
Recommended Vital Circuit Design Guidelines for Directional Stick Circuits at Automatic Signals

Revised 2025 (2 Pages)

A. Purpose

This Manual Part recommends vital circuit design guidelines for directional stick circuits at automatic signals.

B. General

1. Directional stick circuits are used in the control of automatic signals on tracks signaled for bi-directional operation. They are used to permit following train movements and to prevent opposing movements.
2. The vital circuit design guidelines provided in this Manual Part shall also apply to equivalent vital software applications.
3. The vital circuit design guidelines provided in this Manual Part represent one type of design for directional stick circuits at automatic signals. Some aspects of the design may vary depending on the design practices of the individual railroad.

C. Circuit Design

1. Refer to drawing in Manual Part 16.50.2 Line Circuit in Traffic Control System and the circuits for automatic signal 22E that is the first intermediate signal east of CP McKnight on No. 2 track, and the directional stick relays 2ESR and 2WSR. Note that only one of these relays can be energized at a time, because each one checks the other in its de-energized position.

2. Establishing Direction Eastbound

Relay 2ESR is a pre-pick directional stick relay and energizes when track circuit A22WTR becomes occupied, provided the 22EHDR relay is energized and the 2WSR relay is de-energized, as its pick path is through back contacts of the 2WSR, A22WTR and a front contact of the 22EHDR relays.

When an eastbound train passes signal 22E, the 22EHDR relay de-energizes maintaining the 2ESR relay energized through the stick path consisting of back contacts of the 2WSR and the 22EHDR, and the front contact of the 2ESR. The 2ESR will remain energized until the block conditions between signal 22E and signal 20E allow 22EHDR to re-energize, which breaks the stick path, thus de-energizing the 2ESR relay.

In this example, the eastward signals at CP McKnight are able to display an aspect that will permit following trains to move east on No. 2 track toward signal 22E, while the block in advance of this signal is occupied.

The circuit for relay 2WSR illustrates that with the 2ESR relay energized, the 2WSR relay will not pick, and westbound movements on No. 2 track are prevented, as the WHDR line circuits to CP Brannen are open.

Note that relay 22EHDR does not have to be slow release in this pre-pick directional stick circuit because the directional stick relay is energized before the train passes the 22E signal.

3. Establishing Direction Westbound

Relay 2WSR is a post-pick directional stick relay and energizes when the A22WTR track circuit becomes occupied provided the 22WAHDPR relay is energized and the 2ESR relay is de-energized, as its pick path is through back contacts of the 2ESR, A22WTR and a front contact of the 22WAHDPR relays. When a westbound train passes the 22W signal, the 2WSR relay will remain energized through back contacts of the 2ESR and 22WAHDPR relays and a front contact of the 2WSR relay. The 2WSR relay will remain energized until the block conditions between the 22W signal and CP McKnight allow the 22WAHDPR to re-energize.

Relay 22WAHDPR must be slow release to assure that 2WSR energizes after A22WTR de-energizes and before 22WAHDPR de-energizes, as the westbound train accepts the 22W signal.

While relay 2WSR is energized, eastbound moves from CP McKnight cannot be made on No. 2 track, as the back contacts of the 2WSR relay are used in the eastbound line circuit to CP McKnight.

4. The ESR and WSR stick relays are slow release to prevent them from being de-energized during the transition time of the HD or HDPR contacts, which are used in the stick path, as a train passes the signal.