

# Multilin 850R

## Recloser & Switch Controller

The Multilin 850R is a fully integrated universal recloser/switch and sectionalizer controller for overhead applications, delivering comprehensive performance in protection, monitoring, control, and automatic configuration of distribution networks.

At the core of the Multilin 850R is an integrated module comprised of driving electronics, capacitor and battery charger, an uninterrupted power supply eliminating the need for an external module. This optional module delivers high-speed operation, thereby ensuring true multiple-shot capability. This module also enables the Recloser Coil Circuit Supervision, Capacitor voltage alarm, and battery testing and monitoring features with Recloser/Switch health monitoring to ensure reliable performance.

With support for various settable capacitor charging voltage levels based on primary recloser, the 850R can be used with several leading reclosers.

### Key Benefits

- Multifunction Distribution Automation Controller with Recloser/Switch/Sectionalizer (Tie-Bus) control for overhead applications
- Improved distribution network reliability with a fast and reliable dynamic tripping and 4 consecutive shot 1-Phase or 3-Phase Autoreclosing
- Supports 6 Low Energy Analog (LEA) or 4 traditional voltage Inputs
- Autoreclosing integrated high speed driving electronics board with capacitor and battery charging capabilities
- 5 shot switch control function included within the control
- 6 setting groups gives flexibility in building FDIR/FLISR logic as well as loop schemes for 1/3 pole operations, improving system reliability
- Adaptive reclose with zone/sequence coordination
- Support for 41 recloser curves
- Flexibility to assign the current and voltage terminal configuration to match the primary recloser and user terminal configuration
- Integrated Distribute Energy Resources (DER) management including local islanding features to achieve IEEE 1547-2018
- Comprehensive power quality monitoring as per IEEE 519
- Real time asset monitoring for increased reliability and optimized asset life
- Remote device management and easy maintenance with secure WiFi connectivity

### Applications

- Tested to operate with G&W, ABB T&B and Cooper Nova Reclosers
- Recloser controller/ switch controller/tie switch for multi-applications
- Retrofit for existing recloser installations (G&W, ABB T&B and Cooper)
- Retrofit for existing switch controllers (DART replacements for S&C Switches)
- Distribution Automation



### Innovative Technology & Design

- Universal Recloser controller with built-in Driving Electronics, Battery Charger & Monitoring system, Capacitor Charger
- Switch control functionality including Auto Sectionalizing
- 1P/3P control with FDIR/FLISR logic and IEC 61850 GOOSE
- FlexElements/Logic to help build customize complicated reclosing schemes
- Broken conductor & transient ground fault detection for safer overhead distribution
- Fast Under Frequency element for rapid load-shedding
- DER/Renewable interconnections to comply regional Grid Code using customizable under-voltage functions (e.g. 27T, 27Q)

### Embedded Cyber Security

- Built-in cyber security features enabling NERC/CIP compliance & Achilles Level Certified
- AAA Server Support (Radius/LDAP)
- Role Based Access Control (RBAC)
- Syslog
- Encrypted (SSH)

### Advanced Communications

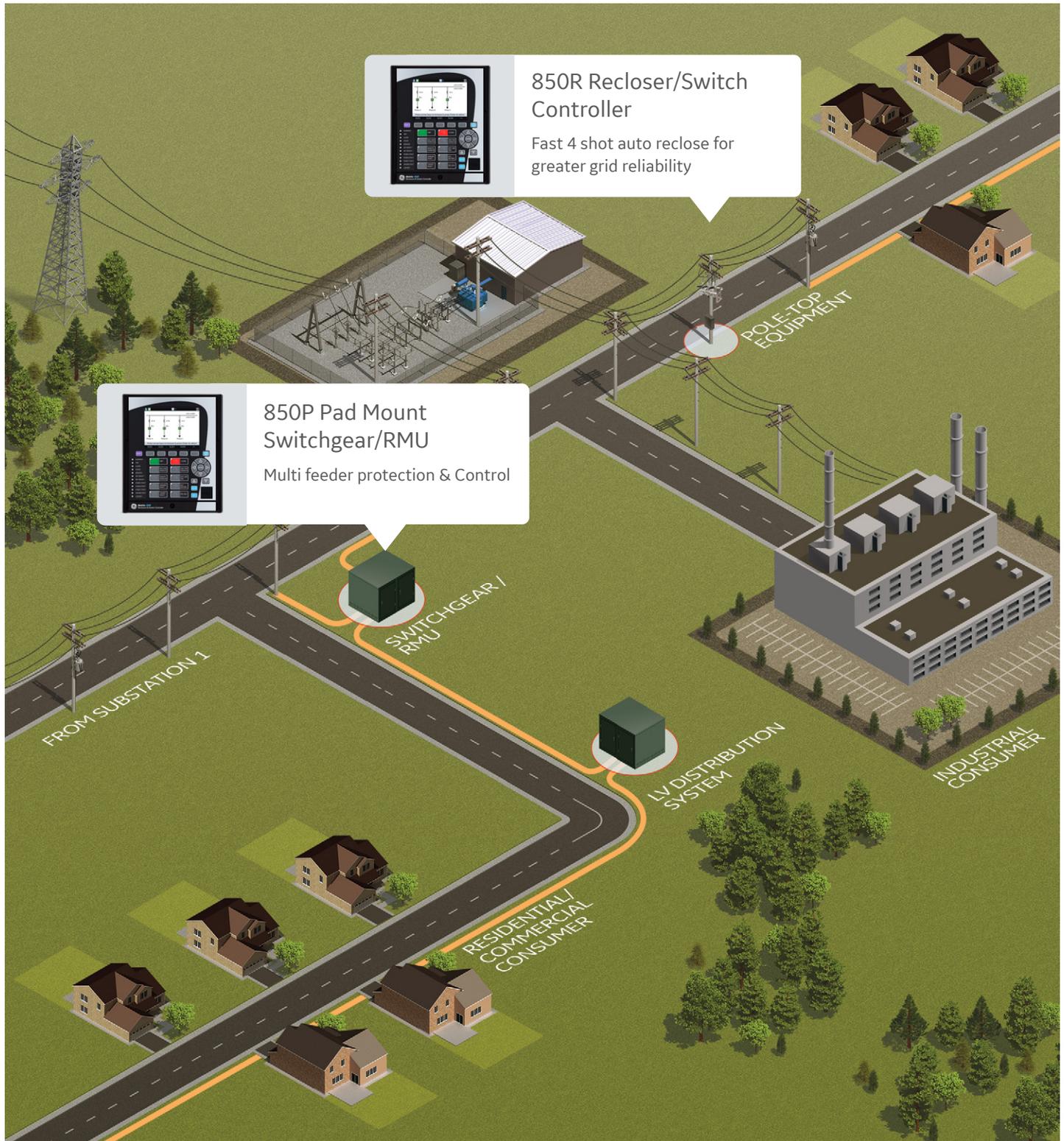
- Modbus RTU, Modbus TCP/IP, IEC 61850 GOOSE, IEC 61850 Ed 2 MMS, DNP 3.0, IEC 60870-5-104, IEC 60870-5-103, OPC-UA
- IEC 61850 GOOSE with 128 Virtual Outputs and Virtual Inputs
- Secure Wi-Fi connectivity (WPA-2 security) for device setup, configuration and diagnostic retrieval



## An integrated Solution

The need to equip distribution networks with devices and software to meet the challenges of distributed generation and increased demand is global. GE has accepted this challenge on behalf of its customers, and is leading the way with products that are more intelligent, simpler to deploy and more effective in addressing the demands of the new network.

The 850R provides high speed distribution automation integrating easily into new or existing networks, enabling more reliable and efficient distribution systems.



## 850R Recloser Controller

The 850R contains a unique universal driving electronics module that has been developed to match with most recloser\* device. This design provides reliable 4 shot auto reclosing.

Supported modes of operation include:

- 3 phase trip, 3 phase lockout
- 1 phase trip, 3 phase lockout
- 1 phase trip, 1 phase lockout

With a 2ms protection pass, the 850R relay provides faster response to current, voltage, power, and frequency protection elements; helping reduce stress on assets.

The 850R provides the flexibility to assign the relay current (CT) and voltage (VT) terminal configuration to match the primary recloser and utilities terminal configuration ensuring that the right phase is always read by the controller irrespective of how the main line were transposed.

In case if distribution feeder has only one VT/voltage source (to measure single phase to neutral voltage or phase-to-phase voltage), the 850R facilitates 3-phase power and energy measurements by deriving pseudo 3-phase voltage from any one VT source connected by assuming a balanced 3-phase system.



The 850R supports redundant Ethernet and fiber port physical interface options and a wide range of industry standard protocols for communication, namely Modbus TCP/IP, DNP 3.0, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, IEC 61850 Ed2, IEC 62439 / PRP/HSR; facilitating easy integration into new or existing SCADA/DCS networks.

The 850R comes with an integrated universal driving electronics that is capable of driving the Open/Close mechanism of practically any make of reclosers.

## Integrated Controller

The 850R has a built in Integrated Recloser controller that comprises the Driving electronics, the UPS switching mechanism, the Battery management system & the capacitor charging system. This integrated system ensure a smoother coordination between the various process that are critical to the flawless operation of the controller.

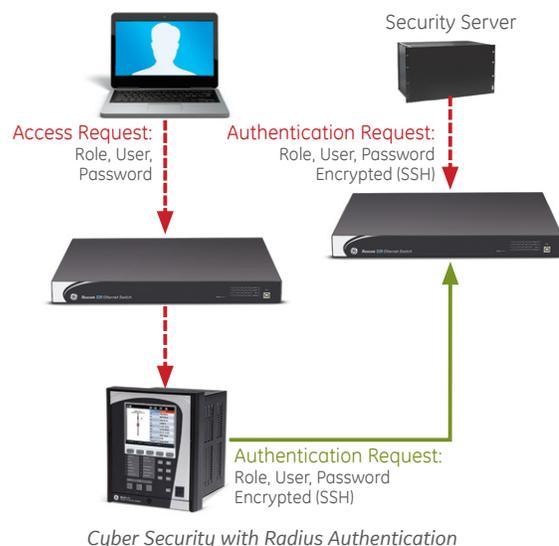
## Supply Switchover

The Supply Switchover function allows the main DC power source to change to battery power in case of a main DC power loss. When the relay is operating on battery power, the system is limited based on a userdefined maximum time or minimum battery voltage level, to avoid overdischarge of the battery. When the minimum battery voltage level is reached or the set time has expired, the 850R relay and any accessories supplied by battery power go into sleep mode (instant shutdown). To Awaken (restart) the relay from sleep mode, press the front panel wakeup button.

## Embedded Cyber Security and Communications

The 8 Series delivers a host of cyber security features that help operators to comply with NERC CIP guidelines and regulations.

- AAA Server Support (Radius/LDAP)
- Role Based Access Control (RBAC)
- Event Recorder (Syslog for SEM)



## Wi-Fi Connectivity

- Simplify set-up and configuration
- Simplify diagnostic retrieval
- Allows personnel to be a safer distance from the front of the switchgear
- WPA-2 security

## Distribution Automation

From simple automation to advanced analytics, the 850R provides the flexibility and scalability required to meet unique application requirements for the distribution utilities.

## Distributed FDIR

The 850R supports peer to peer communication via IEC 61850 GOOSE that can achieve a distributed FDIR scheme. Unlike other vendors, the 850R can communicate with any controller as long as it supports IEC 61850 GOOSE.

## Decentralized FDIR

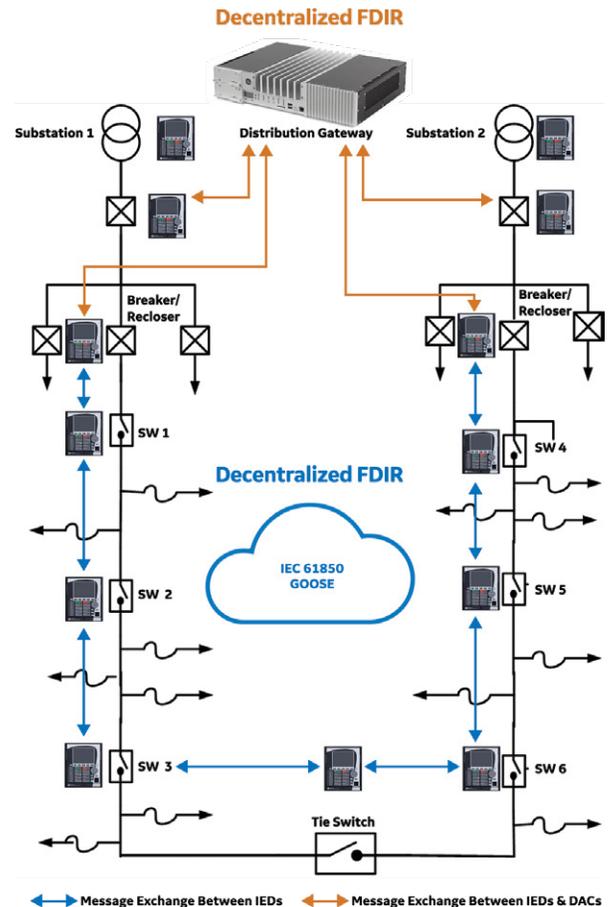
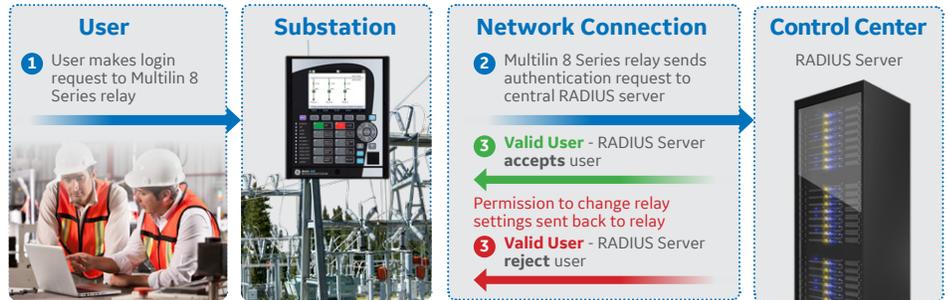
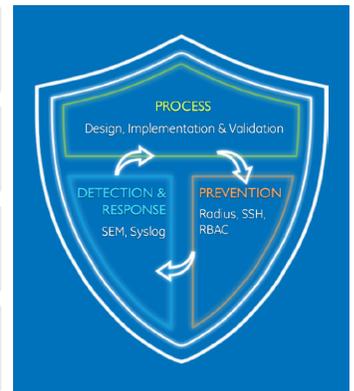
With the G500 Advanced Substation Gateway communicating with the 850R controller out in the field, a system defined decentralized FDIR scheme can be designed with the decision making algorithm residing at the substation level rather than the DMS level. Multiple functionalities like the Gateway functionality, Substation Automation, Station HMI & Distribution Automation can be combined into one G500 bringing in more visibility & local control.

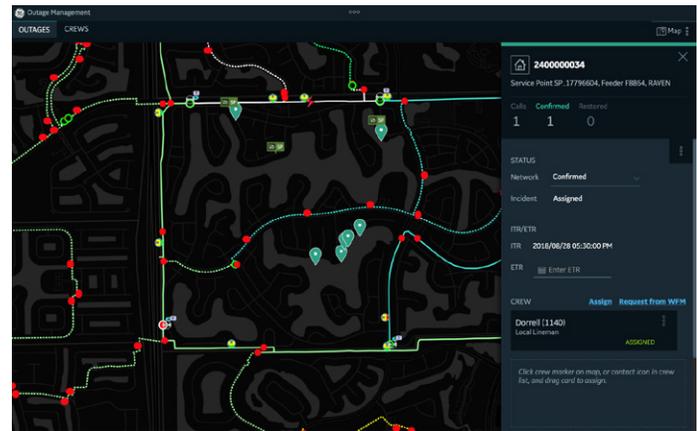
The G500 can also send the received data to the DMS/ADMS for supervisory monitoring and control in a more efficient manner. Automation applications, such as IVVC, can also be added at the substation level.

## Monitoring and Data Input

The 850R delivers accurate data to centralized and decentralized applications enabling advanced analytics. This distributed fault data analysis enables FDIR/FLISR schemes to deliver optimal network reconfiguration in varying neutral treatments, such as direct or high impedance grounding.

<b>RBAC</b>	<ul style="list-style-type: none"> <li>• Role Based Access Control (RBAC)</li> <li>• Administrator, Operator, Observer</li> </ul>
<b>Syslog</b>	<ul style="list-style-type: none"> <li>• Security Event Report through Syslog</li> <li>• Cyber Sentry Security Event Manager (SEM)</li> </ul>
<b>Radius</b>	<ul style="list-style-type: none"> <li>• RADIUS - AAA: Authentication, Authorization &amp; Accounting management</li> </ul>
<b>Certification</b>	<ul style="list-style-type: none"> <li>• Wurdtech Level 1/2 test appliance used</li> <li>• Mu Dynamics test appliance used</li> </ul>

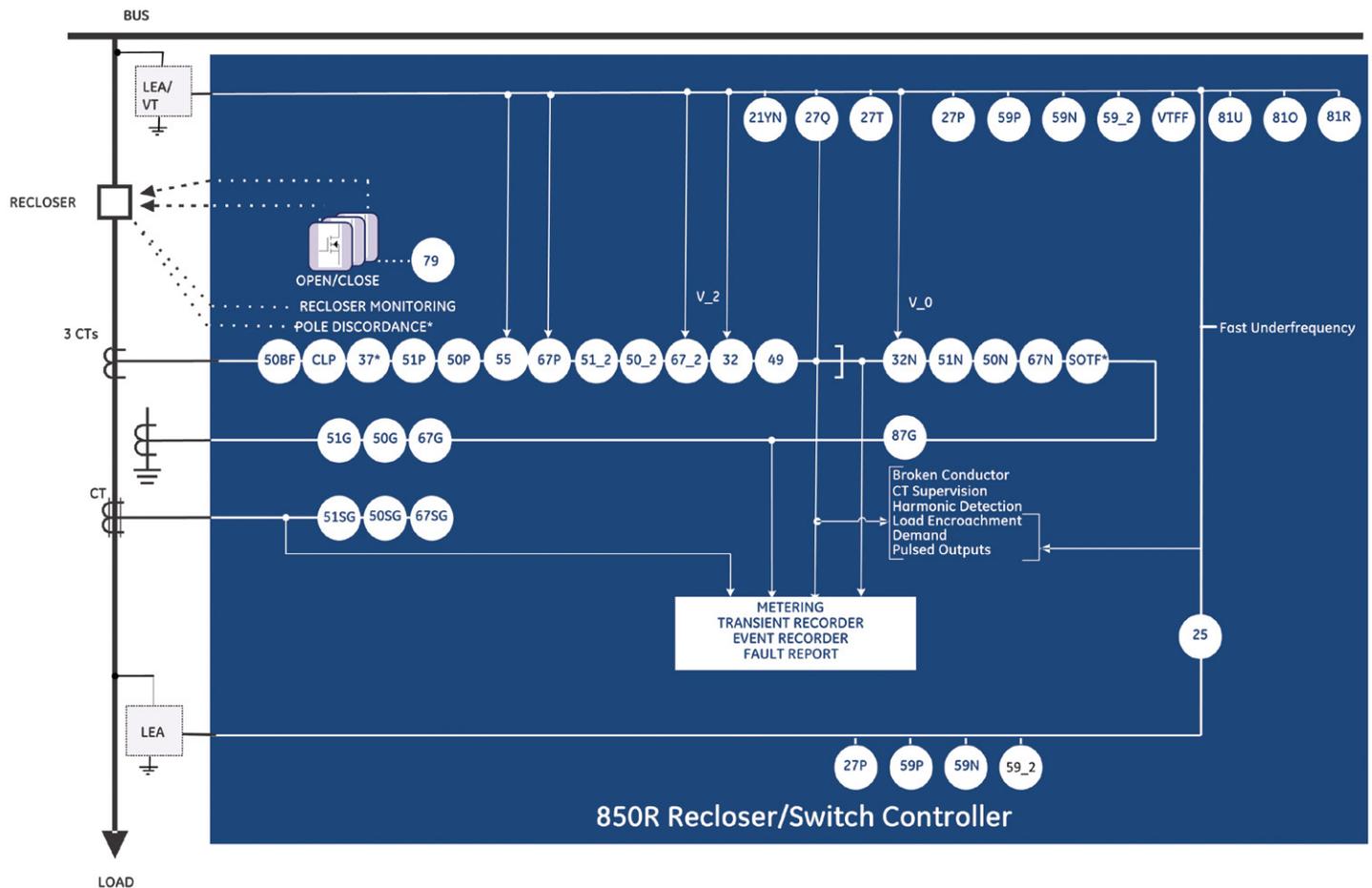




GE's advanced distribution management HMI

## Protection & Control

The 850R provides secure and reliable protection by offering a comprehensive range of standard and advanced elements with multiple-stages and wide setting ranges for each. The controller provides directional and non-directional overcurrent protection along with the option of single-phase tripping and reclosing, to limit system impact and improve reliability synchronism check function ensures that the voltages are within safe limits before allowing closing and auto-reclose operations. Additionally, voltage and frequency protection elements may be used to disconnect DERs connected to the feeder. The 850R includes six voltage inputs to monitor voltages on both Load & Line sides of the recloser thereby delivering a safer level of performance especially for Bus Tie applications.



## ANSI Device Numbers and Functions

ANSI NUMBER	DESCRIPTION
21YN	Neutral Admittance
25	Synchrocheck
27P	Phase Undervoltage
27Q	UV Reactive Power
27T	Timed Undervoltage Protection
27X	Auxiliary Undervoltage
32	Directional Power
32N	Wattmetric Ground Fault (Wattmetric zero sequence directional)
37	Undercurrent
49	Thermal Overload
50BF	Breaker Failure
50G	Ground Instantaneous Overcurrent
50SG	Sensitive Ground Instantaneous Overcurrent
50N	Neutral Instantaneous Overcurrent
50P	Phase Instantaneous Overcurrent
50_2	Negative Sequence Instantaneous Overcurrent

ANSI NUMBER	DESCRIPTION
51G	Ground Time Overcurrent
51SG	Sensitive Ground Time Overcurrent
51N	Neutral Time Overcurrent
51P	Phase Time Overcurrent
51_2	Negative Sequence Time Overcurrent
55	Power Factor
59N	Neutral Overvoltage
59P	Phase Overvoltage
59X	Auxiliary Overvoltage
59_2	Negative Sequence Overvoltage
67G	Ground Directional Element
67SG	Sensitive Ground Directional Element
67N	Neutral Directional Element
67P	Phase Directional Element
67_2	Negative Sequence Directional Element
79	Automatic Recloser
81O	Overfrequency
81U	Underfrequency
81R	Frequency Rate of Change

ANSI NUMBER	DESCRIPTION
87G	Restricted Ground Fault (RGF)
CLP	Cold Load Pickup
I1/12	Broken Conductor
MCB	Manual Close Blocking
SOTF	Switch on to Fault
TGFD	Transient Ground Fault Detection
VTFE	Voltage Transformer Fuse Failure
	Auto Sectionalizer
	Battery Testing and Monitoring
	Capacitor and Coil Monitoring
	Fast Underfrequency
	Load Encroachment
	Overhead Switch Health Monitoring
	Power Loss
	PseudoVoltage
	Recloser Coil, Cap Voltage, and Health Monitoring
	Supply Switchover Function

## Reliability Enhancements

### Autoreclose (1 Pole / 3 Pole)

The Autoreclose function provides greater flexibility to allow its applicability to many different utility control practices, for example:

Up to 4 reclosing shots with separate programmable "dead times" per shot.

850R allows 4 programmable flexcurves that can be initialized by any IEEE/IEC curves or from 41 built-in recloser curves. This enables smoother coordination between Upstream & downstream devices

Third flexible is initiating AR function from any of the multiple overcurrent functions, or derived from the flex logic or even external source (i.e. contact input or GOOSE).

The 850R provides adaptive functionality to reduced system stress. This is achieved by blocking overcurrent functions or raising its pickup level. It also facilitate supervision functionality by monitoring number of reclose shots per hour in order to alarm or lockout the condition.

Adaptive approach allows increase in pickup level per shot and reducing time of operation, and in-turn stress on the system due to number of switching on the fault. Supervision function will enhance the overall life of the breaker and allow condition based breaker maintenance and limit breaker wear due to reclosing operations.

- The 850R supports single-pole and three-pole reclosing
- Initiation can be via any internal protection elements or external
- 4 reclosing "shots" are supported with separate 'dead times' for each shot
- Additional timer is available to extend the dead timer delay
- The 850R has an option to force three-pole reclosing for single-pole trip mode
- The 850R has an option to skip shot number during Reclose-In-Progress
- The 850R can also be programmed to drive to the last shot as well as reduce the maximum number of shots

### Auto-Sectionalizer for Switch Applications

The distribution feeders are equipped with feeder switches (pole-top, pad-mount) that can segment the feeder into electrically isolated sections, and each switch is connected to an 850R relay. Load-break or no-load breaking switches can be controlled using the Auto-Sectionalizing functions that coordinates the actions of the breaker/recloser with the feeder switches. At the end of the switching sequence, the switch remains open, allowing upstream sections to resume normal operation. 850R relays installed over the feeder at reclosers and switches can exchange FDIR/FLISR information over IEC 61850 to deploy distributed automation schemes, improving network reliability.

### Pseudo Voltage

For a distribution feeder with only one VT/voltage source (to measure single phase to neutral voltage or phase-to-phase voltage), 850R facilitates 3-phase power and energy measurements derived from pseudo 3-phase voltages. The pseudo 3-phase voltage are derived from any one VT source connected by considering balanced 3-phase system (i.e. all three phase voltages and currents same in magnitude and placed 120° apart with individual phases). Since, the pseudo 3-phase voltage calculation relies on a balanced power system, calculation accuracies are influenced by system unbalance conditions. For a perfectly balanced system, the calculated pseudo voltages match the actual system voltages, however, errors in 3-phase power and energy calculation increases with system unbalance. The generated 3-phase voltages from a single-phase reference input are only used for calculating the 3-phase metering quantities.

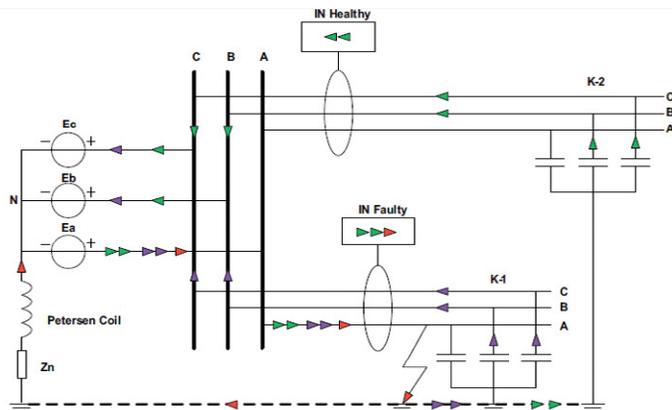
### VT Terminal Interface

Freely configurable terminal interfaces match the distribution utilities line transposition conditions, and thus match internal relay protection calculations.

## Overhead distribution reliability

### Transient Ground Fault Detection (TGFD)

Transient Ground Fault Detection (TGFD) also called Transient Earth Fault Detection (TEFD) is a novel technique to detect the direction of a ground fault in three different grounding systems: ungrounded, resistance grounded and compensated/resonant-ground (i.e. Petersen coil grounded). The advantage of an ungrounded or compensated ground system is that a most common single phase to ground fault does not cause fault current to flow and therefore the system remains operational to enhance network reliability. As a result, these types of systems make it difficult to detect the fault in the system, and must be designed to withstand high transient and steady state overvoltage. Therefore TGFD is generally applied to limited low and medium voltage (LV/MV) distribution systems.



### Broken Conductor

The Broken Conductor detection function will detect a line broken conductor condition or a single-pole breaker malfunction condition through checking the phase current input phasors and the  $I_{L2} / I_{L1}$  ratio. In normal and balanced load situations this ratio is zero, while in severe load fault conditions an unbalance is produced and this ratio increases. The intention of this function is to detect a single-phase broken conductor only. As such two phase or three-phase broken conductors cannot be detected.

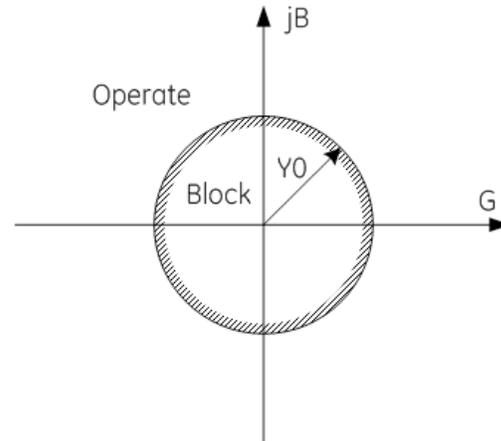
To distinguish between single-phase disappearance and system disturbance in all three phases (such as load change, switching, etc.), the broken conductor element monitors the change in all three phase currents at the present instance and at four cycles previous. It also monitors changes in the  $I_{L2} / I_{L1}$  ratio,  $I_{L1}$  minimum, and  $I_{L1}$  maximum.

The broken conductor function should not be used to respond to fault transients and single-pole tripping/reclosing conditions. The time delay should therefore be programmed to a sufficient length to ensure coordination with the breaker dead time of the recloser function. The broken conductor pickup flag is asserted, when the  $I_{L2} / I_{L1}$  ratio of the current bank is above the PKP value, the positive current is in a range of nominal, and phase current changes. The broken conductor Trip flag is asserted if the element stays picked up for the time defined by the pickup time delay. The element instantaneously drops from pickup without operation, if the  $I_{L2} / I_{L1}$  ratio decreases to 97% to 98% of the pickup value, before the time for operation is reached.

### Neutral Admittance (21YN)

The 850 successfully detects ground fault in compensated or isolated MV networks based on neutral admittance criteria.

Measured or calculated values of neutral current ( $I_0$ ) and neutral voltage ( $V_0$ ) are used to calculate the shunt neutral admittance ( $Y_0$ ), conductance ( $G_0$ ) and susceptance ( $B_0$ ).

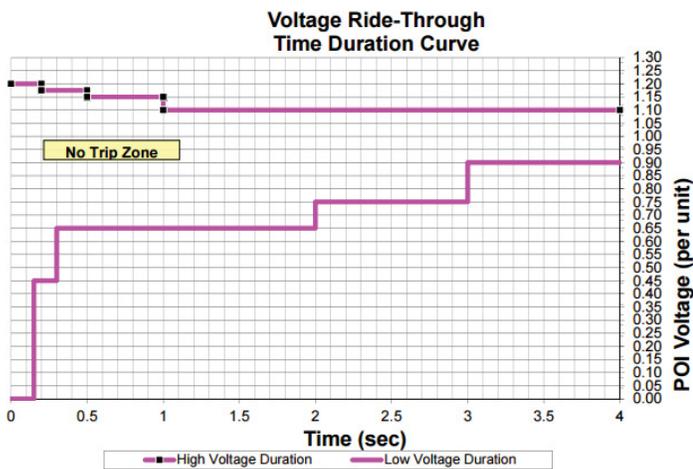


### Distributed Resource Integration

Protection equipment is of considerable importance for secure and reliable operation of networks, connection facilities and generating plants. National grid codes and regulations require that DER units feeding into the MV grid must support the mains voltage of a network failure. Therefore, the purpose of voltage and frequency protection units at machine level is to disconnect the generating units from the grid in case of faults. If the voltage drops and an inductive, reactive power flow in the direction of the generating unit are detected at the network connection point simultaneously, the affected generating unit will be switched off (disconnecting the generator circuit breaker). After an unsuccessful attempt to disconnect the generating unit, the whole DER plant will be switched off by the circuit breaker at the network connection point.

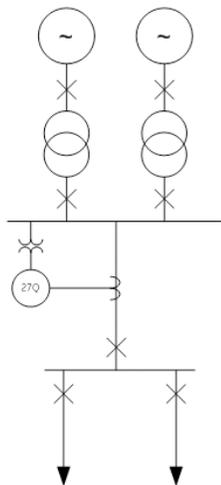
### Time Undervoltage (27T)

Regional requirements, also referred to as Grid Code compliance, are imposed at point of common coupling (PCC) for the integration of renewables/DERs into the distribution system. For example, in case of a voltage drop, power sources are sometimes required to continue supporting the grid and not be disconnected from the grid, which is referred to as Low-Voltage Ride-Through (LVRT) capability. Therefore, a conventional phase undervoltage protection may not be adequate for such scenarios. The timed undervoltage element can be set as a time dependent element which can be programmed with ten configurable points that make up its characteristics curve. Since every region has its own grid code curve, 850 allows a configurable curve to continue grid support for brief voltage drops and operate for voltage drops. Additionally, the element provides counter-based protection which counts the number of transient voltage drops and trips according to the provided threshold for the given time window. The input voltages are the three phase to phase voltages from delta connected VTs (PTs) or three phase to ground voltages from wye connected VTs (PTs).



### Undervoltage Reactive Power (27Q)

National grid codes and regulations require that DER units feeding into the MV grid must support the mains voltage of a network failure. If the voltage drops and an inductive, reactive power flow in the direction of the generating unit are detected at the network connection point simultaneously, the affected generating unit will be switched off (disconnecting the generator).



UV reactive power protection function operates after a settable time delay (programmed as Pickup Delay) as soon as:

- Phase voltages fall below the set voltage level, programmed as Pickup Voltage
- Positive sequence current I1 exceeds the current supervision level
- Reactive power exceeds (Var Direction = Reverse) Pickup, or falls below (when Var Direction = Forward) the Pickup value

With the restoration function, the 850R can send closing command to the generating unit Recloser/CB when:

- Phase voltages are above the minimum voltage level, programmed as Min Voltage, and
- Frequency is within the minimum and maximum range as programmed in the Synchronism Check function

### Synchronism Check

The recloser control includes two synchronism check elements. The function is intended for supervising the paralleling of two parts of . The Synchrocheck elements are typically used at locations where the two power source/generation of the system are interconnected. It is common practice to automatically perform. Synchrocheck function ensures the sources are within allowable voltage, frequency & phase angle limits before permitting closing of the recloser. If this feature is enabled, the check will be performed before either manual close or automatic reclose attempt.

### Undercurrent (37)

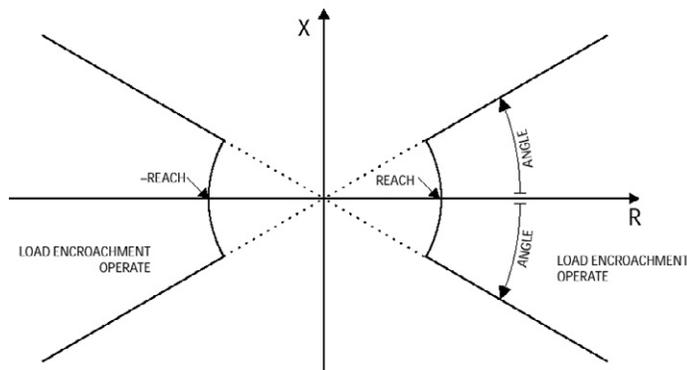
The 850R relay provides three undercurrent element per protection group. The element responds to a per-phase current. An alarm occurs if the magnitude of any phase current falls below the undercurrent alarm pickup level for the time specified by the undercurrent alarm delay. Furthermore, a trip will occur if the magnitude of any phase current falls below the undercurrent trip pickup level for the time specified by the undercurrent trip delay. The alarm and trip pickup levels should be set lower than the lowest feeder loading during normal operations.

### Fast Underfrequency

The Fast Underfrequency element measures frequency by detecting the consecutive voltage zero crossings and measuring the time between them. The measured frequency has the range between 20 to 70 Hz. The out-of-range measurement will be classified as invalid, which will not affect the behavior of SET and RESET counters. Compared to the regular metered voltage frequency value, the fast frequency has the faster response but lesser accuracy.

### Load Encroachment

The load encroachment element responds to the positive-sequence voltage and current and applies a characteristic shown in the figure below:



The element operates if the positive-sequence voltage is above a set level, and asserts its output signal so that it can be used to block selected protection elements such as phase overcurrent.

### Front Panel Visualization

The User interface is a color LCD front panel display with up to 6 configurable Single Line Diagrams (SLD), 12 control objects, 15 status & 15 metering objects with a provision to control the breakers and switches. Display of online metering and status information is also included.

Support for Recloser and switch control including Hot Line Tag through the single line diagram and 10 user-programmable pushbuttons. 10 user-programmable LEDs are used for indication.



## Advanced Monitoring and Diagnostics

### Coil Circuit Supervision

The driving electronics board checks the coil connection continuity of the trip/close circuit, as well as the leakage current to ground. When magnitude of any phase current falls below the undercurrent trip pickup level for the time specified by the undercurrent trip delay. The alarm and trip pickup levels should be set lower than the lowest feeder loading during normal operations.

### Capacitor Voltage Alarm

The Capacitor Voltage Alarm function defines the low voltage alarm for the internal/external capacitor charging power supply circuit. This rated voltage is used for charging the external capacitors that open and close the single-pole of the recloser. If the measured voltage of the capacitors is less than the configured percentage of the rated voltage, then the Cap Volt OP operand is generated. In addition, to prevent the charger from damage due to overloading or load short faults created by incorrect wiring, bad capacitors, or hardware failures, the 850R automatically turns off the capacitor charger to prevent damage.

### Recloser Wear and Recloser/OHSW Health Monitoring

The 850R relay provides recloser/OHSW health information by monitoring and analyzing the operation count, arcing energy of breaking current, arcing time, opening time, and closing time when applicable. The recloser health status depends on many factors, such as permissible operation number, magnitude of breaking current, mechanical wear and contact wear.

### Time of Day Timer

The Time of Day Timer function provides the user with the ability to program control actions based on real time. There are two identical Time of Day Timers.

#### Application

Monitoring of the total accumulated energy/accumulated demand/minimum and maximum power demand at the end of an event or a shift interval.

A shift can be defined by the breaker status operand (opclosed) or operand derived from the Time of Day Timer element.

### Voltage Disturbance

The Voltage disturbance function of Voltage Swell and Voltage Sag, as described in IEEE 1159-2009. When the voltage on any phase drops below this level a voltage sag condition occurs. Voltage sags are usually associated with system faults but can also be caused by switching heavy loads or starting large motors. Short duration voltage sag may cause process disruptions. Voltage swells are usually associated with system fault conditions, but they are much less common than voltage sags. An SLG fault on the system can cause a swell to occur, resulting in a temporary voltage rise on the healthy phases. Swells can also be caused by switching off a large load, load shedding, or switching on a large capacitor bank. Voltage swell may cause failure of the components depending upon the magnitude and frequency of occurrence.

### Battery Monitoring & Testing

850R monitors the battery voltage and supports testing the battery when the battery is fully charged and the system is powered by the main power supply. The system tests the battery condition with a predetermined load, at configured test cycle time (typically once in 24 hours).

## Quality & Reliability

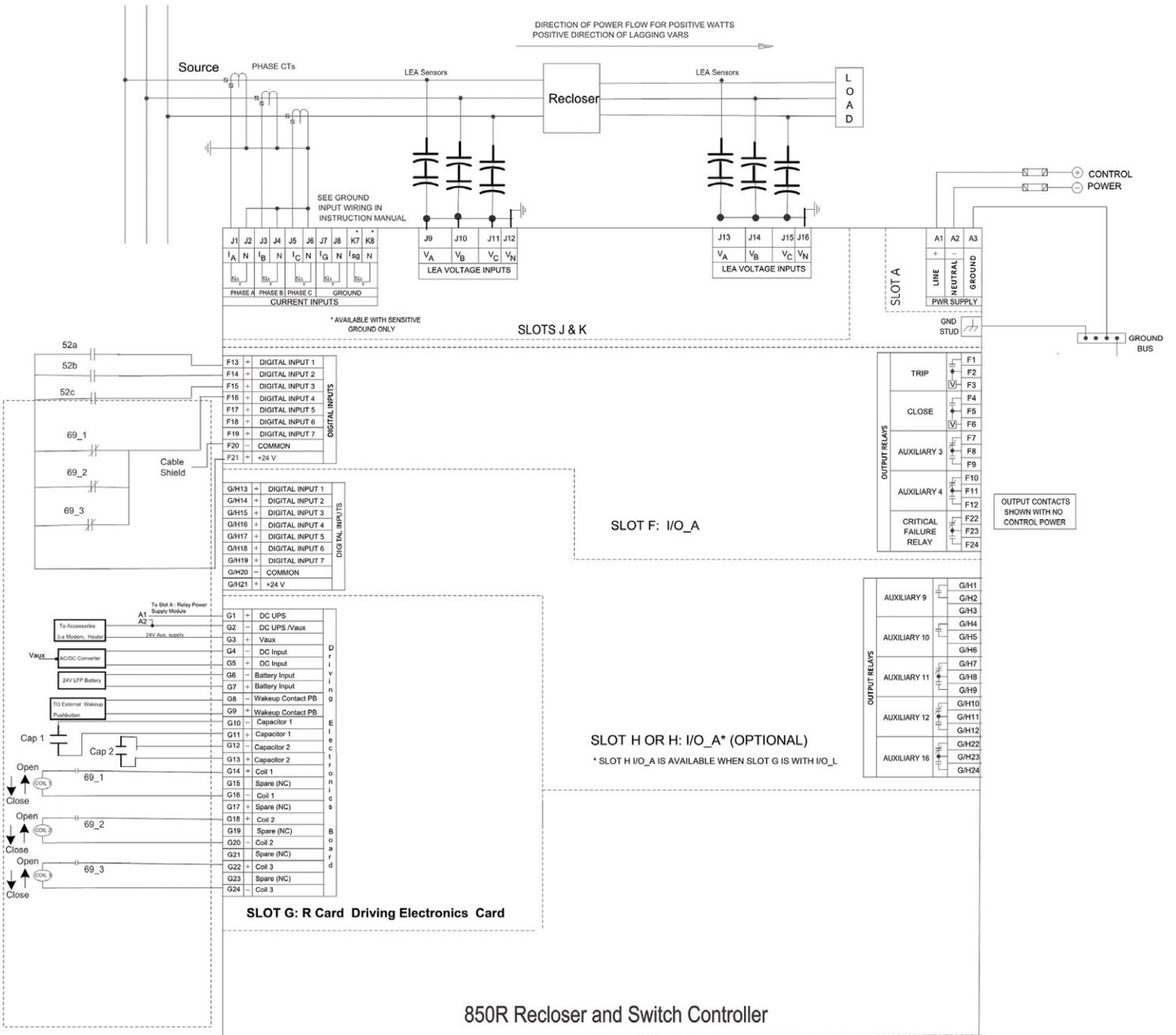
Industry-leading quality, reliability and design processes are at the core of the 850R. Significant investments in state-of-the-art type test facilities simulate a complete and onerous range of operating environments. The 850R is manufactured and designed to the IPC A-610 Class 2 standard, adhering to the highest reliability standards and ensuring rugged performance. Each device completes one hundred percent Electrical Stress screening prior to shipping from GE's facility.

## Setup & Configuration

### EnerVista Setup & Configuration Software

The EnerVista™ Suite is an industry-leading set of software programs that simplifies every aspect of using the 850R. The EnerVista suite provides all the tools to monitor the status of the recloser, maintain the controller, and integrate information measured by the 850R into DCS or SCADA monitoring systems.

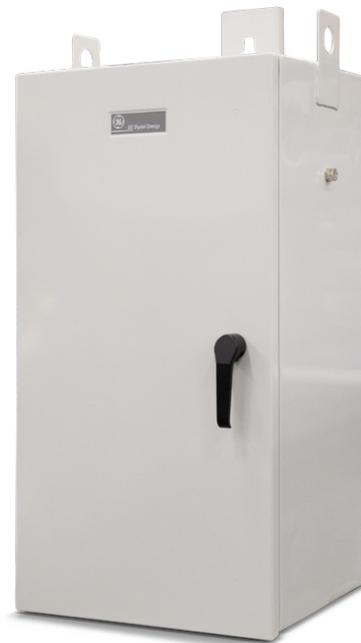
850R Wiring Diagram



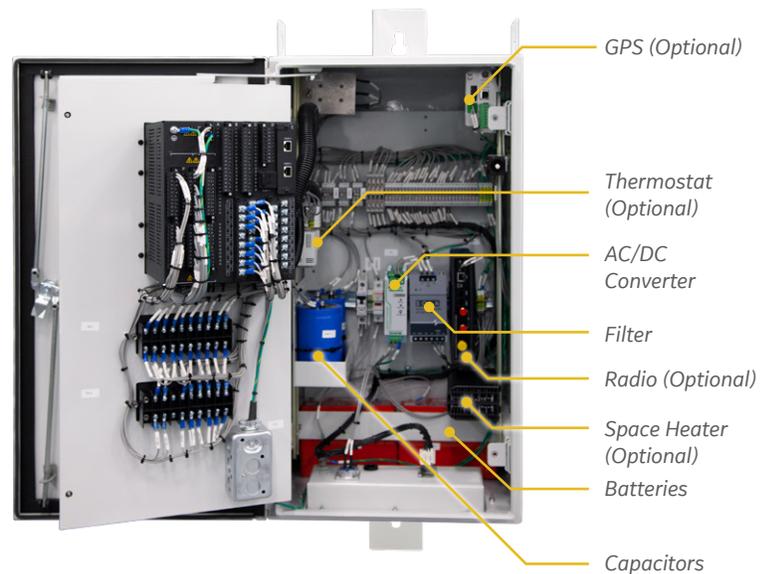
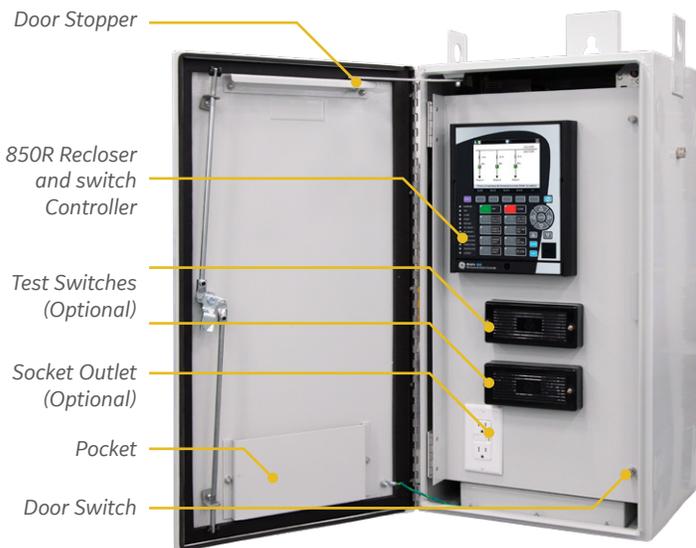
## Enclosure

The 850R can be ordered inside a cabinet complete with Battery system. The main options will be the type of Recloser that needs to be interfaced with e.g. whether it is a traditional 14 pin, 24 pin, 32 pin or the latest 42 pin. With integrated driving electronics inside the 850R, the unit can be used to operate most reclosers just by defining the capacitor charging voltage for the specific recloser.

All enclosures come with a Pad-lockable handle with 3 point contact and provision to mount Radios on DIN Rail. The enclosure comes with a surge protector for the antenna and comes with a provision to attach the antenna to the bottom of the enclosure. The cabinet comes with a door switch with contacts wired to the controller for intrusion alarming. The cabinet comes standard with a duplex outlet and a space heater. Two vent holes with corresponding screened plugs are provided for ventilation with a provision at the bottom for grounding of the enclosure. The bracket for mounting the cabinet is weather resistant with key-hole opening.



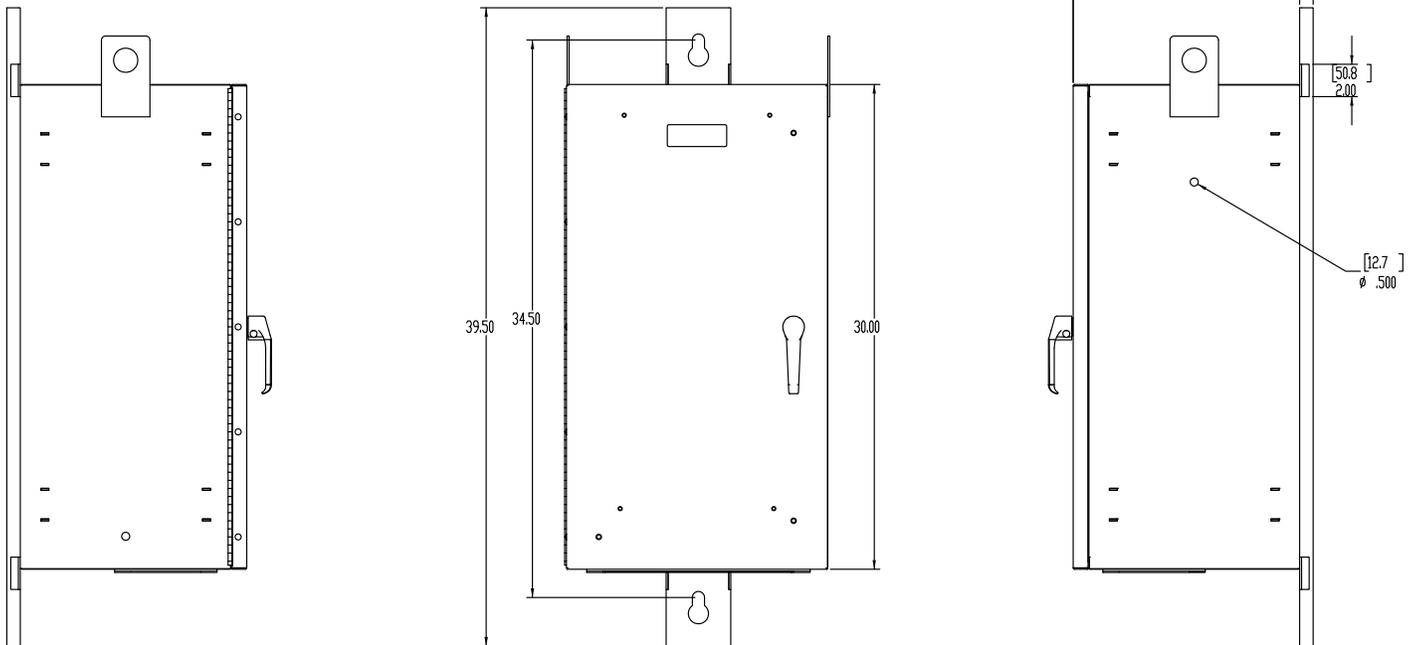
## Cabinet Design



PACKAGE OPTIONS IN A CABINET	
Cabinet options	<ul style="list-style-type: none"> <li>• Steel</li> <li>• Stainless steel</li> </ul>
Interface connector	<ul style="list-style-type: none"> <li>• 14 PIN</li> <li>• 26 PIN</li> <li>• 32 PIN</li> <li>• 37 PIN</li> <li>• 42 PIN</li> </ul>
120V AC Connector	<ul style="list-style-type: none"> <li>• 2 PIN</li> <li>• 3 PIN</li> </ul>

PACKAGE OPTIONS IN A CABINET	
Ext Voltage	• 8 PIN
Radio	• MDS
Batteries	<ul style="list-style-type: none"> <li>• 13 AH</li> <li>• 40 AH</li> </ul>
Other Options	<ul style="list-style-type: none"> <li>• GPS</li> <li>• Test Switch</li> <li>• Heater and Thermostat</li> <li>• Panel Light</li> </ul>

## Enclosure Dimension



## Technical Specifications

TECHNICAL SPECIFICATIONS	
Compatible Reclosers	G&W (Viper ST), ABB Joslyn TriMod , Eaton NOVA-TS or NOVA-ST5
Current Inputs	<ul style="list-style-type: none"> <li>• 3: 1A or 5A – Phase</li> <li>• 1: 1A or 5A – Neutral</li> <li>• 1: Sensitive Ground</li> </ul>
AC Voltage Inputs	4 : Traditional (1 to 275V) or 6: Low Energy Analog (1 to 12V RMS)
Frequency and Phase Rotation	50/60Hz (3-72Hz Tracking)
Communications Ports	2: Ethernet (FO or Copper), RS485
Communications Protocols	<ul style="list-style-type: none"> <li>• Modbus RTU/TCP, DNP3.0 Serial/TCP, IEC60870-5-104, IEC 61850, IEC 61850</li> <li>• GOOSE, IEEE 1588, SNTP, IEC 62439-3 clause 4 (PRP), IEC 60870-5-103</li> </ul>
Power Supply	100 to 240 V at 50/60 Hz or 24 V to 48 V
Weight	9 kg [20.0 lbs] - Controller Only
Operating Temperature Relay module	-40°C to 60°C
Wi-Fi Connectivity	<ul style="list-style-type: none"> <li>• Simplify set-up and configuration</li> <li>• Simplify diagnostic retrieval</li> <li>• Allows personnel to be a safer distance from the front of the switchgear</li> <li>• WPA-2 security</li> </ul>
Cyber Security	The 8 Series delivers a host of cyber security features that help operators to comply with NERC CIP guidelines and regulations
AAA Server Support (Radius/LDAP)	<ul style="list-style-type: none"> <li>• Role Based Access Control (RBAC)</li> <li>• Event Recorder (Syslog for SEM)</li> </ul>

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