

# Westinghouse

## TYPE HRK AND HRP DIRECTIONAL OVERCURRENT GROUND RELAY FOR CARRIER CURRENT RELAY SYSTEMS

### INSTRUCTIONS

#### CAUTION

Before putting the relay into service remove blocking from all the moving parts. Inspect the relay and operate all elements by hand to be sure no damage has occurred during shipment.

#### APPLICATION

These relays are used to provide directional ground fault protection in the carrier current relaying scheme. The HRK relay is used at those locations where neutral current from the power transformer banks is available for polarizing the directional element. The HRP relay is used where this neutral current is not available, and residual voltage must be used for polarizing the element.

#### CONSTRUCTION AND OPERATION

These relays consist of two beam-type overcurrent elements, a directional element, contactor switch, and operation indicator. The trip circuit of the relay includes the directional contacts in series with the contacts of one overcurrent element, the operation indicator, and the contactor switch, as shown in Figure 2. The other overcurrent element is used to start carrier signal transmission. Operation of this relay in connection with the carrier scheme is fully described in I.L. #2717-A.

The construction details of the two overcurrent elements are shown in Figure 1. The element consists of a beam pivoted in the center with a contact arm on one end and a restraining weight on the other. The beam is pulled down to make contact by a current coil, and resets due to the restraining weight. Part of the weight assembly consists of a cylinder filled with tungsten powder that acts to keep vibrations down to a minimum. The moving contacts are also filled with tung-

sten powder which further reduces any tendency of the contacts to chatter.

The directional element is of the induction loop type. A small voltage transformer causes a large current to flow in a single-turn movable secondary, this current being substantially in phase with the voltage. A one-turn aluminum secondary loop is placed in the field produced by the current, and a torque is produced which rotates the loop in either the contact closing or contact opening direction depending upon the direction of power flow. Connection to the moving contact is made with a flexible conducting pigtail. The contact is a small thin-walled cylinder filled with powdered tungsten and mounted on a spring. The action of this assembly is to reduce any tendency of the contact to bounce when it makes. The stationary contact is rigid. The loop has two adjustable stop screws; one to limit the contact separation, and the other to limit contact follow or deflection.

The d-c. contactor switch in the relay has its coil in series with the main contacts of the relay and with the trip coil of the breaker. When the relay contacts close, the coil becomes energized and closes the switch contacts. This shunts the main relay contacts, thereby relieving them of the duty of carrying tripping current. These contacts remain closed until the trip circuit is opened by the auxiliary switch on the breaker. The contactor switch is equipped with a third point which is connected to a terminal on the relay to operate a bell alarm.

The contactor switch operates on a minimum of 2.0 amperes, but the trip circuit should draw at least 4 or 5 amperes in order to keep the time of operation of the switch to a minimum and provide positive operation.

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OVERCURRENT GROUND RELAY**

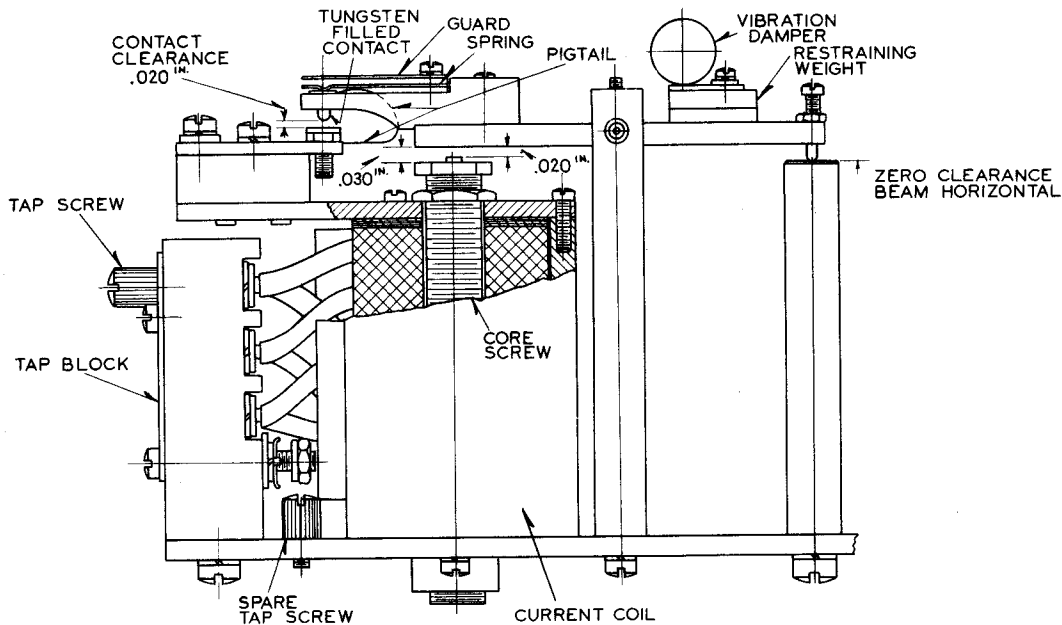


Figure 1  
Section View of Overcurrent Elements

CONNECTIONS AND SETTINGS

The external a-c. connections of both the type HRK and HRP relay are shown in Figure 3. The carrier relaying d-c. schematic (supplied with all carrier orders) should be consulted for the details of the external d-c. connections of these relays.

The overcurrent element of the relays operates in one cycle or less on values of ground fault current above 200% of the tap setting. The taps available are:

.5 to 3.0 ampere range - Taps at .5, .75, 1.0, 1.5, 2.0, 3.0

1.0 to 6.0 ampere range - Taps at 1.0, 1.5, 2.0, 3.0, 4.0, 6.0

The settings should be made by inserting the tap screw in the tap to give the required pick-up.

It is desirable to set the carrier start overcurrent element on a lower tap than the tripping overcurrent element in most carrier installations. This insures positive starting of the carrier oscillator for all faults in the immediate vicinity. If the fault is external, the tripping overcurrent and directional elements in conjunction with the carrier relays will block tripping.

ADJUSTMENTS

The proper adjustment to insure correct

operation of this relay has been made at the factory and should not be disturbed after receipt by the customer. If for any reason the adjustments have been changed or the relay repaired, the following procedure should be followed in reassembling and setting it.

Overcurrent Element

Refer to Figure 1. Adjust the stop screw on the rear of the beam so that when it rests on the stop post, the beam is in a horizontal position. Adjust the front magnetic gap to .020 inches, from the beam to the stop pin in the core screw. Adjust the contact gap to .02 inches. Then put the tap screw in the lowest tap hole and pass tap value current thru the coil and adjust the restraining weight until the beam just trips.

Directional Element

See that the loop is free from friction and that the relay is in a vertical position. Adjust the flexible pigtail so that it does not bias the movable loop when the element is deenergized, and then screw up the back stop screw until it just touches the loop. The loop should now assume a vertical position symmetrical with respect to its magnetic iron circuit. Adjust the stationary contact for a separation of .020 inches. Adjust the front stop screw so that it touches the loop at the same time the contacts close, and then back it off 1/4 turn.

With the polarity as shown in Figure 2, a

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current of 1.5 amperes thru the two current coils of the HRK relay will close the directional contacts.

With the polarity as shown, a current of 4 amperes and a voltage of 3.0 volts will close the HRP directional contacts.

### Contactor Switch

Adjust for 1/8" between the disc and contacts. The switch should close at 2.0 amperes and not freeze closed after 30 amperes d-c. have been applied.

### Operation Indicator

Adjust the indicator to operate at 1.0 ampere gradually increased. Test for sticking after 30 amperes d-c. have been applied.

### Energy Requirements

The burden of the various circuits of these relays are as follows:

Each overcurrent element - .10 V.A. at minimum pick-up.

Directional Element Current coil and One Overcurrent Element (Between Terminals 21 and 22, (Fig. 2) - 11.5 V.A. at 5 amps. 50% P.F. .5 Tap.

Directional Element Current Polarizing Coil (HRK) - 4.0 V.A. at 5 amps. 50% P.F.

Directional Element Voltage Polarizing Coil (HRP including  $\phi$  shifter) 6.0 V.A. at 115 V. 90% P.F.

The overcurrent-elements will reset at 85% of the rated current.

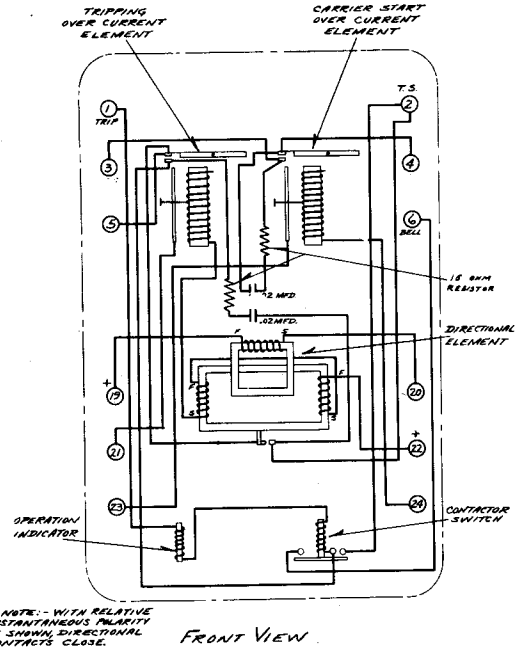


Figure 2  
Internal Wiring Diagram of the HRK-HRP Relays

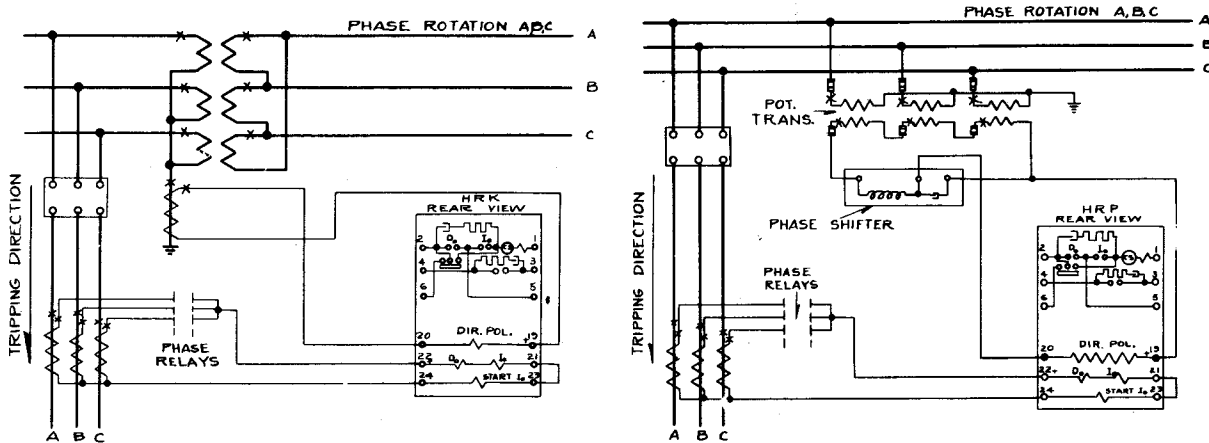


Figure 3  
External A.-C. Connections of the HRK-HRP Relays

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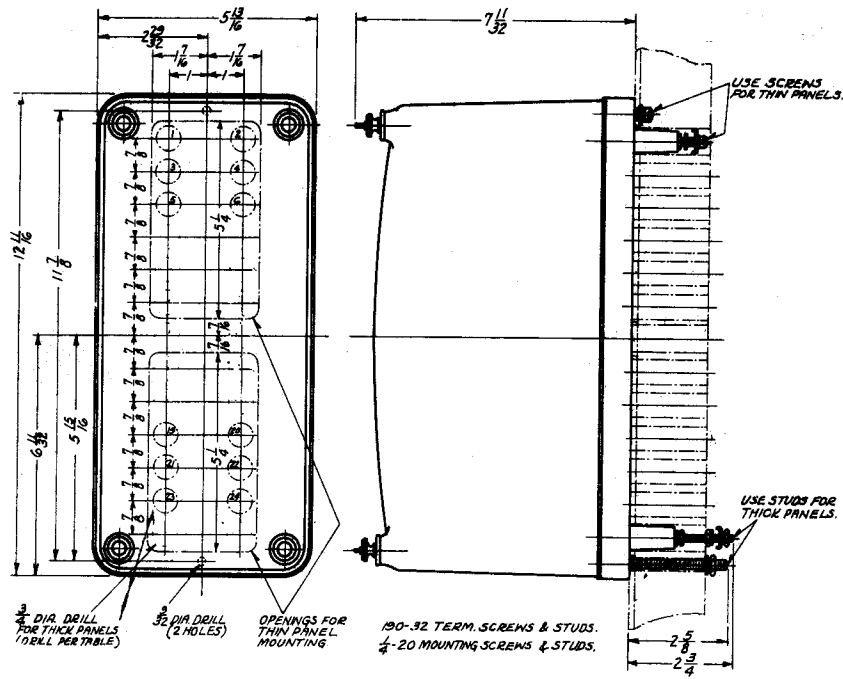


Figure 4  
Outline and Drilling Plan  
for the HRK-HRP Relays Flush type mounting

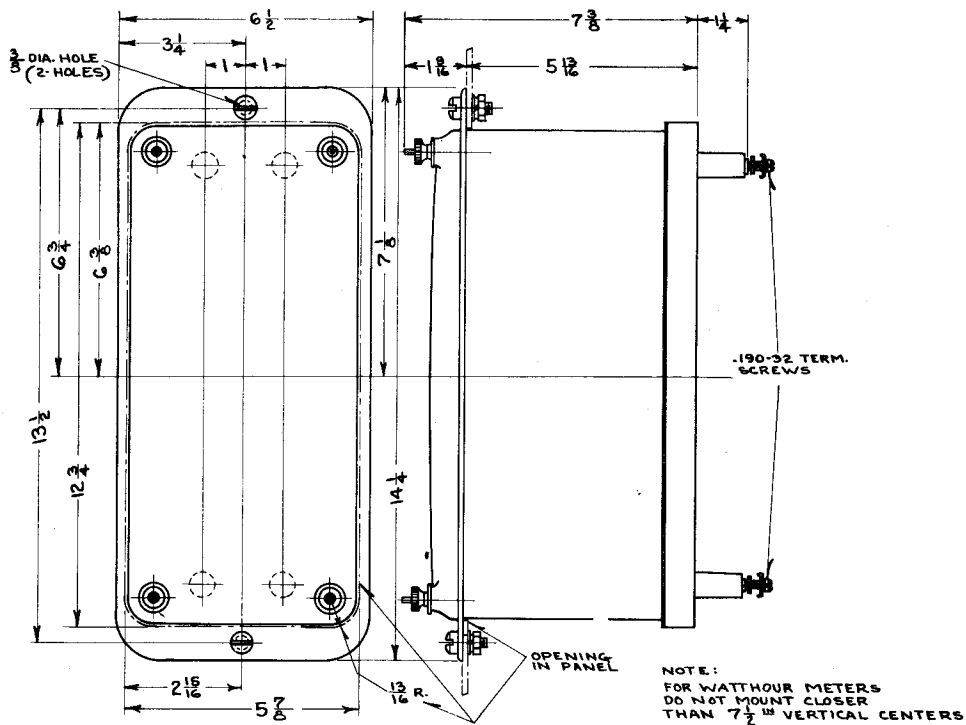
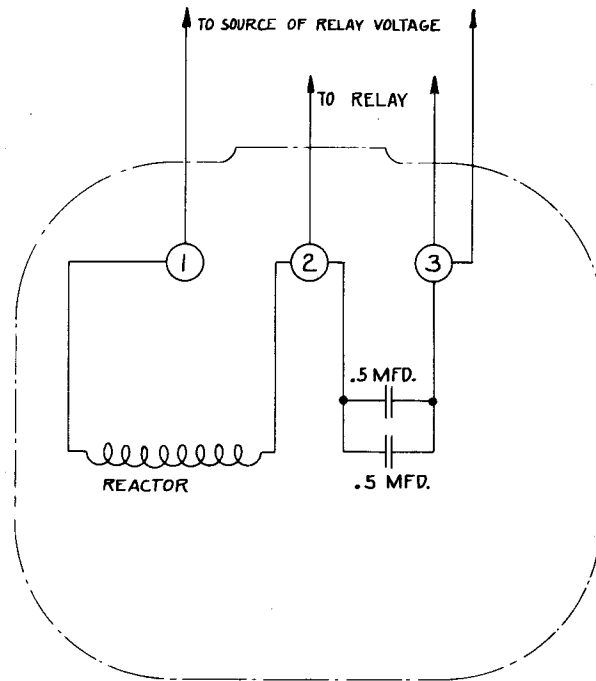


Figure 5  
Outline and Drilling Plan  
for the HRK-HRP Relays Projection type mounting

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TOP VIEW

Figure 6  
Internal Wiring Diagram of the  
Phase Shifter for the Type HRP Relay

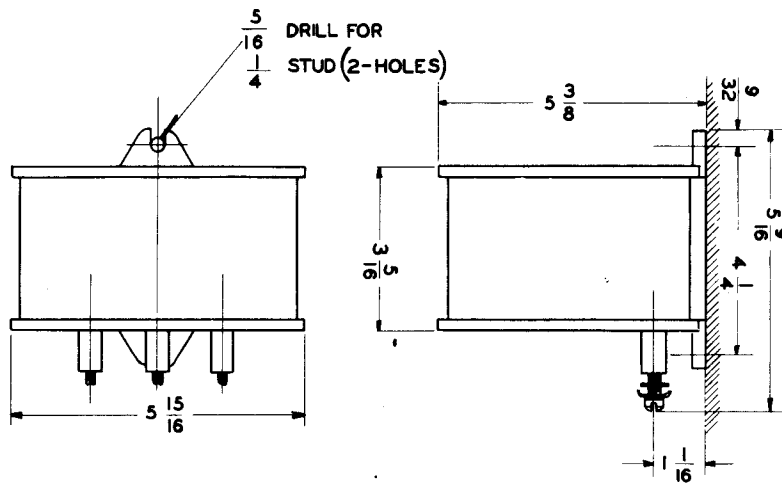


Figure 7  
Outline and Drilling Plan of the  
Phase Shifter for the Type HRP Relay

Westinghouse Electric & Manufacturing Company  
Newark, N. J.