



MIDWEST  
RELIABILITY  
ORGANIZATION

# Meeting Agenda

## Protective Relay Subgroup (PRS)

**December 06, 2022**  
**9:00 am to 3:00 pm central**

*MRO Corporate Offices, King Conference Center  
St. Paul, MN & Webex*

## **VIDEO AND AUDIO RECORDING**

Please note that Midwest Reliability Organization (MRO) may make a video and/or an audio recording of this organizational group meeting for the purposes of making this information available to board members, members, stakeholders and the general public who are unable to attend the meeting in person.

By attending this meeting, I grant MRO:

1. Permission to video and/or audio record the meeting including me; and
2. The right to edit, use, and publish the video and/or audio recording.
3. I understand that neither I nor my employer has any right to be compensated in connection with the video and/or audio recording or the granting of this consent.

## MRO ORGANIZATIONAL GROUP GUIDING PRINCIPLES

These MRO Organizational Group Guiding Principles complement charters. When the Principles are employed by members, they will support the overall purpose of the organizational groups.

Organizational Group Members should:

1. Make every attempt to attend all meetings in person or via webinar.
2. Be responsive to requests, action items, and deadlines.
3. Be active and involved in all organizational group meetings by reviewing all pre-meeting materials and being focused and engaged during the meeting.
4. Be self-motivating, focusing on outcomes during meetings and implementing work plans to benefit MRO and MRO's registered entities.
5. Ensure that the organizational group supports MRO strategic initiatives in current and planned tasks.
6. Be supportive of Highly Effective Reliability Organization (HERO™) principles.
7. Be supportive of proactive initiatives that improve effectiveness and efficiency for MRO and MRO's registered entities.

## MRO PROTECTIVE RELAY SUBGROUP Q4 MEETING AGENDA

### Agenda Item

- 1 Call to Order and Determination of Quorum**  
*Greg Sessler, Protective Relay Subgroup Chair*
  - a. Determination of Quorum
  - b. Robert's Rules of Order
- 2 Standards of Conduct and Antitrust Guidelines**  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
- 3 Chair's Remarks**  
*Greg Sessler, Protective Relay Subgroup Chair*
- 4 Consent Agenda**  
*Greg Sessler, Protective Relay Subgroup Chair*
  - a. Approve August 16, 2022 meeting minutes
  - b. Approve October 18, 2022 meeting minutes
- 5 NERC Activities**  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - a. Update on NERC SPCWG  
*Mark Gutzmann Director, System Protection & Communication Engineering, Xcel Energy*
  - b. NERC MIDASUG Update  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - c. TADS  
*John Grimm, Principal Systems Protection Engineer, MRO*
- 6 PRS Business**
  - a. Updates  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - b. Action Item List Review  
*Greg Sessler, Protective Relay Subgroup Chair*
- 7 2023 Meeting Dates**  
*Greg Sessler, Protective Relay Subgroup Chair*

### Break – 10:00 a.m.

- 8 Misoperations**  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - a. Q2 2022 Results, Review and Discussion
  - b. Project Updates
    - i. **Instantaneous Ground Overcurrent**  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - c. Review NERC Lesson Learned
- 9 Commissioning Best Practices – Alliant Energy**  
*Sarah Marshall, Team Lead System Protection, Alliant Energy and PRS Member*
- 10 Relay Operations During Planned Switching**  
*Greg Sessler, System Protection Team Leader, ATC and PRS Chair*

### Lunch 12:00 p.m.

- 11 Q3 2022 Misoperations Review**  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*
  - a. Breakout Sessions

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### 12 PRS Member Roundtable

*Protective Relay Subgroup Members*

### 13 Other Business and Adjourn

*Greg Sessler, Protective Relay Subgroup Chair*

## AGENDA 1

### Call to Order and Determination of Quorum

#### a. Determination of Quorum

Name	Role	Company	Term
<b>Greg Sessler</b>	<b>Chair</b>	American Transmission Company	12/31/23
<b>David Wheeler</b>	<b>Vice Chair</b>	Southwestern Public Services Co.	12/31/23
Adam Daters	Member	ITC Holdings	12/31/24
Alex Bosgoed	Member	Saskatchewan Power Corporation	12/31/22
Casey Malskeit	Member	Omaha Public Power District	12/31/22
Cody Remboldt	Member	Montana-Dakota Utilities	12/31/24
David Weir	Member	Western Area Power Administration	12/31/22
Dennis Lu	Member	Manitoba Hydro	12/31/23
Derek Vonada	Member	Sunflower Electric Power Corporation	12/31/22
Derrick Schlangen	Member	Great River Energy	12/31/23
Glenn Bryson	Member	American Electric Power	12/31/24
Greg Hill	Member	Nebraska Public Power District	12/31/22
Jeff Beasley	Member	Grand River Dam Authority	12/31/22
Josh Erdmann	Member	Xcel Energy	12/31/24
Matt Boersema	Member	Western Farmers Electric	12/31/22
Ryan Einer	Member	Oklahoma Gas & Electric	12/31/23
Sarah Marshall	Member	Alliant Energy	12/31/24
Scott Paramore	Member	Kansas City Board of Public Utilities	12/31/24
Terry Fett	Member	Central Iowa Power Cooperative	12/31/23

## AGENDA 1

### Call to Order and Determination of Quorum

b. Robert's Rules of Order  
*Greg Sessler, Protective Relay Subgroup Chair*

**Parliamentary Procedures.** Based on Robert's Rules of Order, Newly Revised, Tenth Edition

**Establishing a Quorum.** In order to make efficient use of time at MRO organizational group meetings, once a quorum is established, the meeting will continue, however, no votes will be taken unless a quorum is present at the time any vote is taken.

**Motions.** Unless noted otherwise, all procedures require a "second" to enable discussion.

When you want to...	Procedure	Debatable	Comments
Raise an issue for discussion	Move	Yes	The main action that begins a debate.
Revise a Motion currently under discussion	Amend	Yes	Takes precedence over discussion of main motion. Motions to amend an amendment are allowed, but not any further. The amendment must be germane to the main motion, and cannot reverse the intent of the main motion.
Reconsider a Motion already resolved	Reconsider	Yes	Allowed only by member who voted on the prevailing side of the original motion. Second by anyone.
End debate	Call for the Question or End Debate	No	If the Chair senses that the committee is ready to vote, he may say "if there are no objections, we will now vote on the Motion." Otherwise, this motion is not debatable and subject to majority approval.
Record each member's vote on a Motion	Request a Roll Call Vote	No	Takes precedence over main motion. No debate allowed, but the members must approve by majority.
Postpone discussion until later in the meeting	Lay on the Table	Yes	Takes precedence over main motion. Used only to postpone discussion until later in the meeting.
Postpone discussion until a future date	Postpone until	Yes	Takes precedence over main motion. Debatable only regarding the date (and time) at which to bring the Motion back for further discussion.

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

Remove the motion for any further consideration	Postpone indefinitely	Yes	Takes precedence over main motion. Debate can extend to the discussion of the main motion. If approved, it effectively “kills” the motion. Useful for disposing of a badly chosen motion that cannot be adopted or rejected without undesirable consequences.
Request a review of procedure	Point of order	No	Second not required. The Chair or secretary shall review the parliamentary procedure used during the discussion of the Motion.

### Notes on Motions

**Seconds.** A Motion must have a second to ensure that at least two members wish to discuss the issue. The “seconder” is not required to be recorded in the minutes. Neither are motions that do not receive a second.

**Announcement by the Chair.** The chair should announce the Motion before debate begins. This ensures that the wording is understood by the membership. Once the Motion is announced and seconded, the Committee “owns” the motion, and must deal with it according to parliamentary procedure.

### Voting

Voting Method	When Used	How Recorded in Minutes
	When the Chair senses that the Committee is substantially in agreement, and the Motion needed little or no debate. No actual vote is taken.	The minutes show “by unanimous consent.”
Vote by Voice	The standard practice.	The minutes show Approved or Not Approved (or Failed).
Vote by Show of Hands (tally)	To record the number of votes on each side when an issue has engendered substantial debate or appears to be divisive. Also used when a Voice Vote is inconclusive. (The Chair should ask for a Vote by Show of Hands when requested by a member).	The minutes show both vote totals, and then Approved or Not Approved (or Failed).
Vote by Roll Call	To record each member’s vote. Each member is called upon by the Secretary, and the member indicates either  “Yes,” “No,” or “Present” if abstaining.	The minutes will include the list of members, how each voted or abstained, and the vote totals. Those members for which a “Yes,” “No,” or “Present” is not shown are considered absent for the vote.



## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### Notes on Voting.

**Abstentions.** When a member abstains, he/she is not voting on the Motion, and his/her abstention is not counted in determining the results of the vote. The Chair should not ask for a tally of those who abstained.

**Determining the results.** A simple majority of the votes cast is required to approve an organizational group recommendations or decision.

**“Unanimous Approval.”** Can only be determined by a Roll Call vote because the other methods do not determine whether every member attending the meeting was actually present when the vote was taken, or whether there were abstentions.

**Electronic Votes** – For an e-mail vote to pass, the requirement is a simple majority of the votes cast during the time-period of the vote as established by the Committee Chair.

**Majorities.** Per Robert’s Rules, as well as MRO Policy and Procedure 3, a simple majority (one more than half) is required to pass motions

## **AGENDA 2**

### **Standards of Conduct and Antitrust Guidelines**

*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

#### **Standards of Conduct Reminder:**

Standards of Conduct prohibit MRO staff, committee, subcommittee, and task force members from sharing non-public transmission sensitive information with anyone who is either an affiliate merchant or could be a conduit of information to an affiliate merchant.

#### **Antitrust Reminder:**

Participants in Midwest Reliability Organization meeting activities must refrain from the following when acting in their capacity as participants in Midwest Reliability Organization activities (i.e. meetings, conference calls, and informal discussions):

- Discussions involving pricing information; and
- Discussions of a participants marketing strategies; and
- Discussions regarding how customers and geographical areas are to be divided among competitors; and
- Discussions concerning the exclusion of competitors from markets; and
- Discussions concerning boycotting or group refusals to deal with competitors, vendors, or suppliers.

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### AGENDA 3

#### **Chair's Remarks**

*Greg Sessler, Protective Relay Subgroup Chair*

#### **Action**

Information

#### **Report**

Chair Sessler will lead this discussion during the meeting.

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### AGENDA 4

#### Consent Agenda

- a. Approve August 16, 2022 Meeting Minutes  
*Greg Sessler, Protective Relay Subgroup Chair*

#### Action

Discussion

#### Report

Chair Sessler will lead this discussion during the meeting.



## **Draft Minutes of the Protective Relay Subgroup Meeting**

### **Hybrid: St. Paul, MN and Webex**

*August 16, 2022, 8:02 a.m. to 11:46 a.m. Central*

*Notice for this meeting was electronically posted to the MRO website on July 19, 2022.*

*A final agenda, including advanced reading materials, was also posted on August 9, 2022.*

#### **1. Call to Order and Determination of Quorum**

Protective Relay Subgroup (PRS) Chair Greg Sessler called the meeting to order at 8:02 a.m. Sessler welcomed everyone and roundtable introductions were made. Rebecca Schneider, Reliability Analysis Administrator, advised the chair that a quorum of the PRS was present. A complete list of attendees is included as [Exhibit A](#).

#### **2. Standards of Conduct and Antitrust Guidelines**

Pursuant to Policy and Procedure 4, MRO Senior Systems Protection Engineer, Jake Bernhagen highlighted MRO's Standards of Conduct, Conflict of Interest, and Antitrust Guidelines

#### **3. Chair's Remarks**

Chair Sessler thanked the MRO staff and PRS members who organized and hosted the Protection System Commissioning webinar that took place on July 14, 2022. The presenters were Jake Bernhagen, John Grimm, Max Desruisseaux, Sarah Marshall, Ryan Einer, Cody Remboldt, Rich Bauer and Gilbert Lowe. He also thanked Kevin W. Jones from Xcel Energy for contributing two technical presentations to today's meeting. The HERO Award nominations and organizational group nomination periods were also highlighted.

#### **4. Diversity Initiative**

MRO Assistant Corporate Secretary and Senior Counsel, Julie Peterson, provided an overview of an ongoing initiative of the Organizational Group Oversight Committee (OGOC) to increase diversity on MRO's organizational groups. Peterson highlighted the types of diversity and the value of diverse teams. The nomination and election process and timeline at MRO were also shared.

#### **5. Consent Agenda**

The PRS reviewed the consent agenda, which included draft minutes from the May 3, 2022 meeting.

*Upon a motion duly made and seconded, the Protective Relay Subgroup approved the consent agenda, which included minutes from the May 3, 2022 PRS meeting as written.*

#### **6. NERC Activities**

*Update on NERC System Protection and Control Working Group (SPCWG).*

Mark Gutzmann, MRO representative on the NERC SPCWG, provided an overview of the July 14, 2022 virtual meeting. Areas of focus included: 1) the Inter-Entity Short Circuit Model: a white paper has been developed and is out for comment, should be available to industry by year-end; 2) FERC order 881 with respect to PRC-023 and relay loadability: a sub team is reviewing the impacts of 881 and relay loadability and will respond to FERC/NERC; 3) Commissioning Technical Reference: there was



continued discussion on the commissioning technical reference in the NERC white papers, SPCWG could create an updated version or create a Standard Authorization Request (SAR) or commissioning standard. Discussion ensued.

*NERC Misoperation Information Data Analysis System User Group (MIDASUG) Update.*

Bernhagen provided an update from the Aug. 2, 2022 meeting. Jack Norris, NERC, provided a review of the Misoperations section of the 2022 NERC State of Reliability Report. There was discussion around 2022 MIDAS training which will take place in November 2022. The group discussed updating the capacitor bank protection system example in the MIDAS DRI. There was discussion around whether or not any relay operation due to the failure of a Composite Protection System component would be considered a correct operation (answer: no, with the exception of a catastrophic current transformer (CT) or potential transformer (PT) failure). There was discussion about removing the fault type “other” in the MIDAS DRI when reporting misoperations for cross country faults. The group also covered restoration methods in the bulk submission worksheet. The worksheet does not yet reflect modifications made previously. Discussion ensued.

*Transmission Availability Data System (TADS).*

MRO Principal Systems Protection Engineer, John Grimm, provided an update regarding TADS. The deadline for Q1 and Q2 reporting was Aug. 15, 2022. TADS data is 93 percent complete. The reporting deadline was moved due to an application update that has been delayed. The new implementation date is Q3 or early Q4. The application update will affect shared transmission line inventory. TADS training is scheduled for Oct. 11-12, 2022. Discussion ensued.

## **7. PRS Business**

*Updates.*

Bernhagen informed members that NERC posted two new Lessons Learned: “Forecasting High Wind Speeds” and “Tower Climber Incident.” He noted that due to the PRS Q4 meeting date change, the subgroup will need to hold a special meeting to review the new member nominations prior to the Reliability Advisory Council (RAC) meeting on Nov. 16, 2022. MRO staff will send out a Doodle poll to survey members’ availability for a virtual meeting in October.

*Action Item List Review.*

Chair Sessler reviewed the action item list and updates were made accordingly.

## **8. Misoperations**

### **First Quarter 2022 Results, Review and Discussion.**

*MIDAS and Misoperations Q1 Update.*

Bernhagen provided an overview of first quarter misoperations data. He noted that the Q1 misoperations had not yet been sent out for group review. In Q1 there were 448 operations and 49 misoperations. MRO’s Q1 misop rate is 11 percent, which is a little higher than the five-year average and higher than the NERC average. Bernhagen also reviewed the misoperations section of the NERC State of Reliability report. Discussion ensued

*To accommodate scheduling conflicts, Chair Sessler moved the Misoperations Project Updates Instantaneous Ground Overcurrent report (Agenda Item 8c.i.) ahead on the agenda. These minutes reflect the order in which the reports were provided.*



## **Project Updates**

### *Instantaneous Ground Overcurrent.*

Bernhagen provided an update for this ongoing project. He needs to review the MIDAS data in further detail and hopes to have more information to share with the subgroup at the Q4 meeting. Chair Sessler suggested that Bernhagen schedule a call with the PRS members and guests who volunteered to work on the project (Adam Daters, Greg Sessler and Kenneth Casperson).

## **Technical Presentations**

### *Harrington Substation Event*

Xcel Energy Consulting Engineer, Kevin Jones, provided an overview of the Harrington Bus #3 Outage from January 14, 2022. Jones reviewed the Transmission Work Request (TWR) work summary, TWR execution, unexpected outcome, event root cause analysis and lessons learned. Discussion ensued.

### *Southwest Public Service (SPS) Company Load Shed Philosophy*

Xcel Energy Consulting Engineer, Kevin Jones, provided overview of the SPS Under-frequency Load Shed (UFLS) Program. Jones shared his philosophy regarding the need to overhaul the current UFLS program. Kevin's concern is that the Rate of Change of Frequency (RoCoF) on the power system could become increasingly dramatic due to the retirement of conventional generation sources and the addition of inverter-based resources. Dramatic frequency swings can result in the operation of UFLS schemes and generator over-frequency protection schemes, resulting in cascading blackouts. He reviewed SPS's existing UFLS program, described the new program details and performance, and outlined the next steps to implement the new program. Discussion ensued.

## **9. Protection System Commissioning**

### *Webinar Recap*

PRS member, Cody Remboldt, provided a recap of the Protection System Commissioning webinar sponsored by the Protective Relay Subgroup on July 14, 2022. Remboldt reviewed the panelists and their topics and noted that there were 188 total attendees. He recommended that the subgroup members listen to the webinar recording if they were unable to attend. Remboldt suggested adding commissioning as a standing agenda item for future PRS meetings. There was discussion around a potential for future commissioning standards issued by FERC. Chair Sessler solicited a volunteer to present a commissioning topic at the Q4 meeting. PRS member, Sarah Marshall, volunteered to present commissioning best practices at the Q4 meeting in December. Discussion ensued.

### *Lessons Learned*

PRS member, Cody Remboldt, lead the discussion during the meeting. Discussion ensued.

## **10. NERC State of Reliability**

MRO Principal Systems Protection Engineer, John Grimm reviewed various sections of the 2022 NERC State of Reliability report during the meeting. The report highlighted the February 2021 cold weather event across Texas and the South Central United States; severe weather such as extreme cold and heat, hurricanes and wildfires; electricity and natural gas industry interdependencies; multiple solar loss events in Texas and California; and cyber security threats. Discussion ensued.



### **11. Mitsubishi Falsifying Transformer Test Results**

Bernhagen provide an overview of the Mitsubishi article during the meeting. In April 2022, Mitsubishi Electric Corporation admitted to four decades of fraudulent testing and improper design of their transformers used at nuclear power stations, thermal plants and substations. The factory shipped 8,363 transformers between 1982 – March 2022 and 40 percent (3,400 units) were fraudulently tested or improperly designed. Over half of the fraudulently tested transformers were sent overseas. In some cases, employees falsified figures in quality-testing reports. The factory conducted safety tests, but the voltage levels did not meet international standards. There were 289 transformers shipped to the United States, and 36 U.S. customers are affected. NERC is investigating the issue. Discussion ensued.

### **12. 2022 Dates**

Chair Sessler reviewed the remaining meeting dates for the PRS and the other councils and subgroups. Sessler mentioned that the Q4 PRS meeting on Dec. 6, 2022 will be hybrid, and the misoperations review portion of the meeting will be for members only. The upcoming Security Conference in October 2022 was highlighted.

### **13. PRS Roundtable Discussion**

Chair Sessler invited member participants to share other relevant industry observations. Topics discussed included:

- PRC-004-06: How are entities handling misoperations where no cause is identified?
  - NERC removed R4 requirement from the standard. NERC's intent was to remove the administrative burden the requirement imposed. The expectation is for entities to continue looking for the cause of the misop, but they don't need to formally track it the investigation status. Investigate until solved.
- Chair Sessler solicited a technical presentation for the Q4 meeting.
- Bernhagen asked if entities are seeing any issues with the sunset of analog communication circuits. Respondents mentioned that they are not seeing any forced retirement of these circuits.

### **14. Other Business and Adjourn**

Having no further business to discuss, the meeting was adjourned at 11:46 a.m.

**Prepared by:** Rebecca Schneider, Reliability Analysis Administrator

**Reviewed and Submitted by:** Jake Bernhagen, Senior Systems Protection Engineer





## Exhibit A – Meeting Attendees

Subgroup Members Present	
Name	Company
Greg Sessler, Chair	American Transmission Company
David Wheeler, Vice Chair	Southwestern Public Services Co.
Adam Daters	ITC Holdings
Alex Bosgoed	Saskatchewan Power Corporation
Casey Malskeit	Omaha Public Power District
Cody Remboldt	Montana-Dakota Utilities
David Weir	Western Area Power Administration
Dennis Lu	Manitoba Hydro
Derek Vonada	Sunflower Electric Power Cooperative
Derrick Schlangen	Great River Energy
Glenn Bryson	American Electric Power
Greg Hill	Nebraska Public Power District
Jeff Beasley	Grand River Dam Authority
Josh Erdmann	Xcel Energy
Matt Boersema	Western Farmers Electric
Ryan Einer	Oklahoma Gas & Electric
Sarah Marshall	Alliant Energy
Terry Fett	Central Iowa Power Cooperative
Subgroup Members Not Present	
Name	Title
Scott Paramore	Kansas City Board of Public Utilities



MRO Staff	
Name	Title
Jake Bernhagen	Senior Protection Systems Engineer
Rebecca Schneider	Reliability Analysis Administrator
John Grimm	Principal Systems Protection Engineer
Max Desruisseaux	Senior Power Systems Engineer
Julie Peterson	Assistant Corporate Secretary and Senior Counsel
Cris Zimmerman	Manager of Outreach and Stakeholder Engagement
Guests	
Name	Company
Mark Gutzmann	Xcel Energy
Kevin W. Jones	Xcel Energy
Shawn Weiss	Farmington Electric Utility System (FEUS)
Mark Hopkins	Evergy
Kyle Wright	Evergy
Brandon Janssen	MidAmerican Energy
Allen Halling	Evergy
Rochelle Trefry	MidAmerican Energy
Tyler Baxter	Corn Belt Power Cooperative
Kevin Thompson	ITC Holdings
Steve Klecker	MidAmerican Energy

## AGENDA 5

### NERC Activities

#### a. NERC SPCWG Update

*Mark Gutzmann, Director, System Protection & Communication Engineering, Xcel Energy*

### Action

Information

### Report

Mark Gutzmann will provide an oral report during the meeting.

## AGENDA 5

### NERC Activities

#### b. NERC MIDASUG Update

*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

### Action

Information

### Report

Jake Bernhagen will provide an oral report during the meeting.

## AGENDA 5

### NERC Activities

c. TADS

*John Grimm, Principal Systems Protection Engineer, MRO*

### Action

Information

### Report

John Grimm will provide an oral report during the meeting.

## AGENDA 6

### PRS Business

#### a. Updates

*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

### Action

Information

### Report

Jake Bernhagen will provide an oral report during the meeting.

## AGENDA 6

### PRS Business

- b. Action Item List Review  
*Greg Sessler, Protective Relay Subgroup Chair*

### Action

Information

### Report

Chair Sessler will lead this discussion during the meeting.

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### AGENDA 7

#### 2023 Meeting Dates

*Greg Sessler, Protective Relay Subgroup Chair*

#### Action

Information

#### Report

Chair Sessler will provide an overview during the meeting.

	Q1 2023	Q2 2023	Q3 2023	Q4 2023
RAC	3/1	5/18	8/10	11/9
SAC	2/22	5/24	8/8	10/12
CMEPAC	2/21	5/3	8/9	10/11
SACTF	2/15	5/17	8/2	10/4
PRS	3/14	6/6	9/6	12/5
OGOC	4/12	6/14	9/13	11/15
BOD	4/13	6/15	9/14	11/16

#### MRO CONFERENCE DATES 2023

Q1	RAM Conference: March 21-22, 2023 <b>networking reception and conference (hybrid)</b>
Q2	Reliability Conference: May 16-17, 2023 <b>networking reception and conference (hybrid)</b>
Q3	CMEP Conference: July 25-26, 2023 <b>networking reception and conference (hybrid)</b>
Q4	Security Conference: September 26-28, 2023 <b>networking reception, training and conference (hybrid); Oklahoma City, OK</b>



## AGENDA 8

### Misoperations

- a. Q2 2022 Results, Review and Discussion  
*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

### Action

Information

### Report

Jake Bernhagen will provide an oral report during the meeting.

## AGENDA 8

### Misoperations

#### b. Project Updates

##### i. Instantaneous Ground Overcurrent

***Jake Bernhagen, Senior Systems Protection Engineer, MRO***

### Action

Information

### Report

Jake Bernhagen will provide an oral report during the meeting.

## AGENDA 8

### Misoperations

- c. Review NERC Lessons Learned

*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

### Action

Discussion

### Report

Jake Bernhagen will lead the discussion during the meeting.

# Lesson Learned

## Preventing Unwanted Operations during Relay Diagnostic Restarts

### Primary Interest Groups

Transmission Operators (TOP)  
Transmission Owners (TO)  
Generation Operators (GOP)  
Generation Owners (GO)  
Distribution Providers (DP)

### Problem Statement

Protection relays may experience restarts for various reasons; these can range from diagnostic restarts to settings revisions to setting group changes depending on the type of relay. This lesson learned contains some suggested practices to help prevent unwanted operations during these restarts.

### Details

An entity experienced an unexpected operation of a breaker failure relay that was protecting a breaker on a Bulk Electric System (BES) main bus. This operation resulted in the loss of six transmission line elements connected to the BES main bus. The entity worked with the relay manufacturer to determine the cause of the operation. After a thorough investigation, the manufacturer determined the relay's memory had become corrupted, possibly from cosmic high energy charged particles.<sup>1</sup> The self-diagnostic system of the relay identified the corrupted memory and initiated a diagnostic restart. A closing of an output associated with the breaker failure scheme occurred as part of the relay restart, resulting in the undesired breaker failure trip.

While memory corruption due to cosmic particles is rare, diagnostic and other restarts of a relay should be expected occasionally. There are a number of actions that will result in a relay restart (e.g., new relay installation, change of settings, corrupted memory, firmware change). An unwanted operation during a restart can be significant, especially when it involves bus or breaker failure protection that results in the loss of multiple elements as in this case. A review of previous events analyzed in the ERO Event Analysis Process revealed that unwanted trips associated with diagnostic restarts have been identified with multiple relay manufacturers, suggesting a broader relay logic or technology problem and not a specific manufacturer issue.

### Corrective Actions

The entity performed diagnostics on the relay without determining the cause of the operation, and was unaware of the possibility of a high energy cosmic particle cause at the time. At this point, the entity replaced the unit with another of the same make and model. They then enlisted the help of the relay manufacturer due to the undetermined cause of the tripping on restart. The relay manufacturer had not

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<sup>1</sup> [https://cms-cdn.selinc.com/assets/Literature/Publications/White%20Papers/0027\\_SingleEventUpsets\\_DH-KZ\\_20180330.pdf?v=20180807-170256](https://cms-cdn.selinc.com/assets/Literature/Publications/White%20Papers/0027_SingleEventUpsets_DH-KZ_20180330.pdf?v=20180807-170256)

seen this type of event on this particular model before and performed rigorous testing in an attempt to determine the cause. This testing ultimately led to the complete failure of the relay. The entity who experienced the undesired operation also reached out to their regional protection system professional group to learn what best practices other entities are using to prevent unintended operations during diagnostic restarts. This document captures the practices identified as part of that outreach.

## **Lesson Learned**

When a relay restarts, it is important that the relay be prevented from taking action before system conditions (i.e., values) are either populated in the relay memory or measurements are available on the relay inputs.

It is important to understand the application of the relays being used. For example, some relay models will perform a restart every time there is a setting change. Depending on the relay logic, this restart can potentially result in an undesired operation or signal. The following practices can help prevent unintended operations during a relay restart:

- One practice that can be applied to certain relay models is to specify what the relay should do on the first pass through the free form logic. One helpful option is to block operations when a diagnostic restart is asserted, preventing any unwanted operations until the restart is completed. Another approach is prohibiting any actions within a specified time delay (e.g., relay performs no actions within first 10 cycles after being powered on). This allows the relay to boot up without taking unwanted actions. The order of operations is important when taking this approach. If the logic for the delay follows an input condition read by the programming logic, an unwanted action may already be issued before the relay logic initiates the delay.
- Another identified best practice is to test the relay by applying normal input voltage and load current to the relay and then cycle the power to the relay. This test can be performed during commissioning or during type testing. Testing may identify a relay that is susceptible to closing its output contacts during a diagnostic restart. Changes to relay logic, as noted above, can be made to add a time delay if undesired behavior is identified. Consider adding this practice to your commissioning test procedures.
- A third identified best practice is to isolate the relay from the system by opening its test switches prior to making any changes to the relay. If an undesired output is issued upon restart, there will be no system impact since the relay is isolated. Personnel should ensure there are no standing output(s) coming from the relay prior to returning it to service.
- Sometimes manufacturers will address diagnostic restart issues in firmware changes. It is important for entities to have a process in place to continually be informed of when there is a new firmware version, and to understand what that firmware version addresses in the given relay. Applying an updated firmware version to a relay may prevent unwanted action upon restart. Use caution when applying a new version of firmware as this usually causes the relay to restart. This can be verified through bench testing prior to deployment. Entities are encouraged to review manufacturer specification sheets, bulletins, and/or updates, and compare their existing processes and procedures to see what your entity can implement to mitigate this issue.

NERC's goal with publishing lessons learned is to provide industry with technical and understandable information that assists them with maintaining the reliability of the bulk power system. NERC is asking entities who have taken action on this lesson learned to respond to the short survey provided in the link below.

Click here for: [Lesson Learned Comment Form](#)

**For more Information please contact:**

[NERC – Lessons Learned](#) (via email)

Lesson Learned #: LL20221101

Date Published: November 16, 2022

Category: Relaying and Protection Systems

*This document is designed to convey lessons learned from NERC's various activities. It is not intended to establish new requirements under NERC's Reliability Standards or to modify the requirements in any existing Reliability Standards. Compliance will continue to be determined based on language in the NERC Reliability Standards as they may be amended from time to time. Implementation of this lesson learned is not a substitute for compliance with requirements in NERC's Reliability Standards.*

## MEETING AGENDA – Protective Relay Subgroup (PRS) – December 06, 2022

### AGENDA 9

#### **Commissioning Best Practices – Alliant Energy**

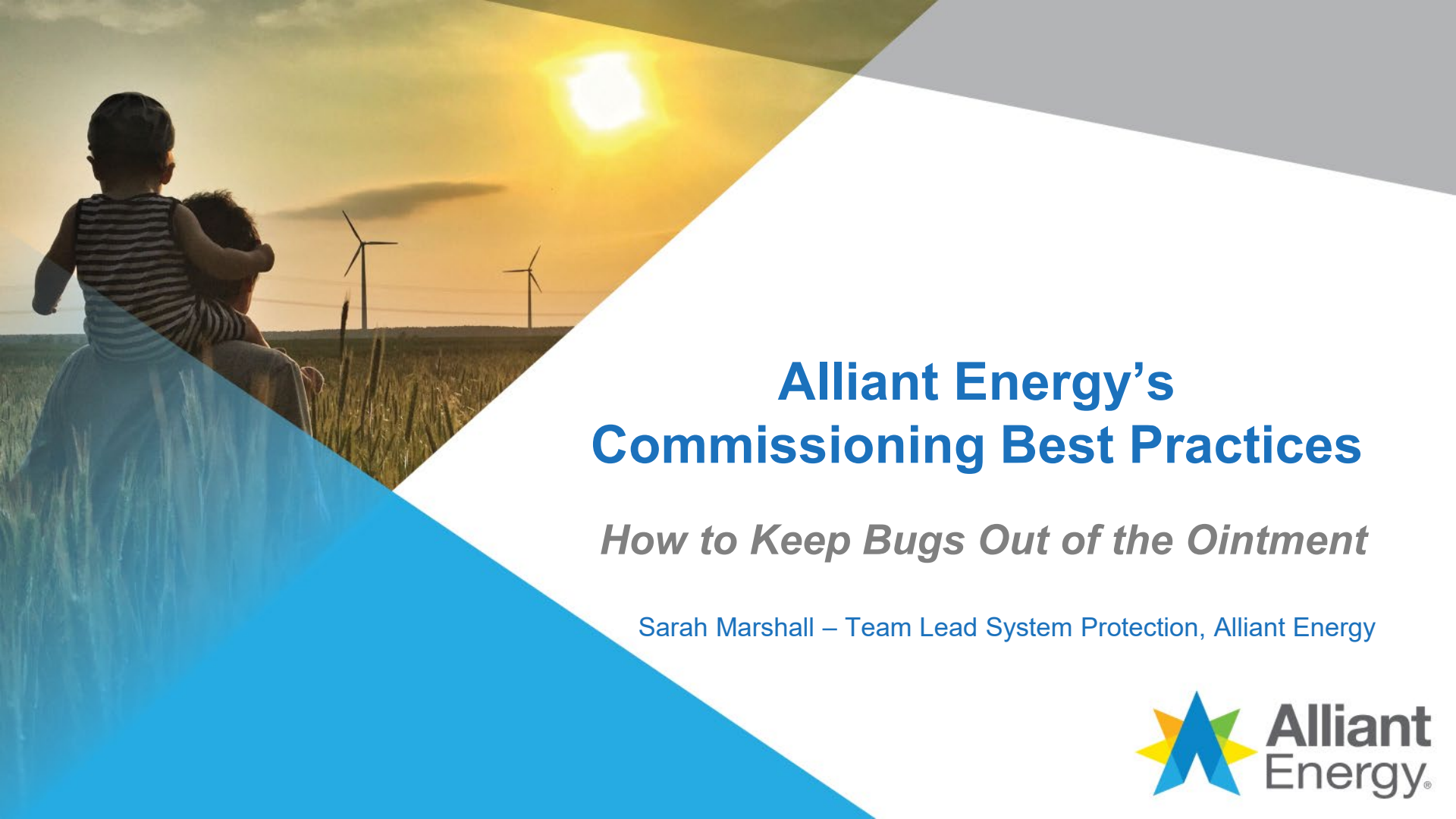
*Sarah Marshall, Team Lead System Protection, Alliant Energy and PRS Member*

#### **Action**

Information

#### **Report**

Sarah Marshall will provide an oral report during the meeting.



# Alliant Energy's Commissioning Best Practices

*How to Keep Bugs Out of the Ointment*

Sarah Marshall – Team Lead System Protection, Alliant Energy





# Alliant Energy

- Wisconsin
  - 270 substations, 9 power plants
  - 2396 microprocessor relays
  - 8 System Protection Engineers
  - 6 Substation Engineers
  - 10 Relay Technicians
- Iowa

# Pillars for Success



STANDARDS



COMMISSIONING  
CHECKLISTS



HUMAN  
PERFORMANCE TOOLS

# System Protection Standards Committee



All template changes reviewed quarterly for approval.



Review team: engineers, operations, management



Limits the frequency of major design changes to 1-2 times per year.

Hardware changes

New protection schemes

Operational changes impacting the design



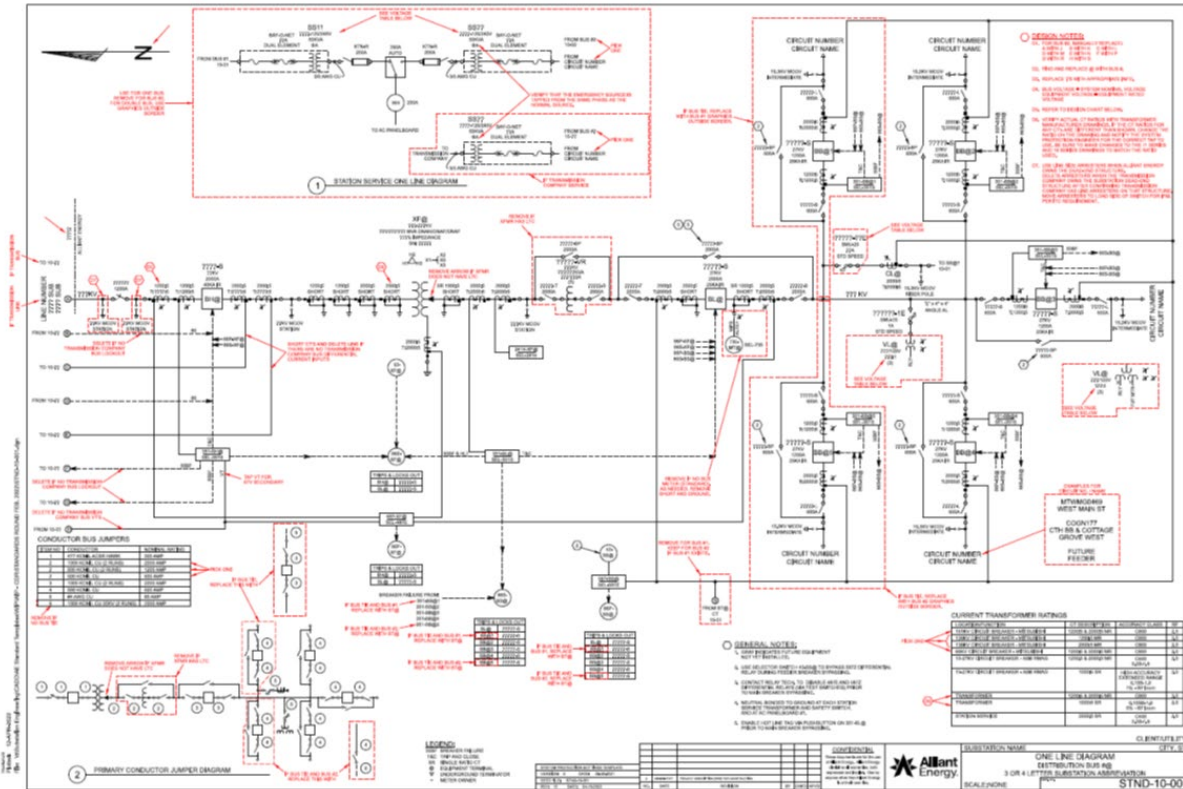
Minor changes are permitted as needed at any time.

Firmware version changes

Correcting design errors

Corrective Action Plans

# Substation Drawing Template



# Relay Settings Template

## Relay Setpoints File

The screenshot shows the 'Relay Setpoints File' interface. On the left is a tree view with 'Group 1' expanded, showing various settings categories like General Settings, Line Settings, and Frequency Elements. The main panel displays the 'Frequency Elements' settings for 'E81: Frequency Elements'. It includes fields for '27B8 1P Undervoltage Block (V,sec)' set to 84.00, '27B8 1P Pickup (Hz)' set to 50.00, and '27B8 1P Time Delay (cyc)' set to 6.00. Below the settings is an 'Errors' section titled 'Found 41 Setting(s)' with a table listing errors for Group 1.

Group	Setting	Value	Message
Group 1	27B8 1P	84.00 ###	Error: Group 1 27B8 1P Setting value "84.00 ###" must be greater than or equal to 25.00 and less than or equal to 300.00.
Group 1	50G2P	4.000 ###	Error: Group 1 50G2P Setting Value "4.000 ###" is not a valid value for this setting.
Group 1	50P 1P	34.60 ###	Error: Group 1 50P 1P Setting Value "34.60 ###" is not a valid value for this setting.
Group 1	50D 2P	5.00 ###	Error: Group 1 50D 2P Setting Value "5.00 ###" is not a valid value for this setting.

System Protection  
Relay Settings Documentation

## Distribution Feeder Guideline

Section: SP-GUID-210  
Version: 6.00  
Issued: 02/04/2022

**Note:** 51Q asserts if negative-sequence current  $3I_2 = I_A + a^2 I_B + a I_C$  for  $a = 1 \angle 120^\circ$ , is greater than negative-sequence time-overcurrent element pickup setting 51QP. Note that this formula is valid only for ABC counterclockwise rotating three-phase system.

### Directional Element

E32 = N Directional elements are not used.  
ELOP = N Note that the loss-of-potential logic still operates with ELOP = N

### Voltage Element

Vnom = 120 VT nominal voltage setting in secondary volts (line-to-neutral [wye-connected VT's] or line-to line [delta-connected VT's]). See below for example calculation, at 24.9kV L-L using L-G wye connected 120:1 ratio VT's.

$$\left[ \frac{24.9KV}{\sqrt{3} \times 120 : 1} \right] = 120V \quad (10)$$

### Underfrequency Element

Underfrequency logic ensures that the following conditions must be met for a trip to occur:

- voltage must be present;
- close failure condition must not exist (CF=0).

### Underfrequency Logic Equations

## Relay Settings Guide

# Commissioning Template

Overview

States

Test Points

Sources

Worksheet

Inputs

Timers

Outputs

Notes

Recording

Formula References

Linear Ramp, Frequency

Test Points

Expected	Actual
50.000 Hz	

Test Parameters

Name	Value
A Offset Frequency	51.000 Hz
B Offset Duration	20.00 cy
C Ramp Rate	-0.100 Hz/s
D Frequency Limit	48.000 Hz

View Graph

Action State Summary

Sources		Connections	
Name	DC	CT/VT Ratio	La
VA	<input type="checkbox"/>	60	
VB	<input type="checkbox"/>	60	
VC	<input type="checkbox"/>	60	
IA	<input type="checkbox"/>	240	
IB	<input type="checkbox"/>	240	
IC	<input type="checkbox"/>	240	

Control Panel

Amplitude	Phase	Frequency
120.0 V	0.0 *	Action
120.0 V	+120.0 *	Action
120.0 V	120.0 *	Action
0.00 A	0.0 *	System
0.00 A	0.0 *	System
0.00 A	0.0 *	System

Sense Settings

Channel ID	Label	Connections	Sense Condition
S1 LN1	LN1		$\phi > 1$

Sense Delay

0.00 cy

Sense Duration

0.00 cy

Play sound when relay operates

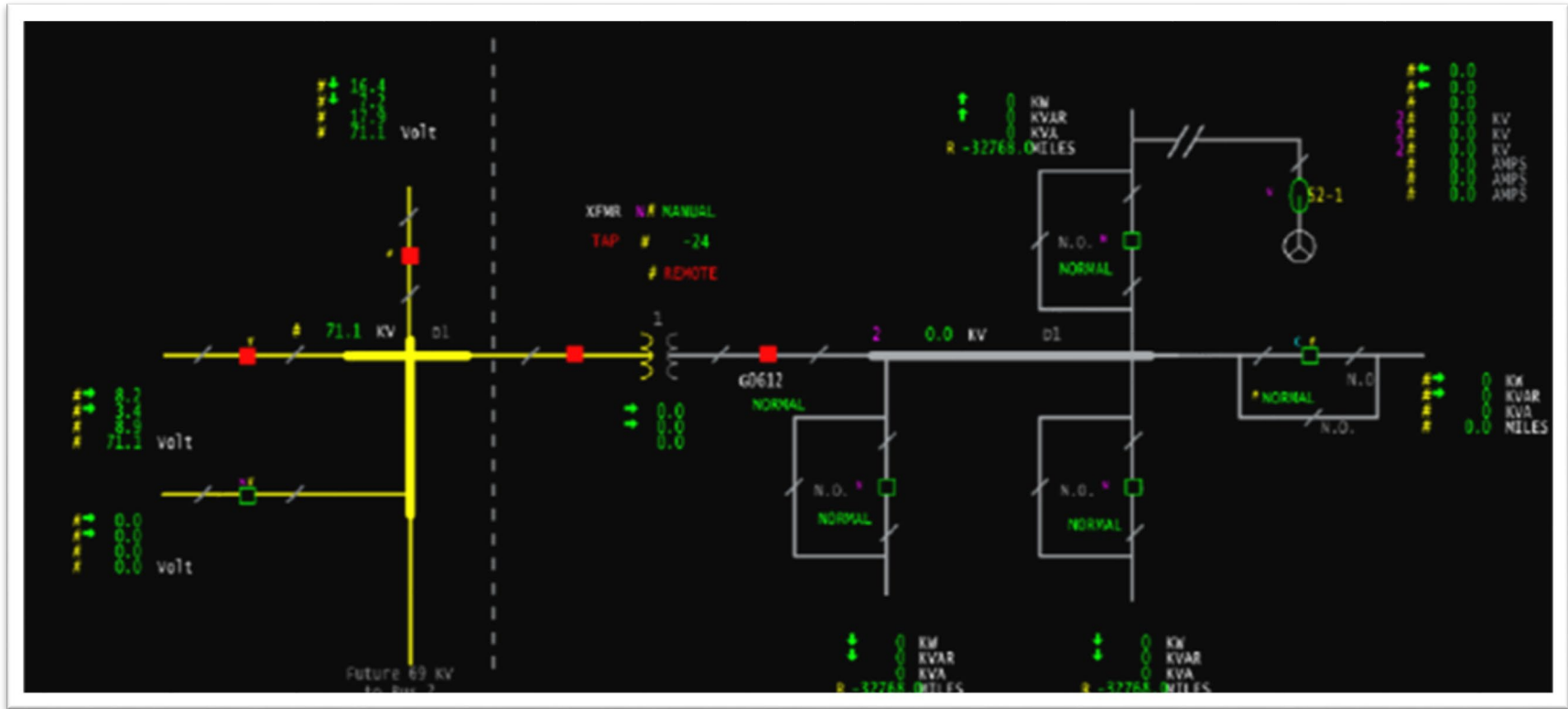
☐

Jumpers

Test comments

#ID1T

# Trip at Substation

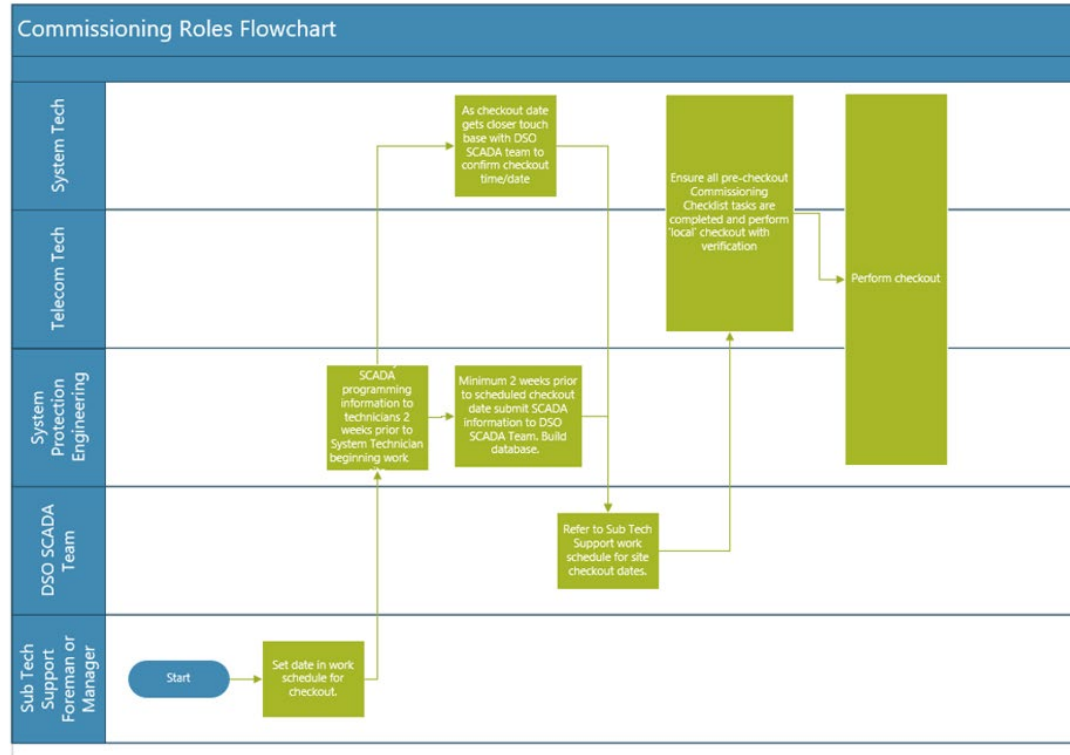


# Commissioning Checklist

Substation Commissioning Review Checklist	
Conduct Review 1 to 4 weeks after Checkout is Complete	
Project:	
Project Checkout Date:	
Review Completion Date:	
Review Completed With (Personnel):	
<input type="checkbox"/>	Comment
<input type="checkbox"/> Is Corporate Project Folder Set Up Correctly (Use Template)	
<input type="checkbox"/> Commissioning Checklist	
Completed and saved to corporate project folder	
<input type="checkbox"/> Protective Relays	
As-Left settings - System Protection Engineering notified to remotely access relays and save settings to corporate database	
Commissioning file saved to corporate project folder	
maintenance test plan complete	
For UFLS implemented relays confirm UF pickup and time delay were tested and Cascade has correct values entered	
<input type="checkbox"/> Instrument Transformers	
Test results saved to corporate project folder?	



# Commissioning Task List



# Human Performance Tools

Pre-Job Briefing

Self-Check

3-Way  
Communication

Barriers

Flagging

Equipment  
Isolation List

# NERC Compliance Program

- NERC Subject Matter Expert overlapping coverage
  - All engineers have a NERC SME role.
  - 2 Subject Matter Experts per standard.
- Controls Program
  - Written process for each NERC Protection & Control standard.

# Settings Change Form

[illegible]

# Settings Change Review

		Setting Being Changed											Sudden Pressure
		##	##	##	##	##	##	##	##	##	##	##	
PRC-002	Disturbance Monitoring & Reporting												
PRC-004	Protection System Misoperation Identification and Correction												
PRC-005	Identify NERC_GP Relays											X	X
	Microprocessor Setting Comparison Work Orders	X	X	X	X	X	X	X	X	X	X	X	X
PRC-006	UFLS										X		
PRC-019	Generator Capabilities, Exciter & Relay Coordination		X	X	X		X	X					
PRC-024	Generator V/Hz No Trip Zone		X	X				X			X		
PRC-025	Generator Relay Loadability	X					X						
PRC-026	Relay Performance During Stable Power Swings	X			X		X			X			
PRC-027	Coordination of Protection Systems During Faults	X					X						

## - Relay element names redacted.

# Automatic Email Reminders – NERC Compliance Tasks



PRC-027 System Protection Coordination Review Due	Every 6 Years-Jan 1
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# Rely on the process.

Find a framework, then use it.



# Questions





**AGENDA 10**

**Relay Operations During Planned Switching**

*Greg Sessler, System Protection Team Leader, ATC and PRS Chair*

**Action**

Information

**Report**

Chair Sessler will provide an oral report during the meeting.

# Relay operations during planned switching

PRESENTED BY

Greg Sessler

December 6, 2022



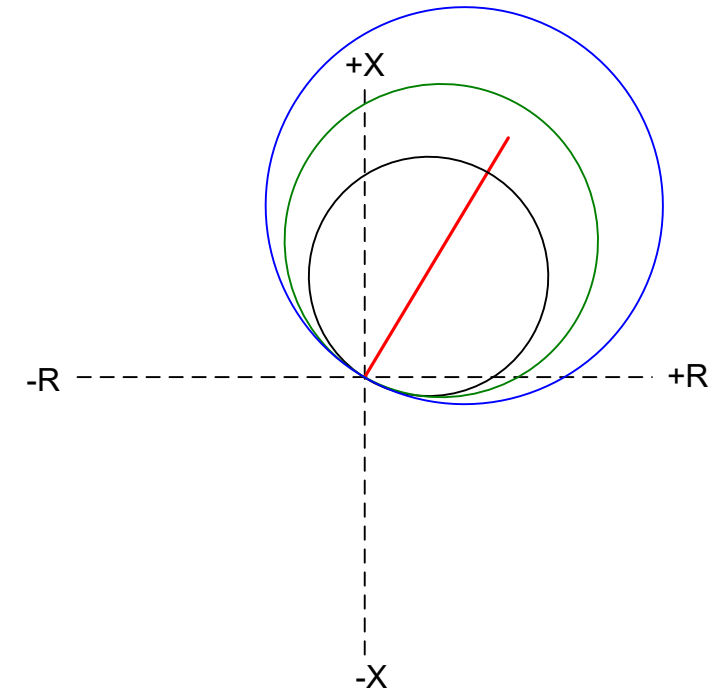
Helping to keep the lights on,  
businesses running and  
communities strong®

# Description

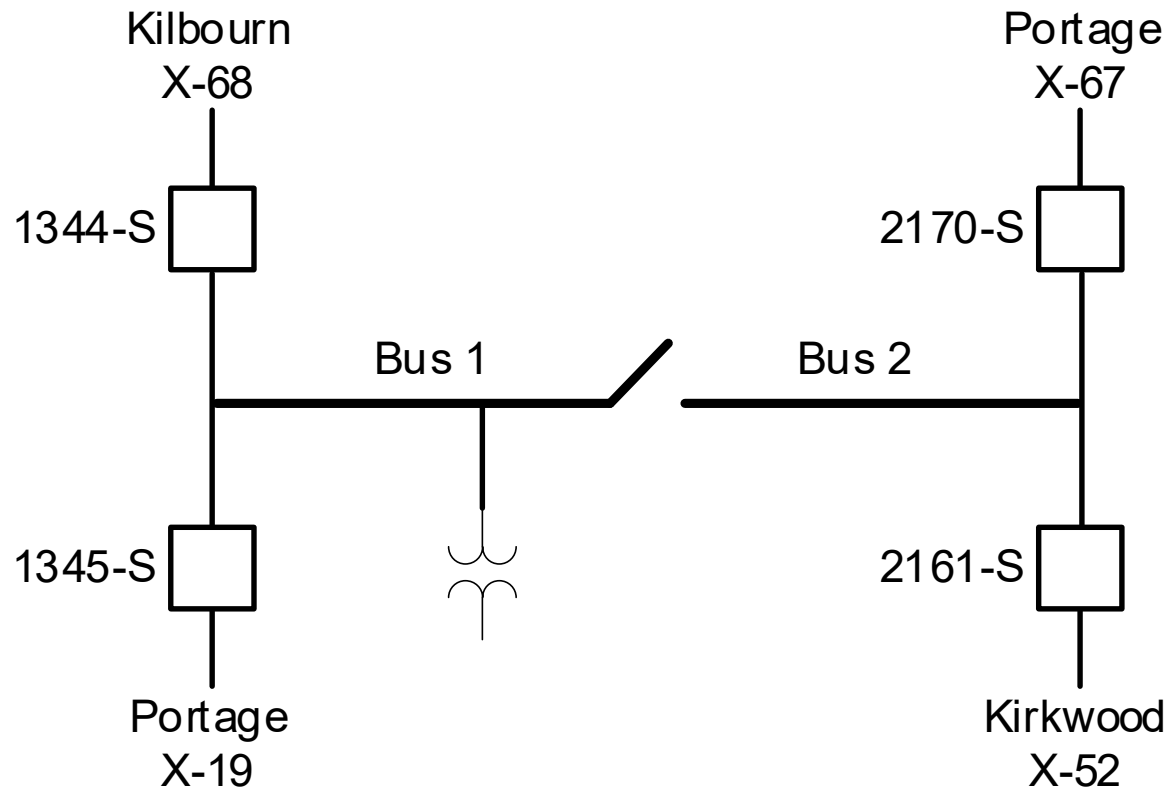
- ATC experienced two relay operations that occurred during planned switching
  - Trienda and Osceola substations (July 2019)
- Line relays operated when relay potential removed from in-service relays
- System Protection was involved in the outage planning
  - Rely on relay Loss of Potential logic for protection and prevent inadvertent tripping

# Loss of Potential logic

- Distance protection
  - Common transmission line protection
  - Voltage and current used to determine fault condition
  - Loss of voltage (potential) may result in trip during normal system load condition
- Loss of Potential (LOP) logic
  - Blocks distance protection from operating for loss of relay potential
  - May enable protection that is not voltage dependent
  - Available and commonly applied in microprocessor relays



# Trienda substation



- Switching to remove 138kV Bus 1 from service for maintenance
  - Partial day outage
- Bus 2 to remain in-service
  - Operational need for regional load support
  - X-67 and X-52 line relays lose potential
- X-67 line relay (SEL-221F) operates when tie switch opened

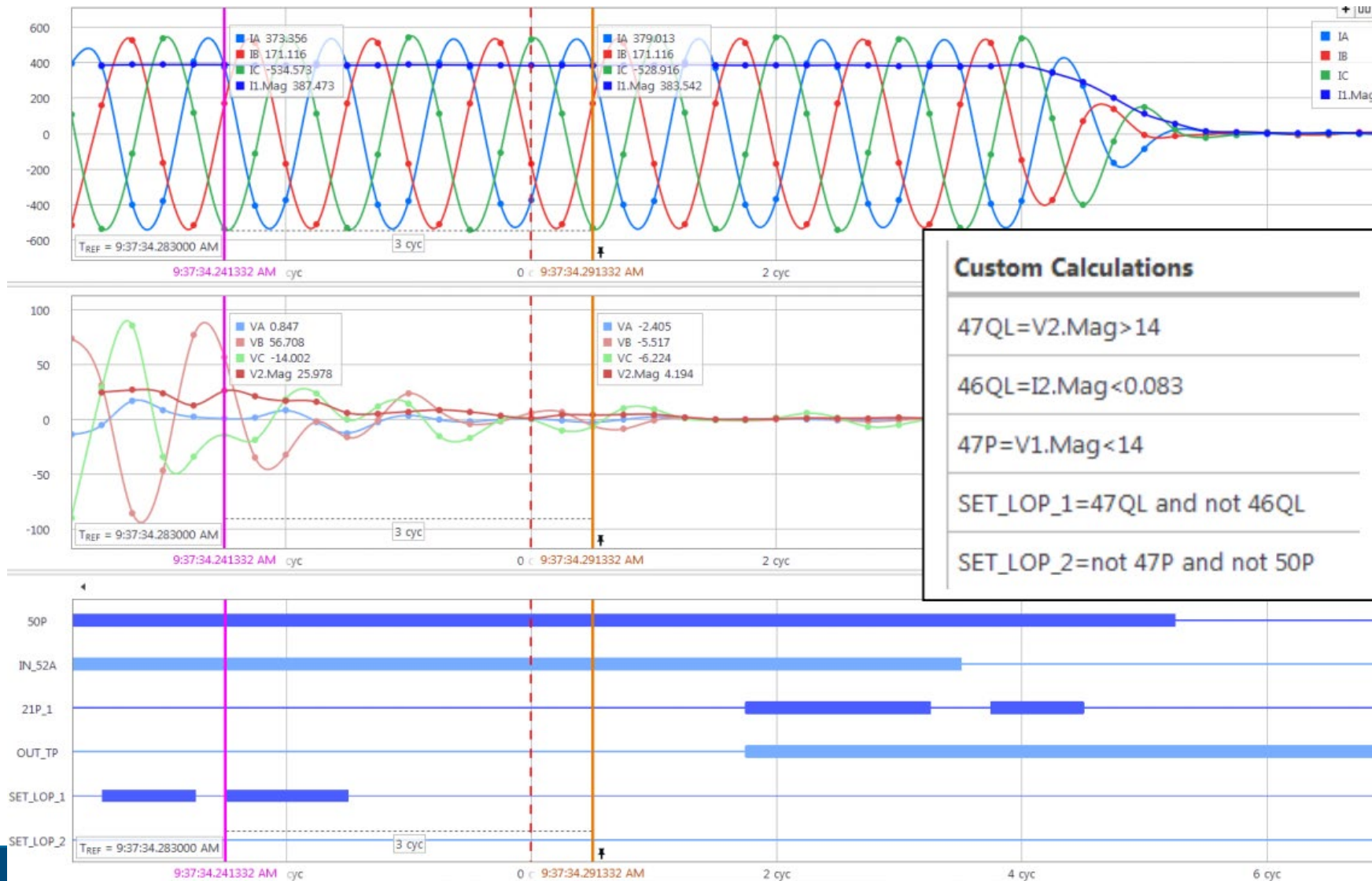
# Trienda SEL-221F LOP protection

- Relay settings provide for LOP logic
  - During LOP condition, distance element operation blocked and nondirectional overcurrent protection enabled
- LOP condition declared when either of the following conditions are met
  - One- or two-phase loss of potential
    - ◆ Unbalanced voltage without unbalanced current
  - Three-phase loss of potential
    - ◆ Low three-phase voltage AND phase current less than a current detector setpoint (120 amps)

# Trienda event

- X-67 experiences three-phase loss of potential
- SEL-221F three-phase LOP logic is not enabled
  - Low three-phase voltage – true
  - Phase current greater than 120 amps - false
    - ◆ X-67 line loading was above the phase current detector setpoint
    - ◆ Phase current detector set according to ATC practice (for fault sensitivity)
- X-67 SEL-221F distance protection operates

# Trienda SEL-221F event



## SET\_LOP\_1 (47QL \* !46QL)

- Unbalance LOP logic
- Not enabled (asserts for less than 3 cycles)
- Operates as expected for 3-phase LOP

## SET\_LOP\_2 (!47P \* !50P)

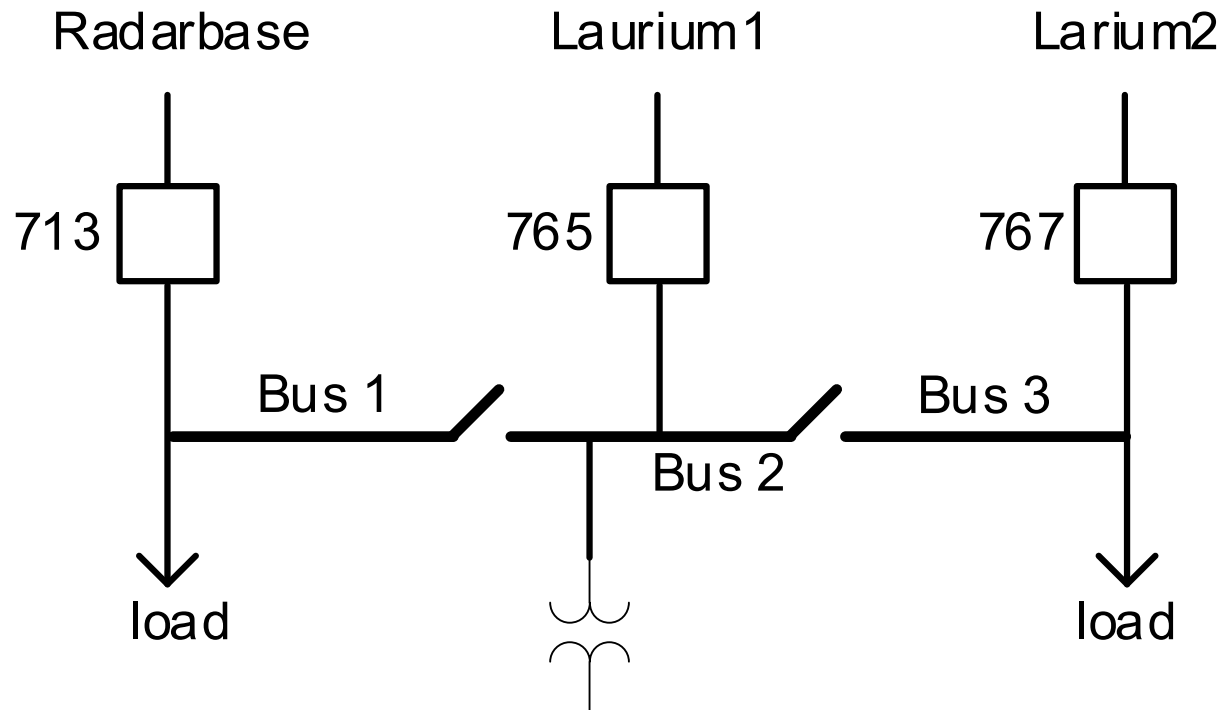
- 3-phase LOP logic
- Not enabled (50P asserted under load)
- Does not operate as expected

## LOP condition not declared

- 21P\_1 trips



# Osceola substation



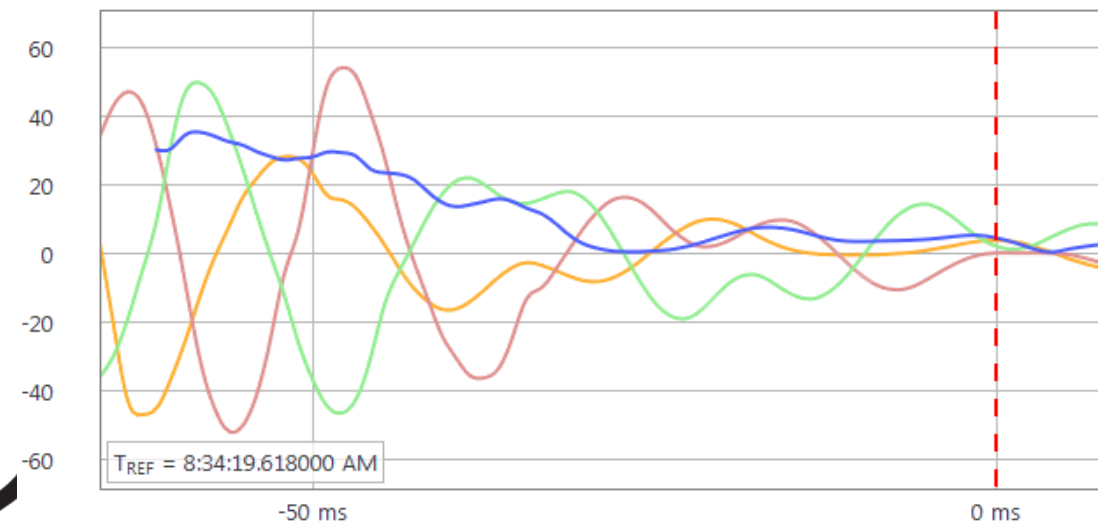
- Switching to remove 69kV Bus 1 & Bus 2 from service for construction
- 69kV Bus 3 to remain in-service
  - Serve Osceola load
  - Larium2 line relays will lose potential
- Larium2 line relays operate when tie switch opened
  - Both SEL-321 and SEL-311C

# Osceola LOP protection

- Relay settings provide for LOP logic
  - During LOP condition, distance element operation blocked and nondirectional overcurrent protection enabled
- SEL-321/311C LOP activated when the following condition is met
  - Greater than a 10% decrease of three-phase voltage  
AND
  - No change in positive or zero-sequence current

# Osceola event

- Larium2 SEL-321 and SEL-311C experience three-phase loss of potential
- LOP logic is not enabled
  - No change in current - true
  - 10% decrease of three-phase voltage - false
    - ◆ Individual phase voltage decay varies due to switch pole opening discordance
- Larium2 distance protection operates
  - SEL-321 and SEL-311C



# Lessons Learned

- Do not rely on LOP protection during planned switching
  - Remove elements impacted by LOP
  - Disable relays subjected to LOP
    - ◆ May required setting other relays to provide protection (Trienda)
- Do not assume legacy relays operate the same as more modern relays
  - SEL-221F LOP logic is different than more modern microprocessor relay logic
- Set shared fault detectors above maximum load whenever possible
  - Minimize risk of incorrect LOP operation
  - If not possible, set as high as possible while maintaining sensitivity

# Actions Taken

- NATF Operating Experience Report (NATF-OER-496)
- Do not allow relays to remain in-service during switching that removes relay potential.
- Review risk of relying on LOP protection during switching
  - Training and documentation focused
    - ◆ System Protection, System Operators, Outage Coordination, Commissioning
  - Add notes/cards cautioning use of bus tie switches at stations with single VT
- Change the Trienda SEL-221F current detector to 310 amps
  - Not above maximum load
  - Minimizes exposure to LOP trip and maintains sensitivity for distance element supervision

# Relay operations during planned switching

Questions?

**AGENDA 11**

**Q3 2022 Misoperations Review**

a. Breakout Sessions

*Jake Bernhagen, Senior Systems Protection Engineer, MRO*

**Action**

Discussion

**Report**

Jake Bernhagen will lead the discussion during the meeting.

**AGENDA 12**

**PRS Roundtable Discussion**

*Greg Sessler, Protective Relay Subgroup Chair*

**Action**

Discussion

**Report**

Chair Sessler will lead this discussion during the meeting.



**AGENDA 13**

**Other Business and Adjourn**

*Greg Sessler, Protective Relay Subgroup Chair*

**Action**

Discussion

**Report**

Chair Sessler will lead this discussion during the meeting.