Instructions for Installation, Operation and Maintenance of Cutler-Hammer IQ Analyzer Electrical Distribution System Monitor

Effective January, 2000

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SECTION 1: INTRODUCTION/QUICK START

1-1 Preliminary Comments And Safety Precautions

This technical document is intended to cover most aspects associated with the installation, application, operation and maintenance of the IQ Analyzer. It is provided as a guide for authorized and qualified personnel in the selection and application of the IQ Analyzer. Please refer to the specific WARNING and CAUTION in Section 1-1.2 before proceeding. If further information is required regarding a particular installation, application or maintenance activity, a Cutler-Hammer representative should be contacted.

1-1.1 Warranty And Liability Information

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OF MERCHANTABILITY, OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS AND DESCRIPTIONS CONTAINED HEREIN. In no event will Cutler-Hammer be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information and descriptions contained herein.

1-1.2 Safety Precautions

All safety codes, safety standards and/or regulations must be strictly observed in the installation, operation and maintenance of this device.

WARNING

THE WARNINGS AND CAUTIONS INCLUDED AS PART OF THE PROCEDURAL STEPS IN THIS DOCUMENT ARE FOR PERSONNEL SAFETY AND PROTECTION OF EQUIPMENT FROM DAMAGE. AN EXAMPLE OF A TYPICAL WARNING LABEL HEADING IS SHOWN ABOVE IN REVERSE TYPE TO FAMILIARIZE PERSONNEL WITH THE STYLE OF PRESENTATION. THIS WILL HELP TO INSURE THAT PERSONNEL ARE ALERT TO WARNINGS, WHICH MAY APPEAR THROUGHOUT THE DOCUMENT. IN ADDITION, CAUTIONS ARE ALL UPPER CASE AND BOLDFACE AS SHOWN BELOW.

CAUTION

COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING INSTALLATION, OPERATION OR APPLICATION OF THE EQUIPMENT. IN ADDITION, ONLY QUALIFIED PERSONS SHOULD BE PERMITTED TO PERFORM ANY WORK ASSOCIATED WITH THE EQUIPMENT. ANY WIRING INSTRUCTIONS PRESENTED IN THIS DOCUMENT MUST BE FOLLOWED PRECISELY. FAILURE TO DO SO COULD CAUSE PERMANENT EQUIPMENT DAMAGE.

1-1.3 Factory Correspondence

Contact Power Management Applications Support at 1-800-809-2772 or 1-412-490-6714 for any questions regarding the operation or troubleshooting of the IQ Analyzer.

1-2 Product Overview

The IQ Analyzer is a micro-processor based electrical distribution system monitor. It provides extensive metering, trending, logging, power quality analysis, remote input monitoring, control relaying, analog input/outputs, and communications capabilities. IQ Analyzer is a compact, panel mounted device. It mounts in less than 7 by 11 inches of space and provides the functionality of dozens of individual meters, relays and recorders (Figure **1-1**).

IQ Analyzer:

- **NEW!** Partitions energy and demands into 4 TOU (Time Of Use) billing rates, according to 32 user programmable schedules.
- **NEW!** Logs 504 event timestamps and reasons
- **NEW!** Stores 4 independent trends with up to 24 items into 90000 bytes (8-cycle or 1-minute resolution). Applications include energy trends, motor starts, load profiling, sag/swell analysis, etc.
- Complies with numerous accuracy standards for revenue meters, including: ANSI C12.20 (0.5%), ANSI C12.16 (1%), IEC687 (0.5%), and Canada (0.5%).
- Displays true rms magnitudes and phase angles through the 50th harmonic (both even and odd).
- Accurately measures nonsinusoidal waveforms up to a 3.0 crest factor
- Monitors neutral and ground conductors in addition to 3 phases
- Simultaneously captures waveforms from all current and voltage inputs

A unique operator interface, which includes an LED backlit LCD display, easy to use “Meter Menu” screens and detailed “Analysis” screens, permits an operator to easily access a wealth of real time and recorded information. The display provides the flexibility of exhibiting large characters with high visibility and small characters for detailed descriptions. All programming can be accomplished through the faceplate or communications port (Figure **1-2**). The on-line Help feature provides useful information on device operation, programming and troubleshooting.

The IQ Analyzer directly monitors 3-phase lines to 600 Vac nominal without the need for external potential transformers. External potential transformers are only required above 600 Vac, even if the system is ungrounded.

IQ Analyzer is comprised of the **IQA-6400 Series** and **IQA-6600 Series** of system monitors. The IQA-6400 Series and IQA-6600 Series are similar in the features offered except that graphic and transient triggering abilities are also part of the IQA-6600 Series.

Six different IQ Analyzer configurations are available, three within the IQA-6400 Series and three within the IQA-6600 Series. Refer to Table **1.1** for specific style numbers.

IQA-6400 Series		**IQA-6600 Series**	
IQA6430:	Powered from three-phase lines	IQA6630:	Like IQA6430 except with graphic and transient triggering abilities
IQA6410:	Accepts separate source, single-phase 100-240 Vac 100-250Vdc control power	IQA6610:	Like IQA6410 except with graphic and transient triggering abilities
IQA6420:	Accepts 24-48 Vdc supply	IQA6620:	Like IQA6420 except with graphic and transient triggering abilities

Figure 1-1. IQ Analyzer (Front View)

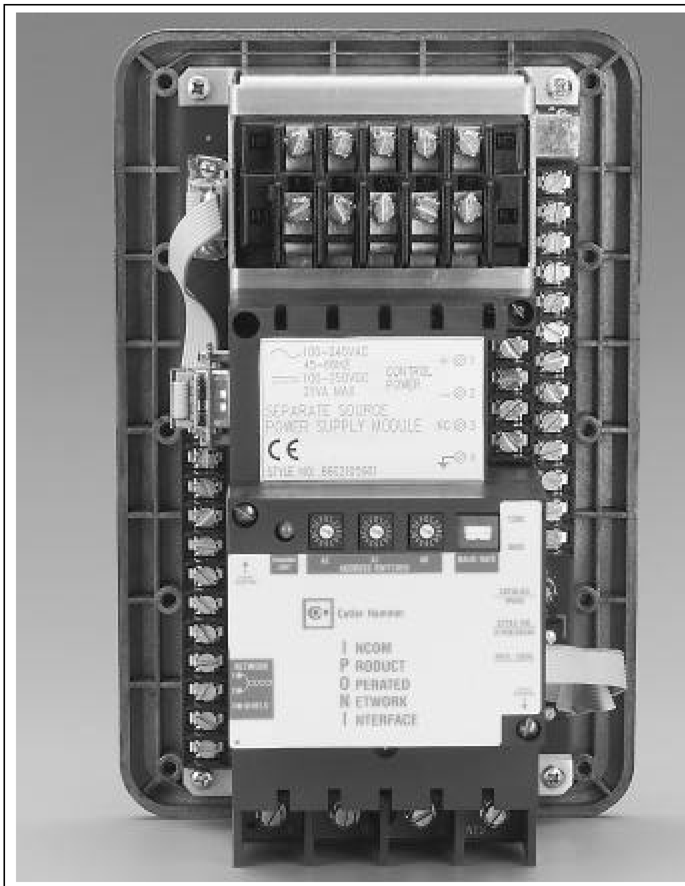

Figure 1-2. IQ Analyzer (Rear View) with optional IPONI (INCOM Product Operated Network Interface) Communication Module Installed

1-2.1 Comprehensive Information

The IQ Analyzer displays the most comprehensive list of metered parameters in its class. Multiple parameters, such as currents of phases A, B and C, are displayed simultaneously for more thorough real-time monitoring. Custom screens can be configured to cycle through 28 parameters, grouped into 4 custom screens. For example, one can group volts, amperes and power factor, for convenience, or to concurrently observe their relationships as conditions change. Regardless of selection, the custom screens provide hands-off operation.

1-2.2 Harmonic Distortion Analysis

Current and voltage distortion data are displayed by the IQ Analyzer and/or accessible through the communications port. This includes:

- % THD
- K-Factor
- Crest Factor
- CBEMA Factor
- Harmonic magnitudes through the 50th
- Harmonic phase angles through the 50th

A snapshot sample of this information may be activated by user commands, discrete inputs, programmable thresholds, or minimum/maximum updates to capture distortion data during conditions of interest. To help eliminate nuisance alarms, harmonic distortion information can be captured and relay outputs activated when THD exceeds a:

- Programmable percentage of fundamental

or

- Programmable magnitude, such as amperes, threshold

1-2.3 Extensive I/O And Communications Capabilities

One analog and three digital inputs are provided to interface with sensors and transducers. Three analog output and four relay contacts are furnished to share data with PLCs and control systems, and to actuate alarms and control relays. Terminals are captive clamp type and finger safe (Figure **2-2**). With the communications option, IQ Analyzer can be remotely monitored, controlled and programmed.

1-2.4 Disturbance Information

The 6600 Series Analyzer or with the communications option and PowerNet Suite software, a waveform analysis will construct waveforms of up to 56 cycles of all currents and voltages, including neutral and ground, to help troubleshoot undervoltage/ sag and overvoltage/swell conditions. For example, by programming a reset threshold, the duration of the voltage disturbance can also be indicated. The IQA6600 Series can also be set to trigger on sub-cycle voltage irregularities, based upon dv/dt and interruption.

1-2.5 High Accuracy

Precision electronic circuitry enables IQ Analyzer to comply with numerous accuracy standards for revenue meters, including: ANSI C12.20 (0.5%), ANSI C12.16 (1%), IEC687 (0.5%), and Industry Canada (0.5%). In addition, accuracy is maintained in applications with high distortion levels. This includes systems exhibiting a 3.0 Crest Factor, harmonics up to the 50th multiple of the fundamental, and frequency variations.

1-2.6 Operational Simplicity

The IQ Analyzer's "Meter Menu" makes commonly viewed parameters easy to access and understand. For additional information, the "Analysis" screens provide comprehensive data on harmonic distortion, current/ power demands, trending and event/alarms. IQ Analyzer also has a "Help" pushbutton to assist in programming, troubleshooting and operating the device.

NOTICE

This manual is accurate to firmware version 2.00. Cutler-Hammer reserves the right to add and/or change features.

1-3 Quick Start

This section is intended to provide an operator with enough basic information to put the IQ Analyzer into service quickly, without reviewing all of the instructions presented in this book. Even if the Quick Start approach is successful, it is strongly recommended that the entire book be reviewed. Taking full advantage of the wide array of features offered by the IQ Analyzer cannot be fully realized by using only the Quick Start approach.

This manual contains the following numbered sections:

1. **Introduction/Quick Start.**

2. **Hardware Description.** Itemizes the operator panel, rear access area, external hardware, and specifications

3. **Operator Panel.** Describes the function of LEDs, display window, and pushbuttons.

4. **Installation.** Describes the mounting, wiring, initial startup, and steps necessary to perform basic metering.

5. **Operation.** Describes the functional details of operation. These include: Meter Menu, help, programmed settings, general setup, inputs and outputs, analysis screens, reset screens, and communications.

6. **Programming.** Describes the entry of programmable settings. This includes the common programming procedures of entering the password, moving through the levels of screens, and a detailed example. Also included are the Screens Trees, which diagram the categories of settings.

7. **Troubleshooting and Maintenance.** Provides a troubleshooting matrix of symptoms, probable causes, and solutions. Also described are the steps for removal, return, and replacement of the unit. For further assistance contact the Power Management Applications Support (PMAS) at 1-800-809-2772.

In addition, an Appendix and Glossary are also provided as follows:

Appendix. Startup Setting Sheets. Provides a summary of settings and a place to logically record programming details

Glossary. Provides a reference for terms and phrases as used throughout this publication.

1-3.1 Quick Start Steps

Step 1: Review the Introductory Comments and Safety, paragraph 1-1.

Step 2: Mount the IQ Analyzer as described in paragraph 4-2.

Step 3: Wire the IQ Analyzer as described in paragraph 4-3 using diagrams of Figures 4-9 to 4-34 as a reference.

Step 4: Follow the Initial Startup procedures of paragraph 4-4 to apply power and setup basic metering.

Step 5: Examine the metered values for consistent currents, voltages, and power. As necessary, refer to the Troubleshooting Guide, Table 7.1.

NOTICE

The IQ Analyzer itself can help the diagnosis of possible miswiring. Manually create an event with the F3 (HARM) and F4 (NEW) soft-keys. In the Power Factor category of the Meter Menu, examine the Fundamental Phase Angles of VA, VB, VC, IA, IB, and IC. In a positive sequenced system, one expects the phase angles of VA, VB, and VC to be 0° -120° and +120°, respectively.

Table 1.1 IQ Analyzer Order Information ①

Device Description	Catalog Number	Style Number
IQ Analyzer with self-powered three phase power module	IQA6430	66C2045G01
IQ Analyzer with separate source power module	IQA6410	66C2045G02
IQ Analyzer with dc power module	IQA6420	66C2045G05
Self-powered, graphic displays and transient triggering	IQA6630	66C2045G03
Separate Source, graphic displays and transient triggering	IQA6610	66C2045G04
dc power module, graphic displays and transient triggering	IQA6620	66C2045G06
IQ Mounting Flange	IQFLANGE	5743B02G01
IQ Analyzer 36 inch extension cable	IQACABLE	2107A55G02
IQ Analyzer 45 inch extension cable	IQA45CABLE	2107A55G03
Self-powered three phase power module only	IQM3PPM	66C2113G01
Separate source power module only	IQMSSPM	66C2105G01
dc source power module only	IQMDCPM	66C2065G01
Communication modules		
INCOM Product Operated Network Interface	IPONI	8793C36G01
Ethernet Product Operated Network Interface (10Base-T only)	EPONI	-
Ethernet Product Operated Network Interface (10Base-& 10Base-FL)	EPONIF	-
Software Support:		
PowerNet Suite (Client/Server)	PNEG100	-
PowerNet Suite (Client)	PNEGC	-
IQ Auxiliary Power Supply (for pre-installation setup)	IQDPAUXPS	-
Portable IQ Analyzer	IQA6610 PORT	4013115G02

① An IQ Analyzer is supplied with a power module and a manual as standard. A communications module (IPONI, EPONI, or EPONIF), potential transformers and current transformers are not supplied with the IQ Analyzer.

ORDERING NOTE:
IQA3PPM and IQASSPM are no longer compatible with the new IQA6400/6600 Series (66D2045).
Order IQM3PPM, IQMSSPM, or IQMDCPM.
The IQA3PPM and IQASSPM modules are replacements for use on the IQA6000/6200 Series (2D82302)

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SECTION 2: HARDWARE DESCRIPTION

2-1 General

The purpose of this section is to familiarize the reader with IQ Analyzer hardware, its nomenclature, and to list the unit's specifications. The information presented is divided into the following four parts:
- Operator Panel
- Rear Access Area
- External Hardware
- Specification Summary

2-2 Operator Panel

The operator panel, which is normally accessible from the outside of a panel or door, provides a means for:
- Being alerted to specific conditions
- Receiving functional help
- Programming
- Parameter Monitoring/Selection

LEDs, a display window, and pushbuttons make up the front accessible operator panel (Figure **2-1**).

Except for the Normal LED, which blinks green, LEDs are red and can be blinking or lit continuously, depending upon their specific function. For detailed information on individual LEDs refer to Paragraph 3-2.

The display window is used to display all IQ Analyzer metered parameters, setpoints and messages in a number of different formats. The information is presented in the form of display screens for a variety of categories. The LED backlit LCD display is approximately 1.5 by 3.0 inches and is able to display up to eight lines of information at a time.

1 Status LEDs
2 Reset Pushbutton
3 Display Window
4 Previous Level Pushbutton
5 Function Pushbuttons
6 Home Pushbutton
7 Display Information LEDs
8 Up and Down Pushbuttons
9 Program Pushbuttons
10 Help Pushbutton

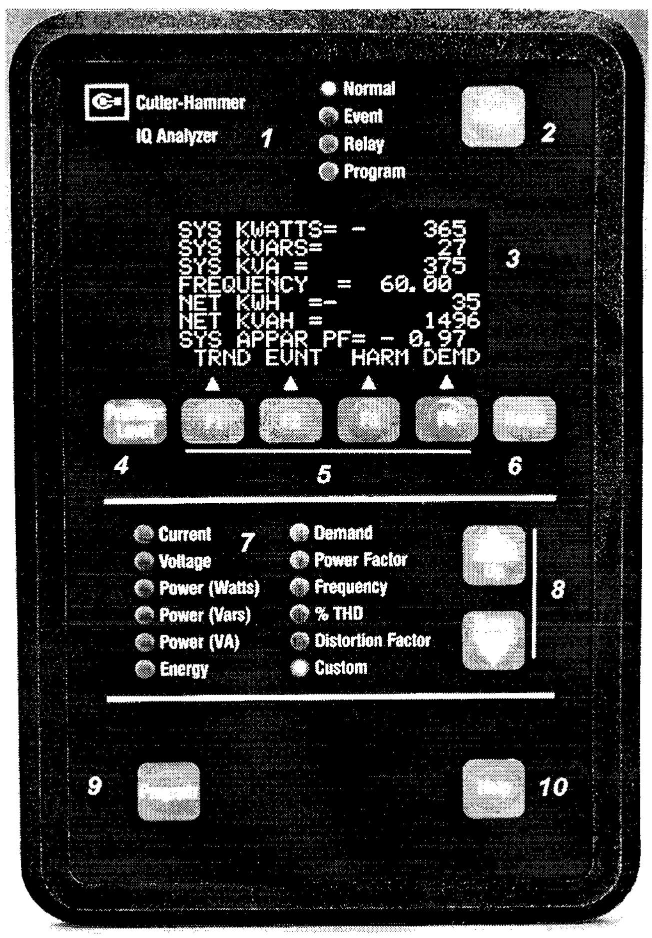

Figure 2-1. IQ Analyzer Operator Panel

For information that is frequently accessed, four custom screens will cycle through 28 Meter Menu parameters of the user's choosing (5 seconds/screen). For details concerning the kind of information and the types of screens that can be viewed in the display window refer to Paragraph 3-3.

The front operator panel supports eleven long-life membrane pushbuttons. Pushbuttons accomplish their function when pressed and released. Certain pushbuttons will, however, continue to scroll if they are pressed and not released. Refer to Paragraph 3-4 for information concerning the function of specific pushbuttons.

2-3 Rear Access Area

The rear access area of the IQ Analyzer is normally accessible from the rear of an open panel door (Figure **2-2**).

All wiring connections to the IQ Analyzer are made at the rear of the chassis. For the sake of uniform identification, the frame of reference when discussing the rear access area is facing the back of the IQ Analyzer with the panel door open. The power module port, for example, is located on the upper left rear of the IQ Analyzer. The communication module port is located on the lower right rear of the unit. Detailed information relative to any connection made to the rear access area is presented in Section 4 entitled "Installation, Startup and Testing."

2-3.1 Back of Chassis

The back of the chassis provides terminal blocks for 3-phase ac line connections and connections for the three required external current transformers plus neutral and ground (Figure **4-7** and **4-8**). The ac line connections are identified on the terminal block "Phases A, B, C and Neutral." The current transformer connections are identified "Phases A, B, C, Neutral and Ground."

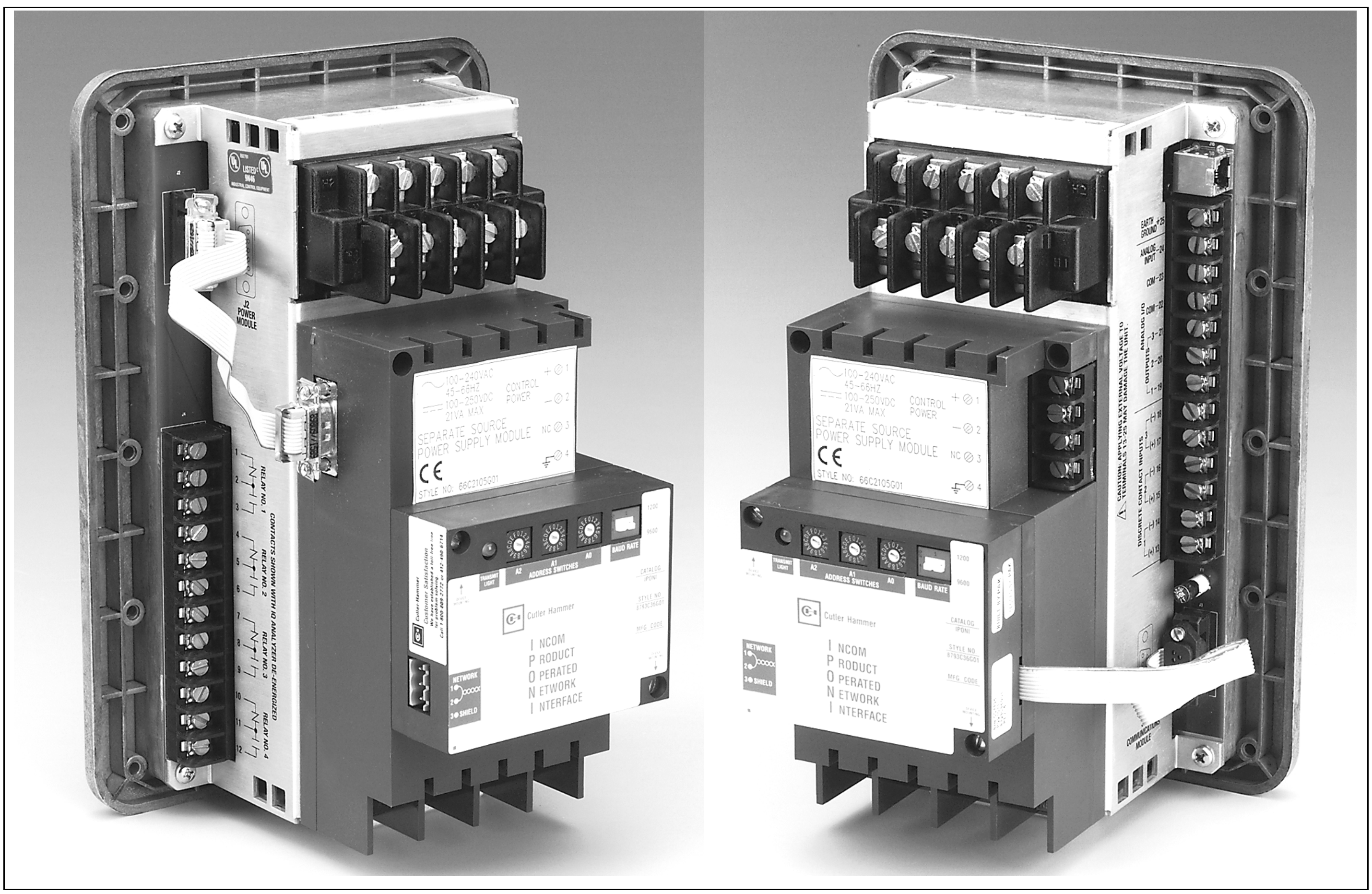

Figure 2-2. IQ Analyzer (Rear Views). See Figures 4-7 and 4-8 for detailed identifications.

In addition, the rear of the chassis, through the use of two stacking screws, provides a means for mounting the standard 3-phase self-powered power module, 100-240V separate source power module, or 24-48Vdc source power module. (Figures **2-3** and **2-4**). An optional communication module (IPONI - INCOM Product Operated Network Interface) is mounted to the power module using the same stacking screws (Figure **2-5**). When a power module is remotely mounted, the IPONI mounts directly to the back of the chassis. Alternatively, Ethernet comminications is available through the same port via an EPONI (Ethernet PONI).

2-3.2 Left Rear of Chassis

The left rear of the chassis provides a port that will accept the D-sub female connector of either the self-powered or separate source power module (Figure **2-2**). Four sets of Form C Relay Output Contacts are also provided for control relay connections.

Figure 2-3. Separate Source Power Module (Shown Mounted)

2-3.3 Right Rear of Chassis

CAUTION

ANALOG I/O IS NOT ISOLATED. EQUIPMENT DAMAGE COULD RESULT IF EXTERNAL VOLTAGE IS APPLIED TO TERMINALS 19-25. WIRE GROUND TERMINALS 22-23 BEFORE THE 3 ANALOG OUTPUT TERMINALS, 19-21.

NOTICE

THE IQ ANALYZER CASE MUST BE GROUNDED FOR PROPER MEASUREMENT. CONNECT A GROUNDING WIRE TO EITHER THE POWER MODULE OR ANALYZER GROUND TERMINAL. FAILURE TO GROUND THE CASE RESULTS IN INCORRECT AND UNSTABLE VOLTAGE AND CURRENT READINGS.

Figure 2-4. Self-Powered Three-Phase Power Module (Unmounted)

The right rear of the chassis provides a port that will accept the D-sub male connector of the optional Communication Module (IPONI, EPONI, or EPONIF) (Figure 2-2).

Three sets of dry contacts for discrete remote inputs are provided. An open contact registers as INACTIVE in the display while a closed contact registers as ACTIVE. Just above the discrete input contacts are Analog I/O terminals.

Output terminals #19-21 are programmable. Terminals #22-23 are ground and internally connected to the chassis ground terminal #25. In the wiring of analog outputs, be sure to connect the ground and load before connecting to terminals #19-#21.

Terminal #24 is the analog input and can sense 0-20 mA from a transducer

2-4 External Hardware

External hardware is defined as any required potential transformers, current transformers, power supply module or communication module. Power supply modules and communication modules are defined as external devices, even though they are usually directly mounted on the back of the IQ Analyzer.

2-4.1 Current Transformers

Each IQ Analyzer requires that at least two external current transformers be wired into the CT input terminal block (Paragraph 2-3.1, Figures **4-7** and **4-8**). Inputs are 5 amperes nominal or up to 40 amperes continuous. Current transformers are supplied by the user and should be selected for appropriate accuracy.

2-4.2 Potential Transformers

Potential transformers are required when the line voltage is above 600 volts line-to-line. They are wired directly to the ac line connection terminals (Figures **4-7** and **4-8**). Potential transformers are also the user's responsibility. Refer to potential transformers in the Glossary before programming, even if potential transformers are not used in the system.

2-4.3 Power Supply Modules

WARNING

NEVER WORK WITH POWER SUPPLY MODULES WHEN AC LINE POWER IS APPLIED TO THE IQ ANALYZER. PERSONAL INJURY OR DEATH COULD RESULT.

A standard 3-phase power module, separate source power module, or dc source power module is shipped from the factory mounted to the back of the IQ Analyzer.

Two stacking screws secure the power module in position (Figure **2-3**). Power modules can be detached and mounted remotely up to 36 inches from the IQ Analyzer through the use of an optional extension cable (IQACABLE). This may be required if local codes prohibit ac power devices from being located on a panel door. Power modules utilize a D-sub female connector to plug into a power port located on the left rear side of the chassis (Figure **2-2**). The cable also unplugs from the power module to permit the installation of an extension cable.

Each 3-phase power module is supplied with 3 line fuses internal to the power module (Figure **2-6**). The fuses are accessed by removing the screws holding the cover in place. Fuse replacement should only be done with all voltages removed from the IQ Analyzer.

Terminals, located on the lower rear portion of each power module, provide sensing inputs for the 3-phase voltage being monitored. The inputs are identified from left to right as A, B, C and NEU (Figures **4-7** and **4-8**). On up to 600 volt systems, direct input can be applied. For systems greater than 600 volts, potential transformers are required.

The separate source power module is supplied with a power input terminal block located in the upper right portion of the power module (Figure 2-3). Standard 3-phase (self-powered) power modules do not require this terminal block input.

2-4.4 Optional Communication Module

The IQ Analyzer is a PowerNet compatible device. PowerNet can remotely monitor, upload waveforms, control, and program the IQ Analyzer.

Communications is made possible by attaching a communications module (IPONI, EPONI, or EPONIF). Since the IQ Analyzer is always supplied with a communications port, any PONI (Product Operated Network Interface) can be easily retrofitted at any time. The PONI modules **may be connected to or disconnected** from the IQ Analyzer under power **without risk of damage** to either product.

2-4.4.1 IPONI

The IPONI (INCOM Product Operated Network Interface) is a small, addressable communication module that attaches to the back of the IQ Analyzer (Figure 2-5). The Communication Module can be mounted directly to the back of the IQ Analyzer or to a Power Module already mounted on the IQ Analyzer. Addresses and BAUD Rates are established on the IPONI itself. Refer to the instruction details supplied with the IPONI for details.

2-4.4.2 EPONI and EPONIF

The EPONI is an Ethernet Product Operated Network interface that attaches directly to the back of the IQ Analyzer. The power module can then be mounted to the PONI or mounted remotely (36 inches away). The EPONIF is an Ethernet PONI with a 10Base-FL (fiber optic) interface. Refer to the instruction details supplied with the EPONI or EPONIF for details.

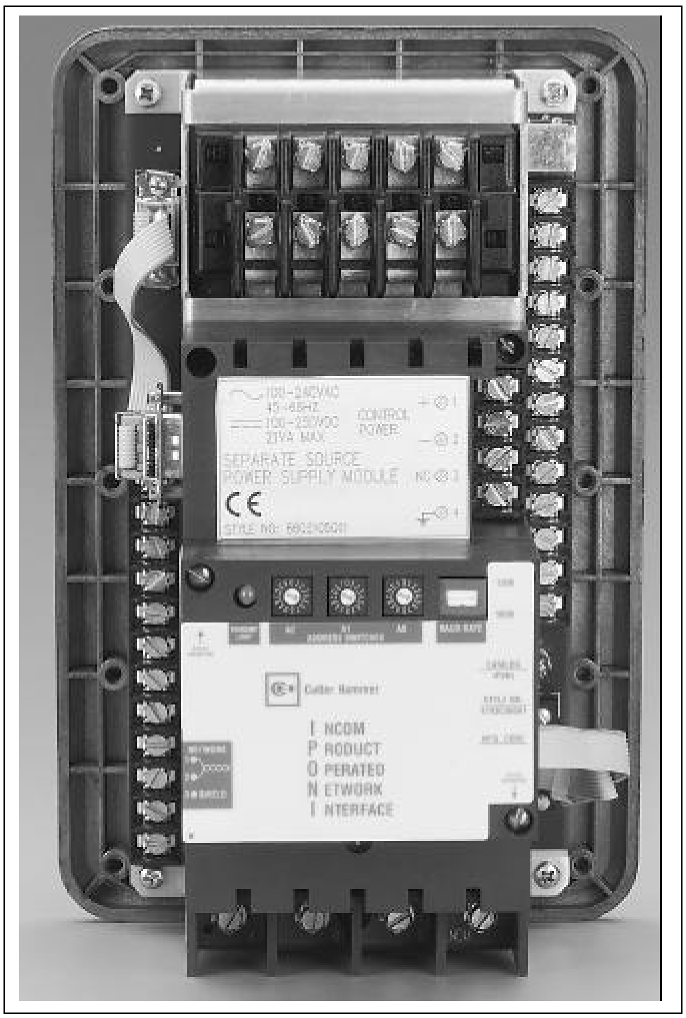

Figure 2-5. Communications Module – IPONI – (Mounted)

2-4.4.3 PowerNet Software Suite

Regardless of the type of PONI chosen, PowerNet offers a two-tied communication system that is based on an Ethernet backbone and an INCOM frequency carrier signal running through equipment rooms. The Ethernet backbone follows standard Ethernet wiring rules, allowing a mix of CAT5 cable and Fiber networks. The INCOM signal may extend up to 10,000 feet and connect 200 devices through a NetLink to the Ethernet backbone.

The PowerNet Software Suite provides the ability to monitor and record power distribution system data as it occurs. PowerNet is a Microsoft™ Windows95/98/NT compatible application that features user-friendly, menu-driven screens.

2-4.4.4 PowerNet Graphics

PowerNet Graphics software provides the capability to generate custom animated color graphics. For example, animated one-line drawings of electrical power distribution systems, flow diagrams of processes, equipment elevation views, and other graphical representations can be developed.

2-4.4.5 Connectivity

A computer running the PowerNet Software Suite can interface with other networks. Example of connectivity interfaces include:

- PLCs (Programmable Logic Controllers)
- DCSs (Distributed control Systems)
- BMSs (Building Management Systems)
- PC-based graphical operator interface programs

2-5 Specification Summary

The IQ Analyzer is intended for indoor use only, and meets the specifications in Table **2.1**.

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

IQ ANALYZER Dimensions:

Overall Depth:	4.7 inches (12 cm)
Overall Height:	10.25 inches (26 cm)
Overall Width:	6.72 inches (17 cm)

IQ ANALYZER weight: 6 pounds (2.7 kg)

Terminals:

Wire Size:	# 12 - 22 AWG
Screw Size:	# 6-32
Torque:	8 - 10 in-lbs

Certification;

ISO:	Manufactured in an ISO9001 certified facility
UL/cUL:	Listed UL-508, File E62791, NKCR Auxiliary Devices (with IQM3PPM) Listed UL-3111, File E185559, Metering (with IQMSSPM, IQMDCPM)
NEMA:	3R and 12 (with supplied gasket)
FCC:	Part 15, Class A
CISPR-11:	Class A
CE:	Units marked with CE comply with IEC1010-1 (1990) incl. Amend 1 & 2 (1995) EN61010-1 (1993), CSA C22.2 #1010.1 (1992) and EN50082-2 (1994)
Measurement Canada:	Electricity Meter, Approval # AE-0782

Current Inputs (Each Channel):

Conversion:	True rms, 32 sample/cycle (all samples used in all rms calculations)
CT Input:	5 Amp secondary (any integer 5:5 to 10,000:5)
Burden:	0.05 VA
Overload Withstand:	40 Amps ac continuous, 300 Amps ac 1 second
Range:	8 x CT Continuous
Accuracy:	0.1% of CT primary rating, 0.2% of reading above 150% of rating, sinusoidal (see accuracy below for non-sinusoidal specifications)
Input Impedance:	0.002 ohm
Wiring:	14 AWG (larger wire requires appropriate terminals)

Voltage Inputs (Each Channel):

Conversion:	True rms, 32 samples/cycle (all samples used in all rms calculations)
PT Input:	Direct or any integer 120:120 to 500,000:120
Range:	30 to 635 (separate source only) Vac
Nominal Full Scale Voltage:	120 - 600 Vac (120 - 440 Vac IQA6020/IQA6220)
Burden:	21 VA (self-powered only)
Overload Withstand:	635 Vac continuous, 700 Vac 1 second
Input Impedance:	1 megohm
Wiring:	12 AWG to 22 AWG ②
Transient Overvoltage:	Category-III

Control Power Input (Separate Source and Self Powered):

	<u>**3-Phase Powered**</u> ① <u>**(IQM3PPM)**</u>	<u>**Separate Source (IQMSSPM)**</u>	<u>**DC Source (IQMDCPM)**</u>
Input Range:	100-220 Vac +/- 10% 100-600 Vac +/- 10%	24-48 Vdc +/- 20% 45 - 66 Hz 110 - 250 Vdc +/- 10%	 N.A.
Burden:	20 VA	20 VA	20 VA
Wiring:	12 AWG to 22 AWG ②	12 AWG to 22 AWG ②	12 AWG to 22 AWG ②
Transient Overvoltage:	Category-III	Category-II	Category-I

① When directly wired to 480 Vac, IQ Analyzer can ride through a continuous sag that is 20% of rated voltage.
② Wire insulation must support line-to-line voltage per local codes.

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

Frequency Range: 20 - 66Hz fundamental (up to 50th harmonic)

Harmonic Response (Voltages, Currents): 50th harmonic (3kHz)

Accuracy (in percent full scale unless specified otherwise):

The IQ Analyzer is a revenue-accurate energy meter that complies with numerous accuracy standards, including: ANSI C12.20(0.5%), ANSI C12.16(1%), IEC687(0.5%), and Canada(0.5%).

(Accuracy is from 5 - 300% of Full Scale and from -0.5 to 1.00 to 0.5 power factor)

Current and Voltage:	±0.20%
Power, Energy, and Demand:	±0.5% of reading
Frequency:	±0.04%
Power Factor:	±1%
THD:	±1% (with continuous current)

Current Accuracies at specific peak current limits:

±0.20% of Full Scale to 200% of Full Scale and 150% Crest Factor
±0.20% of Full Scale to 150% of Full Scale and 200% Crest Factor
±0.20% of Full Scale to 100% of Full Scale and 300% Crest Factor
±0.40% of Reading for Currents to 800% of Full Scale
Power and Energy: Starts recording with an average of 3 mA secondary current
Current: Starts recording at 0.55% of full scale (27 mA of secondary current)

Environmental Conditions:

Operating Temperature:	-20° to 70° C
Storage Temperature:	-30° to 85° C
Operating Humidity:	5 to 95% Relative Humidity (Non-condensing)
Altitude:	5000 m
Pollution Degree:	2 (IEC 664)

Discrete Inputs (Dry Contact):

+30 Vdc differential across each discrete input pair of terminals.
Minimum Pulse Width: 34ms on a 60Hz system, 40ms on a 50Hz system
Optically isolated inputs to protect IQ Analyzer circuitry.
Withstand Rating: 120 Vac

Analog Outputs: (CAUTION: Wire to ground before wiring to output terminals; otherwise, damage may result)

0 to 20m A / 4 to 20 mA into max. 750 ohm load

Accuracy:	1%
Resolution:	0.25%
Withstand Rating:	60Vdc
Wiring:	Shielded twisted pair cable, Belden 9486 or equiv.

Analog Input:

0 to 20 mA / 4 to 20 mA into 200 ohm load (0 to 5 V with external 50 ohm series resistance)

Accuracy:	1%
Resolution:	1%
Withstand Rating:	5 Vdc
Wiring	Shielded twisted pair cable, Belden 9486 or equiv.

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

Relay Output Contacts:

- General Purpose: 100,000 operation under load, 10 million operations as a pulse initiator.
- CAUTION! For pulse-initiator operation, set the pulse rate so that 10 million operations is within the desired lifetime. For example, one pulse/sec accumulates to 10 million in less than 4 months.
- Load shed on any system demand
- Event trigger
- Discrete input
- Remote PowerNet / IMPACC control

Minimum Pulse Width: 4 cycles (68 ms)
Withstand Rating: 1000 Vac (across contacts, 1 minute)
5000 Vac (contacts to coil, 1 minute)
10,000 Vac (contacts to coil, surge voltage)

RELAY Make, Break, and Carry CHARACTERISTICS				
Loading	Voltage	Carry (constant load)	Make (50ms)	Break
Resistive (PF=1.0	120 Vac 250 Vac 30 Vdc 60 Vdc 110 Vdc 250 Vdc	10 A 10 A 10 A 10 A 10 A 10 A	50 A 30 A 30 A 30 A 30 A 30 A	10 A 10 A 10 A 1 A 0.5 A 0 A
Inductive (PF=0.4)	120 Vac 240 Vac	10 A 10 A	43 A 21 A	7 A 7 A

Memory Capacity:

Program Memory: 512KB (EPROM or Flash)
Total Data Memory: 256KB (Non-Volatile RAM)
Program Settings: 2KB (EEPROM)

Event Storage:

The IQ Analyzer stores the waveforms and metered data for 10 events. Each set of waveforms includes 8 cycles of VAN, VBN, VCN, VAB, VBC, VCA, VNG, IA, IB, IC, IN, and IG (2 cycles at 128/cycle & 6 cycles at 32/cycle).

Event Logs:

The IQ Analyzer stores the timestamp and cause of the most recent 504 events. These non only include events that trigger waveform captures but also relevant status changes: Power Up, Relay On, Relay Off, Reset (demand, energy, min/max, relays, events, and trends), Settings, Calibration, Network Connection Established, and Network Disconnected (20sec timeout).

Trend Data:

The IQ Analyzer includes a powerful trending engine that can be applied to 4 indepentent applications. For example, one trend can record energies every few minutes for months while a second trend captures the first seconds or minutes of a motor start.

Independent Trends: 4
Trend Buffers: 100 (900 bytes each)
Items Per Trend: 6
Trend Intervals: 8cycles, 1-5040 minutes
Max Memory Allocation: 1-100 buffers each
Trend1: 8-cycle sampling triggered by Discrete Input#1
Trend2: 8-cycle sampling triggered by Discrete Input#2
Trend3: 8-cycle sampling triggered by Discrete Input#3
Trend4: 8-cycle sampling triggered by waveform capture event (ideal for sag/swell details)

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

MEASURED VALUES [1]

Parameter	Accuracy	Range	Time & Date Stamped
Current	0.2%	0 to 800% of CT	Per phase min/max
Voltage	0.2%	0 to 150% of PT	Per phase min/max
watts	0.4% 0.5% of reading 1 % of reading	0-80000MW (PF = 1; 5%-300% of full scale) (PF > ±0.5; 5%-300% of full scale)	Per phase and system min/max
vars	0.4% 1% of reading	0-80000Mvar (PF < ±0.5; 3%-300% of full scale)	Per phase and system min/max
VA	0.4% 0.5% of reading	0-80000MVA (5%-300% of full scale)	Per phase and system min/max
kWh		999,999,999 kWh	
MWh		999,999,999 Mwh	
kvarh		999,999,999 kvarh	
Mvarh		999,999,999 Mvarh	
kVAh		999,999,999 kVAh	
MVAh		999,999,999 MVAh	
amp demand	0.2%	0 to 800% of CT	Per phase system maximum demand
watt demand	0.4%	0-80000MW	Maximum demand
var demand	0.4%	0-80000Mvar	Maximum demand
VA demand	0.4	0-80000MVA	Maximum demand
Displacement Power Factor (isolates fundamental components)	1%	-.01 to 1 to +.01 and 0	Per phase and system min/max
Apparent Power Factor (includes harmonic components)	1%	-.01 to 1 to +.01 and 0	Per phase and system min/max
Frequency	0.01Hz	20.00 to 70.00Hz	min/max
% amps THD	1.5%	0-9999%	Per phase min/max
Magnitude amps THD	1.5%	0-80000A	Per phase min/max
% volts THD	1.5%	0-600%	Per phase min/max
Magnitude volts THD	1.5%	0-500000V	Per phase min/max
K-factor (during event)	0.5%	0-1.000	Event only
Crest Factor (largest of per-phase values)	0.2%	1.000-3.000	
THDF (CBEMA) (smallest of per-phase values)	0.2%	0-1.414	
Time	10ms resolution	(synchronized via IMPACC with entire system)	
Phase Angle	0.5 degrees	0-360 degrees	Event Only

[1] *All accuracies as % full scale unless noted otherwise*

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

EVENT TRIGGERS ①

# of Selections	Trigger	Description
2	2	Undervoltage - any VLL, VLN (40-100% of PT primary line-to-line)
2	4	Overvoltage - any VLL, VLN (100-750% of PT primary line-to-line)
1	5	Interruption - any VLN (transient trigger only available in the IQA-6200 series)
1	6	Excess dV/dt - any VLN (transient trigger only available in the IQA-6200 series)
26	7-32	Maximum %THD or magnitude THD - any current, any VLL, any VLN, Ia, Ib, Ic, In, Van, Vbn, Vcn, Vab, Vbc, Vca
7	33-39	Maximum Demand - Ia, Ib, Ic, In, system watts, system vars, system VA
5	40-44	Maximum Current - Ia, Ib, Ic, In, Ig
7	45-51	Maximum Voltage - Van, Vbn, Vcn, Vab, Vbc, Vca, Vng
3	52-54	Maximum Power - system watts, system vars, system VA
2	55-56	Maximum Power Factor - (smallest '+' or largest '-') - system displacement, system apparent
3	57-59	Minimum Current - Ia, Ib, Ic
6	60-65	Minimum Voltage - Van, Vbn, Vcn, Vab, Vbc, Vca
3	66-68	Minimum Power - system watts, system vars, system VA
2	69-70	Minimum Power Factor (smallest '-' or largest '+') - system displacement, system apparent
3	71-73	Frequency - high, low, high/low
2	74-75	Voltage Unbalance - VLL, VLN (as % of average)
1	76	Current Unbalance (as % of average)
3	77-79	Discrete Inputs - Input 1, Input 2, Input 3
5	80-84	Min/Max Update - any combination of min/max current, min/max voltage, min/max power factor, min/max power/freq., or min/max THD
2	85-86	Manual - local or via IMPACC

① *Each of the 7 triggers may be programmed to any of 86 selections*

EVENT STORAGE ①

Type	# of records	Description
Event Waveforms and Data	10	Upon event, meter-menu capture, 8-cycle capture, and harmonics 1-50 of Van, Vbn, Vcn, Vab, Vbc, Vca, Vng, Ia, Ib, Ic, In Ig (2-cycles at 128 samples/cycle 6 cycles at 32 samples/cycle),
Event Log (NEW!)	504	Each record includes the time and reason for the event. Also included are records for Powerup time, resets, communications, relay, and setting changes.

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

UPDATE TIMES

Parameter	Time	Comments
Voltage	2 cycles	
Current	8 cycles	
Power	8 cycles	
Energy	8 cycles	
Demand	1-60 min	Programmed or Sync Demand Windows
Power factor	8 cycles	Currents less than 0.05% are ignored
Frequency	8 cycles	Measured each cycle digital filtered with 1s time-constant
THD	8 cycles/ parameter	Parameters: Ia, Ib, Ic, In, Van, Vbn, Vcn, Vab, Vbc, Vca
K-Factor	Of Event	Ka, Kb, Kc K-factor in IMPACC and event data it is the largest of Ka, Kb, Kc
Crest Factor and CBEMA THDF	8 cycles	Largest of Ia, Ib, and Ic crest factors. Currents less than 0.05% are ignored
Discrete Inputs	2 cycles	Dry Contact
Relay Outputs	2 cycles	Plus 15ms (energize), 5ms (de-energize)
Analog Input	8 cycles	
Analog Outputs	8 cycles	
Display Large Text	1 second/screen	e.g., a screen with IA, IB, IC updates in 1 second
Display Small Text	0.5s per screen	e.g., each 7 parameter custom screen updates in 0.5 seconds
Event Trigger Checks	2 cycles	Note that while triggers are checked every 2 cycles, the actual time depends upon the specified trigger. Those triggers based upon voltage, discrete inputs, or manual/IMPACC update in 2 cycles while others update in 8 or more cycles.
Fast Trends (NEW!)	8 cycles (setting=0min)	Trends1-3 triggered by Discrete Input contacts 1-3. Trend4 triggered by waveform event. Each can be programmed to 6 items. Data is continually collected until the programmed memory allocation is full.
Event Driven Trends (NEW!)	Triggered (setting=5040 minutes)	Trends1-3 triggered by Discrete Input contacts 1-3. Trend4 triggered by waveform event. Each can be programmed to 6 items, which is sampled only once per trigger.
Periodic Trends (NEW!)	1-5039 minutes	Periodic Data: Each of 4 trends can be programmed for 6 items and independet update time.

Qualification Tests

Dielectric Strength:	2.3kV for 1 minute to Relays, CTs, PTs, power supply
Transients:	ANSI C37.90 Oscillatory 2.5kV/1MHz, Fast Rise 5kV/10ns
	IEC801-4/EN61000-4-4, 2kV, 5ns rise for 50ns, 5kHz repetition
Dips and Interruptions:	EN61000-4-11 voltage shift at zero crossing
ESD:	IEC801-2/EN61000-4-2, 4kV to terminals, 8kV to faceplate
RFI/EMI:	UL991 10V/m
	ANSI C37.90.2, 150Mhz and 450Mhz, 10V/m
	IEC801-3/EN50140 10V/m, EN50204 10V/m
	IEC801-6/EN50141 10V
	IEC801-8/EN61000-4-8 30A/m
Surge:	IEC801-5/EN61000-4-5, 4kV common mode 1.2 us rise for 50 us

Table 2-1 IQ Analyzer Specifications and Details Summary (continued on next page)

IQ Analyzer Parameter Equations

Basic Metering —

(The "fundamental period" is the time for a single cycle leg, 1/60 sec.)
(T1 = time between samples [e.g. $\frac{1000}{60 \times 12}$ = .1302 ms])
If "T1" is the time between samples, then j*T1 = "time = t", where j = 0,1,2,…,K.
x(j) is the value of function x(t) at a time = j*T1.
v(j) is the value of voltage v(t) at a time = j*T1.
i(j) is the value of current i(t) at a time = j*T1.

Calculation of RMS current and voltage: $X = \text{rms value of } x(t) = \sqrt{1/[K + 1] * \sum_{j=0}^{K} \{[x(j)]^2\}}$.

Calculation of watts: $WATT = 1/[K + 1] * \sum_{j=0}^{K} \{v(j) * i(j)\}$.

Calculation of VARs: $VAR = 1/[K + 1] * \sum_{j=0}^{K} \{v(j + m) * i(j)\}$,

where m = number of samples in "fundamental period"/4.
This is the fundamental "reactive" power.

Calculation of VA: VA = Vrms * Irms (This includes the effects of harmonics).

Calculation of displacement power factor:

$PF\ displacement = WATT/\sqrt{[WATT^2 + VAR^2]}$. (60 Hz components for use in power factor correction calculations)

Calculation of apparent power factor: PF apparent = WATT/VA. (includes harmonics)

Table 2-1 IQ Analyzer Specifications and Details Summary

Power Quality —

Calculation of percent THD:

$$\%THD\ x(t) = 100 * \sqrt{\{x_2^2 + x_3^2 + x_4^2 + \ldots x_n^2\}} / x_1$$

where n is the highest harmonic number used.

Calculation of crest factor: CF = [peak value of x(t)]/[rms value of x(t)].
THDF (Transformer Harmonic Derating Factor) CBEMA = $\sqrt{2}$ / CF

Calculation of "K-factor" (IEEE C57.110-1968):

$$\text{K-factor} = \frac{\sum_{n=1}^{m} h_n^2 (I_n/I_1)^2}{\sum_{n=1}^{m} (I_n/I_1)^2}$$

where: h_n is harmonic number = "n", In is the current of harmonic "n",
I_1 is the first harmonic current (n = 1),
m is the highest harmonic number used.

Calculation of Fourier coefficients:

$$F(n) = \sqrt{[Fsine(n)]^2 + [Fcosine(n)]^2}$$

$$Fsine(n) = 2/[K + 1] * \sum_{j=0}^{k}\{\sin[n*w*j*T1] * x(j)\}$$

$$Fcosine(n) = 2/[K + 1] * \sum_{j=0}^{k}\{cosine[n*w*j*T1] * x(j)\}$$

where: n = harmonic number, w = 2*PI*(fundamental freq)
and the sampling is done over an integral number of cycles.

Power Module Fuse: BUSS KTK-R-3/4 or equivalent (three phase power module)
Littelfuse GDB-250mA, or equivalent, 5 x 20 mm (separate source power module)

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SECTION 3: OPERATOR PANEL

3-1 General

The operator panel, which is normally accessible from the outside of a panel or door, provides a means for being alerted to specific conditions, receiving functional help, programming, and parameter monitoring/selection (Figure 2-1). For the purpose of familiarization, the panel is divided into three sub-sections and discussed individually:

- LEDs
- Display Window
- Pushbuttons

3-2 LEDs

LEDs are used to indicate a number of functions, operations and/or events (Figure 2-1). Four LEDs at the top of the IQ Analyzer provide a quick snapshot of the unit's status. Twelve LEDs located next to the "Up" and "Down" pushbuttons indicate the Meter Menu category.

Normal LED
This LED is blinking green and indicates power to the unit, normal system operation and that all parameters are within programmed thresholds. This LED will not be lighted if the unit is wired incorrectly or experiences a malfunction. The display window will show the cause of the error or failure upon power-up.

Event LED
This LED will blink to indicate that an event has occurred with data available for review via Event Analysis Screens. It continues to blink until data is acknowledged by entries to the event screen or remotely via PowerNet. The event conditions are defined during programming.

Relay LED
This LED will be lighted continuously to indicate one or more of the Form-C relays have changed from a normal operating state. It remains lighted until normal relay conditions are reset. The relay conditions are defined during programming and the Reset Mode.

Program LED
This LED will be lighted continuously to indicate that the Program Mode has been selected and program screens are displayed. While in the Program Mode, the IQ Analyzer continues to perform all the functions it normally performs when not in the Program Mode.

Function LEDs
These LEDs indicate the general grouping of the metered parameters within the "Meter Menu" (current, voltage etc.). The individual LED lighted depends upon the particular group of parameters being displayed at that particular time.

3-3 Display Window

The IQ Analyzer provides a comprehensive array of metered parameters via its Display Window (Figure **2-1**). Eight different categories of Display Screens can be presented via the Display Window.

Eight Basic Display Screen Categories

- Programming
- Meter Menu
- Trend Analysis (min/max and trend data)
- Event Analysis (event data and event log)
- Harmonic Analysis
- Demand Analysis
- Help
- Reset Menu

For all the screens, the flashing parameter is active and will be used when a selection or entry is to be made within a screen.

Program Mode Screens
When the Program Mode Pushbutton is pressed, the IQ Analyzer displays the top level screen of the Program Mode which includes (Figure **6-1**):

- Date/Time of Last Programming
- INCOM Network Address
- Software Version
- Password Entry Fields

The device, upon correct password entry, will enter the tree of screens for setting up the IQ Analyzer (Figure **6-3**). Up to eight lines of text are displayed on each screen (Figure **3-1**).

Meter Menu Screens
The IQ Analyzer allows viewing of commonly used parameters by scrolling through its LED indicator Meter Menu. These screens each show one or more of the main parameters being metered (Figure **3-2**). Movement between the different screens is accomplished using the Up, Down, and Home pushbuttons. The four function pushbuttons just below the Display Window permit access to expanded metering and analysis screens which provide detailed trend, harmonic, event and demand data (Figures **3-3** to **3-6**).

New to the IQA6400/IQA6600 Series Meter Meuu are time of use registers that partition energies and demands into four billing rates, according to the day of week, time of day, and season schedules. In addition, up to 22 holidays can be selected for special scheduling. Figures **3-9** and **3-10** are examples of time of use energy and demand displays.

Trend Analysis Screens (min/max data)
When the TRND(F1) function pushbutton is pressed, the unit enters the tree of screens that stores min/max information. They consist of time and date stamped minimum and/or maximum values for current, voltage, power and power factor. Eight lines of text are displayed per screen (Figure **3-3**). For additional information, refer to paragraph 5-5.

Trend Analysis Screens (trend data)
When the TRND(F1) function pushbutton is *pressed and held*, the unit enters the tree of screens that present stored data for four periodic trends. Eight lines of test are displayed per screen. See Figure **3-11** and Figure **3-12**.

Event Analysis Screens (event data and log)
When the EVNT(F2) function pushbutton is pressed, the unit enters a tree of screens with complete information for up to ten event conditions. Eight lines of text are displayed per screen (Figure **3-4**). For additional information, refer to paragraph 5-5.

When the EVNT(F2) function pushbutton is *pressed and held*, the unit displays the first page of logged events. Use PGDWN(F3) to page down through the logs. Eight lines of test are displayed per screen. See Figures **3-11** through **3-15** for an example of energy trend data. Specifically, Figure **3-11** shows the top-level trends 1-4 while Figure **3-12** shows the trend buffers that are associated with Trend1. Figures **3-13** through **3-15** show the data for a selected buffer.

Harmonic Analysis Screens
The F3 function pushbutton is used to access a tree of screens which contains complete harmonic data for each voltage and current. Eight lines of text are displayed per screen (Figure **3-5**). For additional information, refer to paragraph 5-5.

Demand Analysis Screens
The F4 function pushbutton is used to access a tree of screens with detailed demand data. Eight lines of text are displayed per screen (Figure **3-6**). For additional information, refer to paragraph 5-5.

Help Screens
When the Help Pushbutton is pressed, the IQ Analyzer displays the top level Help Screen. The category of help is selected from the top level Help Screen followed by screens offering different levels of help in a selected category (Figure **3-7**). Troubleshooting includes the firmware revision and date.

Reset Menu Screens
The “Reset” pushbutton is used to access a password protected tree of screens (Figures **3-8** and **5-40**). Up to eight lines can be displayed to direct actions for resetting a variety of programmed parameters. Refer to Reset Pushbutton in paragraph 3-4 and paragraph 5-7 for additional information.

3-4 Pushbuttons

The front operations panel supports eleven membrane pushbuttons (Figure **2-1**). All pushbuttons are blue. Pushbuttons accomplish their function when pressed and released. The “Up” and “Down” pushbuttons and certain function pushbuttons will, however, continue to scroll if they are pressed and not released.

Reset Pushbutton
The “Reset” pushbutton causes the IQ Analyzer to enter a menu of reset functions. If the condition that is outside normal thresholds remains, the IQ Analyzer’s relays will remain in the alarm state.

Pressing and releasing the “Reset” pushbutton prompts the password protected “Reset Display Screen,” allowing an operator to perform certain activities.

Operator Permitted Activities
- Reset Peak Demands or Energy
- Reset Minimum/Maximum Values
- Reset Relay Outputs
- Reset Events and Event Logs
- Reset Trends (1-4)

While in the Reset Mode, the unit continues to monitor the line. Refer to Section 5 for the IQ Analyzer’s operational details.

Program Pushbutton
The IQ Analyzer may be completely programmed via the “Program” pushbutton or through the communications port. While in the Program Mode, the unit continues to monitor the line.

Programming is password protected. In addition, Discrete Input#3 may be used as an additional safeguard for energy related settings. For further descriptions of programming details, see paragraphs under 5-5.7.

The “Program” pushbutton may be used at any time the IQ Analyzer is operational. When pressed and released, the display will change to the top level of the Program Mode hierarchy which displays:

- Date/Time of Last Programming Activity
- INCOM Network Address (IPONI/EPONI)
- Software Version
- Password Entry Fields (10000 default pswd)

The Program Mode will be exited when the “Program” or “Home” pushbutton is pressed and released. The IQ Analyzer automatically returns to the Meter Menu if no programming activity is detected for the optionally programmed time-out period of up to 15 minutes.

Help Pushbutton
The “Help” pushbutton will function any time the IQ Analyzer is operational. When the pushbutton is pressed and released, the displayed screen will change to present a main menu for help. From the main menu a help category is selected with several levels of help The “Help” pushbutton will function any time the IQ Analyzer is operational. When the pushbutton is pressed and released, the displayed screen will change to present a main menu for help. From the main menu a help category is selected with several levels of help screens. The Help message will remain in the screen for the shorter of a programmed time-out period of up to 15 minutes or until any other pushbutton is pressed.

The normal Help Mode, when activated by the “Help” pushbutton, allows the operator to view Help Screens.

Help Screens

- How Help Works
- Faceplate Operation
- Meter Menu Screens
- Trend, Event, Harmonic, and Demand Analysis Screens
- Programming
- Network Option
- Troubleshooting
- Technical Support

Refer to paragraph 5-3 for more detailed information on the Help Mode.

Previous Level Pushbutton
The “Previous Level” pushbutton is used in the Analysis, Program or Help Modes to move the display back to the previous higher level in the tree structure until it ultimately reaches the last “Meter Menu” screen viewed.

Home Pushbutton
When pressed and released while the IQ Analyzer is in any mode except for the “Meter Menu,” the “Home” pushbutton returns the display back to the top level of the menu tree. Pressing again returns back to the last Meter Menu screen viewed. If the “Home” pushbutton is used while in the “Meter Menu” screens, the display returns to the top level screen either *Current* or *Demand*, depending upon which column of “Meter Menu” functions the IQ Analyzer is in at that time. Continued use of the “Home” pushbutton causes the IQ Analyzer to alternate back and forth between the top levels of the two “Meter Menu” columns, namely *Current* and *Demand*.

Up Pushbutton
The “Up” pushbutton steps up through the “Meter Menu” screens of the IQ Analyzer and wraps around from the first menu to the last menu. The display will scroll continuously if the pushbutton is held depressed with a momentary pause on each screen.

Down Pushbutton
The “Down” pushbutton steps down through the “Meter Menu” screens of the IQ Analyzer and wraps around from the last menu to the first menu. The display will scroll continuously if the pushbutton is held depressed with a momentary pause on each screen.

F1-F4 Function Pushbuttons
Four “Function” Pushbuttons located between the “Previous Level” and “Home” pushbuttons provide different operational functions, depending upon the specific screen being viewed. Which pushbutton to use and when will be determined by the individual key labels (definitions) in the display for a specific “Mode.” In the “Meter Menu,” F1 - F4 are:

- Min/Max Data (TRND) = Press F1
- Trend Data (TRND) = Press & Hold F1
- Event Data (EVNT) = Press F2
- Event Log (EVNT) = Press & Hold F2
- Harmonics (HARM) = F3
- Demand (DEMD) = F4

```
PGM/GEN
 SELECT PARAMETER:
 TYPE OF SYSTEM
 FREQUENCY
 INCOMING L-L VOLTAGE
 PT PRIMARY RATING
 CT PRIMARY RATING
SEL      UP        DOWN     PGDN
```

Figure 3-1. Typical Programming Screen

```
IA=            2031
   PEAK AMP DEMAND
∑=+      2634
   PEAK KILOWATT DMD
TRND     EVNT      HARM     DEMD
```

Figure 3-2. Typical Meter Menu Screen

```
/MINMAX/AMPS/IA/MAX

      IA= 2648.43 AMPS
       12/31/99   5:16:15P


NEXT
PARAM              MIN      MAX
```

Figure 3-3. Typical TRND Min/Max Screen

```

 SELECT EVENT:
#1  12/28/99  10:30:03A
     MANUAL CAPTURE
#2  12/31/99  4:49:08P
     PERCENT THD (IA)

SEL      UP        DOWN     PGDN
```

Figure 3-4. Typical Event Analysis Screen

```
/HARMONIC
 SELECT PARAMETER:
 CURRENT-%FUNDAMENTAL
 CURRENT-AMPERES
 VOLTAGE-%FUNDAMENTAL
 VOLTAGE-VOLTS
 #9  12/31/99  12:36:40P
SEL      UP DOWN     NEW
```

Figure 3-5. Typical Harmonic Analysis Screen

```
/DEMAND
 SELECT PARAMETER:
 CURRENT – PRESENT DMD
 CURRENT – PEAK DEMAND
 POWER – PRESENT DEMAND
 POWER -- PEAK DMD
 #9  12/24/99  10:30:00P
SEL      UP DOWN
```

Figure 3-6. Typical Demand Analysis Screen

```
HELP MENU:  SELECT ONE

-HOW HELP WORKS
-FACEPLATE OPERATION
-METER-MENU SCREENS
-TRND  EVNT  HARM  DEMD
-PROGRAMMING
SEL      UP DOWN      PGDN
```

Figure 3-7. Typical Help Screen

```
RESET/
 CHOOSE CATEGORY:
   RESET PEAK DEMAND
   RESET MIN/MAX
   RESET RELAYS
   RESET EVENTS/LOGS
   RESET TRENDS
SEL      UP       DOWN
```

Figure 3-8. Reset Screen

```
 TIME  OF  USE  REGISTERS
       123456789    *  RATE1
       123456789       RATE2
       123456789       RATE3
       123456789       RATE4
       493827156       TOTAL
              NET    KWH
TRND    EVNT     HARM     DEMD
```

Figure 3-9. Typical Time of Use Energy Screen

```
    RATE1   *  IAVG =  1234.56
    RATE2      IAVG =   123.45
    RATE3      IAVG =    12.34
    RATE4      IAVG =        0
    PEAK       IAVG =  1234.56
      1/26/00      11:31:12AM
       PEAK AMP    DEMAND
TRND       EVNT    HARM   DEMD
```

Figure 3-10. Typical Time of Use Peak Demand

```
/TREND
SELECT  PARAMETER:
TREND1          31    BUFFERS
TREND2          NO    BUFFERS
TREND3          NO    BUFFERS
TREND4           5    BUFFERS

  SEL       UP     DOWN
```

Figure 3-11. Trend Analysis Menu

```
/TREND 1
 SELECT  SAVED  BUFFER:
30  OPEN  BUFFER
29  12/31/99  11:45:00P
28  12/30/99  11:30:00P
27  12/29/99  11:15:00P
26  12/28/99  11:00:00P
  SEL       UP     DOWN     PGDN
```

Figure 3-12. Typical Trend Analysis Buffers

```
/TREND 1/BUF29
10 BYTES  /  2 ITEMS
 12/30/99  11:35:00PM OPEN
 12/31/99  11:45:00PM CLOSED
   5  MIN / SAMPLE
 12/30/99  11:35:00PM
NET KWH  =          493826012
                PGDWN     LAST
```

Figure 3-13. Energy Trend Example (Page1)

```
/TREND 1/BUF29               P02
12/30/99  11:40:00PM
NET KWH  =          493826123
12/30/99  11:45:00PM
NET KWH  =          493826234
12/30/99  11:50:00PM
NET KWH  =          493826345
 FIRST    PGUP  PGDWN     LAST
```

Figure 3-14. Energy Trend Example (Page2)

```
/TREND 1/BUF29               P30
12/31/99   6:40:00AM
NET KWH  =          493834567
12/31/99   6:45:00AM
NET KWH  =          493834678
12/31/99  11:45:00AM
NET KWH  =          493834789
 FIRST    PGUP  PGDWN     LAST
```

Figure 3-15. Energy Trend Example (Page30)

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SECTION 4: INSTALLATION

4-1 Introduction

This section describes mounting, wiring, startup and miscellaneous testing details associated with the IQ Analyzer. Earlier sections, especially Sections 1 and 2, should be reviewed prior to installing the IQ Analyzer.

WARNING

INSURE THAT ANY INCOMING AC POWER OR FOREIGN POWER SOURCES ARE TURNED OFF AND LOCKED OUT BEFORE PERFORMING ANY WORK ON THE IQ ANALYZER OR ITS ASSOCIATED EQUIPMENT. FAILURE TO OBSERVE THIS PRACTICE COULD RESULT IN SERIOUS INJURY, DEATH OR EQUIPMENT DAMAGE. THE ONLY EXCEPTION IS WHEN CONNECTING OR DISCONNECTING RIBBON CABLES AT J2 OR J3. THIS CAN BE DONE AT ANY TIME IF CARE IS EXERCISED.

WARNING

DO NOT HIGH-POT OR MEGGER THIS DEVICE.

4-2 Panel Preparation

Panel preparation and mounting of the IQ Analyzer is described for the standard “Flush Mounted Approach” and the optional “Flange Mounted Approach.” The flange mounted approach is used when depth behind the panel is too limited to accommodate the IQ Analyzer (Figure **4-1**). The panel mounted flange permits most of the IQ Analyzer depth to extend from the panel front.

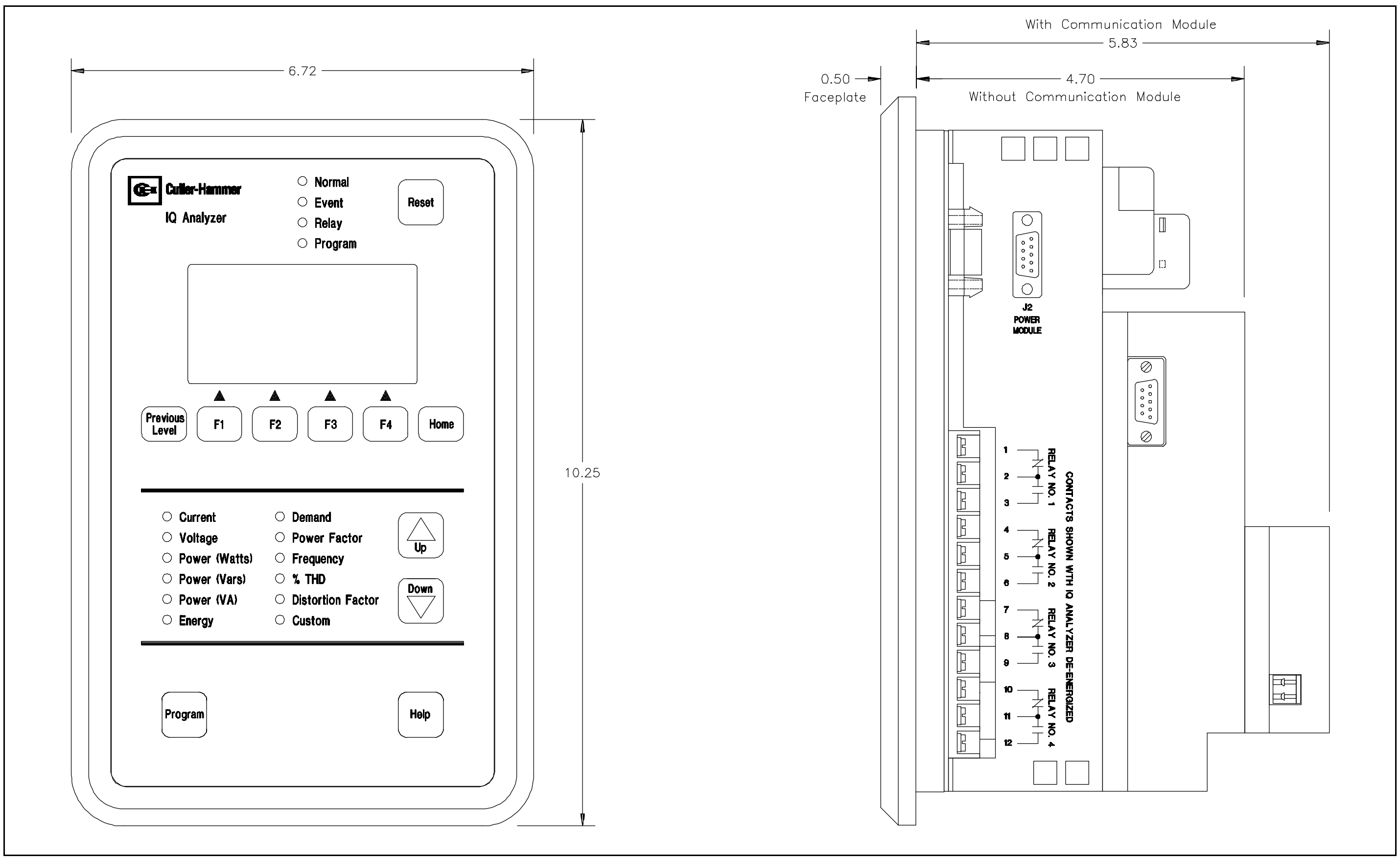


Figure 4-1. IQ Analyzer Dimensions and Cutout (inches)

4-2.1 Standard flush mounted Cutout

Since the IQ Analyzer is typically mounted on a enclosure door, it is necessary to prepare a cutout in which it will be placed. The dimensions for this cutout along with mounting hole locations are shown in Figure **4-2**. Note that the IQ Analyzer has ten mounting holes; however, only the six holes, located at the top, bottom and center are used for a standard installation. If the installation is to be in a NEMA 3R or 12 enclosure, additional mounting holes are provided so that uniform pressure can be maintained on the gasket that is supplied with the unit.

Before cutting the panel, be sure that the required 3-dimensional clearances for the IQ Analyzer chassis allow mounting in the desired location. IQ Analyzer dimensions with and without a Communication Module are shown in Figure **4-1**.

It is necessary to hold several tolerances when making the cutout and placing the holes for the mounting screws. Referring to Figure **4-2**, the holes must be located within 1/16” of the drawing specifications, and a .201” to 7/32” drill bit is recommended. The height and width are less critical and have a 1/4” tolerance. In fact, the width of the cutout may extend to the center of the drilled holes if the holes are pre-drilled.

4-2.2 Standard flush Mounting

Place the IQ Analyzer through the cutout in the panel, making sure the operator panel faces out. Use the 0.5” screws that are included with the unit, and be sure to start the screws from the inside of the panel so they go through the metal first.

While the ten mounting holes are not threaded, do not use a tap since this will remove excessive plastic from the holes. This will result in less threaded material to secure the unit to its mounting panel.

Be careful not to overtighten. For initial installation, 8 in-lbs of torque is sufficient for the 10 self-tapping screws that are supplied with the unit. If for some reason the screws are replaced, limit the torque to 2 inn-bls or carefully tighten by hand.

If it is necessary to remove a Power Module from the IQ Analyzer and mount it separately from the chassis, do the following:

- Make sure the Power Module’s mounting location allows for a cable connection between the IQ Analyzer chassis and the Power Module by means of one of the optional extension cables (IQACABLE or IQA45CABLE).
- Make sure the separated Power Module can physically fit in the location selected (Figure **4-3**).

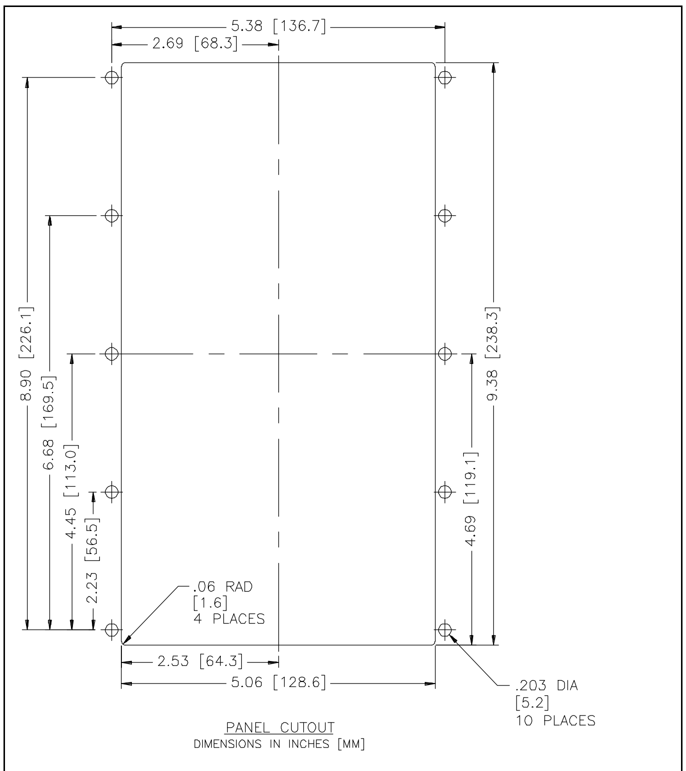


Figure 4-2. Flush Mounted Drilling Pattern (inch [mm])

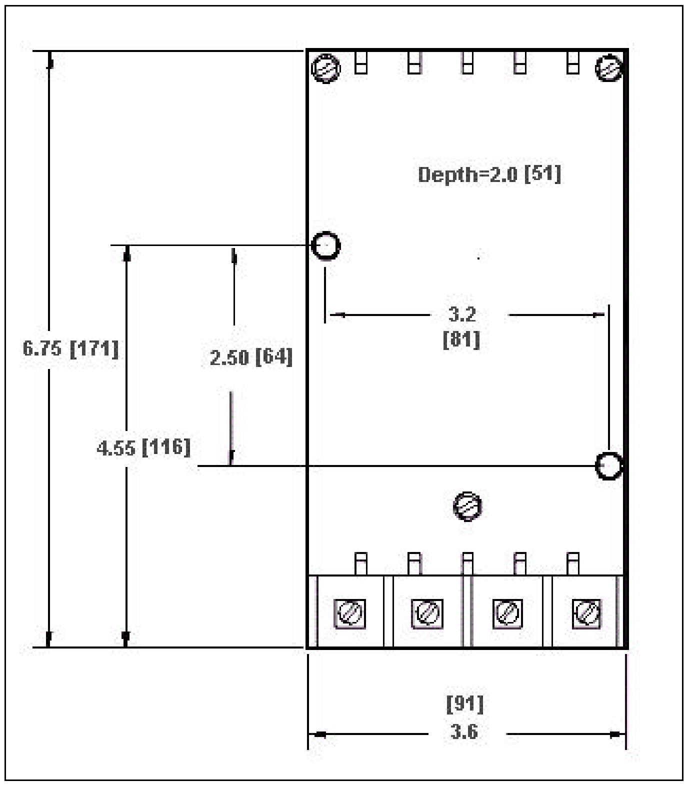


Figure 4-3. Power Module Dimensions (inch [mm])

- Use the Power Module as a drilling template at the new mounting location.
- Use the two removed 8-32 screws to remount the Power Module in properly drilled and tapped holes.

NOTICE

When field installing an IPONI (INCOM Product Operated Network Interface) or EPONI (Ethernet PONI), carefully follow all the installation instructions supplied with the product.

4-2.3 Optional Flange Mounted Cutout and Mounting

When flange mounting the IQ Analyzer, the cutout and mounting guidelines presented in paragraphs 4-2.1 and 4-2.2 should be followed, except for the drilling pattern. Refer to Figure **4-4** for the flange mounted drilling pattern. The cutout opening in the panel when flange mounting is somewhat larger than the flush mounted cutout. This slightly larger opening facilitates flange mounted wiring. The flange permits an additional 2.5 inches of IQ Analyzer depth to protrude beyond the enclosure door (Figure **4-5**).

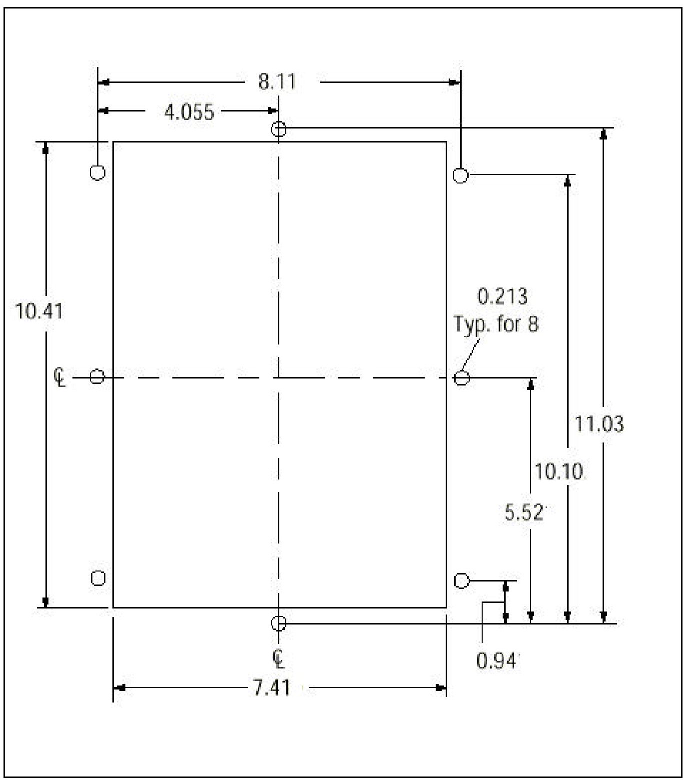
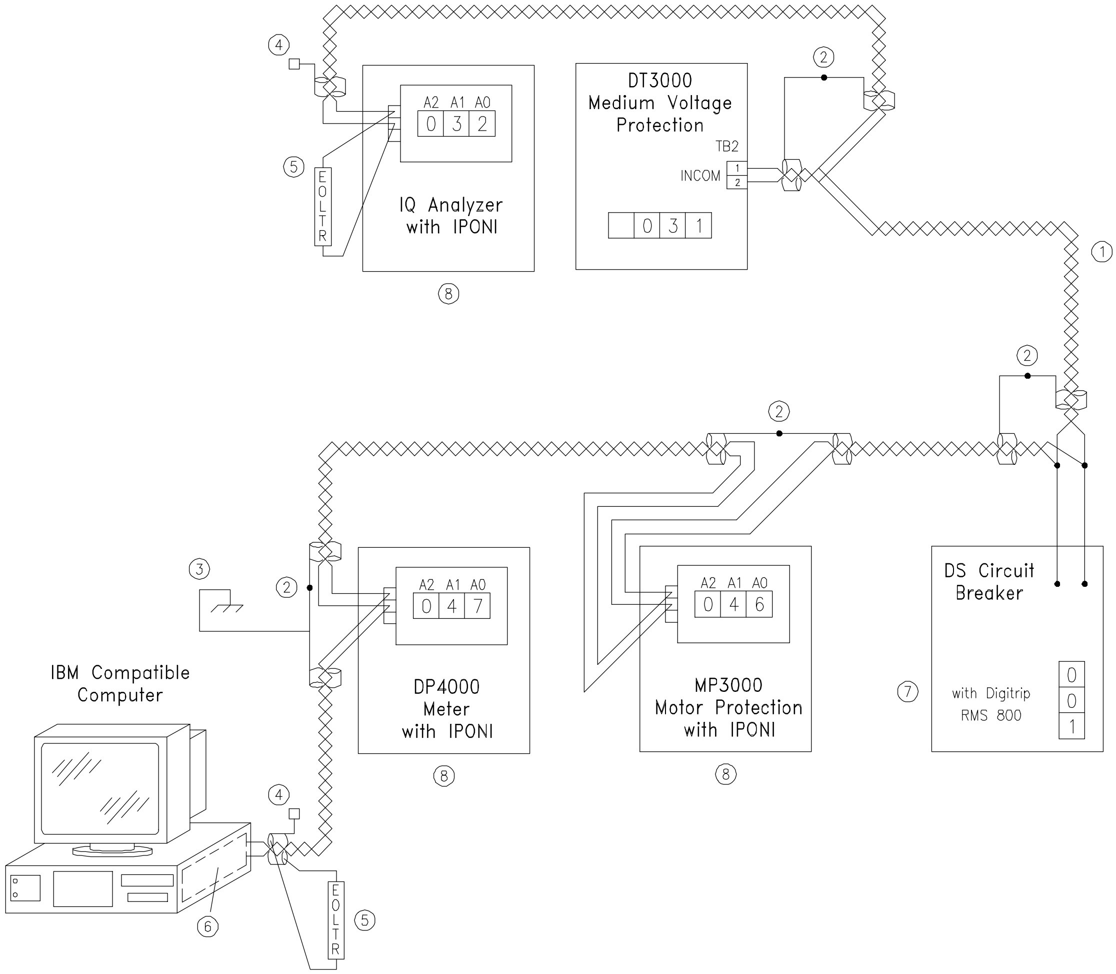


Figure 4-4. Flange Mounted Drilling Pattern (inches)

4-3 Wiring

Wiring of the IQ Analyzer must follow a suitable Wiring Plan Drawing. The phase Wiring Plan, as used here, refers to the drawings made for the specific application. It describes all electrical connections between the IQ Analyzer and external equipment. This drawing is made by the user or OEM. A network wiring diagram can also be helpful for networked systems (Figure **4-6**). Specific IQ Analyzer Wiring Diagrams are useful when creating the overall Wiring Plan Drawing. IQ Analyzer Wiring Diagrams for each system possibility are addressed in Paragraph 4-3.2. Specific IQ Analyzer connection points are identified in Figures **4-7** and **4-8**.

Figure 4-5. IQ Analyzer Shown Mounted Using a Mounting Flange



① For network interconnection cable, use Belden 9463 or Cutler–Hammer IMPCABLE.

② When interconnecting devices, tie shield drain wires together for shield path continuity.

③ Connect the shield path to a solid earth ground at one point only.

④ On last device in network, tape shield drain wire back upon cable.

⑤ Use a 1/2 watt carbon or metal film resistor at each end of the network as an end of line termination resistor (EOLTR). EOLTR should be 100 ohms for 9600 baud communication rate networks or 150 ohms for 1200 baud communication rate networks.

⑥ Network interconnection to computer requires use of an IMPACC master (CONI or MINT).

⑦ On 9600 baud networks, Digitrip RMS 700/800 devices must be placed on AEM subnetwork.

⑧ Devices without built–in communications require network interface module (IPONI).

For detailed network wiring specifications, contact our website at www.cutlerhammer.eaton.com
or contact Power Management Application Support at 1–800–809–2772

Figure 4-6. Typical Network Wiring Diagram

NOTICE

If this device is being used on a single phase system, wire to phase A and NEU.

The following general considerations should be complied with during the wiring process.

1. All wiring must conform to applicable Federal, State and Local codes.
2. The wires to the terminal blocks must not be larger than AWG No. 14. Larger wire will not connect properly to the terminal block. Larger size wires, however, can be used for CT connections with the use of appropriate ring terminals.
3. Terminal blocks have No. 6-32 sems pressure saddle screws.
4. Wiring Diagram contacts are shown in their de-energized position.
5. Because IQ Analyzer monitors the neutral-to-ground voltage, the chassis of the IQ Analyzer must be connected to ground. A good low impedance ground is essential for proper functioning.

4-3.1 Current and Potential Transformer Selection

WARNING

PT AND CT SECONDARY CIRCUITS ARE CAPABLE OF GENERATING DANGEROUS VOLTAGES AND CURRENTS WITH THEIR PRIMARY CIRCUITS ENERGIZED, AND COULD CAUSE PERSONAL INJURY AND/OR DEATH.

The proper selection of any required current transformers or potential transformers is critical to the proper and accurate functioning of the IQ Analyzer. Instrumentation grade devices are required. Shorting blocks for CTs and a three-phase switch or circuit breaker for voltage are recommended near the equipment for ease of installation. If assistance with the selection process is desired, contact your Cutler-Hammer representative.

4-3.2 Wiring Diagrams

Figures **4-9** through **4-34** present IQ Analyzer wiring diagrams for the different system possibilities.

4-4 Initial Startup

The information here is intended to be used when first applying control power to the IQ Analyzer.

4-4.1 Before Power Application

WARNING

STARTUP PROCEDURES MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE IQ ANALYZER AND ITS ASSOCIATED ELECTRICAL AND/OR MECHANICAL EQUIPMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN PERSONAL INJURY, DEATH AND OR EQUIPMENT DAMAGE.

After all installation wiring is complete and before ac power is applied to the IQ Analyzer, perform the following:

a. Verify that the incoming ac power to the system is disconnected and, if possible, locked out.

b. Verify that all wiring is correct as shown on the Wiring Plan Drawing and any applicable Wiring Diagrams.

c. Verify that the case is grounded. Failure to ground the case results in inaccurate and unstable readings.

4-4.2 Initial Power Application

a. Apply the appropriate ac power to the IQ Analyzer.

b. After a few seconds, the green Normal LED should begin to blink. This indicates that there is power to the unit and it has passed its own self-diagnostic test.

c. The absence of a green Normal LED indicates the unit failed its diagnostic test and a reason for the failure message flashes in the display window. If no LED is lit at all, possibly the unit is not being powered. In either case, remove ac power from the unit and refer to the Troubleshooting Guide in Section 7.

d. The display of “High Neutral Voltage” or “Reverse Sequence” indicates a miswired voltage.

e. The display of inconsistent per phase power factors indicates either a miswired voltage, current or polarity.

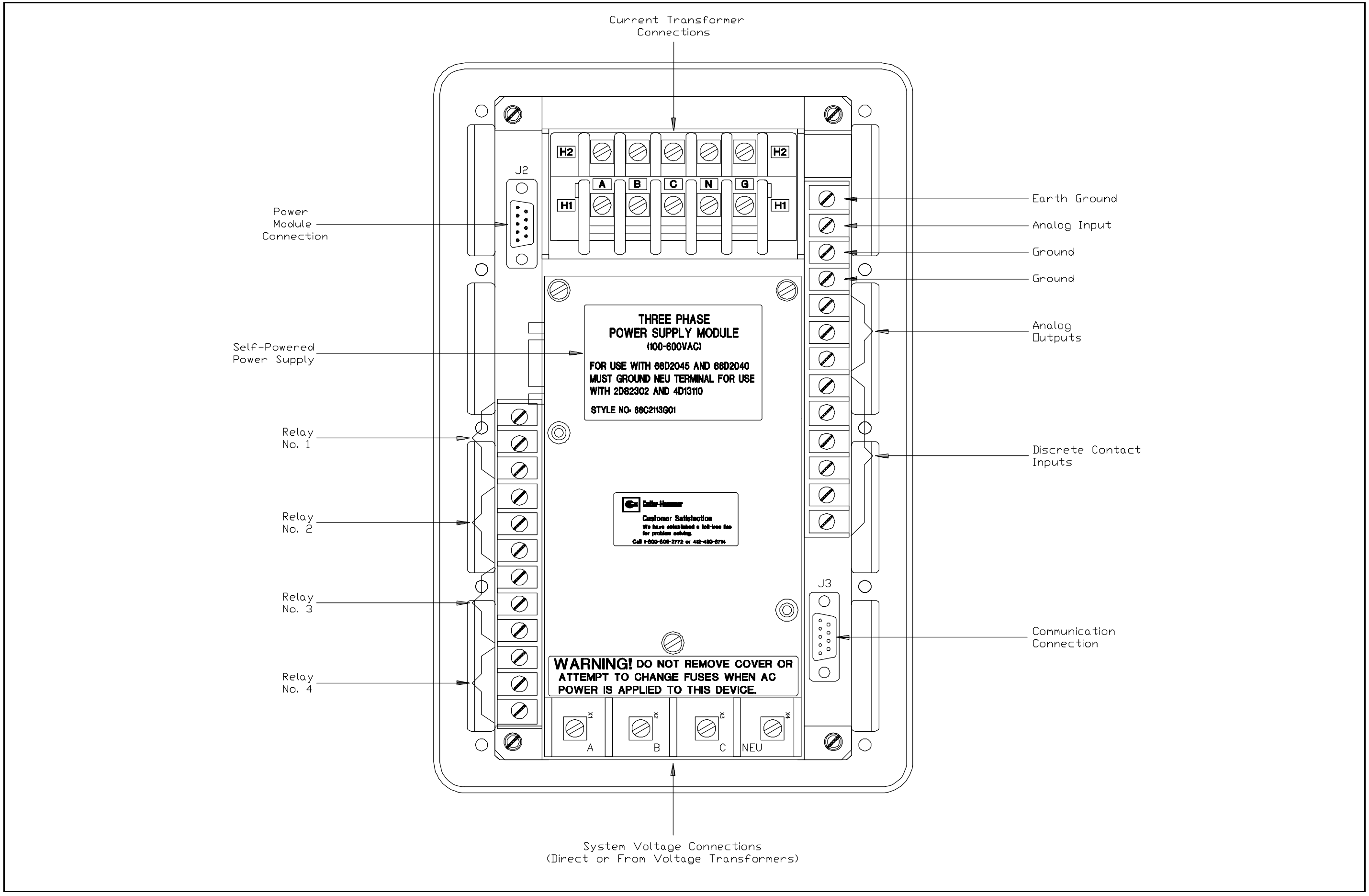


Figure 4-7. IQ Analyzer with Self-Powered Three Phase Power Module (Rear View)

NOTICE

Keep in mind that when an IQ Analyzer is initially powered up for use on a specific system, the displayed "Meter Menu" values may not be what is anticipated for that system. This is because the unit has not yet had necessary pieces of system information programmed into non-volatile memory.

4-5 Quick Start Metering

The intent here is to provide an operator with enough information to get an IQ Analyzer performing basic metering functions quickly without reviewing all the instructions provided in this manual. Whether or not more detailed information is required depends on the individual operator and the complexity of the application. In any case, it is still strongly recommended that the entire manual be reviewed at the earliest possible convenience to take advantage of the wide array of features offered by IQ Analyzer.

Proceed by reading and completing the following steps:

Step 1: Review all applicable material earlier in this section to ensure that the IQ Analyzer is mounted properly and wired in keeping with the appropriate wiring diagram for the application.

Step 2: Follow the initial startup instructions presented in paragraph 4-4, paying particular attention to all WARNINGS and NOTICES.

Step 3: Review the use of the display, LEDs and pushbuttons of the Operator Panel in Section 3, especially Program Mode Screens and Meter Menu Screens.

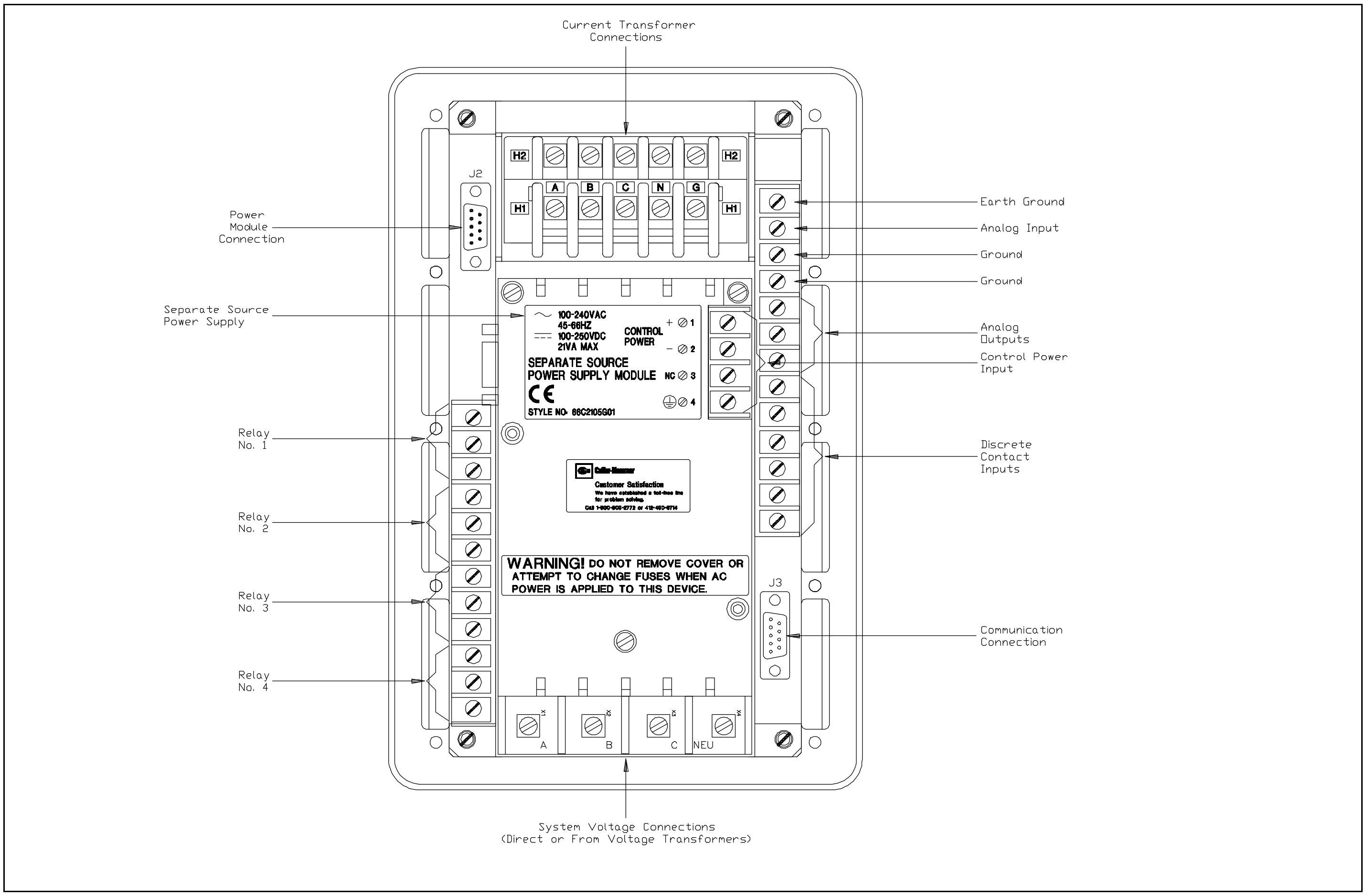


Figure 4-8. IQ Analyzer with Separate Source Power Module (Rear View)

Step 4: Paragraphs 6-1 through 6-2.5 in Section 6, "Programming" provides the required basics for entering and moving around in the Program Mode. Review the material paying particular attention to paragraph 6-2.2, "Password Entry."

Step 5: Program the General Setup portion of the IQ Analyzer to enable it to begin monitoring the system in which it is applied. To accomplish this, first review the General Setup Screens Tree (Figure **6-4**) and General Setup Settings Sheet in Appendix A. This will alert the operator to what information will be required during programming. To facilitate the programming process, make sure that all required information is readily available prior to beginning the actual programming.

Step 6: A review of the simple programming example in section 6-3 will provide the operator with additional familiarization of the programming process, although the intent here is to only program General Setup setpoints.

Step 7: Program the IQ Analyzer with the system information collected in Step 5.

Step 8: Once programming is complete, exit the Program Mode. Table 5.1 outlines the types of displayed parameters available from the Meter Menu.

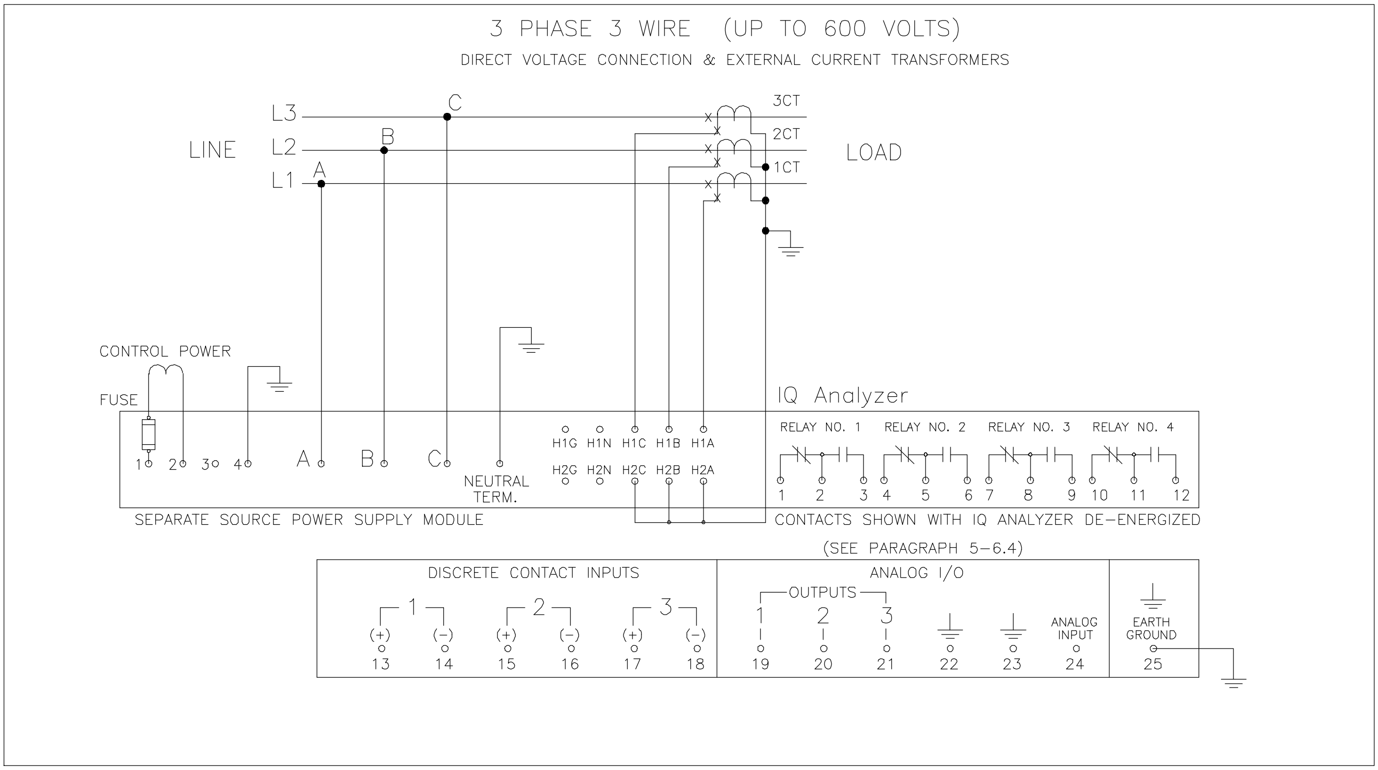


Figure 4-9. 3-phase 3-Wire (Up to 600 Volts) Wiring Diagram

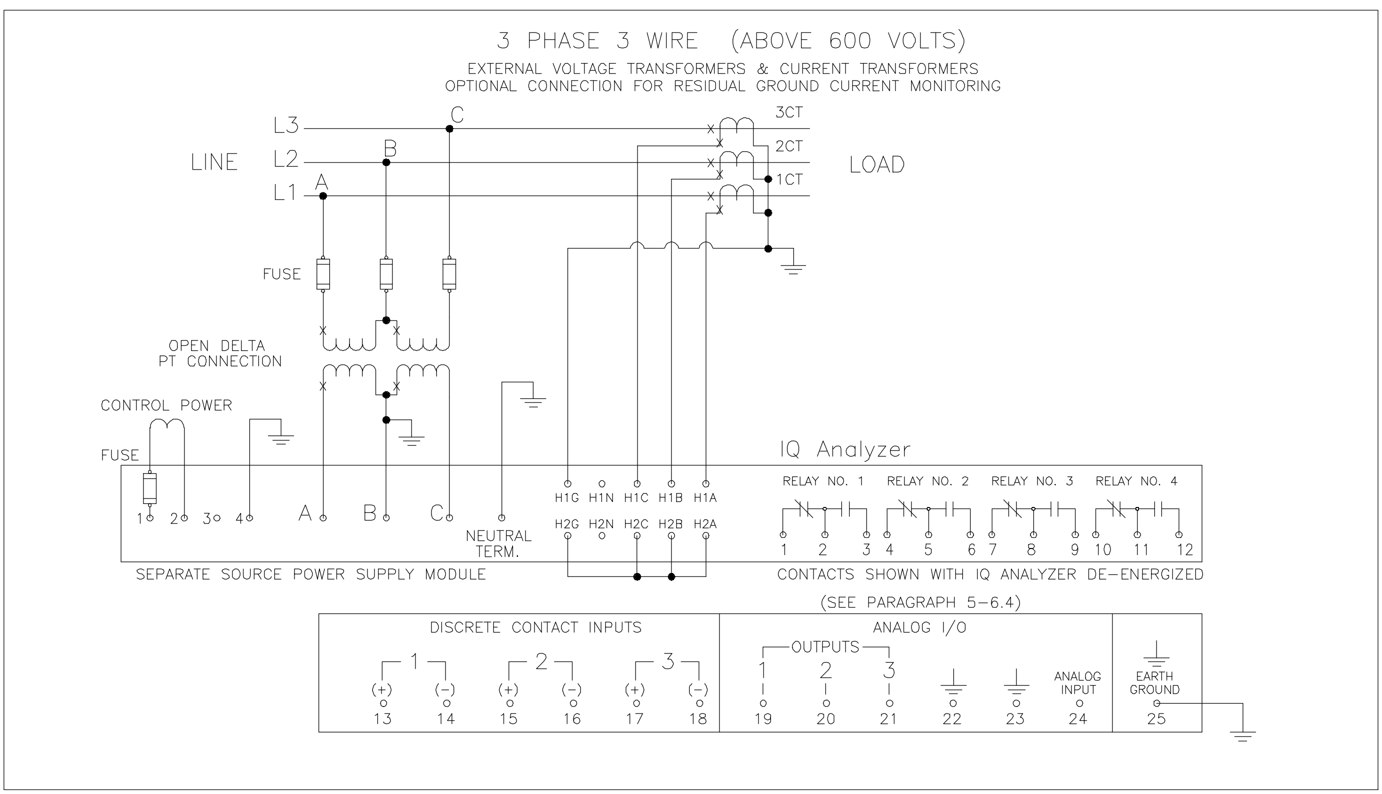


Figure 4-10. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

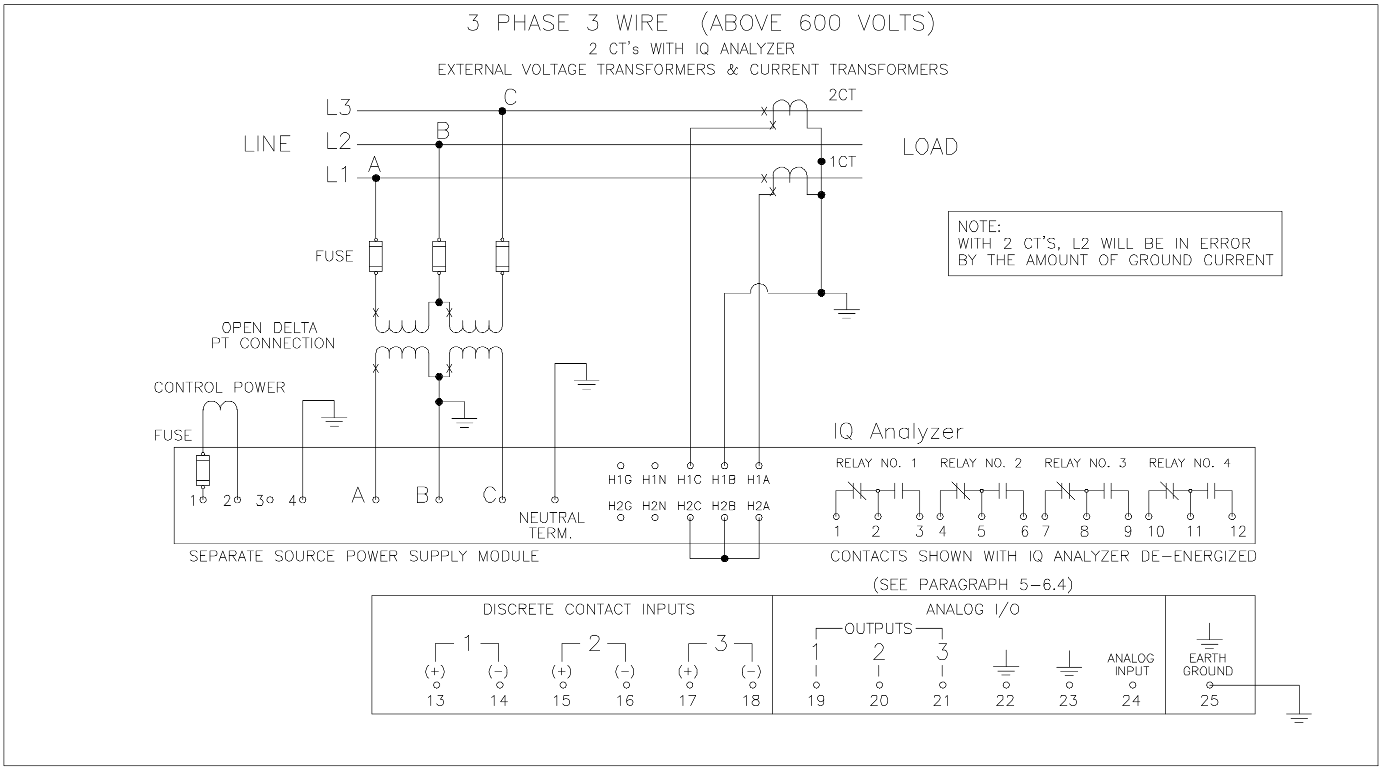


Figure 4-11. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

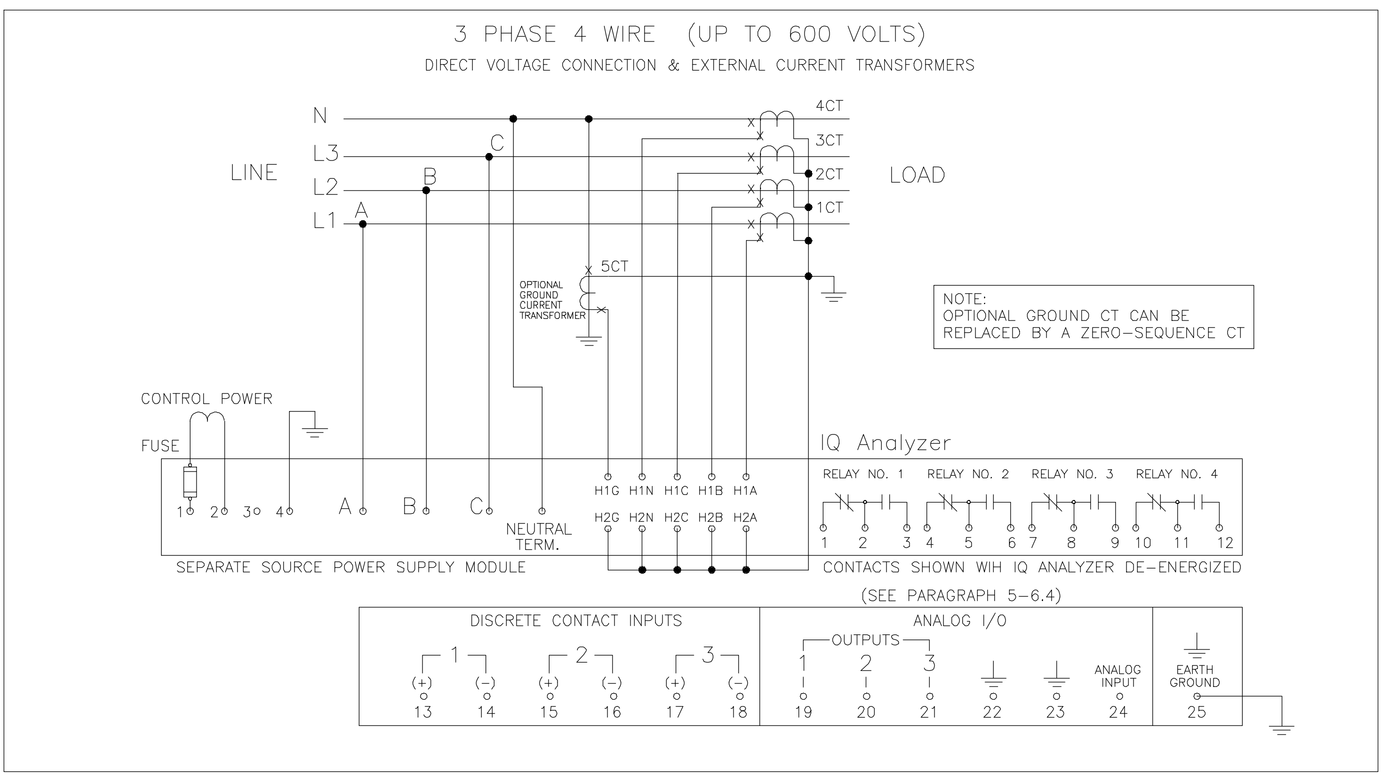


Figure 4-12. 3-phase 4-Wire (Up to 600 Volts) Wiring Diagram

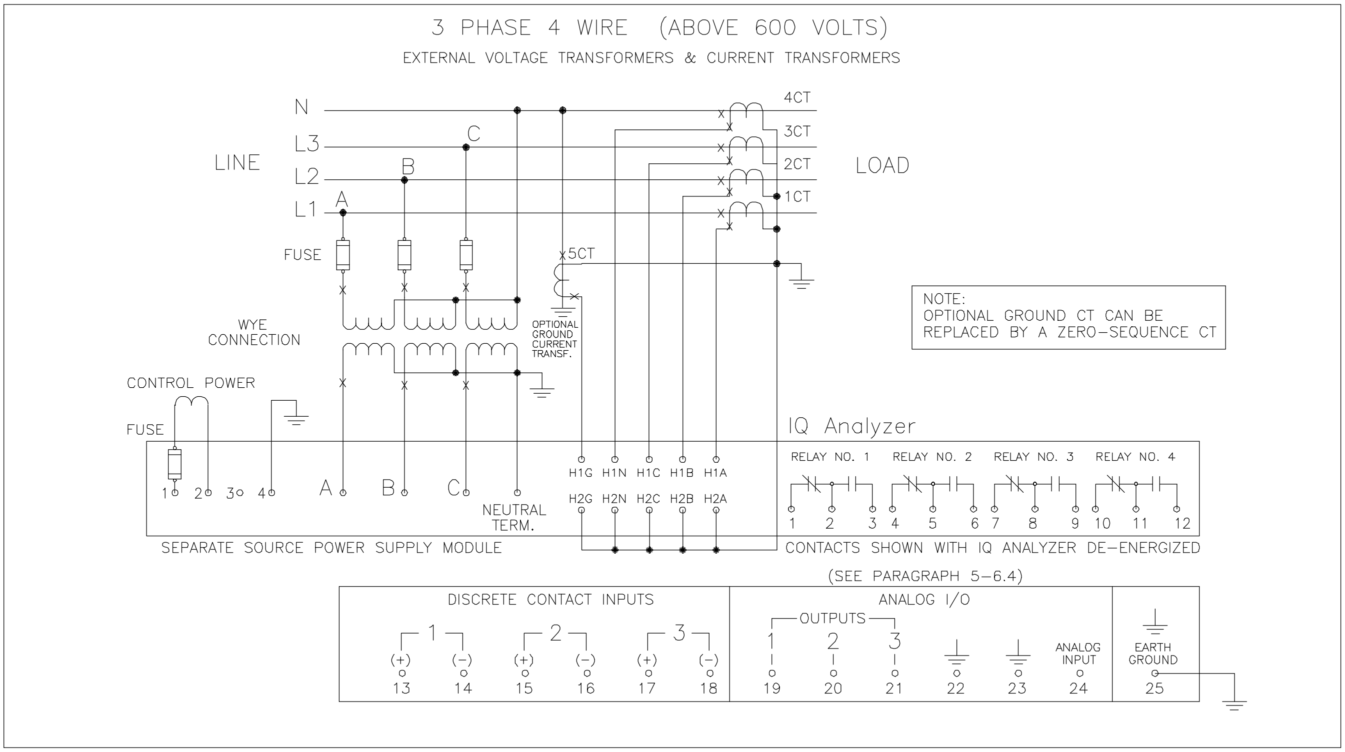


Figure 4-13. 3-phase 4-Wire (Above 600 Volts) Wiring Diagram

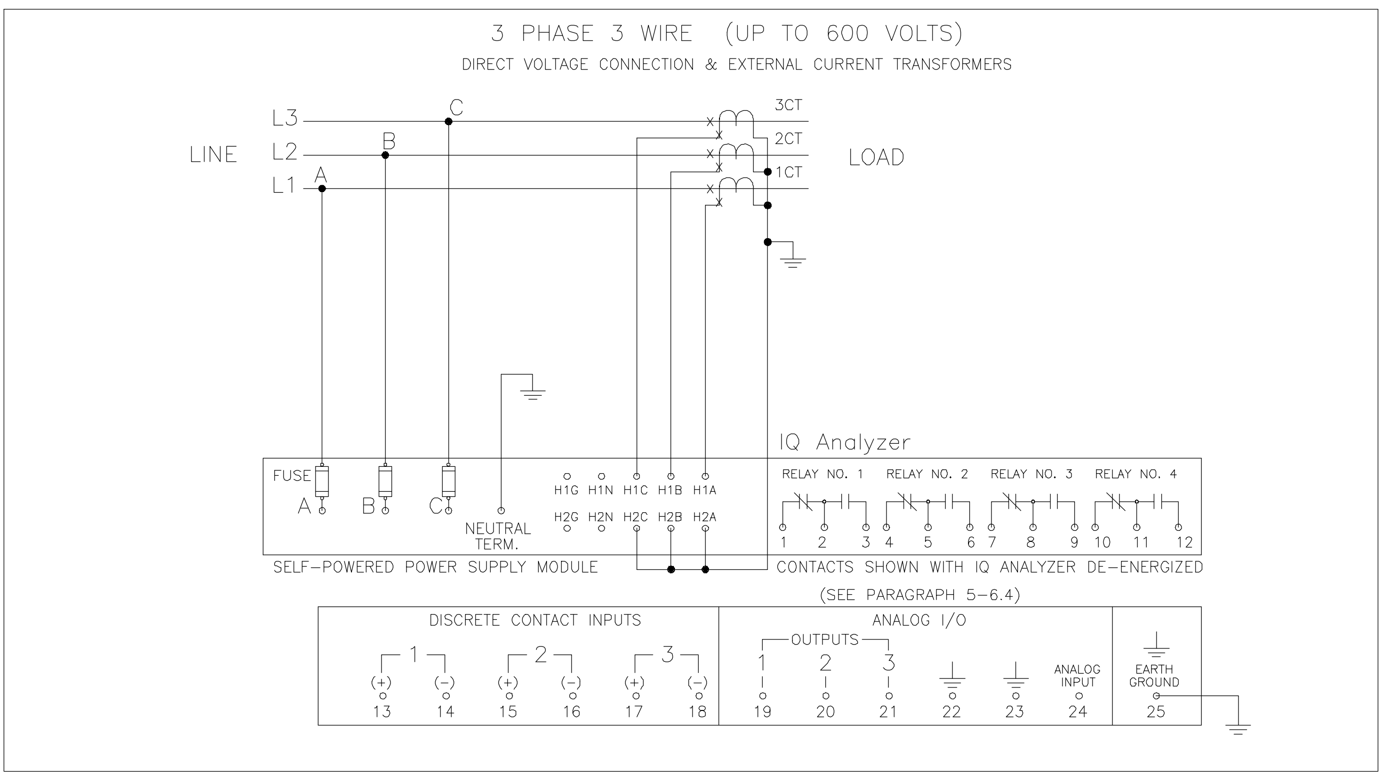


Figure 4-14. 3-phase 4-Wire (96 to 600 Volts) Wiring Diagram

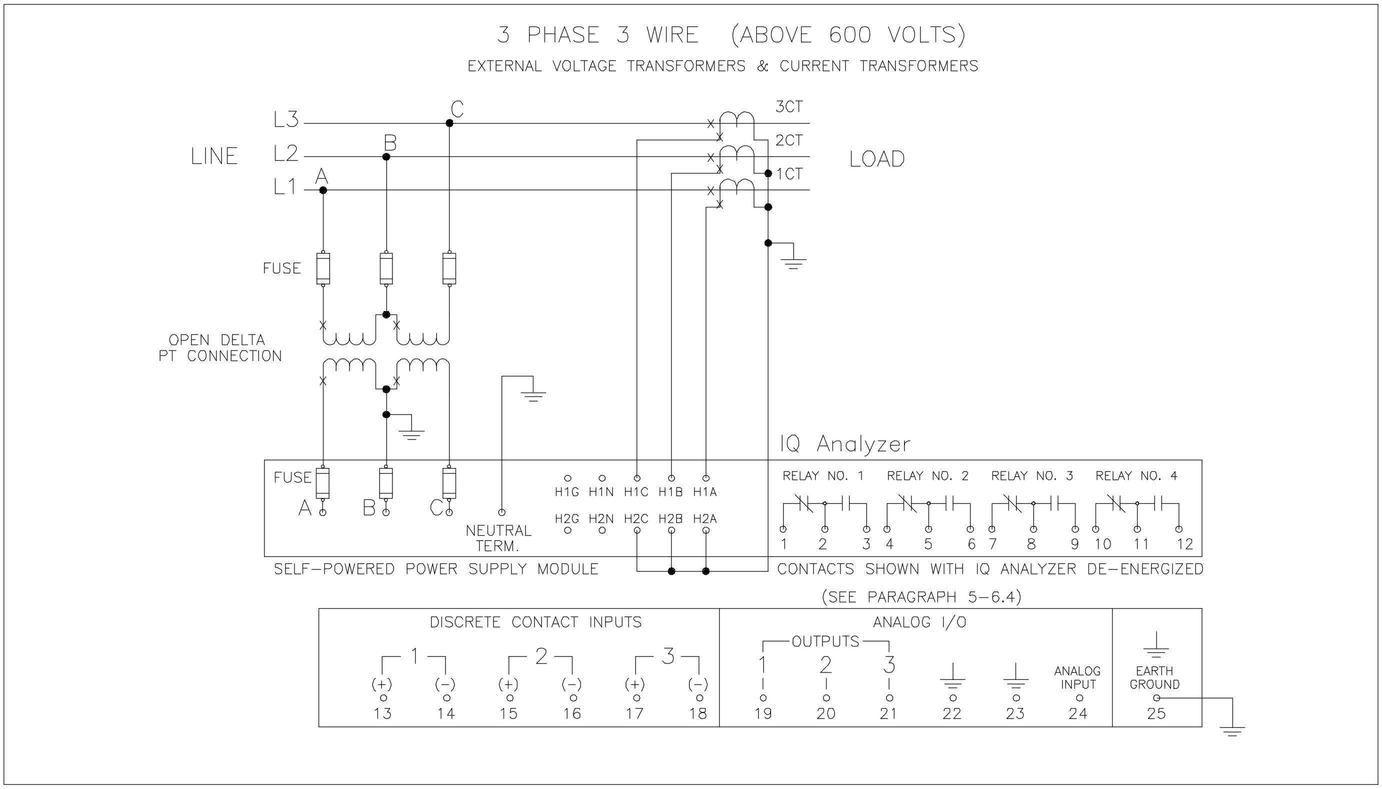


Figure 4-15. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

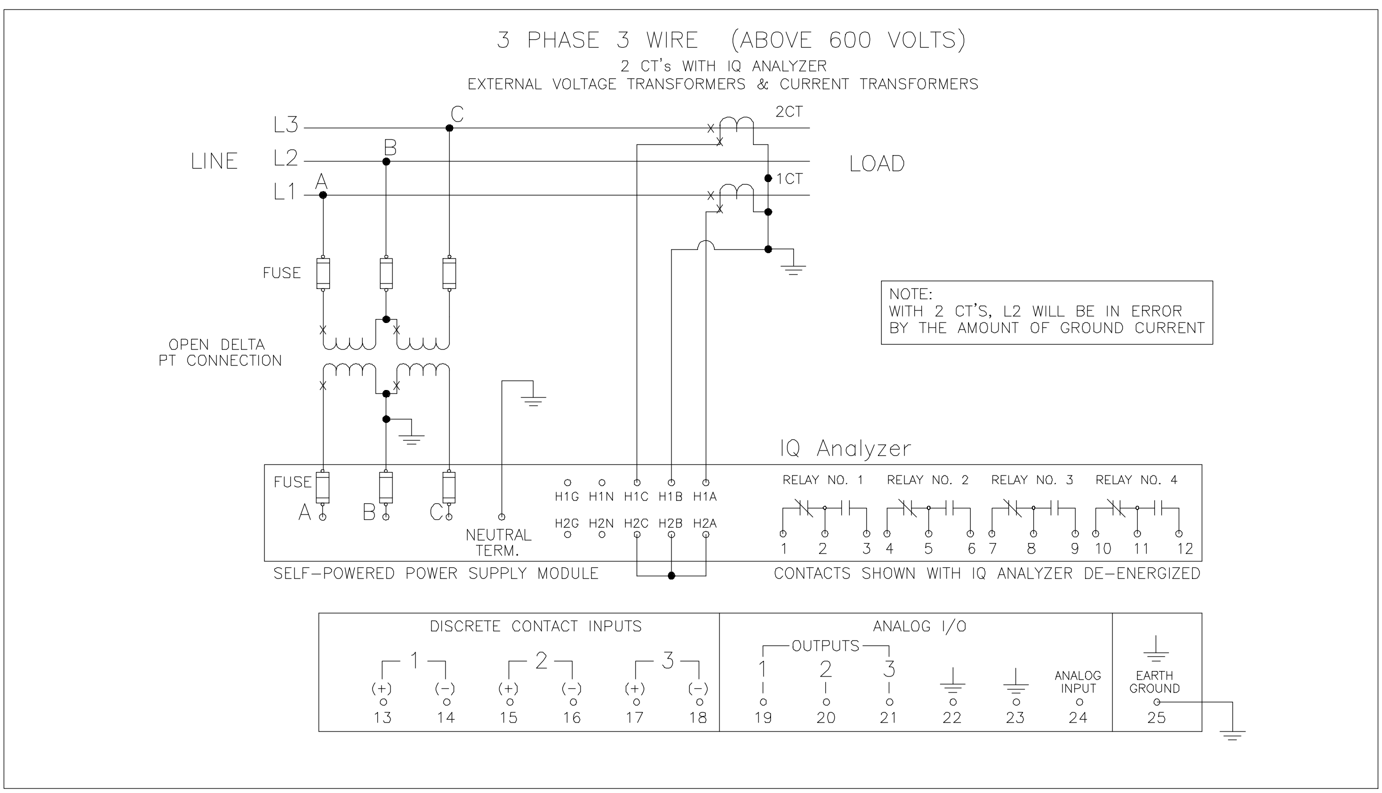


Figure 4-16. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

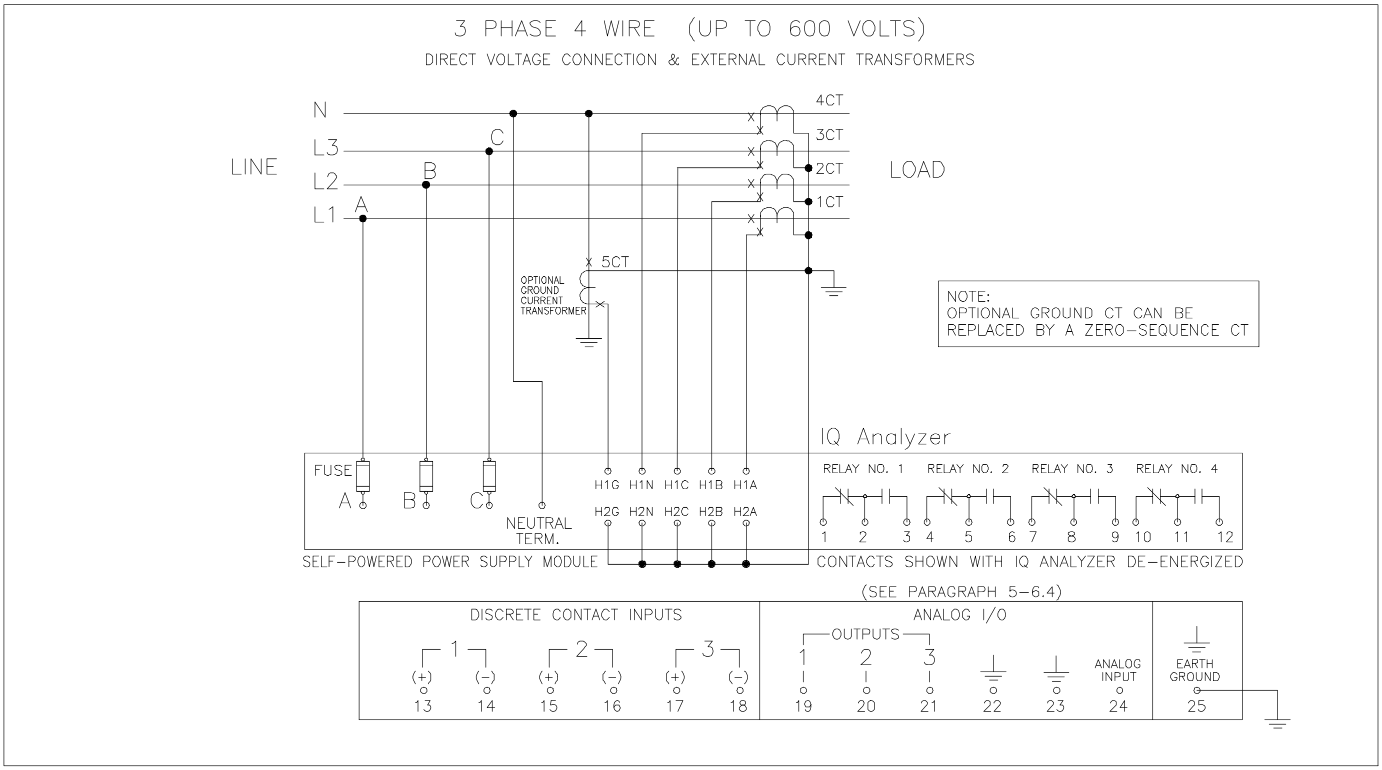


Figure 4-17. 3-phase 4-Wire (96 to 600 Volts) Wiring Diagram

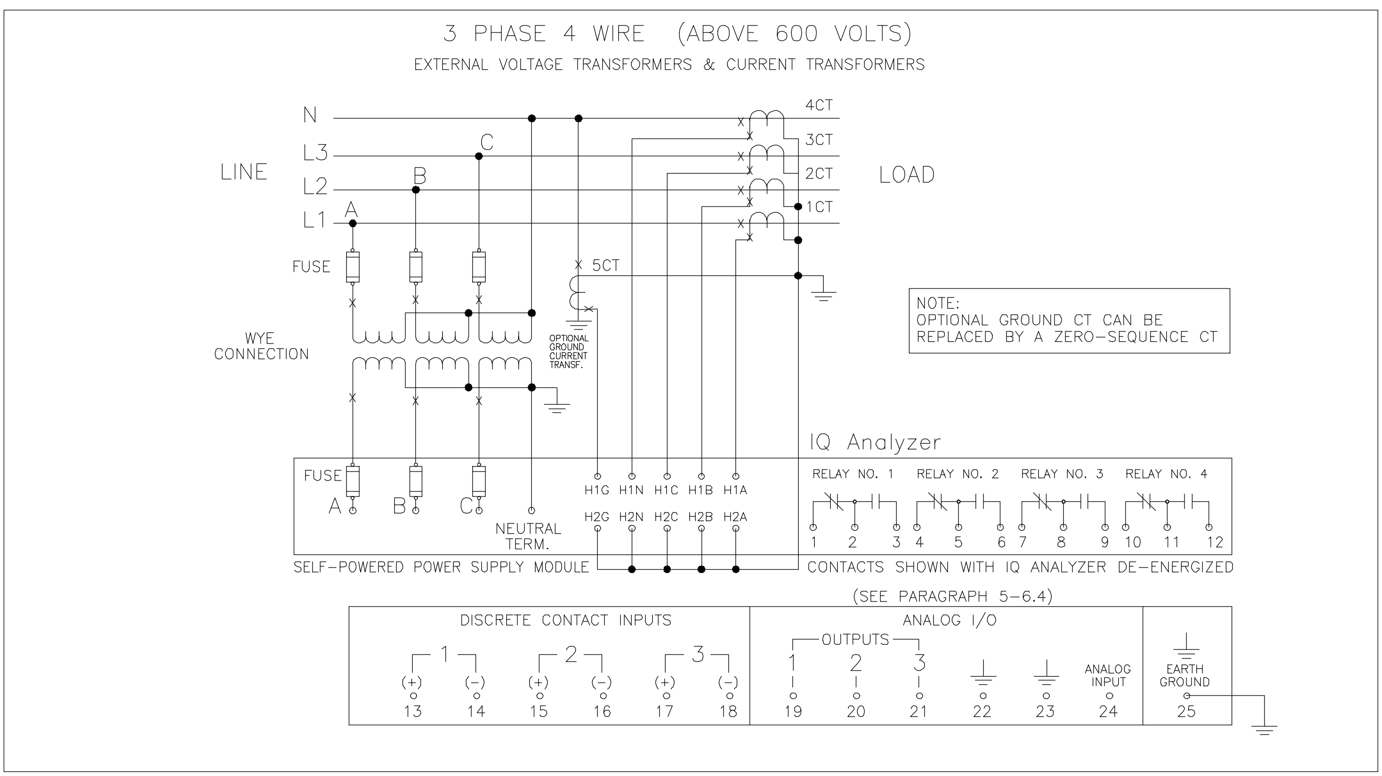


Figure 4-18. 3-phase 4-Wire (Above 600 Volts) Wiring Diagram

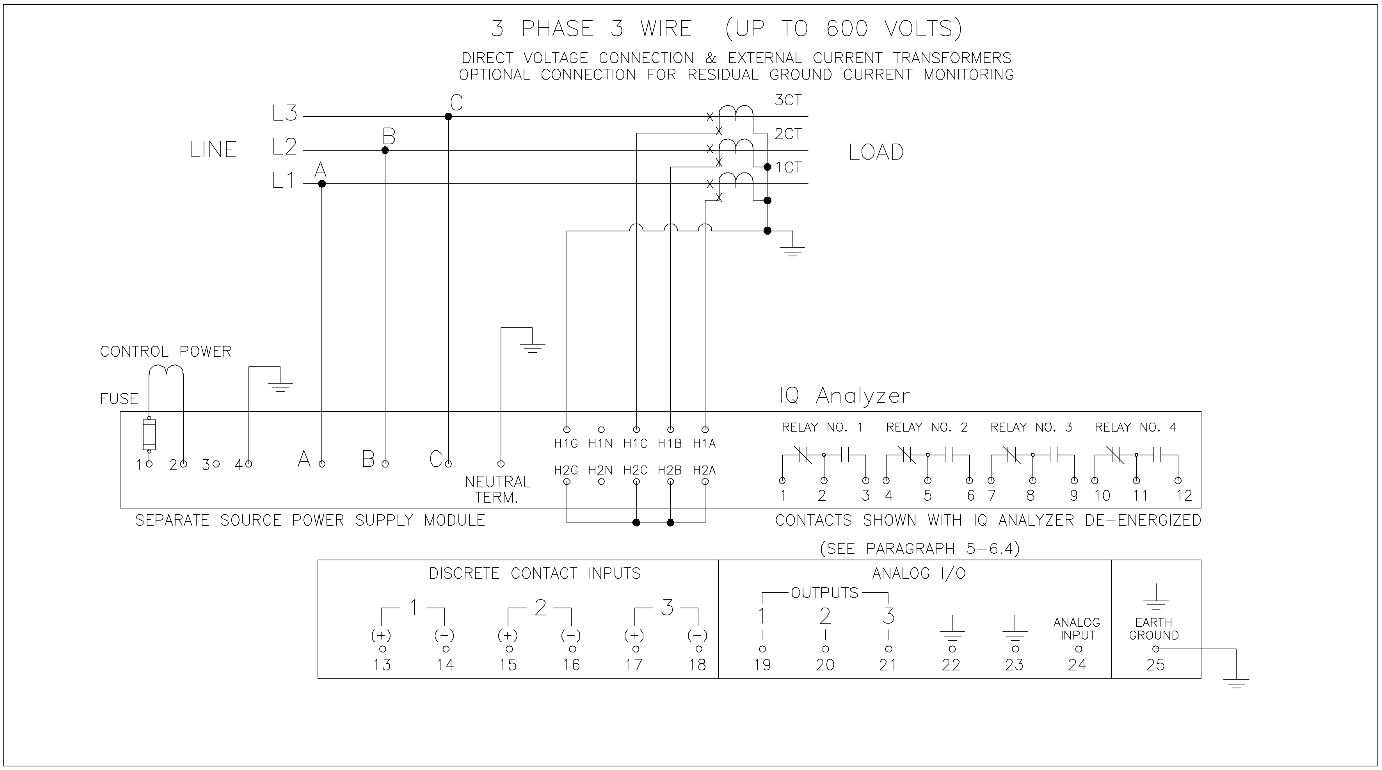


Figure 4-19. 3-phase 3-Wire (Up to 600 Volts) Wiring Diagram

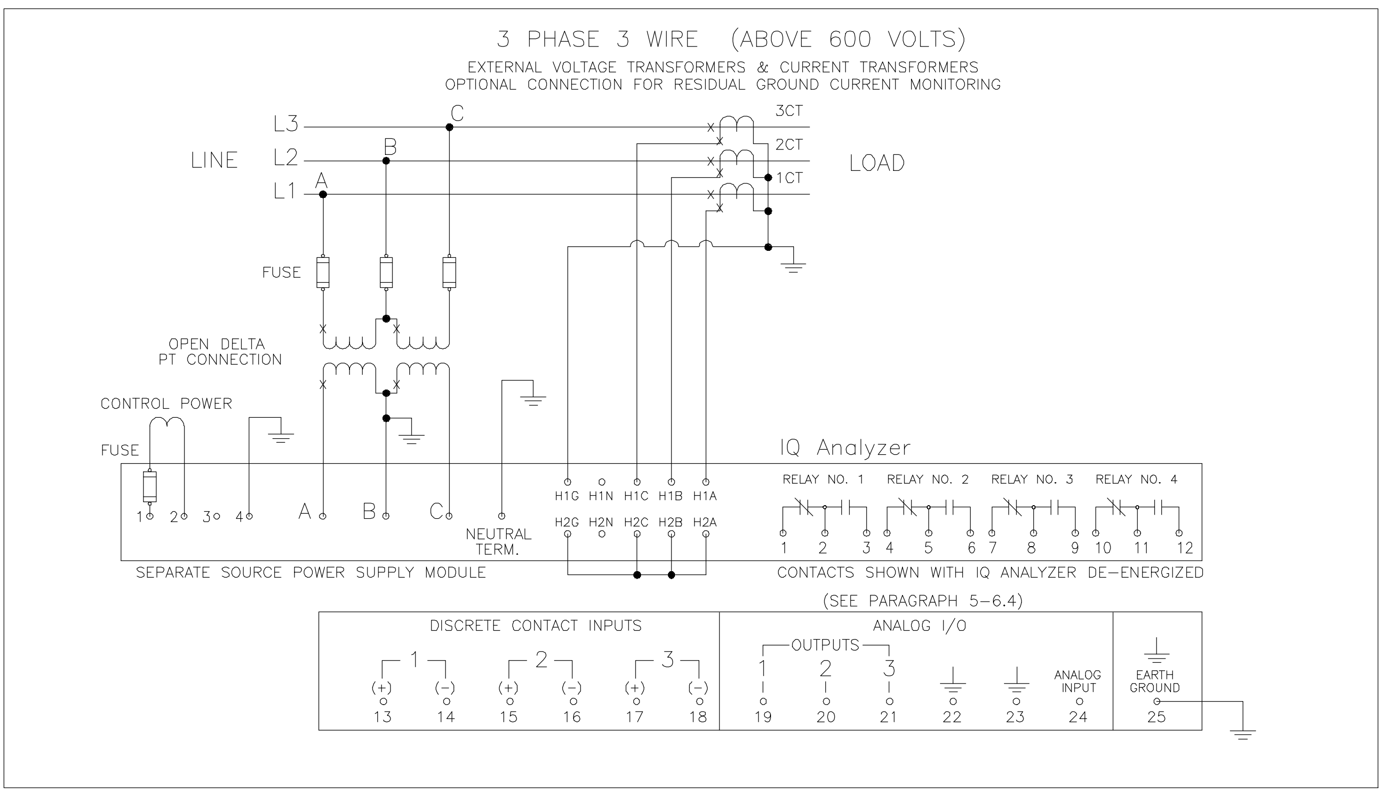


Figure 4-20. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

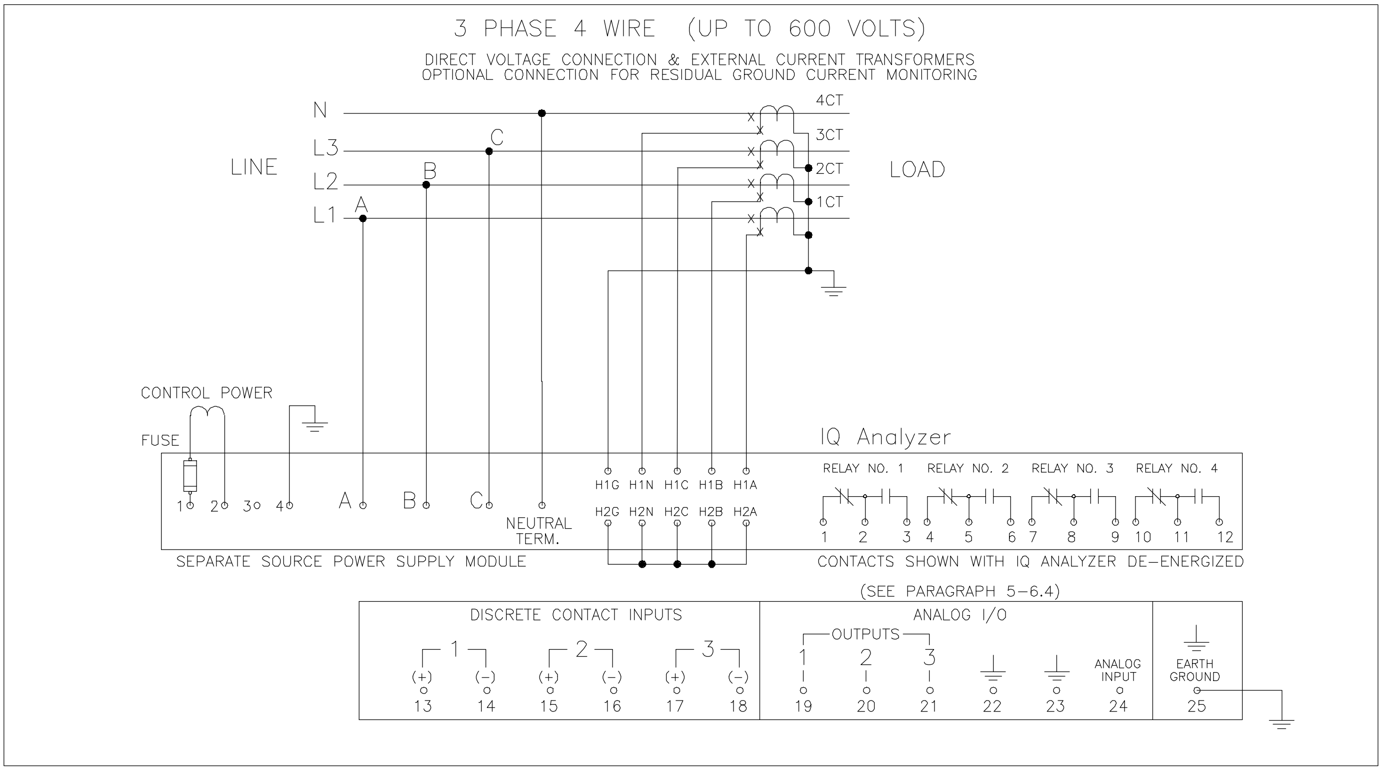


Figure 4-21. 3-phase 4-Wire (Up to 600 Volts) Wiring Diagram

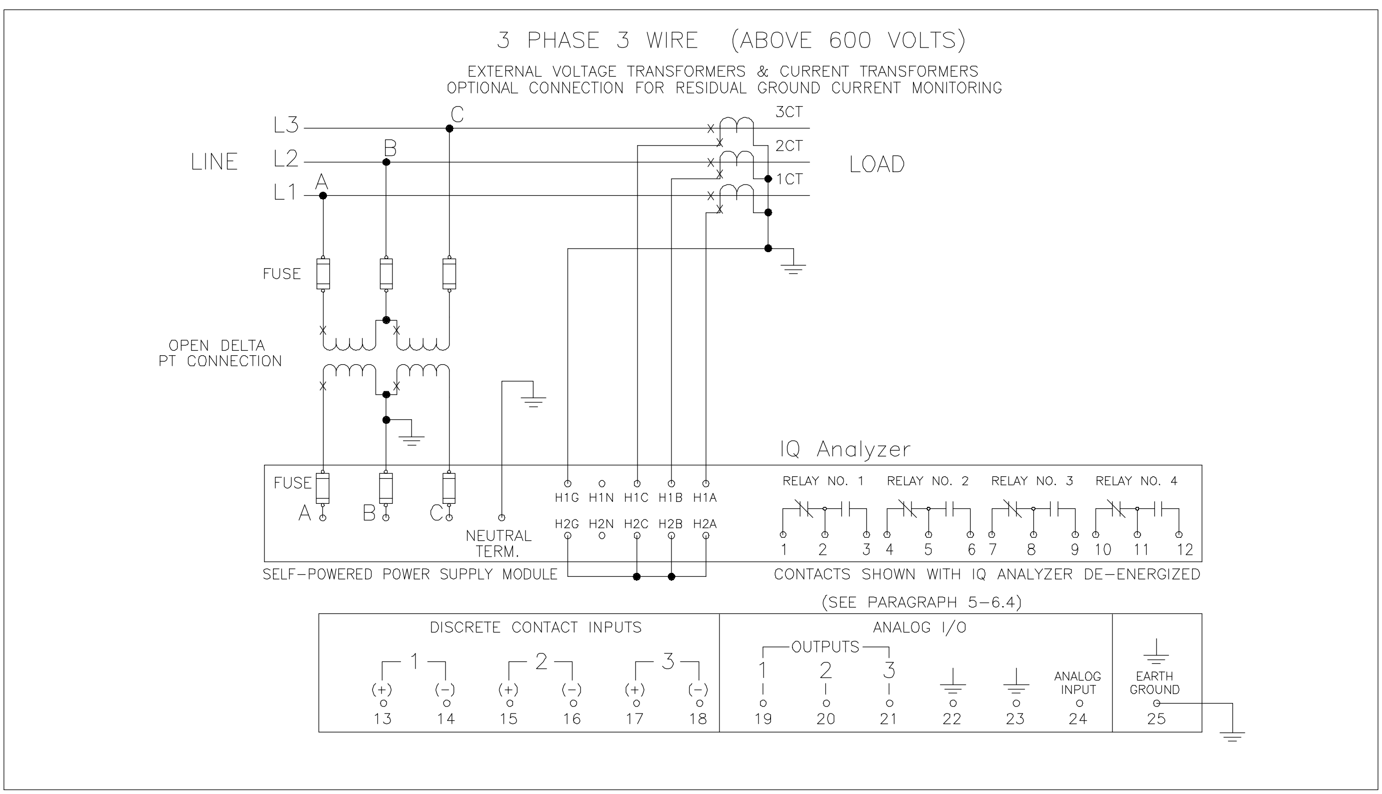


Figure 4-22. 3-phase 4-Wire (Above 600 Volts) Wiring Diagram

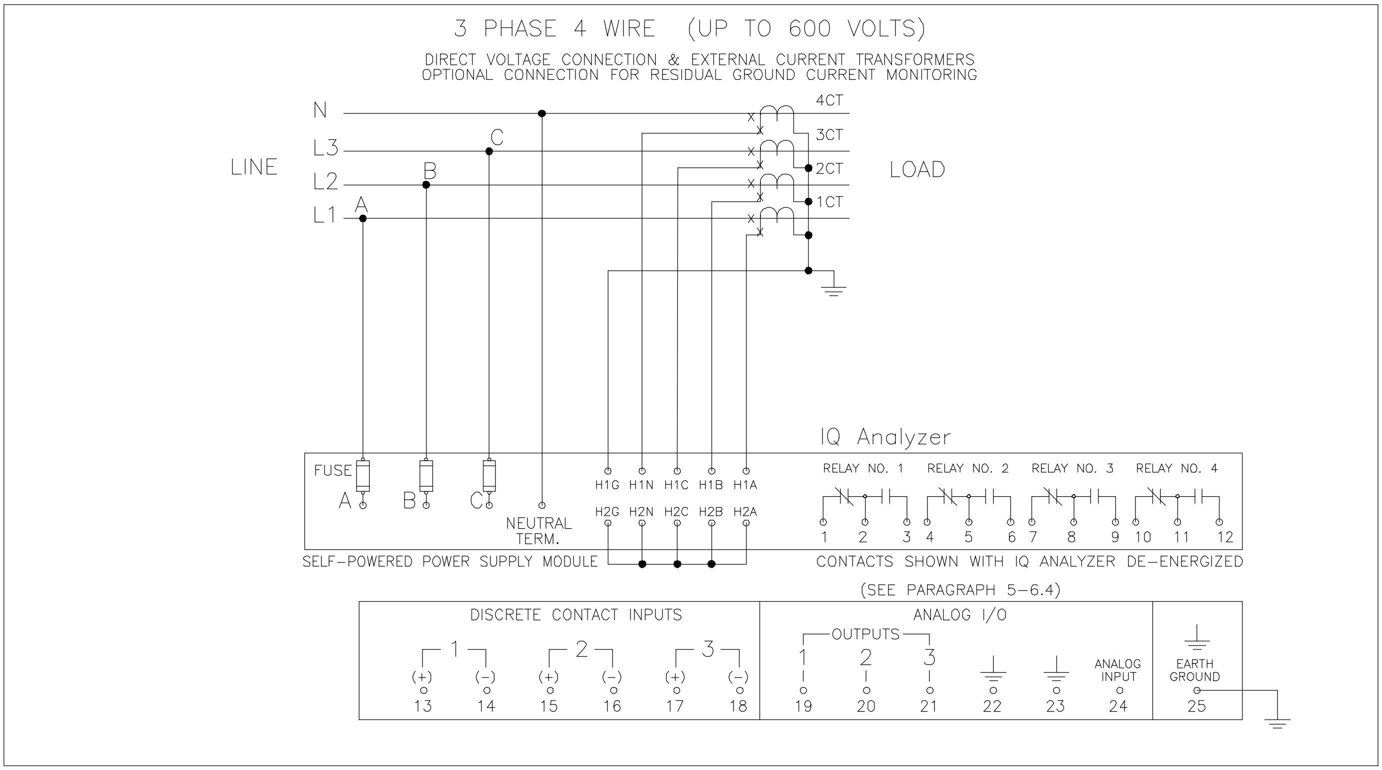


Figure 4-23. 3-phase 3-Wire (Up to 600 Volts) Wiring Diagram

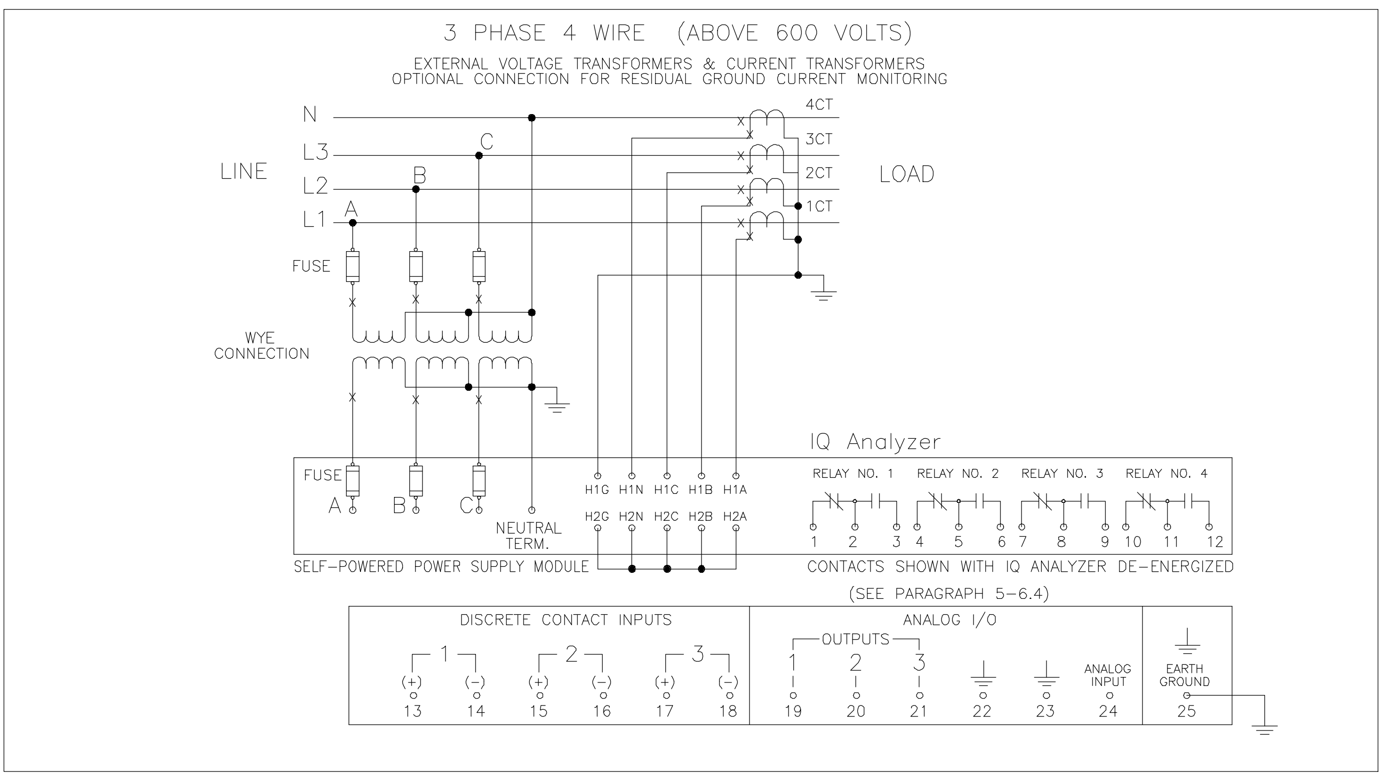


Figure 4-24. 3-phase 3-Wire (Above 600 Volts) Wiring Diagram

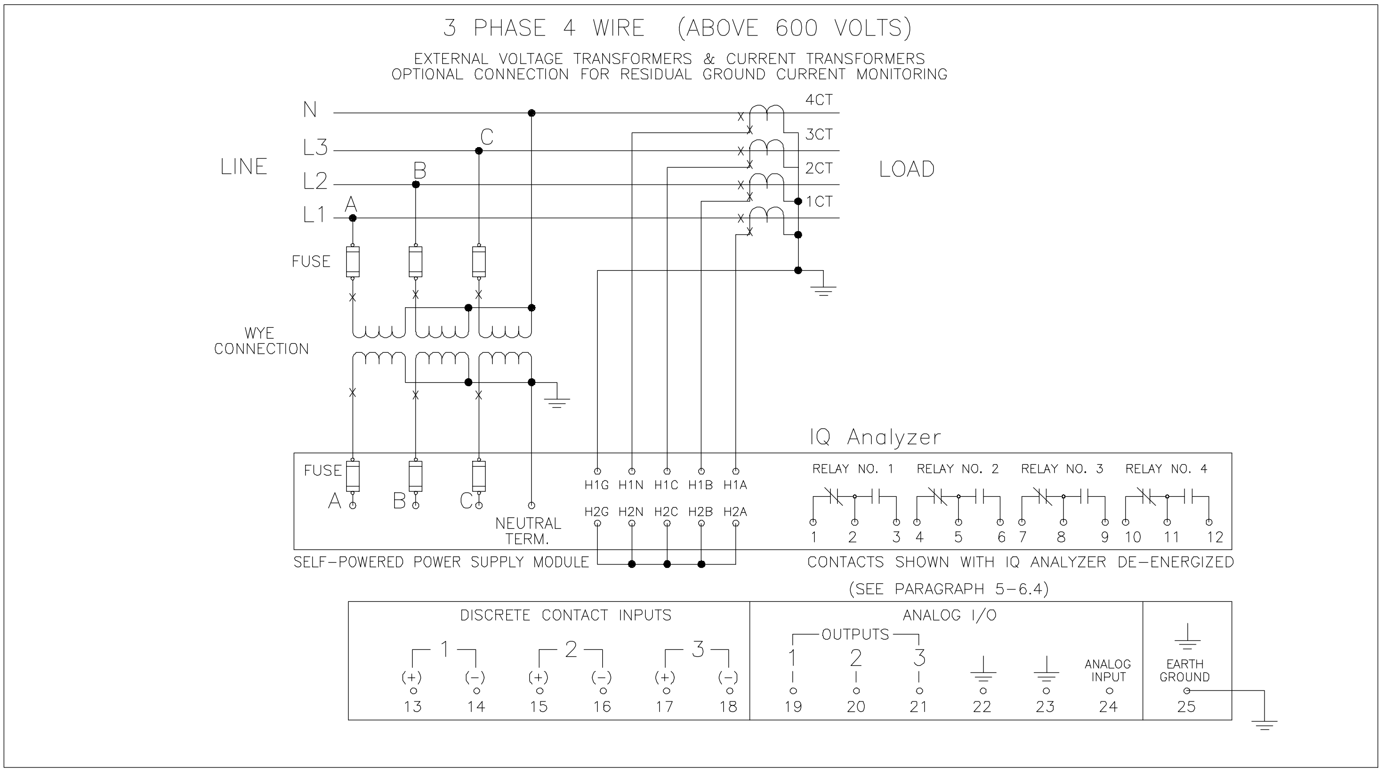


Figure 4-25. 3-phase 4-Wire (Above 600 Volts) Wiring Diagram

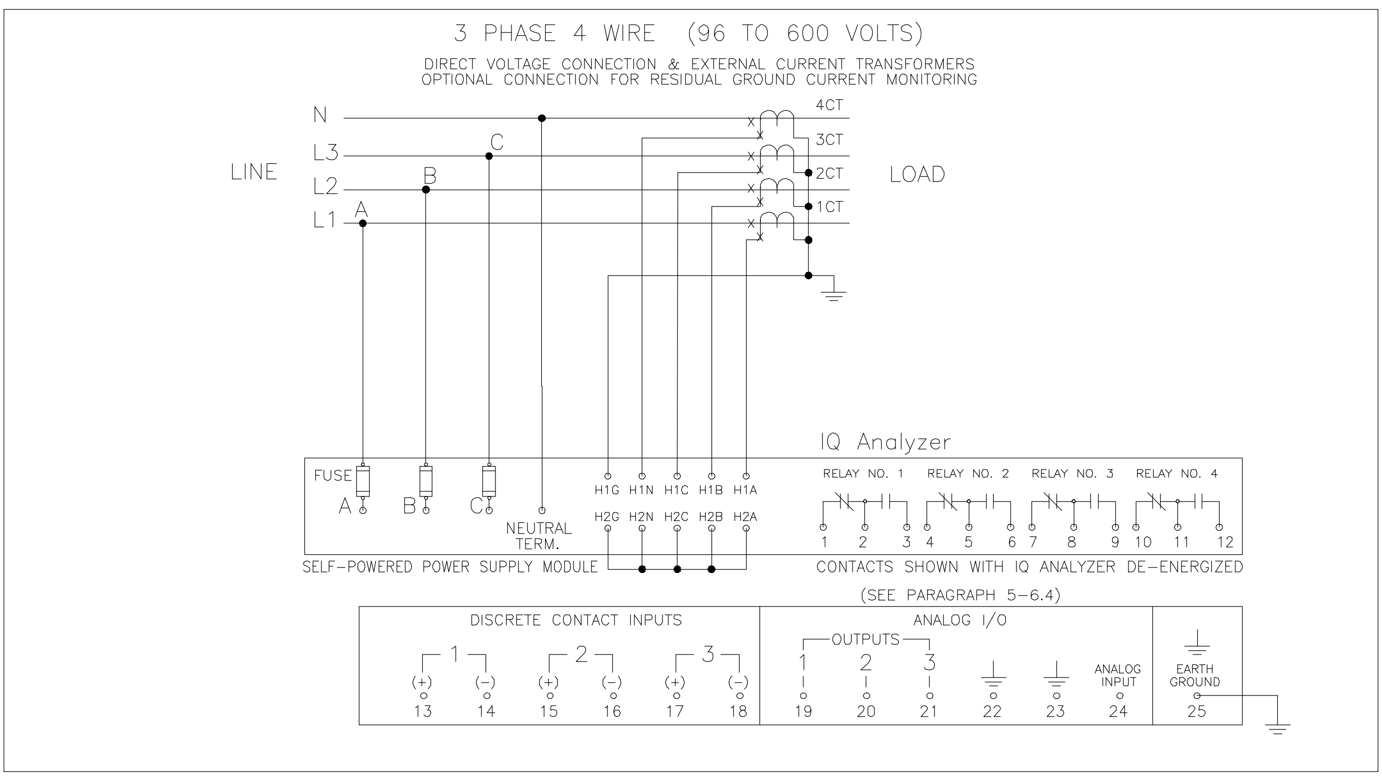


Figure 4-26. 3-phase 4-Wire (96 to 600 Volts) Wiring Diagram

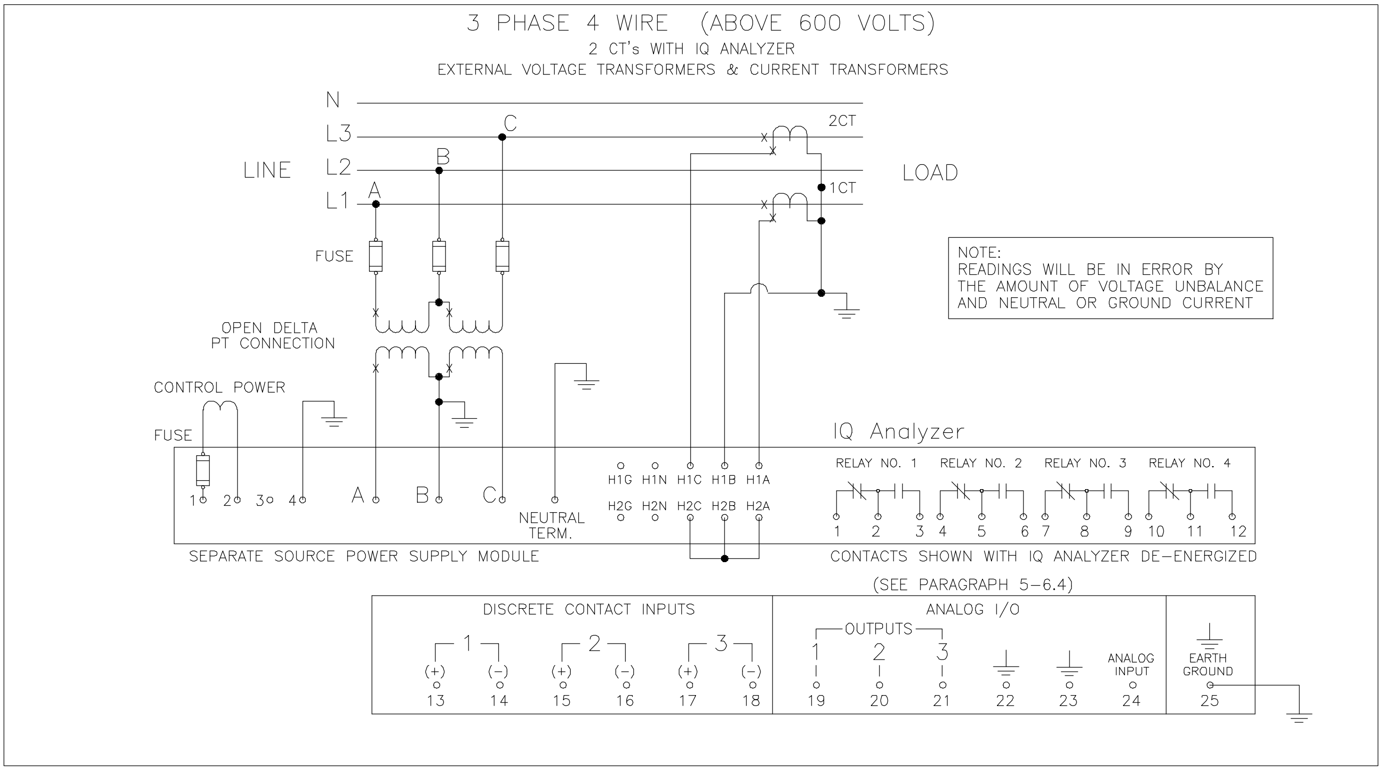


Figure 4-27. 3-phase 4-Wire (Above 600 Volts) Wiring Diagram

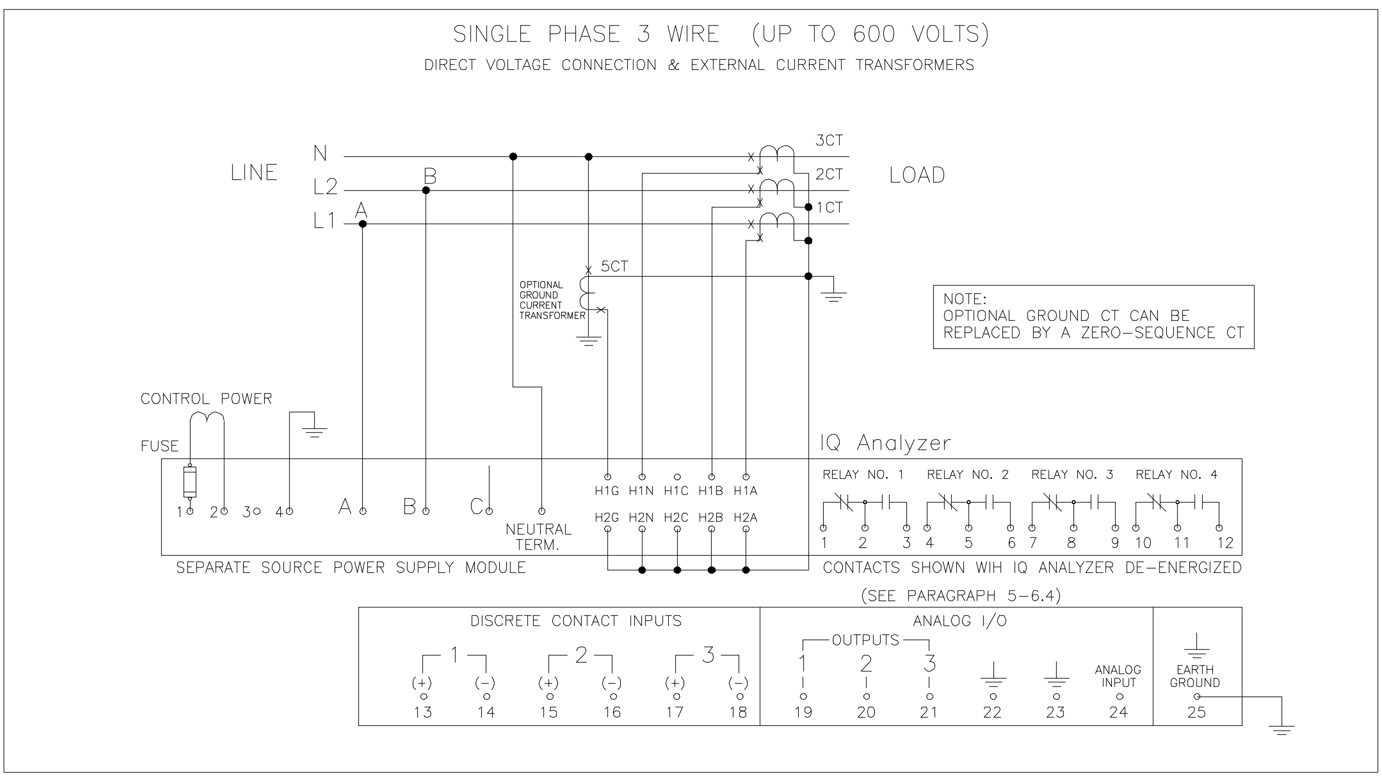


Figure 4-28. Single-phase 3-Wire (Up to 600 Volts) Wiring Diagram

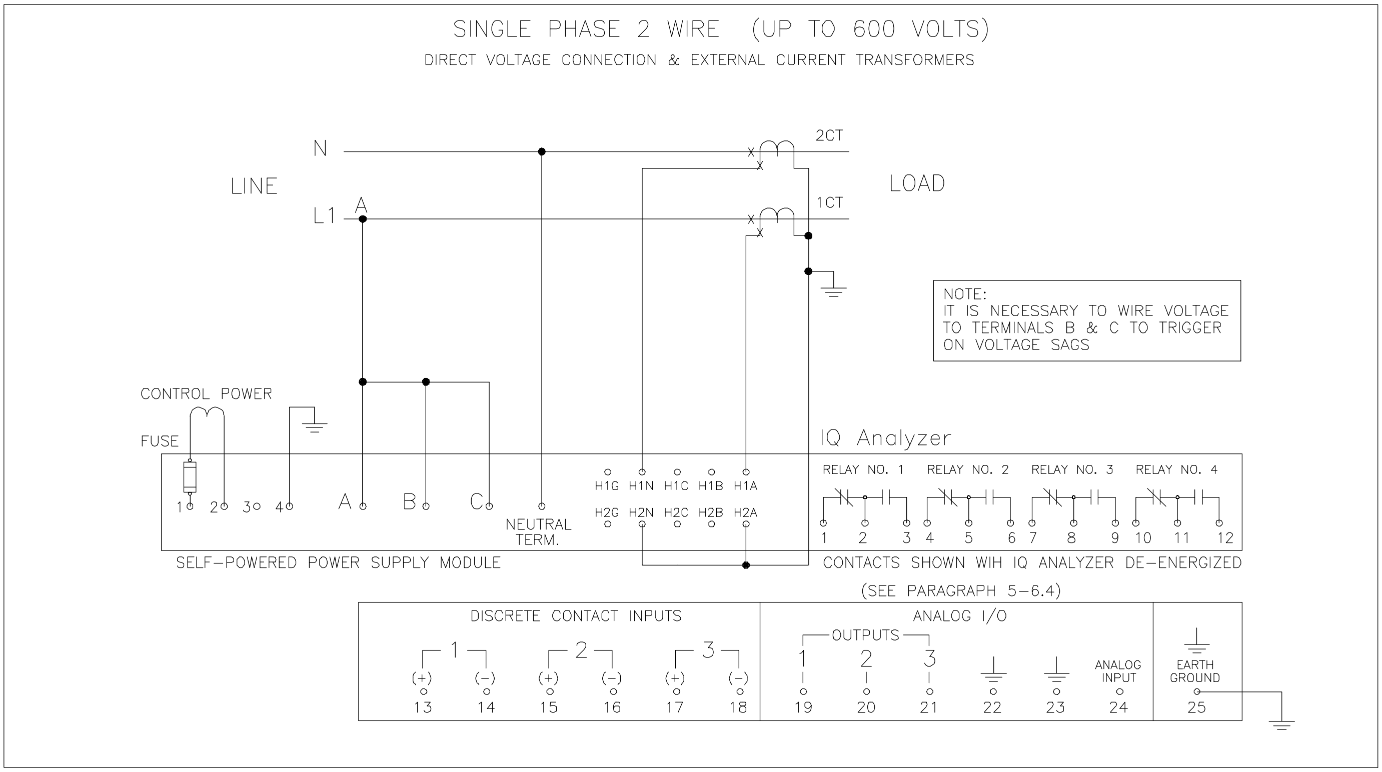
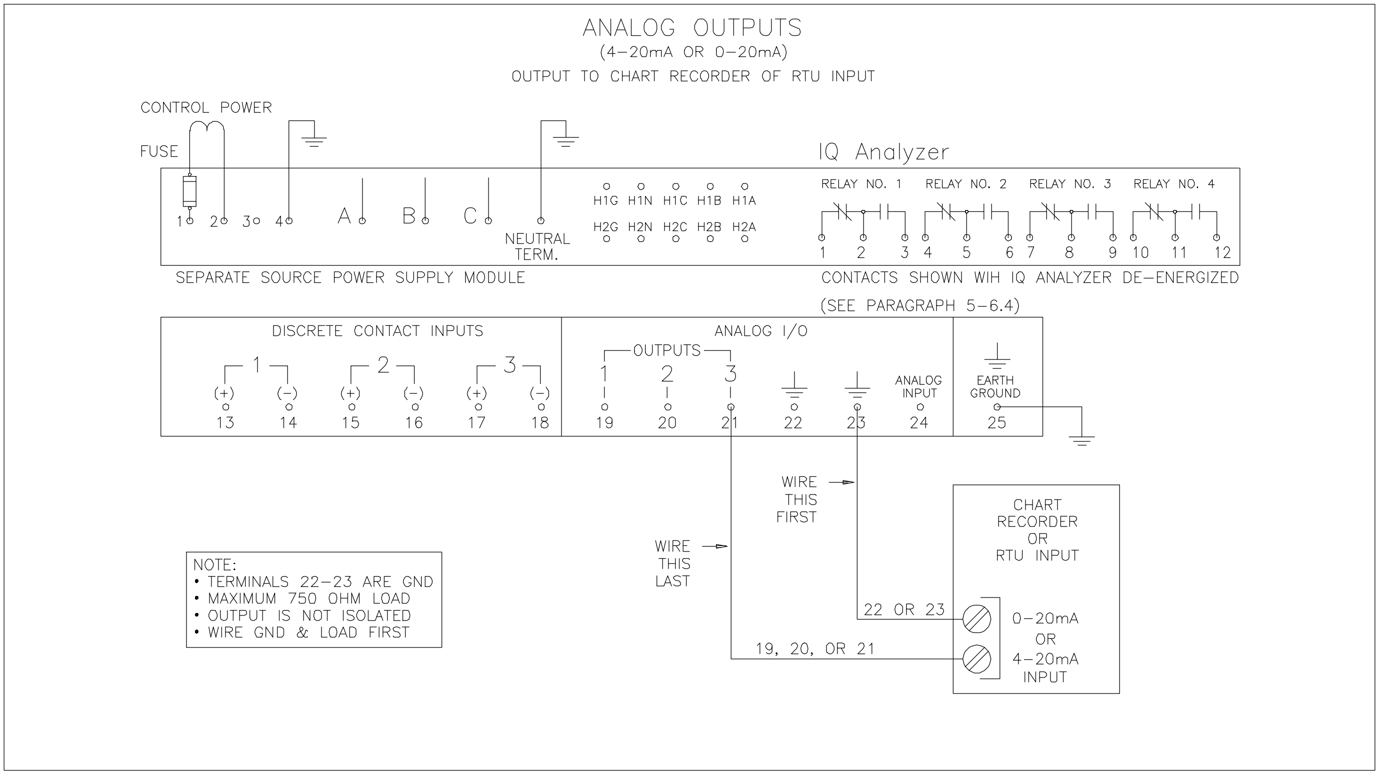


Figure 4-29. Single-phase 2-Wire (Up to 600 Volts) Wiring Diagram



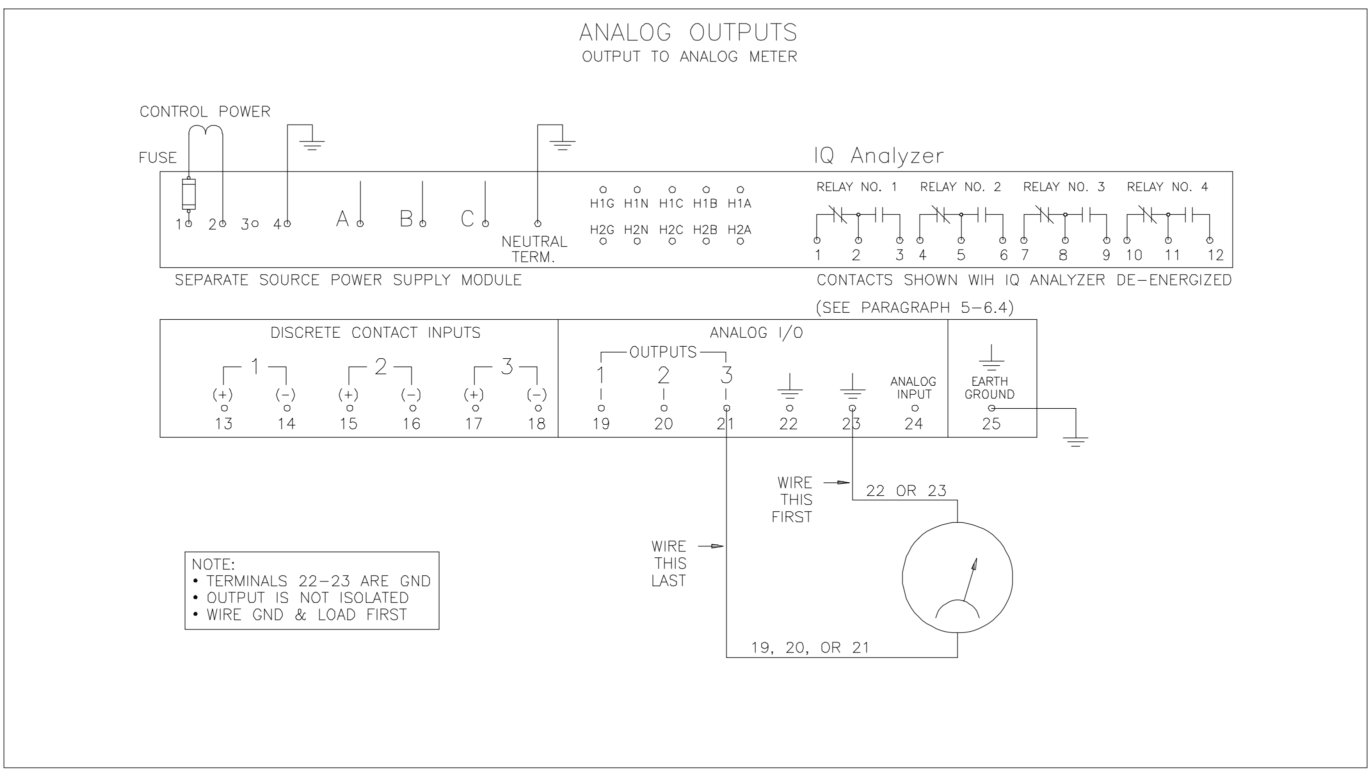


Figure 4-30.   Analog Outputs

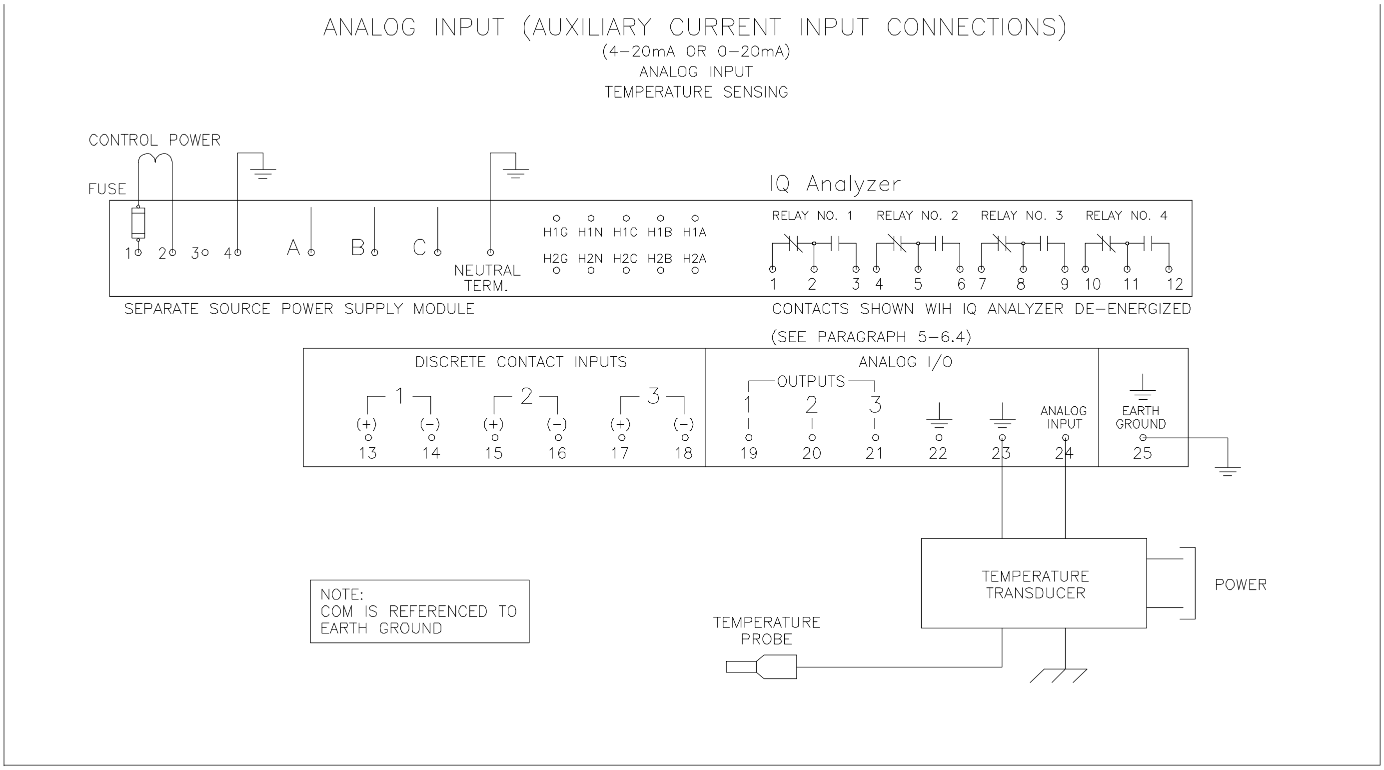


Figure 4-31. Analog Input (Auxiliary Current Input Connections)

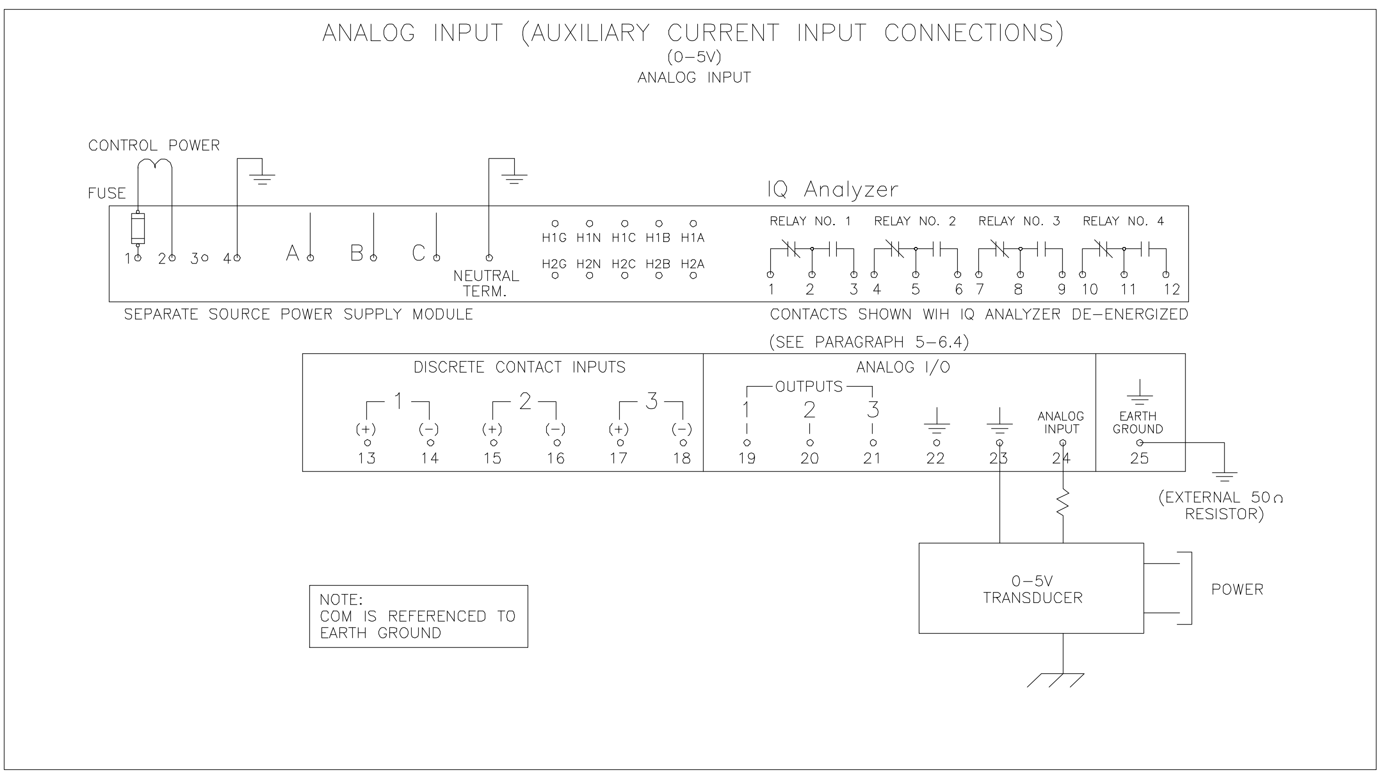


Figure 4-32. Analog Input (Auxiliary Current Input Connections)

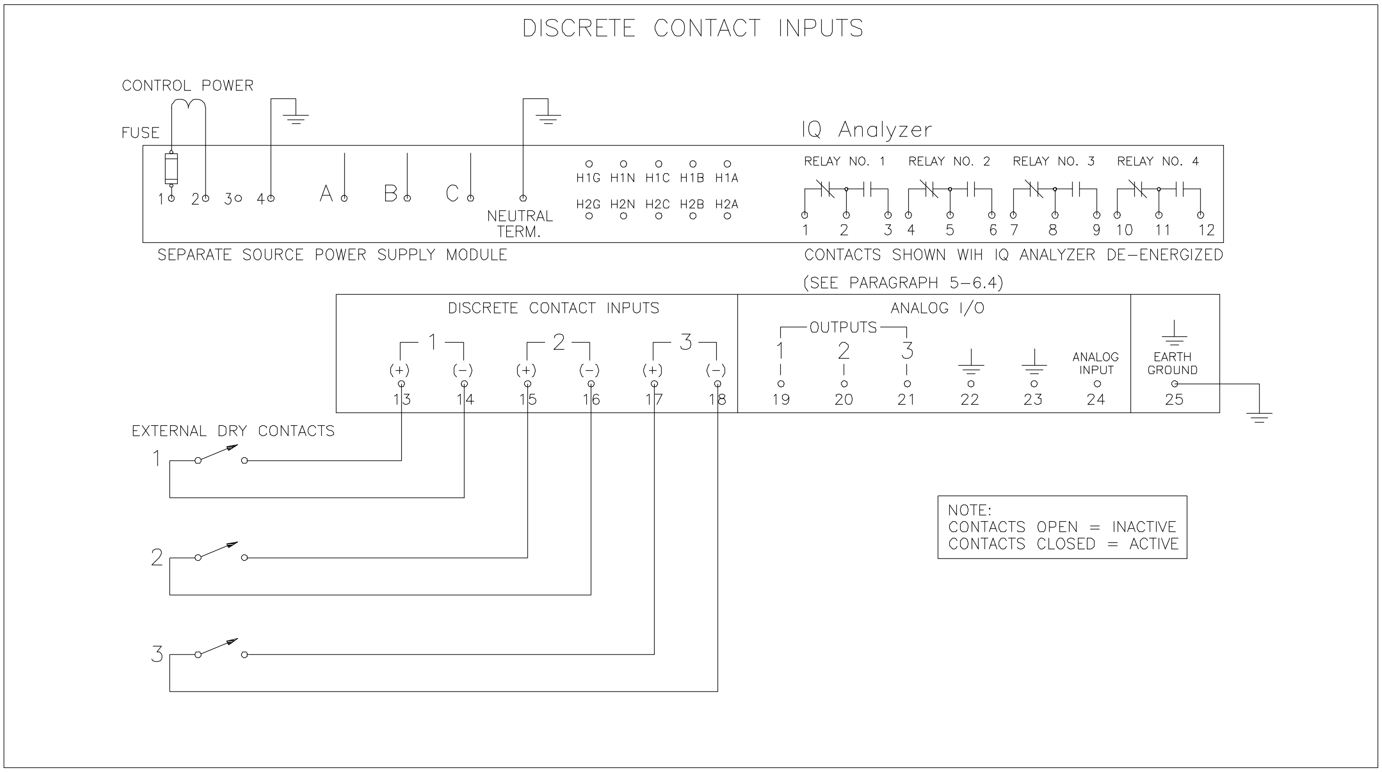
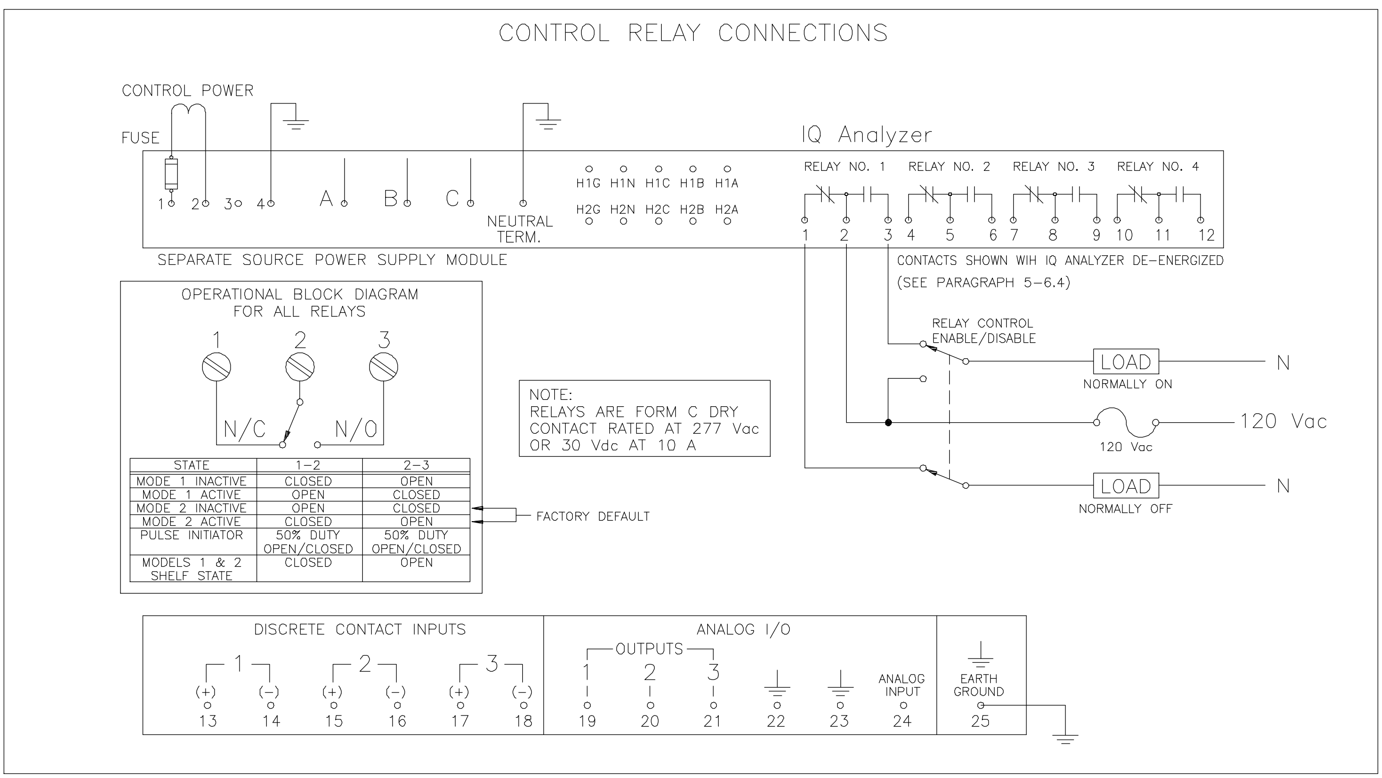


Figure 4-33. Discrete Contact Inputs



STATE	1-2	2-3
MODE 1 INACTIVE	CLOSED	OPEN
MODE 1 ACTIVE	OPEN	CLOSED
MODE 2 INACTIVE	OPEN	CLOSED
MODE 2 ACTIVE	CLOSED	OPEN
PULSE INITIATOR	50% DUTY OPEN/CLOSED	50% DUTY OPEN/CLOSED
MODELS 1 & 2 SHELF STATE	CLOSED	OPEN

Figure 4-34. Control Relay Connections

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SECTION 5: OPERATION

5-1 General

This section specifically describes the operation and functional use of the IQ Analyzer. It is divided into the following main categories:

- Display Mode ("Meter Menu")
- Help Mode
- Programming Mode
- General Setup
- Inputs/Outputs
- Analysis Modes
- Communications
- Reset Mode

The practical use of and operation within each specific category will be discussed. In this section it is assumed that prior sections have been reviewed and that the operator has a basic understanding of the hardware. It is important that the operator have a good grasp of the functional use of the operator panel (Section 3). This will make movement within each category and between categories a simple task and quickly put the capabilities of the IQ Analyzer at the operator's fingertips.

NOTICE

The key labels (definitions) for the F1-F4 Function Pushbuttons change as indicated on the display, depending upon which category is being viewed.

Detailed tables of measured parameters, accuracies and status information associated with any particular category are provided in this section. In addition to the information contained in this section on programming, Section 6 is devoted to actual programming steps and examples to help simplify the process.

5-2 Display Mode ("METER MENU")

The IQ Analyzer monitors and displays a comprehensive list of metered parameters. Multiple parameters, such as the currents of phases A, B and C, are displayed simultaneously for thorough real time monitoring. Custom screens can be configured to view parameter groupings, such as volts, amperes and power factor (paragraph 5-2.3.1).

The "Meter Menu" provides easy access to the most commonly used metered parameters through its combination of the display window, "Up and Down" pushbuttons and 12 Function LEDs (Figure 2-1). When in the Display Mode, the "Up and Down" pushbuttons permit viewing of screens for each of the following categories:

- Current
- Voltage
- Power (Watts)
- Power (Vars)
- Power (VA)
- Energy
- Demand
- Power Factor
- Frequency
- % THD
- Distortion Factor
- Custom

Individual categories are visually presented in the display on one or more screens. Movement from one category to another is accomplished using the "Up" or "Down" pushbuttons. Holding either pushbutton depressed will scroll through the category screens to more quickly reach a particular category of the twelve available. The "Home" pushbutton permits rapid movement back and forth between the Current and Demand categories at the top of each column of LEDs.

When the IQ Analyzer is initially energized, the "Normal LED" will blink green, the "Current LED" indicator of the "Meter Menu" will be lit red, and the display will show phases A, B and C currents in amperes for the system being monitored. Individual screens are identified below the monitored parameters, which would be "AMPERES" for this particular screen. The very bottom of the screen defines the use of function pushbuttons F1-F4 for that particular screen (Figure 5-1). Note that the definitions of the function pushbuttons can change between screens.

The user friendly screens are self explanatory to minimize the amount of definition required by an operator. For example:

- Phase Currents Identified as - IA, IB and IC
- Neutral Current Identified as - IN
- Ground Current Identified as - IG
- **Average Current All Phases Identified as - I***

It will be noticed that any identification that is less than obvious, such as I* for average phase currents, is defined on the screen in which it is used (Figure 5-2).

NOTICE

Keep in mind that when an IQ Analyzer is initially powered up for use on a specific system, the displayed "Meter Menu" values may not be what is anticipated for that system. Application specific parameters such as PT ratio and CT ratio must be programmed.

IA= 100.00
IB= 99.00
IC= 97.00
AMPERES
TRND EVNT HARM DEMD

Figure 5-1 Meter Menu Initial Current Screen

IN= 0.00
IG= 0.00
I*= 98.60
AMPERES
TRND EVNT HARM DEMD

Figure 5-2 Second Meter Menu Current Screen

5-2.1 Displayed Parameters

The IQ Analyzer displays the most comprehensive list of metered parameters in its class. A wide variety of real-time parameters and status parameters are quickly accessible via the front operator panel or through the communications port (Table 5.1).

The displayed information features:

- All information accessible via communications port
- Quality, true rms readings through 50th harmonic
- Accurate readings for non-sinusoidal wave forms with up to 3.0 crest factor
- Screens display auto ranging units, kilo units and mega units as needed
- 9 digit energy readings
- Simultaneously displays multiple parameters
- Custom screen programming

Table 5.1 Meter Menu Displayed Information

Display Type	Comments
Current	• Phase A, B, C, Average • Neurtral • Ground • (Separate CT inputs for each)
Voltage	• Phase A-B, B-C, C-A, Average • Phase A-N, B-N, C-N, Average • Neutral - Ground
Power	• System[1] and Phase A, B, C • Real (watts) • Reactive (vars) • Apparent (VA)
Energy	• Net kWh, kvarh, kVAh (Rates1-4, total) • Forward and Reverse Real (kWh) • Leading and Lagging Reactive (kvarh)
Frequency	• Hz • Time • Date • Day of Week
Peak Demand	• (Rates 1-4, Timestamp) • System Current (A) • System Real Power (kW) • System Reactive Power (kvar) • System Apparent Power (kVA)
Power Factor	• System and Phase A, B, C • Displacement[2] • Apparent[3] • Phase Angle VA,VB,VC,IA,IB,IC,IN
% THD Currents	• Phase A, B, C • Neutral
% THD Voltages	• Phase A-B, B-C, C-A • Phase A-N, B-N, C-N
Distortion Factor	• K-Factor[4] (of Event) • CBEMA Derating Factor (THDF)[5] • Crest Factor (ratio of peak to rms)
Custom	• Input/Output Status, Analog Input • User can program four screens to show any combination of 7 Meter Menu parameters per screen

[1] Line to neutral values do not apply for 3-wire system..
[2] Fundamental watts to VA
[3] Total rms watts to VA
[4] K-Factor: A derating factor which is essentially the sum of the squares of individual harmonic currents times the squares of their harmonic number (i.e., multiples of fundamental). One for each current is displayed with largest recorded in Event metered data.
[5] CBEMA Transformer Harmonic Derating Factor: A transformer harmonic derating factor defined as a pure sine waves crest factor (1.414) divided by the measured crest factor.

5-2.2 Displayed Sign Conventions

As a factory default, lagging vars and power factor are represented as negative values at the load. This is consistent with P = VI. The alternative is a power engineering convention which uses P = VI* such that consumption of power is positive. In this way a motor conveniently consumes positive watts and positive vars. Changing this setting has no effect upon the unsigned **"LEADING KVAR-HR"** and **"LAGGING KVAR-HR"** energy readings. The signed **"NET KVAR-HR"** energy will, however, begin counting in the opposite direction.

The desired sign convention (+ or -) for vars and power factor is programmed using Display Options within Display Manager of the Programming Mode. Refer to paragraph 5-5.8 for specific selection information.

A negative sign convention corresponds to:
- Inductive Load = negative var and power factor values (lagging power factor)
- Capacitive Load = positive var and power factor values (leading power factor)

A positive sign convention corresponds to:
- Inductive Load = positive var and power factor values (lagging power factor)
- Capacitive Load = negative var and power factor values (leading power factor)

As mentioned previously, power engineers typically use the positive sign convention as a standard. The negative sign convention is mathematically correct. The sign convention selected determines whether the leading or lagging power factor is positive or negative in terms of minimum and maximum values. Figure **5-3** illustrates two possibilities. Refer to Figures **5-4** and **5-5** for the specifics associated with both the Mathematical and the Power Engineer's sign conventions.

The following typical examples are offered based on the assumption that the unit is using the Mathematical sign convention:

- Induction Motor Loads (Figures **5-4** and **5-6**): Typically when monitoring induction motor loads the power flow is in Quadrant 4. The watts are positive and the power factor is lagging. By definition, the power factor and vars are negative.

- Power Factor Correction Capacitors (Figure 5-4): When monitoring a load that also has power factor correction capacitors and/or leading power factor synchronous motors so that the new load is capacitive, the power flow is in Quadrant 1.

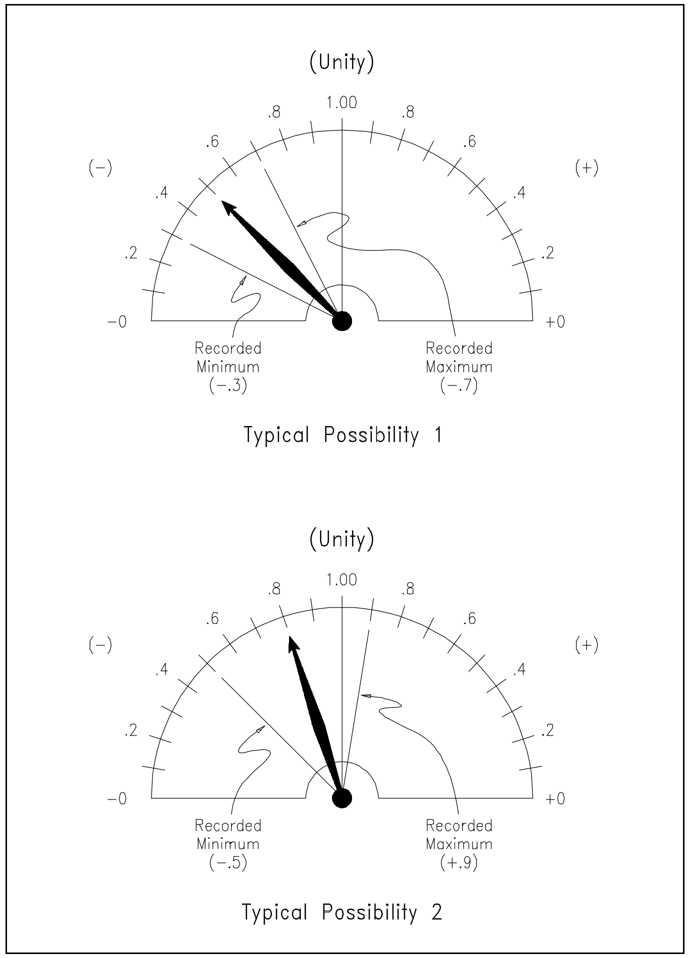


Figure 5-3 Typical Power Factor Minimum/Maximum Possibilities

- Power Distribution (Figures **5-4** and **5-7**): Three conditions are typically encountered when monitoring power distribution systems as follows:

  1. Circuit breakers A and B are closed and C is open. Power flow is in Quadrant 4. The power factor and vars are negative.

  2. Circuit breakers A and C are closed and B is open. Power flow for breakers A and C is in Quadrant 4. The power factor and vars are negative.

  3. Circuit breakers B and C are closed and A is open. The power flow for breaker B is in Quadrant 4 and the metering condition is the same as conditions 1 and 2. However, the power flow for breaker C is reversed and is in Quadrant 2.

Reactive Power

QUADRANT 2	*QUADRANT 1*
Watts Negative	Watts Positive
Vars Positive	Vars Positive
Power Factor Lagging (-)	Power Factor Leading (+)
	Real Power
Watts Negative	Watts Positive
Vars Negative	Vars Negative
Power Factor Leading (+)	Power Factor Lagging (-)
QUADRANT 3	*QUADRANT 4*

Figure 5-4 Power Quadrants, Direct Mathematical Convention P=VI

QUADRANT 2	*QUADRANT 1*
Watts Negative	Watts Positive
Vars Negative	Vars Negative
Power Factor Lagging (+)	Power Factor Leading (-)
	Real Power
Watts Negative	Watts Positive
Vars Positive	Vars Positive
Power Factor Leading (-)	Power Factor Lagging (+)
QUADRANT 3	*QUADRANT 4*

Reactive Power

*Figure 5-5 Power Quadrants, Power Engineering Convention P=VI**

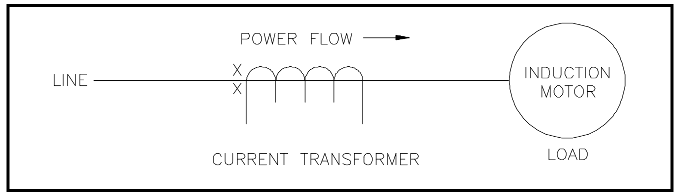


Figure 5-6 Induction Motor Load

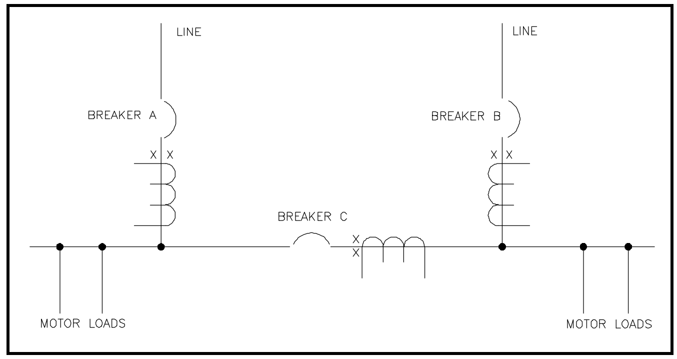


Figure 5-7 Power Distribution

5-2.3 Display Manager

The programmable Display Manager is comprised of three convenience functions:

- Meter Menu Return Time
- Custom Screens
- Screen Saver
- Display Options

5-2.3.1 Meter Menu Return Time

The IQ Analyzer is set at the factory with a 15 minute default time for returning the display to the Main Meter Menu, if no activity is detected by the IQ Analyzer during the 15 minute time period. A programmed return to the Main Meter Menu applies to the Program Mode, Reset Mode, Help Mode or analysis screens. When a return to the Main Meter Menu takes place, a screen saver is automatically activated. Meter Menu Return Time is programmable for 0 to 15 minutes with zero meaning no return.

5-2.3.2 Custom Screens

Custom Screens can be configured to view a grouping of selected parameters for convenience or to concurrently observe their relationships as conditions change. Up to 28 different parameters can be selected from over 90 different parameter possibilities, plus a "Default" selection (Table **5.2**). Selecting "Default" automatically programs 28 pre-selected parameters. For more detailed information on Custom Screens or a comprehensive list of all possible parameter selection, refer to Appendix A, Startup Settings Sheet #8.

5-2.3.3 Screen Saver

The IQ Analyzer has a screen saving feature which either remains in normal operation or dims the display backlight after a programmed time period. The time period will be the same as that programmed for the Meter Menu Return Time. Pressing any pushbutton restores the display to full brightness.

5-2.3.4 Display Options

There are 6 programmable options as shown in Table 5.3. As Figure 5-8 shows. They are arranged in pairs, so one or the other must be selected.

Table 5.2 Custom Screen/Trend Parameters

Category (#items)	Available Parameters
Current (6)	System Amps, Ia, Ib, Ic, In, Ig
Voltage (9)	Van, Vbn, Vcn, Vab, Vbc, Vca, Vng, LL avg, LN avg
Frequency (1)	System
Power (12)	Watts, vars, VA, (Phase a, b, c, and system)
Energy (7)	Forward/reverse/net Wh, lead/lag/net varh, VAh
Peak Demand (4)	Watts, vars, VA, Amps
PF displacement (4)	Phases a, b, c, and system
PF apparent (4)	Phases a,b, c, and system
% THD (10)	Ia, Ib, Ic, In, Van, Vbn, Vcn, Vab, Vbc, Vca
THD Amps (4)	Ia, Ib, Ic, In
THD Voltage (6)	Vab, Vbc, Vca, Van, Vbn, Vcn
Distortion Factor (3)	THDF (CBEMA), Crest Factor, K-Factor
Minimum since latest trend (5)	Amps, VLL avg, VLN avg, PF-apparent, PF-displacement,
Maximum since latest trend (10)	Amps, VLL avg, VLN avg, PF-apparent, PF-displacement, In, Ig, watts, vars, VA
Present Demand (4)	Watts, vars, VA, Amps
Time (1)	Present Time (HH:MM:SS MM/DD/20YY)
Discrete Contact Input Change Counter (3)	16-bit counter s (rollover at 65536) DI#1, DI#2, DI#3
Default 28 Custom Selections in 4 Screens	Screen1: THD Amps (Ia,Ib,Ic,In) %THD Vab,Vbc,Vca) Screen2: System watts, vars and VA, Frequency, kWh, kVAh, PF-apparent Screen3: 3-phase avg.,Ia,Ib,Ic,In,Ig, PF-displacement Screen4: Vab,Vbc,Vca,Van,Vbn,Vcn,Vng

5-3 Help Mode

The IQ Analyzer supports Help screens providing information on the device's operation, programming and troubleshooting. Information displayed is intended as basic reminders on how to move within a specific mode of operation and/or between different modes.

The Help feature is not intended to be a substitute for the information provided in this manual. It is most useful for field applications where this manual may not be available. The most common uses are for the Power Management Applications Support (PMAS) telephone number under TECHNICAL SUPPORT or the default programming password under GENERAL PROGRAMMING.

When the Help Pushbutton is pressed, the first of two Help Menu screens appears highlighting five Help categories (Figure **5-9**). A Help category can be selected from that screen, or the F4 Pushbutton (PGDN) can be used to view the second Help Menu screen. Three additional Help categories are highlighted on the second screen (Figure **5-10**).

Once a Help Category is selected via F1 (SEL), additional screens provide helpful assistance pertaining to the specific Help Category selected. For example, if the Help Category selected is "FACEPLATE OPERATION," two main screens of specific selections are provided (Figures **5-11** and **5-12**). Each selection is supported by additional screens of explanatory information intended to review the use and/or function of every Pushbutton and LED on the faceplate of an IQ Analyzer.

To exit the Help Mode, press and release the "Help" pushbutton. For additional information about pushbuttons, refer to paragraphs 3-3 and 3-4.

5-4 Programming MODE

The IQ Analyzer is fully programmable from the device's faceplate or through a communications port. Programming is password protected whether the programming function is being performed directly from the faceplate or through a remotely located computer. A view only password (00000) is provided to permit viewing but not changing of previously programmed setpoints.

Taking full advantage of the capabilities of IQ Analyzer is heavily dependent on the programming function. Therefore, programming proficiency is highly recommended. Detailed programming information associated with specific features is presented in this section with the individual features, such as programming associated with general setup, trends, events, harmonics, and demands. This information will be helpful, and in some instances required, when the actual programming takes place. Any operator associated with programming will quickly discover that programming an IQ Analyzer is just a matter of simple, repetitive steps.

*Table 5.3 Display Options*①

Option 1	Option 2
ALL ALARM SCREENS: Upon waveform capture event or alarm condition, blink the event LED and display the event timestamp and cause.	NO EVENT ALARM SCREEN: (Default) Upon waveform capture event or alarm condition, blink the event LED but do not interrupt normal display operation.
NO NEUTRAL IN DELTA: (Default) When configured for 3-phase, 3-wire operation, hide line-to-neutral voltage readings, per-phase PF, and per-phase power.	ALWAYS SHOW NEUTRAL: Regardless of the system configuration, display all parameters, including line-to-neutral voltage, etc. NOTE: In 3-phase, 3-wire mode, the IQ Analyzer calculates the center of the power triangle and uses it as neutral for all calculations.
MM/DD/YY FORMAT (Default) Display all dates in month, day, year format. This setting does not affect communications formats.	DD/MM/YY FORMAT Display all dates in day, month, year format. This setting does not affect communications formats.

```
PGM/DISPMGR/OPTS
DISPLAY OPTIONS:
  ALL ALARM SCREENS
*NO EVNT ALARM SCREEN
*NO NEUTRAL IN DELTA
  ALWAYS SHOW NEUTRAL
*MM/DD/YY FORMAT
 SEL      UP DOWN       ENTER
```

Figure 5-8 Display Options Screen

```
HELP MENU:  SELECT ONE

-HOW HELP WORKS
-FACEPLATE OPERATION
-METER-MENU SCREENS
-TRND  EVNT  HARM  DEMD
-PROGRAMMING
 SEL      UP DOWN       PGDN
```

Figure 5-9 First Help Menu

```
HELP MENU:  SELECT ONE

-NETWORK OPTION
-TROUBLESHOOTING
-TECHNICAL SUPPORT


 SEL      UP DOWN       TOP
```

Figure 5-10 Second Help Menu

Because of the importance placed on the programming function, Section 6 is dedicated to general programming activities. Three main topics are addressed in Section 6 to improve programming proficiency:

- Common Programming Procedures
- Programming Example
- Programming Categories

```
HELP MENU:  SELECT ONE

-STATUS LEDS:  NORMAL/
   EVENT/RELAY/PROGRAM
-RESET BUTTON
-PREVIOUS LEVEL  /HOME
-F1-F4 BUTTONS
 SEL      UP DOWN      PGDN
```

Figure 5-11 Faceplate Operation First Screen Selections

```
HELP MENU:  SELECT ONE

-METER-MENU  UP/DOWN
-PROGRAM/HELP  BUTTONS



 SEL      UP DOWN      TOP
```

Figure 5-12 Faceplate Operation Second Screen Selections

5-5 GENERAL SETUP

Performing the steps associated with the general setup of the IQ Analyzer is one of the first activities performed once the IQ Analyzer is properly installed and ready to be utilized. It is recommended that the General Setup Screens Tree (Figure 6-4), the Startup Settings Sheet #1 in Appendix A, and the IQ Analyzer's specifications (Table 2.1) be reviewed first. In addition, Quick Start Metering information is provided in paragraph 4-5 for those users initially interested in having the IQ Analyzer perform only basic metering functions quickly.

5-5.1 System Type

The IQ Analyzer supports four configurations:

- Three-phase, four-wire (wye)
- Three-phase, three-wire (delta)
- Single-phase, two-wire
- Single-phase, three wire

The wye and delta configurations have a phase rotation of ABC or CBA. If the rotation setting does not agree with the incoming voltage, **"REVERSE SEQUENCE, MISWIRING LIKELY"** is displayed.

As a default, the delta configuration disables the display of line-to-neutral voltages. In any case, the neutral terminal on the power module must be connected. In a wye configuration, merely connect the four wires. Similarly, in a single-phase configuration connect the neutral wire to the neutral terminal. In a delta system, however, connect the neutral terminal to the chassis ground. Refer to Section 4 for wiring diagram assistance.

NOTICE

The *chassis ground* on the IQ Analyzer or Separate-Source Power Module *must be wired to ground* for proper operation. Faulure to do so results in inaccurate readings.

NOTICE

It is not uncommon to have misplaced phases throughout a factory such that the actual rotation is the opposite of how the wires are labeled. If a reverse sequence alarm appears, check the phasing through the use of the Harmonic Analysis Mode.

Check the phasing by using the analysis feature as follows:

1. Press the F3 (HARM) pushbutton
2. Capture an event with the F4 (NEW) pushbutton
3. Observe phase angle of the fundamental V_{AB} and V_{CA}

An ABC rotation will have a phase angle of –120 degrees for V_{AB} fundamental. Regardless of the configuration, the voltage between the neutral terminal and ground terminal is measured such that leaving either terminal disconnected may cause the alarm,

"HIGH NEUTRAL VOLTAGE, MISWIRING LIKELY."

Note that acknowledging an alarm screen inhibits alarms again until the screen saver becomes active. This allows the use of the device in situations with persistent alarms.

5-5.2 Frequency

The IQ Analyzer has four default frequencies:

- 25Hz
- 40Hz
- 50Hz
- 60Hz

Upon power up in the absence of a phase-A voltage in which to frequency lock, the IQ Analyzer samples according to the set default. This setting is also used for comparison when programming a trigger on frequency deviation.

5-5.3 Incoming Line-to-Line Voltage

Nominal Line-to-line voltages of up to 600 volts rms can be wired directly into the Analyzer without the need for potential transformers (PTs). In any case, the nominal full-scale voltage needs to be defined. The incoming line-to-line voltage may be set between 100 and 600 volts.

The analog outputs use the INCOMING VLL as their full-scale value. This affects any analog output that is derived from voltage, such as watts, vars, VA, and voltage itself. However, this setting has no effect on the use of the pulse-initiator relays.

Other internal and external applications use the INCOMING VLL to define threshold levels. For example, a 5% sag or swell voltage is the deviation from nominal.

Common PTs have 120V outputs as the nominal secondary, so the INCOMING VLL setting is 120V; however, there are exceptions. For example, one might have a PT with a 14.56kV:120 ratio, but with a nominal voltage of 14.4kV. In this situation, adjust the INCOMING VLL = 120*14.4/14.56 = 118.68. The closest available setting is 119.

Some international applications use PTs with 100V outputs as the nominal secondary, so that the INCOMING VLL setting is 100V.

5-5.4 PT Primary Rating

When no potential transformers (PTs) are used, the PT ratio is 1:1 (i.e. 120:120). For example, a 480 volt system wired directly has a PT primary line-to-line rating of 120 with an incoming line-to-line voltage of 480 volts. This setting in conjunction with the incoming line-to-line voltage and CT primary rating define the full scale range for analog outputs. The PT primary rating may be set from 120 volts to 500 kilovolts.

5-5.5 CT Primary Rating

The rating of the current transformers (CTs) is relative to 5 amperes. Normally, a system rated at 2000 amperes per phase would have a CT ratio of 2000:5. However, since the IQ Analyzer has an 8x overranging capability, as much as 40 amperes can run continuously through the CT inputs. If only a small fraction of the rated current is used, one can increase the resolution 8 times by making the ratio relative to 40 amperes in lieu of 5 amperes. For example, the same 2000 ampere system may be specified as 2000:40, which is 250:5. This setting along with the PT primary rating and incoming line-to-line voltage define the full scale range for analog outputs. The CT primary rating may be set between 5 and 10000 amperes and applies to Ia, Ib, Ic, and In. The full scale value for currents is the CT primary setting.

5-5.6 Ground CT Primary Rating

This is the CT primary rating of the ground current input. Alternatively, a zero-sequence CT may be substituted, with the residual of Ia, Ib, Ic and In run through the input, or leave the input terminals disconnected. As with the other current inputs, **the IQ Analyzer has 8x overranging, such that 40 amperes can run continuously** through the ground current input. Typically, a lower CT ratio is selected for the ground CT primary rating than for other current inputs. The ground CT primary rating may be set between 5 and 10000 amperes. Ig has a full scale value equal to the ground CT primary setting.

5-5.7 Programming Options

For revenue metering applications, the IQ Analyzer has extended PROGRAMMING OPTIONS, previously labeled PROGRAM VIA IMPACC. In this way, the IQ Analyzer simultaneously serves the needs of utilities and industrial users. The factory default is to enable changes at the faceplate and via IMPACC. However, for revenue metering there are two additions – INPUT3 KEY OPEN ONLY and INPUT3 KEY / NETWORK, which disabled selected settings with a contact closure on Discrete Input#3 (Figure **5-13**).

The disabled changes to settings are the General Setup, Discrete Inputs, Pulse Initiator Relays, and Demand. Still, all functions are fully functional. These include: relays for load shedding, relays tied to events or IMPACC. Similarly, changes to analog I/O, event triggers, and display options remain fully enabled.

Also protected are resets of peak demands and energies. These include peak kW, kvar, kVA and kWh, Kvarh, and kVAh.

Operation of FACEPLATE ONLY
With this selection, all settings are changed via the faceplate. Reset of peak demands and energy is possible at the faceplate or via IMPACC network.

Operation of FACEPLATE & NETWORK
With this default selection, all settings are changed at the faceplate or via IMPACC. Reset of peak demands and energy is possible at the faceplate or via IMPACC network. This selection provides the most open access.

Operation of INPUT3 KEY ONLY
With this selection, Discrete Input#3 must remain open to change the protected settings via the faceplate or any settings via IMPACC. The peak demands and energies are similarly protected. This option is most useful when those responsible for energy billing are not the same as those who use the IMPACC system. This selection provides the most restricted access.

Operation of INPUT3 KEY & NETWORK
With this selection, Discrete Input#3 must remain open to change the protected settings or reset peak demands and energies at the faceplate. IMPACC setting changes and resets are enabled. This option is most useful when those responsible for energy billing are also responsible for an IMPACC system that is restricted to authorized personnel.

```
PGM/GEN/PRGOPT
   PROGRAM CHANGES VIA:
         FACEPLATE ONLY
   *     FACEPLATE & NETWORK
         INPUT3 KEY ONLY
         INPUT3 KEY & NETWORK

            UP DOWN      ENTER
```

Figure 5-13 Download Program Screen

5-5.8 Power/Energy Options

KILO or MEGA energy units (kilowatt-hr or megawatt-hr) can be selected for display during the general setup procedure. In addition, the Power Convention can be selected, permitting the user to choose between the mathematical and the power engineering conventions. As a factory default, the IQ Analyzer uses the mathematical convention in which lagging vars and power factor are represented as negative values for a load (positive for a generator).

5-5.9 Date and Time

If an IMPACC system running PowerNet or Series-III software (paragraph 5-8), no entry is necessary as the time and date will be downloaded upon startup and synchronized once a minute. Otherwise, enter the date and time by selecting the desired item from the menu, modifying the value, and entering (Figure **5-14**).

After the hour is entered, the F3 pushbutton is identified as AM/PM. Use this pushbutton to make the AM or PM selection and enter.

```
PGM/GEN/CHGDT
   MONTH:        02
   DAY:          03  THURSDAY
   YEAR:         00
   HOUR:         05P
   MINUTE:       07
   SECOND:       57
SEL      UP      DOWN
```

Figure 5-14 Change Date and Time Screen

Without a network, the IQ Analyzer is dependent upon its own real-time clock. Like a digital watch, time is based upon a precisely tuned crystal; however, there is a linear drift with time. The amount of drift may be as large a 1 minute/month at extreme temperatures (–20^{0}C or +70^{0}C).

For this reason, there is an option within the TIME OF USE settings to synchronize the clock to the incoming voltage. Another option within TIME OF USE adjusts for daylight savings time.

5-5.10 Change Password

Both the Program Mode and Reset Mode are password protected. The correct password must be entered to proceed into these modes. The IQ Analyzer is supplied from the factory with default passwords of **10000** or **44444**. These default passwords can be used on initial powerup and until a new password is programmed by the user. For details on passwords and password entry, refer to paragraph 6-2.2.

5-5.11 Communication Mode

The IQA6400/6600 Series has features that greatly extend the functions of the IQA6000/6200 Series. PowerNet and Series-III from 1999 and earlier know about the IQ Analyzer but not the new Datalogging Analyzer (IQA6400/6600). For backward compatibility in communications, select “IQA6000/IQA6200”. Only select IQA6400/IQA6600 after installing new PowerNet software that supports the Datalogging Analyzer.

5-6 Inputs/Outputs

The IQ Analyzer provides extensive input/output capabilities. One analog and three digital inputs are provided to interface with sensors and transducers. Three analog output and four relay contacts are furnished to share data with PLCs and control systems and to actuate alarms and control relays. Remote monitoring, control and programming is possible through the communications option.

5-6.1 Discrete Contact Inputs

Three programmable dry contact discrete inputs have multiple functions.

- Each can trigger an event to capture metered, harmonic, and waveform data, or trigger a trend
- Each can reset peak demands, min/max values, one relay, or as many as seven locked event triggers.
- Each can trigger the sampling of trend data.
- Each has a 16-bit counter that can be read via network communications.
- Discrete input #1 also functions as the sync demand input, which is then tied to the sync demand pulse from the electric utility.

Even when set as a reset input or sync, each discrete input can trigger an event. As a reset input, it can reset the following:
- Peak current and power demands
- All min/max values
- Locked triggers
- Individual relays (with manual resets)

5-6.2 Analog Input

One analog input is provided and can be configured as 0 to 20 or 4 to 20 mA. It is displayed as a percentage, and provides an interface with gas flow meters, temperature transducers or other analog devices.

The analog input can be configured to accept different inputs (Figures 5-15 and 5-16). Also refer to Figures 4-31 and 4-32 for specific analog input wiring diagrams.

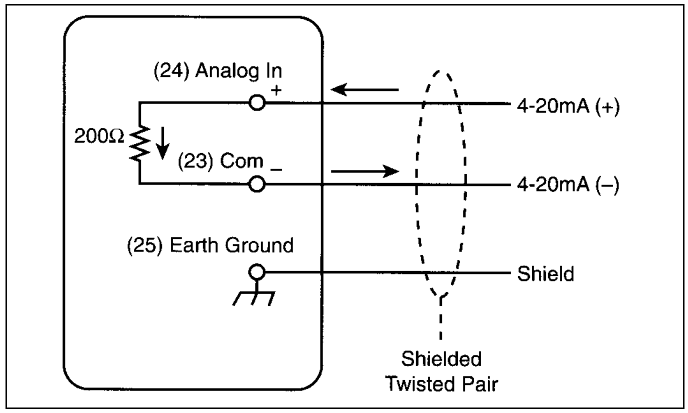


Figure 5-15 Connections for 4-20 or 0-20mA Input Signal

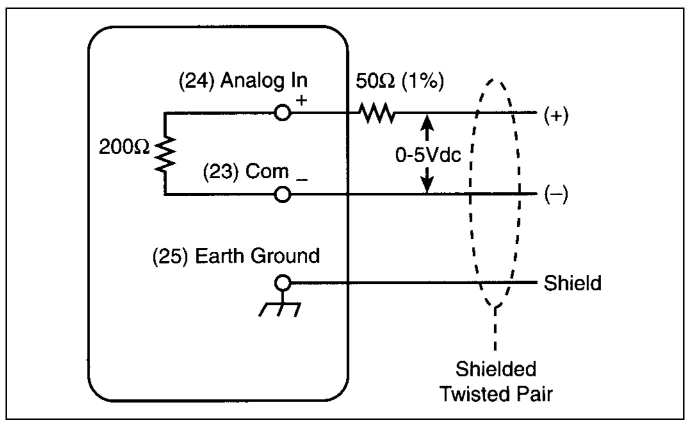


Figure 5-16 Connections for 0-5Vdc Input Signal

WARNING

CONNECT THE SHIELD PATH TO A SOLID EARTH GROUND AT THE DEVICE ONLY. IF THE SHIELDS ARE GROUNDED AT A NUMBER OF POINTS, A GROUND LOOP MAY BE CREATED CAUSING HAZARDOUS VOLTAGES TO BE PRESENT ON THE DEVICE'S CHASSIS. FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN BODILY INJURY OR DEATH.

Table 5.4 Analog Output Parameters

Category	Available Parameters
Current	I_a, I_b, I_c, I_n, I_g, I_{avg}
Voltages	Van, Vbn, Vcn, Vab, Vbc, Vca, Vng
Watts	Phases a, b, c, and sytem
Vars	Phases a, b, c, and sytem
VA	Phases a, b, c, and sytem
% THD Current	Ia, Ib, Ic, In
% THD Voltage	Van, Vbn, Vcn, Vab, Vbc, Vca
Power Factor	System Displacement, System Apparent
Frequency	Van

5-6.3 Analog Outputs

Three analog outputs are provided. The output signal is the analog current value out, which is proportional to a preprogrammed value in the IQ Analyzer. The choices are:

- 0-20mA
- 4-20mA

Analog outputs can be programmed to reflect the parameters in Table 5.4 (currents, voltages, powers, %THDs, frequency, and power factors).

Refer to Analog Output Settings Sheet #3 in Appendix A for all the specific programmable parameters possibilities.

After the output is programmed to represent a specific parameter, set the range to either 0 to 20 or 4 to 20mA and the full scale output to 100% or 200%. For example, a 200% selection means that at 20mA, the selected parameter is twice its full scale value. Frequency is an exception in that 100% is 100Hz, so the output would be 20mA at 100Hz.

For signed power selections, there is a setting for what output represents zero watts or vars as follows:

5-6.3.1 Range

Selections are either 0-20mA or 4-20mA. The analogous operation is that of an analog meter whose largest outputs pegs at 20mA and whose smallest output pegs at either 0mA or 4mA, depending upon selection.

5-6.3.2 Zero Scale / Mid-scale Position

This selection positions the value of zero. For Zero Scale 0mA or 4mA represents zero; this is always true for voltage, current, frequency and %THD. For watts and vars there is the option for zero to be Mid-Scale; zero being either 10mA or12mA in the middle of the range 0 to 20mA or 4 to 20mA range.

The zero position setting is independent of range such that for a 4 to 20mA output with a full scale of 200% and Mid-Scale position the output is as follows: a power of minus two times full scale is 4mA; minus full scale is 8mA; zero is 12mA full scale is 16mA; and two times full scale is 20mA. Power is always in the Mid-Scale position.

The best way to imagine the zero scale is to think about analog meters. There are three possible types. The first reads from a zero position to a positive maximum value. The second reads from zero position to a negative maximum value. The third reads both ways, positive and negative, from a mid-scale zero position.

Zero Scale +: minimum = 0;
maximum = positive value
Zero Scale -: minimum = 0
maximum = negative value
Mid-Scale: minimum = negative value
mid-range = 0
maximum = positive value

Analog outputs are configured as shown in Figure **5-17**. Refer to Figure **4-30** for specific analog output wiring diagram.

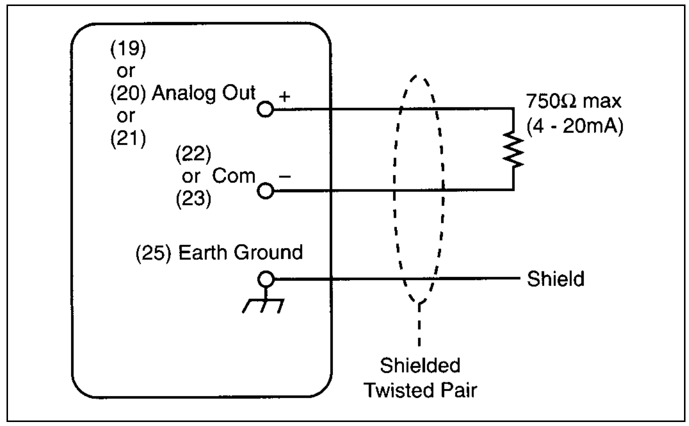


Figure 5-17 Analog Output Connections 4-20 or 0-20mA

5-6.3.3 Full Scale

This determines what value of analog current the preprogrammed maximum value will cause. The choices are:

100% = 20mA
200% = 20mA

The full scale output varies according to the selection (Table 5.5). The goal of the selection is to make 20mA represent a rated measurement (100%) or twice a rated measurement (200%). As discussed in earlier material, the full scale value for currents is the CT primary setting except for the ground current (Ig). Ig has a full scale value equal to the ground CT primary setting. Again, frequency is an exception in that its full scale value at 20mA is 200Hz.

For line-to-line voltages, the full scale value is the product of the incoming line-to-line voltage divided by 120 and PT primary setting. For line-to-neutral voltages, however, the full scale value is that of the line-to-line voltages divided by the square-root of 3.

The full scale value for system powers is three times the line-to-neutral voltage rating times the current rating. In other words, the full scale value of a per-phase watts is the product of the full scale line-to-neutral voltage and full scale current.

For %THD the full scale value is 100% or 200% of the selected item's fundamental frequency.

5-6.3.4 Possible Combinations for Each Analog Output

WARNING

CONNECT THE SHIELD PATH TO A SOLID EARTH GROUND AT THE DEVICE ONLY. IF THE SHIELDS ARE GROUNDED AT A NUMBER OF POINTS, A GROUND LOOP MAY BE CREATED CAUSING HAZARDOUS VOLTAGES TO BE PRESENT ON THE DEVICE'S CHASSIS. FAILURE TO COMPLY WITH THIS WARNING COULD RESULT IN BODILY INJURY OR DEATH.

Table 5.5 Analog Output Combinations

Measured Attribute	Settings for Zero Position and Full Scale	Minimum Output (0-40mA)	Mid-Scale Output (10or 12mA)	Maximum Output (20mA)	Equations (Settings shown in all capitals, see 5-5.3 to 5-5.6)
Frequency of Van (last time it was > 30V)	zero scale	0 Hz	50 Hz	100 Hz	
%THD	100%, zero scale	0%	50%	100%	
%THD zero scale	200%	0%	100%	200%	
Current zero scale	100%	0 A	Irating/2	Irating	Irating = CT PRIMARY RATING or GCT PRIMARY RATING
Current zero scale	200%	0 A	Irating	2*Irating	
Voltage line-to-line	100% zero scale	0 V	VLLrating/2	VLLrating	VLLrating = PRIMARY RATING * INCOMING VLL / 120
System Power	100% zero scale	0 Watts 0 vars 0 VA	SysPwrRating/2	SysPwrRating	SysPwrRating = 3* VLNrating * Irating = (3 * LinePwrRating)
System Power	200% zero scale	0 Watts 0 vars 0 VA	SysPwrRating	2 times the SysPwrRating	
System Power	100% mid-scale	Negative SysPwrRating	0 Watts 0 vars	SysPwrRating	
System Power	200% mid-scale	2* Negative SysPwrRating	0 Watts 0 vars	2 times the SysPwrRating	
System Power Factor (displacement or apparent)	100% mid-scale	Approaches Negative 0	Unity	Approaches +0	Sign convention matches that Of vars. The user may select lagging vars to be represented as positive or negative (see 5-2.2)

Table 5-5 Analog Output Combinations (continued)

Measured Attribute	Settings for Zero Position and Full Scale	Minimum Output (0-40mA)	Mid-Scale Output (10or 12mA)	Maximum Output (20mA)	Equations (Settings shown in all capitals, see 5-5.3 to 5-5.6)
Voltage line-to-line	200% zero scale	0 V	VLLrating	2*VLLrating	
Voltage line-to-neutral	100% zero scale	0 V	VLNrating/2	VLNrating	VLNrating = VLLrating/sqrt(3)
Voltage line-to-neutral	200% zero scale	0 V	VLNrating	2*VLNrating	
Per-Phase Pwr (applies to non- delta systems)	100% zero scale	0 Watts 0 vars 0 VA	LinePwrRating/2	LinePwrRating	LinePwrRating = VLNrating* Irating
Per-Phase Pwr (applies to non- delta systems)	200% zero scale	0 Watts 0 vars 0 VA	LinePwrRating	2 times the LinePwrRating	
Per-Phase Pwr (applies to non- delta systems)	100% mid-scale	Negative LinePwrRating	0 Watts 0 vars	LinePwrRating	
Per-Phase Pwr (applies to non- delta systems)	200% mid-scale	2*Negative LinePwrRating	0 Watts 0 vars	2 times the LinePwrRating	

5-6.4 Relay Output Contacts

Four Form-C (NO/NC) relay contacts are available (Figure **5-18**). Because the relays have both normally open and normally closed contacts, the opposite polarity wiring to the opposite terminal can be chosen. The relays can be independently programmed to (Table **5.6**):

- Be disabled
- Shed a load upon excessive demand
- Act as a pulse initiator
- Indicate a reverse voltage sequence
- Activate upon an event trigger
- Activate upon IMPACC command

Some of these options allow for either a manual reset (via "Reset" pushbutton or discrete input) or auto reset following a specified delay time of zero to 60 seconds.

Each relay output provides three terminals, normally closed, normally open and common. Figure **5-19** shows typical relay output connections.

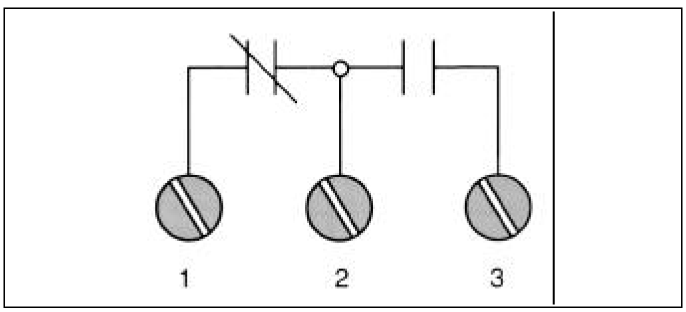


Figure 5-18 Relay Contact with IQ Analyzer De-energized

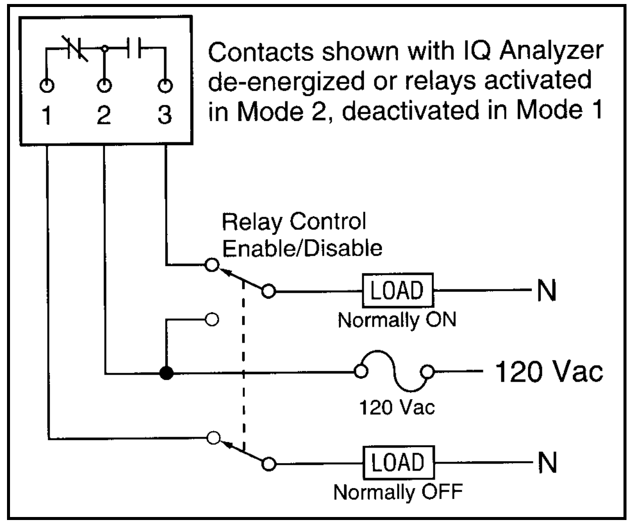


Figure 5-19 Typical Relay Output Connections

Table 5.6 Typical Relay Application Possibilities

Relay Application	Relay Mode	Wired Terminals
Undervoltage, open upon alarm	2	2, 3
Undervoltage, close upon alarm	2	1, 2
Overcurrent, open upon alarm	1	1, 2
Undervoltage, close upon alarm (shunt trip)	1	2, 3
Load shed, open upon alarm, delay power up	2	2, 3
Load shed, open upon alarm	1	1, 2
Low power factor, close to add capacitance	1	2, 3
Reverse sequence, close upon alarm	1	2, 3
Reverse sequence, open upon alarm	1	1, 2
Pulse-Initiator	Either	Either Pair
Alarm only when powered	1	Either Pair
Alarm also when not powered	2	Either Pair

5-6.4.1 Load Shedding

The load can be shed upon demand amps, demand watts, demand reverse watts, demand vars capacitive load, demand vars inductive load, or demand VA. Each load shedding selection has a threshold as if it were a trigger threshold. The relay can only change state on demand window boundaries. For example, with a 15-minute fixed window, the relay can only change state every 15 minutes. For details of demand operation see paragraph 5-7.4

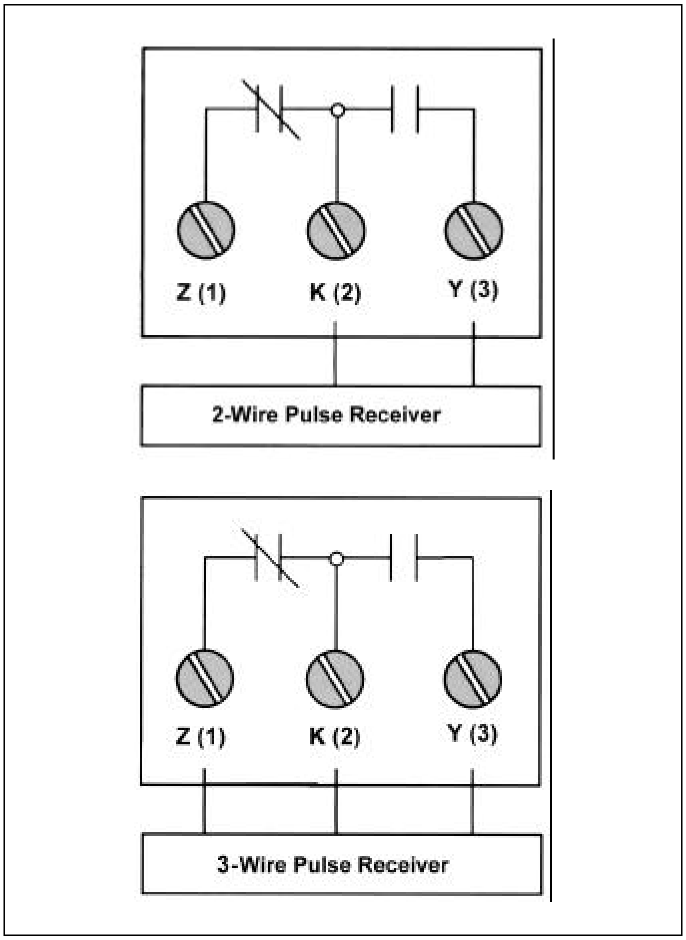


Figure 5-20 Pulse Output Connections

5-6.4.2 Pulse Initiator and Initiator Scale

The relay can serve as a pulse initiator for all energies, whether forward, reverse, real, reactive, or apparent. Upon entering a selection for the pulse initiator, the IQ Analyzer requests a pulse initiator scale factor, which is an integer between 1 and 255. A setting of 1 would cause the relay to change state each 0.6 (Wh, varh, or VAh)*PT ratio *CT ratio. If the current is at the CT primary rating, and the scale factor is 10, the relay changes state every 12 seconds.

NOTICE

Using the pulse initiator with a scale factor of 1 at rated power continuously will wear out the relay within several months. Setting the scale to 100, for example, would extend the relay life by a factor of 100.

The **KYZ** type output can be wired to a 2-wire or 3-wire pulse receiver (Figure **5-20**). Use terminal #3 (K) and terminal #2 (Y) to wire to a 2-wire pulse receiver. Use terminal #3 (K), terminal #2 (Y), and terminal #1 (Z) for a 3-wire pulse receiver.

Normally, energy management systems utilize only two of the three wires available from a KYZ pulse initiator. In a 2-wire application, the associated pulse train looks like alternating open and closed states of a Form-A contact (Figure **5-21**). The pulse resulting from using only one side of the Form-C contact is defined as the transition from OFF to ON. Figure **5-21** identifies these transitions as 1 and 2, with each representing the time when the relay changes from KZ to KY. The receiver counts a pulse at points 1 and 2.

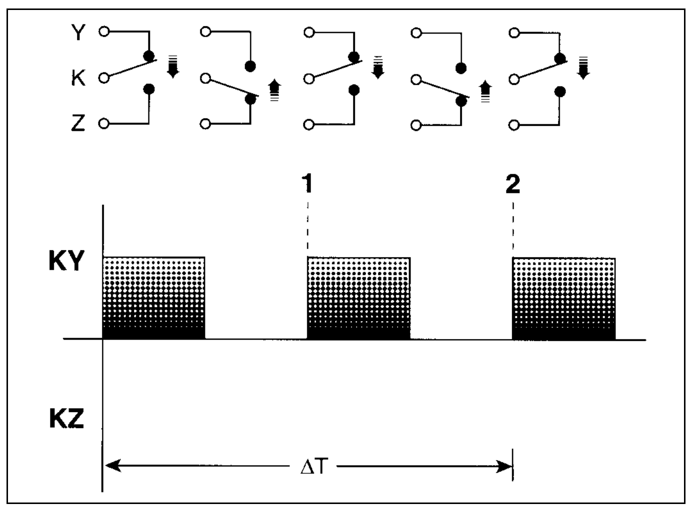


Figure 5-21 2-Wire Pulse Train

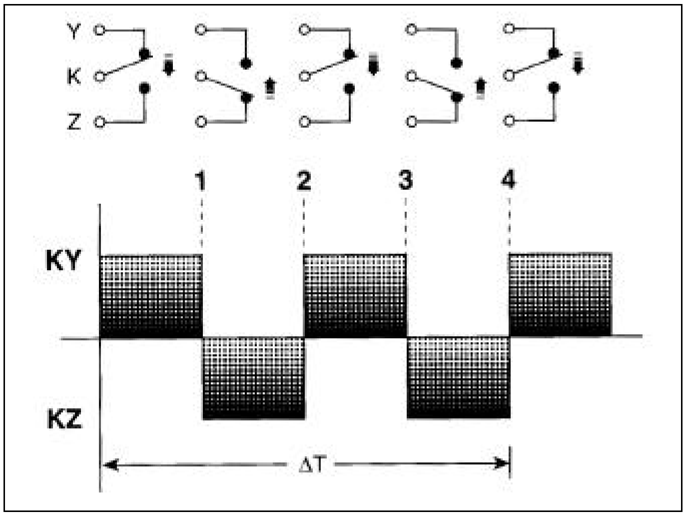


Figure 5-22 3-Wire Pulse Train

Some applications require all three wires from the pulse initiator to wired. In a 3-wire application, the pulses are defined as transitions between KY and KZ (Figure **5-22**). The transitions are identified as 1, 2, 3, and 4, with each transition representing the time when the relay changes from KY to KZ or from KZ to KY. The receiver counts a pulse at points 1, 2, 3, and 4.

5-6.4.3 Event/Discrete Input/NETWORK

Relays can be set for auto or manual reset with a release delay. Each relay can become active from any of the seven triggers that cause events, any of the three discrete inputs, or from an IMPACC command. The relay becomes active when any of the selected items occurs (any item with an asterisk next to it on the display or a checked box in IMPACC software). For example, it may be desirable to have the relay become active when any of several things happens, such as any trigger or discrete input. With auto reset selected, the relay becomes inactive when all selected items become inactive and the additional programmed delay time passes. A **0000 release time** is recommended with IMPACC control.

5-6.4.4 Reverse Sequence Alarm

Relays can be set for auto or manual reset with a release delay. Each relay can serve as a reverse sequence alarm output. On an eight cycle basis, the IQ Analyzer compares the actual phase sequencing with the rotation sequence (ABC or CBA) specified the general setup configuration for three-phase systems. The relay becomes active immediately upon and remains active until reset manually or after the rotation is correct and the set delay has passed.

5-6.4.5 Relay Mode Options

Each relay has a setting that allows the user to choose between MODE 1 (energize relay upon event/alarm) and MODE 2 (release relay upon event/ alarm). Neither mode is ideal for all situations. Mode 2 is ideal as an undervoltage relay while Mode 1 is ideal as an overcurrent relay. The earliest versions of IQ Analyzer only operated in Mode 2 such that the relays were normally energized, but then de-energized upon an event or loss of power to the IQ Analyzer.

NOTICE

A variety of other applications are available for the relays by OR-ing several event triggers or discrete inputs (Table 5.5). For example, a phase loss is a programmable voltage imbalance or current imbalance. Similarly, a single relay can shed upon the OR of high demand current, high demand power, maximum current, magnitude of THD, and discrete input (manual shed).

5-6.4.6 Manual/auto reset (reset delay time)

An additional delay is provided before returning to the inactive state. Refer to Figure 5-26.

5-7 Analysis Modes

The Analysis Mode provides four different categories of detailed information:

- Trend Analysis Information
- Event Analysis Information
- Harmonic Analysis Information
- Demand Analysis Information

Analysis screens for the selected analysis category deliver detailed information concerning the system being monitored in terms relative to the selected category.

Pressing the appropriate function pushbutton F1 through F4 from the "Meter Menu" can quickly access information concerning trends, recorded events, harmonic distortion and demands of current and power (Figure 5-1). Eight lines of text can be displayed on each analysis screen. The F1 through F4 function pushbuttons are always labeled "TRND" (Trend), "EVNT" (Event), "HARM" (Harmonic) and "DEMD" (Demand) respectively in every "Meter Menu" screen. Continuous use of the "Previous Level," "Home" or "Reset" pushbuttons will exit the Analysis Mode being viewed back to the "Meter Menu" screen.

5-7.1 Minimum/Maximum Trend Analysis

From any "Meter Menu" screen, press the F1 (TRND) function pushbutton to access the Trend Analysis screens. These consist of time and date stamped (1 second resolution) minimum and maximum values for the parameters shown in Table 5.7.

Table 5.7 Min/Max Trend Analysis Parameters

Parameter Display	Comments
Min/Max Current	• Phase A, B, C • Neurtral • Ground
Min/Max Voltage	• Phase A-N, B-N, C-N • Phase A-B, B-C, C-A • Neutral - Ground
Min/Max Power	• Real (watts) • Reactive (vars) • Apparent (VA) • Phase A, B, C and System)
Min/Max Power Factor	• Displacement • Apparent • Phase A, B, C and System
Min/Max % and Magnitude THD	• Current (Phase A, B, C, N) • Voltage (Phase A-B, B-C, C-A) (Phase A-N, B-N, C-N)
Min/Max Frequency	• Hz

All minimum and maximum values may be reset via the "Reset" pushbutton, discrete input or communications command. Values are updated at least once every 16 line cycles (Figure 5-23). It should be noted that Trend logging is only available via IMPACC.

```
/MINMAX/AMPS/IG/MAX

      IG =          0.16 AMPS
      12/31/99        3:20:46P


NEXT
PARAM                  MIN    MAX
```

Figure 5-23 Typical Trend Analysis Screen (Ground Current maximum)

```
/EVENT/#1/MTRD
  METERED DATA
IA=            100.00  AMPS
IB=             99.00  AMPS
IC=             97.00  AMPS
IN=              0.00  AMPS
IG=              0.00  AMPS
               PGDWN     LAST
```

Figure 5-24 Typical Event #1 Screen

```
/EVENT/#1/MTRD
  METERED DATA
VAN=            119.0  V
VBN=            120.0  V
VCN=            121.0  V
VAB=            208.0  V
VBC=            209.0  V
FIRST   PGUP   PGDWN     LAST
```

Figure 5-25 Typical Metered Event Voltage Screen

Both %THD and Magnitude THD are offered to maximize the amount of useful information available. In general, Magnitude THD is more informative than %THD. While a 10% harmonic current is 10 amperes when drawing 100 amperes, the percentage often rises when the current draw falls. For example, at night linear loads may be shut down, leaving only harmonic generating loads (the %THD rises). Conversely, the maximum magnitude THD occurs during high demand periods. In summary, the maximum %THD and Magnitude THD occur at different times.

5-7.2 Event Analysis

From any “Meter Menu” screen, press the F2 (EVNT) function pushbutton to access the Event Analysis Screens (Figures **5-24** and **5-25**). The following data can be displayed for up to ten event conditions:

- Description, date and time of event
- Currents, voltages, power readings, frequency and %THD at time of event
- All current and voltage distortion information available at time of event

Event data is stored in non-volatile memory. If a reset threshold is programmed, the duration of the event is also displayed. With the IMPACC communications option and PowerNet software, waveforms and harmonic profiles can be displayed on a personal computer.

Events can be triggered by up to seven Event Conditions shown in Table **5.8**. The seven event triggers and the setting for the number of pre-trigger cycles, which ranges from 0 to 6, are very powerful settings. During programming, the present trigger setting is displayed for each of the seven triggers.

Each trigger causes an event which captures metered, harmonic and waveform data. Normally, one of the seven triggers should be set to manual/IMPACC so that harmonic analysis and waveform capture are available upon request. Most triggers have a trigger threshold, reset threshold, manual reset option, and delay time. However, discrete input manual/IMPACC triggers and min/max have neither thresholds nor delay settings.

NOTICE

If no time delay is programmed, any disturbance lasting 2 cycles (less if the magnitude is sufficient to effect rms readings) will trigger a voltage disturbance event/ alarm.

Refer to Figure **5-26** for a graphical representation of IQ Analyzer’s handling of setting driven alarms. When the trigger threshold has been satisfied for the required trigger delay time, the IQ Analyzer captures all wavefroms and records the date and time. The event is active until the reset threshold is satisfied. The IQ Analyzer clears the event and records the date and time. Following the event, the associated relay remains active for the reset delay time.

Table 5.8 Event Conditions

Condition	General Parmeter Display	Specific Parameter Display
Voltage Disturbance	Undervoltage/sag or dip	Any Voltage L-L Any Voltage L-N
	Overvoltage/swell	Any Voltage L-L(100-150%) Any Voltage L-N(100-150%)
Maximum Thershold Exceeded	% THD (2-1000) (or) Magnitude of THD	Current - Phase A, B, C Any Voltage L-L and L-N
	Demand	Current - Phase A, B, C & N System watts, vars, VA
	Voltage	Neutral to Ground
	Current	Neutral to Ground
Minimum or Maximum Thershold Exceeded	Current	Phase A, B, C
	System Power	watts, vars, VA
	Frequency	Specific
	System Power Factor	Minimum
Voltage Phase Unbalance	Voltage	Any Voltage L-L and L-N
Current Phase Unbalance	Current	Phase A, B, C
Discrete Input Energized	Input	Input 1, 2, 3
IMPACC Command	Command	Through Communications Port
Min/Max Update	Min/Max	Any combination of min/max current, voltage, THD etc.

5-7.2.1 Trigger Threshold

The trigger threshold is the level at which the trigger causes an event. Usually a threshold is shown in actual units (amperes, volts, watts etc.) and as a RAW number. The RAW number is the representation of the setting as stored in the IQ Analyzer’s memory. While it may be tempting to use a formula to determine what RAW number corresponds to a specific threshold, the best approach is much simpler. Merely adjust the RAW

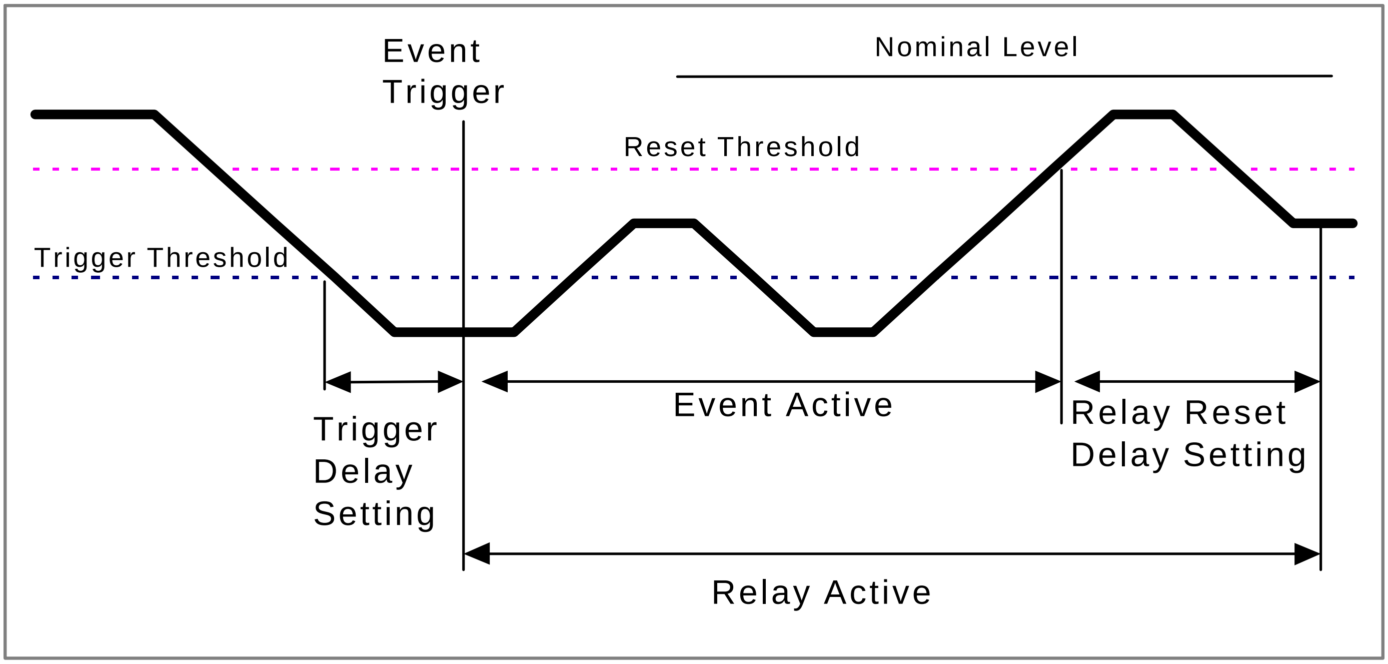


Figure 5-26 Event Trigger, Delay, and Reset Thresholds

number until the real unit threshold value is desirable. For example, with a CT ratio of 5000:5, a RAW number of 40 is 100 amperes and 41 is 102.5 amperes. Continuing with this example, if it is desirable to have a magnitude THD trigger on Ia of 250 amperes, it would be found that the RAW number of 100 corresponds to the desired 250.00 ampere setting. Thresholds whose values are naturally apparent or a percentage, such as %THD, power factor, % current unbalance, % voltage unbalance, and frequency, are shown only as a RAW number.

NOTICE

For a more detailed discussion of RAW number, refer to the glossary in the back of this document.

5-7.2.2 Reset Threshold

The reset threshold makes the trigger ready for another event. This setting applies to both the auto reset only and manual reset. Like the trigger threshold, there is a value in actual units and a RAW number. When the selected measurement is below the reset threshold, the trigger threshold is enabled; otherwise, no event is recorded.

5-7.2.3 Manual/Auto Trigger Reset

The option of manual reset that locks the trigger such that the resulting event cannot be overwritten by a subsequent event. The auto reset selection is the suggested default such that as many as the most recent 10 waveforms of the event can be viewed and the most recent 504 reasons logged.

To use the manual reset (locked-first-occurrence), delete any locked events for that trigger first. That is, the trigger only occurs when the value is below the reset threshold, the value transitions through the trigger threshold, and no locked event exists of that trigger number.

5-7.2.4 Trigger Delay Time

The delay time specifies how long the trigger threshold must be exceeded before causing an event. Depending upon the trigger selection, the delay is either 0.1 to 60 seconds (0.1 second increments) or 0 to 3600 cycles (2 cycle increments). Note that the delay can only be zero for voltage disturbance. For other triggers the threshold must be exceeded for at least two comparisons before an event occurs. Comparisons occur every 2 cycles for voltages and every 8 cycles for currents, power, power factor, frequency, and THD. While any delay can be entered within the range, not all are appropriate. For example, Total Harmonic Distortion (THD) is an attribute associated with a steady state distortion, harmonic distortion implying a periodic waveform. While updates of THD occur every 8 cycles, a delay in the order of seconds is more appropriate.

5-7.2.5 Trigger Settings

The following list of settings are highlighted as potential triggers along with their settings. **Keep in mind that each trigger, where appropriate, has a list of additional settings for trigger threshold, reset threshold, manual/auto reset, and delay just discussed.**

5-7.2.5.1 %THD

On an 8 cycle basis, this trigger takes a snapshot when the entered percentage is exceeded. The raw threshold value is stored as a percentage. This is the most useful for voltages because the %THD of the voltage increases as the voltage sags. That is, the %THD of the voltage is highest when the power quality is at its worst. The parameter options include:
- Ia, Ib, Ic, In
- Van, Vbn, Vcn, Vab, Vbc, Vca
- Worst of Ia, Ib, Ic
- Worst of Van, Vbn, Vcn
- Worst of Vab, Vbc, Vca

5-7.2.5.2 Magnitude THD

This trigger operates on an 8 cycle basis. It is much more useful for currents than %THD. The problem with triggering on a %THD current is that the percentage may rise when the overall current falls. For example, at night when large linear loads are shut down and only fluorescent lighting remains, the overall current is less but the %THD has increased. Conversely, the magnitude THD for current is largest under when the power quality is at its worst. That is, one is more interested in when the harmonic current exceeds 1/10 of the rated current (100 amperes in a 1000 ampere system) rather than 10% of the fundamental current which varies continuously. The parameter options include:
- Ia, Ib, Ic, In
- Van, Vbn, Vcn, Vab, Vbc, Vca
- Worst of Ia, Ib, Ic
- Worst of Van, Vbn, Vcn
- Worst of Vab, Vbc, Vca

5-7.2.5.3 Minimum

This trigger operates on an 8 cycle basis. While the trigger may be set for various currents and powers, it is most useful as a trigger for the displacement power factor or apparent power factor. For example, a trigger may occur as the power factor becomes leading, which indicates too much system capacitance. Ia, Ib, Ic, System (watts, vars, VA, PF displacement, PF apparent).

5-7.2.5.4 Maximum

On an 8 cycle basis, this trigger captures an event when the trigger threshold for the specified current, power or power factor is exceeded. For example, a trigger may occur as the power factor drops to an unhealthy level. Ia, Ib, Ic, In, Is, Vns, System (watts, vars, VA, PF displacement, PF apparent).

5-7.2.5.5 Maximum Demand

This trigger monitors the demand current and powers at each demand subinterval. Note that the current demands update at each current demand interval. The power demands update at each window interval or subinterval, the first of either the IQ Analyzer's internal timer or a sync pulse input (Figure **6-7** and discrete input #1). For example, a sliding demand window with 15 intervals and a subinterval period of 1 minute would update each minute giving the average power over the past 15 minutes. **Setting the trigger threshold with a sliding demand window provides an opportunity to alarm and shed loads several minutes before utility limits will be exceeded.**

As a definition, the **demand interval** is the number of minutes in the average calculation. The **subinterval** is the number of minutes between updates. Ia, Ib, Ic, Iavg, System (watts, vars, VA).

5-7.2.5.6 Voltage Disturbance (Sag or Swell)

On a 2 cycle basis, this trigger detects either a three-phase voltage sag or swell (undervoltage or over-voltage) with a trigger delay time of 0 to 3600 cycles (Figure **5-27**). A trigger occurs for a sag when any of the three-phase line-to-line or line-to-neutral voltages drops below the trigger threshold. When the measured value recovers beyond the reset threshold, the trigger threshold is enabled for a subsequent sag. VLN, VLL.

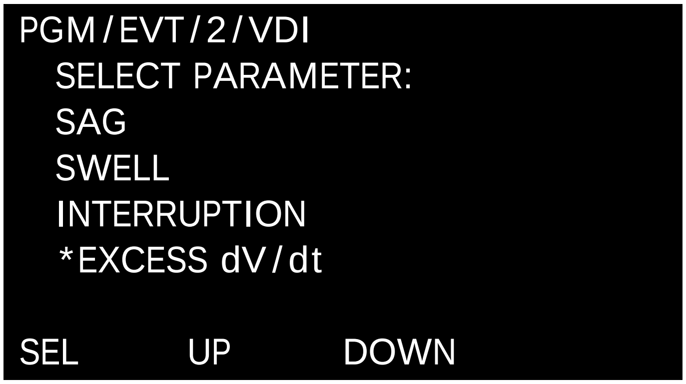


Figure 5-27 Typical Event Voltage Disturbance Screen

5-7.2.5.7 Voltage Disturbance (Interruption or Excess dV/dt) - IQA-6600 Series Only

On a sample by sample basis (32 times per cycle), these triggers detect non-sinusoidal voltages. The intent is to detect poor connections and extreme transients due to lightning or the switching of power factor correcting capacitors while ignoring steady-state distortions.

An interruption trigger occurs when consecutive samples are too close to zero. When sampling a pure Sine wave at 32 times per cycle, it would not be expected to have consecutive samples that are less than 10% of the peak voltage.

An Excess dV/dt trigger occurs when consecutive samples are too far apart. When sampling a pure Sine wave at 32 times per cycle, it would not be expected to have consecutive samples that differ by more than 20% of the peak voltage.

Both the Interruption and Excess dV/dt triggers have internally fixed thresholds that are programmable. These triggers also operate with an auto reset and no delay (neither will create a locked event that cannot be overwritten). Because an individual sample can cause a trigger, the Interruption and Excess dV/dt triggers are much more sensitive than the other triggers within the IQ Analyzer, and some of the recorded events may not be very interesting. The intent, therefore, is not to alarm but to provide waveform information from hard to find events.

Figure **5-28** is an example of a transient captured by the IQ Analyzer at the incoming main, as seen with Waveform Display Software. In this case an internal current transient from capacitor switching causes the voltage disturbance. The same waveforms are available at the IQ Analyzer 6600 Series face.

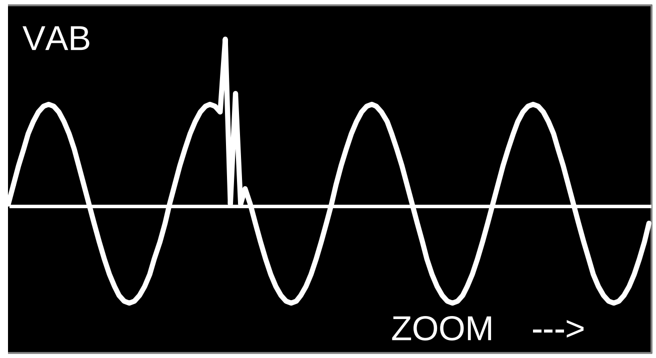


Figure 5-28 Typical Transient Waveform Display on IQA6600 Series

5-7.2.5.8 Frequency Deviation

On an 8 cycle basis the frequency is compared to the system frequency setting (paragraph 5-5.2). An event is triggered when the measured frequency deviates from nominal by the number of specified Hz.

5-7.2.5.9 Current Unbalance

This trigger applies to a three-phase system only. On an 8 cycle basis, the rms currents of the three phases are compared. An event is triggered when the percentage difference between the largest and smallest of the three, relative to the average, is greater than the percentage specified by the setting.

5-7.2.5.10 Voltage Unbalance

This trigger applies to a three-phase system only. On a 2 cycle basis, the rms voltages of the three phases are compared. An event is triggered when the percentage difference between the largest or smallest of the three, relative to the average, is greater than the percentage specified by the setting.

5-7.2.5.11 Discrete Input

Each of the three discrete inputs can trigger an event within 2 cycles of an external contact closure.

5-7.2.5.12 Manual Capture

In most cases, one of the seven triggers should be a manual capture that allows manual requests for waveform capture, either locally or via IMPACC.

5-7.2.5.13 Minimum/Maximum Update

This trigger is not threshold specific like most of the other triggers. Instead, an event is triggered when recorded 8 cycle extremes are exceeded. A menu for this trigger allows the user to select any of min/max voltage, min/max current, min/max power factor, min/max power and frequency, and min/max THD. Any combination of the five can be selected. For example, to trigger events upon extreme voltage or THD conditions, select min/max voltage and min/max THD using the Function pushbuttons (soft keys). Upon the reset of min/max values, the IQ Analyzer records an event and several more events in the first few minutes. As new extremes are detected, new events are captured with decreasing frequency. Normal extremes are likely to be captured after a day or week of operation. Any further recorded events are the extremes of interest.

5-7.3 Harmonic Analysis

From the meter screen, press the F3 (HARM) function pushbutton to access the Harmonic Analysis Screens (Figures 5-29 and 5-30). Two cycles of data sampled at 128 samples/cycle and six cycles of data sampled at 32 samples per cycle are simultaneously recorded for:

- Current - Phase A, B, C, N and G
- Voltage - Phase A-B, B-C and C-A
  Phase A-N, B-N, C-N and V_{NG}

```
/HARMONIC/AMPS
  SELECT PHASE:
    IA
    IB
    IC
    INEUTRAL
    IGROUND
SEL        UP              DOWN
```

Figure 5-29 Typical Amps Selection Phase Screen

```
/HARMONIC/VOLTS/VAB
  #    VOLTS          ANGLE-VAB
  1      208.0            0.0
  2        0.0            0.0
  3        0.5           45.0
  4        0.0            0.0
  5        0.2           60.0
                 PGDWN      LAST
```

Figure 5-30 Typical Volts A-B Screen

Except for VNG, which is generally smaller, magnitudes of each of the above values or their magnitude as a % of the fundamental are displayed. The displays are in odd and even multiples from the fundamental up to the 50th multiple. The phase angles relative to VAB or VAN are also shown. Angles are relative to VAB until a line-to-neutral voltage is viewed. The angles are then relative to VAN.

5-7.4 Demand Analysis

From any “Meter Menu” screen, press the F4 (DEMD) function pushbutton to access the Demand Analysis Screens (Figures 5-31 and 5-32). The following demand data can be displayed:

- Present and Peak Currents - Phase A, B, C andAverage
- Present and Peak System Power
  - Real (watts)
  - Reactive (vars)
  - Apparent (VA)

```
/DEMAND
 SELECT PARAMETER:
 CURRENT – PRESENT DMD
 CURRENT – PEAK DEMAND
 POWER – PRESENT DEMAND
 POWER -- PEAK DMD
 #9 12/24/99 10:30:00P
SEL     UPDOWN
```

Figure 5-31 Demand Analysis #1 Screen

```
/DEMAND/PWR--PRES

 ∑=+            34.0 KW(SYS)
 ∑=+             1.0 KVAR(SYS)
 ∑=+            36.0 KVA(SYS)

WINDOW PERIOD=     1 MIN
```

Figure 5-32 Typical Present Power Demand Screen

```
PGM/DEM/POW/SLID

 SUBDEMAND = 03 MIN
 #INTERVALS = 05
 THE WINDOW PERIOD IS
 THE PRODUCT, (1-60 MINUTES)

- - >      UP   DOWN     ENTER
```

Figure 5-33 Sliding Demand Setpoints Screen

Demand windows are programmable from 1 to 60 minutes. Peak Demands for both current and system power are date and time stamped (one second resolution).

5-7.4.1 Current Demand Window (Fixed Window)

Current demand, which is an average system current over time can be set to average current over a range of 1 to 60 minutes. This is known as a fixed window. For example, setting the current demand window to 15 sets the IQ Analyzer to determine the average current over the past 15 minutes and update the value every 15 minutes.

5-7.4.2 Power Demand Window (Fixed or Sliding Window)

Power demand, can be a fixed window as just described, or a sliding window. That is, a 15 minute average can be obtained that is updated every 3 minutes. To accomplish this, the subdemand interval is set to 3 minutes and the number of intervals to 5 (i.e. 3 minutes times 5 intervals equals 15 minutes) (Figure **5-33**).

NOTICE

The demand interval is the number of minutes in the average calculation. The subinterval is the number of minutes between updates.

The demand settings are adjustable to simulate a variety of thermal time constants. In the discussion of a sliding power demand window, an abrupt change in power achieves 60% of its final value in 9 minutes. Beyond the setting of the IQ Analyzer is the possibility of passing the power or demand power measurement to the analog outputs for analog filtering or to PowerNet for digital filtering.

5-8 Communications

IQ Analyzer is a PowerNet compatible device. PowerNet software can remotely monitor, control, and program the IQ Analyzer.

Communications is made possible by attaching a communications module (IPONI, EPONI, or EPONIF). Since the IQ Analyzer is always supplied with a communications port, any PONI (Product Operated Network Interface) can be easily retrofitted at any time. The PONI modules may be connected to or disconnected from the IQ Analyzer under power without risk of damage to the product (Paragraph 2-3.3 and Figure **2-5**).

5-8.1 IPONI

The IPONI (INCOM Product Operated Interface) is a small, addressable communication module that attaches to the back of the IQ Analyzer. The module can be mounted directly to the back of the Analyzer or to a Power Module that is already mounted on the Analyzer. Addresses and BAUD Rates are established on the IPONI itself. Refer to the instruction details supplied with the IPONI for details.

5-8.2 EPONI and EPONIF

The EPONI is an Ethernet Product Operated Network Interface that attaches directly to the back of the IQ Analyzer. The power module can then be mounted to the EPONI or mounted remotely (36 inches away). The EPONIF is an Ethernet PONI with a 10Base-FL (fiber-optic) interface. Refer to the instruction details supplied with the EPONI for details.

5-8.3 PowerNet Software Suite

Regardless of the type of PONI chosen, PowerNet offers a two-tiered communication system that is based on an Ethernet backbone and an INCOM frequency carrier signal, running inside equipment rooms. The Ethernet backbone follows standard Ethernet wiring rules, allowing a mix of CAT5 cable and Fiber-based networks. The INCOM signal may extend up to 10,000 feet and connect 200 devices through a NetLink to the Ethernet backbone.

The PowerNet Software Suite provides the ability to monitor and record power distribution system data as it occurs. PowerNet is a Microsoft™ Windows® 95/98/NT compatible application featuring user-friendly, menu-driven screens.

5-8.4 PowerNet Graphics

PowerNet Graphics software provides the capability to generate custom animated color graphics. For example, animated one-line drawings of electrical power distribution systems, flow diagrams of processes, equipment elevation view, and other graphical representations can be developed.

5-8.5 Connectivity

A computer running the PowerNet Software Suite can interface with other networks. Examples of connectivity interfaces include:

- PLCs (Programmable Logic Controllers)
- DCSs (Distributed Control Systems)
- BMSs (Building Management Systems)
- PC-based graphical operator interface programs

5-9 IQ Analyzer 6600 Series Graphic Displays

In addition to all the features of the IQ Analyzer 6400 Series, the IQ Analyzer 6600 Series provides event graphic displays from the faceplate.

Under EVNT (pushbutton F2), the IQ Analyzer displays the ten most recent events, or older events if they are locked and require a manual reset. For a particular event, the IQA-6400 Series offers two items, METERED VALUES and HARMONIC VALUES. The IQA-6600 Series offers two additional items, GRAPHIC WAVEFORM and HARMONIC SPECTRUM.

5-9.1 Graphic Waveform

GRAPHIC WAVEFORM displays the waveform captured as a result of an event. There is a menu of the 11 currents and voltages that were simultaneously sampled and saved at the time of the event. Upon the selection of an item, the IQ Analyzer displays the first cycle of high speed sampled data captured as a result of the trigger event. Pressing "-->" (F4 pushbutton) pans to the second cycle, and "ZOOM" (F3 pushbutton) displays the first four saved cycles (Figure **5-34**). While in zoom, pressing "-->" (F4 pushbutton) pans to the second set of four cycles. In either case, pressing "<--" (F1 pushbutton) returns to the first cycle or first four cycles. The high speed sampled data is indicated with the dotted portion of the display axis. An experienced user can often determine the source of an electrical problem from the shape of the captured waveform. Pressing the "Previous Level" or "Home" pushbuttons exits the graphic waveform display.

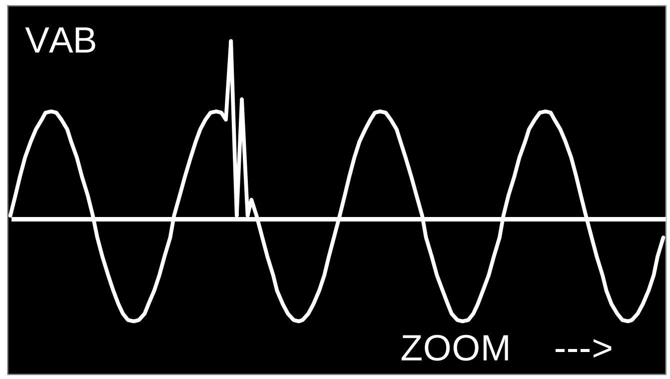


Figure 5-34 Typical Captured Waveform

5-9.2 Harmonic Spectrum

HARMONIC SPECTRUM displays a graphic representation of harmonic values. An experienced user who quickly finds the largest harmonic can often identify electrical problems from the harmonic signature. The primary display shows the fundamental as 100% along with harmonics through the 21st (Figure **5-35**). Pressing "-->" (F4 pushbutton) advances the display to show harmonics 22nd through 42nd. One additional press advances to show harmonics 43rd through 50th. Finally, one more press of "-->" displays the first 21 harmonics again. Pressing the "Previous Level" or "Home" pushbuttons exits the graphic waveform display.

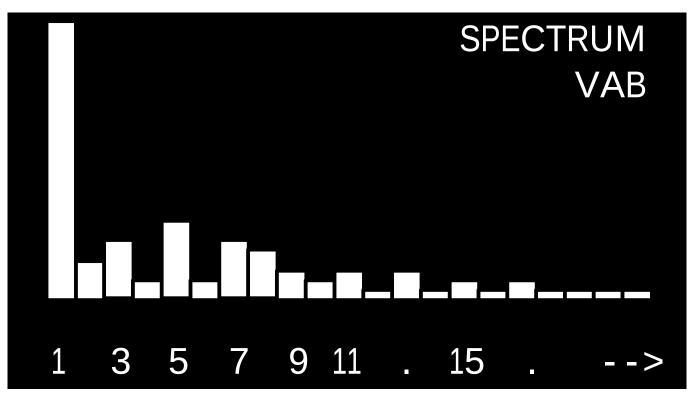


Figure 5-35 Typical Harmonic Spectrum Display

5-10 Reset Mode

Pressing and releasing the "Reset" pushbutton prompts the password protected Reset Display Screen, allowing an operator to:

- Reset Peak Demands or Energy
- Reset Minimum/Maximum Values
- Reset Relay Outputs
- Reset Triggers/Events, or Event Logs

Resets may also be programmed to operate through a discrete input contact(s) and the communications port.

Like the programming category screens trees in Section 6, the Reset Mode can take the form of a screens tree with a number of levels (Figure **5-36**). This screens trees presents an overview of what can be accomplished while in the Reset Mode.

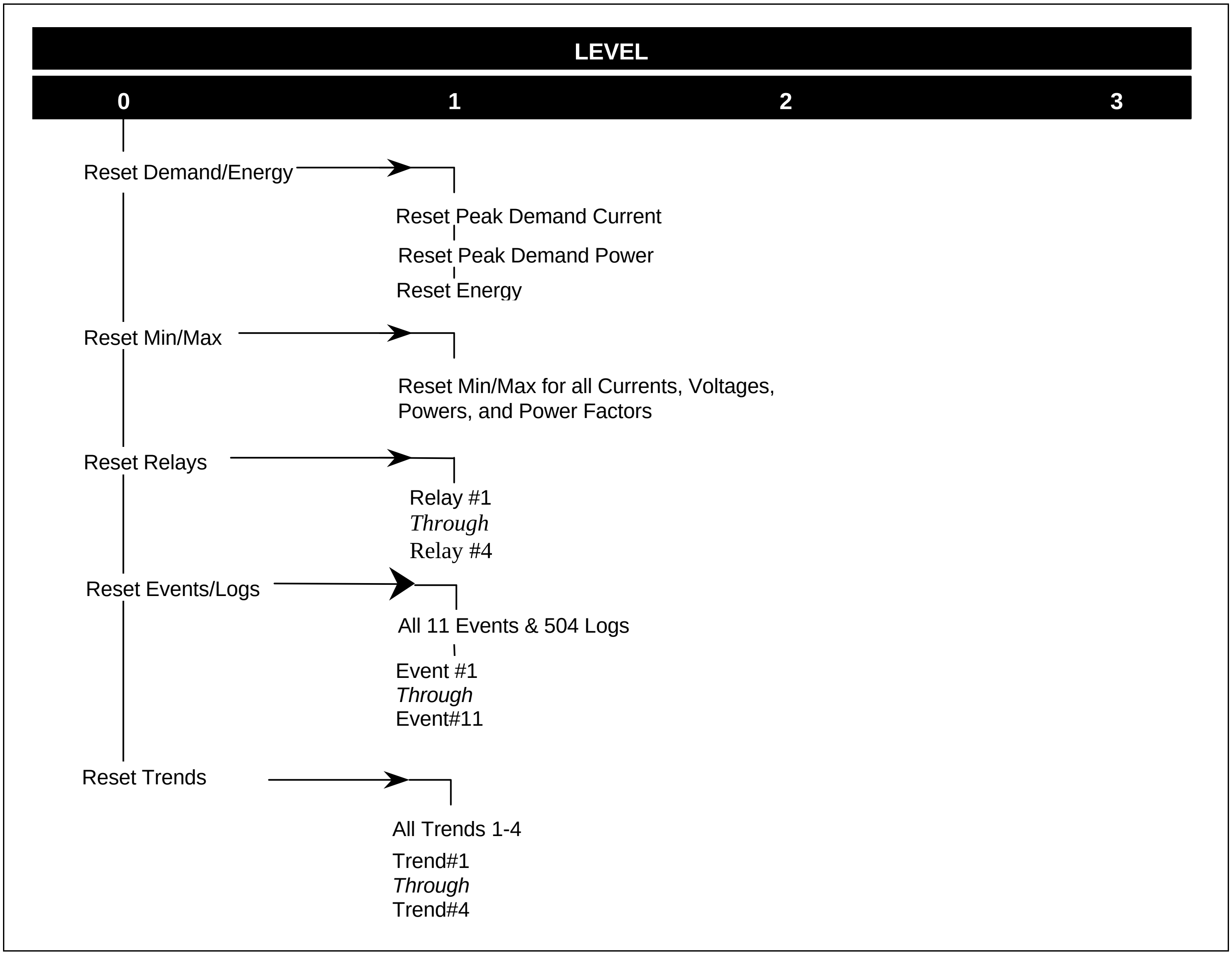


Figure 5-36 Typical Harmonic Spectrum Display

SECTION 6: PROGRAMMING

6-1 Introduction

CAUTION

SELECTED OR ALTERED SETTINGS ARE NOT SAVED UNTIL "ENTER" IS PRESSED. THE F4 FUNCTION PUSHBUTTON ACTS AS THE ENTER BUTTON AND IS IDENTIFIED AS SUCH ON THE APPROPRIATE SCREENS. SETTINGS ARE NOT PERMANENTLY SAVED IN EEPROM UNTIL THE EXIT OF PROGRAM MODE. THE SAVE PROCESS OCCURS IN THE BACKGROUND AND MAY TAKE AS LONG AS 20 SECONDS.

The IQ Analyzer is fully programmable from the device's faceplate or through the communications port. Programming is password protected whether the programming function is being performed directly from the faceplate or through a remotely located computer.

To simplify programming, settings are organized by category. Categories not pertinent to the application at hand may be ignored. Categories are selected by the F1-F4 Function Pushbuttons. These four pushbuttons take on their own unique identity in the Program Mode as indicated directly above each pushbutton in the IQ Analyzer display window. In addition, immediate programming assistance is available through the use of the Help Pushbutton and associated Help Screens. Refer to Paragraph 3-4 for more information about the F1-F4 Function and Help Pushbuttons (Figure **2-1**).

The complete programming function is comprised of a number of programming screens for 10 different programming categories (Table **6.1**).

Programming within each individual category follows a screen hierarchy (screens tree) starting with the top level screen in the hierarchy (Level 1) and proceeding down through the remaining screens. The number of different screens or levels in the hierarchy depends upon the specific category being programmed.

The rest of this section presents the programming function by:

1. Discussing the general requirements and steps associated with programming, no matter which category is being programmed. In many instances, this is all the information that will be required to perform a number of programming steps. Refer to paragraph 6-2 entitled "Common Programming Procedures."
2. Taking the operator through a programming example. The example will cover most of the situations encountered during programming. Refer to paragraph 6-3 entitled "Programming Example."
3. Outlining the specifics within each programming category in terms of its own specific screen hierarchy (screens tree). Although programming within different categories is similar, the specific fields encountered in each category are presented. This will prepare the operator for the types of information that will be necessary to program any or all categories. Refer to paragraph 6-4 entitled "Programming Categories."

NOTICE

If more detailed information is needed about a specific programming category before actually beginning the programming process, refer to paragraph 5-4 entitled "Programming Mode" for a more in depth discussion of what each category is and what it offers.

6-2 Common Programming Procedures

Once the operator becomes familiar with the operator panel and the logical sequence of repetitive steps associated with programming, the IQ Analyzer can be programmed quickly and easily (Figure **2-1** and Section 3).

Table 6.1 Programming Categories

Categories	References	
	Paragraph	Figure
General Setup	5-5	6-4
Analog Input Settings	5-6.2	6-5
Analog Output Settings	5-6.3	6-6
Discrete Input Settings	5-6.1	6-7
Event Trigger Settings	5-7.2	6-8
Relay Output Settings	5-6.4	6-9
Demand Settings	5-7.4	6-10
Display Manager	5-2.3	6-11
Trend Settings	5-11.3	6-12
Time of Use Settings	5-13.2	6-13

6-2.1 Entering Program Mode

The Program Mode can be entered at any time the IQ Analyzer is in operation by pressing the Program Pushbutton. At the top of the unit, the Program LED will be continuous red and the Normal LED blinking green. The top level program screen will be displayed (Figure **6-1**). The active parameter in the display blinks while other parameters are constant. Just as with other mode screens, the operator is required to make Program Mode decisions as instructed by the active menu driven display.

6-2.2 Password Entry

The initial top level screen, which is a “go” or “no go” screen, includes the software version, time/date of last programming and password entry fields (Figure **6-1**). The correct password must be entered to proceed beyond this point. The password entry field contains five digits that can be changed. Default passwords **10000** or **44444** can be used on initial powerup and until a new password is programmed by the user. Establishing a new password is accomplished in the General Setup portion of programming (Figure **6-4**). The F1-F4 Pushbuttons have their specific functions for this screen defined directly above in the IQ Analyzer display (Table **6.2**). If the correct password is not entered, the IQ Analyzer automatically exits the Program Mode and returns to the Meter Menu. If the correct password is entered, the IQ Analyzer moves to the next sequential screen and programming can continue. The next two screens (Program Mode Top Level Menu) display the eight available programming categories previously outlined in Table **6.1** and discussed in paragraph 6-4.

```
PGM-MAIN
  LAST PROGRAMMED
  01/30/00     04:29:28:43P
  INCOM ADDR: 000
  IQA6600 SERIES     2.00
  ENTER PASSWORD:  00000
  (10000=  DEFAULT PASS)
  -->      UP     DOWN    ENTER
```

Figure 6-1. Top Level Screen Showing Password Entry Field

6-2.3 View Only Password

If the five digit password entered is all zeros, viewing of all existing (previously programmed) programming category setpoints is permitted. An asterisk (*) appears next to all previously chosen settings to clearly indicate how the unit is presently programmed. Existing setpoints cannot, however, be altered with the all zero password entered into the password field. In addition, the “View Only” message flashes in the display to remind the user that any changes made will not be saved.

6-2.4 Movement to Previous Levels

During programming, use of the Previous Level Pushbutton moves the display back one level at a time. Use of the Home Pushbutton moves the display all the way back to the Program Mode Top Level Menu, no matter where the operator is in the programming process.

Table 6.2 F1-F4 Pushbutton Functions During Password Entry

Display	⇨	**UP**	**Down**	**Enter**
Function Pushbutton	F1	F2	F3	F4
Defined Function	Makes Next Digit to Right Active (Blinking) Digit	Increases Blinking Digit	Decreases Blinking Digit	Enters Password

NOTICE

Care should be exercised not to inadvertently exit Programming by pressing Previous Level one too many times.

6-2.5 Exiting Program Mode

The Program Mode is exited in five different ways:

1. Press and release Program Pushbutton.
2. Press and release Reset Pushbutton.
3. Press and release Home or Previous Level Pushbuttons while in top level program screen.
4. Enter incorrect password in Program Mode top level screen and return automatically to Main Meter Menu.
5. Perform no programming activity for a user defined timeout period and return automatically to Main Meter Menu. The default timeout period is 15 minutes.

6-3 PROGRAMMING EXAMPLE

The programming example will take the operator through steps in several programming categories. It is intended to familiarize the operator with pushbutton operation and the types of screens encountered during programming. The example is presented as a Flow Chart with Supporting Screens (Figure **6-2**). Since IQ Analyzer programming is a simple and logical sequence of repetitive steps, the Flow Chart Example, in many instances, provides enough familiarity to begin actual programming. If after completing the programming example the operator feels more information is required to be at an acceptable comfort level, additional programming details are offered in paragraph 6-4 entitled “Programming Categories.”

To Facilitate Programming:

- Gather all necessary data to fill in the “Startup Settings Sheets” (Appendix A) ahead of time.
- Review the material presented in Paragraph 6-2 entitled “Common Programming Procedures.”
- If necessary, review the setting possibilities for individual programming categories presented in Appendix A.

For this example, parameters in the General Setup (Figure **6-4**), Discrete Inputs (Figure **6-7**), Event Triggers (Figure **6-8**) and Relay Outputs (Figure **6-9**) Categories will be programmed. The example will begin by entering the Program Mode from the Main Meter Menu and exit back to the Main Meter Menu upon completion.

Programming Reminders:

1. Using the Enter Pushbutton enters (programs) a parameter and returns the display to the most recent previous level where programming can continue.
2. The Previous Level Pushbutton is used to move back one screen at a time. Remember, this push-button will exit programming once at the top level of the Program Mode.
3. Depending upon the function being performed at a given time, the F1-F4 Function Pushbuttons will have one of two sets of definitions (Table **6.3**).
4. A blinking parameter indicates which parameter is active for a decision. The decision will be to accept the blinking parameter, change the blinking parameter or establish a new active (blinking) parameter.
5. A screen’s top line description indicates which screen in the programming screens trees is being viewed.
6. An asterisk (*) appears next to a chosen setting to clearly indicate what is presently programmed.

NOTICE

Before programming an IQ Analyzer, review Potential Transformer in the glossary, whether or not the system uses potential transformers.

6-3.1 Programming Example Input

This example will show how to set up an IQ Analyzer to:

- Meter a typical load on a 480 volt, 3 phase 3 wire (ABC phase rotation), 60 hertz system with 1200/5 CTs, 50/5 ground CTs and no PTs.

NOTICE

If there are no PTs, the PT ratio must be programmed as 120:120, a ratio of unity.

- Record an event of 10% or more %THD (Total Harmonic Distortion) on phase A with a 2 second time delay
- Activate a relay to shed a peak demand of 1000A.

Excerpts from the Startup Settings Sheets (Appendix A) showing the data necessary for programming the IQ Analyzer for this application example are shown in Table **6.4**.

6-4 Programming Categories

Once a password has been accepted, the IQ Analyzer advances automatically to the next level displaying the Program Mode Top Level Menu (Figure **6-3**). Keep in mind that the Help Pushbutton is functional in the Program Mode.

Programming Categories are presented as a series of Screens Trees which identify all the available programming selections within each programming category (Paragraph 6-4.2 and Figures 6-4 through 6-11). Some of the Screens Trees are simple with only one level of selections, while other trees cover as high as five levels of selections. The most important aspect to understand about Screens Trees during programming is - they only differ in size. The category with the largest Screens Tree is programmed in exactly the same manner as the category with the smallest Screens Tree.

Any programming category not applicable to a particular application can be easily by-passed. Advancing past all of the programming categories will return the display back to the first category.

6-4.1 Use of F1-F4 Pushbuttons

The F1-F4 Function Pushbuttons are the key tools to the programming process. Their exact functions during programming are always identified directly above in the

Table 6.3 F1-F4 Pushbutton Functions During Programming

Display 1 Entering a Setpoint Value

Display	**UP**	**UP**	**Down**	**PGDN**①	**Top**
Function Pushbutton	F1	F2	F3	F4	F4
Defined Function	Select a Blinking Parameter	Moves Up List of Previous Parameters	Moves Down List of Additional Parameters	Moves To Next Screen of Parameters	Top Moves Back to Previous Screen

Display 2 Parameter Selection

Display	⇨	**UP**	**Down**	**Enter**
Function Pushbutton	F1	F2	F3	F4
Defined Function	Makes Next Digit to Right Active (Blinking) Digit	Increases Blinking Digit	Decreases Blinking Digit	Enters Password

① "PGDN" will appear in the display only if there are too manyparameters for one screen. "PGDN" will move directly to the next screen to eliminate the need for stepping through individual displayed parameters.

Note: 1. F1, F2 and F3 pushbuttons will continuously wrap around if held depressed.
2. Sometimes the F1 or F2 pushbuttons are not defined in the display. This only means they have no function for that particular screen, and do nothing if pushed and released.

IQ Analyzer display and direct the operator's actions. The four pushbuttons as a group can have two different defined functions during this process (Table **6.3**). The first defined function for pushbuttons F1-F4 is parameter selection from a list of parameters. The second defined function for pushbuttons F1-F4 is the entering of a specific setpoint value. If a particular Function Pushbutton is not defined in the display, it only means that particular pushbutton has no function for that screen.

6-4.2 Programming Category Screens Trees

Each programming category takes the form of a screens tree (screen hierarchy) with a number of different descending levels and selections. Use of the F1-F4 pushbuttons as defined in the display moves the operator through the selected category tree and programmable parameters. Figures **6-4** through **6-11** show the actual screens tree for each of the eight programming categories.

Parameters of the same level are displayed at the same time, although it may take more than one screen to display one entire level of parameters. For example, all Level 1 parameters appear at the same time and a selection is made from all the displayed Level 1 parameters. Level 2 parameters are displayed next followed by Level 3.

To ensure there is a complete understanding of the Screens Tree concept, additional details are offered in the next paragraph (6-4.3).

6-4.3 Screens Tree Details

Appendix A highlights the available setpoint selections. This information is helpful in three respects:

1. It further defines the Screens Trees shown in Figures **6-4** through **6-11**.

2. It assists with completing the "Startup Settings Sheets" of Appendix A.

3. The entire programming process is facilitated when exact programming information is collected and recorded on the "Startup Settings Sheets" prior to actually programming the IQ Analyzer.

Table 6.4 Startup Settings Sheets Excerpts

Programming Example Setpoints	Programming Category Display	Selected Setpoints
General Setup Setpoints (Figure 6-4)		
1	Choose Type of System	3 phase/3 wire
2	Phase Rotation	ABC Phase Rotation
3	Choose Frequency	60Hz
4	Set Incoming L-L Voltage	480 Volts
5	Set PT Primary Rating	120:120
6	Set CT Primary Rating	1200A:5
7	Communication Mode	IQA6400/6600
Discrete Inputs Setpoints (Figure 6-7)		
1	Discrete Inputs	Sync. Input
Event Triggers Setpoints (Figure 6-8)		
1	% THD	IA
2	Trigger Threshold	10%
3	Delay Time	2 seconds
Relay Outputs Setpoints (Figure 6-9)		
1	Demand Amps	1000A

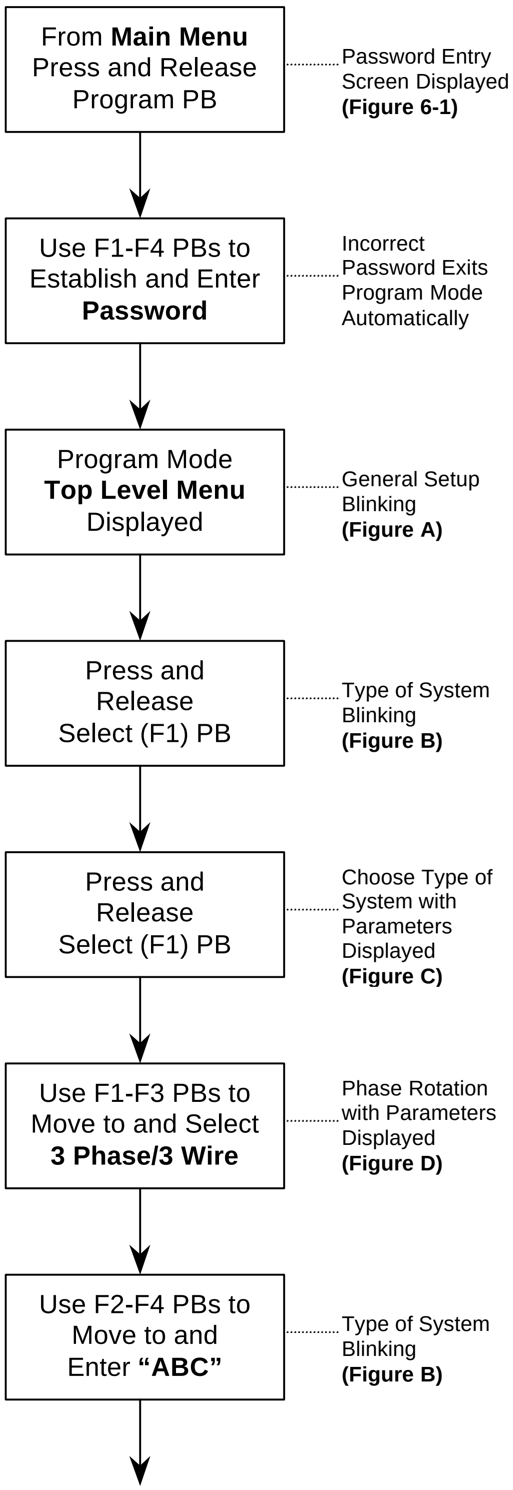


Figure 6-2. Programming Example Flow Chart

```
PGM
 CHOOSE CATEGORY:
  GENERAL SETUP
  ANALOG INPUTS
  ANALOG OUTPUTS
  DISCRETE INPUTS
  EVENT TRIGGERS
SEL    UP    DOWN    PGDN
```

Figure A Typical Top Level Menu Screen

```
PGM/GEN
 SELECT PARAMETER:
 TYPE OF SYSTEM
 FREQUENCY
 INCOMING L-L VOLTAGE
 PT PRIMARY RATING
 CT PRIMARY RATING
SEL    UP    DOWN    PGDN
```

Figure B Typical General Setup Screen

```
PGM/GEN/TYPE
  3 PHASE/4 WIRE
* 3 PHASE/3 WIRE
  SINGLE PHASE/3 WIRE
  SINGLE PHASE/2 WIRE

SEL    UP    DOWN
```

Figure C Typical Choose Type of System Screen

```
PGM/GEN/TYPE/3PH3W
* ABC - PHASE ROTATION
  CBA - PHASE ROTATION

       UP    DOWN    ENTER
```

Figure D Typical Phase Rotation Screen

1. Use F2 or F3 PBs to Move to **Frequency** — Frequency Blinking **(Figure E)**
2. Press and Release Select (F1) PB — Frequency Choices Displayed **(Figure F)**
3. Use F2-F4 PBs to Move to and Enter **60Hz** — Frequency Blinking **(Figure E)**
4. Use F2 or F3 PBs to Move to **Incoming Line-Line Voltage** — Incoming L-L Voltage Blinking **(Figure E)**
5. Press and Release Select (F1) PB — L-L Voltage Rating with 3 Digits Displayed **(Figure G)**
6. Use F1-F4 PBs to Establish and Enter **480 Volts** — Incoming L-L Voltage Blinking **(Figure E)**
7. Use F2-F4 PBs to Move to **PT Primary Rating** — PT Primary Rating Blinking **(Figure E)**

```
PGM/GEN
 SELECT PARAMETER:
 TYPE OF SYSTEM
 FREQUENCY
 INCOMING L-L VOLTAGE
 PT PRIMARY RATING
 CT PRIMARY RATING
SEL     UP      DOWN     PGDN
```

Figure E Typical General Setup Screen

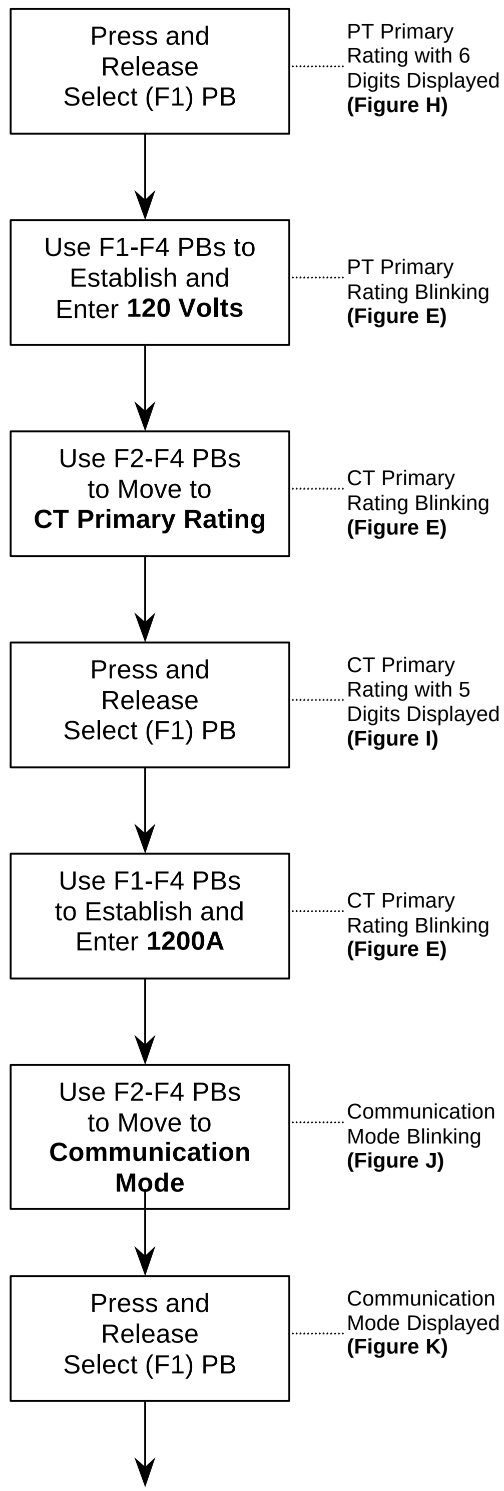
```
PGM/GEN/FREQ
        25 HZ
        40 HZ
        50 HZ
        60 HZ
*

        UP      DOWN     ENTER
```

Figure F Typical Choose Frequency Screen

```
PGM/GEN/INVOLT
  INCOMING L-L VOLTAGE
  APPLIED TO VOLTAGE
  INPUT TERMINALS A, B,
  C, N OF IQ ANALYZER
  (100 to 600 VAC):
                  480
-->     UP      DOWN     ENTER
```

Figure G Typical Incoming L-L Voltage Screen

Figure 6-2. Programming Example Flow Chart (continued from previous page)




```
PGM/GEN/PT
 PT PRIMARY L-L RATING
   120 TO 500,000 V
  ( SEE USER'S MANUAL IF
   NOT USING 120V
   SECONDARY PTS)
            000120:120
-->     UP      DOWN     ENTER
```

Figure H Typical PT Primary Rating Screen

```
PGM/GEN/CT
 CURRENT TRANSFORMER
 PRIMARY RATING:
  5 TO 10,000 AMPS
  ( MUST BE 5 AMP
   SECONDARY CT )
            01200:5
-->     UP      DOWN     ENTER
```

Figure I Typical Set CT Rating Screen

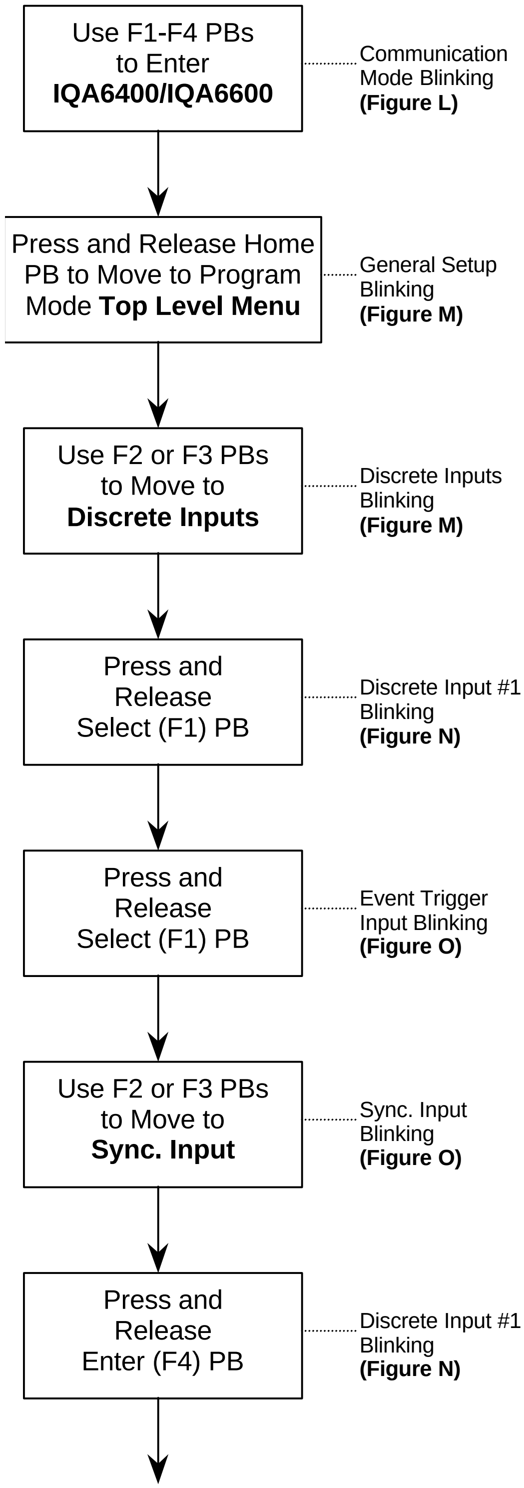
```
PGM/GEN
 SELECT PARAMETER:
 GND CT PRIMARY RATING
 PROGRAMMING OPTIONS
 POWER/ENERGY OPTIONS
 COMMUNICATION MODE
 CHANGE DATE AND TIME
SEL     UP      DOWN     PGDN
```

Figure J Second General Setup Screen

```
PGM/GEN/COMM
 COMMUNICATION MODE:
        IQA6000/6200
*       IQA6400/6600



SEL     UP      DOWN     PGDN
```

Figure K Typical Set GND CT Rating Screen

Figure 6-2. Programming Example Flow Chart (continued from previous page)




```
PGM/GEN
 SELECT PARAMETER:
 GND CT PRIMARY RATING
 PROGRAMMING OPTIONS
 POWER/ENERGY OPTIONS
 COMMUNICATION MODE
 CHANGE DATE AND TIME
 SEL    UP      DOWN     PGDN
```

Figure L Second General Setup Screen

```
PGM
 CHOOSE CATEGORY:
  GENERAL SETUP
  ANALOG INPUTS
  ANALOG OUTPUTS
  DISCRETE INPUTS
  EVENT TRIGGERS
 SEL    UP      DOWN     PGDN
```

Figure M Typical Top Level Menu Screen

```
PGM/DIN
 SELECT INPUT:
 DISCRETE INPUT 1
 DISCRETE INPUT 2
 DISCRETE INPUT 3

 SEL    UP      DOWN
```

Figure N Typical Discrete Inputs Screen

```
PGM/DIN/1
   CHOOSE CATEGORY:
   EVENT TRIGGER INPUT
   RESET INPUT
 * SYNC INPUT


        UP      DOWN     ENTER
```

Figure O Typical Discrete Input #1 Screen

Figure 6-2. Programming Example Flow Chart (continued from previous page)

Press and Release Home PB to Move to Program Mode **Top Level Menu** — General Setup Blinking **(Figure P)**

↓

Use F2 or F3 PBs to Move to **Event Triggers** — Event Triggers Blinking **(Figure P)**

↓

Press and Release Select (F1) PB — # Pre-Trigger Cycles Blinking **(Figure Q)**

↓

Use F2-F4 PBs to move to **T1= Manual Captue** — T1= Manual Capture Blinking **(Figure Q)**

↓

Press and Release Select (F1) PB — Not Used Blinking **(Figure R)**

↓

Use F2 or F3 PBs to Move to **% THD** — % THD Blinking **(Figure R)**

↓

Press and Release Select (F1) PB — IA Blinking **(Figure S)**

↓

Figure 6-2. Programming Example Flow Chart (continued from previous page)

```
PGM
 CHOOSE CATEGORY:
  GENERAL SETUP
  ANALOG INPUTS
  ANALOG OUTPUTS
  DISCRETE INPUTS
  EVENT TRIGGERS
SEL    UP    DOWN    PGDN
```

Figure P Typical Top Level Menu Screen

```
PGM/EVT
 SELECT PARAMETERS:
 PRE-TRIGGER CYCLES
 T1= MANUAL CAPTURE
 T2= UNUSED TRIGGER
 T3= UNUSED TRIGGER
 T4= VOLTAGE SWELL (L-N)
SEL    UP    DOWN    PGDN
```

Figure Q Typical Event Triggers Screen

```
PGM/EVT/1
CHOOSE ONE EVT CAUSE:
  NOT USED
  MAGNITUDE THD
  % THD
  MINIMUM
  MAXIMUM
SEL    UP    DOWN    PGDN
```

Figure R Typical Event Triggers #1 Screen

```
PGM/EVT/1/%THD
   SELECT PARAMETER:
*  IA
   IB
   IC
   IN
   VAN
SEL    UP    DOWN    PGDN
```

Figure S Typical % THD Screen

1. Press and Release Select (F1) PB — Trigger Threshold Blinking **(Figure T)**
2. Press and Release Select (F1) PB — Trigger Threshold with 4 Digits Displayed **(Figure U)**
3. Use F1-F4 PBs to Establish and Enter **10%** — Trigger Threshold Blinking **(Figure T)**
4. Use F3 PB to move to **Delay Time** — Delay Time Blinking **(Figure T)**
5. Press and Release Select (F1) PB — Delay Time with 3 Digits Displayed **(Figure V)**
6. Use F1-F4 PBs to Establish and Enter **2 Seconds** — Delay Time Blinking **(Figure T)**
7. Press and Release Home PB to Move to Program Mode **Top Level Menu** — General Setup Blinking **(Figure W)**

```
PGM/EVT/1/%THD/IA
  SELECT PARAMETER
 TRIGGER THRESHOLD
 RESET THRESHOLD
 RESET (MANUAL/AUTO)
 DELAY TIME

SEL     UP      DOWN
```

Figure T Typical Trigger Threshold Screen

```
PGM/EVT/1/%THD/IA/TT

        TRIGGER THRESHOLD:

         RAW THRESHOLD:
              0010

-->     UP      DOWN     ENTER
```

Figure U Typical Trigger Threshold Screen

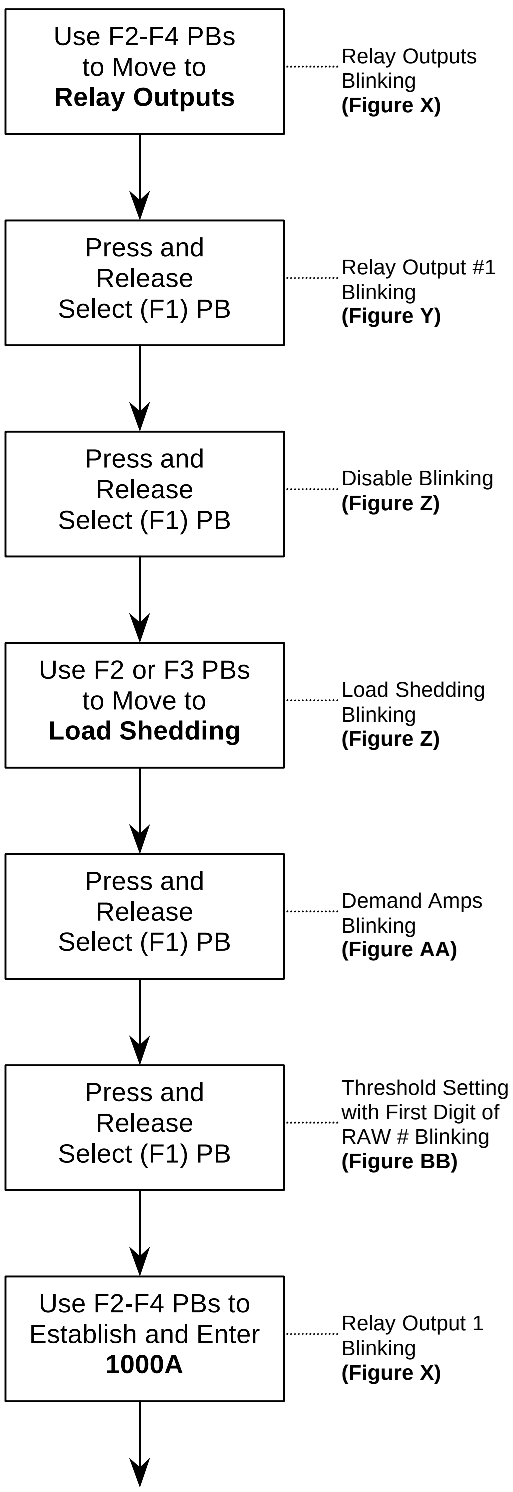
```
PGM/EVT/1/%THD/IA/DT

        DELAY TIME SETTING:
         ( 0.1 TO 60 SECS )

              02.0

-->     UP      DOWN     ENTER
```

Figure V Typical Delay Time Screen

```
PGM
 CHOOSE CATEGORY:
  GENERAL SETUP
  ANALOG INPUTS
  ANALOG OUTPUTS
  DISCRETE INPUTS
  EVENT TRIGGERS
SEL     UP      DOWN     PGDN
```

Figure W Typical Top Level Menu Screen

Figure 6-2. Programming Example Flow Chart (continued from previous page)




```
PGM
 CHOOSE CATEGORY:
  ANALOG INPUTS
  ANALOG OUTPUTS
  DISCRETE INPUTS
  EVENT TRIGGERS
  RELAY OUTPUTS
SEL    UP     DOWN    PGDN
```

Figure X Second Level Menu Screen

```
PGM/ROUT
 SELECT PARAMETER:
 RELAY OUTPUT 1
 RELAY OUTPUT 2
 RELAY OUTPUT 3
 RELAY OUTPUT 4
 RELAY MODE OPTIONS
SEL    UP     DOWN
```

Figure Y Typical Relay Outputs Screen

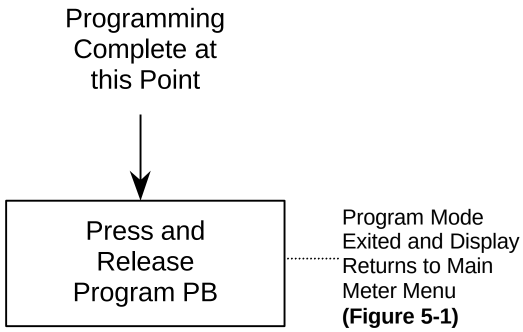
```
PGM/ROUT/1
 CHOOSE CATEGORY:
 DISABLE
*LOAD SHEDDING
 PULSE INITIATOR
 EVENT/ALARM/IMPACC
 REVERSE SEQ ALARM
       UP     DOWN    ENTER
```

Figure Z Typical Relay Output #1 Screen

```
PGM/ROUT/1/LS
 SELECT PARAMETER:
*DEMAND AMPS
 DEMAND FORWARD WATTS
 DEMAND REVERSE WATTS
 DEMAND LEADING VARS
 DEMAND LAGGING VARS
SEL    UP     DOWN    ENTER
```

Figure 6-2. Programming Example Flow Chart (continued from previous page)

Figure AA Typical Load Shedding Screen



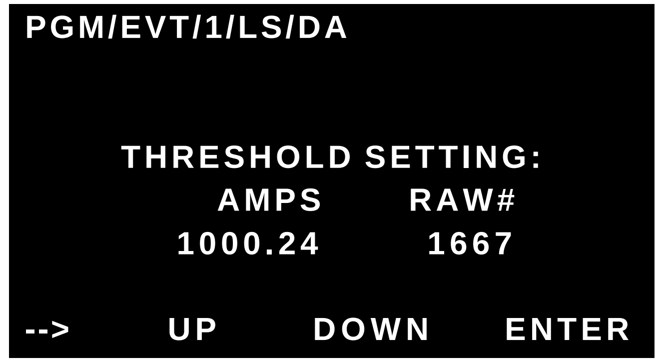


Figure BB Typical Demand Forward Watts Screen

Note: Refer to "RAW #" in the glossary for Assistance with establishing the required current in terms of it's "RAW #."

Figure 6-2 Programming Example Flow Chart (continued from previous page)

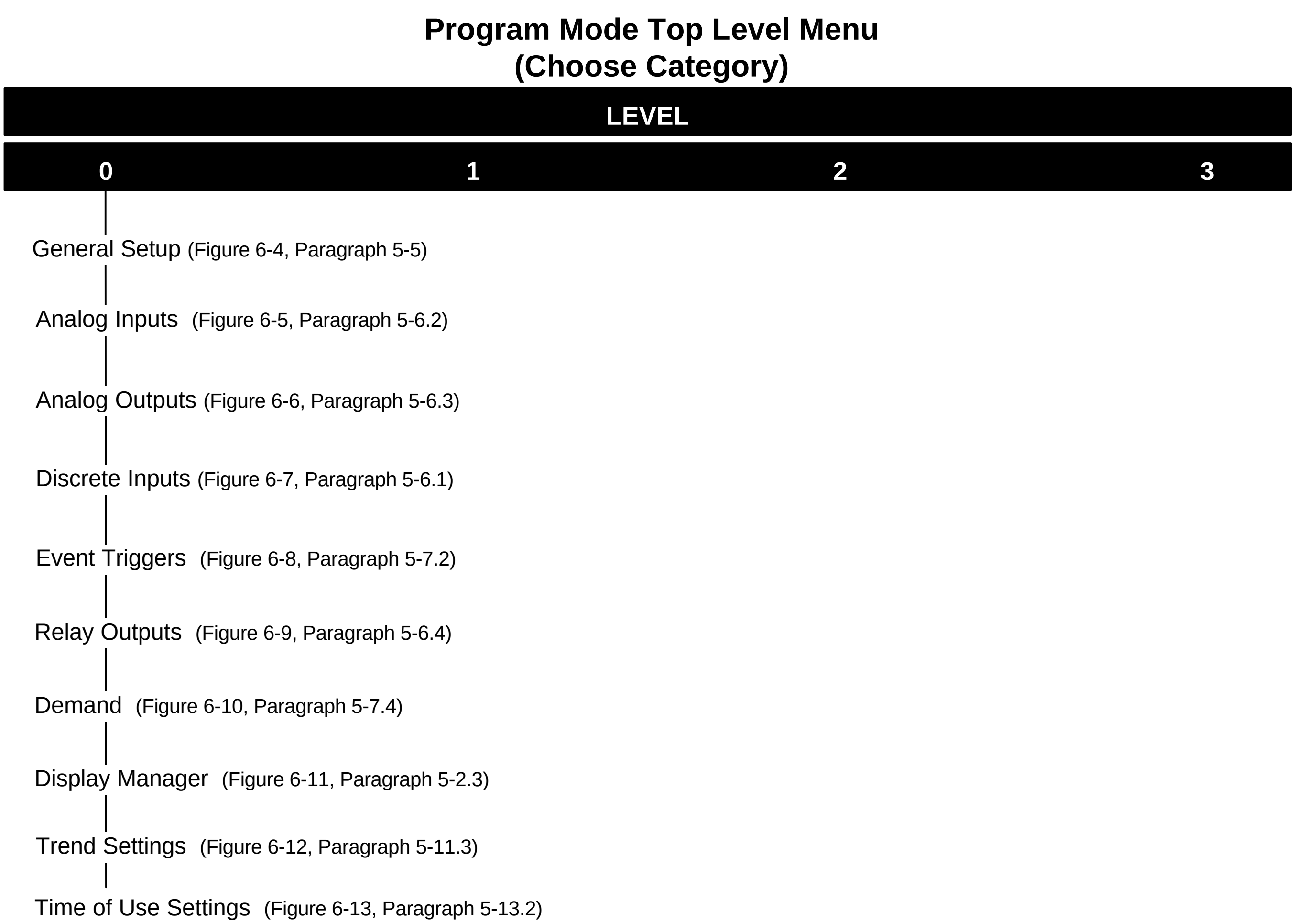


Figure 6-3. Programming Mode Top Level Menu (Choose Category)

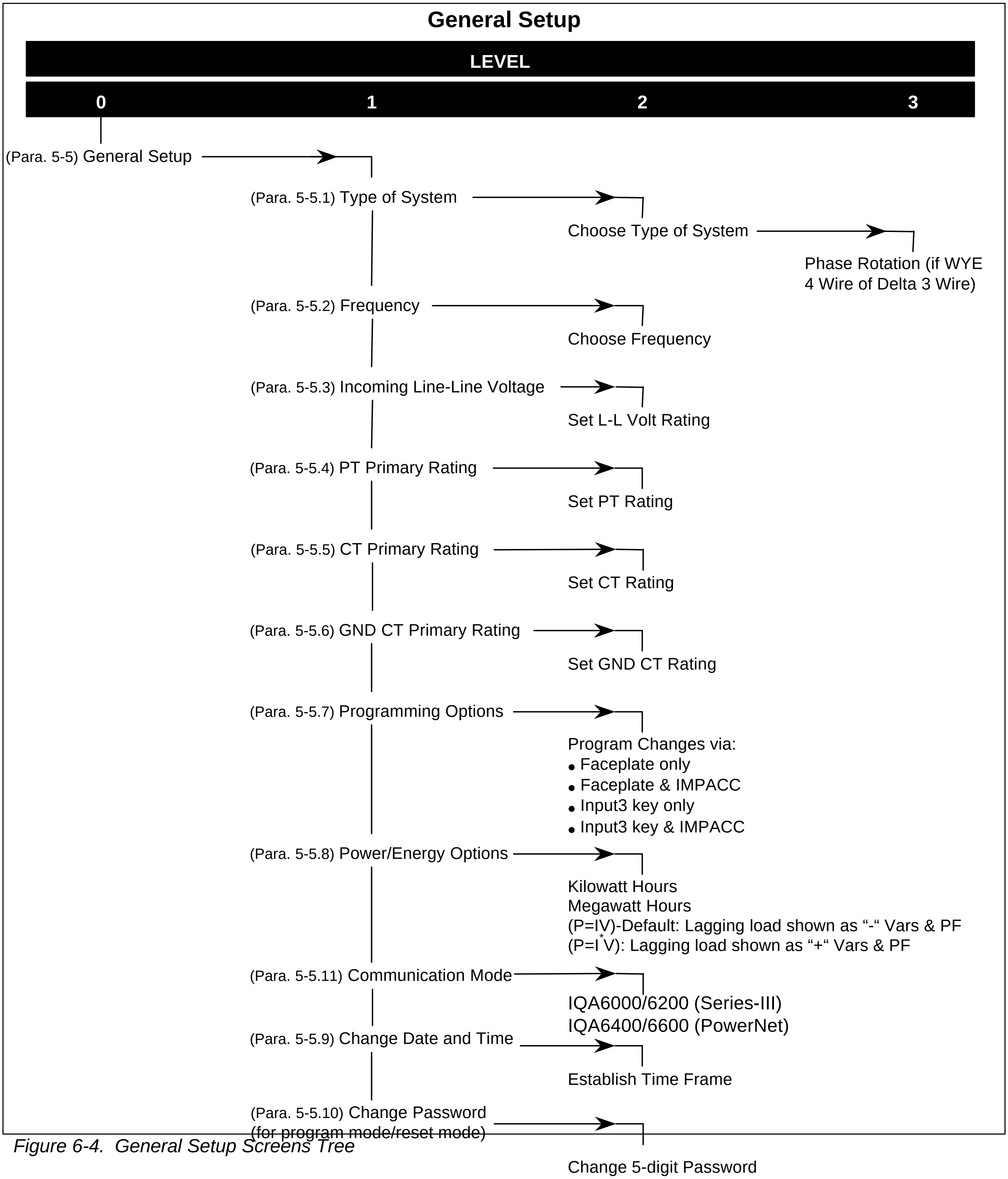


Figure 6-4. General Setup Screens Tree

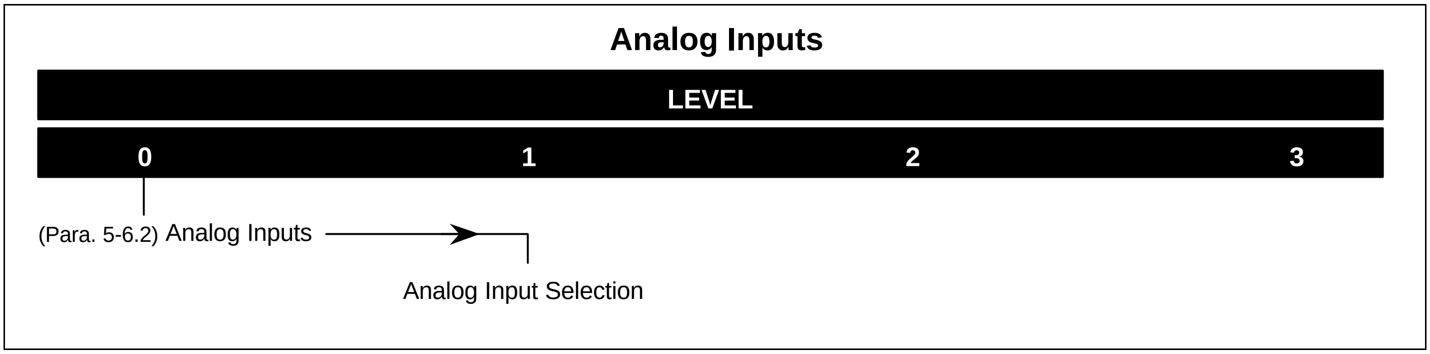


Figure 6-5. Analog Inputs Screens Tree

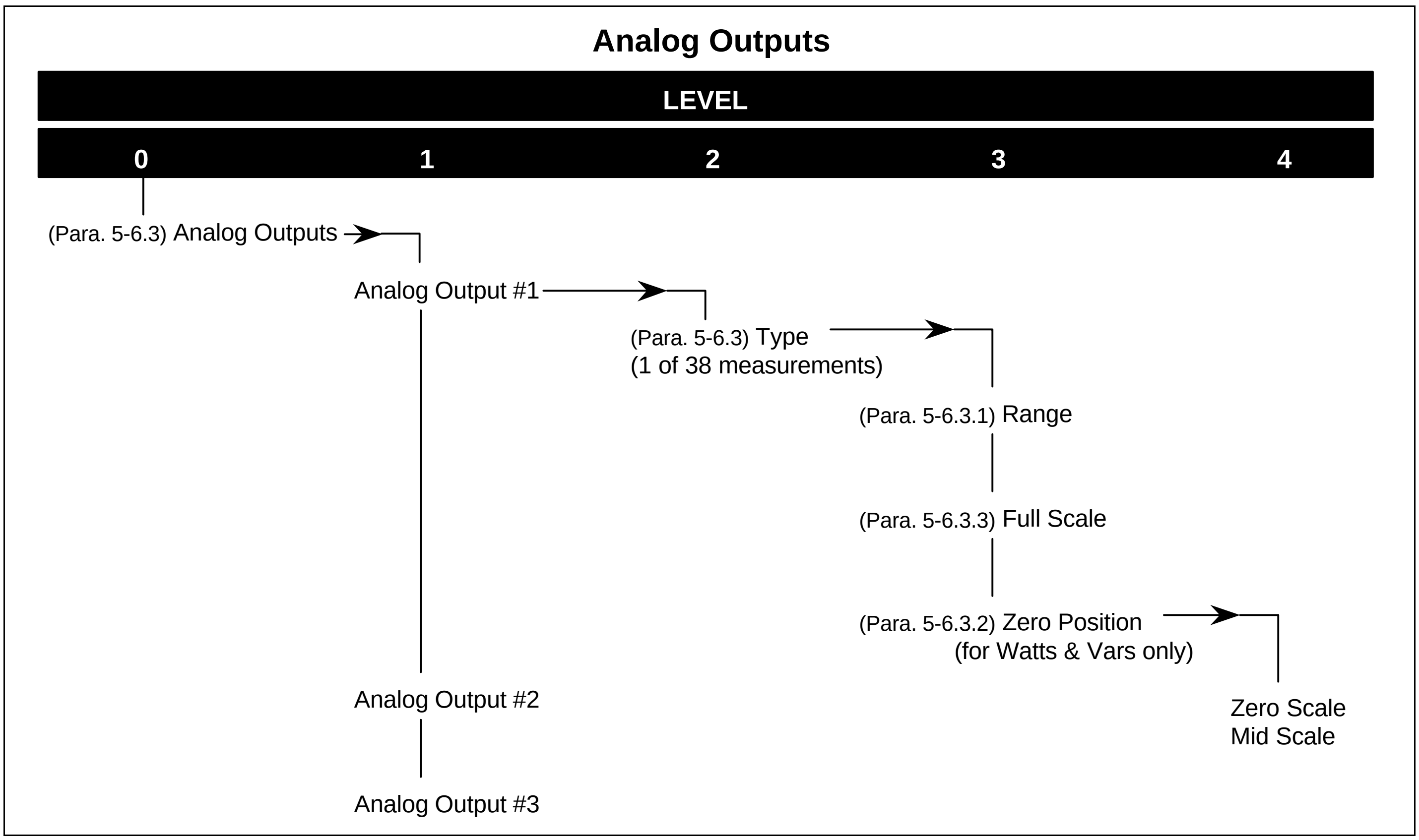


Figure 6-6. Analog Ouputs Screens Tree

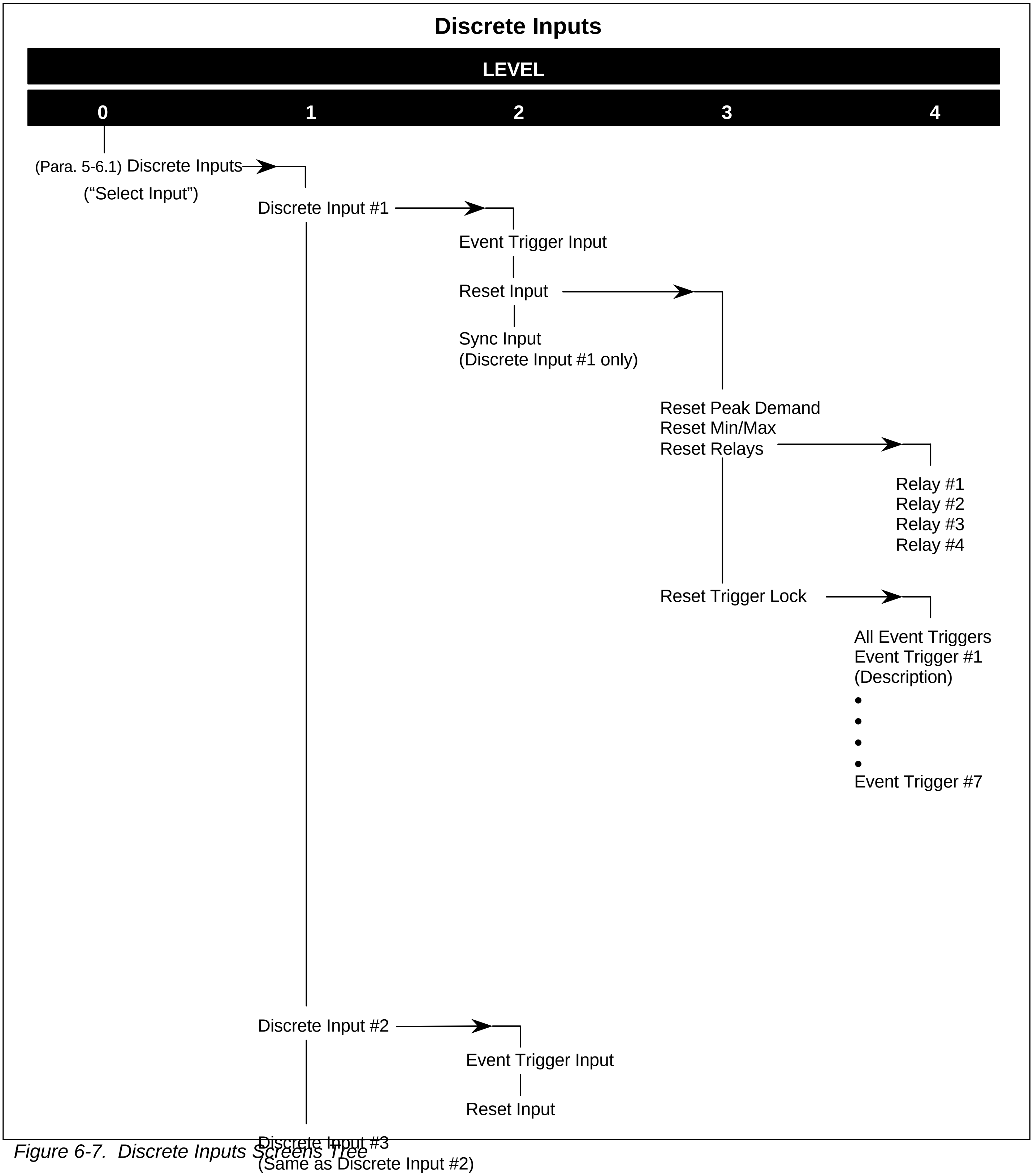


Figure 6-7. Discrete Inputs Screens Tree

Event Triggers

LEVEL					
0	1	2	3	4	5

- Event Triggers (Para. 5-7.2)
  - # Pre-Trigger Cycles (1-6)
  - Event Triggers — "Choose One"
    - Event Trigger T2 Through Event Trigger T7
      - Not Used
      - Magnitude THD (Para. 5-7.2.5.2)
        - IA
        - IB
        - IC
        - IN
        - VAN
        - VBN
        - VCN
        - VAB
        - VBC
        - VCA
          - Trigger Threshold (Para. 5-7.2.1)
          - Reset Threshold (Para. 5-7.2.2)
          - Reset (Manual/Auto) (Para. 5-7.2.3)
          - Delay Time (Para. 5-7.2.4)
      - %THD (Para. 5-7.2.5.1) (Same as Magnitude THD)
      - Minimum (Para. 5-7.2.5.3)
        - IA
        - IB
        - IC
        - System Watts
        - System Vars
        - System VA
        - System PF (displacement)
        - System PF (apparent)
          - (Same as above)
      - Maximum (Para. 5-7.2.5.4)
        - IA
        - IB
        - IC
        - IN
        - IG
        - VNG
        - System Watts
        - System Vars
        - System VA
        - System PF (displacement)
        - System PF (apparent)
          - (Same as above)
      - Maximum Demand (Para. 5-7.2.5.5)
        - IA
        - IB
        - IC
        - IAVG
        - System Watts
        - System Vars
        - System VA
          - Trigger Threshold
          - Reset Threshold
          - Reset (Manual/Auto)

(Continued in Next Column)

LEVEL					
0	1	2	3	4	5

- Voltage Disturbance (Para. 5-7.2.5.6 and 7)
  - Sag/Undervoltage
    - Line-Neutral
    - Line-Line
      - Trigger Thresh
      - Reset Thresh
      - Reset (Manual /Auto)
      - Delay Time
  - Swell/Overvoltage
    - Same as Sag
  - Interruption (IQA-6200 only)
  - Excess dV/dt (IQA-6200 only)
- Frequency Deviation (Para. 5-7.2.5.8)
  - High (over frequency) (.1 to 10Hz)
  - Low (under frequency)
  - High or Low (over/under)
    - Trigger Threshold
    - Reset Threshold
    - Reset (Manual /Auto)
    - Delay Time
- Current Unbalance (Para. 5-7.2.5.9)
  - Trigger Threshold
  - Reset Threshold
  - Reset (Manual /Auto)
  - Delay Time
- Voltage Unbalance (Para. 5-7.2.5.10)
  - Line-Neutral
  - Line-Line
    - Trigger Threshold
    - Reset Threshold
    - Reset (Manual /Auto)
    - Delay Time
- Discrete Input (Para. 5-7.2.5.11)
  - #1 No Threshold
  - #2 No Delay Time
  - #3
- Manual Capture Request (Para. 5-7.2.5.12)
  - Front Panel Only (No Threshold)
  - IMPACC & Front Panel (No Delay Time)
- MIN/MAX Update (Para. 5-7.2.5.13)
  - (Choose any combination below)
  - MIN/MAX CURRENT
  - MIN/MAX VOLTAGE
  - MIN/MAX POWER FACTOR
  - MIN/MAX POWER/FREQUENCY
  - MIN/MAX THD

Figure 6-8. Event Triggers Screens Tree

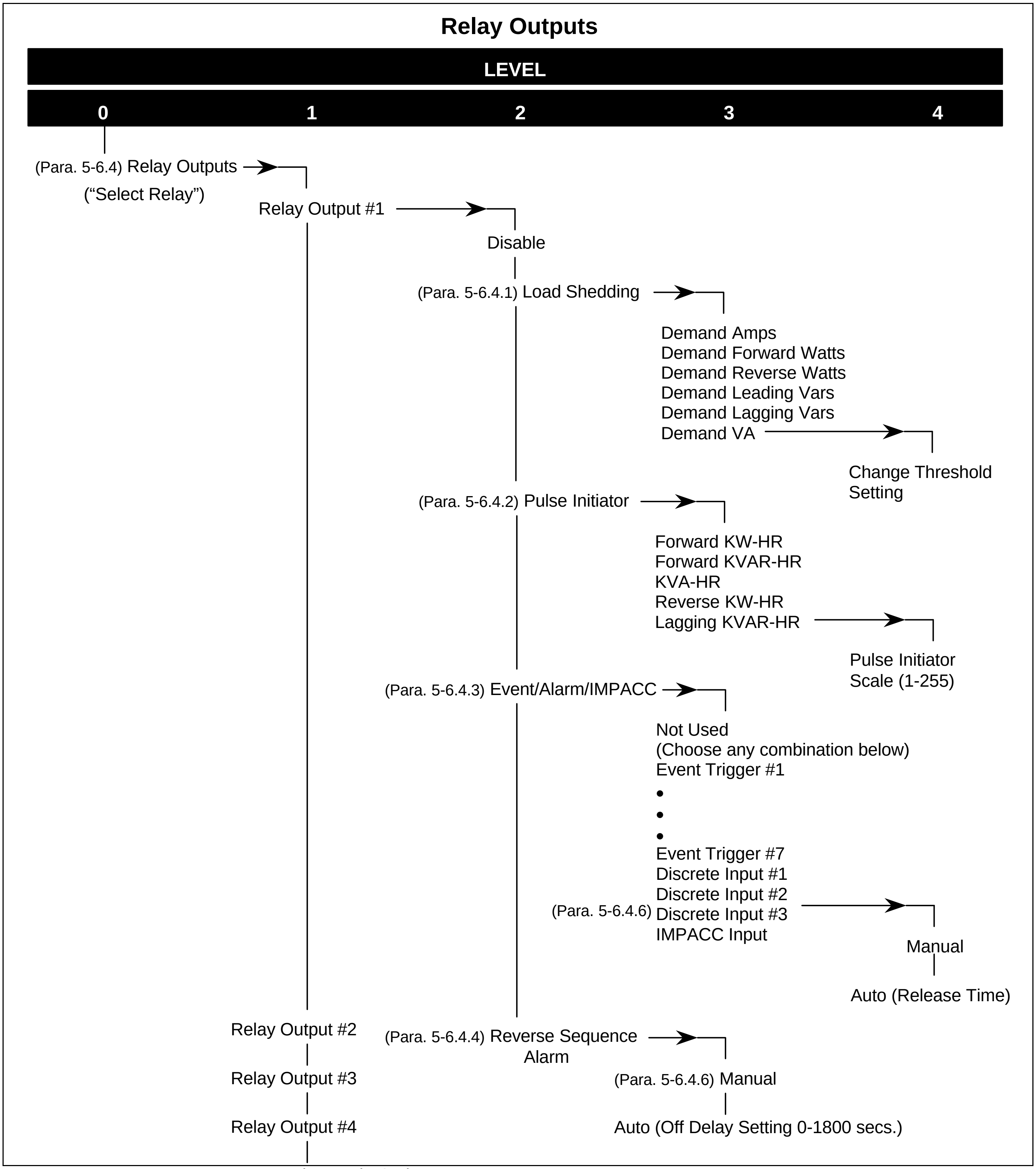


Figure 6-9. Relay Outputs Screens Tree

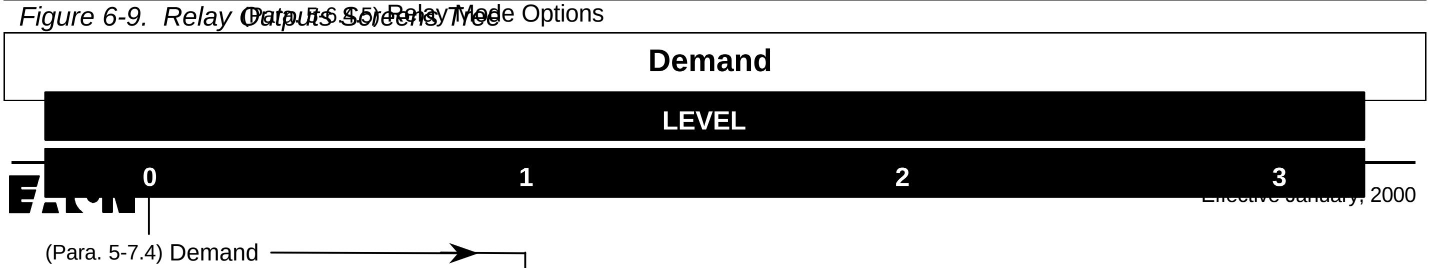


Figure 6-10. Demand Screens Tree

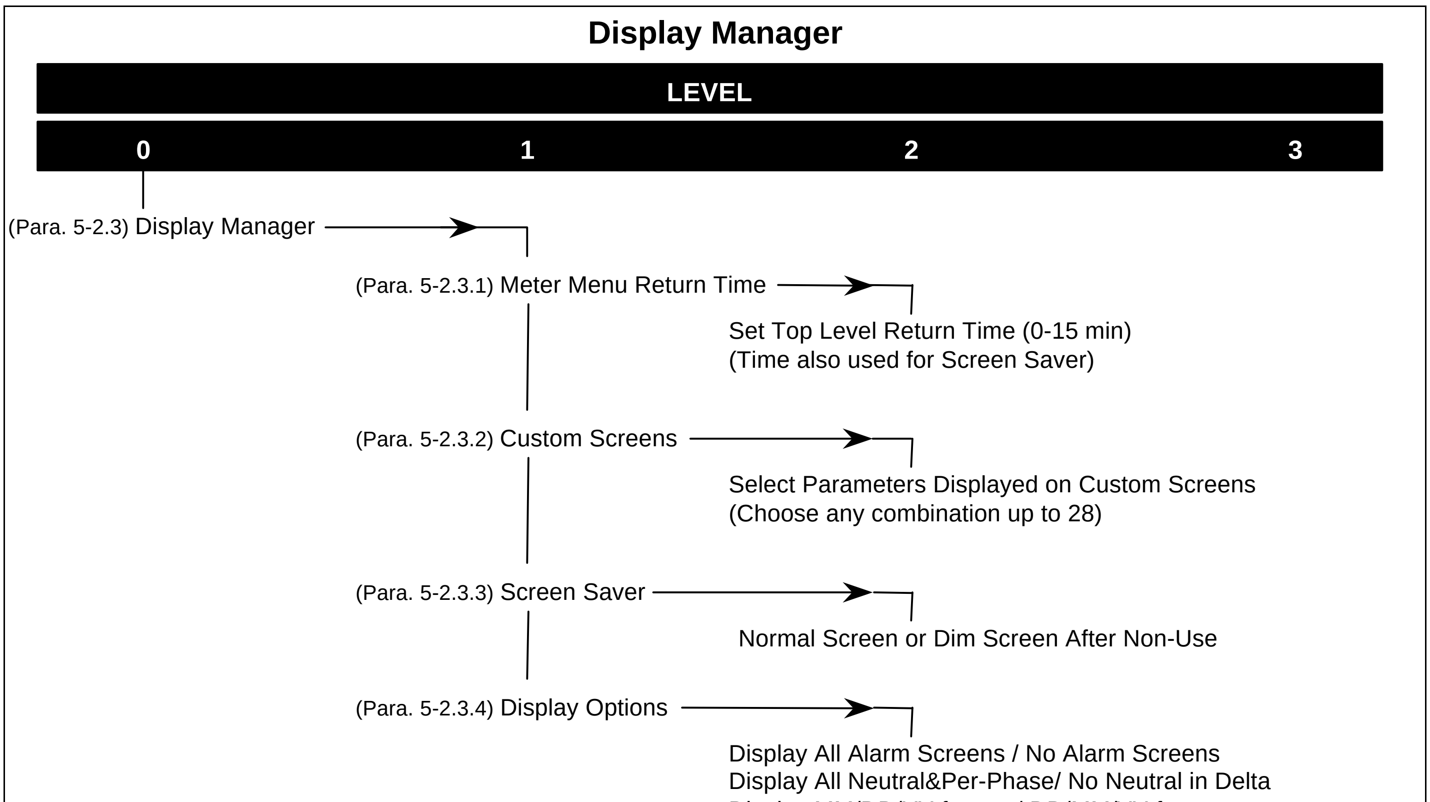


Figure 6-11. Display Manager Screens Tree

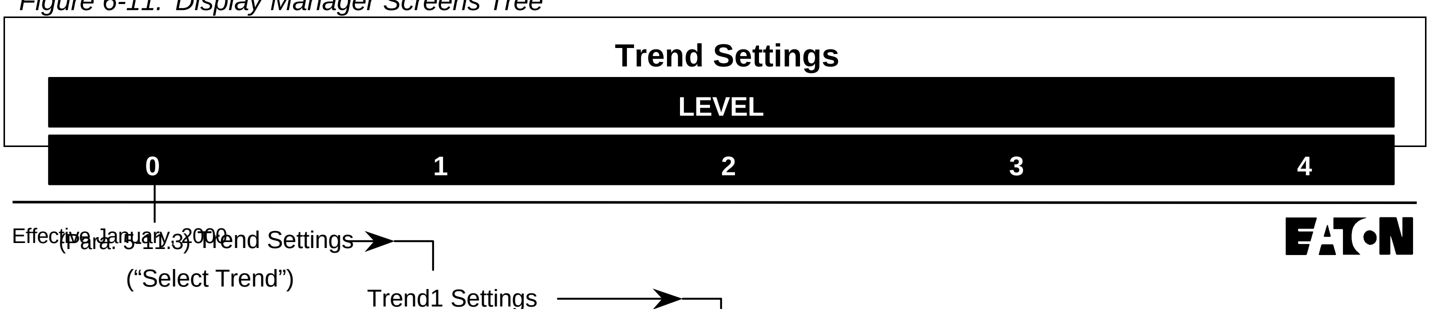


Figure 6-12. Trend Settings Screens Tree

Time of Use Settings

LEVEL				
0	1	2	3	4

(Para. 5-13.2) TOU Settings → Holidays → Holiday1

Figure 6-13. Time of Use Settings Screens Tree

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SECTION 7: TROUBLESHOOTING AND MAINTENANCE

7-1 Level of Repair

This manual is written with the assumption that only unit-level troubleshooting will be performed. If the cause of malfunction is traced to an IQ Analyzer, the unit should be replaced with a spare. The malfunctioning unit should then be returned to Cutler-Hammer for factory repairs.

7-2 Troubleshooting (Table 7.1)

WARNING

ALL MAINTENANCE PROCEDURES MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE IQ ANALYZER AND THE MANNER IN WHICH IT IS APPLIED. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN SERIOUS INJURY, DEATH AND/OR EQUIPMENT DAMAGE.

TROUBLESHOOTING PROCEDURES MAY INVOLVE WORKING IN EQUIPMENT AREAS WITH EXPOSED LIVE PARTS WHERE THE HAZARD OF A FATAL ELECTRIC SHOCK IS PRESENT. PERSONNEL MUST EXERCISE EXTREME CAUTION TO AVOID INJURY OR EVEN DEATH.

ALWAYS DISCONNECT AND LOCK OUT THE CURRENT SOURCE AND CONTROL POWER SUPPLY BEFORE TOUCHING THE COMPONENTS ON THE REAR OF THE IQ ANALYZER.

NOTICE

Keep in mind that when an IQ Analyzer is initially powered up for use on a specific system, the displayed "Meter Menu" values may not be what is anticipated for that system. This is because the unit has not yet had necessary pieces of system information programmed into non-volatile memory.

7-3 Replacement

Follow these procedural steps to replace the IQ Analyzer.

Step 1: Turn off control power at the main disconnect or isolation switch of the control power supply. If the switch is not located in view from the IQ Analyzer, lock it out to guard against other personnel accidentally turning it on.

Step 2: Verify that all "foreign" power sources wired to the IQ Analyzer are deenergized. These may also be present on the relay and input/output terminal block. Current transformer inputs must be temporarily shorted at a point prior to the IQ Analyzer's terminals before attempting to open these terminals on the IQ Analyzer.

Step 3: Before disconnecting any wires from the unit, make sure they are individually identified to assure that reconnection can be correctly performed. Make a sketch to help with the task of terminal and wire identification.

Step 4: If an optional ribbon cable connects with the Communications Port, carefully disconnect it.

Step 5: If the unit has its Power Module remotely located, carefully unplug the optional Extension Cable from the IQ Analyzer's chassis, not the Power Module.

Step 6: Remove wires by loosening or removing the screw terminal where there is a wire connection.

CAUTION

SUPPORT THE IQ ANALYZER FROM THE FRONT SIDE WHEN THE SCREWS ARE LOOSENED OR REMOVED IN STEP 7. WITHOUT SUCH SUPPORT, THE UNIT COULD FALL OR THE PANEL COULD BE DAMAGED.

Step 7: Remove the 6 mounting screws holding the unit against the door or panel. These are accessed from the rear of the unit.

Step 8: Carefully lay the screws aside for later use.

Step 9: Mount the replacement unit. Read paragraph 4-2.2 before attempting this.

Step 10: Reverse the procedure outlined in Steps 4 through 7.

Step 11: Using the sketch mentioned in Step 3, replace each wire at the correct terminal. Be sure that each is firmly tightened. Remove temporary shorts on incoming current transformers.

Step 12: Restore control power. Refer to paragraphs 4-4.2 entitled "Initial Power Application".

Table 7.1 Troubleshooting Guide

Symptom	Probable Cause	Possible Solution(s)
All Operator Panel Indicator LEDs are off	• Line voltage level is deficient. • Separate source control power is deficient. • ac line connections or optional external voltage transformers are not properly wired or installed. • Blown or loose fuses. • IQ Analyzer has malfunctioned.	• Locate cause of deficiency in ac line monitored. • Locate cause of deficiency in the ac control power line. • Verify that the ac line and/or potential transformers are wired as shown on the appropriate wiring plan drawing for the application in Section 4. • Verify line voltage with multimeter. Check fuse(s) on affected phase(s) located just above the voltage inputs bedhind cover of power module (Figure **2-6**). Reseat fuse(s). Replace, if necessary.① If the problem persists, replace the unit. • Replace the unit.
Voltage and current readings are incorrect and unstable	• The case is not grounded	• Attach ground wire to either the power module or IQ Analyzer “Earth Ground” terminal.
One or more voltage Phases read incorrectly.	• Blown or loose fuses. • Incorrect voltage settings	• Verify line voltage with multimeter. Check fuse(s) on affected phase(s) located just above the voltage inputs bedhind cover of power module (Figure **2-6**). Reseat fuse(s). Replace, if necessary.① • Verify correct settings programmed in the IQ Analyzer for system type, L-L voltage and PT rating.
One or more currents read incorrectly.	• Incorrect current transformer ratio setting.	• Verify incoming current to IQ Analyzer with separate ammeter. • Verify proper settings in the IQ Analyzer • Check ct wiring and grounding on appropriate wiring plan drawing in Section 4.
Power parameters (Watt, var, VA, Power Factor) read incorrectly.	• Phasing for voltage and current is mismatched. • Current transformer polarity is reversed.	• Capture an event and compare phase angles of Va, Vb, Vc, Ia, Ib, Ic to detect possible mis-wiring. • Verify connections per wiring diagrams. • Reverse current transformer leads. Verify ground wiring per drawings in technical manual. • Reverse current polarity via settings. Enter factory password (default=27116) and change CT POLARITY under CALIBRATION SETTINGS in programming mode.
Unit displays one or more of the following: HARDWARE FAILURE REGISTER FAILURE MULTIPLY FAILURE DIVIDE FAILURE LOGIC FAILURE ADD/SUBTRACT FAILURE INTERNAL RAM ERROR or EXTERNAL ROM ERROR	• Ambient temperature has exceeded specified operating temperature of 70°C (158°F) • Possible IQ Analyzer hardware failure.	• Reboot unit by momentarily removing power cable at connector J2. • If the problem persists, replace the unit.

① Power Module Fuse: Buss KTK-R-3/4 or equivalent (3/4 amp).

Table 7.1 Troubleshooting Guide (continued from previous page)

Symptom	Probable Cause	Possible Solution(s)
Unit fails to be identified via the IMPACC Network	• Older software (Series-III) does not know the new IQA6400/IQA6600 protocols and features. • Software device configuration does not match the IQ Analyzer. In software, “IQ Analyzer” means IQA6000/IQA6200 while “IQ Analyzer DataLogger” means IQA6400/IQA6600	• Set IQ Analyzer for IQA6000/IQA6200 mode for backward compatibility. Or • Upgrade PowerNet Software and set device configuration to IQ Analyzer DataLogger. Set the IQ Analyzer for IQA6400/IQA6600 communication mode.
Unit displays EEPROM ERROR	• Unit powered down while saving settings. • IQ Analyzer hardware error.	• Enter any setting in Program Mode to re-save settings in EEPROM. • Reboot unit by momentarily removing power cable at connector J2. • Replace the unit.
Unit displays HIGH NEUTRAL VOLTAGE	• IQ Analyzer has detected a high voltage on the Neutral – Ground reading • The neutral terminal is wired incorrectly. • The case is not grounded	• Verify correct connection of the Neutral to the Power Module. Particularly check for reversal of phase C voltage with the Neutral. • Verify proper grounding of the power system and the IQ Analyzer. Attach ground wire to either the power module or IQ Analyzer “Earth Ground” terminal. •Check voltage with multimeter.
Unit displays REVERSE SEQUENCE	• IQ Analyzer has detected phasing difference between programmed phasing setpoint and actual system parameters. Either: parameter is set incorrectly, unit is wired incorrectly, or actual reversal condition exists.	• Verify actual system phasing. Capture an event and compare phase angles of Va, Vb, Vc, Ia, Ib, Ic to detect possible mis-wiring. • Verify IQ Analyzer setpoint matches actual system phasing. • Verify IQ Analyzer connections. • Check power system for cause of actual phase reversal condition.
Unit fails to capture Harmonic Data when manual capture is pressed.	• All 7 waveform capture triggers are programmed and none are set for MANUAL CAPTURE.	• Enter program mode and set up an Event Trigger for MANUAL CAPTURE. Refer to Sectiojn 6 “Programming” and Figure **6-8**.

Table 7.1 Troubleshooting Guide (continued from previous page)

Symptom	Probable Cause	Possible Solution(s)
Analog outputs fail to operate.	• Analog outputs not set up in Program mode. • Output transistor is damaged. The transistor is rated for 60V and is protected for ESD; however, capacitive discharge from the installation of field wiring can cause permanent damage. The load wiring should be grounded at the Analyzer before connecting to the analog output terminal.	• Check input/output fuse beside Communications connector, and replace if needed. ① • Program setpoints to enable analog output proportional to desired parameter. Refer to Section 6 “Programming” and Figure **6-6**. • Replace the unit.
Unit fails to communicate over IMPACC network.	• Wrong of conflicting address set on PONI. • Communications wiring errors. • PONI failure.	• Check that PONI has a unique address on the system and that software is addressing proper unit. • Verify wiring is in conformance to IMPACC Wiring Rules. Refer to Figure **4-6**.
Unit fails to detect contact closure on Discrete Contact Inputs.	• Discrete Inputs not properly configured. • Improper wiring or faulty external device providing contact closure. • Contacts welded.	• Check IQ Analyzer setpoints. • Verify that external contact actually closes and that impedance is essentially zero when contact is closed. Also, verify wiring to Discrete Contact inputs per IL drawings.
Unit setpoints unchanged upon exiting program mode.	• Unit was in View-Only mode using View-Only password (00000).	• Re-enter program setpoints using the proper program password which is either the one the customer has established or which is still the default password(s) set by the factory for initial power-up (44444 or 10000).

7-4 Maintenance and Care

The IQ Analyzer is designed to be a self contained and maintenance free unit. The printed circuit boards are calibrated and conformally coated at the factory. They are intended for service by factory trained personnel only.

The IQ Analyzer should be stored in an environment that does not exceed the storage temperature range of -30°C to +85°C. The environment should also be free of excess humidity. If possible, the device should be stored in its original packing material and container.

Never clean the rear of the IQ Analyzer with power applied. Clean the rear with a clean dry cloth. Clean the face with a dry cloth or damp cloth with water or mild detergent.

7-5 Calibration

IQ Analyzer is permanently calibrated at the factory with no need for further calibration in the field.

7-6 Return Procedure

The Troubleshooting Guide (Table **7.1**) is intended for service personnel to identify whether a problem being observed is external or internal to the unit. For assistance with this determination, contact the Advanced Product Support Center at 1-800-809-2772 or 1-412-490-6714. If a problem is identified to be internal, the unit should be returned to the factory for repair or replacement. To have a unit returned, contact your local Cutler-Hammer authorized distributor.

7-7 Replacement Parts

Refer to Table **1.1** for a list of available parts and accessories for the IQ Analyzer. For ordering information, contact your local Cutler-Hammer authorized distributor.

7-8 Technical Assistance

For information, technical assistance or referral to a local authorized distributor, contact the Advanced Product Support Center at 1-800-809-2772 or 1-412-490-6714.

APPENDIX A—STARTUP SETTINGS SHEETS

Startup Settings Sheets are provided to further simplify the programming process. Startup Settings Sheets do the following:

- Provide a preview of the detailed information required by the IQ Analyzer in the “Program Mode” by individual programming category. This permits the operator to gather all required information prior to beginning the programming process.
- Provide a place to logically record the required programming details for the particular application.

Make a copy of the required sheets and complete them as required for the application. Follow the step by step instructions on each individual sheet. Note that each sheet references the Screens Tree by Figure Number, and the text by Paragraph Number associated with that particular sheet. The Screens Tree is especially helpful since it presents an overall view of the entire programming category.

NOTICE

It is highly recommended that each step on a Startup Settings Sheet be followed carefully in sequence. This will help to insure that all required information is recorded accurately the first time.

Startup Settings Sheet #1

GENERAL SETUP SETTINGS

(Reference Paragraph 5-5 and Figure 6-4)

			Select One
Step 1:	Choose Type of System ➠	3 PHASE/4 WIRE	❑
		3 PHASE/3 WIRE	❑
		1 PHASE/3 WIRE	❑
		1 PHASE/2 WIRE	❑

Step 2: If either single phase system was selected in Step 1, proceed to Step 3. If either three phase system was selected, choose the Phase Rotation.

			Select One
	➠	ABC ROTATION	❑
		CBA ROTATION	❑

			Select One
Step 3:	Choose Frequency ➠	25 HZ	❑
		40 HZ	❑
		50 HZ	❑
		60 HZ	❑

Step 4:	Choose Incoming L-L Voltage	➠ Enter from 100-600 Vac	___ ___ ___
Step 5:	Choose PT Primary Rating (120 volts secondary assumed)	➠ Enter from 120-500,000 volts	___ ___ ___ , ___ ___ ___
Step 6:	Choose CT Primary Rating (5A secondary assumed)	➠ Enter from 5-10,000A	___ ___ , ___ ___ ___
Step 7:	Choose GND CT Primary Rating (5A secondary assumed)	➠ Enter from 5-10,000A	___ ___ , ___ ___ ___

			Select One
Step 8:	Programming Options ➠	Faceplate only	❑
		Faceplate & Network	❑
		Input3 key only	❑
		Input3 key & Network	❑

			Select One
Step 9:	Power Energy Options ➠	Kilowatt-hours	❑
		Megawatt-hours	❑

			Select One
Step 10:	Choose Var Sign Convention ➠	Lagging Vars & PF negative at load	❑
		Lagging Vars & PF Positive at load	❑
Step 11:	Communication Mode ➠	IQA 6000/6200 (Series-III)	❑
		IQ66400/6600 (PowerNet)	❑

Step 12: Date and Time ➠ Enter updated date and time if required________________________________

Step 13: Change Password ➠ Enter new 5 digit password if required ___ ___ ___ ___ ___

GENERAL SETUP PROGRAMMING COMPLETE

Startup Settings Sheet #2

ANALOG INPUT SETTINGS
(Reference Paragraph 5-6.2 and Figure 6-5)

Note: One Analog Input is available

			Select One
Step 1: Analog Input	➠	0-20mA	❑
		4-20mA	❑

ANALOG INPUT PROGRAMMING COMPLETE

Startup Settings Sheet #3

ANALOG OUTPUT SETTINGS

(Reference Paragraph 5-6.3 and Figure 6-6)

Note: Up to three Analog Outputs are available. Each is programmed individually.

			Select Up to Three
Step 1:	Choose Analog Outputs ➠	ANALOG OUTPUT 1	❑
		ANALOG OUTPUT 2	❑
		ANALOG OUTPUT 3	❑

Step 2: Choose and indicate in the space provided one of the below listed parameter types for each of the Analog Outputs selected in Step1.

Parameter Types

Current	Voltage	Power	%THD	Frequency	Power Factor
IA	VAN	SYSTEM WATTS	IA	VAN	System
IB	VBN	PHASE A WATTS	IB		Displacement
IC	VCN	PHASE B WATTS	IC		and
IN	VAB	PHASE C WATTS	IN		System
IG	VBC	SYSTEM VARS	VAN		Apparent
IAVG	VCA	PHASE A VARS	VBN		
	VNG	PHASE B VARS	VCN		
		PHASE C VARS	VAB		
		SYSTEM VA	VBC		
		PHASE A VA	VCA		
		PHASE B VA			
		PHASE C VA			

Parameter Selections

➠ ______________Analog Output 1

______________Analog Output 2

______________Analog Output 3

Step 3: Indicate in the space provided, parameter selections for each of the Analog Outputs selected in Step 1. All spaces within a particular Analog Output should be complete, except as indicated.

	Analog Output 1		**Analog Output 2**		**Analog Output 3**	
Range	4 - 20MA Select One 0 - 20MA	________	4 - 20MA Select One 0 - 20MA	________	4 - 20MA Select One 0 - 20MA	________
Full Scale	100% Select One 200%	________	100% Select One 200%	________	100% Select One 200%	________
Zero Position	ZERO SCALE + OR - Select One (Power Parameter Only) MID SCALE	________	ZERO SCALE + OR - Select One (Power Parameter Only) MID SCALE	________	ZERO SCALE + OR - Select One (Power Parameter Only) MID SCALE	________

ANALOG OUTPUT PROGRAMMING COMPLETE

Startup Settings Sheet #4

DISCRETE INPUT SETTINGS

(Reference Paragraph 5-6.1 and Figure 6-7)

Note: Up to three Discrete Inputs are available. Each is programmed individually.

		Select Up to Three
Step 1: Choose Discrete Inputs ➠	DISCRETE INPUT 1	❏
	DISCRETE INPUT 2	❏
	DISCRETE INPUT 3	❏

Step 2: Choose and indicate in the space provided one of the below listed categories for each of the Discrete Inputs selected in Step1.

Discrete Input Category	**Category**	
EVENT TRIGGER INPUT	➠ ______________________	Discrete Input 1
RESET INPUT	______________________	Discrete Input 2
SYNC INPUT	______________________	Discrete Input 3
(Applicable to Discrete Input #1 Only)		

Note: If "Event Trigger" or "Sync Input" was selected in Step 2, programming is complete for that particular Discrete Input after completing Step 2.

Step 3: If "Reset Input" was selected in Step 2 for any or all of the Discrete Inputs, choose and indicate in the space provided one of the below listed categories for each of the Discrete Inputs from Step 2 requiring additional programming.

Reset Category	**Category**	
RESET PEAK DEMAND	➠ ______________________	Discrete Input 1
RESET MIN/MAX	______________________	Discrete Input 2
RESET RELAYS	______________________	Discrete Input 3
RESET TRIGGER LOCK		

Note: If "Reset Peak Demand" or "Reset Min/Max" was selected in Step 3, programming is complete for that particular Discrete Input after completing Step 3.

Note: If "Reset Trigger Lock" was selected in Step 3 for any particular Discrete Input, proceed directly to Step 5 to complete programming.

Continued on next page

Startup Settings Sheet #4 Discrete Input Programming (continued from previous page)

Step 4: If “Reset Relays” was selected in Step 3 for any particular Discrete Input, choose and indicate in the space provided one of the below listed Relays for each applicable Discrete Input.

Relays	**Relay**
RELAY #1	________________________Discrete Input 1
RELAY #2	________________________Discrete Input 2
RELAY #3	________________________Discrete Input 3
RELAY #4	

Step 5: If “Reset Trigger Lock” was selected in Step 3 for any particular Discrete Input, choose and indicate in the space provided one of the below listed Event Triggers for each applicable Discrete Input.

Trigger Locks	**Trigger Lock**
ALL EVENT TRIGGERS	________________________Discrete Input 1
EVENT TRIGGER #1	________________________Discrete Input 2
EVENT TRIGGER #2	________________________Discrete Input 3
EVENT TRIGGER #3	
EVENT TRIGGER #4	
EVENT TRIGGER #5	
EVENT TRIGGER #6	
EVENT TRIGGER #7	

DISCRETE INPUT PROGRAMMING COMPLETE

Startup Settings Sheet #5

EVENT TRIGGER SETTINGS

(Reference Paragraph 5-7.2, Figure 6-8, and Table 5.7)

Note: Up to seven Event Triggers can be programmed for 1 of 39 different conditions. Each is programmed individually.

Step 1: Choose the number of "Pre-Trigger Cycles" that will apply to all programmed Event Triggers and enter in the space provided.

➠ PRE-TRIGGER CYCLES (0-6) _________

Select Up to Seven

Step 2**:** Choose Event Triggers to be programmed ➠ EVENT TRIGGER 1 ❏

EVENT TRIGGER 2 ❏
EVENT TRIGGER 3 ❏
EVENT TRIGGER 4 ❏
EVENT TRIGGER 5 ❏
EVENT TRIGGER 6 ❏
EVENT TRIGGER 7 ❏

Note: If an Event Trigger will not be programmed, "Not Used" is entered for that particular Event Trigger. Especially as it applies to previously programmed IQ Analyzers, take the time to insure that it is made clear in Step 3 which Event Triggers will not be used. This will help to avoid unexplained Event happenings while the IQ Analyzer is in service.

Note: To complete Event Trigger programming, programming selections will be made from Tables A through L and used to fill in the blank spaces provided in the Data Collection Table for each Event Trigger.

Step 3: Check ( ) "Not Used" in the Data Collection Table if a particular Event Trigger is not to be programmed. Double check to make sure that those checked "Not Used" are consistent with selections made in Step 2. No further programming action will be required for those Event Triggers programmed with "Not Used."

Step 4: To complete Event Trigger programming, make programming level selections from the referenced tables stating with Table A, and indicate the selections in the spaces provided in the Data Collection Table.

Continued on next page

Startup Settings Sheet #5 Event Trigger Programming (continued from previous page)

Data Collection Table

Event Trigger	Not Used ( )	Level 2 Selections (Select 1 from Table A)	Level 3 Selections	Level 4 Selections	Level 5 Selections	Level 6 Selections
1	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
2	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
3	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
4	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
5	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
6	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______
7	❑	______	______	______	______	______
			______	______	______	______
			______	______	______	______
			______	______	______	______

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Startup Settings Sheet #5 Event Trigger Programming (continued from previous side)

Table A
Level 2 Selections

Event Causes ***(Select One for Each Event Trigger being Programmed)***	**Further Programming**
MAGNITUDE THD	If selected, complete programming selections from Table B
% THD	If selected, complete programming selections from Table C
MINIMUM	If selected, complete programming selections from Table D
MAXIMUM	If selected, complete programming selections from Table E
MAXIMUM DEMAND	If selected, complete programming selections from Table F
VOLTAGE DISTURBANCE	If selected, complete programming selections from Table G
FREQUENCY DEVIATION	If selected, complete programming selections from Table H
CURRENT UNBALANCE	If selected, complete programming selections from Table I
VOLTAGE UNBALANCE	If selected, complete programming selections from Table J
DISCRETE INPUT	If selected, complete programming selections from Table K
MANUAL CAPTURE REQUEST	If selected, complete programming selections from Table L
MIN/MAX UPDATE	If selected, complete programming selections from Table M

Table B
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Magnitude THD")

Level 3 ***(Select One Parameter)***	**Level 4** ***(Select One to Four Parameters as Required)***	**Level 5** ***(Establish a Corresponding Input for Each Parameter Selected for Level 4)***
IA IB IC IN VAN VBN VCN VAB VBC VCA	TRIGGER THRESHOLD RESET THRESHOLD REQUEST (MANUAL/AUTO) DELAY TIME	* Required Trigger Threshold Current or Voltage * Required Reset Threshold Current or Voltage Select Auto or Manual Select Delay Time form 0.1 to 60 seconds (in 0.1 second increments)

* Refer to "RAW #" in the glossary if assistance is required with establishing the desired current or voltage in terms of its "RAW #."

Continued on next page

Startup Settings Sheet #5 Event Trigger Programming (continued from previous page)

Table C
Levels 3 through 5 Selections
(Use when Level 2 Selection is "% THD")

Level 3 *(Select One Parameter)*	Level 4 *(Select One to Four Parameters as Required)*	Level 5 *(Establish a Corresponding Input for Each Parameter Selected for Level 4)*
IA IB IC	TRIGGER THRESHOLD	Select Trigger Threshold Percentage up to 1000% (in 1% increments)
IN VAN VBN	RESET THRESHOLD	Select Reset Threshold Percentage up to 1000% (in 1% increments)
VCN VAB	REQUEST (MANUAL/AUTO)	Select Auto or Manual
VBC VCA	DELAY TIME	Select Delay Time form 0.1 to 60 seconds (in 0.1 second increments)

Table D
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Minimum")

Level 3 *(Select One Parameter)*	Level 4 *(Select One to Four Parameters as Required)*	Level 5 *(Establish a Corresponding Input for Each Parameter Selected for Level 4)*
IA IB IC	TRIGGER THRESHOLD	* (Required) Trigger Threshold Current or Watts or Vars or VA or PF
SYSTEM WATTS SYSTEM VARS SYSTEM VA	RESET THRESHOLD	* (Required) Reset Threshold Current or Watts or Vars or VA or PF
SYSTEM PF (DISPLACEMENT) SYSTEM PF (APPARENT)	RESET (MANUAL/AUTO)	Select Auto or Manual
	DELAY TIME	Select Delay Time form 0.1 to 60 seconds (in 0.1 second increments)

1. *Refer to "RAW #" in the glossary if assistance is required with establishing the desired current in terms of its "RAW #."*
2. *Watts, Vars, VA (up to ± 1200)*
3. *Power Factor (± 0 – 100%)*

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Startup Settings Sheet #5 Event Trigger Programming (continued from previous side)

Table E
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Maximum")

Level 3 ***(Select One Parameter)***	**Level 4** ***(Select One to Four Parameters as Required)***	**Level 5** ***(Establish a Corresponding Input for Each Parameter Selected for Level 4)***
IA IB IC	TRIGGER THRESHOLD	* (Required) Trigger Threshold Current or Voltage or Watts or Vars or VA or PF
IN IG VGN	RESET THRESHOLD	* (Required) Reset Threshold Current or Voltage or Watts or Vars or VA or PF
SYSTEM WATTS SYSTEM VARS	RESET (MANUAL/AUTO)	Select Auto or Manual
SYSTEM VA SYSTEM PF (DISPLACEMENT) SYSTEM PF (APPARENT)	DELAY TIME	Select Delay Time form 0.1 to 60 seconds (in 0.1 second increments)

1. *Refer to "RAW #" in the glossary if assistance is required with establishing the desired current or voltage in terms of its "RAW #."*
2. *Watts, Vars, VA (up to ✂ 1200)*
3. *Power Factor (✂ 0 – 100%)*

Table F
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Maximum Demand")

Level 3 ***(Select One Parameter)***	**Level 4** ***(Select One to Three Parameters as Required)***	**Level 5** ***(Establish a Corresponding Input for Each Parameter Selected for Level 4)***
IA IB IC	TRIGGER THRESHOLD	* (Required) Trigger Threshold Current or Watts or Vars or VA
IAVG SYSTEM WATTS SYSTEM VARS	RESET THRESHOLD	* (Required) Reset Threshold Current or Watts or Vars or VA
SYSTEM VA	REQUEST (MANUAL/AUTO)	Select Auto or Manual

1. Refer to *"RAW #" in the glossary if assistance is required with establishing the desired current in terms of its "RAW #."*
2. *Watts, Vars*, VA (up to ± 1200)

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Startup Settings Sheet #5 Event Trigger Programming (continued from previous side)

Table G
Levels 3 through 6 Selections
(Use when Level 2 Selection is "Voltage Disturbance")

Level 3 *(Select One Parameter)*	Level 4 *(Select One Parameter)*	Level 5 *(Select One to Four Parameters as Required)*	Level 6 *(Establish a Corresponding Input for Each Parameter Selected for Level 5)*
SAG SWELL	LINE – LINE VOLTS LINE – NEUTRAL VOLTS	TRIGGER THRESHOLD RESET THRESHOLD RESET (MANUAL/AUTO) DELAY TIME	* Required Trigger Threshold Volts * Required Reset Threshold Volts Select Auto or Manual Select Delay Time from 0 to 3600 cycles (in 2 cycle increments)
Interruption (IQA-6400 only)	…………***No Further Selections Required for Interruption***…………		
Excess dV/dt (IQA-6600 only)	…………***No Further Selections Required for Interruption***…………		

* Refer to "RAW #" in the glossary if assistance is required with establishing the desired current in terms of its "RAW #."

Table H
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Frequency Deviation")

Level 3 *(Select One Parameter)*	Level 4 *(Select One to Four Parameters as Required)*	Level 5 *(Establish a Corresponding Input for Each Parameter Selected for Level 4)*
HIGH LOW HIGH OR LOW	TRIGGER THRESHOLD RESET THRESHOLD REQUEST (MANUAL/AUTO) DELAY TIME	Required Trigger Threshold Frequency (0.02 to 10Hz in increments of 0.01) Required Reset Threshold Frequency (0.02 to 10Hz in increments of 0.01) Select Auto or Manual Select Delay Time from 0.1 to 60 seconds (in 0.1 second increments)

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Startup Settings Sheet #5 Event Trigger Programming (continued from previous side)

Table I
Levels 3 and 4 Selections
(Use when Level 2 Selection is "Current Unbalance")

Level 3 *(Select One to Four Parameters as Required)*	Level 4 *(Establish a Corresponding Input for Each Parameter Selected for Level 3)*
TRIGGER THRESHOLD	Required Trigger Threshold (1 to 100%)
RESET THRESHOLD	Required Reset Threshold (1 to 100%)
RESET (MANUAL/AUTO)	Select Auto or Manual
DELAY TIME	Select Delay Time from 0.1 to 60 seconds (in 0.1 second increments)

Table J
Levels 3 through 5 Selections
(Use when Level 2 Selection is "Voltage Unbalance")

Level 3 *(Select One Parameter)*	Level 4 *(Select One to Four Parameters as Required)*	Level 5 *(Establish a Corresponding Input for Each Parameter Selected for Level 4)*
LINE – LINE VOLTS	TRIGGER THRESHOLD	Required Trigger Threshold (1 to 100%)
LINE – NEUTRAL VOLTS	RESET THRESHOLD	Required Reset Threshold (1 to 100%)
	RESET (MANUAL/AUTO)	Select Auto or Manual
	DELAY TIME	Select Delay Time from 0.1 to 60 seconds (in 0.1 second increments)

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Startup Settings Sheet #5 Event Trigger Programming (continued from previous side)

Table K
Levels 3 Selection
(Use when Level 2 Selection is "Discrete Input")

Level 3 ***(Select One)***
INPUT #1
INPUT #2
INPUT #3

Table L
Levels 3 Selection
(Use when Level 2 Selection is "Manual Capture Request")

Level 3 ***(Select One)***
FRONT PANEL ONLY
IMPACC AND FRONT PANEL

Table M
Levels 3 Selection
(Use when Level 2 Selection is "MIN/MAX UPDATE")

Level 3 ***(Select One to Five Parameters as Required)***
MIN/MAX CURRENT
MIN/MAX VOLTAGE
MIN/MAX POWER FACTOR
MIN/MIX POWER/FREQUENCY
MIN/MAX THD

EVENT TRIGGER PROGRAMMING COMPLETE

Startup Settings Sheet #6

RELAY OUTPUT SETTINGS

(Reference Paragraph 5-6.4 and Figure 6-9)

Note: Up to four Form C (NO/NC) Relay Outputs are available. Each is programmed individually.

Select Up to Four

Step 1: Choose Relay Outputs ➠ RELAY OUTPUT 1 ❑
RELAY OUTPUT 2 ❑
RELAY OUTPUT 3 ❑
RELAY OUTPUT 4 ❑

Step 2: Choose one Mode Option for each Relay Output selected in Step 1.

Relay Output 1 ➠	Mode 1: Active = ON ❑ Mode 2: Active = OFF ❑	Relay Output 3 ➠	Mode 1: Active = ON ❑ Mode 2: Active = OFF ❑
Relay Output 2 ➠	Mode 1: Active = ON ❑ Mode 2: Active = OFF ❑	Relay Output 4 ➠	Mode 1: Active = ON ❑ Mode 2: Active = OFF ❑

Step 3: Choose and indicate in the space provided one of the below listed categories for each of the Relay Outputs selected in Step 1.

Reset Output Category	Category
DISABLE	➠ ________________________ Relay Output 1
LOAD SHEDDING	________________________ Relay Output 2
PULSE INITIATOR	________________________ Relay Output 3
EVENT/DINPUT/NETWORK	________________________ Relay Output 4
REVERSE SEQUENCE ALARM	

Note: If "Disable" was selected in Step 3 for any Relay Output, programming is complete for that particular Relay Output after completing Step 3.

Note: (1) If "Load Shedding" was selected in Step 3 for any Relay Output, proceed directly to Step 4 for those particular Relay Outputs.

(2) If "Pulse Initiator" was selected in Step 3 for any Relay Output, proceed directly to Step 6 for those particular Relay Outputs.

(3) If "Event/Dinput/Network" was selected in Step 3 for any Relay Output, proceed directly to Step 7 for those particular Relay Outputs.

(4) If "Reverse Sequence Alarm" was selected in Step 3 for any Relay Output, proceed directly to Step 8 for those particular Relay Outputs.

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Startup Settings Sheet #6 Relay Output Programming (continued from previous page)

Step 4: For those Relay Outputs with “Load Shedding,” choose and indicate in the space provided one of the below listed parameters for each Relay Output with “Load Shedding.”

Load Shedding Parameters	**Parameters**
DEMAND AMPS	________________ Relay Output 1
DEMAND FORWARD WATTS	________________ Relay Output 2
DEMAND REVERSE WATTS	________________ Relay Output 3
DEMAND FORWARD VARS	________________ Relay Output 4
DEMAND REVERSE VARS	
DEMAND VA	

Step 5: For those Relay Outputs with a specific “Load Shedding Parameter” identified in Step 4, indicate in the space provided below the new “Threshold Setting” for each Relay Output.

Threshold Setting

________________ Relay Output 1

________________ Relay Output 2

________________ Relay Output 3

________________ Relay Output 4

Note: Programming is complete upon completion of Step 5 for any Relay Output with “Load Shedding.”

Step 6: For those Relay Outputs with “Pulse Initiator,” choose and indicate in the space provided one of the below listed parameters for each Relay Output with “Pulse Indicator.”

Pulse Initiator Parameters	**Parameters**
FORWARD KW-HR	________________ Relay Output 1
FORWARD KVAR-HR	________________ Relay Output 2
KVA-HR	________________ Relay Output 3
REVERSE KW-HR	________________ Relay Output 4
REVERSE KVAR-HR	

Note: Programming is complete upon completion of Step 6 for any Relay Output with “Pulse Initiator.”

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Startup Settings Sheet #6 Relay Output Programming (continued from previous page)

Step 7: For those Relay Outputs with "Event/Alarm/IMPACC," select *one or more* "Event/ DINPUT/NETWORK" categories by checking ( ) the appropriate boxes. At the same time, check ( ) the appropriate box to indicate the type of "Reset" for each "Event/DINPUT/NETWORK" category selected. If "Automatic Reset" is selected, indicate in the space provided the "Release Time" from 0 to 1800 seconds.

RELAY OUTPUT 1

Event/Alarm/IMPACC Category		Reset Types (Manual)	Reset Types (Automatic)	Automatic Release Time
➠ NOT USED	❑	--------------***No Further Selection Required***-------------		
EVENT TRIGGER #1	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #2	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #3	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #4	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #5	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #6	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #7	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #1	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #2	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #3	❑	❑	❑	____ ____ ____ ____
NETWORK INPUT	❑	❑	(Recommended)	0 0 0 0

RELAY OUTPUT 2

Event/Alarm/IMPACC Category		Reset Types (Manual)	Reset Types (Automatic)	Automatic Release Time
➠ NOT USED	❑	--------------***No Further Selection Required***-------------		
EVENT TRIGGER #1	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #2	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #3	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #4	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #5	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #6	❑	❑	❑	____ ____ ____ ____
EVENT TRIGGER #7	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #1	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #2	❑	❑	❑	____ ____ ____ ____
DISCRETE INPUT #3	❑	❑	❑	____ ____ ____ ____
NETWORK INPUT	❑	❑	(Recommended)	0 0 0 0

Continued on next page

Startup Settings Sheet #6 Relay Output Programming (continued from previous page)

RELAY OUTPUT 3

Event/Alarm/IMPACC Category		Reset Types (Manual)	Reset Types (Automatic)	Automatic Release Time			
➠ NOT USED	❑	--------------***No Further Selection Required***-------------					
EVENT TRIGGER #1	❑	❑	❑	____	____	____	____
EVENT TRIGGER #2	❑	❑	❑	____	____	____	____
EVENT TRIGGER #3	❑	❑	❑	____	____	____	____
EVENT TRIGGER #4	❑	❑	❑	____	____	____	____
EVENT TRIGGER #5	❑	❑	❑	____	____	____	____
EVENT TRIGGER #6	❑	❑	❑	____	____	____	____
EVENT TRIGGER #7	❑	❑	❑	____	____	____	____
DISCRETE INPUT #1	❑	❑	❑	____	____	____	____
DISCRETE INPUT #2	❑	❑	❑	____	____	____	____
DISCRETE INPUT #3	❑	❑	❑	____	____	____	____
NETWORK INPUT	❑	❑	(Recommended)	0	0	0	0

RELAY OUTPUT 1

Event/Alarm/IMPACC Category		Reset Types (Manual)	Reset Types (Automatic)	Automatic Release Time			
➠ NOT USED	❑	--------------***No Further Selection Required***-------------					
EVENT TRIGGER #1	❑	❑	❑	____	____	____	____
EVENT TRIGGER #2	❑	❑	❑	____	____	____	____
EVENT TRIGGER #3	❑	❑	❑	____	____	____	____
EVENT TRIGGER #4	❑	❑	❑	____	____	____	____
EVENT TRIGGER #5	❑	❑	❑	____	____	____	____
EVENT TRIGGER #6	❑	❑	❑	____	____	____	____
EVENT TRIGGER #7	❑	❑	❑	____	____	____	____
DISCRETE INPUT #1	❑	❑	❑	____	____	____	____
DISCRETE INPUT #2	❑	❑	❑	____	____	____	____
DISCRETE INPUT #3	❑	❑	❑	____	____	____	____
NETWORK INPUT	❑	❑	(Recommended)	0	0	0	0

Note: Programming is complete upon completion of Step 7 for any Relay Output with "Event/DINPUT/Network."

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Startup Settings Sheet #6 Relay Output Programming (continued from previous page)

Step 8: For those Relay Outputs with “Reverse Sequence Alarm,” select Manual or Automatic Reset by checking ( ) the appropriate box. If Automatic Reset is checked for any Relay Output, enter the OFF Delay Setting (0-1800 seconds) in the space provided.

	Reset Types (Manual)	Reset Types (Automatic)	Off Delay Setting (0 – 1800 Seconds)
➠ RELAY OUTPUT #1 ❑	❑	❑	____ ____ ____ ____
RELAY OUTPUT #2 ❑	❑	❑	____ ____ ____ ____
RELAY OUTPUT #3 ❑	❑	❑	____ ____ ____ ____
RELAY OUTPUT #4 ❑	❑	❑	____ ____ ____ ____

RELAY OUTPUT PROGRAMMING COMPLETE

Startup Settings Sheet #7

DEMAND SETTINGS
(Reference Paragraph 5-7.4 and Figure 6-10)

Note: Both Current Demand and Power Demand Windows can be programmed. Each is programmed individually.

Step 1: CURRENT DEMAND WINDOW ➠ Enter from 1-60 minutes _____ _____

Select One

Step 2: POWER DEMAND WINDOW ➠ FIXED WINDOW ❑
SLIDING WINDOW ❑

Note: If "Fixed Window" is selected in Step 2, complete the programming with Step 3. If "Sliding Window" is selected, proceed directly to Step 4 and complete the programming with that step.

Step 3: FIXED WINDOW ➠ Enter a Demand Window of 1-60 minutes _____ _____

Step 4: SLIDING WINDOW ➠ Enter a Sub-Demand Interval of 1-60 minutes _____ _____

(and)

Enter Number of Intervals (1-60) _____ _____

Note: The product of the "Sub-Demand Interval" times the number of intervals is the window period (1-60 minutes).

DEMAND PROGRAMMING COMPLETE

Startup Settings Sheet #8

DISPLAY MANAGER SETTINGS

(Reference Paragraph 5-2.3 and Figure 6-11)

Step 1: METER MENU RETURN TIME ➠ Enter 0-15 minutes _____ _____
(0 = no return)

Step 2: CUSTOM SCREENS

Note:** **Up to 28 different parameters can be programmed to form a customized screen. Listed below are the 60 parameter possibilities plus a “Default” selection. Choosing “Default” will automatically program 28 pre-selected parameters as indicated by the bold type. An asterisk (*) is used in the display to indicate what parameters are presently programmed. To add new parameters and/or delete existing parameters, move to the specific parameter and use the F1 (SELECT) pushbutton. An asterisk will appear or disappear next to the parameter, depending upon whether the parameter is being added or deleted.

Select from 0 to 28 parameters from the list below by checking (✍) appropriate boxes.

❑ **1 AVG CURRENT**
❑ **2 GND CURRENT**
❑ 3 AVG VLL
❑ **4 SYS WATTS**
❑ **5 SYS VARS**
❑ **6 SYS VA**
❑ **7 NET WATT-HOURS**
❑ 8 NET VAR-HOURS
❑ **9 FREQUENCY**
❑ **10 DISP POWER FACTOR**
❑ 11 %THD IA
❑ **12 %THD VAB**
❑ 13 K-FACTOR
❑ 14 PEAK SYS DMD WATTS
❑ **15 IA AMPS**
❑ **16 IB AMPS**
❑ **17 IC AMPS**
❑ **18 IN AMPS**
❑ **19 VAB VOLTS**
❑ **20 VBC VOLTS**
❑ **21 VCA VOLTS**
❑ **22 VAN VOLTS**
❑ **23 VBN VOLTS**
❑ **24 VCN VOLTS**
❑ 25 PEAK SYS DMD VARS
❑ 26 PEAK SYS DMD VA
❑ 27 PHASE A VA
❑ 28 PHASE B VA
❑ 29 PHASE C VA
❑ 30 PHASE A VARS
❑ 31 PHASE B VARS
❑ 32 PHASE C VARS
❑ 33 PHASE A WATTS
❑ 34 PHASE B WATTS
❑ 35 PHASE C WATTS
❑ 36 FORWARD WATT-HOURS
❑ 37 REVERSE WATT-HOURS
❑ 38 LEADING VAR-HOURS
❑ 39 LAGGING VAR-HOURS
❑ **40 VA-HOURS**
❑ 41 PEAK DMD CURRENT
❑ 42 AVG VLN VOLTS
❑ **43 VNG VOLTS**
❑ 44 DISP PF PHASE A
❑ 45 DISP PF PHASE B
❑ 46 DISP PF PHASE C
❑ 47 APPARENT PF PHASE A
❑ 48 APPARENT PF PHASE B
❑ 49 APPARENT PF PHASE C
❑ **50 APPARENT SYS PF**
❑ 51 %THD IB
❑ 52 %THD IC
❑ 53 %THD IN
❑ **54 %THD VCA**
❑ **55 %THD VBC**
❑ 56 %THD VAN
❑ 57 %THD VBN
❑ 58 %THD VCN
❑ 59 THDF (CBEMA Xfmr Derating)
❑ 60 CREST FACTOR
❑ **61 THD AMPS IA**
❑ **62 THD AMPS IB**
❑ **63 THD AMPS IC**
❑ **64 THD AMPS IN**
❑ 65 THD VOLTS VAB
❑ 66 THD VOLTS VBC
❑ 67 THD VOLTS VCA
❑ 68 THD VOLTS VAN
❑ 69 THD VOLTS VBN
❑ 70 THD VOLTS VCN
❑ 71 MIN AVG AMPS
❑ 72 MAX AVG AMPS
❑ 73 MIN VLL VOLTS
❑ 74 MAX VLL VOLTS
❑ 75 MIN VLN VOLTS
❑ 76 MAX VLN VOLTS
❑ 77 MAX IN AMPS
❑ 78 MAX IG AMPS
❑ 79 MAX VNG VOLTS
❑ 80 MAX SYS WATTS
❑ 81 MAX SYS VARS
❑ 82 MAX SYS VA
❑ 83 MIN APPARENT PF
❑ 84 MAX APPARENT PF
❑ 85 MIN DISP PF
❑ 86 MIN DISP PF
❑ 87 PRESENT DMD WATTS
❑ 88 PRESENT DMD VARS
❑ 89 PRESENT DMD VA
❑ 90 PRESENT DMD AMPS
❑ 91 TIMESTAMP (HMSMDY)
❑ 92 INPUT#1 CHANGE COUNT
❑ 93 INPUT#2 CHANGE COUNT
❑ 94 INPUT#3 CHANGE COUNT
❑ DEFAULT 28 (IN **BOLD**)

Continued on next page

Startup Settings Sheet #8 Display Manager Programming (continued from previous page)

Select One

Step 3: SCREEN SAVER
- ❏ 0 = DIM
- ❏ 1 = Normal

Step 4: ALARM SCREEN
- ❏ ALL ALARM SCREENS
- ❏ NO EVENT ALARM SCREEN

Step 5: NEUTRAL DISPLAYS
- ❏ NO NEUTRAL IN DELTA
- ❏ ALWAYS SHOW NEUTRAL

Step 6: DATE FORMAT
- ❏ MM/DD/20YY
- ❏ DD/MM/20YY

Display Options(1)

Option 1	Option 2
ALL ALARM SCREENS: Upon waveform capture event or alarm condition, blink the event LED and display the event timestamp and cause.	NO EVENT ALARM SCREEN: (Default) Upon waveform capture event or alarm condition, blink the event LED but do not interrupt normal display operation.
NO NEUTRAL IN DELTA: (Default) When configured for 3-phase, 3-wire operation, hide line-to-neutral voltage readings, per-phase PF, and per-phase power.	ALWAYS SHOW NEUTRAL: Regardless of the system configuration, display all parameters, including line-to-neutral voltage, etc. NOTE: In 3-phase, 3-wire mode, the IQ Analyzer calculates the center of the power triangle and uses it as neutral for all calculations.
MM/DD/YY FORMAT (Default) Display all dates in month, day, year format. This setting does not affect communications formats.	DD/MM/YY FORMAT Display all dates in day, month, year format. This setting does not affect communications formats.

DISPLAY MANAGER PROGRAMMING COMPLETE

Startup Settings Sheet #9

TREND SETTINGS

(Reference Paragraph 5-11.3 and Figure 6-12)

Time Between Trends

0 minutes => every 8 line cycles
1-5039 minutes => periodic sampling
5040 minutes => one sample per triggering input for Trend1-3 or waveform event for Trend4

Trend1 Interval (0-5040) _ ___ ___ ___(5)
Trend2 Interval (0-5040) _ ___ ___ ___ (5)
Trend3 Interval (0-5040) _ ___ ___ ___ (5)
Trend4 Interval (0-5040) _ ___ ___ ___ (0)

Maximum Memory Allocation in Percent

Trend1 Allocation (0-100) _ ___ ___ (93%)
Trend2 Allocation (0-100) _ ___ ___ (1%)
Trend3 Allocation (0-100) _ ___ ___ (1%)
Trend4 Allocation (0-100) _ ___ ___(5%)

Items to Trend (up to 6 items per trend)
The defaults are 0 (unused) unless marked otherwise.

Trend1 Item1 ______ (Default 91 Time)
Trend1 Item2 ______ (Default 7 Watt-Hrs)
Trend1 Item3 ______
Trend1 Item4 ______
Trend1 Item5 ______
Trend1 Item6 ______

Trend2 Item1 ______
Trend2 Item2 ______
Trend2 Item3 ______
Trend2 Item4 ______
Trend2 Item5 ______
Trend2 Item6 ______

Trend3 Item1 ______
Trend3 Item2 ______
Trend3 Item3 ______
Trend3 Item4 ______
Trend3 Item5 ______
Trend3 Item6 ______

Trend4 Item1 ______(Default 19 VAB)
Trend4 Item2 ______ (Default 20 VBC)
Trend4 Item3 ______ (Default 21 VCA)
Trend4 Item4 ______ (Default 22 VAN)
Trend4 Item5 ______ (Default 23 VBN)
Trend4 Item6 ______ (Default 24 VCN)

❏ 0 UNUSED
❏ 1 AVG CURRENT
❏ 2 GND CURRENT
❏ 3 AVG VLL
❏ 4 SYS WATTS
❏ 5 SYS VARS
❏ 6 SYS VA
❏ 7 NET WATT-HOURS (Trend1)
❏ 8 NET VAR-HOURS
❏ 9 FREQUENCY
❏ 10 DISP POWER FACTOR
❏ 11 %THD IA
❏ 12 %THD VAB
❏ 13 K-FACTOR
❏ 14 PEAK SYS DMD WATTS
❏ 15 IA AMPS
❏ 16 IB AMPS
❏ 17 IC AMPS
❏ 18 IN AMPS
❏ 19 VAB VOLTS (Trend4)
❏ 20 VBC VOLTS (Trend4)
❏ 21 VCA VOLTS (Trend4)
❏ 22 VAN VOLTS (Trend4)
❏ 23 VBN VOLTS (Trend4)
❏ 24 VCN VOLTS (Trend4)
❏ 25 PEAK SYS DMD VARS
❏ 26 PEAK SYS DMD VA
❏ 27 PHASE A VA
❏ 28 PHASE B VA
❏ 29 PHASE C VA
❏ 30 PHASE A VARS
❏ 31 PHASE B VARS
❏ 32 PHASE C VARS
❏ 33 PHASE A WATTS
❏ 34 PHASE B WATTS
❏ 35 PHASE C WATTS
❏ 36 FORWARD WATT-HOURS
❏ 37 REVERSE WATT-HOURS
❏ 38 LEADING VAR-HOURS
❏ 39 LAGGING VAR-HOURS
❏ 40 VA-HOURS
❏ 41 PEAK DMD CURRENT
❏ 42 AVG VLN VOLTS
❏ 43 VNG VOLTS
❏ 44 DISP PF PHASE A
❏ 45 DISP PF PHASE B
❏ 46 DISP PF PHASE C
❏ 47 APPARENT PF PHASE A
❏ 48 APPARENT PF PHASE B
❏ 49 APPARENT PF PHASE C
❏ 50 APPARENT SYS PF
❏ 51 %THD IB
❏ 52 %THD IC
❏ 53 %THD IN
❏ 54 %THD VCA
❏ 55 %THD VBC
❏ 56 %THD VAN
❏ 57 %THD VBN
❏ 58 %THD VCN
❏ 59 THDF (CBEMA Xfmr Derating)
❏ 60 CREST FACTOR
❏ 61 THD AMPS IA
❏ 62 THD AMPS IB
❏ 63 THD AMPS IC
❏ 64 THD AMPS IN
❏ 65 THD VOLTS VAB
❏ 66 THD VOLTS VBC
❏ 67 THD VOLTS VCA
❏ 68 THD VOLTS VAN
❏ 69 THD VOLTS VBN
❏ 70 THD VOLTS VCN
❏ 71 MIN AVG AMPS
❏ 72 MAX AVG AMPS
❏ 73 MIN VLL VOLTS
❏ 74 MAX VLL VOLTS
❏ 75 MIN VLN VOLTS
❏ 76 MAX VLN VOLTS
❏ 77 MAX IN AMPS
❏ 78 MAX IG AMPS
❏ 79 MAX VNG VOLTS
❏ 80 MAX SYS WATTS
❏ 81 MAX SYS VARS
❏ 82 MAX SYS VA
❏ 83 MIN APPARENT PF
❏ 84 MAX APPARENT PF
❏ 85 MIN DISP PF
❏ 86 MIN DISP PF
❏ 87 PRESENT DMD WATTS
❏ 88 PRESENT DMD VARS
❏ 89 PRESENT DMD VA
❏ 90 PRESENT DMD AMPS
❏ 91 TIMESTAMP (Trend1)
❏ 92 INPUT#1 CHANGE COUNT
❏ 93 INPUT#2 CHANGE COUNT
❏ 94 INPUT#3 CHANGE COUNT

Startup Settings Sheet #10

TIME OF USE SETTINGS
(Reference Paragraph 5-13.2 and Figure 6-13)

Select Holidays (up to 22 dates)

Holiday1 Month & Day __________ ___ ______
Holiday2 Month & Day __________ ___ ______
Holiday3 Month & Day __________ ___ ______
Holiday4 Month & Day __________ ___ ______
Holiday5 Month & Day __________ ___ ______
Holiday6 Month & Day __________ ___ ______
Holiday7 Month & Day __________ ___ ______
Holiday8 Month & Day __________ ___ ______
Holiday9 Month & Day __________ ___ ______
Holiday10 Month & Day _________ ___
Holiday11 Month & Day _________ ___
Holiday12 Month & Day _________ ___
Holiday13 Month & Day _________ ___
Holiday14 Month & Day _________ ___
Holiday15 Month & Day _________ ___
Holiday16 Month & Day _________ ___
Holiday17 Month & Day _________ ___
Holiday18 Month & Day _________ ___
Holiday19 Month & Day _________ ___
Holiday20 Month & Day _________ ___
Holiday21 Month & Day _________ ___
Holiday22 Month & Day _________ ___

Seasons (up to 8 starting dates)

Season1 Month & Day __________ ___
Season2 Month & Day __________ ___
Season3 Month & Day __________ ___
Season4 Month & Day __________ ___
Season5 Month & Day __________ ___
Season6 Month & Day __________ ___
Season7 Month & Day __________ ___
Season8 Month & Day __________ ___

Choose Daylight Savings Adjustment

Select One

No daylight savings adjustment ❏

Set present time to Standard (winter) ❏

Set present time to Daylight (summer) ❏

Choose Clock Synchronization

Select One

Synchronize Clock to Line Voltage ❏

No Clock Sync (free-running watch) ❏

The DEFAULT MINIMUM is recommended as the starting point for schedules. There will be a single season beginning on January 1, and holidays are cleared. All schedules begin at 12AM and are preloaded with the following rates: Weekdays (Rate1), Saturdays(Rate2), Sundays(Rate3), and Holidays(Rate4).

Schedule for Weekdays in Season1
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season1
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season1
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season1
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season2
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season2
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season2
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season2
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)
TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season3
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season3
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season3
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season3
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season4
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season4
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season4
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season4
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season5
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season5
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season5
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season5
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season6
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season6
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season6
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season6
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season7
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season7
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season7
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season7
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Weekdays in Season8
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Saturdays in Season8
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Sundays in Season8
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

Schedule for Holidays in Season8
Each period has a Starting Time
(Hr:Min AM/PM) and Rate (1-4)

TR01 12 :00 AM Rate= ___
TR02 ___:___ ___ Rate= ___
TR03 ___:___ ___ Rate= ___
TR04 ___:___ ___ Rate= ___
TR05 ___:___ ___ Rate= ___
TR06 ___:___ ___ Rate= ___
TR07 ___:___ ___ Rate= ___
TR08 ___:___ ___ Rate= ___
TR09 ___:___ ___ Rate= ___
TR10 ___:___ ___ Rate= ___

GLOSSARY

The terms and phrases contained in this Glossary are defined as used in the context of this publication, and are not intended to be all inclusive definitions. In many instances, you will be asked to refer to a specific or section for a definition and/or discussion. Some terms and/or phrases are used, but not covered in detail in any specific section. In those cases, a definition or discussion is presented in the Glossary.

Analog Input
Pages 2-3, 2-7, 4-6, 4-7, 4-20, 5-11, 6-1, 6-13, 6-15, A-4

Analog Output
Pages 2-3, 2-8, 4-6, 4-7, 4-19, 5-13, 6-1, 6-13, 6-15, A-5

Apparent Power Factor
A ratio of total real power, including harmonic component, to reactive power (Total rms watts to VA).

Analysis Mode
Page 5-18

CBEMA Factor
A transformer harmonic derating factor (THDF) defined as a pure sine wave's crest factor (1.4141) divided by the measured crest factor.

Communications
Pages 2-4, 4-4, 5-11, 5-25

Communication Module
Pages 2-4, 5-25

Crest Factor
Ratio of peak current to rms current. A pure sine wave has a crest factor of 1.414.

Custom Screen
(See Display Manager)

Demand
Pages 5-24, 6-1, 6-13, 6-19, A-21

Demand Analysis
Page 5-24

Discrete Input
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Displacement Power Factor
A ratio of fundamental (50/60 Hz) real power to apparent power (Fundamental watts to Fundamental VA).

Display
Page 3-1

Display Manager
Pages 5-5, 6-13, 6-19, A22

Displayed Parameters
Pages 5-1, 5-2

Dry Contact
Contact not providing voltage (e.g., a pushbutton)

EPONI (Ethernet PONI)
Pages 2-5, 5-25

Event Analysis
Page 5-20

Excess dV/dt (IQA-6600 only)
Pages 5-23, A-8

Event Log
Pages 5-33

Event Triggers
Pages 5-20, 5-22, 6-1, 6-13, 6-17, A-8

Flange Mounted
Page 4-2

Form C Contact
Standard 1 normally open and 1 normally closed contacts.

General Setup
Pages 5-8, 6-1, 6-14, A-1

Graphic Screens (IQA-6600 only)
Page 5-26

Harmonic Analysis
Pages 5-24, 5-26

Help Mode
Page 5-5

IMPACC (Integraged Metering, Protection, And Control Communications)
Page 5-25

K-Factor

A derating factor related to the sum of the squares of harmonic current times the squares of their harmonic numbers (multiples of the fundamental).

Potential Transformer

The IQ Analyzer assumes a 120 volt potential transformer secondary and utilizes the ratio between the primary and secondary for calculation purposes. Two conditions exist that require special consideration. These conditions are:

1. Line voltage is 600 volts or below and potential transformers are not used.
2. Potential transformer secondary voltage is not 120 volts.

Condition 1: During General Setup programming the potential transformer primary must be programmed to 120 volts to yield a 1/1 (unity ratio) ratio for calculation purposes.

Condition 2: If the potential transformers being used do not have 120 volt secondaries, the primary must be programmed to a voltage that will yield an equivalent ratio with 120 volts as the ratio of the actual potential transformers being applied.

Example:

Potential Transformers to be Applied	Potential Transformers Programming
220/110 Ratio 2/1	240/120 Ratio 2/1

RAW #
During several programming steps, the IQ Analyzer will request that a RAW # be programmed. The RAW # is an internal electronic scaling factor associated with the chip. A complete understanding of RAW # is not required. Merely change the RAW # until the programmed parameter reaches the desired value. Knowing its mathematical relationship to certain parameters, however, is useful for certain programming steps. This relationship is presented here in the form of two formulas, one for current and one for voltage.

Use the appropriate formula to determine what RAW # should be programmed to arrive at the required current or voltage setting as shown in the display. Keep in mind that the calculated RAW # should be rounded to the nearest whole number for programming. The resulting current or voltage setting in the display may not be the exact number selected. The setting will, however, be well within acceptable accuracies.

RAW # Formulas

1. When a current parameter must be determined, use the following formula:

$$\text{RAW \#} = \frac{\text{(Ampere Setting Required)(400)}}{\text{CT Ratio}}$$

2. When a voltage parameter must be determined, use the following formula:

$$\text{RAW \#} = \frac{\text{Voltage Setting Required}}{\text{(0.12)(PT Ratio)}}$$

RAW # Calculation Example

Refer to the programming example presented in Section 6 and Figure BB of the Programming Flow Chart on page 6-13. The last programming item, Demand Amps, uses a RAW # for the programming process to program 1000A. The CT ratio used in the formula was previously programmed as 1200/5. Using the current parameter formula results in the following RAW #:

$$\text{RAW \#} = \frac{(\text{Ampere Setting Required})(400)}{\text{CT Ratio}}$$

$$\text{RAW \#} = \frac{(1000\text{A})(400)}{1200/5}$$

$$\text{RAW \#} = \frac{400{,}00}{240} = 1666.6$$

RAW # = 1667 (Rounded to Nearest Whole Number)

Figure BB on page 6-13 shows the programmed RAW # of 1667 and the resultant ampere setting of 1000.24A, well within accuracy levels.

Relay Output Contacts
Pages 2-2, 2-8, 4-21, 5-16, 6-1, 6-13, 6-18, A-16

Reset Mode
Page 5-27

Sag
As defined with respect to the IQ Analyzer, a sag is an undervoltage condition lasting from 0 to 3600 cycles.

Screens Trees
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Software
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Sign Conventions
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Page 2-6

Startup Settings Sheets
(See Appendix A)

Swell
As defined with respect to the IQ Analyzer, a swell is an overvoltage condition lasting from 0 to 3600 cycles.

Sync. Pulse Input
A sync. pulse input is essentially a sensor that receives a signal from a utility company, synchronizing the IQ Analyzer with the demand window the utility billing is based on. The sync. pulse is activated by programming Discrete Input #1 for Sync. input. Refer to Figure **6-7** for the Discrete Input Screens Tree.

The sync. pulse input should be wired to contacts 13 and 14 on the IQ Analyzer as shown in Figure **4-33**. When an exterior contact is closed by the utility and the circuit is completed across terminals 13 and 14, the last demand period is ended, the peak demand values are updated, and the new demand period begins in line with the utility. (See Demand.)

Time Of Use
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Trend Data
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Triggers
(See Event Triggers)

Troubleshooting
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Wiring
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WARNING

IMPROPERLY INSTALLING OR MAINTAINING THIS PRODUCT CAN RESULT IN DEATH, SERIOUS PERSONAL INJURY, OR PROPERTY DAMAGE.

READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE ATTEMPTING ANY UNPACKING, ASSEMBLY, OPERATION OR MAINTENANCE OF THE PRODUCT.

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Cutler-Hammer
Power Distribution Components Division
1000 Cherrington Pkwy
Moon Township PA 15108

www.cutlerhammer.eaton.com

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of particular equipment, contact a Cutler-Hammer representative.

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Cutler-Hammer
Power Management Products Center
240 Vista Park Drive
Pittsburgh, PA 15205
www.cutlerhammer.com

Effective January, 2000 Style 66A2005H02
Printed in U.S.A.