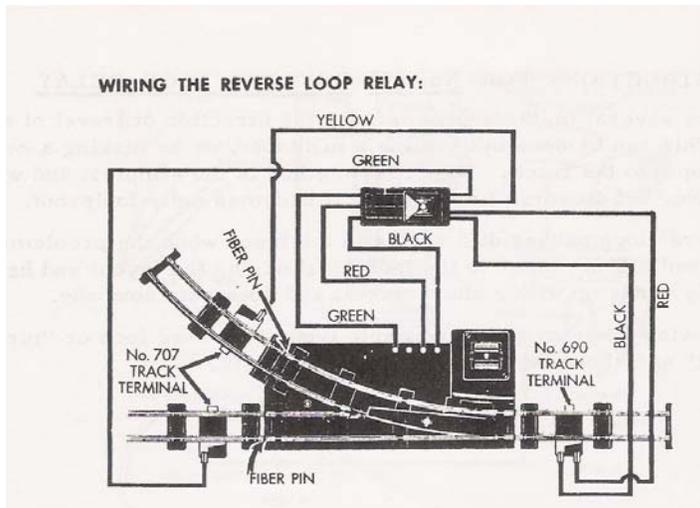
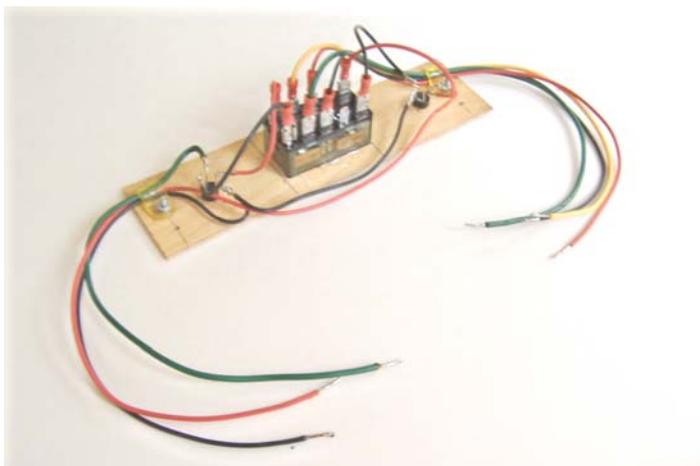


## Replacement for AF 695 Reverse Loop Relay

A replacement for the AF 695 Reverse Loop Relay that uses a latching relay and a few auxiliary parts is presented. The entire replacement can be built for around 25 dollars. The replacement is built using the same color-coded wires as used on the AF 695. The control wires exit one end of the unit and the power wires exit the opposite end as shown below in the connection diagram for the original 695 Reverse Loop Relay.



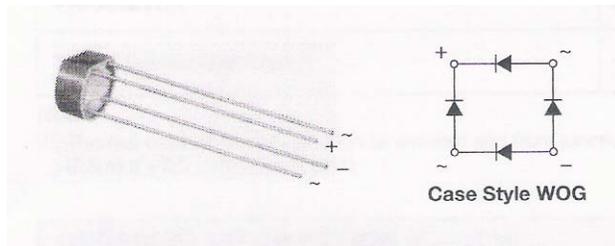
The replacement shown below uses a Panasonic relay that requires a DC voltage to operate each of the two control coils. Each of the control coils requires a bridge rectifier to convert the AC control voltage to DC. The "Set" coil is energized when the AF 720 remote control track switches are switched to the "Straight" position. The "Reset" coil is energized when the AF 720 remote control track switches are switched to the "Curve" position.



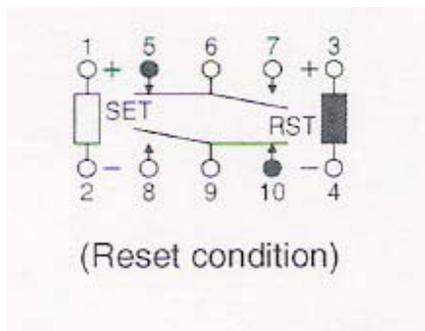
AF 695 Replacement Circuit

## Construction and Wiring Instructions:

The latching relay is mounted upside down on a thin sheet of hobby plywood using glue. The connections are numbered on the relay adjacent to the spade terminals. The "set" relay coil is at left end of the relay and the "reset" coil at the right end when the relay is positioned with terminals "1" and "2" toward the left end of the board (control wire end). The bridge rectifier which powers each coil is mounted with a glue gun at the end of the relay nearest the coil being powered. Connections are made to the relay using a female spade connector that pushes onto the relay terminals.



Connection Diagram for Bridge Rectifier



Connection Diagram for Latching Relay

The wires described as "free hanging" are AWG 18 gauge wires that either connect to the control terminals of the AF switch or connect as power leads to the track. The length of these leads will be determined by the location of their connection points on the layout.

### Connections for the "Set" relay coil:

1. Connect a red wire from the "+" lead of the "set" rectifier to terminal "1" of the relay.
2. Connect a black wire from the "-" lead of the "set" rectifier to terminal "2" of the relay.
3. Run a free hanging black wire from left end of the relay board to the "~" AC lead of the "set" rectifier. This is the lead that connects to the black AF switch control post.
4. Run a free hanging green wire from the left end of the relay board and connect it to the other rectifier "~" AC lead. This is the lead that connects to the green AF switch control post.

### Connections for the "Reset" relay coil:

1. Connect a red wire from the "+" lead of the "reset" rectifier to terminal "3" of the relay.
2. Connect a black wire from the "-" lead of the "reset" rectifier to terminal "4" of the relay.
3. Run a black wire from the "~" AC lead of the "reset" rectifier and connect it to the black wire on the "~" AC lead of the "set" rectifier.
4. Run a free hanging red wire from the left end of the relay board and connect it to the other "reset" rectifier "~" AC lead. This is the lead that connects to the red AF switch control post.

### Relay Power Switching Connections:

1. Connect a free hanging red wire to terminal "6" of the relay and run the wire out the right end of the relay board.
2. Connect a free hanging black wire to terminal "9" of the relay and run the wire out the right end of the relay board.
3. Connect a free hanging green wire to terminal "8" of the relay and run the wire out the right end of the relay board.
4. Connect a free hanging yellow wire to terminal "5" of the relay and run the wire out the right end of the relay board.

### Parts List

All parts listed below that are required for construction of the Reverse Loop Relay replacement can be purchased from the Digikey website.

Item	Manufacturer	Digikey Part No.	Rating	QTY	Price
DPDT Latching Relay	Panasonic	255-1490-ND	Contacts: 15 A Coil: 12 VDC	1	22.60 ea
Bridge Rectifier	Vishay	B250C800G-E4/51	Current: 0.9 A Reverse Voltage: 400	2	0.48 ea.
Female Spade Connector	Amp	A0907-ND		8	10 for 4.21
Cable Clamp	unknown			2	

### Verifying Operation of Unit

The proper operation of the replacement unit can be verified using a transformer with a 15 or 16 volt output to represent the fixed output accessory voltage connection to a train transformer.

1. Connect the black control wire at the left end of the unit to one connection on the transformer.
2. Quickly touch the green control wire to the other transformer terminal simulating the momentary connection that would be used to throw the AF 720 switch to the "Straight" position..
3. Verify that there is a "short" between the black power wire and the green power wire at the right end of the board.
4. Verify that there is an "open" connection between the red power wire and the yellow power wire at the right end of the board.
5. Quickly touch the red control wire to the transformer terminal simulating the momentary connection that would be used to throw the AF 720 switch to the "Curve" position..
6. Verify that there is a "short" between the red power wire and the yellow power wire at the right end of the board.
7. Verify that there is an "open" connection between the black power wire and the green power wire at the right end of the board.
8. Repeat steps 2 and 3 to confirm that the relay responds to the "set" command. This is necessary since the relay may have already been in the "set" position before control voltage was applied.

### **Transformer Considerations**

Proper operation of the reverse relay replacement circuit depends on usage of a transformer with a sufficient power rating. This is especially true when the reverse loop is set up with two AF switches being activated simultaneously. Each switch draws a 5 ampere current when activated which translates to power draw of 75 watts at 15 volts from the transformer. The transformer voltage could fall below the voltage necessary to operate the latching relay, especially during a 10 ampere current draw. My layout required a dedicated 90 watt (Lionel 1033) transformer to insure proper operation with two AF track switches operated simultaneously.

The average DC voltage available to operate the relay coil will be 0.8 times the transformer AC voltage. The coil requires a minimum of 8 volts for reliable operation. The transformer voltage on my layout dropped to 12 volts when the two AF switches were operated simultaneously. The available coil voltage under these conditions was 9.6 volts.

It is recommended that a dedicated transformer be used to operate the reverse loop switches, especially if two switches are operated simultaneously. This will make the available transformer voltage independent of any power draw related to the operation of a train.

It is suggested that reference 1 below be reviewed by those not familiar with setting up reverse loops.

**References/websites:**

1. Website containing the Detailed Article Describing the Operation and Connection of the Original AF 695

<http://baltimoreamericanflyerclub.org/articles/how-to-articles/>

2. Website Source for Ordering Parts (Digikey)

<https://www.digikey.com>

3. Bridge Rectifier Datasheet

<http://www.vishay.com/docs/88534/800g.pdf>

4. Panasonic Relay Datasheet

[https://www3.panasonic.biz/ac/e\\_download/control/relay/power/catalog/mech\\_eng\\_sp.pdf](https://www3.panasonic.biz/ac/e_download/control/relay/power/catalog/mech_eng_sp.pdf)

Carl Kellenbenz  
Baltimore Area American Flyer Club