

**NETWORK MANAGEMENT SYSTEM  
DISTRIBUTION MANAGEMENT SYSTEM (DMS)  
v2.5**

**5.5.1.1 NMS(DMS).Manage Fault Location Isolation and Service  
Restoration (FLISR)**

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## Brief Description

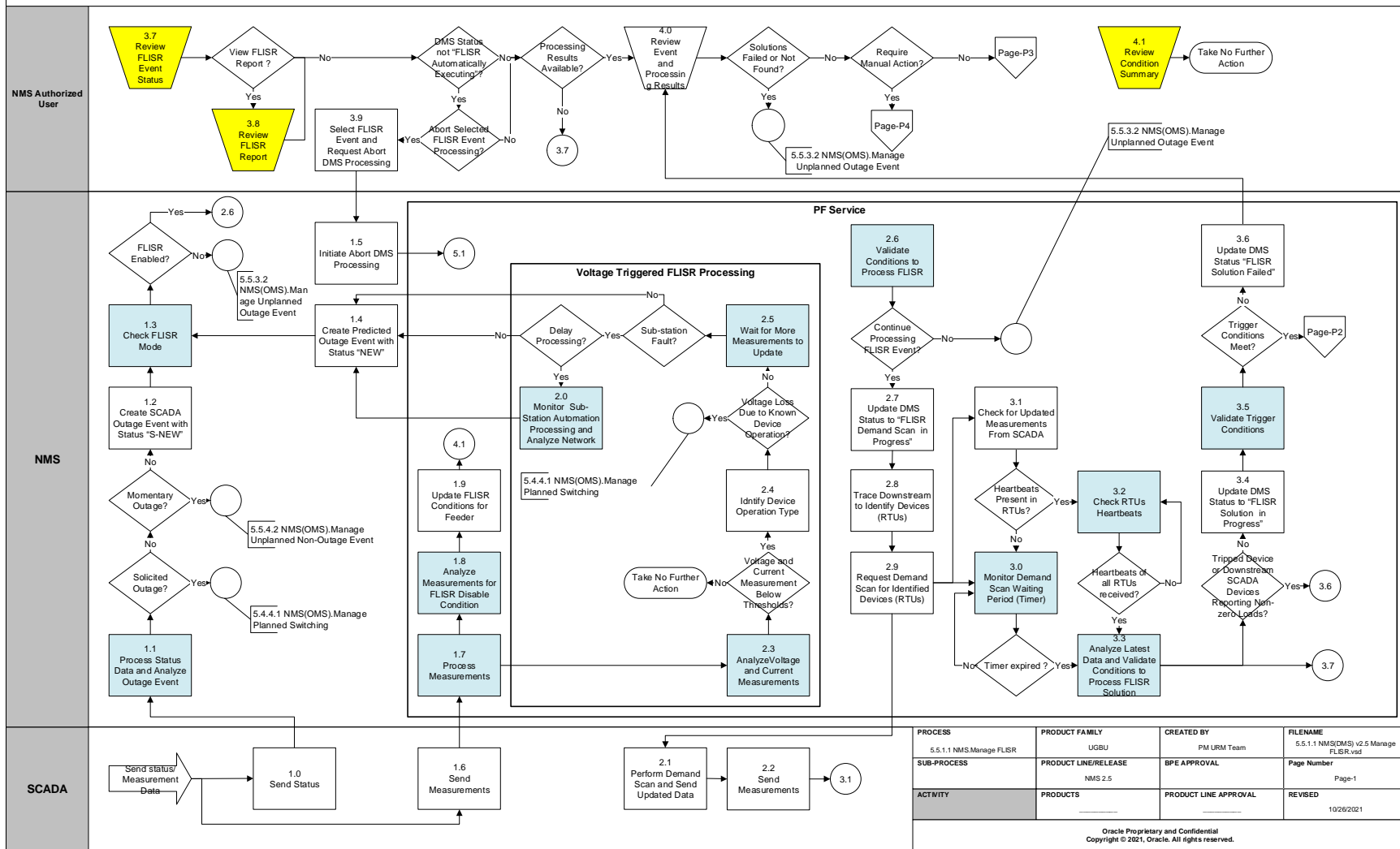
<b>Business Process:</b>	<b>5.5.1.1. NMS(DMS).Manage Automatic Fault Recovery (FLISR)</b>
<b>Process Type:</b>	<b>Sub Process</b>
<b>Parent Process:</b>	<b>5.5.1 NMS(DMS).Manage Network Faults</b>
<b>Sibling Processes:</b>	<b>5.5.4.2 NMS(OMS).Manage Unplanned Non-Outage Event Outage, 5.5.4.1 NMS(OMS).Manage Unplanned Outage Event</b>

Faults occur on distribution networks every now and then due to various abnormal circuit conditions. The Oracle NMS Fault Location Isolation and Service Restoration (FLISR) application works to identify the faulted feeder section and then re-route power from alternative sources to restore service to the un-faulted feeder sections. The FLISR application can work in both, a closed loop automated role and a manual role, which requires operator intervention before operating devices.

When a fault occurs, generally, a protective device opens to clear the fault. Thus, de-energizing all or a portion of a feeder. If this device is SCADA monitored, the device open will be detected within the NMS. If a SCADA fault indication is present on the feeder, FLISR can utilize those pieces of telemetry to identify the faulted section of the feeder. After identifying the faulted feeder section, FLISR will begin to analyze the surrounding feeders to determine if alternative sources are available which can be used to pick up the un-faulted feeder sections. Thus, restoring portions of the faulted feeder. FLISR will also analyze whether any of the restore options will create overloads on the network. After generating viable switching options for isolation and restoration FLISR will follow one of the following paths depending on the mode it is currently set for. If in automatic mode, FLISR was able to find a viable solution that did not result in any overloads, it will automatically execute the switching actions using outbound SCADA control. If overloads were detected while in automatic mode FLISR will not execute the switching actions. The operator will need to review the switching actions before execution of the plan can begin. If in manual mode, FLISR will never automatically execute the switching actions. It will be up to the operator to review actions of the plan before allowing execution.

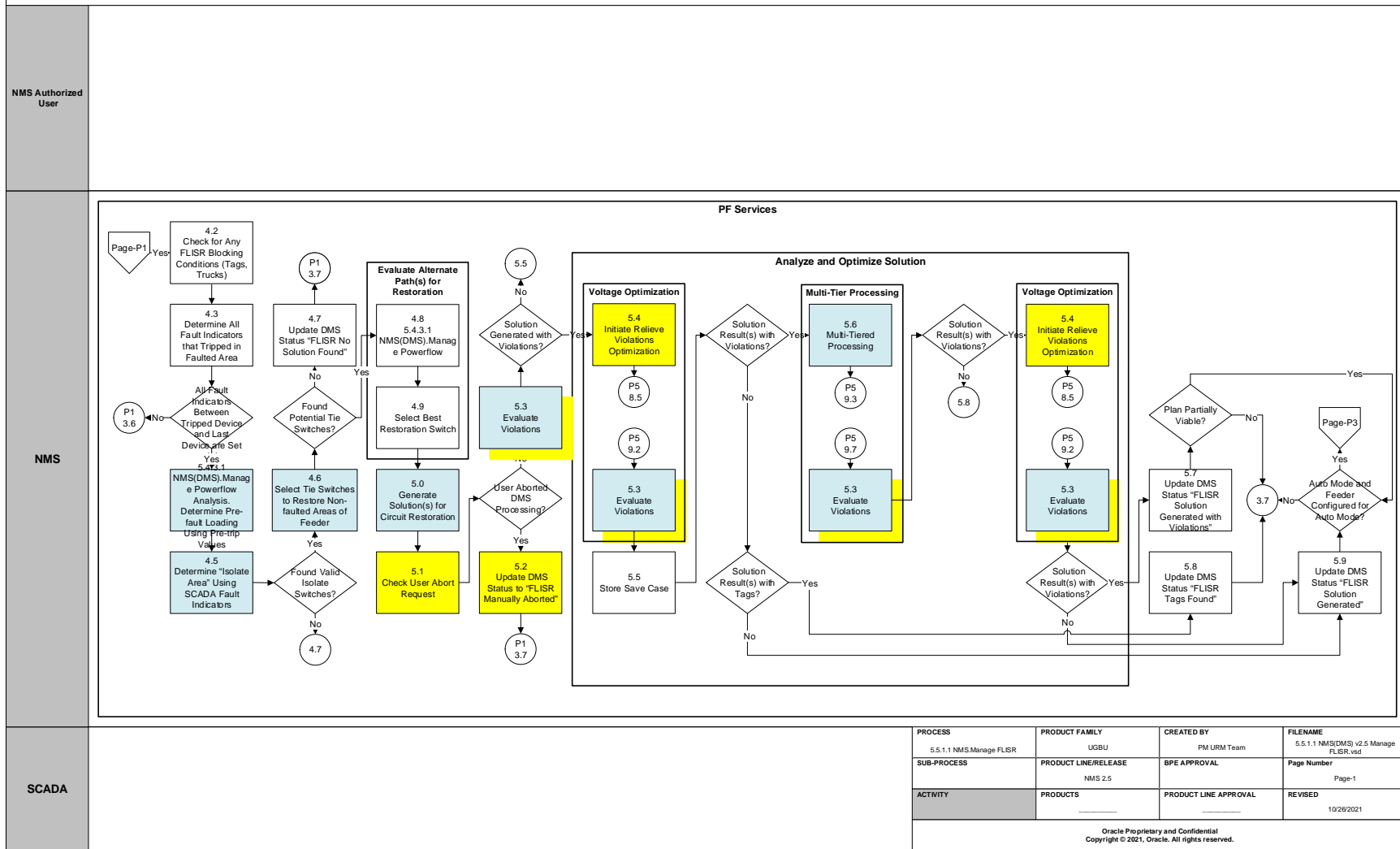
# Business Process Model Page 1

## 5.5.1.1 NMS(DMS) V2.5 *Manage Fault Location Isolation and Service Restoration(FLISR)*



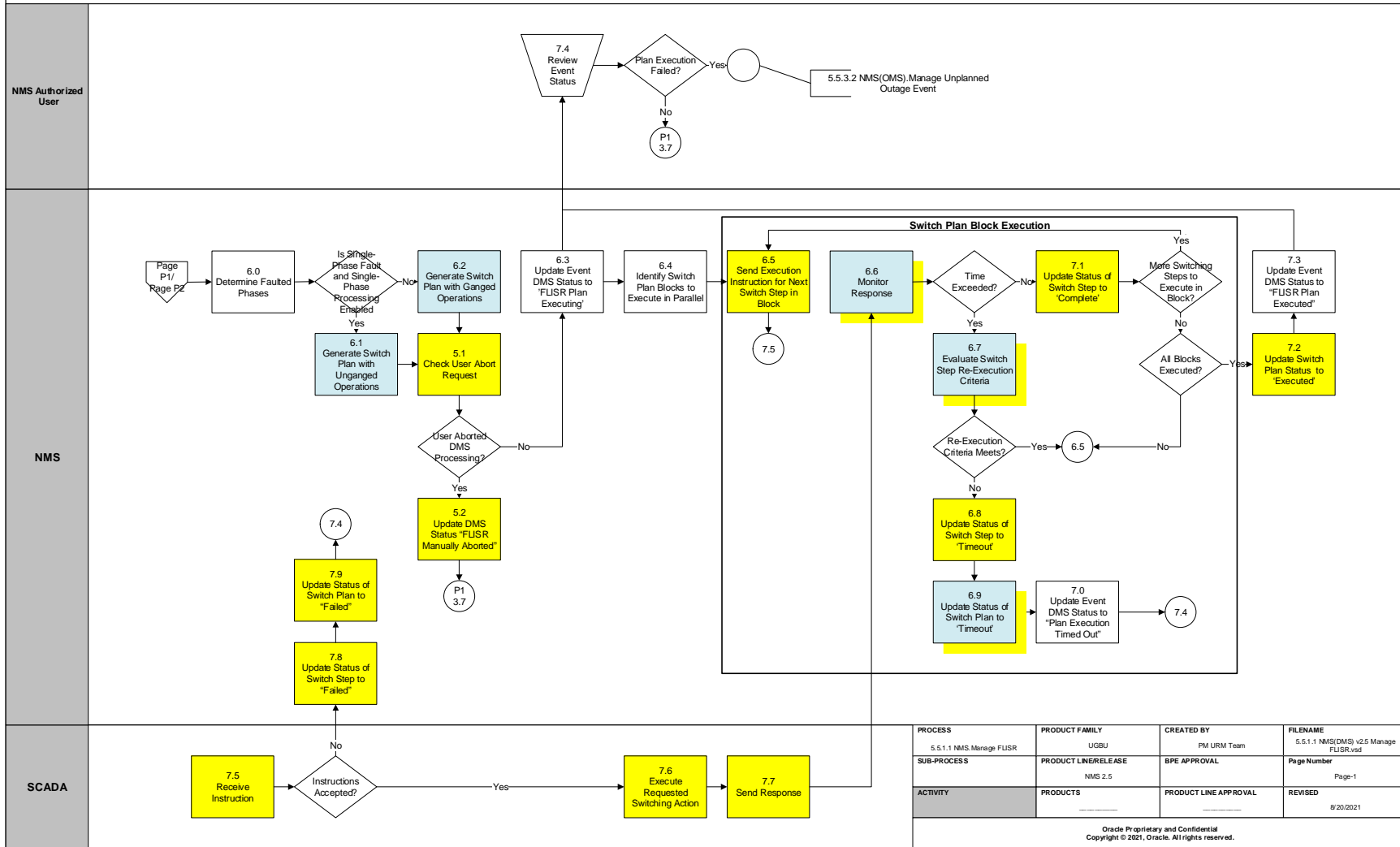
# Business Process Model Page 2

## 5.5.1.1 NMS(DMS) V2.5 *Manage Fault Location Isolation and Service Restoration(FLISR).Plan Generation*



# Business Process Model Page 3

## 5.5.1.1 NMS V2.5 *Manage Fault Location Isolation and Service Restoration(FLISR).Auto Mode*

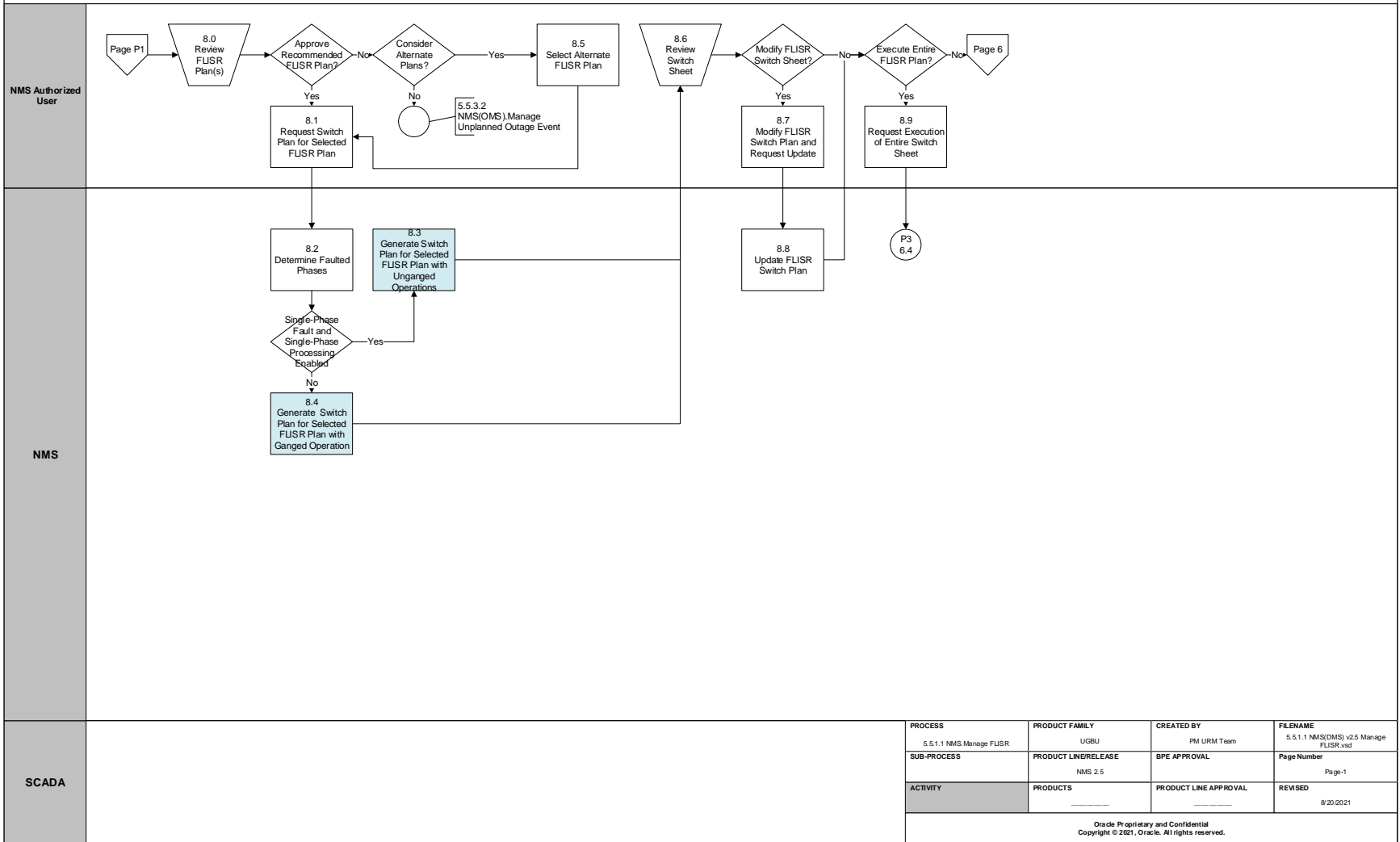


PROCESS	5.5.1.1 NMS.Manage FLISR	PRODUCT FAMILY	UGBU	CREATED BY	PM URM Team	FILENAME	5.5.1.1 NMS(DMS).v2.5 Manage FLISR.rsd
SUB-PROCESS		PRODUCT LINERELEASE	NMS 2.5	BPE APPROVAL		Page Number	Page-1
ACTIVITY		PRODUCTS		PRODUCT LINE APPROVAL		REVISED	8/20/2021

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# Business Process Model Page 4

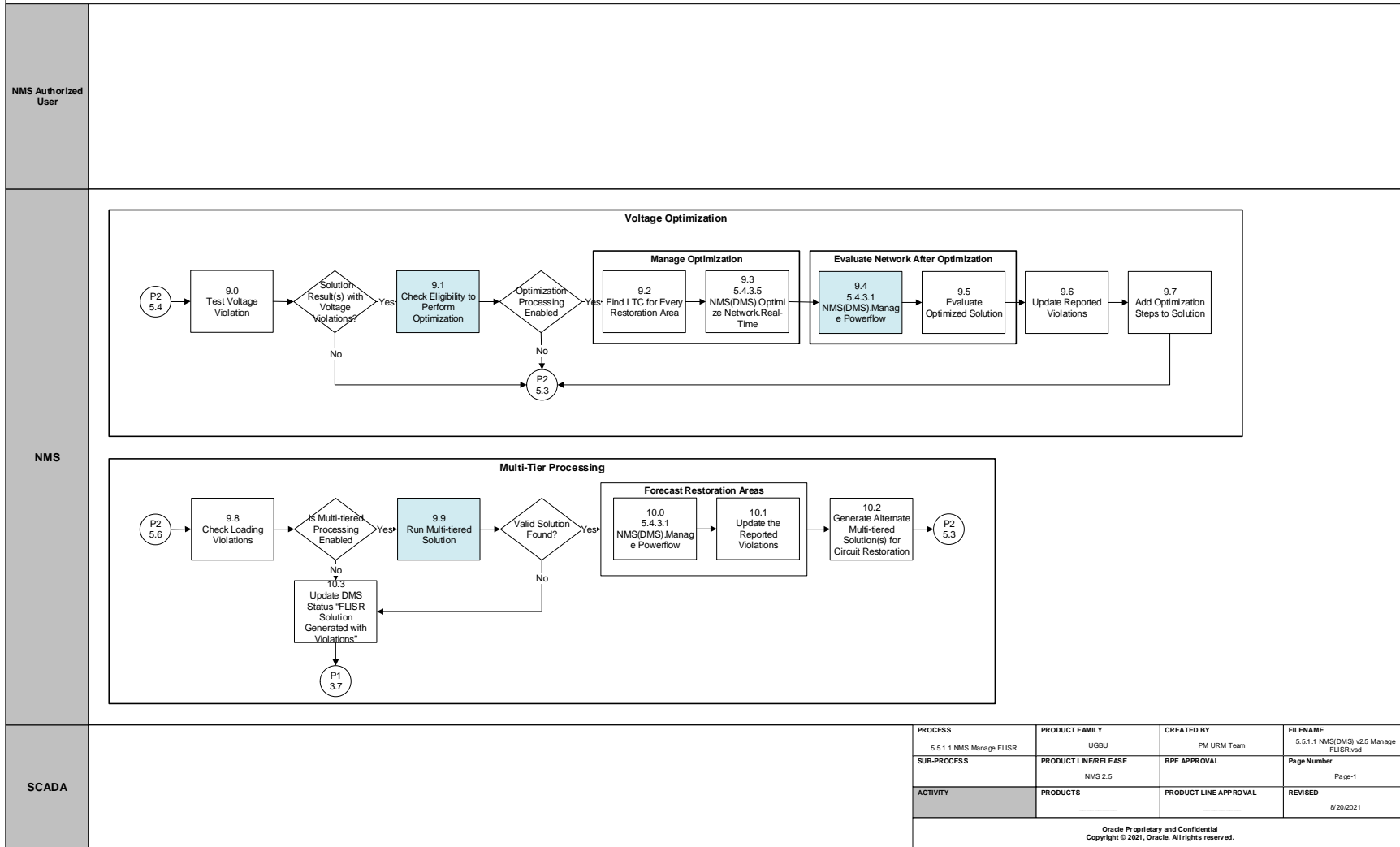
## 5.5.1.1 NMS V2.5 *Manage Fault Location Isolation and Service Restoration (FLISR).Manual Mode*





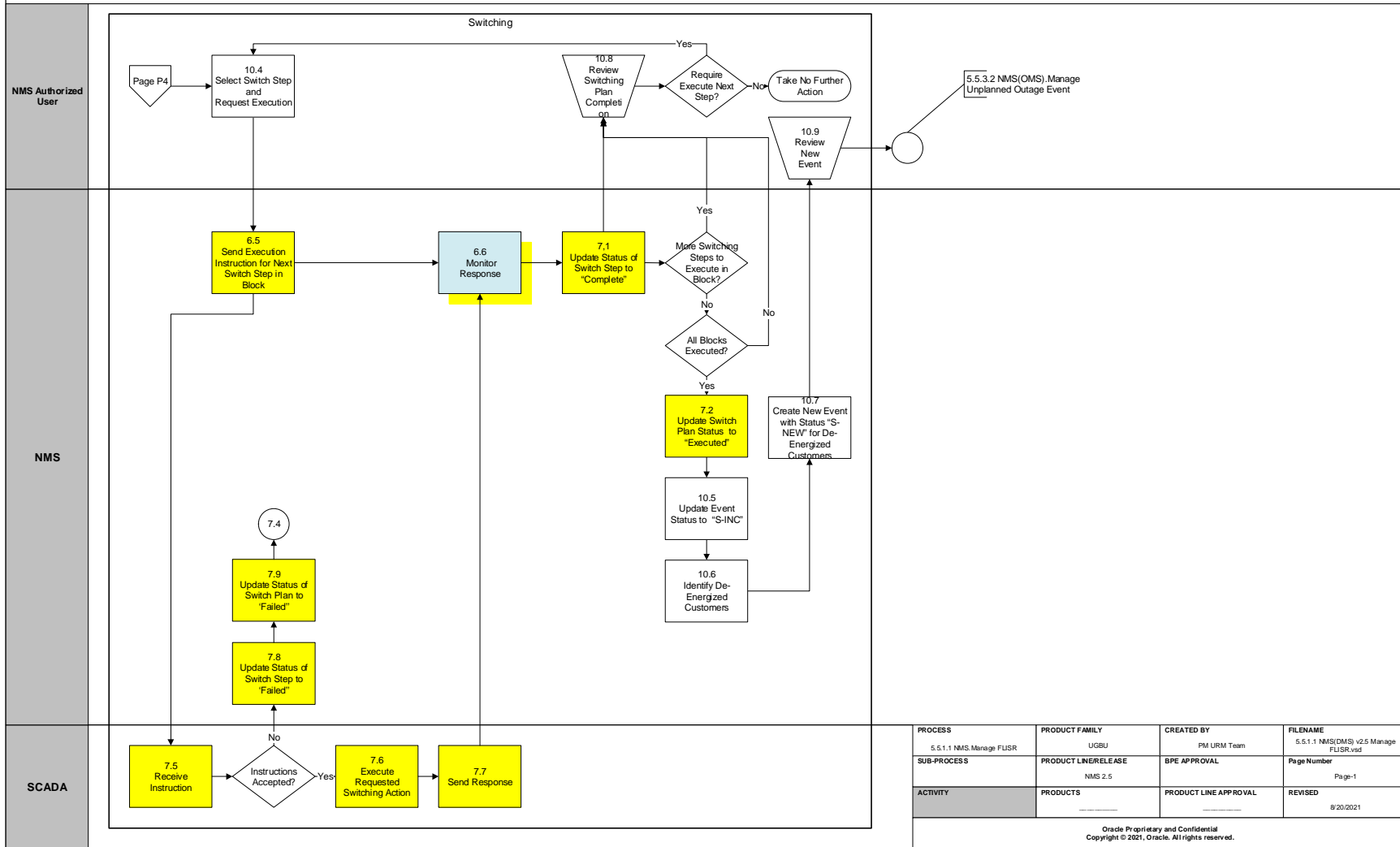
# Business Process Model Page 5

## 5.5.1.1 NMS V2.5 *Manage Fault Location Isolation and Service Restoration (FLISR). Optimization and Multi-Tiered Processing*



# Business Process Model Page 6

## 5.5.1.1 NMS V2.5 *Manage Fault Location Isolation and Service Restoration (FLISR). Manual Switching*

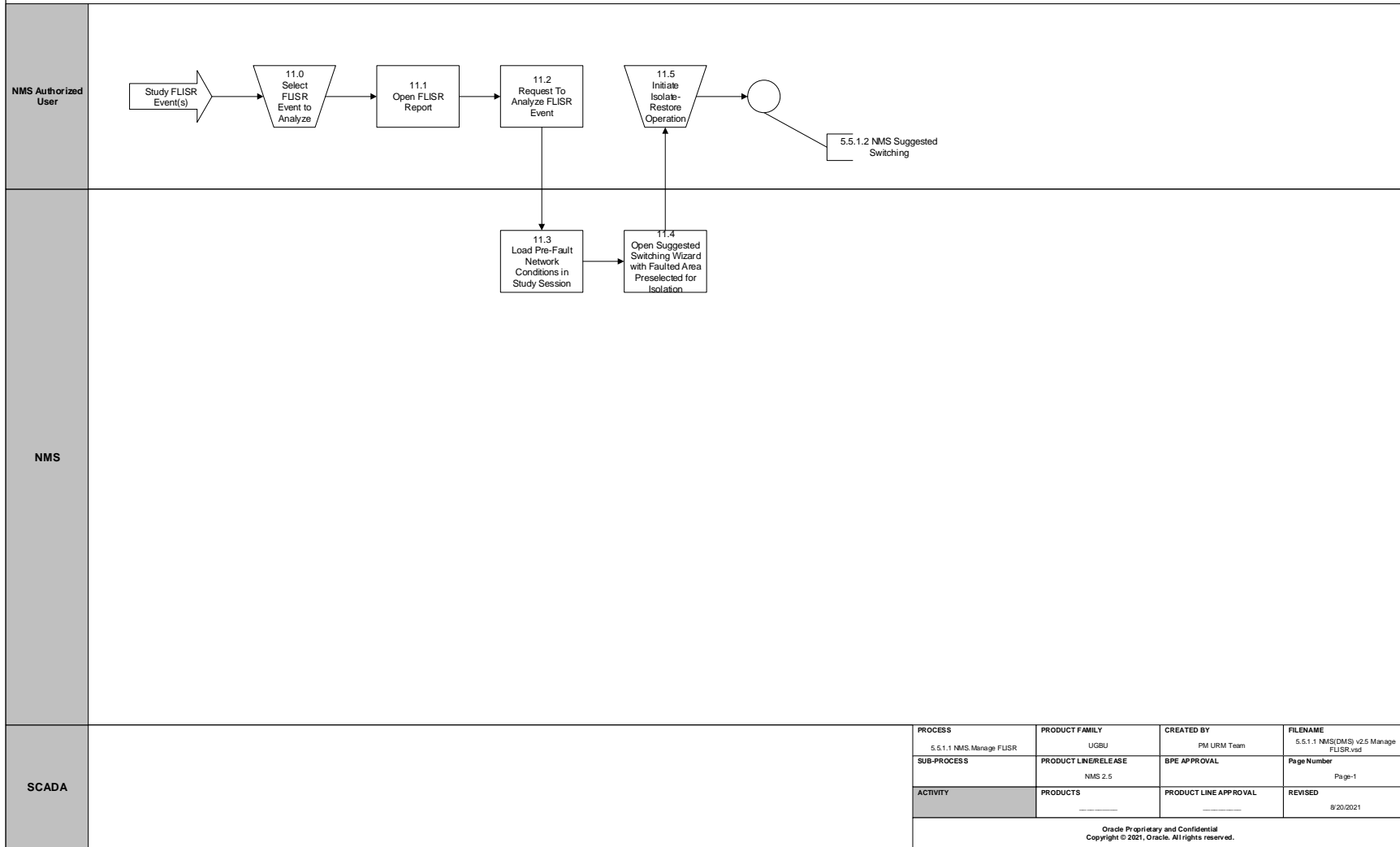


PROCESS	PRODUCT FAMILY	CREATED BY	FILENAME
5.5.1.1 NMS.Manage FLISR	UGBU	PM URM Team	5.5.1.1 NMS(DMS).v2.5 Manage FLISR.rsd
SUB-PROCESS	PRODUCT LINE/RELEASE	BPE APPROVAL	Page Number
	NMS 2.5		Page-1
ACTIVITY	PRODUCTS	PRODUCT LINE APPROVAL	REVISED
			8/20/2021

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# Business Process Model Page 7

## 5.5.1.1 NMS V2.5 *Manage Fault Location Isolation and Service Restoration(FLISR).FLISR Event SaveCase Analysis*



## Detail Business Process Model Description

### 1.0 Send Status

**Actor/Role:** SCADA

**Description:** The 3<sup>rd</sup> Party Application SCADA sends a “status” measurement to the NMS that indicates a device has opened in the field thus creating an outage event.

### 1.1 Process Status Data and Analyze Outage Event

**Actor/Role:** NMS

**Description:** NMS receives and processes the “status” measurement from the SCADA system. This data will be used to determine the type of outage that is created in the NMS. For example, if an open and immediate close is received NMS will create a momentary outage event.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	manualOperationMeasurementName

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
SCADA Measurement	autoRecloseMeasurementName
SCADA Measurement	recloseLockoutMeasurementName
SCADA Measurement	recloseLockoutAMeasurementName
SCADA Measurement	recloseLockoutBMeasurementName
SCADA Measurement	recloseLockoutCMeasurementName
SCADA Measurement	recloseLockoutNMeasurementName

### 1.2 Create SCADA Outage Event with Status “S-NEW”

**Actor/Role:** NMS

**Description:** If the event is not a momentary outage the NMS will create an “S-NEW” outage event because of the device open that was received from SCADA. The device status will also be opened in the network model to mirror the field status.

### 1.3 Check FLISR Mode

**Actor/Role:** NMS

**Description:** There are three FLISR modes available in NMS – Automatic, Manual, and Disabled. FLISR will start its processing only when FLISR mode is set to either Automatic or Manual.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrMode

SRS Rules	allowFlisrAutoMode
SRS Rules	flisrAutoRecloseDisable

#### 1.4 Create Predicted Outage Event with Status “NEW”

**Actor/Role:** NMS

**Description:** If NMS receives voltage and current measurements below the threshold from SCADA, it will create a “NEW” outage event. The device status will not be opened in the network model to mirror the field status as NMS has no information about this outage.

#### 1.5 Initiate Abort DMS Processing

**Actor/Role:** NMS

**Description:** If FLISR receives a signal from the user to abort the DMS processing, it initiates the abort process and stops the FLISR execution as early as it can depending upon the processing stage FLISR is in.

#### 1.6 Send Measurements

**Actor/Role:** SCADA

**Description:** The 3<sup>rd</sup> Party Application SCADA sends additional measurements (digitals/analog) to the NMS. These may have been sent to the NMS before or after the device “status” change depending on latency.

#### 1.7 Process Measurements

**Actor/Role:** NMS

**Description:** NMS processes various analog and digital measurements send by the 3<sup>rd</sup> party SCADA system to trigger the appropriate response. Based on the measurement it determines whether FLISR is triggered due to an unsolicited device operation or due to the loss of voltage on a feeder.

**Configuration required (Y) Entities to Configure:**

Mechanism	Rule
SCADA Measurement	_PF_MEAS_PHASE_KV
SCADA Measurement	_PF_MEAS_PHASE_KV_A
SCADA Measurement	_PF_MEAS_PHASE_KV_B
SCADA Measurement	_PF_MEAS_PHASE_KV_C
SCADA Measurement	_PF_MEAS_AMPS
SCADA Measurement	_PF_MEAS_AMPS_A
SCADA Measurement	_PF_MEAS_AMPS_B
SCADA Measurement	_PF_MEAS_AMPS_C

#### 1.8 Analyze Measurements for FLISR Disable Condition

**Actor/Role:** NMS

**Description:** NMS analyzes the FLISR Disable measurement to determine whether FLISR processing can be triggered or not for a particular event.

**Configuration required (Y)    Entities to Configure:**

Mechanism	Rule
SCADA Measurement	_PF_MEAS_FLISR_DISABLE
SCADA Measurement	_PF_MEAS_FLISR_FEEDER_DISABLE
SCADA Measurement	_PF_MEAS_GLOBAL_FLISR_MODE

### 1.9 Update FLISR Conditions for Feeder

**Actor/Role:**    NMS

**Description:**    When auto reclosing has been turned off at the tripped device or a device upstream of the tripped device has FLISR disabled condition, FLISR mode for the feeder will be set to “FLISR Disabled”

#### Group: Voltage Triggered FLISR Processing

### 2.0 Monitor Sub-Station Automation Processing and Analyze Network

**Actor/Role:**    NMS

**Description:**    Once NMS determines that the fault is in sub-station, it waits for the configured amount of time for the sub-station automation to finish its processing.

**Task Customizable (Y)                    Available Rule(s):**

Mechanism	Rule
SRS Rules	FLISR_SUBST_REST_DELAY

### 2.1 Perform Demand Scan and Send Updated Data

**Actor/Role:**    SCADA

**Description:**    The SCADA system receives the request to perform the demand scan. The SCADA system polls the field devices to obtain any updated telemetry.

### 2.2 Send Measurements

**Actor/Role:**    SCADA

**Description:**    Based on the request to perform a demand scan the SCADA system sends updated telemetry to the NMS.

#### Group: Voltage Triggered FLISR Processing

### 2.3 Analyze Voltage and Current Measurements

**Actor/Role:**    NMS

**Description:**    Some feeders may not have SCADA enabled protective devices available at the head of the feeder. However, if they have non-protective SCADA devices available downstream, NMS will analyze the voltage and current measurements to detect loss of voltage in the feeder. If NMS detects that voltage and current measurements are below the configured threshold, it triggers the FLISR processing.

**Task Customizable (Y)                    Available Rule(s):**

5.5.1.1 NMS(DMS).v2.5 Manage Automatic Fault Recovery (FLISR)

Mechanism	Rule
SRS Rules	FLISR_VOLT_LOSS_THRESHOLDS

#### 2.4 Identify Device Operation Type

**Actor/Role:** NMS

**Description:** Based on the information available to NMS, it identifies whether the loss of voltage is due to a solicited device operation or an unsolicited device operation.

#### Group: Voltage Triggered FLISR Processing

#### 2.5 Wait for More Measurements to Update

**Actor/Role:** NMS

**Description:** If NMS detects loss of voltage on a feeder due to an unsolicited device operation, it waits for the configured time and makes sure that voltage and current measurements of all the SCADA devices of the feeder are consistent.

#### 2.6 Validate Conditions to Process FLISR

**Actor/Role:** NMS

**Description:** The following validations are checked

- 1.) FLISR is enabled globally?
- 2.) Tripped Device is FLISR enabled?
- 3.) Feeder is FLISR enabled?
- 4.) Tripped Device has valid RTU ID?
- 5.) Tripped Device has valid SCADA measurements?

If the event is unplanned and all of the above are true, then FLISR will process this event.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	FLISR_DISABLE_TIME_AFTER_FAULT
SRS Rules	FLISR_DISABLE_FDR_FOR_RESTORATION_TIME
SRS Rules	FLISR_ABORT_ON_MISSING_LOCKOUT_IND

#### 2.7 Update DMS Status to “FLISR Demand Scan In Progress”

**Actor/Role:** NMS

**Description:** The DMS Status will update to “FLISR (A) Demand Scan In Progress” (for automatic) or “FLISR (M) Demand Scan In Progress” (for manual) after the demand scan request is initiated by NMS.

#### 2.8 Trace Downstream to Identify Devices (RTUs)

**Actor/Role:** NMS

**Description:** If conditions are valid to continue processing outage as a FLISR event, FLISR will trace downstream in the network model and identify downstream SCADA devices and assemble a list of RTU IDs.

### 2.9 Request Demand Scan for Identified Devices (RTUs)

**Actor/Role:** NMS

**Description:** After FLISR has traced downstream and identified a list of RTU IDs that correspond to SCADA devices it will send a request out to perform the demand scan of the devices.

**Task Customizable (Y)**

**Configuration required (Y) Entities to Configure:**

SCADA adapter will need to be configured to pick up message from FLISR

### 3.0 Monitor Demand Scan Waiting Period (Timer)

**Actor/Role:** NMS

**Description:** After the demand scan request has been sent out from FLISR it starts a configurable countdown timer (demand scan timer) to wait for the updated telemetry from SCADA.

**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrDemandScanThreshold
SRS Rules	flisrLatchTime
SRS Rules	FLISR_ENABLE_VOLT_MEAS_CHECK

### 3.1 Check for Updated Measurements From SCADA

**Actor/Role:** NMS

**Description:** NMS analyzes the updates measurements received from SCADA system.

### 3.2 Check RTUs Heartbeats

**Actor/Role:** NMS

**Description:** A heartbeat measurement is sent by each RTU to indicate that new measurements have been sent by that RTU.

**Configuration required (Y) Entities to Configure:**

Mechanism	Rule
SCADA Measurements	_PF_MEAS_RTU_HEARTBEAT

### 3.3 Analyze Latest Data and Validate Conditions to Process FLISR Solution

**Actor/Role:** NMS

**Description:** After the FLISR demand scan timer completes and updated telemetry has been received it begins to analyze if conditions still are valid to continue the FLISR processing. At this step FLISR checks the consistency of all fault targets on all upstream devices with fault indicators



**Task Customizable (Y)**      **Available Rule(s):**

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
SRS Rules	recloseLockoutMeasurementName
SRS Rules	FLISR Abort on Inconsistent Fls
Mechanism	Rule
SCADA Measurements	_PF_MEAS_FAULT_INDICATOR
SCADA Measurements	_PF_MEAS_FAULT_INDICATOR_A
SCADA Measurements	_PF_MEAS_FAULT_INDICATOR_B
SCADA Measurements	_PF_MEAS_FAULT_INDICATOR_C
SCADA Measurements	_PF_MEAS_FAULT_INDICATOR_N

### [3.4 Update DMS Status to “FLISR Solution in Progress”](#)

**Actor/Role:** NMS

**Description:** When the demand scan timer expires and we have all of the measurements, then the DMS status is updated to “FLISR (A) Solution In Progress” (for Automatic mode) or “FLISR (M) Solution In Progress” (for Manual mode)

### [3.5 Validate Trigger Conditions](#)

**Actor/Role:** NMS

**Description:** NMS performs various checks to see if conditions which triggered FLISR processing are still valid. It performs the checks such as -

- 1) Fault indication is set at the tripped device.
- 2) Lockout protection is present and set to the “On” status at the tripped device.
- 3) The tripped device is still de-energized.
- 4) If all fault indicators between the tripped device and last device are set.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	FLISR_DISABLE_ON_FAILURE

### [3.6 Update DMS Status to “FLISR Solution Failed”](#)

**Actor/Role:** NMS

**Description:** If any of the above-mentioned conditions fail, the DMS Status will be set to “FLISR (A) Solution Failed” (for automatic) or “FLISR (M) Solution Failed” (for manual).

### [3.7 Review FLISR Event Status](#)

**Actor/Role:** NMS Authorized User

**Description:** The NMS Authorized User will be able to see the “DMS Status” column for the outage event display the current “DMS Status”.

### [3.8 Review FLISR Report](#)

**Actor/Role:** NMS Authorized User

**Description:** After FLISR produces the [FLISR report](#) for the selected outage event a NMS Authorized User can view the details and information within the report.

### [3.9 Select FLISR Event and Request Abort DMS Processing](#)

**Actor/Role:** NMS Authorized User

**Description:** If NMS Authorized User wishes to abort the FLISR processing, he/she can select the event in the work agenda and click on 'Abort DMS Processing'. FLISR will abort its processing as soon as it can upon receiving this request.

### [4.0 Review Event and Processing Results](#)

**Actor/Role:** NMS Authorized User

**Description:** The NMS Authorized User will be able to see the "DMS Status" column for the outage event and he can also review the results of the FLISR processing in the FLISR report.

### [4.1 Review Condition Summary](#)

**Actor/Role:** NMS Authorized User

**Description:** The NMS Authorized User will be able to see the FLISR Disable condition of the feeder from Condition Summary dialog.

### [4.2 Check for any FLISR blocking conditions \(Tags, Trucks\)](#)

**Actor/Role:** NMS

**Description:** Check for conditions that may block FLISR processing. (e.g. Tags, Trucks, etc.)

**Configuration required (Y) Entities to Configure:**

Mechanism	Rule
Inheritance	block_flisr Class

### [4.3 Determine all Fault Indicators that Tripped in Faulted Area](#)

**Actor/Role:** NMS

**Description:** Determine all the fault indicators that have tripped in the faulted area, these will be used to identify the faulted feeder section.

**Configuration required (Y) Entities to Configure:**

Mechanism	Rule
SCADA Measurement	_PF_MEAS_FAULT_INDICATOR
SCADA Measurement	_PF_MEAS_FAULT_INDICATOR_A
SCADA Measurement	_PF_MEAS_FAULT_INDICATOR_B
SCADA Measurement	_PF_MEAS_FAULT_INDICATOR_C
SCADA Measurement	_PF_MEAS_FAULT_INDICATOR_N

#### 4.4 Manage Powerflow Analysis. Determine Pre-fault Loading Using Pre-trip Values

**Actor/Role:** NMS

**Description:** Power flow analysis will be conducted using the pre-trip load values to determine pre-fault loading.

**Task Customizable (N)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrSolutionEngine

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
SCADA Measurement	_PF_MEAS_PRE_TRIP_KVAR
SCADA Measurement	_PF_MEAS_PRE_TRIP_KVAR_A
SCADA Measurement	_PF_MEAS_PRE_TRIP_KVAR_B
SCADA Measurement	_PF_MEAS_PRE_TRIP_KVAR_C
SCADA Measurement	_PF_MEAS_PRE_TRIP_KW
SCADA Measurement	_PF_MEAS_PRE_TRIP_KW_A
SCADA Measurement	_PF_MEAS_PRE_TRIP_KW_B
SCADA Measurement	_PF_MEAS_PRE_TRIP_KW_C
SCADA Measurement	_PF_MEAS_PRE_TRIP_AMPS
SCADA Measurement	_PF_MEAS_PRE_TRIP_AMPS_A
SCADA Measurement	_PF_MEAS_PRE_TRIP_AMPS_B
SCADA Measurement	_PF_MEAS_PRE_TRIP_AMPS_C

#### 4.5 Determine "Isolate Area" Using SCADA Fault Indicators

**Actor/Role:** NMS

**Description:** FLISR will utilize SCADA fault indicator trips to determine how to isolate the faulted feeder section. Generally, the faulted section will be downstream of the last SCADA device that had a fault indicator trip but upstream of the first device that did not have a fault indicator trip.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	FLISR_IGNORE_MISSING_FI
SRS Rules	FLISR_ABORT_ON_PF_FAIL
SRS Rules	FLISR_ABORT_ON_PROTECTION_FAULTED
SRS Rules	FLISR_ABORT_ON_INCONSISTENT_FI

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
Inheritance	scada_sef_unreliable
Inheritance	scada_sef_semireliable
SCADA Measurement	_PF_MEAS_EARTH_LEAKAGE

#### [4.6 Select Tie Switches to Restore Non-faulted Areas of Feeder](#)

**Actor/Role:** NMS

**Description:** FLISR will locate and analyze tie points that are capable of restoring the non-faulted feeder sections. FLISR can be configured to prioritize the restoration feeder to use by setting parameters in the SRS rule “FLISR Plan Preferences”.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrDefaultOperationTime
SRS Rules	FLISR Plan Preferences
SRS Rules	flisrForecastHours
SRS Rules	flisrKvaTolerance
SRS Rules	VHILIMIT_FLISR
SRS Rules	VLOLIMIT_FLISR
SRS Rules	HIVOLTAGE_WARNINGS_DIFF_THRESHOLD_FLISR
SRS Rules	LOVOLTAGE_WARNINGS_DIFF_THRESHOLD_FLISR
SRS Rules	LIMIT_TYPE_FLISR
SRS Rules	LIMIT_TYPE_IEEE1547_FLISR
SRS Rules	FLISR_DISABLE_FDR_FOR_RESTORATION_TIME
SRS Rules	FLISR_AUTO_RESTORE_ON_ALL_FEEDERS
SRS Rules	FLISR_SUPPRESS_ALL_RECLOSERS
SRS Rules	FLISR_CHECK_PROT_REACH_VIOL
SRS Rules	FLISR_VOLT_ANGLE_MISMATCH_THRESHOLD
SRS Rules	FLISR_TIE_CHECK_FOR_PDO
SRS Rules	FLISR_TIE_MIN_VOLTAGE_PERCENT

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
SCADA Measurement	_PF_MEAS_ALT_PHASE_KV_A
SCADA Measurement	_PF_MEAS_ALT_PHASE_KV_B
SCADA Measurement	_PF_MEAS_ALT_PHASE_KV_C

#### [4.7 Update DMS Status “FLISR No Solution Found”](#)

**Actor/Role:** NMS

**Description:** The DMS Status will be set to “FLISR No Solution Found (A)” (for automatic) or “FLISR No Solution Found (M)” (for manual) if one of the following situations is detected. \*

- 1) Sensitive Earth Protection indication is set to the “On” status
- 2) Connectivity model is checked to make sure device energization is consistent. If the model indicates that the device is de-energized on both sides, or energized on both sides, processing will abort with “No Plan Found”.

**Group: Evaluate Alternate Path(s) for Restoration**

#### [4.8 Manage Powerflow](#)

**Actor/Role:** NMS

**Description:** After FLISR has determined the faulted feeder section and identified the available tie points capable of restoring the non-faulted feeder sections it will run a load flow to verify which paths are viable for restoration. This is to search for potential overloads using particular restore options.

#### **Group: Evaluate Alternate Path(s) for Restoration**

##### **4.9 Select Best Restoration Switch**

**Actor/Role:** NMS

**Description:** After identifying all possible restore switches, FLISR selects the best tie switch to restore the non-faulted section. Generally, the best tie switch is the one which ties the faulted feeder to the restore feeder with maximum available capacity.

##### **5.0 Generate Solutions(s) for Circuit Restoration**

**Actor/Role:** NMS

**Description:** After determining a viable option(s) for fault isolation and restoration FLISR will create the solutions(s). The “most viable” solution is marked as the preferred option. The rules for selecting “most viable” option are:

- 1) Restore switch has capacity to restore the load.
- 2) Restore switch is fed from same zone substation, thereby eliminating overloads in Sub-Transmission.
- 3) Restore feeder does not have cogens present.

When multiple restore scenarios match the above criteria, then the ‘most viable’ option will be the one that leaves the most capacity on the restore feeder after switching.

**Task Customizable (Y)**

**Available Rule(s):**

<b>Mechanism</b>	<b>Rule</b>
SRS Rules	FLISR_RST_PLAN_FDR_SAME_SS_WT
SRS Rules	FLISR_RST_PLAN_COGEN_WT
SRS Rules	FLISR_RST_PLAN_WITHOUT_COGEN_WT
SRS Rules	FLISR_RST_PLAN_VIOL_WT
SRS Rules	FLISR_RST_PLAN_CUST_RST_WT
SRS Rules	FLISR_RST_PLAN_CRIT_CUST_RST_WT
SRS Rules	FLISR_RST_PLAN_STEP_COUNT_WT
SRS Rules	FLISR_RST_PLAN_REG_STEP_COUNT_WT
SRS Rules	FLISR_RST_PLAN_CAP_STEP_COUNT_WT
SRS Rules	FLISR_RST_PLAN_TOTAL_LOSSES_WT

##### **5.1 Check User Abort Request**

**Actor/Role:** NMS

**Description:** NMS checks if a user has requested to abort processing this event.

## 5.2 Update DMS Status to “FLISR Manually Aborted”

**Actor/Role:** NMS

**Description:** If NMS Authorized User has requested to abort the processing of this event, then NMS sets the DMS status to ‘FLISR Manually Aborted’ and stops further processing of this event.

**Group:** Analyze and Optimize Solution

**Group:** Voltage Optimization

**Group:** Multi-Tier Processing

## 5.3 Evaluate Violations

**Actor/Role:** NMS

**Description:** After identifying the suitable isolate-switches and tie switches, NMS evaluates the plan for possible violations and warnings.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	DISTRIBUTION_TRANSFORMER_WARNING_THRESHOLD_FLISR
SRS Rules	DISTRIBUTION_TRANSFORMER_VIOLATION_THRESHOLD_FLISR
SRS Rules	FLISR_AUTO_EXECUTE_WITH_VIOLATIONS
SRS Rules	maxFlisrSolutionTime

**Group:** Analyze and Optimize Solution

**Group:** Voltage Optimization

## 5.4 Initiate Relieve Violations Optimization

**Actor/Role:** NMS

**Description:** If NMS cannot find a plan without violations then voltage optimization is performed in an attempt to relieve the voltage violations.

**Group:** Analyze and Optimize Solution

## 5.5 Store Save Case

**Actor/Role:** NMS

**Description:** NMS saves the pre-fault network conditions in a ‘Save Case’ which can be retrieved later to analyze the FLISR event and generated solution.

**Group:** Analyze and Optimize Solution

**Group:** Multi-Tier Processing

## 5.6 Multi-Tiered Processing

**Actor/Role:** NMS

**Description:** If no FLISR solution is present without loading violations, then FLISR performs a multi-tier processing to distribute the load into the configured number of tiers.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrNumSearchTiers

### **5.7 Update DMS Status “FLISR Solution Generated with Violations”**

**Actor/Role:** NMS

**Description:** If a solution was found but it resulted in violations FLISR will update the event status to “FLISR (A) Solution Generated With Violations” if the plan was originally determined to execute in automatic mode, if the plan was originally intended to execute in manual mode the status will be “FLISR (M) Solutions Generated With Violations”. If FLISR is in automatic mode, this condition will cause the event to be demoted to a manual event. The operator will have to review the solution before authorizing FLISR to execute it.

### **5.8 Update DMS Status “FLISR Tags Found”**

**Actor/Role:** NMS

**Description:** If a solution was found but FLISR block conditions were found FLISR will update the DMS Status to “FLISR (A) Tags Found” if the plan was originally intended to execute in automatic mode, or it will be set to “FLISR (M) Tags Found” if the plan was originally intended to execute in manual mode. If FLISR is in automatic mode, this condition will cause the event to be demoted to a manual event. The operator will have to review the solution before authorizing FLISR to execute it.

### **5.9 Update DMS Status “FLISR Solution Generated”**

**Actor/Role:** NMS

**Description:** The DMS Status will update to “FLISR (A) Solution Generated” (for automatic) or “FLISR (M) Solution Generated” (for manual) if a viable option was found with no overloads or FLISR block conditions.

### **6.0 Determine Faulted Phases**

**Actor/Role:** NMS

**Description:** NMS can determine the faulted phases if per phase fault indicators and per phase lock out indicators are present.

### **6.1 Generate Switch Plan with Unganged Operation**

**Actor/Role:** NMS

**Description:** If fault is determined to be present on some specific phase(s), then FLISR can generate a switch plan to isolate and restore the feeder on that specific faulted phase(s). In this case, depending on the configuration, FLISR can either generate a ‘restore first’ plan or ‘isolate first’ plan. In ‘restore first’ plan, FLISR first isolates the faulted section of the feeder on the faulted phase(s) only and then closes the tie switches on all the phases. Thus, it creates a parallel on the non-faulted phases. After that it opens the isolate switch on the non-faulted phases to break the parallel. This mode avoids de-energizing the customers on the non-faulted phases. In ‘isolate first’ mode, FLISR first isolates the faulted section of the feeder on all the phases and only then it closes the tie switch to restore the non-faulted section.

**Task Customizable (Y)**

**Available Rule(s):**

<b>Mechanism</b>	<b>Rule</b>
SRS Rules	flisrSwitchPlanType
SRS Rules	FLISR_SINGLE_PHASE_MODE
SRS Rules	FLISR_ENABLE_SINGLE_PHASE_OPERATION_ON_GANGED_TRIP

## [6.2 Generate Switch Plan with Ganged Operation](#)

**Actor/Role:** NMS

**Description:** If FLISR is processing the three-phase fault or when FLISR is configured for ganged operation, it generates a switch plan where open/close operations are performed on three phases.

**Task Customizable (Y)**      **Available Rule(s):**

<b>Mechanism</b>	<b>Rule</b>
SRS Rules	flisrSwitchPlanType
SRS Rules	flisrTemplateBase
SRS Rules	flisrTemplateDisable
SRS Rules	flisrTemplateEnable
SRS Rules	flisrTemplateArSuppress
SRS Rules	flisrTemplateArEnable
SRS Rules	flisrTemplateWait
SRS Rules	flisrTemplateWaitForTD
SRS Rules	flisrTemplateIsolate
SRS Rules	flisrTemplateRestore
SRS Rules	flisrTemplateValidateOperation

## [6.3 Update Event DMS Status to “FLISR Plan Executing”](#)

**Actor/Role:** NMS

**Description:** FLISR will update the DMS Status to “FLISR Automatically Executing”.

## [6.4 Identify Switch Plan Block to Execute in Parallel](#)

**Actor/Role:** NMS

**Description:** NMS identifies the switching blocks in the switch sheet to execute them in parallel.

### Group: Switch Plan Block Execution

## [6.5 Send Execution Instruction for Next Switch Step in Block](#)

**Actor/Role:** NMS

**Description:** The NMS sends the switching action for the switch step to SCADA.

### Group: Switch Plan Block Execution

## [6.6 Monitor Response](#)

**Actor/Role:** NMS

**Description:** The NMS will monitor for SCADA updates related to the device action sent.

**Configuration required (Y)**      **Entities to Configure:**

<b>Mechanism</b>	<b>Rule</b>
SCADA Controls	Timeout



**Group: Switch Plan Block Execution****6.7 Evaluate Switch Step Re-Execution Criteria****Actor/Role:** NMS**Description:** If SCADA fails to execute a switching step, NMS send this step back to SCADA for re-execution. The number of re-tries can be configured using the SRS-rule given below.**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	failStepOnSCADATimeout
SRS Rules	DMS_SW_STEP_FAIL_RETRIES_WAIT_TIME

**Group: Switch Plan Block Execution****6.8 Update Status of Switch Step to 'Timeout'****Actor/Role:** NMS**Description:** FLISR will update the Switch Step status to "Timeout" if SCADA fails to execute this step even after the configured number of tries.**Group: Switch Plan Block Execution****6.9 Update Status of Switch Plan to 'Timeout'****Actor/Role:** NMS**Description:** FLISR allows a maximum amount of time for automatic FLISR switching sheet execution. FLISR aborts automatic execution of plan if the execution time exceeds the configurable time and updates the Switch Plan status to "Timeout".**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	FLISR_PLAN_EXECUTION_TIMEOUT

**Group: Switch Plan Block Execution****7.0 Update Event DMS Status to 'Plan Execution Timed Out'****Actor/Role:** NMS**Description:** FLISR will update the DMS Status to "Plan Execution Timed Out" if switch plan execution time exceeds the configured execution time.**Group: Switch Plan Block Execution****7.1 Update Status of Switch Step to 'Complete'****Actor/Role:** NMS**Description:** If the step completes successfully and a valid response is received from SCADA the Switch Step status will update to "Complete"**7.2 Update Switch Plan Status to 'Executed'****Actor/Role:** NMS

**Description:** If all Switch Steps are completed successfully and no other steps are left to execute the Switch Plan status will be updated to “Executed”

### [7.3](#) Update Event DMS Status to “FLISR Plan Executed”

**Actor/Role:** NMS

**Description:** If the entire switch plan is successfully executed by the NMS while in automatic mode the DMS Status will update to “FLISR Plan Executed”.

### [7.4](#) Review Event Status

**Actor/Role:** NMS Authorized User

**Description:** The NMS Authorized User will be able to see the “DMS Status” column for the outage event display the current “DMS Status”.

### [7.5](#) Receive Instruction

**Actor/Role:** SCADA

**Description:** The SCADA system receives the switching action from NMS.

### [7.6](#) Execute Requested Switching Action

**Actor/Role:** SCADA

**Description:** The SCADA system sends the action to the field device.

### [7.7](#) Send Response

**Actor/Role:** SCADA

**Description:** SCADA system will send a response back to the NMS for the action.

### [7.8](#) Update Status of Switch Step to “Failed”

**Actor/Role:** SCADA

**Description:** If SCADA system does not accept the switching action, the Switch Step is set to a value of “Failed”.

### [7.9](#) Update Status of Switch Plan to “Failed”

**Actor/Role:** SCADA

**Description:** If a particular step fails the Switch Plan status is set to “Failed”. For basic plans where only one block of switch steps exist FLISR will not continue processing other steps as successful completion of each step is critical. For more complex plans that result in multiple blocks of switch steps it may be possible for FLISR to continue processing the other blocks since each block is independent.

## [8.0 Review FLISR Plan\(s\)](#)

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User will review the isolate-restore plan generated by FLISR.

## [8.1 Request Switch Plan for Selected FLISR Plan](#)

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User requests to generate a switch plan for the selected FLISR plan.

## [8.2 Determine Faulted Phases](#)

**Actor/Role:** NMS

**Description:** NMS can determine the faulted phases if per phase fault indicators and per phase lock out indicators are present.

## [8.3 Generate Switch Plan for Selected FLISR Plan with Unganged Operation](#)

**Actor/Role:** NMS

**Description:** If fault is determined to be present on some specific phase(s), then FLISR can generate a switch plan to isolate and restore the feeder on that specific faulted phase(s). In this case, depending on the configuration, FLISR can either generate a 'restore first' plan or 'isolate first' plan. In 'restore first' plan, FLISR first isolates the faulted section of the feeder on the faulted phase(s) only and then closes the tie switches on all the phases. Thus, it creates a parallel on the non-faulted phases. After that it opens the isolate switch on the non-faulted phases to break the parallel. This mode avoids de-energizing the customers on the non-faulted phases. In 'isolate first' mode, FLISR first isolates the faulted section of the feeder on all the phases and only then it closes the tie switch to restore the non-faulted section.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrSwitchPlanType

**Configuration required (Y)**      **Entities to Configure:**

Mechanism	Rule
SRS Rules	_PF_MEAS_GANG_MODE

## [8.4 Generate Switch Plan with Ganged Operation](#)

**Actor/Role:** NMS

**Description:** If FLISR is processing the three-phase fault or when FLISR is configured for ganged operation, it generates a switch plan where open/close operations are performed on three phases.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	flisrSwitchPlanType

## [8.5 Select Alternate FLISR Plan](#)

**Actor/Role:** NMS Authorized User

**Description:** User will select an alternate FLISR plan other than the default one that picked by FLISR. This assumes FLISR is in manual mode and plans were successfully generated.

### **8.6 Review Switch Sheet**

**Actor/Role:** NMS Authorized User

**Description:** After generating the switch sheet NMS Authorized User can review the switch plan.

### **8.7 Modify FLISR Switch Plan and Request Update**

**Actor/Role:** NMS Authorized User

**Description:** The FLISR switch plan can be modified within switching management by the NMS Authorized User. Typical items that may be added here would be related to safety (tags, safety documents, etc.)

### **8.8 Update FLISR Switch Plan**

**Actor/Role:** NMS

**Description:** NMS will update the switch plan based on the NMS Authorized Users inputs.

### **8.9 Request Execution of Entire Switch Sheet**

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User can request to execute the entire switch sheet after reviewing and/or modifying it.

### **Group: Voltage Optimization**

#### **9.0 Test Voltage Violation**

**Actor/Role:** NMS

**Description:** NMS evaluates the restoration plan to identify the possible violations. If it identifies any voltage violations in the plan, FLISR attempts to address them by executing the network optimization.

### **Group: Voltage Optimization**

#### **9.1 Check Eligibility to Perform Optimization**

**Actor/Role:** NMS

**Description:** NMS checks if Optimization module is licensed and enabled so that it can perform the volt-var optimization to relieve the voltage violations.

### **Group: Voltage Optimization**

### **Group: Manage Optimization**

#### **9.2 Find LTC for Every Restoration Area**

**Actor/Role:** NMS

**Description:** NMS identifies the load tap changers in the sub-station of the restoration area to perform the volt-var optimization.

**Group: Voltage Optimization**

**Group: Manage Optimization**

**9.3 Optimize Network Real-Time**

**Actor/Role:** NMS

**Description:** NMS runs the volt-var optimization on the restoration feeder.

**Group: Voltage Optimization**

**Group: Evaluate Network After Optimization**

**9.4 Manage Powerflow**

**Actor/Role:** NMS

**Description:** NMS performs the Powerflow to analyze the network after volt-var optimization.

**Group: Voltage Optimization**

**Group: Evaluate Network After Optimization**

**9.5 Evaluate Optimized Solution**

**Actor/Role:** NMS

**Description:** NMS identifies the violations after performing the optimization.

**Group: Voltage Optimization**

**9.6 Update the Reported Violations**

**Actor/Role:** NMS

**Description:** NMS reports the violations to evaluate whether violations have got better or worse after the optimization.

**Group: Voltage Optimization**

**9.7 Add Optimization Steps to Solution**

**Actor/Role:** NMS

**Description:** FLISR will append the steps of the optimization at the end to the FLISR plan.

**Group: Multi- Tier Processing**

**9.8 Check Loading Violations**

**Actor/Role:** NMS

**Description:** FLISR evaluates the proposed restoration plan for any overload violations.

**Group: Multi- Tier Processing****9.9 Run Multi-tiered Solution****Actor/Role:** NMS**Description:** FLISR performs a multi-tier processing to relieve the overload violations.**Group: Multi- Tier Processing****Group: Forecast Restoration Area****10.0 Manage Powerflow****Actor/Role:** NMS**Description:** FLISR again performs the Powerflow to analyze the network conditions after the multi-tier processing.**Group: Multi- Tier Processing****Group: Forecast Restoration Area****10.1 Update the Reported Violations****Actor/Role:** NMS**Description:** NMS will update the switch plan based on the NMS Authorized Users inputs.**Group: Multi-Tier Processing****10.2 Generate Alternate Multi-Tiered Solution(s) for Circuit Restoration****Actor/Role:** NMS**Description:** NMS generates a switch plan based on the multi-tier solution.**10.3 Update DMS Status “FLISR Solution Generated with Violations”****Actor/Role:** NMS**Description:** If a solution was found but it resulted in violations FLISR will update the event status to “FLISR (A) Solution Generated With Violations” if the plan was originally determined to execute in automatic mode, if the plan was originally intended to execute in manual mode the status will be “FLISR (M) Solutions Generated With Violations”. If FLISR is in automatic mode, this condition will cause the event to be demoted to a manual event. The operator will have to review the solution before authorizing FLISR to execute it.**10.4 Select Switch Step and Request Execution****Actor/Role:** NMS Authorized User**Description:** After FLISR generates a switch sheet and if it requires a manual intervention to execute it, an NMS Authorized User can select the individual switch step and sends a request to NMS to execute it.**10.5 Update Event Status to “S-INC”****Actor/Role:** NMS

**Description:** After the switch plan has been successfully executed NMS will update the outage event status to “S-INC” as there will still be customers that need to be restored on the faulted feeder section.

#### **10.6 Identify De-Energized Customers**

**Actor/Role:** NMS

**Description:** NMS will identify the remaining customers that are still de-energized on the faulted feeder section.

#### **10.7 Create New Event with Status “S-NEW” for De-Energized Customers**

**Actor/Role:** NMS

**Description:** NMS will create a “S-NEW” event for the customers that are still de-energized.

#### **10.8 Review Switching Plan Completion**

**Actor/Role:** NMS Authorized User

**Description:** If no steps are left to execute the NMS Authorized User can view the switch plan completion.

#### **10.9 Review New Event**

**Actor/Role:** NMS Authorized User

**Description:** The S-NEW event can now be reviewed by the NMS Authorized User.

#### **11.0 Select FLISR Event to Analyze**

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User can select a FLISR event in the workagenda to analyze at a later time.

#### **11.1 Open FLISR Report**

**Actor/Role:** NMS Authorized User

**Description:** User opens the [FLISR report](#) for the event selected for analysis.

#### **11.2 Request to Analyze FLISR Event**

**Actor/Role:** NMS Authorized User

**Description:** User can request the analysis of the FLISR report by clicking the ‘Analyze’ button on the FLISR report.

#### **11.3 Load Pre-Fault Network Conditions in Study Session**

**Actor/Role:** NMS

**Description:** NMS opens a viewer and loads the pre-fault network conditions in the study session for the selected event.

#### **11.4 Open Suggested Switching Wizard with Faulted Area Preselected for Isolation**

**Actor/Role:** NMS

**Description:** NMS opens the Suggested Switching Wizard with a feeder section in the faulted area pre-selected for isolate and restore.

#### **11.5 Initiate Isolate-Restore Operation**

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User can analyze the event by initiating an Isolate-Restore operation in the Suggested Switching wizard.



## Document Control

### Change Record

Date	Author	Version	Change Reference
04/01/2014	Srinivas Kanteti	1	Initial Version
03/30/2015	Andrew Neddermeyer	1.1	Updates based on feedback
6/24/2015	Ian Hoogendam	1.2	Updated to reflect functionality and configuration of 2.3.0.1. Added reference document for error codes.
5/14/2019	Saurabh Gupta	1.3	Reflect latest changes to V2.3.0.1 and beyond
6/14/2021	Saurabh Gupta	2.5.0.1	Redesign for NMS v2.5.0.1
6/22/2021	Ian Hoogendam	2.5.0.1	Reviewed
6/23/2021	Andrew Neddermeyer	2.5.0.1	Reviewed
6/24/2021	Palak Jain	2.5.0.1	Reviewed
6/25/2021	Mike Langford	2.5.0.1	Reviewed
8/18/2021	Galina Polonsky		Reviewed, Approved

# Attachments

## FLISR Report

Event Details 🔍 🗖 🗑

6775 : BR2421 x

File Actions Help 📁 📄 📧 📧 📧 📧 📧

EVENT #	6775	# EMER.	2	START DATE	04/15/21 14:31	DEVICE	BR2421	Ungang Scada Rack Air Circuit Br
PHASES OUT	A	# MED.	0	EST RESTORE DATE	04/15/21 15:51	SHEET #	FLISR 1017	
# CALLS	0	# KEY	16	RESTORE DATE	04/15/21 14:32	CLUES		
CUSTOMERS OUT	295	# SENS.	0	EST TIME TO REPAIR	##:##	ZONE	OPAL Stark Lake Lake Sub 2421S	

Job Actions Completion Actions Equipment Failure Trouble Info Damage Assessments Event Log Steps FLISR Report Attachments

File Actions 📁 🗑 🗑 🗑

SCADA Measurements

DEVICE	STATUS	PRE-TRIP AMPS	FAULT INDICATOR	LOCKOUT INDICATOR	PRE-TRIP KW	PRE-TRIP KVAR	QUALITY
BR2421	Tripped	151 / 152 / 122	Y/N/N/N	Y/N/N/N	3363	1028	Ok
S4570	Closed	81 / 89 / 30	Y/N/N/N	N/A	1558	424	Ok
S5057	Closed	43 / 52 / 21	N/N/N/N	N/A	906	244	Ok

FLISR Messages

DEVICE	DATE	IS ALARM	MESSAGE DESCRIPTION
BR2421	04/15/21 14:31:09.156	N	0261: FLISR processing started due to trip/lockout on [BR2421]
BR2421	04/15/21 14:31:09.171	N	0240: FLISR demand scan started
BR2421	04/15/21 14:31:19.288	N	0250: FLISR demand scan completed

FLISR Solutions

Single-Tier

OPEN SWITCH	ISOLATION PHASES	CLOSE SWITCH	EXECUTION MODE	RANK	PICKUP AMPS	RESTORE PHASES	FEEDER	PEAK LOAD TIME	BEFORE FEEDER AMPS	AFTER FEEDER AMPS	VIOLATION START TIME	VIOLATION END TIME	LIMIT DEVICE
▼ S4570	Y/Y/Y/N	<input type="checkbox"/>	BR2421	Automatic	1 77 / 0 / 0	Y/N/N/N	Feeder-2421S	Thu, Apr 15 14:31	0 / 99 / 102	77 / 100 / 103			UG1P-2282565-444686...
▼ S5057	Y/Y/Y/N	<input type="checkbox"/>	S4581		1 7 / 2 / 33	Y/Y/Y/N	Feeder-2433	Thu, Apr 15 15:00	250 / 246 / 266	80 / 239 / 233	Thu, Apr 15 14:31	Thu, Apr 15 16:00	UG3P-2270563-459352...

## Summary of FLISR Messages

Summary of FLISR Messages NMS v2.5.0.1		
Message #	Message String	URM Box#
0010	FLISR Disabled	1.3
0011	FLISR Disabled	HLM
0020	FLISR in Automatic Mode	1.3
0030	FLISR in Manual Mode	1.3
0040	FLISR set to invalid mode	1.3
0050	FLISR Automatic Mode not allowed	1.3
0060	FLISR Solution started for event [Job index]	2.6
0070	FLISR Solution failed for event [Job index]	3.6
0080	FLISR Solution completed for event [Job index]	5.9
0090	Unable to select a restore switch for this isolate switch [\$DEVICE]	4.6
0091	No restore switches selected [\$VAL1]	4.7
0100	Started FLISR Switch sheet creation for event [Job index]	6.0
0110	Completed FLISR Switch sheet creation for event [Job index]	6.1, 6.2
0120	Failed to create FLISR Switch sheet for event [Job index]	6.1, 6.2
0130	Executing switch sheet [Switching sheet index]	6.3
0140	Sheet [Switching sheet index] for event [Event index] locked by [Name of the user who locked the switching sheet]	6.3
0150	Unable to start auto restoration event [Job index] for sheet [Sheet index]	6.3
0160	Unable to create sheet for event [Job index]	6.1, 6.2
0170	Event [Job index] is demoted for manual execution	5.9
0180	Started FLISR Switch sheet [Switching sheet index] execution for event [Job index]	6.3
0190	Completed FLISR Switch sheet [Switching sheet index] execution for event [Job index]	7.2
0200	Failed to execute FLISR Switch sheet [Switching sheet index] for event [Job index]	7.8
0210	FLISR action validation failed.	6.5

0220	Disabled by Switch Plan.	6.5
0230	Auto-execution of this action type not supported.	6.5
0231	Auto-execution of this action type not supported.	6.5
0240	FLISR demand scan started	2.9
0250	FLISR demand scan completed	3.3
0260	FLISR processing started due to voltage loss on [DEVICE_ALIAS]	2.5
0261	FLISR processing started due to trip/lockout on [DEVICE_ALIAS]	2.6
0280	FLISR manually aborted while executing Switch sheet [SHEET_ID] for event [EVENT_ID]	6.3
0290	Multi-tier FLISR Solution started	5.6
0300	Multi-tier FLISR Solution completed	5.6
0310	Multi-tier FLISR Solution failed	5.6
0311	Multi-tier FLISR Solution failed	5.6
0312	Multi-tier FLISR Solution unloading failed.	5.6
0320	Multi-tier FLISR tags found, reverting to single-tier solution	5.6
0330	FLISR is disabled due to Load Shed	1.3
0340	FLISR failed to create save case for study-mode	5.5
1010	Lockout indicator is not set	2.6
1011	Lockout indicator is not set	2.6
1020	Invalid device - not found or modeled incorrectly	2.6
1021	Invalid device - not found or modeled incorrectly	2.8
1022	Invalid device - not found or modeled incorrectly	3.3
1023	Invalid device - not found or modeled incorrectly	3.3
1024	Invalid device - not found or modeled incorrectly	3.3
1025	Invalid device - not found or modeled incorrectly	5.6
1030	Tripped device is closed on one or more phases	2.6
1040	Load side still energized	2.6
1050	Device is deenergized. Another device may have tripped upstream	2.6
1051	Device is deenergized on all phases.	2.8

1052	Device is deenergized. Another upstream device is found tripped in demand scan	3.3
1053	Device is deenergized. Source of the device is not found	4.8
1054	Device is deenergized. It does not belong to any island.	4.8
1055	Device is deenergized. It does not belong to any feeder.	4.8
1056	Device is part of a power flow disabled feeder	2.9
1060	No SCADA measurements available	2.8
1061	No SCADA measurements available	4.6
1062	No SCADA measurements available	4.8
1070	Fault indicators are not consistent on all devices	2.8
1080	Device has already been re-energized	3.3
1081	Device has already been re-energized	2.6
1085	Tripped device still reporting flow or voltage measurements	2.6
1086	Potential isolate device still reporting flow or voltage measurements	2.6
1087	Potential restoration device reporting flow measurements	4.6
1090	FLISR is ignoring the missing Fault Indicator	2.6
1100	Fault indicator is not set	2.6
1110	Has sensitive earth fault	2.6
1120	Telemetry Failed	4.3
1121	Telemetry Failed	4.5
1122	Telemetry Failed	4.6
1123	Telemetry Failed	4.8
1124	Telemetry Failed	4.8
1130	Power Flow solution failed for [Device Alias]	4.4
1140	Invalid device or model state - FLISR cannot process	2.6
1150	FLISR is ignoring the missing Lockout Indicator on [Tripped Device]	2.6
1160	FLISR is demoted to manual mode; voltage measurements are missing	2.6
1161	FLISR is demoted to manual mode; voltage measurements are missing	4.6

1162	FLISR is demoted to manual mode; voltage measurements are missing	4.6
1170	FLISR is aborted; voltage measurements are missing	2.6
1171	FLISR is aborted; voltage measurements are missing	4.6
1172	FLISR is aborted; voltage measurements are missing	4.6
1180	Multi-tier Power-flow solution failed	5.6
1190	Power-flow solution failed; FLISR cannot forecast the restore scenarios	4.6
1191	Power-flow solution failed; FLISR cannot forecast the restore scenarios	4.6
2010	Device is FLISR disabled	2.6
2011	Device is FLISR disabled	2.6, 3.3
2012	Device is FLISR disabled	4.3
2013	Device is FLISR disabled	4.8
2014	Device is FLISR disabled	5.6
2020	Recently operated	4.8
2030	Device [Handle] is FLISR re-enabled	HLM
2040	Device [Handle] is FLISR disabled	HLM
2050	Switch is de-energized from both sides	4.6
2051	Switch is de-energized from both sides	5.6
2060	FLISR cannot find original pickup area for split switch [\$DEVICE]	5.6
2070	Tripped device is [\$STRIPPED_DEV], faulted device is [\$FAULTED_DEV]	5.5
3010	Feeder [Feeder Alias] is in manual mode	2.6
3020	FLISR aborted due to multiple faults on the same feeder	2.6
3030	Feeder upstream is disabled	2.6, 3.3
3040	Protection switch signaling fault	4.3
3041	Protection switch signaling fault	4.3
3050	A Fault Indicator is not set upstream	4.3
3060	Device is looped	4.3
3061	Device is looped	4.8
3070	FLISR aborted due to the presence of a loop in the faulted area	4.6

3080	No valid solution isolate switches found	4.6
3090	FLISR Disabled on restoring feeder	4.8
3095	Power Flow Disabled on restoring feeder [Feeder Name]	4.6
3100	No valid areas found to restore	4.8
3110	Event demoted for manual execution. Current state of restoration Feeder [\$VAL1] does not allow automatic execution.	4.8
3120	[Feeder Name] to PU Load to [Isolation Switch] via [Restoration Switch] Load = \$PU_AMPS_A / \$PU_AMPS_B / \$PU_AMPS_C'	4.8
3125	Unload [Feeder Name] ex [Isolation Switch] -> [Restored Feeder] via [Restoration Switch] Load = \$IN_AMPS_A / \$IN_AMPS_B / \$IN_AMPS_C + \$PU_AMPS_A / \$PU_AMPS_B / \$PU_AMPS_C = \$RF_AMPS_A / \$RF_AMPS_B / \$RF_AMPS_C	4.8
3130	[Feeder Name] ex [Isolation Switch] -> [Restored Feeder] via [Restoration Switch] Load = \$IN_AMPS_A / \$IN_AMPS_B / \$IN_AMPS_C + \$PU_AMPS_A / \$PU_AMPS_B / \$PU_AMPS_C = \$RF_AMPS_A / \$RF_AMPS_B / \$RF_AMPS_C	4.8
3140	FLISR has disabled feeder [Feeder Alias]	3.4, 3.6, 4.7, 5.7, 7.9
3150	FLISR Feeder already disabled.	6.5
3160	FLISR Feeder already enabled.	6.5
3170	Tripped breaker and [RESTORE_SWITCH] have different nominal voltages	4.6
3180	Restoration switch [SWITCH] has voltage angle difference of [x.xx] degrees between the tied feeders, which exceeds the threshold of [ANGLE_THRESHOLD] degrees	4.6
4010	Found restore feeder blocking condition [CONDITION] when processing event [EVENT]	4.6
4011	Found faulted feeder blocking condition [CONDITION] when processing event [EVENT]	2.6, 3.3

4020	Cannot automatically execute event [Job index] due to conditions in area	5.9
4030	FLISR Switch Plan [Switching sheet index].	6.5
4040	Step condition class undefined.	6.5
5010	FLISR aborted due to the delayed reporting of the SCADA event	2.6
5020	SCADA event reporting is delayed	2.6
5030	No job found	3.3
5040	RTU \$RTU failed to respond to demand scan within configured period of \$TIMEOUT seconds	3.2
5050	RTU \$RTU does not have mandatory heartbeat present	3.2
5060	SCADA quality invalid. Device demoted to manual	4.2, 4.6
5061	Flisr_Exclude point is asserted. Device demoted to manual.	4.2, 4.6
5062	Flisr Exclude tag is found. Device demoted to manual.	4.2, 4.6
5064	FLISR: Optimization steps are added to the plan. Initial violations = \$INIT_VIOL, Final violations = \$FINAL_VIOL.	4.6
5065	Multi-Tier FLISR: Optimization steps are added to the plan. Initial violations = \$INIT_VIOL, Final violations = \$FINAL_VIOL.	4.6
5066	Optimization global is disabled. Restoration network is not optimized.	4.6
5067	FLISR Plan is demoted to manual as Optimization global status is manual	4.6
5070	Using "isolate-first" mode due to neutral imbalance on \$VAL1.	4.6
5080	Rejected tie switch due to poor quality voltage scada measurement	4.6
4.6	Rejected tie switch due to absence of de-energized voltage scada measurements	4.6
5100	Rejected tie switch due to low voltage on phase \$PHASE. Voltage = \$VOLT pu, Minimum = \$MIN pu.	4.6
5110	Rejected tie switch due to error when looking for upstream Predicted Device Outage. Error = \$ERROR.	4.6
5120	Rejected tie switch due to presence of upstream Predicted Device Outage.	4.6



\*HLM = High Level Message