

EAT•N

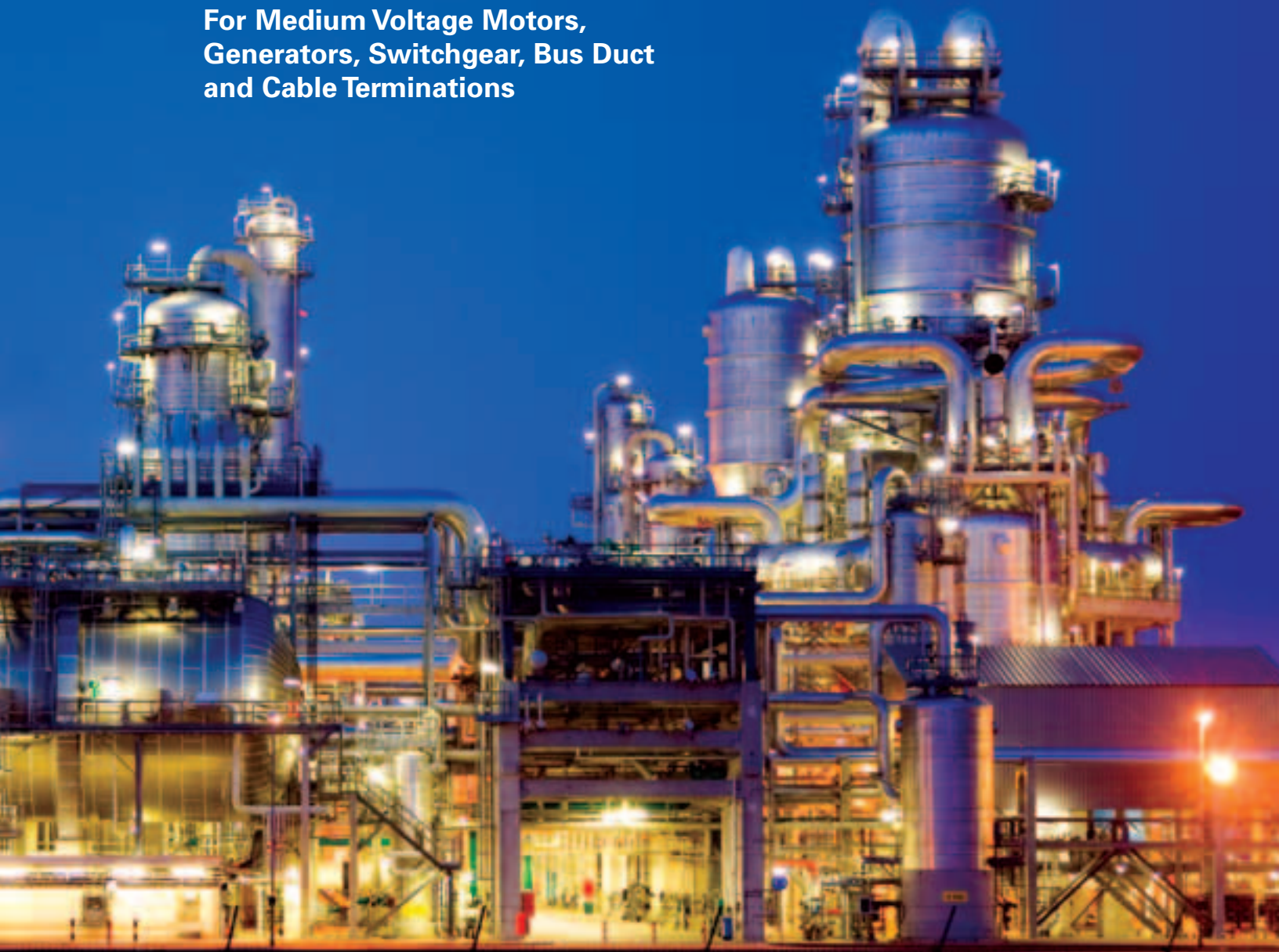
Cutler-Hammer

InsulGard™

Product Focus

Maximize Your Uptime

**For Medium Voltage Motors,
Generators, Switchgear, Bus Duct
and Cable Terminations**



InsulGard



1. InsulGard (Front)

2. InsulGard (Back)

Why InsulGard™?...Economics and Safety

Insulation failures cost time and money. What's even more damaging is that insulation failures lead to arc flash events, equipment failure, unscheduled outages, or worst of all, accidents involving personnel.

Mitigate Your Risk

Eaton's Cutler-Hammer® InsulGard system predicts insulation failures BEFORE they occur.

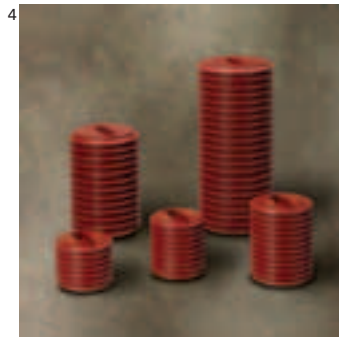
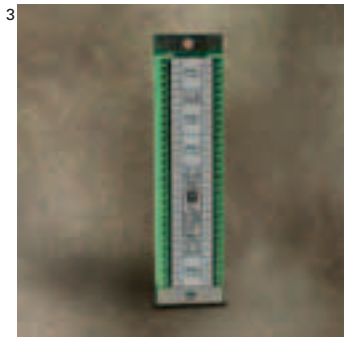


3. Resistive Temperature Device Sensor for Rotating Equipment

4. 95 kV BIL Rated Partial Discharge Sensing Coupling Capacitors Available from 5 – 38 kV

5. Radio Frequency Current Transformer for Partial Discharge Detection

6. Typical Rotating Machine Application



How Does it Work?

By measuring partial discharge activity in medium voltage equipment, InsulGard provides intelligence about the wellness of electrical insulation, enabling better decision-making for managing electrical assets and increasing safety for plant personnel.

What is the Payback?

The average cost of motors, generators and switchgear can range from \$100k to many millions, and if that station is shut down, that loss can be catastrophic. In addition, buying equipment is only part of the expense to replace it.

Protect Your Investment

In many circumstances, InsulGard can double the equipment life span.

InsulGard Can Maximize Your Uptime

InsulGard is a more economical alternative for maintaining electrical power equipment.

Eliminate Periodic Scheduling of Downtime to Perform Tests and Time-based Maintenance Leading to Customer Inconvenience

The InsulGard Predictive Relay revolutionized predictive maintenance practices by introducing one *continuous, on-line* partial discharge (PD) monitoring system designed for the following medium voltage applications:

- Generators
- Motors
- Switchgear
- Unit substation dry-type transformers
- Bus duct
- Cable connections

- *Continuous* eliminates the chances of failures occurring between periodic test events.
- *On-line* eliminates the inaccuracies of off-line tests.
- InsulGard also reduces the level of expertise required to analyze PD data with user-friendly software.

InsulGard Technology Works for You 24/7, 365 Days a Year — Reliable Support You Can Count On

The InsulGard system detects partial discharge (PD) activity on-line, with the entire electrical system energized — no off-line testing necessary. It analyzes radio frequency (RF) signals emitted by the partial discharge

pulses and measures pulse quantity and magnitude, then correlates the data to temperature, humidity and various other electrical system dynamics. If PD levels exceed programmable set points, alerts are initiated. With or without alerts, you can quickly view or analyze trends using InsulGard software.

The predictive relay works as a single, local device or in a communication network with multiple devices.

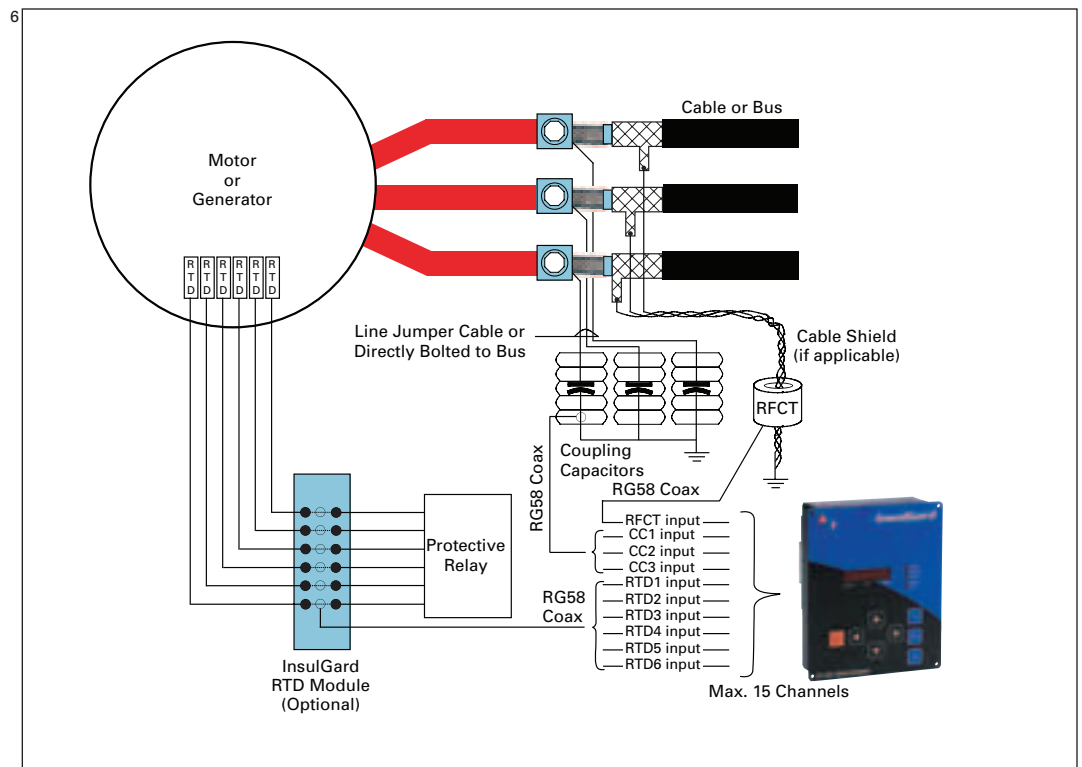
The most commonly used sensors include Coupling Capacitors and Radio Frequency Current Transformers (RFCTs). For rotating machinery, such as generators and motors, additional sensing technologies are available.

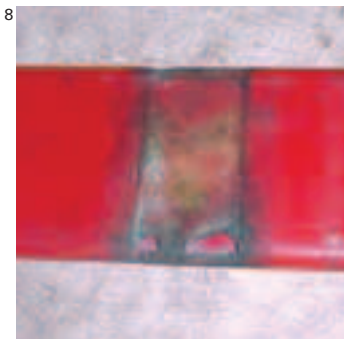
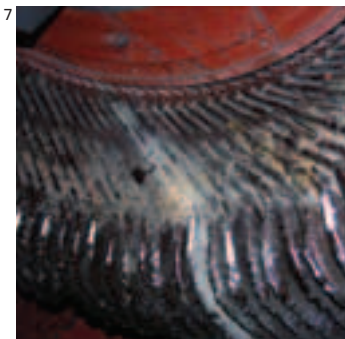
For sites with pre-existing sensors, the InsulGard Predictive Relay is fully compatible and can be instantaneously commissioned.

InsulGard Features and Benefits

- Advanced filters and three noise algorithms provide clarity in the PD signal, which leads to quicker and easier diagnostics.
- InsulGard can operate in a lower RF bandwidth of 1 – 20 MHz.

This bandwidth provides a broader sensing range for identification of more partial discharge activity that higher bandwidths can completely miss.





7. Corona Damage on the Motor Windings

8. Damage to Bus Caused by Air Gaps Within Bus Support

9. Typical Switchgear Application

InsulGard is the Ideal, Advanced-Warning Solution

Where Can the InsulGard System be Used?

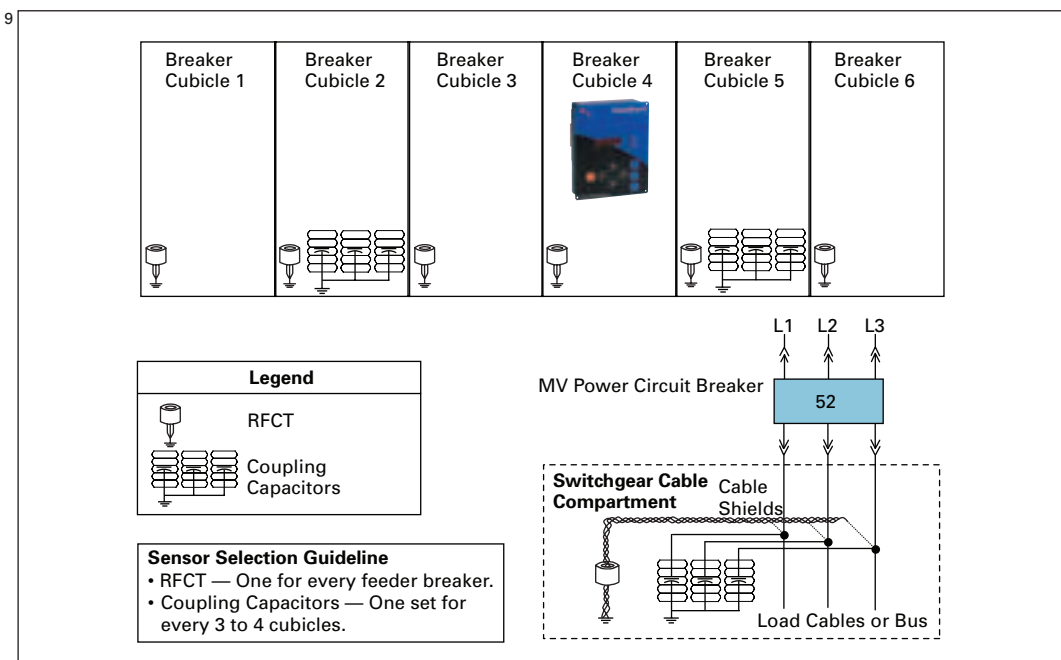
Generators and Motors

Available sensors for rotating machinery include Coupling Capacitors and RFCTs. The traditional sensor of choice is the coupling capacitor and with this sensor alone, InsulGard technology provides much broader coverage of the stator winding when compared to the competition. An optional RTD module takes advantage of a third PD sensing technology that dramatically increases the coverage of the stator winding for maximum coverage.

Customers can take advantage of the RTD circuits, using them as PD antennae, with the InsulGard technology. There is no additional cost to install RTDs, and they connect to the InsulGard Predictive Relay through the RTD module. The RTD module is fully compatible with makes and models of protective relays, so no RTDs are sacrificed for their normal purpose. Used alone or in combination, the PD sensors, along with sensors for humidity, load and temperature, connect to the InsulGard Predictive Relay for monitoring, data collection and analysis.

Problems that partial discharge analysis can detect within rotating equipment include:

- Early stages of insulation deterioration
- Sparks in voids and between windings
- Corona on end windings



Switchgear and Unit Substation Dry-Type Transformers

Available sensors for switchgear include Coupling Capacitors and RFCTs.

Coupling Capacitors detect partial discharges within cubicles and typically connect to the load side of the feeder breakers or on the main bus.

RFCTs identify partial discharges related to the feeder cables and connect around the cable shields.

The same sensors apply to power center transformers, cable terminations and bus duct.

Problems that partial discharge analysis can detect within switchgear apparatus include:

- Discharges in air gaps (between bus and support window, etc.)
- Surface tracking (on supporting isolator or bus insulation surface)
- Sparks within insulation voids

- Insulation problems in cable terminations and connected equipment
- Poor electrical connections (floating potentials)
- Defective current transformers and potential transformers
- Incoming bus ducts

10. Simplified PD Process

11. InsulGard Software

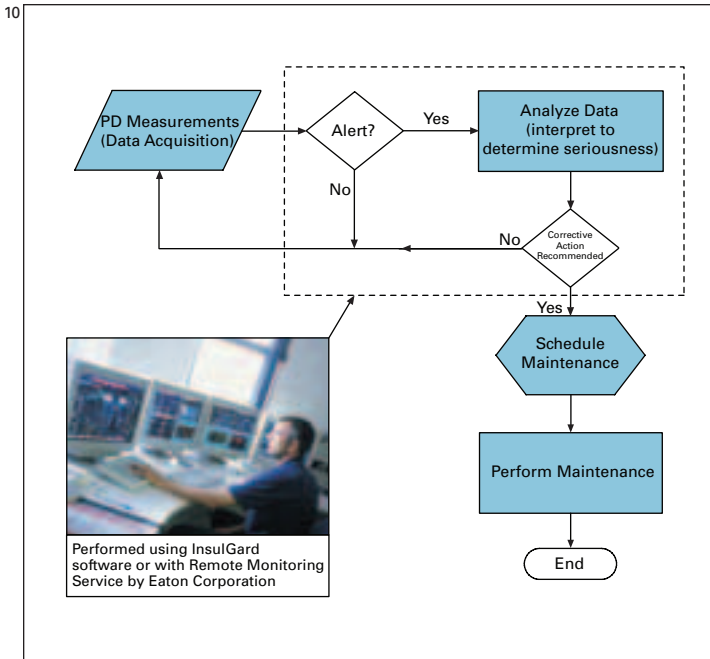
Screen shot showing the seasonal affects of PD measurements on a motor application.

12. InsulGard Software

Screen shot showing the PD before and after a generator stator repair.

13. InsulGard Software

Screen shot for identification of early-stage corona damage occurring to bus in 15 kV switchgear. InsulGard software automatically combines both pulse magnitude and pulse repetition rate to display PD Intensity (PDI), expressed in mW of lost energy.

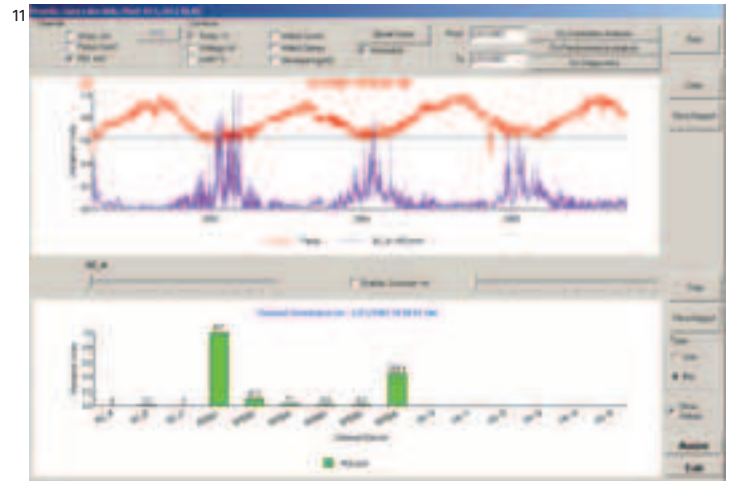


Software and Remote Monitoring

InsulGard software provides remarkably easy viewing, charting, analyzing and reporting of all PD-related data and trends.

Customers can independently analyze their data, or Eaton offers remote monitoring service contracts.

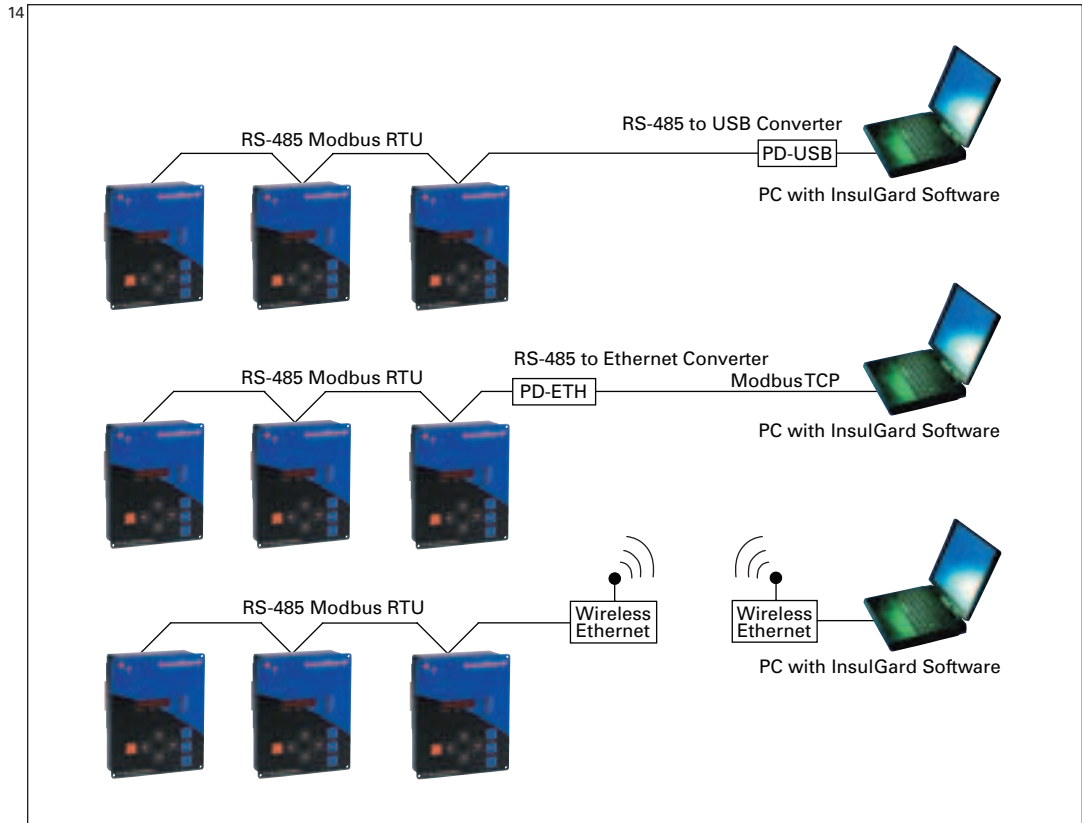
Eaton does offer PD training for customers who want to understand more detail.





Communications and Connectivity

InsulGard connects to a local PC using an RS-485 to USB adapter. Standard features include an isolated RS-485 port with Modbus® RTU Protocol for local or remote communications. An isolated 4 – 20 mA output provides a signal proportional to whichever channel contains the largest amount of PD. Event monitoring warnings are provided with standard dry-contact relay outputs. Communication options include Industrial Modems, Ethernet and 802.11 Wireless Ethernet.



For Technical Specifications and Additional Information

Please contact your local Eaton representative or visit our Web site at <http://www.partialdischarge.com/>.



Eaton's electrical business is a global leader in electrical control, power distribution, uninterruptible power supply and industrial automation products and services. Eaton's global electrical brands, including Cutler-Hammer®, Powerware®, Holec® and MEM®, provide customer-driven PowerChain Management® solutions to serve the power system needs of the industrial, institutional, government, utility, commercial, residential, IT, mission critical and OEM markets worldwide.

Eaton Corporation is a diversified industrial manufacturer with 2006 sales of \$12.4 billion. Eaton is a global leader in electrical systems and components for power quality, distribution and control; fluid power systems and services for industrial, mobile and aircraft equipment; intelligent truck drivetrain systems for safety and fuel economy; and automotive engine air management systems, powertrain solutions and specialty controls for performance, fuel economy and safety. Eaton has 62,000 employees and sells products to customers in more than 125 countries. For more information, visit www.eaton.com.

Eaton Corporation
Electrical Group
1000 Cherrington Parkway
Moon Township, PA 15108
United States
877-ETN-CARE (877-386-2273)
Eaton.com



PowerChain Management is a registered trademark of Eaton Corporation. Cutler-Hammer is a federally registered trademark of Eaton Corporation. NEMA is the registered trademark and service mark of the National Electrical Manufacturers Association. Modbus is a registered trademark of Modicon, a division of Schneider Electric Industries SA. InsulGard is a trademark of Eaton Corporation.

EATON

Cutler-Hammer

© 2007 Eaton Corporation
All Rights Reserved
Printed in USA
Publication No. BR02713001E / Z6050
November 2007