Westinghouse

TYPES SM-1 AND SM-3

INSTANTANEOUS OVERCURRENT RELAYS

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 SM relays are used to provide instantaneous overcurrent protection of transmission lines and electrical equipment. They are commonly used to supplement existing induction type overcurrent relays to provide instantaneous protection for heavy faults. In these applications the system characteristics should permit selective operation on overcurrent alone so that the relay may be set to operate on internal faults and not operate for external faults either at the near or remote busses.

The type SM-1 relay has a single overcurrent element, and the type SM-3, three overcurrent elements.

CONSTRUCTION AND OPERATION

The type SM-1 relay consists of one overcurrent element and one operation indicator. The type SM-3 relay consists of three overcurrent elements, three operation indicators, and one contactor switch.

Overcurrent Element

The overcurrent element is a small solenoid type element. A cylindrical plunger rides up and down on a vertical guide rod in the center of the solenoid coil. The guide rod is fastened to the stationary core, which in turn screws into the element frame. A silver disc is fastened to the moving plunger through a helical spring. When the coil is energized, the plunger moves upward carrying the silver disc which bridges three conical-shaped stationary contacts. In this position, the helical spring is compressed and the plunger is free to move while the contact remains stationary. Thus, a-c vibrations of the plunger are prevented from causing contact bouncing. A Micarta disc mounted on a tapped bushing can be screwed up or down on the threaded guide rod to change the initial position of the plunger, thus determining the pick-up current. A locknut secures the disc in its selected position.

Operation Indicator

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.

Contactor Switch

The contactor switch is similar to the overcurrent element except that a silver disc is fastened directly to the moving plunger for d-c operation, and there is no calibrated scale. 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 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.

CHARACTERISTICS

The standard ranges of the types SM-1 and SM-3 relays are 4-16, 10-40, 20-80, and 40-160 amperes a-c. The continuous ampere rating is 10 amperes for the 4-16 ampere range and 20 amperes on the other ranges. The ratio of drop-out minimum pick-up (4,10,20 or 40 amperes for the ranges above; not the setting used) varies with individual relays between 50 to 70%.

The contacts will close a circuit carrying 30 amperes and will carry this current long enough to trip the circuit breaker. The contacts will carry a current of 5 amperes continuously. At the minimum current setting of the relay the contact gap and the interrupting capacity is a minimum. At this minimum setting the contacts will break an inductive circuit carrying 25 amperes at 115 volts a-c. or 15 amperes, 230 volts a-c. They will break an inductive circuit carrying 0.5 ampere at 125 volts d-c. or a resistive circuit carrying 3.5 amperes at the same voltage. This interrupting capacity is obtained by having two gaps in series.

The relays are supplied with either 0.2 or 1.0 ampere operation indicators. The contactor switch in the type SM-3 is normally a 2.0 ampere switch.

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

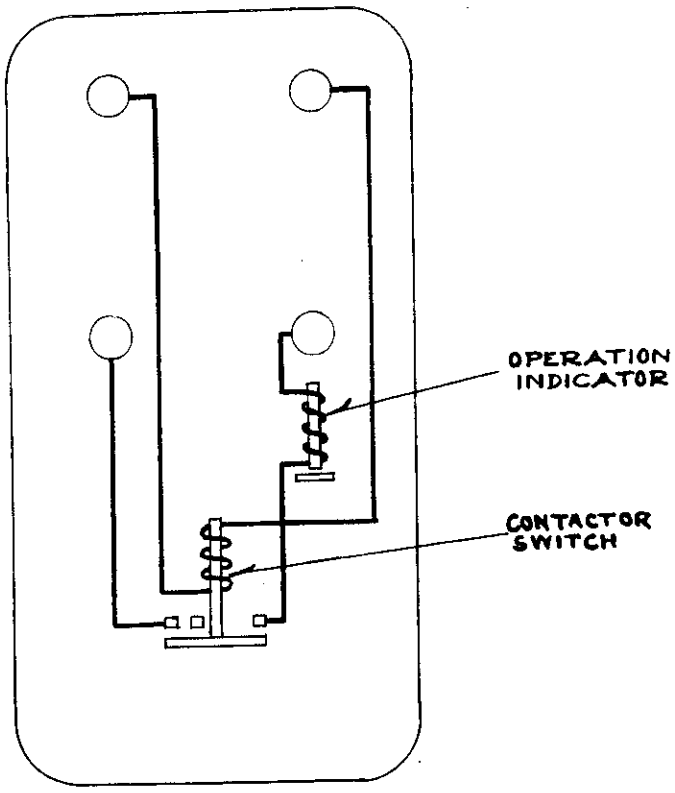


Figure 1
Internal Wiring of the Type SM-1 Relay.

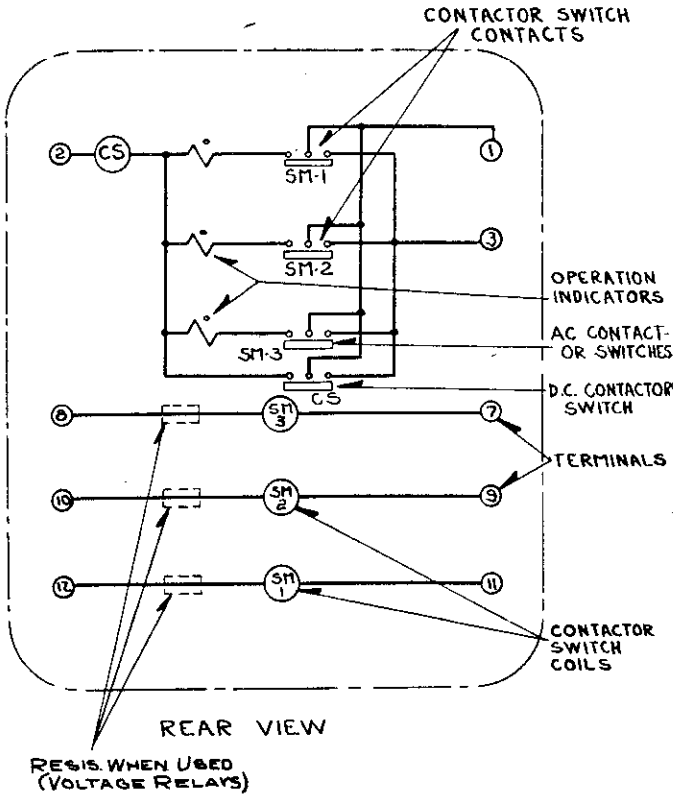


Figure 2
Internal Wiring of the Type SM-3 Relay in the Standard Case of Figure 7.

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 four 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. The chassis operated shorting switch located behind the current test switch prevents open circuiting the current transformers when the current type test switches are closed.

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 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. Opening the current test switch short-circuits the current transformer secondary and disconnects one side of the relay coil but leaves the other side of the coil connected to the external circuit thru the current test jack jaws. This circuit can be isolated by inserting the current test plug (without external connections), by inserting the ten circuit test plug, or by inserting a piece of insulating material approximately 1/32" thick into the current test jack jaws. Both switches of the current test switch pair must be open when using the current test plug or insulating material in this manner to short-circuit the current transformer secondary.

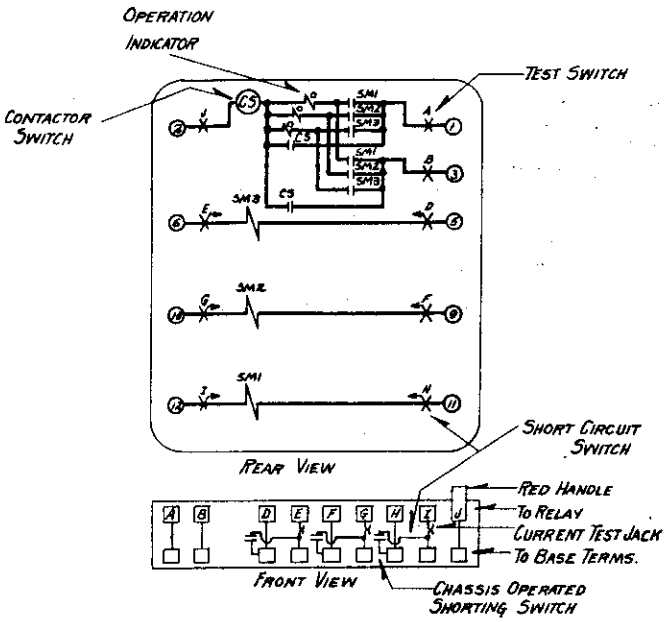


Figure 3
Internal Schematic of the Type SM-3 Relay in the Type FT Case of Figures 8 and 9.

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:-The ammeter test plug can be inserted in the current test jaws after opening the knife-blade switch to check the current thru the relay. This plug consists of two conducting strips separated by an insulating strip. The ammeter is connected to these strips by terminal screws and the leads are carried out thru holes in the back of the insulated handle.

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 jaw 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. When connecting an external test circuit to the current elements using clip leads, care should be taken to see that the current test jack jaws are open so that the relay is completely isolated from the external circuits. Suggested means for isolating this circuit are outlined above, under "Electrical Circuits".

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.

SETTINGS

The pick-up of the switch may be varied by screwing the Micarta disc up or down on the central core screw. The vertical scale at the edge of the disc shows the pick-up values over the range for which the switch is intended to be used.

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.

Overcurrent Element

The position of the Micarta disc at the bottom of the overcurrent element determines the pick-up setting of the element, and the position of the core screw at the top of the element determines the drop-out ratio and also affects the pick-up point. If the element has been dismantled or must be readjusted, the core screw should be adjusted so that the ratio of drop-out current to pick-up current at the lower end of the specified adjustment range is about 60 or 65%. The contact gap should be about 3/64" to 1/16" at minimum pick-up. At currents 5 to 10% above pick-up the plunger will vibrate up and down slightly at a uniform rate, but without opening the contacts. Occasional plunger movements of greater amplitude which may open the contacts are objectionable and usually are due to too high a drop-out setting.

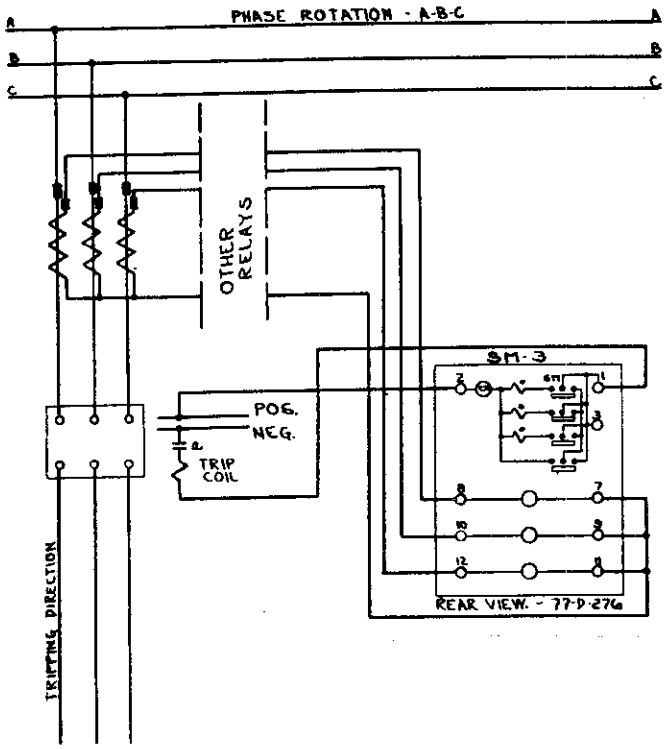


Figure 4
Typical External Connections of the Type SM-3 Relay in the Standard Case for Phase Instantaneous Overcurrent Protection of a Three Phase Line.

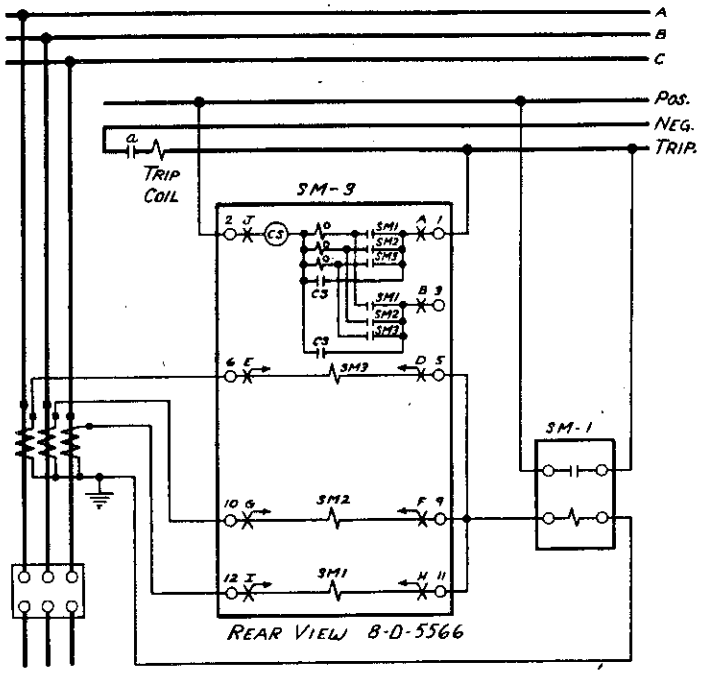


Figure 5
Typical External Connections of the Type SM-3 Relay in Type FT Case and the Type SM-1 Relay for Phase and Ground Instantaneous Overcurrent Protection of a Three Phase Line.

Operation Indicator

Adjust the indicator to operate at 0.2 or 1.0 amperes d-c gradually applied by loosening the two screws on the under side 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 1 ampere calibration. The coil resistance is 2.8 ohms for the 0.2 ampere indicator, and 0.16 ohm for the 1.0 ampere indicator.

Contactor Switch

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-half 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 ohm.

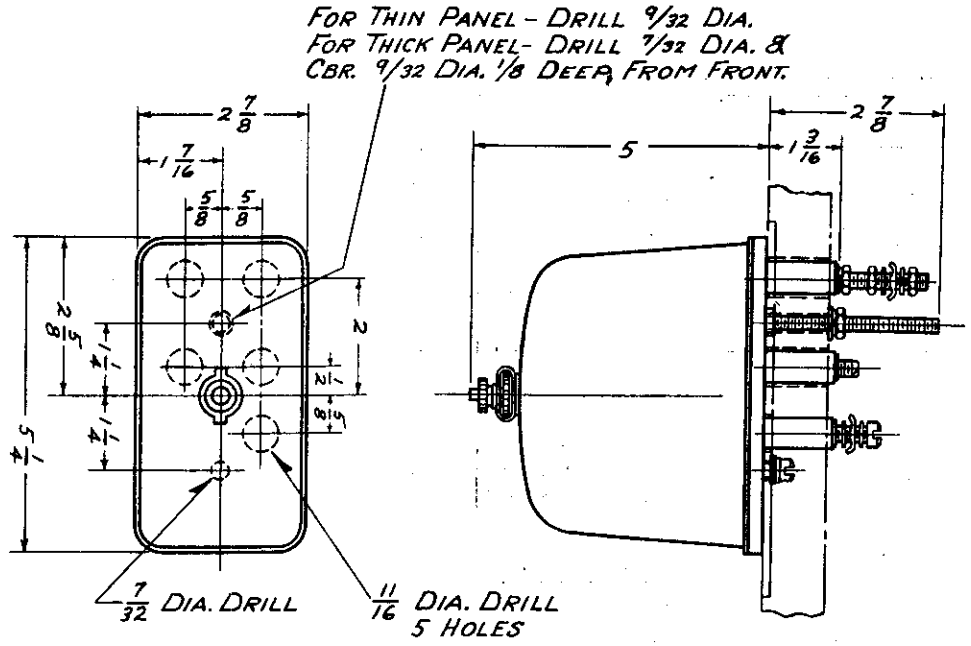
RENEWAL PARTS

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 complete nameplate data.

ENERGY REQUIREMENTS

The burden of the type SM-1 or each element of the type SM-3 relays at 5 amperes, 60 cycles is as follows:

Ampere Range	Voltamperes Min. Setting	P. F. Angle (Lag)
4 - 16	0.8	26°
10 - 40	0.13	26°
20 - 80	0.03	26°
40 - 160	0.009	26°



FOR 1/8 IN OR 3/16 IN SWITCHBOARD USE SCREWS FOR MOUNTING RELAY AND FOR TERMINALS.
FOR 1/4 IN TO 1 IN SWITCHBOARD USE STUDS FOR MTG. RELAY AND SCREWS FOR TERMINALS.
FOR OTHER SWITCHBOARDS USE STUDS FOR MTG. RELAY AND FOR TERMINALS.

Figure 6
Outline and Drilling Plan of the Type SM-1 Relay. (For Reference Only).

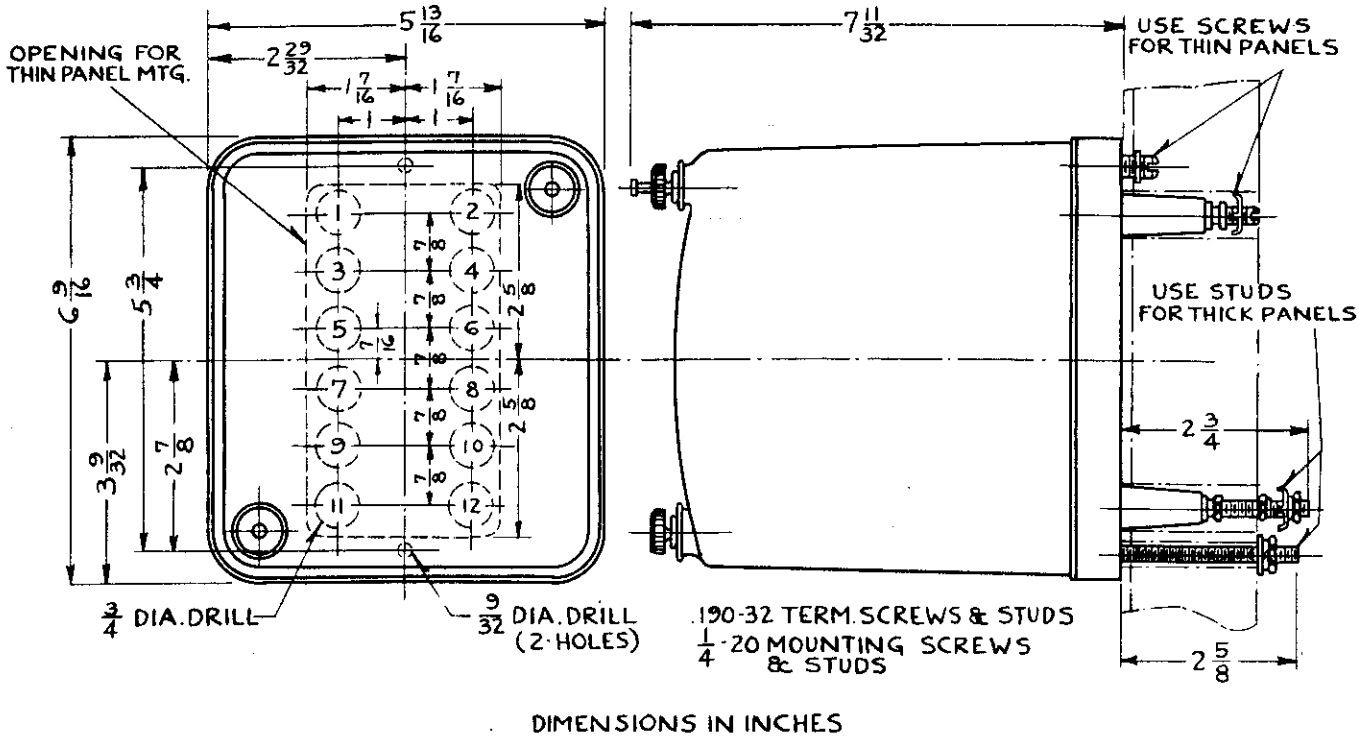


Figure 7
Outline and Drilling Plan of the Type SM-3 Relay in the Standard Case. (For Reference Only).
See the Internal Wiring for the Terminals Supplied.

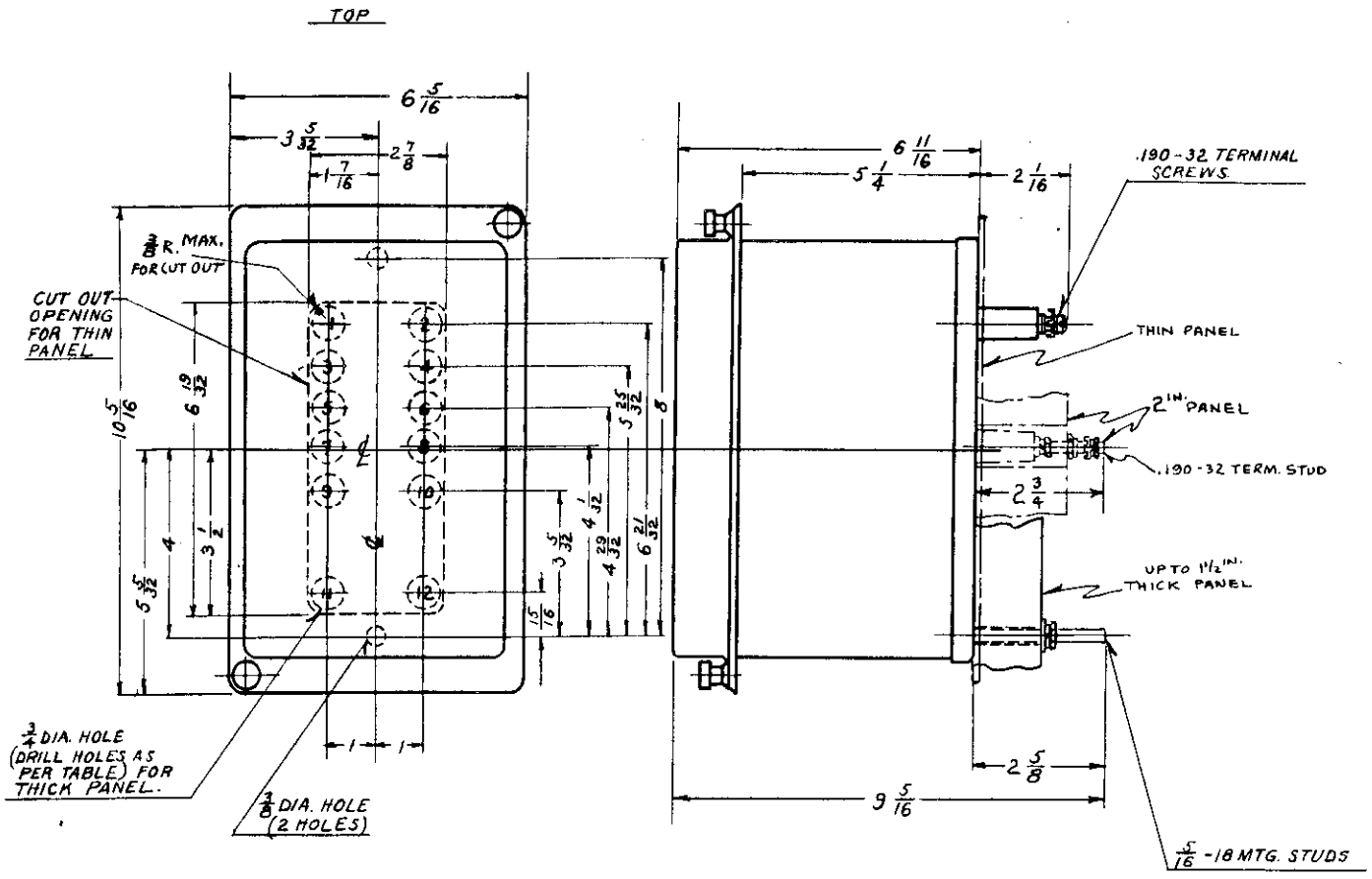


Figure 8
Outline and Drilling Plan for the S10 Projection Type FT Flexitest Case. (For Reference Only).
See the Internal Schematic for the Terminals Supplied.

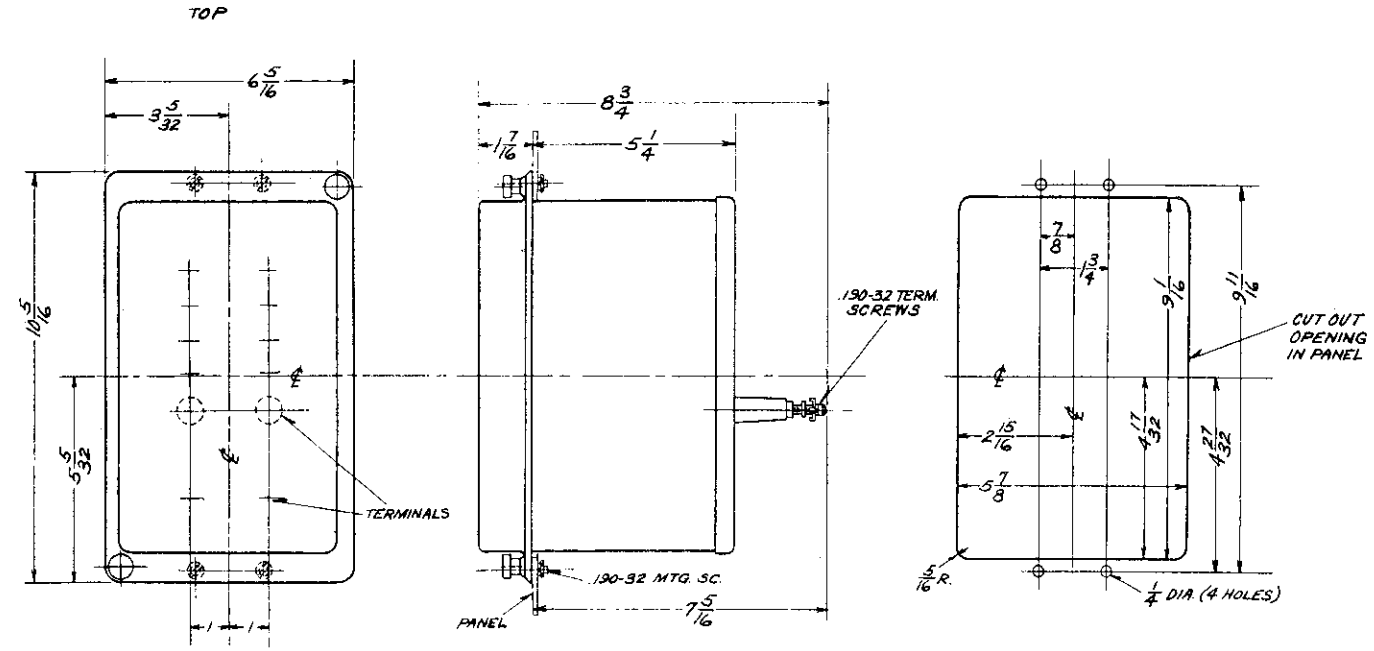


Figure 9
Outline and Drilling Plan for the S10 Semi-Flush Type FT Flexitest Case. (For Reference Only).