



Reactor Protection System

Section 12.1



Objectives

- 1.State the purposes of the Reactor Protection System (RPS).
2. Explain how the following design features are incorporated into the RPS:
 - a. Single failure criterion
 - b. Testability
 - c. Equipment qualification
 - d. Independence
 - e. Diversity
 - f. Control and protection system interaction

Objectives (Continued)

3. Describe the sequence of events (flowpath) beginning at the sensor up to and including the starting of an Engineered Safety Feature (ESF) component and/or the opening of a reactor trip breaker.
4. Explain how failures in the rod control system are prevented from affecting reactor trip capability.

The purposes of the reactor protection system (RPS) are as follows: (Obj-1)

The overall purpose of the RPS is to prevent the release of radioactivity to the environment (by maintaining the integrity of the 3 barriers: fuel cladding, RCS pressure boundary, and Containment) by:

- 1) Initiating a reactor trip if safe operating limits are exceeded, or
- 2) Initiating engineered safety features actuation(s) if an accident occurs.

12.1.2.3 Single Failure Criterion (Obj-2a)

- Any single failure will not prevent protective action.
- Redundant (multiple) instrumentation channels per protective function.
- Two trains separated physically and electrically.
- Either train can provide protective actions.
- Fail safe (de-energize to trip).

12.1.2.4 Testability (Obj-2b)

- Testable during all plant conditions without reducing reliability of operation.
- Tested in a segmented fashion where test overlaps adjacent test sections.
- Insures availability and accuracy of the system from the sensor to the trip breakers or ESF equipment.

12.1.2.5 Equipment Qualification

(Obj-2c)

- All safety systems, components , and instruments must remain functional under the wide range of environmental conditions that could occur in containment during an accident. (i.e., temperature, pressure, radiation).
- Wide range of qualification tests are performed to meet GDC 22.

12.1.2.6 Independence (Obj-2d)

- Each process instrument is assigned to one of four protective channels.
- Channel separation is maintained throughout the system, both physical and electrical.
- Separate transmitters, process inst. racks, penetrations, cable trays, protection racks, power supplies, and finally reactor trip breakers.

12.1.2.7 Diversity (Obj-2e)

- To ensure safe operation of the core and RCS, the RPS continuously monitors numerous process variables.
- One or more protection functions would terminate an accident before intolerable consequences could occur.

12.1.2.8 Control and Protection

System Interaction (Obj-2f)

- RPS independent of process control.
- Isolation amplifiers prevent control circuit fault (short circuit, etc.) from being input to protective circuit.
- Signal passing through the isolation amplifier never returned.
- Failure of process inst./component will not prevent RPS from performing its safety function.

Figure 12.1-1A Relay Protection System

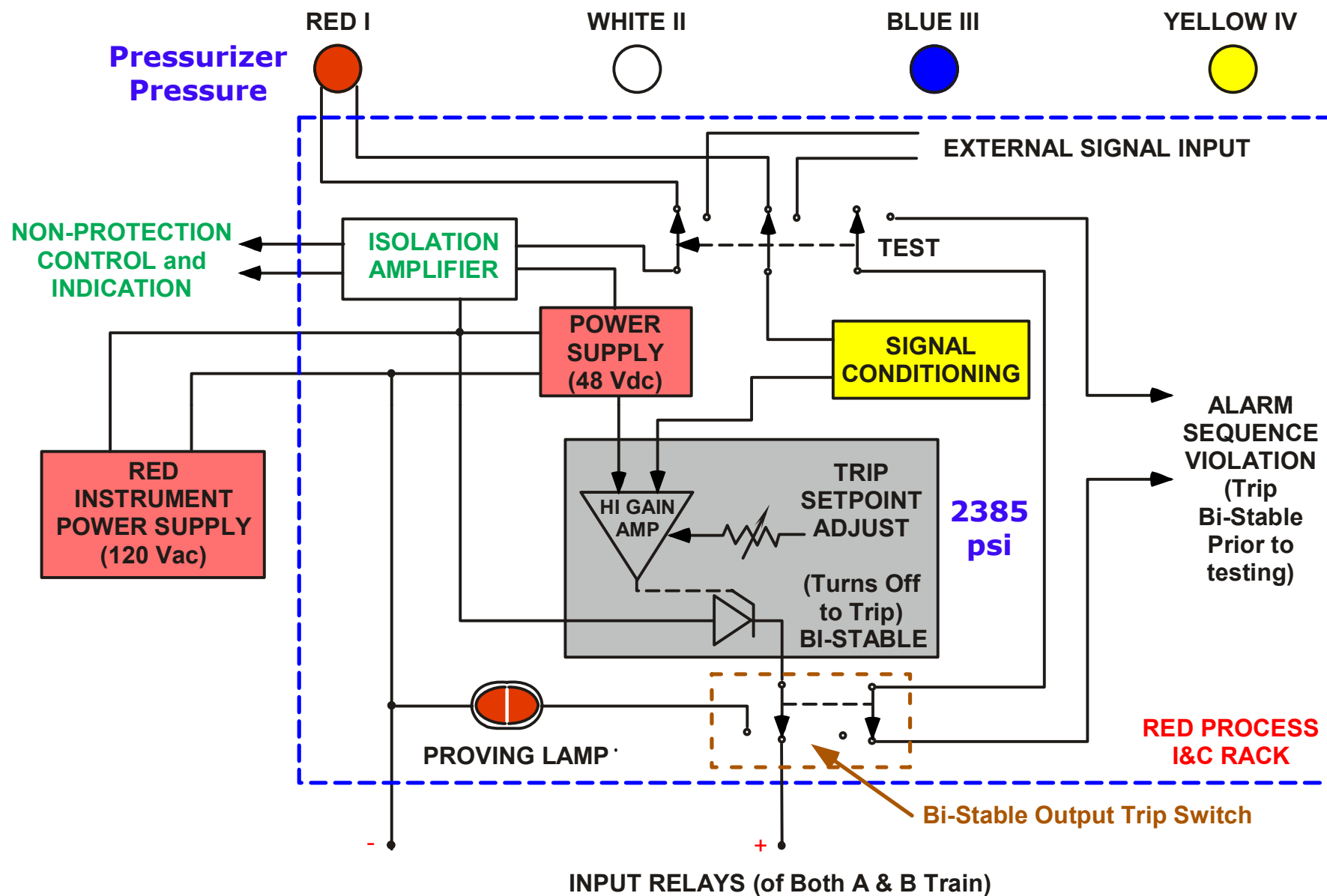


Figure 12.1-1B Relay Protection System

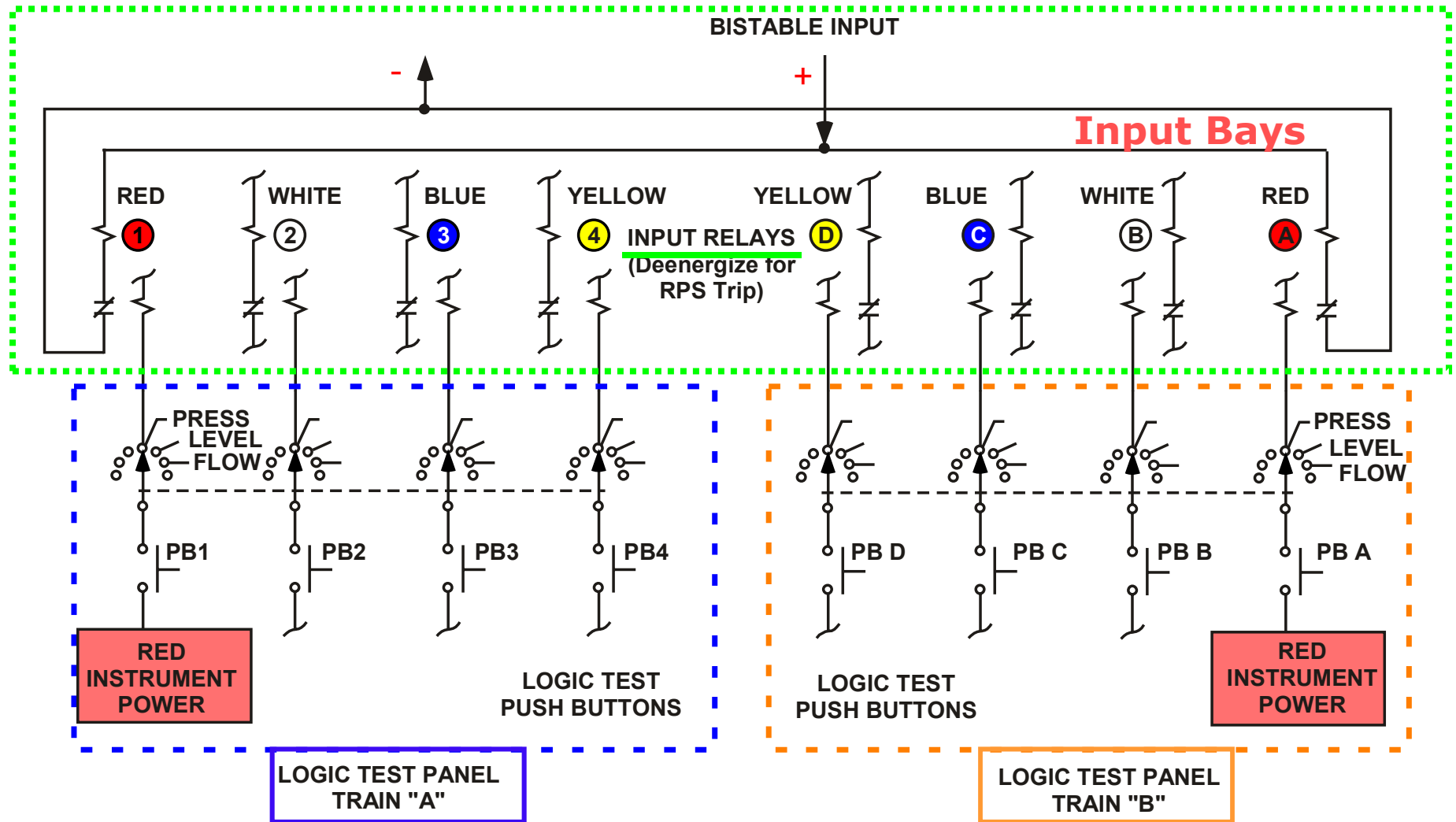


Figure 12.1-1c Relay Protection System

The Red Channel by its self will not cause a Rx Trip

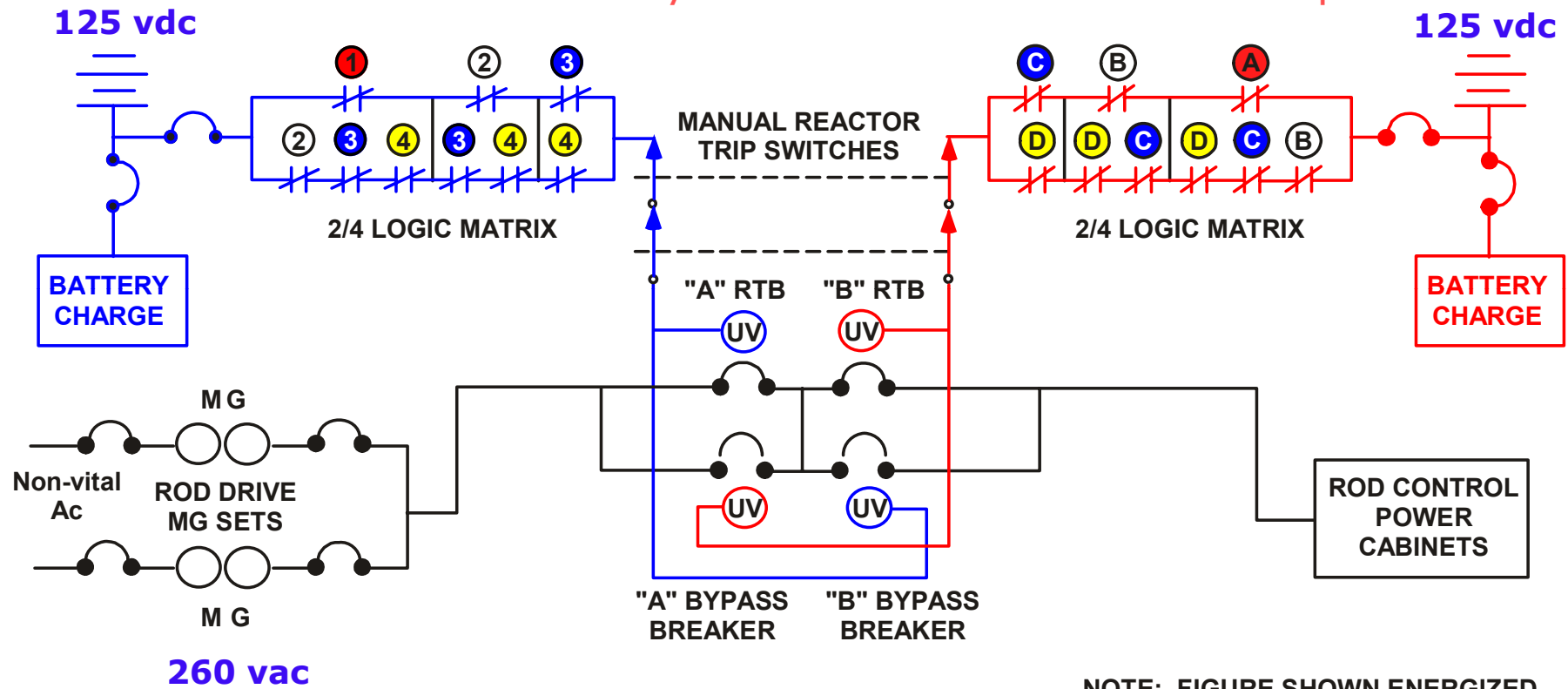


Fig. 12.1-2

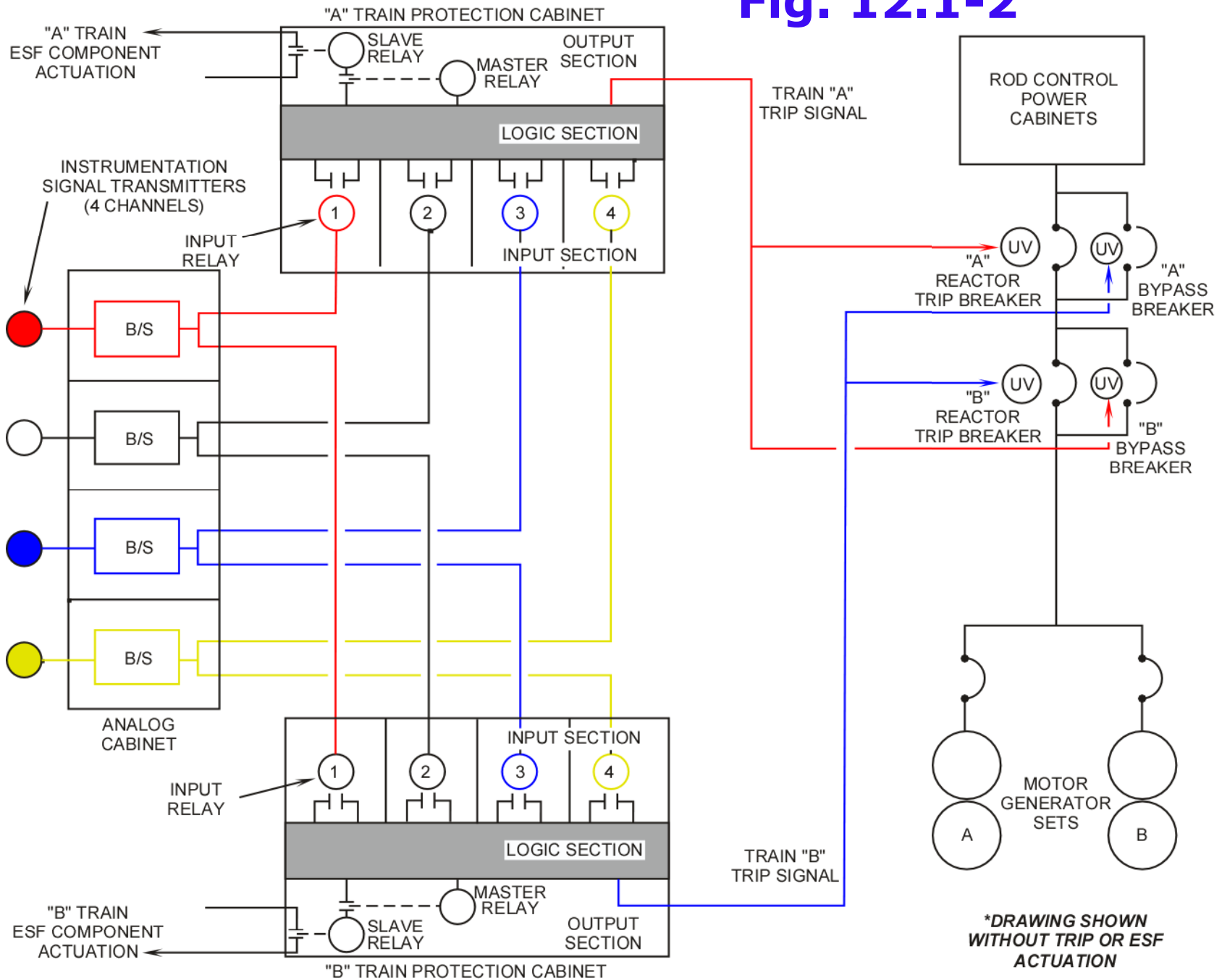


Fig. 12.1-3

