

GE Consumer & Industrial
Electrical Distribution

Entellisys™ Low-Voltage Switchgear



The difference Entellisys™ makes for you

Entellisys™ is a major breakthrough in the evolution of power distribution protection by low voltage switchgear: an integrated system whose protection, control, monitoring and diagnostics are based on synchronized, real-time information from every circuit breaker, simultaneously processed in one place.

Entellisys provides uniquely powerful capabilities for advanced protection and control functions to interact and eliminate the long-standing compromise between selectivity and protection that ordinary systems force designers to make.

Entellisys, SCADA and PMCS

The rich information Entellisys delivers on the health of your power system and the comprehensive protection it provides far exceed the capabilities of traditional SCADA or PMCS systems.

Entellisys also lets you interact with the system in ways not easily achieved with traditional technology.

Some of the differences Entellisys can make for you:

- Advanced Zone-based Protection gets around the need for cascaded time delays.
- Bus differential protection can detect faults below the gear's full current rating.
- Zone interlocking can interlock an instantaneous trip with a short time trip.



- Advanced Zone Based Protection functions without incremental hardware or wiring to deliver . . .
 - GFI in systems with multiple solidly grounded sources.
 - Selective protection without need for cascaded time delays.
- Comprehensive arc flash energy safety:
 - Near-gear and remote user interface options can be outside the arc energy zone.
 - Reduced energy let thru settings allow minimum time delay settings to operate at the main bus on command.
 - A remote racking device can be used on breakers and keeps the user outside the arc energy.
- Real-time system visibility and monitoring:
 - Waveform capture from every breaker synchronized across the system within microseconds.
 - Time stamped event record including device events, circuit events and the Entellisis electronics.
 - Over 550 different event classifications can be captured thousands at a time, each time stamped and fully identified.
- Late point identification for fast, flexible design and installation:
 - Control, metering and protection configuration can be changed at any time with equal ease, whether at the design stage, during installation or years after commissioning.
- Intuitive HMI reduces opportunities for operator error:
 - All system information and interaction come through an intuitive user interface with easily navigated screens.
 - Change any system setting, including protection, control, metering and monitoring, from a common HMI, whether at the gear, near the gear or at a remote location.



Advanced protection

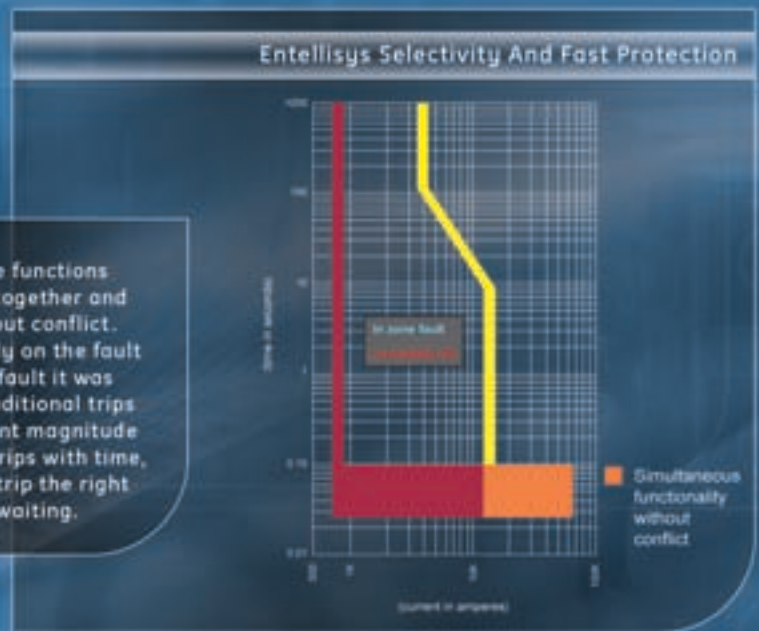
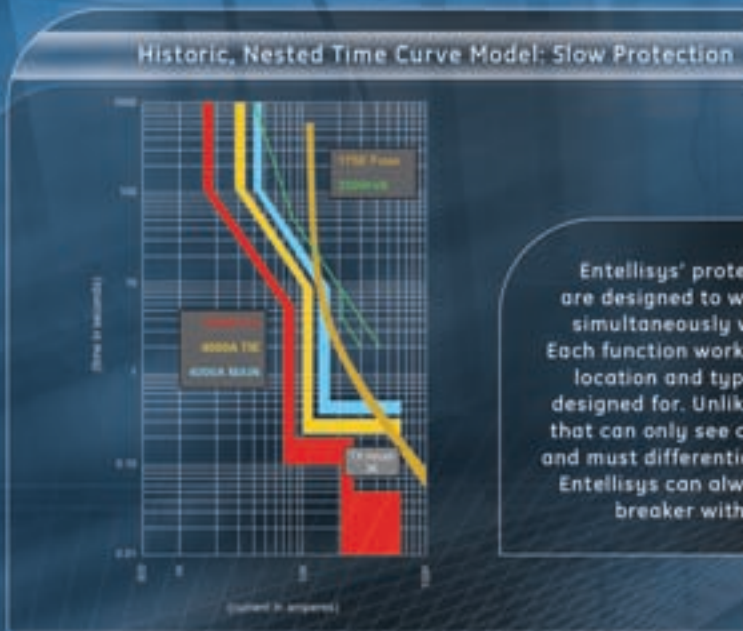
In addition to basic over current and relay protection, Entellisys is the only low voltage switchgear with efficient, advanced multiple source ground fault protection, zone based protection and settings that can change based on the active sources at any one time. Entellisys ensures fast fault interruption despite fault magnitude while maintaining complete selectivity. Fast fault clearing reduces potential incident energy.

Comprehensive fault protection for bolted faults, arcing faults and overloads

Available as software options thru the HMI on the base system, bus differential, zone interlocking and multi-source ground fault protection complement traditional over current protection and

virtually eliminate the need to sacrifice fast protection for selectivity, or vice versa.

1. Dynamic zone based protection complements traditional time current and fixed delay protection, yielding selectivity and fast fault clearing. Entellisys lets line side mains and ties dynamically set delays best fitting each fault location whether it's in or out of the device's protection zone, regardless of fault magnitude, source variance or tie configuration within the system.
2. Entellisys provides comprehensive fault protection from high impedance arcing faults to the largest bolted fault expected, selectively clearing the circuit in minimal time every time. Detecting faults earlier at lower currents and reducing clearing times, Entellisys can lower the total energy of arcing or bolted faults within the switchgear.



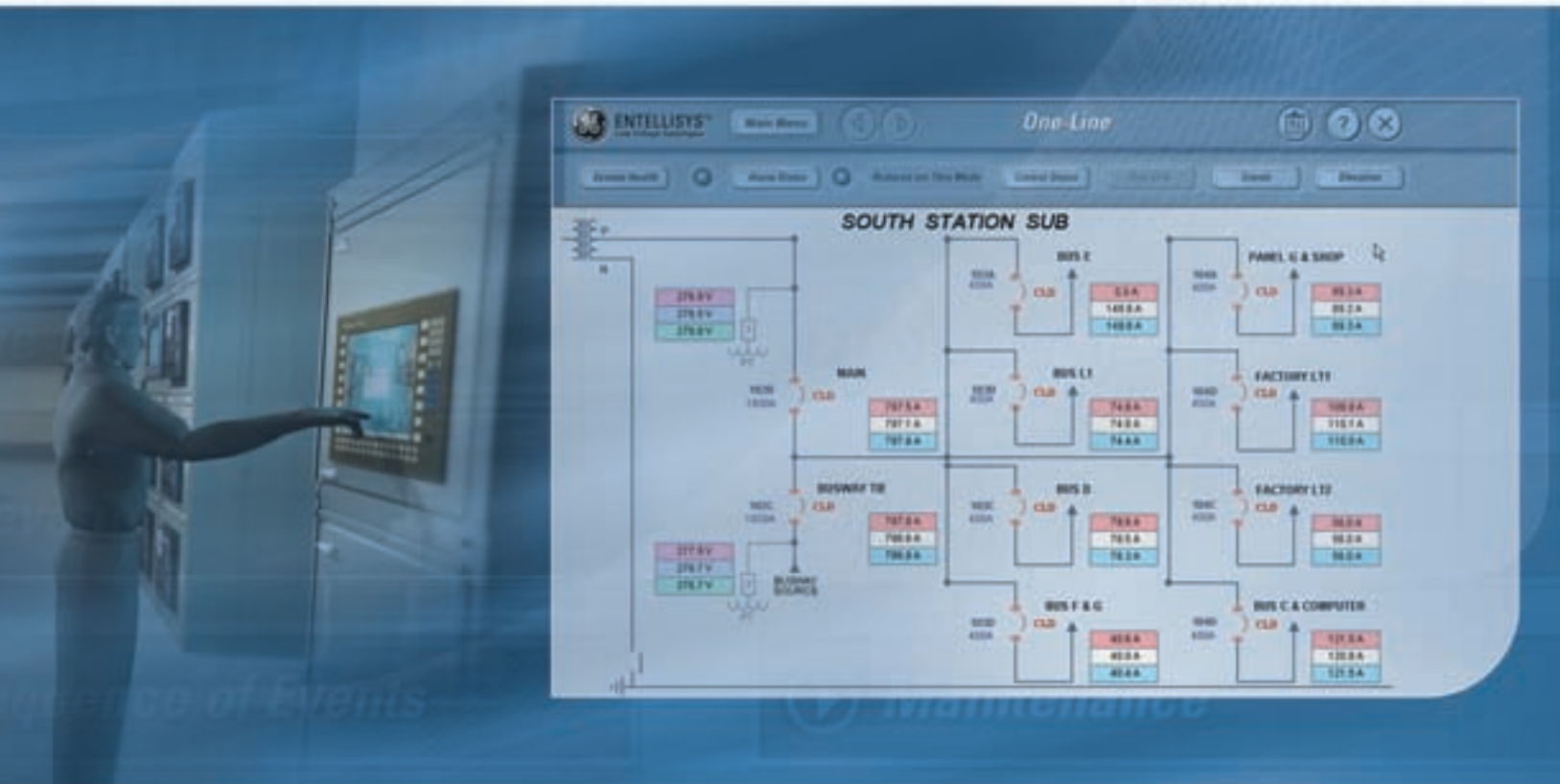
Real-time system visibility

Entellisis' three HMI options provide full control and monitoring with interactivity and complete system visibility to synchronized real-time information from every breaker:

1. On gear HMI is the standard configuration.
2. Near gear HMI in a stand-alone or wall mount unit can be placed well beyond the arc flash boundary.
3. HMI interface installed on a remote desktop or laptop PC connected via a LAN or the Web.

The ability to locate complete control and monitoring away from the arc flash boundary can increase safety and provide complete operational power to the remote user. Multiple security levels allow different types of users to have varying levels of access to information and control of the equipment.

With each HMI, you interact with the system through an integrated set of activity windows, including a dynamic one-line, elevation view, circuit breaker details, metering data, waveforms, system health, events, alarms, preventive maintenance information and user settings for protection as well as discrete I/O, control and more.



Entellisys vs. traditional switchgear: Simple is better

Entellisys marks a historic turning point in the control, monitoring and protection of power distribution systems and personnel. Entellisys flexibility satisfies today's needs and accommodates tomorrow's changing demands.

The problem

Historically, advancements in power distribution protection, control and monitoring have seen developments in multiple separate components: circuit breakers and the trips controlling them, PLCs controlling the circuit breakers and meters measuring the circuits. Switchgear has deployed electronic relays, meters and multiple special purpose devices to gather, analyze and display information, and in some cases control

circuit breakers. But this solution forces multiple, independent devices to execute multiple, independent actions.

To provide centralized monitoring or control, the devices must connect to a central computer, such as a SCADA system, or be part of a distributed control system. Such solutions yield better control and productivity, but have limited effect on protection. Plus, they create costly, increasingly complex systems with substantial wiring and other limitations.

A more fundamental problem? Circuit protection still depends on individual devices looking at mere subsets of the available information.



Above: Traditional switchgear wiring. Right: Entellisys' greatly reduced wiring means many fewer terminations and faster, easier installations.



Re-thinking switchgear: covering today's needs and tomorrow's changes

To dramatically increase protection for equipment and personnel alike, to make power distribution and the facilities served more reliable and productive, and to simplify system design, installation and maintenance—we re-architected the system.

Entellisys' central architecture integrates redundant industrial computers as the "brain," with redundant, high speed, deterministic communications networks routing raw current readings from highly accurate sensors at each breaker.

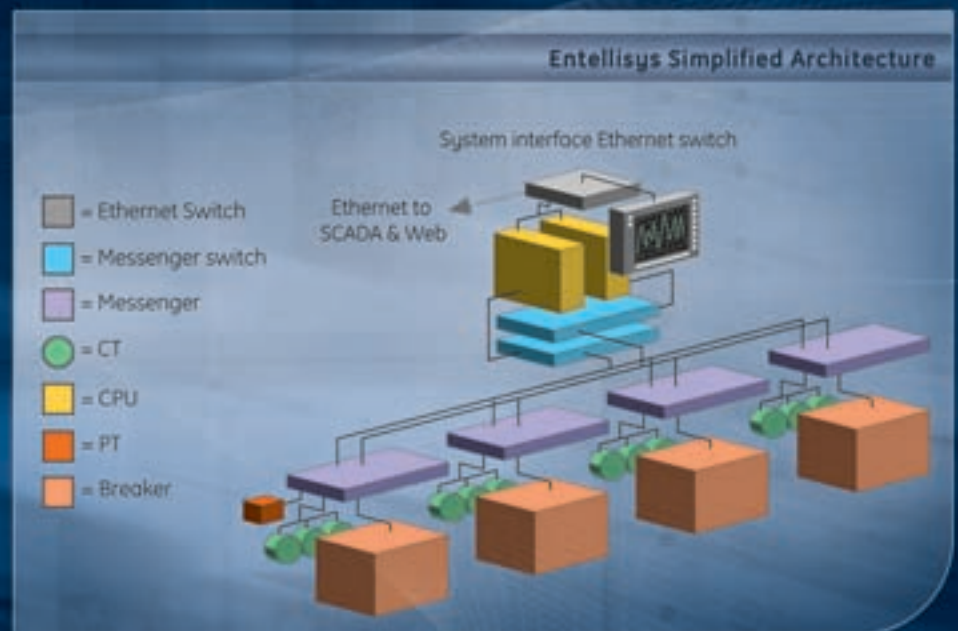
The Entellisys base platform needs minimal components. Software modules provide the system's unique functionality, including faster, easier upgrades. Entellisys can add or change features without adding hardware.

For instance, you can add or change a metering function from feeder to main from the HMI. Likewise, add or subtract protective functions for a member circuit breaker via the HMI (subject to UL listing limitations). Similarly, add a generator and ground the new source separately—without system hardware changes.

Furthermore, the Entelliguard™ breaker has been simplified to include fewer accessories while increasing functionality.



Above: Simplified Entellisys breaker compartment.



Entellisys: designed to make differences

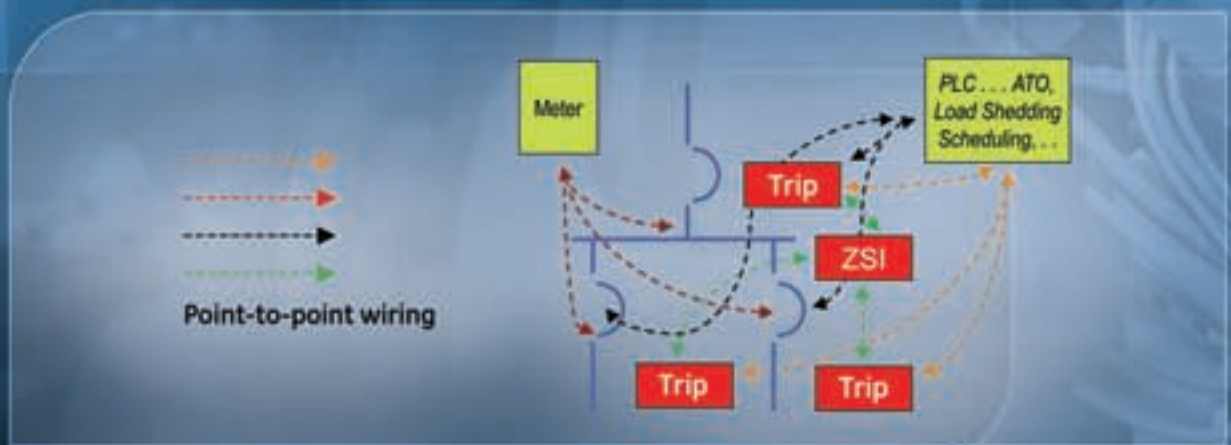
Historic, complex design

Grouped protective devices are the foundation of power distribution equipment. These devices have become more powerful and capable. But, regardless of the devices' capabilities, they are limited: They can only work with the information available from the circuit they are protecting. Each has its own trip mechanism, capable of considering only the current flowing through it.

Digital electronic trips have evolved into powerful special purpose devices capable of current and voltage measurements. For more sophisticated applications, communications be-

tween trips have enabled protective functions such as ZSI and even allowed central data reporting to computerized displays on board the equipment or to remote computers. Separate relays and meters are often employed to achieve better protection and metering. But this historical, incremental model weighs down systems with ever increasing complexity.

To use yesterday's metering and protection devices, a system designer must juggle many different electronic devices simultaneously. These devices often need to be connected to dedicated sensors or CT's; i.e., multiple sensors measure the same parameter but for different devices and purposes.



Traditional switchgear complexity; multiple trips with different information, all independent.

To get better performance, many of these devices must communicate with one another or to a central computer. Lacking adherence to a single industry wide standard makes intercommunication difficult. Designers have to sort through potential protocols and software packages to find a common denominator and software interfaces that can take the data received from the multiple devices and turn it into useful, understandable information. The process is complex and limited by tradeoffs, compromises and cost concerns.

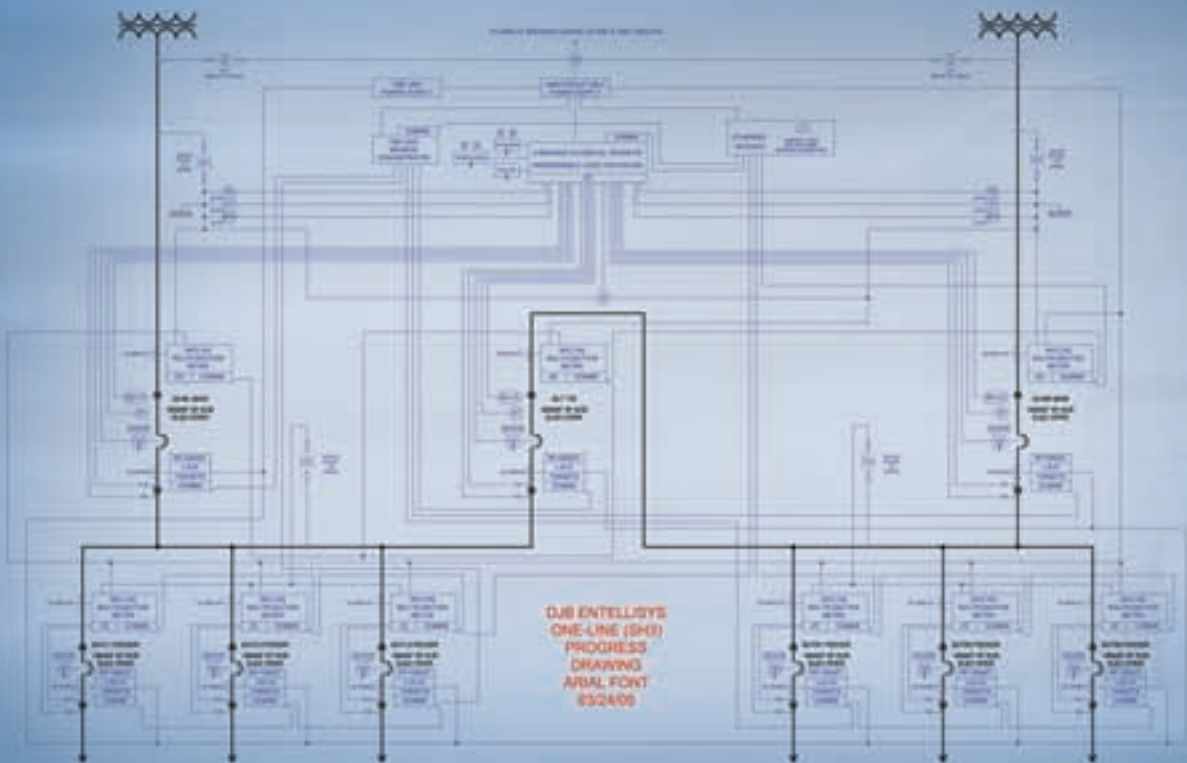
Streamlined for enhanced capabilities

Entellisys, on the other hand, was designed with simplicity as a primary virtue.

The CPU integrates raw current information collected in real time from each breaker as well as the voltage readings from each bus. The CPU also initiates most protection and all control functions. With Entellisys, system wide protection and control is based on system wide intelligence.

Current sensors (CTs) are located in each breaker compartment and feed Entelliguard messengers. Only one voltage transformer (PT) set per source is needed.

Furthermore, the redundant communications network allows the system to monitor itself, informing you of any problems while the system redundancy allows protection and control to continue uninterrupted.



System wide protection and control

Here is a summary of Entellisys' operations:

1. Accurate sensors read voltage at each bus, and current at each circuit breaker.
2. Messengers digitize and communicate this data to the CPUs, using redundant communications networks.
3. The CPU takes all the circuit and circuit breaker data from all the sensors, processing this system wide data with relevant algorithms for protection and control.

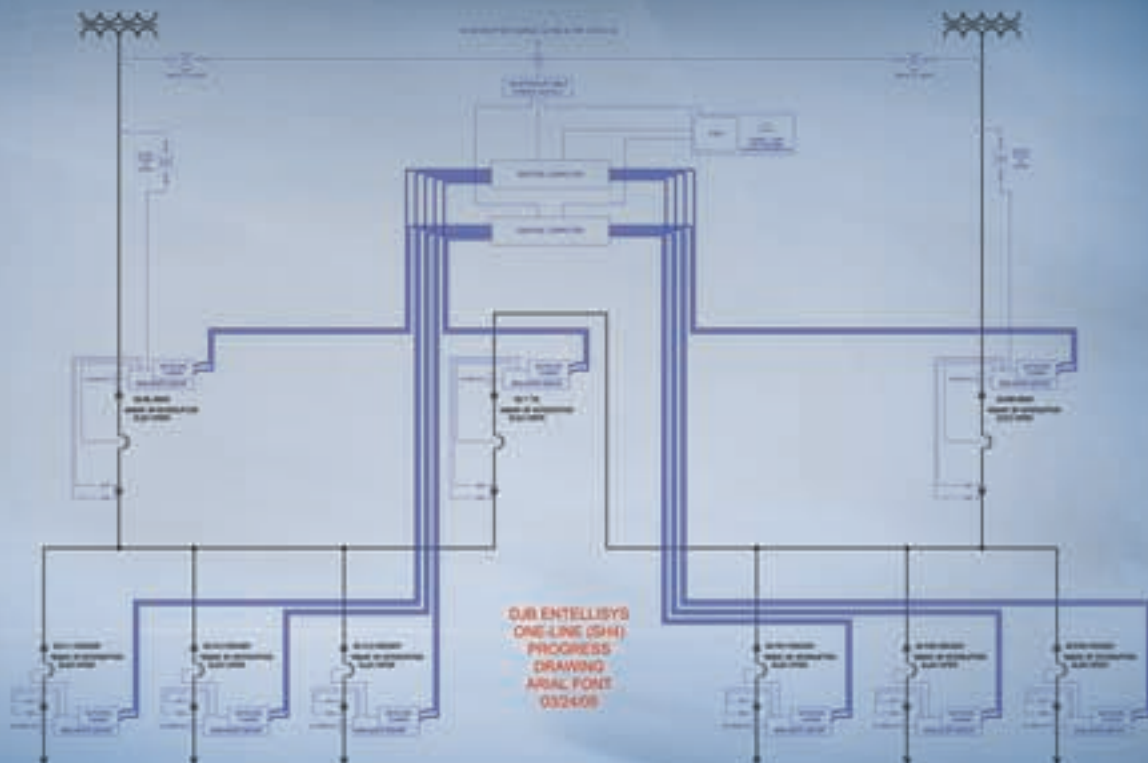
The CPU then issues the necessary commands to all the circuit breakers that require a status change based on protection or control needs. The key difference is that the CPU is able to look at all the data and make

decisions optimized on the entire system's need. A circuit breaker's trip unit is limited to one circuit's data.

System wide visibility and security

Entellisys communicates information to you via the HMI about the health of the power network it is protecting, as well as its own status. The HMI is a separate computer, letting you view the power distribution network and Entellisys as well as change protection, control, metering and other functions.

With HMI screen options at the gear, in a remote space or on a PC connected via the Web, locating full control and monitoring away from the arc flash boundary can increase safety. This also gives the remote user complete operational latitude.



Multiple security levels allow you to grant users varying levels of information access and equipment control. The system can track all changes to the setting—who made them and when. Supervisory personnel at a remote location can instantly review any change made locally. This enables solid control over your power distribution system even under emergency conditions.

The differences between Entellisys and conventional low voltage switchgear

Below are two sets of one-lines. The ones on the left show how a traditional system adds capabilities—and the complexity that goes with it.

On the right, you see how elegantly Entellisys provides the same functionality and more—while simplifying system components and maintenance. Entellisys decreases component counts, wiring and related maintenance. Entellisys also simplifies future expansion and any changes to system functions.



Reliability, uptime, system availability

To increase uptime, Entellisys uses a minimal number of standard components, reducing potential failure points and enhancing the overall availability of power at your loads.

Entellisys embodies simplification in pursuit of higher reliability. Entelliguard™ circuit breakers have been pared to essentials; less peripheral hardware and fewer relays, trips and other auxiliary devices mean fewer potential points of failure. Less wiring means fewer connections to worry about during installation, startup and over the life of the equipment.

Entellisys features system redundancy, from the control power to the CPUs and communications network. Each subsystem's back-up will take over immediately, providing no single point of failure for the system.

Built-in redundancy:

- Two CPUs capable of control and protection; each can flag other component failures, including the other CPU
- Two communications networks
- Two control power systems (UPS)
- Redundant, self powered, over-current backup protection at each circuit breaker



Comprehensive arc energy protection

Entellisys offers comprehensive safety options to protect operators and maintenance personnel from arc flash energy and other potential sources of harm:

- Using a LAN or Web connection, Entellisys remote HMI gives you complete system information as well as full system interaction wherever you are.
- Entellisys' near gear HMI, in either a stand-alone or wall mount unit, can be placed up to 250 feet away from the system, well outside the arc flash zone, giving you complete system information as well as full system interaction.
- The remote racking device lets operators rack a breaker in or out, up to 30 feet away from the breaker.
- Bus differential and zone based protection provide fast detection and clearing of low or high level bus faults without the need for cascaded time delays to achieve selectivity.
- Entellisys' reduced energy let thru settings, used in conjunction with bus differential protection, make it easy to set the system to minimum settings when personnel must be close to the gear.



Diagnostics

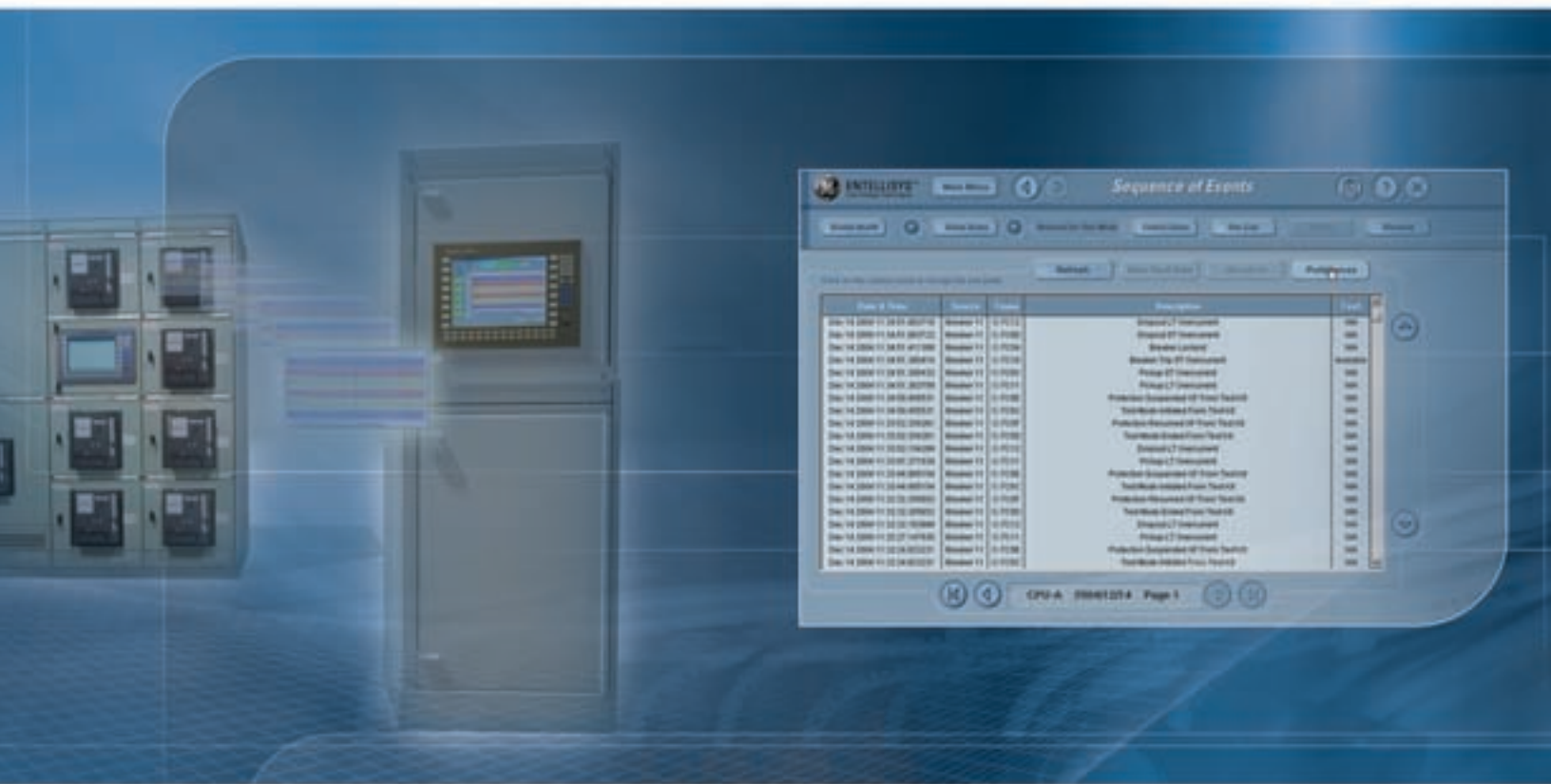
Entellisys enables real-time visibility into both the health of your power distribution network and Entellisys itself.

- Entellisys offers synchronized, system wide waveform capture, fault report and event log. Traditional gear offers waveform capture only on a breaker by breaker basis, typically limited to the mains and selected feeders.
- Using current and voltage waveforms before, during and after an event for each breaker, Entellisys enables root cause analysis of disturbances rippling through your system.
- Entellisys records the history of manual and commanded trips as well as faults. Entellisys distinguishes between manual opening and operator generated opening from any user inter-

face, and internal algorithms that caused a breaker to trip. Entellisys records the history of actual fault conditions, showing you exactly what occurred at each breaker—and exactly when it happened.

Maintenance:

- Entellisys enables predictive and prescriptive breaker maintenance based on exactly how much use the device has seen. It alerts you via the HMI or e-mail when maintenance might be needed based on actual circuit data and thresholds you chose.
- You can optimize maintenance based on need rather than schedule, reducing maintenance costs and equipment downtime while increasing equipment reliability.



Flexibility, flexibility and flexibility

Entellisys redefines flexibility in system design, installation, maintenance, upgrades—and most importantly, lifetime value:

- The Entellisys low voltage switchgear system has field upgradable protection, control and monitoring without hardware changes.
- When adding a breaker or changing the load on a particular breaker, you can also add complete circuit protection, monitoring, control and metering without additional wiring.
- Mobile metering lets you assign metering to any circuit without additional CTs, wiring or system shutdown.

- A wide range of metering capabilities is available—from basic volts and amperes to demand and harmonics.
- Entellisys' flexibility lets you make important design decisions even after the equipment is installed, accommodating last-minute changes in load or operational conditions during the construction phase. You can also make changes after owning the equipment for years.



Summary info

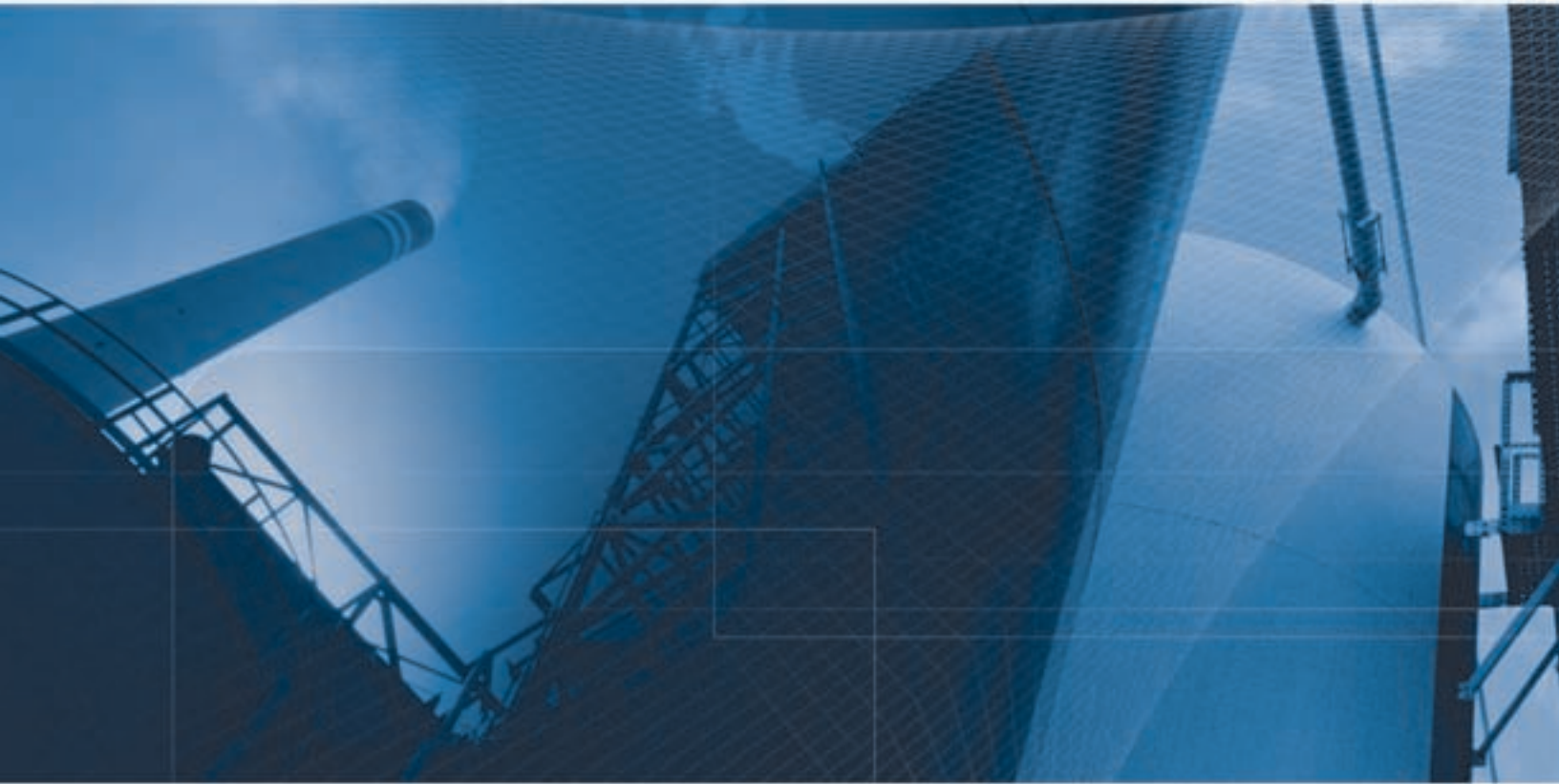
Entellisys is low voltage switchgear designed for the 21st century: an intelligent system with advanced protection and control for intelligent facilities where real-time visibility matters.

Entellisys is fast and easy to design, install, operate and maintain.

Entellisys is reliable.

Of course, no amount of information can take the place of experience and personal evaluation.

You can begin the Entellisys experience yourself by reviewing any materials included with this brochure. For complete technical information, see the Entellisys Application Guide and other resources at <http://www.geelectrical.com>.



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