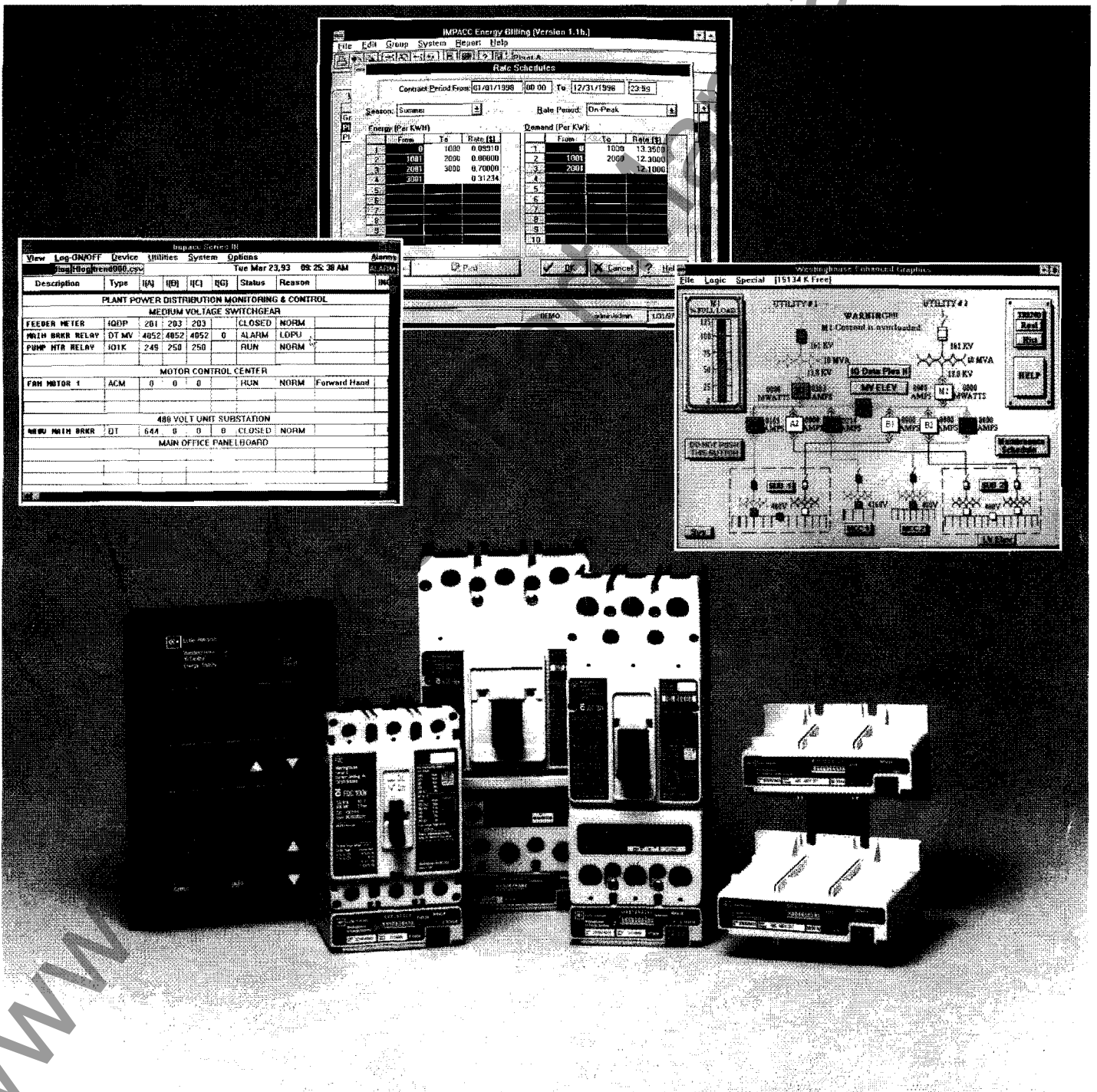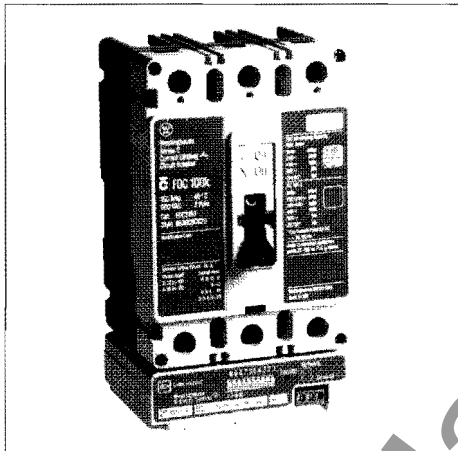# Cutler-Hammer
IQ Sentinel
Products

EAT•N

Cutler-Hammer IQ Metering Devices

The IQ Power Sentinel and the IQ Energy Sentinel are part of the latest addition to the Westinghouse line of IQ Metering devices, which includes the IQ Data, the IQ Generator, IQ DP-4000, and the IQ Analyzer. These solid-state products provide centralized alternatives to individually mounted ammeters, voltmeters, frequency meters, watt-hour meters, and more. All are easily, retrofitted into existing systems, and communicate over the Westinghouse IMPACC System, a local area network designed specifically for use in Electrical distribution systems.

IQ Sentinels

IQ Sentinels are a highly accurate, microprocessor-based submeter, design to monitor power, energy, currents, voltages, power factor, frequency, apparent power, and reactive power. They represent an alternative to installing separate watt-meters, watt-hour meters, watt demand meters, ammeters, voltmeters, and more.

IQ Sentinels are available with two different capabilities:

- The Energy Sentinel version which monitors watts, watt-hour, and watt demand
- The Power Sentinel version which monitors watts, watt-hour, watt demand, currents, voltages, power factor, frequency, apparent power and reactive power.

Key advantages include unmatched savings in space, lower installation costs, and the capability to communicate data readings in a variety of ways.

IQ Sentinels with built-in CTs and communications have the added benefit of greater overall system accuracy. Conventional metering often is less accurate since external CTs and separate transducers may each have inaccuracies of 1% or more.

IQ Sentinels provide a unique cost-effective method to implement energy submetering at lower levels in the distribution system.

The ability to monitor power distribution systems down to the machine or process level at an industrial facility has become essential to provide key benefits such as to verify the accuracy of the utility bill, identify and track energy usage to the loads that consume it, develop a facility energy profile to establish a baseline, allocate energy costs to create accountability, etc.

IQ Energy Sentinel Features	IQ Power Sentinel Features	IQ Sentinels Benefits
• Monitors (1% of full scale accuracy) Kilowatts Kilowatts Demand Kilowatt Hour	• Monitors (1% of full scale accuracy) AC line current (each phase) AC line-to-line voltage AC line-to-neutral voltages Watts (each phase and total) Vars (each phase and total) VA (each phase and total) Apparent Power Factor (each phase and total) Displacement Power Factor (each phase and total) Demand (total watts) Frequency Watt-hours	• One device replaces multiple meters and/or transducers
• Built-in CTs version up to 400 Amps or external CTs version up to 4000 Amps	• Built-in CTs version up to 400 Amps	• Improved system accuracy
• Breaker, Panel or DIN-rail mounted	• Panel or DIN-rail mounted	• Savings in product cost • Savings in space • Savings in installation cost
• Powered directly off the line	• Powered directly off the line	• No external power source is needed
• Built-in communication capability Address set by DIPswitches Communication at 9600 baud Noise immune INCOM protocol	• Built-in communication capability Address set by DIPswitches Communication at 9600 baud Noise immune INCOM protocol	• Permits remote monitoring and interconnection with programmable logic controllers and building management systems. For further information see section on IMPACC
• Choice of operator interfaces IQ Central Energy Display Breaker Interface Module (BIM) E-Bill Energy billing software IMPACC Series III software	• Choice of operator interfaces IQ Central Energy Display Breaker Interface Module E-Bill Energy billing software IMPACC Series III software	• Designed to interface directly with E-Bill, energy billing software • Flexibility – displays what is needed where it is needed
• UL and CSA listed	• UL and CSA listed • CE mark	• E-Bill software
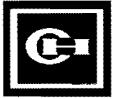
Submetering application examples for the IQ Sentinels include energy demand monitoring, product cost analysis, process machine tool efficiency and productivity improvement, and energy cost allocation or tenant billing for commercial, industrial, recreational, and residential facilities.

Note: For customer billing applications, consult local utility for metering requirements.

Commercial applications include energy cost allocation within convention halls, office buildings, shopping malls, hospitals, warehouses, and storage facilities.

Industrial applications include departmental billing and process/assembly line energy cost analysis. IQ Energy Sentinels may be substituted for watt transducers when monitoring machine tool and equipment performance within plants.

Recreational facilities include sports arenas, camping grounds, trailer parks, and marinas.

The IQ Sentinel may be applied on three-phase (3- or 4-wire) as well as single-phase (3-wire) systems.

IQ Sentinels may be applied on either 50 or 60 Hz systems.

IQ Energy Sentinels

The IQ Energy Sentinel is available in the three different package versions: breaker mounted, universal breaker with internal CTs, and universal breaker with external CTs.

Breaker Mount Applications

New Equipment:
Designed for mounting on Cutler-Hammer Series C Circuit Breakers utilized in Cutler-Hammer assemblies such as:

- Pow-R-Line 4 Panelboards — Feeder circuits
- Power-R-Line C Switchboards – Feeder circuits
- Series 2100 Motor Control Centers and enclosed control with circuit breaker disconnects — Starter or feeder circuits
- Enclosed Motor Control
- Enclosed Circuit Breakers
- Pow-R-Way II Bus Plugs with circuit breaker disconnects.

Retrofitting:
The space saving design characteristics of the breaker mount IQ Energy Sentinel allow them to be added to existing Series C Circuit Breakers at any time. . . often with no additional space or modifications required.

Or they may be installed when upgrading to Series C from older circuit breakers. . . often with no additional space or modifications required.

Universal Mount Applications
The universal mount IQ Energy Sentinel with internal CTs includes integral 400A CTs and may be applied on loads up to 400A. The universal mount IQ Energy Sentinels

with internal CTs may be utilized wherever breaker mounting is not feasible or possible.

The universal mount IQ Energy Sentinel with provisions for external CTs may be applied on loads up to 4000A. They are usually utilized for monitoring loads larger than 400 Amps, on power cable sizes larger than 500 MCM or on circuits containing more than one conductor per phase.

IQ Power Sentinel

Like the IQ Energy Sentinel, the IQ Power Sentinel is a highly accurate microprocessor-based submeter designed to monitor power and energy. In addition to watts, watt-hour, and watt-demand, the IQ power sentinel monitors current, voltage, reactive power (VARs), apparent power (VA), power factor, and frequency. The IQ Power Sentinel offers an accurate and economic alternative to separate meters and transducers.
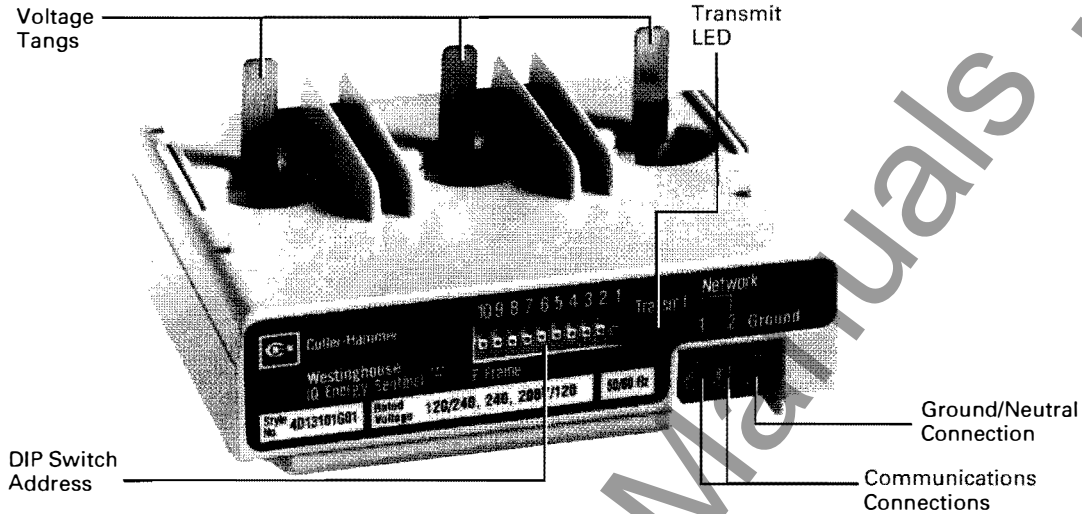
Universal Mount Applications
The IQ Power Sentinel is available in a universal mount package with exactly the same physical dimensions as the IQ Energy Sentinel. The universal mount IQ Power Sentinel with internal CTs includes integral 400A CTs and may be applied on loads up to 400A.

The universal mount IQ Power Sentinel with provisions for external CTs may be applied on loads up to 4000A. They are usually utilized for monitoring loads larger than 400 Amps, on power cable sizes larger than 500 MCM or on circuits containing more than one conductor per phase.

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Energy Sentinel Features

Voltage Tangs

Transmit LED

DIP Switch Address

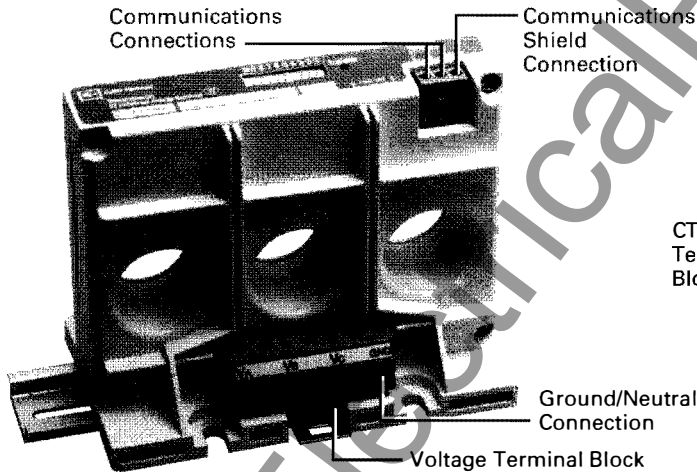Ground/Neutral Connection

Communications Connections

Cutler-Hammer Series C Breaker Mount

Note: The breaker mount version is not available on the IQ Power Sentinel.

The breaker mount IQ Energy Sentinel installs in less than 10 minutes on the load side of a Cutler-Hammer Series C F-frame (150 Amp), J-frame (250 Amp), or K-frame (400 Amp) circuit breaker.

Energy and Power Sentinels Features

Communications Connections

Communications Shield Connection

Ground/Neutral Connection

Voltage Terminal Block

Universal Mount with Internal CTs

The Universal Mount IQ Energy Sentinel with internal CTs may be panel mounted or DIN-rail mounted on disconnects or other circuits up to 400 Amps. A pull-apart terminal block is provided on the device for connection of the system voltage reference wiring.

Note: The Universal Mount with Internal CTs is available in both IQ Power Sentinel and IQ Energy Sentinel versions. The location of the ground/neutral connection differs on Breaker Mount IQ Energy Sentinels from the location of the ground/neutral connection on Universal Mount IQ Sentinels. Incorrect wiring to the ground/neutral and communications connections may result in accuracy and communication errors.


Communications Connections

Communications Shield Connection

CT Terminal Block

Ground/Neutral Connection

Voltage Terminal Block
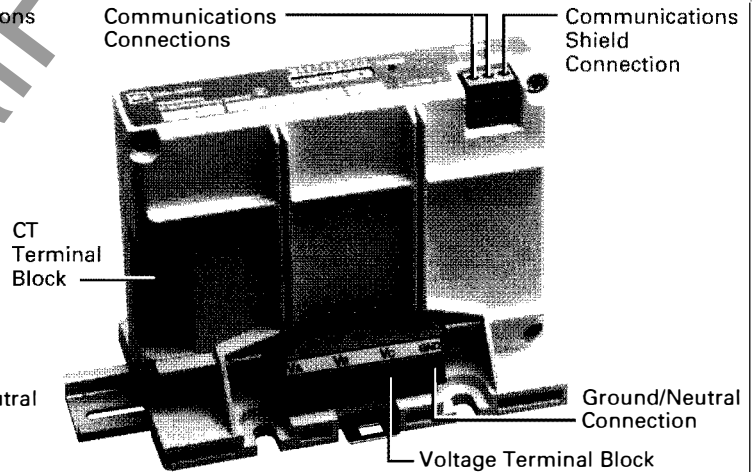
Universal Mount for External CTs*

The Universal Mount IQ Energy Sentinel for external CTs may be panel mounted or DIN-rail mounted on circuits up to 4000 Amps.

A pull-apart terminal block is provided on the device for connection of the system voltage reference wiring as well as another terminal block for connection to the user's existing 5-amp secondary CTs which may range in standard ratios from 25:5 up to 4000:5.

If the device will be disconnected without interruption of the monitored load, the use of a CT shorting block is advised.

***Note:** The Universal Mount IQ Power Sentinel with provisions for External CTs will be available in third quarter of 1998.
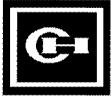
Specifications

System Accuracy
Breaker Mount or Universal with Internal CTs:
  +/-1% of full scale current rating

Universal for External CTs:
  +/-1% of full scale current rating plus CT accuracy

Current Input
Current Range: 1% to 125% of current rating

Burden: 1 VA

Voltage Input
Voltage Range: +/-20% of voltage rating

Frequency
50 or 60 Hertz

Power Factor Range
All (-1 to +1)

Communications
9600 Baud
INCOM compatible

Environmental Conditions
Operating Temperature: -25° to 70°C [1]
  (-13° to 158°F)
Storage Temperature: -40° to 85°C [1]
  (-40° to 185°F)
Operating Humidity: 5% to 95% relative humidity non-condensing

Dimensions DxWxH (inches)
F 3.20 x 4.12 x 1.30; CT window size* 0.59
J 4.04 x 4.12 x 1.28; CT window size* 0.77
K 4.04 x 5.31 x 1.25; CT window size* 0.96
UI 4.36 x 5.31 x 3.00; hole clearance 1.17
UE 4.36 x 5.31 x 3.00

Weight (lbs):
F .65
J .69
K .87
UI 1.10
UE 1.10

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* CT window available for bare cable after stripping insulation.

[1] 40°C (standard) maximum for Series C circuit breakers.

System Voltage Considerations (Application Note)
The Ground (GND) terminal of the IQ Energy Sentinel should be connected to the ground bus or other non-current carrying ground with 600V rated wire to ensure accuracy.

IQ Energy Sentinels

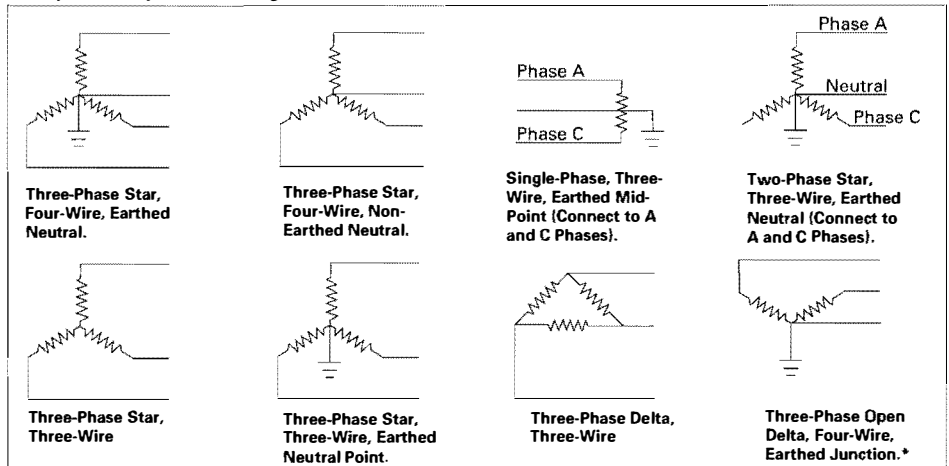| Description	Voltage Rating - Vac	Current Rating Max. Amperes	Catalog Number
For F-frame Breakers	120/240, 240, 208Y/120	150	IQESF208
For F-frame Breakers	220/380, 230/400, 240/415	150	IQESF400
For F-frame Breakers	480, 480Y/277	150	IQESF480
For F-frame Breakers	600, 600Y/347	150	IQESF600
For J-frame Breakers	120/240, 240, 208Y/120	250	IQESJ208
For J-frame Breakers	220/380, 230/400, 240/415	250	IQESJ400
For J-frame Breakers	480, 480Y/277	250	IQESJ480
For J-frame Breakers	600, 600Y/347	250	IQESJ600
For K-frame Breakers	120/240, 240, 208Y/120	400	IQESK208
For K-frame Breakers	220/380, 230/400, 240/415	400	IQESK400
For K-frame Breakers	480, 480Y/277	400	IQESK480
For K-frame Breakers	600, 600Y/347	400	IQESK600
Universal with Internal CTs	120/240, 240, 208Y/120	400	IQESUI208
Universal with Internal CTs	220/380, 230/400, 240/415	400	IQESUI400
Universal with Internal CTs	480, 480Y/277	400	IQESUI480
Universal with Internal CTs	600, 600Y/347	400	IQESUI600
Universal for External CTs	120/240, 240, 208Y/120	4000	IQESUE208
Universal for External CTs	220/380, 230/400, 240/415	4000	IQESUE400
Universal for External CTs	480, 480Y/277	4000	IQESUE480
Universal for External CTs	600, 600Y/347	4000	IQESUE600

IQ Power Sentinels

Description	Voltage Rating - Vac	Current Rating Max. Amperes	Catalog Number
Universal with Internal CTs	120/240, 240, 208Y/120	400	IQPSUI208
Universal with Internal CTs	220/380, 230/400, 240/415	400	IQPSUI400
Universal with Internal CTs	480, 480Y/277	400	IQPSUI480
Universal with Internal CTs	600, 600Y/347	400	IQPSUI600

Terminal, Cable and Wiring Guidelines

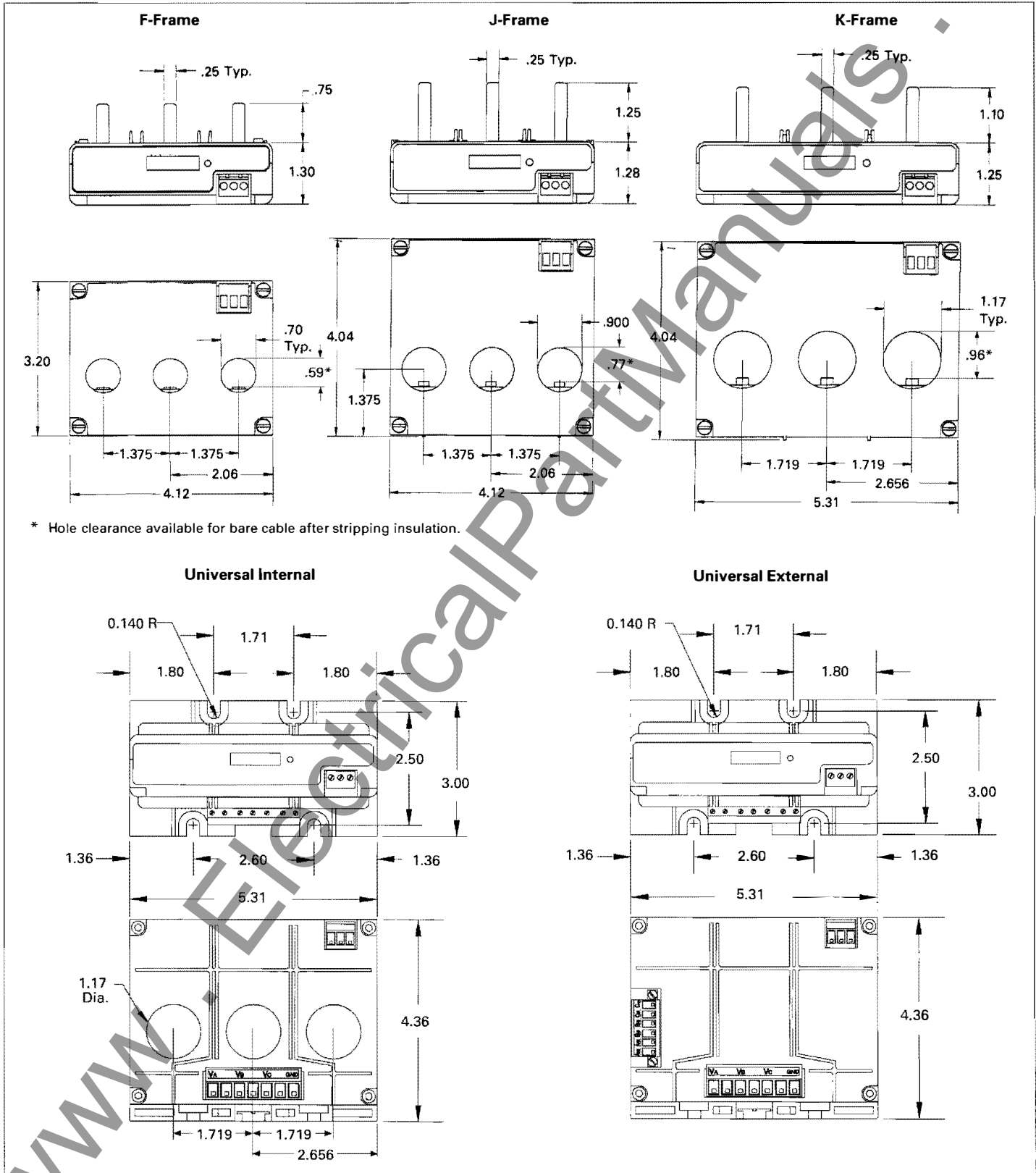| Sentinel	Westinghouse Series C Terminal	Wire Size (Single Conductor)
F-frame	624B100G02, G17, G18, G19	#14-1/0, #4-4/0, #4-4/01, #14-1/0 AWG
J-frame	T250KB, TA250KB	#4-350 MCM
K-frame	T350K, TA350KB	#250-500 MCM
Universal with Internal CTs		#250-500 MCM
System Voltage Reference Wiring		#24-#10 AWG
Current Transformer Wiring		#12 AWG (max.)
Ground Reference Wiring		#22-#12 AWG (minimum 600V rated)
Communications Wiring		Cutler-Hammer IMPCABLE or Belden 9463 family

Acceptable System Configurations:

Three-Phase Star, Four-Wire, Earthed Neutral.

Three-Phase Star, Four-Wire, Non-Earthed Neutral.

Single-Phase, Three-Wire, Earthed Mid-Point (Connect to A and C Phases).

Two-Phase Star, Three-Wire, Earthed Neutral (Connect to A and C Phases).

Three-Phase Star, Three-Wire

Three-Phase Star, Three-Wire, Earthed Neutral Point.

Three-Phase Delta, Three-Wire

Three-Phase Open Delta, Four-Wire, Earthed Junction.*

* Acceptable for Universal IQ Energy Sentinels only.

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Sentinel Dimensions (in Inches)

F-Frame

3.20

.70 Typ.

.59*

1.375 — 1.375

2.06

4.12

J-Frame

4.04

.900

.77*

1.375

1.375 — 1.375

2.06

4.12

K-Frame

4.04

1.17 Typ.

.96*

1.719 — 1.719

2.656

5.31

* Hole clearance available for bare cable after stripping insulation.

Universal Internal

0.140 R

1.71

1.80   1.80

2.50

3.00

1.36   1.36

5.31

1.17 Dia.

4.36

1.719 — 1.719

2.656

Universal External

0.140 R

1.71

1.80   1.80

2.50

3.00

1.36 — 2.60 — 1.36

5.31

4.36

Operator Interfaces and Software
IQ Energy Sentinels operate with a choice of interfaces that allow remote monitoring from a centralized location.

IQ Central Energy Display II
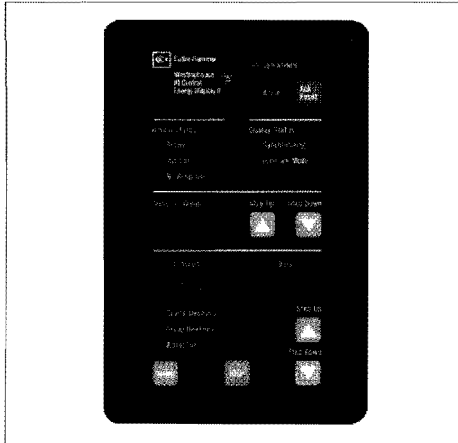
The IQ Central Energy Display II (IQ CED II) can monitor and display the energy parameters of up to 50 IQ Sentinels and 8 IQ Data Plus IIs. The IQ CED II is a compact, panel-mounted device which provides a centralized alternative to individually mounted watt, watt-hour, and watt demand meters.

The IQ CED II version 4.3 and higher supports the power sentinel. The CED will display watts, watt-hour, and watt demand and transmit these and all other available parameters via the INCOM network.

Parameters Displayed
The following are displayed on the membrane NEMA 3R, 12 faceplate:
- Energy – Forward and reverse (watt-hours)
- Peak power demand (see pg. 7)
- Power (watts)
- Present power demand
- Group readings – able to sum the energy, present demand, and peak demand readings for up to 8 customer selected device groups
- Status of device
  – Active
  – Inactive
  – No response
- Historical alarm log
- User-programmed, custom description of each device
- Date and time.

Programmable Alarms
The IQ CED II can be programmed to alarm for any of the following conditions:
- Value and time a peak demand exceeds the user programmed maximum (individual or group)

- Device inactive or no response.

During set-up, the customer is given the option of deciding whether or not a security access code is needed to acknowledge and reset alarms. Alarms can also be acknowledged and reset over IMPACC.

Communications
Communications between the IQ CED II and IQ Energy Sentinels, Addressable Relay IIs, and IQ Data Plus IIs is accomplished over a twisted pair of conductors on the highly reliable INCOM local area network. This is achieved through an addressable communications module (PONI) that is easily field mountable on the back of the IQ Data Plus IIs. The IQ Energy Sentinels and Addressable Relay IIs have direct communications capability.

The IQ CED II communicates to its subnetwork at either 1200 or 9600 baud. Maximum total distance is 10,000 feet.

The IQ CED II may be used to program the CT ratio settings of Universal mount IQ Energy Sentinels for external CTs.

The IQ CED II can transmit all data from the IQ Energy Sentinels and IQ Data Plus IIs to a remote computer or programmable controller over the INCOM network. This is achieved by mounting a Product Operated Network Interface (PONI) module to the IQ CED II and wiring it to the remote computer or programmable controller. The computer or programmable controller must be used with a Computer Operated Network Interface (CONI) card and Master INCOM Network Translator (MINT) II.

The communication option provides, the following modes of communications:
- Locally over IMPACC (distances up to 10,000 feet)
- Off-site monitoring (distances farther than 10,000 feet) using telephone modems or networking.

The remote communications option can be included at any time by mounting the PONI module to the IQ CED II. No reprogramming of the IQ CED II is required.

Self-Learning
The IQ CED II polls its subnetwork and stores the addresses of the IQ Energy Sentinels and IQ Data Plus IIs. This is done automatically after the unit is turned on for the first time, or may be operator invoked in the program mode.

A custom description for each device can be entered on the 8-digit alphanumeric window of the IQ CED II for easy location reference.

Non-Volatile Memory
There is no need to reload after an AC power loss. The addresses, description of devices, and desired alarming that are programmed in memory during the learn mode are retained throughout a power loss. Unless there has been a change in the local area network, it is not necessary to re-enter the learn mode. The real-time clock is battery backed. Once the time is set, there is no need to reload it, even if control power is lost.

User Friendly
- Operator panel (faceplate) is self-explanatory
- A "HELP" function key scrolls explanations across the alphanumeric window
- Self-learning
- Minimal external connections (3-wires for AC input and 2-wires twisted pair for communications)

Flexible
- Programmable watt-hour pulse output for a (user defined) group of IQ Energy Sentinels and IQ Data Plus IIs
- Can be mounted at a remote location to monitor one or more assemblies (up to 10,000 feet away)
- Can be mounted directly onto assemblies
- Remote communications option can be added at any time. No internal changes are required
- Can interface with a variety of IMPACC networks

General Specifications

Power Requirement
10 VA maximum

Input Voltage
120 or 240 VAC (±20%)
Auto selecting

Frequency
50 or 60 Hz

Operating Temperature
0° to 70°C
(32° to 158°F)

Storage Temperature
- 20° to 85°C
(- 40° to 185°F)

Humidity
5% to 95% R.H. non-condensing

Alarm Contact Ratings
10 A @ 277 VAC (resistive)
10 A @ 30 VAC (resistive)
1/3 HP 125, 250 VAC

Description	Catalog Number
IQ Central Energy Display II	IQCEDII

November 1997

F·T·N

IMPACC Communications Option

IMPACC–Integrated Monitoring Protection and Control Communications – is a noise immune communications system that cost effectively and easily gathers information from metering, protection and control devices. IMPACC provides the capability to control devices and read, log and trend information over a single twisted pair of wire. IMPACC may be installed in new gear or retrofitted into existing equipment.

A variety of IMPACC compatible products can be added to all levels of a commercial or industrial electrical distribution system – from high-voltage substations down to switchboards, panelboards and even individual breakers and motor starters.

The IQ Energy Sentinel comes with built-in communications capability and can communicate over IMPACC with no modifications.

Functions Available Through Communications:
- Monitoring and trending of displayed values and devices status
- Energy Billing
- Energy Trending
- Retrieving event information
- Product Cost Analysis.

Series III and Enhanced Graphics

**Examples of Series III and Enhanced Graphics Screens on PC**

Series III

Series III software provides monitoring and recording of power distribution system data as it is occurring. Series III is a Microsoft Windows™-compatible application that features user-friendly, menu-driven screens with easy setup and operation. Other features include:
- System/device alarm logging and reporting
- Time/event historical data logging
- Data trending
- Information storage and retrieval by device event
- Hardware diagnostics
- Dedicated computer not required
- Security/password protection.

Enhanced Graphics

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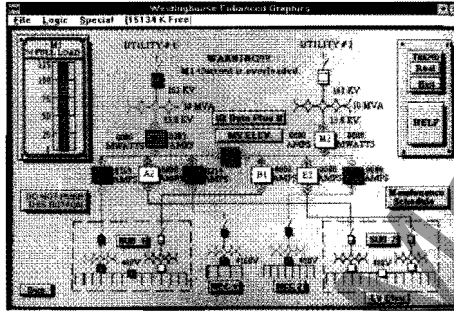
Example of Enhanced Graphics Screen

E-Bill

E-Bill is a graphical software package which monitors IMPACC compatible devices for the primary purpose of identifying and allocating energy consumption costs and trends beyond the utility's revenue meter. E-Bill can either be installed with Series III or is available in a stand-alone version.

Applications include tenant sub-metering and billing, departmental energy cost allocation and billing, product or process energy cost allocation, and energy consumption trends. Sub-metering is achieved through the use of IQ Energy Sentinels and other IQ devices.

The initial configuration of E-Bill is a two-step process involving utility rate structure emulation and the creation of "energy users" made up of various combinations of IMPACC compatible devices.

Example of E-Bill Screen

Utility rate information includes defining Seasons, Weekday/Weekends, Holidays,

Rate Periods (on-peak/off-peak etc.), and various rate charges for kW and kWH. Optional charges such as taxes and penalties can also be set up and can be allocated by several methods to each energy consumer.

Each energy user (department etc.) is assigned a meter, or any arithmetic combination of meters (+, -, x, /, % etc.). Common loads (such as HVAC and lighting) can also be allocated to each energy user by various methods (weight points, % kWH etc.).

The result is a formal and accurate report (bill) detailing energy usage for each energy consumer being metered, including departments, tenants, products or processes.

E-Trend

E-Trend is a software tool which allows customers to graphically plot energy consumption over a user specified time period. Kilowatts (kW) and Kilowatt hours (kWH) can be displayed for meters or energy users (combination of meters). E-Trend monitors IMPACC devices and stores data in an ODBC data base. E-Trend includes the ability to schedule automatic daily, weekly, or monthly load profile printouts. It's the ideal product to establish a historical baseline of consumption patterns.
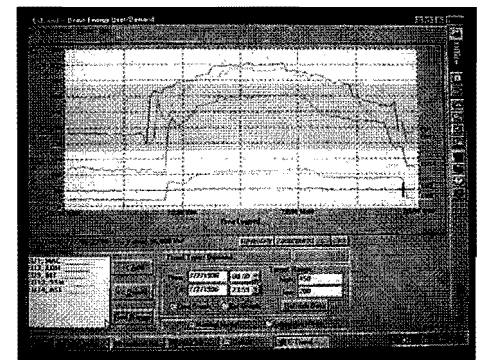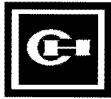

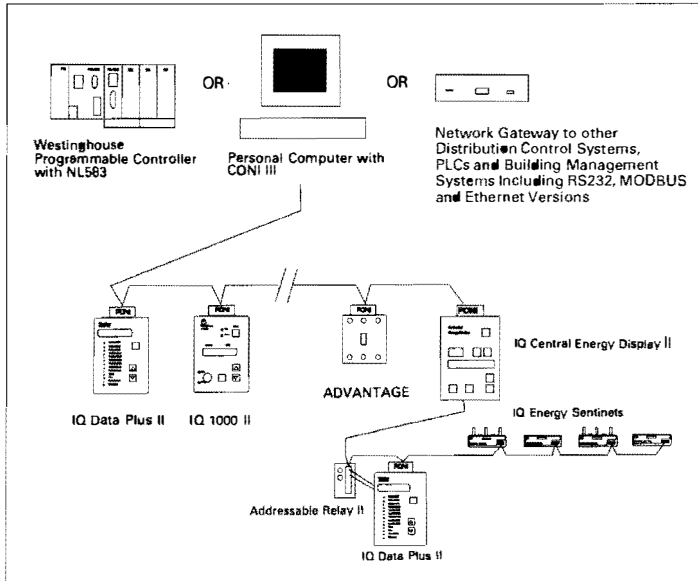**Example of E-Trend Screen**

IMPACC Connectivity

IMPACC makes communications easier by providing a wide range of interfaces to other vendors that make the centralization of power distribution information possible. An IMPACC System can easily be linked to building management systems, programmable logic controllers, and distributed control systems. This provides the capability to move data between and across different levels within an installation.

Interfaces have been developed with many vendors including Wonderware, Johnson Controls, Honeywell, Allen-Bradley, Bailey, Expert Edge, Fisher-Provox, Siemens, Foxboro, Iconics, Intellution, and Modicon.
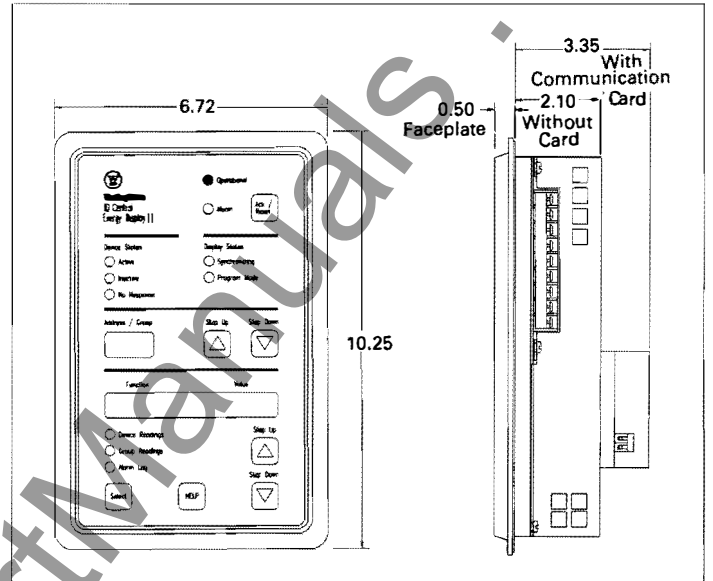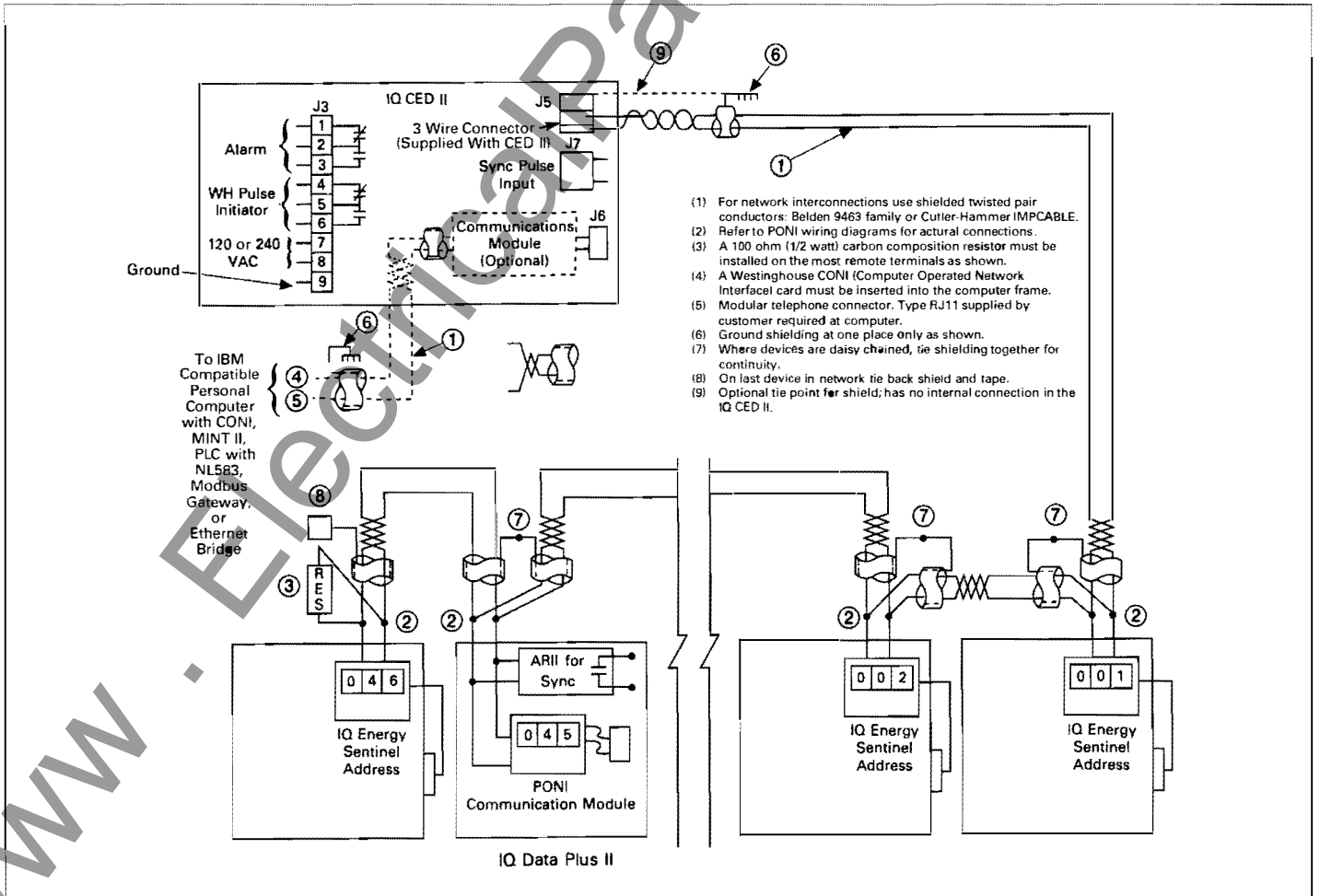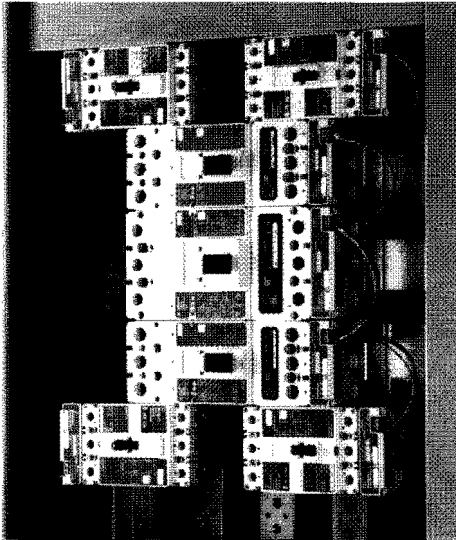
Networking

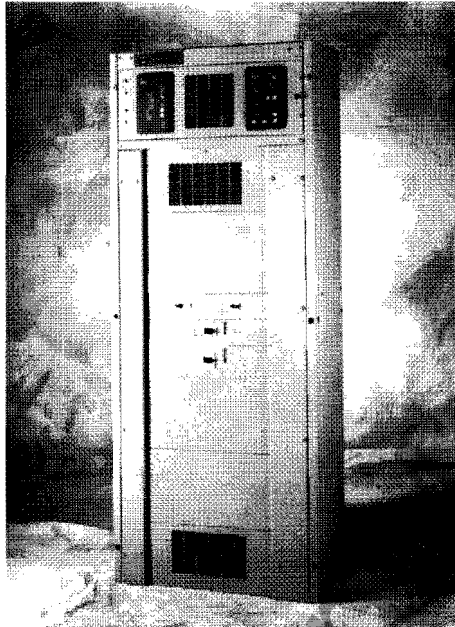Westinghouse Programmable Controller with NL583

OR

Personal Computer with CONI III

OR

Network Gateway to other Distribution Control Systems, PLCs and Building Management Systems Including RS232, MODBUS and Ethernet Versions

IQ Data Plus II   IQ 1000 II

ADVANTAGE

IQ Central Energy Display II

IQ Energy Sentinels

Addressable Relay II

IQ Data Plus II

Dimensions

6.72

0.50 Faceplate

3.35 With Communication Card

2.10

Without Card

10.25

Typical Wiring Diagram

IQ CED II

J3

Alarm

WH Pulse Initiator

120 or 240 VAC

Ground

3 Wire Connector (Supplied With CED II)

Sync Pulse Input

Communications Module (Optional)

J5

J7

J6

(9) (6)

(1)

To IBM Compatible Personal Computer with CONI, MINT II, PLC with NL583, Modbus Gateway, or Ethernet Bridge

(1) For network interconnections use shielded twisted pair conductors: Belden 9463 family or Cutler-Hammer IMPCABLE.
(2) Refer to PONI wiring diagrams for actural connections.
(3) A 100 ohm (1/2 watt) carbon composition resistor must be installed on the most remote terminals as shown.
(4) A Westinghouse CONI (Computer Operated Network Interface) card must be inserted into the computer frame.
(5) Modular telephone connector. Type RJ11 supplied by customer required at computer.
(6) Ground shielding at one place only as shown.
(7) Where devices are daisy chained, tie shielding together for continuity.
(8) On last device in network tie back shield and tape.
(9) Optional tie point for shield; has no internal connection in the IQ CED II.

ARII for Sync

0 4 5

PONI Communication Module

0 4 6
IQ Energy Sentinel Address

0 0 2
IQ Energy Sentinel Address

0 0 1
IQ Energy Sentinel Address

IQ Data Plus II

F·A·T·N

IQ Energy Sentinel Mounted on Load Side of Series C Feeder Breakers

Metering Switchboard with IQ Energy Sentinel

IQ Energy Sentinel Applications
Left to Right: MCC Starter, Enclosed Starter, Enclosed Breaker and Busplug

IMPACC connectivity provides for maximum flexibility, meaning computers and PLCs can communicate with each other; or multiple computers in various locations communicating with each other.

Information from Series III can be exchanged via DDE with other Windows™ based programs such as Excel, Word, or any other DDE-compatible program. For higher performance, information can be shared through DDE over a customer Local Area Network (LAN) into remote graphical displays.

Peak Power Demand (Application Note)

- **Selecting Demand Windows**
  To help match peak demand windows of IQ devices with a utility's demand window, the E-Bill Software allows the user to select 15-, 30-, or 60-minute windows for IQ Sentinels, and IQ DP-4000 peak demand readings. Series III software can monitor 10-, 15-, 30- and 60-minute demand windows. The IQ CED II can monitor demand windows from 1 to 60 minutes.

- **Synchronizing Demand Windows**
  E-Bill will "synchronize" (reset) the demand windows of IQ Sentinels on the hour and at 15- or 30-minute intervals (programmable) between the hours. This "synchronizing" feature ensures all devices' demand windows start and stop at the same time.

  The IQ CED II will synchronize the demand windows of IQ Sentinels on its subnetwork at 5-, 10-, 15-, 30-, and 60- minute intervals. If a utility sync pulse signal is wired into the IQ CED II's sync pulse input, the IQ CED II can synchronize the demand windows of the IQ Sentinels on its subnetwork to the utility's demand signal. The IQ CED II will also synchronize demand windows of other IQ meters (IQ Data Plus II and DP 4000) on its subnetwork if Addressable Relay IIs are on the subnetwork and wired to the sync pulse inputs. Of course, the utility sync pulse signal may be connected directly to the IQ Data Plus II's and IQ DP-4000's sync pulse inputs.

- **Capturing the highest overall peak demand of the building ("coincident" power demand)**
  E-Bill allows the user to capture "coincident" demands of IQ devices at the time of highest **overall** peak demand of the facility. This helps to ensure tenants/ departments are not inaccurately billed for peak demand charges.

Product Support

Application Support
Cutler-Hammer sales offices worldwide provide technical assistance in the specification and use of Cutler Hammer IQ products.

Factory Assistance
Cutler-Hammer provides factory applications and technical assistance to its customers. Available by telephone, Cutler-Hammer personnel quickly respond to customer needs – troubleshooting problems, analyzing system operation, and coordinating component repair or replacement.

Factory assistance may be obtained by calling the Advanced Products Support Center at (800) 809-2772 or (412) 490-6714.

Energy Auditing

Energy Management Consultation
Cutler-Hammer can provide professional technical consultation to assist users in creating effective energy management programs. Employing the services of a Certified Energy Manager (CEM), Cutler-Hammer can also offer detailed *Energy Auditing Services*. An audit can be in the form of a walk-through estimate or a more detailed energy study. The audit will provide the customer with the following information:

- Analysis of current utility bills to identify demand management opportunities and wasteful energy practices
- Equipment inventory
- Estimates or measurements of equipment load and usage
- Recommended process improvements and equipment replacements
- Recommended metering devices and device locations
- Estimates of the cost and savings of likely energy projects.

Complete Power Management Systems
Cutler-Hammer manufactures all hardware and software necessary to build a complete *Power Management System*. Each system is highly specialized and customized to meet specific customer needs. A typical Power Management System consists of:

- A System Control Unit (Personal Computer) with Windows and Excel software
- Computer Operated Network Interface (CONI) or Master INCOM Network Translator (MINT) hardware to provide an interface between the physical communication network and the application software

- IMPACC software: Series III, Enhanced Graphics, E-Log, E-Bill, E-Trend, E-Track, Waveform Display, Trip Curve Display
- Customized graphic programming including system one-lines, elevation views and site plans
- Devices for metering, monitoring, protection and control
- Networking equipment and software.

Installation and Retrofit
Cutler-Hammer can provide electrical engineering services to install a new project or add communications capability to existing distribution equipment. *Installation and Retrofit Services* include:

- Installing IQ devices as part of a new installation or on existing gear
- Configuring IQ devices for IMPACC communications
- Installing the data lines from the devices to the computer.

Start-up Services
Cutler-Hammer will provide the services of a highly skilled technician who will start-up and configure your IMPACC system. *Start-up Service* includes:

- Configuring the computer and loading necessary software
- Setting all of the addresses of the devices in the network
- Verifying and assisting the electrical contractor troubleshoot the integrity of the data line
- Assisting the electrical contractor in correcting any data line problems
- Ensuring that all devices are on the network and communicating properly.

Training Services
Cutler-Hammer can provide both on-site training and in depth classroom training on your IMPACC system. *On-site Training* includes:

- Hands on training of site personnel (max. 5 people)
- Explanation of how to use and configure Series III software
- Explanation of device operation
- Explanation of how to set up trending and logging
- Instruction on any other software provided with the customer system.

Cutler-Hammer also offers IQ/IMPACC training courses in its Pittsburgh based Training Center. These courses are designed

to help users stay "on top" of rapid changes in the technology, programming, maintenance and troubleshooting of IQ/IMPACC products. Courses are designed to provide a practical working knowledge of products and are taught by skilled, knowledgeable instructors. Pittsburgh based IMPACC training includes instruction on:

- Loading application software: Series III, Excel, Windows, E-Bill, Enhanced Graphics
- IQ Device operation
- Device configuration in Series III
- Enhanced Graphics: demo programs and graphics development
- Connectivity and computer networking
- E-Bill: configuration and bill generation.

Aftermarket Services
Cutler-Hammer can provide an on-going service to support installed power management systems. *Aftermarket Services* include:

- Periodic Billing Services (daily, weekly, monthly etc.)
- Energy Trend Reporting - by meter or energy user
- Energy Bill/Trend Aggregation.

24/Hour 800 Number Technical Support
The Power Management Applications Support team is available 24 hours a day, seven days a week to assist you with your problems or questions. The PMAS team provides technical support on all IMPACC software and IQ metering products. They can also assist with connectivity and system configuration issues. PMAS has the capability to troubleshoot and solve most problems over the phone. If an issue can not be resolved in this manner, the PMAS group can authorize warranty support.

The Power Management Applications Team Support can be reached at 1-800-809-2772 or 1-800-542-7883.

Further Information
Selling Policy 25-000
User's Manual
  F-frame IL 17537
  J-frame IL 17538
  K-frame IL 17539
  Universal Internal IL 17540
  Universal External IL 17541
IMPACC Wiring Specification TD 17513
Discount Symbol C10-S24
UL File No. E64983
CSA File No. LR106359-1

IQ Energy Sentinel

Westinghouse IQ Metering Devices

The IQ Energy Sentinel is the latest addition to the Westinghouse line of IQ Metering devices, which includes the IQ Data, IQ Generator, IQ Data Plus II, and IQ Data Plus II 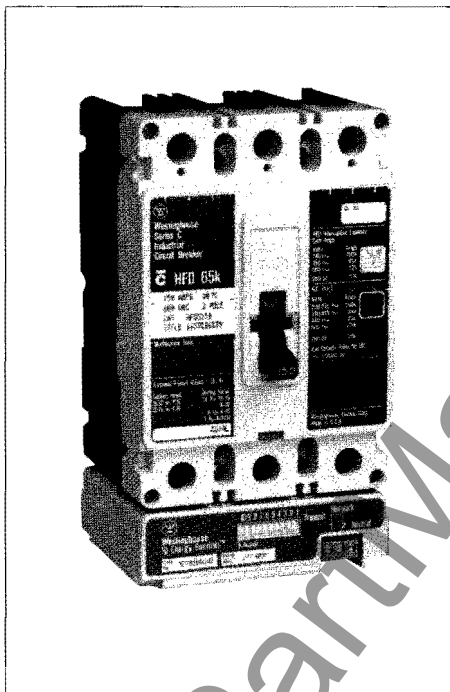HV. These solid state products provide centralized alternatives to individually mounted ammeters, voltmeters, frequency meters, watt hour meters, and more. All are easily retrofitted into existing systems, and communicate over IMPACC, Westinghouse's local area network for electrical distribution systems.

IQ Energy Sentinel

The IQ Energy Sentinel is a highly accurate, microprocessor-based, breaker-mounted device designed to monitor power and energy readings. It represents an alternative to watt meters, watt-hour meters, and watt demand meters. Key advantages include savings in space, lower installation costs, and remote monitoring capability.

The IQ Energy Sentinel mounts on the load side of a Westinghouse Series C F (150 Amp), J (250 Amp), or K (400 Amp) frame circuit breaker. It can be applied on three phase, four wire systems, or single phase, three wire systems utilizing a three pole breaker with voltage connected through phases A and C. (See "System Voltage Considerations" Application Note).

Submetering application examples for the IQ Energy Sentinel include energy monitoring and billing for commercial and industrial facilities. Commercial applications include tenant billing within convention halls, office buildings, shopping malls, hospitals, warehouses, storage facilities and parks. Industrial applications include departmental billing, process/assembly line energy cost analysis, and machine monitoring within plants.

Note: For customer billing applications, consult local utility for metering requirements.

Applications in Westinghouse assemblies include:
- Pow-R-Line 4 Panelboards – feeder circuits
- Pow-R-Line C Switchboards – feeder circuits
- Series 2100 Motor Control Centers and Enclosed Control with circuit breaker disconnects
- Enclosed Circuit Breakers
- Low Voltage Bus Plugs with circuit breaker disconnects

Specifications

Voltage Inputs (±20%)③
Single phase, three wire
120/240 VAC
Three phase, four wire
120/208 VAC
277/480 VAC

Current Inputs (Accuracy Range)
Minimum: 0.01 x frame rating
Maximum: 1.25 x frame rating

Accuracy
±1% of breaker frame rating

Frequency
60 Hz

Power Consumption
1 VA

Power Factor Rating
90° lagging to 30° leading

Operating Temperature
−25° to 70° C①
(−13° to 158° F)

Storage Temperature
−40° to 85° C
(−40° to 185° F)

Humidity
0 to 95% R. H.
non condensing

Communications
9600 baud

Features
- Monitors (1% breaker frame rating)
  Kilowatts
  Kilowatt Demand (see p. 7)
  Kilowatt Hours
- No external CTs or PTs required
- Mounts directly onto the load side of Westinghouse Series C F, J, and K Frame circuit breakers
- Powered directly from the circuit breaker
- Built-in communications capability
  Address set by DIP switches
  Communications at 9600 baud
- Choice of operator interfaces
  IQ Central Energy Display
  Custom Billing Software
  IMPACC Series III Software
- UL listed②

Benefits
- One device replaces multiple meters

- Savings in space
- Savings in cost
- Savings in installation cost

- No external power source needed
- Remote monitoring
  Direct communications

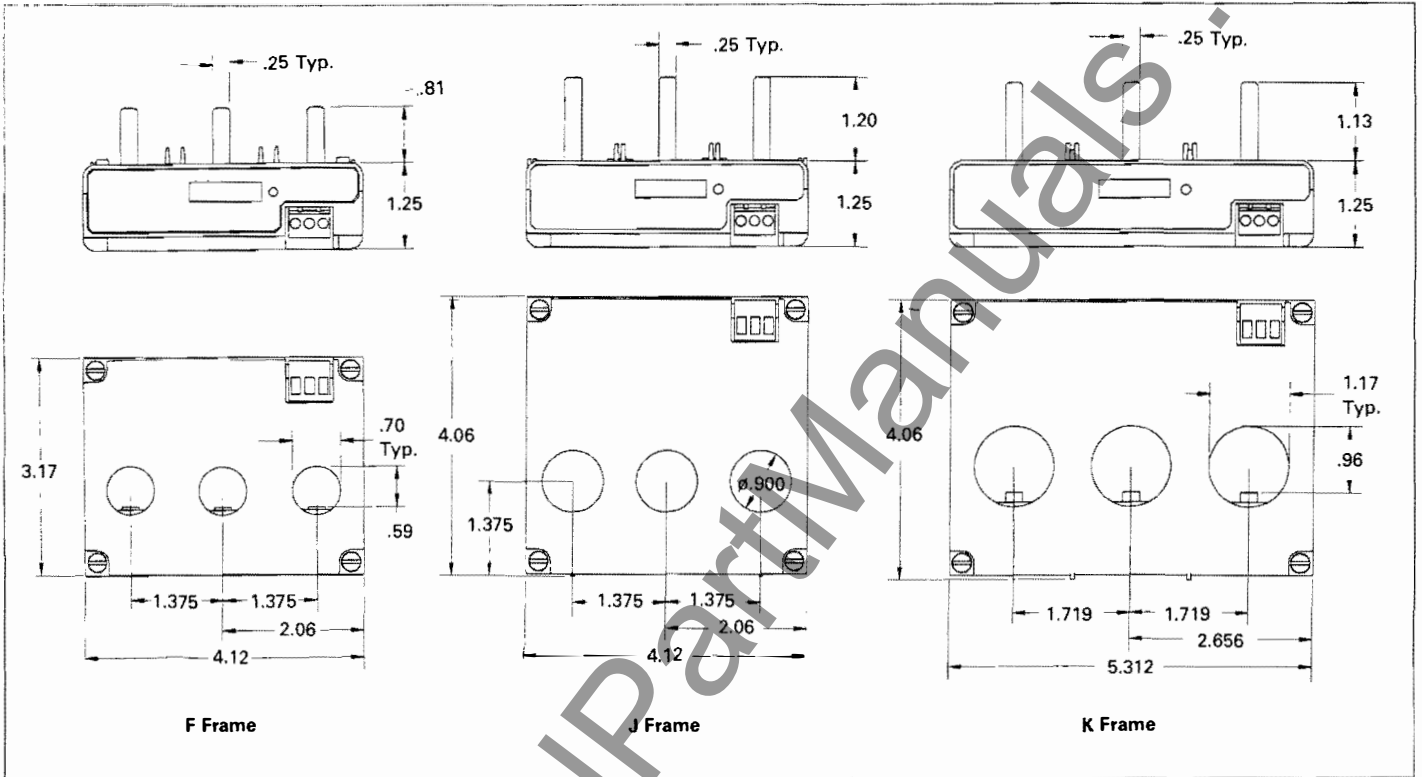- Flexibility – displays what is needed where it is needed

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Terminal & Cable Guidelines

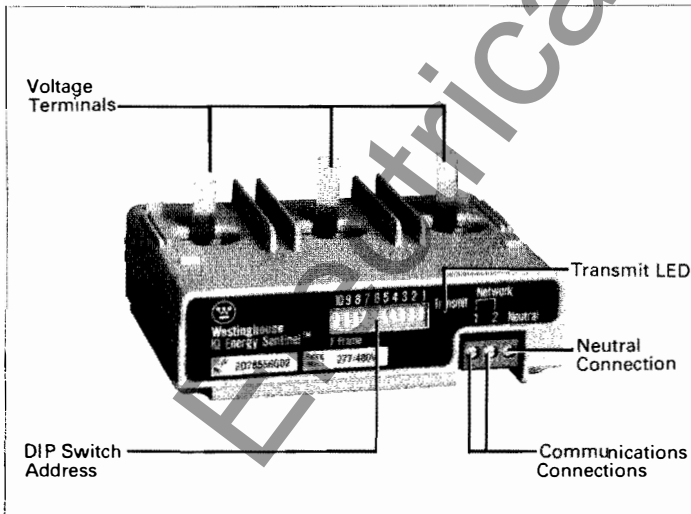| Energy Sentinel	Westinghouse Series C Terminal	Wire Size (Single Conductor)
IQESF208	624B100G02, G17, G18, G19	#14-1/0, #4-4/0, #4-4/01, #14-1/0 AWG
IQESF480	624B100G02, G17, G18, G19	#14-1/0, #4-4/0, #4-4/01, #14-1/0 AWG
IQESJ208	T250KB	#4-350 MCM
IQESJ480	TA250KB	#4-350 MCM
IQESK208	T350K	#250-500 MCM
IQESK480	TA350K	#250-500 MCM
Neutral Wire		*#12-22 AWG*

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① 40°C (standard) maximum for Series C circuit breakers
② For use with Westinghouse Series C circuit breakers
③ Ground/Neutral Terminal of IQ Energy Sentinel should be connected to the system neutral to insure accuracy.
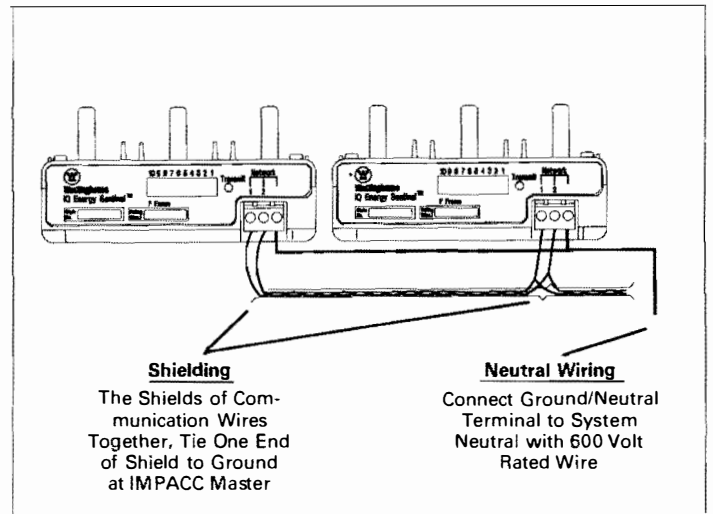
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Energy Sentinel Dimensions

F Frame

J Frame

K Frame

Energy Sentinel Features

Voltage Terminals

Transmit LED

Neutral Connection

DIP Switch Address

Communications Connections

Energy Sentinel Wiring

Shielding
The Shields of Communication Wires Together, Tie One End of Shield to Ground at IMPACC Master

Neutral Wiring
Connect Ground/Neutral Terminal to System Neutral with 600 Volt Rated Wire

| Description	Catalog Number
IQ Energy Sentinel, F Frame③, 120/208, 120/240 VAC (150 A. max)	IQESF208
IQ Energy Sentinel, F Frame③, 277/480 VAC (150 A. max)	IQESF480
IQ Energy Sentinel, J Frame③, 120/208, 120/240 VAC (250 A. max)	IQESJ208
IQ Energy Sentinel, J Frame③, 277/480 VAC (250 A. max)	IQESJ480
IQ Energy Sentinel, K Frame③, 120/208, 120/240 VAC (400 A. max)	IQESK208
IQ Energy Sentinel, K Frame③, 277/480 VAC (400 A. max)	IQESK480

③ For use with Westinghouse Series C circuit breakers

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Operator Interfaces and Software

IQ Energy Sentinels operate with a choice of interfaces that allow remote monitoring from a centralized location.

IQ Central Energy Display
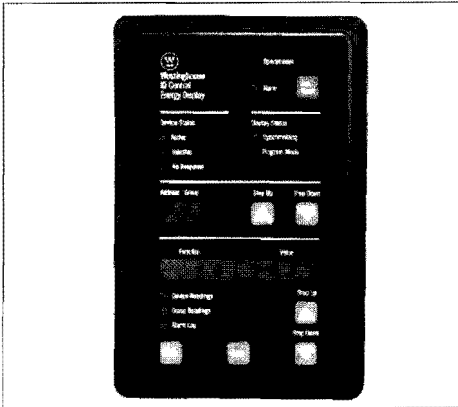
The IQ Central Energy Display (CED) monitors and displays energy parameters from up to 50 IQ Energy Sentinels and 8 IQ Data Plus IIs. The IQ CED is a compact, panel-mounted device which provides a centralized alternative to individually mounted watt, watt-hour, and watt demand meters.

Parameters Displayed

The following are displayed on the membrane NEMA 3R, 12 faceplate:
- Energy (watt-hours)
- Peak power demand (see p. 7)
- Power (watts)
- Present power demand
- Group readings – able to sum the energy, present demand, and peak demand readings for up to 8 customer selected device groups
- Status of device
  - Active
  - Inactive
  - No response
- Historical alarm log
- User-programmed, custom description of each device
- Date and time

Programmable Alarms

The IQ CED can be programmed to alarm for any of the following conditions:
- Value and time a peak demand exceeds the user programmed maximum (individual or group)
- Device inactive or no response

During set-up, the customer is given the option of deciding whether or not a security code is needed to access the acknowledgment and resetting of alarms. Alarms can also be acknowledged and reset over IMPACC.

Communications

Communications between the IQ CED and IQ Energy Sentinels, Addressable Relay IIs, and IQ Data Plus IIs is accomplished over a twisted pair of conductors on the highly reliable IMPACC local area network. This is achieved through an addressable communications module (PONI) that is easily field mountable on the back of the IQ Data Plus IIs. The IQ Energy Sentinels and Addressable Relay IIs have direct communications capability.

The IQ CED communicates to its subnetwork at either 1200 or 9600 baud. Maximum total distance is 7500 feet.

The IQ CED can transmit all data from the IQ Energy Sentinels and IQ Data Plus IIs to a remote computer or programmable controller over the IMPACC network. This is achieved by mounting a PONI module to the IQ CED and wiring it to the remote computer or programmable controller. The computer or programmable controller must be equipped with a CONI or MINT II.

The IQ CED can communicate to the remote master at either 1200 baud or 9600 baud. The communication option provides, with appropriate PONI modules, the following modes of communications:
- Locally over IMPACC (distances less than 7500 feet) or RS232C protocol
- Off-site monitoring (distances further than 7500 feet) using telephone modems

The remote communications option can be included at any time by mounting the PONI module to the IQ CED. No reprogramming of the IQ CED is required.

Self-Learning

The IQ CED polls its subnetwork and stores the addresses of the IQ Energy Sentinels and IQ Data Plus IIs. This is done automatically after the unit is turned on for the first time, or may be operator invoked in the program mode.

A custom description for each device can be entered on the 8 digit alphanumeric window of the IQ CED for easy location reference.

Non-Volatile Memory

There is no need to reload after an AC power loss. The addresses, types, and description of devices that are stored in memory during the learn mode are also retained throughout a power loss. Unless there has been a change in the local area network, it is not necessary to re-enter the learn mode. The real time clock is battery backed. Once the time is set, there is no need to reload it, even if control power is lost.

User Friendly
- Operator panel (faceplate) is self-explanatory
- "HELP" function scrolls explanations across the alphanumeric window
- Self-learning
- Minimal external connections (3 wires for AC input and 2 wires twisted pair for communications)

Flexible
- Programmable watt-hour pulse output for a (user defined) group of IQ Energy Sentinels and IQ Data Plus IIs.
- Can be mounted at a remote location to monitor one or more assemblies (up to 7500 feet away)
- Can be mounted directly onto assemblies
- Remote communications option can be added at any time. No internal changes are required.
- Can interface with a variety of IMPACC networks

General Specifications

Power Requirement
10 VA maximum

Input Voltage
120 or 240 VAC ($\pm$ 20%)
Auto selecting

Frequency
50 or 60 Hz

Operating Temperature
0°C to 70°C
(32°F to 158°F)

Storage Temperature
-20°C to 85°C
(-40°F to 185°F)

Humidity
0 to 95% R.H. non condensing

Alarm Contact Ratings
10 A @ 277 VAC (resistive)
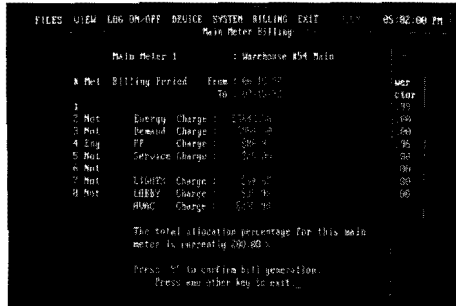10 A @ 30 VAC (resistive)
1/3 HP 125, 250 VAC

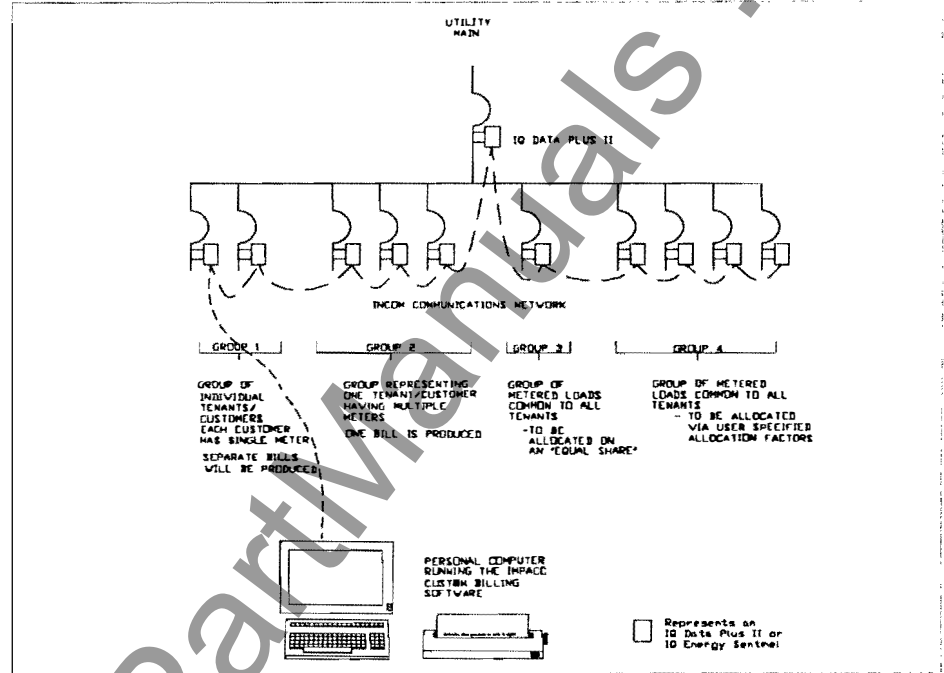| Description	Catalog Number
IQ Central Energy Display	IQCED

Custom Billing Software


```
FILES  VIEW  CBS ON/OFF  DEVICE  SYSTEM  BILLING  EXIT        05:82:00 PM
                          Main Meter Billing

        Main Meter 1           : Warehouse #54 Main

  X Met  Billing Period   From : 66 02 92                      wer
                            To :                               ctor
                                                               99
  2 Met    Energy  Charge :                                    66
  3 Met    Demand  Charge :                                    80
  4 Eng    PF      Charge :                                    95
  5 Met    Service Charge :                                    66
  6 Met                                                        86
  7 Met    LIGHTS  Charge :                                    00
  8 Met    LOBBY   Charge :                                    66
           HVAC    Charge :

        The total allocation percentage for this main
        meter is currently 290.80 %

        Press 'Y' to confirm bill generation.
        Press any other key to exit.
```

BILLING STATEMENT

From 7/24/92 To 8/24/92		Bill Date 7/27/92	
		Due Date 8/11/92	
Customer The John Doe Company		Remit To: The Office Complex	
		123 Prospect Drive	
		Pittsburgh, PA 15000	

Current Energy Reading	2750 kWh		
Previous Energy Reading	0.00 kWh		
Total Energy Usage	2750 kWh	$	220.560
Total Demand Usage	50 kW	$	50.293
(8/23 @ 8:15 AM)			
Unmetered Cost			
Energy	0.0470 kW	$	0.000
Demand	0.000 kW	$	0.000
Common Cost			
Energy	6663.028 kWh	$	513.961
Demand	9.764 kWh	$	0.781
Power Factor Charge		$	47.040
Service Charge		$	57.436
Surcharge for LIGHTS		$	25.000
Surcharge for MAINTN		$	50.000
Surcharge for MISC.		$	16.690
Total Remittance Due		$	981.75

The IMPACC Custom Billing Software allows the generation of individual electric bills by distributing the electric costs billed to a main utility meter. These costs are spread across various departments, tenants, or customers who consume the power flowing through the main meter. This "sub-metering" is achieved through the use of Westinghouse's IQ Data Plus IIs and IQ Energy Sentinels. The Custom Billing Software then tracks and records the electric usage measured by each device.

The Custom Billing Software is capable of dividing a bill among 64 device groups. Internal bills can be generated based upon any of the following:
- Energy (kilowatt-hours)
- Demand (peak kilowatts)
- Utility Service
- Up to 3 user-defined charges

User-defined charges allow the user to impose additional charges (e.g., surcharges, maintenance fees) based on application and need.

Energy readings can be taken for each of the following:
- Main (electrical input from utility)④
- Individual occupants/tenants/customers
- Common loads (e.g. HVAC, lobby)

Other features include the following:
- Monitoring views:
  Network
  Main meters
  Groups
  Device

May 1993

- Demand windows – 15, 30, and 60 minutes
- Capable of billing any 90 day period within the last year
- Monitors device information and set points
- Generates formatted bill
- Nonvolatile memory
- Gateway interface
- Password protection

Note: Presently, the Custom Billing Software does not support IQ CEDs.

The Custom Billing Software requires 640 kBytes minimum RAM and a 40 MByte minimum hard drive. A MINT II or CONI is also necessary at the personal computer.

Series III Software

Enhanced Graphics

Custom Billing Software Configuration
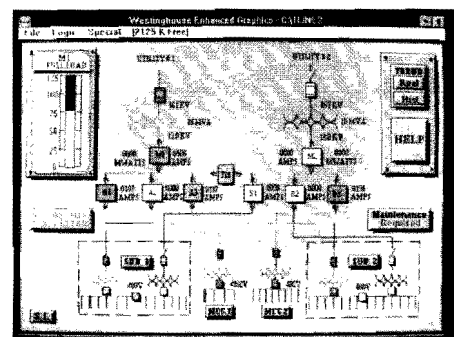
Description	**Catalog Number**
Custom Billing Software	CBS

Series III is a Windows™-based software program for IMPACC – Integrated, Monitoring, Protection, and Control Communications – the Westinghouse centralized electrical distribution system network. It offers user-friendly, menu-driven screens that permit easy set-up and operation. Standard Series III features include the following:
- Monitoring and recording of vital system data as it occurs
- System/device alarm logging and reporting
- Time/event data logging
- Information storage and retrieval by event
- Hardware diagnostics
- Security
- Analog alarming

In addition, an optional Enhanced Graphics package adds the capabilities of generating custom animated color graphics of one-line drawings and elevation view of assemblies for electrical power distribution systems while running Series III.
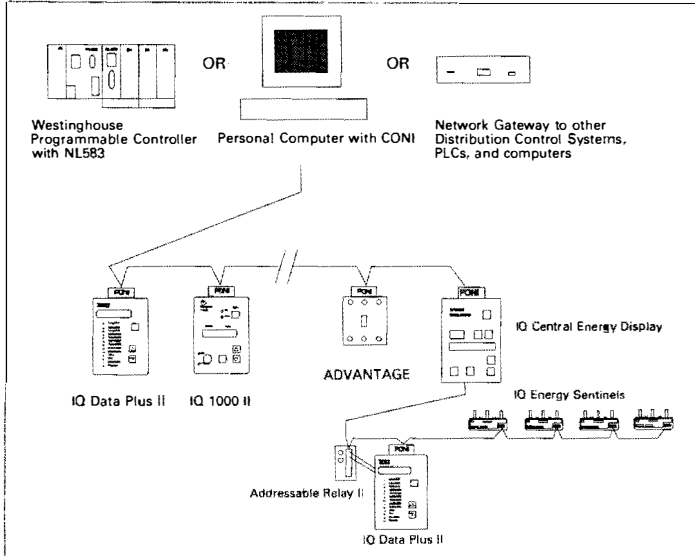
With the IQ Energy Sentinel, IMPACC Series III performs the above functions for:
- Present demand
- Peak demand
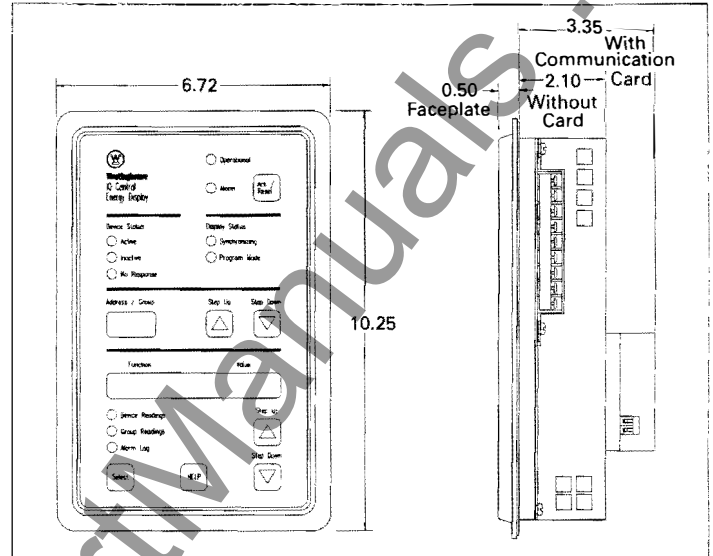- Programmable demand windows (10, 15, 30, and 60 minutes)

④ For coincident peak demand, an IQ Data Plus II and Addressable Relay II are required on each incoming utility main.
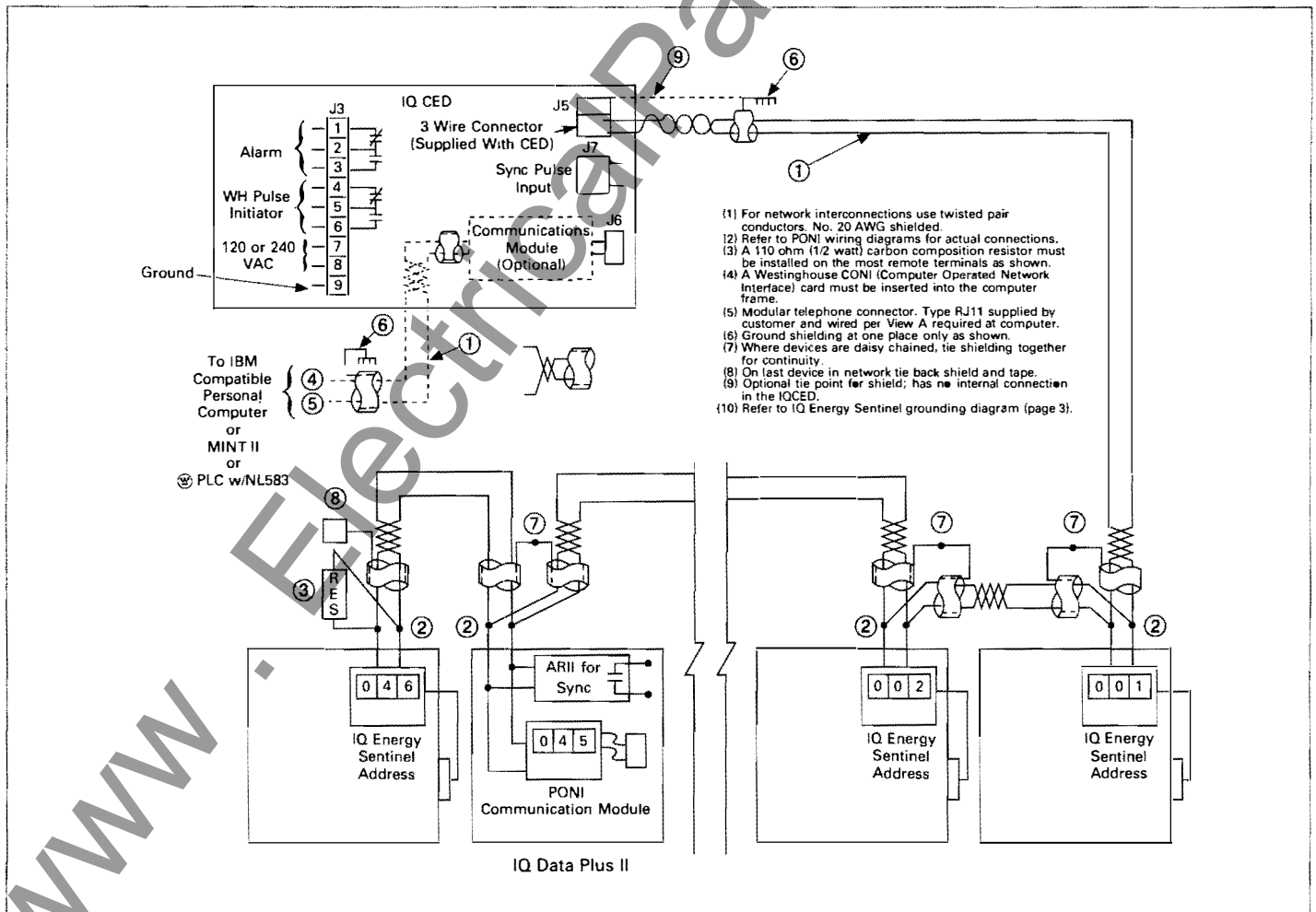
Networking

Westinghouse
Programmable Controller
with NL583

OR

Personal Computer with CONI

OR

Network Gateway to other
Distribution Control Systems,
PLCs, and computers

IQ Central Energy Display

ADVANTAGE

IQ Data Plus II   IQ 1000 II

IQ Energy Sentinels

Addressable Relay II

IQ Data Plus II

Dimensions

6.72

0.50
Faceplate

3.35
With
Communication
Card

2.10
Without
Card

10.25

Typical Wiring Diagram

J3
IQ CED
J5

3 Wire Connector
(Supplied With CED)

Alarm

WH Pulse
Initiator

120 or 240
VAC

Ground

J7
Sync Pulse
Input

Communications
Module
(Optional)

J6

(1) For network interconnections use twisted pair
   conductors. No. 20 AWG shielded.
(2) Refer to PONI wiring diagrams for actual connections.
(3) A 110 ohm (1/2 watt) carbon composition resistor must
   be installed on the most remote terminals as shown.
(4) A Westinghouse CONI (Computer Operated Network
   Interface) card must be inserted into the computer
   frame.
(5) Modular telephone connector. Type RJ11 supplied by
   customer and wired per View A required at computer.
(6) Ground shielding at one place only as shown.
(7) Where devices are daisy chained, tie shielding together
   for continuity.
(8) On last device in network tie back shield and tape.
(9) Optional tie point for shield; has no internal connection
   in the IQCED.
(10) Refer to IQ Energy Sentinel grounding diagram (page 3).

To IBM
Compatible
Personal
Computer
or
MINT II
or
Ⓦ PLC w/NL583

R
E
S

0 4 6

IQ Energy
Sentinel
Address

ARII for
Sync

0 4 5

PONI
Communication Module

0 0 2

IQ Energy
Sentinel
Address

0 0 1

IQ Energy
Sentinel
Address

IQ Data Plus II

Other Devices
IQ Data Plus II
The IQ Data Plus II is an RMS sensing multimeter as well as a protective device that provides complete electrical metering and system voltage protection. The IQ Data Plus II provides an alternative to individually mounted and wired ammeters, voltmeters, ammeter and voltmeter switches, wattmeters, watt-hour meters, varmeters, power factor meters, frequency meters, and watt demand meters.

Addressable Relay II
The Addressable Relay II has two status inputs, and a Form C contact output. One of its applications is to control the length of the demand window for the IQ Data Plus II.

IQ Energy Sentinel Mounted on Load Side of Series C Feeder Breakers

Metering Switchboard with IQ Energy Sentinel ▶

IQ Energy Sentinel Applications
Left to Right: MCC Starter, Enclosed Starter, Enclosed Breaker and Busplug.

Peak Power Demand (Application Note)

- **Selecting Demand Windows**
  To help match peak demand windows of IQ devices with a utility's demand window, the Custom Billing Software allows the user to select 15, 30, or 60 minute windows for IQ Energy Sentinel and IQ Data Plus II peak demand readings. Series III software and the IQ CED can also monitor 5 and 10 minute demand windows.

- **Synchronizing Demand Windows**
  Custom Billing Software will "synchronize" (reset) the demand windows of IQ Energy Sentinels on the hour and at 15 or 30 minute intervals (programmable) between the hours. It will also synchronize demand windows of IQ Data Plus IIs if Addressable Relays IIs are on the network and wired to their synch pulse inputs (see Custom Billing Software). This "synchronizing" feature insures all devices' demand windows start and stop at the same time.

  The IQ CED will synchronize the demand windows of IQ Energy Sentinels on its subnetwork at 5, 10, 15, 30, and 60 minute intervals. If a utility synch pulse signal is wired into the IQ CED's synch pulse input, the IQ CED can synchronize the demand windows of the IQ Energy Sentinels on its subnetwork to the utility's demand signal. The IQ CED will also synchronize demand windows of IQ Data Plus IIs on its subnetwork if Addressable Relay IIs are on the subnetwork and wired to the IQ Data Plus IIs' synch pulse inputs. Of course, the utility synch pulse signal may be connected directly to the IQ Data Plus IIs' synch pulse inputs.

- **Capturing the highest overall peak demand of the building ("coincident" power demand)**
  Custom Billing Software allows the user to capture "coincident" demands of IQ Energy Sentinels and IQ Data Plus IIs at the time of highest **overall** peak demand of the facility. This helps to insure tenants/departments are not inaccurately billed for peak demand charges. To use this feature, an IQ Data Plus II, with an Addressable Relay II wired into its synch pulse input, must monitor the incoming main from the utility (see Custom Billing Software).
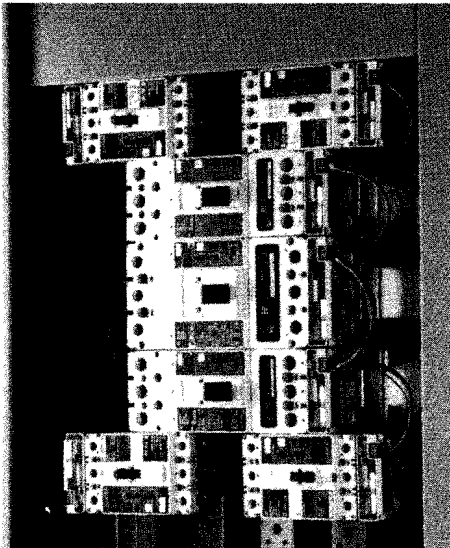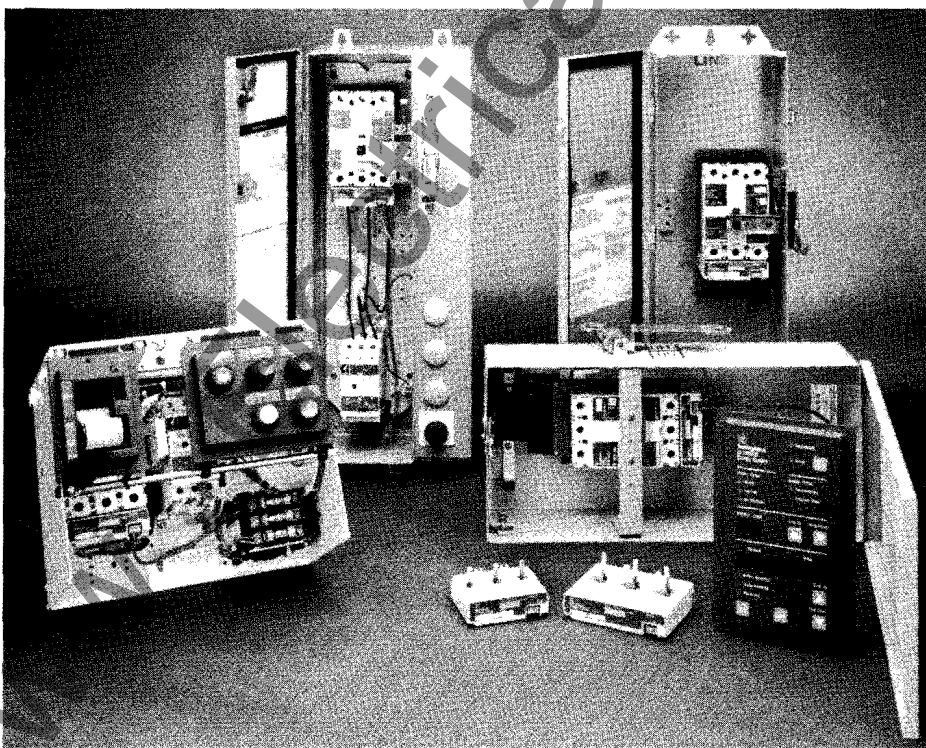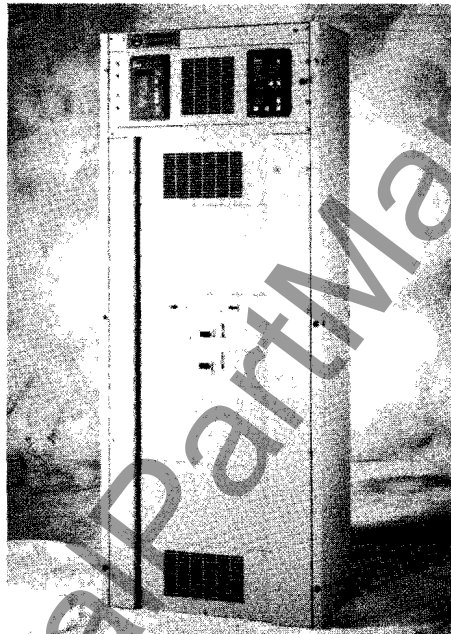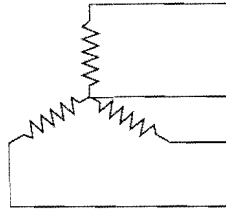
## System Voltage Considerations (Application Note)

The IQ Energy Sentinel uses Line-to-Neutral Voltage in its power calculations. Its Ground/Neutral Terminal should be connected to the system neutral to insure accuracy.
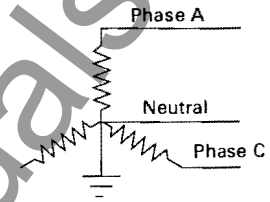Acceptable supply voltages:
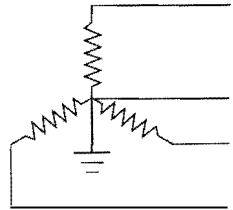
(A)
Three-Phase Star;
Four-Wire; Earthed
Neutral (208/120; 480/277)

(B)
Three-Phase Star;
Four-Wire; Non-
Earthed Neutral (208/120; 480/277)
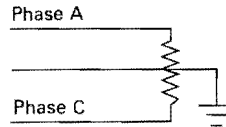
(C)
Single-Phase; Three-
Wire; Earthed Mid
Point (240/120 – connect
to A and C phases)

(D)
Two-Phase Star;
Three-Wire; Earthed
Neutral (208/120 – connect
to A and C phases)

Product Support

Application Support
Westinghouse sales offices world-wide provide technical assistance in the specification and use of Westinghouse IQ products.

Factory Assistance
Westinghouse provides factory applications and technical assistance to its customers. Available by telephone, Westinghouse personnel quickly respond to customer needs – troubleshooting problems, analyzing system operation, and coordinating component repair or replacement.

Factory assistance may be obtained by calling the Advanced Products Support Center at (800) 542-7883 or (412) 937-6790.

Training
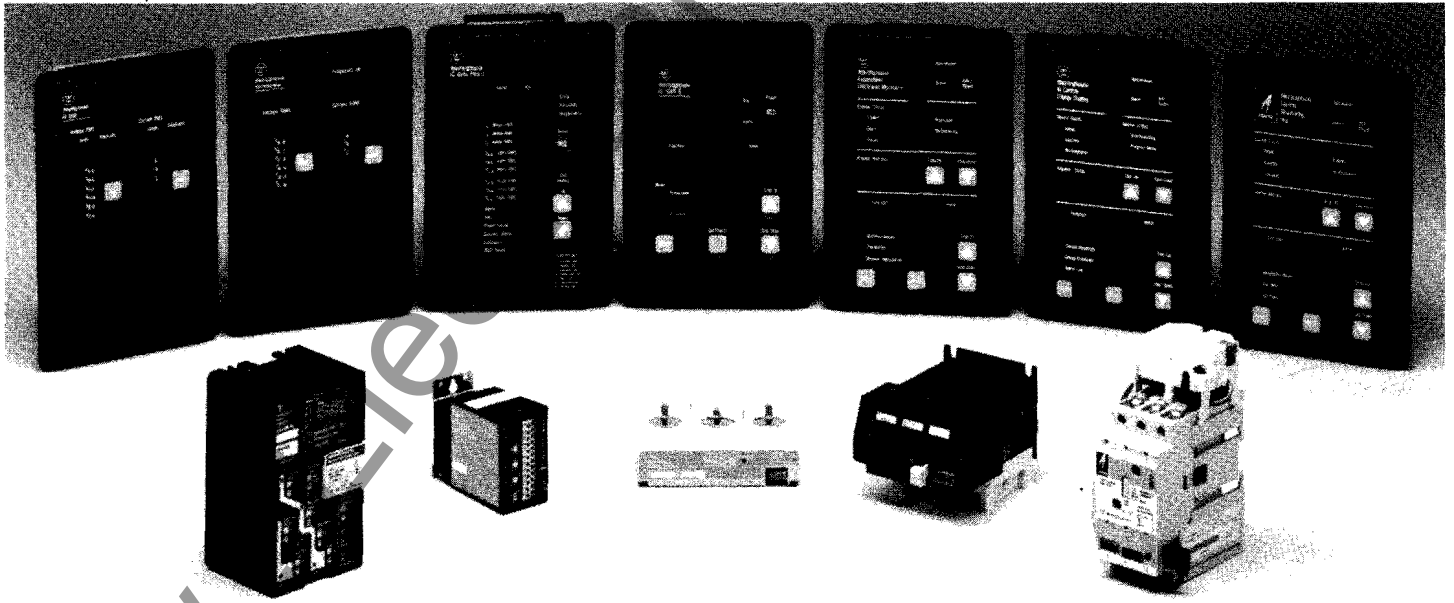Westinghouse also provides comprehensive training on IMPACC and IMPACC compatible devices from its Pittsburgh Training Center. The Training Center also offers on-site training for all of its courses. For more information on training, please call (412) 937-6270.

Further Information

List Prices
Westinghouse IQ and   PL 8174
IMPACC Products

IMPACC Compatible Devices