

EATON

Cutler-Hammer

IQ 300 SERIES

**INSTRUCTIONS FOR INSTALLATION,
OPERATION AND MAINTENANCE OF
THE CUTLER-HAMMER IQ 300 SERIES
OF ELECTRICAL DISTRIBUTION
SYSTEM METERS**

**INSTRUCTION
LEAFLET
IL17574C**

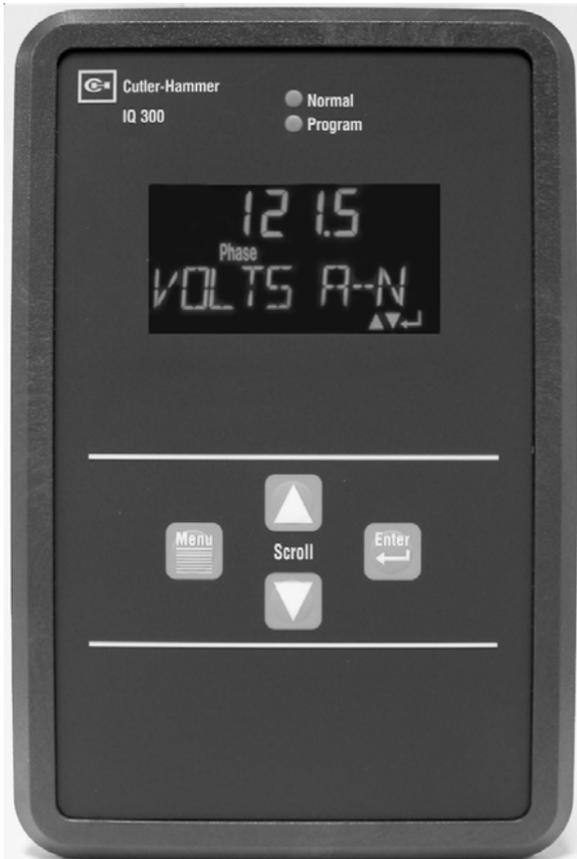


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SECTION 1: INTRODUCTION

1.1 PRELIMINARY COMMENTS AND SAFETY PRECAUTIONS

This Technical Document covers most aspects of installation, operation, and unit-level maintenance of the IQ 300. This document is a guide only for authorized and qualified personnel who select and use the IQ 300. Please refer to the specific WARNING and CAUTION in this section before proceeding. If you require further information regarding a particular installation, application or maintenance activity, contact your Cutler-Hammer representative.

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 this information, recommendations, 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 CAUTION LABEL IS SHOWN ABOVE. THIS WILL HELP TO ENSURE THAT PERSONNEL ARE ALERT TO WARNINGS WHICH MAY APPEAR THROUGHOUT THE DOCUMENT.



CAUTION



COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING TO INSTALL, OPERATE OR USE 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

For additional information, technical assistance or referral to a local authorized distributor, contact Power Management Application Support (PMAS) at 1-800-809-2772, option 1 / option 1.

1.2 PRODUCT OVERVIEW

NOTE: Throughout this document, references to IQ 300 are intended for all Base types in the series, the IQ 310, IQ 320, IQ 330 and the IQ 330M. Units with functions and specifications that differentiate from the Base Unit are noted in the relevant sections.

The IQ 300 is a microprocessor based series of monitoring devices that provide single phase, 2 or 3 wire, and 3 phase, 3 or 4 wire electrical metering designed to replace numerous individual meters and recorders. The IQ 300 series devices are compact, and consist of a panel-mounted Display Module and a Base Module that can be attached to the Display Module or mounted remotely. The devices are password protected, menu driven and display a variety of user-selected electrical system values and provide control over certain measurement and data output functions. The IQ 300 series Base Modules communicate with the IQ 300 Display Module, providing access to view and reset system, phase and min/max values, and for providing viewing and editing of set points.

Typical System Wiring Configuration:

3 Phase 4 Wire	3 Phase 3 Wire	3 Phase 3 or 4 Wire	Single Phase 2 or 3 Wire
208 Y / 120 Vac	240 Vac	220 / 380 Vac	120 / 240 Vac
480 Y / 277 Vac	480 Vac	230 / 400 Vac	
600 Y / 347 Vac	600 Vac	240 / 415 Vac	

The IQ 300 series includes four variations of the IQ 300 Base Module and a single IQ 300 Display Module that functions with any Base type. The IQ 310 Base Module is a reduced function variation, while the IQ 320, the IQ 330 and the IQ 330M Base Modules have additional capabilities.

The IQ 320 includes a wider ranging power supply, PowerNet communication, by way of the INCOM port, which provides information to the network master device and a KYZ Pulse output proportional to the energy consumed by the system being monitored.

IQ300 Series Features:

Meter Model	Display Size (in inches)	Power Supply	Comm	KYZ Output	Digital Inputs	Digital Outputs	Analog Input	Utility Sealing
IQ310	10.25x6.72	110-240 Vac 125-250 Vdc	NO	NO	NO	NO	NO	NO
IQ320	10.25x6.72	90-600 Vac 48-250 Vdc	INCOM	YES	NO	NO	NO	NO
IQ330	10.25x6.72	90-600 Vac 48-250 Vdc	INCOM	YES	2	2	1	YES
IQ330M	10.25x6.72	90-600 Vac 48-250 Vdc	Modbus	YES	2	2	1	YES

The IQ 330 includes a wider ranging power supply. PowerNet communication, by way of the INCOM port, provides information to the network master device. A KYZ Pulse output proportional to the energy consumed by the system being monitored, 2 digital outputs (form A contacts), 2 digital inputs, that read and count transitional edges (that occur as often as 8ms) and 1 analog input to read 4 to 20 ma signal and display a percentage of 0 to 100.

While the IQ 330M includes everything the IQ 330 Base Module includes, the INCOM communication is replaced with MODBUS.

The IQ 300 displays the following values:

Values Displayed		
System	Each Phase	Minimum/Maximum
Power	Current	Currents
Frequency	Current Demand	Line to Line Voltages
Apparent Power Factor	Current Peak Demand	Line to Neutral Voltages
Displacement Power Factor	Line to Line Voltage	System Power (W, vars, VA)
Watt Hours	Line to Neutral Voltage	System Frequency
var Hours	Watts	System Apparent Power Factor
VA Hours	vars	System Displacement Power Factor
Demand (W, var, VA)	VA	
Peak Demand (W, var, VA)	Apparent Power Factor	
	Displacement Power Factor	

SECTION 2: HARDWARE DESCRIPTION

2.1 GENERAL

This section describes the IQ 300 hardware, its functions and nomenclature, and lists the IQ 300 specifications. An IQ 300 consists of two components, the Display Module, figure 2.1, and a Base Module, figure 2.2.

Do not attempt to disassemble or open the case of either the IQ 300 Display Module or the IQ 300 Base Modules (IQ 310, IQ 320 or IQ 330). The units contain no user-serviceable components.



Figure 2.1 IQ 300 Display Module

2.1.1 IQ 300 Display Module

The Display Module screen presents system values and functions. The *Menu*, up/down *Scroll*, and *Enter* buttons allow the operator to view, change, and reset system parameters. The port for connecting to an IQ 300 Base Module (IQ 310, IQ 320, IQ 330 or IQ 330M) is located on the back side of the IQ 300 Display Module.

2.1.2 IQ 300 Base Modules

The IQ 300 Base Modules measure system values and provide metering data. Current and voltage input terminals, power supply terminals and the display port are all located on the rear face of the IQ 300 Base Modules. On the IQ 320 and IQ 330 an additional I/O is provided by way of a KYZ pulse output. Two contact outputs, two digital inputs, one analog input, an INCOM™ communications port and an INCOM™ transmit indicator LED are provided on the IQ 330. A MODBUS™ communications port is provided on the IQ 330M.

The IQ 330 and IQ 330M also provide lock out features for certain programming setpoints and reset values. This lock out feature will not allow a user to change these settings until the lock out feature is turned off. See Section 4.6.4 for additional information about the lock out features.



Figure 2.2 IQ 310 Base Module

Figure 2.2 IQ 320 Base Module

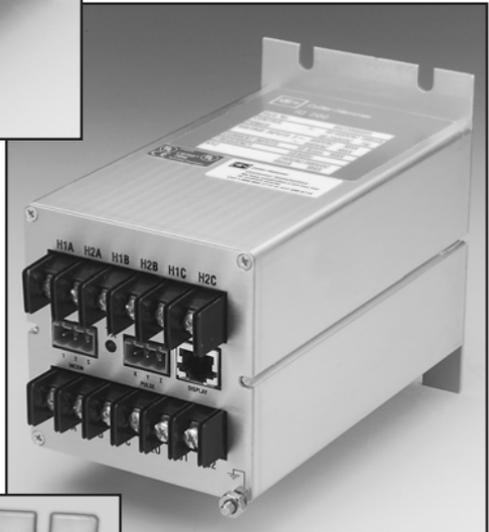


Figure 2.2 IQ 330 Base Module

2.1.3 Installation

The IQ 300 is usually mounted inside an environmentally suitable electrical switch-gear enclosure. The IQ 300 Display Unit and the IQ 300 Base Module can be mounted together or separately in a variety of ways, described fully in **SECTION 3: INSTALLATION**.

2.2 OPERATOR PANEL

The Operator Panel is the front face of the IQ 300 Display Module. It is usually installed so that it is visible and accessible from the outside of the panel or door into which it is mounted.

The *Menu*, *up/down Scroll* and *Enter* buttons allow the operator to view, change and reset various system parameters.

- Display measured system, phase and min/max values
- View and edit all or individual set points:

- Password
- INCOM™ network address and baud rate (*IQ 320 and IQ 330 only*)
- MODBUS™ network address and baud rate (*IQ 330M only*)
- System frequency
- Wiring configuration
- CT and PT ratios
- Demand window
- Energy tracking (KYZ pulse output) - (*IQ 320 and IQ 330 only*)
- Digital Output Setup (*IQ 330 only*)

- View energy, view and reset peak demands, and all or individual minimum and maximum values.
- Change the display contrast for best viewing



Figure 2.3 Operator Panel

The Operator Panel is an integral part of the IQ 300 Display Module. Do not attempt to remove it from the IQ 300 Display Module.

2.3 BASE MODULE REAR ACCESS AREA

All wiring connections are made from the rear face of the chassis, shown in figure 2.4a, 2.4b and 2.4c.

The current transformer terminal block is located at the top rear of the chassis. The IQ 310 and the IQ 320 each have 6 terminals, grouped in 3 pairs: one pair for each phase current transformer, see Figure 2.4a and 2.4b.

The IQ 330 has twelve terminals, grouped into six pairs: one pair for each phase current transformer, as shown below, and one pair for each of the two digital inputs and the one analog input.

Note: For sections 2.3.1 through 2.3.4 refer to figures 2.4c, 2.4d and 2.4e.

2.3.1 Current and Voltage Inputs

The voltage terminal block is located at the bottom rear of the chassis. It has four terminals for wiring the phase voltages and the neutral, as shown in Figure 2.5. The neutral terminal *must* be connected to system neutral or ground depending on system configuration. All connections must be made in accordance with national and local requirements and codes.

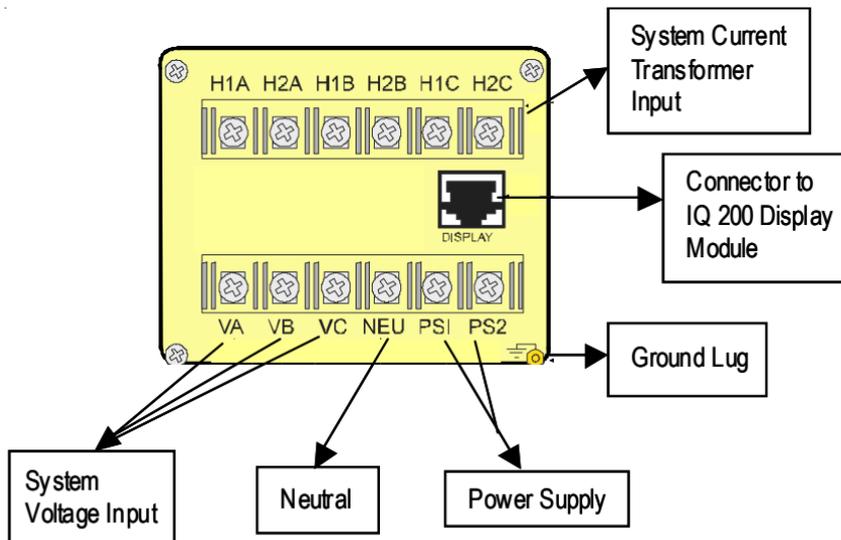


Figure 2.4a IQ 310 Rear Face View

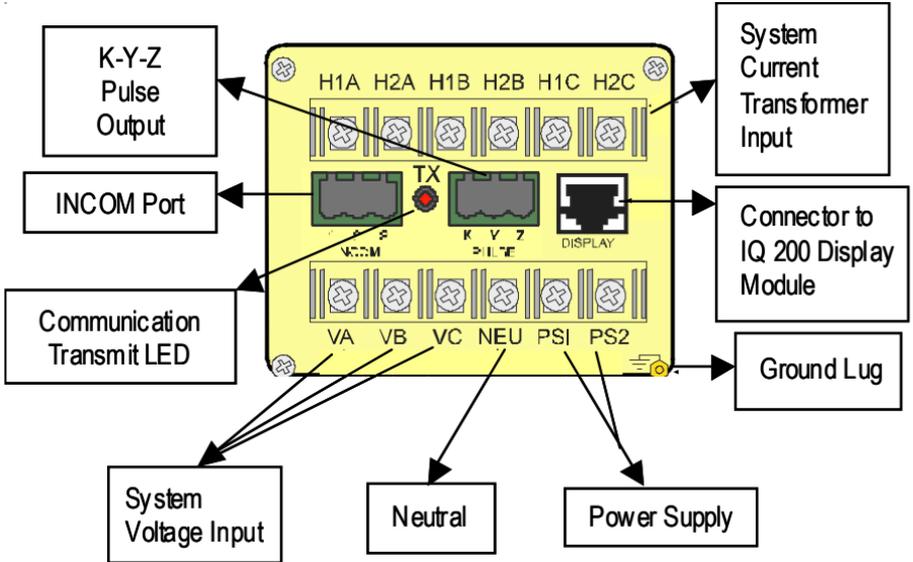


Figure 2.4b IQ 320 Rear Face View

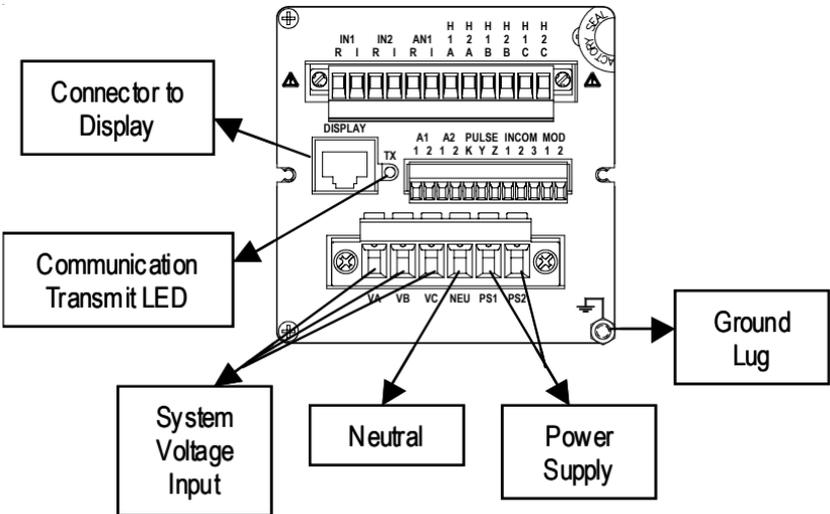


Figure 2.4c IQ 330 Rear Face View

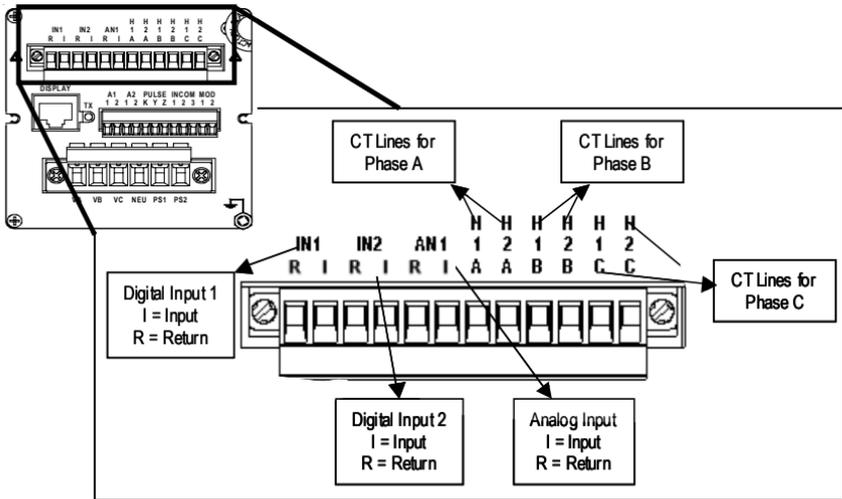


Figure 2.4d IQ 300 Rear Face Views (continued)

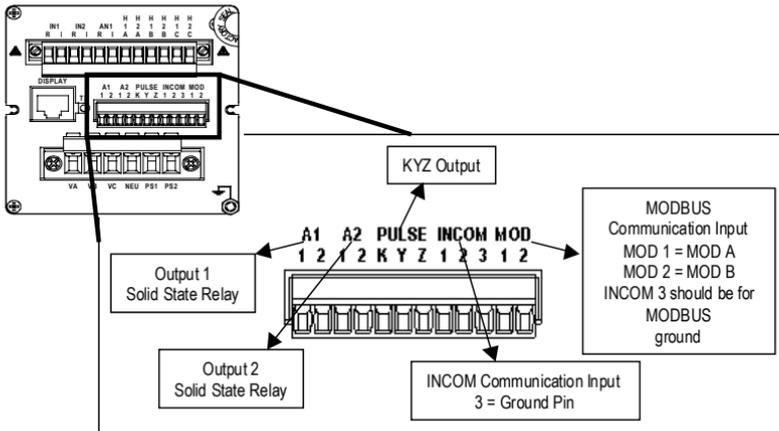


Figure 2.4e IQ 230 Rear Face View (continued)



WARNING



THIS TERMINAL BLOCK MUST NEVER BE REMOVED WHILE THE UNIT IS ENERGIZED. PERSONAL INJURY AND / OR EQUIPMENT DAMAGE MAY RESULT.

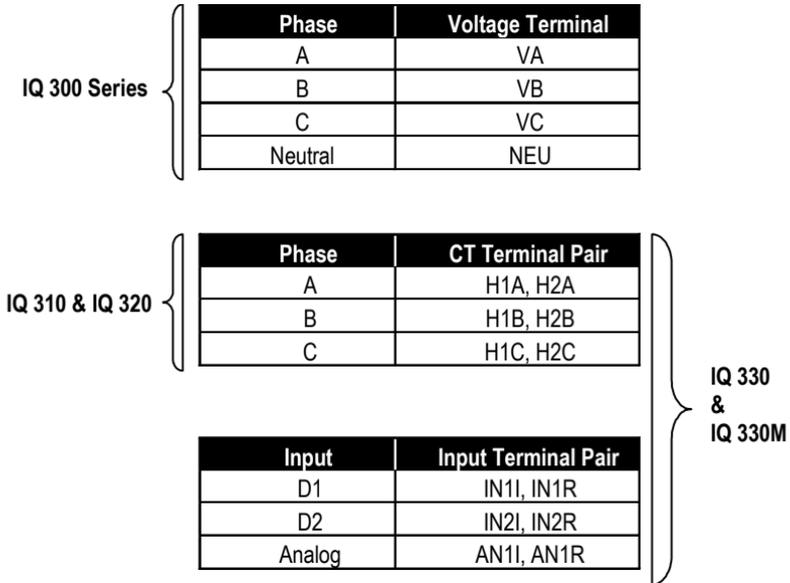


Figure 2.5 Current and Voltage Inputs

2.3.2 Power Supply Input

The IQ 300 power supply input is connected to the *PS1* and *PS2* terminals on the lower right rear of the Base Module chassis. The IQ 310 Base version requires 110 to 240 Vac or 125 to 250 Vdc. The IQ 320 and IQ 330 Base versions have a wider operating power supply input range in comparison to the IQ 310 version. The IQ 320 and the IQ 330 power supply can accommodate 90 to 600 VAC or 48 to 250 Vdc. The power supply may be directly wired to the monitored system, if the voltage is within the proper range.

2.3.3 Local Display Connection

The supplied *Category 5 cable* connects to the *DISPLAY* port located on the left rear of the chassis and to the port on the IQ 300 Display Module. *Do not route the Category 5 cable in the same enclosure or cable tray as 600 V system wiring.* Maximum certified cable length is 10 feet.

2.3.4 PowerNet Communications (IQ 320 and IQ 330 Base Module only)

The IQ 320 and IQ 330 Electrical Distribution System Meter is a PowerNet compatible device. When connected to a PowerNet System, via the INCOM port, it can be remotely monitored and functionally modified.

PowerNet enables efficient monitoring, trending and alarm indication for electrical

distribution system equipment. PowerNet is a noise-immune communication system that permits communication between a master computer and system devices, such as the IQ 320 and the IQ 330.

Consult *TD17513 IMPACC Wiring Specification Base Rules* for detailed information on proper installation and termination of network cable.

The following functions can be performed remotely when the IQ 320 or IQ 330 is connected to an external PowerNet compatible network:

- Display measured system, phase and min/max values
- View and edit set points
 - System frequency
 - Wiring configuration
 - CT and PT ratios
 - Demand window
 - Energy tracking (KYZ pulse output)
- View energy, view and reset peak demands, and all or individual minimum and maximum values.
- View status or count of the 2 digit inputs, reset digital outputs and read analog input (IQ 330 ONLY).

2.3.5 MODBUS Communications

The IQ 330M Enhanced Electrical Distribution System Meter is a MODBUS compatible device. When connected via the MODBUS port, values can be remotely read using the addresses provided in the MODBUS table. Further capabilities can be obtained through the use of INCOM PASSTHRU and SLAVE ACTION techniques explained in chapter 5.

2.4 EXTERNAL HARDWARE

2.4.1 Current Transformers

The IQ 300 series requires at least two user-supplied external *instrument class* current transformers with 5 amp secondaries. These transformers must be connected to the current transformer terminals on the IQ 300 Base Module as detailed in *section 3.3*.

2.4.2 Potential Transformers

The IQ 300 series requires user-supplied potential transformers if the system line voltage is above 600 volts. These transformers must be connected to the voltage terminals on the IQ 300 Base Module as detailed in *section 3.3*.

2.4.3 External Fuses

It is recommended that user-supplied fuses be installed as described below to protect the IQ 300 and related components from damage.

2.4.3.1 Fusing IQ 300 Power Supply

External fuses should be installed in the IQ 300 power supply lines, near the IQ 300 Base Module. 600 volt ½ Ampere BUSS type KTK-R-1/2 Fast Acting or equivalent fuses are recommended for the IQ 300 Base PS1 and PS2 power supply lines.

2.4.3.2 Fusing Potential Transformers

External fuses should be installed in the potential transformer lines as specified in the National Electric Code for the specific application.

2.5 PRODUCT SPECIFICATIONS

Refer to tables 2.1 through 2.5 for all IQ 300 specifications.

2.5.1 Regulatory/Standards Compliance

The IQ 300 series meets UL, CSA and CE requirements.

Table 2.1 IQ 300 Safety Specifications

Safety
IEC 1010-1 (1990) Incl. Amend 1&2 (1995)
EN61010-1 (1993)
CSA C22.2 #1010.1 (1992)
UL3111
EMC
<i>Emissions</i>
FCC Part 15 Class A
CISPR 11 (1990) / EN55011 (1991) Group 1 Class A
<i>Immunity</i>
Electrostatic Discharge
EN61000-4-2 (1995) / EN61000-6-2 (1999) 4kV CD
8kV AD
Electrical Fast Transient
EN61000-4-4 (1995) / EN61000-6-2 (1999) 2kV PL
2kV SL
Radiated Immunity
EN61000-4-3 (1999) / EN61000-6-2 (1999) 10V/m
Conducted Immunity
EN61000-4-6 (1999) / EN61000-6-2 (1999) 10Vrms
Power Frequency Magnetic Field
EN61000-4-8 (1995) / EN62000-6-2 (1999) 30 A/m
Surge Voltage
EN61000-4-5 / EN61000-6-2 (1999)
Voltage Dips
EN61000-4-11 / EN61000-6-2 (1999)

Table 2.2 IQ 300 Operating Specifications

Environment	Indoor use only
Maximum Operating Altitude	3000 meters
Operating Temperature	
<i>Base Unit</i>	-20° to 50° C
<i>Display Module</i>	0° to 50° C
Storage Temperature	
<i>Base Unit</i>	-30° to 85° C
<i>Display Module</i>	-20° to 60° C
Maximum Relative Humidity:	(80% for temperatures up to 31° C)
<i>Base Unit</i>	decreasing linearly to 50% at 50° C
<i>Display Module</i>	decreasing linearly to 50% at 50° C
Current Inputs	5 A nominal, 10 A maximum
<i>Input Impedance</i>	0.01 Ω
<i>Burden</i>	0.25 VA
<i>Overload Withstand</i>	150 A ac 1 second
<i>Accuracy Range</i>	0.5% to 200% of nominal full scale
Voltage Inputs	90 to 600 volts nominal ±10%
<i>Input Impedance</i>	2 M Ω
<i>Overload Withstand</i>	660 Vac continuous
INCOM Communication	1200 Baud FSK
Speeds (<i>IQ 320 & IQ330 only</i>)	9600 Baud FSK
MODBUS Communication Speeds	9600 Baud RTU
(<i>IQ330 M only</i>)	19200 Baud RTU
KYZ (<i>IQ 320 only</i>)	
<i>Maximum Input Voltage</i>	240 Vac/300 Vdc
<i>Maximum Current Rating</i>	96 mA
<i>Input/Output Isolation Voltage</i>	3750 V _{rms}
KYZ (<i>IQ 330 only</i>)	
<i>Maximum Input Voltage</i>	125 Vac/176 Vdc
<i>Maximum Current Rating</i>	96 mA
<i>Input/Output Isolation Voltage</i>	3750 V _{rms}
Digital Input (<i>IQ 330 only</i>)	
<i>Input Voltage</i>	12 to 48 Vdc
<i>Maximum Current Rating</i>	96 mA
Analog Input (<i>IQ 330 only</i>)	
<i>Maximum Current Rating</i>	4- 20 mA
Digital Output (<i>IQ 330 only</i>)	
<i>Maximum Input Voltage</i>	125 Vac/176 Vdc
<i>Maximum Current Rating</i>	96 mA
<i>Input/Output Isolation Voltage</i>	3750 V _{rms}
Transient Overvoltage Category	OVERVOLTAGE CATEGORY III
Pollution Degree	2 (IEC 664)

Table 2.2 IQ 300 Operating Specifications (cont.)

Control Power			
Input Range	<i>IQ 310 Base</i>	110-240 Vac \pm 10%	125-250 Vdc \pm 10%
	<i>IQ 320 Base</i>	90-600 Vac \pm 10%	48-250 Vdc \pm 10%
	<i>IQ 300 Base</i>	90-600 Vac \pm 10%	48-250 Vdc \pm 10%
Frequency Range		50/60 Hz	—
Burden	<i>IQ 310 Base</i>	7 W	7 W
	<i>IQ 320 Base</i>	180 mA	7 W
	<i>IQ 300 Base</i>	200 mA	8 W

Table 2.3 IQ 300 Metering Accuracy

Parameter	Accuracy
Current (< 5 amps)	\pm .5% of Full Scale
Current (> 5 amps)	\pm .5% of Reading
Voltage, line-to-line	\pm .5% of Full Scale
Voltage, line-to-neutral	\pm .5% of Full Scale
Watts (< 5 amps)	\pm 1% of Full Scale
Watts (> 5 amps)	\pm 1% of Reading
vars (< 5 amps)	\pm 1% of Full Scale
vars (> 5 amps)	\pm 1% of Reading
VA (< 5 amps)	\pm 1% of Full Scale
VA (> 5 amps)	\pm 1% of Reading
Power Factor	\pm 2% of Full Scale
Frequency	\pm 0.1 Hz

ANSI C12 Note: The IQ 300 has been designed and verified to meet ANSI C12 Class 10 Revenue metering accuracy. This classification makes the IQ 300 an ideal choice for sub-metering and sub-billing applications.

Table 2.4 IQ 300 Measurement Ranges

Parameter	Max Data Range
Current	0...65,535 amps
Voltage	0...2,097,120 volts
Power	
Watts	-1,073,709,057...+1,073,709,056 Watts
vars	-1,073,709,057...+1,073,709,056 vars
VA	0...2,147,450,880 VA
Energy	
Fwd / Rev Wh	0...999,999,999 kWh
Fwd / Rev varh	0...999,999,999 kvarh
Net Wh	-999,999,999...+999,999,999 kWh
Net varh	-999,999,999...+999,999,999 kvarh
Net VAh	0...999,999,999 kVAh
Power Factor	-1.00...+1.00
Frequency	0...255.996 Hz

Table 2.5 IQ 310 and IQ 320 Physical Characteristics

Dimension	Display Module	Base Module
Length	1.14 in. ⁽¹⁾	6.74 in. ⁽²⁾
Height	10.25 in.	3.56 in. ⁽³⁾
Width	6.72 in.	3.56 in.
Base Unit Terminals		
Wire Size	#12-22 AWG	
Screw Size	#6-32	
Torque Rating	9 in.-lbs. Maximum	
Distance Between Barriers	0.32 in.	
Weight		
Display Module	0.56 lbs.	
Base Module	2.35 lbs.	

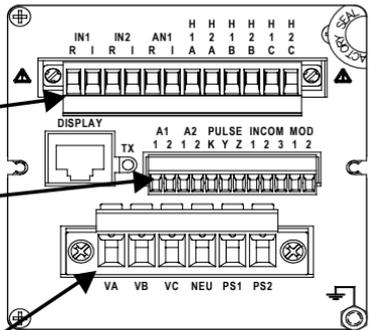
1. includes 0.35 in. connector
2. includes 0.62 in. terminal block
3. centered on front face mounting plate

IQ 330 Physical Characteristics

Dimension	Display Module	Base Module
Length	1.14. ⁽¹⁾	6.74 in. ⁽²⁾
Height	10.25 in.	3.56 in. ⁽³⁾
Width	6.72 in.	3.56 in.
Weight		
Display Module	0.56 lbs.	
Base Module	2.35 lbs.	

- (1) includes 0.35 in. connector
- (2) includes 0.62 in. terminal block
- (3) centered on front face mounting plate

Base Unit Terminals	
Wire Size	#24-12 AWG
Torque Rating	.5 - .6 Nm
Base Unit Terminals	
Wire Size	#16-28 AWG
Torque Rating	.22 - .25 Nm



Base Unit Terminals	
Wire Size	#12-22 AWG
Screw Size	#6-32
Torque Rating	9 in.-lbs. Maximum
Distance Between Barriers	0.32 in.

2.6 ORDERING INFORMATION

Please refer to the Catalog Number listed in the following table when ordering IQ 300 components.

Table 2.6 IQ 300 Ordering Information

Description		Catalog Number	
IQ 310 Base Module		IQ310TRAN	
IQ 320 Base Module		IQ320TRAN	
IQ 330 Base Module		IQ330TRAN	
IQ 330 MODBUS Base Module		IQ330MTRAN	
IQ 300 Series Display Module		IQ300D	
IQ 310 Complete Meter with Base Module & IQ 300 Display Module & 14" Cable		IQ310	
IQ 320 Complete Meter with Base Module & IQ 300 Display Module & 14" Cable		IQ320	
IQ 330 Complete Meter with Base Module & IQ 300 Display Module & 14" Cable		IQ330	
IQ 330 MODBUS Complete Meter with Base Module & IQ 300 Display & 14" Cable		IQ330M	
3 foot long Category 5 Cable		IQ23CABLE	
6 foot long Category 5 Cable		IQ26CABLE	
10 foot long Category Cable		IQ210CABLE	
IQ 310 Base Module	IQ 320 Base Module	IQ 330 Base Module	IQ330M Base Module
(1) IQ 310 Base (1) DIN Rail Clip (1) L-Bracket (4) ½" #10 (10-32) screws (4) #10 Locking Washers (2) ¼" #8 (8-32) screws	(1) IQ 320 Base (1) DIN Rail Clip (1) L-Bracket (4) ½" #10 (10-32) screws (4) #10 Locking Washers (2) ¼" #8 (8-32) screws	(1) IQ 330 Base (1) 1' shielded Cat. 5 patch cable (1) Gasket (2) Mounting Brackets (4) #8 Locking Washers (4) #8 Hex Nuts (2) Plug-in Contacts	(1) IQ 330 Base (1) DIN Rail Clip (1) L-Bracket (4) ½" #10 (10-32) screws (4) #10 Locking Washers (2) ¼" #8 (8-32) screws (2) Plug-in Contacts

SECTION 3: INSTALLATION

3.1 INTRODUCTION

The IQ 300 is designed to be installed, operated and maintained by adequately trained personnel. These instructions do not cover all details, variations or combinations of the equipment, its storage, delivery, installation, checkout, safe operation or maintenance. Care must be exercised to comply with local, state and national regulations, as well as with industry standard safety practices for this class of equipment. Refer to figure 3.5 through 3.14 for wiring details.



WARNING



A THREE PHASE SWITCH OR CIRCUIT BREAKER SHOULD BE IN CLOSE PROXIMITY TO THE IQ 300 MOUNTING LOCATION AND MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT. ADDITIONALLY, IT IS RECOMMENDED THAT CT SHORTING TERMINAL BLOCKS BE USED IN ORDER TO FACILITATE ANY FUTURE MAINTENANCE OR REMOVAL OF THE IQ 300 BASE MODULE.



WARNING



TURN OFF AND LOCK OUT POWER SUPPLYING THE PANEL BOARD OR SWITCH GEAR IN WHICH THE IQ 300 IS BEING INSTALLED. FAILURE TO DO SO MAY CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.

3.2 PANEL PREPARATION

It is recommended that the IQ 300 be mounted in an electrical switch gear enclosure that is suitable for its environment. The IQ 300 Display and IQ 300 Base Modules may be mounted together or separately. The IQ 300 is designed with flexibility in mind. While it is recommended that the IQ 300 Display Module be door- or panel-mounted, the Base Module may be attached to the IQ 300 Display Module; mounted remotely using the supplied L-bracket; directly to a panel or floor; or attached to a DIN rail using the supplied DIN clip. For floor or panel mounting, a #10 (10-32) or #12 (12-28) screw is recommended.

In *all* instances where the IQ 300 Base Module is mounted remotely, the IQ 300 Display Module Chassis *must* be connected to earth ground.

Before installing the IQ 300, refer to dimensions listed in table 2.5 and allow adequate room for wiring and access to the IQ 300 Base Module terminals and

connectors.

3.2.1 Mounting the IQ 300 Modules as a Single Unit

Since the IQ 300 is typically mounted on an 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 3.1. Note that the IQ 300 actually has ten mounting holes. Normally the top, bottom and center holes are used for a standard installation. If the installation is to be in a NEMA 3R or 12 inclosure, additional mounting holes are provided so that uniform pressure can be maintained on the gasket all the way around the unit.

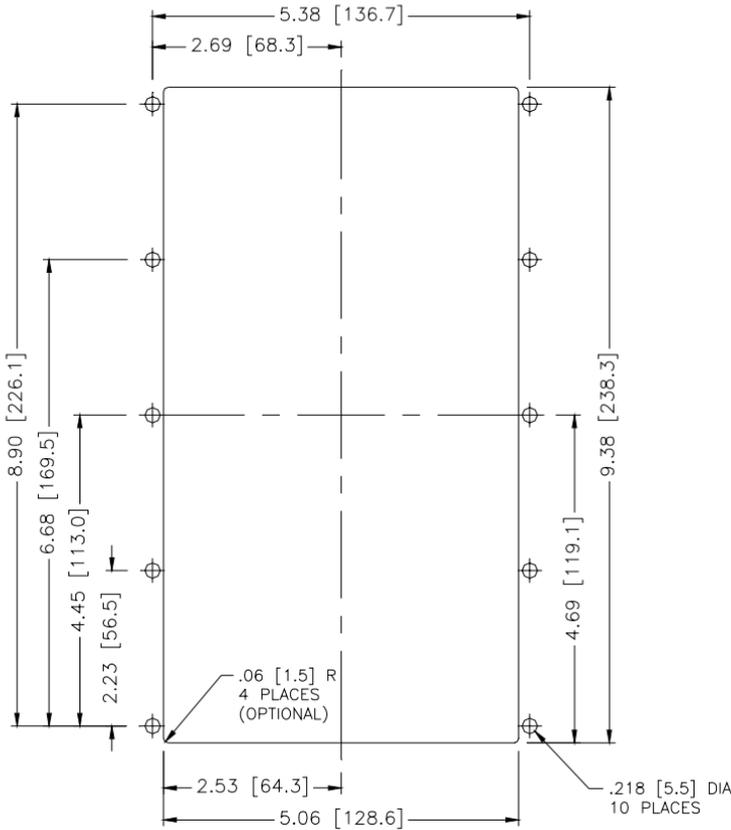


Figure 3.1 Mounting Holes for the IQ 300 Display Module

Before actually cutting the panel, be sure that the required 3-dimensional clearances for the IQ 300 chassis allow mounting in the desired location. IQ 300 dimensions without and with a base unit are shown in figures 3.2 and 3.3 respectively.

It is necessary to hold the tolerances shown when making the cutouts and placing the holes for the mounting screws. In particular, the horizontal dimensions between the center of the mounting holes are the vertical edge of the cutout must be within 0 and +0.050 in.

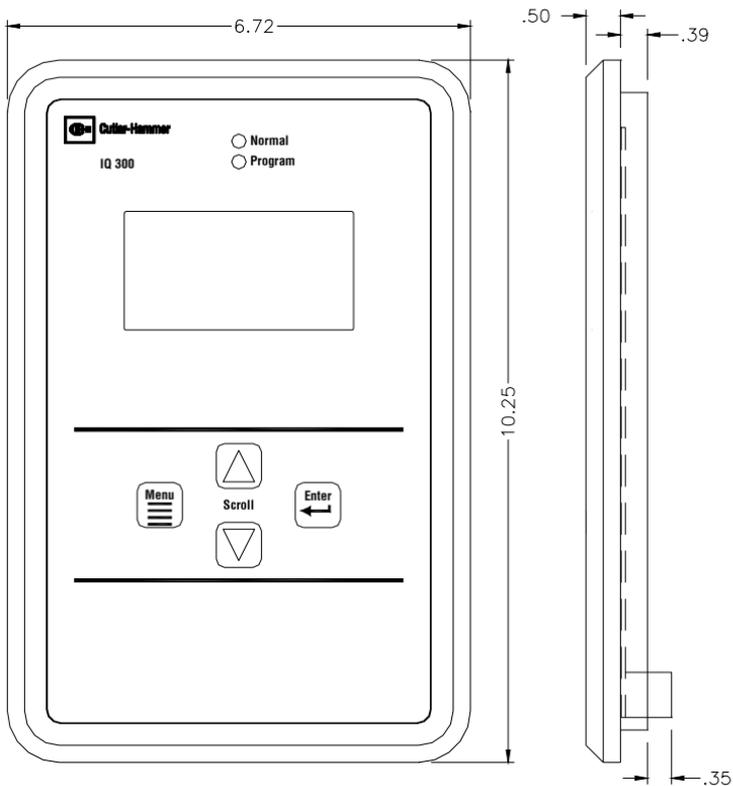


Figure 3.2 Dimension on the IQ 300 Display Module

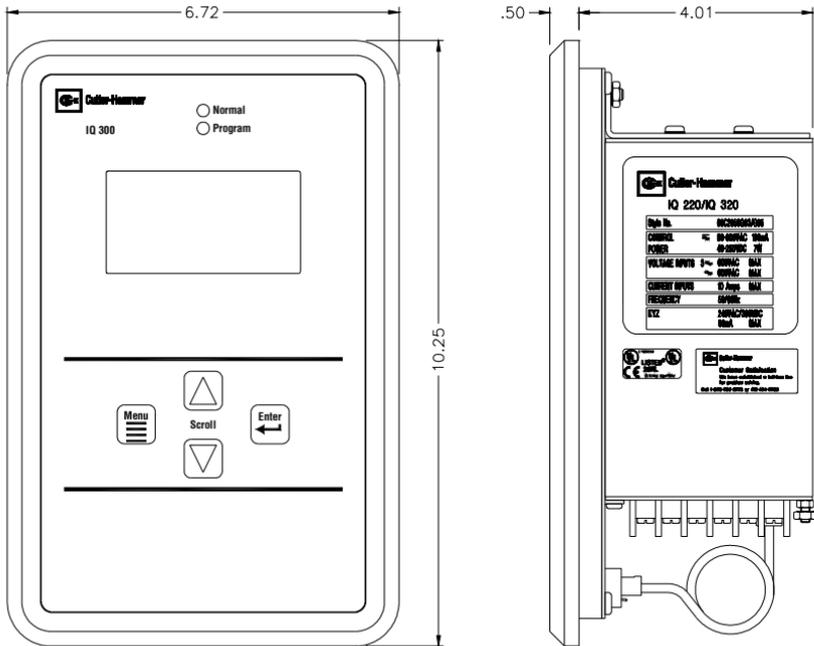


Figure 3.3 Dimensions for the IQ 300 Display Module with Base

3.2.2 Mounting the IQ 300 Display and Base Modules Separately

In all instances where the IQ 300 Base Module is mounted remotely, the IQ 300 Display Module Chassis *must* be connected to earth ground.

Display Module: Cut a 9.38" H x 5.38" W access cutout in the switch gear door or other panel where the IQ 300 is to be mounted as shown in figure 3.1. Install the IQ 300 Display Module as shown in figure 3.1, following these steps:

- Slide the supplied gasket over the rear of the IQ 300 Display Module and mounting studs until it is flush with the rear of the back cover.
- Insert the IQ 300 Display Module with gasket installed into the cutout.
- Insert one end of the Category 5 cable into the port on the rear of the Display Module.
- Installing from the rear, use the 10 mounting screws provided to secure the display to the panel.

Base Module: Select a location for the IQ 300 Base Module. Depending on the location, use the mounting holes in the flange on the front face of the IQ 300 Base Module, the supplied L bracket, or the DIN clip to secure the IQ 300 Base Module in the desired location and orientation. Typical mounting options are shown in figure 3.4. The hole drilling pattern for mounting the IQ 300 Base Module to floor, wall or

other surface is shown in figure 3.5.

Connect the IQ 300 Base Module to earth ground using the grounding terminal on the rear face.

Route the Category 5 cable from the IQ 300 Base Module to the IQ 300 Display Module. *Do not route the Category 5 cable in the same enclosure or cable tray as 600V system wiring.*

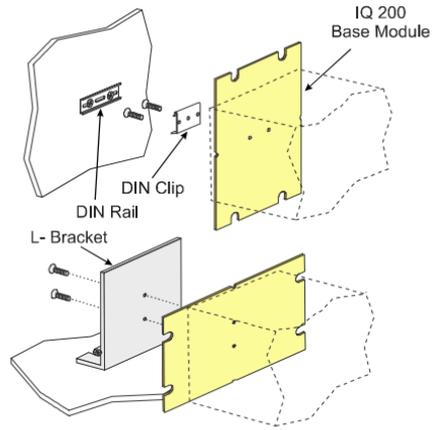


Figure 3.4 Typical Mounting Options for Mounting the IQ 300 Base Module

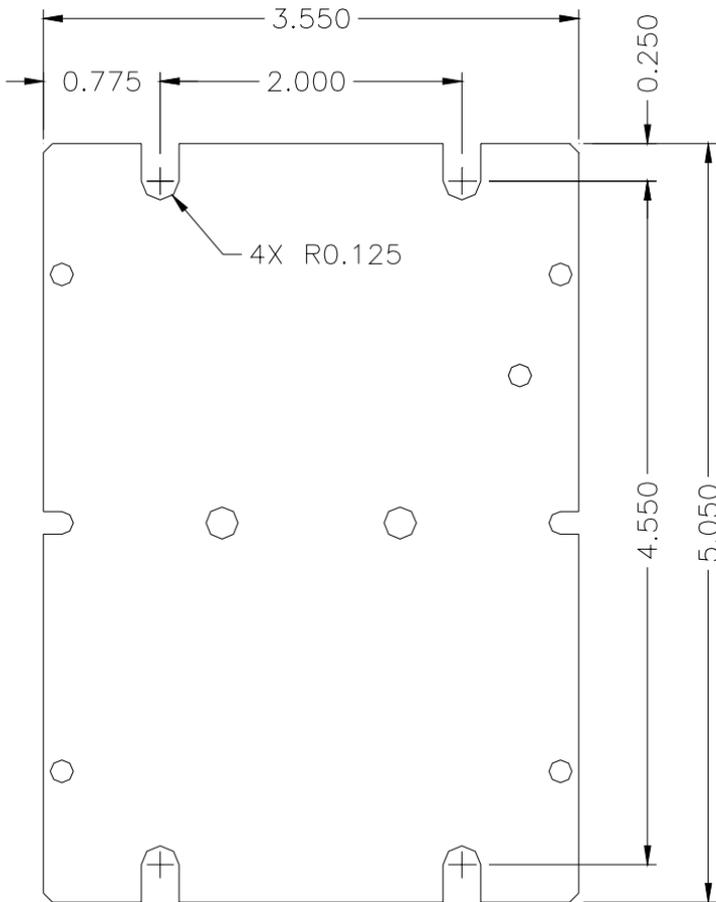


Figure 3.5 Mounting Hole Pattern for the IQ 300 Base Module

Connect the IQ 300 Display Module to the IQ 300 Base Module by inserting the remaining end of the Category 5 cable into the *DISPLAY* port on the IQ 300 Base Module.

Proceed to *section 3.3 Wiring*.

3.3 WIRING

The IQ 300 requires connection to system currents and voltages. If mounted separately, the case of IQ 300 Display Module *and* the IQ 300 Base Module case *must* be connected to earth ground. If mounted together as one unit, the case of the IQ 300 Base Module *must* be connected to earth ground.

Additionally, the IQ 300 may require connection to a PowerNet network and/or an external pulse counter (*IQ 320 Base version*). The steps for completing each type of wiring are described in the following sections.

Note: Cutler-Hammer recommends using a ferrule connector on all plug-in connectors to eliminate stray wires from shorting.



CAUTION



ALL WIRING MUST CONFORM TO NATIONAL AND LOCAL CODES. SUFFICIENT ROOM MUST BE PROVIDED FOR ROUTING OF ALL POWER CABLES. ALL SIGNAL CABLES MUST BE ROUTED SEPARATELY FROM POWER CABLES. THE CATEGORY 5 CABLE CONNECTING THE IQ 300 DISPLAY MODULE AND THE IQ 300 BASE MODULE IS RATED AT 300V. THIS CABLE MUST NOT BE ROUTED IN THE SAME WIRING CHANNEL AS THE SYSTEM POWER.

3.3.1 *Wiring System Current and Voltage*

The IQ 300 must be connected to sources of current and voltage for each phase that is to be monitored. Current transformers having a 5 A secondary provide the phase current measurement. Phase voltages under 600V may be measured directly by the IQ 300. Phase voltages over 600V must be measured using potential transformers.

3.3.2 *Wiring Diagrams for Various System Configurations*

Recommended IQ 300 wiring diagrams for current and potential transformers are shown below in figures 3.5 through 3.14. It is the user's responsibility to determine which wiring diagram applies and to specify and install all current transformers, potential transformers, fuses and other components.

3.3.2.1 IQ 330 & IQ 330M Current Connector

This warning applies with reference to the current connector.



WARNING



THE IQ 330 AND IQ 330M TERMINAL BLOCK (FIGURE 2.4d) MUST NEVER BE REMOVED WHILE THE UNIT IS ENERGIZED. PERSONAL INJURY AND / OR EQUIPMENT DAMAGE MAY RESULT.

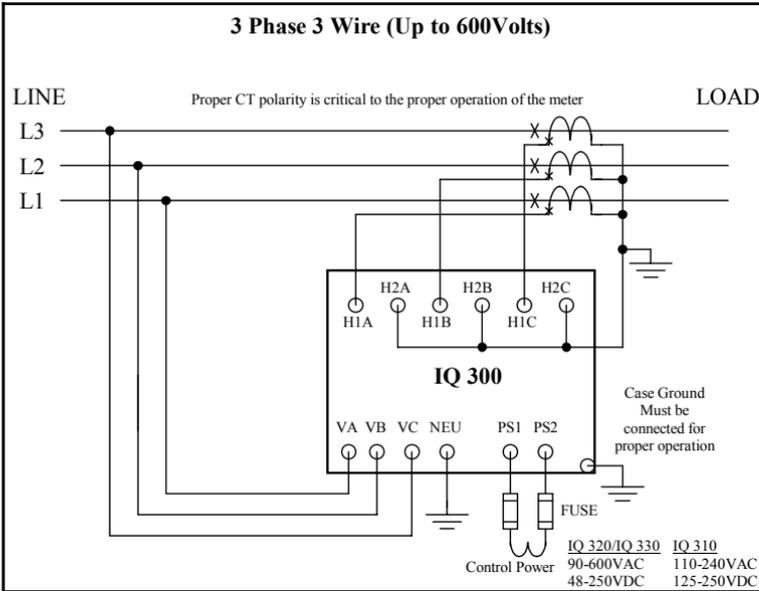


Figure 3.5 3 Phase 3 Wire Configuration (Up to 600 Volts)

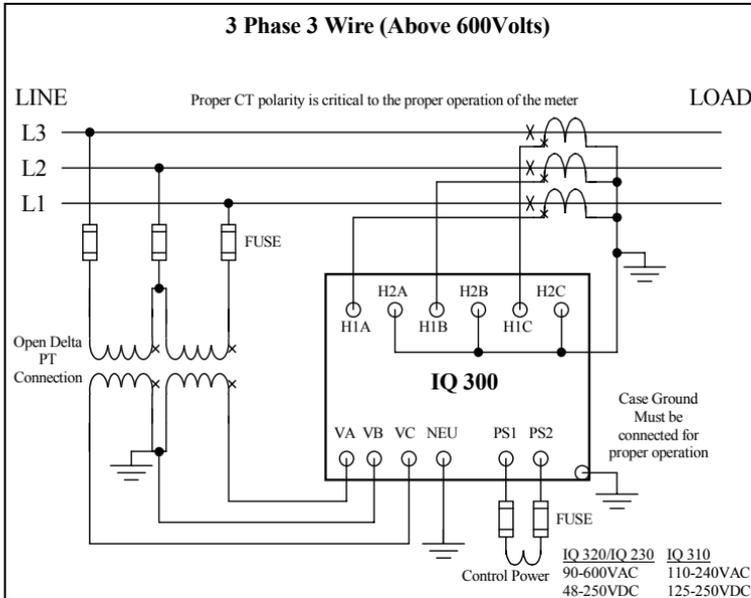


Figure 3.6 3 Phase 3 Wire Configuration (Above 600 Volts)

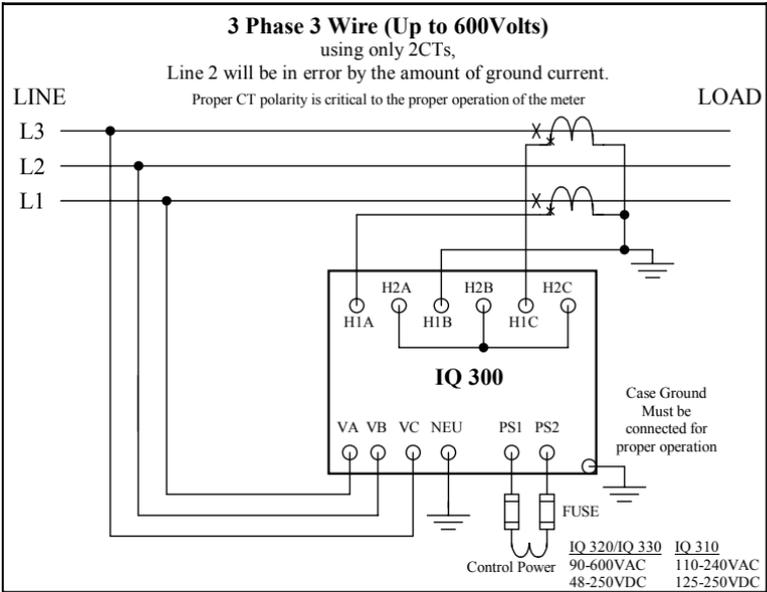


Figure 3.7 3 Phase 3 Wire, 2 CT Configuration (Up to 600 Volts)

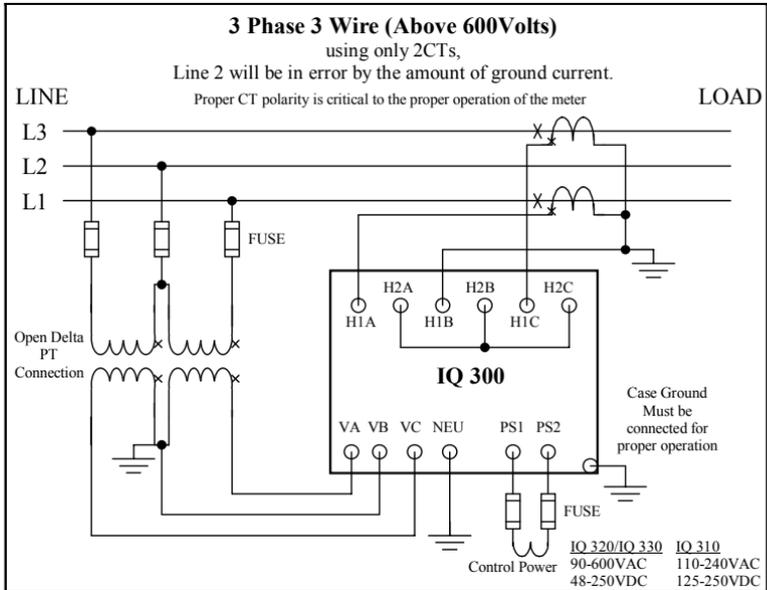


Figure: 3.8 3 Phase 3 Wire, 2CT Configuration (Above 600 Volts)

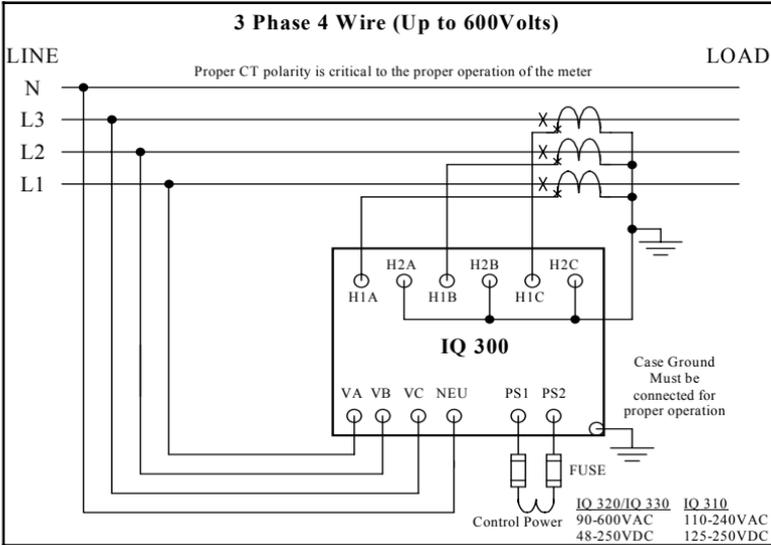


Figure: 3.9 3 Phase 4 Wire Configuration (Up to 600 Volts)

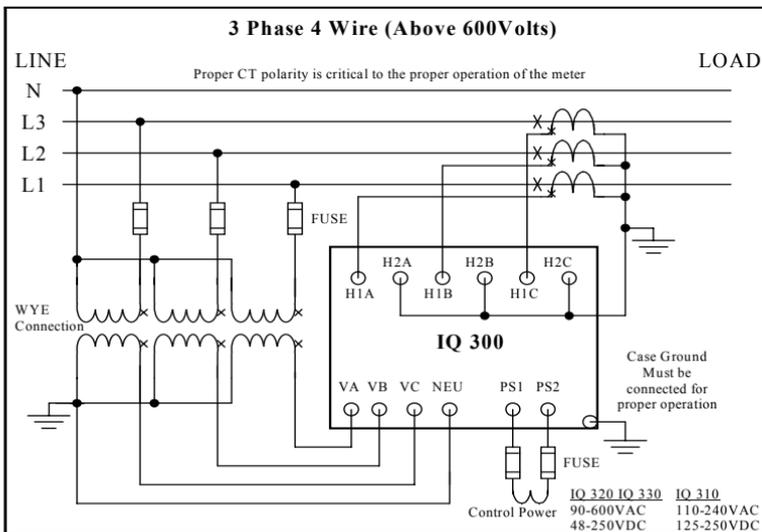


Figure 3.10 3 Phase 4 Wire Configuration (Above 600 Volts)

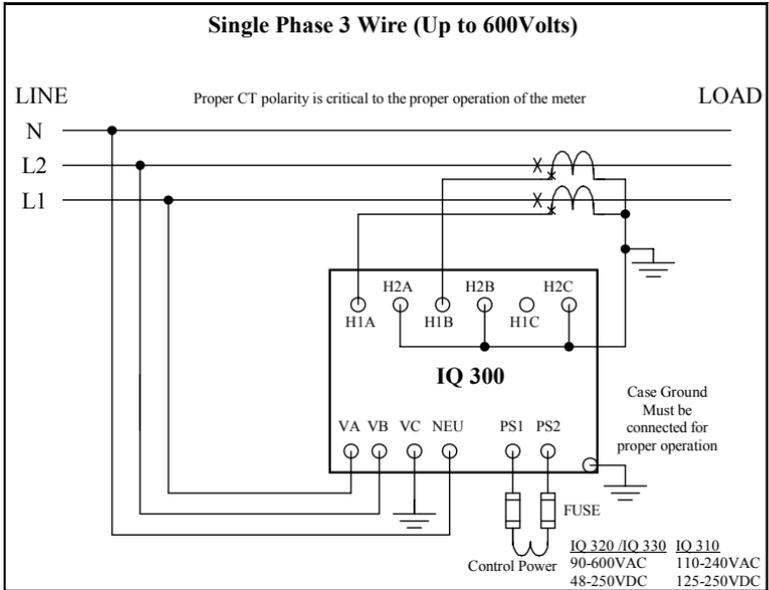


Figure 3.11 Single Phase 3 Wire Configuration (Up to 600 Volts)

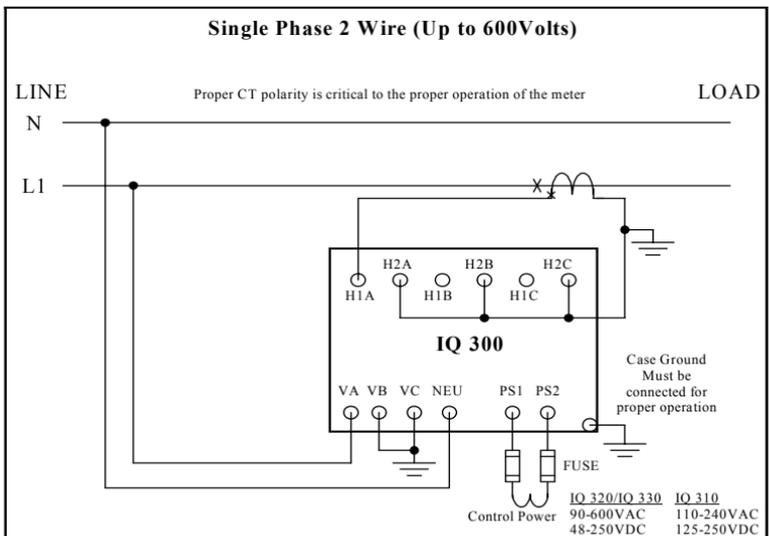


Figure 3.12 Single Phase 2 Wire Configuration (Up to 600 Volts)

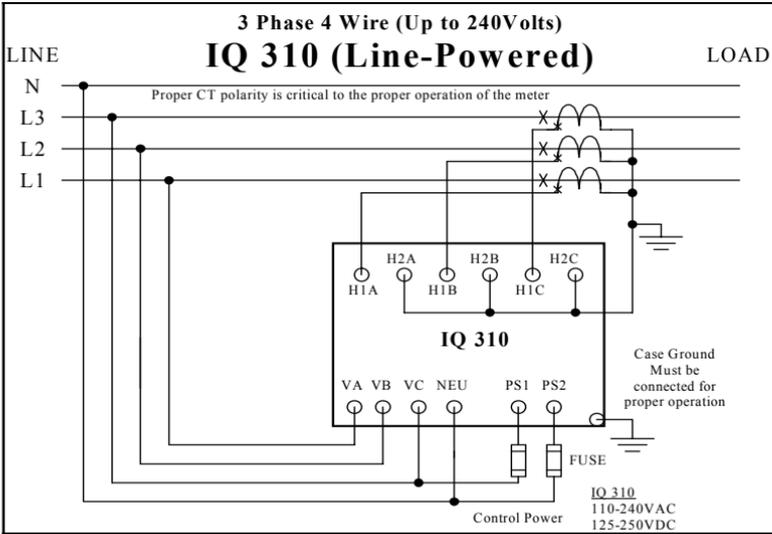


Figure 3.13 Typical IQ 310 Line-Powered Configuration (Up to 240 Volts)

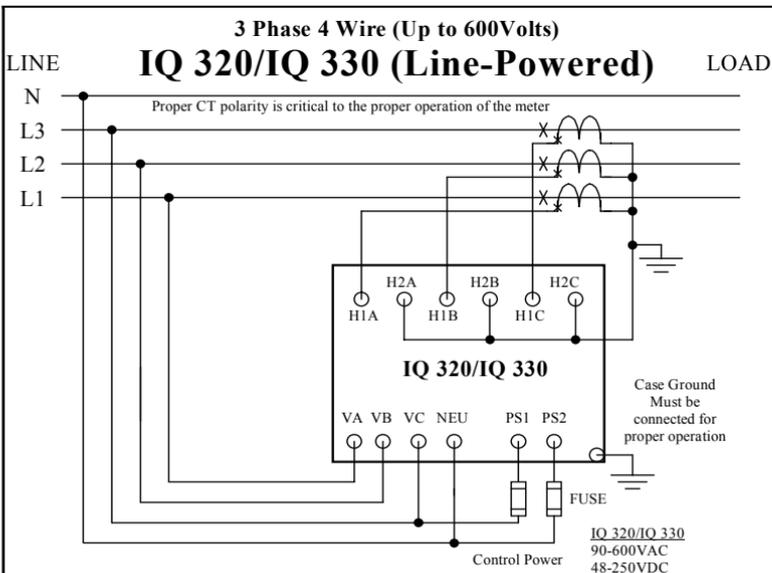


Figure 3.14 Typical IQ 320/IQ 330 Line-Powered Configuration (Up to 600 Volts)

3.3.3 PowerNet Communications (IQ 320 and IQ 330 Base Modules Only)

Note: To satisfy proper Wiring Specifications use only Belden 9463 or 3072F, or Cutler-Hammer IMPCABLE shielded twisted pair cable or equivalent, according to system requirements. SEE TD17513, IMPACC WIRING SPECIFICATIONS BASE RULES for more detailed information.

Connect the IQ 320 / IQ 330 to the PowerNet network by connecting the twisted pair communication cable to the INCOM™ port located on the rear face of the IQ 320 / IQ 330 Base Module. The polarity of the twisted pair is not important.

Tie the communication cable shield to ground only once at the INCOM™ master device. If there is more than one remote INCOM™ compatible devices (such as the IQ 320 or IQ 330) cabled to the master device, tie the communication cable shields together but *do not* connect to ground.

Care must be taken in stripping wire due to close proximity of terminals.

3.3.4 KYZ Pulse Initiator (IQ 320 and IQ 330 Base Modules Only)

The KYZ Pulse Initiator output can be wired to a 2-wire (K-Y terminals) or 3 wire (KYZ terminals) pulse receiver. In order to achieve emissions and immunity standards, shield cable should be used. The cable should be grounded on the non-IQ Base end. These terminal configurations and the resulting pulse trains are shown in figures 3.15 and 3.16. The energy represented by each pulse can be specified by the user as: *apparent* (VAh); *forward* or *reverse real* ($\pm Wh$); or *reactive* ($\pm varh$). The procedure for specifying the *energy per pulse* is described in section 4.10.9.

Each pulse that arrives at the pulse counter indicates that the specified energy has been consumed by the monitored system. The frequency and spacing of these pulses represent the energy consumption pattern of the monitored system.

Because the energy represented corresponds to the energy at the *secondary* winding of the CTs and PTs, the CT and PT ratios must be taken into account when specifying the *energy per pulse* value. An example of how to specify the *energy per pulse* value is given below.

Example:

System Configuration
 CT = 1400:5
 PT = 2:1

Desired value to monitor
 watthours

System parameters

Assume the IQ 320 is monitoring a constant system power of 16,800 Watts.

Step 1: Calculate the CT and PT ratios

CT ratio = $1400/5 = 280$

PT ratio = $2/1=2$

Step 2: Calculate the power at the secondary of the CTs and PTs

power at secondaries = $16,800 \text{ Watts} / (\text{CT ratio} \times \text{PT ratio})$

power at secondaries = $16,800 \text{ Watts} / (280 \times 2)$

power at secondaries = $16,800 \text{ Watts} / 560$

power at secondaries = $30 \text{ Watts (or 30 watthours in 1 hour)}$

Step 3: Specify the energy per pulse as desired

Specify secondary energy per pulse = 1 watthour per pulse;
 then, each pulse represents system energy of:

$(1400/5) \times (2/1) \times 1$; or 560 watthours per pulse

or

Specify secondary energy per pulse = 7 watthours per pulse;
 then, each pulse represents system energy of:

$(1400/5) \times (2/1) \times 7$; or 3,920 watthours per pulse

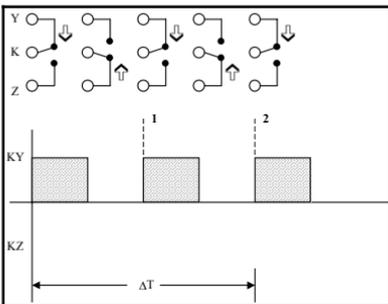


Figure 3.15 2-Terminal (K-Y) Configuration

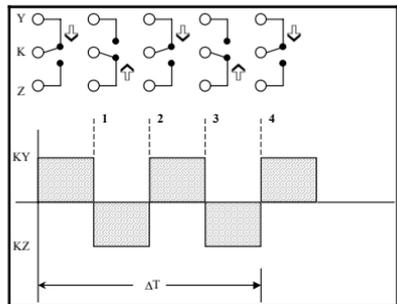


Figure 3.16 3-Terminal (K-Y-Z) Configuration

3.3.5 Inputs and Outputs (IQ 330 and IQ 330M only)

The IQ 330 offers additional inputs and outputs. In order to achieve the emissions and immunity standards, shielded cable should be used. The cable should be grounded on the non-IQ Base side of the cable. These inputs and outputs include the Digital Inputs labeled IN1 and IN2, the Analog Input labeled AN1 and the two Outputs labeled A1 and A2.

Digital inputs and long Modbus responses compete for the same processor bandwidth. In order to ensure accurate input readings, limit block requests in Modbus to 3 variables (6 Modbus registers) when reading digital inputs with pulse width of 200 ms between 5 and 10 Hz. Limit block requests in Modbus to 6 variables (12 Modbus registers) when reading digital inputs with pulse width of 200 ms.

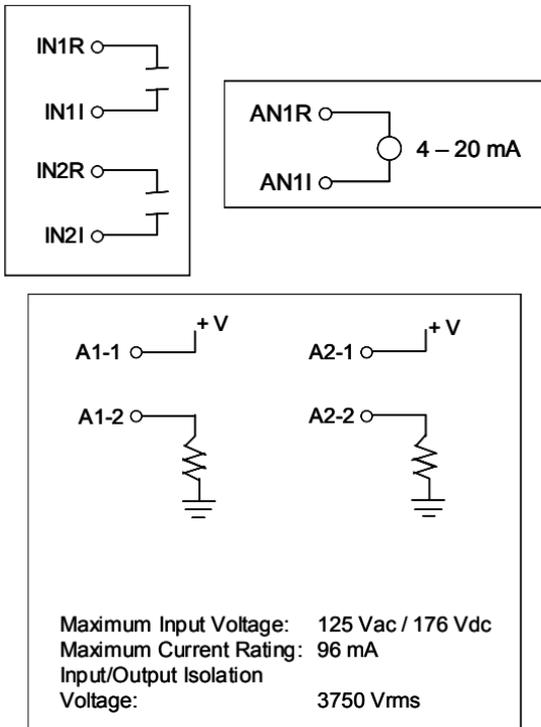


Figure 3.17 Inputs and Outputs

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SECTION 4: OPERATION

4.1 GENERAL

The IQ 300 Display Module provides both local display of system values and a method of assigning an INCOM address to the IQ 320 and IQ 330, and a separate MODBUS address to the IQ 330 to enable communications.

The IQ 300 Display Module allows the user to view information and to specify or change the functions of the IQ 300 system. These items include system and phase data, min/max data, set points and screen contrast.

It also provides a method of assigning a network address and communication baud rate to the IQ 320 and IQ 330 Base variation, should it be networked to a PowerNet master device.

All functions of the IQ 300 are available through *menus* visible on the screen of the IQ 300 Display Module Operator Panel. Choice of menu and selection of menu options is accomplished by pressing the buttons on the face of the Operator Panel.

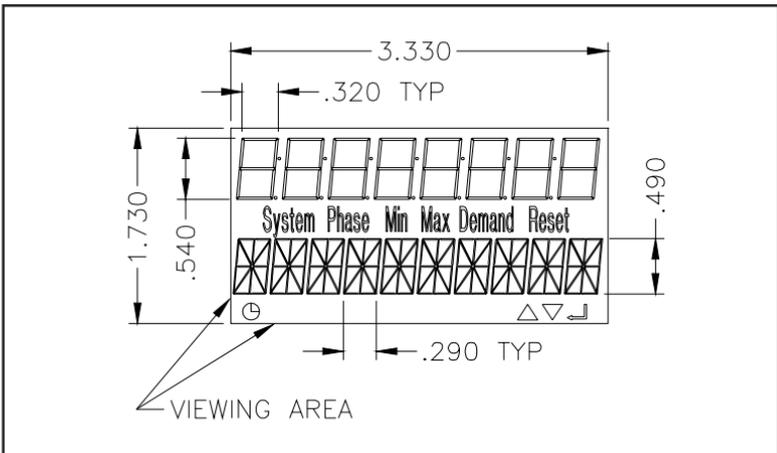


Figure 4.0 IQ 300 Screen

The screen of the IQ 300 is divided into four sections. The numeric top row that allows you to read the numerical value of what you have chosen. The alphanumeric digits on the bottom row describes the value. The center row of words tells you which menu and which branch of menu you are in. These words can be used alone or in combination with each other. For example if the maximum phase A current is being displayed both the Phase and Max words will be displayed. The lower right corner of the display has 3 icons. The ▲ arrow is on when up is a valid path and

the ▼ arrow is on when down is a valid path. The ◀ icon is on when Enter can be used.

The six words on the display are:

System - When this word is displayed the three phase system values are being displayed.

Phase - When this word is displayed single phase values are being displayed.

Min - When this word is displayed a stored minimum value is being displayed.

Max - When this word is displayed a stored maximum value is being displayed.

Demand - When this word is displayed a power demand value is being displayed.

Reset - This word is displayed while you are in the reset values submenu.

The symbols in the lower right hand corner of the screen indicate what buttons are active while viewing a specific value. The up triangle represents the scroll up button, the down triangle represents the scroll down button, and the arrow pointing to the left represents the enter button. If you push one of these buttons while their corresponding symbol is not visible on the screen nothing will occur.

The clock symbol in the lower left hand corner is not in use at this time.

The menus provide access to the following values and functions:

System Data

Phase Data

Min/Max Data

View Set points

Edit Set points (with optional password protection / refer to Section 4.6.4 for IQ 330 and IQ 330M seal out feature information)

Reset Values (with optional password protection / refer to Section 4.6.4 for IQ 330 and IQ 330M seal out feature information))

Contrast Adjust

Diagnostics

Exit Menu

4.2 BUTTONS

There are four buttons on the Operator Panel: *Menu*, up and down *Scroll*, and *Enter*. Their functions are described in the table below.

Button	Function
Menu	Allows the user to step through the menu options, starting with the Phase Data screen.
Scroll	Navigates the user through menu items <i>and</i> through system values to be displayed
Enter	Confirms the option, value or screen currently selected and also allows rapid movement through data screens.

4.3 CONTRAST

The contrast of the screen can be adjusted in the Contrast Adjust mode or by holding in the *Enter* button while pressing the *Scroll* up arrow button (to decrease contrast) or the *Scroll* down arrow button (to increase contrast).

4.4 DISPLAYED SIGN CONVENTIONS

Display	Indication
Lg	lagging (inductive)
Ld	leading (capacitive)

The IQ 300 not only displays system values, but also indicates whether factors are lagging or leading by displaying Lg or Ld, see table to the left.

The IQ 300 is shipped with lagging vars and power factor represented by negative values at the load, conforming to the *mathematical sign convention*. The IQ 320 and IQ 330 allows the user the ability to change to the *power engineer convention*, which assumes positive values at the load. The convention can be changed in the IQ 320 and IQ 330 via the INCOM communications interface. The IQ 320 and the IQ 330 must be connected to a PowerNet network and programmed accordingly. Only the mathematical convention is available when using the IQ 310 Base.

The following relationships apply:

Convention	Load	var Values	Power Factor Values
Mathematic	inductive	negative	Negative (lagging PF)
Mathematic	capacitive	positive	positive (leading PF)
Power Engineer	inductive	positive	positive (lagging PF)
Power Engineer	capacitive	negative	Negative (leading PF)

The relationships among system power values are shown schematically in figure 4.1.

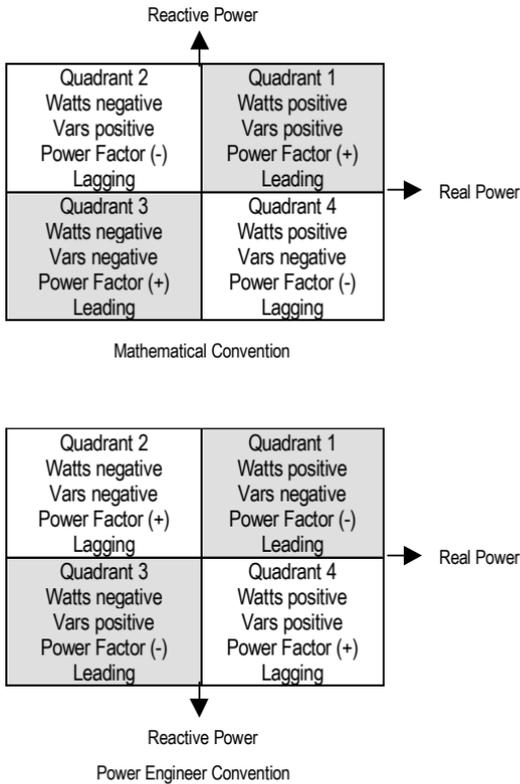


Figure 4.1 System Power Value Relationships

4.5 USING THE OPERATOR PANEL

When the IQ 300 is first powered on, the Operator Panel screen displays a brief initialization message identifying the product and version. The screen then displays the System Power screen. (At this point, pressing the *Scroll* arrows will display system data as described in *section 4.6 System Data Display Mode.*)

Press the *Menu* button to proceed. The menu options are shown one at a time, starting with Phase Data, see figure 4.2. Press the scroll up or down arrows to step through all the main menu options. The presence of additional items is indicated by the up and down triangles at the bottom right edge of the screen.

Keep in mind that the *values* displayed under several menu items depend on which unit you are using and whether the system being monitored is 3 or 4 wire, and require that the appropriate configuration be selected under the **Edit Setpoints** menu. Menu descriptions cover both 3 and 4 wire systems where appropriate.

Note: The lagging or leading indicator and any signs may be the opposite of that shown in the sample screens.

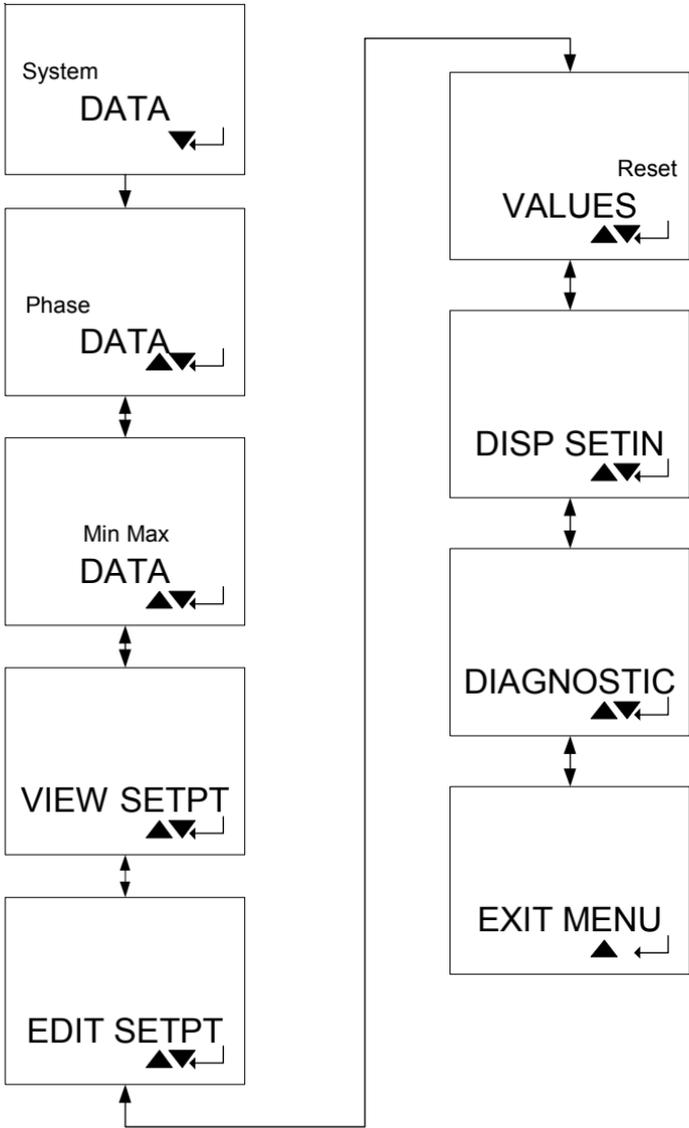


Figure 4.2 Main Menu

4.6 MAIN MENU DISPLAY FOR THE IQ 300

The Main Menu provides access to all information monitored by the IQ 300. Scroll through the menu list in figure 4.2 and hit Enter to access the values contained in that item. Refer to 4.9 View Setpoints to select 3 or 4 wire setup.

4.6.1 System Data Display Mode

The System Data menu provides access to System information monitored by the IQ 300. Select the System Data menu item and press Enter. The screens shown in figure 4.3 display as the Scroll arrows are pressed.

4.6.2 3 Wire System and 4 Wire System

The System Data screens, shown in figure 4.3, are the same for 3 and 4 wire systems. Only when you are using the IQ 330 or IQ 330M will you see the digital input counters and lock status display screens.

4.6.3 System Input (IQ 330 and IQ 330M only)

The System Input displays the accumulated counts of the two digital inputs and the value of the 4 to 20ma analog input. The digital inputs count the positive and negative edges of a square wave signal. The signal must have an amplitude greater than 12 volts and will be clamped at 50 volts. The counts will roll-over the display at 65535. The counts can be tracked to 4294967295 via INCOM and the MODBUS pass through commands before roll over occurs.

The 4 to 20ma analog input will be represented as 0 to 100 percent on the display.

4.6.4 System Lock (IQ 330 and IQ 330M only)

The lockout feature is unique to the IQ 330 type models. The feature is a physical shaft or button protruding from the top of the base. The shaft has a hole in it so the wire tamper proof seal can be employed to disable it. The feature is a toggle. Press the button and the unit will be locked. Press the button again and the unit will be unlocked.

While in the locked state changes to setup and reset values (listed below) will be denied. When a user tries to change any of the values in the list below an ERROR TRY AGAIN message will appear. Simple unlock the IQ 330 to access these functions.

- System Frequency
- Wiring Configuration
- CT Ratio
- PT Ratio
- Demand Window
- KYZ Setup
- Reset Peak Demand
- Reset System Energy

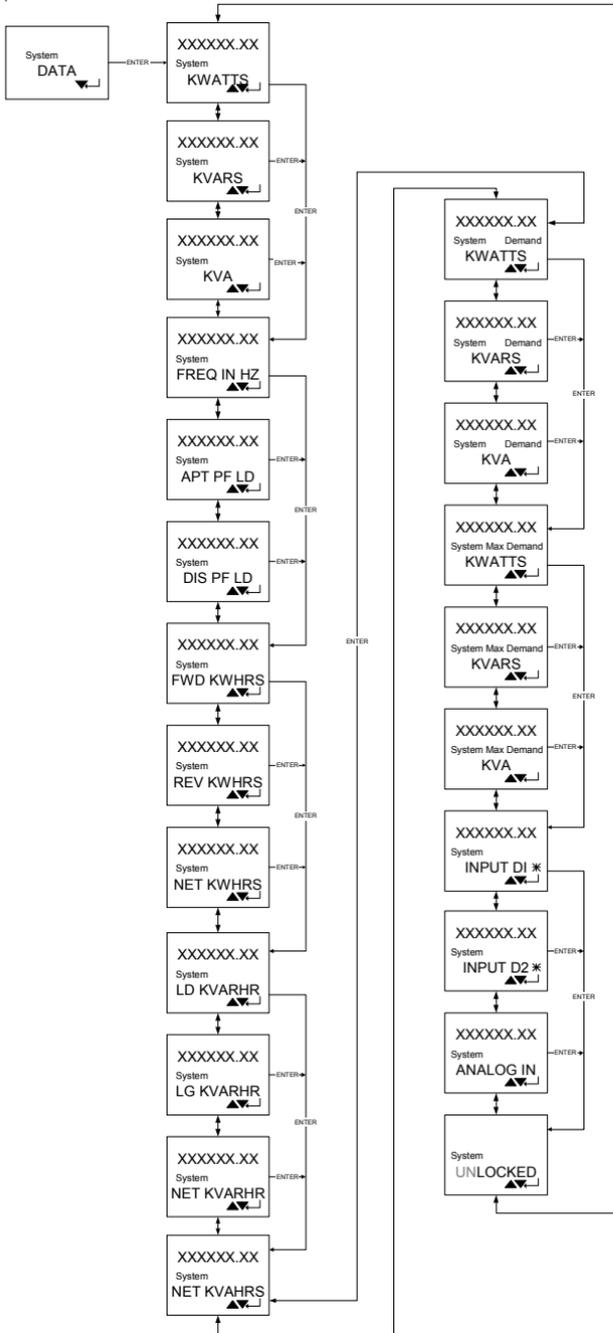


Figure 4.3 System Data

4.7 PHASE DATA DISPLAY MODE

The Phase Data menu provides access to all Phase information monitored by the IQ 300. Position the selection arrow next to the Phase Data menu item and press *Enter*.

4.7.1 3 Wire System

The screens shown in figure 4.4 display as the *Scroll* arrows are pressed.

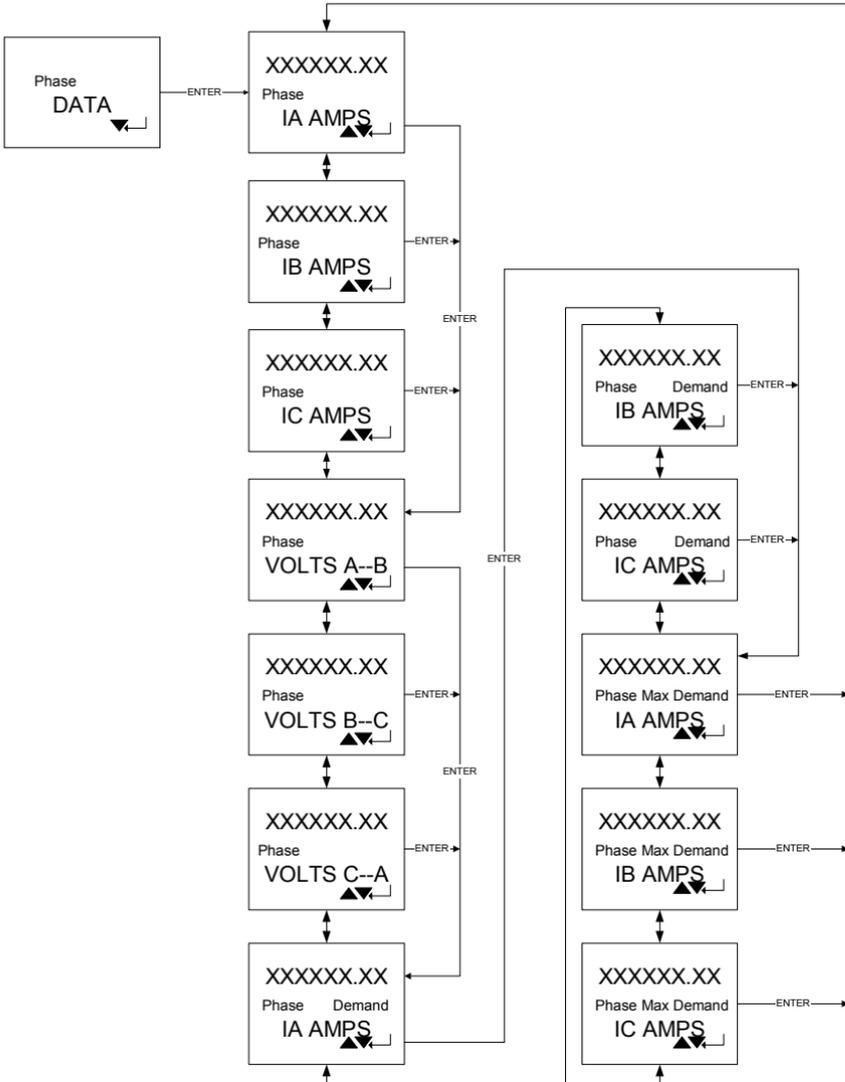


Figure 4.4 3 Wire Phase Display

4.7.2 4 Wire System

The screens shown in figure 4.5 display as the Scroll down arrow is pressed.

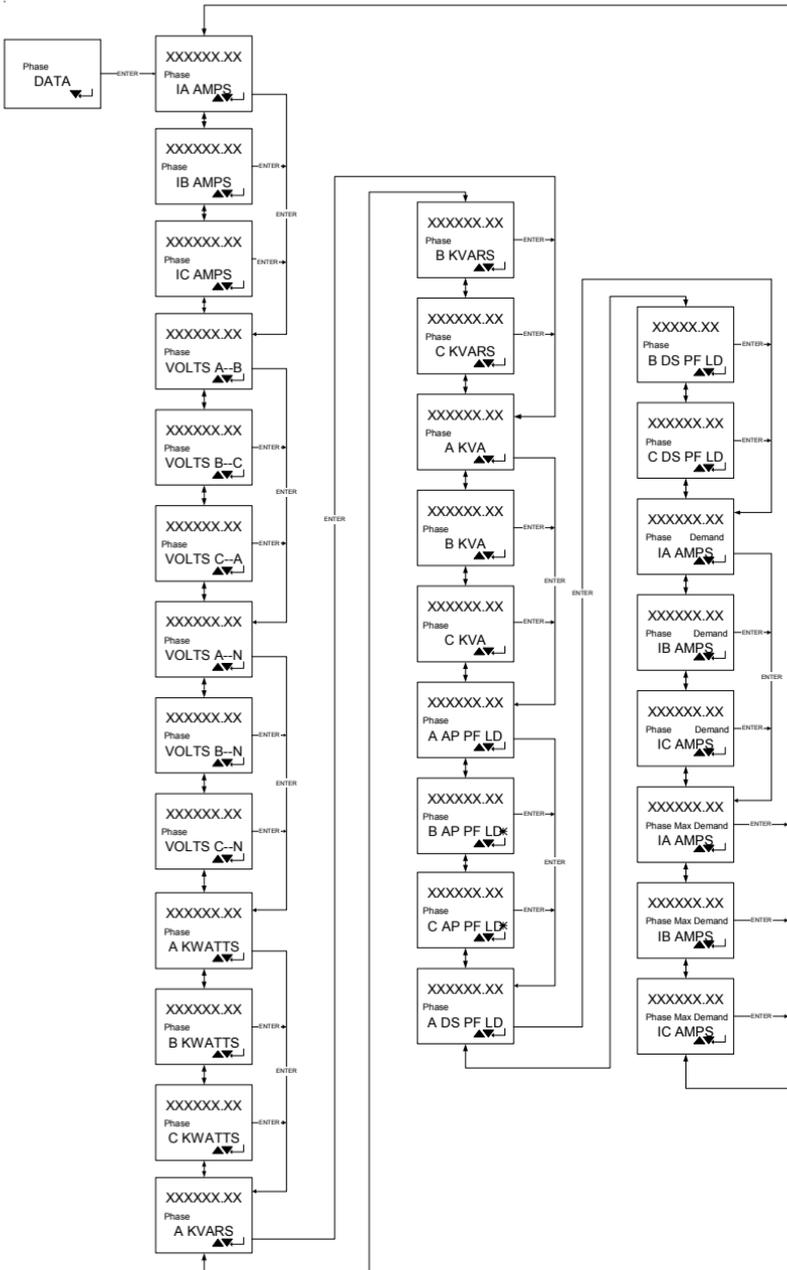


Figure 4.5 4 Wire Phase Display

4.8 MIN/MAX DATA DISPLAY MODE

4.8.1 3 and 4 Wire Systems

These screens, shown in figure 4.6, display the minimums and maximums of values monitored by the IQ 300 for a 3 wire system. Figure 4.7 displays the minimums and maximums of values monitored for a 4 wire system.

Select Min/Max Data from the main menu options. The list in figure 4.6 and 4.7 are displayed as the scroll arrows are pressed. Note how the Enter button moves you forward through the list.

Also note that the LD and LG shown on some of the screens are interchangeable depending on the system value being displayed. If the value is leading, LD will be displayed; if the value is lagging, LG will be displayed. See section 4.4 Displayed Sign Convention for additional information.

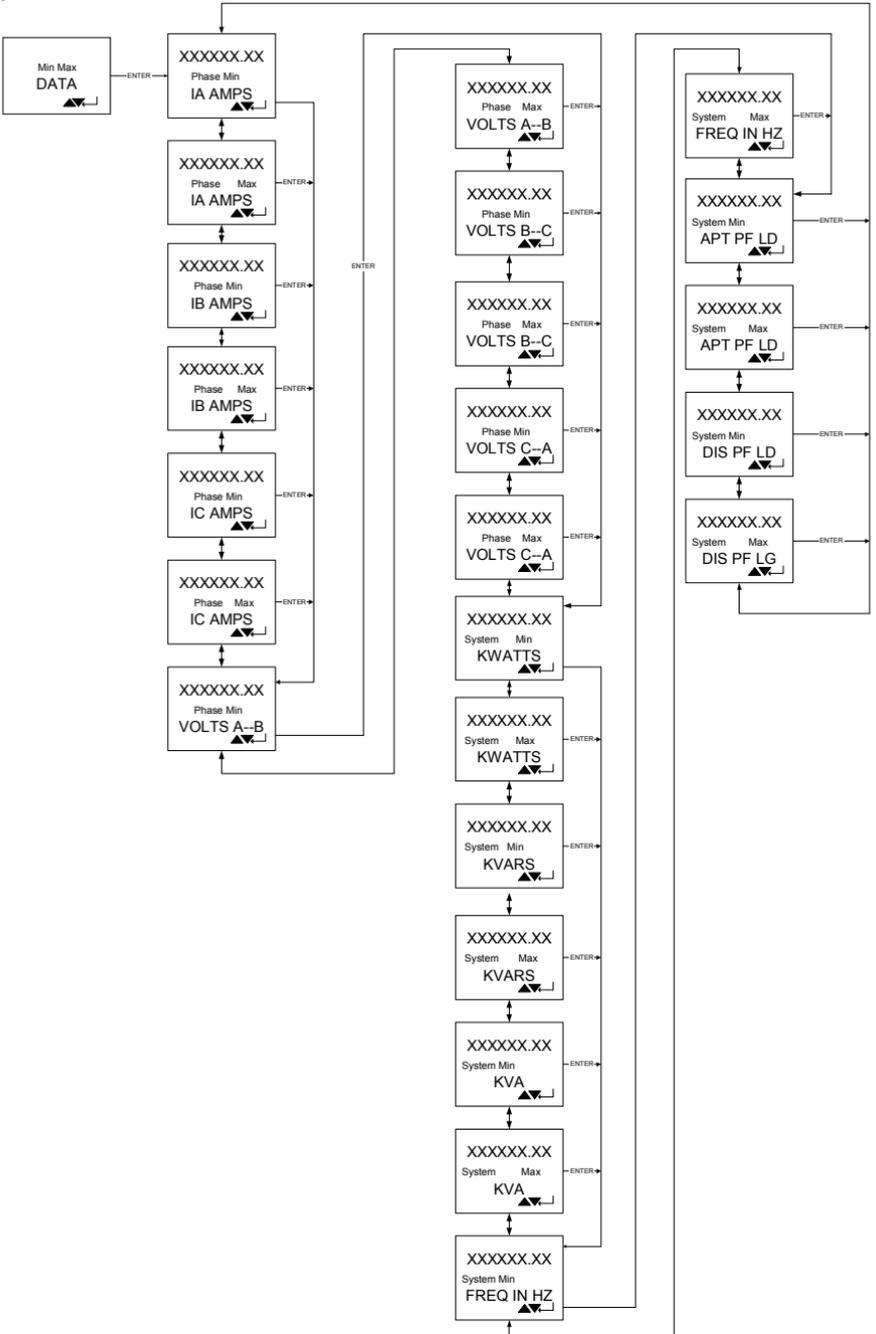


Figure 4.6 3 Wire Min/Max Data

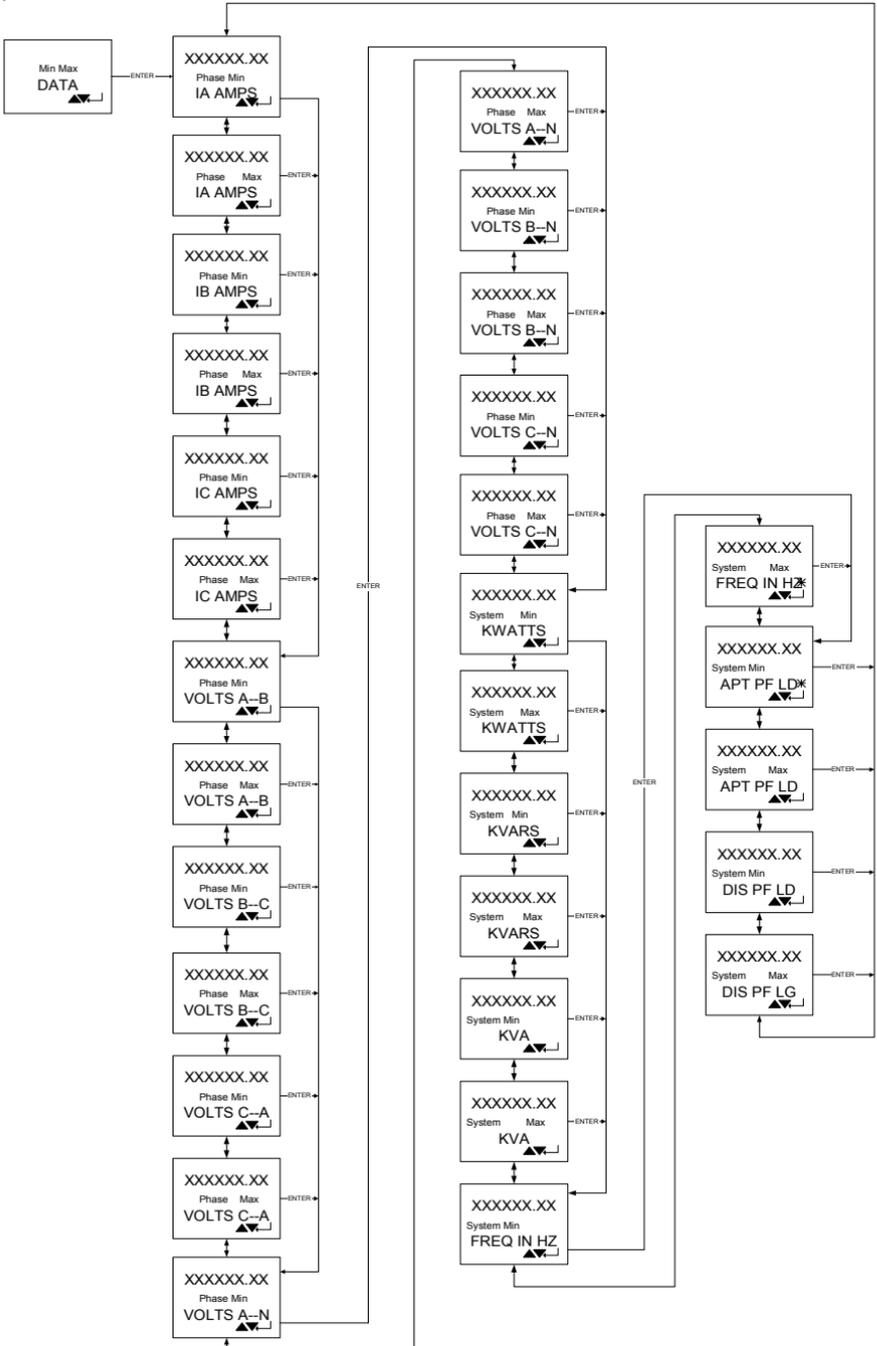
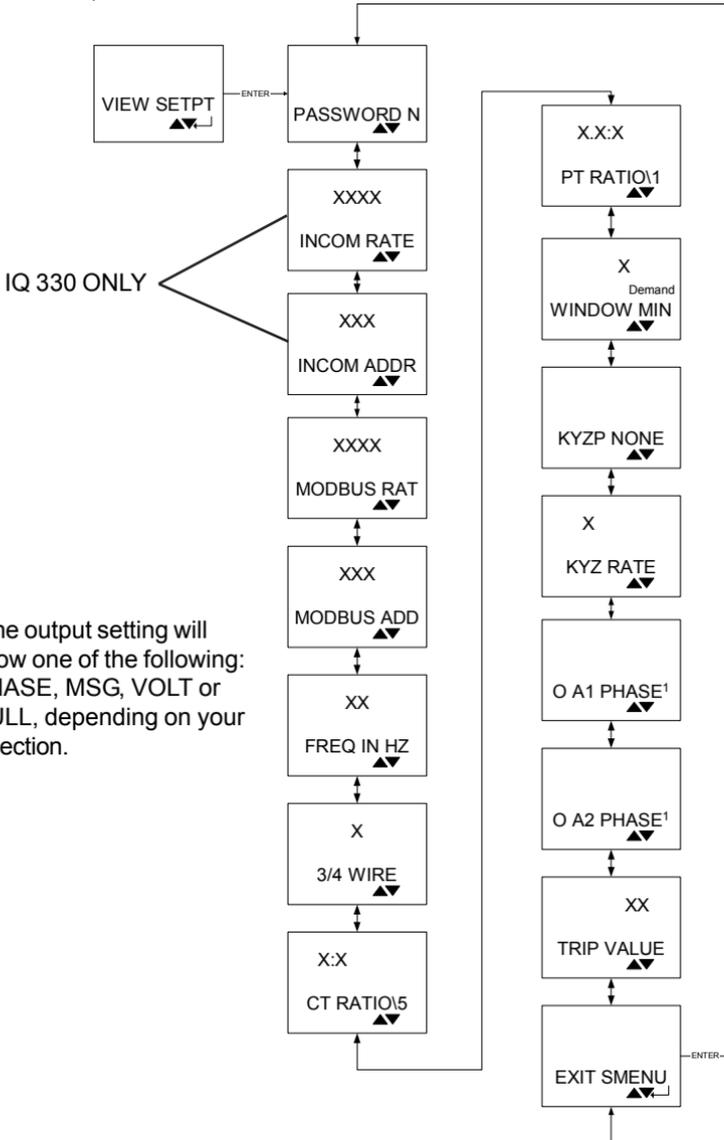


Figure 4.7 4 Wire Min/Max Data

4.9 VIEW SET POINTS (3 AND 4 WIRE SYSTEMS)

This menu selection, shown in figure 4.8, permits the user to view but not change all of the IQ 300 set points and system parameters. To change these values, proceed to section 4.10 Edit Set Points.

Select View Setpt from the main menu options. The list in figure 4.8 displays as the scroll arrows are pressed.



¹The output setting will show one of the following: PHASE, MSG, VOLT or NULL, depending on your selection.

Figure 4.8 View Setpoints

4.9.1 Password Setup

Once the View Setpt option is selected from the main menu the first screen to be shown is the Password Setup screen. One of two screens will display.

One screen, figure 4.9, indicates that no password is necessary to change the IQ 300 set points or system parameters.

The other screen, figure 4.10, indicates that a password is required to change set points or system parameters.



Figure 4.9 No Password Required



Figure 4.10 Password Required

4.9.2 INCOM™ Setup (IQ 320 and IQ 330 Base Modules only)

Scroll up or down until INCOM™ RATE or INCOM™ ADDR is displayed.

The Incom Rate screen, shown in figure 4.11, indicates the baud rate at which the IQ 320/IQ 330 will communicate over the PowerNet network. The Incom Address screen, shown in figure 4.12, indicates the network address (in hexadecimal) assigned to the IQ 320/IQ 330. The baud rate and the address must be set to the values required by the PowerNet network for network communication to occur.



Figure 4.11 Incom Rate Display



Figure 4.12 Incom Address Display

4.9.3 MODBUS™ Setup (IQ 330M Base Modules only)

Scroll up or down until MODBUS™ RAT or MODBUS™ ADD is displayed.

The MODBUS Rate screen, shown in figure 4.13, indicates the baud rate at which the IQ 330M will communicate over the MODBUS network. The MODBUS Address screen, shown in figure 4.14, indicates the network address (in hexadecimal) assigned to the IQ 330M. The baud rate and the address must be set to the values required by the MODBUS network for network communication to occur. The Modbus address should be limited by the user to 0FF (hexadecimal).

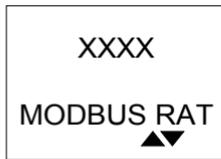


Figure 4.13
MODBUS Rate
Display

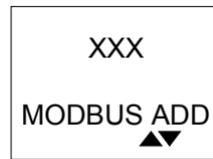


Figure 4.14 MODBUS
Address Display

4.9.4 System Frequency

Scroll up or down until **FREQ IN HZ** is displayed.

This screen, shown in figure 4.15, indicates the frequency selected for the system being monitored. The screen will display either 50 Hz or 60 Hz. If the frequency displayed is not correct, proceed to section 4.10 Edit Set Points for additional information.



Figure 4.15 System
Frequency Display

4.9.5 Wiring Configuration

Scroll up or down until **3/4 WIRE** is displayed.

This screen, shown in figure 4.16, indicates the wiring configuration selected for the system being monitored. The screen will display *either* 3 Wire or 4 Wire. If the wiring configuration displayed is *not* correct, proceed to section 4.10 Edit Set Points for additional information.



Figure 4.16 System
Frequency Display

4.9.6 CT Ratio

Scroll up or down until **CT RATIO\5** is displayed.

This screen, shown in figure 4.17, indicates the current transformer ratio selected as the ratio of the current transformers being used with the IQ 300. If the ratio displayed is not correct, proceed to section 4.10 Edit Set Points for additional information.



Figure 4.17 CT Ratio
Display

4.9.7 PT Ratio

Scroll up or down until **PT RATIO\1** is displayed.

This screen, shown in figure 4.18, indicates the potential transformer ratio selected as the ratio of the potential transformers being used with the IQ 300. If the ratio displayed is not correct, proceed to section 4.10 Edit Set Points for additional information.

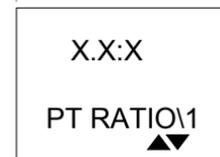


Figure 4.18 PT
Ratio Display

4.9.8 Demand Window

Scroll up or down until WINDOW MIN is displayed.

This screen, shown in figure 4.19, indicates the time over which demand parameters are measured. If the time displayed is not correct, proceed to section 4.10 Edit Set Points for additional information.



Figure 4.19 Demand Window

4.9.9 KYZ Setup (IQ 320 and IQ 330 Base Module only)

Scroll up or down until KYZP <XXXX> or KYZ RATE is displayed. The <XXXX> will be replaced with NONE, VAh, -VARh, +VARh, -Wh or +Wh, this represents the system value being monitored.

The KYZP <XXXX> screen, shown in figure 4.20, indicates the system value which the IQ 320 and the IQ 330 will monitor, or Track. The KYZ rate screen, shown in figure 4.21, indicates the energy per pulse Rate over which energy demand (consumption) is measured. If the values displayed are not correct, proceed to section 4.10 Edit Set Points for additional information.

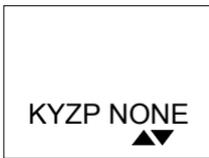


Figure 4.20 KYZ Value

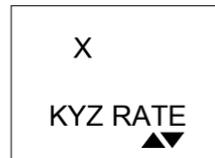


Figure 4.21 KYZ Rate Display

4.9.10 Digital Output Setup (IQ 330 & IQ 330M Base Module Only)

Scroll up or down until O A1: <XXXX> or O A2: <XXXX> is displayed. The <XXXX> will be replaced with PHASE, MSG, VOLT or NULL, depending on your selection.

These screens, shown in figure 4.22 and 4.23, indicates the status of the two “form A” output relays. Each of the two relays can be programmed to respond to MESSAGE, VOLTAGE or PHASE. When NULL is displayed the output is disabled.

When in MESSAGE mode the relay will be open or closed depending on an external message received by the unit.



Figure 4.22 Digital Output A1



Figure 4.23 Digital Output A2

In PHASE mode the output will be in closed state when the three phase voltages are in phase and the open state when the three phase voltages are out of phase.

When in Voltage mode the output will be closed when the voltage strays from the 100% nominal reading. The nominal readings will be 120, 240, 480 and 575. The programmable trip value will determine when the output will be closed. If the rms voltage drops below a percentage less than 100% the relay will be closed. If the rms voltage goes above a percentage that is above 100% the relay will be closed. In both cases the relay will stay closed until open by a message. For example if the nominal voltage is 480 V and you want the unit to trip if the voltage drops below 420 V, multiply 420 by 100 and divide it by 480 to find your setting.



Figure 4.24 Trip Value Display

To view the status of the trip value scroll up or down on the view setpoints menu to TRIP VALUE, see figure 4.24.

Note: the MODBUS and INCOM forms of communication do not read the output values. Refer to 4.10.8 notes for information on entering proper nominal readings.

4.9.11 Exit

To exit the view setpoints options scroll up or down the menu options till you reach EXIT SMENU, see figure 4.25, press the enter button.



Figure 4.25 Exit Menu Display

4.10 EDIT SET POINTS (3 AND 4 WIRE SYSTEMS)

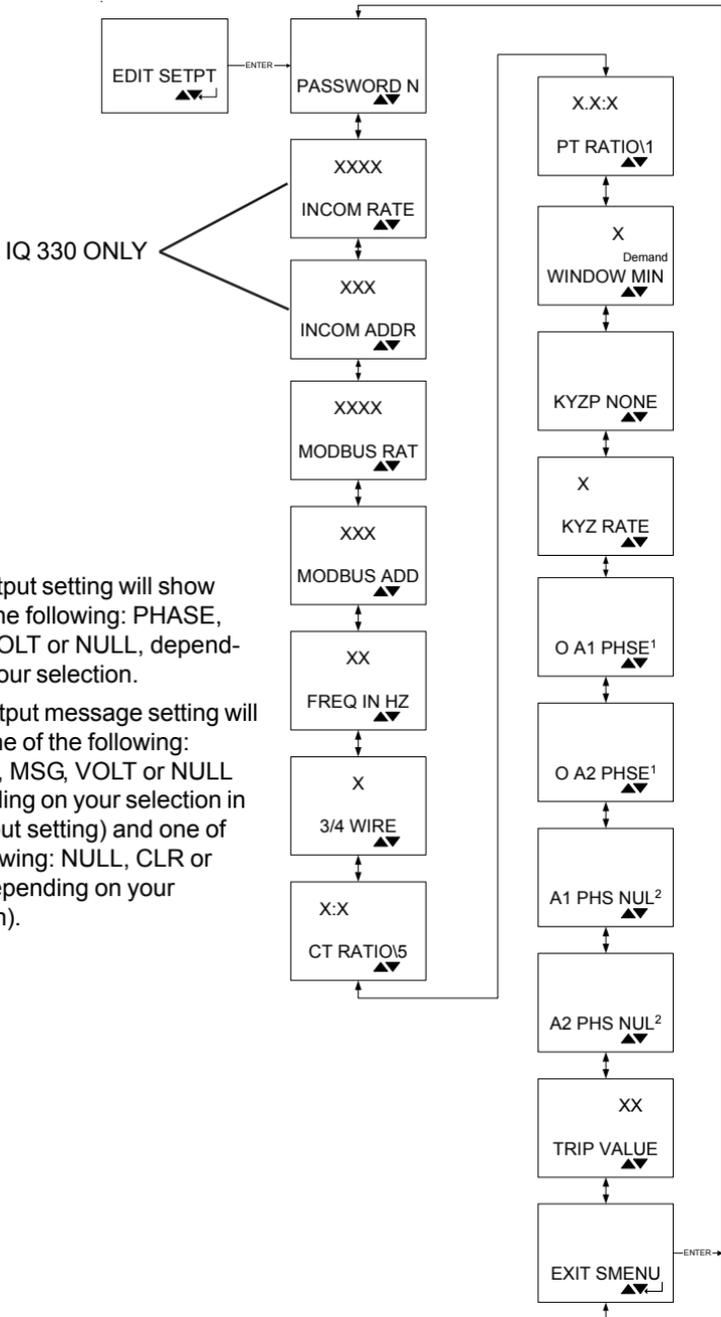
These screens, shown in figure 4.26, permit the user to change all of the IQ 300 set points and system parameters.

Select EDIT SETPT from the main menu options. If the Password option has been enabled, the system requests the password.

To enter the password, press the enter button to move the blinking number to the desired digit. Then use the Scroll up arrow to increase the digit or the Scroll down arrow to decrease the digit. When the desired choice is displayed, press enter to lock in the selection.

If an incorrect password is entered, the message ERROR displays. Press Menu to return to the previous screen showing Edit Set Points. Press Enter to retry entering the password.

If the correct password is entered, or if the Password option is not enabled, the screens shown in figure 4.26 will be available. Use the scroll arrows to move through the screens.



¹The output setting will show one of the following: PHASE, MSG, VOLT or NULL, depending on your selection.

²The output message setting will show one of the following: PHASE, MSG, VOLT or NULL (depending on your selection in the output setting) and one of the following: NULL, CLR or SET (depending on your selection).

Figure 4.26 Edit Setpoints

4.10.1 Password Setup

Scroll up and down the Edit Menu options, when you reach Password press enter. The screen changes to show the digits of the current password blinking. To change any digit of the password, first select it by pressing Enter to move the blinking to the desired digit. Then use the Scroll up arrow to increase the digit or the Scroll down arrow to decrease the digit. When the desired choice is displayed, press Enter to lock in the selection.

This screen also allows the user to specify if a password is required to change the IQ 300 set points or system parameters and shows the user what the password is or would be if it were in use.

The screen initializes when Password Y is selected. To specify if a password is required, press either of the Scroll arrows to toggle between Y and N. When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

If an error occurs in the New Password selection process, an error message displays. Press Enter to return to the previous screen, and repeat the steps above.

4.10.2 INCOM™ Setup (IQ 320 and IQ 330 Base Modules only)

Note: A display is required to configure the INCOM™ address.

To set these values on IQ 320 and IQ 330 Base modules installed without a permanently connected IQ 300 display module, temporarily connect an IQ 300 display module and follow the procedure below.

Scroll up or down the Edit Menu options, when you reach the INCOM RATE option or the INCOM ADDR option, press the enter button.

The INCOM RATE screen, shown in figure 4.27, displays the baud rate at which the IQ 320 and IQ 330 will communicate over the PowerNet network. The INCOM ADDR screen, shown in figure 4.28, indicates the network address (in hexadecimal) currently assigned to the IQ 320 or IQ 330.

The screen initializes with Baud Rate selected and the current value displayed. To select a baud rate at which the IQ 320 or IQ 330 will communicate over the PowerNet network, press either of the *Scroll* arrows to step through the choices 9600 or 1200 baud. When the desired choice is displayed, press *Enter* to lock in the selection.



Figure 4.27 Incom Rate Display



Figure 4.28 Incom Address Display

To change any digit of the address, first select it by pressing Enter, the current setting will begin to blink. Press enter again until you reach the desired digit needing changed. Use the Scroll up arrow to increase the digit or the Scroll down arrow to decrease the digit. When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.10.3 MODBUS™ Setup (IQ 330M Base Module only)

Note: A display is required to configure the MODBUS™ address.

To set these values on IQ 330 Base modules installed without a permanently connected IQ 300 display module, temporarily connect an IQ 300 display module and follow the procedure below.

Scroll up or down the Edit Menu options, when you reach the MODBUS RAT option or the MODBUS ADD option, press the enter button.

The MODBUS rate screen, shown in figure 4.29, displays the baud rate at which the IQ 330 will communicate over the MODBUS network, and indicates the network address (in hexadecimal) currently assigned to the IQ 330.

The screen initializes with Baud Rate selected displayed. To select a baud rate at which the IQ 330 will communicate over the PowerNet network, press either of the Scroll arrows to step through the choices of 19200 or 9600 baud. When the desired choice is displayed, press Enter to lock in the selection.

To change any digit of the address, first select it by pressing Enter, the current setting will begin to blink. Then use the Scroll up arrow to increase the digit or the Scroll down arrow to decrease the digit. When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

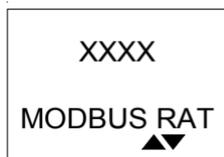


Figure 4.29
MODBUS Rate
Display

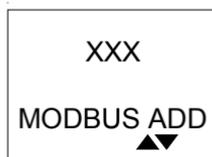


Figure 4.30 MODBUS
Address Display

4.10.4 System Frequency

Scroll up or down the Edit Menu options, when you reach **FREQ IN HZ**, press the Enter button.

This screen, shown in figure 4.31, displays the electrical system frequency in Hz.

This screen initializes with the frequency of the system being monitored selected and displayed. The screen will display either 60 Hz or 50 Hz.

To specify the frequency of the system being monitored, press either of the Scroll arrows to toggle between 60 Hz and 50 Hz. When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.



Figure 4.31 System Frequency Display

4.10.5 Wiring Configuration

Scroll up or down the Edit Menu options until you reach the **3/4 WIRE** option, press the Enter button.

This screen displays the current wiring configuration of the system being monitored.

This screen, shown in figure 4.32, initializes with the wiring configuration of the system being monitored selected and displayed. The screen will display *either* 3 Wire or 4 Wire.

To specify the wiring configuration of the system being monitored, press either of the Scroll arrows to toggle between 3 Wire and 4 Wire. When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

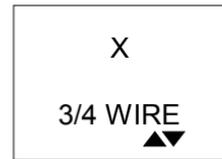


Figure 4.32 System Frequency Display

4.10.6 CT Ratio

Note: See table 2.4 for data ranges before specifying the CT ratio.

Scroll up or down the Edit Menu options until you reach the **CT RATIO\5** screen, press the Enter button.

This screen, shown in figure 4.33, displays the ratios of the current transformers connected to the IQ 300. This screen initializes with the ratio of the current transformers being used with the IQ 300 selected and displayed.

To specify the ratio of the current transformers being used with the IQ 300, press either of the Scroll arrows repeatedly to step through the choices individually, or press and hold either of the Scroll arrows to step through the choices rapidly. There



Figure 4.33 CT Ratio Display

are 256 choices from 5 to 8000, displayed as follows:

- 5 to 110 in increments of 5
- 110 to 1000 in increments of 10
- 1000 to 1250 in increments of 25
- 1250 to 8000 in increments of 50

When the desired choice is displayed, press *Enter* to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.10.7 PT Ratio

Note: See table 2.4 for data ranges before specifying the PT ratio.

Scroll up or down the Edit Menu until you reach the PT RATIO\1 option, press the Enter button.

This screen, shown in figure 4.34, displays the ratio of the potential transformers connected to the IQ 300.

This screen initializes with the ratio of the potential transformers being used with the IQ 300 selected and displayed.

To specify the potential transformer ratio of the potential transformers being used with the IQ 300, press either of the *Scroll* arrows repeatedly to step through the choices individually, or press and hold either of the *Scroll* arrows to step through the choices rapidly. There are 256 choices from 1.0 to 1690, displayed as follows:

- 1.0 to 6 in increments of 0.1
- 6 to 20 in increments of 1
- 20 to 260 in increments of 5
- 260 to 1690 in increments of 10

Note: If no potential transformers are being used set the PT ratio at 1.0 to 1.

Note: Enter the PT Ratio two times every time you install the IQ 330. This will ensure proper default voltage and calculation when your using the Voltage Trip feature.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.10.8 Demand Window

Scroll up or down the Edit Menu until you reach the WINDOW MIN option, press the Enter button.

This screen, shown in figure 4.35, displays the current value of the demand time

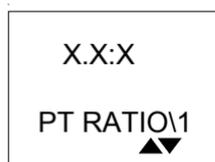


Figure 4.34 PT Ratio Display

window.

The screen initializes with the time window over which demand (parameters) are measured, selected and displayed.

To specify the Demand Window, press either of the *Scroll* arrows to step through the choices. There are 8 choices from 5 minutes to 60 minutes, displayed as follows:

- 5 min. to 30 min. in increments of 5 min.
- 45 min.
- 60 min.

When the desired choice is displayed, press *Enter* to lock in the selection.

If the procedure completes successfully, *Download OK* appears briefly. The display then returns to the previous screen.

The Demand Window is a fixed period of time over which average system parameters are calculated. For example, setting the Demand Window to 15 instructs the IQ 300 to calculate the average current or power over the past 15 minutes and to update that calculation every 15 minutes.

If multiple IQ 320 or IQ 330 units exist on a PowerNet network, all their Demand Windows can be simultaneously reset and synchronized using INCOM™ communication unless the lockout feature is applied on the IQ 330.

4.10.9 KYZ Setup (IQ 320 and IQ 330 Base Modules Only)

Position the selection arrow next to *KYZ Setup* and press *Enter*.

These screens, shown in figure 4.36 and 4.37, displays the system value communi-

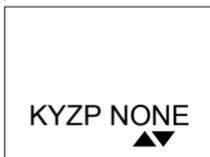


Figure 4.36 KYZ Value



Figure 4.37 KYZ Rate Display

cated by the KYZ pulse train.

To select a system value (\pm kWh, \pm kvarh, kVAh) which the IQ 320 or IQ 330 will Track, press either of the *Scroll* arrows repeatedly to setup through the choices individually, or press and hold either of the *Scroll* arrows to step through the choices rapidly. There are up to 32 choices from 1/32 to 100 displayed as follows:

Note: Some rates are available only in the IQ 320 or IQ 330 firmware version 1.02



Figure 4.35 Demand Window

Version 1.01 and Earlier:	Version 1.02 and Later:
1 through 10 in increments of 1	1/32, 1/16, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4
20, 40, 50, 60, 80, 100	1 through 15 in increments of 1
	20 through 100 in increments of 10

and greater.

When the desired choice is displayed, press *Enter* to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

The KYZ RATE screen, shown in figure 4.37, shows the energy per pulse Rate selected. To change the rate, press either of the Scroll arrows to step through the choices. When the desired choice is displayed, press *Enter* to lock in the selection. See 3.3.4 KYZ Pulse Initiator for details about choosing Track and Rate.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.10.10 Digital Output Setup (IQ 330 & IQ 330M Base Module Only)

Scroll up or down the Edit Menu options, when you reach either the O A1 <XXXX> or O A2 <XXXX> screen press the *Enter* button.

The screens, shown in Fig 4.37 and 4.38, indicate the selection of the mode to be used for the two outputs. The TRIP VALUE screen, shown in figure 4.39, will show the percentage used relative to the trip value assigned to the IQ 330.

To select a mode to be assigned to output A1 or A2, press either of the *Scroll* arrows to step through the choices MESSAGE, VOLTAGE, PHASE or NULL. When the desired choice is displayed, press *Enter* to lock in the selection. Repeat this method for both A1 and A2.



Figure 4.37 Digital Output A1



Figure 4.38 Digital Output A2

In Message mode, the outputs are opened or closed via a message through the communications port. In Phase mode, the outputs are opened or closed depending on proper phasing. In Voltage mode, when the PT Ratio is entered twice the powered A, B & C phases are sampled and a default value is selected from one of four: 120, 240, 480 or 575. From this point the Trip Value is determined by the

default value chosen. This is all computed internally based on 3 Phase Voltage readings. This value can not be viewed and will only be one of the four values listed.

Enter the PT Ratio two times every time you install the IQ 230. This will ensure proper default voltage and calculation when your using the Voltage Trip feature.

Once the mode is selected for the two outputs The Trip Value can be assigned. To change the Trip Value setting, scroll up or down the Edit Menu options until you reach the TRIP VALUE screen, press the Enter button. Use the up Scroll arrow to increase the value or the down Scroll arrow to decrease the value. The range is from 0 to 124 percent.

When the desired choice is displayed, press Enter to lock in the selection.

If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.



Figure 4.39 Trip Value Display

4.10.12 Message to Outputs A1 and A2 (IQ 330 & IQ 330M Base Module Only)

Scroll up or down the Edit Menu options, when you reach either the A1 or A2 Message Display, shown in figures 4.40 and 4.41, press the Enter button.

Note that the second word on this screen indicates the selection made in the Digital Output Setting, either Message, Voltage, Phase or Null. The below example represents the message screen if Phase was chosen for both A1 and A2 Digital Outputs.

The screens also indicate the selection of the message to be sent to either of the two outputs. The initial result should be NULL. This means if you exit no message will be sent.

To select the message to be assigned to output A1 or A2, press either of the Scroll arrows to step through the choices SET, CLEAR or NULL. When the desired choice is displayed, press Enter to lock in the selection.

The possible selections will be determined by the choices made in Output A Setup.

A Message choice will let you chose all possibilities.

A Voltage choice will let you chose NULL or CLEAR.

A Phase choice will not let you send a message to that output.

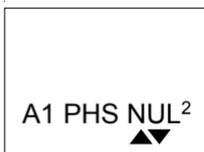


Figure 4.40 Output A1 Message Display



Figure 4.41 Output A2 Message Display

When the desired choice is displayed, press Enter to lock in the selection.

When Download OK appears briefly the messages to the outputs will be sent. The display then returns to the previous screen.

4.10.13 Exit

Pressing Enter when the EXIT SMENU option appears returns the display to the Main Menu.

4.11 RESET VALUES

These menu items allow the user to reset to zero or to default IQ 300 system values and parameters.

Scroll up or down the Main Menu options, when you reach the VALUE screen press the Enter button. The screens, in figure 4.42 on the next page, displays the Reset Values choices.

Every choice can be displayed by using the Scroll arrows. If Reset ALL Min/Max is chosen, all the Min/Max values (Amps, Volts, Power, Freq, PF) will be reset.

Press the Enter button once you reach the screen for the item you want to reset. A new screen will appear asking if you are sure you want to reset the value(s).

To change the selection to Yes, press either of the Scroll arrows to toggle between Y (yes) and N (no). When Y is displayed, press Enter to lock in the selection. If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

Pressing Enter while N is displayed returns you to the Reset Selection screen. An error message will appear if the unit is in LOCKED mode and the Enter button is pressed while Y is displayed.

4.12 CONTRAST ADJUST

To adjust the contrast of the display screen scroll up or down the main menu to you reach the DISP SETIN option, press the Enter button. Scroll up or down again until you reach the CONTRAST screen, press the Enter button. When ADJ appears above CONTRAST you are able to adjust the contrast setting. Hold the up or down arrow until you reach your desired contrast setting, then press the Enter button. If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

Alternatively, the contrast of the screen can be adjusted without entering the Contrast Adjust menu by holding in the Enter button while pressing the Scroll up arrow (to decrease contrast) or the Scroll down arrow (to increase contrast).

4.13 SCROLL MODE

The IQ 300 also has the ability to scroll through every data item while the unit is not in use. To select this Scroll Mode option use the up or down arrow to scroll through

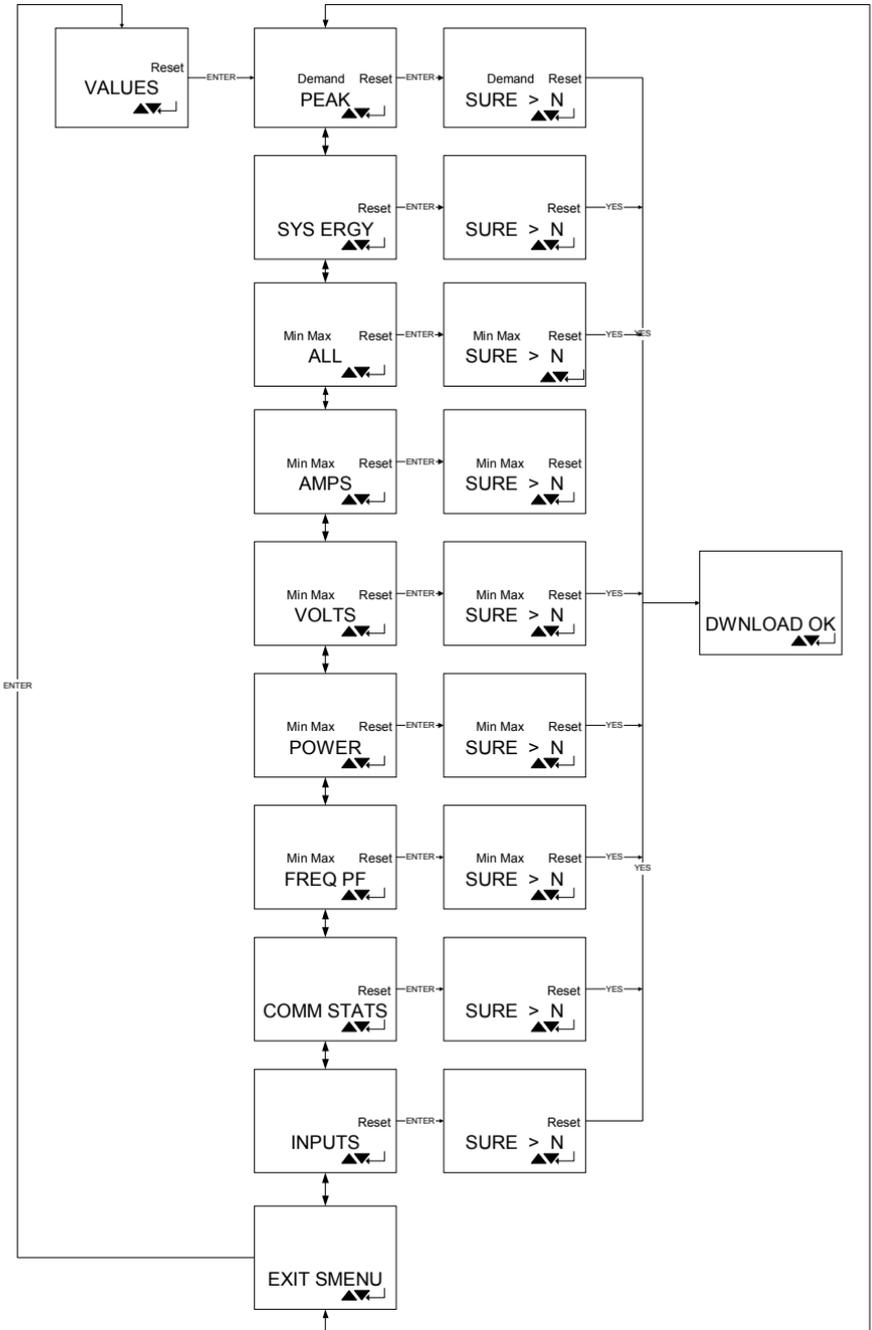


Figure 4.42 Reset Values

the main menu options. When you reach the DISP SETIN screen, press the Enter button. Scroll up or down again until you reach the SCROL MODE screen and press the Enter button. On or OFF will be blinking at the top of the screen. Use the arrow buttons to toggle between the two options. Press the Enter button to select your preferred option. If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.14 BACKLIGHT

If the faceplate buttons are not pushed for 5 minutes the IQ 300 will go into a sleep mode, causing the backlight to go dim or Lo. Once you begin using the IQ 300 the backlight automatically comes on, making the screen easier to read.

You have the option of keeping the backlight on even when the unit is not in use. To do so, use the up or down arrow to scroll through the main menu options. When you reach the DISP SETIN screen, press the Enter button. Scroll up or down again until you reach the BACKLIGHT screen, press the Enter button. On or Lo will be blinking at the top of the screen. Use the arrow buttons to toggle between the two options and press the Enter button to select your preferred option. If the procedure completes successfully, Download OK appears briefly. The display then returns to the previous screen.

4.15 DIAGNOSTICS

This menu item is reserved for the use of Cutler-Hammer service personnel. There are no user-accessible functions on this screen.

4.16 EXIT MENU

To exit out of the main menu options simply press the Menu button, or press the Enter button when the EXIT MENU screen is displayed, this will return you to the main data screen.

SECTION 5: NETWORK COMMUNICATION PROTOCOLS

5.1 MODBUS RS485 NETWORK

The IQ 330M can be accessed by MODBUS messages through a RS485 interface. In order to do this properly please refer to IL 17384, Part A and Part B: IMPACC Communications Standard, EATON | Cutler-Hammer “Modicon MODBUS Protocol” and IL 66A7508H01 Instructions for the mMINT MODBUS Translator Module.

The following simplified rules apply to a given system consisting of master and slave devices. For more complex configurations please refer to standard MODBUS RTU wiring specification rules for the RS485 network.

The recommended MODBUS cable has twisted-pair wires (24AWG stranded 7x32 conductors with PVC insulation) having an aluminum/mylar foil shield with drain wire.

The maximum system capacity is 4,000 feet of communications cable and 32 devices on the MODBUS RTU network.

Make sure the twisted-pair wire is recommended for MODBUS RTU network use. Use shielded twisted-pair wire to connect each slave to the MODBUS RTU network, daisy-chain style. The polarity of the twisted pair is critically important, MODPIN1 is MOD(A) and MODPIN2 is MOD(B).

Tie the communication cable shield to ground only once at the MODBUS master device. If there are more than one remote MODBUS compatible device cabled to the master device, tie the communication cable shields together but *do not* connect to ground.

5.2 OVERVIEW

The contents of MODBUS registers are product objects (e.g. Ia – phase A current). There is a single register map for all Eaton | Cutler-Hammer IQ products. Consequently, the objects listed in the following tables are identical registers called out by the mMINT. The IQ 330M supports the fixed values only and occupy two registers. See table 5.1.

Table 5.1 IQ 300 Objects

Objects - (complete list)		Units	Modbus Address (hex)	INCOM Products - (partial list)	
Name	Numeric			Fixed point (FP) (hex)	FP scale factor
status cause	primary		1200 or 1800 hi		x
	secondary		1200 or 1800 lo		x
	cause		1201 or 1801		x
current	I _A	A	1802	10	x
	I _B	A	1804	10	x
	I _C	A	1806	10	x
	I _G	A	1808	10	
	I _N	A	180A	10	
	I _{avg}	A avg	180C	10	
L-L voltage	V _{AB}	V	180E	10	x
	V _{BC}	V	1810	10	x
	V _{CA}	V	1812	10	x
	V _{LLavg}	Vavg	1814	10	
L-N voltage	V _{AN}	V	1816	10	x
	V _{BN}	V	1818	10	x
	V _{CN}	V	181A	10	x
	V _{LN}	V avg	181C	10	
N-G voltage	V _{NG}	V	181E	10	
current	peak I _A demand	A	1820	10	x
	peak I _B demand	A	1822	10	x
	peak I _C demand	A	1824	10	x
	peak I _G demand	A	1826	10	
	peak I _N demand	A	1828	10	
power	real 3 ph (power)	W	182A	1	x
	reactive 3 ph	VAR	182C	1	x
	apparent 3 ph	VA	182E	1	x
power factor	displacement 3 ph	pf	1830	100	
	apparent	pf	1832	100	x
frequency	freq	Hz	1834	10	x
K-factor	K-factor		1836	1	
THD factor	THD factor		1838	1	

Table 5.1 IQ 300 Objects Cont.

Objects - (complete list)		Units	Modbus Address (hex)	INCOM Products - (partial list)	
Name	Numeric			Fixed point (FP) (hex)	FP scale factor
power	A ph	W	183A	1	x
	B ph	W	183C	1	x
	C ph	W	183E	1	x
	reactive A ph	VAR	1840	1	x
	reactive B ph	VAR	1842	1	x
	reactive C ph	VAR	1844	1	x
	apparent A ph	VA	1846	1	x
	apparent B ph	VA	1848	1	x
	apparent C ph	VA	184A	1	x
power factor	displacement A ph	pf	184C	100	x
	displacement B ph	pf	184E	100	x
	displacement C ph	pf	1850	100	x
	apparent A ph	pf	1852	100	x
	apparent B ph	pf	1854	100	x
	apparent C ph	pf	1856	100	x
power	peak demand	W	1858	1	x
source 1	V _{AB}	V	185A	10	
	V _{BC}	V	185C	10	
	V _{CA}	V	185E	10	
	freq	Hz	1860	10	
source 2	V _{AB}	V	1862	10	
	V _{BC}	V	1864	10	
	V _{CA}	V	1866	10	
	freq	Hz	1868	10	
power	power (real 3 ph)	W	186A	1	x
power factor	pf (°)	pf	186C	100	x
prod ID	prod ID		186E		x
frequency	freq	Hz	1870	100	x
energy	forward	kWh	1872	1	x
	reverse	kWh	1874	1	x
	net	kWh	1876	1	x
reactive energy	lead	kVARh	1878	1	x
	lag	kVARh	187A	1	x
	net	kVARh	187C	1	x
energy (4 reg)	apparent	kVAh	187E	1	x

5.3 FUNCTION CODES

The IQ 300 responds to a limited number of MODBUS function codes. These are function codes 04 and 10 hex.

5.4 BLOCK OF REGISTERS

Using the 04 MODBUS command you can read any block from table 5.1. The beginning address and the size of the block are the elements of the 04 command. Below is an example of message for retrieval of data.

Table 5.2 Example Messages

Field Name	Example (HEX)
Slave Address	TBD
Function	04
Starting Address Hi	18
Starting Address Lo	03
Number of Points Hi	00
Number of Points Lo	02
Error Check (LRC or CRC)	--

The register data in the response message are packed as two bytes per register. For each register, the first byte contains the high-order bits and the second contains the low-order bits.

Because all of the data in the IQ 330M is stored as a 32 bit signed integer, you always want to retrieve two registers to get the result. See below for an example.

One item is made up of 4 bytes of information. Using table 5.1 locate the MODBUS address of 1804, this is the numeric object or item for I_B . Each item (in this example I_B) equals 2 registers. Each register equals 2 bytes, therefore 1 item (I_B) equals 4 bytes.

Table 5.3 Example Responses

Field Name	Example (Hex)
Slave Address	TBD
Function	04
Byte Count	04
Data Hi (Bits 15 thru 8)	01
Data Lo (Bits 7 thru 0)	02
Data Hi (Bits 31 thru 24)	00
Data Lo (Bits 23 thru 16)	0A
Error Check (LRC or CRC)	--

There are two locations that are not 32 bit signed integers, "status cause" and "product ID". These two locations will give valid single register (two byte) response and respond in the following format.

Table 5.3A Example Responses

Field Name	Example (Hex)
Slave Address	TBD
Function	04
Byte Count	04
Data Hi (Register X (1800))	01
Data Lo (Register X (1800))	02
Data Hi (Register X+1 (1801))	00
Data Lo (Register X+1 (1801))	0A
Error Check (LRC or CRC)	--

5.5 UNDERSTANDING ADDRESS 1800 AND 1801

Address 1800 and 1801 are made up of three fields, Primary, Secondary and Cause. The Primary field is the high byte of address 1800. The Secondary field is the low byte of 1800. The Cause field is all of address 1801. Value found in these three fields are defined below.

Definition	Cause Field	
Energy Error	2	Decimal
RAM Error	39	Decimal
ROM Error	43	Decimal
Calibration Error	113	Decimal
External RAM Error	44	Decimal
Setpoint Error	77	Decimal
No Error	1	Decimal

Definition	Primary		Secondary	
Active	9	Decimal	0	Decimal
Alarm	4	Decimal	8	Decimal

5.6 EXTENDED COMMUNICATIONS VIA MODBUS

Since a control error could result in unwanted actions initiated by MODBUS the IQ 300 requires a specific protocol by the MODBUS Master in order to perform control related functions within the IQ 300

A set of registers is reserved for the control protocol. They begin at register 6200 hex and extend through 6203 hex. These three registers are written with a 'slave action number' and it's 1's complement, using function code 10 hex. The format of the data is shown in figure 5.2. These three registers, and only these three registers, must be written in one MODBUS transaction.

If the 'slave action number' is valid and not blocked by a LOCKED system, the IQ 300 issues the 'slave action' control command.

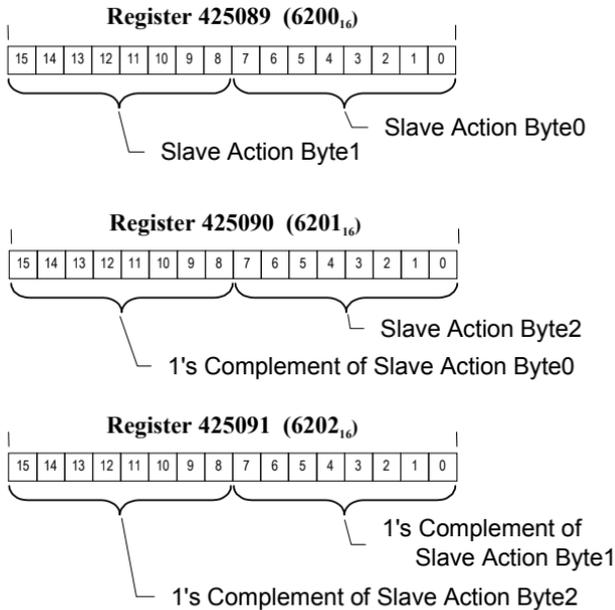


Figure 5.2 Control Product Data Format

Table 5.4 Example Slave Actions

Field Name	Example (HEX)
Slave Address	TBD
Function	10
Address Hi	62
Address Lo	00
Quantity of Registers Hi	00
Quantity of Registers Lo	03
Byte Count	06
Slave Action Byte 1	01
Slave Action Byte 0	04
Don't Care	XX
Slave Action Byte 2	00
Don't Care	XX
Don't Care	XX
Error Check (LRC or CRC)	--

Table 5.4 is an example of the 'slave action' command which will reset all min/max values.

Table 5.5 Example Responses

Field Name	Example (Hex)
Slave Address	TBD
Function	10
Starting Address Hi	62
Starting Address Lo	00
Number of Registers Hi	00
Number of Registers Lo	03
Error Check (LRC or CRC)	--

The normal response returns the slave address, function code, starting address and quantity of registers preset. Table 5.5 is an example of a response to the query shown in table 5.4.

The types of 'slave action' request are defined below.

Table 5.6 Slave Action Definitions

<u>Byte2</u>	<u>Byte1</u>	<u>Byte0</u>	<u>Definition</u>
0	0	4	Reset Peak Demand Watts
0	0	8	Reset Energy (kWh) and input counters
0	0	40h	Reset (synchronize) Demand Watts Window
0	0	80h	Snapshot Energy
0	1	1	Reset Peak Demand Currents
0	1	4	Reset all Min/Max values
0	1	6	Reset input counters
0	1	13	Reset Min/Max Currents
0	1	14	Reset Min/Max L-L Voltages
0	1	15	Reset Min/Max L-N Voltages
0	1	16	Reset Min/Max Power Factor-Apparent
0	1	17	Reset Min/Max Power Factor-Displacement
0	1	18	Reset Min/Max Power
3	0	2	Reset INCOM Slave Interface Statistics
3	0	3	Reset product specific statistics
3	0	6	Acknowledge energy reset
4	1	X	Activate Relay Output #X (X = relay output number: 1 or 2)
4	2	X	De-activate Relay Output #X (X = relay output number 1 or 2)
6	6	0	Acknowledge Digital Input Reset

5.7 COMMAND DATA PASS THROUGH

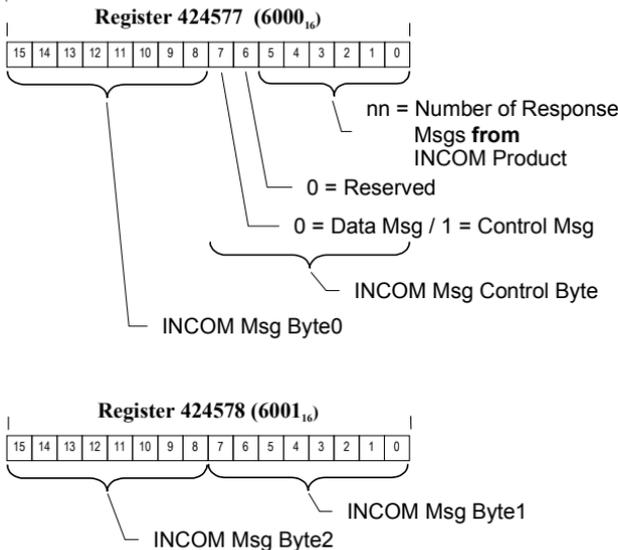
A feature of the IQ 330 is its capability to pass INCOM commands/data directly via the MODBUS command. Thus, with access to IL 17384 Parts A and B, every INCOM product object and capability is available to the MODBUS master.

When the pass through command is issued the unit saves the INCOM response in a holding register until the MODBUS Master queries for the last response. The Unit makes no modification to or interpretation of the product response data.

The MODBUS master writes the product command data using function code 10 hex beginning at register 6000 hex.

The data format for pass through data is given in Figure 5.3

Figure 5.3 Pass through to INCOM Product Query Data Format



The MODBUS master reads the INCOM product response to a pass through query using either function 04 beginning at register 6100 hex.

The number of points (registers) of the read query is 2*nn – where nn is the number of INCOM messages in the response.

The format of the data acquired by the IQ 330M from the pass through INCOM product query's response is given in Figure 5.4 . Note that each INCOM response message contains a status byte which indicates its validity.

Figure 5.4 Pass Through to INCOM Product Response Data Format

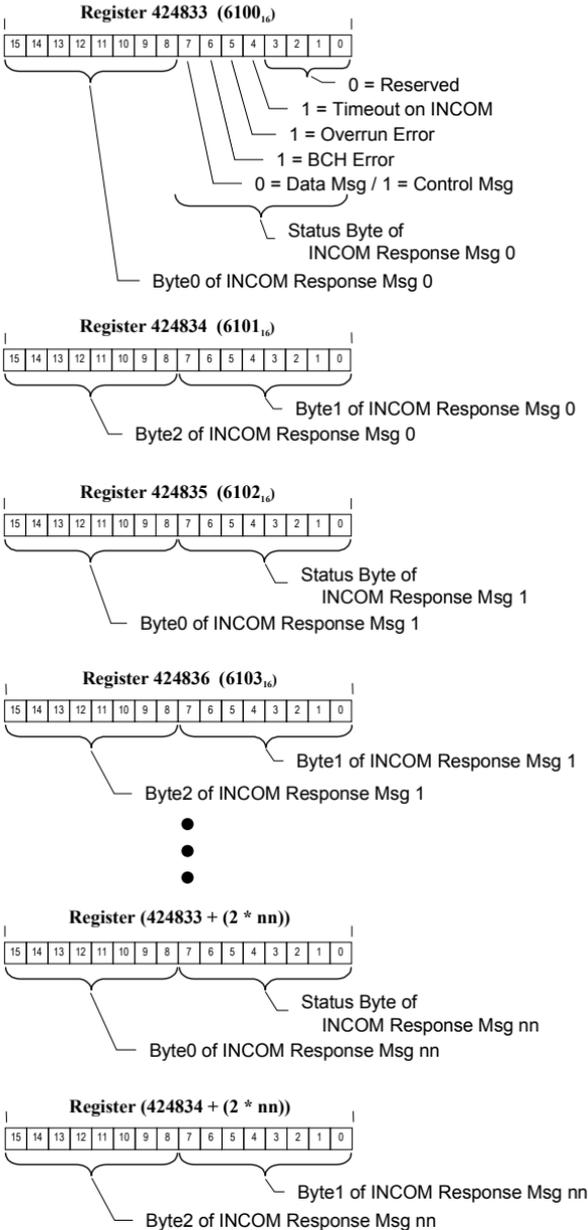


Table 5.7 Example INCOM 305 Command

Field Name	Example (HEX)
Slave Address	TBD
Function	10
Address Hi	60
Address Lo	00
Quantity of Registers Hi	00
Quantity of Registers Lo	02
Byte Count	04
INCOM Msg Byte 0	03
INCOM Msg Control Byte	84
INCOM Msg Byte 2	50
INCOM Msg Byte 1	00
Error Check (LRC or CRC)	--

The INCOM Pass Through capability is a powerful tool, it allows you to retrieve any data that you could have retrieved with INCOM while using the MODBUS protocol. The Pass Through method requires the use of the sixteen command to start the INCOM request, followed by the four commands to read the response beginning at register 6100. Table 5.7 is an example of the INCOM 305 command.

Table 5.8 Example Response

The normal response returns a slave address, function code, starting address and quantity of registers preset. Table 5.8 is an example of the response to the query shown above.

Field Name	Example (Hex)
Slave Address	TBD
Function	10
Starting Address Hi	60
Starting Address Lo	00
Number of Registers Hi	00
Number of Registers Lo	02
Error Check (LRC or CRC)	--

Table 5.9 Example

Field Name	Example (HEX)
Slave Address	TBD
Function	04
Starting Address Hi	61
Starting Address Lo	00
Number of Points Hi	00
Number of Points Lo	06
Error Check (LRC or CRC)	--

Now you must retrieve the information starting at register 6100. First you need to know how many registers to retrieve.

Second, be able to decipher the INCOM floating point format that they will be in, along with the details individually related to each command. Table 5.9 is an example.

Refer to IL 17384 Part B related to IQ 330 for additional information.

The register data in the response message are packed as two bytes per register, with binary contents right justified with in each byte. For each register, the first byte contains the high-order bits and the second contains the low-order bits, see Table 5.10.

Table 5.10 Example Register Data Response

Field Name	Example (Hex)
Slave Address	TBD
Function	04
Byte Count	0C
Data Hi (Register 6100)	00
Data Lo (Register 6100)	0A
:	:
:	:
Data Hi (Register 6106)	00
Data Lo (Register 6106)	0A
Error Check (LRC or CRC)	--

The only Pass Through command that does not require a read of register 6100 is the Download of Setpoints command (3F9). It is the only command that sends data to the IQ 330. See Table 5.11 for a description of this command.

From slave address to and including Message 1 Byte 0 the data is specific. In Message 2 Byte 0 and 02 hex represents a CT ratio of 15:5 as shown in table 5.11. A 00 hex in message 2 byte 1 shows a PT ratio of 1:1. An 0A hex in Message 2 Byte 2 shows a Dmd Window of 5 minutes, 3 wire, 60 hertz, with +VARs for lagging power factor. A 01 hex in Message 3 Byte 0 shows no KYZ selection. A 0A hex in Message 4 Byte 0 shows Output 1 in message mode and Output 2 in phase mode. A 02 hex in Message 4 Byte 2 shows a voltage trip value of 2%.

Table 5.11 Download Setpoints Command

Field Name	Example (HEX)
Slave Address	TBD
Function	10
Address Hi	60
Address Lo	00
Quantity of Registers Hi	00
Quantity of Registers Lo	0B
Byte Count	16
Msg Byte 0	F3
Msg Control Byte	85
Msg Byte 2	90
Msg Byte 1	00
Message 1 Byte 0	05
Message 1 Byte 1	XX don't care
Message 1 Byte 2	XX don't care
Message 2 Byte 0	02
Message 2 Byte 1	00
Message 2 Byte 2	0A
Message 3 Byte 0	01
Message 3 Byte 1	XX don't care
Message 3 Byte 2	XX don't care
Message 4 Byte 0	31
Message 4 Byte 1	XX don't care
Message 4 Byte 2	02
Message 5 Byte 0	XX don't care
Message 5 Byte 1	XX don't care
Message 5 Byte 2	XX don't care
Message 6 Byte 0	TBD
Message 6 Byte 1	TBD
Message 6 Byte 2	TBD
Error Check (LRC or CRC)	TBD

Table 5.12 Example Response

Field Name	Example (Hex)
Slave Address	TBD
Function	10
Starting Address Hi	60
Starting Address Lo	00
Number of Registers Hi	00
Number of Registers Lo	0B
Error Check (LRC or CRC)	--

The normal response returns a slave address, function code, starting address and quantity of registers preset. Table 5.12 is an example of the response to the query shown in Table 5.11. The description of setpoints is shown in Table 5.13.

Table 5.13 Setpoint Descriptions (3F9)

Message	Byte	Description
1	Byte0	Number of additional data messages = 5
	Byte1	Firmware Revision
	Byte2	Firmware Version
2	Byte0	CT-Ratio
		<u>Code</u> <u>Ratio</u> <u>Increment</u>
		00 – 15 5:5 – 110:5 5:5
		16 – 6E 120:5 – 1000:5 10:5
		6F – 78 1025:5 – 1250:5 25:5
		79 – FF 1300:5 – 8000:5 50:5
	Byte1	PT-Ratio
		<u>Code</u> <u>Ratio</u> <u>Increment</u>
		00 – 32 1:1 – 6:1 0.1:1
		33 – 40 7:1 – 20:1 1:1
		41 – 70 25:1 – 260:1 5:1
		71 – FF 270:1 – 1690:1 10:1
	Byte2	<u>Bit</u> <u>Description</u>
	B0	Frequency (0=60 Hertz, 1=50 Hertz)
	B1	VAR sign change (1 = +VARs for lagging power factor, -VARs for leading power factor. 0 = -VARs for lagging power factor, +VARs for leading power factor.)
	B2-3	Wiring Configuration 00 = 4-wire, 10 & 01 = 3-wire, 11 = Single phase
	B4-6	<u>Code</u> <u>Dmd Window</u> <u>Code</u> <u>Dmd Window</u>
		000 5 minute 100 25 minute
		001 10 minute 101 30 minute
		010 15 minute 110 45 minute
		011 20 minute 111 60 minute
	B7	Reserved = 0

Table 5.13 Cont.

Message	Byte	Description																																																																																																																																																					
3	Byte0	<table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>B0-2</td> <td>KYZ Selection</td> </tr> <tr> <td></td> <td> <table border="1"> <thead> <tr> <th>Code</th> <th>KYZ Selection</th> <th>Code</th> <th>Selection</th> </tr> </thead> <tbody> <tr> <td>000</td> <td>None selected</td> <td>100</td> <td>-Wh</td> </tr> <tr> <td>001</td> <td>None selected</td> <td>101</td> <td>+VARh</td> </tr> <tr> <td>101</td> <td>None selected</td> <td>110</td> <td>-VARh</td> </tr> <tr> <td>011</td> <td>+Wh</td> <td>111</td> <td>Vah</td> </tr> </tbody> </table> </td> </tr> <tr> <td>B4-7</td> <td>KYZ Rate B3 = 0</td> </tr> <tr> <td></td> <td> <table border="1"> <thead> <tr> <th>Code</th> <th>Rate</th> <th>Code</th> <th>Rate</th> <th>Code</th> <th>Rate</th> </tr> </thead> <tbody> <tr> <td>0000</td> <td>1Wh</td> <td>0110</td> <td>7Wh</td> <td>1100</td> <td>50Wh</td> </tr> <tr> <td>0001</td> <td>2Wh</td> <td>0111</td> <td>8Wh</td> <td>1101</td> <td>60Wh</td> </tr> 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5.8 MODBUS EXCEPTION CODES

You can expect the following exception codes from the unit in a modbus exception message.

Exception Code (Hex)	Description
01	Invalid Function
02	Invalid Register
03	Invalid Data
84	Partial Register Access Error

SECTION 6: TROUBLESHOOTING AND MAINTENANCE

6.1 GENERAL

6.1.1 Level of Repair

These troubleshooting procedures will determine only if the IQ 300 Display Module or the IQ 300 Base Module is the cause of a malfunction. They will not permit troubleshooting of components within the IQ 300 Modules. If an IQ 300 Module is determined to be at fault, replace it with a spare and return the malfunctioning Module to Cutler-Hammer for repair.

6.1.2 Maintenance and Care

The IQ 300 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 to be serviced by factory trained personnel only.

Never clean the IQ 300 with system or power on. Clean the IQ 300 using only a clean, dry cloth. Do not use water or solvents of any kind.

Operate the IQ 300 Base Module in an environment within the temperature range of -20°C to 50°C and the IQ 300 Display Module within a range of 0°C to 50°C. The environment should also be free of excess humidity.

If you have spare units, store them in the original packing material and container. The base unit storage environment temperature range should be -30°C to 85°C and -20°C to 60°C for the display module.

6.2 REMOVAL AND REPLACEMENT



WARNING



ALL MAINTENANCE PROCEDURES MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE IQ 300 AND ITS USES. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN EQUIPMENT DAMAGE, SERIOUS INJURY AND/OR DEATH.

TROUBLESHOOTING PROCEDURES MAY INVOLVE WORKING ON EQUIPMENT IN AREAS WITH EXPOSED ENERGIZED (LIVE) ELECTRICAL WIRING AND/OR PARTS WHERE THE HAZARD OF FATAL ELECTRIC SHOCK IS PRESENT. PERSONNEL MUST EXERCISE EXTREME CARE TO AVOID INJURY OR DEATH. ALWAYS DISCONNECT, LOCK OUT AND TAG THE CURRENT AND VOLTAGE SOURCES AND

THE CONTROL POWER SUPPLY CIRCUIT BEFORE TOUCHING THE CONNECTIONS OR COMPONENTS ON THE REAR FACE OF THE IQ 300 BASE UNIT.

6.2.1 General Safety Precautions

- Turn off, lock out and tag all sources of system power to the IQ 300 Base Module.
- Temporarily install a short circuit between the output legs of each current transformer connected to the IQ 300 Base Module, and tag.
- Disconnect the Category 5 cable from the IQ 300 Base Module, and mark it for later reconnecting.
- If the IQ 300 Base Module is attached to the IQ 300 Display Module, detach it by removing the four #10 screws that secure the Base to the mounting brackets.
- Grasp the IQ 300 Display Module to prevent it from falling and remove the hex nuts and washers that secure the mounting brackets, gasket and Display Module to the panel.
- Withdraw the IQ 300 Display Module and gasket (if in use).
- To reinstall or to replace the IQ 300 Display Module, reverse the above steps.

6.2.2 IQ 300 Base Module

Perform the following steps to replace the IQ 300 Base Module:

- Disconnect the Category 5 cable from the IQ 300 Base Module and mark it for later reconnecting.
- Disconnect the INCOME cable, if used, and mark it for later reconnecting.
- Disconnect all system voltage and current leads, and mark them for reconnecting. Making a simple sketch of the connections may be helpful during reinstallation.
- Remove the ground connection and mark it for reconnecting.
- If the IQ 300 Base Module is attached to the IQ 300 Display Module, detach it by removing the four #10 screws that secure the Base to the mounting brackets.
- If the IQ 300 Base Module is mounted using the DIN clip, remove it by disengaging the DIN clip mounted on the IQ 300 Base Module from the IN rail
- Turn off, lock out and tag the IQ 300 Base Module power supply circuit.
- To reinstall or to replace the IQ 300 Base Module, reverse the above steps.

6.2.3 IQ 300 Display Module

Perform the following steps to replace the IQ 300 Display Module:

- Disconnect the Category 5 cable from the IQ 300 Base Module, and mark it for later reconnecting.
- If the IQ 300 Base Module is attached to the IQ 300 Display Module, detach it by removing the four #10 screws that secure the Base to the mounting brackets.
- Grasp the IQ 300 Display Module to prevent it from falling and remove the hex nuts and washers that secure the mounting brackets, gasket and Display Module to

the panel.

- Withdraw the IQ 300 Display Module and gasket (if in use).
- To reinstall or to replace the IQ 300 Display Module, reverse the above steps.

6.3 GENERAL TROUBLESHOOTING PROCEDURES

These procedures cover the IQ 300 only, and can only indicate or eliminate the IQ 300 as a cause of the malfunction. Please be aware that other system components may be causing or contributing to system malfunctions.

To use the following troubleshooting guide, first identify the *symptom* of the malfunction in the first column. Note the corresponding *probable cause* listed in the second column and attempt one or more of the corresponding *possible solutions* in the third column. If following this general troubleshooting guide fails to correct the malfunction, contact the plant maintenance department or contact Cutler-Hammer Power Management Applications Support (PMAS) at 1-800-809-2772, option 1 / option 1. You can also e-mail PMAS at pmpapps@eaton.com

Table 6.1 Troubleshooting Guide

IQ 300 Troubleshooting Guide		
Symptom	Probable Cause	Possible Solution
One or more voltage phases read incorrectly	<ul style="list-style-type: none"> Incorrect PT ratio 	<ul style="list-style-type: none"> Check PT ratio using the View Setpoints screen of the display module. Adjust if incorrect using the edit setpoints screen.
Incorrect or zero current readings	<ul style="list-style-type: none"> Incorrect CT ratio 	<ul style="list-style-type: none"> Check CT ratio using the View Setpoints screen of the display module. Adjust if incorrect using the edit setpoints screen.
Incorrect Power readings	<ul style="list-style-type: none"> Incorrect phasing of voltage and (or) currents 	<ul style="list-style-type: none"> Check phasing and verify connections with wiring diagrams.
Unit fails to communicate over PowerNet network	<ul style="list-style-type: none"> Wrong or conflicting address set for IQ 320 Incorrect baud rate set for the IQ 320 Communication wiring error 	<ul style="list-style-type: none"> Check the address of the IQ 320 base unit via a display module and verify that the software is addressing the proper unit. Check the baud rate set for the base unit via a display module and verify that it is the same as the system rate. Verify that wiring conforms to proper wiring base rules. (see TD 17513)
Display module LCD screen is blank	<ul style="list-style-type: none"> Contrast is set too low Power to display module is absent 	<ul style="list-style-type: none"> Press and hold the ENTER button the press and hold the "down" scroll button to adjust the contrast. Check Category 5 cable connection to display module and base unit. Check control power fuses, wiring connections, and voltage level.
Display module displays asterisks in place of numbers	<ul style="list-style-type: none"> Processor not responding to display Faulty Category 5 cable Excessive Modbus communications 	<ul style="list-style-type: none"> Processor failure requires factory repair. Repair or replace Category 5 cable. Reduce Modbus communications.
Digital input failure	<ul style="list-style-type: none"> Heavy Modbus communications 	<ul style="list-style-type: none"> Reduce Modbus communications, refer to Section 3.3.5

6.4 TECHNICAL ASSISTANCE

For additional information, technical assistance or referral to a local authorized distributor, contact Power Management Applications Support at 1-800-809-2772, option 1 / option 1 (outside the United States please call 1-414-449-7100 option 1 / option 1). You can also e-mail us at pmpapps@eaton.com or visit us on the web www.cutler-hammer.eaton.com and follow the power management products link.

You can also access our searchable database C-H eXpert that provides self-help solutions with trouble-shooting information. Simply connect to the C-H eXpert Web site at <http://chexpert.ch.cutler-hammer.com/chexpert> and type in a keyword or product for your particular technical problem in the search box.

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