

Electronic Power Supplies, Grounding, and other issues

- ...the electricians had connected a 120 VAC control power source across two 24 VDC digital output points via wiring in the motor control center. They had energized the circuit to test it near shift change in the evening. They de-energized before leaving for the night and re-energized the next morning to continue testing. The wiring modifications they made agreed with the construction drawings they were working with. The problem was that the modified design assumed that the output contact was a *dry* relay contact capable of handling this voltage, rather than a transistor circuit. Contributing to this mistake was that the existing electrical drawings showed merely a normally open contact labeled as "DCS permissive" and did not clearly show the control systems interface. Although significant field verification work was done, the designers did not trace the circuitry back to the ultimate endpoint of the connection with the process computer, nor did they review the associated control systems drawings.

- Nomenclature
 - Contacts/Output
 - Relay Contacts
 - Dry vs. Mercury wetted
 - » Form A, Form B, Form C, Form D
 - Common Emitter

- Form A – Normally Open



- Form B – Normally Closed



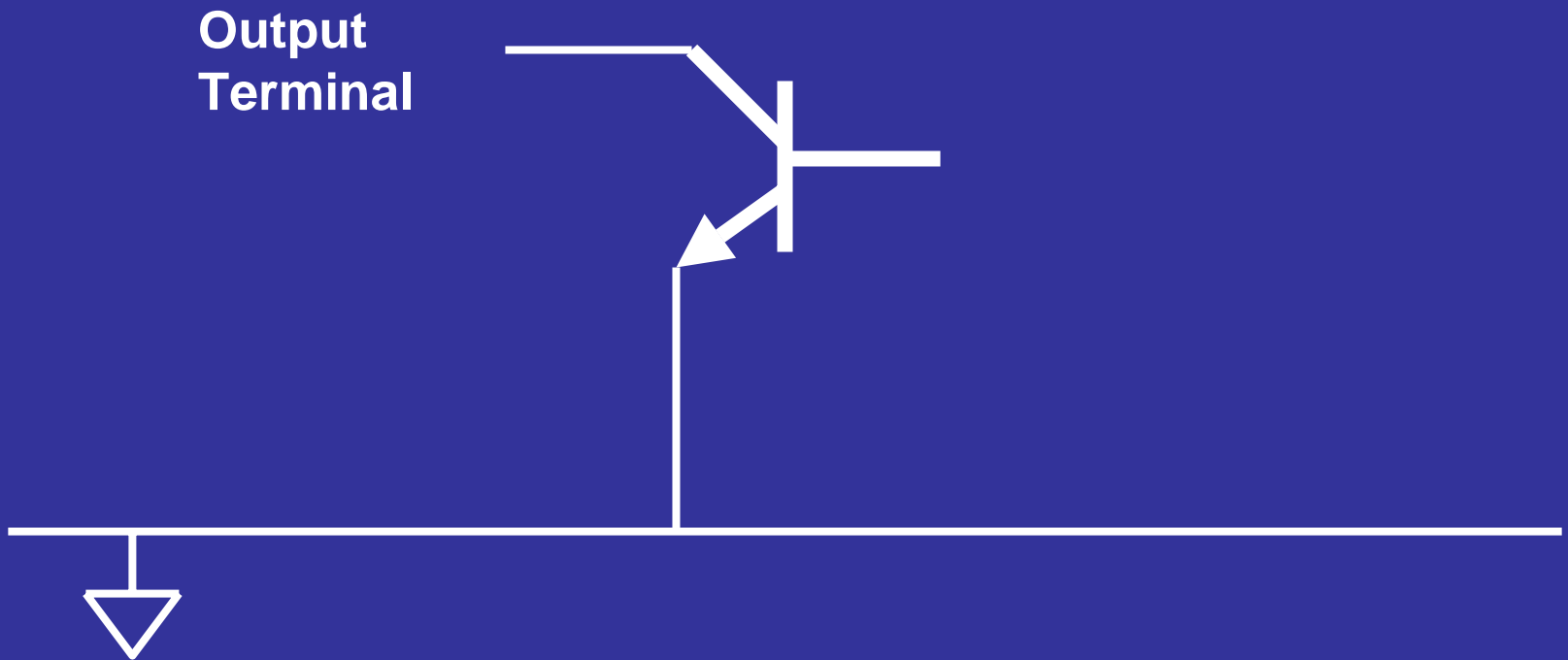
- Form C – Open and Closed, Break before Make

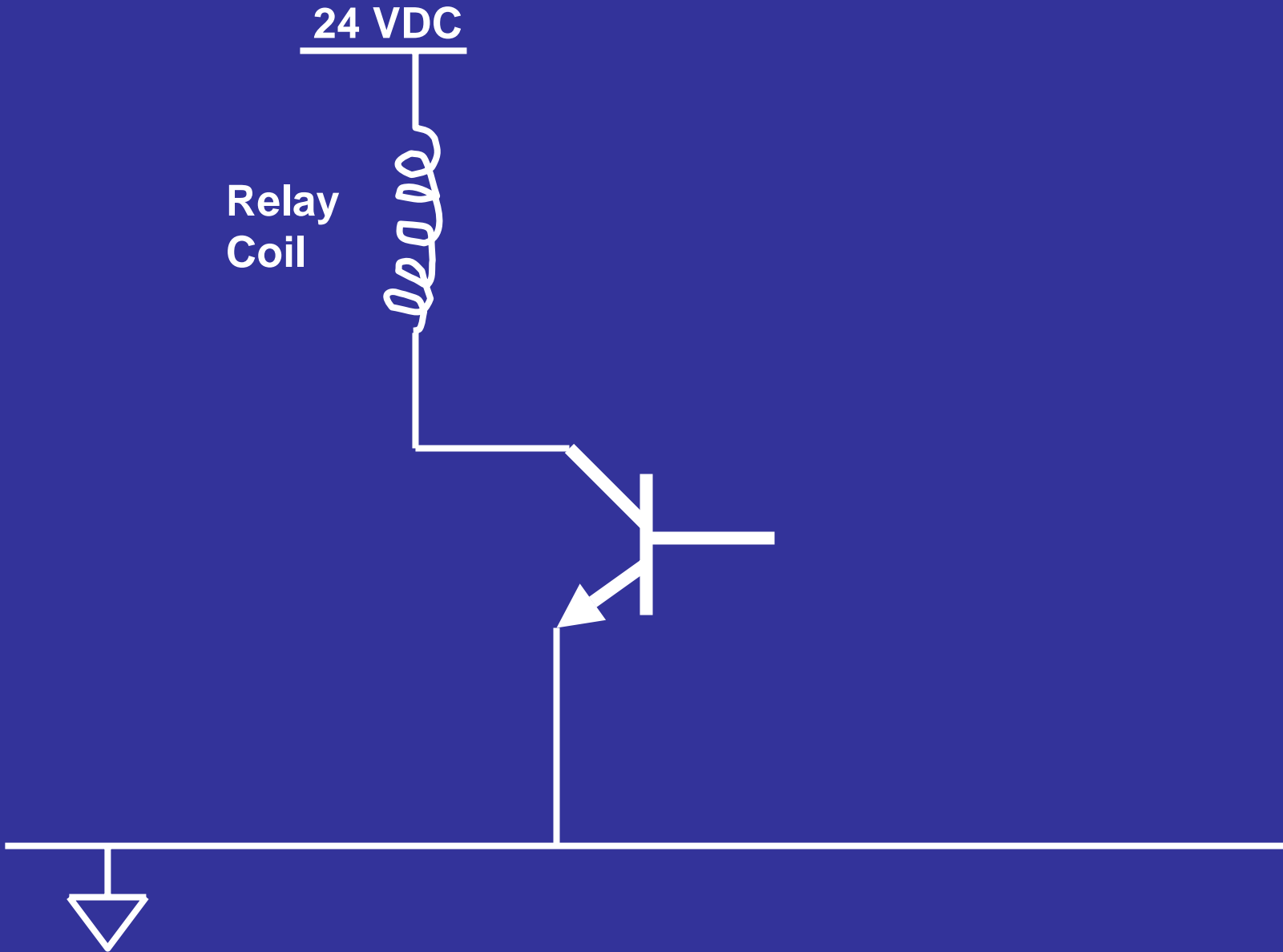


- Form D – Open and Closed, Make before Break



Common Emitter





UL508A, September 1, 2005

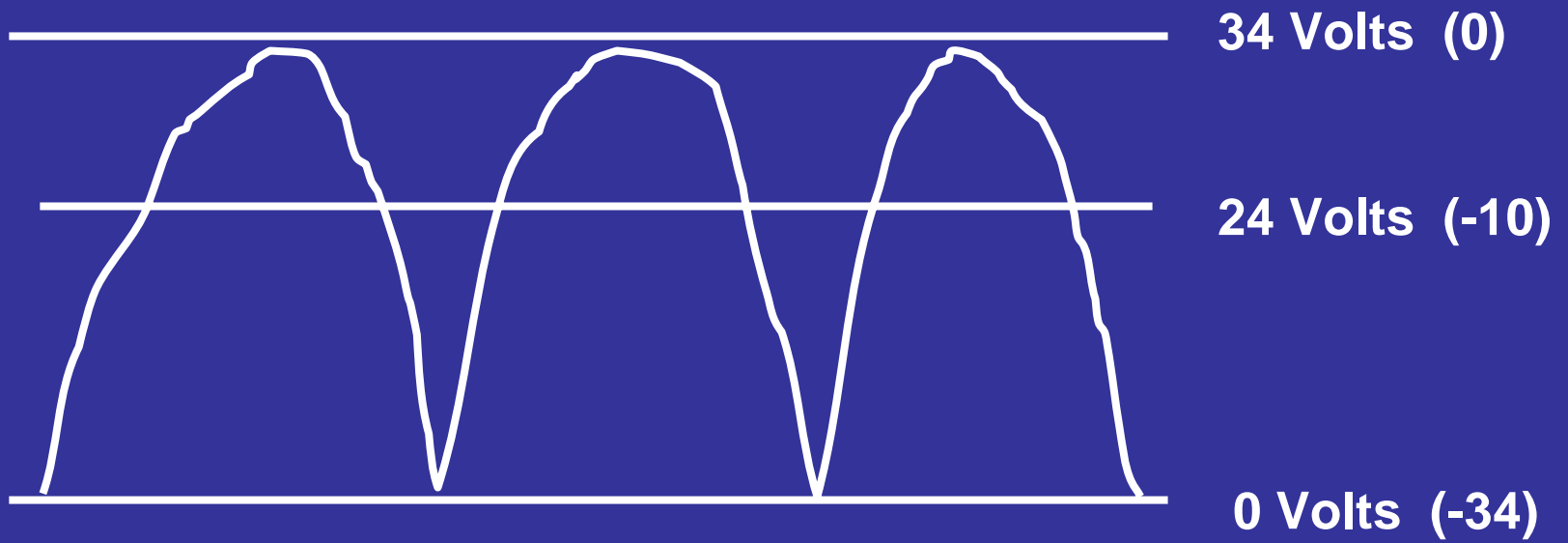
- 16.1 A secondary circuit that contains field wiring terminals and is supplied from a power transformer, control transformer, or power supply shall have the secondary grounded under any of the following conditions:
 - a) When the secondary voltage is less than 50 volts; and
 - 1) The supply to the primary is over 150 volts to ground; or
 - 2) The supply to the primary at any voltage is ungrounded.

Example from the Fire Alarm Industry

- It is required by *Code* that Ground Faults be detectable on both the – and + sides of a Fire Alarm power supply (feeding field circuits). To do this, 24 V Full Wave is used for the external circuits. A diode is connected to the + side of the power supply and is then connected to a filter capacitor. The filtered terminal is connected to chassis.

Example from the Fire Alarm Industry

- This gives a voltage reference to the supply and results in:
 - Chassis 0 Volts
 - Power Supply + -10 Volts (to chassis)
 - Power Supply - -34 Volts (to chassis)



Notes

- Power supplies do not have to have their outputs referenced to Ground if they are fed from a 120 Volt supply and if the output(s) are less than 50 Volts.
- But...
 - If the output is “floating,” be prepared for unusual results. Single ground faults will not cause fuses to blow but might cause unwanted effects.

On a related issue...

- All electrical systems must be connected to the Grounding Electrode System. In areas where the NEC has been adopted, it is not legal to have an electrical load (such as a process computer), which is powered by an electrical distribution system, to have its own isolated ground.

NEC 250.4(A)(3)

- **Bonding of Electrical Equipment.** Non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected together and to the electrical supply source in a manner that established an effective ground-fault current path.

NEC 250.4(A)(4)

- **Bonding of Electrically Conductive Materials and Other Equipment.** Electrically conductive materials that are likely to become energized shall be connected together and to the electrical supply source in a manner that establishes an effective ground-fault current path.

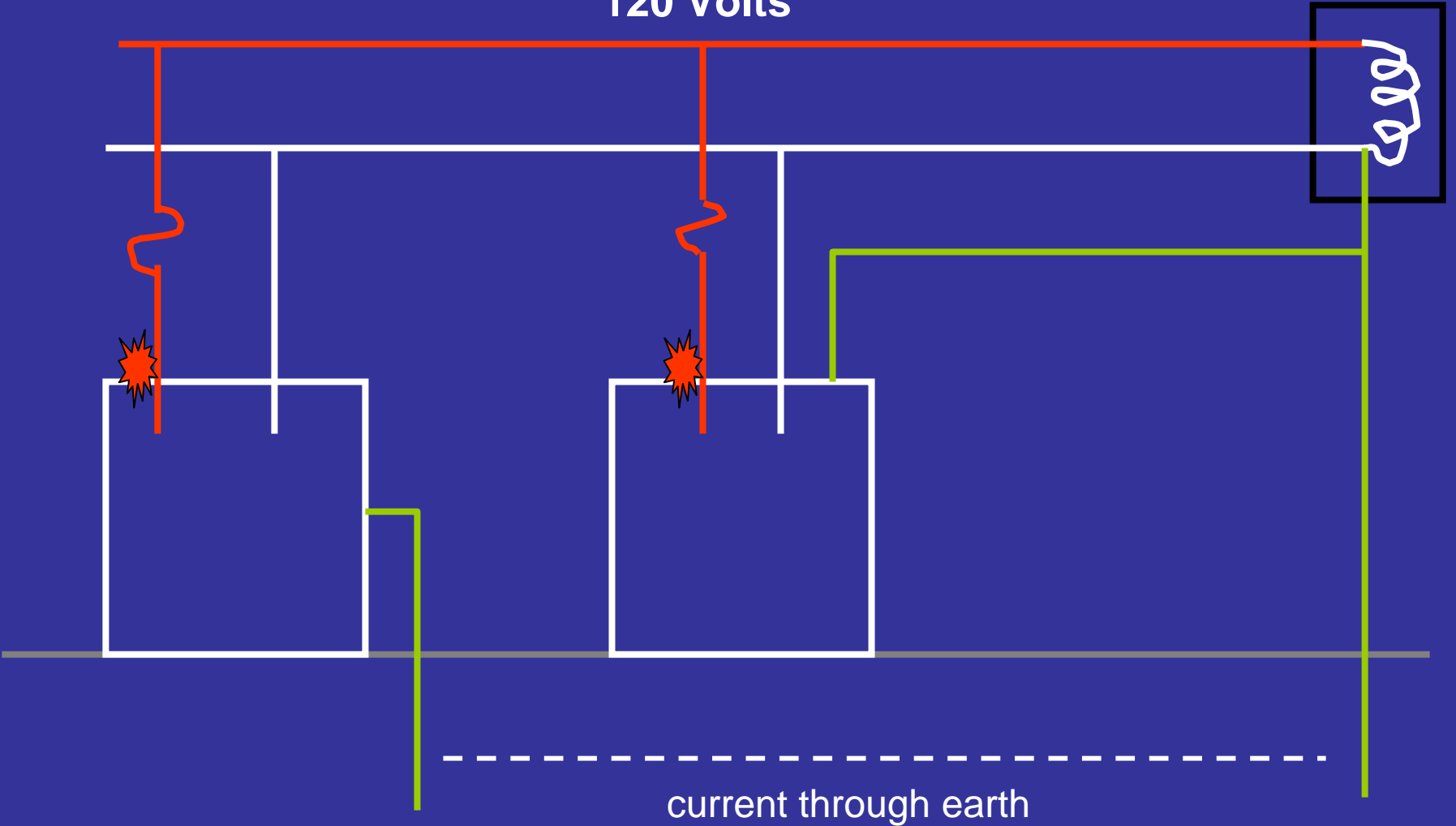
So from where is the
misinterpretation coming?

250.54 Supplementary Grounding Electrodes.

- Supplementary grounding electrodes shall be permitted to be connected to the equipment grounding conductors specified in 250.118 and shall not be required to comply with the electrode bonding requirements of 250.50 or 250.53(C) or the resistance requirements of 250.56, but the earth shall not be used as an effective ground-fault current path.

So what's the problem?

120 Volts



Questions?

Eric Stromberg, P.E.
Stromberg Engineering, Inc.

979.285.4975

eric@strombergengineering.com

www.strombergengineering.com