



Survallent.

Fault Location, Isolation and Service Restoration (FLISR)

Training by
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Your Experience with FLISR

Who here has worked directly with FLISR?

How would you rate your knowledge of FLISR?

Beginner | **Intermediate** | Advanced

Who here has seen FLISR in action at a utility?



Training Objectives

- Understand What FLISR is and The Role It Plays in Modern Distribution Networks
- Understand How SurvalentONE FLISR Works
- Identify What SurvalentONE FLISR Needs to Function
- Understand Database and Graphics Considerations for Optimal FLISR Operations
- Answer Some of The Commonly Asked Questions About SurvalentONE FLISR



Table of Contents

Module 1: The Basics

- Core Definitions and Principles
- Why FLISR?
- SurvalentONE FLISR
 - DMS Phased Approach (where FLISR fits)
 - FLISR Capabilities
 - FLISR Requirements
 - Illustrations: How it Works
 - Load Calculation Methods
- More Details on The KB

Module 2: System Setup

- Licenses
- Database
- SmartVU

Module 3: Operation and Demonstrations

- End-to-End FLISR Sequence
- Handling Exceptions

Module 1: The Basics



What is FLISR

- **F**AULT, **L**OCATION, **I**SO LATION and **S**ERVICE **R**ESTORATION
- A distribution automation application that utilities can deploy to:
 - Enable automatic load sectionalization and restoration
 - Detect and locate faults in real time
 - Automatically isolate faulted sections
 - Reroute power to minimize affected customers
 - Restore service quickly and safely

Centralized FLISR vs Decentralized FLISR

Decentralized FLISR

- **Decentralized** – A **scripted solution** that executes pre-defined, programmed activities to re-energize feeders using power from adjacent feeders
- Requires **script** creation for **every possible network configuration**
- Use **proprietary vendor equipment**, you may not be able to utilize all the smart devices you invested in
- Difficult to scale to large grids because the number of **restoration scenarios increases exponentially with each additional device**
- Best suited for feeders with critical loads that require **sub-second restoration**, such as hospitals
- May prove to be laborious to maintain long term

Centralized FLISR

- **Centralized** – A **model-based solution** that uses real-time data from the network to identify the best network reconfiguration, isolate the faulted area, and restore power to customers outside the faulted area
- **No need to define a “normal” state.** FLISR will base its analysis on the current state of the network eliminating the need to write a script for each possible state
- Before transferring load to an adjacent feeder, the solution analyzes that the feeder has sufficient capacity to avoid overloading it
- **Vastly scalable**, so ideal for any size of network, small to large

Survalent's FLISR is Centralized



Centralized FLISR

Impact on Customers without FLISR



Fault
Occurs

Fault
Discovered
(through customers/
SCADA devices)

Travel
Time

1 - 10 mins

30 - 45 mins

Locating
the Fault

10 - 15 mins

Manual Switching
for Partial
Restoration

10 - 20 mins

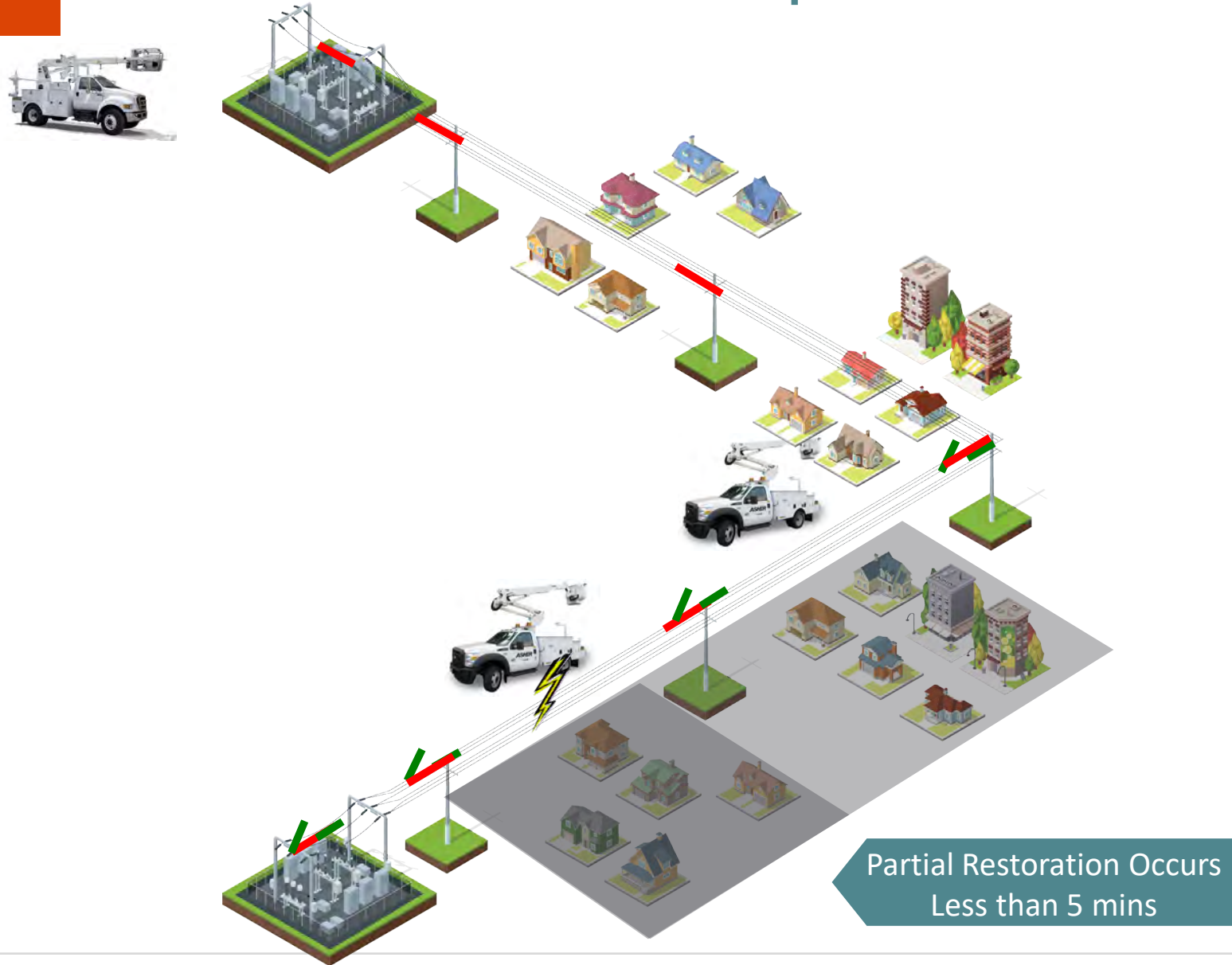
Repair Time

1 - 4 hours

Return to
Normal State

Partial Restoration Occurs
50 - 90 mins

How It Works And Its Impact on Customers



Fault
Occurs

Partial Restoration
at utility
control room

Less than 5 mins

Travel Time &
Locating the Fault

40 - 60 mins

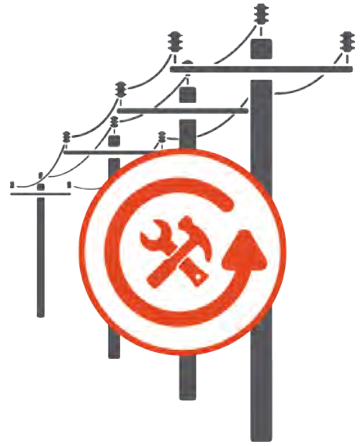
Repair
Time

1 - 4 hours

Return to
Normal State

Partial Restoration Occurs
Less than 5 mins

Why FLISR - Utility Benefits



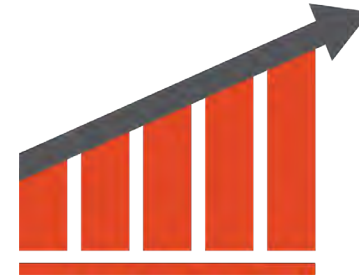
**Rapid fault
location & service
restoration**



**Reduce operating
expenses**



Lower field costs



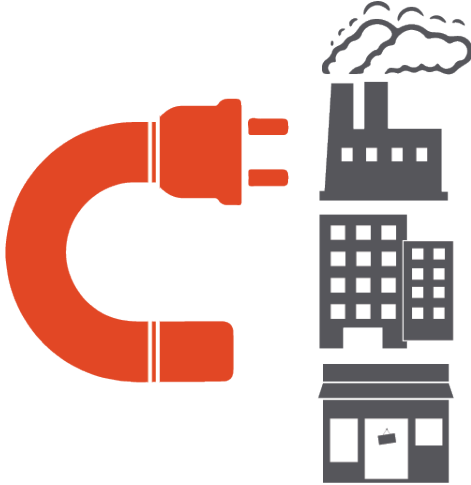



Increase revenue



**Better decision -
making in the
control room**

Why FLISR - Utility Benefits

 <ul style="list-style-type: none">▪ SAIDI▪ SAIFI▪ CMI			
Improve reliability indicators	Less outage downtime	Attract C&I customers with premium power	Compliance with regulatory standards



What's The Biggest FLISR Benefit for You?



SurvalentONE FLISR

DMS Application Deployment

PHASE 1:

No network model/connectivity required

- Switch Orders
- Load Management
 - Power Factor Control
 - Dynamic Voltage Regulation (DVR)
 - Voltage Reduction
 - Load Curtailment
 - Rotational Load Shedding
- Short-term Load Forecasting / Load Estimation

PHASE 2:

Connectivity required

- Fault Location, Isolation and Service Restoration (FLISR) & Loss of Voltage (LOV)
- Protection Settings Manager (PSM)
- Distribution Contingency Analysis (DCA)
- Schematic Generator

PHASE 3:

Network model/connectivity required

- Distribution Power Flow (DPF)/Distribution State Estimation (DSE)
 - FLISR with DPF
 - Short-circuit analysis
- Contingency Analysis
- Fault Location
- Volt/VAR Optimization (VVO)
- Optimal Feeder Reconfiguration (OFR)



SurvalentONE FLISR and LOV Overview

- SurvalentONE FLISR comes in one package with Loss of Voltage (LOV)
- Handles any network configuration
- Triggered by a Lockout. The breaker/recloser that triggers FLISR/LOV can be located inside or outside the substation
- It determines fault location using fault targets/indicators
- Can adapt to exclude disabled, telemetry failed & tagged devices (including hot-line tags applied by the field crew)
- Load transfer segmentation available
- Single phase or multi-phase fault detection
- SurvalentONE Loss of Voltage (LOV) application: Monitors the network for sudden voltage drops. LOV attempts to isolate the cause of voltage loss; Reroute power to customers
- You can set FLISR and LOV mode and status on a per-device basis. Global option is also available to disable FLISR on all feeders

Available Operating Modes

Manual Mode

- Only detects if a fault is in the network

Semi-Automatic Mode

- Creates a switch order that isolates the fault & provides service restoration around the isolated area to the operator for approval & execution

Automatic Mode

- Creates & executes a switch order that isolates the fault & provides service restoration around the isolated area without operator intervention
- Quickest option to restore power
- Most likely to turn sustained outages into momentary outages

FLISR Requirements

License Requirements

FLISR and LOV

- FLISR and LOV requires a license
- Single license for both applications

Topology Processor

- Calculates and displays the energized or de-energized status of network line sections

Switch Orders

- Uses switching operations and tags that produce conditions for which a guarantee may be issued

Technical Requirements

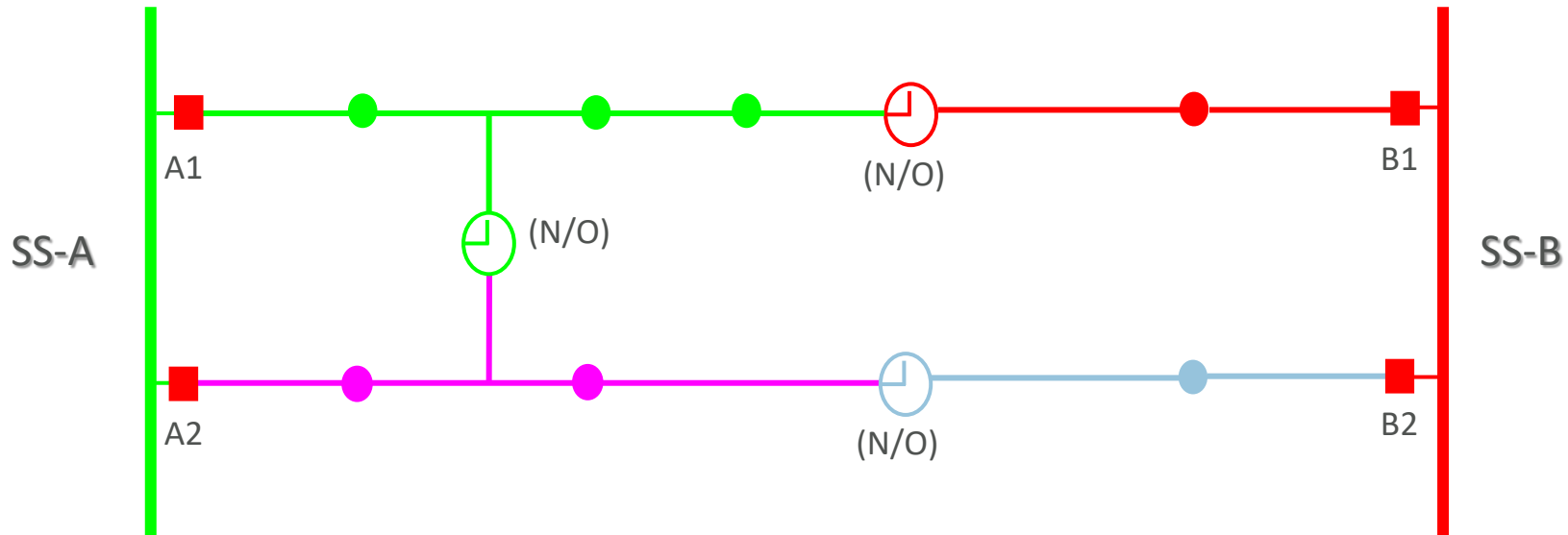
Non Survalent (Dependencies)

- Telemetered Switches
- Telemetered Tie Switches to backup feeder(s)
- Fault Targets/Indicators
- Current Measurements
- Reclosing (EN/DIS)

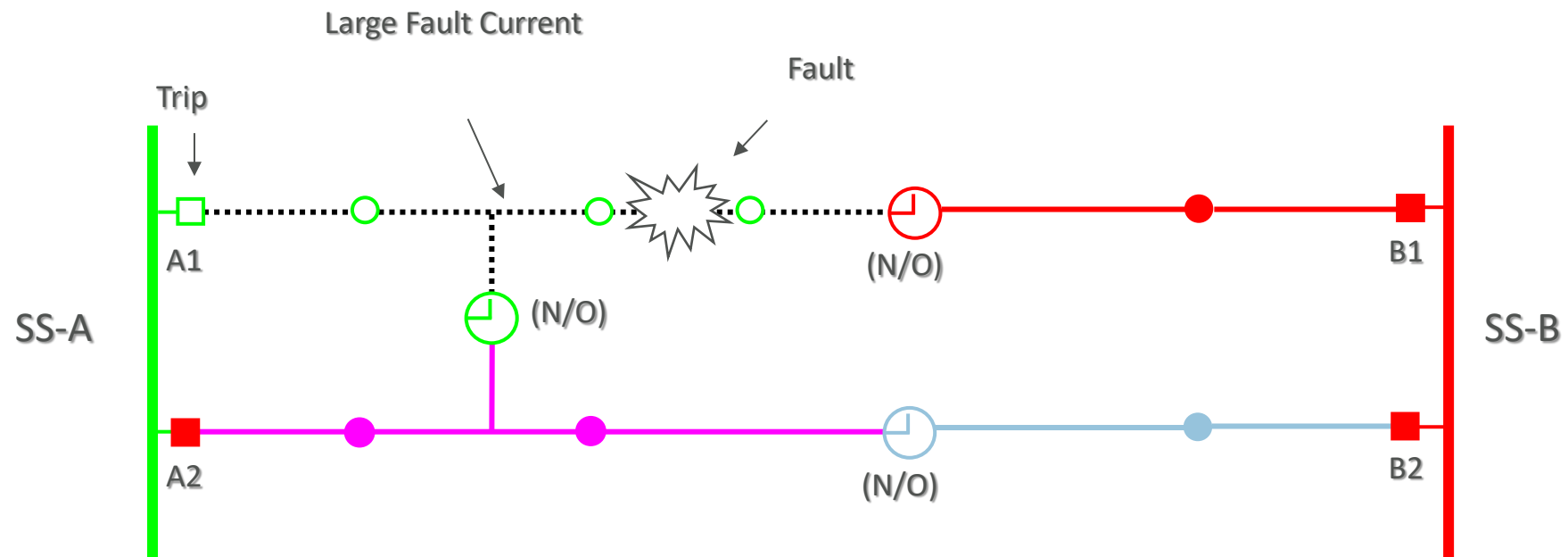


FLISR Example Scenarios

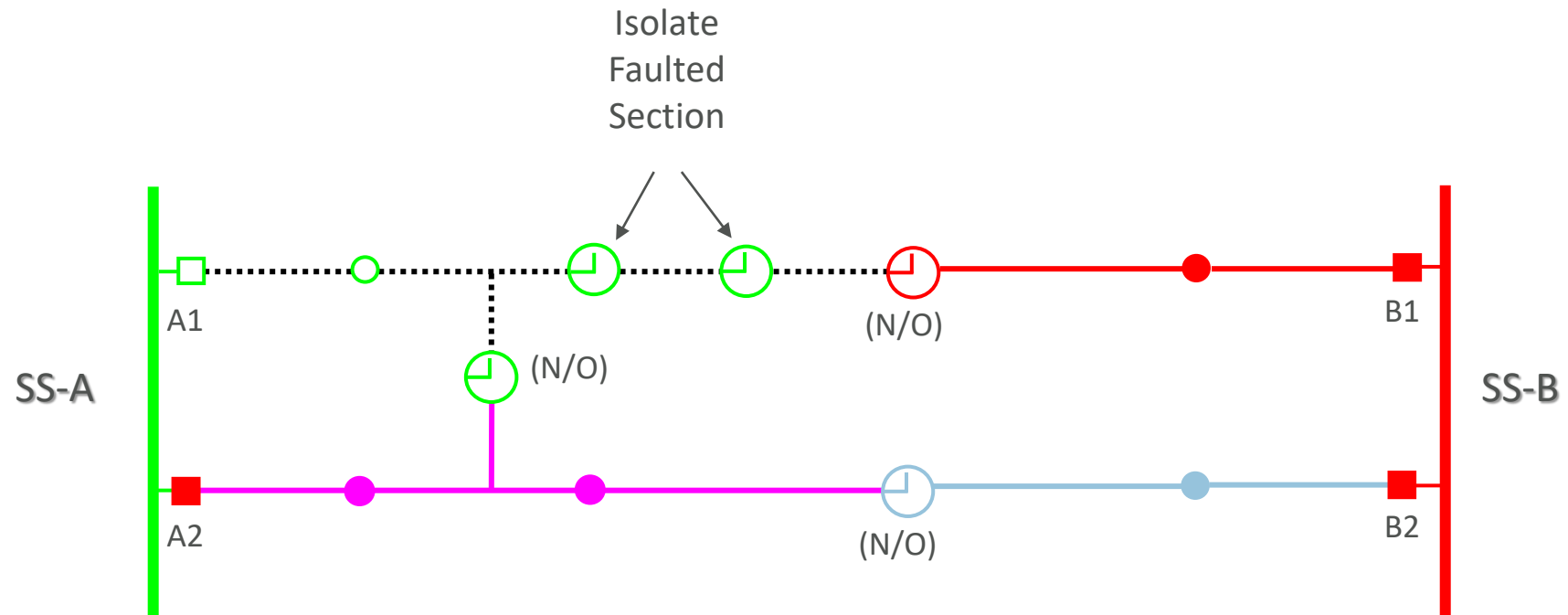
FLISR Scenario 1: Normal Configuration



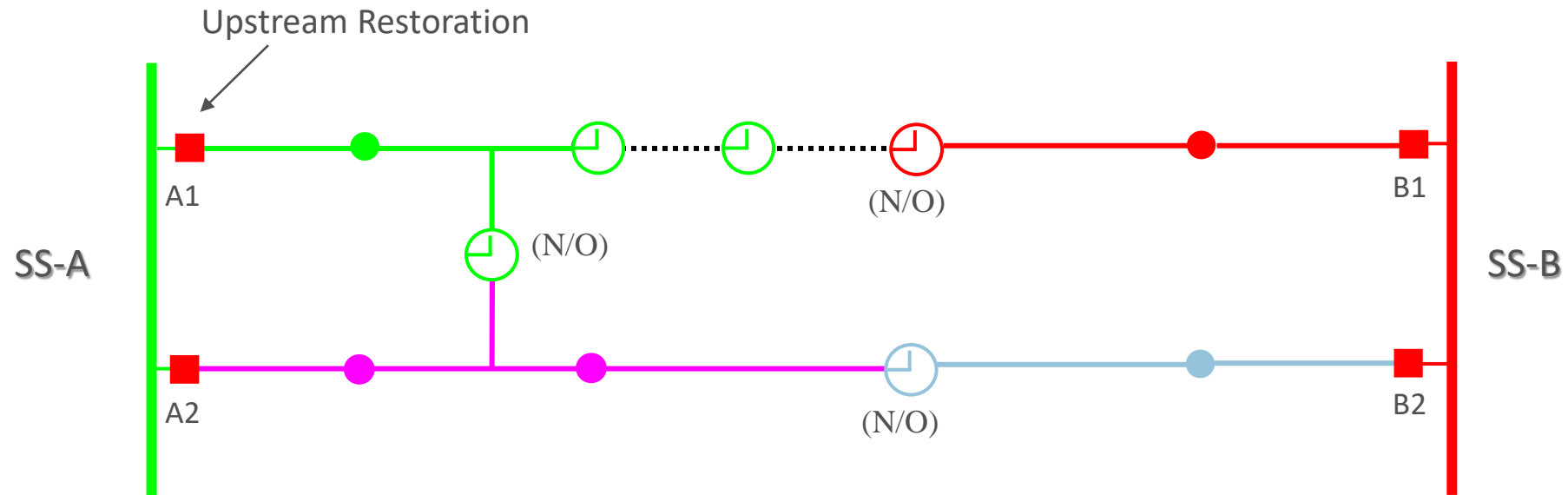
FLISR Scenario 1: Fault Occurrence



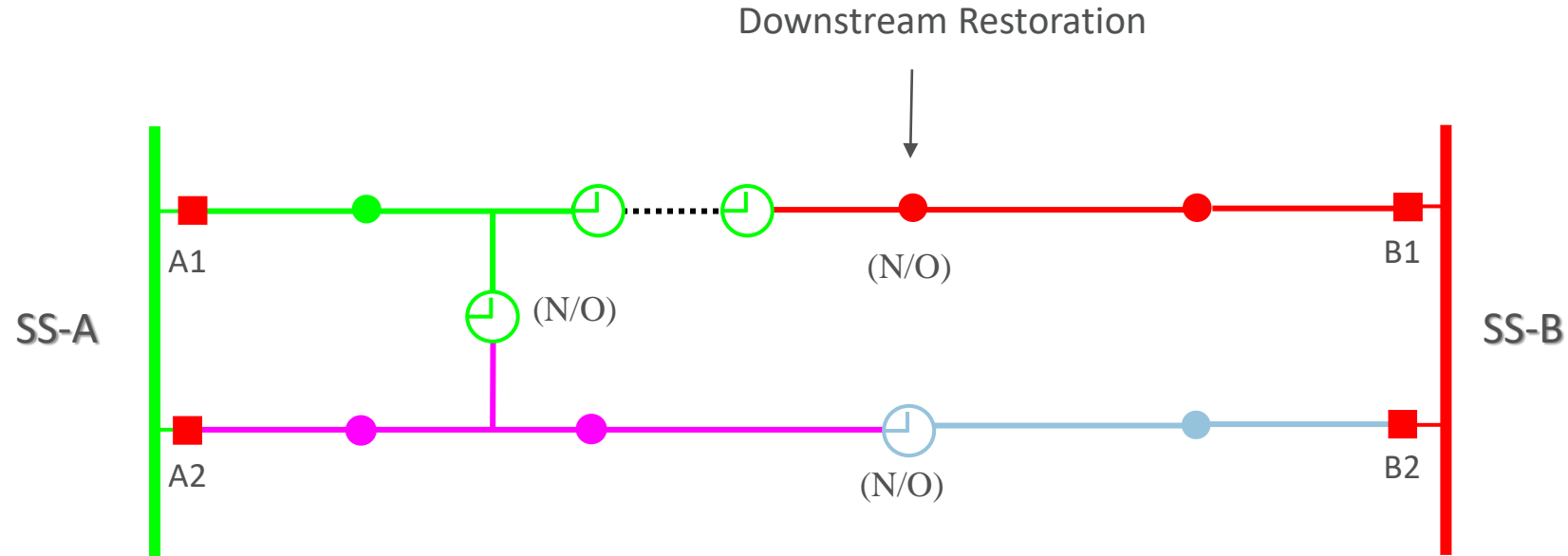
FLISR Scenario 1: Isolating Faulted Section



FLISR Scenario : Upstream Restoration

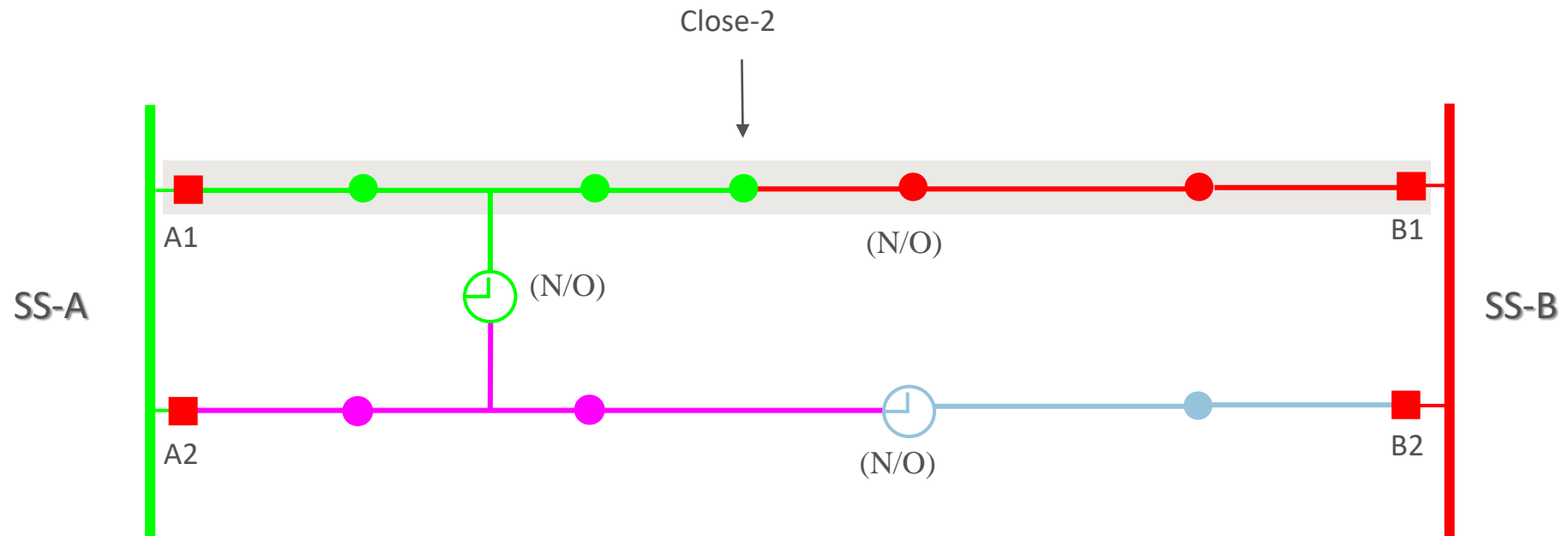


FLISR Scenario 1: Downstream Restoration

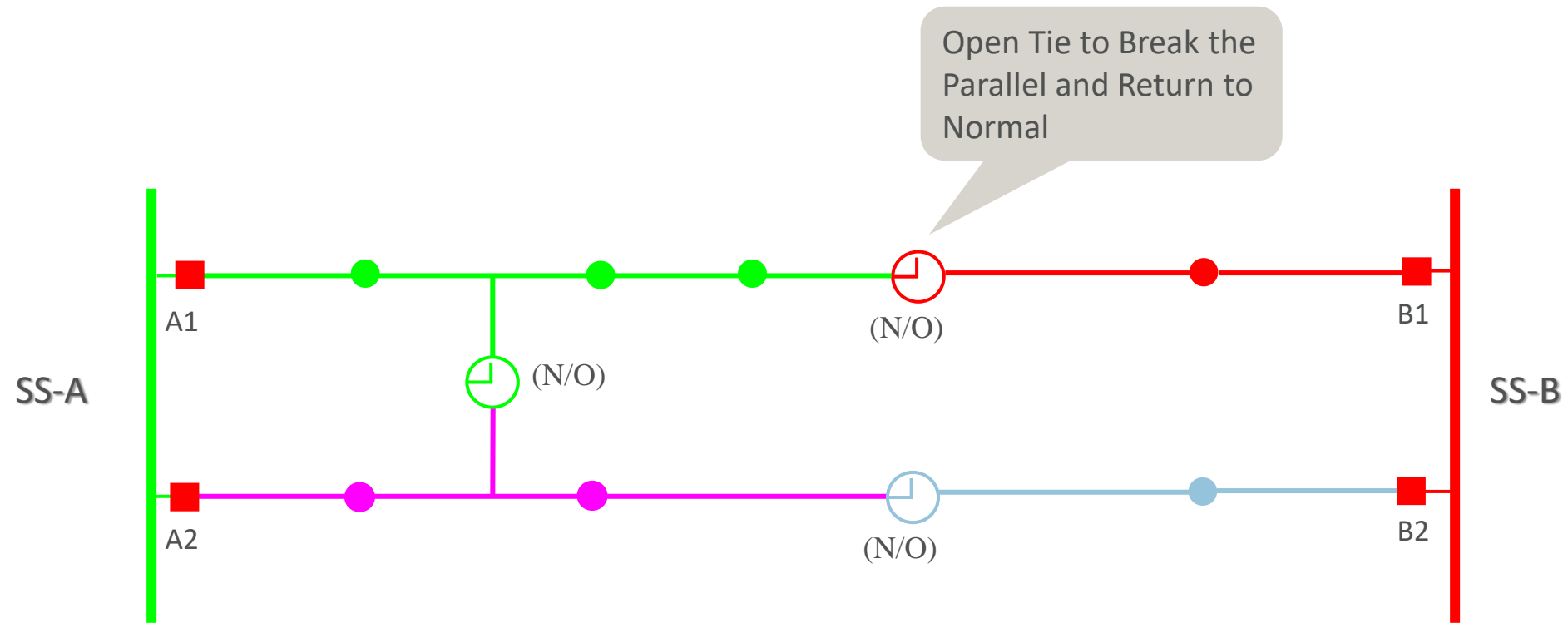


Send crews to investigate and repair the faulted section

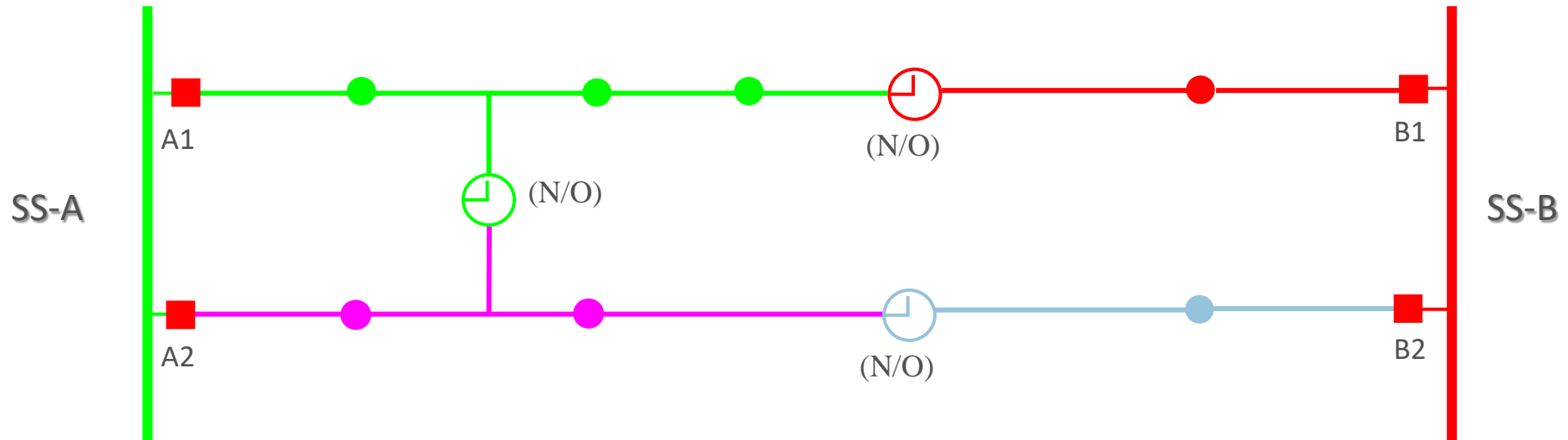
FLISR Scenario 1: Temporary Parallel



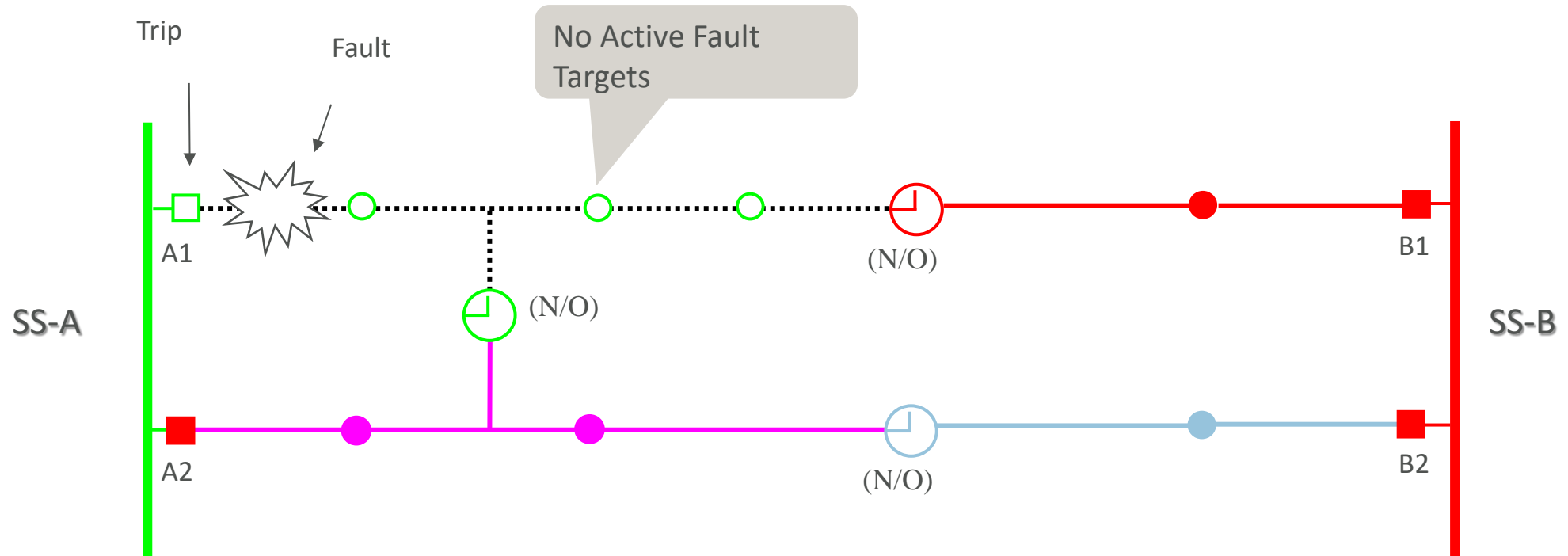
FLISR Scenario 1: Last Step



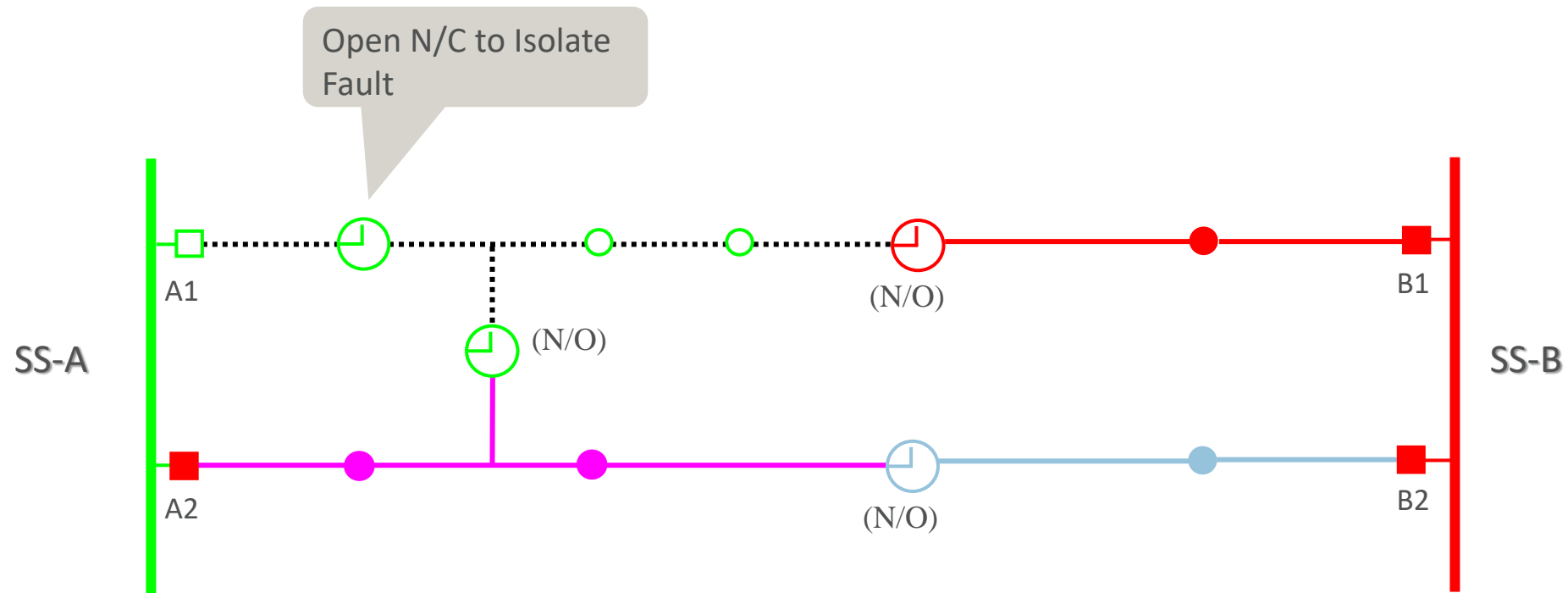
FLISR Scenario 2: Normal Configuration



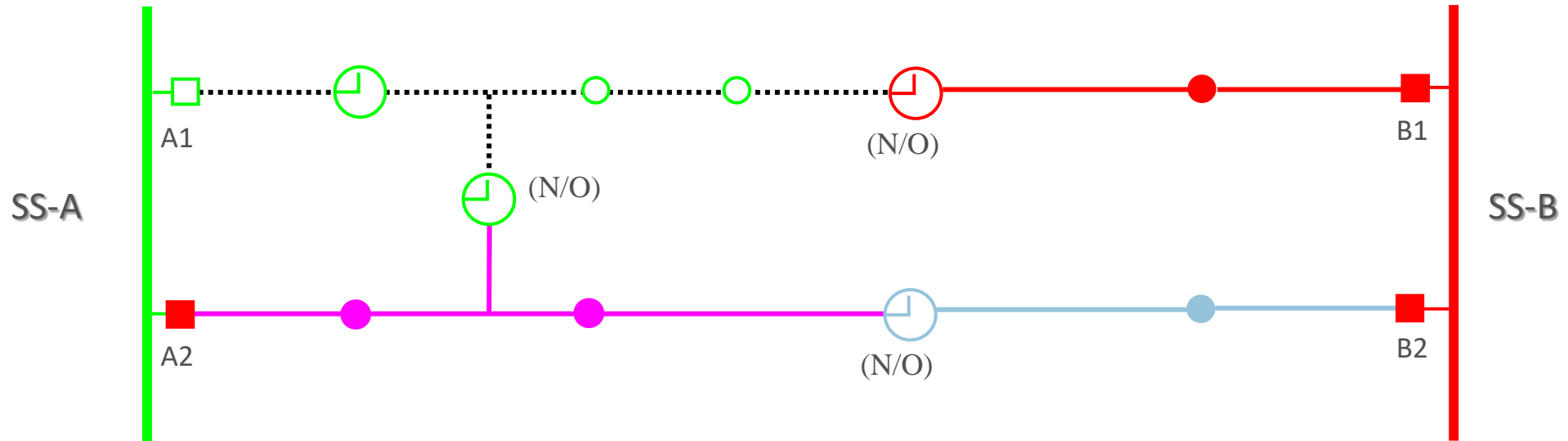
FLISR Scenario 2: Fault Occurrence



FLISR - Scenario 2 - Isolate Faulted Section

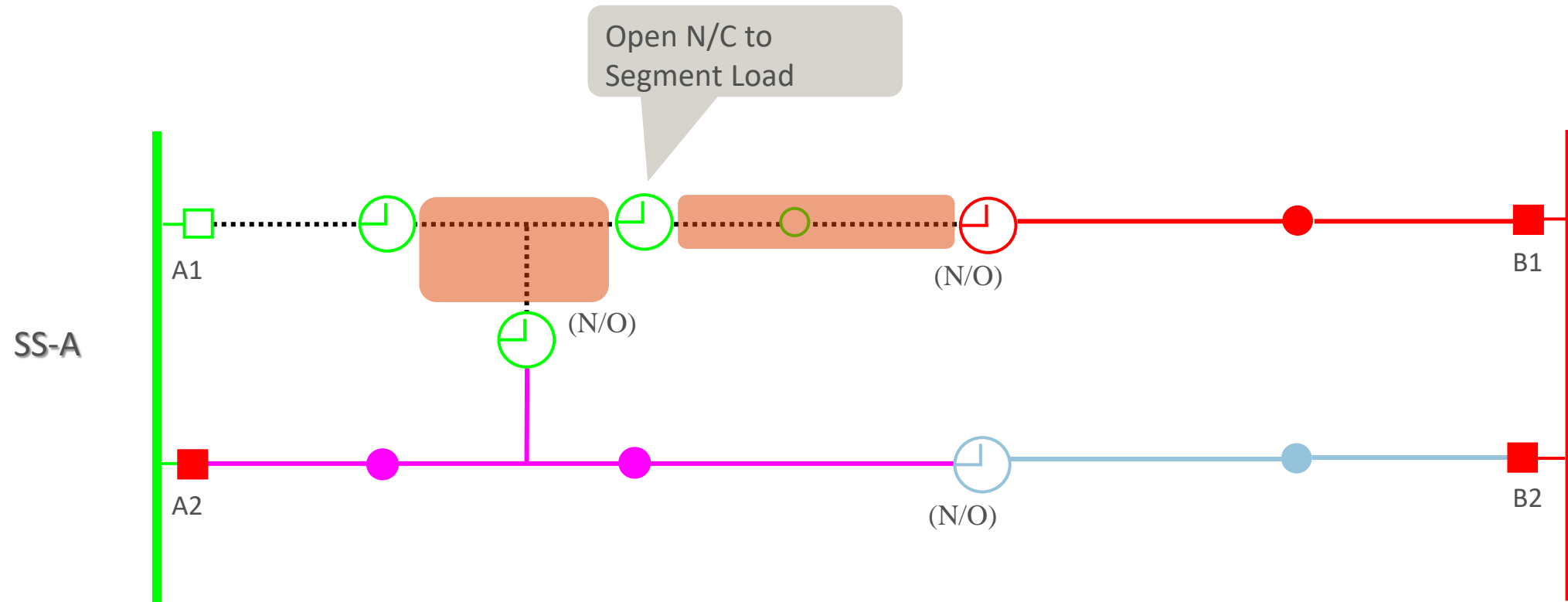


FLISR Scenario 2: Downstream Restoration

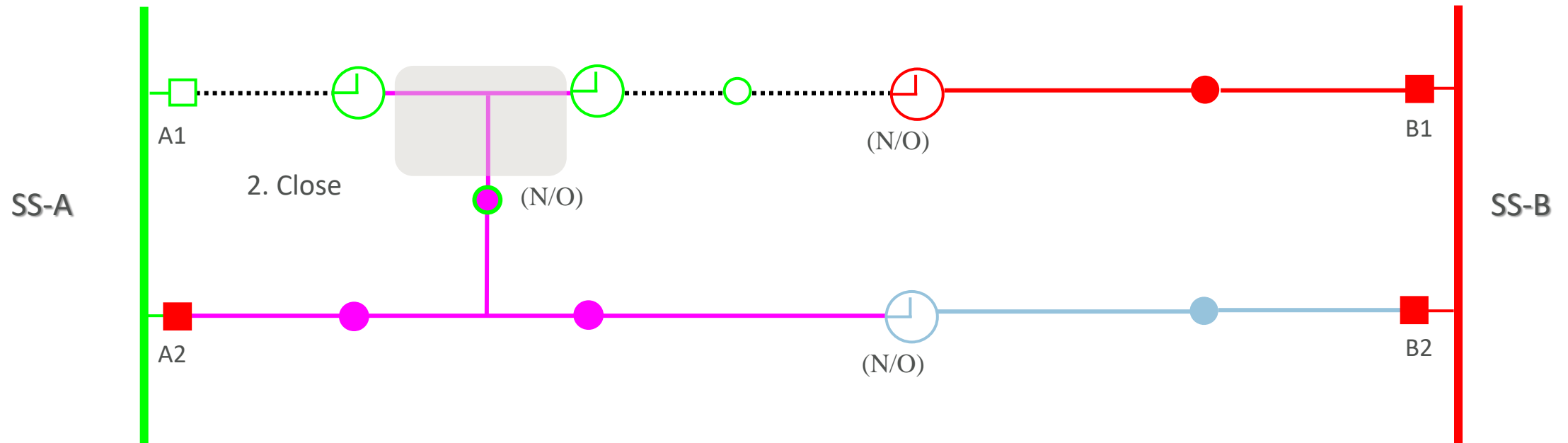


**** If the load is too large to be picked up, FLISR will do load segmentation and then load transfer**

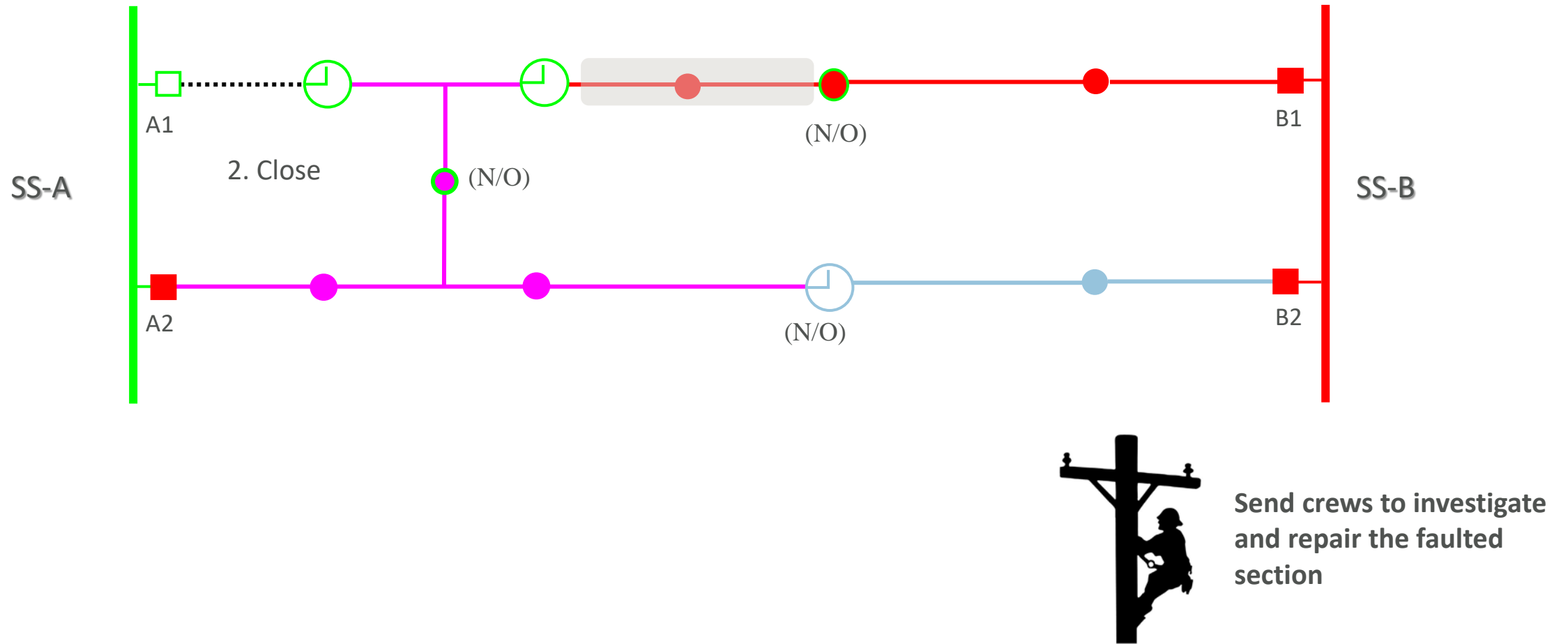
FLISR Scenario 2: Load Segmentation



FLISR Scenario 2: Downstream Restoration 1



FLISR Scenario 2: Downstream Restoration 2





Demo



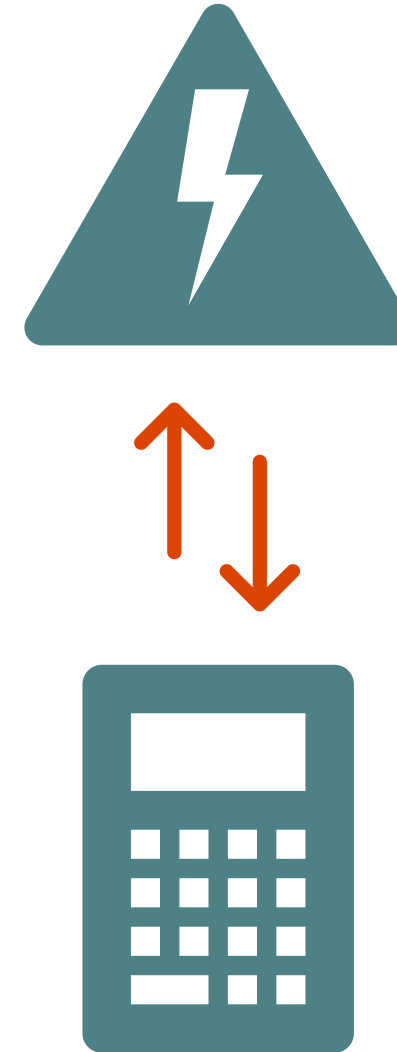
Communication Considerations

Factors that can affect the response time of FLISR:

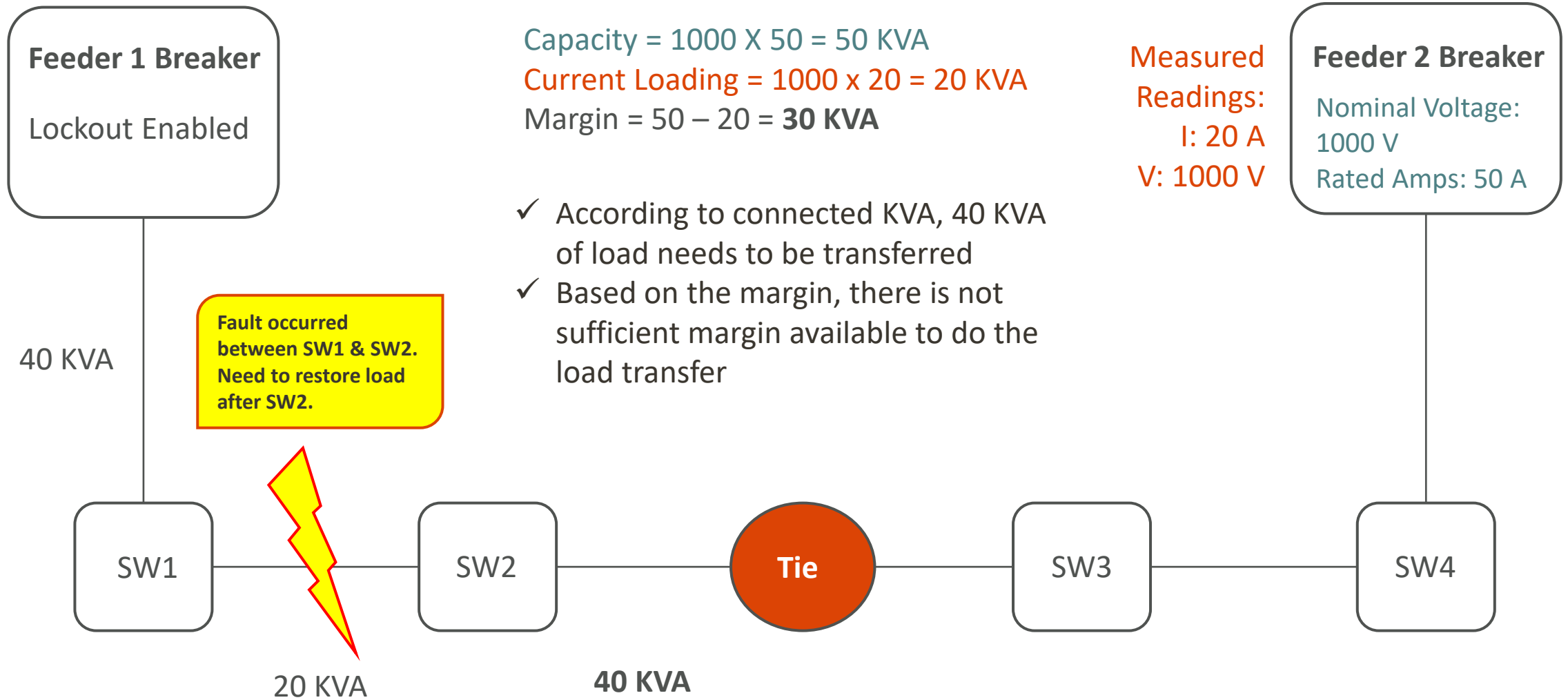
- **Lockout Timer:** FLISR will only start once a lockout has occurred
- **Verification Phase:** after the lockout has been detected, FLISR updates the status of all the devices/points that could be used. This can take up to two minutes. Any device/point who does not respond within two minutes is automatically excluded from consideration
- **Issuing Commands:** before going to the next step, FLISR needs to be sure that that the command was successfully sent. After receiving an ACK from a device, FLISR repolls the device in 5s to ensure that the operation was successful

FLISR Service Restoration Options

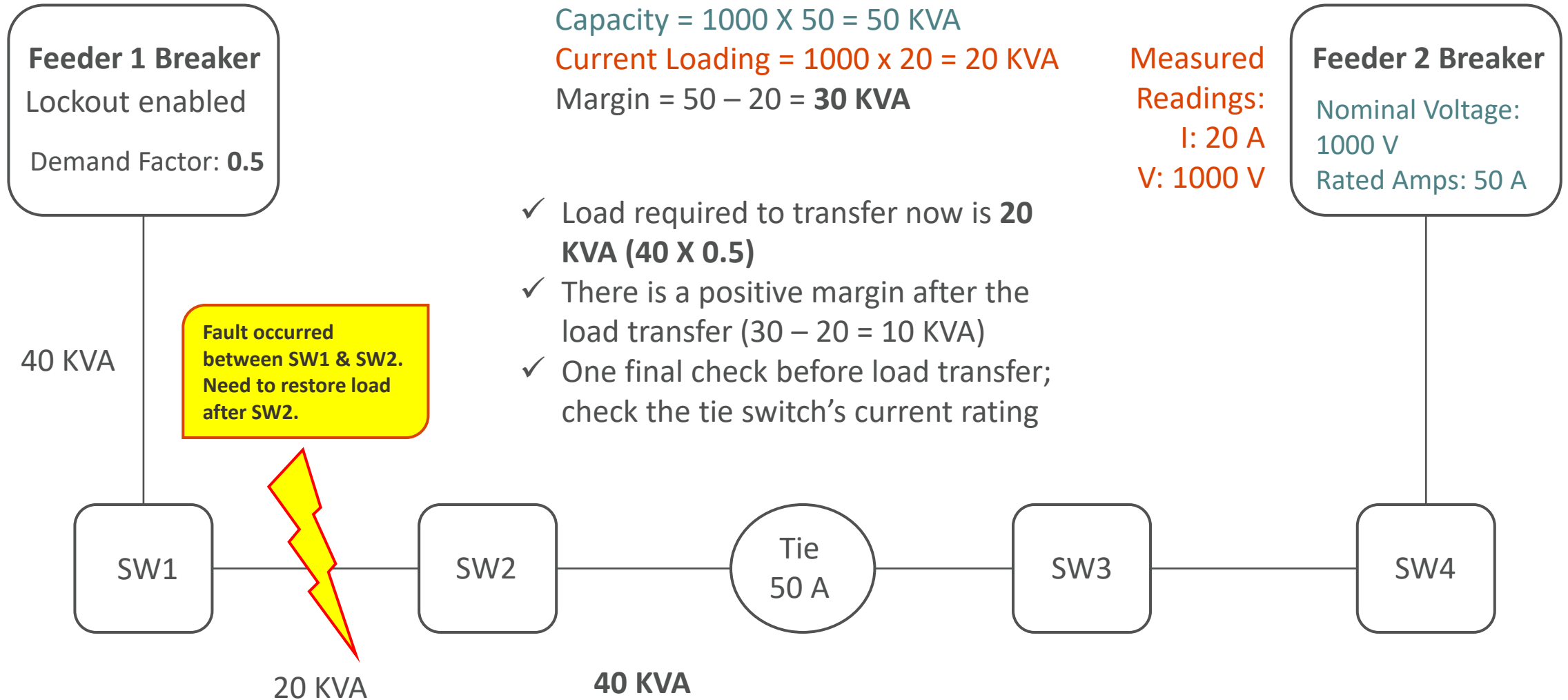
- Transformer's connected KVA
- Transformer's connected KVA scaled by demand factor
- Transformer's connected KVA scaled by feeder injections
- Telemetered values
- Power flow study



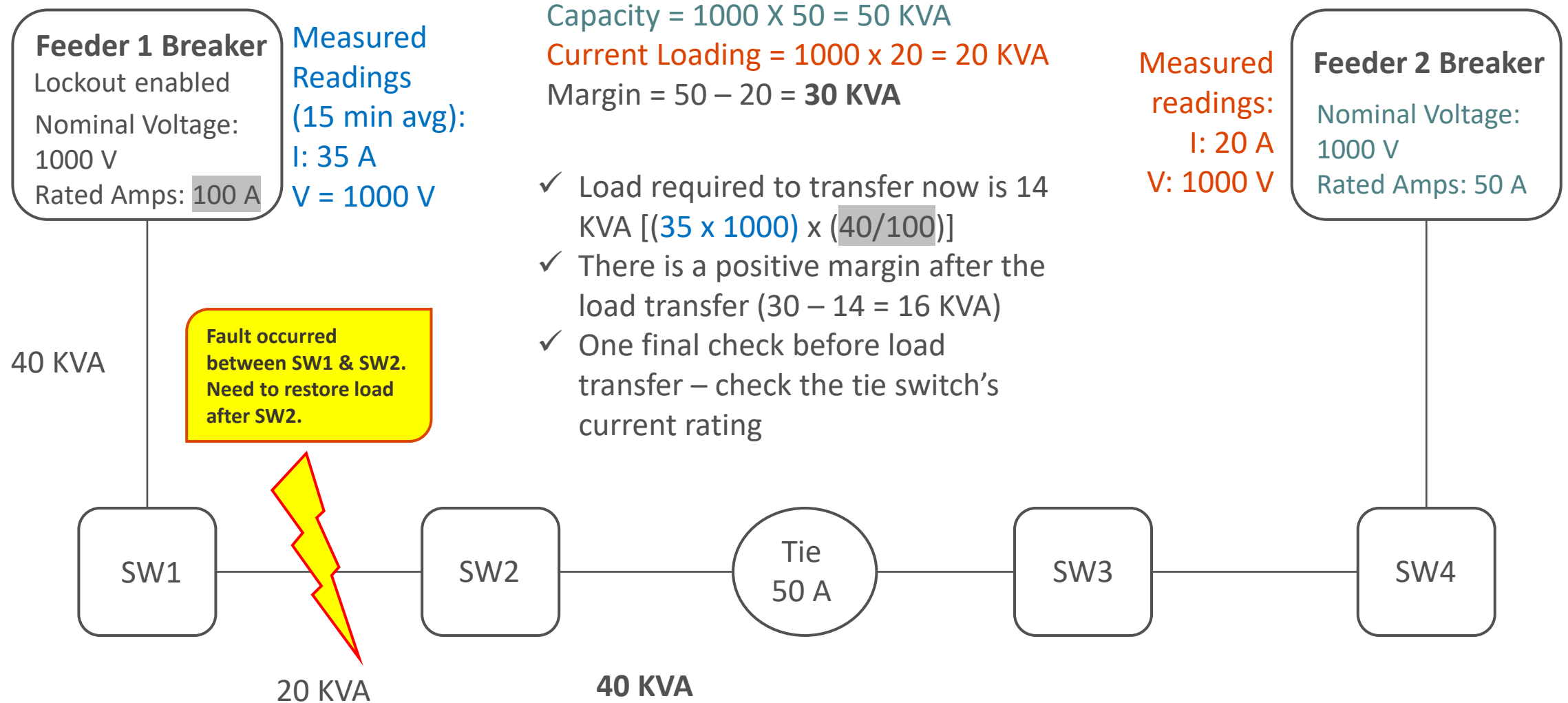
Load Transfer Using Connected KVA



Load Transfer Using Connected KVA with Demand Factor



Load Transfer Using Connected KVA Scaled by Feeder Injection



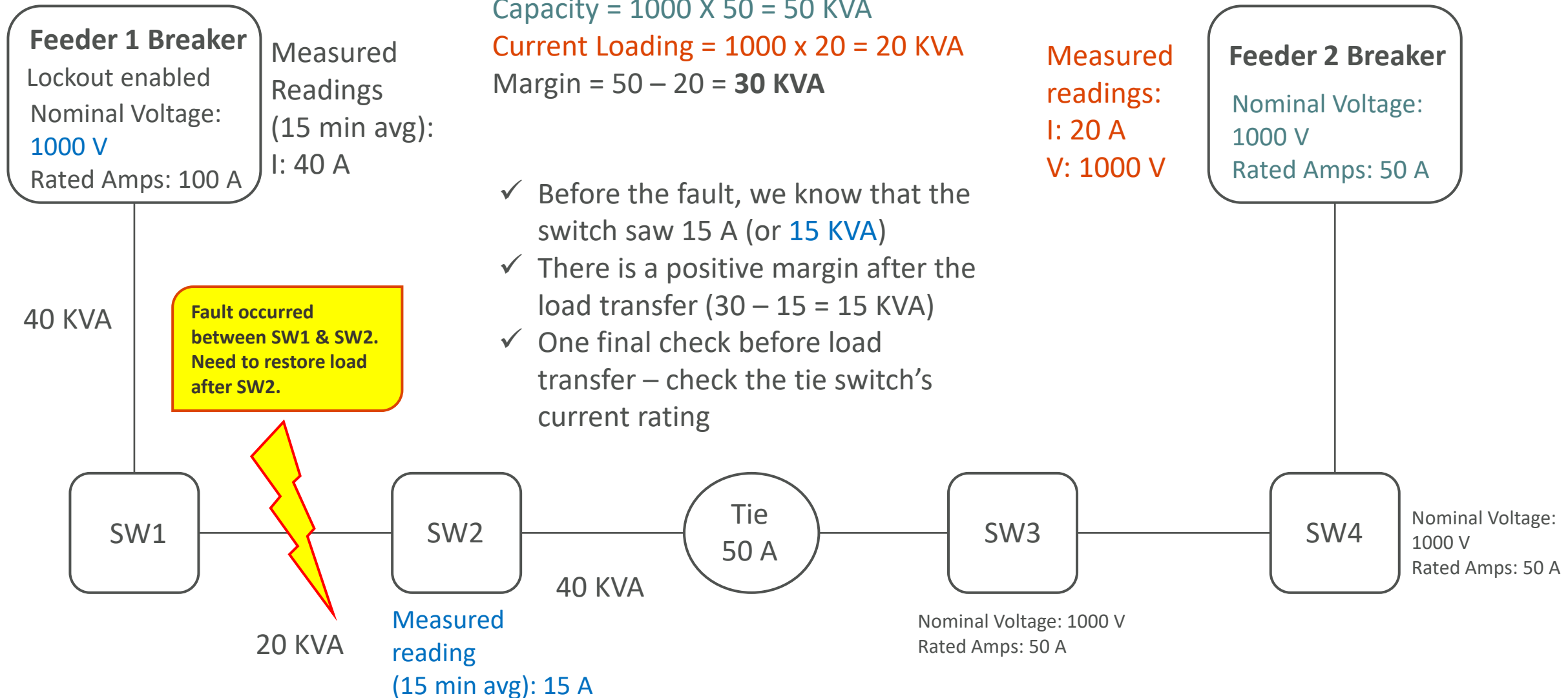
How Do We Determine The Current Reading

- Loading is Nominal Voltage * Current Reading
- In memory we keep 1 min average, for points related to FLISR
- When the fault happens, if the 1 min average is altered by the fault, we compare it with the 15 min average
 - If the discrepancy is <10%, take the 1 min average
 - If the discrepancy is >10%, take the 15 min average

Case #1	
15 min AVG	30
1 min AVG	60
<10%	1 min
>10%	15 min
30	

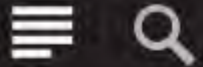
Case #2	
15 min AV	30
1 min AVG	31
<10%	1 min
>10%	15 min
31	

Load Transfer Using Telemetered Values



FLISR in The KB

Survalent.



- Home
- Release Notes
- SurvalentONE SCADA
- SurvalentONE OMS
- SurvalentONE DMS**
- DMS Administration
- Terms and Concepts
- Network Model
- Catalogs and Settings
- DMS Equipment Editors
- Power Flow Implementation
- FLISR Implementation**
- Database Preparation
- SmartVU Preparation
- Other Suggestions
- Checklist
- Volt-VAR Optimization Implementation
- DER Schedules
- Table and Database Adjustments

Navigation: SurvalentONE

FLISR in

This section contains

The FLISR feature is designed for operation deployment.

FLISR Registration

In case you have a new region in the regions list, you need to register it.

The point number is the same as the region name.

The value 1 is the region name.

- Categories
- Comments
- Issues
- Caller Types
- Utility Types
- TX Phase Outage
- KPI's
- Major Event Types
- Regions
- Municipalities
- Notifications
- Transformer Types
- Departments
- Job Categories
- Major Streets
- Problems
- DER

Survalent.



- Home
- Release Notes
- SurvalentONE SCADA
- SurvalentONE OMS
- SurvalentONE DMS**
- DMS Administration
- DPF (Distribution Power Flow)
- FLISR (Fault Location, Isolation, and Service Restoration)**
- FLISR Deployment
- Online DMS Viewer
- FLISR Operation
- DMS Dashboard for FLISR/LOV
- VVO (Volt-VAR Optimization)
- DCA (Distribution Contingency Analysis)
- FLA (Fault Location Analysis)
- STLF (Short-Term Load Forecasting)
- DVR (Dynamic Voltage Regulation)
- LC (Load Curtailment)

Module 2: Setup



Setup – Knowledge Check

How Familiar Are You with Database Editing?

Familiar | **Somewhat Familiar** | Not Familiar

How Familiar Are You with How NTP Works?

Familiar | **Somewhat Familiar** | Not Familiar

How Familiar Are You with Line Section Editing?

Familiar | **Somewhat Familiar** | Not Familiar

How Familiar Are You with Switch Orders?

Familiar | **Somewhat Familiar** | Not Familiar

Licensing

Licenses

- DMS BASE
- FLISR/LOV
- Switch Orders
- Topology Processor

License Manager

General Information about your licensed System :

Location : FILE SCADA Points (Max.) Used : (Unlimited) 3525
Type : Demo Redundancy : QUAD
Max. Version Family : 99 OMS Meters (Max.) Used : (Unlimited) 1035
Status : OK FLISR/LOV Feeders (Max.) Used : (Unlimited) 4
Expiry : 36 days left Map Clients : Unlimited

Choose a product or component to filter the list of licenses available:

Product: ADMS Filter: Advanced

License	Licensed	Component	Sub-Component	Expiry Date
Distribution Power Flow	<input checked="" type="checkbox"/>	Advanced	DMS	
Distribution State Estim...	<input checked="" type="checkbox"/>	Advanced	DMS	
DMS Base	<input checked="" type="checkbox"/>	Advanced	DMS	
Dynamic Voltage Regula...	<input checked="" type="checkbox"/>	Advanced	Distribution Aut...	
Email Notifications	<input checked="" type="checkbox"/>	Advanced	OMS	
Fault Location Analysis	<input checked="" type="checkbox"/>	Advanced	DMS	
FLISR/LOV	<input checked="" type="checkbox"/>	Advanced	FLISR	
Load Curtainment	<input checked="" type="checkbox"/>	Advanced	Distribution Aut...	
Load Estimation	<input checked="" type="checkbox"/>	Advanced	DMS	
LV Topology	<input checked="" type="checkbox"/>	Advanced	SCS	
Major Event Management	<input checked="" type="checkbox"/>	Advanced	OMS	
Mobile Crew	<input checked="" type="checkbox"/>	Advanced	OMS	
Operation Analysis Envi...	<input checked="" type="checkbox"/>	Advanced	OAE	
Playback Server	<input checked="" type="checkbox"/>	Advanced	Playback	

Configure

License Manager

General Information about your licensed System :

Location : FILE SCADA Points (Max.) Used : (Unlimited) 3525
Type : Demo Redundancy : QUAD
Max. Version Family : 99 OMS Meters (Max.) Used : (Unlimited) 1035
Status : OK FLISR/LOV Feeders (Max.) Used : (Unlimited) 4
Expiry : 36 days left Map Clients : Unlimited

Choose a product or component to filter the list of licenses available:

Product: ADMS Filter: --All

License	Licensed	Component	Sub-Component	Expiry Date
SNMP v3	<input checked="" type="checkbox"/>	Protocols	Protocols	
Subscription	<input checked="" type="checkbox"/>	Protocols	Protocols	
Survallent Historian	<input checked="" type="checkbox"/>	Historian		
Switch Orders	<input checked="" type="checkbox"/>	SCADA	Features	
Tejas Series 3&5	<input checked="" type="checkbox"/>	Protocols	Protocols	
Text Service (Text)	<input checked="" type="checkbox"/>	Interfaces	MultiSpeak™	
Text Service (Text)	<input checked="" type="checkbox"/>	Interfaces	Other	
Topology Processor	<input checked="" type="checkbox"/>	Advanced	SCS	
Video Surveillance	<input checked="" type="checkbox"/>			
Volt/VAR Optimization	<input checked="" type="checkbox"/>	Advanced	DMS	
Voltage Reduction	<input checked="" type="checkbox"/>	Advanced	Distribution Aut...	
Web Call Handler	<input checked="" type="checkbox"/>	Advanced	OMS	
WebSurv	<input checked="" type="checkbox"/>			
WebSurv Mobile	<input checked="" type="checkbox"/>			

Configure

Database Preparation



Database Preparation – Table Resizing

Prior to running FLISR you must first adjust the following table sizes

- ScsData, ScsEdit, ScsCalc and ScsWork
- LfData, LfEdit, LfWork, LfMeans
- LfFeederData, LfFeederEdit, LfFeederWork
- LfTransformerData, LfTransformerEdit, LfTransformerWork
- LfSwitchData, LfSwitchEdit, LfSwitchWork
- LfConductorsData, LfConductorsEdit, LfConductorsWork

Notes

- ADMS server needs to be turned off before adjusting the tables sizes
- Lf stands for Load Flow
- SCS stands for System Configuration Status which is now called Topology Processing
- SCS Calc, SCS Data, SCS Edit, and SCS work all must have same size
- LfFData, LfEdit, LfMeas, and LfWork all must have the same size



Demo

Database Preparation – Command State Strings

- Some Command State Strings such as EnDis might already be in the Database
- Create only the missing ones, these are
 - FLISR Mode
 - FLISR Lockout
 - Fault Reset

The screenshot shows the 'Command-State Strings' dialog box with the following fields:

- General:**
 - Name: EnDis (ID: 23)
 - Description: Enabled/Disabled
- Command:**
 - Command 0: ENABLE
 - Command 1: DISABLE
 - Command 2: (empty)
 - Command 3: (empty)
- State:**
 - State 0: ENABLED
 - State 1: DISABLED
 - State 2: (empty)
 - State 3: (empty)
- Buttons: OK, Cancel

The screenshot shows the 'Command-State Strings' dialog box with the following fields:

- General:**
 - Name: FLISR Mode (ID: 82)
 - Description: FLISR Operational Mode
- Command:**
 - Command 0: MANUAL
 - Command 1: SEMI-AUTO
 - Command 2: AUTOMATIC
 - Command 3: (empty)
- State:**
 - State 0: MANUAL
 - State 1: SEMI-AUTO
 - State 2: AUTOMATIC
 - State 3: (empty)
- Buttons: OK, Cancel

The screenshot shows the 'Command-State Strings' dialog box with the following fields:

- General:**
 - Name: FLISR Lockout (ID: 85)
 - Description: FLISR Breaker Lockout
- Command:**
 - Command 0: LOCKOUT
 - Command 1: NORMAL
 - Command 2: (empty)
 - Command 3: (empty)
- State:**
 - State 0: LOCKED-OUT
 - State 1: NORMAL
 - State 2: (empty)
 - State 3: (empty)
- Buttons: OK, Cancel

The screenshot shows the 'Command-State Strings' dialog box with the following fields:

- General:**
 - Name: C_Reset (ID: 2)
 - Description: Reset control
- Command:**
 - Command 0: RESET
 - Command 1: RESET
 - Command 2: (empty)
 - Command 3: (empty)
- State:**
 - State 0: NORMAL
 - State 1: FAULT
 - State 2: (empty)
 - State 3: (empty)
- Buttons: OK, Cancel



Database Preparation – Admin Point Creation

- FLISR Enable/Disable Points
 - Global
 - Regions (optional)
 - Transformers
 - Feeders
 - Individual Switches/Reclosers
- FLISR Mode Point (Manual, Semi-Automatic, Automatic)
 - Can be per feeder or switching device
 - For FLISR to consider a device/feeder, they must have the same mode of operation
- FLISR Lockout Point

Database Preparation – Breaker Lockout Point

- For each reclosure that has FLISR enabled on it
- If the device doesn't have a telemetered LOCKOUT point, use a Pseudo point.
- For Pseudo points, you need to set the "Lockout Timer"
 - the timer should be long enough to account for one reclosing attempt
 - if the breaker recloses in the field, the timer will be reset.
 - if the breaker trips again, the timer will start again
 - the lockout timer doesn't start if the device was remotely operated
- If the device has a telemetered LOCKOUT point,
 - set the timer to 0
 - the Lockout points is set to "Active" when
 - Breaker locks out in the field
 - an operator issues a command from the control room or
 - the crew manually opens the device in the field

[SUNSET_MS13,F3_BRK] Status Point

General | Telemetry | Alarms

Station: SUNSET_MS13 | Name: F3_BRK

Description: F3 Breaker | 400975

User Type: 4kV_BRK | Device Class: Sustained | Zone Group: Sunset SS | Command-State: OpenClose | Anti-Chatter Filter: <None> | Bay: <None>

Lockout Point: SUNSET_MS13,F3_BRK_Lockout

Lockout Timer, sec: 5

Privilege Mode: ☐ | Disturbance: ☐ | Outage: ☐ | SCS Enabled: ☒ | No Manual Set Flag: ☐ | Can be controlled by Bay: ☐ | Auto Select Un-Commanded Changes for Summary Reports: ☐ | Don't alarm states 2 and 3 on control operations: ☐

Event Data Recording: ☒ | SOE Event: ☒ | No Redundant Controls: ☐ | Control Password Required: ☐ | Send to Historian: ☐ | Do not Compress: ☐

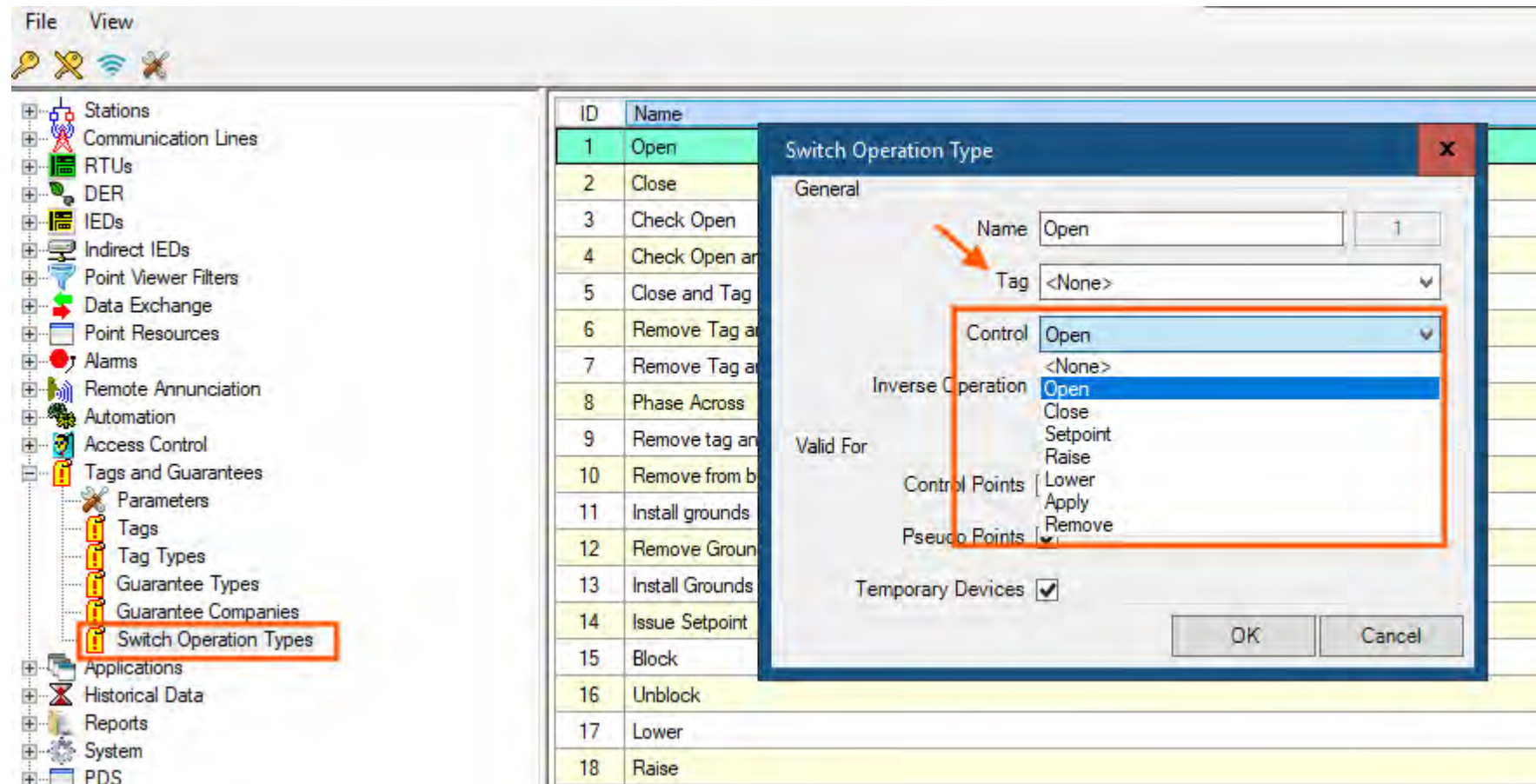
OK | Cancel

Existing Point

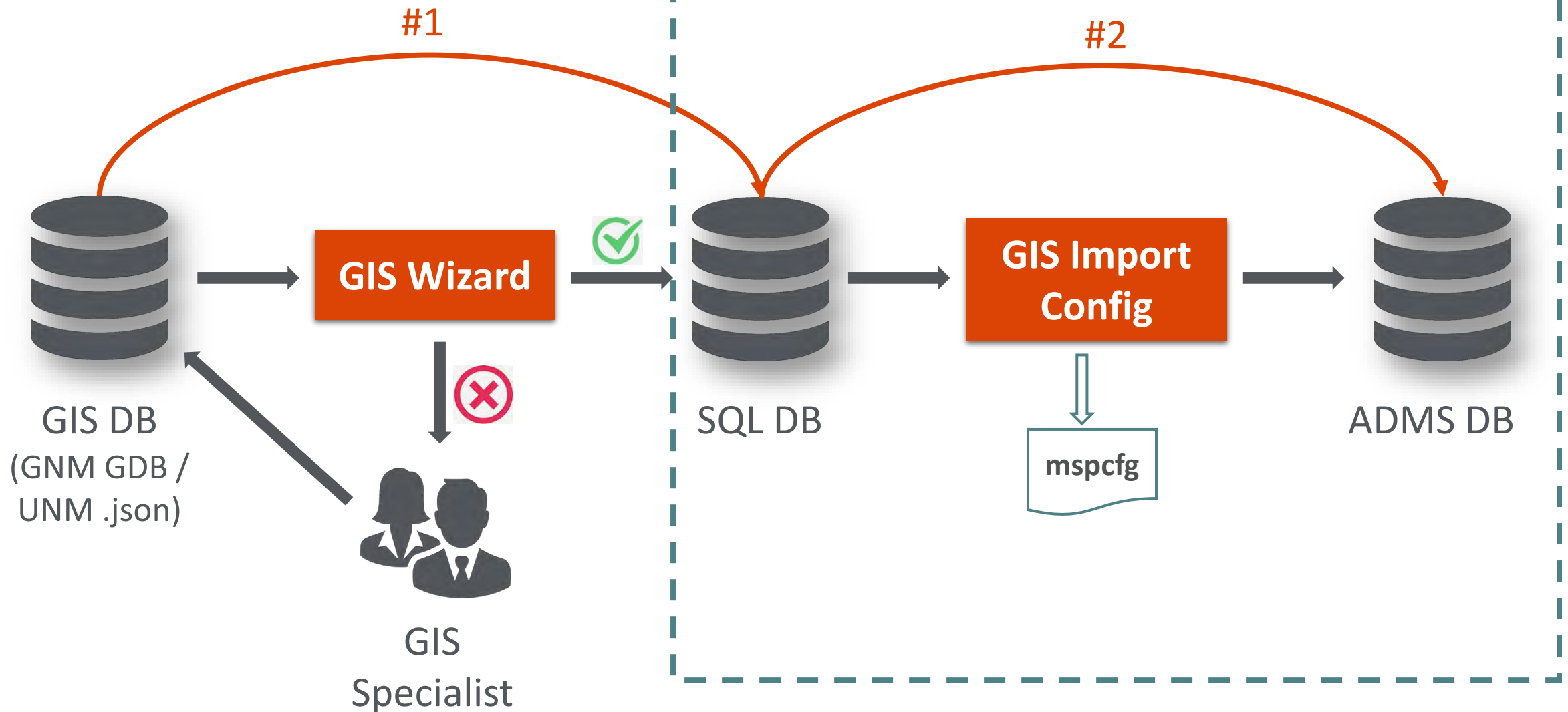
Database Preparation – Switch Operations Creation

If Switch Orders and Guarantees was not previously licensed and configured, you will have to configure the Switch Operations Types for FLISR to USE

- OPEN
- CLOSE
- OPEN and TAG
- CLOSE and TAG
- REMOVE TAG and CLOSE
- REMOVE TAG and OPEN
- BLOCK RECLOSING
- UNBLOCK RECLOSING
- RESET FAULT TARGETS



GIS Wizard – Importing Process



Database Preparation – Distribution Transformers Import

- This task imports all distribution transformation from the GIS Exported SQL data into the SCADA DB
- The same **mshpcfg** file that is used for the connectivity import needs to be used for the distribution transformer import
- This task can be scheduled to run as frequently as needed

Import Task

General Transformer Options

☒ Use Coordinates

☒ Delete Transformers Not Imported

☒ Set Nameplate

☒ Allow Create New Nameplate

Default Nameplate: <None>

Company Name:

Configuration File

File Name: GIS_Connectivity Import.mshpcfg

Import Now OK Cancel

Database Preparation – GIS Interface

- To perform imports from GIS, you must first define a GIS interface
 - The protocol must be **Survalent**
- Once the GIS interface is defined you can import **Transformers, Service locations and Generators**

The screenshot displays the Survalent software interface. On the left, a tree view shows the 'Applications' folder expanded, with 'OMS' and 'Interfaces' highlighted. The 'Interfaces' folder is further expanded, showing 'GIS Interfaces' selected. On the right, a table lists various interfaces, with 'STC GIS' highlighted. A 'GIS Interface' configuration window is open, showing the 'General' tab. The 'Name' field is 'STC GIS', the 'Description' is 'Database Structure', and the 'Protocol' is set to 'Survalent'. The 'Version' field is empty. The 'GIS Vendor' field is empty. The 'Response Timer, sec' is set to 0. The 'GIS provides GPS data' checkbox is checked. The 'Configuration Switches' field is empty. The 'OK' and 'Cancel' buttons are at the bottom right.

ID	Name	Description
1	ESRI	Oakville ESRI
2	WindMil	Mid-Ohio App Version 7
3	Autodesk	Innisfil GIS
4	STC GIS	Database Structure
5	OMAN_ES	
6	SRD_ESR	

GIS Interface

General | Survalent

Name: STC GIS | 4

Description: Database Structure

Protocol: Survalent | Version:

GIS Vendor:

Response Timer, sec: 0 | GIS provides GPS data: ☒

Configuration Switches:

OK Cancel

Database Preparation – Distribution Transformers Import

The screenshot displays the Survalent software interface. On the left is a tree view of system components, including Stations, Communication Lines, RTUs, DER, IEDs, Indirect IEDs, Point Viewer Filters, Data Exchange, Point Resources, Alarms, Remote Annunciation, Automation, Access Control, Tags and Guarantees, Applications, Load Management, Load Forecasting, Weather, Automatic Generation Control, Operations and Outages, Fault Recorders, Data Loggers, Protection Settings, Dynamic Voltage Regulation, Automatic Vehicle Location, Mapboards, OMS, OMS Parameters, Interfaces, Tasks, Imports, Database Maintenance, and Task Schedules. The 'Task Schedules' item is highlighted with a red box.

On the right, the 'Task Schedule' configuration window is open. It contains the following fields and options:

- General:**
 - Name: Transformers
 - ID: 1
 - Task: Transformers (selected from a dropdown menu, highlighted with a red box)
 - Description: Transformers Import
- Time of Day:**
 - From: 21:00
 - Midnight: ☐
- Day of Week:**
 - ☒ Sunday
 - ☒ Monday
 - ☒ Tuesday
 - ☒ Wednesday
 - ☒ Thursday
 - ☒ Friday
 - ☒ Saturday
- Day of Month:**
 - ☒ 1
 - ☐ 2
 - ☐ 3
 - ☐ 4
 - ☐ 5
 - ☐ 6
 - ☐ 7
 - ☐ 8
 - ☐ 9
 - ☐ 10
 - ☐ 11

At the bottom of the window are 'OK' and 'Cancel' buttons.

Database Preparation – KVA Aggregation

- This task runs through all the line section conductors and aggregate the KVA of the attached transformers
- The KVA info comes from the GIS
- Manually created transformers can be included in the aggregation
- You have to schedule a task for KVA aggregation, typically after the transformer import task

The screenshot displays the Survalent software interface. On the left is a tree view of system components, including Stations, Communication Lines, RTUs, DER, IEDs, Indirect IEDs, Point Viewer Filters, Data Exchange, Point Resources, Alarms, Remote Annunciation, Automation, Access Control, Tags and Guarantees, Applications, Load Management, Load Forecasting, Weather, Automatic Generation Control, Operations and Outages, Fault Recorders, Data Loggers, Protection Settings, Dynamic Voltage Regulation, Automatic Vehicle Location, Mapboards, OMS, OMS Parameters, Interfaces, Tasks, Imports, Database Maintenance, and Task Schedules. The 'Task Schedules' item is highlighted with a red box. On the right, the 'Task Schedule' dialog box is open, showing the 'General' tab. The 'Name' field is 'KVA_Aggregation' and the 'Description' is 'KVA Aggregation'. The 'Task' dropdown menu is set to 'KVA Aggregation' and is highlighted with a red box. The 'Time of Day' section shows 'From 21:00' and 'Midnight' is unchecked. The 'Day of Week' section has checkboxes for Sunday through Saturday, all of which are checked. The 'Day of Month' section has checkboxes for days 1 through 11, with day 2 checked. At the bottom of the dialog are 'OK' and 'Cancel' buttons. Below the dialog, there is an 'Execute Now' button and another set of 'OK' and 'Cancel' buttons.

ID	Name	Description
1	Transformers	Transformers Import
2	KVA_Aggregation	KVA Aggregation

Task Schedule

General

Name: KVA_Aggregation 2 Task: KVA Aggregation

Description: KVA Aggregation

Time of Day: From 21:00 [] Midnight

Day of Week:

- ☒ Sunday
- ☒ Monday
- ☒ Tuesday
- ☒ Wednesday
- ☒ Thursday
- ☒ Friday
- ☒ Saturday

Day of Month:

- ☐ 1
- ☒ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11

OK Cancel

Execute Now OK Cancel



Database Preparation – Summary

- ✓ Table Resizing
- ✓ Command State Strings
- ✓ Admin Point Creation
 - Enable/Disable
 - FLISR Mode
 - Lockout
- ✓ Switch Operations Creation
- ✓ GIS Interface Setup
- ✓ Tasks Setup and Scheduling
 - Distribution Transformers Import
 - KVA Aggregation

SmartVU Preparation

SmartVU Preparation - DMS Settings Catalog

Settings Catalog

- Global Settings
 - *GLOBAL RECORD*
 - DMS Tx Settings

FLISR

General Power Flow **FLISR** Parameters Application Data

☒ Create FLISR Restoration Orders ☐ Block All Reclosers in Backup Path

☒ Perform Second Pass in Load Transfer ☐ Check Transformer Capacity

☐ Do Not Restore Backup Feeder on a Failed Load Transfer

☐ Confirm LOV with Measurement at Both Sides

☐ Ignore Feeder's Recloser Points

Age Limit on Lockout (s)

☒ Ignore lockout age

☒ Apply Tags to Isolation Switches

Tag Type to Use

PC10A or PC10C ☐ Treat all non-info tags as Full tags

HLT Action in the Faulted Feeder

Treat as Tag ☐ Skip this Backup

Segmentation Priority Order

Critical, Customers, Load ☐ Action if phase error is detected

Switch FLISR to 3-Phase

Options for Handling Security Violations if Load Transfer uses Power Flow

Over Voltage ☒ Always Accept ☐ Accept if Only Choice ☐ Always Reject

Under Voltage ☒ Always Accept ☐ Accept if Only Choice ☐ Always Reject

proprietary

63



Settings Catalog

Glob

HLT Action in the Faulted Feeder

DMS

Treat as Tag

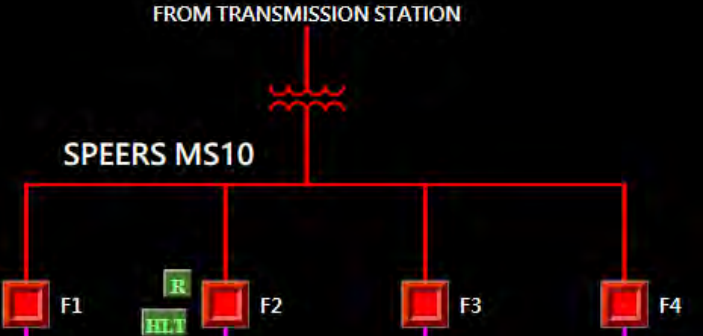
Do Nothing

Treat as Tag

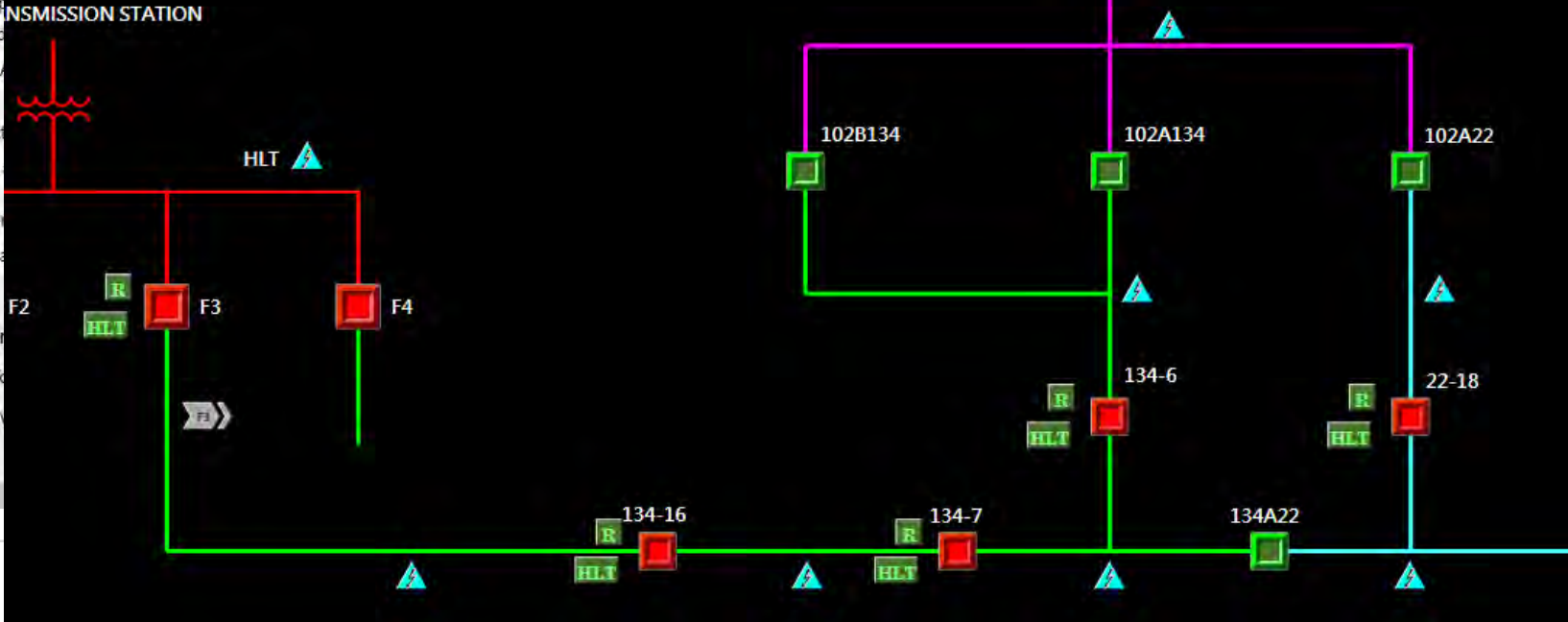
Disable FLISR/LOV in the entire circuit

Disable FLISR/LOV in the transfer area

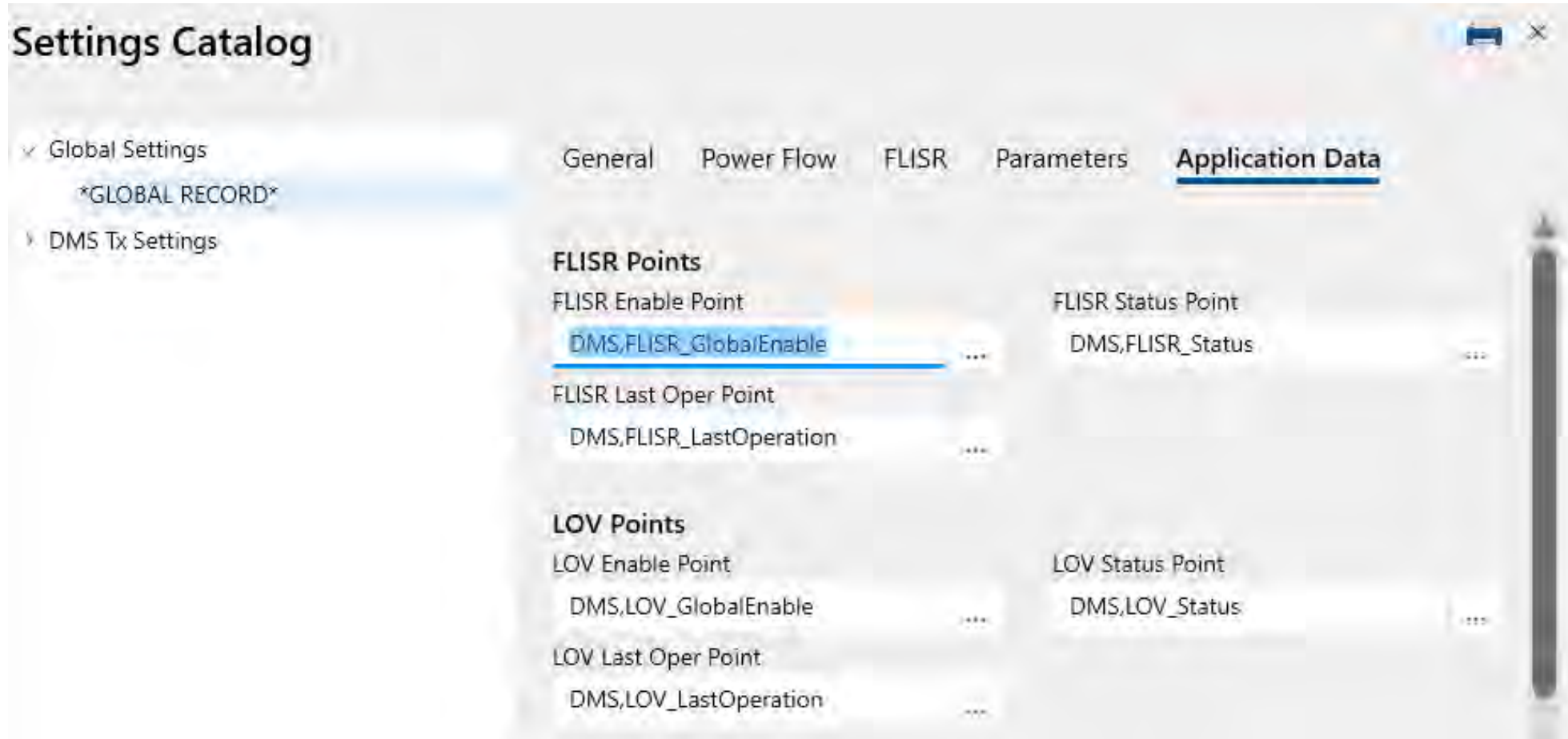
- Operate as you would do as if in a normal state
- Skip the device and look for an alternative
- Do nothing (do not isolate nor restore), basically FLISR in Manual Mode
- Do not restore



Description
When you check this check box the system will set an Isolation switch during the Isolation operation in order to notify the operator that the area is added to a fault area.
Use this to select the tag if you have a field.
Use this to select the Transformer Capacity as per analysis.
Use this to treat all no-info tags as full operations. Info tag is a type of operation.
Use this checkbox if you have devices that have sensors at both sides of the device (like in a switch), and the idea is that if you detect zero voltage on one side AND THE SWITCH IS CLOSED the other side must be zero too, to confirm a valid no-voltage condition in the device. If you have voltage on one side and no voltage in the other we log the mismatch for LOV.



SmartVU Preparation - DMS Settings Catalog



Add the points that were created during the Database Preparation phase

SmartVU Preparation - DMS Settings Catalog

Settings Catalog

Global Settings
GLOBAL RECORD
DMS Tx Settings

General Power Flow FLISR Parameters Application Data

LOV Last Oper Point
DMS,LOV_LastOperation

VVO Points
VVO Enable Point

OTO Operations

	Control 0		Control 1	
→ Switch	Open	▼	Close	▼
→ Block Recloser	Block	▼	Block	▼
→ Unblock Recloser	Unblock	▼	Unblock	▼
→ Reset Fault Target	Reset	▼	Reset	▼
Capacitor Switch	Open	▼	Close	▼
Tap Changer L R	Lower	▼	Raise	▼
→ Set / Clear Tags	Tag	▼	Untag	▼
Set point	Issue Setpoint	▼		

- Select the Switching Operations (defined during the Database Preparation phase) to be used in switch orders for FLISR
- The following Switching Operations are used by FLISR
 - Switch
 - Block Recloser
 - Unblock Recloser
 - Rest Fault Targets
 - Set/Clear Tags

SmartVU Preparation – LS DMS Record – Substation TFXR

- The Nominal Voltage used for the FLISR calculation
- Transformer-level FLISR EnDis point

Substation Transformer

Points **Transformer** Drag & Drop Points

General

☐ 3Ph Transformer ☒ N Grounded

kVA

Phase A	Phase B	Phase C
10000	10000	10000

Voltage Low (LN)
2500

Voltage High (LN)
13394.5

Connection Type
Y-Y

DMS Settings Catalog
T1

Core Impedance (Ohms P.U.)

FLISR/LOV

TX Internal Failure	LOV Verification Delay(Sec)	Underfrequency Condition
...	5	...
Enable FLISR SUNSET_MS13.Sunset_FLISR_Status		Enable LOV SUNSET_MS13.Sunset_LOV_Status

SmartVU Preparation – LS DMS Record – Feeder Main

- Rated Amps: important for FLISR when we are calculating the maximum load (KVA) a feeder can handle (Capacity).
- Reclosure Status Point: both Reclosers current state and for purposes of control
 - Blocked: Select the state (0 or 1) that corresponds to the "Blocked" state of the recloser
- Feeder-level FLISR EnDis
- Feeder-Level FLISR Mode

Feeder Main

Points **Feeder** Drag & Drop Points

General

Rated Amps: 300

Feeder Type: Dist Substation

☒ Enable Power Flow

☒ Enable DSE

FLISR/LOV

Recloser Status Point: SUNSET_MS13,F3_REC ... Blocked: 0

☐ Ignore Feeder's Recloser Point

Demand Factor: ...

Calculate Load Transfer: Power Flow

☐ Don't Block Reclosing if the Feeder is the Backup

Single-phase

☐ Enable Single-Phase FLISR/LOV

Load Transfer Options: ...

Switching Operations

Open Control Timeout: 5000 ms

Close Confirmation Delay: 5000 ms

Number of Retries: 0

FLISR

FLISR Enable Point: SUNSET_MS13,F3_BRK_FLISR_Status ...

FLISR Mode: SUNSET_MS13,F3_BRK_FLISR_Mode ...

Age Limit on Lockout: 0 Sec

Fault Target Verification Time Limit: 30 Sec

☐ Breaker Does Not Have Fault Indicators

SmartVU Preparation – LS DMS Record – Switch

- Current Rating: For a tie switch, if we are transferring load, the system will check if the current post-transfer is lower than this rating.
- Fault targets Status and Reset
- Device-level FLISR EnDis
- Device-Level FLISR Mode

Points Switch Drag & Drop Points

Current Rating (A)	Serial Number	Voltage Rating (kV)	Interruption Capacity (A)
500 per Phase		4.16	0 per Phase
Ganged Control	Protection Current Limit	Local/Remote	Hot Line Tag
...	SUNSET_MS13,F3_HL ...

Fault Status Point

Phase A	Phase B	Phase C	Neutral
SUNSET_MS13,F3_Ph ...	SUNSET_MS13,F3_Ph ...	SUNSET_MS13,F3_Ph
Fault Status Reset Point	Reset is to		
SUNSET_MS13,F3_FL ...	0	▼	

FLISR/LOV

Recloser Status Point	Demand Factor Point	Blocked
...	...	0
Calculate Load Transfer		
Connected KVA		▼

Controls to Operate before Closing this Device in FLISR LOV Load Transfer

☐ Enable

Disable Local Automation	Suspend Protection	Value to Send
		1

Send Restore Protection Command

☐ Enable

Restore Protection	Value to Send	Delay (Sec)
	0	0

Switch Triggers FLISR ←

☐ Enable

FLISR Enable Point	FLISR Mode Point

SmartVU Preparation – LS DMS Record – Conductor

- Connected KVA is calculated by a Task in STC explorer and then assigned to every Conductor LS in SmartVU

Conductor

Points

Cable

Drag & Drop Points

General

Allocation Data

Transformer kVA

Phase A

0

Phase B

0

Phase C

0

Winter MWh

0

0

0

Summer MWh

0

0

0

Renewable Energy

Solar kW

Phase A

0

Phase B

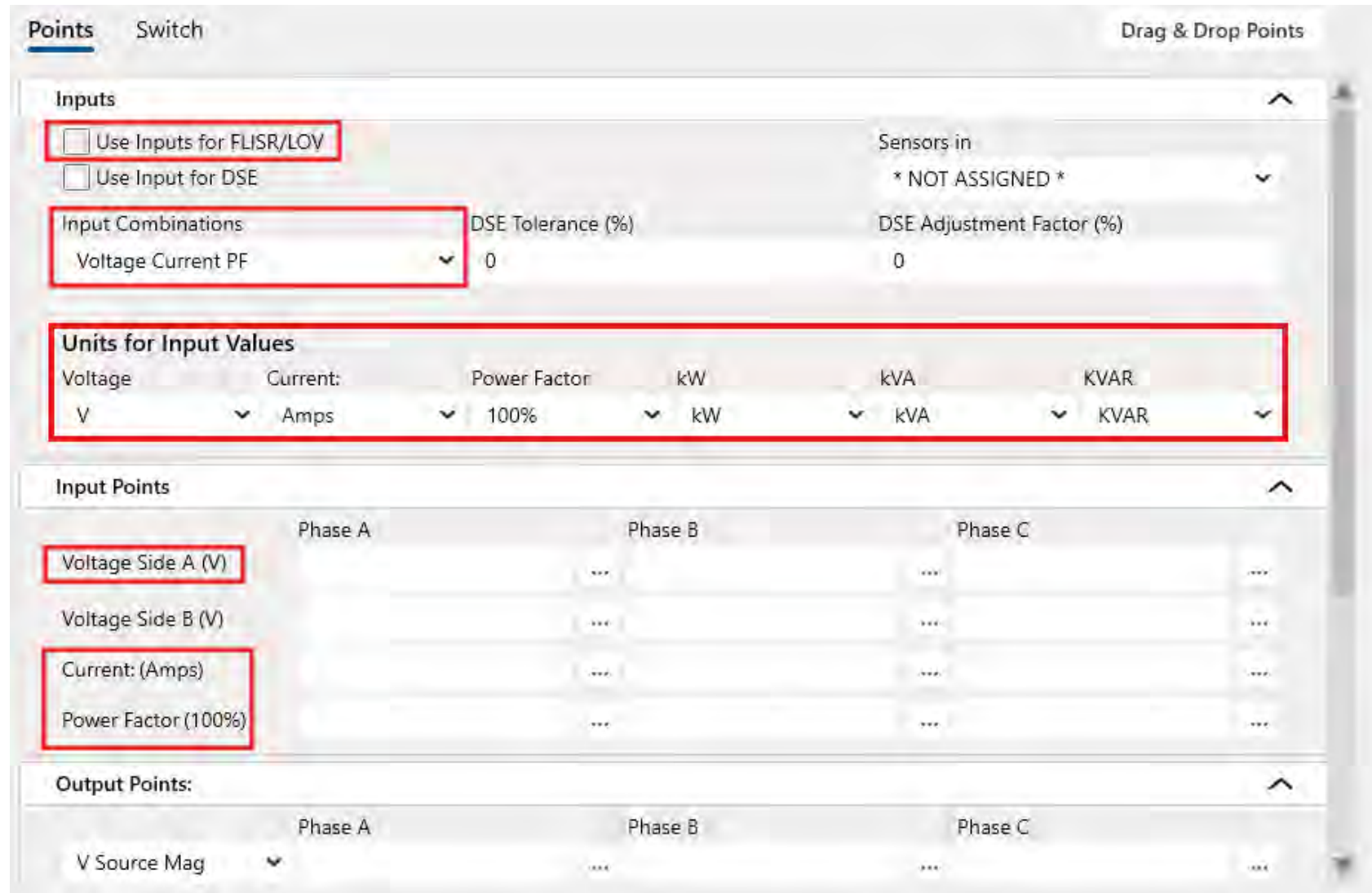
0

Phase C

0

SmartVU Preparation – Points Tap

- Units for Input Value: we assume all the readings coming from the field are in these units
- Input Points: these are the telemetered points coming from the field
 - These points will be used if the check box for “Use Measurements if Available” is checked on the Feeder main



Points Switch Drag & Drop Points

Inputs

☐ Use Inputs for FLISR/LOV

☐ Use Input for DSE

Input Combinations: Voltage Current PF

DSE Tolerance (%): 0

Sensors in: * NOT ASSIGNED *

DSE Adjustment Factor (%): 0

Units for Input Values

Voltage	Current:	Power Factor	kW	kVA	KVAR
V	Amps	100%	kW	kVA	KVAR

Input Points

	Phase A	Phase B	Phase C
Voltage Side A (V)
Voltage Side B (V)
Current: (Amps)
Power Factor (100%)

Output Points:

	Phase A	Phase B	Phase C
V Source Mag

Database Preparation – Summary

- ✓ DMS Catalog
 - FLISR
 - Application Data
- ✓ LS DMS Record
 - Substation Transformer
 - Feeder Main
 - Switches/Breakers
 - Conductor

Module 3: Operation & Demonstrations

FLISR Operations – What Is Considered

- FLISR Control Points

- FLISR Status **Local (EnDis) / Global (DisEn)**
- FLISR Mode **(Man/Semi/Auto)**

- In the Substation

- Substation Transformer

- Substation Transformer Capacity

- Feeder

- Breaker

- Backup Feeder Capacity
- Inputs (Current+Power+Voltage by Phase)
- Breaker Control Points
- Restoration Options**
- Reclosing Control Points

- On the Circuit

- Tie switches to neighboring feeders

- Reclosers, isolation switches

- Network and Topology Model

- Distribution Transformer data

- Telemetered Fault Indicators
- Reset Targets Command
- Lockout Point **(LockNormal)**

- Typically Imported From GIS

- Assigned via KVA Aggregation



FLISR Operations - FLISR Steps

- **Detection**
 - A device has locked out
 - Fault targets are active
- **Verification**
 - Make sure that data is up to date
 - Poll all the devices in the circuit where the fault was detected
- **Confirmation**
 - Check for tagging, failed telemetry, and updated statuses after polling devices
- **Localization**
 - What is the last devices that saw the fault (has Active Fault Targets)
- **Isolation**
 - Generate and execute OTO to isolate faulted area
- **Restoration**
- **Load transfer**
 - Calculate KVA and determine the candidate backup feeder/s



FLISR Operations - Operation

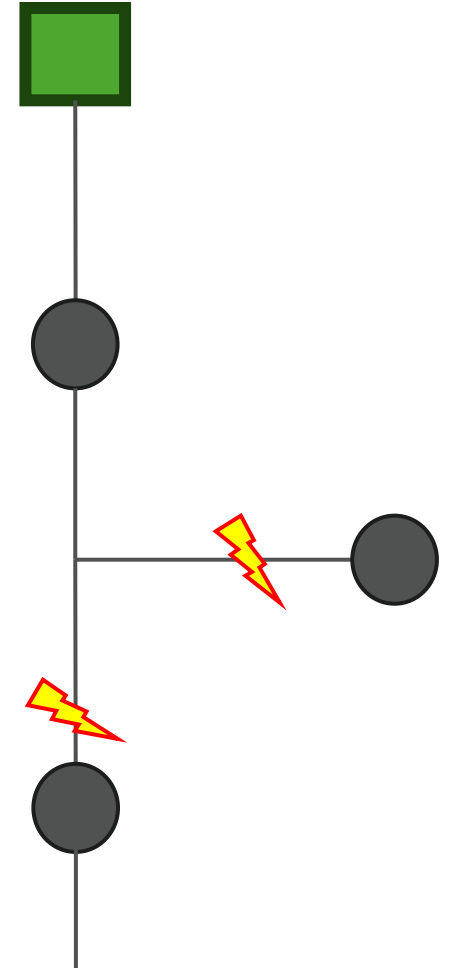
DEMO

- Initial fault
 - DMS Dashboard; FLISR Report
- Cascading fault
- Second pass

Bonus

DID YOU KNOW!

- If we send a control and it fails, FLISR will switch to semi-auto, and create the SO (the SO will have all the operations, the ones where the control was successful will be marked as executed and the following ones will be marked as not executed).
- FLISR will abort under these conditions:
 - If a tie is closed and the protection in the backup feeder trips. We will backtrack the operation (open the tie and close the device that trips) and send an alarm with the abortion
 - Fault found in 2 different branches of the same feeder. Before abortion, FLISR will open the switch before the branching. The Alarm will clarify the reason for the abortion
 - If after the verification step a control command is sent to a device and the device doesn't respond (no status change is detected)
 - If the reclosing point is missing or disabled on the faulted feeder (the device that triggered FLISR)





Common Questions

- **Can we prioritize one backup feeder over another?**

No, we work on the current configuration with the data that we get from the field at the time of the fault.

- **Do we take into account the transformer margins at the transmission level?**

No, just at the distribution level.

- **If FLISR is disabled on a Feeder, can it still consider it as a backup option?**

No. If FLISR is disabled on a feeder, it will not be considered at all in the isolation or restoration.

- **Can we have FLISR with different Modes (Semi-auto, Auto) on different feeders?**

You can have different segments of the system working in different modes and using different load transfer calculations. However, for neighboring feeders (those that FLISR is to consider for isolation and restoration) they need to have the Mode and the Load Transfer Calculation method.

Survalent.



Questions?



Thank You