



# **IQ Insulator<sup>®</sup>**

**Self-powered Line Sensor & Insulator  
with Wireless Communications**

**Monitor System Performance & Reliability**

**Load Profiling and Fault Recording & Indication**

- **Intelligent and Flexible**

**Monitor Circuits – Detect & Record Load Profiles and Fault Events  
All Distribution Voltages  
All Conductor Types**

- **Programmable**

**Designate Profiling and Data Collection options  
Customize Disturbance or Fault Recorder Settings  
Assignable Device Identification**

- **Simple to Install & Operate**

**Pin-Type Insulator Mounting for New Construction or Retrofit  
Integral conductor clamp eliminates need for tie wire  
Wireless Communications for Field Configuration and Data Acquisition**

- **Maintenance-Free**

**Self-powered Energy Harvesting Technology – No Batteries to Replace  
Durable High Density Polyethylene Housing  
Environmentally Friendly – RoHS Compliant**

# Specifications

**Operating Voltage:** 35kV maximum  
**Current Range:** 10 – 1000A  
**Current Withstand:** 10kA  
**Conductor Range:** 0.25 – 1.5 inch diameter  
**Housing Material:** High Density Polyethylene

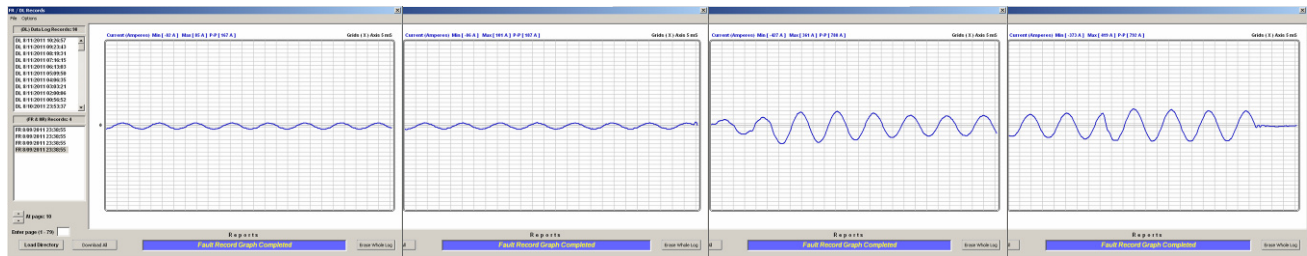
**Fault Detection:** Adaptive or Fixed  
**Inrush Restraint:** Programmable  
**Indicator Time:** Programmable  
**Communication Range:** 150 ft  
**EMI/EFI immunity:** FCC Part 15

**Data Storage:** 64Mbit capacity to support over 1 million readings  
**Power Source:** Self-powered; harvests magnetic field energy  
**Fault Indicator:** High-brightness, wide-angle Red LED

## Ordering Information

Catalog Number	Description
<b>IQ Sensor</b>	
IQI-11	Distribution Monitor and Fault Recorder
<b>IQ Communication Tools</b>	
IQ-USB	USB Interface for Laptop PC ( <i>Windows XP/Vista/7</i> ) with Application Software and Dipole Antenna

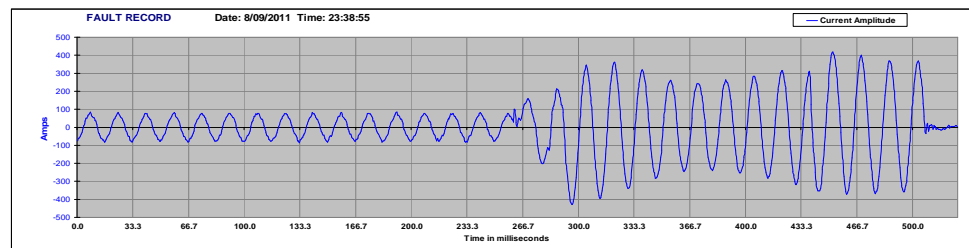
### Fault Record – IQ Application Charts



**IQ-USB**



### Same Fault Record Charted with Desktop Application



IQ Insulator is a registered trademark and Hendrix is a brand name of its proprietor, Marmon Utility LLC, a Marmon Wire & Cable, Berkshire Hathaway Company. Marmon Utility products appearing in this document are covered under one or more of the following Patents 7072163, 7187275, 7295133, 7710069B2, 7808400 and Patents Pending.

**Hendrix Molded Products**

**Marmon Utility LLC**  
[www.hendrix-wc.com](http://www.hendrix-wc.com)

## **IQ Sensor – Distribution Line Monitor**

### **Description:**

The IQ Sensor is a programmable power-line measurement platform that provides high-speed monitoring of power system performance and reliability. It detects, collects, records & transmits time-stamped operational data for overhead systems up to 35kV. Integral fault detection and indication circuitry assists personnel in locating and characterizing disturbances or faulted circuits.

Each sensor has embedded electronic sensor ICs, microcontrollers, wireless communications and an advanced power supply; all housed in a durable High-Density Polyethylene body. All units are maintenance-free, with no batteries or other components to replace.

The IQ Sensor is coupled with a Hendrix Vise-Top Pin Insulator, to form the IQ Insulator<sup>®</sup>. Standard 1" or 1-3/8" pin mounting provides for simple installation on new or existing circuits, without the need for cutting conductors or de-energizing circuits. A wireless communication interface is then used with a PC to configure settings and access operational data.



**IQ Insulator<sup>®</sup>**



**IQ USB  
PC Communication Interface**

### **Benefits:**

- Gain system intelligence – Demand profile, Peak load, and Fault data
- Reduce outage duration by minimizing patrol time
- Access and download data wirelessly – Eliminates up & down labor
- Advanced power supply technology (Battery-free) eliminates maintenance

### **Application:**

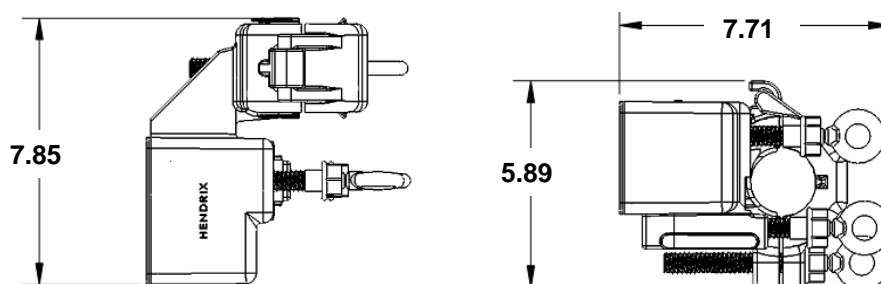
The IQ Insulator<sup>®</sup> is designed for bare or covered conductors up to 1.5" diameter and is suitable for installation as a permanent line monitor. Line current is continuously monitored; data is collected at user-defined intervals and upon a faulted line condition. This data is permanently stored in non-volatile flash memory. Generous storage capacity provides for extensive data collection; for example, setting a one minute interval allows for well over one year of circuit profiling. Each unit also has wireless programmable setting options to allow for customized unit identification, disturbance detection and LED alert duration.

# IQ Sensor – Distribution Line Monitor

## Technical Data & Ordering Information

Feature	Value
Operating Voltage:	35kV maximum
Current Range:	10 – 1000A
Load Profiling:	Time-stamped RMS current values Programmable log intervals from 1 cycle to 8 hours
Current Accuracy:	+/- 2% of reading +/- 3A
Disturbance/Fault Detection	
Detection Mode:	Programmable; Adaptive and Fixed trigger modes
Inrush Restraint:	Programmable
LED Indicating Time:	Programmable from zero to 18 hours
LED Flash Frequency:	1 second
Event Recording:	Current Amplitude and Waveforms (30 cycles per event)
Memory Capacity:	64Mbit Flash; stores over 1 million records
Communication Range:	150 ft
EMI/EFI immunity:	FCC Part 15
Power Source:	Self-powered; harvests magnetic field energy
Conductor Range:	1.5 inch max.; bare or covered wire
Housing Material:	High Density Polyethylene (HDPE)
Weight:	3.3 lbs
Operating Temp:	-40°C to 65°C
Encapsulation:	Weatherproof

### Dimensions (in.):



Catalog Number	Description
IQI-11	Distribution Line Monitor and Fault Recorder
IQ-USB	USB Interface and PC Software (XP/Vista/7 compatible)

Covered under Patents 7072163, 7187275, 7295133, 7710069B2, 7808400 and Patents Pending  
Specifications subject to change without notice

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## IQ Insulator®

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**Question:** **What is an IQ Insulator®?**

**Answer:** The IQ Insulator® is a smart electronic insulator that observes and logs events on overhead power distribution lines. It is the combination of the Vise-Top Insulator (pin-type) with a power-line monitor, called the IQ Sensor. It can detect, collect, record & transmit operational data for use in Load Profiling and Line Balancing. It can also detect and characterize line disturbance or fault events.

**Question:** **What operational data is collected?**

**Answer:** Normal operating current is continuously monitored and recorded at each user-defined log interval. Abnormal events trigger high-speed current waveform capture of thirty (30) cycles. All information is saved to non-volatile (permanent) flash memory to provide secure extended storage capability.

**Question:** **How does the IQ Insulator® recognize line faults or other disturbances?**

**Answer:** Advanced detection circuitry offers both adaptive and fixed modes of operation, including programmable thresholds and trip criteria. The IQ is preset for adaptive mode to suit many typical applications; however, it can be reconfigured for improved coordination with protection schemes. Abnormal or fault events trigger data & waveform capture and activate a visual (LED) indicator. The LED flash duration is preset at 2-hours and is adjustable to suit user preference.

**Question:** **How does the IQ Insulator® differ from Data Loggers and Faulted Circuit Indicators?**

**Answer:** The IQ builds upon the features of traditional electrical sensors and indicators by integrating wireless communications with high-speed microprocessors and a unique power supply, to provide user-programmable sensing & detection of line current conditions. These enhancements create a robust self-contained smart power-line monitor, suitable for permanent installation and maintenance-free operation.

**Question:** **What is required to access stored information?**

**Answer:** A laptop PC and a radio interface, called the IQ-USB, establish a short-range wireless communication link. The interface's embedded firmware and RF transceiver allow for viewing records and device settings. Records may be downloaded to the PC and analyzed using standard desktop applications, such as Microsoft Excel.

**Question:** **How does the IQ Insulator® operate without batteries?**

**Answer:** Two significant developments allow the IQ to bypass common power sources and eliminate the problems associated with batteries or external power supplies. It starts with patented energy collection and storage technology to harness power-line energy without a direct physical connection. Then a highly efficient electronic design is coupled to this power supply to minimize power consumption.

**Question:** **How long will the IQ Insulator® operate if lines are out for extended periods? Will line crews have a fault indicator to locate problems?**

**Answer:** During normal conditions, the IQ stores reserve energy that allows it to ride through service outages. This provides sufficient energy to power the LED fault indicator for its maximum setting of eighteen hours on de-energized circuits. When extended outages occur, internal controllers suspend monitoring activity and switch the sensor to a low-energy standby state. When power is restored, the sensor will wake-up and resume its prior monitoring activity.

**Question:** **Our network has several voltage classes and conductors sizes, with wide ranging circuit ratings and protection systems, how many different models will be needed?**

**Answer:** The sensor body of the IQ is interchangeable with all VT Insulator sizes and designed to operate on any system up to 35kV, with either bare or covered conductors up to 1.5" diameter. Each sensor is user programmable, allowing customization to fit your specific application. And it can be wirelessly reprogrammed while in service to adapt to your changing system needs.

**Question:** **What is the life expectancy and recommended maintenance?**

**Answer:** There are no batteries or other parts requiring maintenance or replacement. All sensors are self-contained devices, so they can form a permanent maintenance-free solution for continuous monitoring of the power delivery network. Housings are made of the same high-density polyethylene used in our insulators, with over 40 years of proven field experience. Based on electronic design criteria, component selection and manufacturing process, a lifetime of over 15 years is anticipated.

**Question:** **If product upgrades are developed, would installed units be rendered obsolete and require replacement?**

**Answer:** Software upgrades could be developed to further enhance product flexibility and functionality. Each IQ is equipped with boot loader capability that allows for software upgrades to be uploaded wirelessly.

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# **IQ Insulator<sup>®</sup>**

power-line monitoring technology

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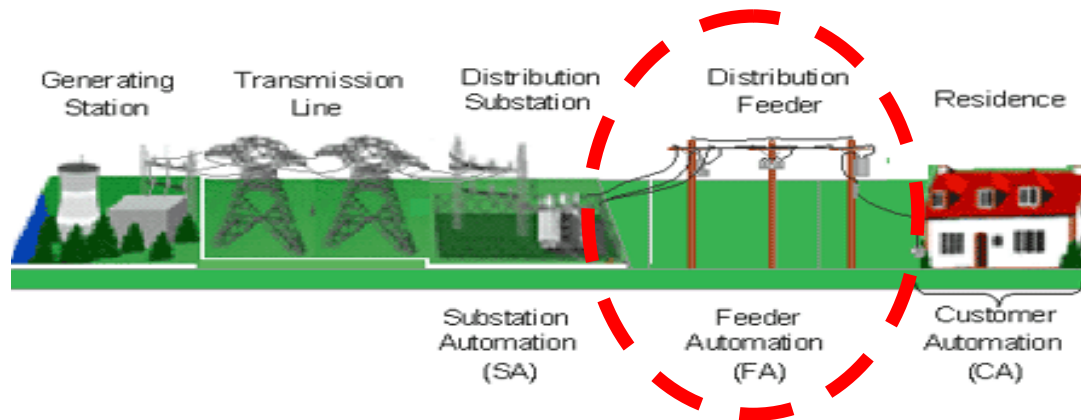
**Hendrix Molded Products**  
**Marmon Utility LLC**



A Marmon Wire & Cable/Berkshire Hathaway Company

# IQ Insulator®

- ❖ New Technology for building a Smarter Grid
  - Advanced sensors with wireless communication



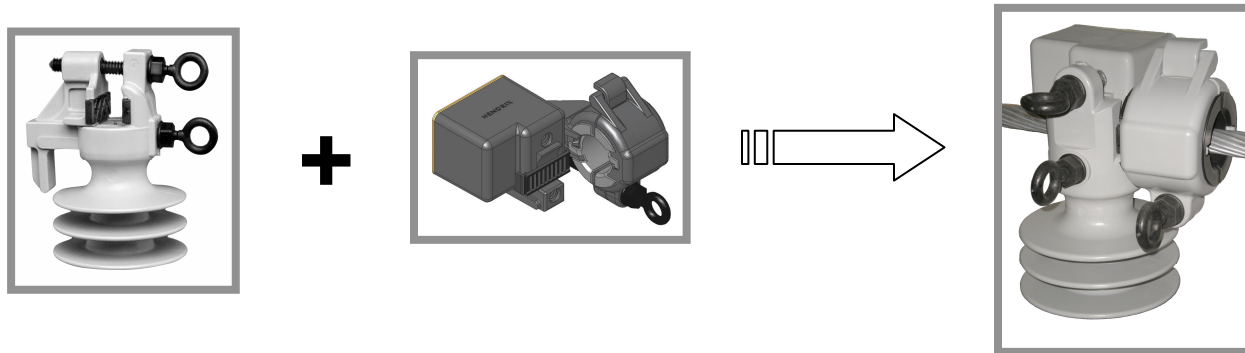
- ❖ Application Focus on Overhead Distribution Monitoring
  - Intelligent      Circuit Profiling & Event / Fault Recording
  - Flexible          User-defined parameters
  - Sustainable      Maintenance-free device, No Batteries



# IQ Insulator<sup>®</sup>

## ❖ IQ Insulator<sup>®</sup>

- HPI Vise-top Pin Insulator + IQ Sensor
- New Construction or Retrofit, Bare or Covered



## ❖ IQ USB – Communications Interface

- RF Transceiver for PC
- Embedded Firmware
- PC Application Software



# IQ Technology

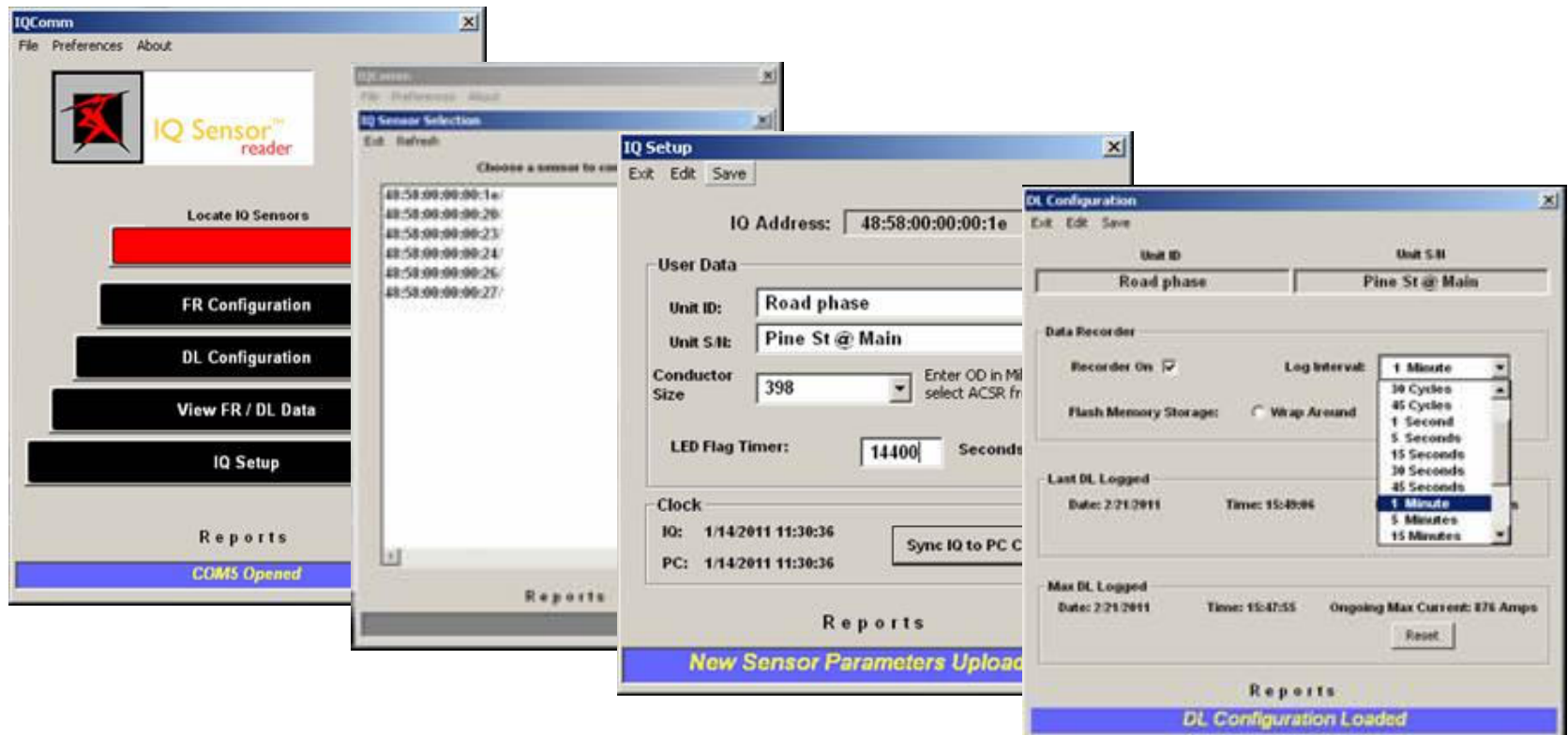
## ❖ Embedded System Design

- **Sensor ICs**  
High-speed Current measurement
- **Advanced Microcontrollers**  
nanoWatt technology, CPU, A/D conversion,  
Real-Time Clock, High-endurance Flash/EEPROM
- **RF Communications**  
License-free 900 MHz Wireless  
Range to 150 ft
- **Power Supply**  
Harvests magnetic field energy – no hard line connection,  
no external supply, and no battery



# IQ Operation

- ❖ Search, Set-up & Configuration Options
  - User-defined ID and behavior
  - Programmable Data Logger and Fault Recorder

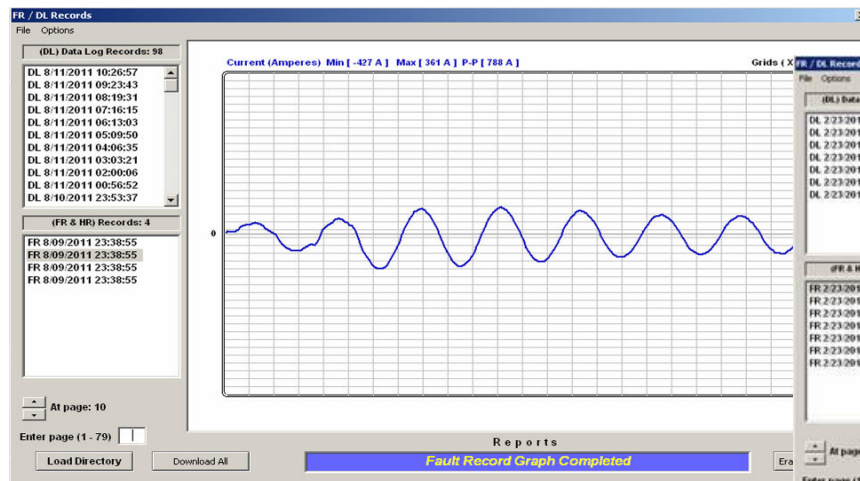


# IQ Operation

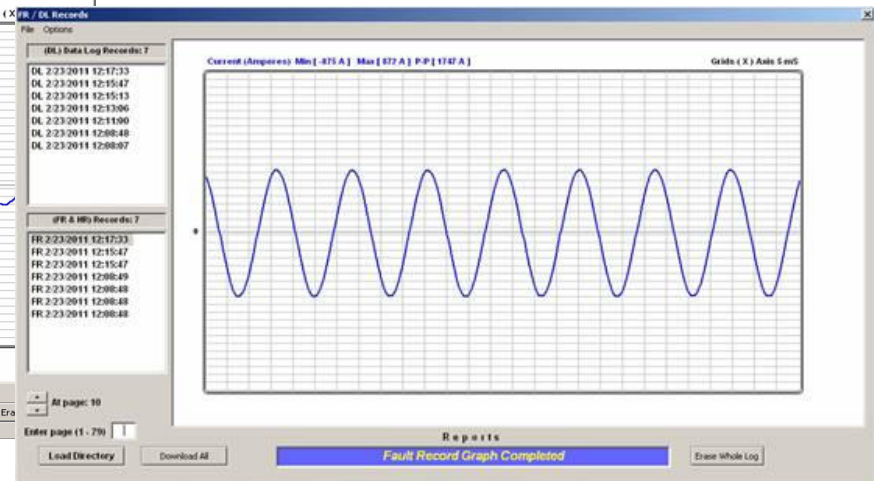
## ❖ Event Records

- Line Fault or Snapshot (manual trigger)
- Waveform capture – sampling rate 32/cycle
- Stored in non-volatile flash memory

*Trip Example*



*Snapshot Example*



# IQ Operation

## ❖ Save & Download Records

- Transfer files (TSV format) to desktop
- Graph data with Excel templates

middle phase	7/8/2011 22:30	-2250000	51	0	87
middle phase	7/8/2011 22:30	-2232000	48	0	87
middle phase	7/8/2011 22:30	-2214000	46	0	88
middle phase	7/8/2011 22:30	-2196000	49	0	88
middle phase	7/8/2011 22:30	-2178000	49	0	88

### Data-Log Example

5-min  
intervals

1-week  
profile

middle phase	7/8/2011 22:30	-1656000	51	0	83
middle phase	7/8/2011 22:30	-1638000	53	0	84
middle phase	7/8/2011 22:30	-1620000	53	0	83
middle phase	7/8/2011 22:30	-1602000	49	0	82
middle phase	7/8/2011 22:30	-1584000	47	0	82
middle phase	7/8/2011 22:30	-1566000	56	0	82
middle phase	7/8/2011 22:30	-1548000	50	0	82

