TripSaver® FXR Recloser

SIMPLIFY OPERATIONS, ELEVATE AND SCALE PROTECTION, AND FACILITATE ADVANCED DATA ANALYSIS WITH NEXT-LEVEL LATERAL AUTOMATION

Expand grid coverage with interrupting ratings of 10.6 kA at 17.5 kV and 8 kA at 29.3 kV.

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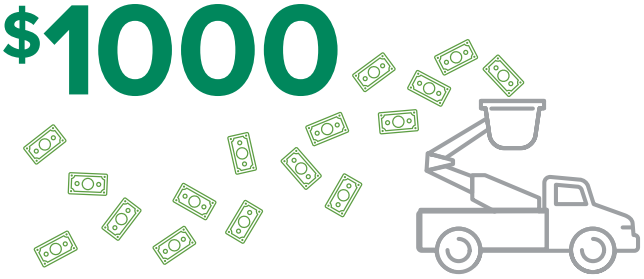
The Benefits of a Lateral Reclosing Strategy

More than 80% of overhead distribution faults are temporary. A utility's lateral protection strategy could either cause more momentary outages or more truck rolls.

A truck roll can exceed

$1000



With all the laterals on a utility's system, truck-roll costs can add up to millions of dollars every year.

Over the years, utilities have dealt with lateral protection in two ways.

Fuse-blowing philosophy

The substation feeder breaker or feeder recloser is properly coordinated with the lateral fuse so the fuse, not the breaker, will clear any downstream fault within its rating. Customers on the lateral experience permanent service interruption—even for a temporary fault, as shown in **Figure 1**. And the utility must deal with the high cost of service calls to replace lateral fuses.

Fuse-saving philosophy

The first trip of the substation feeder breaker or feeder recloser is intentionally coordinated so the breaker operates faster than the lateral fuse to clear a fault downstream of the lateral fuse. The second trip of the breaker is slower, so if the fault is still present, the lateral fuse will operate to clear it. All customers on the feeder experience a momentary interruption for all faults, as shown in **Figure 2**.

Lateral reclosing strategy

TripSaver® Reclosers combine the best of fuse-saving and fuse-blowing philosophies to improve reliability. A lateral reclosing strategy ensures temporary faults do not result in a sustained interruption and other laterals on the feeder are not "blinked." Power can be restored automatically for temporary faults, avoiding a sustained interruption or the need for a truck roll. Utilities will see immediate improvement in the frequency of sustained outages on their system.

Another benefit of a lateral reclosing strategy is it moves the reclosing closer to the fault, allowing only the faulted lateral to experience a blink. See **Figure 3 on page 3**.

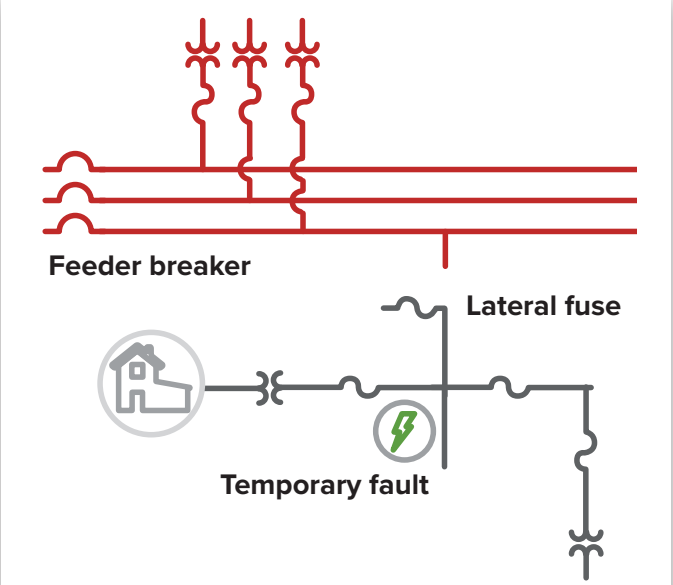


FIGURE 1. "Fuse-blowing" philosophy

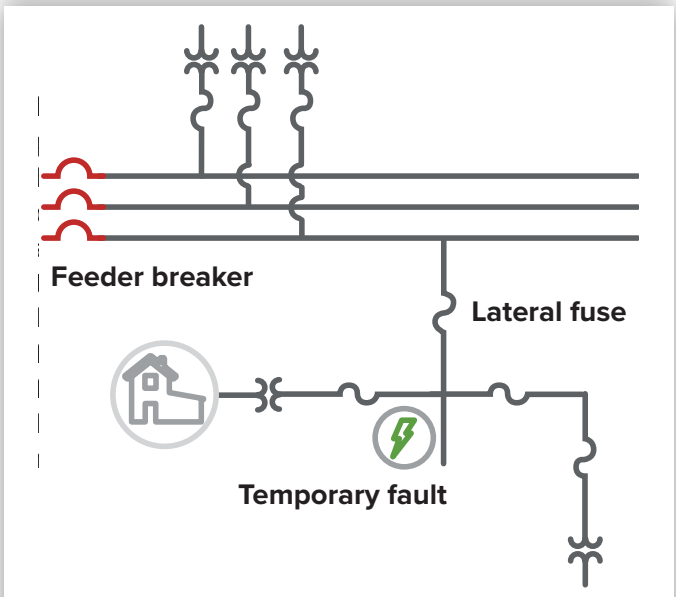


FIGURE 2. "Fuse-saving" philosophy

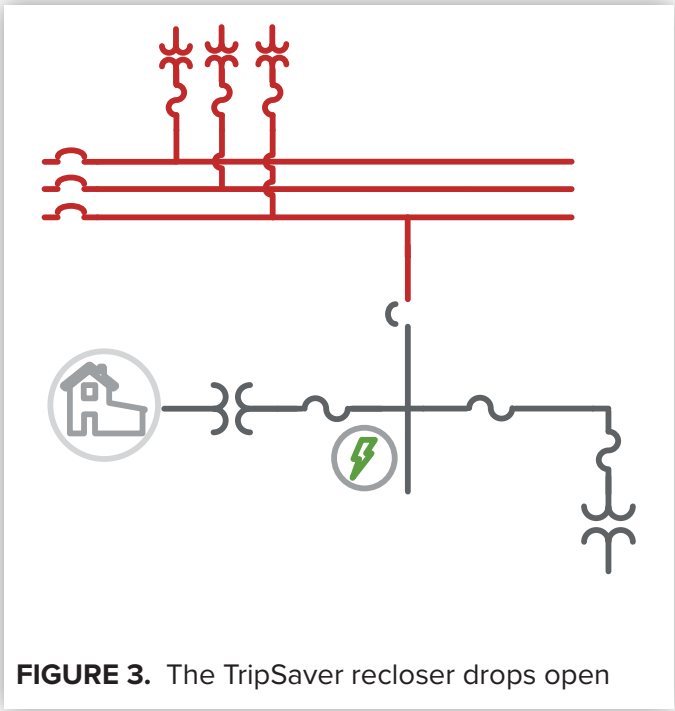


FIGURE 3. The TripSaver recloser drops open

Application

Operating sequence

The TripSaver FXR Recloser supports up to three reclosing operations (four tripping operations in total) before it drops open. A variety of time-current characteristic (TCC) curves are available. The duration of the open interval between tripping operations is user-configurable. It has a range from 0.5 seconds to 30 seconds.

The vacuum interrupter remains open after the recloser drops open. The operator can then manually close the recloser back into the mounting after the fault has been repaired. The TripSaver FXR recloser features a medium-voltage capacitor that harvests energy from line voltage to automatically close the vacuum interrupter after a configurable time delay. The default time delay is 30 seconds after full charge is achieved.

In instances when a temporary fault clears before the recloser reaches the end of its operating sequence, the recloser will revert to its first TCC curve after its sequence reset timer expires. The sequence reset time is also user-configurable, and it has a range from 0.5 seconds to 1,000 seconds.

Response for a temporary fault

Consider a temporary fault downstream of the TripSaver FXR recloser. Using its fast TCC curve, the recloser opens, as shown in **Figure 3**. Only customers served from the lateral downstream of the TripSaver FXR recloser experience a momentary interruption.

After the open interval, the recloser closes, restoring power to customers served from the lateral downstream. Because the fault was temporary and cleared, additional tripping operations aren't needed. The recloser reverts to its first TCC curve after the sequence reset time.

Response for a permanent fault

Consider a permanent fault downstream of the TripSaver FXR recloser. Because the fault is permanent, the recloser performs additional tripping operations per the specified TCC curves. The recloser drops open at the end of its operating sequence in the same manner as a standard fuse cutout—providing visual indication the faulted lateral has been isolated, as shown in **Figure 4**. The vacuum interrupter remains open after the recloser drops open. The recloser may then be manually closed back into the mounting by the operator when the cause of the fault has been repaired. The recloser will automatically close the vacuum interrupter after a configurable time delay. The default time delay is 30 seconds after full charge is achieved.

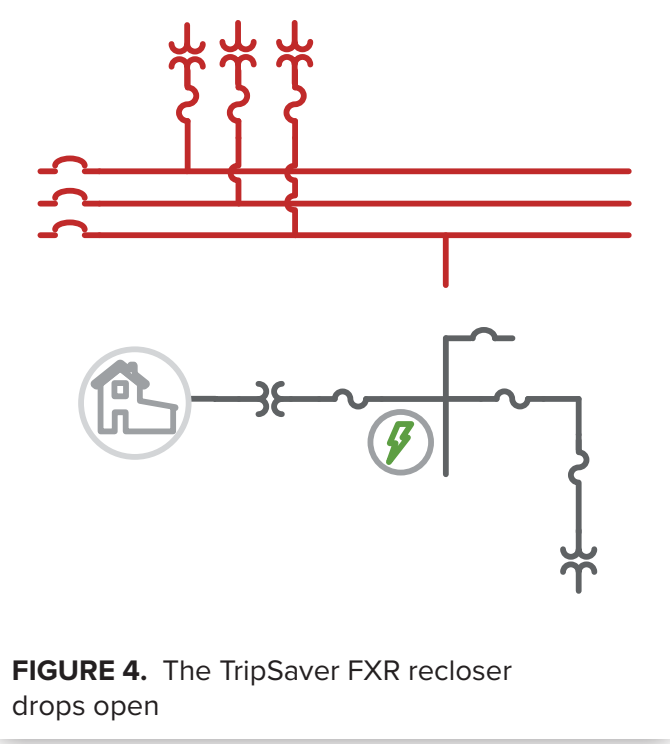
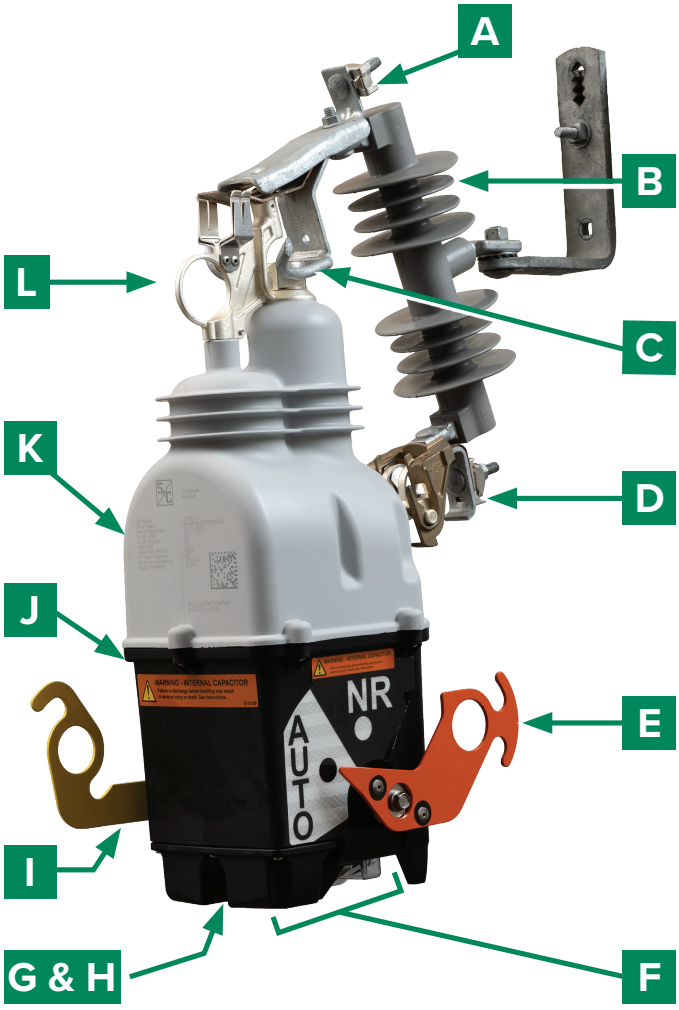


FIGURE 4. The TripSaver FXR recloser drops open

Device Overview



A Parallel-groove connector—Fabricated of tin-plated cast red brass (for ease of connection, the recloser accommodates two conductors of different sizes). Standard and 90-degree eye-bolt connectors are also available.

B Type XS Fuse Cutout Mounting—With its birdproof design and composite polymer silicone or porcelain insulators, Type XS Fuse Cutout Mountings provide better characteristics than ANSI distribution cutout standards. TripSaver FXR reclosers can be installed in new or existing production ("-R10" or "-R11") mountings.

C Bumper and retainer—A unique spring-loaded retainer and bumper dampen impact on closing, reducing the possibility of bounce-back.

D Trunnion—High-strength cast bronze, silver-plated (surfaces around the trunnion bear on broad hinge surfaces to keep the TripSaver FXR recloser in alignment during closing. Its special shape facilitates easy removal and reduces vibration.)

E MODE-SELECTOR lever—Toggles between Auto and Non-Reclose mode.

F Module Cavity—Houses a protective Cover Module that is swapped with a Data Module when configuring or servicing the device.

G POSITION indicator—Indicates position of internal vacuum interrupter with highly visible red or green target.

H Status LED—Indicates the health and charging status of the TripSaver FXR recloser.

I OPEN/CLOSE lever—Immediately and mechanically opens the vacuum interrupter. Provides a manual and automatic delayed electrical closing for the vacuum interrupter.

J Medium-voltage capacitor—Powers the TripSaver FXR recloser from the line voltage when the vacuum interrupter is open. Enables a delayed close function after the recloser is manually closed into the cutout.

K Vacuum fault interrupter—Located in the upper housing, it quietly contains and interrupts the fault without exhaust or sparking.

L Pull ring—Allows the TripSaver FXR recloser to be manually opened or closed into the cutout with a hotstick.

Main Features

Sequence Coordination

The **Sequence Coordination** feature maintains proper coordination between the TripSaver FXR recloser and downstream reclosers. If a fault is cleared by a downstream recloser, the TripSaver FXR recloser will shift to a user-configured (usually slower) TCC curve before fault-testing. The TripSaver FXR recloser will maintain its sequence coordination setting until the **Coordination Reset** timer expires.

Sectionalizing mode

The TripSaver FXR recloser features a **Sectionalizing** mode in both 8-kA and 10.6-kA rated models. When enabled, the recloser will operate as a sectionalizer over a user-specified range of fault currents when the source-side circuit breaker or recloser trips faster than the TripSaver FXR recloser. It counts the number of operations of the source-side circuit breaker or recloser and drops open after a user-specified number of counts.

Inrush-Restraint feature

The TripSaver FXR recloser has an **Inrush-Restraint** feature that is always on, measuring second-harmonic current to distinguish fault current from inrush current. If inrush current is detected, the recloser will not trip. The **Inrush-Restraint** feature facilitates lower minimum pickup currents down to 5 amperes.

Non-reclose TCC curves

The **Non-Reclose** feature allows the user to configure three TCC curves from the library for use during **Non-Reclose (NR)** mode. These new TCC curves are named the Normal Non-Reclose TCC curve, the Post-Fault Wakeup Non-Reclose TCC curve, and the Cold Wakeup Non-Reclose TCC curve.

The curve that will be active is dependent on the load or fault condition prior to **Non-Reclose** mode activation or when a dropout previously occurred. The TCC curve selection will occur automatically without requiring the operator to manually select the appropriate settings.

Modular Design & Data Modules

TripSaver FXR reclosers feature an innovative modular design that expedites configuration and simplifies data retrieval. Data Modules are easily accessible without special software or driver downloads. Engineers access them to upload settings files or download captured device data. For line technicians, they are simple plug-and-go data portability tools. Data Modules can also provide external power to de-energized devices. See **Figure 5**.

FIGURE 5. Read-Write Data Module

Module types

- **Cover Module**—Used to keep insects and debris out of the module cavity of a TripSaver FXR recloser.
- **Read-Only Data Module**—Used to retrieve logs and waveforms from a TripSaver FXR recloser.
- **Read-Write Data Module**—Used to write settings to a TripSaver FXR recloser, download logs and waveforms, and perform firmware updates.

Ordering & Kitting

TripSaver FXR reclosers include a Cover Module. Data Modules are ordered separately to fit your deployment needs. A Module Kit is included with any Data Module. The kit includes a T-shaped module prong, an instruction sheet, adhesive labels for recording user-configured parameters, USB-C to USB-A cable for charging and connecting the module to the user's PC, a wall power adapter; a 5-A car power adapter, and a soft, water-resistant storage case with a plastic organizer insert. See **Figure 6**.

FIGURE 6. Module Kit

Configuration & Data Management

S&C Tripsaver FXR Recloser Settings Application

A web-based settings management tool can be used to create and manage settings files. The tool can be accessed from anywhere with an internet connection and does not require administrative rights. A centralized data storage structure makes collaboration and sharing easy. Its simple permission structure enhances security by offering better control and easier implementation of security measures. See **Figure 7**.

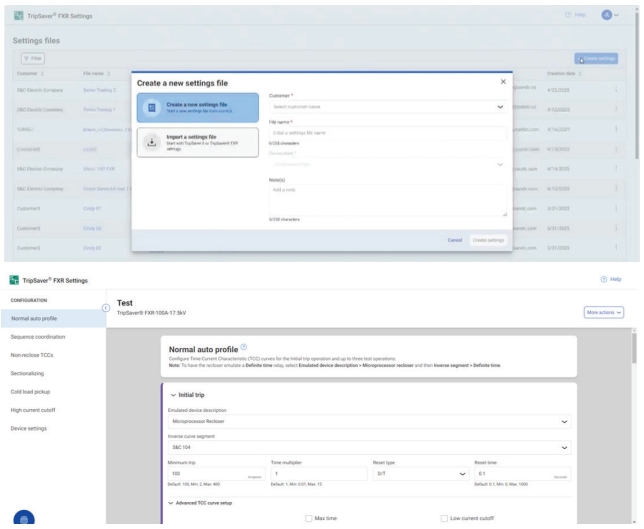


FIGURE 7. Settings Application

Configuration

Settings files are human-readable in .json format and can be generated using the S&C TripSaver FXR Recloser Settings Application, hand-generated using a pure ASCII text editor, or provided by S&C. Settings files are transferred to a Read-Write Data Module using a command-line interface, such as Windows PowerShell, or software that uses FTP, such as the free open-source FTP Client WinSCP. See **Figure 8**.

FIGURE 8. Data Module connected to PC

One pre-configured Read-Write Data Module can then be used to rapidly program multiple TripSaver FXR reclosers by plugging into the module cavity in a service center or in the field. Settings uploads are automatic upon insertion. See **Figure 9**.

FIGURE 9. Inserting Data Module into Module Cavity

Data retrieval and management

A Read-Only or Read-Write Data Module can be inserted into a TripSaver FXR recloser in the field to check the basic status of the recloser or retrieve recorded device data. See **Figure 10**.

Data Modules with captured data can then be accessed through a computer using Ethernet-over-USB connection. Logged data are human-readable in .csv format. Fault waveform captures are in COMTRADE format.

FIGURE 10. Inserting Data Module with T-shaped module prong

Logged data

TripSaver FXR reclosers provide advanced data capture to help improve utility operations and grid reliability. Data can be leveraged to monitor system performance, identify potential hazards or inefficiencies in the system, and determine locations for upgrades.

All device activity is captured with absolute time stamping and unique IDs in a simple, structured format:

- **Overcurrent Timing and Trip Events**—Assess the TripSaver FXR recloser's contribution to system reliability. Data includes automatic operations, responses to fault current, high current lockout, and coordination with an upstream device.
- **Engineering Events**—See everything that's happened on a device to aid with troubleshooting. Data includes device interactions and error and warning codes.
- **Security Events**—Track activity related to device access. Data includes login attempts and password resets.
- **Device Statistics & System Analytics**—Gain visibility into what's happening on lateral lines to help evaluate and optimize your system. Aggregated historical data shows trends and insights into events and system average current levels.
- **Fault Waveform Capture**—Deep dive into fault interrupting and overcurrent timing events with a crucial forensic tool for understanding power quality issues and load characteristics.

Protection Ratings Overview

50/60-Hz Ratings[1] System Class, kV	50/60-Hz Ratings[1] Max, kV	50/60-Hz Ratings[1] BIL, kV	50/60-Hz Ratings[1] Cont. Amperes, RMS	50/60-Hz Ratings[1] Interr., Sym. Amperes, RMS[2]	With Porcelain Insulator Leakage Distance to Ground Minimum, Inches (mm)	With Polymer Insulator Leakage Distance to Ground Minimum, Inches (mm)
15	17.5	110	200	10 600	8½ (216)	14¾ (375)
25	29.3	150	200	8 000	17 (432)	26½ (673)

TABLE 1. Complete Overhead—Pole-Top Style TripSaver FXR Reclosers—Includes TripSaver FXR recloser, Cover Module, shorting wire, and connectors.

1 For 50-Hz applications, specify the microprocessor control for application on 50-Hz systems, catalog number suffix "-F."

2 Minimum trip is 5-A TripSaver FXR reclosers

TripSaver Recloser Product Line Comparison

	TripSaver FXR Recloser	TripSaver® II Cutout-Mounted Recloser
Summary		
System Class	15 kV, 25 kV	15 kV, 25 kV
Max Voltage	17.5 kV, 29.3 kV	15.5 kV, 29 kV
Continuous Current	200A	40A, 100A, 200A
Interrupting Current	10.6 kA at 17.5 kV 8.0 kA at 29.3 kV	6.3 kA at 15.5, 29 kV 4.0 kA at 15.5, 29 kV
TCC Library	200+ curves with fuse and hydraulic recloser emulations	200+ curves with fuse and hydraulic recloser emulations
Weight	36.5 lbs (16.5 kg) for 15 kV 38 lbs (17.2 kg) for 25 kV	23 lbs (10.4 kg) for 15 kV 25 lbs (11.3 kg) for 25 kV
Communications	Communications-ready with modular design	Communications-ready with pole-mounted gateway
Environmental		
Ambient Temperature	-40 to +60 Celsius	-40 to +40 Celsius
Insulation	Silicone Rubber	Polycarbonate
Ice-Breaking	3/4 in (20 mm)	3/4 in (20 mm)
Protection		
Min. Reclose Interval	0.5 seconds	0.5 seconds
Max. Reclose Interval	30 seconds	30 seconds with battery (-O suffix option)
Fastest Total Clear Time	1.5 cycles	2 cycles
Non-Reclose Mode	Yes	Yes
Sequence Coordination	Yes	Yes
Sectionalizing Mode	Yes	Yes
Inrush Restraint	Yes	Yes
Cold Load Pickup	Yes	No
Cold Wakeup NR TCC	Yes	Yes
Cold Start Clear Time	2 cycles	2.5 cycles
Multi-Phase Lockout	Not currently supported	Supported with pole-mounted gateway
Operation		
Delayed Close	Default capability	Requires Cordless Power Module (Firmware v.2.1 or later)
Status Indicator	Semaphore & LED	LCD Screen

TABLE 2. TripSaver Recloser Product Line Comparison

	TripSaver FXR Recloser	TripSaver® II Cutout-Mounted Recloser
Operation (continued)		
Mode Selector	Dedicated lever	Toggle with multi-function lever
Manual Open	Dedicated lever	Toggle with multi-function lever
Remote Drop-Open	Not currently supported	Supported with pole-mounted gateway
SCADA Integration	Not currently supported	Supported with pole-mounted gateway
Configuration		
Settings Development	TripSaver FXR Recloser Settings Application or plain-text file editor	S&C Service Center Configuration Software
Settings Management	Managed with web-based settings applications with option to store locally or in the cloud	Managed with configuration software, stored locally
File Transfer	Transfer to Data Module using FTP for automatic plug-in upload across many reclosers	Wireless connection via laptop with configuration software
Data Capture		
Time Stamping	Absolute	Relative
Operations Counter	Yes, with momentary/sustained interruptions counter per IEEE 1366	Yes
Operations Logging	Yes	Yes
Event Logging	Overcurrent, timing, security, engineering	Overcurrent
Fault Waveform Capture	Yes	No
Device Statistics	Yearly count of momentary/sustained interruptions, total fault events	Not provided
System Analytics	Hourly, daily, monthly, and yearly average current	Not provided
Data Access	Local retrieval via Data Module, no proprietary software required	Local retrieval via wireless laptop connection, remote retrieval via optional gateway, and SCADA. Configuration software required
Data formats	.json (settings), .csv (events logs), COMTRADE (waveform captures)	Proprietary setpoint file (settings), proprietary snapshot file (event logs)

TABLE 3. TripSaver Recloser Product Line Comparison (Continued)

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