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# **Facilities Instructions, Standards, and Techniques - Volume 6-4**

**Management of Protective Relay Settings**

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# **Facilities Instructions, Standards, and Techniques - Volume 6-4**

## **Management of Protective Relay Settings**

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## **Mission Statements**

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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## Appendices

Appendix A – Work Examples

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## Reclamation Standards and Documents

FAC P04 *Hydroelectric Power*

FAC 04-14 *Power Facilities Technical Documents.*

FIST 3-8 *Operation, Maintenance, and Field Test Procedures for Protective Relays and Associated Circuits*

## Reclamation Forms

POM-226, FIST Revision Request

Review Resources located @ <https://intra.usbr.gov/power/hydrores/pomreview/checksheets.html>

## Acronyms and Abbreviations

FIST	Facilities Instructions, Standards, and Techniques
NERC	North American Electric Reliability Corporation
PRC	protection and control (NERC)
PRIS	Power Review Information System
PRO	Power Resources Office
RRD	Reclamation Relay Database
TSC	Technical Service Center





## 1.0 Introduction

The Bureau of Reclamation (Reclamation) relies on protective relays to sense abnormal or potentially dangerous conditions in its power facilities and initiate actions to quickly de-energize the affected equipment to minimize damage and protect personnel. The settings in these protective relays determine the protection that is provided for equipment and personnel and are therefore crucial to the safe operation of Reclamation's power and pumping facilities. Management of protective relay settings is a critical component in ensuring the protective relays operate in the intended sequence for abnormal conditions (e.g., faults), provide desired protection, and are readily available for troubleshooting or post event analysis.

### 1.1 Purpose and Scope

The purpose of the Facilities Instructions, Standards, and Techniques (FIST) Volume 6-4 is to establish a standard Reclamation process for the management of protective relay settings. This document establishes procedures, roles, responsibilities, and requirements to ensure protective relay settings are documented and developed so that the protective relays operate in the intended sequence during faults. This document also provides guidance and requirements regarding peer review, approval, and finalization of records and documentation for coordinating protective relay settings with interconnected entities.

This volume applies to all Reclamation owned and operated power and pumping facilities. This document covers protective relays installed on the main powertrain and on other critical equipment in Reclamation facilities. The main powertrain typically includes the generator/motor and all electrical equipment (e.g., busway, cables, transformers, breakers) up to and including the connection with the Bulk Electric System. This document also applies to protective relays on station service units and switchgear that provide power to critical equipment.

This volume does not define the practices for operating, maintaining, and testing protective relays. Refer to FIST 3-8 for this information.

### 1.2 Reclamation Standard Practices

FIST manuals are designed to provide guidance for maintenance and testing on equipment in Reclamation's facilities. There may be multiple ways to accomplish tasks outlined in this document. Facilities may exercise discretion as to how to accomplish certain tasks based on equipment configurations and available resources.

Reclamation's regions, PRO, and TSC agree that certain practices are required to be consistent across all Reclamation facilities. Mandatory FIST procedures, practices, and schedules that appear in **{Red, bold, and bracketed}** or **[Black, bold, and bracketed]** text are considered Reclamation requirements for the O&M of equipment in power facilities. RM D&S FAC 04-14, Power Facilities

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Technical Documents, describes the responsibilities required by text designations: **{Red, bold, and bracketed}**, **[Black, bold, and bracketed]**, and plain text, within this technical document. Refer to RM D&S FAC 04-14 for more details concerning technical documents.

### 1.3 FIST Revision Requests

The FIST Revision Request Form (POM-226) is used to request changes to a FIST document. Each request includes a summary of the recommended changes and a basis for the revision or new FIST. These forms are submitted to the Manager, PRO. The Manager, PRO, keeps a list of revision requests for each FIST and includes these in the next scheduled revision unless a request is so important that the change needs to be prioritized sooner.

### 1.4 Definitions

Reclamation uses a centralized database known as the Reclamation Relay Database (RRD) (commonly referred to as the ASPEN Database because of its use of ASPEN software) for documentation and version control of protective relay settings. This section defines the protective relay setting states. Employees working with protective relay settings should be familiar with the use of each of these terms.

**Archived.** A setting status option in the RRD for a setting entry to denote that the relay setting information is outdated or no longer accurate. This status is assigned to preserve the information in a setting entry after relay settings have been changed.

**As-Found.** A setting status to denote the recorded relay setting information at the start of interaction with a relay. As-found settings are associated with a date and time.

**As-Left.** A setting status to denote the recorded relay setting information at the conclusion of interaction with a relay. As-left settings are associated with a date and time. This information is in the form of setting files downloaded from the relay or dated test reports that document the settings from the relay. These settings are used to update the RRD relay setting entries. The as-left settings information may not match the in-service setting entry in the RRD until both statuses have been updated.

**As-Specified.** A term used to denote relay settings that have been designed and approved for a protective relay in accordance with North American Electric Reliability Corporation (NERC) standards.

**In-Service.** A setting status option in the RRD to denote the latest documented status of operational equipment (e.g., protective relay or breaker) or implemented version of settings within a protective relay (e.g., setting entry).

Note: Equipment and setting entries marked as in-service are only valid at the time of documentation in the RRD (e.g., settings validation date or date of memo field note). If time has

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passed since the RRD was updated and changes have been made in the facility (e.g., new version of relay settings implemented), it is possible for the setting entry denoted as in-service in the RRD to no longer be accurate and require updating. Once in-service settings are approved and signed in the RRD by a Protection System Engineer, they become as-specified.

**Interconnected Entity.** An electrically-joined organization or company that is separate from the Bureau of Reclamation.

**Pending.** A setting status option in the RRD for a setting entry to denote the desired and recommended settings that should be installed in the relay.

**Protection System Engineer.** An engineer assigned to develop protective relay settings and peer review developed settings. This engineer has experience in performing complex power system evaluations, including relay event analysis, compliance with NERC protection and control (PRC) standards, short circuit analysis, protective device coordination studies, dynamic power system modeling, and symmetrical component calculations. This engineer routinely performs these functions in the evaluation, development, and peer review of protective relay settings.

**Protective Relay.** A device that measures or analyzes physical or electrical properties to detect abnormal or dangerous conditions that could damage equipment or endanger personnel. The protective relay causes the operational status of the equipment to change to its de-energized state, such as by tripping a breaker. A protective relay can be an electromechanical, solid state, or microprocessor device.

**Protective Relay System.** The entire protective system, including the relays themselves, all associated wiring and terminals, all relay inputs and their current and voltage sources, control relays, and associated sensors and transducers. This includes all relay outputs and all devices in breaker trip circuits such as lockout relays, limit switches, etc. This includes breaker trip coils and circuit breakers. This also includes both alternating current and direct current supply systems, including the battery, battery chargers, and all associated wiring and circuits. This includes communications systems necessary for correct operation of protective functions.

**Setting Entry.** An entry in the RRD that documents the settings for a specific protective relay. Each setting entry is unique and is assigned a revision number in the RRD.

**Settings Validation Date.** A data field in the RRD that represents the date of as-left settings documentation. This date can be the relay testing date, work performed date, or date in the relay settings software denoting when the as-left setting file was downloaded from the relay.

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## 2.0 Responsibilities

### 2.1 Power Manager or Designee

**{Power Manager or Designee:**

1. ensure that protective relays are documented in the RRD;
2. ensure that protective relay settings are updated in the RRD; and
3. designate an RRD Facility Data Administrator.}

The Power Manager has the authority to delegate these tasks or develop an agreement for the tasks to be accomplished by the desired person or group of their choosing.

### 2.2 RRD Facility Data Administrator

**[RRD Facility Data Administrators:**

1. ensure relays and relay settings in the RRD are accurate and up-to-date;
2. ensure new or revised protective relay settings are entered into the RRD as in-service within 30 calendar days of the completed installation of the settings;
3. assist Protection System Engineers with protective relay data requests; and
4. determine access permissions to the RRD for authorized users at their facility.]

The RRD Facility Data Administrator can be assigned to multiple facilities.

### 2.3 Protection System Engineer

**{Protection System Engineers:**

1. develop new or revised protective relay settings and complete POM 174;
2. peer-review protective relay settings;
3. document implementation of required settings and changes in the RRD;
4. document correspondence of coordination with other interconnected entities;}
5. [work with RRD Facility Data Administrators to resolve questions pertaining to protective relays and their settings; and
6. review and approve in-service protective relay settings submitted from the field within 30 calendar days of receipt with a signature and date in the RRD.]

## 2.4 RRD Administrator

[RRD Administrators:

1. manage RRD accounts and password resets;
2. enter and maintain the RRD Facility Data Administrator contact information in the RRD under the respective facility;
3. work with RRD Facility Data Administrators to add, modify, or delete access permissions for authorized users;
4. provide technical support and training to RRD users;
5. provide notice of planned outages or maintenance of the RRD; and
6. distribute quarterly summary reports that detail pending setting entries yet to be implemented to the regional power managers or their designated contact.]

**Note:** The RRD Administrator function is assigned to TSC personnel under a service agreement with the PRO. Please contact the Power System Analysis and Control (86-68440) group for RRD assistance or support (303-445-2300).

## 2.5 RRD Authorized User

An RRD authorized user is any individual who has been granted access to the RRD. These users may have different level of permissions. The duties of authorized users may include:

1. Providing relay information and setting files to the RRD Facility Data Administrator.
2. Reviewing/editing information in the RRD.
3. Printing RRD reports.
4. Attaching relay test reports or setting files.
5. Using the RRD settings comparison feature.

**Note:** It is acceptable to use the TSC, through a service agreement, to document protective relays, settings, and equipment in the RRD.

## 3.0 Reclamation Relay Database (RRD)

Documentation, including version control, is important to ensure that the desired protective relay settings are installed. Protective relays are routinely replaced or upgraded, and settings of in-service protective relays are revised regularly to account for changes in protection methodology, compliance requirements, new protection capabilities, relay misoperations, event analysis, 5-year relay reviews, and electrical system changes. Months or even years can sometimes pass before proposed installations or revisions are implemented in the field and as-left settings become available to be documented.

**{Use the RRD to document the following information on all installed protective relays and their settings:**

- **Relay designation (e.g., 111G, 287T).**
- **Equipment protected by the relay (e.g., G1, K1A).**
- **Primary protective function of the relay (e.g., generator protection or transformer differential).**
- **Relay manufacturer, style, and model (e.g., SEL-300G).**
- **Relay device part number (e.g., 300G303425X14XXX).**
- **Approximate date that the as-left settings were last taken from and documented in the RRD (i.e., settings validation date).**
- **Setting entries for installed protective relays.}**

Note: Only one setting entry should have an in-service setting status for each unique protective relay.

The protective relay setting documentation in the RRD should cover the relays installed on the main powertrain as stated in the Section 1.1 of this document. Each protective relay should contain the settings developed or approved by the Protection System Engineer.

The RRD should also contain the following information for Reclamation power facilities:

- Generator, power circuit breaker, and transformer nameplate ratings (associated with relays in the RRD).
- Instrument transformer ratings (current and potential transformers associated with relays in the RRD).
- Uploaded protective relay setting files or test sheets that are the source of documentation for the protective relay settings in the RRD.
- Reference drawings, such as relay logic, single-line, and three-line diagrams.

### 3.1 Updates to the Reclamation Relay Database

The following subsections outline the requirements to update information in the RRD.

#### 3.1.1 New Protective Relays

If new protective relays have been or are planned to be installed in a facility, perform the following steps to update the documentation in the RRD.

1. [Add a new relay entry in the RRD.
2. Enter the required protective relay device information (see Section 3.0) and assign the appropriate relay disposition option to the new relay entry.
3. Create a new setting entry under the new relay and enter the in-service setting information.
  - a. Assign the appropriate setting status (e.g., in-service) and include a setting entry revision number.
  - b. Include a memo note in the setting entry to document and reference the in-service relay setting information (e.g., 8/7/2018 – As-left commissioned relay setting information from 8/1/2018 received from facility. MW).
  - c. For microprocessor-based relays, attach the corresponding as-left setting file to the setting entry.
4. If this protective relay has a pending setting entry, notify the Protection System Engineer who created the pending setting entry that the newly created in-service setting entry is ready for review.
  - a. Send relevant as-left setting documentation (setting files, test reports, etc.) to the Protection System Engineer if this information has not been uploaded in the RRD.
5. Review and approve the in-service settings within 30 calendar days of receiving the as-left setting documentation.
  - a. Include a memo note in the setting entry to document and reference the as-specified relay setting information (e.g., 8/7/2018 – In-service relay setting information is as specified. MW).
  - b. Resolve the pending setting entry.]

#### 3.1.2 Pending/Recommended Setting Entries

If setting changes are recommended for existing or new protective relays, perform the following steps to add this documentation to the RRD.

1. [Create a new pending setting entry in the RRD under the appropriate relay and enter the recommended settings information.
  - a. Include a memo note in the setting entry to document the source of the recommendation and why setting changes are recommended (e.g., 8/7/2018 – PRIS recommendation 20180831-RR-2-B from August 2018 Review of



Protective Relaying to improve protection and update the protection methodology for transformer K1A. MW).

- b. For microprocessor-based relays, attach the corresponding recommended setting file to the pending setting entry.]

### **3.1.3 Updating Existing Protective Relay Setting Entries**

If updates are necessary for existing protective relay setting entry information, such as for relay setting changes, perform the following steps to update the documentation in the RRD.

1. [Open the existing in-service setting entry in the RRD that is outdated and change its setting status to archived. If no in-service setting entry exists, move to Step 2.
  - a. Include a memo note in the RRD to document this change in status (e.g., 8/7/2018 – Settings archived, changes made to implement the 2017 Protective Relay Review report setting recommendations. MW).
2. Create a new setting entry in the RRD under the same relay and enter the latest as-left settings information.
  - a. Assign the appropriate setting status (e.g., in-service) and include a setting entry revision number.
  - b. Include a memo note in the RRD to document adding this setting entry. (e.g., 8/7/2018 – New in-service settings, 2017 Protective Relay Review report setting recommendations implemented in relay on 7/25/2018. MW).
  - c. For microprocessor-based relays, attach the corresponding as-left setting file to the setting entry.
3. Update the settings validation date field in the relay device information page in the RRD.
4. If the protective relay has a pending setting entry, notify the Protection System Engineer who created the pending setting entry that the newly created in-service setting entry is ready for review.
  - a. Send relevant as-left setting documentation (setting files, test reports, etc.) to the Protection System Engineer if this information has not been uploaded in the RRD.
5. Review and approve the in-service setting entry within 30 calendar days of receiving the as-left setting documentation.
  - a. Include a memo note in the setting entry to document and reference the as-specified relay setting information (e.g., 8/17/2018 – In-service relay setting information is as specified. MW).
  - b. Resolve the pending setting entry.]

### **3.1.4 Removing Protective Relays From Service**

Perform the following step to update the documentation in the RRD when removing protective relays from service or replacing them with new equipment:

1. [Change the relay disposition to “removed from service.”
  - a. Include a memo note under the relay entry in the RRD to document the change (e.g., 12/5/2015 – Relay removed from service, replaced by a new SEL-300G in December of 2015. MW)]

### **3.1.5 RRD Data Retention**

**{Protective relay information, documentation, or settings are never deleted from the RRD.}**

It is vital that setting information is not deleted or overwritten when performing setting revisions or updates in the database. Mark information for equipment that is no longer in service as archived to keep a historical record of the protective relays installed at Reclamation facilities. All records, regardless of media, shall be managed and maintained in accordance with Reclamation’s Information Management Handbook as referenced in Reclamation Manual Directive and Standard, Information Management (RCD 05-01).

## 4.0 Development of Protective Relay Settings

This section provides an overview of the tasks that Protection System Engineers perform as part of the process for developing new or revised protective relay settings.

Follow the processes defined in the following subsections to comply with Requirement R1 of NERC standard PRC-027-1.

### 4.1 Short Circuit and Protection System Data

**{Short-circuit model data for BES elements under study must be reviewed and updated using accurate information.}** Short-circuit model data is used to develop new or revised protective relay settings.

Protection system data is also necessary to develop new or revised protective relay settings to ensure the protection system is coordinated and will operate in the intended sequence during faults.

Therefore, applicable short-circuit model and protection system data and relay settings should be obtained from the pertinent facility, RRD, or entity before developing protective relay settings. This may involve requesting information from entities other than Reclamation, such as Transmission Planners, Planning Coordinators, or Transmission Owners.

Any existing short-circuit model and protection system data used for the development of protective relay settings should be reviewed for accuracy. If existing data or received data from another entity is found to contain errors, this should be communicated to the respective entity to update the data.

### 4.2 Peer Review

**{A peer review must be performed for all new or revised protective relay settings.}**

[A peer reviewer:

1. Shall be Protection System Engineer.
2. Peer reviews newly developed or revised protective relay settings that the engineer was not involved in developing.
3. Is responsible for ensuring proposed protective relay settings are adequately documented, technically sound, and free from typographical and calculation errors.
4. Is responsible for ensuring the appropriate technical coordination with outside entities has been documented.]

### 4.3 Documented Communication with Other Interconnected Entities

Reclamation documents communication with other interconnected entities to ensure potential coordination issues are addressed prior to implementing proposed protective relay settings. **{A Protection System Engineer must provide proposed protective relay settings to the other entity (e.g., Transmission Owner, Generator Owner, or Distribution Provider)}**, if these settings could operate for a fault on the other entity's system or affect the protection system's intended sequence of operation during faults. The applicable protective relay settings typically include the following protection system elements (not a complete list):

- Distance protection that reaches into another entity's system.
- Overcurrent protection, including voltage controlled/restrained, that could operate on another entity's system.
- Communication-aided protection systems between entities.
- Elements that provide protection for equipment owned by another entity.

A Protection System Engineer determines the proposed protective relay settings that need to be provided to another entity.

The other entity is required to respond after receiving proposed settings. The response documents receipt of the settings and provides an opportunity for the other entity to identify any coordination issues or confirm that no coordination issues were identified. If the response indicates that coordination issues were identified, **{Reclamation must verify and document that these coordination issues are addressed prior to implementing the proposed protective relay settings.}**

If coordination issues are identified, Reclamation and another entity may agree not to mitigate all the issues based on engineering judgment. Protection philosophies may differ between Reclamation and the other entity, but both parties may agree that these differences do not create coordination issues. It may take time to resolve identified coordination issues if the resolution involves additional system modifications that were not in the initial project scope at the time of communication to the other entity.

**{If another entity provides proposed protective relay settings to Reclamation for review, a Protection System Engineer must respond in a timely manner to the appropriate entity either identifying any coordination issues or confirming that no coordination issues were identified.}**

**{If an unforeseen circumstance requiring immediate revision of protective relay settings arise during implementation of proposed protective relay settings (such as during commissioning, misoperation investigations, maintenance activities, or emergency replacements required as a result of protection system component failure), the Protection System Engineer must communicate the applicable protective relay settings revisions to any**

**other pertinent entities to ensure that any potential coordination issues are addressed as soon as possible.}**

**{The Protection System Engineer compiles and uploads dated correspondence and the associated protection system settings information to the RRD}**. This information documents the coordination of the protection system, the evaluation of applicable new or revised protection system settings, and that any identified coordination issues were resolved prior to implementing protection system settings.

## Appendix A – Work Examples

### A.1 Scenario #1 – Settings Changes to Relays Initiated by the Facility

Facility personnel use the following process to initiate changes to relay settings. This process ensures the relay settings are properly managed and the RRD is properly updated.

1. Facility personnel send a request to a Protection System Engineer with their requested relay setting changes, along with supporting data and the rationale for the change.
2. The Protection System Engineer considers the requested relay setting changes and approves or rejects them.
  - a. If the requested relay setting changes are rejected, the Protection System Engineer notifies the facility of the rationale for rejection.
  - b. If the requested relay changes are approved, the Protection System Engineer obtains a peer review of the requested relay setting changes.
3. The Protection System Engineer manages and documents any required setting coordination with other entities.
4. The Protection System Engineer supplies the relay setting file with the desired relay setting changes.
5. The Protection System Engineer creates a pending setting entry in the RRD to document the recommended settings (see Appendix B, RRD Example #2 below).
6. Facility personnel implement the recommended setting changes in the relays and gather the necessary as-left setting information from the relays (e.g., download setting files or documented test report sheets).
7. Facility personnel send the as-left setting information to the Facility Data Administrator. The Facility Data Administrator follows RRD Example #4 to update the in-service setting entries in the RRD.
8. The Protection System Engineer follows RRD Example #5 to resolve the existing pending setting entry and approve the existing in-service setting entry in the RRD within 30 calendar days of receiving the as-left setting documentation.

## **A.2 Scenario #2 – Implementing a Relay Setting Change Recommendation from a Protection System Engineer**

The following process ensures relay settings are properly managed and the RRD is properly updated when a Protection System Engineer recommends changing relay setting at a facility, either through a formal Power Review Information System (PRIS) recommendation (e.g., from a report or investigation) or an informal recommendation to the facility (e.g., email):

1. The Protection System Engineer creates a pending setting entry in the RRD to document the recommended settings (see RRD Example #2).
2. Facility personnel implement the recommended setting changes in the relays and gather the necessary as-left setting information from the relays (e.g., download setting files or documented test report sheets).
3. Facility personnel send the as-left setting information to the Facility Data Administrator. The Facility Data Administrator follows RRD Example #4 to update the in-service setting entries in the RRD.
4. The Protection System Engineer follows RRD Example #5 to resolve the existing pending setting entry and approves the existing in-service setting entry in the RRD within 30 calendar days of receiving the as-left setting documentation.

## **A.3 Scenario #3 – Routine Relay Testing and Verification that Settings are as Specified (PRC-005)**

During routine relay testing, use the following steps to verify that the as-found settings in a relay represent the latest specified settings in the RRD:

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, determine if there is an existing setting entry marked with a pending setting status.
  - a. If a pending setting entry exists, follow RRD Example #3 to retrieve this information to use in implementing the recommended setting changes.
    - i. Facility personnel implement the recommended setting changes in the relays and gather the necessary as-left setting information from the relays (e.g., download setting files or documented test report sheets).

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- ii. Facility personnel send the as-left setting information to the Facility Data Administrator. The Facility Data Administrator follows RRD Example #4 to update the in-service setting entries in the RRD.
  - iii. The Protection System Engineer follows RRD Example #5 to resolve the existing pending setting entry and approve the existing in-service setting entry in the RRD within 30 calendar days of receiving the as-left setting documentation.
- b. If a pending setting entry does not exist and the existing in-service setting entry has a Protection System Engineer's approval signature, the in-service settings are the as-specified settings for the relay.

Note: Facility personnel should work with a Protection System Engineer to determine if there is an ongoing Protective Relay Review or other work that would result in setting changes in the near future for relays.

- i. Follow the process in RRD Example #4.1 to determine if the as-found settings match the in-service setting entry in the RRD.
- ii. If the comparison results in a 100% match, then relay testing can proceed. Facility personnel send the as-left setting information to the Facility Data Administrator. The Facility Data Administrator follows RRD Example #4 to update the in-service setting entries in the RRD.

Note: If the comparison did not result in a 100% match (even if only 1 setting differed), then this should be investigated by the relay tester until a complete match is made.

- c. If a pending setting entry does not exist and the existing in-service setting entry does not have a Protection System Engineer's approval signature, use RRD Example #4.3 to create a setting entry from the as-left setting information taken directly from the relay.


Note: Facility personnel should work with a Protection System Engineer to validate the settings before performing maintenance in the event that settings need to be changed.



## Appendix B – RRD Examples

### B.1 RRD Example #1 – How to Create a New Relay Entry in the RRD

This example applies to new protective relays that have been or are planned to be installed in a facility. The following steps describe how to create a new relay entry and add the settings information, if it is available, to the RRD:

1. Create a new relay entry for the appropriate facility using either 1a or 1b:
  - a. Insert a new record  from the relay page in the RRD.
  - b. Copy a similar existing relay entry and then revise the information for the new relay.
2. Complete steps 2a through 2h to create a relay entry for a new relay. Enter the protective relay device information into the new relay entry for the following fields:
  - a. Protecting – equipment protected by the relay.
  - b. Relay designation – equipment/drawing name for the relay at the facility.
  - c. Relay disposition – denotes the status of the relay; assign an option from the following based on what is appropriate for the status of the relay:
    - i. In-service – the relay is installed and providing protection for equipment.
    - ii. Pending installation – relay is not yet installed but will be in the future.
  - d. Application – a brief description of the type of protection provided the relay (e.g., generator protection, transformer protection, bus differential, loss of field, etc.).
  - e. IEEE number – the corresponding ANSI device code for the relay.
  - f. Manufacturer, style, and model number – information on the type and part number for the relay from the manufacturer.
  - g. Setting template – a drop-down menu with all the available setting templates in the RRD. Pick a template that is similar to the manufacturer, style, and model number for the new relay.
  - h. Memo – a large comment field to provide information about the relay device (e.g., firmware information), when the relay was installed or added to the RRD, and other useful information about the relay.


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3. If relay setting information/documentation is available for the newly created relay entry, use steps 3a and 3b to determine how to proceed.
  - a. If as-left relay setting information is available for the new relay, perform steps 4 through 8 of Example #1.


Note: This is typically done when the relay disposition for the newly created relay entry was denoted with the in-service option.

- b. If pending/recommended relay setting information is available for the new relay, skip to RRD Example #2.

Note: This is typically done when the relay disposition for the newly created relay entry was denoted with the pending installation option. RRD Example #2 is typically only used by protection system engineers to document the recommended/proposed settings for a relay.

4. Create a new setting entry in the setting tab for the newly created relay entry in the RRD using one of the following methods:
  - a. Blank Setting Entry – Click the “insert a request”  icon and select a setting template from the drop-down menu to create a setting entry. Enter the relay settings manually into the new setting entry.


Note: This method is typically used for relays with few settings that are not cumbersome to enter manually.

- b. Import Setting Entry – Click the “import setting request”  icon and select the appropriate relay setting file type to automatically import into the RRD. Follow the subsequent import wizard options to create the setting entry.

Note: This method is typically used for SEL relays with .MDB or .RDB setting files.

5. Enter the necessary information into the new setting entry, which includes the following fields:
  - a. Revision – the setting entry version number (e.g., 1)
  - b. Setting status – assign the in-service option to this field to denote that the setting entry is being created from as-left settings information taken directly from the relay.
  - c. Memo – a large comment field to provide information about the setting entry, such as:
    - i. When the as-left settings information were taken from the relay.
    - ii. When the setting entry was added to the RRD.

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- iii. Who entered this information in the RRD.
  - d. Attach files  1 File – upload and attach appropriate files for the relay settings, such as a PDF copy of the relay test report or setting files used for the setting entry import.
6. Save and close the newly created setting entry. Then navigate back to the relay tab for the relay entry.
  7. Enter a settings validation date in the relay entry, which corresponds to the approximate date when the as-left settings information was downloaded or recorded from the protective relay.

Note: This is the date that personnel at the facility downloaded the as-left settings directly from the relay or the date on a test report that documents the as-left settings for the relay. It is not the date on an email when settings were transmitted to the person who is adding this information in the RRD.

8. Inform the Protection System Engineer that a new relay has been entered in the RRD and provide them with as-left setting information taken directly from the relay. The Protection System Engineer performs the steps in RRD Example #5 to resolve the pending setting entry and/or approve the in-service setting entry for the relay in the RRD.


### **B.2 RRD Example #2 – How to Create a Setting Entry for Pending/Recommended Settings in the RRD**

This example describes how to create a pending setting entry in the RRD. Protection System Engineers typically perform these steps when they have developed or recommended setting changes for protective relays at a facility. These setting changes could be for existing (RRD relay entry disposition = in-service) or new (RRD relay entry disposition = pending installation) protective relays at the facility. It is necessary to add this information into the RRD to document that there are desired setting changes for a protective relay.

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, create a new setting entry using one of the following methods:
  - a. Blank Setting Entry – Click the “insert a request”  icon and select a setting template from the drop-down menu to create a setting entry. Enter the relay settings manually into the new setting entry.


Note: This method is typically used for relays with few settings that are not cumbersome to enter manually.

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- b. Import Setting Entry – Click the “import setting request”  icon and select the appropriate relay setting file type to automatically import into the RRD. Follow the subsequent import wizard options to create the setting entry.

Note: This method is typically used for SEL relays with .MDB or .RDB setting files.


3. Enter the necessary information into the new setting entry, which includes the following fields:
  - a. Revision – the setting entry version number

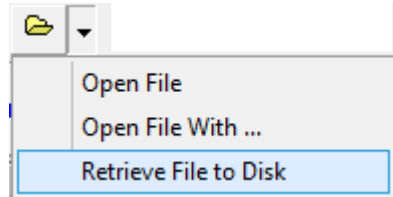
Note: Use a high number (e.g., 99) to highlight that the setting entry is for recommended settings and allow room for other setting entries to be added, such as from RRD Example #4.
  - b. Setting status – assign the pending option to this field to denote that the setting entry represents recommended settings that should be installed in the relay.
  - c. Sent to field on – the expected date that the recommended settings will be transmitted to the facility.
  - d. Memo – a large comment field to provide information about the setting entry, such as:
    - i. The source of the recommendation (e.g., PRIS recommendation number or report).
    - ii. Why setting changes are recommended.
    - iii. When the setting entry was added to the RRD.
    - iv. Who entered this information in the RRD.
  - e. Attach files  1 File – upload and attach appropriate files for the relay settings, such as the recommended setting files used for the setting entry import.


There should only be one setting entry marked with a pending setting status for a relay in the RRD. If the relay contains an existing pending setting entry, the setting changes in the setting entry should be investigated to determine if they are included in the more recent recommended settings or are no longer desired.

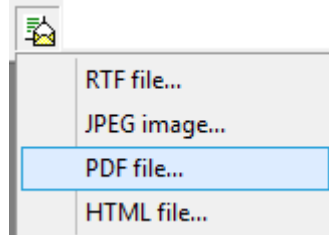
### B.3 RRD Example #3 – How to Retrieve Pending/Recommended Settings from a Setting Entry in the RRD

Typically, notification of recommended setting changes to protective relays and their associated relay setting files are transmitted via email or are available in a Review of Protective Relaying report. Setting entries in the RRD that are denoted with a Pending setting status also contain this information for recommended relay settings changes to existing or new protective relays. Facility personnel perform these steps to retrieve information from a pending setting entry in the RRD.

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. Click on the settings tab for the relay entry and open the setting entry marked with a pending setting status.
3. The pending setting entry is now open and information can be retrieved.
  - a. Download attached files.
    - i. Click on the attached file icon  in the opened setting entry and select “Manage Stored Files.”
    - ii. Select the file to download and click on the arrow next to the folder icon, then select “retrieve file to disk” and save the file.



- b. Print the settings in the setting entry.
        - i. Click on the printer icon 
        - ii. Wait for the report to generate and then export to a PDF file.



- iii. Save the PDF file.
4. The documentation retrieved from the pending setting entry can be used to make the necessary settings changes in the relay.

## **B.4 RRD Example #4 – How to Update a Setting Entry in the RRD**

This example has multiple parts to cover the typical scenarios that involve making updates to the setting entries in the RRD.

Overall, this example applies when the settings for an existing in-service setting entry in the RRD are no longer accurate and do not represent what is presently installed/implemented in the relay at the facility. This would normally occur when setting changes have been recently made to a relay at the facility or if it was discovered the existing information in the RRD was out of date and was no longer accurate.

Updating setting entries in the RRD requires following multiple parts described in this example. Each scenario involves a specific combination of examples to be followed as part of the overall RRD Example #4 process to make setting entry updates in the RRD. The following subsections provide guidance on which sub example is next in the process to cover each scenario. In general, RRD Example #4.1 is always applicable and should be performed first.

### **B.4.1 RRD Example #4.1 – How to Determine if Setting Entry Updates are Necessary in the RRD**

To confirm or verify if the existing in-service setting entry for a relay in the RRD accurately represents what is presently installed/implemented in the relay, compare the information in that setting entry in the RRD with the as-left setting information taken directly from the relay. The outcome of this comparison determines which updates are necessary in the RRD. The following steps describe how to carry out this comparison:

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, perform one of the following actions to begin the comparison process:
  - a. Open the setting entry that is marked with the in-service setting status and manually compare each setting in the RRD with the as-left settings information taken directly from the relay.

Note: This action is normally used for relays with few settings that are not cumbersome to compare manually.

- b. Right-click the setting entry that is marked with the in-service setting status and select “compare request to” then “setting from file.” Select the appropriate file type to run an automatic comparison.

Note: This action is normally used for SEL microprocessor relays that have many settings.

The results of this comparison determine whether to follow step 3 or step 4 next.

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3. If the comparison resulted in a 100% match, complete this example following step 3a to update the information in the RRD:
  - a. In the relay tab for the relay entry, update the settings validation date field with the latest date from the as-left setting information taken directly from the relay.
    - i. This date corresponds to the approximate date when the as-left settings information was either downloaded directly from the relay or the date on a test report that documents the as-left settings for the relay.
4. If the comparison did not result in a 100% match (even if only 1 setting differed), follow RRD Example #4.2 to update the information in the RRD.

Note: The existing in-service setting entry is considered outdated based on this comparison outcome.

#### **B.4.2 RRD Example #4.2 – How to Archive a Setting Entry in the RRD**

If RRD Example #4.1 identifies that the existing in-service setting entry is outdated, follow steps 1 and 2 to change the setting entry to archived.

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, open the setting entry that is marked with the in-service setting status and perform the following actions:
  - a. Change the setting status for the setting entry from in-service to archived. This denotes that the setting entry is obsolete and will be saved for historical purposes.
  - b. In the memo field for the setting entry, add a note to document this change and include the following applicable information:
    - i. The change in setting status and when it was made in the RRD.
    - ii. Why the settings are obsolete or the reason for marking the setting entry as archived.
    - iii. When setting changes were made in the relay.
    - iv. Who entered this information in the RRD.
    - v. Example: 8/7/2018 – Setting entry archived, updated settings information received from facility, setting changes were made on 8/1/2018 to implement the 2017 Protective Relay Review report setting recommendations. MW
  - c. Save and close the setting entry. There should now be no setting entries marked with an in-service setting status for this relay.


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Follow RRD Example #4.3 as the next part of the overall RRD Example #4 process to update the RRD with the as-left setting information taken directly from the relay and create a new in-service setting entry.


### **B.4.3 RRD Example #4.3 – How to Create a Setting Entry in the RRD from the As-Left Setting Information**

The following steps describe how to create a setting entry from the as-left setting information taken directly from a relay.

Note: At this point, there should be not be an existing setting entry marked with an in-service setting status in the RRD for the pertinent relay. See RRD Example #5 regarding an existing setting entry marked with a pending setting status in the RRD for this relay.

1. Create a new setting entry using one of the following methods:
  - a. Blank Setting Entry – Click the “insert a request”  icon and select a setting template from the drop-down menu to create a setting entry. Enter the relay settings manually into the new setting entry.

Note: This method is typically used for relays with few settings that are not cumbersome to enter manually.
  - b. Import Setting Entry – Click the “import setting request”  icon and select the appropriate relay setting file type to automatically import into the RRD. Follow the subsequent import wizard options to create the setting entry.

Note: This method is typically used for SEL relays with .MDB or .RDB setting files.
2. Enter the necessary information into the new setting entry, which includes the following fields:
  - a. Revision – the setting entry version number.
  - b. Setting status – assign the in-service option to this field to denote that the setting entry is being created from as-left settings information taken directly from the relay.
  - c. Memo – a large comment field to provide information about the setting entry, such as:
    - i. When the as-left settings information were taken from the relay.
    - ii. When the setting entry was added to the RRD.
    - iii. Who entered this information in the RRD.
  - d. Attach files  1 File – upload and attach appropriate files for the relay settings, such as a PDF copy of the relay test report or setting files used for the setting entry



import.

3. Save and close the newly created setting entry. Then navigate back to the relay tab for the relay entry.
4. Enter a settings validation date in the relay entry that corresponds to the approximate date when the as-left settings information was downloaded or recorded from the protective relay.
  - a. Note: This is the date that personnel at the facility downloaded the as-left settings directly from the relay or the date on a test report that documents the as-left settings for the relay. It is not the date on an email when settings were transmitted to the person that is adding this information in the RRD.
5. Inform the Protection System Engineer the RRD has been updated and provide them with as-left setting information taken directly from the relay. The Protection System Engineer performs the steps in RRD Example #5 to resolve the pending setting entry and/or approve the in-service setting entry for the relay in the RRD.

This completes the RRD Example #4 update process.

## **B.5 RRD Example #5 – How to Resolve Pending Setting Entries and/or Approve In-Service Setting Entries in the RRD**

This section describes how to document if recommended setting changes have been made in a relay, what updates are necessary in the RRD to resolve an existing setting entry marked with a pending setting status, and how to document that an existing setting entry marked with an in-service setting status for a relay in the RRD represents the latest desired settings that should be implemented in the relay.

This example assumes that the steps in RRD Example #4 have already been performed to update the RRD with the as-left setting information for the implemented relay setting changes. The following subsections provide sequential guidance. Protection System Engineers perform these steps when they receive as-left setting information taken directly from a relay or notification that updates have been made to the RRD and are ready for their review.

Note: Only follow the sub examples if they are applicable (i.e., only follow RRD Example #5.1 if there is an existing setting entry marked with a pending setting status for a relay in the RRD).

### **B.5.1 RRD Example #5.1 – Pending Setting Entry Comparison**

The following steps describe how to compare as-left setting information with an existing setting entry marked with a pending setting status in the RRD.

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1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, begin the comparison process by performing either step 2a or 2b.
  - a. Open the setting entry that is marked with the pending setting status and manually compare each setting in the RRD with the as-left settings information taken directly from the relay.

Note: This action is normally used for relays with few settings that are not cumbersome to compare manually.

- b. Right-click the setting entry that is marked with the pending setting status and select “compare request to” then “setting from file.” Select the appropriate file type to run an automatic comparison.
- Note: This action is normally used for SEL microprocessor relays that have many settings.
3. Document the results of this comparison in a separate location from the RRD that can be referenced later.

### **B.5.2 RRD Example #5.2 – In-Service Setting Entry Comparison**

The following steps describe how to compare as-left setting information with an existing setting entry marked with an in-service setting status in the RRD.

1. Navigate to the appropriate relay in the RRD and open the relay entry.
2. In the setting tab for the relay entry, begin the comparison process by performing either step 2a or 2b.
  - a. Open the setting entry that is marked with the in-service setting status and manually compare each setting in the RRD with the as-left settings information taken directly from the relay.

Note: This action is normally used for relays with few settings that are not cumbersome to compare manually.

- b. Right-click the setting entry that is marked with the in-service setting status and select “compare request to” then “setting from file.” Select the appropriate file type to run an automatic comparison.

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Note: This action is normally used for SEL microprocessor relays that have many settings.

3. Document the results of this comparison in a separate location from the RRD that can be referenced later.

### **B.5.3 RRD Example #5.3 – Comparison Results Evaluation**

The following subsections describe the next steps based on the outcome of the comparisons performed in RRD Example #5.1 and/or RRD Example #5.2.

#### ***Example #5.3.1 – 100% Match in Both Comparisons***

If the RRD Example #5.1 and RRD Example #5.2 comparisons both resulted in a 100% match to the as-left setting information, perform the following steps:

1. The Protection System Engineer will open the existing setting entry marked with an in-service setting status and sign the setting entry. Also, create a memo note in the setting entry to document that they are as-specified. (e.g., 8/7/2018 - In-service relay setting information is as specified. MW). Save and close the setting entry.
2. Inform the RRD Administrator that the existing in-service setting entry has been signed and the desired settings are implemented in the relay(s).
3. The existing pending setting entry is no longer applicable and can be either archived or deleted to resolve it, which denotes that the pending/proposed settings have been implemented in the relay.

Note: It is acceptable to delete pending setting entries as they do not represent settings that were installed in the relays.

#### ***Example #5.3.2 – Pending setting entry differs***

If the Example #5.1 comparison did not result in a 100% match (even if only 1 setting differed), perform the following steps:

1. Inform the Facility Data Administrator that the desired recommended settings were not implemented in the relay and begin a discussion to resolve this topic.
2. If it is determined that the recommended setting changes are still applicable, retain the existing pending setting entry in the RRD or revise it based on the outcome of the discussion.

Note: For microprocessor relays, minor differences that do not affect the protection provided by the relay can occur in port settings or front panel display settings. If these differences are acceptable to the Protection System Engineer, resolve the

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pending setting entry as described in Example #5.3.1.

3. The existing setting entry marked with an in-service setting status will not receive a Protection System Engineer signature as setting changes are still desired to be implemented in the relay.

### ***Example #5.3.3 – In-Service Setting Entry Differs***

If the Example #5.2 comparison did not result in a 100% match (even if only 1 setting differed), perform the following steps:

1. Inform the Facility Data Administrator that the existing setting entry marked with an in-service setting status in the RRD does not match the as-left setting information received for review and begin a discussion to resolve this issue.
2. Follow Example #4 to update the RRD with the correct as-left setting information taken directly from the relay.
3. When the Protection System Engineer receives the updated as-left setting information to review, start at the beginning of Example #5 again.