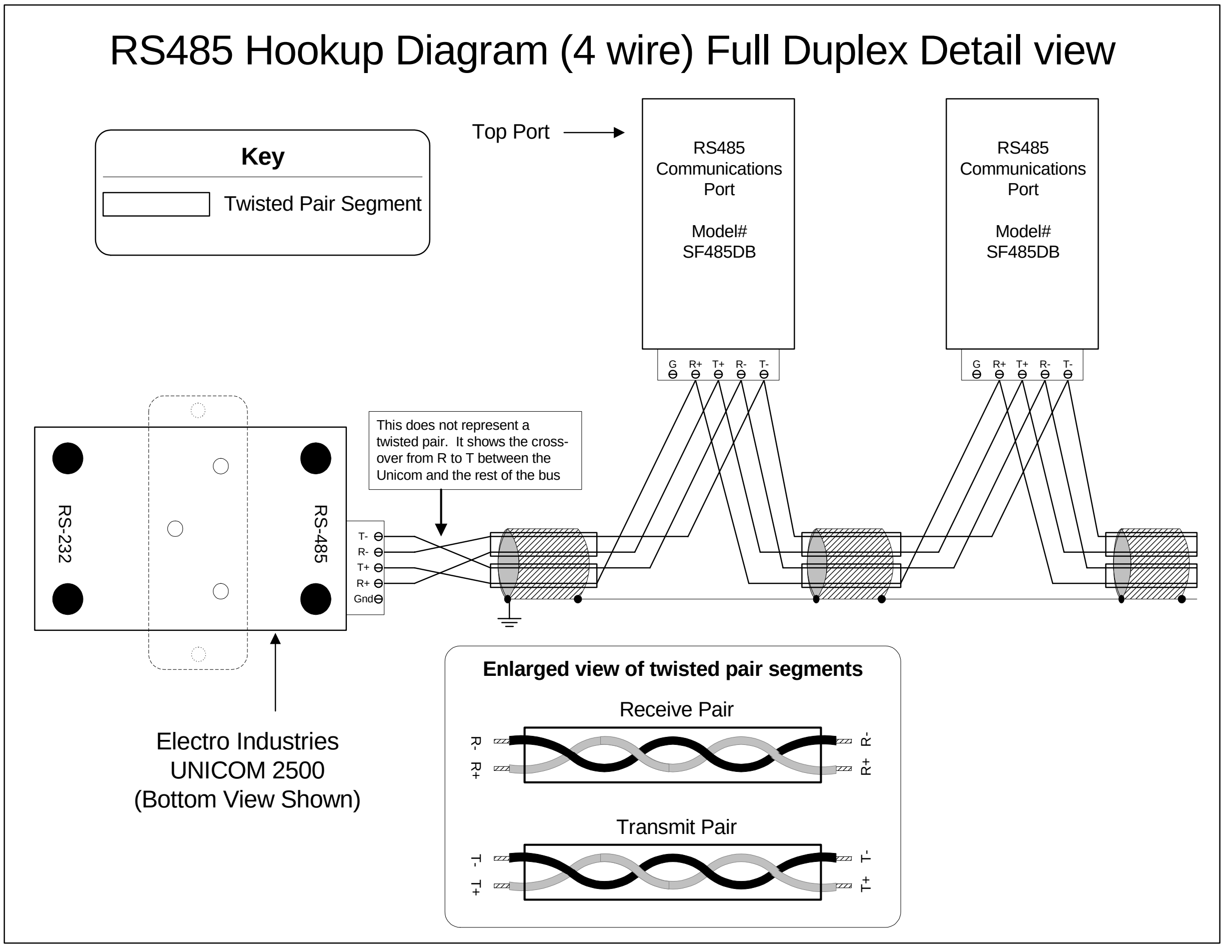


Figure 4.3: 4-Wire RS485 Communication Connection Installation Full Duplex Detail View

<u>Connecting 4-Wire bus to RS485 Port:</u>

- Connect the T- wire of the Unicom 2500 to the R- on the RS485 port
- Connect the R- wire of the Unicom 2500 to the T- on the RS485 port
- Connect the T+ wire of the Unicom 2500 to the R+ on the RS485 port
- Connect the R+ wire of the Unicom 2500 to the T+ on the RS485 port

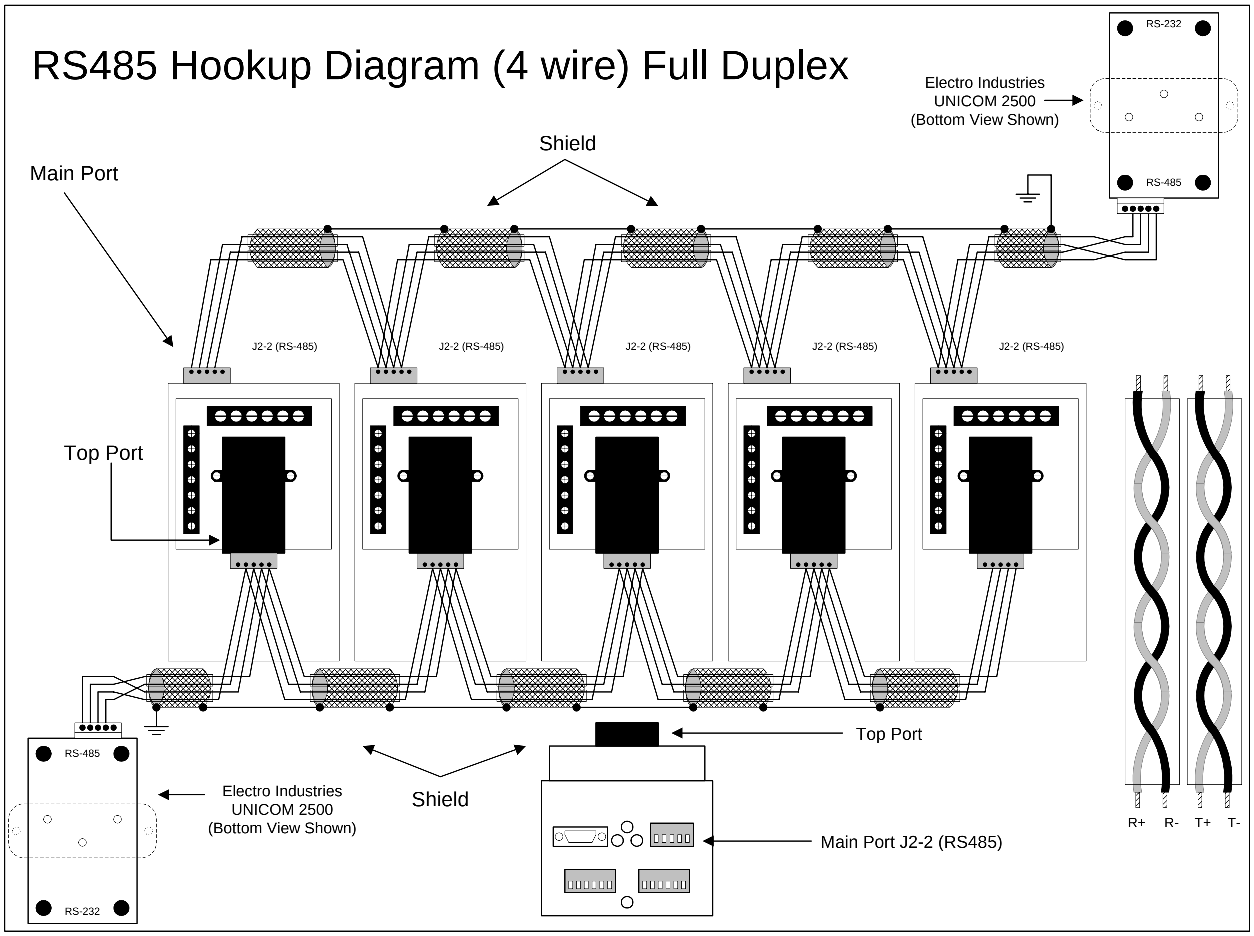


Figure 4.4: 4-Wire RS485 Communication Connection Installation Full Duplex for Top and Main Ports

Connecting 4-Wire bus to RS485 Port:

- Connect the T- wire of the Unicom 2500 to the R- on the RS485 port
- Connect the R- wire of the Unicom 2500 to the T- on the RS485 port
- Connect the T+ wire of the Unicom 2500 to the R+ on the RS485 port
- Connect the R+ wire of the Unicom 2500 to the T+ on the RS485 port

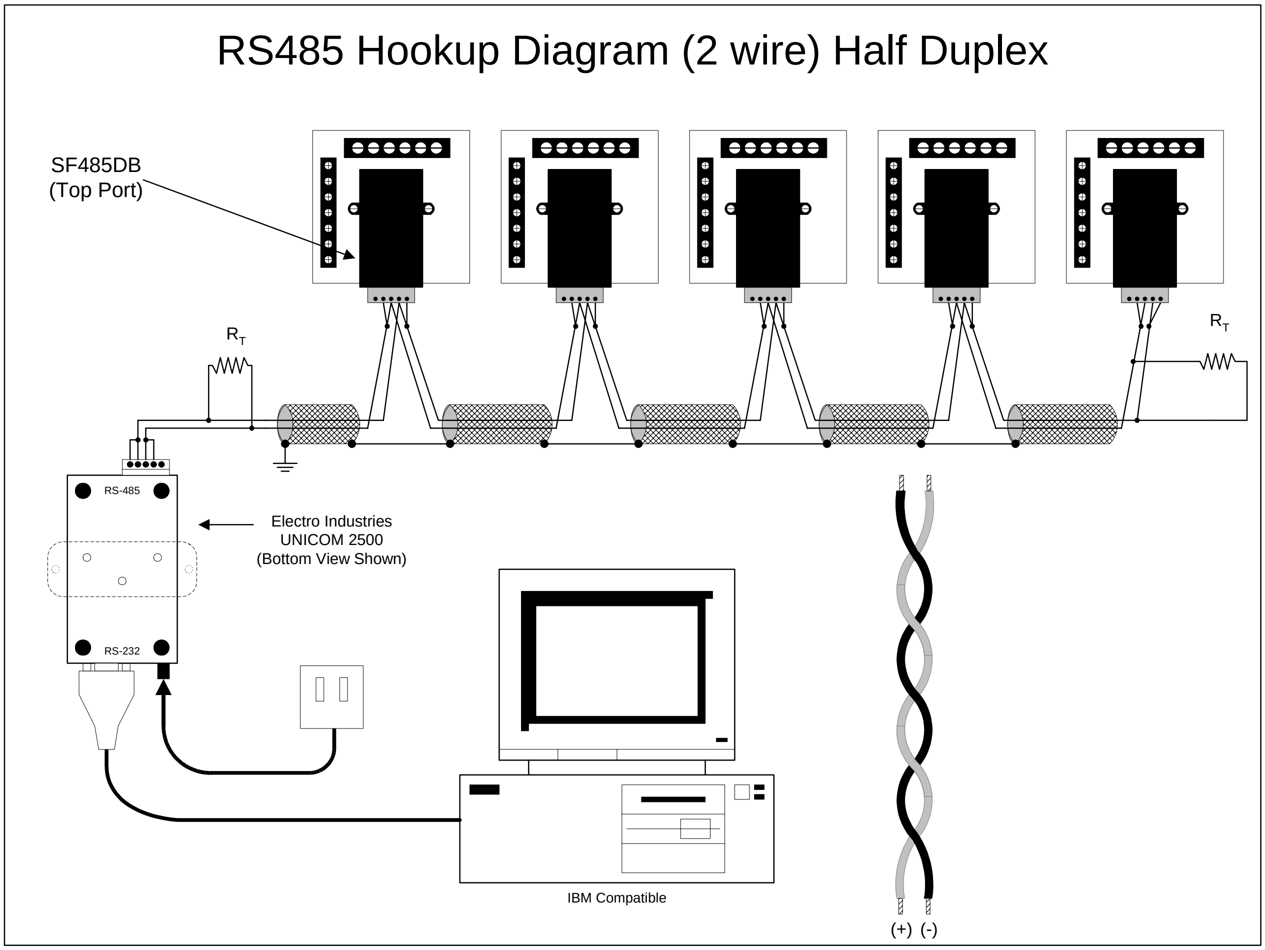


Figure 4.5: 2-Wire RS485 Communication Connection Installation Half Duplex for Top Port
—Detail view on following page

Connecting two wire bus to RS485 Port on CPU-1000

Take the positive (+) wire and connect to R+ on the RS485 Port.
Connect a jumper from R+ to T+ on the RS485 Port.
Take the negative (-) wire and connect to R- on the RS485 Port.
Connect a jumper from R- to T-.on the RS485 Port.

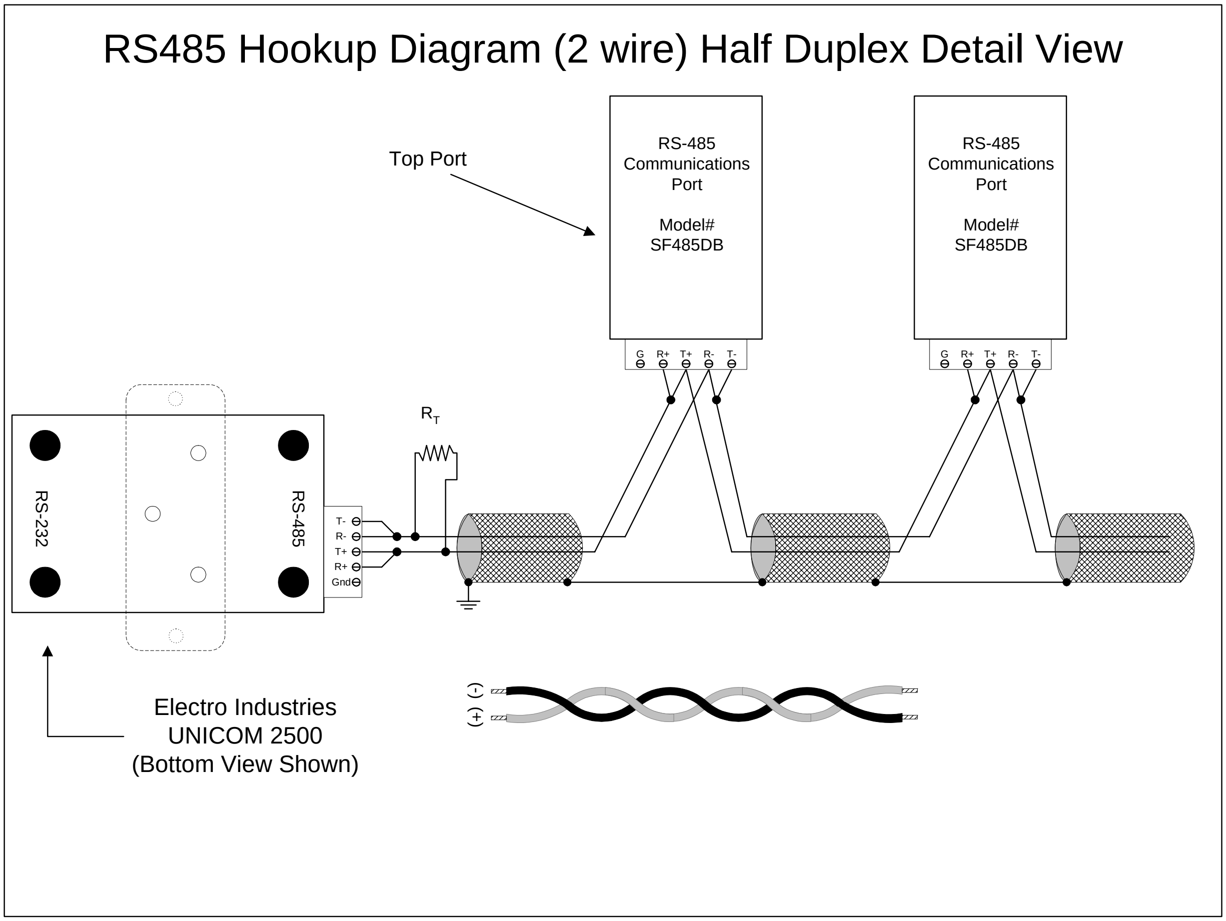


Figure 4.6: 2-Wire RS485 Communication Connection Installation Half Duplex Detail View

Connecting two wire BUS to Top Port RS485 on CPU-1000

- Take the positive (+) wire and connect to R+ on the RS485 Port.
- Connect a jumper from R+ to T+ on the RS485 Port.
- Take the negative (-) wire and connect to R- on the RS485 Port.
- Connect a jumper from R- to T-.on the RS485 Port.

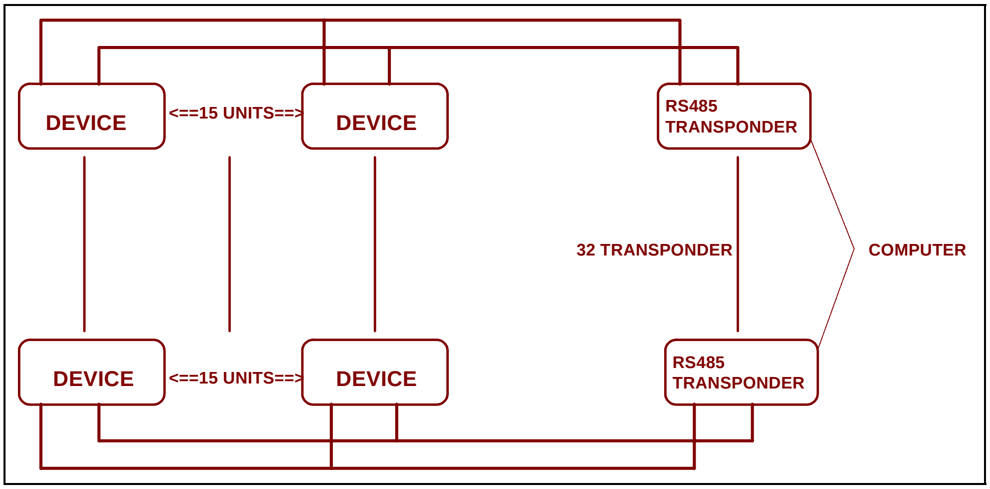


Figure 4.7: 2-Wire RS485 Communication Installation Connection with Transponder

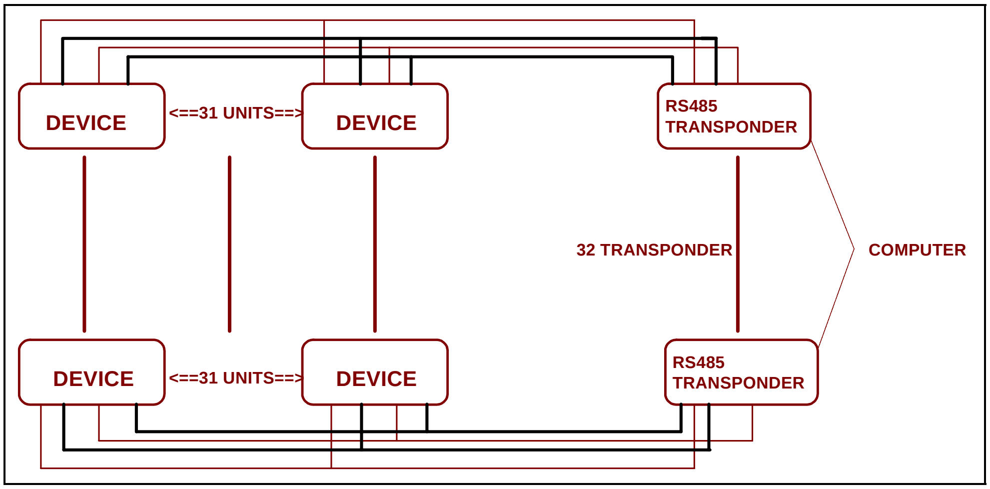


Figure 4.8: 4-Wire RS485 Communication Installation Connection with Transponder

4.3: Network of Instruments and Long Distance Communication

Use the RS485 Transponder for a large instrument network. In a two-wire connection, a maximum of 900 instruments can be included in the same network (**Figure 4.7**). In a four-wire connection, a maximum of 3600 instruments can be included in the same link (**Figure 4.8**).

You may want to use a Modem Manager RS485-RS232 Converter. When speaking to most RS485 or RS232C based devices, the remote modem must be programmed for the communication to work. This task is often quite complicated because modems are quirky when talking to remote devices. To make this task easier, EIG has designed a Modem Manager RS485 to RS232C converter. This device automatically programs the modem to the proper configuration. Also, if you have poor telephone lines, modem manager acts as a line buffer, making the communication more reliable. Use modems (dedicated or dial-up) when the instruments are at great distances. However, set the modem to auto answer at the recommended 1200 baud rate if noise conditions exist.

4.4: Compatible Software (Optional)

Compatible software for the Futura+ Series is Communicator EXT. Use this software for data-download if memory options are ordered. This software has multimeter connection capability for reading real-time data.

4.5: Connection Diagram for Modem to EI Device

Remote connection requires a Null modem between remote modem and EI device.

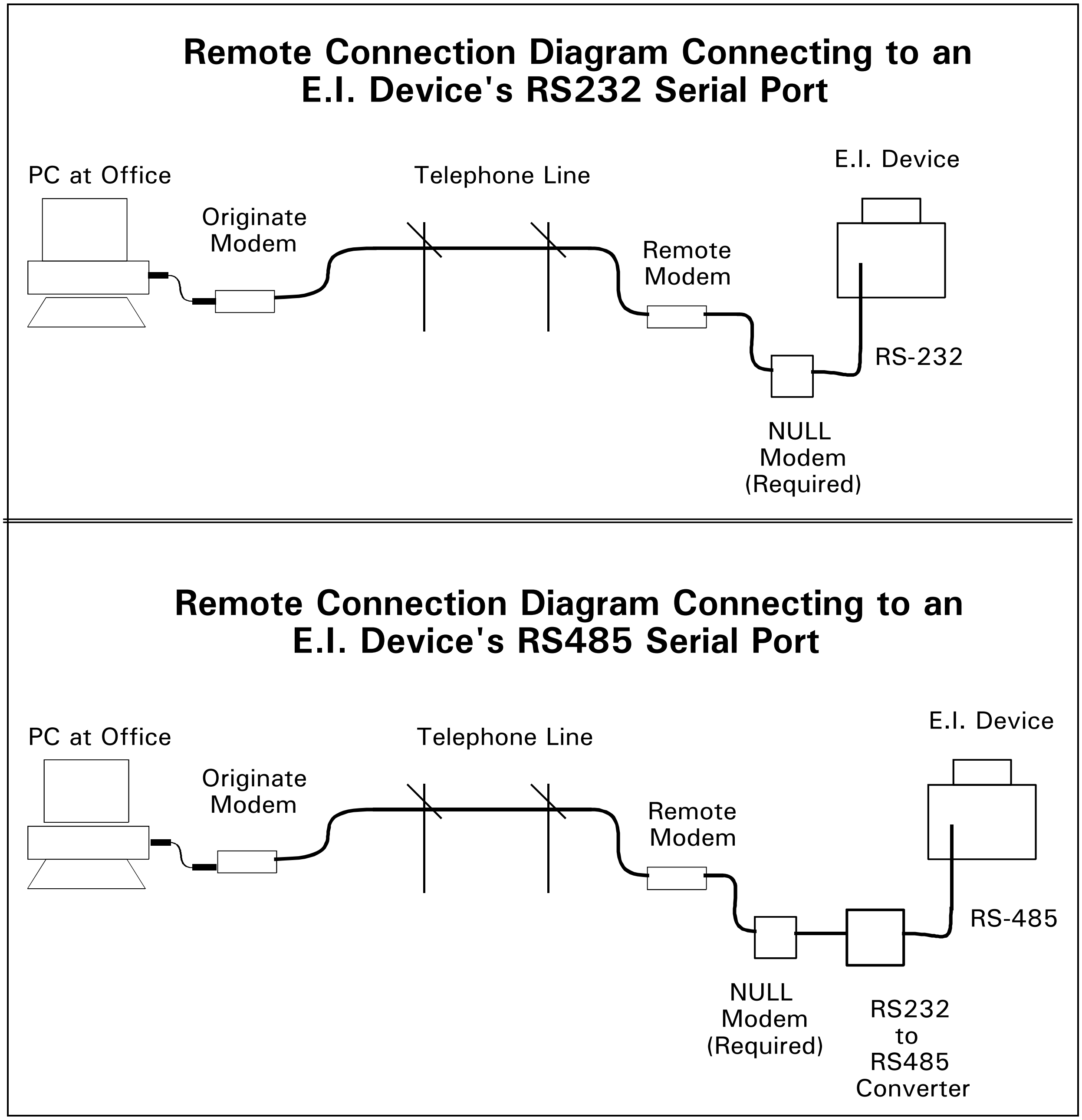


Figure 4.9

I. MODEM CONNECTED TO COMPUTER (ORIGINATE MODEM)

Programming the Modem

Comply with the modem's instruction manual and follow these instructions:

Restore Modem to Factory Settings:
- Erases all previously programmed settings.

Set Modem to Display Result Codes:
- The device uses the result codes.

Set Modem to Verbal Result Code:
- The device uses the verbal codes.

Set Modem to Ignore DTR Signal:
- Necessary for the device to ensure connection with originate modem.

Set Modem to Disable Flow Control:
- Necessary to communicate with remote modem connected to device.

Tell Modem to Write the New Settings to Activate Profile:
- Places these settings into nonvolatile memory; the settings take effect after the modem powers up.

II. MODEM CONNECTED TO THE DEVICE (REMOTE MODEM)

Programming the Modem

Comply with the modem's instruction manual and follow these instructions:

Restore Modem to Factory Settings:
- Erases all previously programmed settings.

Set Modem to Auto Answer on **N** Rings:
- Sets the remote modem to answer the call after **N** rings.

Set the Modem to Auto Negotiate Mode:
- Sets the remote to auto-negotiate to communicate successfully with the Futura+ Series and other devices in the modem.

Set Modem to Return Numeric Result Codes:
- Increases speed connection with the Futura+ Series.

Set Modem to Ignore DTR Signal:
- Necessary for device to ensure connection with originate modem.

Set Modem to Disable Flow Control:
- Necessary to communicate with remote modem connected to the Futura+ Series

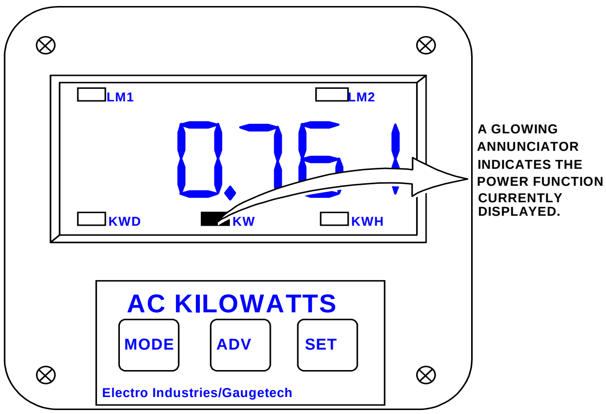
Tell the Modem to Write the New Settings to Activate Profile:
- Places new settings into nonvolatile memory; settings take effect after the modem powers up.

Part II: Display Modules

CHAPTER 5

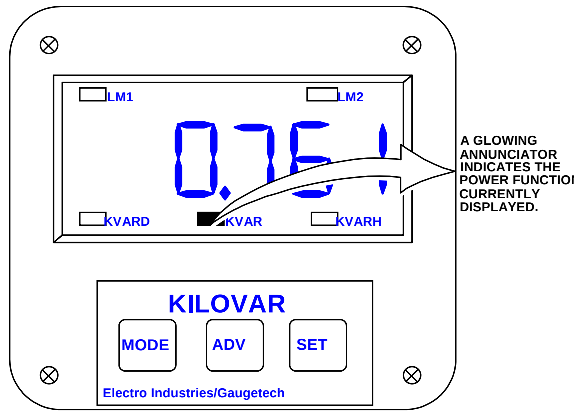
P14 AND P15 OPTIONAL DISPLAY OVERVIEW

The **P14** monitors Kilowatt, Kilowatt Demand and Kilowatt-Hour readings.



*The **P14** front panel with display and keypad*

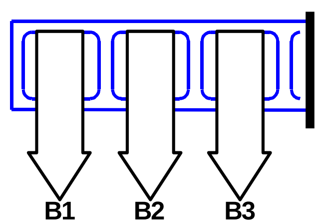
The **P15** monitors reactive power: VAR/VARD/VARH.



*The **P15** front panel with display and keypad*

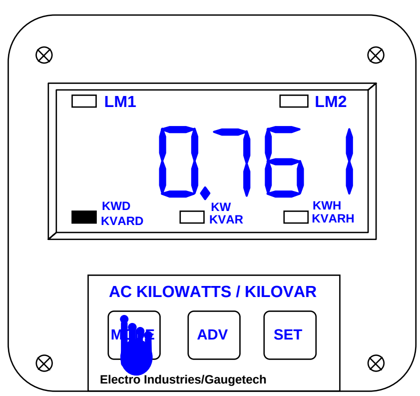
Keypad Buttons

In the following illustrations and examples the keypad buttons have been assigned the names B1, B2 and B3, moving from left to right.

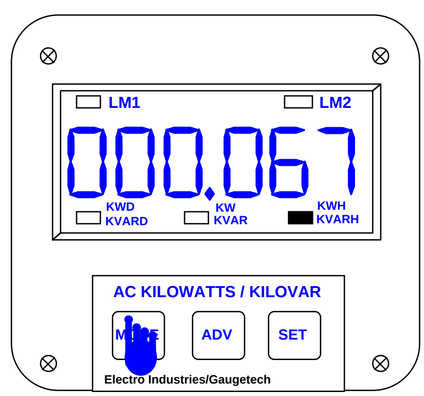


5:1. Accessing KW, KWD, KWH or KVAR, KVARD, KVARH

⇨Upon power up, the *P14 or P15* monitors instantaneous kilowatts or kilovar and the annunciator labeled *KW* or *KVAR* glows.



Step 1:
a. To access the demand reading, press ***B1*** once and the annunciator labeled *KWD* or *KVARD* glows.



Step 2:
a. Press ***B1*** once more to access hour reading; the annunciator for *KWH* or *KVARH* glows.

5.2: Resetting KWD/KWH or KVARD/KVARH Readings

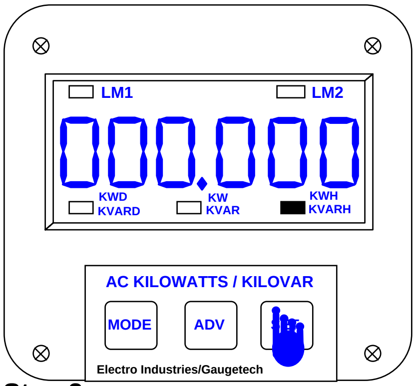
Use the reset function if a new value is desired. It is available in two different modes.

1. **UNPROTECTED MODE**: Allows quick and easy resetting of demand and hour readings.
2. **PROTECTED MODE**: Prevents unauthorized personnel from resetting the demand and hour readings.

UNPROTECTED RESET

To reset KWH or KVARH in the unprotected mode:

Step 1:
a. Select the reading (*KWD* or *KWH*, *KVARD* or *KVARH*) by pressing ***B1***.



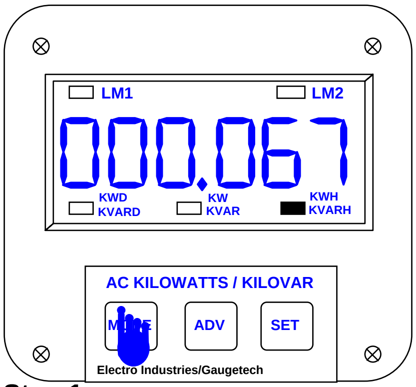
Step 2:
a. Press ***B3*** to reset.

⇨The display blanks and the *KWH* or *KVARH* readings reset to *000.000*.

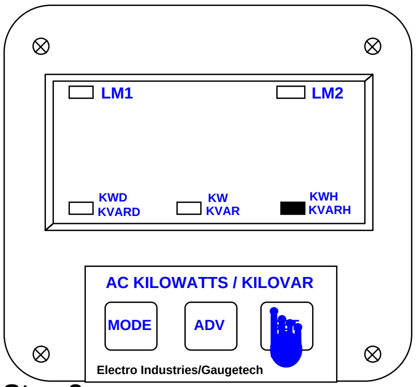
PROTECTED RESET

A password must be entered before any readings can be reset. The password is ***005***.

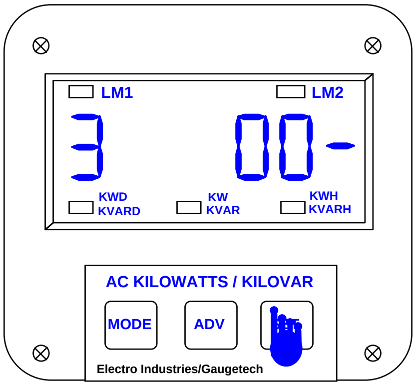
To reset KWH or KVARH in the protected mode:

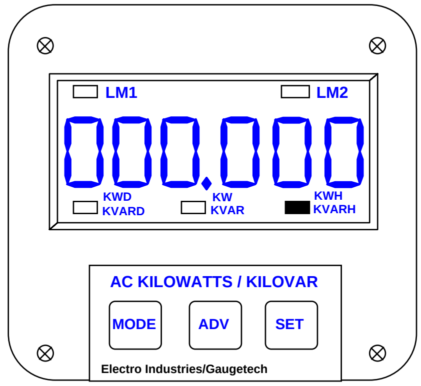


Step 1:
a. Select the *Kilowatt-hour* or *Kilovar-Hour* reading by pressing ***B1***.



Step 2:
a. Press ***B3*** to start the reset procedure.





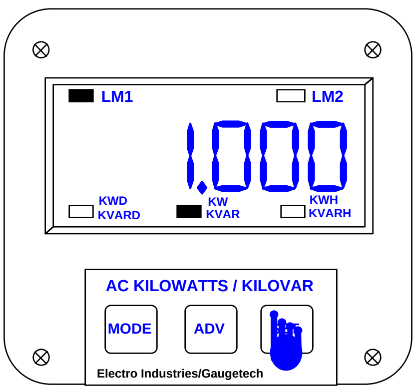
Step 3:
⇨Three dashes appear on the right side; digits begin scrolling on the left side.

⇨When 005 is entered, the display blanks and the *KWH* or *KVARH* reading resets to *000.000*.

a. Press ***B3*** each time a password digit appears.

5.3. Accessing the LM1/LM2 Set Limits For KW/KVAR

SET LIMITS: The point when the relay changes position (if equipped with Relay Option Packages L-100 or L-200; see Chapters 14 and 15). The P14 and the P15 have two manual set limits that monitor the instantaneous readings and warn the user of any abnormal conditions. Each limit detects readings above or below set level. If a limit is exceeded, the LM1 or LM2 annunciator indicator glows and the display flashes, alternating between the instantaneous reading and the limit (LM1 or LM2).



Press ***B3***:

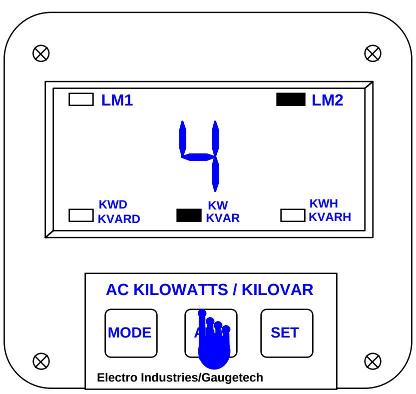
- Once to access positive LM1 limit
- Twice to access the positive LM2 limit
- Three times to access the negative LM1 limit
- Four times to access the negative LM2 limit

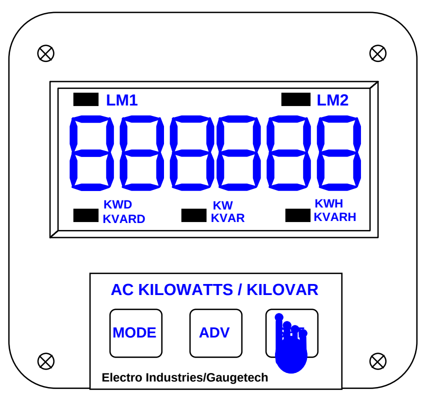
⇨The set limits appear momentarily.

Note**: LM1 and LM2 are available* **only** ***for KW or KVAR.

5.4. LED Test

The LED test checks if the LEDs and annunciators are functioning properly.





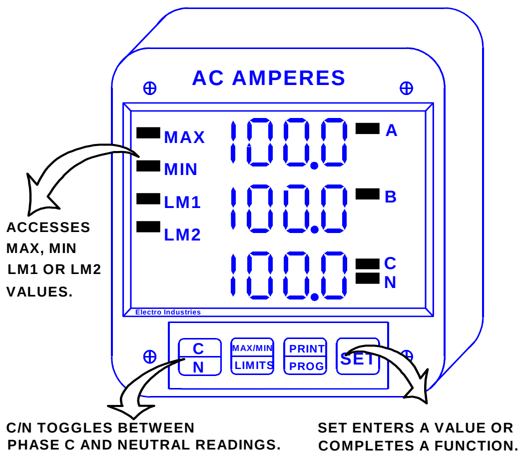
Step 1:
a. Press ***B2*** until ***4*** appears.

Step 2:
a. While the 4 is displayed, press ***B3***
⇨All LEDs glow twice.

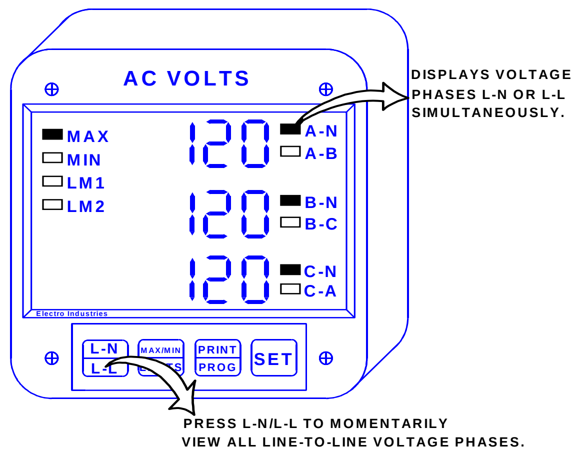
CHAPTER 6

P31 & P32 OPTIONAL DISPLAY OVERVIEW

The **P31** displays three phases of current simultaneously. The **P32** measures voltage line-neutral and line-to-line.



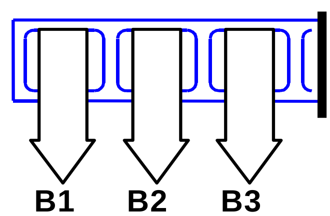
*The **P31** front panel with display and keypad*



*The **P32** front panel with display and keypad*

KEYPAD BUTTONS

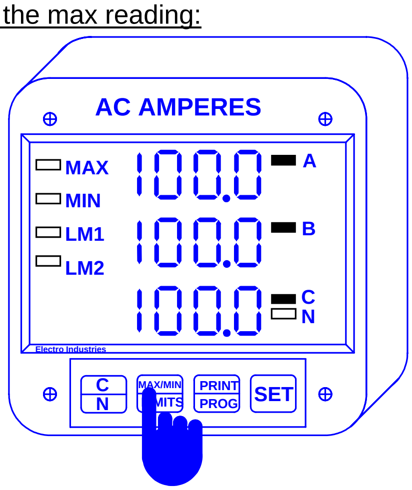
In the following illustrations and examples the keypad buttons have been assigned the names B1, B2, B3 and B4, moving from left to right.



6.1: Accessing Max/Min Values

Max/min values are available for all instantaneous measurements. Max/min values represent the highest and lowest average demand over a user-programmable time period. This is known as the **Integration Interval**. Readings are calculated using a rolling average technique. Each second a new reading is used to calculate the max/min; the last reading of the interval is dropped.

To view the max reading:



Press ***B2***:

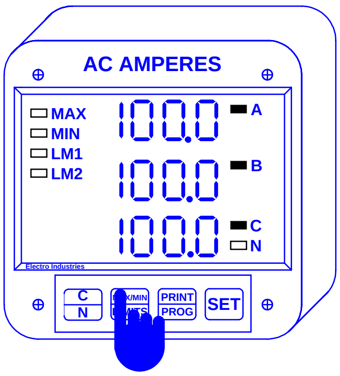
- Once to view the max values
- Twice to view the min values

6.2: Resetting Max/Min Values

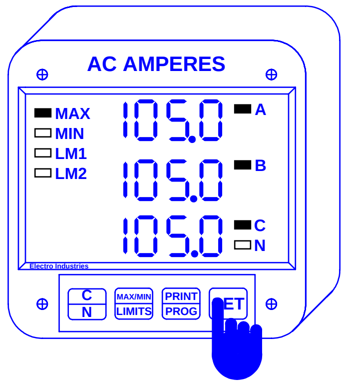
Use the reset function if a new value is desired. It is available in two different modes.

1. **UNPROTECTED MODE**: Allows quick and easy resetting of max/min values.
2. **PROTECTED MODE**: Prevents unauthorized personnel from resetting the max/min values.

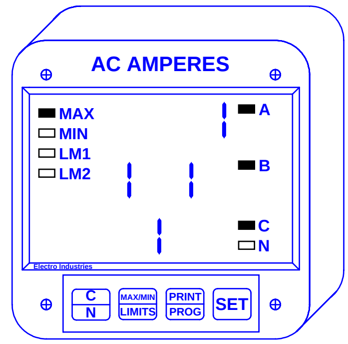
UNPROTECTED RESET



Step 1:
a. Press ***B2*** once for the max, twice for the min.



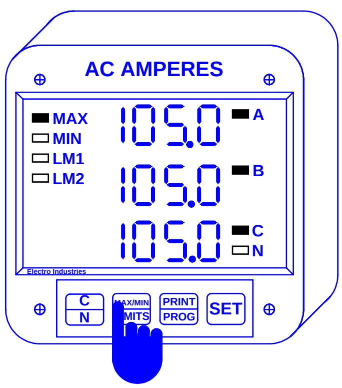
Step 2:
a. While the max or min is displayed, press ***B4*** once to reset.



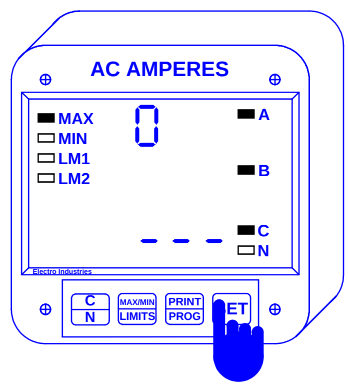
⇨The display blanks and a check mark appears momentarily, confirming a successful reset.

PROTECTED RESET

A password must be entered before any readings can be reset. The password is ***005***.

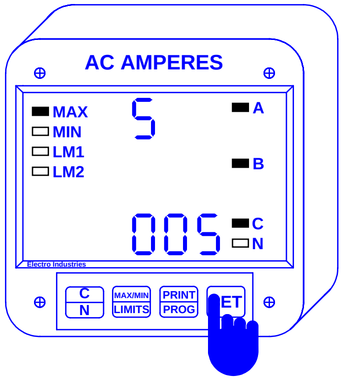


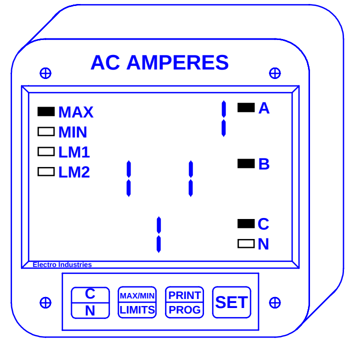
Step 1:
a. Press ***B2*** once for the max, twice for the min.



Step 2:
a. While the max/min is displayed, press ***B4*** once to begin protected reset.

⇨Three dashes appear in lower display and digits begin scrolling in upper display.



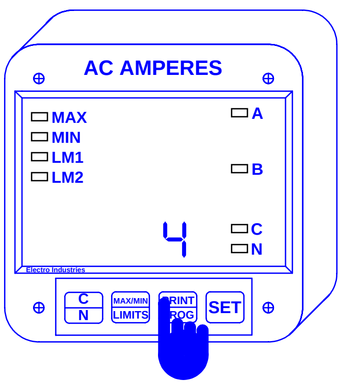


Step 3:
a. Press ***B4*** each time a password digit appears, until 0-0-5 is entered.

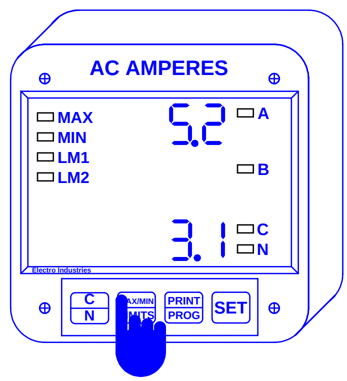
⇨When 005 is entered, the display blanks and a check mark appears momentarily, confirming a successful reset.

6.3: Firmware Version/LED Test

The P31 and P32 access the firmware version number of the analog and digital microprocessors. Also available is an LED test to check if the LEDs and annunciators are functioning properly.



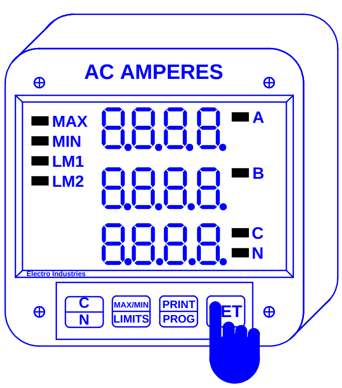
Step 1:
a. Press ***B3*** until a ***4*** appears.



For Firmware Versions

Step 2:
a. While the 4 is displayed, press **B2** to view Firmware Versions momentarily.

⇨The upper display indicates the **analog** processor version; the lower display indicates the **digital** processor.



For the LED test

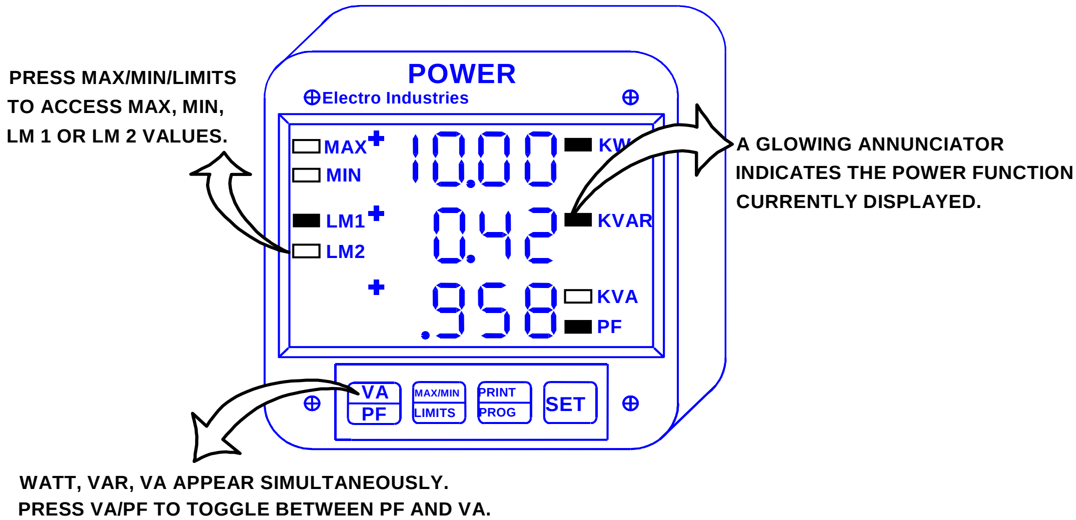
Step 2:
a. While the 4 is displayed**,** press **B4** for the LED test.

All segments and annunciators glow simultaneously; the display returns to current reading.

CHAPTER 7

P33 OPTIONAL DISPLAY OVERVIEW

The **P33** monitors four electrical parameters: WATT, VAR, VA and PF.



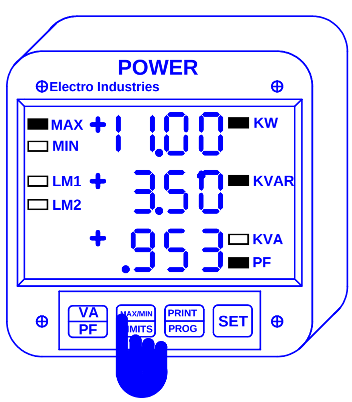
*The **P33** front panel with display and keypad*

The P33 reads to 0.50% accuracy with a resolution of 0.1% at a range up to 2000 counts. It also reads PF to 1.0% at a range of 1.0 to ± 0.5.

7.1: Accessing Max/Min Values

Max/min values are available for all instantaneous measurements. Max/min values represent the highest and lowest average demand over a user-programmable time period. This is known as the **INTEGRATION INTERVAL**. Readings are calculated using a rolling average technique. Each second a new reading is used to calculate the max/min; the last reading of the interval is dropped.

To access the max/min:



Press ***MAX/MIN/LIMITS***:

- Once to view the max values
- Twice to view the min
- Five times to view the negative max
- Six times for the negative min

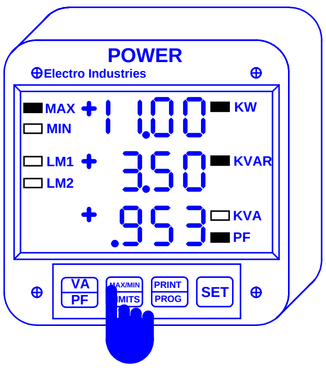
⇨ Values appear momentarily.

7.2: Resetting Max/Min Values

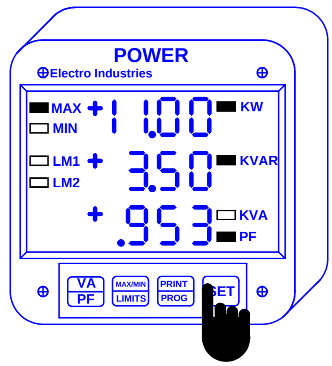
Use the reset function if a new value is desired. It is available in two different modes.

1. **UNPROTECTED MODE**: Allows quick and easy resetting of kilowatt-demand/kilovar-demand and kilowatt-hour/kilovar-hour readings.
2. **PROTECTED MODE**: Prevents unauthorized resetting of the kilowatt-demand/kilovar-demand and kilowatt-hour/kilovar-hour readings.

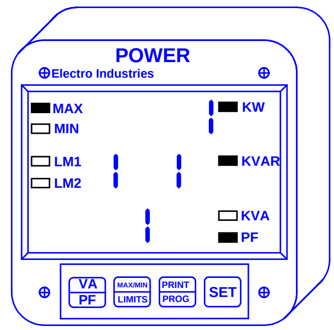
UNPROTECTED RESET



Step 1
a. Press ***MAX/MIN/LIMITS*** to reset in the unprotected mode.



Step 2
a. While the max or min is displayed, press ***SET*** to reset values.

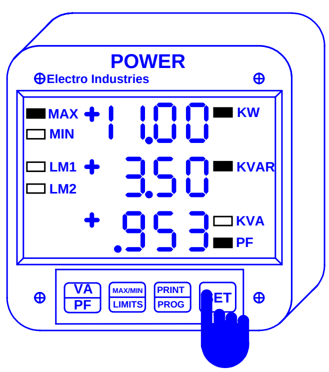


⇨The display blanks and a check mark appears momentarily, confirming a successful reset.

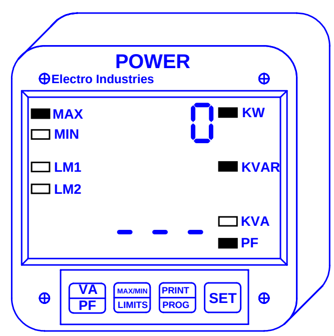
PROTECTED RESET

A password must be entered before any readings can be reset. The password ***005***.

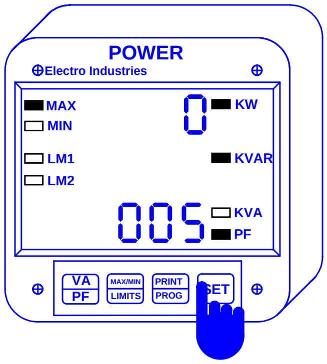
<u>To reset:</u>



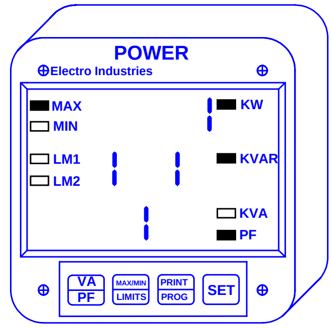
Step 1:
a. Press ***MAX/MIN/LIMITS***. While the max/min number is displayed, press ***SET*** to reset values.



⇨Three dashes appear in lower display; digits begin scrolling in upper display.



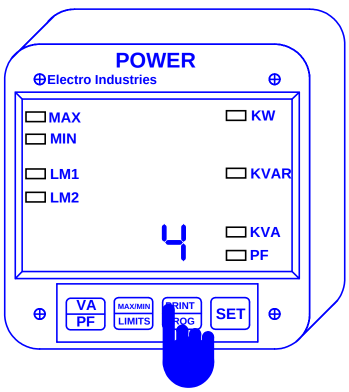
Step 2:
a. Press ***SET*** each time a password digit appears until 0-0-5 is entered.



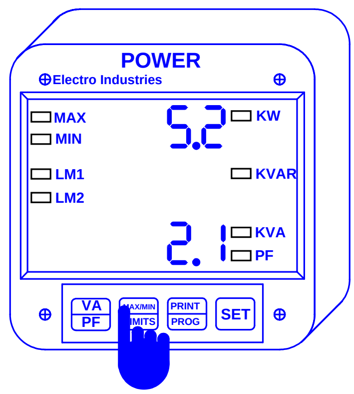
⇨When 005 is entered, the display blanks and a checkmark appears momentarily, confirming a successful reset.

7.3: Firmware Version/LED Test

The P33 accesses the firmware version number of the analog and digital microprocessors. Also available is an LED test to check if the LEDs and annunciators are functioning properly.



Step 1:
a. Press ***PRINT/PROG*** until **4** appears.

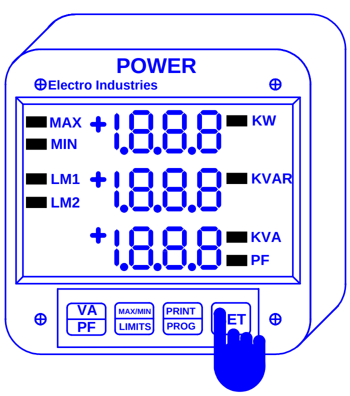


For Firmware Versions

Step 2:
a While the 4 is displayed, press ***MAX/MIN/LIMITS*** for the Firmware Versions.

⇨ Upper display indicates the **analog** processor version; lower display indicates the **digital** processor version.

⇨ Versions appear momentarily.



For LED Test

Step 2:
a. While the 4 is displayed**,** press ***SET*** for the LED Test.

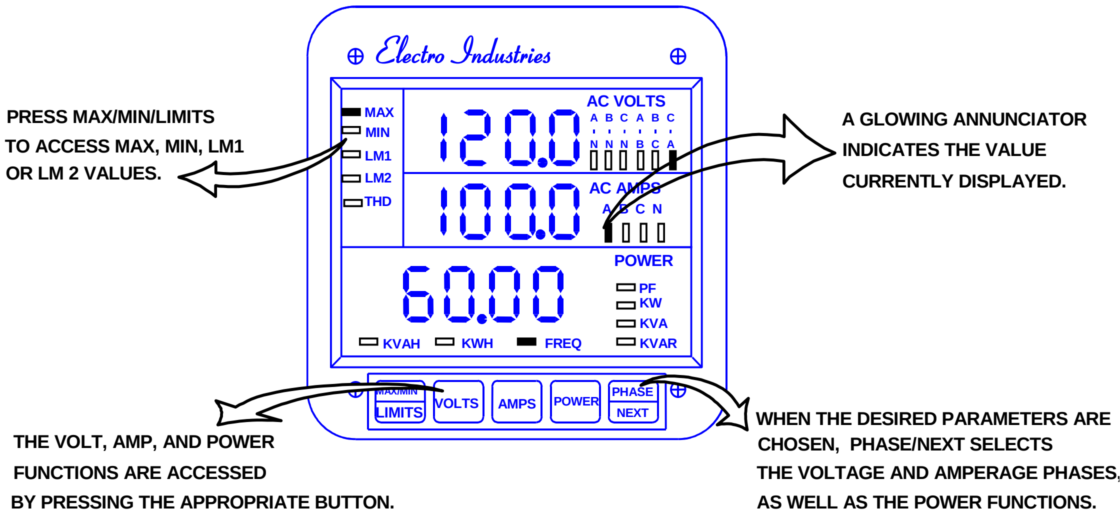
⇨ All segments and annunciators glow simultaneously and the display returns to the current readings.

CHAPTER 8

P34 OPTIONAL DISPLAY OVERVIEW

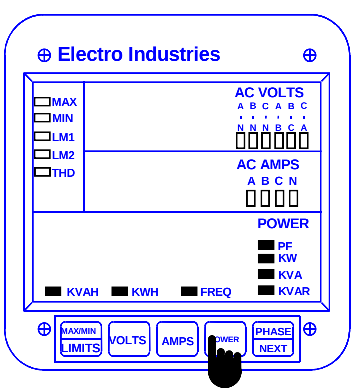
The **P34** has 17 electrical parameters. Values for each parameter are accessed through the keypad.

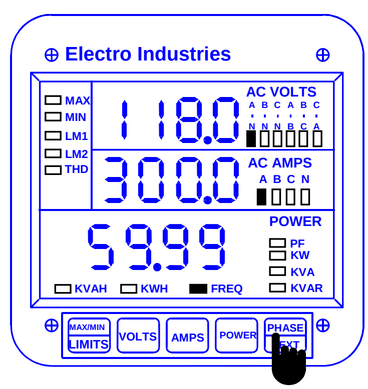
VOLTS	AMPS	POWER A, B, C
A-N	A	± KW
B-N	B	± KVAR
C-N	C	KVA
A-B	N	± PF
B-C		Freq
C-A		± Total KWH Total KVAH



*The **P34** front panel with display and keypad*

8.1: Accessing the Power Functions





Step 1:
a. Press ***POWER*** to select the power category.

⇨The display blanks and the annunciators in the power section glow, confirming the selection.

Step 2:
a. Press ***PHASE/NEXT*** to select desired power function.

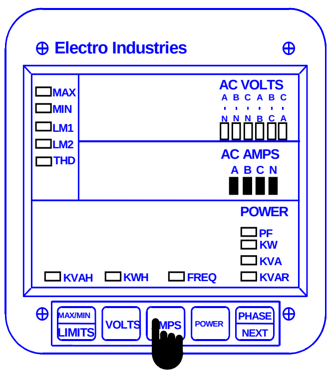
⇨The functions are accessed in a clockwise sequence.

<u>Note:</u> For KWH readings the first digit on the left of the KWH counter will blank out on the display upon rollover at 199999 KWH. The actual value of the first digit can only be viewed through digital communications. Otherwise reset the KWH counter to zero to avoid confusion.

8.2: Accessing Voltage and Current Phases

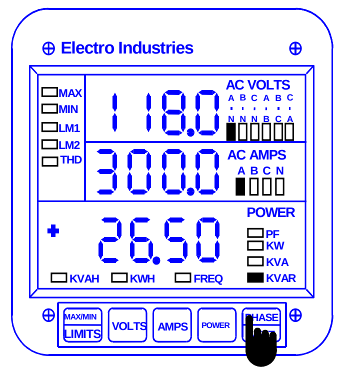
The P34 displays four current measurements (phases A, B, C and Neutral) and six voltage measurements—phase-to-phase: A-B, B-C, C-A; and phase-to-neutral: A-N, B-N, C-N.

<u>To access voltage and current phases:</u>



Step 1:
a. Press ***AMPS*** (or ***VOLTS***) to select the Amps (or Volts) category.

⇨The display blanks and all annunciators in the section glow, confirming selection.

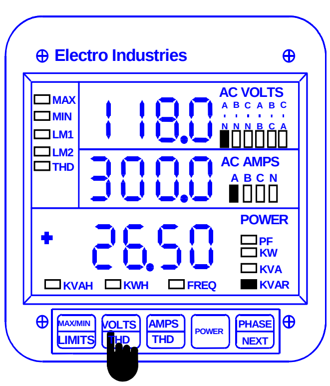


Step 2:
a. Press ***PHASE/NEXT*** for desired phase.

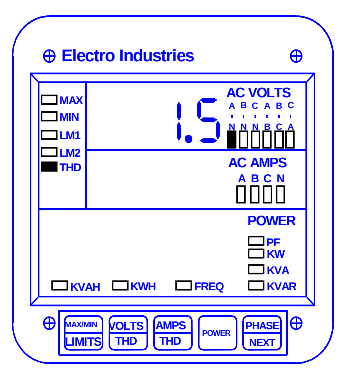
8.3: Accessing %THD Functions

This display measures harmonic waveforms and %THD for current phases A, B, C and voltage phases A-N, B-N, C-N. Measurement capability reaches the 31st harmonic order.

<u>To access %THD:</u>



Step 1:
a. Press ***VOLTS/THD*** (or ***AMPS/THD***) twice to access %THD values for a voltage or current phase.



⇨The display blanks and %THD values appear momentarily.

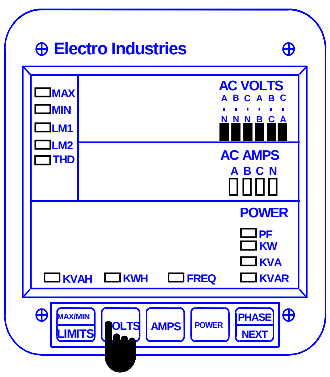
8.4: Accessing Max/Min Values

Max/min values are available for all instantaneous measurements. Max/min values represent the highest and lowest average demand over a user-programmable time period. This is known as the **Integration Interval**. Readings are calculated using a rolling average technique. Each second a new reading is used to calculate the max/min; the last reading of the interval is dropped. To faceplate program the Integration Interval, see Chapter 10, section 10.1.

To access a max or min value, while a desired measurement appears, press ***MAX/MIN/LIMITS*** once for max value and twice for the min. Examples given below are for voltage and current phases; use the same procedure to access %THD max/min readings.

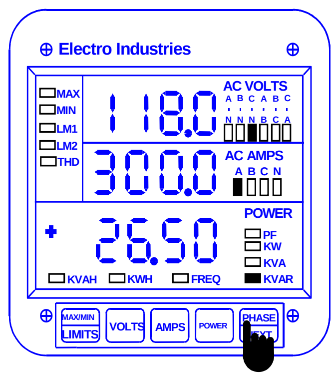
To access KW, KVAR and PF negative measurements indicating leading current, press ***MAX/MIN/LIMITS*** five times for negative max and six times for negative min.

<u>To access max/min values:</u>

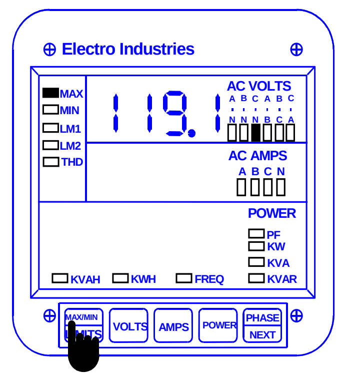


Step 1:
a. Press ***VOLTS*** (or ***AMPS***) to select Volts (or Amps).

⇨The display blanks and the annunciators glow, confirming the selection.



Step 2:
a. Press ***PHASE/NEXT*** for the desired phase.



Step 3:
a. Press ***MAX/MIN/LIMITS*** once to view the max reading.

⇨The display blanks and momentarily displays the max value.

8.5: Resetting Values

Use the reset function if a new value is desired. It is available in two different modes.

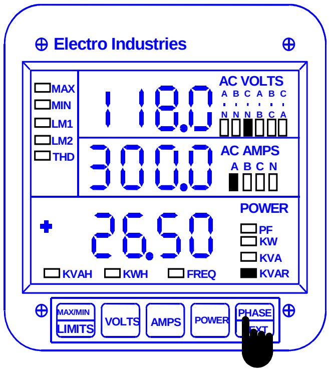
1. **UNPROTECTED MODE**: Allows quick and easy resetting of kilowatt-demand/kilovar-demand and kilowatt-hour/kilovar-hour readings.

2. **PROTECTED MODE**: Prevents unauthorized resetting of the kilowatt-demand/kilovar-demand and kilowatt-hour/kilovar-hour readings. To select this mode, enter Group 0, Function 3, Pack 1, Switch B of the faceplate Programming Mode—see Chapter 10.

Even if the unprotected mode is selected during programming, the KWH and negative KWH are always in protected mode. The following examples are for the max and min; the procedure is the same for totalized power functions.

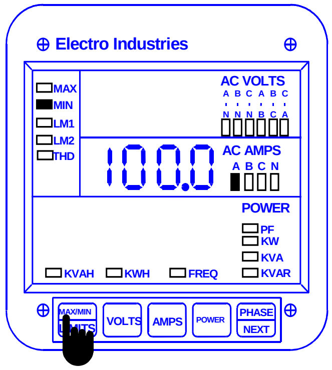
UNPROTECTED RESET

For example—To reset the min of Amps A:

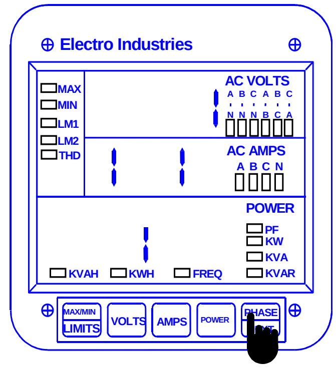


Step 1:
a. Press ***AMPS*** if not already in the Amps category.

b. Press ***PHASE/NEXT*** until Phase A appears.



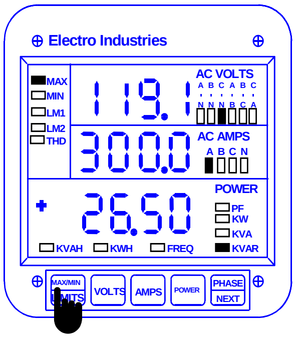
Step 2:
a. Press ***MAX/MIN/LIMITS*** twice to access the min value for Amps A.



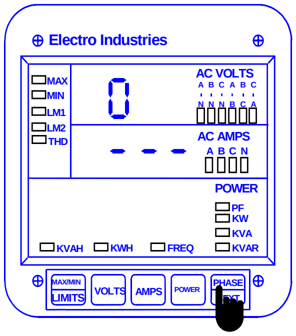
Step 3:
a. While the min value is displayed, press ***PHASE/NEXT*** to reset.
⇨The display blanks and a checkmark appears, confirming reset.
⇨Repeat this procedure for each value you wish to reset.

PROTECTED RESET

The password for the reset is **005**. A password must be entered before any readings can be reset.

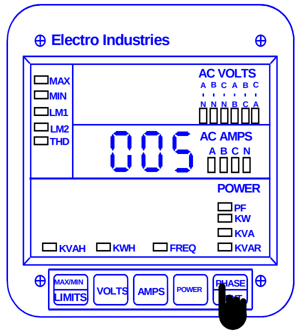


Step 1:
a. Press ***MAX/MIN/LIMITS*** once to access the max value and twice for min value of selected parameters.

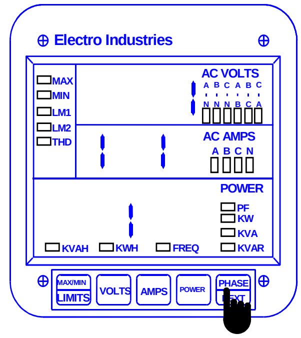


Step 2:
a. While the value is displayed, press ***PHASE/NEXT*** to commence protected reset.

⇨The display blanks, three dashes appear in middle display and digits begin scrolling in upper display.



Step 3:
a. Press ***PHASE/NEXT*** each time a password digit appears, until 0-0-5 is entered.



⇨When 005 is entered a checkmark appears, confirming reset.

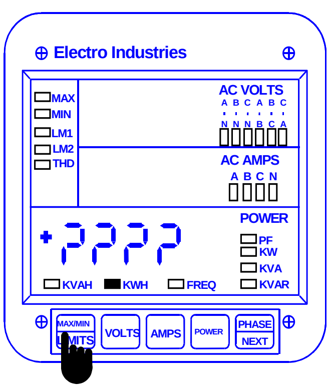
PROCEDURE FOR RESETTING HOUR READINGS

(These readings are always in protected mode.)

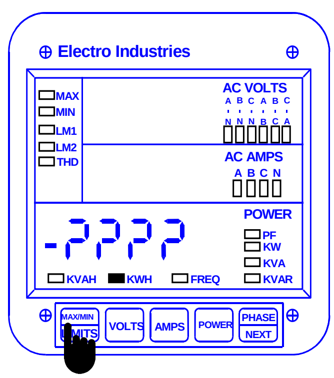
1) Press **POWER** once.

2) Press **PHASE/NEXT** until desired hour function appears.

Step 2a) For positive hour reset, press ***MAX/MIN/LIMITS*** until the (+) sign appears with question marks.



Step 2b) For negative hour reset, press **MAX/MIN/LIMITS** until the (-) sign appears with question marks.

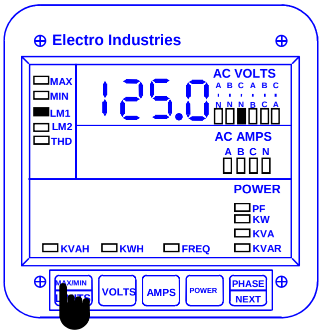


3) While the question marks are displayed, press **PHASE/NEXT.**
⇨The display blanks, three dashes appear in middle display and digits begin scrolling in upper display.

4) Press **PHASE/NEXT** each time a password digit appears, until 005 is entered. A check mark appears, indicating a successful reset.

8.6: Accessing the LM1/LM2 Set Limits

SET LIMITS: The point when the relay changes position (if equipped with Relay Option Package—L100 or L200; see Chapters 14 and 15). The P34 has two manual set limits that monitor the instantaneous readings and warn the user of any abnormal conditions. Each limit detects readings above or below a set level. If a limit is exceeded, only the annunciator for LM1 and/or LM2 flashes.



To access the set limit, press ***MAX/MIN/LIMITS***

- three times for LM1
- four times for LM2

TO LOCATE READINGS THAT EXCEEDED LIMIT 1:

a. Press ***MAX/MIN/LIMIT*** three times. While the value is displayed, press ***PHASE/ NEXT.***

⇨ The display blanks.
⇨Middle display indicates *L1*; annunciators for parameters that exceeded their Limit 1 glow.

TO LOCATE READINGS THAT EXCEEDED LIMIT 2:

a. Press ***MAX/MIN/LIMIT*** four times. While the value is displayed, press ***PHASE/NEXT***.

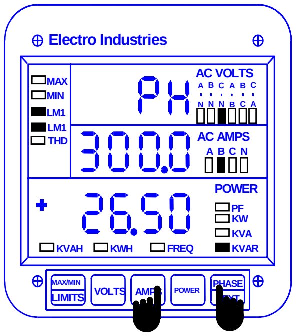
⇨ The display blanks.
⇨ Middle display indicates *L2* ; annunciators for parameters that exceeded their Limit 2 glow.

8.7: Voltage Phase Reversal and Imbalance

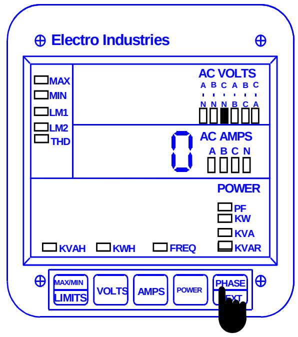
In a three-phase power distribution system, normal phase shift between each line is 120°. The P34 detects any abnormalities and displays a **PH** message.

VOLTAGE PHASE REVERSAL: Occurs if there is an incorrect connection, such as mistaking line A for line B. A **PH** message appears. The correct sequence is A-B-C.

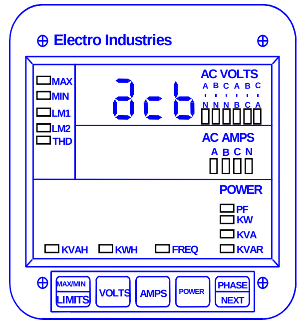
VOLTAGE PHASE IMBALANCE LIMIT: Can be detected using the phase imbalance limit in the faceplate programming mode: enter Group 0, Function 3, Pack 0, Switch D; see Chapter 10. The phase imbalance is expressed as a percentage, with 0% indicating a 120° phase shift between each line. A **PH** message occurs if the limit is exceeded.



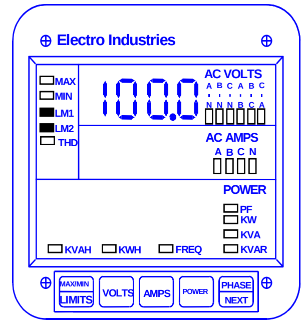
Step 1:
a. Press ***AMPS*** and ***PHASE/NEXT*** simultaneously to access the display.



Step 2:
a. Press ***PHASE/NEXT*** to select zero.



⇨This display indicates a Voltage Phase Reversal.



⇨This display indicates a Voltage Phase Imbalance

—A display of **PH** indicates Voltage Phase Reversals **and** Voltage Phase Imbalances.

If the Voltage Phase Reversal and Voltage Phase Imbalance occur simultaneously, the display alternates between the incorrect phase sequence and the exceeded limit percentage. After six seconds the display returns to normal operating mode.

8.8: Access Modes

The following commands allow the user to perform specific operations.

ACCESS	OPERATION
1	Print Operating Data
2	Print Programming Data
3	Enter Programming Mode (see Part III: Programming)
4	Firmware Version/LED Test

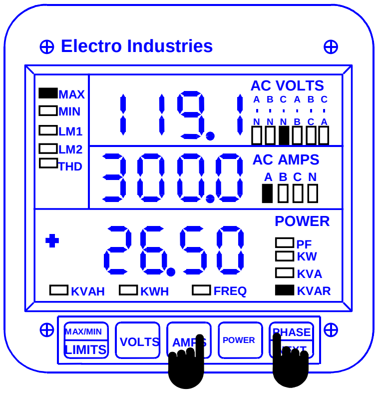
***<u>Note</u>*: Print commands 1 and 2 are only available if enabled in the programming mode: Group 0, Function 3, Pack 3, Switch D; see section Chapter 10. They are not recommended when using the multimeter connection RS485. The print option should be disabled when using the RS485. Disabling prevents the user from corrupting data at a computer terminal while multiple meters are being polled.**

8.9: Print Operating Data

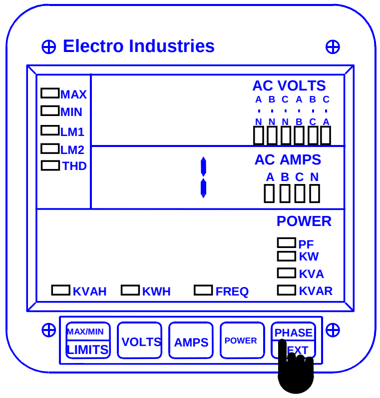
***<u>Note</u>*: This function applies only if a serial printer is connected to the Futura+ device via an RS232C Communication Converter.**

This function sends data to a serial printer, creating a hard copy of the instantaneous, max and min data of the functions.

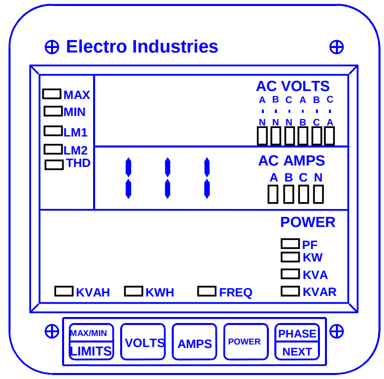
To print the operating data:



Step 1:
a. Press and hold ***PHASE/NEXT***.
b. While holding ***PHASE/NEXT***, press ***AMPS*** until a number appears in the middle display. Then **release** both buttons.



Step 2:
a. Press ***AMPS*** until a **1** appears.
b. Press ***PHASE/NEXT*** to select.



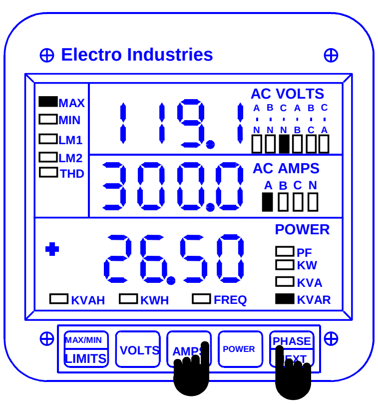
⇨***111*** appears, confirming a successful print command.

8.10: Print Programming Data

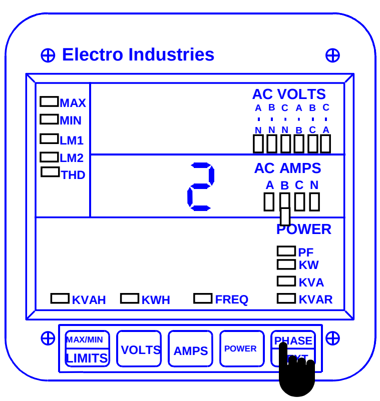
***Note**: This function applies only if a serial printer is connected to the Futura+ device via an RS232C Communication Converter.*

This function sends programming data (also known as the *meter setup*) to a serial printer for verification and quick reference.

To print the programming data:

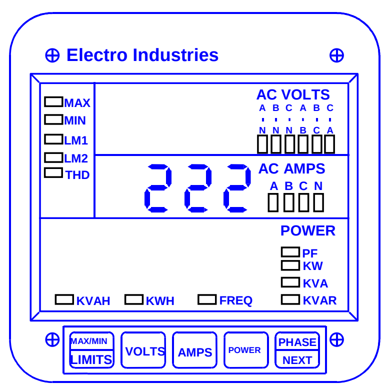


Step 1:
a. Press and hold ***PHASE/NEXT***.
b. While holding ***PHASE/NEXT***, press ***AMPS*** until a number appears in the middle display. Then **release** both buttons.



Step 2:
a. Press ***AMPS*** until **2** appears.

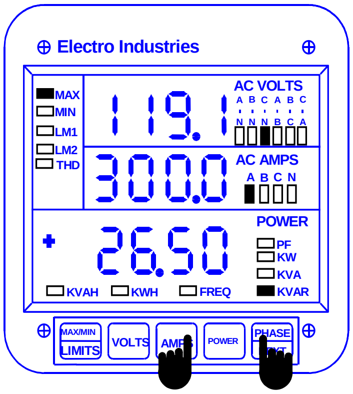
b. Press ***PHASE/NEXT*** to select.

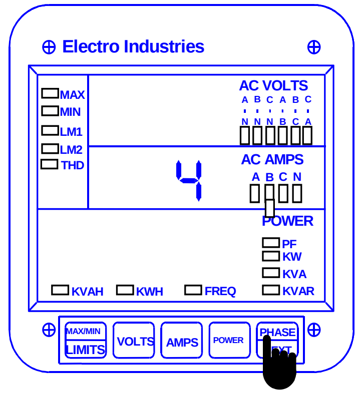


⇨**222** appears, confirming a successful print command.

8.11: Accessing Firmware Version/LED Test

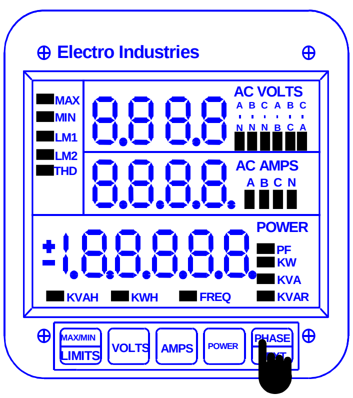
The P34 can display the firmware version number of the analog and digital microprocessors. Also available is an LED test to check if the LEDs and annunciators are functioning properly.





Step 1:
a. Press and hold ***PHASE/NEXT***.
b. While holding ***PHASE/NEXT***, press ***AMPS*** until a number appears in the middle display. Then **release** both buttons.

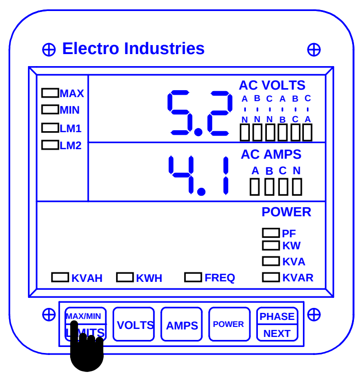
Step 2:
a. Press ***AMPS*** until **4** appears.



<u>For the LED Test:</u>

While the 4 is displayed press ***PHASE/NEXT*** to select.

⇨All segments and annunciators glow.



<u>For Firmware Versions:</u>

While the 4 is displayed, press ***MAX/MIN/ LIMITS*** for the firmware versions.

<u>Firmware versions:</u>
Upper display—analog processor version
Middle display—digital processor

Part III: Faceplate Programming the P34 Display

CHAPTER 9
FACEPLATE PROGRAMMING OVERVIEW

- Faceplate programming is only available with the P-34 display module.
- Programming the unit through a computer is much **faster** and **easier**. Programming software is included with each unit. Plug the computer into the RS232 port to program. If you do not have a copy of Communicator EXT software, contact EIG for a free copy.
- This chapter describes basic procedures. Refer to chapters 10–12 for details on specific programming features.

9.1 General Procedure

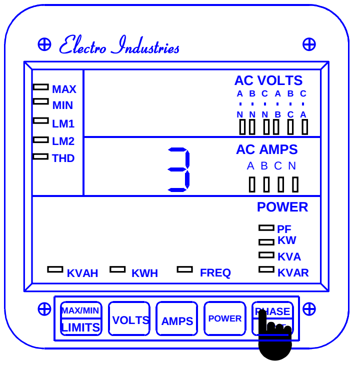
To faceplate program your Futura+ Series you will:

1. Enter a **password** to gain access to the programming mode (section 9.2).
2. Select a programming **GROUP** to work in (section 9.3).
3. Select a **FUNCTION** or **SWITCH PACK** within that GROUP (section 9.3).
4. Change the selected parameters of the FUNCTION or SWITCH PACK with **DATA ENTRY** (section 9.4).
5. **Exit** the programming mode to store your changes permanently (section 9.6).

9.2: Password Entry

To access the programming mode a password must be entered. Password entry ensures information security and eliminates unauthorized intrusion. The password is preset at the factory and cannot be changed. It is **555**.

<u>To enter the programming mode:</u>



Step 1:
a. Press and hold ***PHASE/NEXT***.

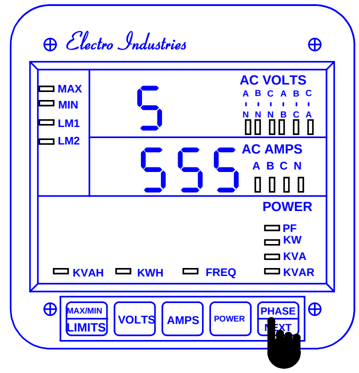
b. While holding ***PHASE/NEXT***, press ***AMPS*** until a number appears in middle display. Then **release** both buttons.

⇨If ***3*** does not appear:

c. Press ***AMPS*** until ***3*** appears.

d. Press ***PHASE/NEXT*** to multiply the ***3*** to ***333***.

⇨***333*** flashes momentarily in middle display.

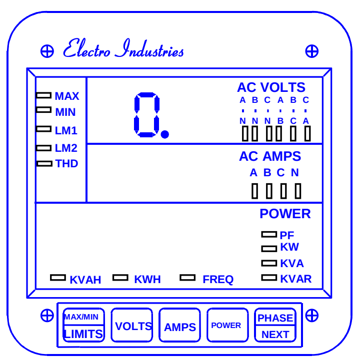


Step 2:
⇨Digits begin scrolling in upper display.

⌦The password is **555**.

a. Press ***PHASE/NEXT*** each time **5** appears until 5-5-5 is entered.

⇨Selected digits appear in middle display.



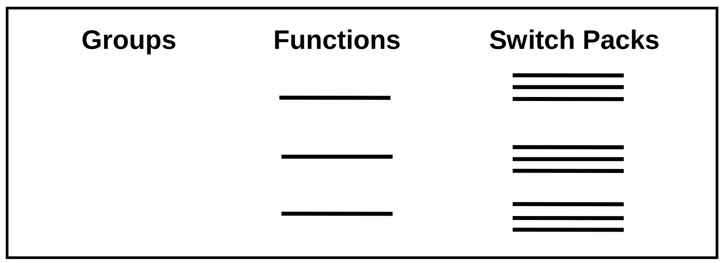
⇨When 555 is entered**,** the display blanks and ***PPP*** flashes in upper display, confirming a correctly entered password.

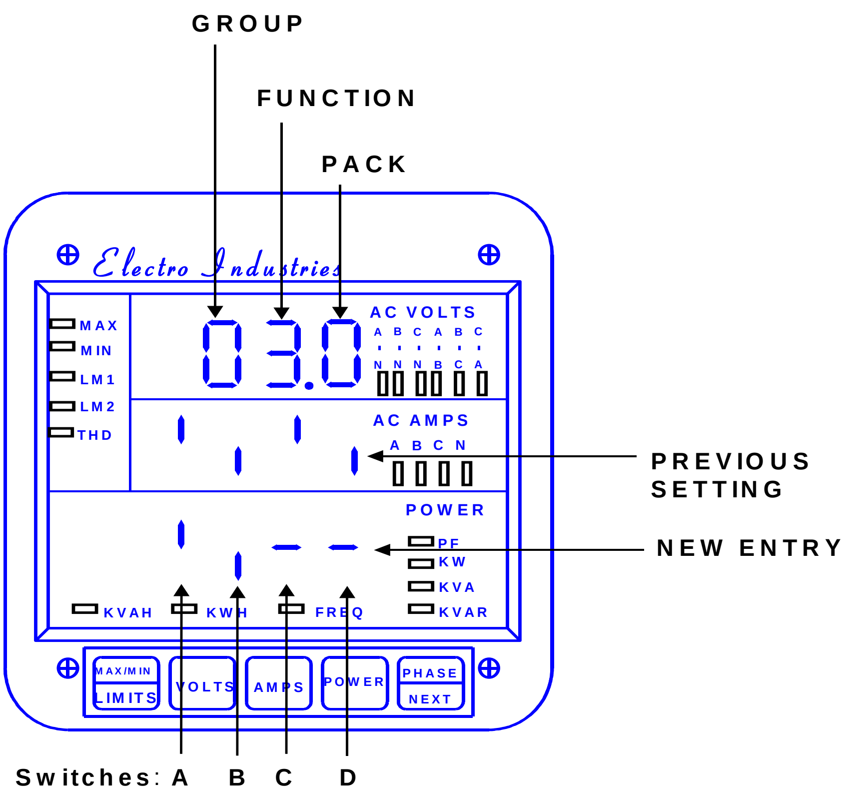
⇨***PPP*** is replaced by **0.** and the meter is now in Programming Mode, GROUP 0.

9.3: Selecting Groups and Functions

Programming tasks are bundled into **GROUPS**. Located within each **GROUP** are specific meter **FUNCTIONS**. See Chapters 10–12 for descriptions of the different tasks performed by each GROUP.

Some FUNCTIONS are further divided into SWITCH PACKS, which are a set of separate ON/OFF toggle switches. Toggle switches have only two positions: either UP segment or DOWN segment. By setting the segment to UP or DOWN a particular feature is turned ON or OFF, respectively.



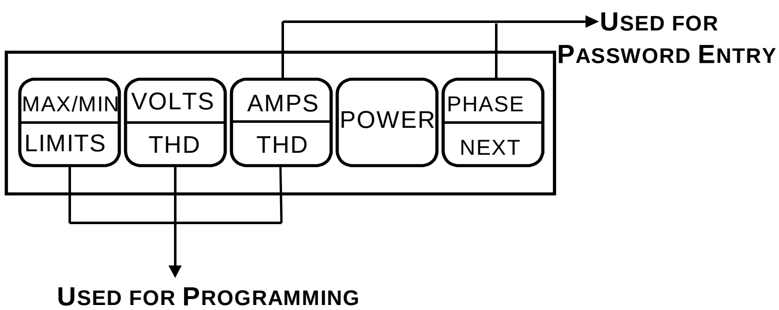


The Programming Mode—toggle segments for Group 0, Function 3, Switch Pack 0.

9.4: Data Entry

Programmable FUNCTION values are always four-digit numeric fields designed to accept any value between 0000 and 9999. When entering the value of a parameter you must enter all four digits, leading zeros included. For example, if you want to enter the number 25, you must enter 0025.

The P-34's faceplate programming mode utilizes only three out of the five keypad buttons: the **MAX/MIN/LIMITS**, **VOLTS/THD**, and **AMPS/THD** buttons.



BUTTON	FUNCTION	DESCRIPTION
MAX/MIN/LIMITS	ADVANCES	Scrolls groups, functions, and advances to exit point from function and group level.
VOLTS/THD	CHANGE VALUE	Scrolls packs, digit counters, and changes switch pack position UP or DOWN.
AMPS/THD	STORE	Activates new data entry, and enters or exits from group or function level.

9.5: Checksum Error—Protective Mechanism

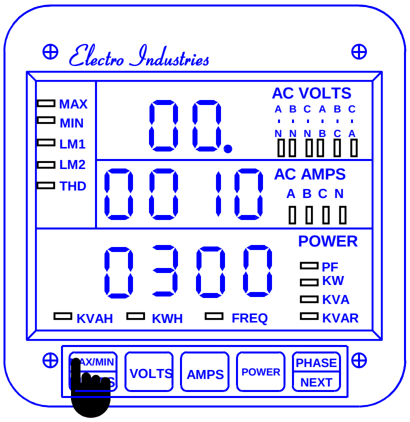
If the control power is interrupted while in Programming Mode or the user does not completely exit, the meter enters a checksum mode. The max LED flashes. Press ***AMPS*** and ***PHASE/NEXT*** simultaneously and the unit recovers. Follow the procedure to enter Programming Mode to check program data. If the data is correct, then exit.

This checksum error is a protective mechanism. It alerts the user when a procedure was not correctly followed so that the meter will not read erroneous numbers.

9.6: Exiting the Programming Mode

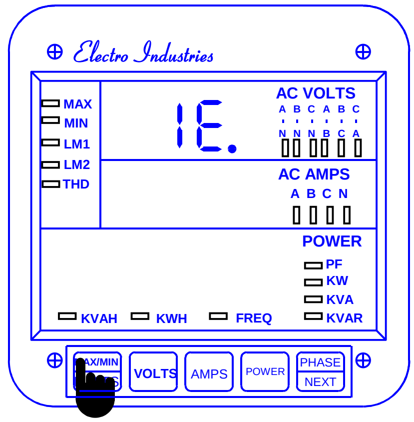
The steps for exiting the programming mode vary depending upon the level of programming.

If you are located in the Function Level—begin at **Step 1**.
If you are located in the Group Level—begin at **Step 2**.



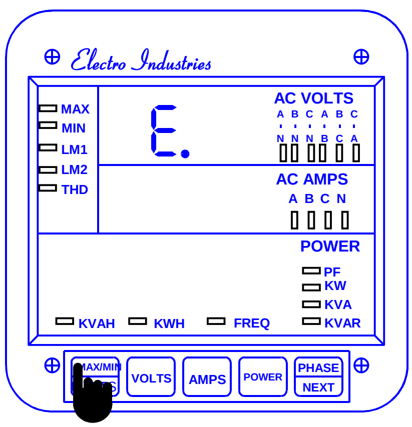
Step 1:
EXITING FROM FUNCTION LEVEL

a. Press ***MAX/MIN/LIMITS*** until the Group number in upper display is followed by ***E.***



Step 1a.:

a. Press ***AMPS*** to exit from Function Level to Group Level.



Step 2:
EXITING FROM GROUP LEVEL

a. Press ***MAX/MIN/LIMITS*** until ***E.*** appears in upper display.

b. Press ***AMPS*** to exit entirely from Programming Mode.

CHAPTER 10

PROGRAMMING GROUP 0—GLOBAL METER SETUP

The Global Meter Setup includes FUNCTIONS 0-3 and 7, which control configuration and basic operation of the CPU-1000. Below is an outline of GROUP 0, showing its specific features. FUNCTION 3—System Configuration—contains Switch PACKS with various options, including Open Delta Installation, Communications and DC Output Setup.

GROUP AND FUNCTION NUMBER	FUNCTION
00.	Integration Interval
01.	Meter Address for Communication
02.	Baud Rate for Communication
03.	System Configuration (see Table 10-2)
07.	Number of Phases
0E.	Exit Programming GROUP 0

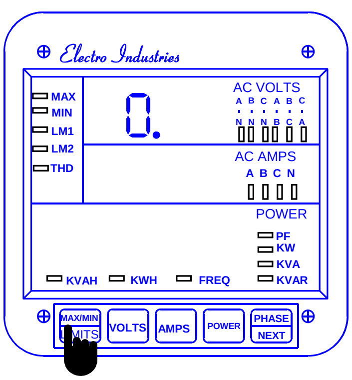
Table 3-1: Group 0 Programming Format

10.1: Group 0, Function 0—Integration Interval

The **Integration Interval** is the time period over which all instantaneous readings are averaged to obtain a max and min demand. The Integration Interval is entered in seconds. When entering 15 minutes, enter: 0900 seconds. The default value is 900 seconds.

To change the Integration Interval:

<u>Note</u>: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.

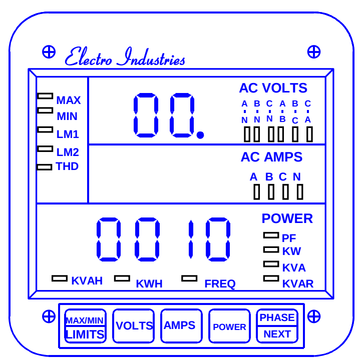


Step 1:

a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

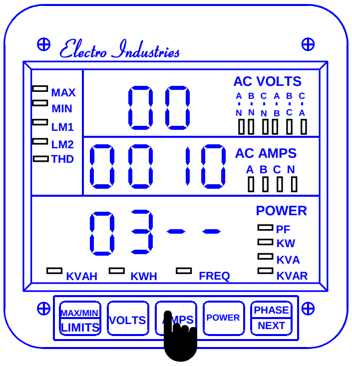
b. Press ***MAX/MIN/LIMITS*** until **0.** appears in upper display.

c. Press ***AMPS*** to activate the Group.



⇨Function **00.** appears in upper display.

⇨Lower display indicates current Interval setting.

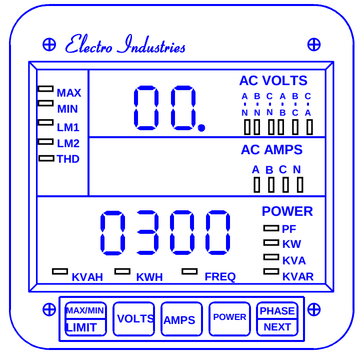


Step 2:
a. Press ***AMPS*** once to begin Data Entry Sequence.

⇨The previous value shifts to middle display and four dashes appear in lower display.

b. Press ***VOLTS*** to select a number.

c. Press ***AMPS*** to store it.



⇨Repeat this procedure until new Integration Interval is entered.

⇨When complete, middle display blanks and lower display indicates new Integration Interval.

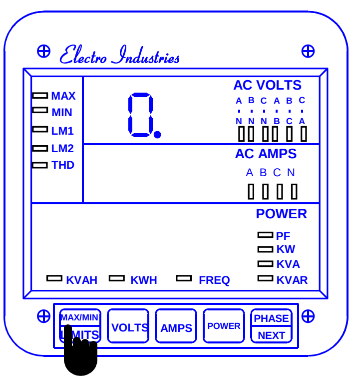
See Chapter 9, section 9.6 to exit.

10.2: Group 0, Function 1—Meter Address

The **Meter Address** identifies the meter when communicating with digital communications. When numerous meters are at one site, it is essential that each meter have its own address. Otherwise, all meters speak at the same time and communication is useless.

<u>To change the Meter Address:</u>

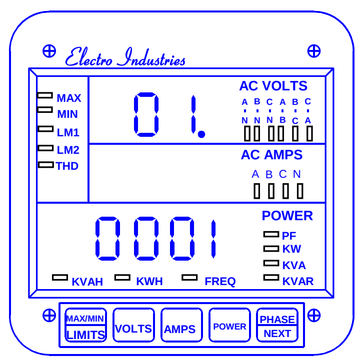
<u>Note</u>: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

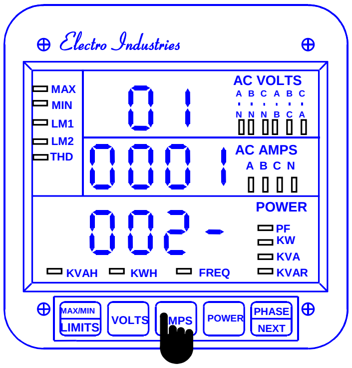
b. Press ***MAX/MIN/LIMITS*** until **0.** appears.

c. Press ***AMPS*** to activate the Group.



Step 2:
a. Press ***MAX/MIN/LIMITS*** until Function **01*.*** appears in upper display.

⇨Lower display indicates the current Meter Address.

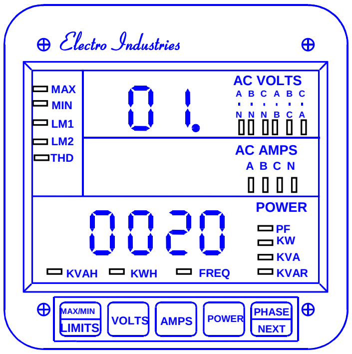


Step 3:
a. Press ***AMPS*** to begin Data Entry Sequence.

⇨The previous value shifts to middle display and four dashes appear in lower display.

b. Press ***VOLTS*** to select a number.

c. Press ***AMPS*** to store it.



⇨Repeat this procedure until new Address is entered.

⇨When complete, middle display blanks and lower display indicates new Address.

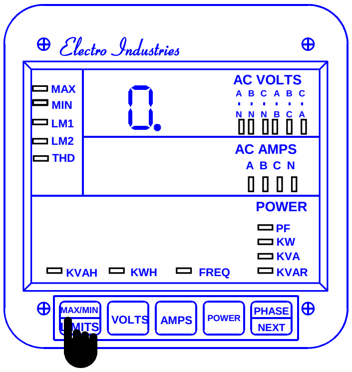
See Chapter 9, section 9.6 to Exit.

10.3: Group 0, Function 2—Baud Rate

The Baud Rate is the speed at which data is transmitted between meter and remote computer or serial printer. The rate programmed into the meter must match the rate used by the remote device. Valid Baud Rates are 1200, 2400, 4800 and 9600.

To change the Baud Rate:

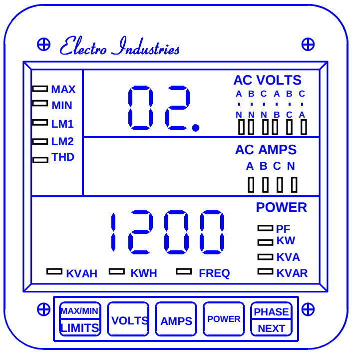
Note: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

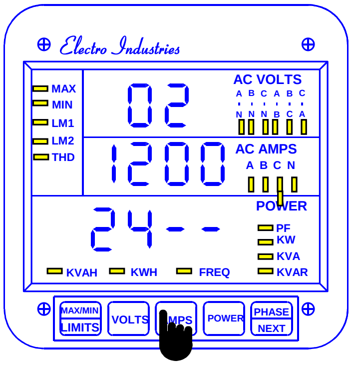
b. Press ***MAX/MIN/LIMITS*** until **0.** appears.

c. Press ***AMPS*** to activate the Group.



Step 2:
a. Press ***MAX/MIN/LIMITS*** until Function **02.** appears in upper display.

⇨Lower display indicates current Baud Rate.



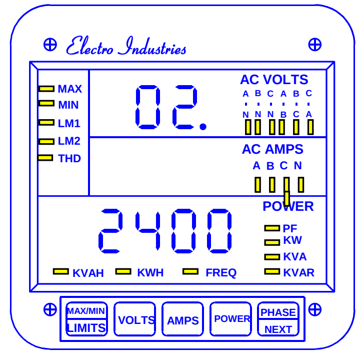
Step 3:

a. Press ***AMPS*** to begin Data Entry Sequence.

⇨The previous value shifts to middle display and four dashes appear in lower display.

b. Press ***VOLTS*** to select a number.

c. Press ***AMPS*** to store it.



⇨Repeat this procedure until new Communication Baud Rate is entered.

⇨When complete, middle display blanks and lower display indicates new Baud Rate.

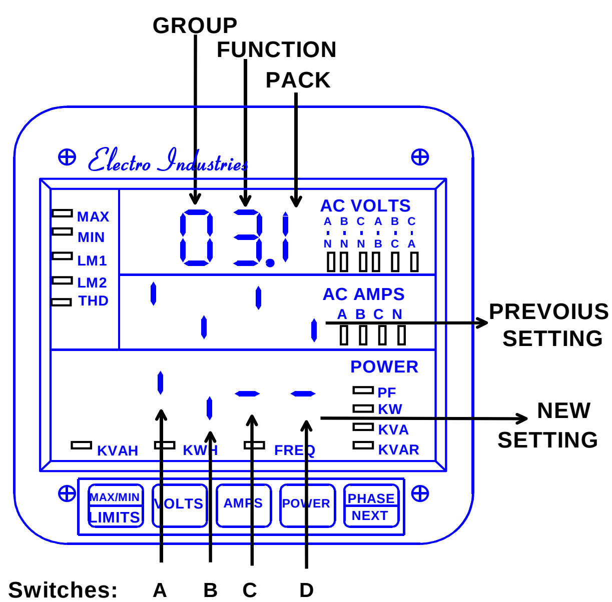
See Chapter 9 section 9.6 to Exit.

10.4: Group 0, Function 3—System Configuration

The System Configuration sets the CPU-1000's basic operational parameters. This Function utilizes Switch PACKS (see Table 10-2).

- FUNCTION 3 contains four different Switch Packs: 0–3. Each PACK contains four UP/DOWN segments.
- Toggling the segment UP or DOWN toggles the switch ON or OFF, or chooses between two options.
- The meter displays one Switch Pack at a time.

⇨Press ***VOLTS*** to scroll from Pack to Pack.



PACK	SWITCH	FEATURE	SEGMENT POSITION
0	A	Reserved	—
	B	Reserved	—
	C	Reserved	—
	D	Phase Reversal Limit Detection	UP—Enable DOWN—Disable
1	A	Non-significant will Blank Leading Zero	UP—Enable DOWN—Disable
	B	Reset Protection (See Part I: Installation and Operation)	UP—Enable DOWN—Disable
	C	Phase Reversal Rotation Selection	UP—CBA Rotation DOWN —ABC Rotation
	D	Open Delta Installation (See Part I: Installation and Operation)	UP—Enable DOWN—Disable
2	A	Reserved	—
	B	Power Factor Polarity Indicates + (voltage referenced) or - (current referenced)	UP— -PF DOWN— +PF
	C	Modbus Options (See Section 10.4.B, below)	UP—ASCII DOWN—RTU UP—DNP 3.0
	D	Protocol Options	UP—MODBUS DOWN—EI-BUS DOWN—DNP 3.0
3	B	Reserved	—
	C	RS232 or RS485 Communications or Print on DSP 2 Port	UP—Enable DOWN—Disable
	D	Print Operating and Programming Data (To print, set PACK 3 Switches C and D to UP position)	UP—Enable Print DOWN—Disable Print

Table 10-2: System Configuration—Switch Features

10.4.A: Open Delta System Installation Programming

A special switch indicates the electrical system monitored is a Three-phase, Three-Wire Open Delta System using the connection installation—see Chapter 3). The switch is located in GROUP 0, FUNCTION 3, Pack 1, Switch D.

***WARNING**: Set this switch UP only if the electrical system is a Three-Wire Delta or Open Delta, using 2 PTs. Otherwise, set the switch DOWN. Failure to select this switch results in phase-to-neutral readings and incorrect power readings with the 2-PT connection.*

10.4.B: Switching Communication Protocols: EI-BUS/MODBUS RTU/ASC II

- For EI-BUS protocol: Pack 2, Switch D is DOWN.
- For MODBUS ASCII protocol: Pack 2, Switch D is UP and Pack 2, Switch C is UP.
- For MODBUS RTU protocol: Pack 2, Switch D is UP and Pack 2, Switch C is DOWN.
- For DNP 3.0 protocol, RTU framing: PACK 2, Switch C is UP, Switch D is DOWN.
- MODBUS LIPA (Long Island Power Authority) mappings are accessible through communication.

10.4.C: Printing Option

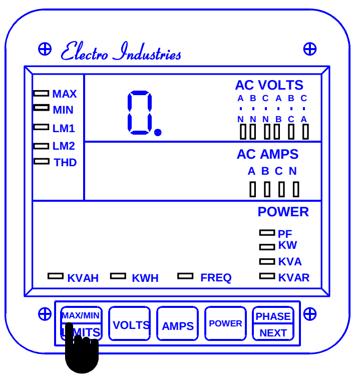
To print, use access Mode 1 and Mode 2 (see Chapter 8, section 8.8). Disable printing serial options when using a multimeter communications connection RS485 (set Switch D of Group 0, Function 3, Pack 3 DOWN to disable.

Disabling prevents:
1. Printing through the keypad.
2. Corrupting data at a computer terminal while multiple meters poll.
3. Corrupting printing commands through communications.

This option connects a serial printer to the RS232 port and prints the data. When the meter does not use an RS232 port (i.e., RS485 or DC outputs are being used), disable this feature.

To change the System Configuration Switch Settings:

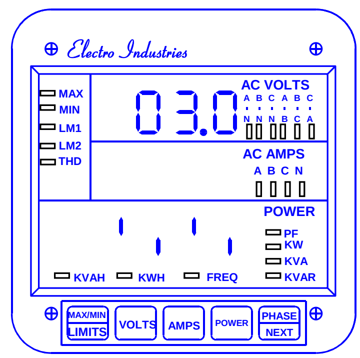
***Note**: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.*



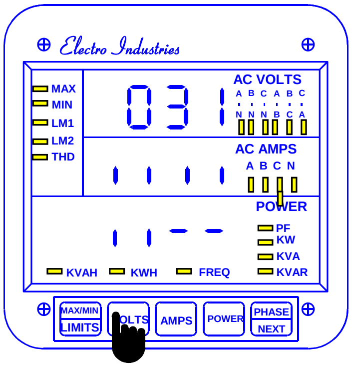
Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

b. Press ***MAX/MIN/LIMITS*** until **0.** appears in upper display.

c. Press ***AMPS*** to activate the Group.



Step 2:
a. Press ***MAX/MIN/LIMITS*** until Function **03.0** appears in upper display.
b. Press ***AMPS*** to activate.
⇨Lower display indicates current PACK 0 Switch Settings.



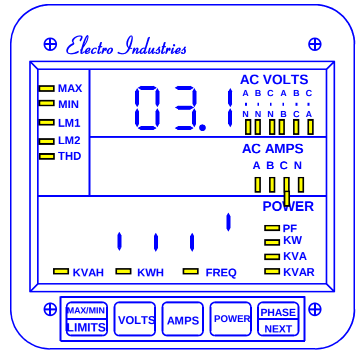
Step 3:
a. Press **VOLTS** until desired PACK appears.

b. Press **AMPS** to begin Data Entry Sequence.

⇨The previous Switch settings shift to middle display and four dashes appear in lower display.

c. Press **VOLTS** to toggle a segment up or down for desired setting.

d. Press **AMPS** to store it.



⇨Repeat procedure until new Switch Setting is entered.

⇨The middle display blanks and new Switch Settings are indicated on lower display.

(This example shows enabling of Open Delta Installation switch).

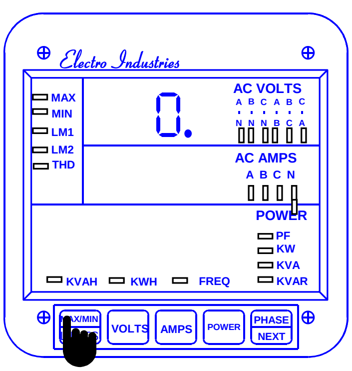
See Chapter 9, section 9.6 to Exit.

10.5: Group 0, Function 7—Number of Phases

***Note**: Standard factory set-up is three-phase, four-wire.*

To change the number of phases:

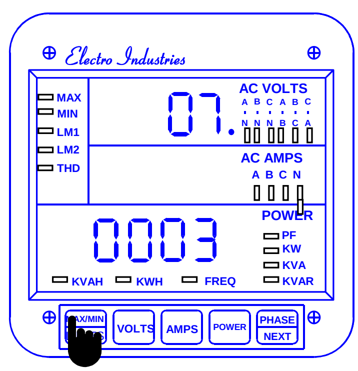
***Note**: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.*



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

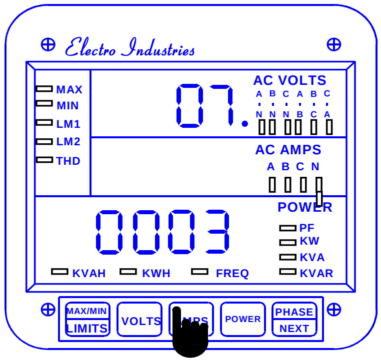
b. Press ***MAX/MIN/LIMITS*** until **0.** appears in upper display.

c. Press ***AMPS*** to activate the Group.



Step 2:
a. Press ***MAX/MIN/LIMITS*** until Function **07** appears in upper display.

a. Press ***AMPS*** to activate the Function.



Step 3:

a. Press ***VOLTS*** to select numbers 1, 2 or 3.

ENTER **1** FOR SINGLE PHASE/SINGLE WIRE.
ENTER **2** FOR SINGLE PHASE/TWO WIRE.
ENTER **3** FOR THREE-PHASE/THREE OR FOUR WIRE.

b. Press ***AMPS*** to store.

See Chapter 9, section 9.6 to Exit.

CHAPTER 11

PROGRAMMING GROUP 1—VOLTAGE, AMPERAGE AND WATT SCALE SETTINGS

Programming GROUP 1 contains:

- Voltage, Amperage and Watt Full Scale Selection
- Scale Factor Selection & Decimal Point Placement

GROUP AND FUNCTION NUMBER	FUNCTION
10.	Full Scale Selection for Volts
11.	Full Scale Selection for Amps
12.	Full Scale Selection for Watts
1E.	Exit Programming GROUP 1

Table 11-1: Group 1 Programming Format

***Note*: The Futura+ Series full scales will be pre-programmed at the factory if the order specified current and voltage transformer ratios. The meter label indicates any full scale setup.**

The user can re-scale without removing the Futura+ Series device for calibration. The CPU-1000 has been calibrated at standard levels in GROUP 2. Mathematically convert any full scale ratios to those calibrated levels. If a different current or voltage transformer is used, program the primary value of its ratio. If necessary, convert the ratio to a secondary value of five amps standard current (1 amp is a special order) and 120V or 75V nominal voltage (options L only).

Formulas:

$$\frac{\text{Primary}}{\text{Secondary}} \times 120V \qquad \frac{\text{Primary}}{\text{Secondary}} \times 75V \qquad \frac{\text{Primary}}{\text{Secondary}} \times 5A$$

It may be necessary to convert the full scale to a larger unit. There is a resolution limitation for all full scales of 2000. If a display reading exceeds 2000, it may be unstable and subject to zeroing problems.

For example: The full scale for a CT ratio of 3000/5 should be 03.00 kA.

When changing a PT or CT full scale, calculate the new watts full scale and make any necessary changes. The watts full scale will not auto-range.

11.1: Group 1, Function 0—Voltage Full Scale

ELECTRICAL SYSTEM	PT RATIO	FULL SCALE
75 V (Suffix 75) L-N MAX	120:1	9.00 KV
120/208 V	1:1 (Direct)	0120 V
120/208 V	4:1	0480 V
120/208 V	120:1	014.4 KV
277/480 V (Suffix G)	1:1 (Direct)	0300 V

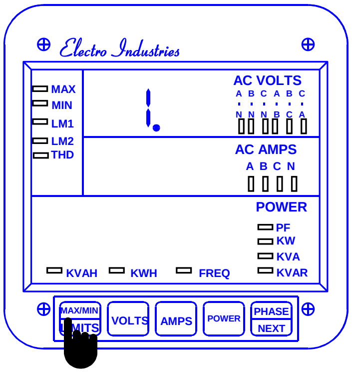
Table 11-2: Full Scale Settings for Volts

***Note*: If PT is connected line to line, the full scale can be 14.40 KV. Full scale is 300 V L-N, not 277, because the factory calibration is 300 V.**

VOLTAGE FULL SCALE:

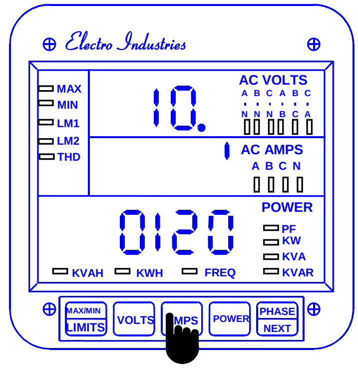
To change the full scale settings:

***Note*: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.**



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

b. Press ***MAX/MIN/LIMITS*** until ***1.*** appears in upper display.

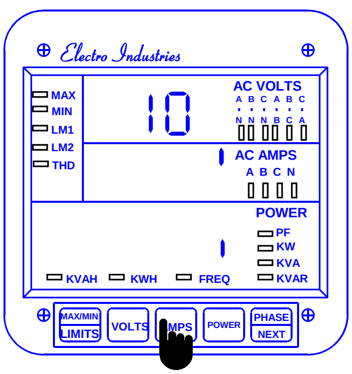


Step 2:
a. Press ***AMPS*** to activate GROUP 1.

⇨**10.** appears in upper display.

⇨Middle display indicates Scale Factor Setting.

⇨Lower display indicates Full Scale for voltage.



ENTERING THE SCALE FACTOR:

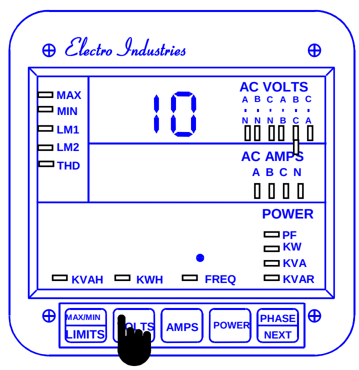
Step 3:
a. Press ***AMPS*** to begin Data Entry Sequence.

⇨Lower display is replaced with a single dash.

b. Press ***VOLTS*** to move the segment UP or DOWN to set Scale Factor.

⇨UP signifies Kilovolts.
⇨DOWN signifies Volts.

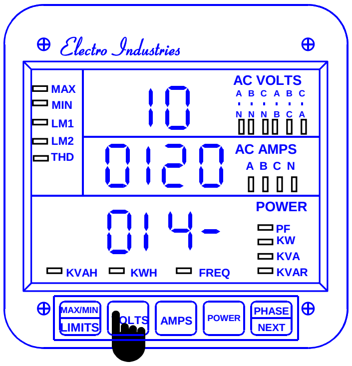
c. Press ***AMPS*** to store.



DECIMAL POINT SELECTION:

Step 4:
a. Press ***VOLTS*** to move decimal point.

b. Press ***AMPS*** to store.



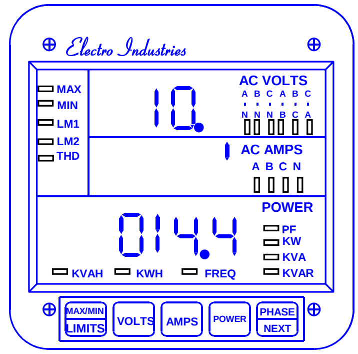
Step 5:
⇨Middle display indicates present Full Scale for volts.

⇨Four dashes appear in lower display.

⇨Enter the four-digit full scale.

a. Press ***VOLTS*** to select a number.

b. Press ***AMPS*** to store it.



⇨Repeat this procedure until desired value is entered.

⇨Lower display indicates new Full Scale Setting.

⇨Middle display indicates Scale Factor.

⇨Group and Function Number (including decimal point) appear in upper display.

See Chapter 9, section 9.6 to exit.

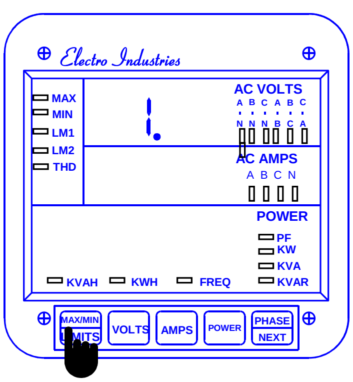
11.2: Group 1, Function 1—Amperage Full Scale

CT TYPE	FULL SCALE
None	05.00 A
1000/5	1000 A
5000/5	05.00 KA
2000/5	2000
3000/5	03.00 KA
600/5	0600 A

Table 11-3: Full Scale Settings for Amps

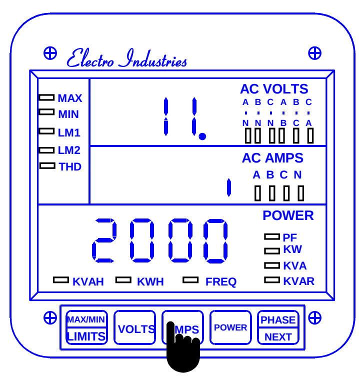
To change the full scale settings:

***Note*: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.**



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

b. Press ***MAX/MIN/LIMITS*** until **1.** appears in upper display.

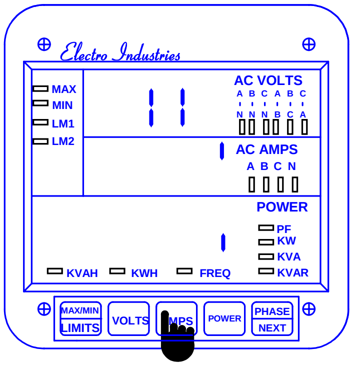


Step 2:
a. Press ***AMPS*** to activate the Group.

b. Press ***MAX/MIN/LIMITS*** until **11.** appears in upper display.

⇨Middle display indicates Scale Factor Setting.

⇨Lower display indicates Full Scale.



ENTERING THE SCALE FACTOR:

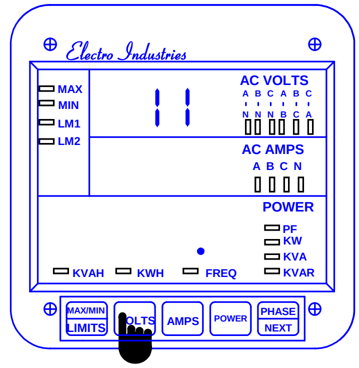
Step 3:
a. Press ***AMPS*** to begin Data Entry Sequence.

⇨Lower display is replaced with a single dash.

b. Press ***VOLTS*** to move the segment UP or DOWN to set Scale Factor.

⇨UP signifies Kilo-Amps.
⇨DOWN signifies Amps.

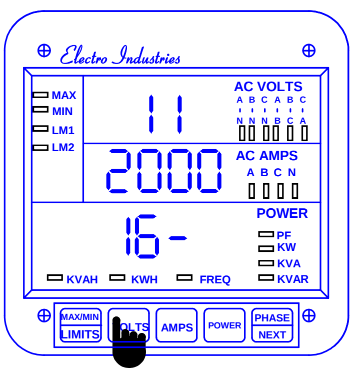
c. Press ***AMPS*** to store.



DECIMAL POINT SELECTION:

Step 4:
a. Press ***VOLTS*** to move decimal point.

b. Press ***AMPS*** to store.



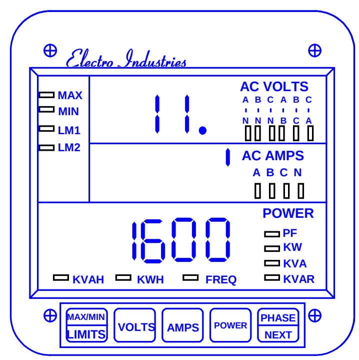
Step 5:
⇨The Full Scale for current is indicated in middle display.

⇨Four dashes appear in lower display.

⇨Enter the four-digit full scale.

a. Press ***VOLTS*** to select a number.

b. Press ***AMPS*** to store it.



⇨Repeat this procedure until the value is entered.

⇨Lower display indicates new Full Scale Setting.

⇨Middle display indicates Scale Factor.

⇨ Group and Function Number appear (including a decimal point) in upper display.

See Chapter 9, section 9.6 to exit.

11.3: Group 1, Function 2—Watts Scale Selection and Decimal Placement

Programming GROUP 1 also provides decimal positioning for maximum resolution. The following examples assist in selecting the best decimal position for FUNCTION *2*.

***Note*: Shift the decimal left to increase resolution. Wattage should not exceed a numeral value of 2000. Shift the decimal one position right to decrease resolution.**

EXAMPLE 1:

Full Scale Voltage (FSV)=120 V
Full Scale Amperage (FSA)=5.00 A

Full Scale Wattage (FSW) is the product of FSV and FSA. For FSW for three phases multiply the FSW per phase by 3.

FSW (one phase) =120 V x 5.00 A
FSW (one phase)=600 W
FSW (three phase)=600 W x 3 = 1,800 W

Here the FSW is too small a value for a Megawatt meter. FSW in the Kilowatt meter equals 1.800 KW. In FUNCTION *2,* place the decimal point after the first digit.

EXAMPLE 2: 480/120 PT, 1000/5 CT

FSV=480 V
FSA=1000 A
FSW (one phase)=480 V x 1000 A
FSW (one phase)=480,000 W
FSW (three phase)=480,000 W x 3 = 1,440,000 W

FSW for Kilowatt a meter equals 1440. KW. FSW for a Megawatt meter equals 1.440 MW. In FUNCTION *2* place the decimal point after the last digit for a Kilowatt meter and after the first digit for a Megawatt meter. It is important to note which type of bezel labeling you have when making this decision.

EXAMPLE 3: 1.44 KV/120, 1000/5 CT

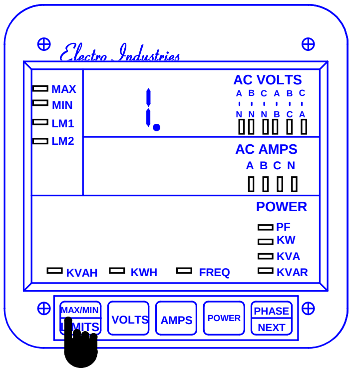
FSV=1.440 KV
FSA=1000 A
FSW (one phase)=1440 Vx1000 A
FSW (one phase)=1,440,000 W
FSW (three phase)=1,440, 000 Wx3 = 4,320,000 W

FSW for a Kilowatt meter equals 4320 KW. Here the FSW is too large a value for a Kilowatt meter (the range is 000–1999). FSW for a Megawatt meter equals 04.32 MW. In FUNCTION *2*, place the decimal after the second digit.

***Note*: In some applications where the load is normally very low, the watts resolution can be increased by moving the decimal one position left.**

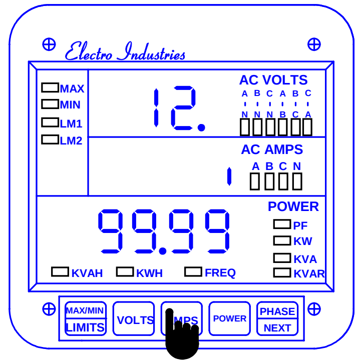
To change the WATT scale factor setting:

***Note*: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.**



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

b. Press ***MAX/MIN/LIMITS*** until **1.** appears in upper display.

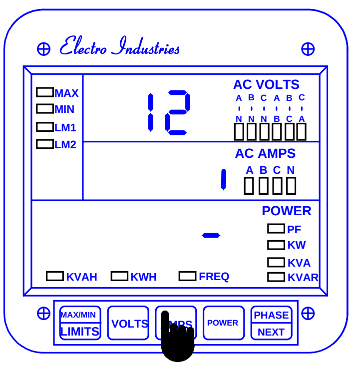


Step 2:
a. Press ***AMPS*** to activate the Group.

b. Press ***MAX/MIN/LIMITS*** until **12.** appears in upper display.

⇨Middle display indicates current Scale Factor Setting.

⇨Lower display indicates **9999** (including current decimal placement).



ENTERING THE SCALE FACTOR**:**

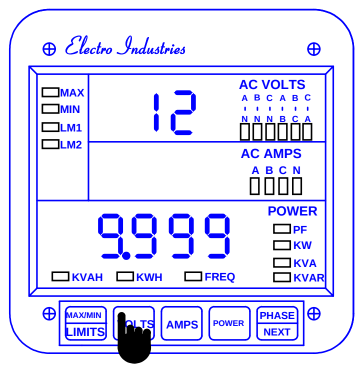
Step 3:
a. Press ***AMPS*** to begin Data Entry Sequence.

⇨Lower display is replaced with a single dash.

b. Press ***VOLTS*** to move the segment

⇨UP signifies *Megawatts*.
⇨DOWN signifies *Kilowatts*.

c. Press ***AMPS*** to store.



DECIMAL POINT SELECTION**:**

Step 4:
⇨Display blanks and ***9999*** appears in lower display (including current decimal setting).

a. Press ***VOLTS*** to move decimal.

b. Press ***AMPS*** to store.

See Chapter 9, section 9.6 to Exit.

CHAPTER 12
PROGRAMMING GROUP 2—METER CALIBRATION

WARNING—READ THIS SECTION CAREFULLY BEFORE PROCEEDING:

- *Any rescaling, such as a change in a transformer ratio, can be accomplished in GROUP 1. Calibration is not necessary.*
- *Meter calibration cannot be performed if the meter is installed for service. The sensing inputs must be connected to a power supply with variable voltage and separate current outputs.*
- *The calibration procedure requires highly accurate and stable input signals. Incorrect readings result from improper calibration procedures. If unsure, return unit to EIG for calibration.*
- *BEFORE calibrating any channel, make a note of its Full Scale Setting (See Chapter 11). Set the Full Scale in accordance with **Table 12-2** for calibration. Restore original Full Scale Setting when calibration is completed.*
- *The first function in GROUP 2 (STD.CORR) is **NOT** to be changed by the user. Please make a note of the value here [___________] before using any other function in this group. If the STD.CORR value is inadvertently lost or changed, contact the factory for assistance.*

A significant drift in calibration is unlikely. Therefore, a yearly re-calibration of the meter is generally not required.

12.1: Calibration Requirements

FUNCTIONS 0–8 (High and Low End Calibration) can be calibrated by qualified site technicians, if a stable calibration source can be applied.

Calibration on the CPU-1000 requires precise inputs of 120 Volts, 5 Amps, and 2.5 Amps. The CPU-1000-G model requires precise inputs of 300 Volts, 5 Amps, and 2.5 Amps. If this equipment is unavailable, contact EIG for assistance.

GROUP AND FUNCTION NUMBER	FUNCTION
2P.	Standard Correction—Factory Procedure only
20.	High End Calibration—Volts AN
21.	High End Calibration—Volts BN
22.	High End Calibration—Volts CN
23.	High End Calibration—Amps A
24.	High End Calibration—Amps B
25.	High End Calibration—Amps C
26.	Low End Calibration—Amps A
27.	Low End Calibration—Amps B
28.	Low End Calibration—Amps C
2E.	Exit Programming GROUP 2

Table 12-1: Group 2 Programming Format

***Note**: The voltage and current scales are calibrated with the maximum range value of 2000 for current and 14.40 for voltage (300 for option G.) The calibration value can be identical to the full scale value in GROUP 1, for better accuracy than the specification. However, if a full scale is ever changed to a higher value than the calibrated value, the value may be less accurate.*

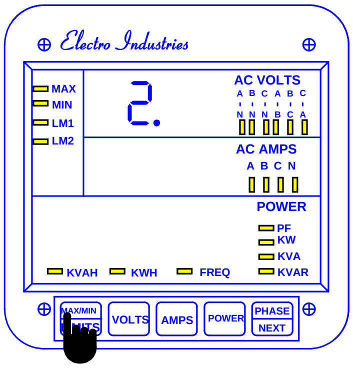
VOLTAGE RANGE	INPUT SOURCE	GROUP 2 VALUE
69.3/120V	75V	1440
120/208V	120V L-N	1440
277/480V	300V	0300
5A CT High End	5A	2000
2.5A Low End	2.5A	1000

Table 12-2: Calibration Source, Full Scale And Value Settings For Calibration

12.2: Group 2, Functions 0–8—High End Calibration of Voltage Channels, High and Low End Calibration of Amperage Channels

To change the calibration for functions 0–5:

Note*: *Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.



Step 1:
a. Enter Group Level of Programming Mode (Chapter 9, 9.2).

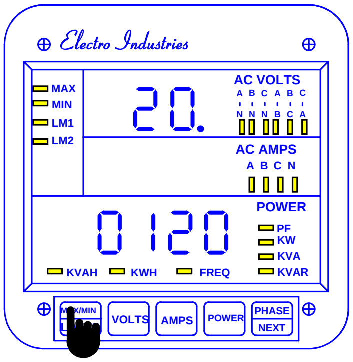
b. Press ***MAX/MIN/LIMITS*** until ***2.*** appears in upper display.

c. Press ***AMPS*** to activate the Group.

⇨A one digit password is required to continue.

d. Press ***VOLTS*** until ***5*** appears.

e. Press ***AMPS*** to select.

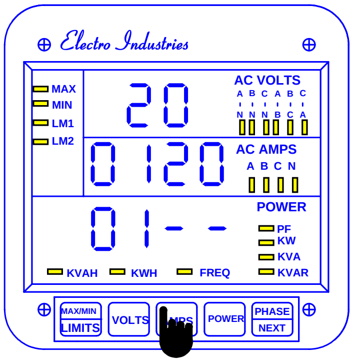


Step 2:
⇨Refer to **Table 12-1** for the function number that corresponds to the channel requiring calibration.

a. Press ***MAX/MIN/LIMITS*** to change Function number.

b. (For example, to calibrate Volts CN) press ***MAX/MIN/LIMITS*** until **22.** appears in upper display.

⇨*(2P is pre-calibrated. This is a factory-set value and should not be altered.)*



Step 3:
➪Apply the calibration source to appropriate channel. The level of the source is critical for accurate calibration.

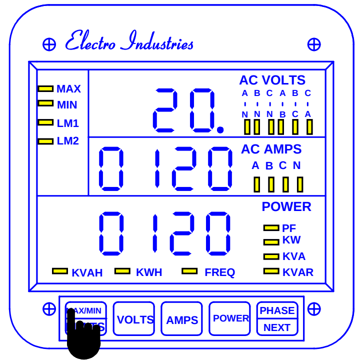
a. Press ***AMPS*** to activate calibration.

➪Current setting moves to middle display.

➪Four dashes appear in bottom display.

b. Press ***VOLTS*** to select a number.

c. Press ***AMPS*** to store it.



Step 4:
➪The new value moves to middle display.

➪Lower display indicates new calibration, including actual measurements for verification after 15 seconds.

➪If the calibrated reading is unacceptable, repeat entire procedure (after checking all connections and inputs).

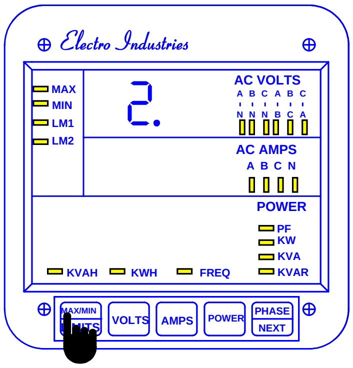
a. Press ***MAX/MIN/LIMITS***; a decimal appears after the function digit and the value moves to lower display.

➪Proceed to calibrate another function, or exit.

See Chapter 9, section 9.6 to Exit.

To change the calibration for amps low end (functions 6–8):

***Note**: Press MAX/MIN/LIMITS, at any time, to cancel before storing the last digit or switch.*



Step 1:
a. Enter Group Level of Programming Mode (see Chapter 9, section 9.2).

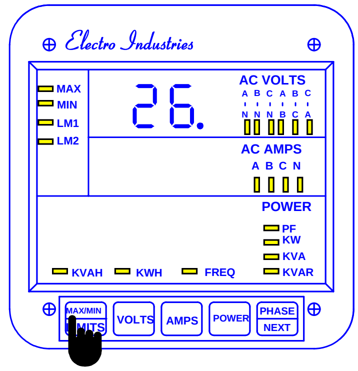
b. Press ***MAX/MIN/LIMITS*** until ***2.*** appears in upper display.

c. Press ***AMPS*** to activate the Group.

⇨A one digit password is required to continue.

d. Press ***VOLTS*** until ***5*** appears.

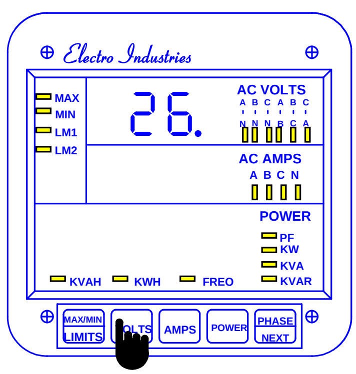
e. Press ***AMPS*** to select.



Step 2:
a. Press ***MAX/MIN/LIMITS*** until ***26.*** appears in upper display.

b. Press ***AMPS*** to activate.

⇨Middle and lower displays blank.



Step 3:
⇨ New value moves to middle display.

⇨Lower display indicates the calibrated reading after 10-15 seconds.

a. Press ***VOLTS*** to select desired number.

b. Press ***AMPS*** to store.

c. Press ***MAX/MIN/LIMITS*** to end calibration procedure.

See Chapter 9, section 9.6 to Exit.

Part IV: Optional Modules

CHAPTER 13

0–1mA AND 4–20mA ANALOG OUTPUT MODULES

Analog outputs are available for 0–1mA or 4–20 mA. These modules are internally mounted into the CP-1000 monitor.

13.1: 0–1mA Analog Output Module—Model # 1mAO

The 10 channel 0–1mA module provides 7 uni-directional and 3 bi-directional channels. Uni-directional reads from 0–1mA. Bi-directional reads from (-1)–(0)–(+1). Both the uni- and bi-directional channels can be mapped to any scaling. The user selects where the zero is placed. To program the channels, see the Futura+ Communicator software manual.

0–1mA modules are self powered. Maximum load factor is 10 K-ohms; loop power is provided internally.

Uni-directional channels: 3,4,5,6,7,8,9
Bi-directional channels: 0,1,2

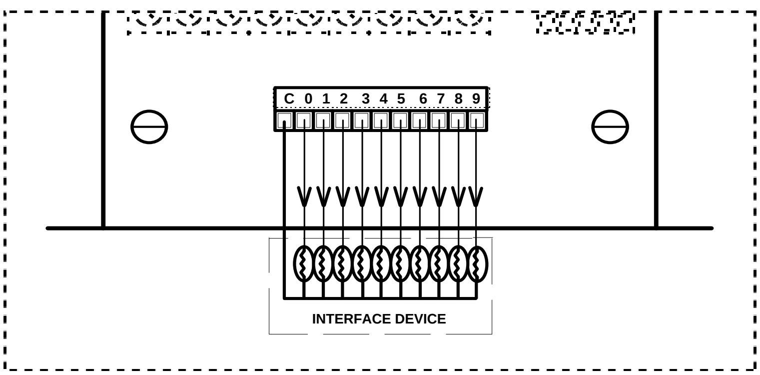


Figure 13.1: 0–1mA Electrical Installation—10 Channel 0-1mA DC Analog Output Module

***Note*: Do not exceed 10 K-ohms input impedance**!

13.2: 4–20mA Analog Output Module—Model #20mAO

The 4-20mA module provides 10 uni- or bi-directional channels. 4–20mA modules can be used as either uni-directional 4–20 outputs or bi-directional 4-12-20 outputs. The designation is field programmable. See the Futura+ Communicator software manual.

Maximum load impedance is 250 ohms; 24V loop power must be provided externally.

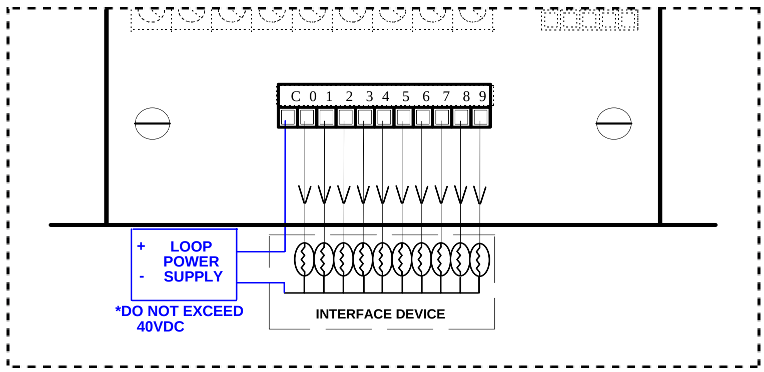


Figure 13-2: 4–20mA Electrical Installation—10 Channel 4-20mA DC Analog Output Module
***Note**: Do not exceed 40 VDC on Loop Power Supply!*
***Note**: Do not exceed 250 ohms impedance!*

13.3 Standard Factory Configuration

The following tables show the factory default DC Output channel mappings (parameter assignment to a DC Output Channel). The mapping in each meter model is programmed according to the appropriate table, unless otherwise advised by the user. Please consult the software manual, Futura+ Communicator, for programming these functions.

***Note**: Programming is not necessary if standard factory settings are acceptable.*

For the DC Output Modules 1mAO (0-1mA DC Output, 10 channels) and 20mAO (4-20mA DC Output, 10 channels), the factory default for the meter models are:

Channel	Parameter
0	TOTAL WATTS
1	TOTAL VARS
2	FREQUENCY
3	VOLTS A-N
4	VOLTS B-N
5	VOLTS C-N
6	AMPS A
7	AMPS B
8	AMPS C
9	AMPS N

For WYE Settings

Channel	Parameter
0	TOTAL WATTS
1	TOTAL VARS
2	FREQUENCY
3	VOLTS A-B
4	VOLTS B-C
5	VOLTS C-A
6	AMPS A
7	AMPS B
8	AMPS C
9	RESERVED

For DELTA Settings

13.4 DC-Output Chart

Below is the Meter Reading Ranges for 0-1mA and 4-20mA DC current output models. The Meter Ranges apply to 10-channel models. Watts refers to actual secondary input watts, not the display reading. For example, 1500 Watts or 120 Volts and 4.17 Amps (in a three-phase system) input to all elements (assuming power factor unity).

Find the applicable measurement, meter suffix and DC Output model to determine the meter input required for the DC Output.

MEASUREMENT	**UNI-DIRECTIONAL** 0-(+1) mA OUTPUT	**BI-DIRECTIONAL** (-1) -0- (+1) OUTPUT
	METER INPUT	**METER INPUT**
3 Elements Watt/Var—Suffix L	*Not Applicable*	(-750W) -0- (+750W)
3 Element Watt/Var.	*Not Applicable*	(-1500)W -0- (+1500)W
3 Element Watt/Var—Suffix G	*Not Applicable*	(-3000)W -0- (+3000)W
2 Element Open Delta Watt/Var—Suffix L	*Not Applicable*	(-500W) -0- (+500W)
2 Element Open Delta Watt/Var.	*Not Applicable*	(-1000)W -0- (+1000)W
2 Element Open Delta Watt/Var–Suffix G	*Not Applicable*	(-1500)W -0- (+1500)W
Power Factor	*Not Applicable*	(-0.500) -1- (+0.500)
Volts—Suffix L	0–75 VAC L-N	*Not Applicable*
Volts	0–150 VAC L-N	*Not Applicable*
Volts Suffix G	0–300 VAC L-N	*Not Applicable*
Amperes	0–5A	*Not Applicable*
Frequency—50 Hz	*Not Applicable*	45 - 50 - 55 Hz
Frequency—60 Hz	*Not Applicable*	55 - 60 - 65 Hz

Table 13.1: 0-1mA DC Analog Output Modules

MEASUREMENT	**UNI-DIRECTIONAL** 4-20 mA OUTPUT	**BI-DIRECTIONAL** 4-12-20 mA OUTPUT
	METER INPUT	**METER INPUT**
3 Elements Watt/Var—Suffix L	0—750W	(-750W) -0- (+750W)
3 Element Watt/Var.	0—1500W	(-1500)W -0- (+1500)W
3 Element Watt/Var—Suffix G	0—3000W	(-3000)W -0- (+3000)W
2 Element Open Delta Watt/Var—Suffix L	0—500W	(-500W)-0-(+500W)
2 Element Open Delta Watt/Var.	0—1000W	(-1000)W -0- (+1000)W
2 Element Open Delta Watt/Var—Suffix G	0—1500W	(-1500)W -0- (+1500)W
Power Factor	*Not Applicable*	(-0.500) -1- (+0.500)
Volts—Suffix L	0—75 VAC L-N	*Not Applicable*
Volts	0—150 VAC L-N	*Not Applicable*
Volts Suffix G	0—300 VAC L-N	*Not Applicable*
Amperes	0—5A	*Not Applicable*
Frequency—50 Hz	*Not Applicable*	45 - 50 - 55 Hz
Frequency—60 Hz	*Not Applicable*	55 - 60 - 65 Hz

Table 13.2: 4-20 mA DC Analog Output Modules

13.5: DC Output Programming and Calibration

For DC Output Programming and Calibration, use EIG's Communicator EXT software.

13.6: Formulas for DC output

The following formulas are for 4-20mA models. For 1mA applications:

1) Substitute 4mA with 0mA; 20mA with 1mA.
2) Substitute 4mA with -1mA; 12mA with 0mA; and 20mA with 1mA.

<u>Note</u>: The following formulas apply to the 20mA models. For the 1mA models, apply these formulas but remove either (x16 +4) or (x12+8), depending on the formula being used.

<u>FORMULA 1: 20mA UNI-DIRECTIONAL WATT/VAR/VA</u>

$$\text{UniDirectionalWattDC} = \left\{\left[\frac{\text{DisplayedReading}}{CT * PT * K * R} \times 16\right] + 4\right\} mA$$

K—the number of PT's Installed in the system:
K= 2 for an open delta connection
K= 3 for any other connection

CT—Amps full-scale entered in programming Group 1, Function 1.

PT—Volts full-scale entered in programming Group 1, Function 0.

Displayed Reading—The unsigned WATT/VAR reading currently displayed.

R—Ratio of the difference of the meter Full Scale and the DC Output Full Scale
R=0.667 for 300 volts and 75 volts PT units
R=0.833 for 120 volts PT units
<u>For example</u>:

$$\frac{100V \times 5A \times 3}{120V \times 5A \times 3} = \frac{1500W}{1800W}$$

$$\frac{1500W \text{ (DC Output Full Scale)}}{1800W \text{ (Meter Full Scale)}} = .833$$

- Same formula applies for VAR DC-Output calculations
-

<u>FORMULA 2: 20mA BI-DIRECTIONAL WATT/VAR</u>

$$\text{BiDirectional WattDC} = \left\{\left[\frac{\text{DisplayedReading}}{CT \times PT \times K \times R} \times 8\right] + 12\right\} mA$$

K—the number of PT's Installed in the system:
K= 2 for an open delta connection
K= 3 for any other connection

CT—Amps full-scale entered in programming Group 1, Function 1.

PT—Volts full-scale entered in programming Group 1, Function 0.

Displayed Reading—The signed WATT/VAR reading currently displayed.

R—Ratio of the difference of the meter Full Scale and the DC Output Full Scale
R=0.667 for 300 volts and 75 volts PT units
R=0.833 for 120 volts PT units
For example:

$$\frac{100V \times 5A \times 3}{120V \times 5A \times 3} = \frac{1500W}{1800W}$$

$$\frac{1500W\ \text{(DC Output Full Scale)}}{1800W\ \text{(Meter Full Scale)}} = .833$$

- Same formula applies for VAR DC-Output Calculations

***Note**: Bi-directional Formula does not apply to VA.*

FORMULA 3: 20mA UNI-DIRECTIONAL VOLTS

$$\text{UniDirectionalVoltsDC} = \left\{\left[\frac{\text{Displayed Reading}}{\text{PT}} \times R \times 16\right] + 4\right\} \text{mA}$$

PT—Volts full-scale entered in programming Group 1, Function 0.

Displayed Reading—The VOLTS reading currently displayed.

Range—0–150 Volts (secondary)=4.0000–20.000mA
0–75 Volts (secondary)=4.000–20.000mA
0–300 Volts (secondary)=4.000–20.000mA

R—Ratio of the difference of the Meter Full Scale and the DC Output Full Scale for Voltage.
R=0.800 if 120 Volts PT Unit
R=1.000 otherwise
For example:

$$\frac{120\ \text{V Meter full scale}}{150\ \text{V DC Output}} = \frac{120}{150} = .8$$

FORMULA 4: 20mA UNI-DIRECTIONAL AMPS

$$\text{UniDirectionalAmpsDC} = \left\{\left[\frac{\text{DisplayedReading}}{\text{CT}} * 16\right] + 4\right\}\text{mA}$$

CT—Amps full-scale entered in programming GROUP 1 Function 1.

Displayed Reading—The AMPS value currently displayed.

Range—0.000–5.000Amps (secondary) = 4.000–20.000 mA

FORMULA 5: 20mA BI-DIRECTIONAL FREQUENCY 60 HZ

$$\text{BiDirectionalFreqDC} = \left\{\left[\frac{\text{DisplayedReading} - 60.00}{5.00} \times 8\right] + 12\right\}\text{mA}$$

Displayed Reading—The Frequency reading currently displayed.

Range—55.00–60.00–65.00Hz. = 4.000–12.000–20.000mA

FORMULA 6: 20mA BI-DIRECTIONAL FREQUENCY 50 HZ

$$\text{BiDirectionalFreqDC} = \left\{\left[\frac{\text{DisplayedReading} - 50.00}{5.00} \times 8\right] + 12\right\}\text{mA}$$

Displayed Reading—The Frequency reading currently displayed.
Range—45.00–50.00–55.00Hz. = 4.000–12.000–20.000mA

FORMULA 7: 20mA BI-DIRECTIONAL POWER FACTOR

$$\text{BiDirectionalPfDC} = \left\{\begin{Bmatrix} + \ldots.if\ Pos\ Pf \\ - \ldots.if\ Neg\ Pf \end{Bmatrix}\left[\frac{1.000 - (|\text{DisplayedReading}|)}{0.500} \times 8\right] + 12\right\}\text{mA}$$

Displayed Reading—The Power factor reading currently displayed.
Range— -0.500 ..... ±1.000 ..... +0.500 = 4.000–12.000–20.000mA

EXAMPLE 1:
WATT DC-OUTPUT CALCULATION—NON-OPEN DELTA CONNECTION

***Note*: *Same Calculations and Formula apply for VAR*.**

Meter Full Scales:

PT=14400/120

CT=2000/5

Meter Reading= –20.3 MW

K=3

R=0.833

Formula #2:

$$\text{BiDirectional} \quad \text{WattDC} = \left\{\left[\frac{\text{Displayed Reading}}{CT \times PT \times K \times R} \times 8\right] + 12\right\} \text{mA}$$

Step 1: Insert known values:

$$= \left\{\left[\frac{\text{Displayed Reading}}{2000 \times 14400 \times 3 \times 0.833} \times 8\right] + 12\right\} \text{mA}$$

$$= \left\{\left[\frac{\text{Displayed Reading}}{71.997\text{MW}} \times 8\right] + 12\right\} \text{mA}$$

Step 2: Insert Displayed Reading:

$$= \left\{\left[\frac{-20.3\text{MW}}{71.997\text{MW}} \times 8\right] + 12\right\} \text{mA}$$

={(–2.256) + 12}ma

=+9.744ma

- With a WATT reading of –20.3MW the DC output will be **+9.744mA**.
- With a WATT reading of +20.3 MW the DC output would be **+14.256mA**

***Note*: Do not forget the sign of the reading.**

EXAMPLE 2:
WATT DC-OUTPUT CALCULATION—OPEN DELTA CONNECTION

***Note*: Same Calculations and Formula apply for VAR.**

Meter Full Scales:

PT=14400/120

CT=2000/5

Meter Reading= –20.3 MW

K=2

R=0.833

Formula #2:

$$\text{BiDirectional} \quad \text{WattDC} = \left\{ \left[\frac{\text{Displayed Reading}}{CT \times PT \times K \times R} \times 8 \right] + 12 \right\} mA$$

Step 1: Insert known values:

$$= \left\{ \left[\frac{\text{Displayed Reading}}{2000 \times 14400 \times 2 \times 0.833} \times 8 \right] + 12 \right\} mA$$

$$= \left\{ \left[\frac{\text{Displayed Reading}}{47.98MW} \times 8 \right] + 12 \right\} mA$$

Step 2: Insert Display Reading:

$$= \left\{ \left[\frac{-20.3MW}{47.98MW} \times 8 \right] + 12 \right\} mA$$

={(–3.384) + 12}ma

=+8.615

- With a WATT reading of –20.3MW the DC output will be **+8.615ma**.
- With a WATT reading of +20.3 MW the DC output would be **+15.384**

***Note*: Do not forget the sign of the reading.**

CHAPTER 14

RELAY AND INPUT-SENSING USING THE L-100 I/O MODULE

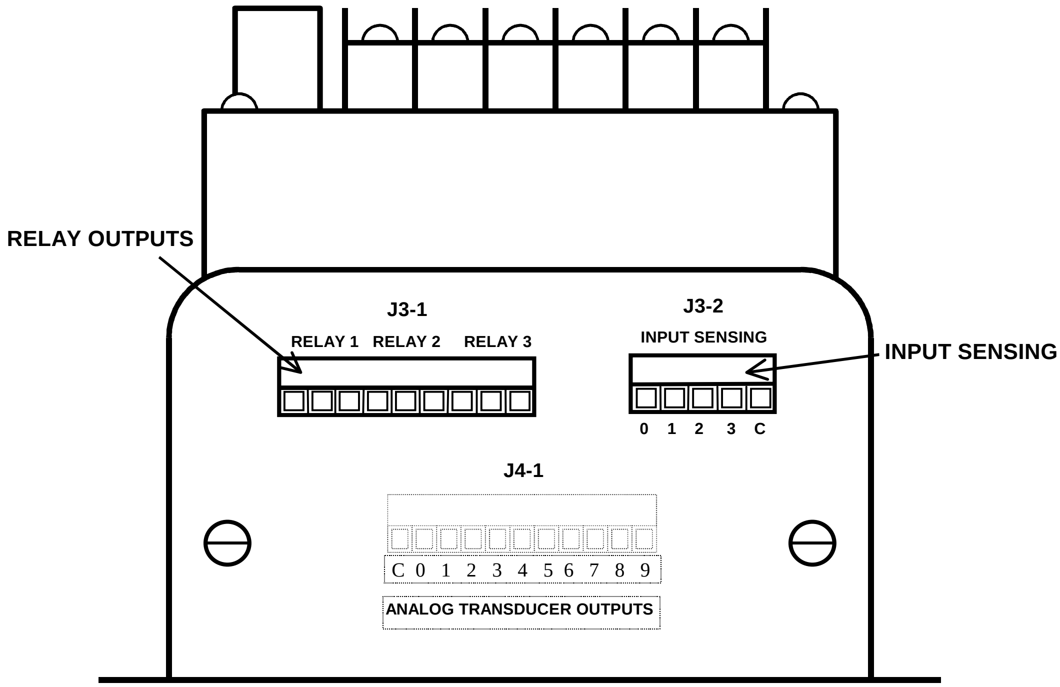


Figure 14.1: The L-100 I/0 Module

The **Futura+ L-100 I/O module** uses sensing inputs and triggers relays for alarm and secondary protection purposes. When used in conjunction with M100 or M200 memory module, the Futura+ acts as an event recorder and stores up to 256 events with a time/date stamp in on-board mass memory.

14.1: Input Status Contacts

The user can harness up to four input channels. The inputs can be set to relays or breakers or any contact closure. The input status contacts are field-programmable to detect contact closures or voltage sensing for up to 150 volts DC.

***Warning**: The user must change internal DIP switches to assign whether the input sensing will be for contact closures or voltage detection. Placing a voltage in the L100 module while it is set for detecting contact closure results in I/O board destruction.*

The DIP switches for detecting dry contacts or for voltage sensing are located between the relay contact and input sensing connector on the I/O board. Figures 14.2 and 14.3 on the following page show how to configure these switches.

The meter is defaulted to input status detection.

DRY CONTACT INPUTS: All six DIP switches must be set to the ON position:

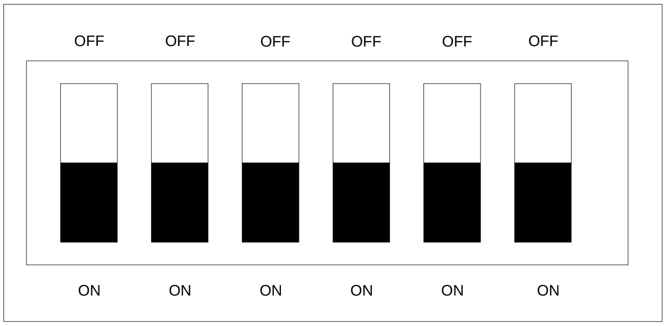


Figure 14.2: Dry Contact Inputs

VOLTAGE SENSING: In this mode, all DIP switches must be in the OFF position:

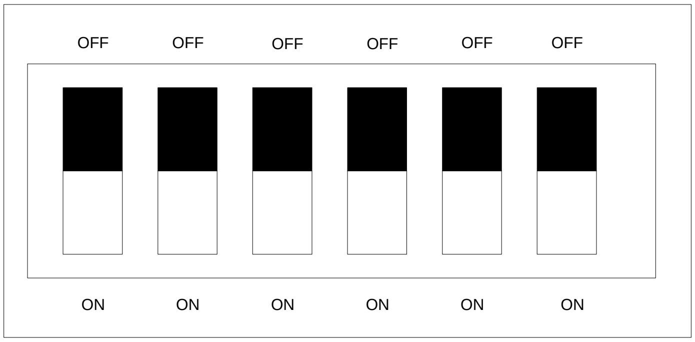


Figure 14.3: Voltage Sensing

14.2: Internal Relay Activation

This module activates 3 dry contact output relays for alarm or secondary protection. Relay status is stored along with time/date stamp in the on-board mass memory when relays activate or deactivate. The relay can also manually engage or disengage, engage and lock, or disengage and lock via digital communication using Futura+ Communicator software.

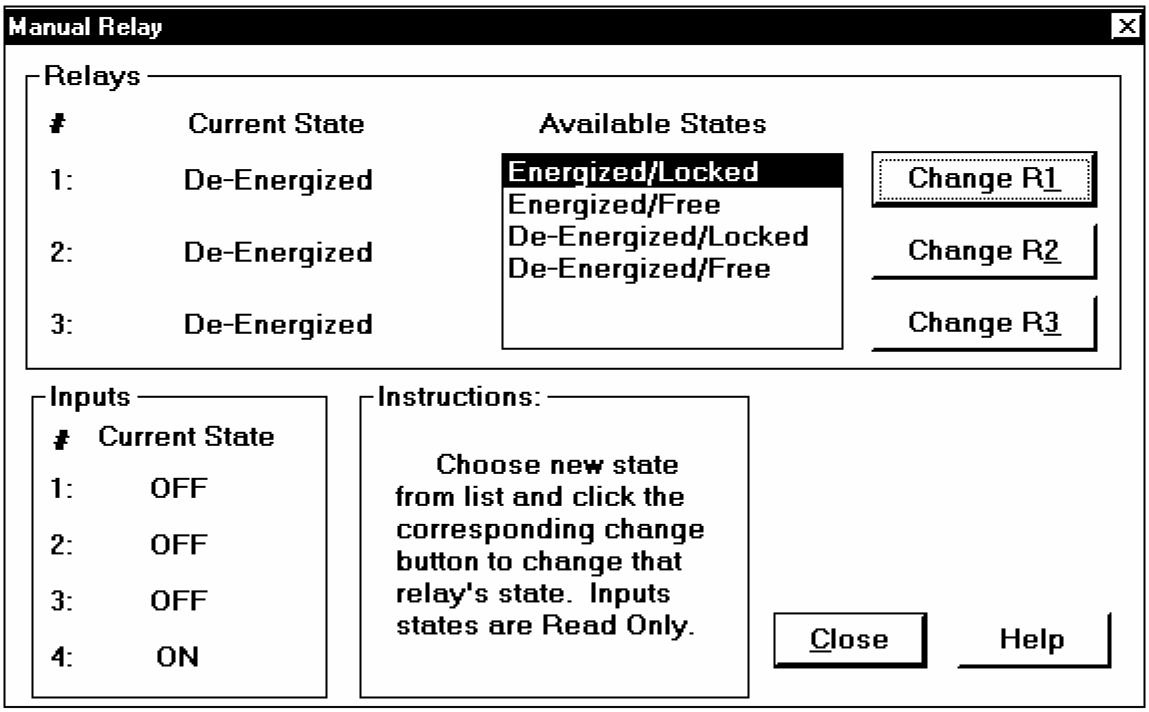


Figure 14.4: Communicator EXT Manual Relay Control Screen

These limits also configure to activate when limit conditions occur. The user programs these limit conditions using Communicator EXT software through digital communication. The relays configure to trigger for the following conditions:

- Over/Under Voltage—AN, BN, CN, AB, BC, CA
- Over and Reverse Power
- Over KVA
- Over/Under Frequency
- Voltage Phase Reversals
- Under/Over Current—A, B, C, N —Fault detection
- Under PF/KVAR—Lag or Lead
- Voltage Imbalance
- Over %THD

CHAPTER 15

RELAY AND INPUT SENSING USING THE L-200/L-200KYZ MODULES

The **Futura+ L-200** and **L200/KYZ I/O modules** use sensing inputs to trigger relays that control alarms and provide secondary protection. A Futura + also equipped with an M100 or M200 memory module can record and store 256 time- and date-stamped events.

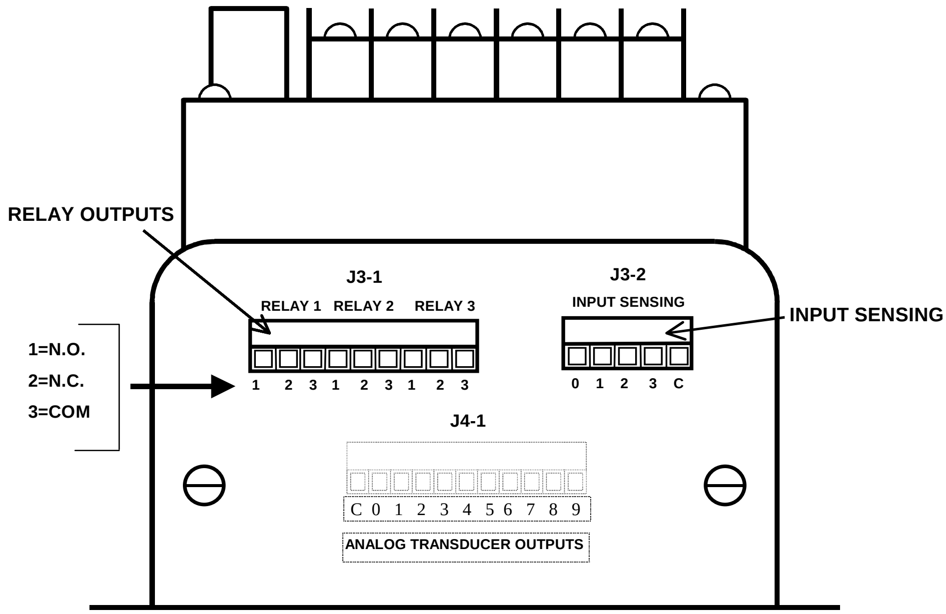


Figure 15.1: The L-200 I/0 board

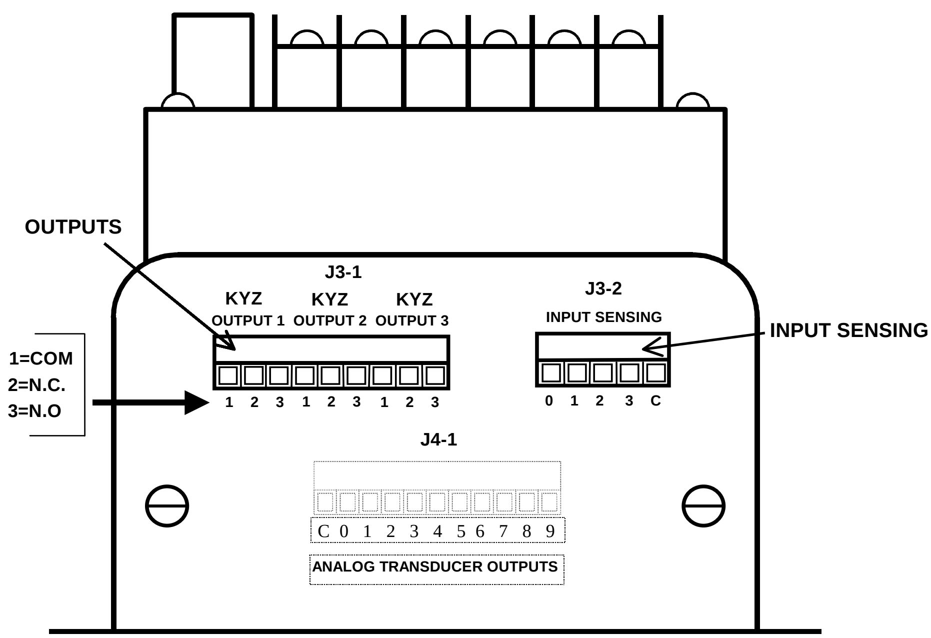


Figure 15.2: The L-200KYZ board

The optional L200 I/O board (Figure 15.1) has three relay outputs (1, 2 and 3) and four sense inputs (0, 1, and 3).

The optional L200/KYZ board (Figure 15.2) has three KYZ-pulse outputs (K, Y and Z) and four sense inputs (0, 1, 2 and 3)

15.1: Outputs

- Relay Outputs are triggered manually or by programmed limits.
- KYZ-Pulse Outputs are assigned to VAR-hours, Watt-hours or VA-hours. These outputs can be programmed with any desired value.

15.2: Sense Inputs

The four sense inputs can be used for either contact or DC voltage sensing. The common rides on a unit-generated 15VDC. To have a sense input act as a voltage sensor, just short it to this common. In this configuration, the external DC (of up to 150V) will be in series with the common (see Figure 15.3, below).

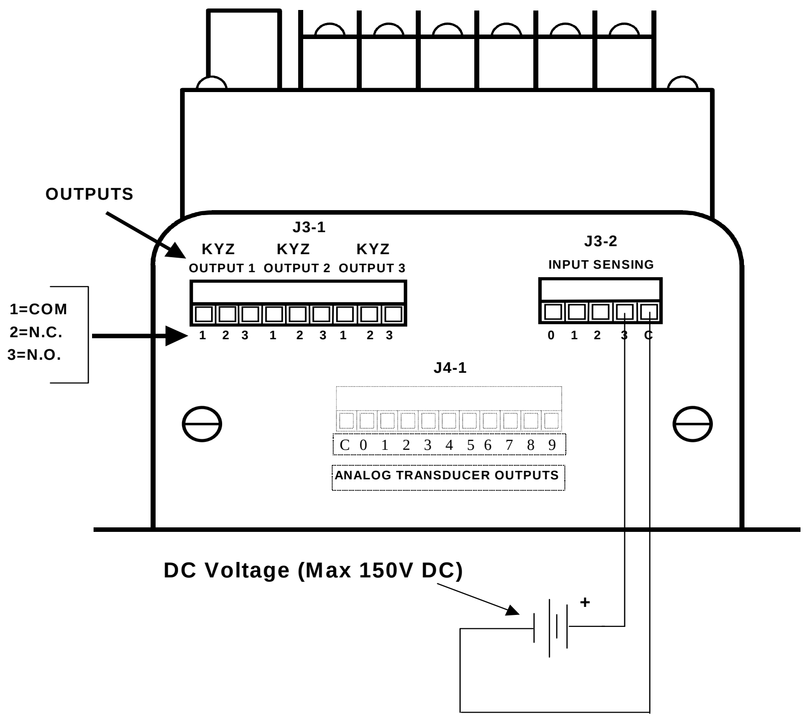


Figure 15.3: Sense Inputs for Voltage Sense