

**Guide d'application de la norme TPL-001-5.1  
(version anglaise)**



Reliability and Security  
Technical Committee  
(RSTC)

System Protection and  
Control Working  
Group (SPCWG)

# Implementation Guidance TPL-001-5.1 Trip Circuit Monitoring

TPL-001-5.1 Table 1 Footnote 13.d

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## Introduction

Industry interpretations of the terms “trip coil” and “trip circuit” and the demarcation between the two functions, vary. These variations are compounded by the acronym “TCM” (trip coil monitor or trip circuit monitor), leading to imprecise discussions among protection subject matter experts. This implies a need to settle on a common understanding of the subject. For example, Section 2.5.3, Trip Circuit Monitors, of the IEEE PSRC Committee *Relay Scheme Design Using Microprocessor Relay* report uses the phrase “trip coil monitoring” when discussing “trip circuit monitoring.” For this document, the use of TCM refers to trip **circuit** monitoring.

The examples provided in this Implementation Guidance (IG) show clearly what portions of a trip circuit are monitored by a typical TCM function to improve the understanding of Standard TPL-001-5.1.

This issue is relevant to the applicable functional entities for consistently evaluating and defining the scope of work necessary to meet the compliance requirements for TPL-001-5.1 Table 1 Footnote 13.d: *“A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center).”*

## Goal/Problem Statement

Reference material for demonstrating a dc control circuit configuration with trip circuit monitoring (TCM that qualifies for the exclusion contained in TPL-001-5.1 footnote 13d is not available for use by the applicable functional entities. The intent of this document is to help applicable entities evaluate and identify Table 1 Footnote 13.d applicability.

## Scope

Substation dc control circuit design usually includes a “trip circuit monitor” (TCM) located within a control room that monitors both the combined configuration of the “trip circuit” and the interrupter “trip coil.” Breaker configuration (single-pole tripping capability, for example) and TCM placement require evaluation to understand the effective extents of the monitoring system.

The TCM functions by detecting a loss of voltage or a loss of circuit continuity from the positive source terminal of the circuit to the negative source terminal of the circuit. The logic generally includes an element sensing voltage across the normally open protective relay tripping contacts—typically between the positive bus of the circuit and the trip bus of the circuit. The logic also requires an element sensing the status of the breaker. The trip circuit includes a contact in series with the trip coil that is open when the breaker is open, 52A. This contact is necessary to interrupt the coil’s dc current when the breaker successfully opens. The status input blocks the TCM function from false alarms for this normal condition. A timer is also required to ride through the period between when the trip contact closes, shorting the TCM sensing element, and when the breaker successfully opens. The source of breaker status sensing is a critical detail in the implementation of the TCM function. For example, if the logic senses 52A status that obtains its voltage from the trip circuit being monitored, loss of dc to the circuit would indicate that the breaker is open, meaning that de-assertion

of the TCM sensing element is expected and the TCM alarm should be blocked. Three solutions are generally used to eliminate this common mode failure, as follows:

- Obtain the breaker status from a circuit independent of the trip circuit being monitored
- Obtain the breaker status from a contact that is open when the breaker is closed, 52B
- Include separate sensing to alarm for complete loss of dc to the trip circuit

This document will provide an example of a dc control circuit with trip circuit monitoring that meets the exclusion condition of footnote 13d with respect to monitoring and reporting to a control center. This example will result in a better understanding of the TPL-001-5.1 Table 1 Footnote 13.d exclusion.

The illustration that follows is described below:

The illustration depicts a Protection System with redundant protective relays and a single control circuit from the dc supply through a single trip coil in the circuit breaker. The circuit includes a trip circuit monitor (TCM) that monitors the single circuitry components and single trip coil. The trip circuit monitor alarms the Control Center for any discontinuity in the circuit.

Composite protection system “Y” is adequately designed depending on the position of the TCM.

Test switches are not shown and can be assumed to be wired in series with each tripping output if they are used.

Trip circuit graphics in blue shading with a checkboard pattern represent portions of the trip circuit that are monitored and exempted by the exclusion.

Trip circuit graphics without shading and pattern represent adequate redundancy; use of the exclusion is not necessary for that portion of the circuit.

## **Reliability Standard**

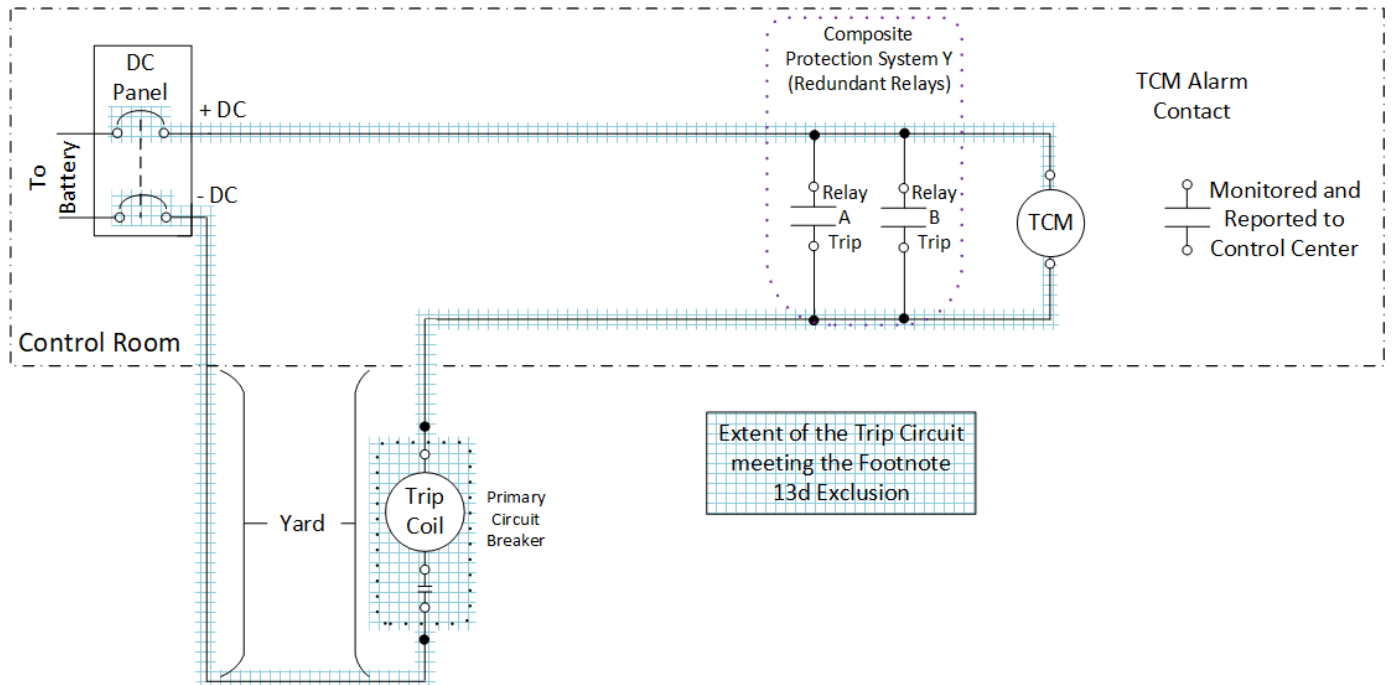
### **TPL-001-5.1 Table 1 Category P5 Footnote 13.d.**

#### **Requirement R3 and R4**

Requirements R3 and R4 require planning studies to be performed to assess system performance due to delayed clearing for failures of non-redundant components of protection systems. Footnote 13d provides an exclusion if the non-redundant trip coil is monitored and reported to a Control Center.

**Example 1**

This example shows redundant protective relays with a trip circuit monitor (TCM) that monitors all of the single trip circuit components including the single trip coil. The TCM alarms the Control Center for any discontinuity of the trip circuit, including the trip coils. This configuration would qualify for the footnote 13d exclusion.



**Note:** This example shows a single trip circuit with a single trip coil that is monitored and reported to a control center. If the trip circuit contains non-redundant lockout/auxiliary relays, that type of trip circuit would not qualify for exclusion and would have to be assessed according to TPL-001-5.1 Table 1 Category P5.

**Periodic Review**

The System Protection and Control Working Group (SPCWG) will review this IG every three years or upon a new version of the standard being approved.