

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Industry Webinar

Project 2019-04 Modifications to PRC-005

Brian Kasmarzik, Chair
July 13, 2023

RELIABILITY | RESILIENCE | SECURITY



Administrative

- Review NERC Antitrust Compliance Guidelines and Public Announcement

Agenda

- Project Background
- Reliability Standard PRC-005-6 Revisions
- Examples
- Next Steps
- Q&A

- North American Electric Reliability Corporation (NERC) Antitrust Guidelines
 - It is NERC's policy and practice to obey the antitrust laws and to avoid all conduct that unreasonably restrains competition. This policy requires the avoidance of any conduct that violates, or that might appear to violate, the antitrust laws. Among other things, the antitrust laws forbid any agreement between or among competitors regarding prices, availability of service, product design, terms of sale, division of markets, allocation of customers or any other activity that unreasonably restrains competition
- Notice of Open Meeting
 - Participants are reminded that this webinar is public. The access number was widely distributed. Speakers on the call should keep in mind that the listening audience may include members of the press and representatives of various governmental authorities, in addition to the expected participation by industry stakeholders.

- Participants are reminded that this webinar is being recorded. The purpose of the recording is to provide individuals an opportunity to review the content following the webinar. Questions can also be sent via the Q&A feature. If you are unable to submit questions via the Q&A feature, please submit via the chat feature during the presentation.
- All questions will be taken at the end of the presentation.



Name	Entity
Brian Kasmarzik	Quanta-Technology
Steve Turner	Arizona Public Service
Deborah Schneider	Santee Cooper
Michael Gerken	Eversource
Giuseppe Giannuzzi	Hydro-Québec
Eric Graftaas	Xcel Energy
Cesar Huerta	AEP
Andrew Miraldi	FZSonick, Inc.
Sudhir Thakur	Constellation
Kevin Thompson	ITC
Devon Tremont	Taunton Municipal Lighting Plant
Zhibo Wang	Mitsubishi Electric Power Products, Inc. (MEPPI)

- **Background**

- In June of 2016, Xcel Energy submitted a Request for Interpretation (RFI) to NERC seeking clarification on what equipment should be included in the scope of an entity's Protection System Maintenance Program relative to NERC Reliability Standard PRC-005-6. Xcel Energy noted that many modern generator excitation systems have the capability to respond to electrical quantities and initiate trip signals to either the generator lockout or generator output breaker. Xcel Energy asked whether a protection function (if enabled) that is embedded in a generator's excitation system or voltage regulator would meet the definition of Protection System, and therefore be included in the scope of PRC-005-6. The RFI was rejected by the NERC Standards Committee at the recommendation of NERC staff, the standards developer, and leadership of the PRC-005-6 drafting team (DT) for the following reason:

- *"The generator excitation systems and voltage regulators described in Xcel Energy's RFI are capable of monitoring electrical quantities, such as voltage or current, and responding to those quantities, by causing a trip of the generator in response to these signals. Therefore, it is clear that these embedded protective functions, if enabled, would be included in the scope of Reliability Standard PRC-005-6 as set out in the Applicability section of the standard."*
- Despite this perceived clarity, the North American Generator Forum (NAGF) received feedback from members indicating that significant confusion still remains throughout the industry regarding the applicability of protective functions inside synchronous generator excitation systems to PRC-005. Consequently, in May 2019, the NAGF submitted a Standard Authorization Request (SAR) to NERC requesting revisions be made to PRC-005-6 that would provide clear and unambiguous language within the standard pertaining to the applicability of protective functions within an Automatic Voltage Regulators (AVR) and any maintenance requirements (activities and intervals) associated with those protective functions.

- In response to industry comments received from three postings of the SAR, the Standard Drafting Team has considered the following in modifying PRC-005-6:
 - Clarify that BES protective functions enabled within analog/digital AVRs, excitation systems, and BES protective functions enabled within control systems that respond to measured BES electrical quantities and trip BES Elements either directly or via lockout or auxiliary tripping relays are within the scope of the standard, and include updates to associated maintenance tables as necessary.
 - Include new DC supplies (e.g., lithium ion, flow) for Protection Systems in the maintenance tables.
 - Include entities registered as UFLS-Only Distribution Providers in the Applicability section to be consistent with changes made to the NERC's FERC-approved Risk-Based Registration.

- Update the PRC-005-6 Supplementary Reference and FAQ to align with all revisions made to the standard.
- Revise the Applicability section of the standard.

- The Standard Drafting Team recognized the need to modify the definition of Protection System.
 - Modifications are necessary to provide clarity on the inclusion of components of control systems which measure and utilize similar quantities as protective relays and perform similar functions as protective relays.

- Numerous other standards required modification in response to protective functions in control systems
 - PRC-019
 - Footnote 5: *Frequency, voltage, and volts per hertz protection (whether provided by relaying or functions within associated control systems) that respond to electrical signals and: (i) directly trip the generating resource(s); or (ii) provide signals to the generating resource(s) to either trip or cease injecting current*
 - *PRC-019 – Project 2021-01*
 - *The in-service ~~limiters~~ limiter functions are set to operate before the ~~Protection System-protective functions~~ of the applicable Facility in order to avoid disconnecting the generator unnecessarily.*

- Standards that may require future modification to address protective functions
 - If devices utilize the same technology and have the same inputs/outputs as relays:
 - Should their operations be analyzed? (PRC-004)
 - Should they be studied for Single Point of Failure? (TPL-001)
 - Should they be studied for loadability? (PRC-023, PRC-025)
 - Should they be coordinated? (*PRC-027*)

- Proposed revised definition of Protection System:
 - Protection System – **One or more of the following components:**
 - Protective relays **and components of control systems** which respond to measured electrical quantities **and provide protective functions**;
 - Communications systems necessary for correct operation of protective functions;
 - Voltage and current sensing devices providing inputs **necessary for the correct operation of protective functions**;
 - Station dc supply associated with protective functions (including station batteries, battery chargers, and non-battery based dc supply; and/or
 - Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.

- A Technical Rationale document has been developed to accompany the Protection System definition modification.
- UFLS-Only Distribution Provider (DP) added to Applicability Section
 - Entities registered as UFLS-only DPs have PRC-005 applicable Protection Systems; and
 - For consistency with the FERC-approved Risk Based Registration (RBR) changes.

- **Measured Electrical Quantities**
 - The Standard Drafting Team recognized the need for clarity in the phrase “respond to electrical quantities” due to the fact that nearly all measured quantities are converted to electrical signals prior to input into protection and control systems.
 - Measured electrical quantities are those that represent Primary ac or dc voltage and current for applicable Facilities, such as:
 - Generating unit terminal voltage and current,
 - Excitation voltage.
 - Included are any quantities derived from voltage and current measurements, such as:
 - Frequency,
 - Real and Reactive Power, and
 - Phase angles.

- **Protective Functions**

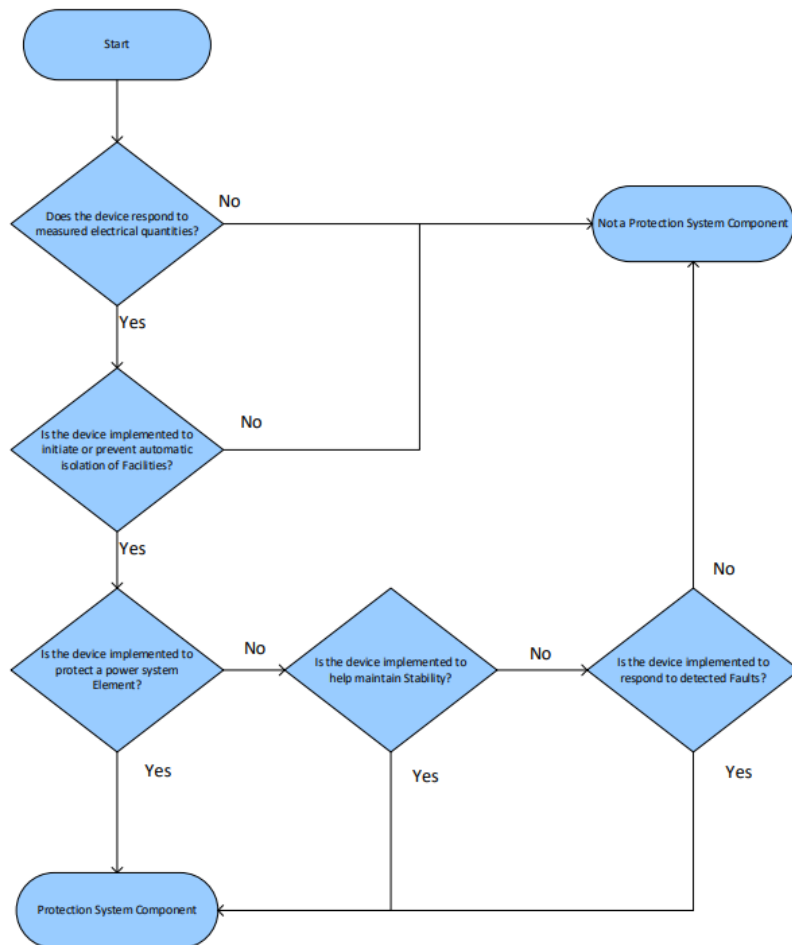
- The SDT used the following criteria to establish which functions meet the criteria of protective functions for inclusion in the definition:
 - Functions that are implemented to initiate or prevent the automatic isolation of Facilities:
 - To protect power system Elements,
 - To maintain Stability, or
 - In response to detected faults.
 - Functions not applicable to the definition include those which do not initiate or prevent automatic isolation, such as:
 - Limiters or functions which only provide indication; or
 - Devices which do not respond to the aforementioned scenarios, such as:
 - those detecting malfunctions of an excitation system, or
 - automatic switching of capacitor banks for the purpose of voltage-control.

- Evaluation of Functions

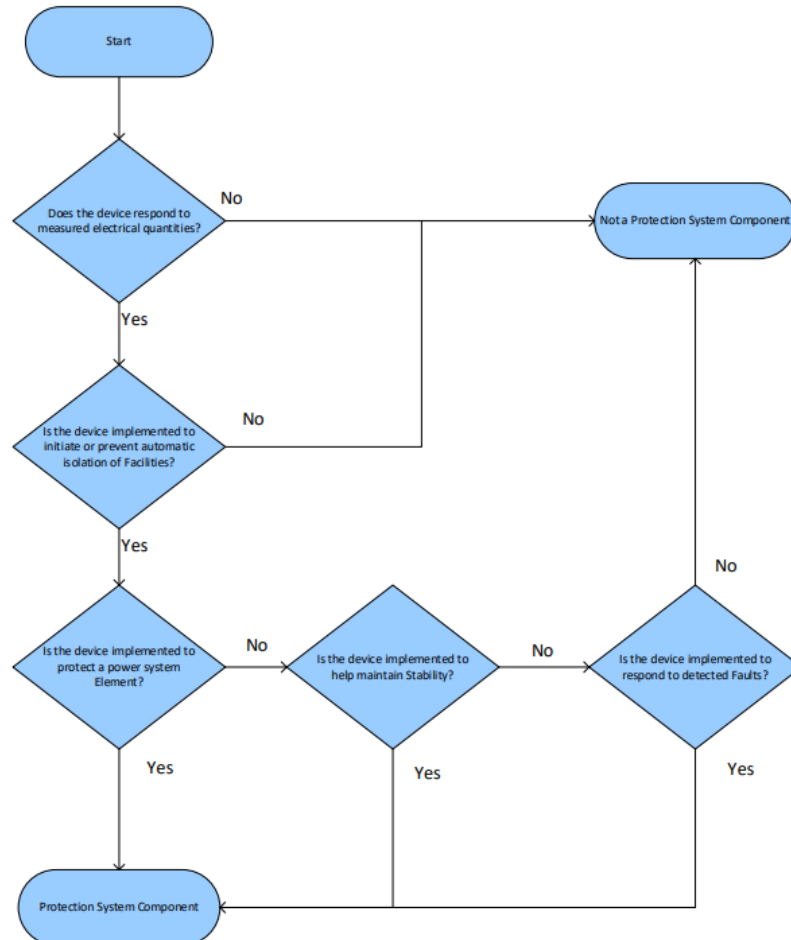
- The SDT performed an analysis of IEEE device numbers using the criteria above as an example of the analysis to determine which functions should be considered for inclusion in Protection Systems.
- The results of the example analysis were consistent with the analysis performed by the SPCWG in *SPCS Order 758 Sudden Pressure Relay Report*, which was performed in response to FERC Order No. 758 to determine which protective functions not included in the Protection System definition should be considered for inclusion in PRC-005.
- A list of all IEEE device numbers, including a description of each device, is included in Appendix A.
- Each device was evaluated to determine applicability, the results of which can be seen in Appendix B.

1. IEEE Standard C37.2, 2008

Appendix C – Protection System Decision Tree



Appendix C – Protection System Decision Tree



Example 1: Generator Volts-per-Hz

- Respond to Measured Electrical Quantities?
- Initiate or Prevent Automatic Isolation?
- **Protect power system Element?**

Example 2: Underfrequency

- Respond to Measured Electrical Quantities?
- Initiate or Prevent Automatic Isolation?
- Protect power system Element?
- **Maintain Stability?**

Example 3: Synchronous Generator Limiter

- Respond to Measured Electrical Quantities?
- **Initiate or Prevent Automatic Isolation?**

Example 4: Sudden Pressure Relay

- **Respond to Electrical Quantities?**



- April 19, 2023 Standards Committee for authorization for 45-day initial comment period with 10-day ballot.
- 45-day initial comment period with 10-day ballot May 25 – **July 24, 2023**.
- Slides and recording of this webinar will be posted on the NERC website within 24-72 hours.
- Point of Contact
 - Laura Anderson, Senior Standards Developer
 - laura.anderson@nerc.net or call 404-782-1870



- Informal Discussion
 - Via the Questions and Answers feature.
 - Respond to stakeholder questions.
- Other
 - Some questions may require future SDT consideration.
 - Please reference slide number, standard section, etc., if applicable.
 - SDT will address as many questions as possible.
 - Webinar and chat comments are not a part of the official project record.
 - Questions regarding compliance with existing Reliability Standards should be directed to ERO Enterprise compliance staff, not the SDT.



Questions and Answers