Westinghouse

TYPE CP REVERSE PHASE RELAY

INSTRUCTIONS

CAUTION

Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type CP reverse-phase relay operates upon phase reversal to disconnect motors from the circuit. However if one phase opens resulting from a blown fuse or some similar interruption of service, with polyphase motors operating on the system, the relay may not operate unless the motors are so heavily loaded that normal voltage cannot be maintained on all phases. Normally, the relay will operate as soon as the machines are stopped, thus preventing them from being started again if one phase wire is open.

Since the relay is essentially a three phase contact making voltmeter, it may also be applied to close one set of contacts on 3 phase overvoltage conditions, and the other set of contacts on three phase undervoltage conditions.

CONSTRUCTION AND OPERATION

The type CP relay consists of an induction disc type element, a contactor switch, and an operation indicator when supplied. In addition an external box containing three resistors is supplied. Each of these resistors is to be connected in series with one phase winding of the relay.

The operating element is an induction disc type element operating on three phase voltage. The induction disc is a thin four-inch diameter conducting disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and on the upper end by a stainless steel pin.

On the single pole relays, the moving contact is a small silver rod hemispherically shaped at either end to form a double throw arrangement. It is fastened on the end of a conducting arm. The other end of this arm is clamped to an insulating tube on the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjusted disc which in turn fastens to the moulded insulation block mounted on the element.

On the double pole relays, two silver contacts are fastened (one vertically above the other) to the end of the conducting arm. The stationary contacts may be wired to provide a double pole, double throw contact arrangement, or may be supplied to give an independent front and back tripping arrangement with the moving contacts acting as a conducting bridge.

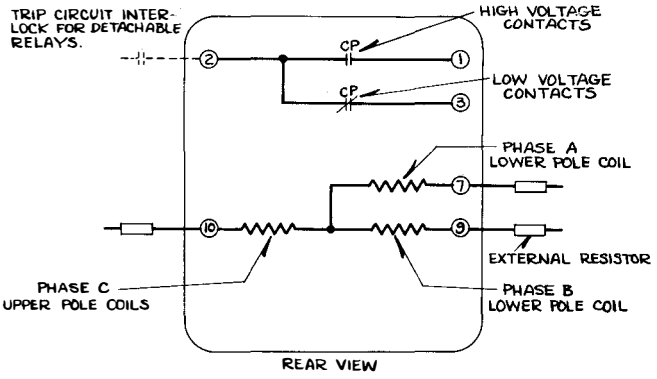
The front and back stationary contact assemblies are both adjustable. Each mounts on a lever which can be set anywhere about the periphery of a calibrated scale. The moulded brackets, upon which the stationary contact leaf springs are mounted, are each secured to their respective lever arms by two screws. These screws may be loosened and the moulded contact supports pivoted to the positions required for correct tracking of both contact assemblies on the calibrated scale.

The relay electromagnet consists of a main potential coil, and two upper pole potential coils. The main coil is tapped, and the tap point is used as a neutral (not brought out) for a WYE connection of the relay coils. The three legs of the WYE are respectively, the two upper pole coils connected in series, and each half of the tapped main pole winding.

When energized by three phase voltages, the fluxes of the main and upper pole circuits react to produce torque on the induction disc. This torque is a function of the positive and negative sequence components of voltage, each set tending to produce opposite rotation of the induction disc. Thus positive sequence voltage tends to make the high voltage contacts close while negative sequence tends to close the low voltage contacts. A reversed phase (which means negative sequence phase rotation) will cause the relay low voltage contacts to trip. In addition, unbalance in the voltages impressed on the relay will also cause the low voltage contacts to close, if due to unbalance sufficient negative sequence voltage is present to reduce the relay torque to the low voltage tripping point.

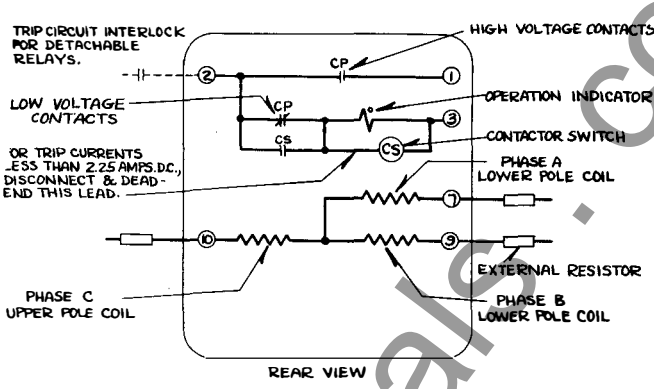
Contactor Switch (When Supplied)

The d-c contactor switch in the relay is a small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts. The coil is 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



NOTE: MOVING CONTACT IS IN THE LEFT HAND POSITION (FRONT VIEW) WHEN THE VOLTAGE IS LOW OR THE PHASE REVERSED.

Figure 1
Internal Schematic of The Type CP Relay in the Standard Case Without Operation Indicator, or Contactor Switch.



NOTE: MOVING CONTACT IS IN THE LEFT HAND POSITION (FRONT VIEW) WHEN THE VOLTAGE IS LOW OR THE PHASE REVERSED.

Figure 2
Internal Schematic of The Type CP Relay in the Standard Case With Operation Indicator and Contactor Switch in the Low Voltage Circuit.

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.

Operation Indicator (When Supplied)

The operation indicator is a small solenoid coil connected in the trip circuit. When the coil is energized, a spring-restrained armature releases the white target which falls by gravity to indicate completion of the trip circuit. The indicator is reset from outside of the case by a push rod in the cover or cover stud.

CHARACTERISTICS

The type CP reverse phase relay has adjustable high and low voltage contacts which can be set around the periphery of a scale. For the 115 volt relay this scale is calibrated from 70 to 120 volts, and for the 230 volt relay, the scale is calibrated from 140 to 240 volts.

The voltage values indicated on the scale, represent balanced three phase voltages applied to the relay. The relay contacts will just close when the balanced three phase line to line voltages reach the value indicated by the pointer of either of the adjustable stationary contacts.

If the contacts are set to close for a particular line to line value of balanced three phase voltage, and if that exact voltage is applied, then the relay is operating at its minimum trip point and the times on repeated operations are not repetitive within close tolerances. However, voltages appreciably greater than the overvoltage setting, or appreciably less than the undervoltage setting, result in relay timing operations which are consistent for repeated trials.

The relay has inverse timing; that is, the greater the increase in voltage the faster the relay contact will travel. Typical time curves for various contact settings are shown in Figures 5 and 6.

RELAYS IN TYPE FT CASE

The type FT cases are dust-proof enclosures combining relay elements and knife-blade test switches in the same case. This combination provides a compact flexible assembly easy to maintain, inspect, test and adjust. There are three main units of the type FT case: the case, cover and chassis. The case is an all welded steel housing containing the hinge half of the knife-blade test switches and the terminals for external connections. The cover is a drawn steel frame with a clear window which fits over the front of the case with the switches closed. The chassis is a frame that houses the relay elements and supports the contact jaw half of the test switches. This slides in and out of the case. The electrical connections between the base and chassis are completed through the closed knife-blades.

Removing Chassis

To remove the chassis, first remove the cover by unscrewing the captive nuts at the corners. There are two cover nuts on the S size case and four on the L and M size cases. This exposes the relay elements and all the test switches for inspection and testing. The next step is to open the test switches. Always open the elongated red handle switches first before any of the black handle switches or the cam action latches. This opens the trip circuit to prevent accidental trip out. Then open all the remaining switches. The order of opening the remaining switches is not important. In opening the test switches they should be moved all the way back against the stops. With all the switches fully opened, grasp the two cam action latch arms and pull outward. This releases the chassis from the case. Using the latch arms as handles, pull the chassis out of the case. The chassis can be set on a test bench in a normal upright position as well as on its top, back or sides for easy inspection, maintenance and test.

After removing the chassis a duplicate chassis may be inserted in the case or the blade portion of the switches can be closed and the cover put in place without the chassis.

When the chassis is to be put back in the case, the above procedure is to be followed in the reversed order. The elongated red handle switch should not be closed until after the

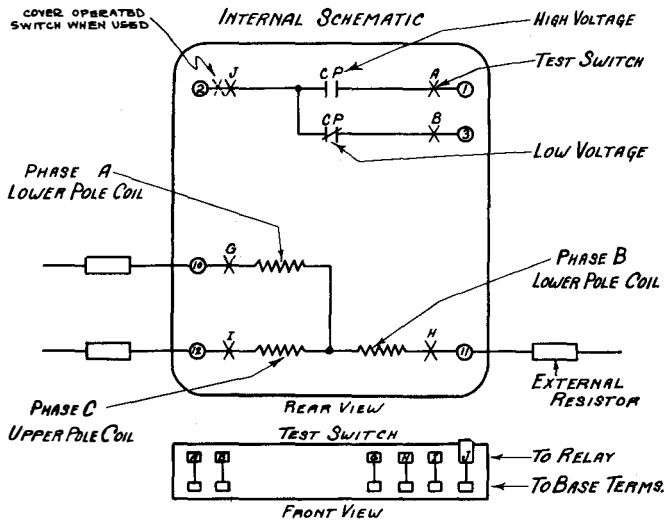


Figure 3
Internal Schematic of The Type CP Relay in the Type FT Case without Operation Indicator or Contactor Switch.

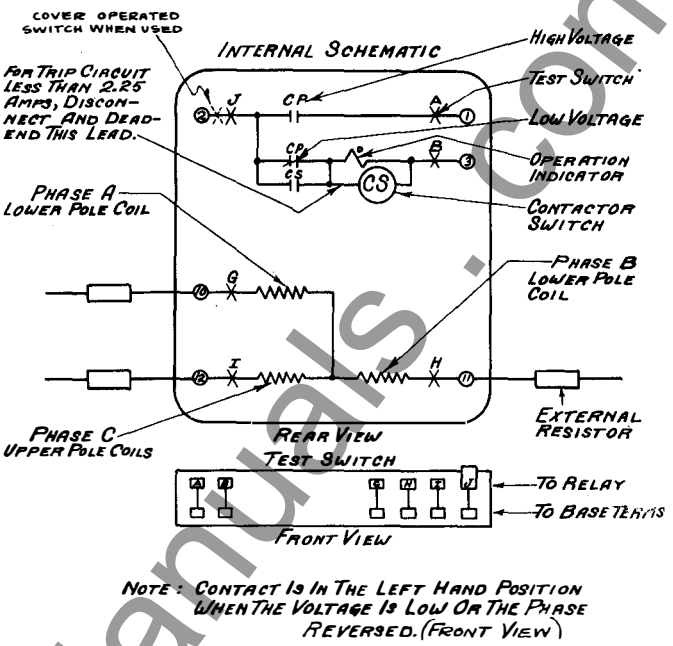


Figure 4
Internal Schematic of The Type CP Relay in the Type FT Case with Operation Indicator and Contactor Switch in the Low Voltage Circuit.

chassis has been latched in place and all of the black handle switches closed.

Electrical Circuits

Each terminal in the base connects thru a test switch to the relay elements in the chassis as shown on the internal schematic diagrams. The relay terminal is identified by numbers marked on both the inside and outside of the base. The test switch positions are identified by letters marked on the top and bottom surface of the moulded blocks. These letters can be seen when the chassis is removed from the case.

The potential and control circuits thru the relay are disconnected from the external circuit by opening the associated test switches.

A cover operated switch can be supplied with its contacts wired in series with the trip circuit. This switch opens the trip circuit when the cover is removed. This switch can be added to the existing type FT cases at any time.

Testing

The relays can be tested in service, in the case but with the external circuits isolated or out of the case as follows:

Testing In Service

Voltages between the potential circuits can be measured conveniently by clamping #2 clip leads on the projecting clip lead lug on the contact jaw.

Testing In Case

With all blades in the full open position, the ten circuit test plug can be inserted in the contact jaws. This connects the relay elements to a set of binding posts and completely isolates the relay circuits from the external connections by means of an insulating barrier on the plug. The external test circuits are connected to these binding posts. The plug is inserted in the bottom test jaws with the binding posts up and in the top test switch jaws with the binding posts down.

The external test circuits may be made to the relay elements by #2 test clip leads instead of the test plug.

Testing Out of Case

With the chassis removed from the base, relay elements may be tested by using the ten circuit test plug or by #2 test clip leads as described above. The factory calibration is made with the chassis in the case and removing the chassis from the case will change the calibration values by a small percentage. It is recommended that the relay be checked in position as a final check on the calibration.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

The relays with operation indicator and contactor switch are normally supplied with the universal connection, which consists of the 0.2 ampere indicator (Resistance = 2.8 ohms) and the 2.0 ampere contactor switch (Resistance = .25 ohm) in parallel. This provides a trip circuit resistance of approximately 0.25 ohm, and is suitable for all trip currents above 2.25 amperes d-c. If the trip current is less, disconnect the contactor switch coil. To disconnect the coil in the standard case relays, remove the

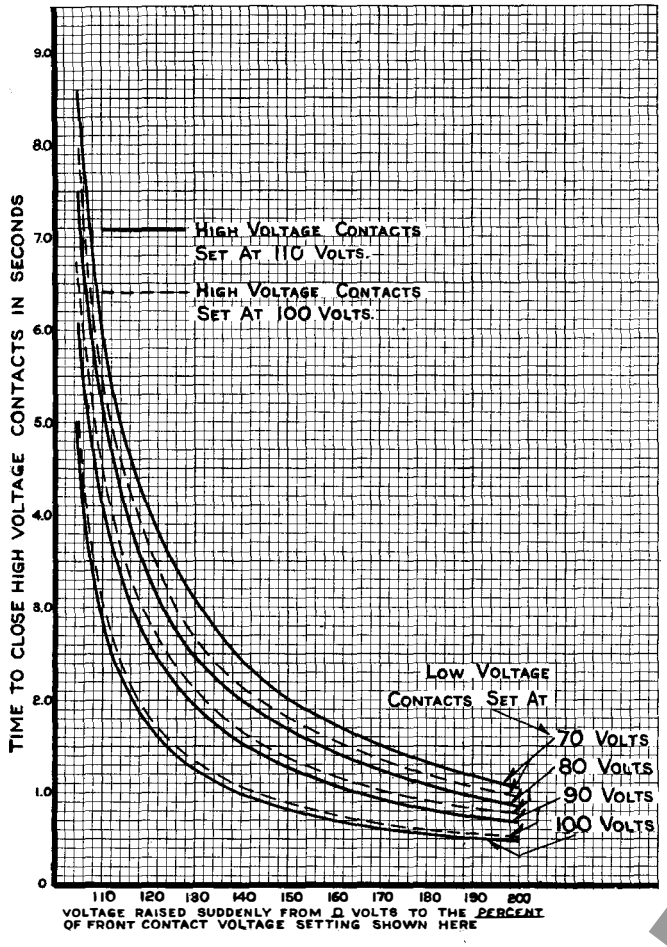


Figure 5
Typical Overvoltage Time Curves for the Type CP Relay.

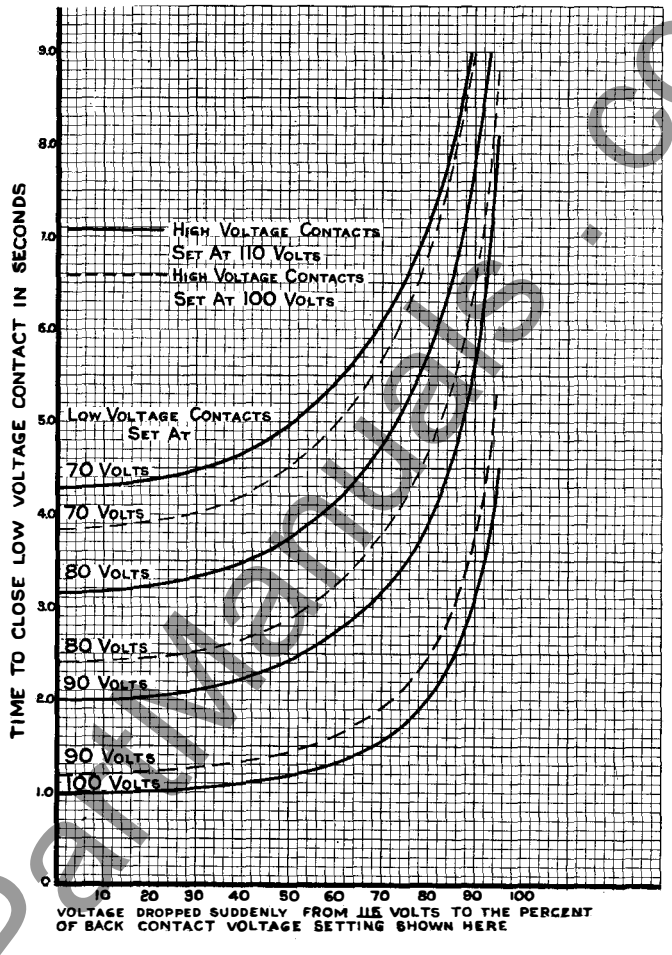


Figure 6
Typical Undervoltage Time Curves for the Type CP Relay.

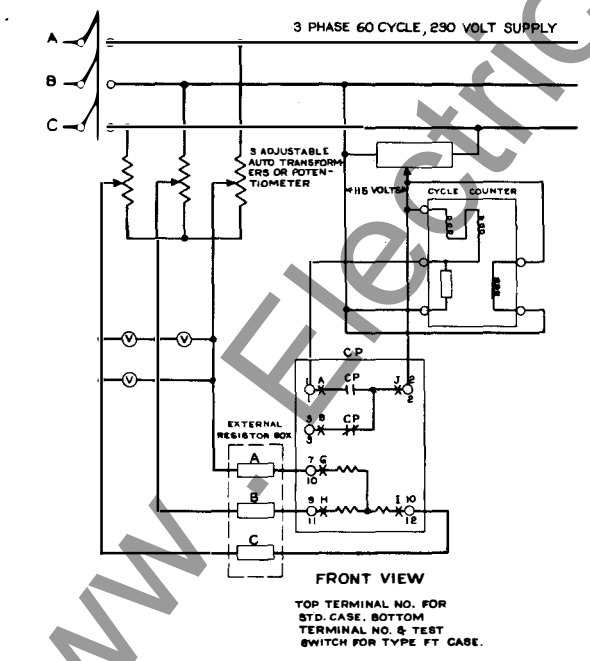


Figure 7
Diagram of Test Connections for checking The Overvoltage Time Curves of the Type CP Relay.

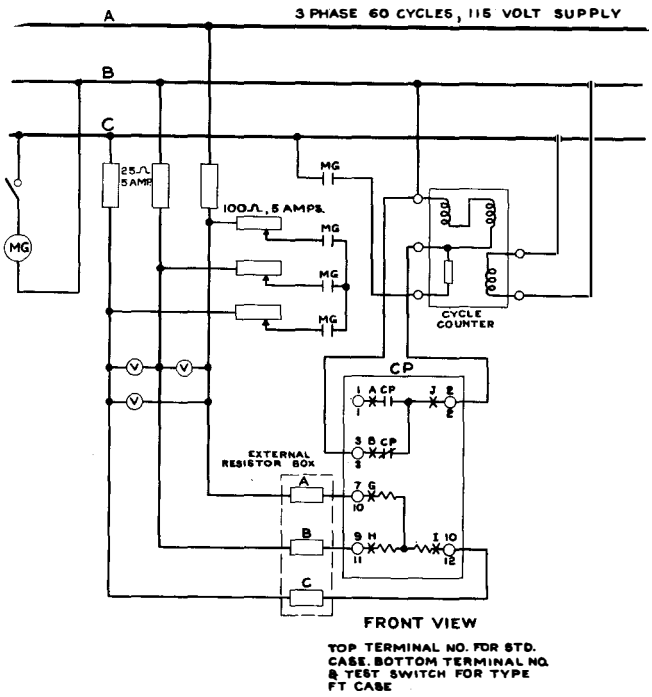


Figure 8
Diagram of Test Connections for checking The Undervoltage Time Curves of The Type CP Relay.

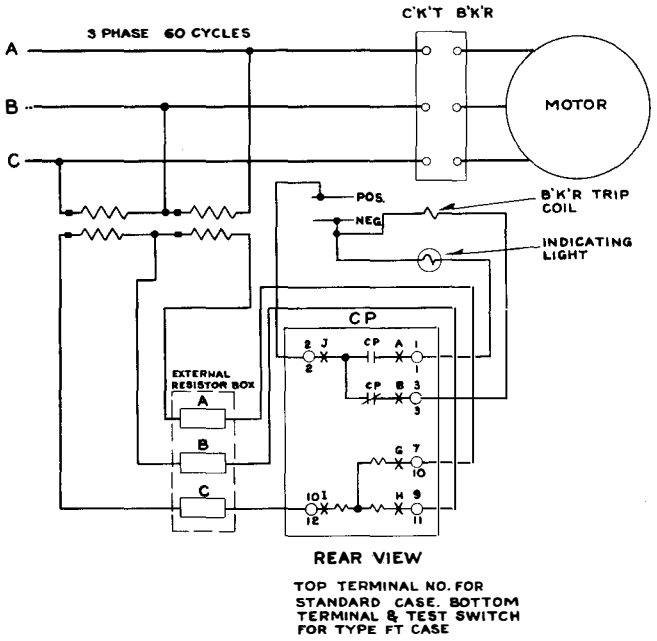


Figure 9
Typical External Connections of The Type CP Reverse Phase Relay.

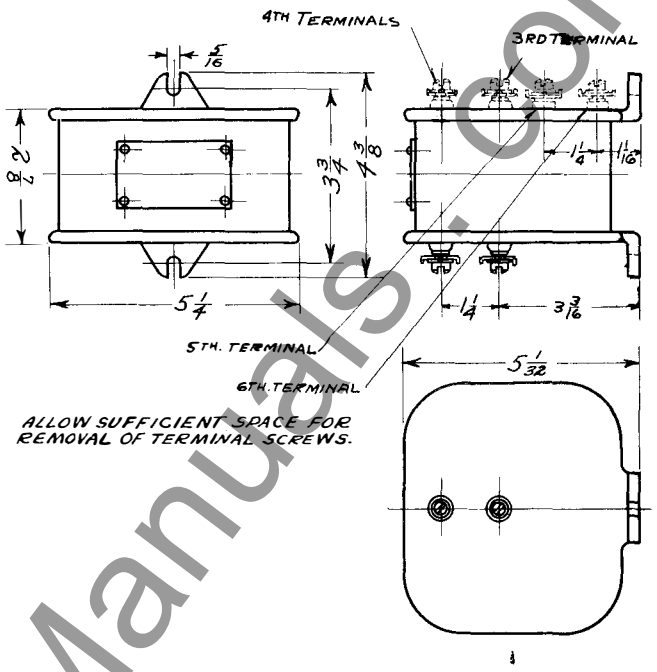


Figure 10
Outline & Drilling Plan of the External Resistor. For Reference Only.

short lead to the coil on the front stationary contact of the switch. This lead should be fastened (dead ended) under the small filister head screw located in the Micarta base of the contactor switch. To disconnect the coil in the type FT case relays, remove the coil lead at the spring adjuster and dead end it under the screw near the top of the moulded bracket.

SETTINGS

There are two independent relay adjustments. These are the high voltage and low voltage contact settings as described under "Characteristics". These settings determine the balanced three phase line-to-line voltage at which the relay contacts trip. The relay timing is not an independent adjustment, since it is fixed by the contact settings chosen. Typical time curves for various contact settings are given in Figures 5 & 6.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be periodically cleaned with a fine file. S#1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

The relay has front and back adjustable stationary contacts; to adjust these properly, set the two levers so they are at approximately the mid-scale position with both pointers indicating the same voltage value on the scale. Then adjust the position of the front and back contacts so they both just touch on either side of the moving contact. This is done by loosening the two screws at the top of each lever and rotating the adjustable contact assembly slightly until the desired contact positions are obtained. The screws should be tightened securely.

To check the relay calibration, an adjustable three phase voltage source must be used. Various balanced three phase voltages may be impressed on the relay, and the position of the adjustable contacts checked for the various values. This may be best done by means of an indicating lamp suitably connected in the trip circuit.

If readjustments are necessary, they can be made by rotating the notched spring adjuster with a screw driver blade inserted in one of the notches.

The relay time curves may be checked with the arrangements given in Figures 7 and 8, the former for the overvoltage curve, the latter for the undervoltage curve.

Operation Indicator (When Supplied)

Adjust the indicator to operate at 0.2 ampere d-c gradually applied by loosening the two screws on the underside of the assembly, and moving the bracket forward or backward. If the two helical springs which reset the armature are replaced by new springs, they should be weakened slightly by stretching to obtain the .2 ampere calibration. The coil resistance is approximately 2.8 ohms.

Contactor Switch (When Supplied)

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked up. This can be most conveniently done by turning the relay up-side-down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point where the play in the moving contact assembly is taken up and where the moving core just separates from the stationary core screw. Back off the stationary core screw one turn beyond this point and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism Adjust the contact clearance for 3/32

inch by means of the two small nuts on either side of the Micarta disc. The switch should pick up at 2 amperes d-c. Test for sticking after 30 amperes d-c have been passed thru the coil. The coil resistance is approximately 0.25 ohms.

REPAIR WORK

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complate nameplate data.

ENERGY REQUIREMENTS

The type CP relay when energized at 115 volts balanced 3 phase, and with the external resistance box connected, has the following VA burdens for each phase.

	Watts	Vars	VA	Lagging Power Factor Angle
Phase A	8.5	.30	8.5	2.0°
Phase B	9.0	1.6	9.1	10.2°
Phase C	7.6	1.2	7.7	9.0°

The continuous voltage rating of the relays is 110% of rated voltage.

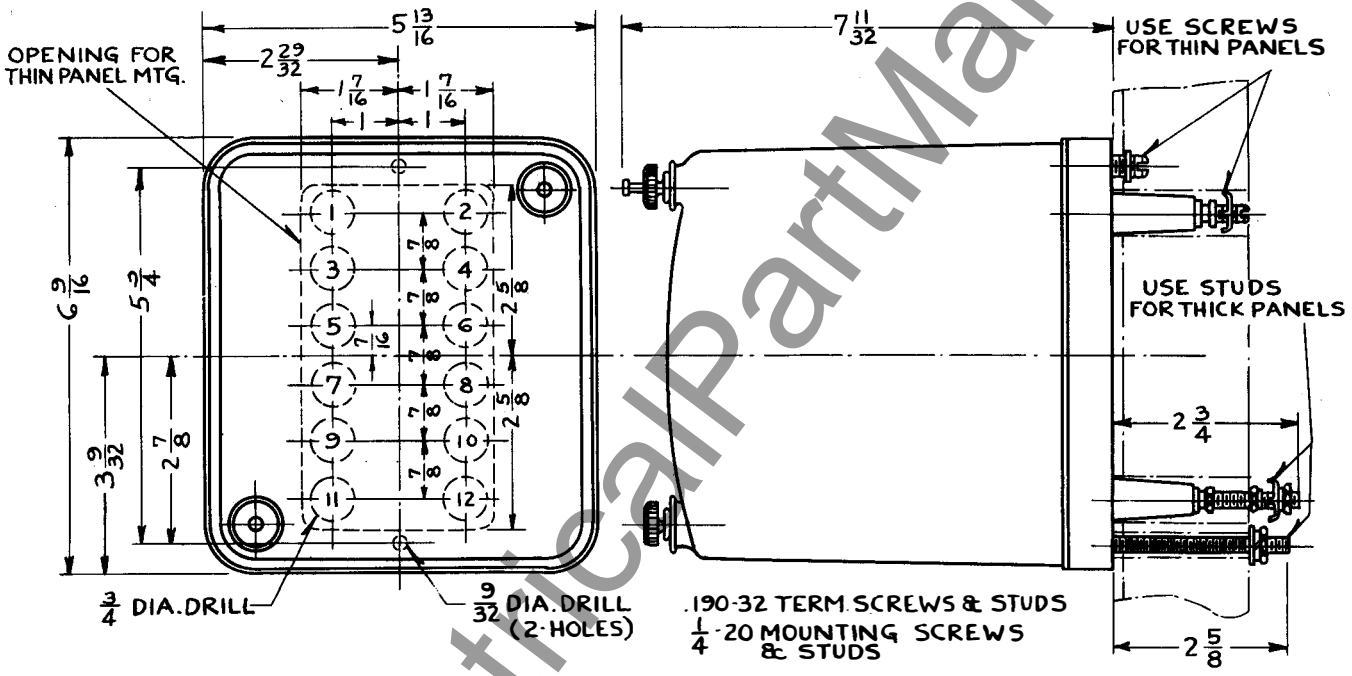


Figure 11
Outline and Drilling Plan for The Standard Projection Case. See the Internal Schematic for The Terminals Supplied. For Reference Only.

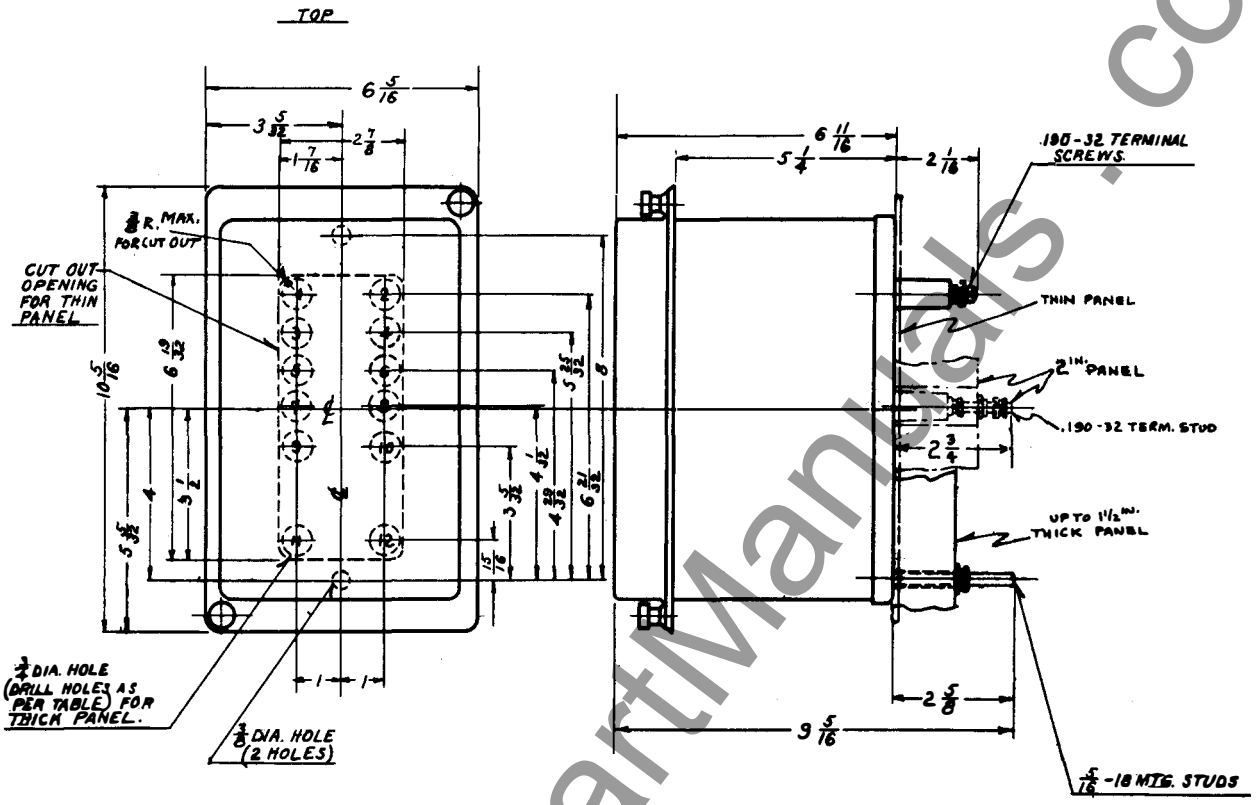


Figure 12
Outline and Drilling Plan for The S10 Projection Type FT Flexitest Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

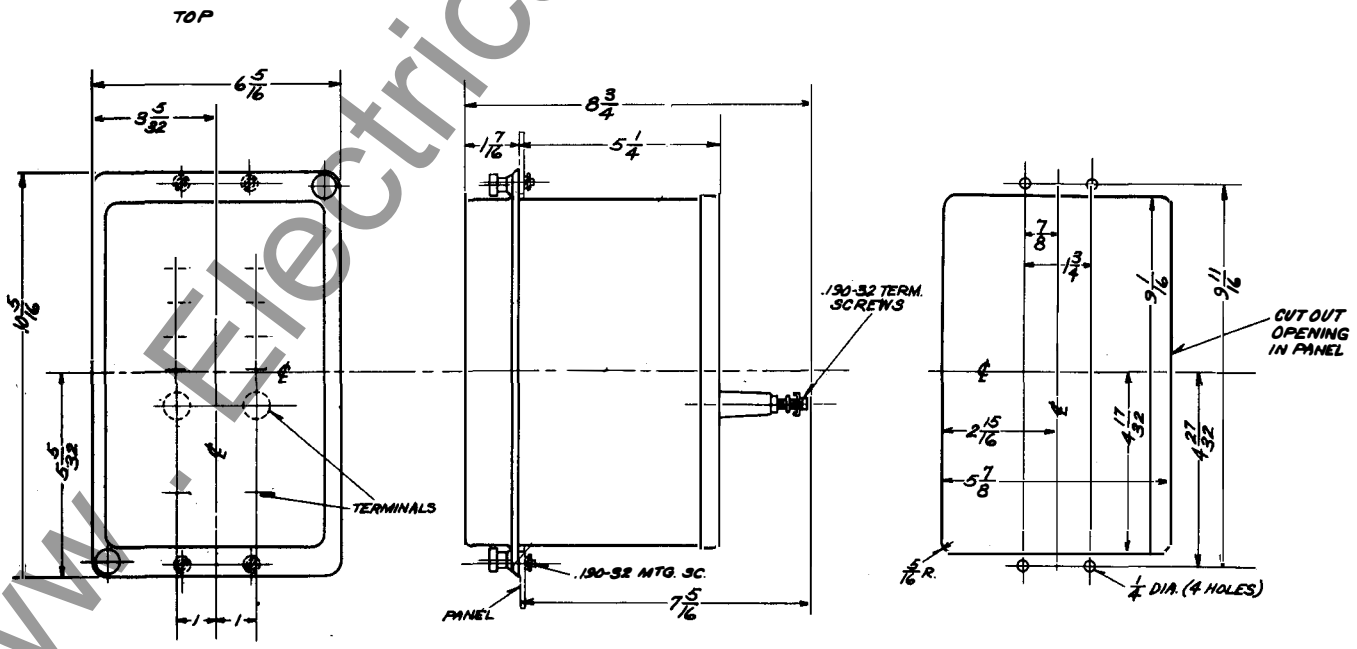


Figure 13
Outline and Drilling Plan for the S10 Semi-flush Type FT Flexitest Case. For Reference Only.

PRINTED IN U.S.A.

WESTINGHOUSE ELECTRIC CORPORATION
Meter Division, Newark, N. J.

11-45