

**ERO ENTERPRISE-ENDORSED**

# **Standard Application Guide**

**PRC-002-2**

**Clarification of Fault Recorder (FR) Trigger Setting Requirements**

**February 20, 2020**



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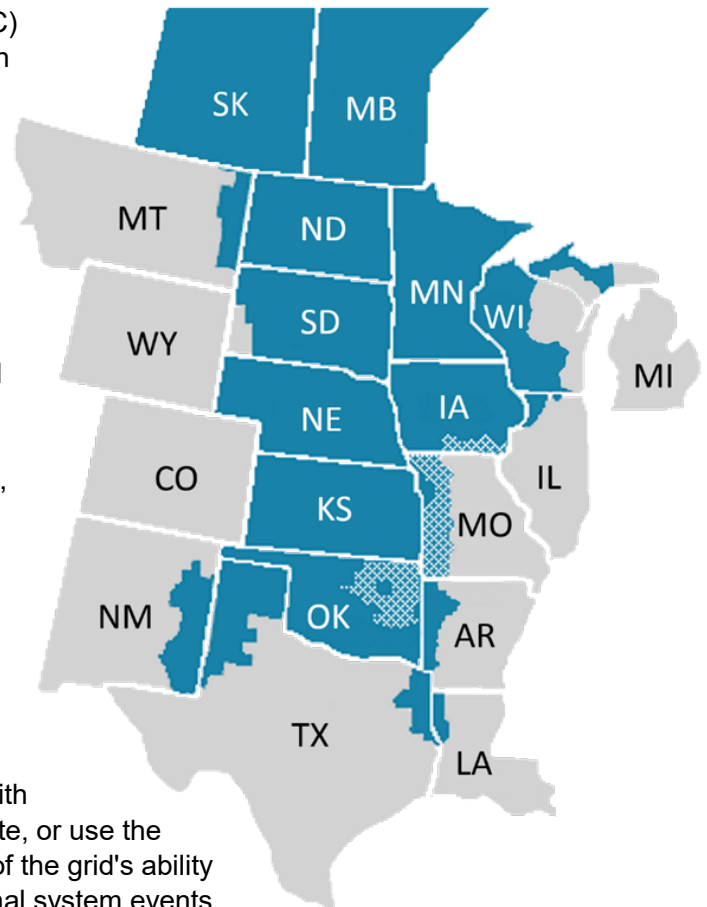
## PREFACE

Midwest Reliability Organization (MRO) is dedicated to its vision of **a highly reliable and secure North American bulk power system**. To ensure reliability of the bulk power system in the United States, Congress passed the Energy Policy Act of 2005, creating a new regulatory organization called the Electric Reliability Organization (ERO) to establish mandatory Reliability Standards and monitor and enforce compliance with those standards on those who own, operate or use the interconnected power grid.

In 2006, the Federal Energy Regulatory Commission (FERC) approved the North American Electric Reliability Corporation (NERC) as the ERO under section 215(e)(4) of the Federal Power Act. NERC delegates its authority to monitor and enforce compliance to seven Regional Entities established across North America, of which MRO is one. Recognizing the international nature of the grid, NERC as the ERO, along with MRO, established similar arrangements with provincial authorities in Canada.

The MRO region spans the provinces of Saskatchewan and Manitoba, and all or parts of the states of Arkansas, Illinois, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wisconsin. The region includes approximately 200 organizations that are involved in the production and delivery of electricity, including municipal utilities, cooperatives, investor-owned utilities, transmission system operators, federal power marketing agencies, Canadian Crown Corporations, and independent power producers.

MRO's primary responsibilities are to: ensure compliance with mandatory Reliability Standards by entities who own, operate, or use the North American bulk power system; conduct assessments of the grid's ability to meet electricity demand in the region; and analyze regional system events. Additionally, MRO creates an open forum for stakeholder experts in the region to discuss important topics related to addressing risk and improving reliable operations of the bulk power system.



## DISCLAIMER

The Midwest Reliability Organization (MRO) Compliance Monitoring and Enforcement Advisory Council (CMEPAC) is committed to providing training and non-binding guidance to industry stakeholders regarding existing and emerging Reliability Standards. Any materials, including presentations, were developed through the MRO CMEPAC by Subject Matter Experts (SMEs) from member organizations within the MRO region.

SMEs in the field of disturbance monitoring were brought together to prepare a guide for complying with North American Electric Reliability Corporation (NERC) Reliability Standard PRC-002-2 - Disturbance Monitoring and Reporting Requirements. Participants include representatives from Generator Owners (GOs) and Transmission Owners.

### **PRC-002-2 Application Guide – Development Team Subject Matter Experts**

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The materials have been reviewed by MRO staff and provide reasonable application guidance for the standard(s) addressed. Ultimately, demonstrating compliance depends on a number of factors including the precise language of the standard, the specific facts and circumstances, and quality of evidence.

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The MRO Subject Matter Expert Team is an industry stakeholder group which includes subject matter experts from MRO member organizations in various technical areas. Any materials, guidance, and views from stakeholder groups are meant to be helpful to industry participants; but should not be considered approved or endorsed by MRO staff or its board of directors unless specified.



## INTRODUCTION

The purpose of this Standard Application Guide (SAG) for NERC Reliability Standard PRC-002-2 - Disturbance Monitoring and Reporting Requirements is to provide additional guidance on the implementation of PRC-002-2 to Generator Owners (GOs) and Transmission Owners (TOs) when protective relays are used to meet PRC-002-2 requirements.

### Overview

This SAG focuses on the trigger setting requirements of PRC-002-2 R4.3 when using protective relays to meet PRC-002-2 requirements. This SAG makes recommendations on FR triggers in the protective relay to comply with PRC-002-2 R4.3 but at the same time prevent excessive event triggering which could result in the loss of meaningful system event records due to exceeding the event logging capabilities of the relay.

### Methodology

This SAG contains clarifications, techniques and recommendations, collectively the 'suggested methodology', to adhere to the requirements of the PRC-002-2 R4.3. These methods represent the intended best practices of members of the MRO PRC-002-2 Subject Matter Expert Team (SMET).

### Common Terms and Definitions

This SAG uses terms defined in the NERC Glossary of Terms used in NERC Reliability Standards, updated July 03, 2018<sup>1</sup>. Where the MRO PRC-002-2 SMET introduced terms not defined by NERC, as necessary, inline definitions or narratives around the intent of those terms has been provided.

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<sup>1</sup> NERC Glossary of Terms used in NERC Reliability Standards, updated July 03, 2018.  
[https://www.nerc.com/files/glossary\\_of\\_terms.pdf](https://www.nerc.com/files/glossary_of_terms.pdf)



## EVALUATING PRC-002-2, SECTION 4 - APPLICABILITY

### Analysis or Recommended Application Guidance:

As previously stated, the scope of this SAG is PRC-002-2 R4.3 when using protective relays. These recommendations are not intended for dedicated fault recorders (FR).

## EVALUATING PRC-002-2, REQUIREMENTS

### Analysis or Recommended Application Guidance:

As previously stated, the purpose of this SAG is to provide recommendations when using protective relays to comply with PRC-002-2 R4.3. The objective is to limit record triggers to only faults within the relay zone of protection to ensure that important FR data is not lost.

### Recommendations

#### *General*

1. Impedance elements (which utilize a combination of voltage and current quantities) alone do not meet the requirement of the PRC-002-2 standard. R4.3 specifies FR data triggers for at least the following:  
Neutral (residual) overcurrent, and phase undervoltage or overcurrent.
2. When there is a fault in a BES element connected to an identified BES bus, it is necessary to capture the bus voltage and only the currents of the faulted BES element; it is not necessary to trigger the relays on the unfaulted BES elements to capture their currents.
3. It is acceptable to use directional overcurrent elements (instead of non-directional) to limit record triggering to faults within the protective relay zone of protection.
4. It is recommended to trigger a fault record whenever the protective relay issues a trip. In addition, as per R4.3, there is a requirement to set record triggers for neutral (residual) overcurrent, and phase undervoltage or overcurrent. These elements should be set to trigger a fault record for any fault in the zone of protection.
5. The data requirements for PRC-002-2 are based on a system configuration assuming all normally closed circuit breakers on a bus are closed.
6. The voltages of identified BES busses are required to be captured in fault records. This could be achieved with cross-triggering if the bus voltages are not connected to the protective relay.

#### *Transmission Lines*

1. The protective relay is required to be configured to trigger a fault record for all faults on the line using neutral (residual) overcurrent, and phase undervoltage or overcurrent. Use directional ground and phase overcurrent elements as dedicated event recorder triggers.
2. Trigger setting criteria:  
Set overcurrent triggers to trigger a recording for a remote bus fault at a minimum.
3. Recommendation is to not use undervoltage elements for triggering for the following reasons:



- The element is non-directional and more difficult to coordinate for out of zone faults.
- PRC-002-2 requires either phase overcurrent or undervoltage triggers, not both.

### *Transformers*

1. The protective relay is required to be set to trigger a recording for all faults in the zone of protection using neutral (residual) overcurrent, and phase undervoltage or overcurrent. Use directional ground and phase overcurrent elements as dedicated event recorder triggers.
2. Trigger setting criteria:  
Set the overcurrent triggers to pick up for all faults within the zone of protection.
3. Recommendation is to not use undervoltage elements for triggering for the following reasons:
  - The element is non-directional and more difficult to coordinate for out of zone faults.
  - PRC-002-2 requires either phase overcurrent or undervoltage triggers, not both.



| Revision Table |         |                  |
|----------------|---------|------------------|
| Date           | Version | Notes/Change     |
| February 2020  | 1.0     | Initial Document |
|                |         |                  |

