

Recommended Vital Circuit Design Guidelines For Traffic Circuits at Interlockings and Controlled Points

Revised 2025 (3 Pages)

A. Purpose

This Manual Part recommends vital circuit design guidelines for traffic circuits at interlockings and controlled points.

B. General

1. The vital circuit design guidelines provided in this Manual Part shall also apply to equivalent vital software applications.
2. The vital circuit design guidelines provided in this Manual Part represent one type of design for traffic control and locking circuits. Some aspects of the circuit designs may vary depending on the design practices of the individual railroads.

C. Design

1. The traffic circuit design shall prevent the display of permissive signal aspects; set any signals that may be displaying permissive aspects to stop or stop-and-proceed between interlockings and / or controlled points on signals that directly oppose a controlled signal that has established a route, is running time (time locking in effect) or is being traversed by a train. Refer to Manual Parts 16.50.2 Line Circuit in Traffic Control System, 16.4.1 Recommended Vital Circuit Design Guidelines for Time Locking, and 16.4.2 Recommended Vital Circuit Design Guidelines for Route Locking, 16.4.21 Recommended Vital Circuit Design Guidelines for Engine Return Stick Circuits at Interlockings and Controlled Points.
 - a. In the example four-wire tumbledown circuits shown in MP 16.50.2 (Page 2 of 2), this is achieved by placing the front contacts of the west route locking stick relay 1WSR in the 18EHD line circuit, which will prevent signal 18E from displaying a permissive aspect. The 18EHD line circuit is one portion of the line circuit functions that govern the movement of eastbound traffic from CP McKnight to CP Brannen.
 - b. Normal circuit operating sequence when establishing traffic direction for a westbound move. Note that the signals are approach lighted and that all AER relays are normally energized:
 - (1) When the 1WSR relay becomes de-energized (a route has been established) the 18EHDR relay will de-energize, the 18EHDPR relay will then become de-energized and the 18E signal will display Stop & Proceed.

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- (2) Contacts of the 18EHDPDR repeater relay are used in the 20EHDR line circuit, which will de-energize next and set the 20E signal to display Stop & Proceed.
 - (3) Contacts of the 20EHDR relay are used in the 22EHDR line circuit, which will de-energize next and set the 22E signal to display Stop & Proceed.
 - (4) Finally, contacts of the 22EHDPDR are used in the 2EH line circuit, which will de-energize and cause the 2EHR, 2EHPR and the 2EHDR relays to de-energize and prevent the display of permissive signals on the eastward home signals at CP McKnight into track 2.
- c. The normal circuit operating sequence to establish traffic in the eastbound direction is similar, except that a de-energized 2ESR relay at CP McKnight will cause the normally energized WHDR, and WHDPR relays to de-energize until the cascade / tumbledown reaches CP Brannen and de-energizes the 2WHR, 2WHPR and 2WHDR relays, which will prevent the display of permissive signals on the westward home signals at CP Brannen into track 2.
2. In addition to the initial process of establishing a direction of movement and locking out the opposing movements as described above, the traffic circuit design shall also include provisions that prevent the established direction of traffic from being changed while the track section (block) between the controlled points is occupied.
- a. This is achieved by checking every track circuit between the entering controlled signal and the next controlled signal. For example, from the westward home signals at CP Brannen to signal 2W at CP McKnight:
- (1) As shown in MP 16.50.2 Line Circuit in Traffic Control System, the front contacts of every track circuit in the block section between the control points are directly checked in the line circuits as a part of the overall signal aspect control functions provided by the HR, HPR, HDR and HDPR relays. Refer to Manual Part 16.5.1 Recommended Vital Circuit Design Guidelines for Four Wire Tumbledown Line Circuits in Traffic Control Systems.
 - (2) As shown in MP 16.4.2 Recommended Vital Circuit Design Guidelines for Route Locking, a check of the track circuits for a given route within the controlled points is already included in their respective route-locking relays. For example, considering a route from signal 2W to 2E at CP Brannen, the

1WSR relay will include a direct check of the 1T track circuit. It is controlled by the 3WSR relay, which will include a direct check of the 3T track circuit. The 3WSR relay is controlled by the 7WSR relay, which includes a check of the 7T track circuit.

3. Whenever front contacts of a stick relay are used to circumvent traffic, back contacts of the same relay shall be inserted in the line circuit to verify that the relay has become de-energized after the train movement is completed. Refer to Manual Part 16.4.20 Recommended Vital Circuit Design Guidelines for Following Move Stick Circuits at Interlockings and Controlled Points; and Manual Part 16.4.21 Recommended Vital Circuit Design Guidelines for Engine Return Stick Circuits at Interlockings and Controlled Points.

- a. In the case of a following move, back contacts of the following move stick relay, which bypass the traffic check in the route check and home networks, shall be inserted in the opposing HD circuit to prevent opposing traffic from being lined.

For example, the back contacts of the following move stick relay 2WF5R are checked in the 18EHD line, which as described previously, is part of the circuit functions that controls the traffic to allow eastbound moves towards CP Brannen.

- b. When the design provides for return to train moves and incorporates a return to train stick circuit, which will also be used to bypass the traffic check in the route check, back contacts of the engine return stick relay shall be inserted in the HD circuit to prevent opposing traffic from being lined.

For example, the back contact of the engine return stick relay 2EERSR is checked in the 2EHD line circuit that governs the traffic for eastbound moves towards CP McKnight. Refer to the circuit diagram in Manual Part 16.4.21.

- c. In some cases, train operations require that opposing movements (for switching or maintenance purposes) be made onto the same section of track. In these cases, the circuit design will provide for opposing train moves after the elapse of a predetermined time interval, and incorporates a stick circuit (usually referred to as a TESR), which bypasses the traffic check in the route check network. As indicated in the preceding examples, back contacts of the TESR stick relay shall be inserted in the corresponding HD line circuit to prevent opposing traffic from being established unless the TESR is de-energized.