INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CV VOLTAGE RELAY

CAUTION Before putting protective 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 CV relay is a single-phase induction-disc type relay operating either on under or over voltage or both. This relay operates on under or over voltage and is applied as a voltage fault detector operating in conjunction with other protective relays. The relay is also used as a timing device for various automatic operations. Either geared or non-geared type relays are available. The non-geared relay gives short time operation with quick reset. The geared relay gives longer time of operation with longer reset. The contacts may be single or double to operate on either over or under voltage or may be single-pole, double-throw operating on both over and under voltages.

CONSTRUCTION AND OPERATION

The type CV relay consists of an induction-disc type voltage element, contactor switch and an operation indicator.

Voltage Element

The induction disc of this element is a thin four-inch diameter aluminum 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.

The moving contact is a small silver hemisphere fastened on the end of a rigid arm. The other end of this arm is clamped to an insulated section of the disc shaft in the non-geared type relays, or to an auxiliary shaft geared to the disc shaft in the geared type relays. The electrical connection is made from the moving contact thru the arm and spiral spring. One end of the spring fastens to the arm, and the other to a slotted spring adjuster disc which in turn fastens to the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf spring. This spring is fastened to a Micarta block and mounted on the element frame. A small set screw permits the adjustment of contact follow. When double trip is required another leaf spring is mounted on the Micarta block and a double contact is mounted on the rigid moving arm. Then the stationary contact set screws permit adjustment so that both circuits will be made simultaneously.

Torque is produced to rotate the disc by an electromagnet in the rear of the relay. A permanent damping magnet is mounted in the front. In the non-geared relay the disc rotates only a fraction of a revolution and has graduated perforations in the disc which gives the relay an approximately constant pick-up value regardless of the time lever setting. The lower pole of the electromagnet is energized by voltage. In order to produce torque the upper pole circuit is energized with the voltage induced across a few secondary turns wound on the lower pole. This circuit is connected to a slide-wire resistor mounted on top of the electromagnet and connected through the upper pole windings. Changing the resistance of this circuit varies

the pick-up of the relay, as shown by the calibration marks on the scale above the resistance wire. When the slider is clamped under the calibration marks, the pick-up is as indicated.

Contactor Switch and Operation Indicator

The contactor switch element is a small solenoid type switch, the coil of which is normally connected in the trip circuit. A small cylindrical plunger with a silver disc supported on its lower end rides up and down on a veritcal 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. When the coil is energized and the plunger pulled up, the silver disc moves up, bridging three stationary contacts.

The operation indicator is a small solenoid coil connected in the trip circuit which operates to release the white target when energized.

CHARACTERISTICS

The relay is available in 3 ranges which refer to the range of voltage at which the relay will operate.

115	volt	relay	adjustable	from	50	to 140 volts
230	"	"	"	"	100	to 280 "
460	"	"	"	"	200	to 560 "

Typical operating curves of these relays are shown in figures 6 through 9.

These instructions also apply in general to the older design relays with an external resistor and ranges as follows:

115	volt	relay	adjustable	from	50	to 120 volts
220	"	"	"	"	120	to 240 "
440	"	"	"	"	250	to 500 "

The start and tripping points of the non-geared relay are approximately the same; but for the geared relay are separated by more than 10%.

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 an 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

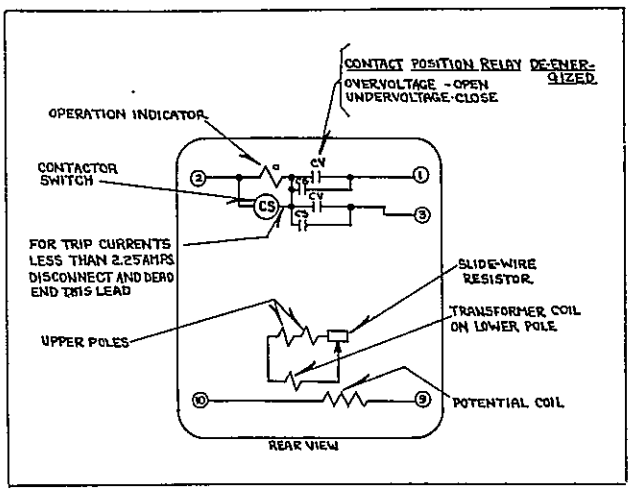

Fig. 1 — Internal Schematic of the Double Trip Under or Over-Voltage Type CV Relay in the Standard Case. For the Single Trip Relays Omit Terminal 3 and Associated Circuits.

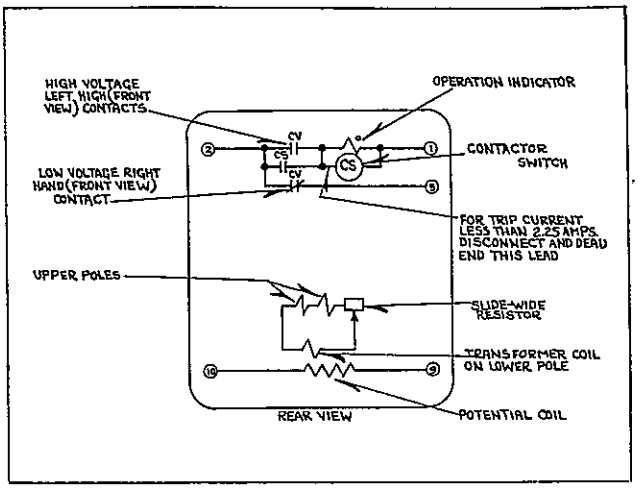

Fig. 2 — Internal Schematic of the Single Pole Double-Throw Under or Over-Voltage Type CV Relay in the Standard Case. The Relays are also Supplied With the Universal Indicator in the Back Contact Circuit.

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 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.

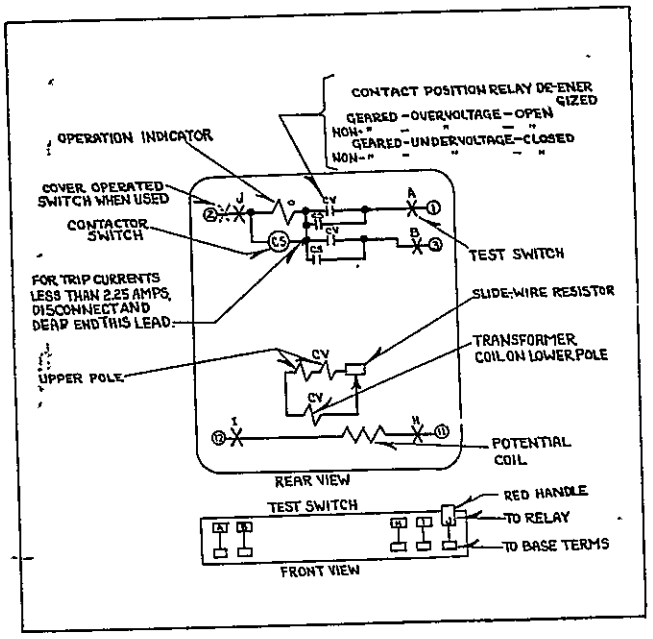

Fig. 3 — Internal Schematic of the Double Trip Under or Over-Voltage Type CV Relay in the Type FT Case. For the Single Trip Relays Omit Terminal 3 and Associated Circuits.

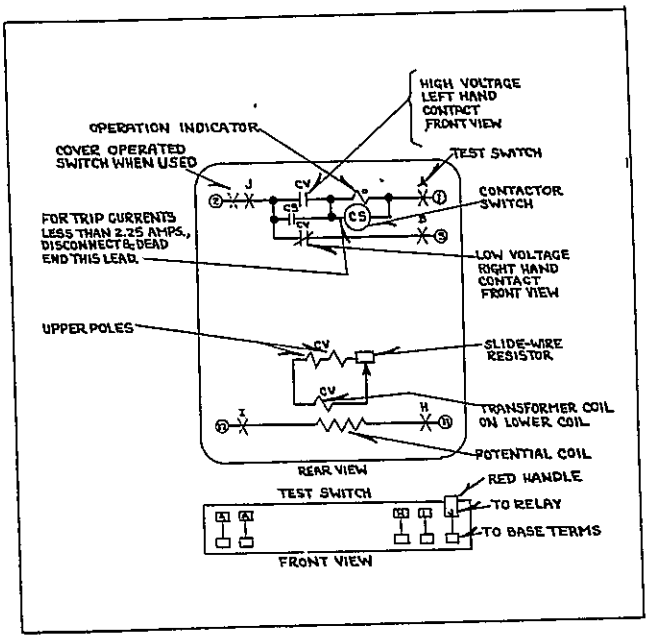

Fig. 4 — Internal Schematic of the Single Pole Double-Throw Under or Over-Voltage Type CV Relay in the Type FT Case. The Relays are also Supplied With the Universal Indicator in the Back Contact Circuit.

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 less than 1 or 2%. 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.

Voltage Element Connections

Connect the relay coil directly to the potential transformer. For phase-to-phase operation, either delta or star voltages may be used as desired. For phase-to-ground operation, the broken delta secondary of a ground star connected primary will provide the required residual voltage.

The external resistor on the older design relay is connected in series with the voltage coil.

Trip Circuit Connections

The relays are shipped with the contactor switch and operation indicator in parallel. This circuit is suitable for all trip currents above 2.25 amperes d-c. to 30 amperes at 250 volts d-c. The resistance of both coils in parallel is approximately 0.25 ohms. If the trip current is less than 2.25 amperes, there is no need for the contactor

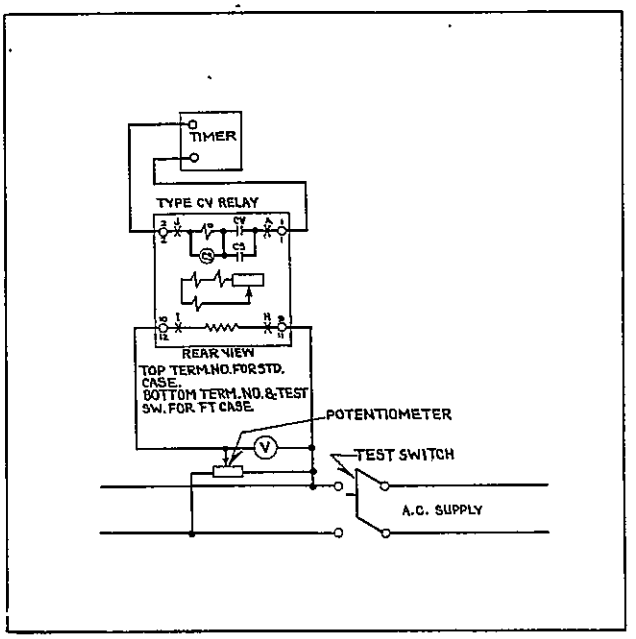

Fig. 5 — Diagram of Test Connections for the Type CV Relay.

switch and it should be disconnected. To disconnect the coil in the standard case relays, remove the short lead to the coil on the front stationary contact of the contactor switch. This lead should be fastened (dead ended) under the small filisterhead screw located in the Micarta base of the contactor switch. For the Flexitest relay, with single throw contacts the coil is disconnected by removing the coil lead at the spring adjuster and dead-ending it under a screw at the top of the Micarta support. For the Flexitest relays with double throw contacts, the coil is disconnected by removing the coil lead at the proper stationary contact and dead-ending it under a screw at the top of the Micarta support. The resistance of the operation indicator coil is 2.8 ohms. An auxiliary switch on the circuit breaker must be provided so that when the circuit breaker is tripped, the tripping circuit will be opened by this switch, thus relieving the relay contacts of that duty.

SETTINGS

The type CV relay has two adjustments: The voltage slider setting and the time lever setting. The calibration marks on the voltage slide wire indicate the minimum operating voltage. If front and back contacts are used, the front contact closes on the value indicated on the slide wire calibration and the back contact will close when the voltage is somewhat lower. The time delay between these two operations depends upon the time lever setting.

The effect of the time lever adjustment is shown on the typical curves of figures 6 to 9. The accuracy of the type CV relay is approximately $\pm$ 5%.

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 if 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 time of operation can be checked with a timer using the test diagram of figure 5.

Voltage Element

Adjust the back stop of the time lever so that the moving contact just touches the stationary contact when the time lever is in the zero position. The small adjustment screw on the stationary contact should not be screwed in far enough to limit the follow of the stationary contact. For double-trip relays adjust these screws so that both circuits make at the same instant.

The convolutions of the spring should not touch each other for all conditions of the

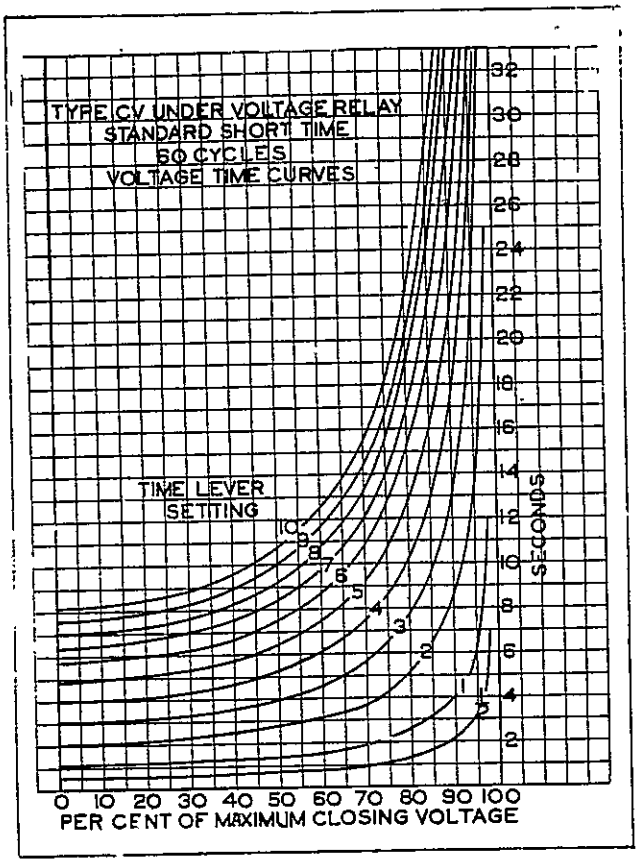

Fig. 6 — Typical Voltage Time Curves for the Ungeared Under-Voltage Relay.

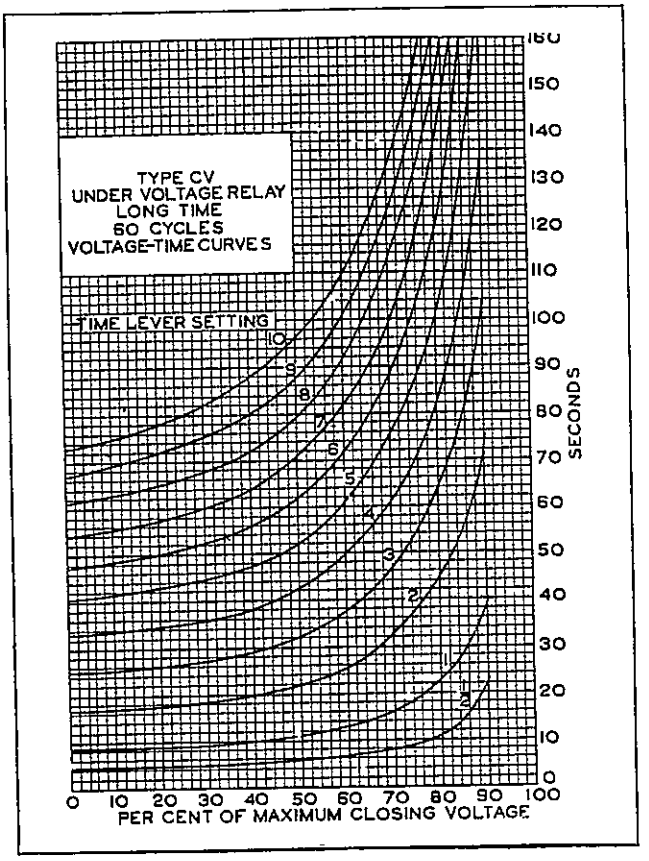

Fig. 7 — Typical Voltage Time Curves for the Geared Under-Voltage Relay.

moving contacts. Adjust the tension of the spiral spring so that the contacts will operate on the voltage indicated on the calibration resistance and follow the time curve as shown. This may necessitate shifting the position of the damping magnets, as their position affects the time characteristics.

The reset time with the #10 lever setting is 83 seconds for the geared over-voltage relay.

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 disconnecting the switch and turning it or the relay upside-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 through the coil.

Adjust the indicator to operate at 0.2 ampere d.c. gradually applied. Test for sticking after 30 ampere d.c. is passed.

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 name-plate data.

ENERGY REQUIREMENTS

The burdens of the various relays are as follows:

Rated Volts [1]	Frequency	Voltage Setting	Volt-Amps.	Watts	Vars	P.F.	R [2-3] Ohms	X [2] Ohms	Z [2] Ohms
	25	Highest	16.8	4.4	16.2	.26	206	760	788
		Rated	16.9	4.6	16.3	.27	213	753	783
		Lowest	17.4	10.0	14.2	.58	438	621	762
115	50	Highest	7.5	2.0	7.2	.27	471	1700	1770
230		Rated	7.6	2.1	7.3	.28	482	1680	1742
460		Lowest	11.4	8.0	8.1	.70	815	826	1172
	60	Highest	6.1	1.3	5.9	.21	462	2120	2170
		Rated	6.2	1.5	6.0	.24	527	2086	2150
		Lowest	10.0	7.3	6.8	.73	965	900	1322

1. These relays will stand 110% of rated voltage continuously.
2. Values are for 115 volt relay. For the 230 and 460 volt relays, multiply values by 4 and 16, respectively.
3. Resistance is a-c value.

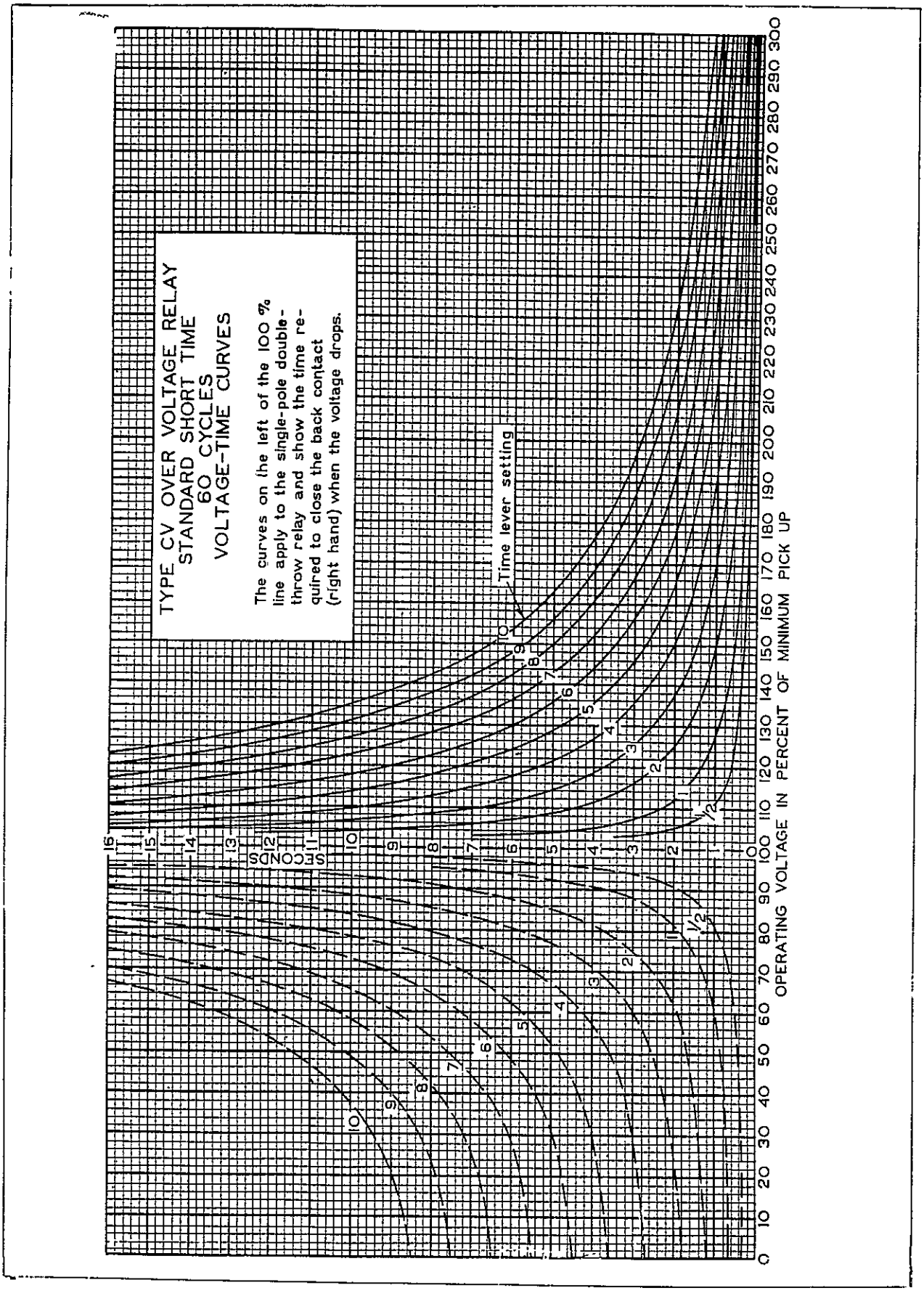

Fig. 8 — Typical Voltage Time Curves for the Ungeared Over-Voltage Relay.

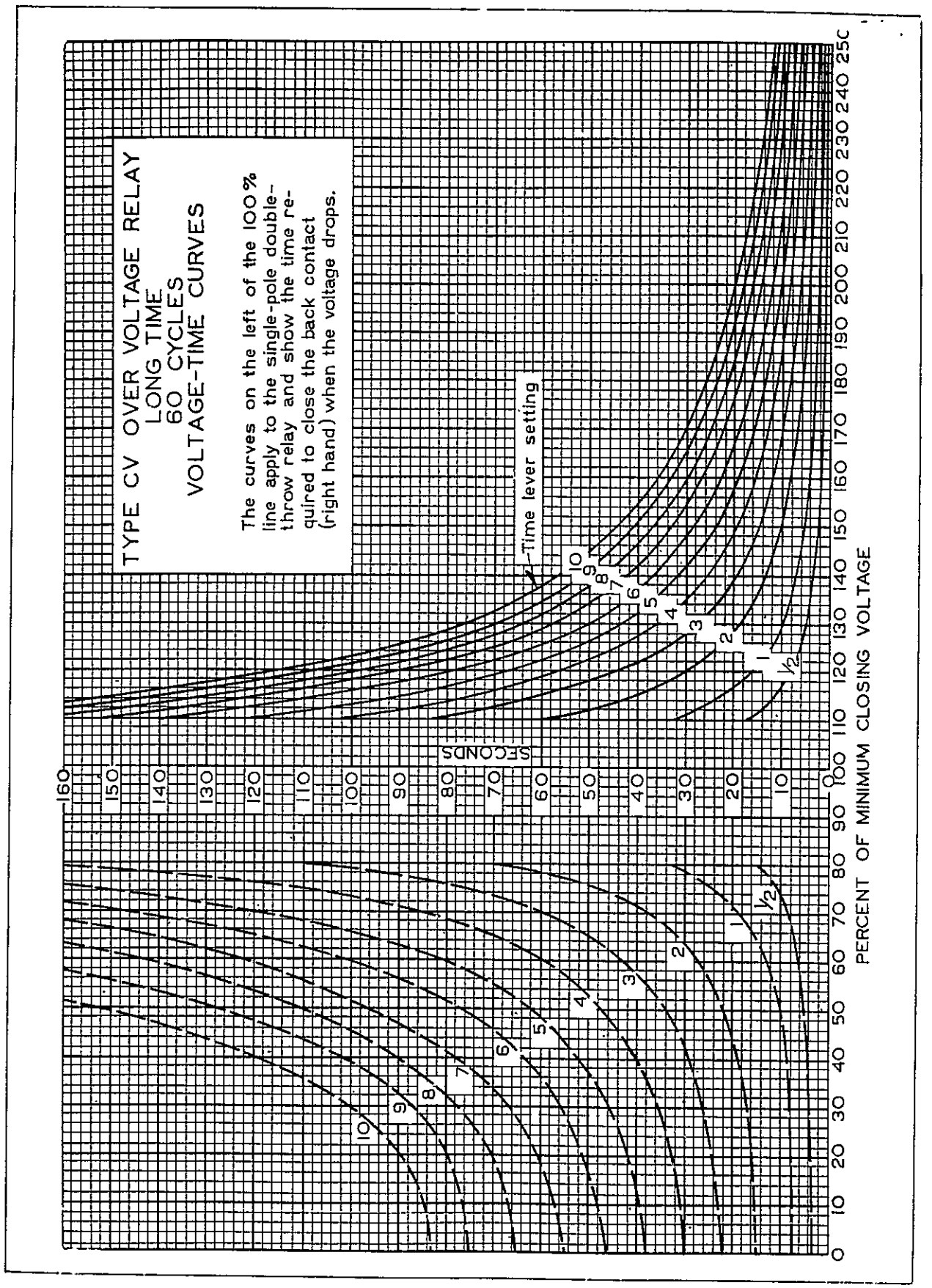

Fig. 9 — Typical Voltage Time Curves for the Geared Over-Voltage Relay.

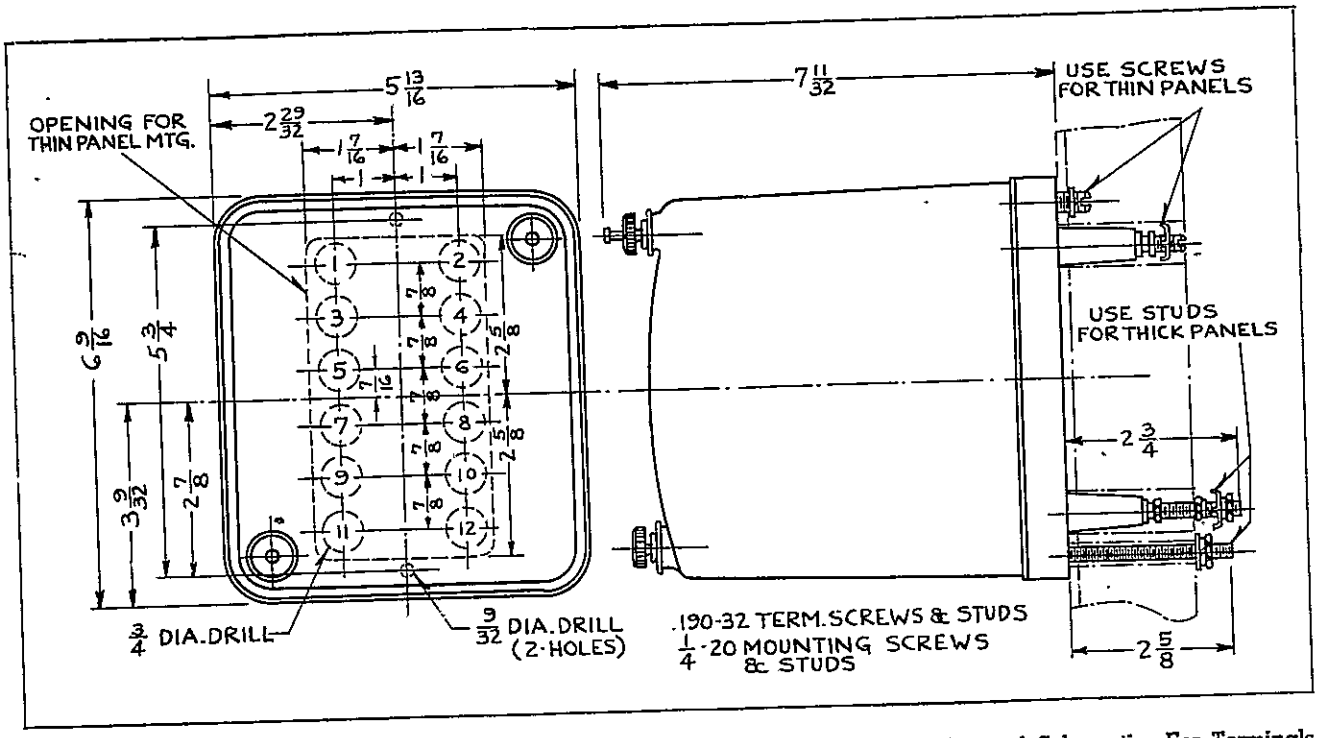

Fig. 10 — Outline And Drilling Plan for the Standard Projection Type Case. See The Internal Schematics For Terminals Supplied. For Reference Only.

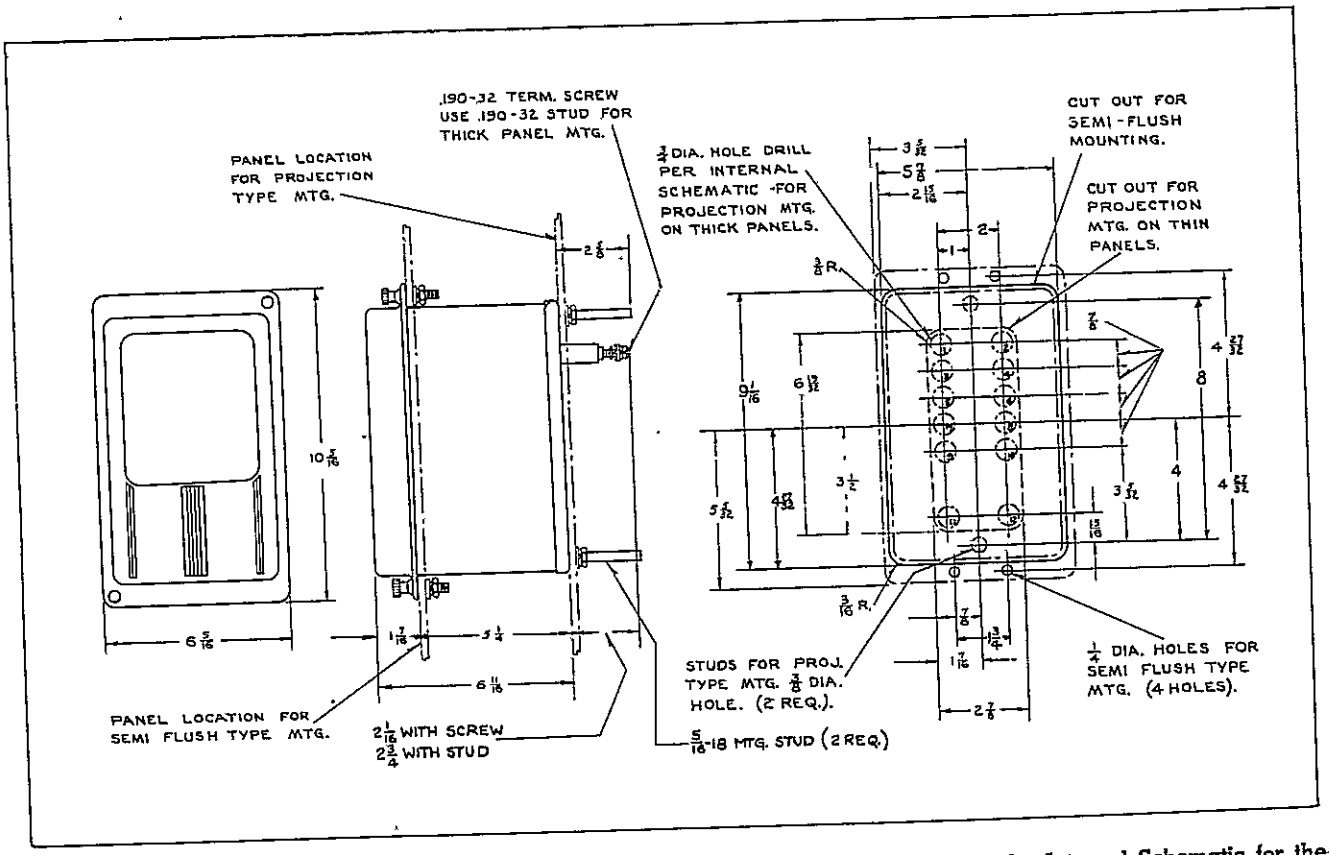

Fig. 11 — Outline and Drilling Plan for The S10 Projection or Semi-Flush Type FT Case. See the Internal Schematic for the Terminals Supplied. For Reference Only.

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