

# Easy Series

## EasyPact MVS - TS Trip System

### User Guide

Easy Series offers essential and accessible value devices.

DOCA0299EN-03  
09/2025



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# Safety Information

## Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

### **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

### **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

### **CAUTION**

**CAUTION** indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

### **NOTICE**

**NOTICE** is used to address practices not related to physical injury.

## Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

## Security Notice

### **WARNING**

#### **HAZARD OF ELECTRIC SHOCK**

Do not use EasyPact MVS circuit breakers with TS trip systems on power systems with IT grounding systems with voltage above 660 Vac.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

# Cybersecurity Safety Notice

## **⚠ WARNING**

### **POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**

- Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.
- Disable unused ports/services and default accounts to help minimize pathways for malicious attackers.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example, least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

# About the Book

## Document Scope

The aim of this guide is to provide users, installers, and maintenance personnel with the technical information needed to operate TS trip system in EasyPact MVS™ circuit breakers.

This guide applies to the following TS trip systems.

| Trip system                                                                               | Commercial reference |
|-------------------------------------------------------------------------------------------|----------------------|
| TS 2.0                                                                                    | MVS15562             |
| TS 5.0                                                                                    | MVS15563             |
| TS 2.0S                                                                                   | MVS15556             |
| TS 5.0S                                                                                   | MVS15557             |
| TS 6.0S                                                                                   | MVS15558             |
| <b>NOTE:</b> The commercial reference is printed on the front face of the TS trip system. |                      |

## Related Documents

| Title of documentation                                                                               | Reference number |
|------------------------------------------------------------------------------------------------------|------------------|
| <i>EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide</i>                               | DOCA0297EN       |
| <i>EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide</i>                               | DOCA0298EN       |
| <i>EasyPact MVS - TS Trip System - Firmware Release Notes</i>                                        | DOCA0315EN       |
| <i>EasyPact MVS1/MVS2 Fixed and Drawout Circuit Breakers with TS Trip System - Instruction Sheet</i> | S1B70236         |

You can download these technical publications and other technical information from our website at [www.se.com/ww/en/download/](http://www.se.com/ww/en/download/).

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# Introduction to TS Trip System

## What’s in This Part

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## Easy Series Master Range

Easy Series delivers a range of energy management and industrial automation products that focus on core features to meet the needs of the customers at a value price. The Easy Series products are intuitive to set up and ride. The series includes essential product lines such as circuit breakers, UPS, metering, motion and drives, human-machine interface, PLC, and push buttons.

# Presentation

## TS Trip System - Overview

EasyPact MVS circuit breakers with TS trip system provide protection functions.

The TS trip systems are:

- TS 2.0, 5.0
- TS 2.0S, 5.0S, and 6.0S

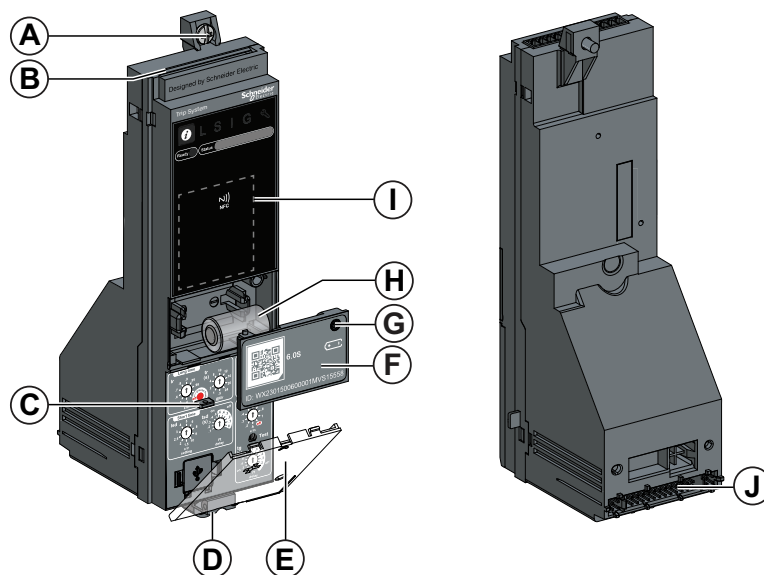
## Range of TS Trip System

The following table indicates the functions available on EasyPact MVS circuit breakers with TS trip system:

|                                                | TS 2.0   | TS 5.0   | TS 2.0S  | TS 5.0S  | TS 6.0S  |
|------------------------------------------------|----------|----------|----------|----------|----------|
| Commercial reference                           | MVS15562 | MVS15563 | MVS15556 | MVS15557 | MVS15558 |
| Long-time overcurrent protection (L)           | ✓        | ✓        | ✓        | ✓        | ✓        |
| Short-time overcurrent protection (S)          | –        | ✓        | –        | ✓        | ✓        |
| Instantaneous overcurrent protection (I)       | ✓        | ✓        | ✓        | ✓        | ✓        |
| Ground-fault protection (G)                    | –        | –        | –        | –        | ✓        |
| Neutral protection (N)                         | ✓        | ✓        | ✓        | ✓        | ✓        |
| Self-diagnosis and ready status indication     | –        | –        | ✓        | ✓        | ✓        |
| Overcurrent prealarm and alarm indication      | –        | –        | ✓        | ✓        | ✓        |
| Ground-fault prealarm indication               | –        | –        | –        | –        | ✓        |
| Internal fault alarm indication                | –        | –        | ✓        | ✓        | ✓        |
| Overcurrent & Internal fault trip indication   | –        | –        | ✓        | ✓        | ✓        |
| Protection & Alarm setting change traceability | ✓        | ✓        | ✓        | ✓        | ✓        |
| RMS current measurements                       | –        | –        | ✓        | ✓        | ✓        |
| Trip history                                   | Last 1   | Last 1   | Last 30  | Last 30  | Last 30  |
| Event history                                  | –        | –        | Last 70  | Last 70  | Last 70  |
| Embedded NFC-EPD smart phone APP               | –        | –        | ✓        | ✓        | ✓        |
| Embedded USB port-EPC desktop software         | ✓        | ✓        | ✓        | ✓        | ✓        |
| Firmware upgradable                            | ✓        | ✓        | ✓        | ✓        | ✓        |

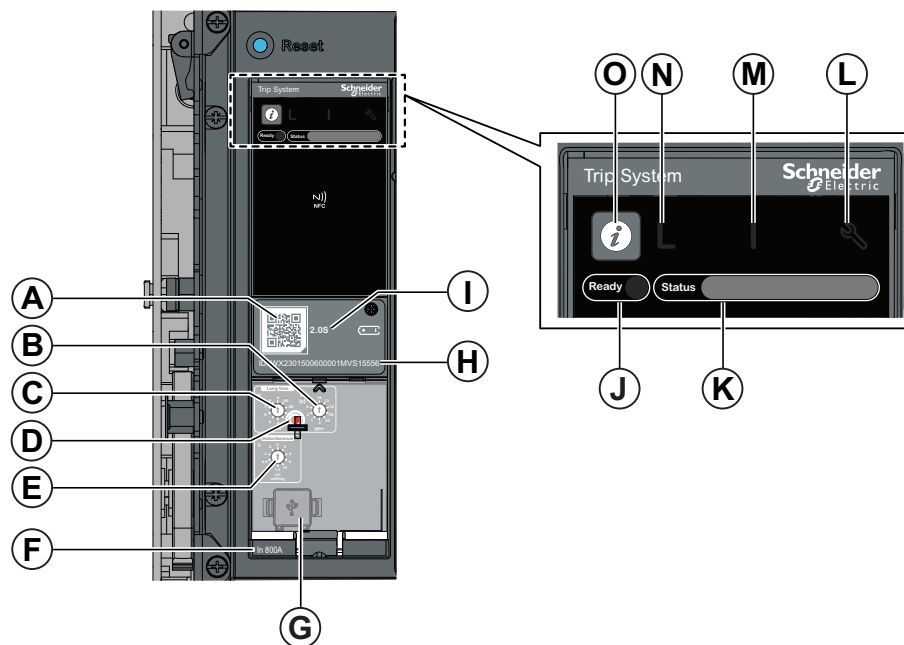
# Description

## TS Trip System



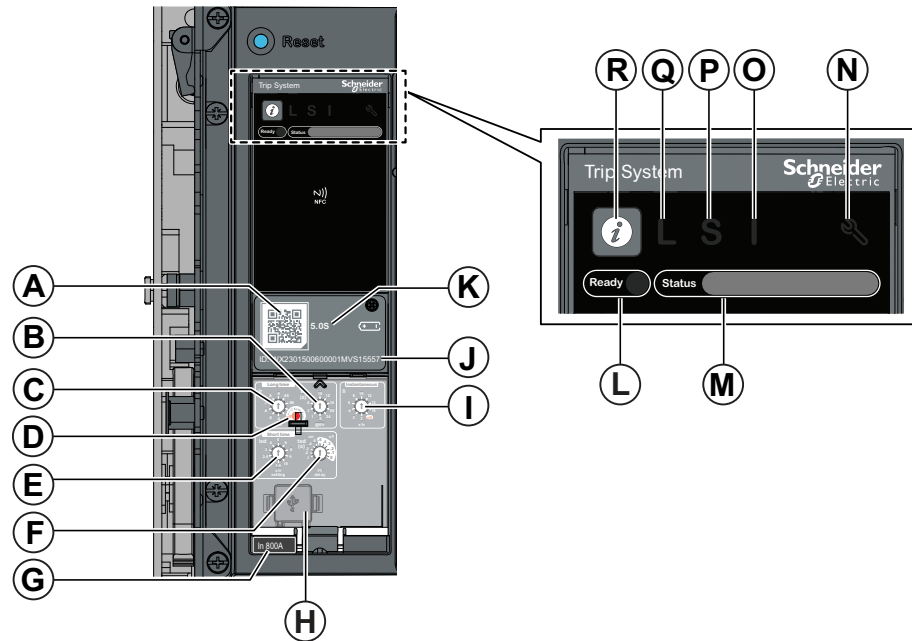
- A. Top fastener
- B. Terminal block for external connections
- C. Lead seal fixture for protective cover
- D. Bottom fastener
- E. Protective cover (shown open)
- F. Internal battery cover (shown open)
- G. Screw for internal battery cover (available for TS 2.0S, 5.0S, and 6.0S only)
- H. Internal battery (available for TS 2.0S, 5.0S, and 6.0S only)
- I. NFC wireless communication zone
- J. Connection with circuit breaker

## TS 2.0 and 2.0S Trip System



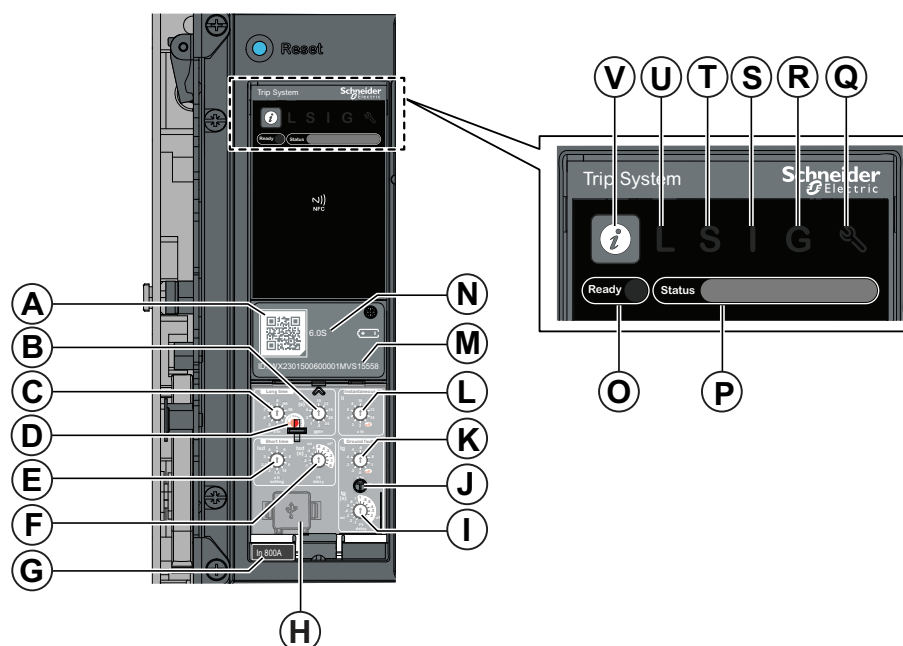
- A. QR code to access product information and trip system type
- B. Long-time time delay tr
- C. Long-time current setting Ir
- D. Ir off push-button
- E. Instantaneous pickup li
- F. Sensor plug with the rated current of the circuit breaker
- G. 5-pin plug for function test and isolation module (under cover)
- H. Trip system identification number
- I. Trip system type
- J. Ready LED
- K. Status bar
- L. Service LED
- M. Instantaneous trip cause LED
- N. Long-time trip cause LED
- O. Test/Reset button (i)

## TS 5.0 and 5.0S Trip System



- A. QR code to access product information and trip system type
- B. Long-time time delay tr
- C. Long-time current setting Ir
- D. Ir off push-button
- E. Short-time pickup Isd
- F. Short-time time delay tsd
- G. Sensor plug with the rated current of the circuit breaker
- H. 5-pin plug for function test and isolation module (under cover)
- I. Instantaneous pickup Ii
- J. Trip system identification number
- K. Trip system type
- L. Ready LED
- M. Status bar
- N. Service LED
- O. Instantaneous trip cause LED
- P. Short-time trip cause LED
- Q. Long-time trip cause LED
- R. Test/Reset button (i)

## TS 6.0S Trip System



- A. QR code to access product information and trip system type
- B. Long-time time delay tr
- C. Long-time current setting Ir
- D. Ir off push-button
- E. Short-time pickup Isd
- F. Short-time time delay tsd
- G. Sensor plug with the rated current of the circuit breaker
- H. 5-pin plug for function test and isolation module (under cover)
- I. Ground-fault time delay tg
- J. Test button for ground-fault protection
- K. Ground-fault pickup Ig
- L. Instantaneous pickup Ii
- M. Trip system identification number
- N. Trip system type
- O. Ready LED
- P. Status bar
- Q. Service LED
- R. Ground-fault trip cause LED
- S. Instantaneous trip cause LED
- T. Short-time trip cause LED
- U. Long-time trip cause LED
- V. Test/Reset button (ⓘ)

## Test Button for Ground-Fault Protection (TS 6.0S)

Use the Ground-fault Test button to test the ground-fault protection, page 42 for TS 6.0S trip system.

# Ir off Push-Button

|                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b><i>NOTICE</i></b></p> <p><b>HAZARD OF EQUIPMENT DAMAGE</b></p> <p>Do not use sharp tool to push the button during setting Ir rotary switch to off position.</p> <p><b>Failure to follow these instructions can result in equipment damage.</b></p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Press and hold Ir off push-button before turning the long-time current setting Ir rotary switch to off position. For the operation of this button, refer to Long-Time Overcurrent Protection (L or ANSI 49RMS/51), page 34.

# QR Code

When the QR code on the front face of a TS trip system is scanned with a smartphone running a QR code reader and connected to the Internet, the Go2SE Landing Page, page 21 is displayed.

The landing page displays:

- Information about the TS trip system.
- A list of menus.

# Trip System Identification Number

The identification number PPYYWWDLLLNNNNNMVS1.... is made up as follows:

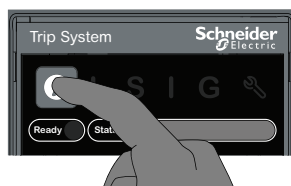
- Serial number of the TS trip system in the format:
  - PP = Plant code (2 alphanumeric characters)
  - YY = Year of manufacture
  - WW = Week of the year
  - D = Day of the week of manufacture (Monday = 1)
  - LLL = Line or machine number (alphanumeric characters)
  - NNNNN = Unique product number manufactured
- Commercial reference of the TS trip system (8 alphanumeric characters): MVS1....

# Trip System Type

The TS trip system **X.0** or **X.0S** type is coded as follows:

- **X.0** indicates the protection functions provided by the TS trip system, page 11.
- **S** indicates the Standard TS trip system with NFC wireless communication.
- **No S** indicates the Basic TS trip system without NFC wireless communication.

## Test/Reset Button



Use the **i** button to:

- Check the internal battery
- Reactivate the trip cause LEDs
- Reset the trip cause indications
- Reset to factory settings

## Check the Internal Battery

Follow the procedure below to start the internal battery test:

1. Press and hold the **i** button for less than 3 seconds.
2. The four trip cause LEDs turn on for 2 seconds (only 1 trip cause LED turns on if last trip cause is not reset): the battery is ok.
3. The four trip cause LEDs do not light: replace the battery.

## Reactivate the Trip Cause LEDs

If a trip cause LED was turned on and then turned off after 2 hours, press the **i** button for less than 3 seconds to reactivate the trip cause LED for 10 seconds.

## Reset the Trip Cause Indications

Check the trip cause on the circuit breaker. The trip cause indication is active until the trip system is reset. Follow the procedure below to reset the trip cause indications:

1. Press the **i** button for 3 to 10 seconds.
2. Check the parameter settings of the trip system.

## Reset to Factory Settings

Reset the TS trip system to factory settings and clean the memory before removal or replacement of the trip system.

**NOTE:** Administrator password sets to default password after resetting to factory settings.

Follow the procedure below to reset to factory settings:

1. Press and hold the **i** button until the Service LED starts blinking (around 10 seconds), and then release it.
2. The service LED blinks for 30 seconds, indicating TS is ready to reset.
3. Press the **i** button again within 30 seconds to confirm the reset.

**NOTE:** If no action is performed during this time frame, the trip system exits the reset mode and the Service LED stops blinking.

4. The reset process starts. The service LED is solid-on during the process for around 10 seconds.
5. Once the reset process completes, TS reboots automatically.

## Indication LEDs

The TS trip system and circuit breaker status are indicated locally by a combination of LEDs:

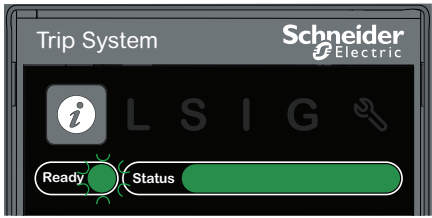
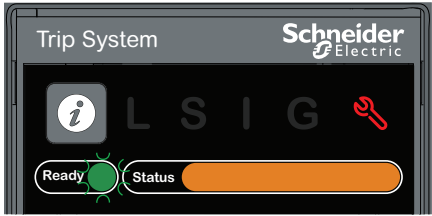
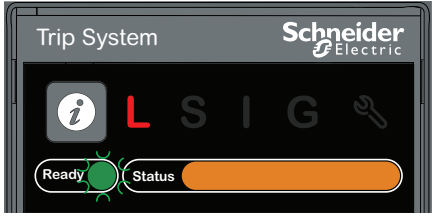
- The status bar
- The service LED
- The ready LED
- The trip cause and alarm LEDs

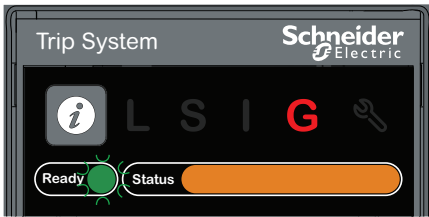
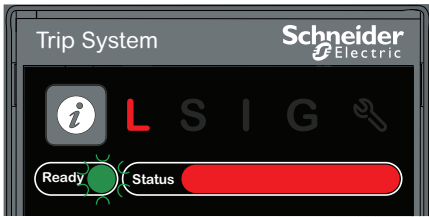
The indication given by the LEDs depends on how the TS trip system is supplied by:

- The internal current transformers (CT)
- The internal battery

## Indication LEDs with TS Trip System Supplied by Current Transformers

The TS trip system is supplied by the internal current transformers (CT) when the EasyPact MVS circuit breaker is closed. If the load current is more than 0.2 In, the local indication is provided as indicated in following table.

| Description                                                                    | Indication LEDs                                                                     |                                                                                                                                  |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| No action required                                                             |  | Ready LED: blinking green<br>Status bar: green on<br>Service LED: off<br>All trip cause LEDs: off                                |
| Major or minor internal malfunction detected, corrective action to be planned. |  | Ready LED: blinking green<br>Status bar: orange on<br>Service LED: red on<br>All trip cause LEDs: off                            |
| Overload pre-alarm:<br>90% Ir < Phase current < 105% Ir                        |  | Ready LED: blinking green<br>Status bar: orange on<br>Service LED: off<br>L trip cause LED: red on<br>Other trip cause LEDs: off |

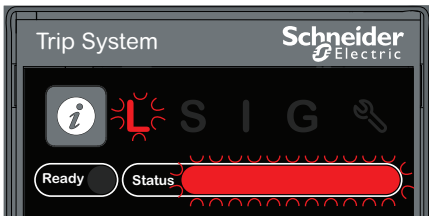
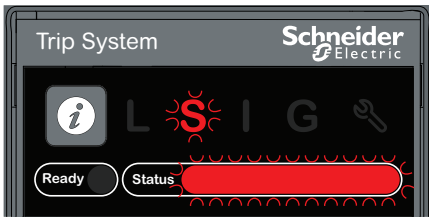
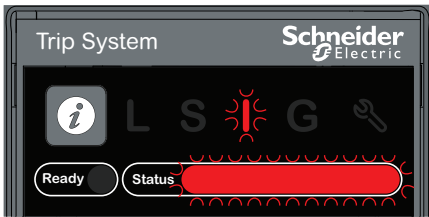
| Description                                                         | Indication LEDs                                                                    |                                                                                                                                  |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Ground-fault alarm:<br>I <sub>g</sub> current ≥ 80 % I <sub>g</sub> |  | Ready LED: blinking green<br>Status bar: orange on<br>Service LED: off<br>G trip cause LED: red on<br>Other trip cause LEDs: off |
| Overload alarm:<br>current ≥ 105 % I <sub>r</sub>                   |  | Ready LED: blinking green<br>Status bar: red on<br>Service LED: off<br>L trip cause LED: red on<br>Other trip cause LEDs: off    |

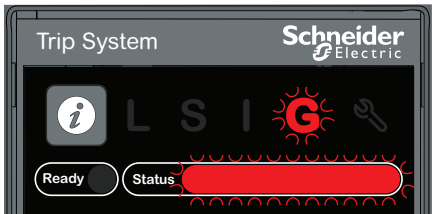
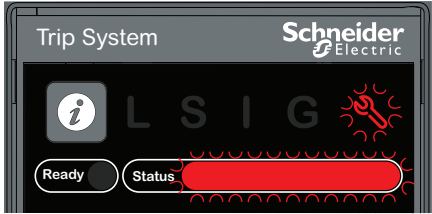
## Trip Indication LEDs After a Trip

When the circuit breaker is tripped, the trip cause is indicated by the trip cause LEDs and the status bar. The trip cause LEDs and the status bar are powered by the internal battery.

When powered by the internal battery, the trip cause and alarm LEDs are turned off after 2 hours.

After 2 hours, use the **i** button to switch on the indication LEDs.

| Description                          | Indication LEDs                                                                      |                                                                                                                                |
|--------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Trip on long-time protection (L)     |  | Ready LED: off<br>Status bar: blinking red<br>Service LED: off<br>L trip cause LED: blinking red<br>Other trip cause LEDs: off |
| Trip on short-time protection (S)    |  | Ready LED: off<br>Status bar: blinking red<br>Service LED: off<br>S trip cause LED: blinking red<br>Other trip cause LEDs: off |
| Trip on instantaneous protection (I) |  | Ready LED: off<br>Status bar: blinking red<br>Service LED: off<br>I trip cause LED: blinking red<br>Other trip cause LEDs: off |

| Description                         | Indication LEDs                                                                   |                                                                                                                                                       |
|-------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trip on ground-fault protection (G) |  | <p>Ready LED: off</p> <p>Status bar: blinking red</p> <p>Service LED: off</p> <p>G trip cause LED: blinking red</p> <p>Other trip cause LEDs: off</p> |
| Major internal malfunction detected |  | <p>Ready LED: off</p> <p>Status bar: blinking red</p> <p>Service LED: blinking red</p> <p>All trip cause LEDs: off</p>                                |

# Go2SE Landing Page

## Presentation

When the QR code on the front face of a TS trip system is scanned with a smartphone running a QR code reader and connected to the Internet, the Go2SE landing page is displayed.

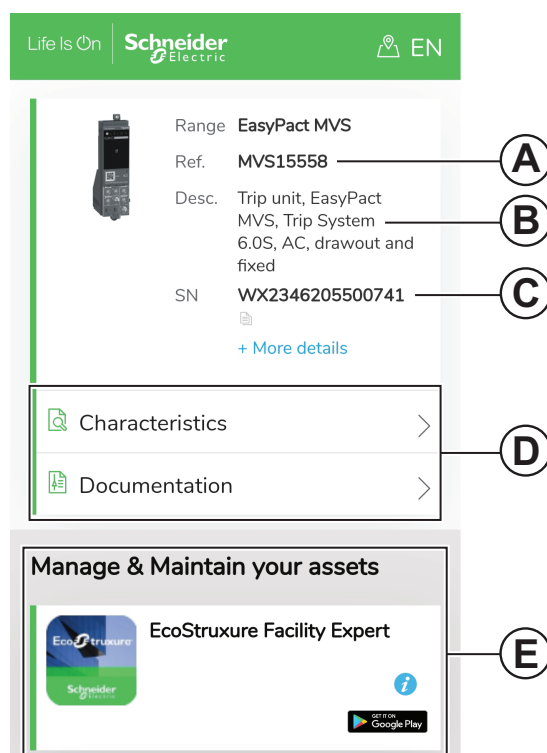
The landing page displays:

- Information about the TS trip system.
- A list of menus.

## Landing Page Description

The landing page is accessible from Android and iOS smartphones. It displays the same list of menus with slight differences in presentation.

The following example shows the landing page displayed on an Android smartphone:



- A. TS trip system commercial reference
- B. TS trip system description
- C. TS trip system serial number
- D. Landing page menus. See the following menu descriptions for details.
- E. Downloadable applications

## Characteristics

Selecting this menu gives access to a product datasheet with detailed information about the TS trip system.

## Documentation

Selecting this menu gives access to the technical publications of:

- TS trip system
- EasyPact MVS circuit breakers

## mySchneider App

Selecting this application gives access to the Schneider Electric customer care mobile application **mySchneider** app that can be downloaded on Android and iOS smartphones. For smartphone compatibility, check on your application store. The customer care application offers self-service instructions and easy access to expert support and information.

# EcoStruxure Power Commission Software

## Overview

EcoStruxure Power Commission software helps you to manage a project as part of testing, commissioning, and maintenance phases of the project life cycle. The innovative features in it provide simple ways to configure, test, and commission the smart electrical devices.

EcoStruxure Power Commission software automatically discovers the smart devices and allows you to add the devices for an easy configuration. You can generate comprehensive reports as part of Factory Acceptance Test and Site Acceptance Test to replace your heavy manual work. Additionally, when the panels are under operation, any change of settings made can be easily identified by a yellow highlighter. This indicates the difference between the project and device values, and hence provides a system consistency during the operation and maintenance phase.

The EcoStruxure Power Commission software enables the configuration of the EasyPact MVS circuit breakers with TS trip system.

For more information, refer to the *EcoStruxure Power Commission Online Help*.

Click [here](#) to download the latest version of EcoStruxure Power Commission software.

## Key Features

EcoStruxure Power Commission software performs the following actions for the supported devices and modules:

- Create projects by device discovery.
- Save the project in the EcoStruxure Power Commission cloud for reference (not available in China).
- Upload alarms settings to the circuit breaker and download settings from the circuit breaker.
- Set the alarm threshold.
- Generate and print the circuit breaker settings report.
- View the measurements, logs, and maintenance information.
- View the status of the circuit breaker.
- View the alarm details.
- Check the system firmware compatibility status.
- Update to the latest device firmware.
- Perform force trip test, and automatic trip curve tests with preconfigured or custom test points.

# EcoStruxure Power Device App

## Presentation

EcoStruxure™ Power Device app is a single mobile application with the necessary information and capabilities to operate and efficiently maintain devices in the EcoStruxure architecture.

The application enables you to connect to devices, including the following:

- EasyPact MVS circuit breakers
- TeSys GV4 motor circuit breakers
- Easergy P3 protection relays

The application can be installed on a smartphone by downloading from:

- Google Play Store or other app stores in China for Android smartphones.
- App Store for iOS smartphones.

## EasyPact MVS Devices in EcoStruxure Power Device App

With the EcoStruxure Power Device app, a smartphone can be used with EasyPact MVS circuit breakers as the primary interface for day-to-day and critical case maintenance.

The TS trip system is identified on the application by scanning the QR code on the trip system.

Wireless communication is available by NFC communication.

## Using an NFC Connection

Connecting to EcoStruxure Power Device app with an NFC connection is always possible, even when the TS trip system is not powered. For more information, refer to the [NFC connection procedure](#), page 65.

It gives access to the following information:

- Information about the TS trip system
  - Protection settings (display only)
  - Alarm indications
- Last trip context: trip type; current values before trip
- List of up to 5 active alarms
- Real time measurements: current measurements, maximum currents, and unbalance current
- Circuit breaker maintenance counters
  - Counter of electrical operations
  - Counter of trips

# Password Management

## General Description

Remote access to data on TS trip system by using the EcoStruxure Power Commission software is protected by password.

A TS trip system has a password for administrator profile.

The following table shows the functions allowed for each user profile:

| User profile                                                                                | Read ID | Monitoring | Test | Recovery function | Firmware update |
|---------------------------------------------------------------------------------------------|---------|------------|------|-------------------|-----------------|
| Administrator                                                                               | ✓       | ✓          | ✓    | ✓                 | ✓               |
| Not login                                                                                   | ✓       | –          | –    | ✓                 | –               |
| No user mode <sup>(1)</sup>                                                                 | ✓       | ✓          | ✓    | ✓                 | ✓               |
| <sup>(1)</sup> The device acts as <b>No user mode</b> if the user creation step is skipped. |         |            |      |                   |                 |

The following table describes the functions:

| Function                 | Description                                       |
|--------------------------|---------------------------------------------------|
| <b>Read ID</b>           | Read the identification number of the trip system |
| <b>Monitoring</b>        | Read all settings, measurements, and data         |
| <b>Test</b>              | Send test commands                                |
| <b>Recovery function</b> | Reset password and delete all users               |
| <b>Firmware update</b>   | Update firmware to the latest version             |

## Default Passwords

| <b>⚠ WARNING</b>                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY</b><br><br>Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.<br><br><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b> |

The default Administrator password is **+Schneider0**.

## Changing a Password

A password can be changed with EcoStruxure Power Commission software, page 23.

Entering the current password for a given user profile is required to change the password of this user profile. Entering the Administrator password enables you to change the password of any user profile.

A password is composed of exactly 8-32 ASCII characters. It is case-sensitive and the allowed characters are:

- Digits from 0 to 9
- Letters from a to z
- Letters from A to Z
- ASCII code special characters from 33 ("!") to 126 ("~")

## Password Reset

In the case that the Administrator password is lost or forgotten, the password can be reset to the default password with *EcoStruxure Power Commission* software, page 23, and with the support of the Schneider Electric Customer Care Center.

# Power Supply

## Internal Power Supply

The TS trip system is powered by the current through the internal current transformers (CT).

- The standard protection functions of TS trip system operate with the internal current supply.
- If the load current is higher than  $0.2 I_n$ , the internal current transformers provides the power supply for the full functioning of the TS trip system. This includes:
  - The status bar
  - The ready LED
  - The service LED
  - The trip cause LEDs
  - The protection functions
  - The alarms
  - The diagnostic functions

## Internal Battery

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, NOM-029-STPS or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Do not touch live parts during battery replacement.
- Put back all devices, doors, and covers before turning on power to this equipment.
- Beware of potential hazards, and carefully inspect the work area for tools and objects that may have been left inside the equipment.

**Failure to follow these instructions will result in death or serious injury.**

When there is no power supply to the TS trip system, the internal battery powers:

- The status bar
- The ready LED
- The trip cause LEDs

The internal battery of the TS trip system can be replaced on site when discharged. The replacement can be made with the circuit breaker in the open or closed position, and the trip system supplied with power. A test of the internal battery, page 17 must be carried out immediately after the replacement to check the correct functioning of the new battery.

Order a new battery with the Schneider Electric commercial reference M012115.

For information about internal battery replacement and installation, refer to the instruction sheet on the Schneider Electric website: PKR86279.

Battery lifetime is 5 years in the following conditions:

- Ambient temperature at 25°C.

- 2 trips per year, with LEDs supplied by the battery during 2 hours.

# Firmware Update

## Introduction

The primary reason for updating the firmware of a TS trip system is to obtain the latest TS features. If the latest TS features are not required, it is not mandatory to update the firmware of the TS trip system.

The standard protection functions of the TS trip system is not active during a firmware update.

Use the latest version of EcoStruxure Power Commission software, page 23 for all firmware updates.

For more information about firmware updates, refer to the DOCA0315EN *EasyPact MVS - TS Trip System Firmware Release Notes*.

## Checking the Firmware Version

Check the firmware version:

- With EcoStruxure Power Commission software, page 23
- With EcoStruxure Power Device app, page 24

## Updating Firmware With EcoStruxure Power Commission Software

### ⚠ WARNING

#### FIRE HAZARD

Put the circuit breaker in OFF position before starting the firmware update. During firmware update, the circuit breaker cannot provide protection.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

### NOTICE

#### INTERRUPTION OF POWER SUPPLY

- The TS trip system must be powered by USB during the firmware update.
- Do not disconnect the function test and isolation module before clicking the **CLOSE** button at the end of the update procedure with EcoStruxure Power Commission software.

**Failure to follow these instructions can result in equipment damage.**

The prerequisites for updating the firmware with EcoStruxure Power Commission software are the following:

- The latest version of EcoStruxure Power Commission software must be downloaded and installed on the PC.
- The PC must be connected to a power supply. Standby mode must be deactivated to avoid the possibility of interruption during the update.
- The PC must be connected to the 5-pin plug on the TS trip system through a function test and isolation module (commercial reference LV910200SP).

The Administrator password of the TS trip system is required to launch the firmware update.

**NOTE:** The protection functions are not active during TS firmware update.

For more information, refer to *EcoStruxure Power Commission Online Help*.

## Predefined Events

The following events can be generated when a firmware update is performed:

| Code          | Event                                 | History    | Severity |
|---------------|---------------------------------------|------------|----------|
| 0x1434 (5172) | <b>Firmware self diagnostic error</b> | Diagnostic | High     |

Predefined events cannot be modified by the user. For general information about events, refer to *Event Management*, page 73.

## Recommended Actions

| Code          | Event                                 | Recommended Actions                                                                |
|---------------|---------------------------------------|------------------------------------------------------------------------------------|
| 0x1434 (5172) | <b>Firmware self diagnostic error</b> | Update the firmware of the trip system with EcoStruxure Power Commission software. |

Contact your Schneider Electric Services representative for more information about who can carry out the recommended actions.

# Protection Functions

## What’s in This Part

- Electrical Distribution Protection ..... 32
- Long-Time Overcurrent Protection (L or ANSI 49RMS/51) ..... 34
- Short-Time Overcurrent Protection (S or ANSI 50TD/51) ..... 38
- Instantaneous Overcurrent Protection (I or ANSI 50)..... 40
- Ground-Fault Protection (G or ANSI 50N-TD/51N)..... 42
- Neutral Protection ..... 45
- Testing the TS Trip System ..... 48
- Thermal Memory..... 50
- Tripping Curves..... 51

# Electrical Distribution Protection

## Presentation

TS trip system are designed to provide protection against overcurrents and ground-fault currents.

The TS trip system are powered by the current flowing through the circuit breaker. The protection functions of TS trip system operate without an auxiliary power supply.

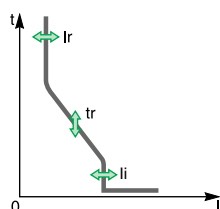
## Description

When choosing protection characteristics, take into account:

- Overcurrents (overloads and short-circuits) and potential ground-fault currents.
- Conductors that need protection.
- Coordination and selectivity between the devices.
- The presence of harmonic currents.

Protection characteristics can be represented on a trip curve that shows the circuit breaker trip time as a function of the measured current and protection settings. Protection settings are indexed on the rated current  $I_n$  of the TS trip system.

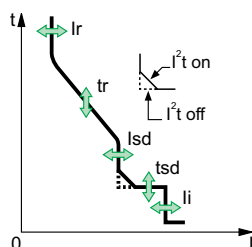
## TS 2.0 and 2.0S Trip System



TS 2.0 and 2.0S trip system provide:

- Long-time overcurrent protection ( $I_r$ )
- Instantaneous overcurrent protection ( $I_i$ )

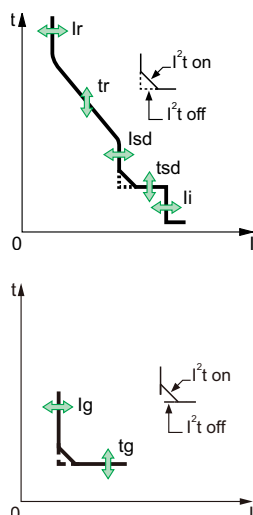
## TS 5.0 and 5.0S Trip System



TS 5.0 and 5.0S trip system provide:

- Long-time overcurrent protection ( $I_r$ )
- Short-time overcurrent protection ( $I_{sd}$ )
- Instantaneous overcurrent protection ( $I_i$ )

## TS 6.0S Trip System



TS 6.0S trip system provide:

- Long-time overcurrent protection ( $I_r$ )
- Short-time overcurrent protection ( $I_{sd}$ )
- Instantaneous overcurrent protection ( $I_i$ )
- Ground-fault protection ( $I_g$ )

## Setting Change Traceability

Changing the protection settings by using any rotary switch on the front face of the TS trip system generates the following event.

| Code          | Event                                                                                         | History    | Severity | Recommended actions                                                                 |
|---------------|-----------------------------------------------------------------------------------------------|------------|----------|-------------------------------------------------------------------------------------|
| 0x1519 (5401) | <b>Protection in fallback settings for Rotary switch failure during power on initializing</b> | Protection | Medium   | Adjust the rotary switch setting again. If it fails again, replace the trip system. |

## DIN / DINF Instantaneous Protections

DIN / DINF instantaneous protections are internal protections used when the short-circuit current reaches the withstand limit of the circuit breaker. These protections are not adjustable and are unlikely to be triggered in normal operating conditions.

The following predefined event can be generated by the DIN / DINF instantaneous protections.

| Code           | Event                                             | History | Severity | Recommended actions                  |
|----------------|---------------------------------------------------|---------|----------|--------------------------------------|
| 0x641D (25629) | <b>Ultimate self-protection trip (DIN / DINF)</b> | Trip    | High     | Check the load and reset the device. |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#), page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Long-Time Overcurrent Protection (L or ANSI 49RMS/51)

## Presentation

Long-time overcurrent protection helps to protect cables, busbars, and busbar trunking against overloads, based on the true RMS current. It is implemented independently for each phase and for the neutral.

This protection function is an overcurrent time-dependent protection with thermal memory, page 50. It operates as a thermal image, using the heating and cooling model of a conductor. After tripping, the protection continues to integrate the cooling of the conductor.

This protection function can be used also for transformer or generator protection thanks to the wide range of settings offered.

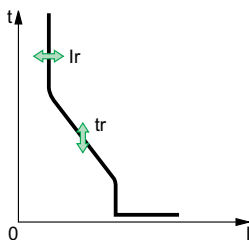
## Availability

Long-time overcurrent protection is available on:

- TS 2.0 and 2.0S, 5.0 and 5.0S, and 6.0S trip system
- 3-pole and 4-pole circuit breakers

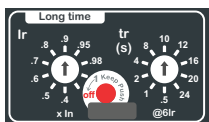
Long-time overcurrent protection is powered by the current flowing through the internal current transformers of the circuit breaker and it does not require additional external power supply.

## Operating Principle



- Long-time overcurrent protection is based on the true RMS current of phases and neutral.
- Long-time overcurrent protection is implemented independently for each phase and for neutral when present, page 45.

## Setting the Protection



The long-time overcurrent protection settings are:

- Ir: long-time overcurrent protection pickup
- tr: long-time overcurrent protection time delay

They can be set by using the Ir and tr rotary switches on the front face of the TS trip system.

The protection settings and alarm settings can be read by EcoStruxure Power Commission software, and EcoStruxure Power Device app.

The settings are displayed with:

- EcoStruxure Power Commission software
- EcoStruxure Power Device app

## Setting the Ir Pickup

The Ir pickup setting value is expressed according to the rated current  $I_n$ .

### ⚠ WARNING

#### HAZARD OF FIRE

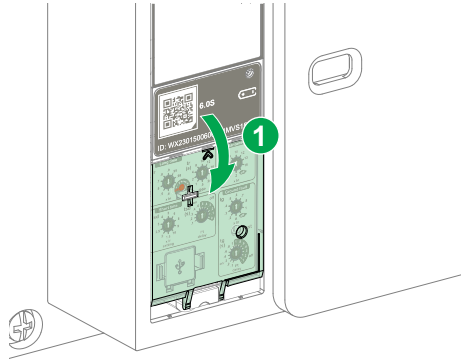
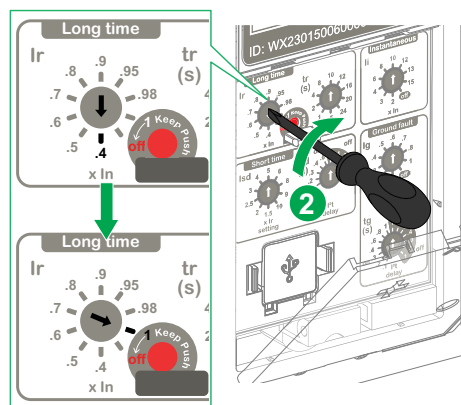
- It is recommended not to set the long-time overcurrent protection pickup Ir to off.
- When Ir is set to off, the long-time protection does not protect the system against overload. The instantaneous and/or short-time protections must be set accordingly.

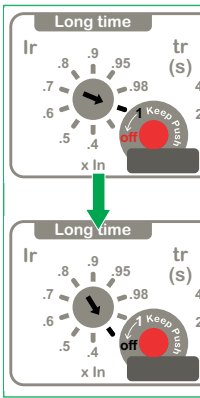
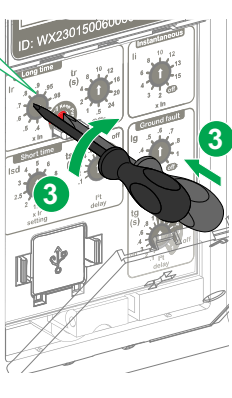
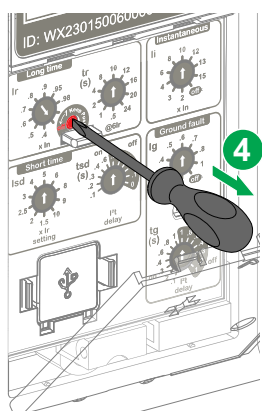
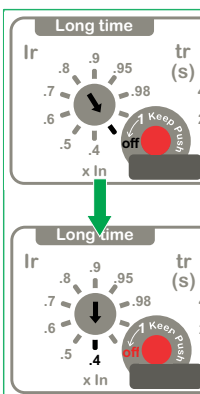
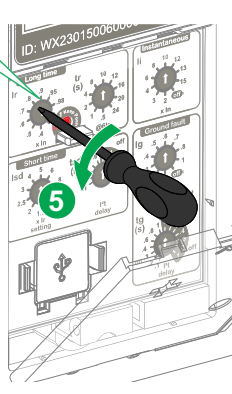
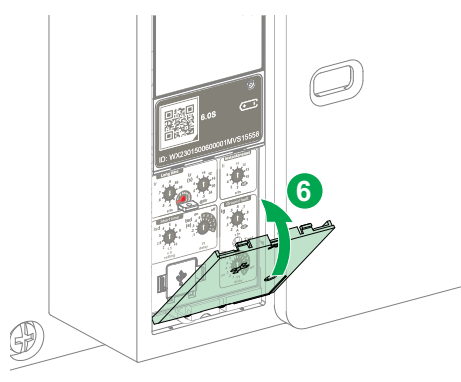
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

$I_r \text{ pickup} = I_r \text{ setting} \times I_n \text{ rated current.}$

The Ir setting values are: 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 0.98, 1 and off.

To set the Ir setting to off, follow the instructions below:

| Step | Action                                                                                                                                                     |                                                                                      |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1    | Open the trip system cover.                                                                                                                                |   |
| 2    | Rotate the Ir rotary switch in clockwise and set to value 1 by using a screwdriver.<br><b>NOTE:</b> Do not use any other sharp tools to rotate the switch. |  |

| Step | Action                                                                                                                                                                                                                                                                          |                                                                                                                                                                            |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3    | <p>Press and hold the Ir push button using a screw driver. Rotate the Ir rotary switch to off position while holding the Ir push button.</p> <p><b>NOTE:</b> The Ir off push button must be pressed and held in order to turn the Ir setting rotary switch to off position.</p> |       |
| 4    | Release the push button. The Ir setting is set to off.                                                                                                                                                                                                                          |                                                                                         |
| 5    | Rotate the Ir rotary switch to the value directly to change the Ir setting from off to other settings.                                                                                                                                                                          |   |
| 6    | Close the trip system cover.                                                                                                                                                                                                                                                    |                                                                                        |

When the current is higher than  $I_{sd}$  or  $I_i$ , only short-time overcurrent protection and instantaneous protection are operational.

## Setting the tr Time Delay

The time delay settings correspond to the tripping times for an overload of  $6 \times I_r$  in cold-state conditions.

The table below gives tripping times according to tr time delay.

| tr setting                                  | Accuracy  | 0.5 s               | 1 s    | 2 s    | 4 s   | 8 s   | 10 s  | 12 s  | 16 s  | 20 s   | 24 s   |
|---------------------------------------------|-----------|---------------------|--------|--------|-------|-------|-------|-------|-------|--------|--------|
| Resulting tripping time at $1.5 \times I_r$ | 0 to -30% | 12.5 s              | 25 s   | 50 s   | 100 s | 200 s | 250 s | 300 s | 400 s | 500 s  | 600 s  |
| Resulting tripping time at $6 \times I_r$   | 0 to -20% | 0.5 s <sup>1</sup>  | 1 s    | 2 s    | 4 s   | 8 s   | 10 s  | 12 s  | 16 s  | 20 s   | 24 s   |
| Resulting tripping time at $7.2 \times I_r$ | 0 to -20% | 0.36 s <sup>2</sup> | 0.69 s | 1.38 s | 2.8 s | 5.5 s | 6.9 s | 8.3 s | 11 s  | 13.8 s | 16.6 s |
| 1: Accuracy 0 to -40%                       |           |                     |        |        |       |       |       |       |       |        |        |
| 2: Accuracy 0 to -60%                       |           |                     |        |        |       |       |       |       |       |        |        |

## Predefined Events

The function generates the following predefined events:

| Code           | Event                                                      | History    | Severity |
|----------------|------------------------------------------------------------|------------|----------|
| 0x6400 (25600) | <b>I<sub>r</sub> trip</b>                                  | Trip       | High     |
| 0x6200 (25088) | <b>I<sub>r</sub> start (<math>I \geq 105\% I_r</math>)</b> | Protection | Medium   |
| 0x0C07 (3079)  | <b>I<sub>r</sub> protection off</b>                        | Protection | Medium   |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

Protection events are generated as follows:

- The start event is generated when the protection picks up.
- The trip event is generated when the circuit breaker tripping voltage release (MITOP) activates.

## Recommended Actions

| Code           | Event                                                      | Recommended actions                  |
|----------------|------------------------------------------------------------|--------------------------------------|
| 0x6400 (25600) | <b>I<sub>r</sub> trip</b>                                  | Check the load and reset the device. |
| 0x6200 (25088) | <b>I<sub>r</sub> start (<math>I \geq 105\% I_r</math>)</b> | Check the load.                      |
| 0x0C07 (3079)  | <b>I<sub>r</sub> protection off</b>                        | No action required.                  |

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#), page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Short-Time Overcurrent Protection (S or ANSI 50TD/51)

## Presentation

Short-time overcurrent protection helps to protect equipment against phase-to-phase, phase-to-neutral and phase-to-ground short circuits with total selectivity. It includes two characteristics, definite time and inverse time, which depend on the status of the  $I^2t$  setting.

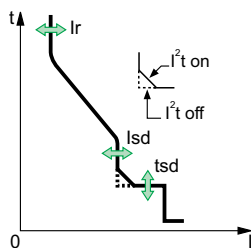
## Availability

Short-time overcurrent protection is available on:

- TS 5.0, 5.0S, and 6.0S trip system
- 3-pole and 4-pole circuit breakers

Short-time overcurrent protection is powered by the current flowing through the internal current transformers of the circuit breaker and it does not require additional external power supply.

## Operating Principle



The short-time overcurrent pickup  $I_{sd}$  sets the level of short-circuit current at which the circuit breaker trips when reaching the short-time overcurrent time delay.

The short-time overcurrent time delay  $t_{sd}$  sets the length of time during which the circuit breaker carries a short circuit within the short-time overcurrent pickup range.

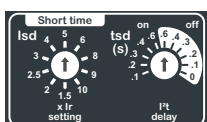
The short-time overcurrent time delay can be adjusted to:

- Five setting values with  $I^2t$  on.
  - Up to  $10 I_r$ , the tripping curve is an inverse time curve. The time delay decreases as the current increases.
  - Above  $10 I_r$ , the tripping curve is a definite time curve with a constant tripping time.
- Six setting values with  $I^2t$  off. The tripping curve is a definite time curve with a constant tripping time.

Short-time overcurrent protection is based on the true RMS current of phases and neutral.

In order to trip on an intermittent fault, the trip system accumulates the intermittent currents in the short-time tripping range that do not last long enough to trigger a trip. This accumulation may lead to shorter tripping times than those set.

## Setting the Protection



The short-time overcurrent protection settings are:

- $I_{sd}$ : short-time overcurrent protection pickup
- $t_{sd}$ : short-time overcurrent protection time delay
- $I^2t$  ( $t_{sd}$ ): short-time overcurrent protection curve ( $I^2t$  on or  $I^2t$  off)

They can be set by using the lsd and tsd rotary switches on the front face of the TS trip system.

## Setting the lsd Pickup

The short-time protection pickup lsd is set by using the lr and lsd rotary switches on the front face of the TS trip system.

The setting value is expressed in multiples of lr.

Follow the procedure below to set the short-time protection pickup:

1. Set the lr long-time protection pickup.
2. Turn the lsd rotary switch to the value required.
3. lsd pickup = lsd setting x lr pickup.

**NOTE:** When lr is set to off, lsd pickup = lsd setting x ln rated current.

The lsd setting values are: 1.5, 2, 2.5, 3, 4, 5, 6, 8, 9, 10. Accuracy: +/-10 %.

## Setting the tsd Time Delay

|                                                                                |                      |    |     |     |     |     |     |
|--------------------------------------------------------------------------------|----------------------|----|-----|-----|-----|-----|-----|
| tsd time delay (s)                                                             | l <sup>2</sup> t off | 0  | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 |
|                                                                                | l <sup>2</sup> t on  | –  | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 |
| Tripping time at 10 x lr (ms) with l <sup>2</sup> t on or l <sup>2</sup> t off | Non tripping time    | 20 | 80  | 140 | 230 | 350 | 550 |
|                                                                                | Maximum break time   | 80 | 140 | 200 | 320 | 500 | 630 |

## Predefined Events

| Code           | Event    | History | Severity |
|----------------|----------|---------|----------|
| 0x6401 (25601) | lsd trip | Trip    | High     |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

## Recommended Actions

| Code           | Event    | Recommended actions                 |
|----------------|----------|-------------------------------------|
| 0x6401 (25601) | lsd trip | Check the load and reset the device |

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#), page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Instantaneous Overcurrent Protection (I or ANSI 50)

## Presentation

Instantaneous protection helps to protect equipment against phase-to-phase, phase-to-neutral and phase-to-ground short circuits. The protection operates with a definite time characteristic. It trips without additional time delay as soon as the setting current is exceeded.

## Availability

Instantaneous overcurrent protection is available on:

- TS 2.0 and 2.0S, 5.0 and 5.0S, and 6.0S trip system
- 3-pole and 4-pole circuit breakers

Instantaneous overcurrent protection is powered by the current flowing through the internal current transformers of the circuit breaker and it does not require an additional external power supply.

## Operating Principle

The instantaneous overcurrent protection pickup sets the level of short-circuit current at which the circuit breaker trips with no intentional time delay.

Instantaneous overcurrent protection overrides short-time overcurrent protection when the instantaneous overcurrent pickup is adjusted to the same or a lower setting than the short-time overcurrent pickup.

## Setting Instantaneous Protection for TS 2.0 and 2.0S



The instantaneous protection pickup  $I_i$  is set by using the  $I_r$  and  $I_i$  rotary switches on the front face of the TS trip system.

The setting value is expressed in multiples of  $I_r$  long-time protection pickup.

1. Set the  $I_r$  long-time protection pickup.
2. Turn the  $I_i$  rotary switch to the value required.
3.  $I_i$  pickup =  $I_i$  setting  $\times I_r$  pickup.

**NOTE:** When  $I_r$  is set to off,  $I_i$  pickup =  $I_i$  setting  $\times I_n$  rated current.

The  $I_i$  setting values are: 1.5, 2, 2.5, 3, 4, 5, 6, 8, 9, 10. Accuracy:  $\pm 10\%$ .

**NOTE:** The tripping time cannot be adjusted. The tripping time characteristics are:

- Non tripping time: 20 ms
- Maximum break time: 80 ms

## Setting Instantaneous Protection for TS 5.0 and 5.0S, and 6.0S



The instantaneous protection pickup  $I_i$  is set by using the  $I_i$  rotary switch on the front face of the TS trip system.

The setting value is expressed in multiples of  $I_n$  rated current.

1. Turn the  $I_i$  rotary switch to the value required.
2.  $I_i$  pickup =  $I_i$  setting  $\times I_n$  rated current.

The  $I_i$  setting values are: 2, 3, 4, 5, 6, 8, 10, 12, 13, 15 and off. Accuracy:  $\pm 10\%$ .

The off setting disables the instantaneous overcurrent protection.

**NOTE:** The tripping time cannot be adjusted. The tripping time characteristics are:

- Non tripping time: 20 ms
- Maximum break time: 50 ms

## Predefined Events

| Code           | Event                                  | History    | Severity |
|----------------|----------------------------------------|------------|----------|
| 0x6402 (25602) | <b><math>I_i</math> trip</b>           | Trip       | High     |
| 0x0C08 (3080)  | <b><math>I_i</math> protection off</b> | Protection | Medium   |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

## Recommended Actions

| Code           | Event                                  | Recommended actions                  |
|----------------|----------------------------------------|--------------------------------------|
| 0x6402 (25602) | <b><math>I_i</math> trip</b>           | Check the load and reset the device. |
| 0x0C08 (3080)  | <b><math>I_i</math> protection off</b> | No action required.                  |

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#), page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Ground-Fault Protection (G or ANSI 50N-TD/51N)

## Presentation

Ground-fault protection provides protection against phase-to-ground fault, which is more sensitive than protection based on phase current only. It is generally used in TN-S systems but could also be used in other earthing systems.

A ground-fault in the protection conductors can cause local temperature rise at the site of the fault or in the conductors.

**NOTE:** Ground-fault protection is also called earth-fault protection.

Ground-fault and neutral protection are independent and can therefore be combined.

Ground-fault protection is based on the summation of the phases and neutral current. It detects faults downstream of the circuit breaker.

## Availability

Ground-fault protection is available on:

- TS 6.0S trip system.
- 3-pole and 4-pole circuit breakers.

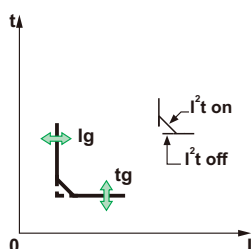
External Neutral Current Transformer (ENCT) can be used to measure the current on neutral. The commercial references of the compatible ENCT are: 33576, 34035, 34036. For information about the installation of ENCT, refer to the ENCT Instruction Sheet - 48049-222-04, and 48049-273-04.

Ground-fault protection is powered by the current flowing through the internal current transformers of the circuit breaker and it does not require an additional external power supply.

## Operating Principle

The ground-fault current is calculated or measured according to the circuit breaker configuration, as shown in the following table.

| Circuit breaker configuration | I <sub>g</sub> ground-fault current          |
|-------------------------------|----------------------------------------------|
| 3P                            | $I_g = I_A + I_B + I_C$                      |
| 4P                            | $I_g = I_A + I_B + I_C + I_N$                |
| 3P + ENCT                     | $I_g = I_A + I_B + I_C + I_N \text{ (ENCT)}$ |



The ground-fault protection pickup  $I_g$  sets the level of ground-fault current at which the circuit breaker trips when reaching the ground-fault protection time delay  $t_g$ .

The time delay  $t_g$  sets the length of time during which the circuit breaker carries a ground-fault within the ground-fault protection pickup  $I_g$  range.

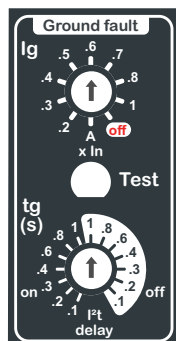
The time delay  $t_g$  can be adjusted to:

- Seven setting values with  $I^2 t$  on. In this case, the tripping curve is an inverse time curve up to  $2 \times I_r$ , meaning that the time delay decreases as the current increases. Above  $2 \times I_r$ , the tripping curve is a definite time curve with a constant tripping time.
- Seven setting values with  $I^2 t$  off. In this case, the tripping curve is a definite time curve with a constant tripping time.

Ground-fault protection is based on the true RMS current of phases and neutral.

In order to trip on an intermittent electrical fault, the trip system accumulates the intermittent currents in the ground-fault tripping range that do not last long enough to trigger a trip. This accumulation leads to shorter tripping times than those set.

## Setting the Protection



The ground-fault protection settings are:

- $I_g$ : ground-fault protection pickup
- $t_g$ : ground-fault protection time delay
- $I^2t$  ( $t_g$ ): ground-fault protection curve ( $I^2t$  on or  $I^2t$  off)

They can be set by using the  $I_g$  and  $t_g$  rotary switches on the front face of the TS trip system.

## Setting the $I_g$ Pickup

The  $I_g$  pickup setting value is expressed according to the rated current  $I_n$ .

$I_g$  pickup =  $I_g$  setting  $\times I_n$  rated current.

The  $I_g$  setting values are: A, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 1, and off.

- when  $I_n < 3200$  A, A = 0.2
- when  $I_n \geq 3200$  A, A = 500 A

## Setting the $t_g$ Time Delay

|                                                          |                    |     |     |     |     |     |     |      |
|----------------------------------------------------------|--------------------|-----|-----|-----|-----|-----|-----|------|
| $t_g$ Time delay (s)                                     | $I^2t$ off         | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.8 | 1    |
|                                                          | $I^2t$ on          | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.8 | 1    |
| Tripping time (ms) at $I_n$ with $I^2t$ on or $I^2t$ off | Non tripping time  | 80  | 140 | 230 | 350 | 550 | 710 | 900  |
|                                                          | Maximum break time | 140 | 200 | 320 | 500 | 630 | 800 | 1000 |

## Testing the Ground-Fault Protection

Test the operation of ground-fault protection as follows:

1. Check that the circuit breaker is closed.
2. Use a thin screwdriver to briefly push in (< 1 s) the **TEST** button on the front face of the TS trip system.
3. The circuit breaker trips.
4. If the circuit breaker does not trip, contact your Schneider Electric Services representative.

## Predefined Events

| Code           | Event                                | History    | Severity |
|----------------|--------------------------------------|------------|----------|
| 0x6403 (25603) | <b>Ig trip</b>                       | Trip       | High     |
| 0x641E (25630) | <b>Ig test trip with test button</b> | Trip       | High     |
| 0x0C09 (3081)  | <b>Ig protection off</b>             | Protection | Medium   |
| 0x1413 (5139)  | <b>Ig test - no trip</b>             | Diagnostic | High     |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

## Recommended Actions

| Code           | Event                                | Recommended actions                                          |
|----------------|--------------------------------------|--------------------------------------------------------------|
| 0x6403 (25603) | <b>Ig trip</b>                       | Check the load and reset the device.                         |
| 0x641E (25630) | <b>Ig test trip with test button</b> | Reset the device.                                            |
| 0x0C09 (3081)  | <b>Ig protection off</b>             | No action required.                                          |
| 0x1413 (5139)  | <b>Ig test - no trip</b>             | Restart the test. Replace the trip system if the test fails. |

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#), page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Neutral Protection

## Presentation

A long-time overcurrent protection function is dedicated to the neutral protection.

## Availability

Neutral protection is available on:

- TS 2.0 and 2.0S, 5.0 and 5.0S, and 6.0S trip system
- 4-pole circuit breakers

## Description

Where the cross-sectional area of the neutral conductor is at least equivalent to that of the phase conductor, and the current in the neutral is expected not to exceed the value in the phase conductor, it is not necessary to provide overcurrent protection for the neutral conductor.

The neutral conductor must have protection against overcurrent if:

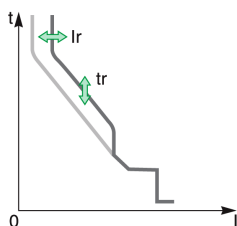
- The cross-sectional area of the neutral conductor is less than the cross-sectional area of the phase conductors.
- Non-linear loads generating third order harmonics (or multiples thereof) are installed.

TS trip system are suitable for the following protection types.

| Possible types                                 | Neutral protection |
|------------------------------------------------|--------------------|
| 4P, 3D                                         | Off                |
| 4P, 3D + N/2                                   | Half neutral       |
| 4P, 4D                                         | Full neutral       |
| P: Pole, D: Trip system, N: Neutral protection |                    |

**NOTE:** With the 4P 3D setting, the current in the neutral must not exceed the rated current of the circuit breaker.

## Operating Principle

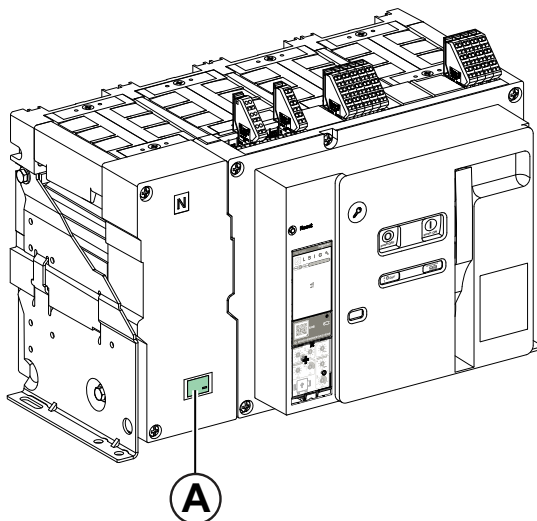


Neutral protection has the same characteristics as phase protection:

- Its pickup is proportional to the long-time protection pickup  $I_r$ .
- It has the same  $t_r$  time delay values as long-time protection.
- Its short-time and instantaneous protections are identical.

## Setting the Neutral Protection

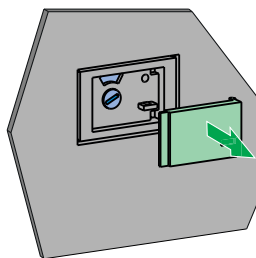
Set the type of neutral protection by using the three-position switch on four-pole EasyPact MVS circuit breakers.



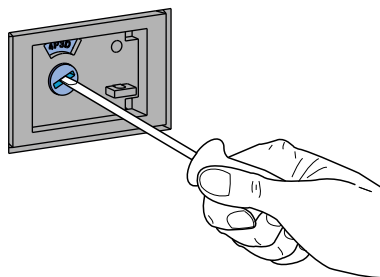
A. Cover for neutral protection three-position switch.

Follow the procedure below to set the type of neutral protection:

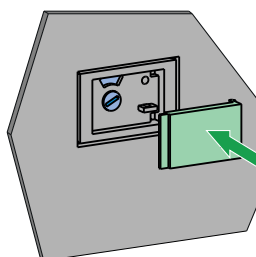
1. Remove the cover of the switch.



2. Select the protection type.



3. Put the cover back in place.



## Setting Values for Neutral Protection

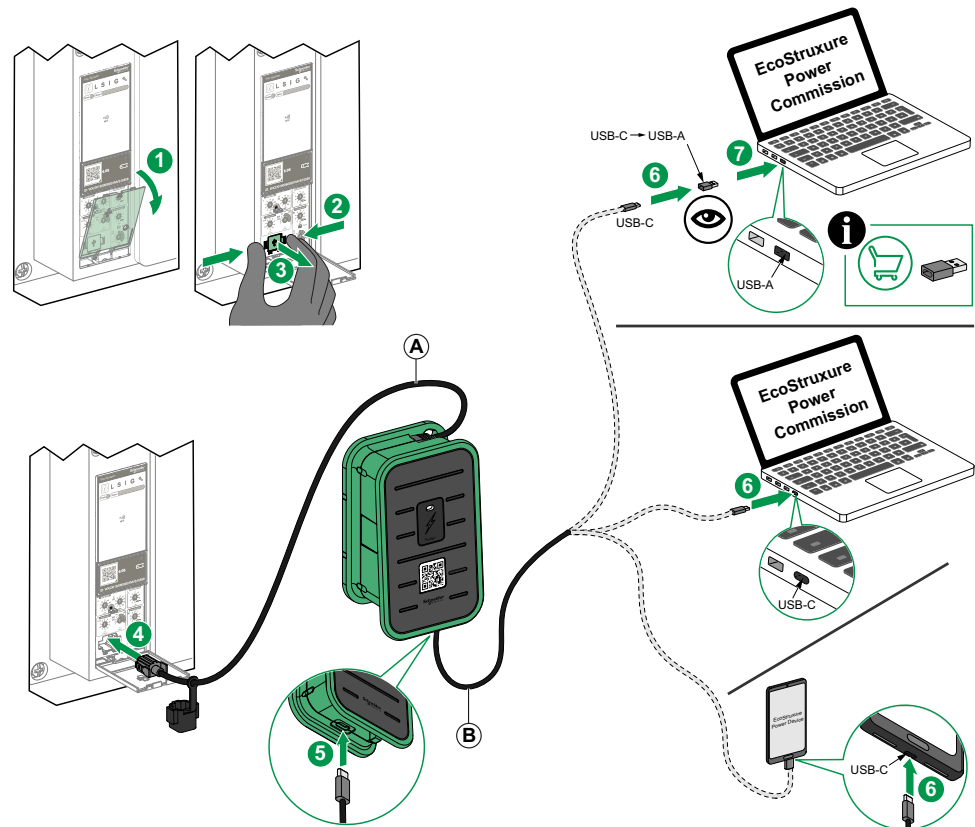
The following table shows the setting values of the neutral long-time protection and pickup for the type of neutral protection selected:

| Neutral protection type | Neutral long-time pickup value      |
|-------------------------|-------------------------------------|
| OFF                     | No long-time protection for neutral |
| N/2 (factory setting)   | $I_r/2$                             |
| N                       | $I_r$                               |

# Testing the TS Trip System

Test the TS Trip System using EcoStruxure Power Commission software installed on a PC and connected to the TS Trip System through the function test and isolation module.

## Testing Architecture



A. 5-pin cable for TS trip system

B. Cable with 2 USB-C connectors

For more information, refer to [PKR4267807 Function test and isolation module instruction sheet](#).

## Test Functions with EcoStruxure Power Commission Software

EcoStruxure Power Commission software allows you to perform the following actions on a TS trip system communicating through the function test and isolation module:

- Automatic trip curve tests
- Device check up (Force trip test)
- Preparation for primary injection tests

For more information, refer to relevant document, page 8:

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

## Trip System Test Mode

The test mode is activated when EcoStruxure Power Commission software is connected to the device through a PC connected to the 5-pin plug on the TS trip system and the **Force trip** button is clicked. For more information, refer to *EcoStruxure Power Commission Online Help*.

# Thermal Memory

## Introduction

The thermal memory is a means to simulate temperature rise and cooling caused by changes in the flow of current in the conductors.

These changes may be caused by:

- Repetitive motor starting
- Loads fluctuating near the protection settings
- Repeated circuit-breaker closing on a fault

Trip system without a thermal memory (contrary to bimetal strip thermal protection) do not react to the above types of overloads because they do not last long enough to cause tripping. However, each overload produces a temperature rise and the cumulative effect can lead to dangerous overheating.

Trip system with a thermal memory record the temperature rise caused by each overload. Even very short overloads produce a temperature rise that is stored in the memory. This information stored in the thermal memory reduces the tripping time.

## TS Trip System and Thermal Memory

The TS trip system are equipped as standard with a thermal memory.

- For the protection functions, prior to tripping, the temperature-rise and cooling time constants are equal and depend on the time delay in question:
  - If the time delay is short, the time constant is low
  - If the time delay is long, the time constant is high
- For long-time protection, following tripping, the cooling curve is simulated by the trip system. Closing of the circuit breaker prior to the end of the time constant (approximately 15 minutes) reduces the tripping time indicated in the tripping curves.

## Short-Time Protection and Intermittent Faults

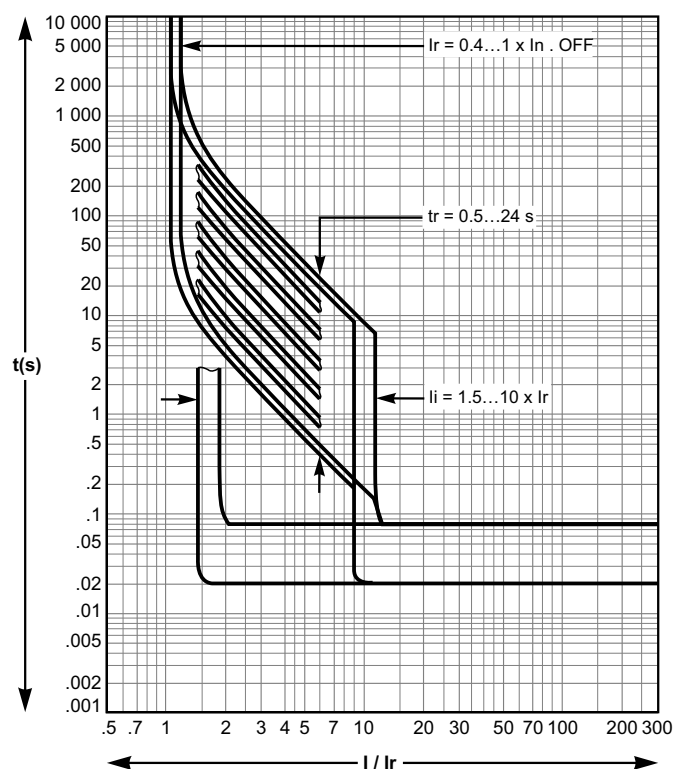
For the short-time protection function, intermittent currents that do not provoke tripping are stored in the TS memory. This information is equivalent to the long-time thermal memory and reduces the time delay for the short-time protection.

## Ground-Fault Protection and Intermittent Faults

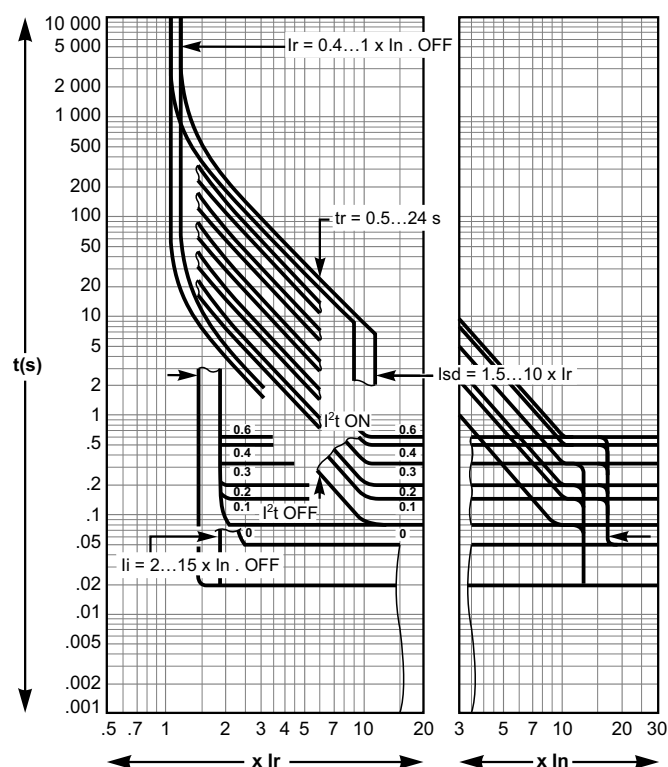
The ground-fault protection implements the same function as the short-time protection.

# Tripping Curves

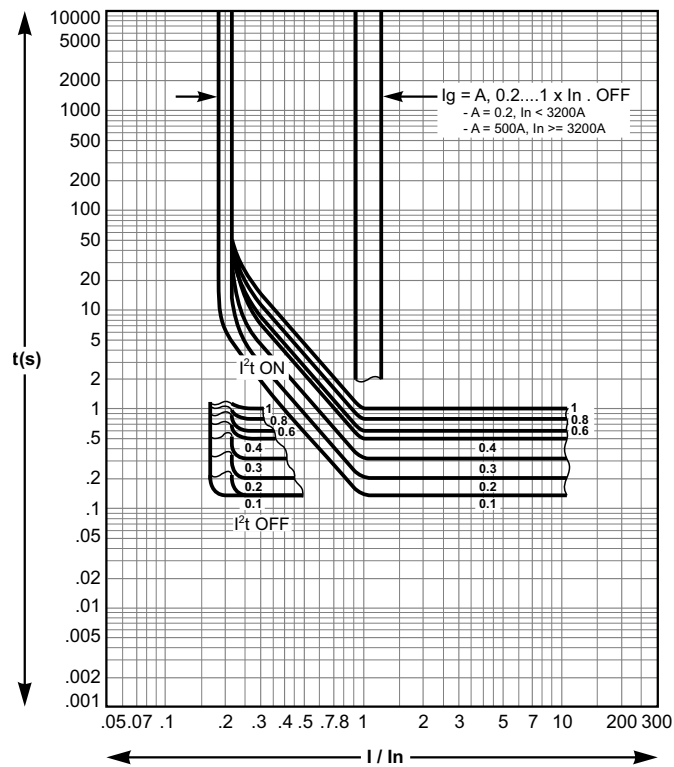
## Long-Time and Instantaneous Protection - TS 2.0 and 2.0S



## Long-Time, Short-Time, and Instantaneous Protection - TS 5.0 and 5.0S, and 6.0S



## Ground-Fault Protection - TS 6.0S



# Metering and Diagnostic Functions

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Circuit Breaker Maintenance Counters ..... 56

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Monitoring the Internal Functioning of the TS Trip System ..... 62

# Real-Time Measurements

## Presentation

TS trip system perform the following real-time tasks:

- Measure the following currents in real time and as an RMS value:
  - Current for each phase and the neutral (if present)
  - Ground-fault current
- Determine the maximum values for these electrical quantities
- Calculate the current unbalances

The values of the electrical quantities, whether measured or calculated in real time, update once a second at rated frequency.

## Measurement Availability

Measurement data is available on the EcoStruxure Power Device app through NFC wireless communication.

## Measuring the Neutral Current

4-pole circuit breakers or 3-pole circuit breakers with the ENCT wired and configured measure the neutral current:

- For a 3-pole circuit breaker, the neutral current is measured by adding a current transformer on the neutral conductor.
- For a 4-pole circuit breaker, the neutral current is measured systematically.

The neutral current is measured in the same way as the phase currents.

## Measuring the Ground-Fault Current

The ground-fault current is calculated or measured in the same way as the phase currents, according to the circuit breaker configuration, as shown in the following table.

| Circuit breaker configuration | I <sub>g</sub> ground-fault current          |
|-------------------------------|----------------------------------------------|
| 3P                            | $I_g = I_A + I_B + I_C$                      |
| 4P                            | $I_g = I_A + I_B + I_C + I_N$                |
| 3P + ENCT                     | $I_g = I_A + I_B + I_C + I_N \text{ (ENCT)}$ |

## Measuring the Current Unbalances

TS trip system calculate the current unbalance for each phase (three values).

The current unbalance is a percentage of the average current:

$$I_k \text{ unbalance (\%)} = \frac{|I_k - I_{avg}|}{I_{avg}} \times 100 \quad \text{where } k = 1, 2, 3$$

## Maximum Values

The TS trip system determines the maximum (MAX) value reached by the following electrical quantities for the period from the last reset to the present time:

- Phase and neutral currents
- Ground fault current

# Circuit Breaker Maintenance Counters

## Presentation

The maintenance indicator helps to anticipate the replacement of the breaking block before mechanical or electrical breakdown. Circuit breaker service life depends on the daily number of operating cycles with or without current.

## Operating Principle

Each time the circuit breaker operates (performs an open and close cycle with or without current), the corresponding mechanical and electrical operating counters are incremented.

The list of maintenance counters:

- Counter of total operations
- Total trip operations
- Counter of long-time trips
- Counter of short-time trips
- Counter of instantaneous trips
- Counter of ground-fault trips
- Counter of trips during tests

## Data Availability

Data is available with EcoStruxure Power Device app through NFC wireless communication.

# Alarms

## Presentation

TS trip system generates the following alarms:

- Overload alarm
- Ground-fault alarm
- Current unbalance alarm

## Overload Alarm

The overload alarm is available on TS 2.0S, 5.0S, and 6.0S trip system.

The overload alarm is detected when the load current is above 90% of  $I_r$ , the long-time overcurrent protection pickup.

## Ground-Fault Alarm

The ground-fault alarm is available on TS 6.0S trip system. As the ground-fault protection, the ground-fault alarm is based either on the summation of the phases and neutral current or on the signal delivered by an external sensor or an external neutral current transformer (ENCT).

The ground-fault alarm is detected when the ground-fault current is above the ground-fault alarm threshold:

- Setting range:  $0.2-1 \times I_n$ , in step of 1 A
- Factory setting:  $0.2 \times I_n$

The ground-fault alarm threshold can be set with EcoStruxure Power Commission software (password-protected). The setting can be read by EcoStruxure Power Commission software, and EcoStruxure Power Device app.

The modification of the ground-fault alarm threshold generates the **Configuration change** event.

## Current Unbalance Alarm

The current unbalance alarm is available on TS 2.0S, 5.0S, and 6.0S trip system.

The current unbalance alarm is detected when the current unbalance is above 50% of the average current, arithmetic mean of the 3 phase currents.

## Predefined Events

The function generates the following predefined events:

| Code          | Event                                                                          | History    | Severity |
|---------------|--------------------------------------------------------------------------------|------------|----------|
| 0x03F5 (1013) | <b><math>I_r</math> prealarm (<math>90\% I_r &lt; I &lt; 105\% I_r</math>)</b> | Protection | Medium   |
| 0x050C (1292) | <b><math>I_g</math> alarm (<math>I \geq 80\% I_g</math>)</b>                   | Protection | Medium   |
| 0x1517 (5399) | <b>Current unbalance &gt; 50%</b>                                              | Diagnostic | Low      |

Predefined events cannot be modified by the user. For general information about events, refer to [Event Management](#), page 73.

## Recommended Actions

| Code          | Event                                           | Recommended actions                                        |
|---------------|-------------------------------------------------|------------------------------------------------------------|
| 0x03F5 (1013) | <b>Ir prealarm (90% Ir &lt; I &lt; 105% Ir)</b> | Check the load.                                            |
| 0x050C (1292) | <b>Ig alarm ( I ≥ 80% Ig)</b>                   | Check insulation between phase/neutral and ground (earth). |
| 0x1517 (5399) | <b>Current unbalance &gt; 50%</b>               | Check the load.                                            |

# Monitoring the Tripping Circuit

## Presentation

When the TS trip system is energized, it provides constant monitoring of the following:

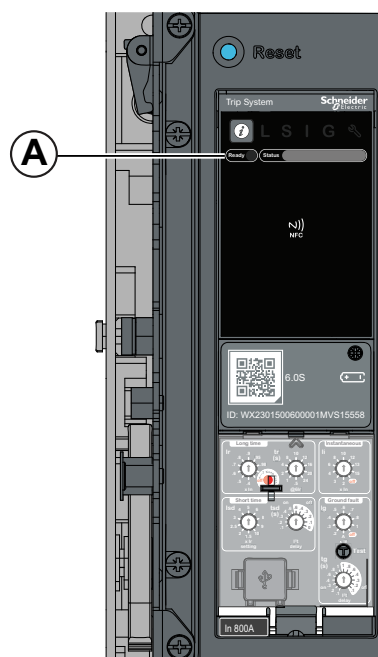
- The internal tripping circuit.
- The connection of the internal sensors (internal current transformers, sensor plug, performer plug).
- The connection of the circuit breaker tripping voltage release (MITOP) to the TS trip system.

**NOTE:** The mechanism is not monitored. It is recommended to perform preventive maintenance as proposed by Schneider Electric.

## Availability

Monitoring the tripping circuit function of the TS trip system is available on TS 2.0S, 5.0S, and 6.0S trip system.

## Operating Principle: Ready LED



A. Ready LED

The result of the monitoring is indicated by the ready LED on the front face of the TS trip system, as follows:

- The ready LED is flashing green: the internal tripping circuit of the circuit breaker is functioning correctly.
- The ready LED is off:
  - The TS trip system is not powered.
  - Or there is a detected incident in the tripping circuit.

## Circuit Breaker Status

Following the detection of an incident in the tripping circuit the circuit breaker may be tripped or not, depending on the type of incident detected.

## Tripping Data and Availability

The following data about the tripping function is logged by the TS trip system:

- Total number of trips
- The recent trip cause

The tripping data is available with:

- The EcoStruxure Power Commission software for last 30 trip records.
- The EcoStruxure Power Device app through NFC communication.

## Predefined Events

The monitoring of the tripping circuit generates the following events:

| Code           | Event                                               | History    | Severity |
|----------------|-----------------------------------------------------|------------|----------|
| 0x6407 (25607) | Self diagnostic trip                                | Trip       | High     |
| 0x6433 (25651) | Phase current transformer sensors open circuit trip | Trip       | High     |
| 0x1400 (5120)  | Control unit self test major malfunction 1          | Diagnostic | High     |
| 0x1402 (5122)  | Internal current sensor disconnected                | Diagnostic | High     |
| 0x1404 (5124)  | Control unit self test major malfunction 2          | Diagnostic | High     |
| 0x1405 (5125)  | Control unit self test major malfunction 3          | Diagnostic | High     |
| 0x1406 (5126)  | Control unit self test major malfunction 4          | Diagnostic | High     |
| 0x1416 (5142)  | Control unit self test major malfunction 5          | Diagnostic | High     |
| 0x1409 (5129)  | Unable to read sensor plug                          | Diagnostic | High     |
| 0x1518 (5400)  | Control unit self test major malfunction 6          | Diagnostic | High     |

Predefined events cannot be modified by the user. For general information about events, refer to the [Event Management](#), page 73.

## Recommended Actions

| Code           | Event                                               | Recommended actions                                                                                                                                            |
|----------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x6407 (25607) | Self diagnostic trip                                | Plan to replace the TS trip system.                                                                                                                            |
| 0x6433 (25651) | Phase current transformer sensors open circuit trip | Plan to replace the circuit breaker.                                                                                                                           |
| 0x1400 (5120)  | Control unit self test major malfunction 1          | Plan to replace the TS trip system.                                                                                                                            |
| 0x1402 (5122)  | Internal current sensor disconnected                | Plan to replace the circuit breaker.                                                                                                                           |
| 0x1404 (5124)  | Control unit self test major malfunction 2          | Plan to replace the TS trip system.                                                                                                                            |
| 0x1405 (5125)  | Control unit self test major malfunction 3          | Plan to replace the TS trip system.                                                                                                                            |
| 0x1406 (5126)  | Control unit self test major malfunction 4          | Plan to replace the TS trip system.                                                                                                                            |
| 0x1416 (5142)  | Control unit self test major malfunction 5          | Plan to replace the TS trip system.                                                                                                                            |
| 0x1409 (5129)  | Unable to read sensor plug                          | Check connection of the sensor plug and performer plug. If the connection is good but the event is detected again, replace the sensor plug or the trip system. |
| 0x1518 (5400)  | Control unit self test major malfunction 6          | Plan to replace the TS trip system.                                                                                                                            |

Contact Schneider Electric Support or your Schneider Electric Services representative for more information about who can carry out the recommended actions.

## Resetting a Trip Event

For information about resetting the circuit breaker after a trip due to an electrical fault, refer to the [relevant document](#):

- *EasyPact MVS1 Circuit Breakers with TS Trip System - User Guide*
- *EasyPact MVS2 Circuit Breakers with TS Trip System - User Guide*

# Monitoring the Internal Functioning of the TS Trip System

## Presentation

The TS trip system carries out a series of self tests to monitor:

- Correct internal functioning
- Wireless NFS communication
- The presence and state of the internal battery
- The presence of the internal current power supply sensors
- Internal temperature

## Availability

Monitoring the internal functioning of the TS trip system is available on TS 2.0S, 5.0S, and 6.0S trip system.

## Operating Principle

The ready LED, status bar, service LED, and trip cause LEDs provide visual information about the health state of the TS trip system. The detection of an invalid result in the self tests generates an event (logged in the Diagnostic history) which can be classified as high, medium, or low severity:

- Low severity event indicates the detection of an invalid result which has no operational impact. The standard (LSIG) protection functions are unaffected.
- Medium severity event indicates the detection of an invalid result which has a minor operational impact. The standard (LSIG) protection functions are unaffected. A check must be performed at next maintenance.
  - The ready LED is flashing in green
  - The service LED is lit in red if the event requires non-urgent maintenance
  - All trip cause LEDs are off
  - The status bar is lit in orange
- High severity event indicates the detection of an invalid result which can have a major operational impact. The standard (LSIG) protection functions can be affected. The trip system must be replaced without delay.
  - The ready LED is off
  - The service LED is flashing in red if the event requires immediate maintenance
  - Status bar is flashing in red

When monitoring of the internal functioning of TS trip system detects an invalid result with medium or high severity, an event is generated with corresponding event message.

## Data Availability

Monitoring data is available with:

- The EcoStruxure Power Commission software for all severities.

- The EcoStruxure Power Device app through NFC communication.

## Predefined Events

The function generates the following events:

| Code           | Event                                                                           | History    | Severity |
|----------------|---------------------------------------------------------------------------------|------------|----------|
| 0x142F (5167)  | <b>Last modification of protection settings has not been completely applied</b> | Diagnostic | Medium   |
| 0x0D09 (3337)  | <b>Firmware discrepancy within control unit</b>                                 | Diagnostic | Medium   |
| 0x151A (5402)  | <b>Control unit over temperature</b>                                            | Diagnostic | Medium   |
| 0x6405 (25605) | <b>Over temperature trip</b>                                                    | Trip       | High     |
| 0x150F (5391)  | <b>Internal Current Power Supply (CPS) sensors malfunction.</b>                 | Diagnostic | High     |

Predefined events cannot be modified by the user. For general information about events, refer to the [Event Management](#), page 73.

## Recommended Actions

| Code           | Event                                                                           | Recommended actions                                                                                                                                    |
|----------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x142F (5167)  | <b>Last modification of protection settings has not been completely applied</b> | Apply again the protection settings.                                                                                                                   |
| 0x0D09 (3337)  | <b>Firmware discrepancy within control unit</b>                                 | Check the firmware version of the TS trip system with EcoStruxure Power Commission software. If not latest, update the firmware of the TS trip system. |
| 0x1414 (5140)  | <b>NFC invalid communication #2</b>                                             | Plan to replace the trip system.                                                                                                                       |
| 0x6405 (25605) | <b>Over temperature trip</b>                                                    | Check the load and reset the trip system.                                                                                                              |
| 0x150F (5391)  | <b>Internal Current Power Supply (CPS) sensors malfunction.</b>                 | Replace the circuit breaker.                                                                                                                           |
| 0x151A (5402)  | <b>Control unit over temperature</b>                                            | Check the trip system.                                                                                                                                 |

Contact Schneider Electric Support or your Schneider Electric Services representative for more information about who can carry out the recommended actions.

## Internal Battery Replacement

The internal battery of the TS 6.0S trip system can be replaced on site when discharged. The replacement can be made with the circuit breaker in the open or closed position, and the trip system supplied with power.

To check the correct functioning of the new battery. A test of the internal battery must be carried out immediately after the replacement of the internal battery.

For information about internal battery replacement and installation, refer to the instruction sheet on the Schneider Electric website: [PKR86279](#).

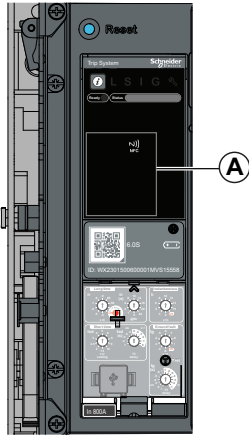
# Communication Functions

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| Cybersecurity Recommendations ..... | 68 |
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# NFC Communication

## Description



A. NFC wireless communication zone

Using Near Field Communication (NFC), you can access the TS trip system from a smartphone running the *EcoStruxure Power Device* app, page 24 and download data to your smartphone, even when the trip system is not powered.

NFC communication is always enabled and cannot be disabled.

You can establish an NFC connection with only one TS trip system at the same time and only one smartphone at a time can connect to a trip system.

TS trip system use a passive NFC tag, which does not have a power source. It draws power from the smartphone that reads it, and therefore does not emit any electromagnetic waves when NFC communication is not in use.

## Availability

NFC communication is available on TS 2.0S, 5.0S, and 6.0S trip system.

## Prerequisites for Using NFC

The prerequisites for establishing an NFC connection are:

- You must have a smartphone running the *EcoStruxure Power Device* app.
- The smartphone must support NFC wireless communication.
  - An Android smartphone with version 4.4 and above.
  - An iOS smartphone with iOS 13 is the minimum requirement.
- You must have physical access to the TS trip system. The smartphone must be held within 20 mm of the NFC wireless communication zone of the trip system.

## Establishing an NFC Connection

Follow the procedure below to establish an NFC connection from your smartphone to the TS trip system.

1. Start *EcoStruxure Power Device* app on your smartphone.
2. Select **Connect to device through NFC**.

- Place your smartphone against the TS NFC wireless communication zone at a maximum distance of 20 mm.

**NOTE:** The NFC antenna of the trip system is located around the TS NFC wireless communication zone. The position of the NFC antenna on the smartphone depends on the model used. If communication is not established, check where the NFC antenna is located on your smartphone and repeat the procedure.

The first beep indicates that the communication is established. The EcoStruxure Power Device app then starts downloading data. The second beep indicates that the data download is complete.

**NOTE:** You must not remove your smartphone from the TS NFC wireless communication zone while the data download is in progress. If you do, the download is incomplete (you lose the NFC connection).

- Remove your smartphone from the TS NFC wireless communication zone.

NFC data downloaded from the TS trip system is not automatically refreshed. To get updates, you must establish a new NFC connection. Be aware that each new set of data downloaded overwrites the previous data. You can use the EcoStruxure Power Device app to consult downloaded data.

## Troubleshooting NFC Communication Issues

The following table lists common problems when establishing an NFC connection to the TS trip system.

| Problem description                                                                                            | Probable causes                                                                                        | Solutions                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The NFC connection is not established. (No beep)                                                               | The smartphone is out of the NFC wireless communication zone.                                          | Move your smartphone so that its antenna is in the NFC wireless communication zone and repeat the connection procedure.                                            |
|                                                                                                                | Your smartphone has a reinforced case (for example, metallic) which is blocking the signal.            | Remove the case of your smartphone and repeat the connection procedure.                                                                                            |
|                                                                                                                | Your smartphone does not have NFC capability.                                                          | –                                                                                                                                                                  |
|                                                                                                                | NFC communication is not activated on your smartphone.                                                 | Make sure NFC communication is activated on your smartphone.                                                                                                       |
| The NFC connection was established but the signal is lost. (No second beep)                                    | The smartphone was moved out of NFC wireless communication zone before the data transmission finished. | Move your smartphone into the NFC wireless communication zone and repeat the connection procedure. Keep the smartphone in the zone until you hear the second beep. |
| The data is not transmitted. The message <b>Memory fail. Please try again.</b> is displayed on the smartphone. |                                                                                                        |                                                                                                                                                                    |
| Information not available, or limited.                                                                         | The internal battery charge is too low to record the information.                                      | Replace the internal battery for information to be recorded in future.                                                                                             |

# USB Connection

## Description

From a PC running EcoStruxure Power Commission software, you can access all of the monitoring and test functions of the TS trip system by connecting a PC to the trip system through the function test and isolation module.

## Prerequisites for Using a USB Connection

The prerequisites for establishing a USB connection are:

- You must have the USB driver installed on the PC.
- You must have physical access to the TS trip system to connect the cable directly to the trip system.
- You must have the function test and isolation module (commercial reference LV910200SP) to connect the USB port of the PC to the TS trip system.

## Connecting a PC Running EcoStruxure Power Commission Software to 5-Pin Plug

Follow the procedure below to connect to the TS trip system using the function test and isolation module:

1. Connect your PC to the TS trip system through the function test and isolation module (same connection as for testing the protection functions, page 48).  
The PC provides power to the TS trip system if necessary.
2. Start EcoStruxure Power Commission software on the PC and log in.
3. On the EcoStruxure Power Commission home page, connect to the TS trip system. There are different ways to connect EcoStruxure Power Commission software to the TS trip system, depending on whether it is the first connection and how the device is discovered. For more information, refer to *EcoStruxure Power Commission Online Help*.
4. With EcoStruxure Power Commission software connected to the TS trip system you have access to all functions of the software.

# Cybersecurity Recommendations

## Overview

The EasyPact MVS circuit breaker with its TS trip system is a key component of your installation. It offers multiple communication features that bring greater efficiency and flexibility in managing your installation. However the features also make it potentially vulnerable to cyber attacks.

This section lists some of the elementary precautions that you must take to protect the communications paths that give access to information about your installation, and control over it.

The communication paths to protect include:

- Local access communication paths
  - Wireless NFC communication
  - Function test and isolation module

For more detailed information about cybersecurity for the EasyPact MVS circuit breakers, refer to *DOCA0122EN MasterPacT, ComPacT, PowerPacT - Cybersecurity Guide*.

## General Cybersecurity Recommendations

 **WARNING**

**POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**

- Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.
- Disable unused ports/services and default accounts to help minimize pathways for malicious attackers.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example, least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**NOTICE**

**INTERRUPTION OF POWER SUPPLY**

The TS trip system must be continuously powered by USB during the firmware update.

**Failure to follow these instructions can result in equipment damage.**

## Cybersecurity Recommendations for Local Access Communication Paths

To help protect local access communication paths, it is recommended to:

- Keep locked the enclosure where the EasyPact MVS circuit breaker is located so that no unauthorized person can access the TS trip system.
- For the HMI (if any), a lead seal shall be used to prevent unauthorized access to buttons or rotary switches.

## Specific Cybersecurity Recommendations for Wireless NFC Communication

To protect access to data accessible through NFC, it is recommended to make sure that the smartphones running the EcoStruxure Power Device app are password-protected and for professional use only.

## Specific Cybersecurity Recommendations for USB Connection

To protect access to functions accessible through a USB connection on the TS trip system, it is recommended that:

- The PCs running the monitoring software are hardened following the guidelines provided in *MasterPacT*, *ComPacT*, *PowerPacT - Cybersecurity Guide*.
- The most up-to-date hardening methods for the operating system are running on your PCs.

# Security Log

## Description

The security log feature of the TS trip system generates the security related events such as:

- Successful or unsuccessful login attempts
- User account or password change
- Configuration change

The security events are recorded in a security log and provide information to monitor activities carried out in the system. The security log can record up to 252 security events. Each new security event overwrites the oldest event, when the security log is full.

**NOTE:** To avoid overwriting old security logs, export the security log every half-year.

The security log can be exported by Schneider Electric Services representative. The security log delivered by Schneider Electric Services can be used to detect and respond in the event of security compromise.

## Security Log Export

The security log is a file in CVS format, with one security event per line.

Below is the example of security log file:

| A     | B                        | C                    | D      | E                      | F                    | G                                                    | H | I                          |
|-------|--------------------------|----------------------|--------|------------------------|----------------------|------------------------------------------------------|---|----------------------------|
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | CONNECTION_SUCCESS     | [meta sequenceld=1]  | [authn@3833 itf=USB user=DefUser]                    |   | EPC connection             |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | CONNECTION_FAILURE     | [meta sequenceld=2]  | [authn@3833 itf=USB user=DefUser]                    |   | Unknown user               |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | CONNECTION_FAILURE     | [meta sequenceld=3]  | [authn@3833 itf=USB user=DefUser]                    |   | Invalid password           |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | FIRMWARE_UPDATE        | [meta sequenceld=4]  | [config@3833 object=Firmware value=version]          |   | Protection firmware update |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | CONNECTION_SUCCESS     | [meta sequenceld=5]  | [authn@3833 itf=USB user=DefUser]                    |   | EPC connection             |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=6]  | [cred@3833 user=DefUser]                             |   | User account creation      |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=7]  | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=8]  | [cred@3833 user=DefUser]                             |   | Password update            |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=9]  | [cred@3833 user=DefUser]                             |   | Password reset             |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=10] | [cred@3833 user=DefUser]                             |   | User account deletion      |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=11] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=12] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=13] | [cred@3833 user=DefUser]                             |   | User account deletion      |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=14] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=15] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | User   | USERACCOUNT_CHANGE     | [meta sequenceld=16] | [cred@3833 user=DefUser]                             |   | User account deletion      |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=17] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=18] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=19] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=20] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=21] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=22] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | OPERATION_UNAUTHORIZED | [meta sequenceld=23] | [authz@3833 user=DefUser object=C-API action=Update] |   | Unauthorized operation     |
| <86>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | COAP   | CONNECTION_SUCCESS     | [meta sequenceld=24] | [authn@3833 itf=USB user=DefUser]                    |   | EPC connection             |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | System | OPERATING_MODE_CHANGE  | [meta sequenceld=25] | [system@3833 object=Protection]                      |   | Enter test mode            |
| <85>1 | 2000-01-01T00:00:00.000Z | Trip System MVS15557 | System | OPERATING_MODE_CHANGE  | [meta sequenceld=26] | [system@3833 object=Protection]                      |   | Exit test mode             |

A security event has following data available:

- Column A: Event Severity
  - 81 (Alert): urgent corrective action is required.
  - 85 (Notice): corrective action needs to be scheduled.
  - 86 (Information): for information only.
- Column B: Date and time of event occurrence (TS trip system only)
- Column C: Host name, commercial reference of the TS trip system
- Column D: Event Category
  - CoAP: USB communication interface with CoAP protocol
  - Config: Device configuration
  - System: System mode
  - Security Log: Security log related behavior
  - User: User account who does the operation
- Column E: Message ID

- Column F: Security log sequence number, helps to show the event occurrence sequence when the time is not synced.
- Column G: Pre-defined event information structure, including user name, type, etc.
- Column H: Event message

## Security Event List

| Category     | Severity    | Event message                    | Description                                                               | Recommended actions                                                                                                                         |
|--------------|-------------|----------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| CoAP         | Information | EPC connection                   | Successful connection                                                     | -                                                                                                                                           |
| CoAP         | Information | User logout                      | Disconnection                                                             | -                                                                                                                                           |
| CoAP         | Alert       | Password expired                 | Successful connection with invalid credentials.                           | Change the expired password and login again.                                                                                                |
| CoAP         | Notice      | Invalid password                 | Unsuccessful connection                                                   | Check if the unsuccessful connection is normal.                                                                                             |
|              |             | Unknown user                     | Unsuccessful connection                                                   | Check the unknown user.                                                                                                                     |
| CoAP         | Alert       | Account locking                  | User account locking due to 3 times unsuccessful authentication attempts. | <ul style="list-style-type: none"> <li>• Abnormal scenario</li> <li>• Check if any unauthorized user trying to login the device.</li> </ul> |
| CoAP         | Alert       | Login denied                     | Denied login (account is blocked)                                         | <ul style="list-style-type: none"> <li>• Abnormal scenario</li> <li>• Check if any unauthorized user trying to login the device.</li> </ul> |
| CoAP         | Notice      | Unauthorized operation           | Unauthorized operation                                                    | Check for account abnormal operation.                                                                                                       |
| Update       | Information | Protection firmware update       | Firmware update                                                           | Check if the firmware upgrade operation is normal.                                                                                          |
| Update       | Alert       | Invalid format                   | The updated firmware format is invalid                                    | <ul style="list-style-type: none"> <li>• Abnormal firmware release.</li> <li>• Check the firmware release file and its origin.</li> </ul>   |
|              |             | Incompatible version             | The version is not compatible.                                            |                                                                                                                                             |
|              |             | Unauthenticated origin           | The firmware origin cannot be authenticated.                              |                                                                                                                                             |
|              |             | Invalid signature                | The firmware signature is invalid.                                        |                                                                                                                                             |
|              |             | Rollback operation detected      | The firmware version rollback.                                            |                                                                                                                                             |
| Config       | Information | Overload pre-alarm threshold     | Configuration change                                                      | Check if the mode switch operation is normal.                                                                                               |
|              |             | Ground fault pre-alarm threshold |                                                                           |                                                                                                                                             |
| System       | Notice      | Enter test mode                  | Operating mode change                                                     | Check if the mode switch is normal.                                                                                                         |
|              |             | Exit test mode                   |                                                                           |                                                                                                                                             |
| Security Log | Information | Security log export              | Retrieval/export of the security logs of the device.                      | -                                                                                                                                           |
| Security Log | Notice      | Security log cleared             | Security logs are cleared                                                 | Check if the security log clear operation is normal.                                                                                        |

| Category | Severity    | Event message             | Description                         | Recommended actions                                      |
|----------|-------------|---------------------------|-------------------------------------|----------------------------------------------------------|
| User     | Information | User account creation     | User account creation               | Check if the user account and password change is normal. |
|          |             | User account modification | User account modification           |                                                          |
|          |             | User account deletion     | User account deletion               |                                                          |
|          |             | Password update           | Password update                     |                                                          |
|          |             | Password reset            | Password reset                      |                                                          |
| User     | Information | Reset to factory default  | Reset to factory default operation. | Check if the reset factory operation is normal.          |

## Security Recommended Actions

Contact your Schneider Electric Services representative to get the security log, if you detect an abnormal situation like:

- Account or password abnormal behavior
- Unwanted change in data or settings
- Device abnormal behavior

Your Schneider Electric Services representative can provide support in analyzing the events recorded in the security log.

- Check regularly the security log, to find whether the device is potentially at risk of being attacked and whether there have already been some existing illegal people's attacks.
- Check the security events of user authentication and authorization of the device whether there are:
  - Multiple login failure events
  - Account lock events
  - Login events using expired passwords
  - Unauthorized events of user creation and password modification
  - Unauthorized reset
- Check the device USB configuration connection events, whether there are:
  - Illegal connection events
  - Illegal data and configuration operations via USB connection
- Check the device configuration data change and operation mode change events, whether there are abnormal configuration and mode change operations.
- Check the events of clearing security logs to detect if there is potential attackers who illegally clear security log records.
- Check firmware update events to detect if there are illegal and failed upgrades.
- Check the events record of factory reset settings to detect if there is any illegal factory reset operation.

# Event Management

## What’s in This Part

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# Event Definition

## Definition

An event is a change in state of digital data, or any incident detected by the TS trip system.

Events are time stamped and logged in the event history of each module.

Events are categorized according to a level of severity:

- High: urgent corrective action is required.
- Medium: corrective action needs to be scheduled.
- Low: for information only.

Events can be consulted with:

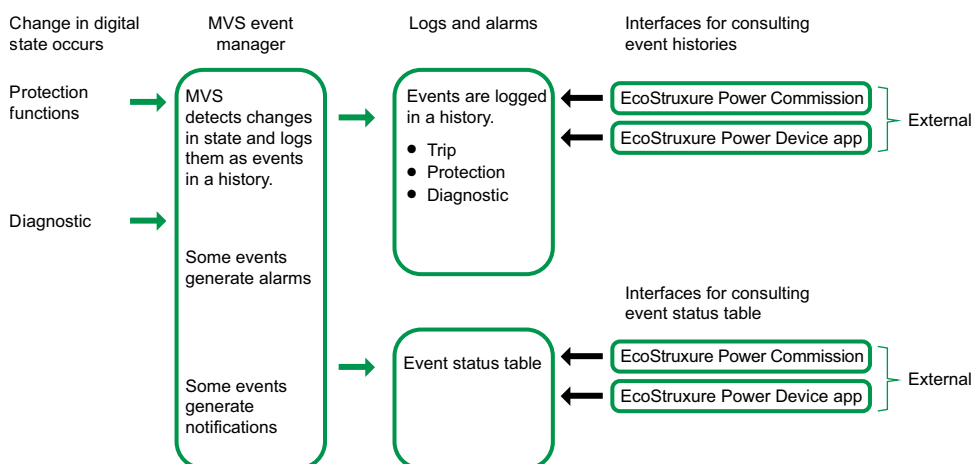
- The EcoStruxure Power Commission software
- The EcoStruxure Power Device app

Alarms and trips are events that require specific attention from the user:

- A trip is a high severity event generated when the circuit breaker trips.
- An alarm is an event with medium or high severity.

## Management of Events by TS Trip System

The following diagram gives an overview of how events are managed by the TS trip system.



# Event Type

## Overview

Events can be the following types:

- **Occurrence/completion** (Entry/Exit): Events which have a defined beginning and end, representing the beginning or end of a system state. The occurrence and completion are both time-stamped and logged in a history. For example, **Ir prealarm (90% Ir < I < 105% Ir)** is an occurrence/completion event.
- **Instantaneous** (Pulse): Events with no duration. Only the occurrence of the event is time-stamped and logged in a history. For example, a circuit breaker trip is an instantaneous event.

The event type cannot be customized.

## Event Status Definition

The status of an event is active, inactive, or held. It depends on the event type and latch mode. The status of all events can be consulted at any time, page 84.

## Latch Mode

An event can be unlatched or latched:

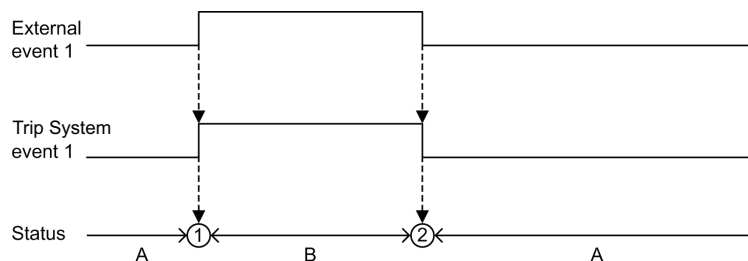
- **Unlatched:** The event status is active while the cause of the event is present. It automatically returns to inactive when the cause of the event disappears or is resolved.
- **Latched:** The event status does not automatically return to inactive when the cause of the event disappears or is resolved. It stays in the held state until it is reset by the user.

## Activity

Certain events can be disabled so that the event is not taken into consideration by the TS trip system. In this case, the event is not logged in a history and does not generate an alarm.

## Unlatched Occurrence/Completion Events

The following graph shows the event status for an unlatched occurrence/completion event:



**A** Event inactive

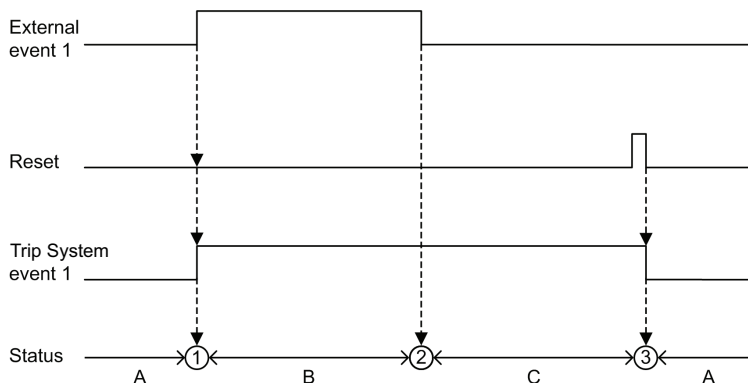
**B** Event active

**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event completion: event is logged in a history.

## Latched Occurrence/Completion Events

The following graph shows the event status for a latched occurrence/completion event:



**A** Event inactive

**B** Event active

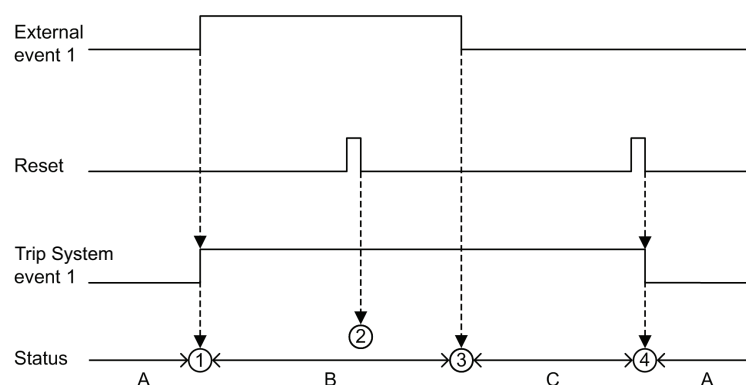
**C** Event held

**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event completion: event is logged in a history.

**3** Event reset: reset command is logged in operation history. All held events are reset.

The following graph shows the event status for a latched event where a reset is attempted before completion of the event:



**A** Event inactive

**B** Event active

**C** Event held

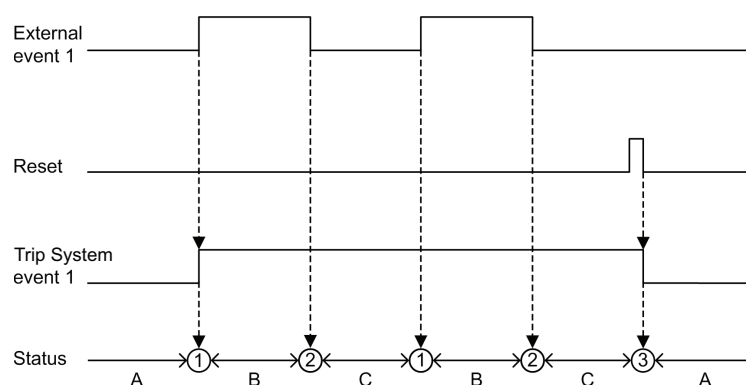
**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event reset: reset command is logged in the operation history but has no effect on TS event 1 as external event is not completed.

**3** Event completion: event is logged in a history.

**4** Event reset: reset command is logged in the operation history. All held events are reset.

The following graph shows the event status for a latched, recurring occurrence/completion event:



**A** Event inactive

**B** Event active

**C** Event held

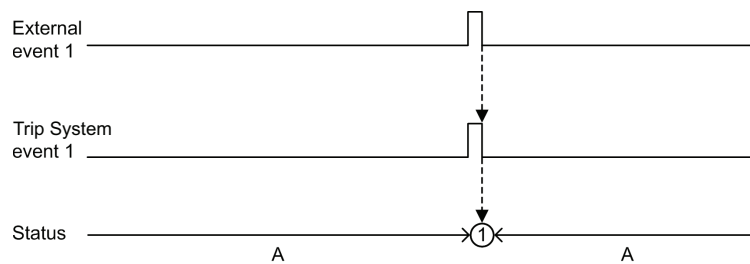
**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event completion: event is logged in a history.

**3** Event reset: reset command is logged in the operation history. All held events are reset.

## Unlatched Instantaneous Events

The following graph shows the event status for an unlatched instantaneous event:

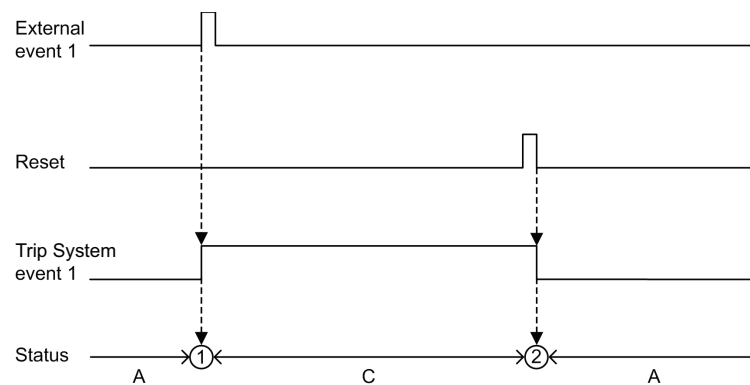


**A** Event inactive

**1** Event occurrence: event is logged in a history and notified, depending on severity.

## Latched Instantaneous Events

The following graph shows the event status for a latched instantaneous event:



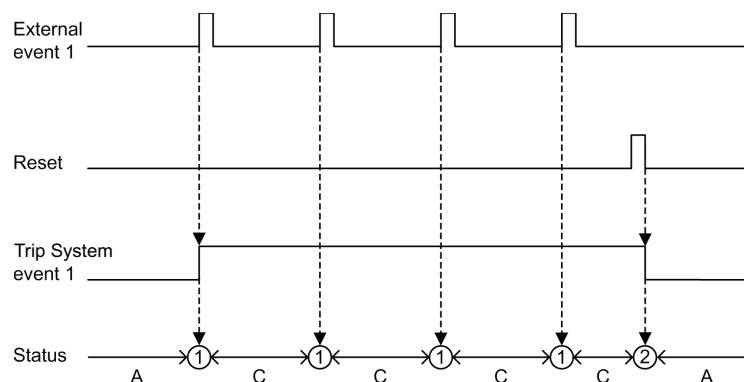
**A** Event inactive

**C** Event held

**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event reset: reset command is logged in the operation history. All held events are reset.

The following graph shows the event status for a latched, recurring instantaneous event:



**A** Event inactive

**C** Event held

**1** Event occurrence: event is logged in a history and notified, depending on severity.

**2** Event reset: reset command is logged in the operation history. All held events are reset.

## Resetting Latched Events

Latched events can be reset by pressing the **i** button on the front of the TS trip system for 3–10 seconds.

Reset commands do not target specific events. All held event states managed by the TS trip system are reset, and all trip cause LEDs are cleared.

## Event Notifications

Trip events are notified by SDE1 standard fault-trip indication contact and SDE2 optional fault-trip indication contact.

# Event Display

## Introduction

The event status table contains the status of all events at the time of consultation. The status can be inactive, active, or held.

Events which are in the active and held state are displayed on the following interfaces:

- EcoStruxure Power Commission software.
- EcoStruxure Power Device app.

## Displaying Events on EcoStruxure Power Commission Software

All events severity, active and held events are displayed.

Events can be sorted by:

- Severity:
  - High severity events
  - Medium severity events
  - Low severity events
- History
- Type

## Displaying Events on EcoStruxure Power Device App

By default, events are sorted chronologically. They can be sorted by other parameters such as severity, type or history.

The EcoStruxure Power Device app displays only a selection of events, see the details in the [Event List](#), page 84.

# Event History

## Overview

All events are logged in one of the histories of the TS trip system:

- Trip
- Protection
- Diagnostic

All severities of events are logged, including low-severity events.

Events logged in histories are displayed with:

- EcoStruxure Power Device app
- EcoStruxure Power Commission software

Events logged in histories can be erased with EcoStruxure Power Commission software.

The following information is logged in a history for each event:

- Event ID: event code
- Event type: Entry/Exit or Pulse
- Context data (only for certain events)

## Maximum Number of Events in Each History

Each history has a predefined maximum size. When a history is full, each new event overwrites the oldest event in the relevant history.

| Event history | Maximum number of events stored |                                 |
|---------------|---------------------------------|---------------------------------|
|               | TS 2.0 and 5.0 history          | TS 2.0S, 5.0S, and 6.0S history |
| Trip          | 1                               | 30                              |
| Protection    | 0                               | 25                              |
| Diagnostic    | 0                               | 35                              |

## Displaying Event History on EcoStruxure Power Commission Software

All events logged in histories can be consulted using EcoStruxure Power Commission software. The events can be exported as an Excel file.

Events in histories are displayed in chronological order, starting with the most recent event.

## Displaying Event History on EcoStruxure Power Device App

The latest five events logged in histories are displayed on the EcoStruxure Power Device app.

Events in histories are displayed in chronological order, starting with the most recent event.

Events can be sorted by sequence number, and filtered by using the following criteria:

- Type
- History

Clicking on a specific event in the list displays a list of all occurrences of the same event, in chronological order.

# Event List

## Event Characteristics

The events are listed according to the history in which they are logged, page 82.

Each event is defined by the following characteristics:

- Code: event code
- Event: user message
- History, page 82
- Type, page 75: not customizable
  - Entry/Exit: occurrence/completion event
  - Pulse: instantaneous event
- Latched, page 75:
  - Yes: the event is latched and the user must reset the event status.
  - No: the event is unlatched.
- Activity, page 75:
  - Enabled
  - Disabled
- Severity, page 74:
  - High severity events
  - Medium severity events
  - Low severity events
- Service LED:
  - Yes: the service LED is lit in either red or flashing in red, depending on the severity of the event. Maintenance action is required.
  - No: the service LED is not lit. No maintenance action is required.
- EPD App, page 24:
  - Yes: the event can be displayed on a smartphone with EcoStruxure Power Device app (EPD).
  - No: the event cannot be displayed on a smartphone with EcoStruxure Power Device app (EPD).

## Trip Events

| Code              | Event                                  | History | Type  | Latched | Activity | Severity | Service LED | EPD app |
|-------------------|----------------------------------------|---------|-------|---------|----------|----------|-------------|---------|
| 0x6400<br>(25600) | <b>Ir trip</b> , page 34               | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x6401<br>(25601) | <b>Isd trip</b> , page 38              | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x6402<br>(25602) | <b>Ii trip</b> , page 40               | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x6403<br>(25603) | <b>Ig trip</b> , page 42               | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x6405<br>(25605) | <b>Over temperature trip</b> , page 62 | Trip    | Pulse | Latched | Enabled  | High     | Yes         | Yes     |
| 0x6407<br>(25607) | <b>Self diagnostic trip</b> , page 59  | Trip    | Pulse | Latched | Enabled  | High     | Yes         | Yes     |

| Code           | Event                                                                | History | Type  | Latched | Activity | Severity | Service LED | EPD app |
|----------------|----------------------------------------------------------------------|---------|-------|---------|----------|----------|-------------|---------|
| 0x641D (25629) | <b>Ultimate self-protection trip (DIN/DINF)</b> , page 33            | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x641E (25630) | <b>Ig test trip with test button</b> , page 42                       | Trip    | Pulse | Latched | Enabled  | High     | No          | Yes     |
| 0x6433 (25651) | <b>Phase current transformer sensors open circuit trip</b> , page 59 | Trip    | Pulse | Latched | Enabled  | High     | Yes         | Yes     |

## Protection Events

| Code           | Event                                                                                                   | History    | Type       | Latched   | Activity | Severity | Service LED | EPD app |
|----------------|---------------------------------------------------------------------------------------------------------|------------|------------|-----------|----------|----------|-------------|---------|
| 0x03F5 (1013)  | <b>Ir prealarm (90% Ir &lt; I &lt; 105% Ir)</b> , page 57                                               | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | Yes     |
| 0x6200 (25088) | <b>Ir start (I ≥ 105% Ir)</b> , page 34                                                                 | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | Yes     |
| 0x050C (1292)  | <b>Ig alarm (I ≥ 80% Ig)</b> , page 57                                                                  | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | Yes     |
| 0x0C07 (3079)  | <b>Ir protection off</b> , page 34                                                                      | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | No      |
| 0x0C08 (3080)  | <b>Ii protection off</b> , page 40                                                                      | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | No      |
| 0x0C09 (3081)  | <b>Ig protection off</b> , page 42                                                                      | Protection | Entry/Exit | Unlatched | Enabled  | Medium   | No          | No      |
| 0x1519 (5401)  | <b>Protection in fallback settings for Rotary switch failure during power on initializing</b> , page 32 | Protection | Pulse      | Unlatched | Enabled  | High     | Yes         | Yes     |

## Diagnostic Events

| Code          | Event                                                                                     | History    | Type       | Latched   | Activity | Severity | Service LED | EPD app |
|---------------|-------------------------------------------------------------------------------------------|------------|------------|-----------|----------|----------|-------------|---------|
| 0x1400 (5120) | <b>Control unit self test major malfunction 1</b> , page 59                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1402 (5122) | <b>Internal current sensor disconnected</b> , page 59                                     | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | No          | No      |
| 0x1404 (5124) | <b>Control unit self test major malfunction 2</b> , page 59                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1405 (5125) | <b>Control unit self test major malfunction 3</b> , page 59                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1406 (5126) | <b>Control unit self test major malfunction 4</b> , page 59                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1409 (5129) | <b>Unable to read sensor plug</b> , page 59                                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1413 (5139) | <b>Ig test - no trip</b> , page 42                                                        | Diagnostic | Pulse      | Unlatched | Enabled  | High     | No          | No      |
| 0x1414 (5140) | <b>NFC invalid communication #2</b> , page 62                                             | Diagnostic | Entry/Exit | Unlatched | Enabled  | Medium   | Yes         | No      |
| 0x1416 (5142) | <b>Control unit self test major malfunction 5</b> , page 59                               | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x142F (5167) | <b>Last modification of protection settings has not been completely applied</b> , page 62 | Diagnostic | Entry/Exit | Unlatched | Enabled  | Medium   | Yes         | Yes     |

| Code          | Event                                                                    | History    | Type       | Latched   | Activity | Severity | Service LED | EPD app |
|---------------|--------------------------------------------------------------------------|------------|------------|-----------|----------|----------|-------------|---------|
| 0x151A (5402) | <b>Control unit over temperature</b> , page 63                           | Diagnostic | Entry/Exit | Unlatched | Enabled  | Medium   | Yes         | Yes     |
| 0x1434 (5172) | <b>Firmware self diagnostic error</b> , page 29                          | Diagnostic | Entry/Exit | Unlatched | Disabled | High     | Yes         | Yes     |
| 0x150F (5391) | <b>Internal Current Power Supply (CPS) sensors malfunction</b> , page 62 | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |
| 0x1517 (5399) | <b>Current unbalance &gt; 50%</b> , page 57                              | Diagnostic | Entry/Exit | Unlatched | Enabled  | Low      | No          | No      |
| 0x1518 (5400) | <b>Control unit self test major malfunction 6</b> , page 59              | Diagnostic | Entry/Exit | Unlatched | Enabled  | High     | Yes         | Yes     |



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