SEL Distribution Management System (DMS)

Blueframe® Application Suite

Optimize distribution system management with secure wide-area control applications.

- Easily draw and expand your system over time using a graphical interface.
- Reduce outage times with a modular and scalable software-based fault location, isolation, and service restoration (FLISR) solution.
- Test system performance and safety with an integrated simulator.
- Automatically generate detailed reports for actions taken by FLISR.


RIGHT LANE
MUST
TURN RIGHT
W Main St
ONLY

Overview

SEL DMS is a suite of integrated wide-area control applications designed to continuously monitor, optimize, and control distribution systems. DMS currently includes three applications: Model Data Import (MDI), Power System Model (PSM), and FLISR.

FLISR is a solution that reduces customer outage times during a permanent fault. It continuously monitors breakers, reclosers, and switches for a permanent fault and takes over after any involved protection is finished. FLISR opens switching devices to isolate the faulted area and uses adjacent sources to restore power to as many customers as possible. FLISR supports any circuit breaker, recloser, or switch control that uses the DNP3 protocol.

With the MDI application, you can import real-world geographic information system (GIS) data to automatically configure and update system models. You can view and modify those system models or design new topologies manually using the PSM application, which offers a simple and intuitive graphical configuration interface.

With its graphical interface and integrated simulator, the DMS suite allows you to build and test your system in minutes. Once tested and deployed, the feeder configuration transforms into the live view in the FLISR application, providing you with at-a-glance status information in the web browser.

DMS applications run on SEL Blueframe, a secure, modular application platform. Deploy SEL Blueframe on any of the SEL computing platforms (SEL-3350, SEL-3355, and SEL-3360) or virtual machines.

Applications

FLISR—Continuously monitor the distribution system and provide fully automated service restoration. See system status at a glance using built-in graphical feeder topology. Additionally, issue behavior controls and view data from field devices.

Power System Model—Easily configure a power system model for applications such as FLISR. Draw your system feeder by feeder using a simple graphical interface.

Model Data Import—Import real-world GIS data to automatically configure your power system model for applications such as FLISR. The MDI app makes it easy to scale to and update large systems with hundreds or thousands of feeders.

Key Benefits

Rapidly Detect Faults and Respond

FLISR continuously monitors switching devices through a supported protocol connection and automatically detects permanent faults or open-phase events. After protection devices complete their action, FLISR isolates the fault and restores load from one or more neighboring sources. It maximizes the load restored and available margin and minimizes switching operations to increase field equipment life.

Streamline Feeder Configuration

Automatically configure and update your system using real-world GIS data. You can also build your system in minutes using an intuitive graphical interface that allows you to draw each feeder on a digital canvas. Add breakers, reclosers, and switches, connect them, and configure properties to support your operational needs. Once configured, move feeders to testing or deployment at the click of a button.

Easily Scale Your System

Scale your FLISR system using the PSM application, or manage your entire model contents through MDI. Deployed feeders remain operational while new feeders are configured.

Directly Test Performance and Safety

The FLISR application package includes a simulator that allows you to test new feeder configurations and changes to existing configurations directly in Blueframe, without interrupting the live system. Integrating simulation in the configuration and commissioning process is also useful for operations training and for evaluating hypothetical scenarios during distribution design.

Automatically Generate Detailed Reports

FLISR automatically creates reports that describe event type and location information, mitigation steps taken, any problems encountered, and a time sequence of events.

Integrate Existing Field Devices

Deploy FLISR economically using existing breakers, reclosers, and switch controls that support the DNP3 protocol. As your system grows, add devices to existing feeder configurations at no additional cost.

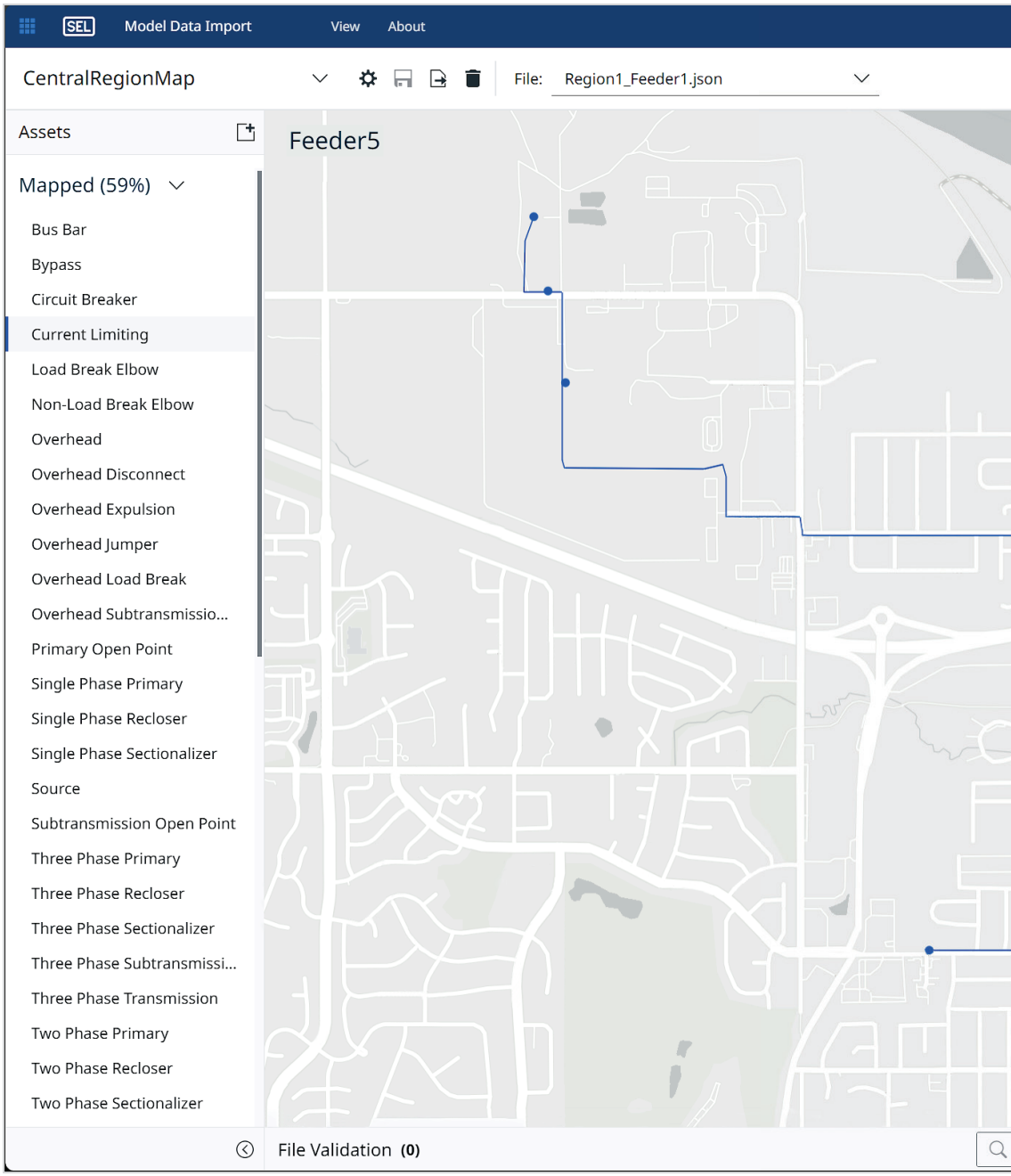
Deploy FLISR in Advisory Mode

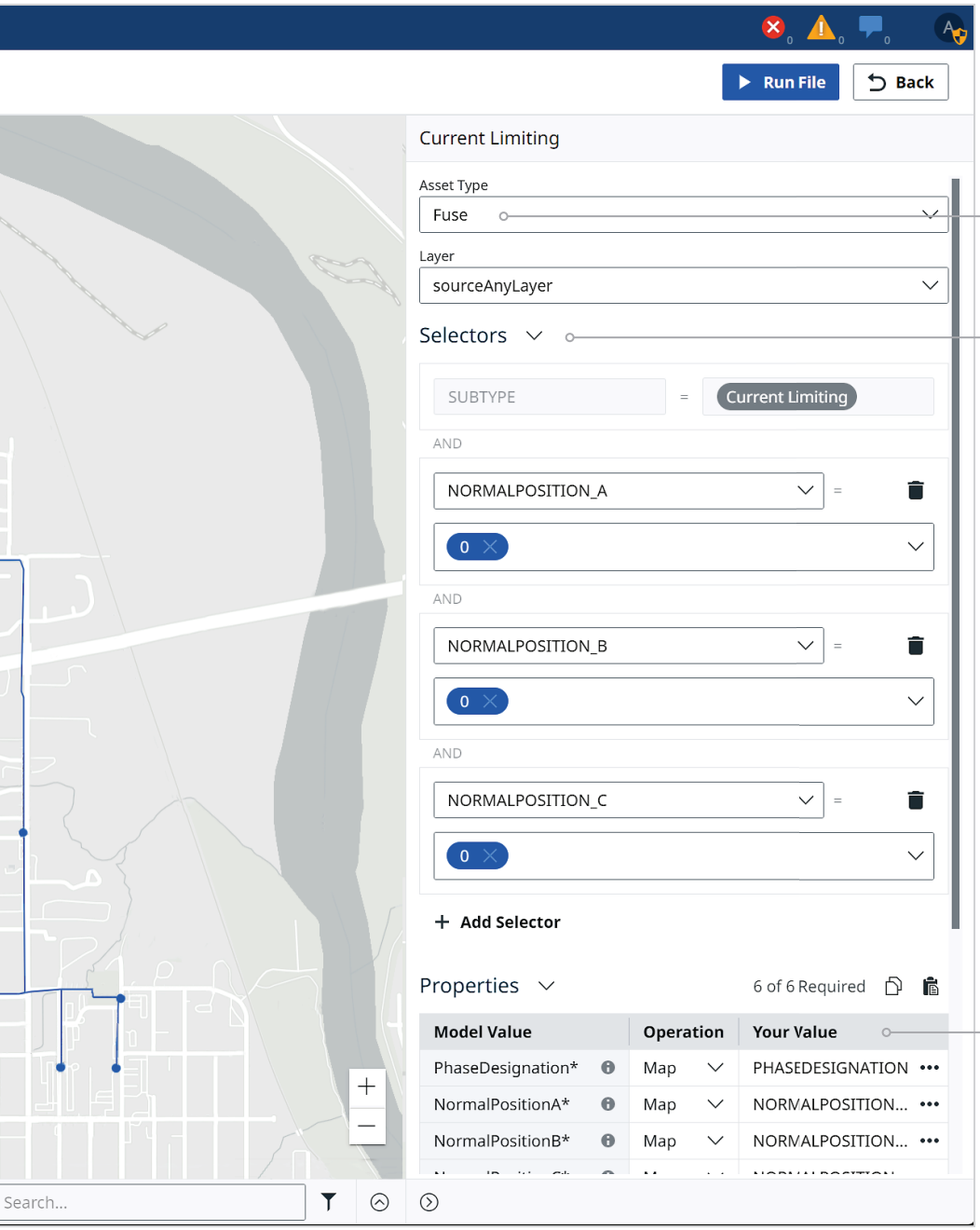
Manually perform isolation and restoration switching sequences through an existing SCADA system. In advisory mode, FLISR will generate a detailed report complete with load distribution calculations and switching sequences for isolating a fault and restoring the load.

Features

MDI Application

Select and define all assets to map into your SEL DMS model.





Define what SEL DMS asset will be assigned to your model asset.

Refine asset properties during model migration.

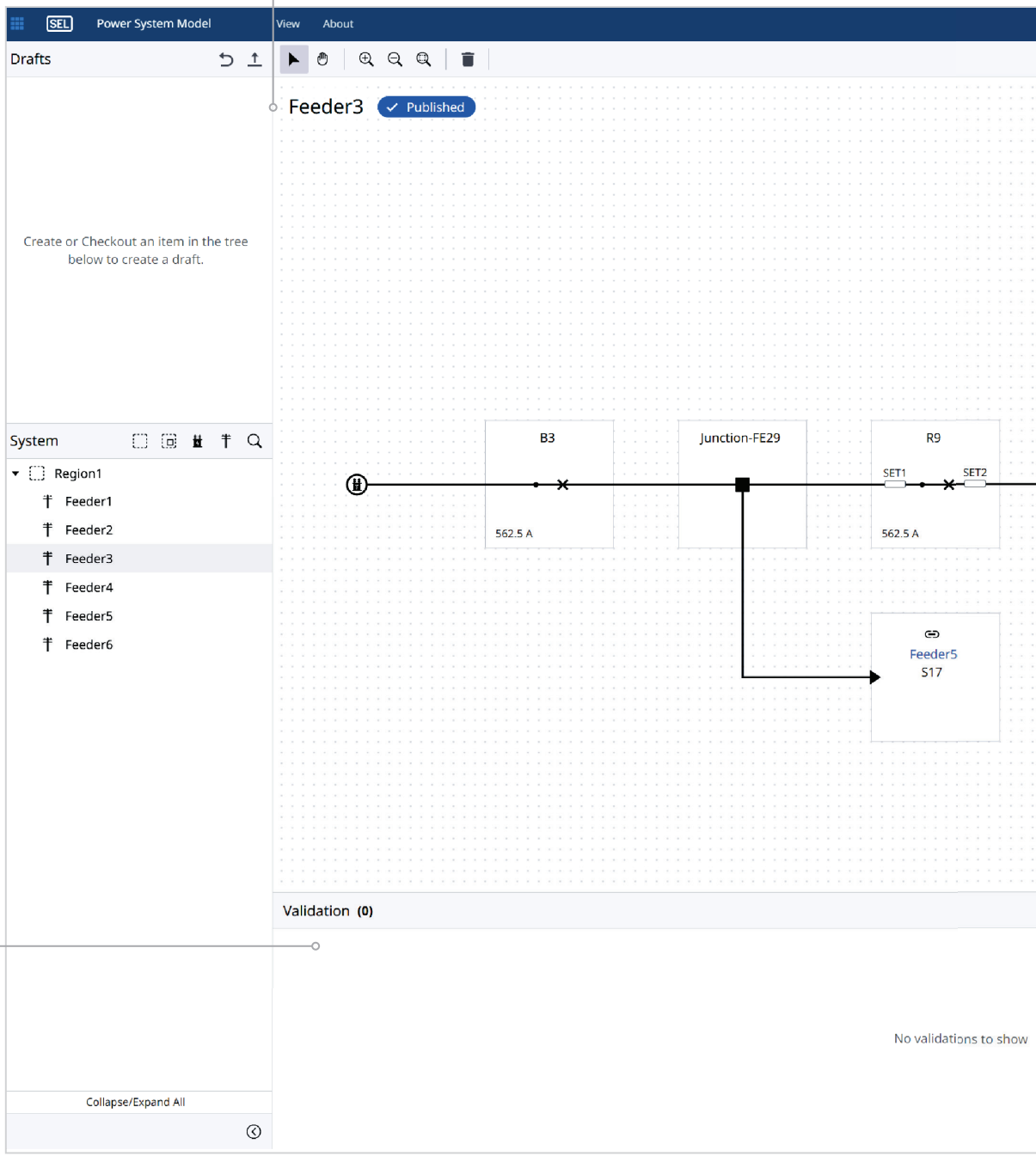
Specify whether assets receive data from a mapped source or a user-defined value. Easily copy and paste properties between SEL DMS assets.

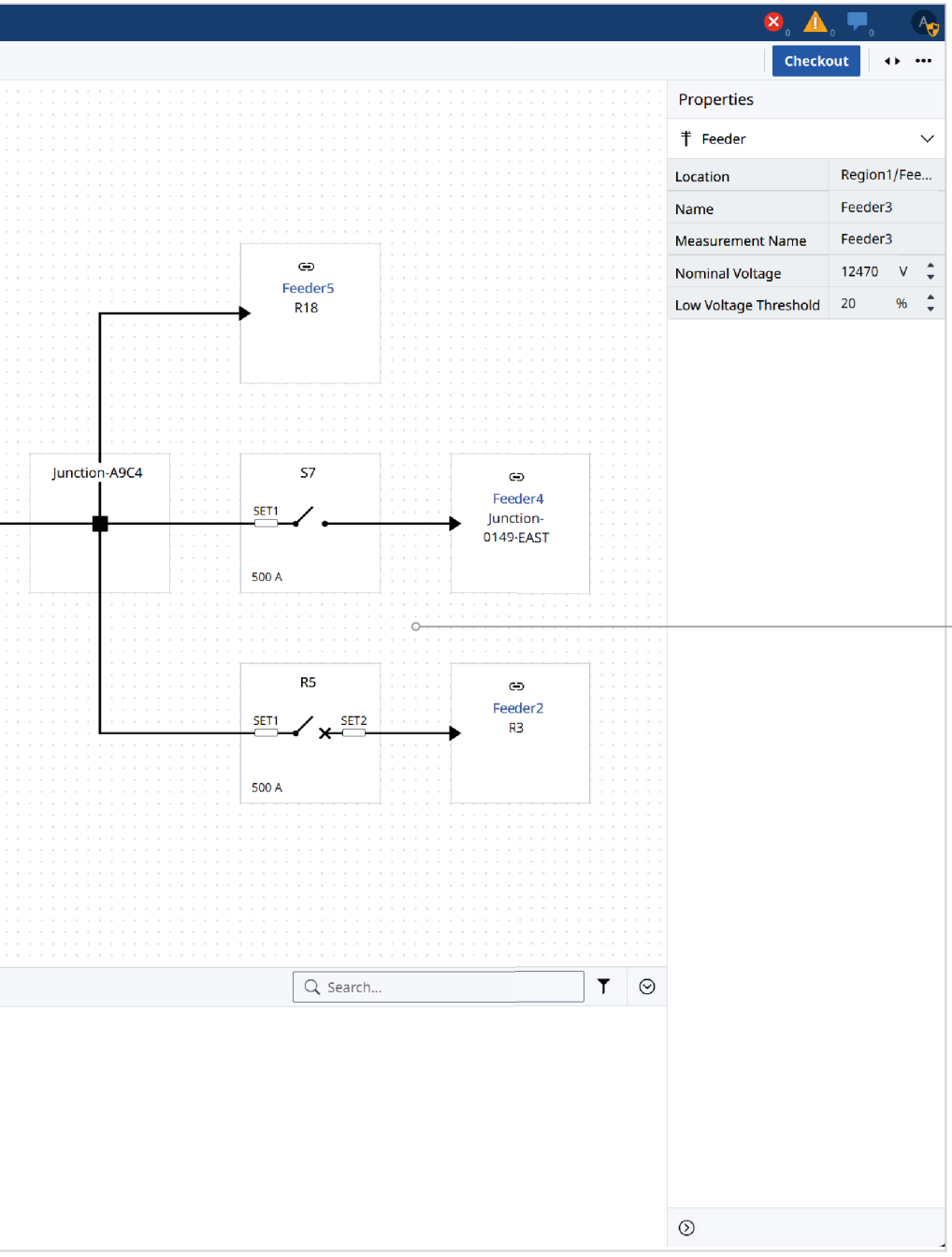
PSM Application

Each feeder has a dedicated digital canvas where settings are drawn, which allows you to scale your system without adding complexity. Navigate to or search for feeders from this location.

Quickly create a system hierarchy to separate feeders for quick reference and upstream assignment.

Active validation and error notifications help you efficiently and successfully configure your system.





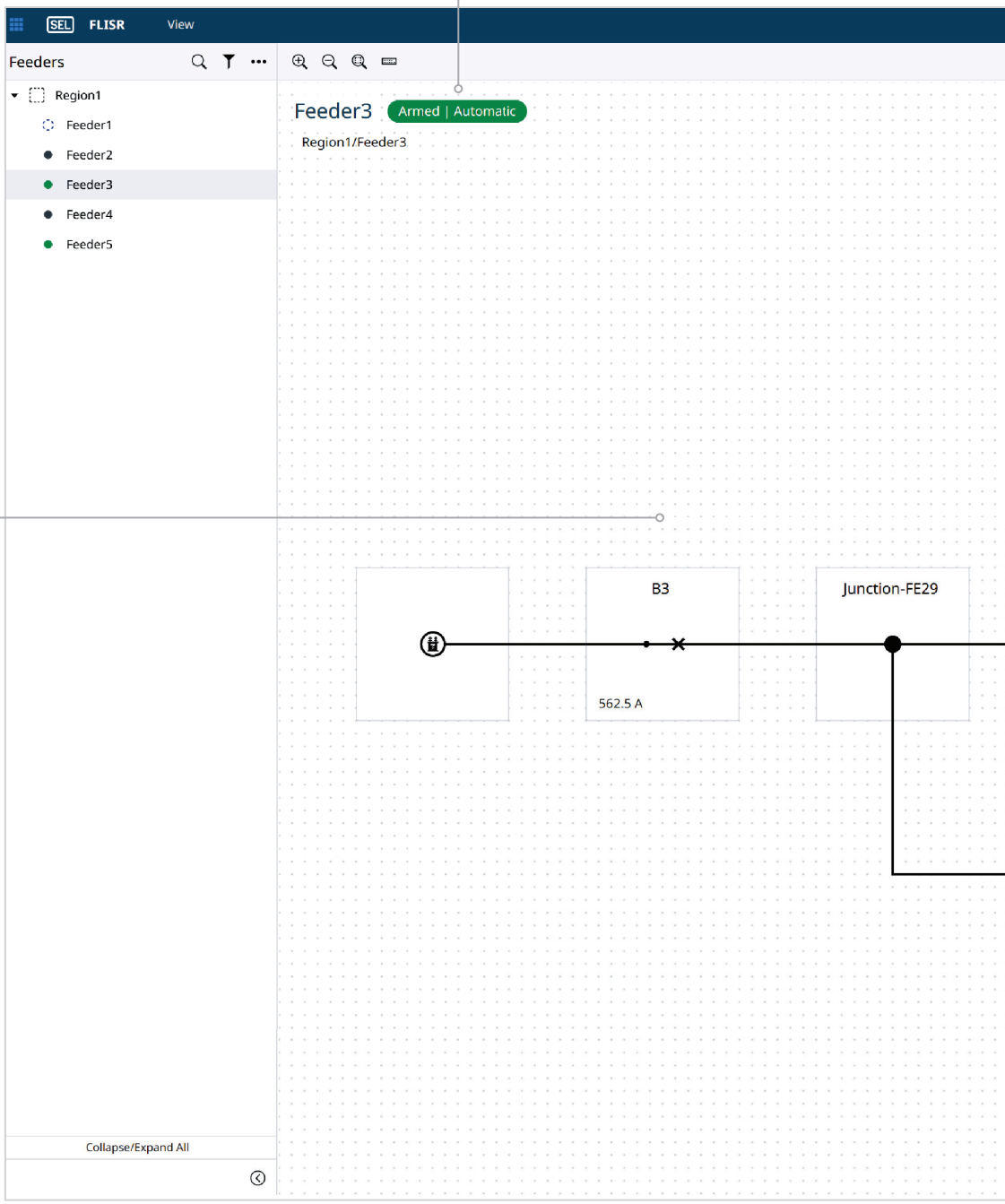
Quickly set device-specific settings for your system.

Draw your model quickly or manage your MDI GIS import one-line view using the PSM digital canvas. Once commissioned, the diagram you draw becomes the FLISR application view, providing at-a-glance insight into the system status and operations.

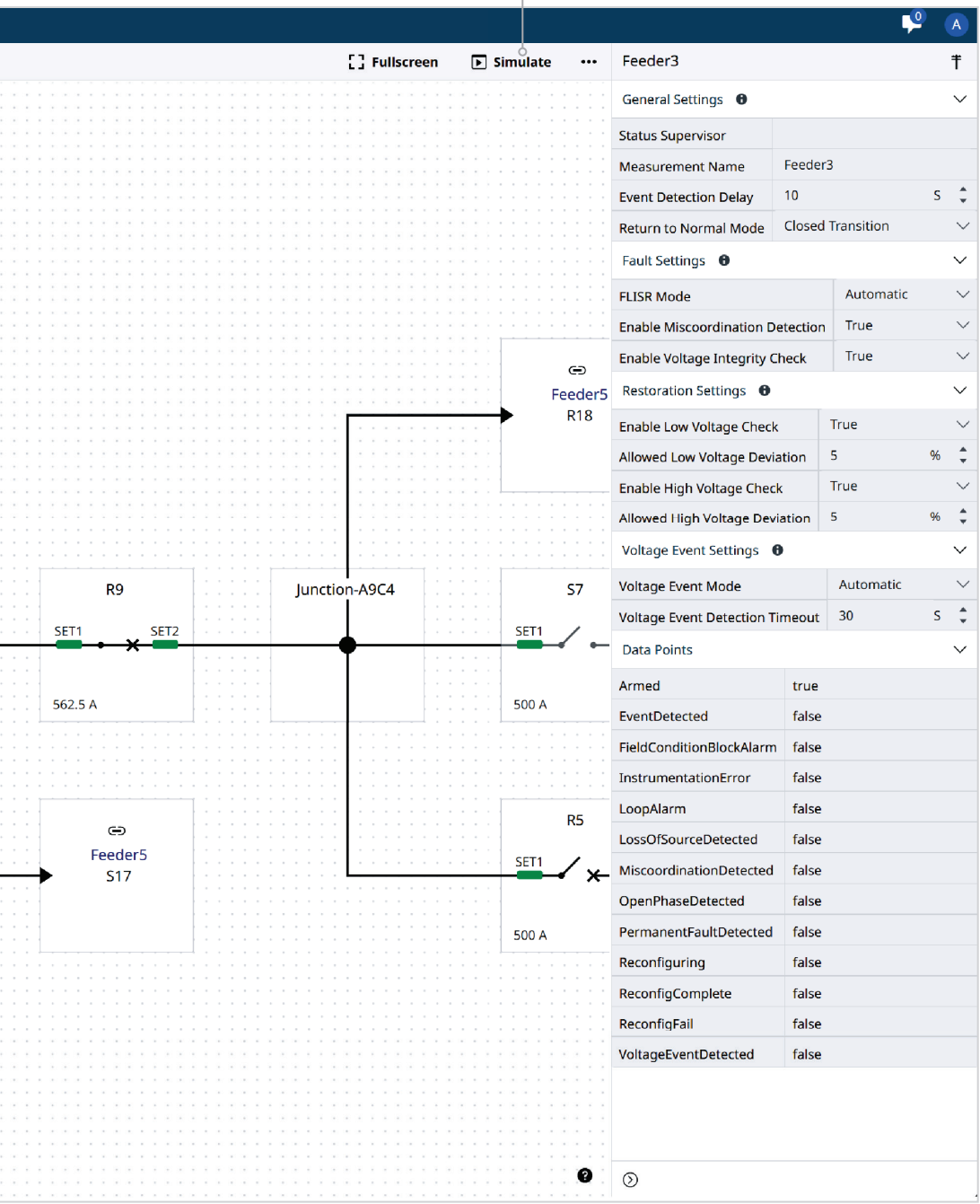
FLISR Application

See the current state of FLISR with color-coded status indicators.

See your system operate at a glance using the built-in graphical feeder topology.



Test your system with a simulator
that launches at the click of a button.



Automated Reports

The FLISR application package automatically generates reports with detailed information about events detected and mitigation steps taken by FLISR. These reports are designed to be easily read and interpreted and include before and after diagrams that mirror the user interface. In advisory mode, FLISR will generate reports that advise on how to manually execute isolation and restoration switching sequences.

The report summary shows the feeder location, event type, start and end times, and total event duration.

FLISR Automatic Response Report

Permanent Fault detected on Feeder_1 at 2023-12-06 | 11:14:46.933 AM

Summary

Feeder: Feeder_1

Event Start: 2023-12-06 | 11:14:46.933 AM

Event End: 2023-12-06 | 11:15:01.958 AM

Event Result: Success

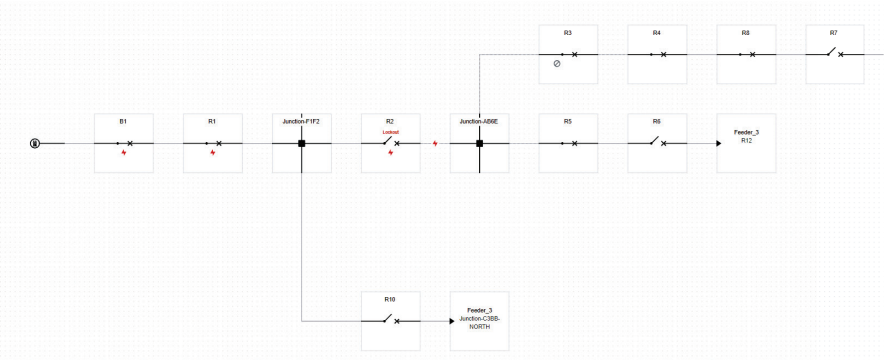
Event Type: Fault

Lockout Time (From Device): 2023-12-06 | 11:14:46.915 AM

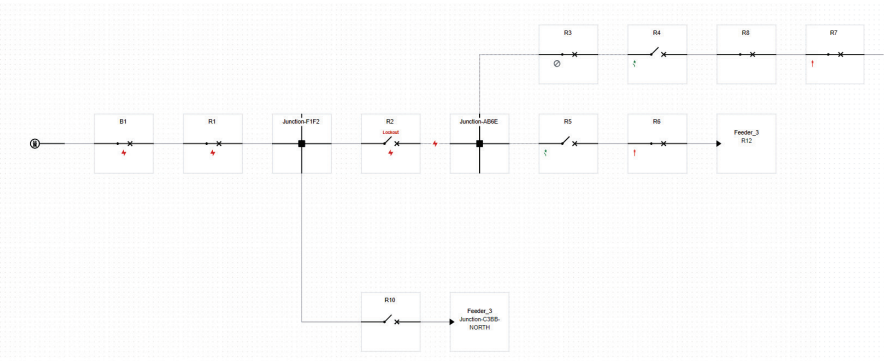
Duration: 15.024 seconds

The graphical feeder state diagrams display the feeder state at the moment the event was detected and the feeder state once the event was complete, including fault indications, fault location, and FLISR control operations.

Feeder State at Time of Event



Feeder State After Restoration



The before and after restoration table provides pre-event loading and status, post-event status, and service restoration performance.

Device Details

Device	Initial Load (A)			Post-Lockout Voltage (V)						Reconfiguration Status	
				Left PT			Right PT				
	A	B	C	A	B	C	A	B	C	Before	After
B1	101	101	101	12,470	12,470	12,470	12,470	12,470	12,470	Closed	Closed
R1	91	91	91	12,470	12,470	12,470	12,470	12,470	12,470	Closed	Closed
R10	0	0	0	12,470	12,470	12,470	12,470	12,470	12,470	Open	Open
R2	70	70	70	12,470	12,470	12,470	0	0	0	Open	Open
R3	30	30	30	0	0	0	0	0	0	Closed	Closed
R4	20	20	20	0	0	0	0	0	0	Closed	Open
R5	10	10	10	0	0	0	0	0	0	Closed	Open
R6	0	0	0	0	0	0	12,470	12,470	12,470	Open	Closed
R7	0	0	0	0	0	0	12,470	12,470	12,470	Open	Closed
R8	10	10	10	0	0	0	0	0	0	Closed	Closed

Adjacent Circuit Details

Connection	Initial Margin (A)	Feeder State	Reconfiguration Status	
			Before	After
Feeder_2.B2	200	Enabled	Source Connected	Source Connected
Feeder_3.Junction-C3BB-NORTH	200	Enabled	Source Connected	Source Connected
Feeder_3.R12	200	Enabled	Source Connected	Source Connected

Post-Reconfiguration Loading

Initial Load Lost (A): 70 **Restored Load (A):** 30

Fault Zone Load Lost (A): 40 **Unrestored Load (A):** 0

The control sequence plan shows what control actions FLISR took to isolate the fault and to restore service.

Reconfiguration Plan

Control Sequence 1

1. ISOLATE	Open R2	Device was already open
2. SECTIONALIZE	Open R10	Device was already open
3. RESTORE	Close B1	Device was already closed
4. RESTORE	Close R1	Device was already closed

Control Sequence 2

1. ISOLATE	Open R4	Completed at 11:14:58.970 AM
2. RESTORE	Send close request to connection Feeder_2.B2	Completed at 11:14:58.972 AM
3. RESTORE	Close R7	Completed at 11:15:01.950 AM
4. RESTORE	Close R8	Device was already closed

Control Sequence 3

1. ISOLATE	Open R5	Completed at 11:14:58.971 AM
2. RESTORE	Send close request to connection Feeder_3.R12	Completed at 11:14:58.972 AM
3. RESTORE	Close R6	Completed at 11:15:01.950 AM

Control Sequence 4

1. SECTIONALIZE	Open R10	Device was already open

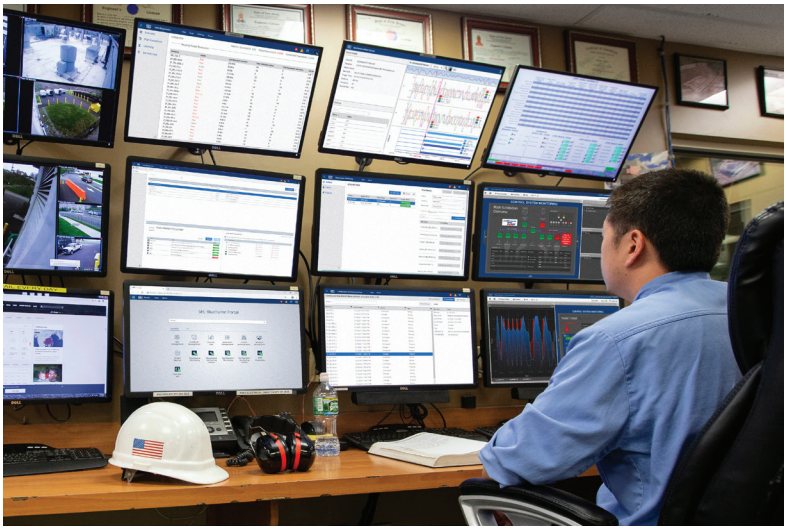
Optimization Order

1. Minimize unrestored load
2. Maximize energized segments
3. Minimize switching operations
4. Maximize margin

Deployment Options

Centralized FLISR

FLISR is well-suited to a centralized deployment. FLISR is designed to scale, making it equally simple to deploy the 1st, 10th, and 100th feeder without affecting currently deployed feeders. FLISR is designed to run on the secure SEL Blueframe operating system but is built using the same technology as modern cloud-native applications. It supports SEL rugged computing platforms as well as a virtualized environment and a private Blueframe cluster.



Regional FLISR COMING SOON

FLISR was built to be distributable, enabling utilities to push their automation intelligence solutions toward the grid edge. Many utilities deploy FLISR in regions, zones, or substations. This could mean the physical distribution of Blueframe instances or the organizational distribution of settings across multiple co-located Blueframe instances. Distributed systems can be more resilient to severe weather conditions and reduce the communications burden placed on radio systems.

SEL Blueframe Application Platform

Platform

DMS applications run on the SEL Blueframe application platform. Blueframe is a secure, modular system for installing SEL applications and for managing and exchanging data between supported applications. Blueframe is designed to minimize the attack surface and includes several security measures, like allowlisting, to prevent unauthorized access and attacks. It provides a scalable and customizable solution to accommodate your specific needs.

Hardware

Blueframe runs on powerful and reliable SEL computing platforms that ensure system availability in the most demanding applications and environments. Select the right hardware for your application by choosing from models that offer a variety of processing power options, drives, memory modules, expansion capabilities, and form factors. Blueframe and its specialized applications come embedded in your chosen computing platform.

Blueframe can also be deployed virtually on other server-grade hardware through a subscription contract. For more information about virtual deployments and minimum hardware requirements, contact your local support.

	SEL-3350	SEL-3355	SEL-3360S	SEL-3360E
Processor	Intel Atom x5-E3940 quad-core, 1.6 GHz	Intel Xeon quad-core, 2.0 or 2.8 GHz	Intel Xeon quad-core, 2.0 or 2.8 GHz	Intel Xeon quad-core, 2.0 GHz
Memory	8 GB DDR3L RAM with error-correcting code (ECC)	Up to 64 GB DDR4 RAM with ECC	Up to 64 GB DDR4 RAM with ECC	Up to 64 GB DDR4 RAM with ECC
Storage[1]	Up to 2 SSDs, 2 TB each, 2.5" SATA III (6.0 GB/s)	Up to 4 SSDs, 2 TB each, 2.5" SATA II (3.0 GB/s)	Up to 2 SSDs, 2 TB each, 2.5" SATA II (3.0 GB/s)	Up to 2 SSDs, 2 TB each, 2.5" SATA II (3.0 GB/s)
Chassis	19" rack or panel mount, 1U or 3U	19" rack or panel mount, 3U	Conductive panel-mount or standard wall-mount cooling	Conductive panel-mount or standard wall-mount cooling

[1]Blueframe only supports a single drive at this time.

Specifications

General	
Event Detection Capabilities	Permanent fault with and without miscoordination Upstream voltage loss and open-phase events
Supported Protocols	DNP3 Client and Server
Scalability	By feeder
Operating System	SEL Blueframe
Deployment Options	Embedded on SEL computing platforms or virtualized on other server-grade hardware

SEL SCHWEITZER ENGINEERING LABORATORIES

Making Electric Power Safer, More Reliable, and More Economical
+1.509.332.1890 | info@selinc.com | selinc.com

PF00687 • 20240108