Westinghouse

Types CO, COH and COA Overcurrent Relays

INSTRUCTIONS*

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 can close properly. Operate the relay to check the settings and electrical connections.

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. Either of these studs may be utilized for grounding the metal base. 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.

Because the circuit-opening relay contacts short circuit the trip coil, it is important that the relay be mounted where it will not be subjected to shocks which may jar the contacts open and thereby allow current to flow through the trip coil. Trouble of this kind can be avoided by preventing jars to the switchboard and also by setting the trip coil high enough so that it will not operate on normal load current. This is an extra safe-guard so that there is no danger from even an excessive shock unless the current is also heavy.

Typical external connections are shown in Figures 12 to 16. When using the circuit-opening relays for phase protection, ground protection may be secured by using a low-energy circuit-closing relay operating on a-c. voltage trip coil, as shown in Figure 16.

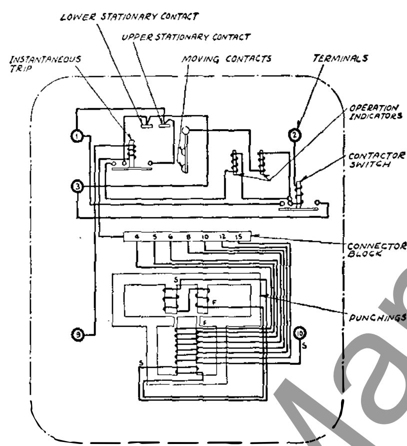


FIG. 1—INTERNAL CONNECTIONS OF THE DOUBLE-TRIP, INVERSE AND VERY-INVERSE, LOW-ENERGY CIRCUIT CLOSING TYPE CO RELAY AND THE TYPE COH RELAY IN THE STANDARD CASE WITH INSTANTANEOUS TRIP ATTACHMENT

APPLICATION

These induction-overcurrent relays are used to disconnect circuits or apparatus when the current in them exceeds a given value.

The low-energy type relay is used in preference to the standard-energy relay where the requirements necessitate (1) a lower burden on the current transformer, or (2) a more inverse curve for selectivity, or (3) a very low current range as for example, ground protection of transmission systems.

The very-inverse relay is similar to the low-energy relay and is used where a still more inverse curve is desired. The term "low energy" refers to the burden that is placed on the current transformers and does not refer to the current rating.

A 40-second relay is specially designed to protect motors against overloads. This can be equipped with an instantaneous attachment that will operate, if a short-circuit occurs in the motor.

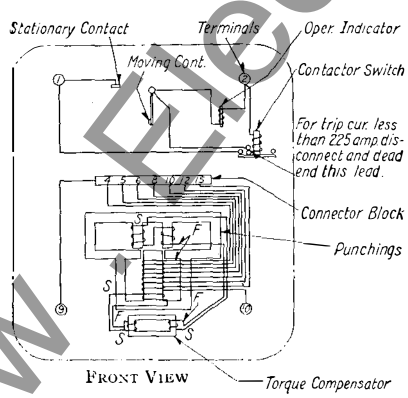
The type COH relay finds application for phase and ground protection where the type CO is considered too slow and the instantaneous-type relay, such as the type SC, too fast or not applicable.

CONSTRUCTION AND OPERATION

CIRCUIT-CLOSING RELAYS—The circuit-closing relays consist of an induction-disk element operating on overcurrent, an operation indicator, a contactor switch, and an instantaneous trip attachment where required.

The operating torque is obtained by the circuit arrangement shown in Figure 1. The main pole coil of the relay acts as a transformer and induces a voltage in a secondary coil. Current from this secondary coil flows through the upper pole coils and thus produces torque in the disk by the reaction between the fluxes of the upper and lower poles. The inverse and very inverse relays operate on this principle. The definite-time, standard-energy relay obtains its flat characteristic curve because of a small saturating transformer that is interposed between the secondary coil and the upper pole coils. This is called the torque compensator and it slows down the disk movement to such an extent that no gearing is required. (See Fig. 2).

The 40-second relay is a geared relay with a standard definite time electromagnet and torque compensator.



FRONT VIEW

FIG. 2—INTERNAL CONNECTIONS OF THE SINGLE-TRIP, DEFINITE TIME, STANDARD ENERGY, AND FOUR-SECOND LOW-ENERGY, CIRCUIT CLOSING TYPE CO RELAY IN THE STANDARD CASE.

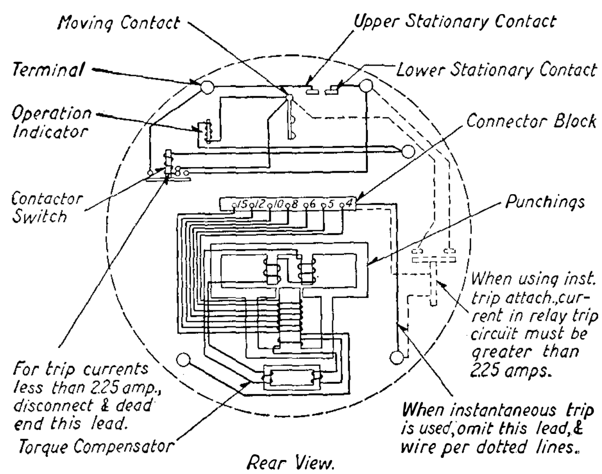


FIG. 3—INTERNAL CONNECTIONS OF THE DOUBLE-TRIP, DEFINITE TIME, STANDARD ENERGY, AND FOUR-SECOND LOW-ENERGY, CIRCUIT CLOSING TYPE CO RELAY IN THE ROUND CASE.

*Supersedes I.L. 3295

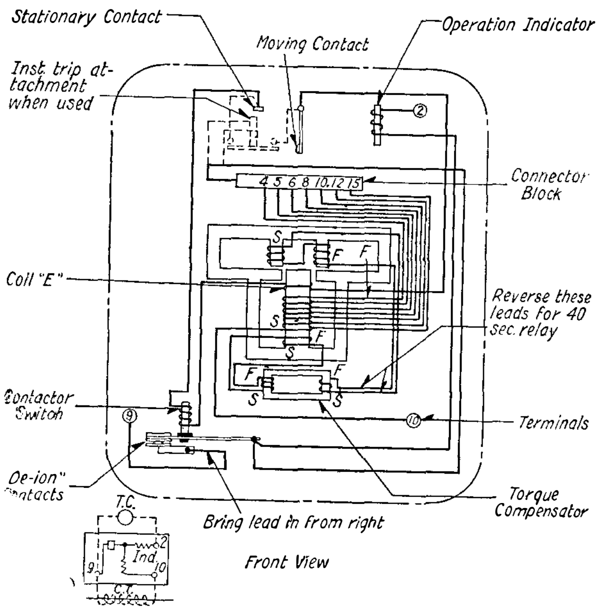


FIG. 4—INTERNAL CONNECTIONS OF THE DEFINITE TIME, STANDARD ENERGY, CIRCUIT OPENING TYPE CO RELAY IN THE STANDARD CASE

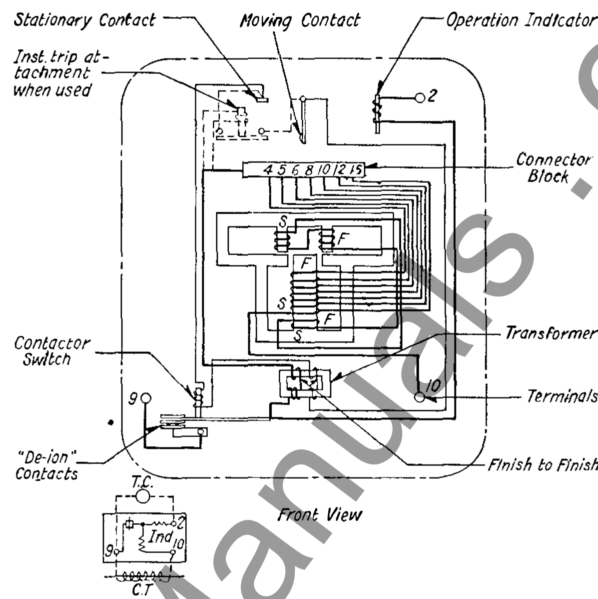


FIG. 5—INTERNAL CONNECTIONS OF THE INVERSE AND VERY-INVERSE, LOW-ENERGY, CIRCUIT OPENING TYPE CO RELAY IN THE STANDARD CASE

Contactor Switch and Operation Indicator—The contactor switch is a small solenoid seal-in switch the coil of which is normally connected in the trip circuit. The plunger has a circular conducting disk mounted on its lower end, and as the plunger travels upward, the disk bridges three silver stationary contacts. In the single-trip relays, two of these contacts seal around the main relay contacts. In the double-trip relays all three contacts are used to seal in both trip circuits. The trip circuit is suitable for service up to 250 volts d-c. and on breakers that require not more than 30 amperes in the trip coil. When the overcurrent contact closes and energizes the trip circuit, the operation indicator shows a white operation target and the contactor switch picks up to seal in around the main contacts. A breaker auxiliary switch is required to open the trip circuit.

The relay is shipped with the operation indicator and the contactor switch coils in parallel. This circuit has a resistance of approximately 0.25 ohm and is suitable for all trip circuits above 2.25 amperes d-c. If the trip current is less than 2.25 amperes, there is no need for the contactor switch and it should be disconnected. To disconnect the coil, remove the lower lead on the front stationary contact of the contactor switch (see Figure 17) and this lead should be fastened (dead ended) under the small fillister-head screw (located in the Micarta base of the contactor switch (See Figure 18). The operation indicator will operate for trip currents above 0.2 amperes d-c. The resistance of its coil is approximately 2.8 ohms.

The circuit-closing relay may also be used to trip a circuit breaker equipped with a Westinghouse "direct trip attachment" on the trip coils. This is a device that trips a circuit breaker by energy received from a current transformer.

When circuit breakers are instantaneously reclosed, it is necessary to use special quick-opening contacts on the low-energy type of relay. In this case stiff stationary contacts, without any follow, are used.

CIRCUIT-OPENING RELAYS—The circuit-opening Type CO relay consists of an overcurrent element, a de-ion contactor switch, an operation indicator and an instantaneous trip attachment where required

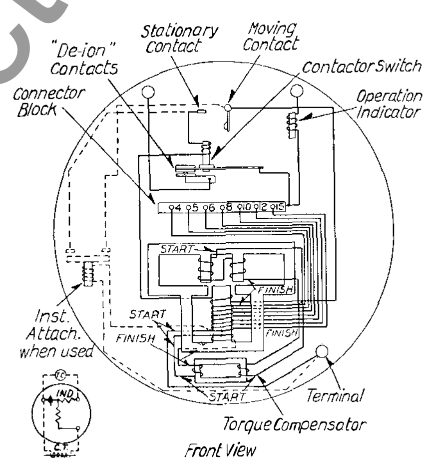


FIG. 6—INTERNAL CONNECTIONS OF THE DEFINITE TIME, STANDARD ENERGY, CIRCUIT OPENING TYPE CO RELAY IN THE ROUND CASE

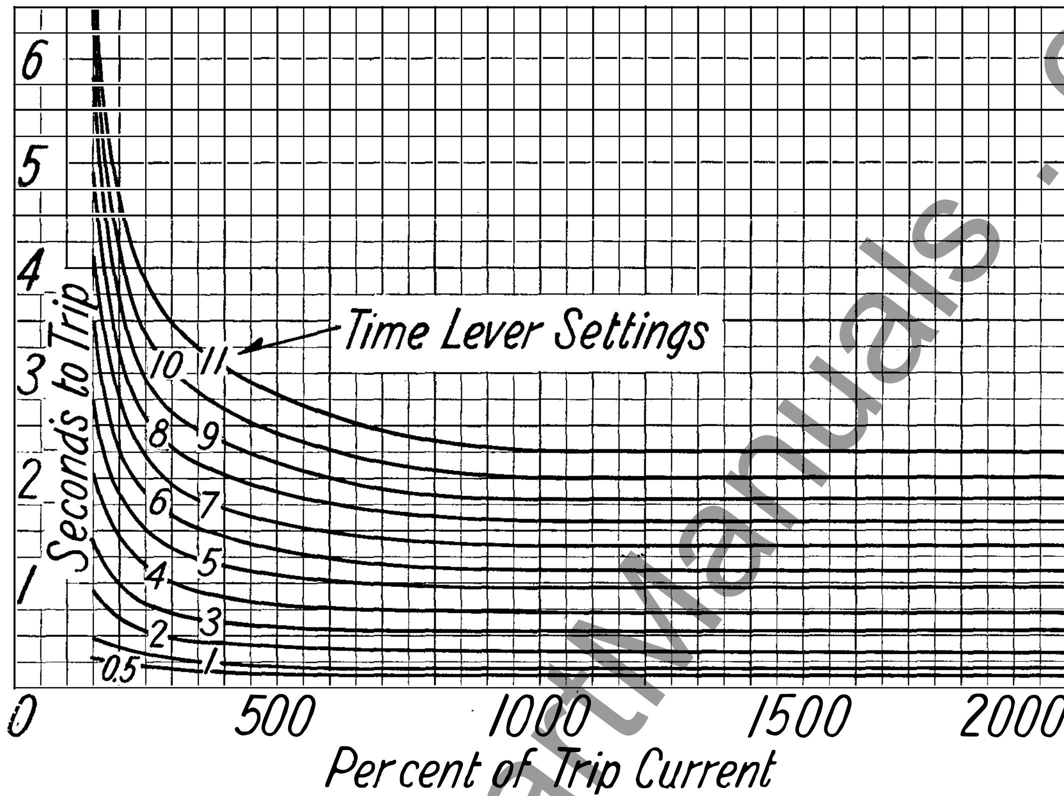


FIG. 7—TYPICAL DEFINITE TIME CURVES OF THE TYPES CO AND COA STANDARD ENERGY RELAYS

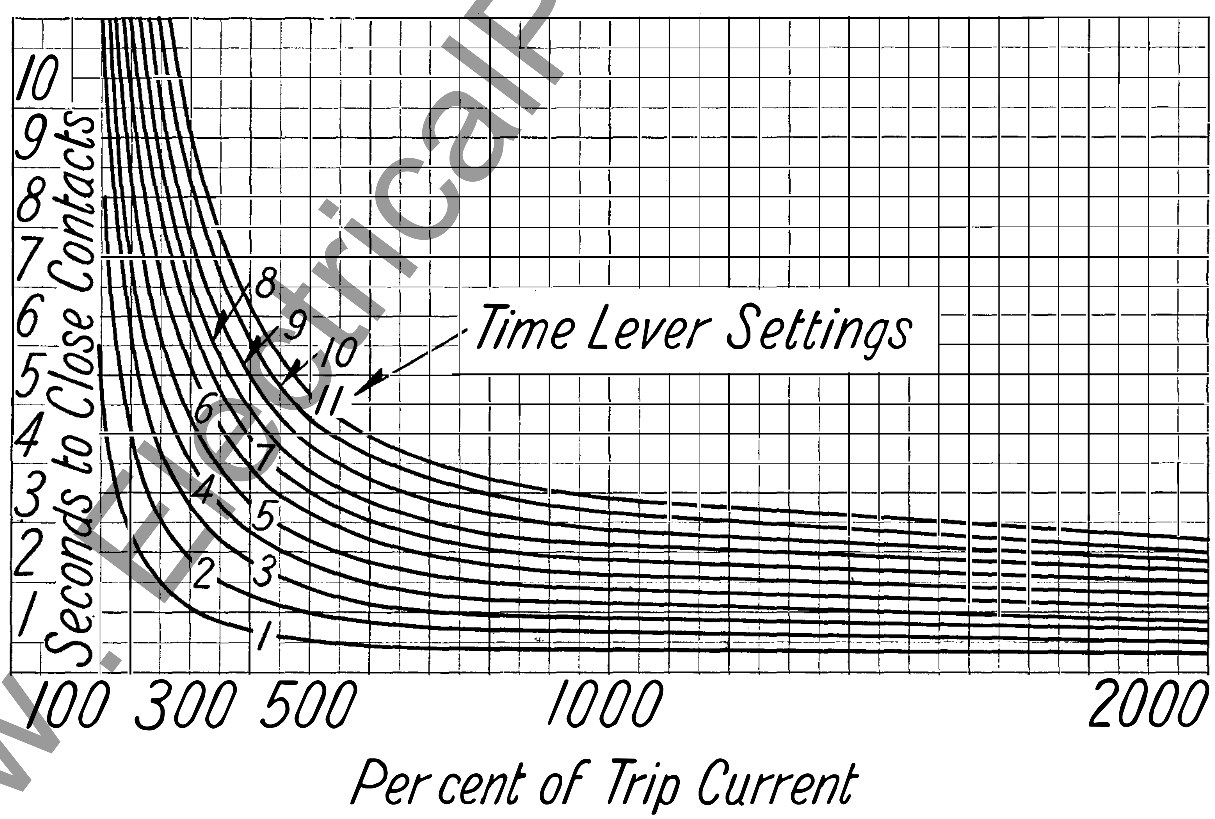


FIG. 8—TYPICAL INVERSE TIME CURVES OF THE TYPE CO LOW-ENERGY RELAY

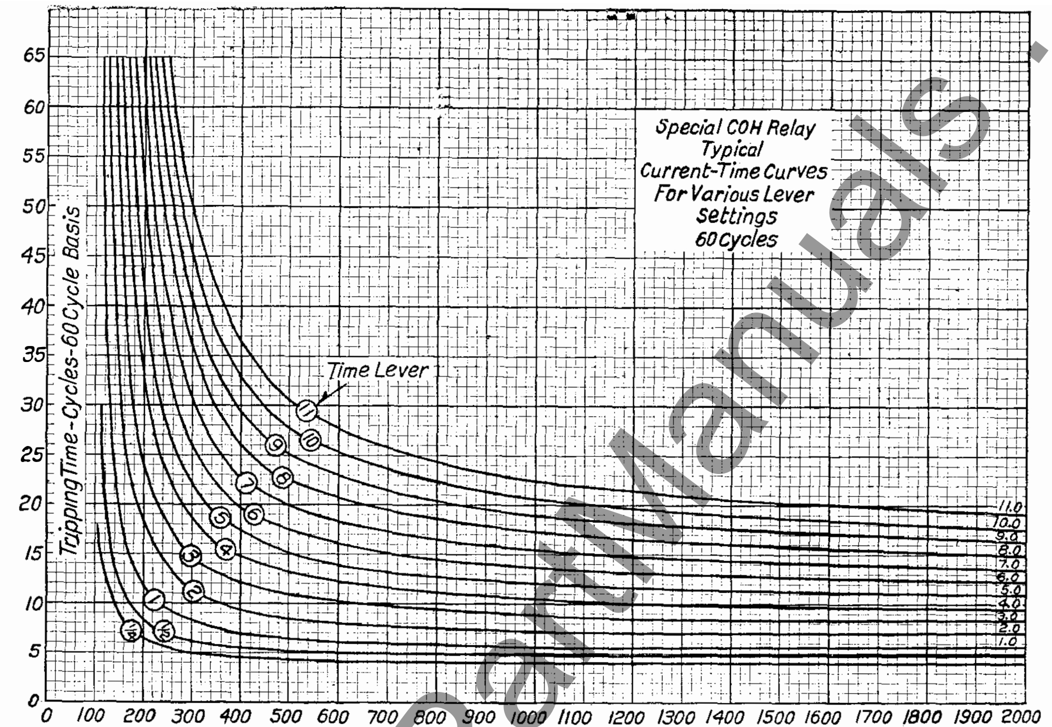


Fig. 10—Typical Inverse Time Curves of the Type COH Relay

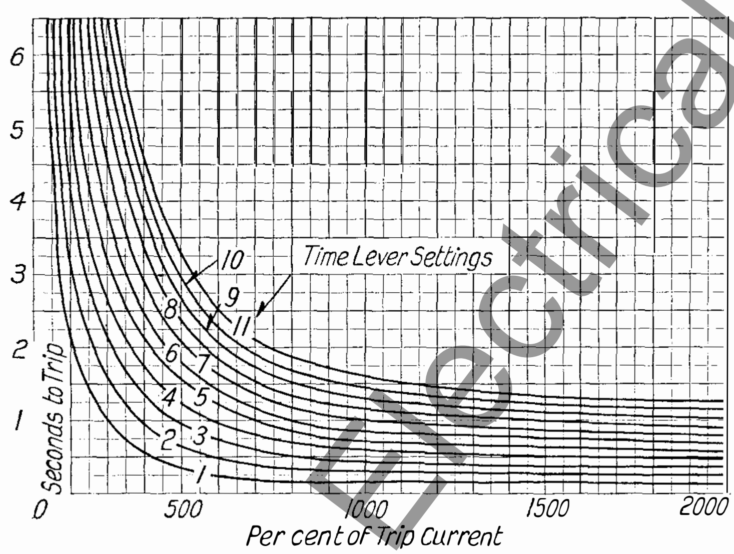


Fig. 9—Typical Very-Inverse Time Curves of the Type CO Low-Energy Relay

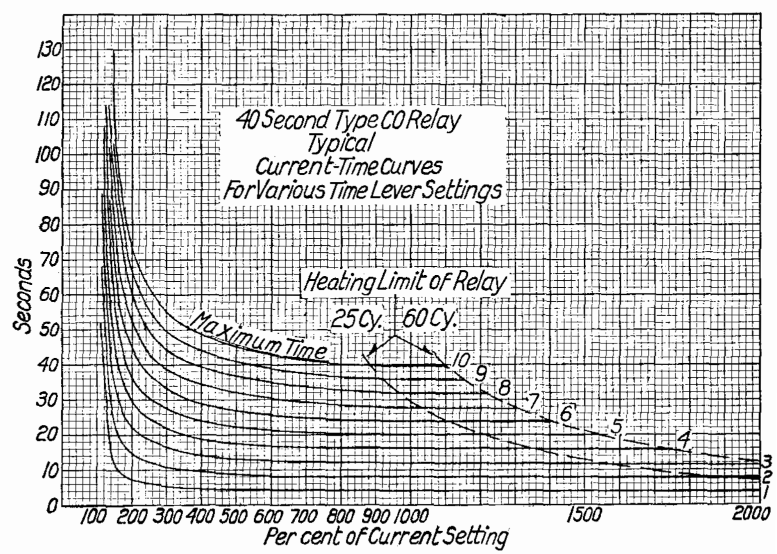


Fig. 11—Typical Definite Time Curves of the Long-Time, 40-Second Type CO Standard Energy Relay.

De-ion Contactor Switch—This switch is a small a-c. solenoid switch whose coil is energized from a few turns on the lower pole of the overcurrent element in the standard-energy type relays, and from a small transformer connected in the main current circuit in the low-energy type relays. Its construction is similar to the d-c. type switch except that the plunger operates a spring leaf arm with a silver contact surface on one end and rigidly fixed to the frame on the other end.

The overcurrent element contacts are in the contactor switch coil circuit and when they close, the solenoid plunger moves upward to open the de-ion contacts which normally short circuit the trip coil. These contacts are able to break the heavy current due to a short circuit and permit this current to energize the breaker trip coil.

Operation Indicator—The operation indicator is in series with the breaker trip coil, and has a minimum pick-up of 4 amperes a-c.

TYPE COA RELAY—These are standard relays with a self-contained ammeter scale. The entire scale moves and the reading is indicated by a fixed pointer.

The current reading depends upon the tap setting of the relay and this should be determined before the scale is marked in amperes. Some relays are marked in percent so that any tap value may be used.

TYPE COH RELAY—These are not geared and have no torque compensators and are designed to give very fast action.

CHARACTERISTICS

The characteristic curves of the four different type CO relays is shown in Figures 7 to 11. The standard-energy definite-time relay is made in either of the following current ranges.

2—2.5—3—3.5—4—5—6 or
4—5—6—8—10—12—15

The low-energy type relays for the above two tap ranges and also for the following range frequently used for ground protection:

.5—.6—.8—1.0—1.5—2—2.5

The circuit-opening relay is made only in the 4 to 15 ampere range. A lower range is not desirable because the burden of a low-range trip coil is too heavy on the current transformer. One trip coil is required for each relay. See Figure 16.

SETTINGS

There are two settings (A), the current value at which the relay closes its contacts and (B), the time required to close them. When the relay is to be used to protect equipment against overload, the setting must be determined by the nature of the load, the magnitude of the peaks, and the frequency of their occurrence.

For sectionalizing transmission systems the current and time setting must be determined by calculation, due consideration being given to the time required for circuit breakers to open so that proper selective action can be obtained throughout the system.

CURRENT SETTING—The connector screw on the terminal plate above the time scale makes connections to various turns on the operating coil. By placing this screw in the various holes, the relay will just close contacts at the corresponding current, 4-5-6-8-10-12 or 15 amperes, or as marked on the terminal plate.

The tripping value of the relay on any tap may be altered by changing the initial tension of the spiral spring. This can be accomplished by turning the spring adjuster by means of a screw driver inserted in one of the notches of the plate to which the outside convolution of the spring is fastened. An adjustment of tripping current approximately 15 percent above or below any tap value, can be secured without materially affecting the operating characteristics of the relay. By choosing the proper tap, a continuous adjustment of tripping current from 3.4 amperes to 17.5 amperes may be secured. The characteristic time curve will be affected less for any large adjustment if the next

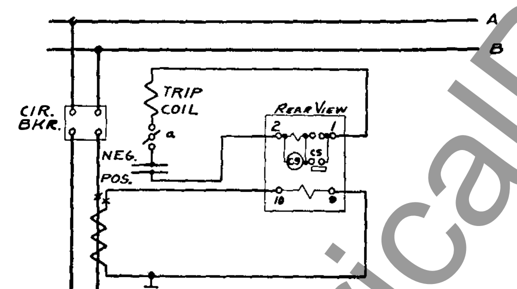


Fig. 12—External Connections for Single Phase System

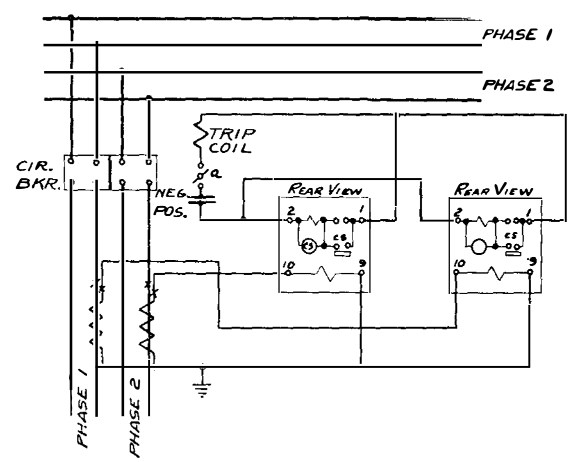
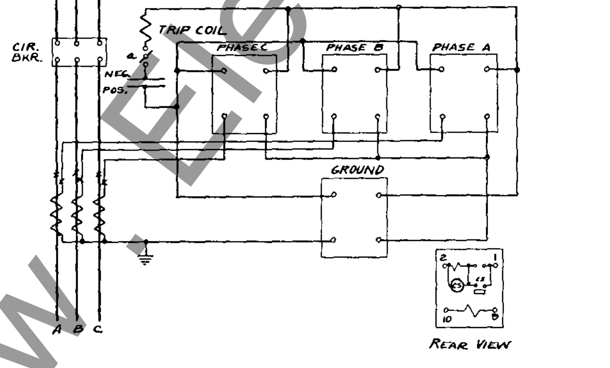
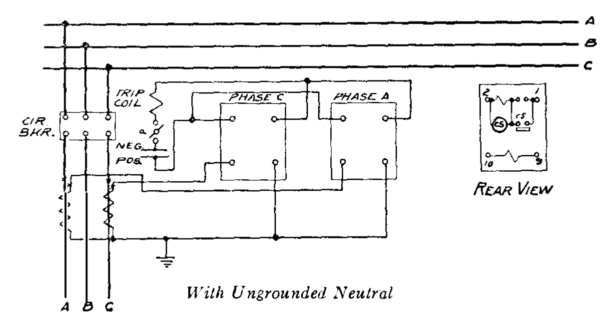


Fig. 13—External Connections for 2 Phase System



With Grounded Neutral System for Complete Phase and Ground Protection

Fig. 14—External Connections for Complete Short Circuit and Ground Protection on Three Phase System



With Ungrounded Neutral

Note: No Protection for Simultaneous Ground Fault on Phase B and in Generator.

Fig. 15—External Connections for Short Circuit Protection on Ungrounded Neutral Three Phase System Using Only Two Relays

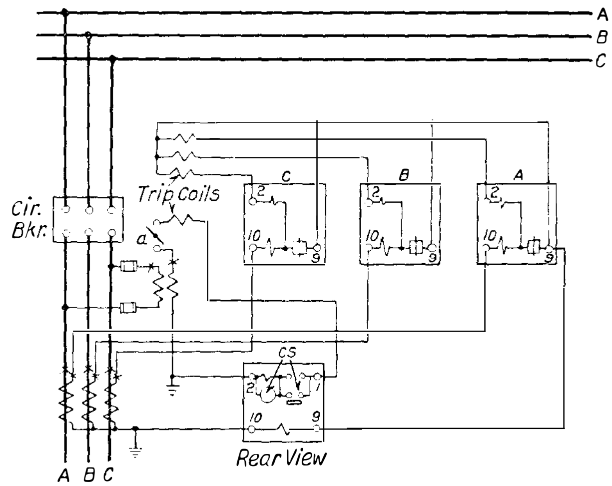


Fig. 16—External Connections, Using Circuit Opening Type CO Relays for Phase Protection and Circuit Closing Type CO Relay for Ground Protection

higher tap is selected and the initial tension of the spiral spring is decreased to secure the desired tripping value. For example, the relay should be set on the 8 ampere tap with less initial tension in order to secure a 7 ampere tripping value.

Caution—Be sure that the connector screw is turned up tight so as to make a good contact, for the operating current passes through it. Since the overload element is connected directly in the current transformer circuit, the latter should be short-circuited before changing the connector screw. This can be done conveniently by inserting the extra connector screw, located on the right-hand mounting boss, in the new tap and removing the old screw from its original setting.

TIME LEVER SETTING—The index or time lever, limits the motion of the disk and thus varies the time of operation. The latter is proportional to the lever setting, that is, with the lever on the number 5 setting, at 2000 percent load, the relay will operate in one second and similarly on the number 1 setting the time of operation is 0.2 second.

The relay has been calibrated from the #10 time lever setting according to the curve engraved on the nameplate. The #11 time setting may be used to secure a time delay approximately 10 per cent longer, that is, to secure a setting of 2.2 seconds for a 2-second relay.

ADJUSTMENTS AND MAINTENANCE

All relays should be inspected periodically and the time of operation should be checked at least once every six months. For this purpose, a cycle counter should be employed, because of its convenience and accuracy. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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 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 or the relay taken apart for repairs, the following instructions should be followed in reassembling and setting it.

THE OVERCURRENT ELEMENT—Shift the position of the contact stop on the time lever and adjust the contacts so that they barely touch when the time lever is set on zero.

Adjust the tension of the spiral spring so that the relay will close its contacts at its rated current, as shown by the position of the screw on the terminal block. Shift the position of the damping magnets so that the time characteristics of the relay, as shown by test with a cycle counter, are the same as shown on the calibration curve.*

The position of the torque compensator on the overload element is adjustable, influencing the shape of the curve. This is a factory adjustment and the location of the torque compensator should not be changed in the field. If the relay has a metal cover, this cover must be in place when making tests.

CONTACTOR SWITCH (CIRCUIT-CLOSING RELAYS)—Adjust the stationary core for a clearance between the stationary core and the moving core of 1/64" when the switches are picked up. This can be done by disconnecting the switch, turning it up-side-down, and screwing up the core screw until the contacts just separate. Then back off the core screw approximately one turn 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" by means of the two small nuts on either side of the Micarta disk. The switch should pick up and seal in at 2.0 amperes d-c. Test for sticking after 30 amperes d-c. is passed.

OPERATION INDICATOR (CIRCUIT-CLOSING RELAYS)—Adjust the indicator to operate at 0.2 ampere d-c. gradually applied. Test for sticking after 5 amperes d-c. is passed.

DE-ION CONTACTOR SWITCH (CIRCUIT-OPENING RELAY)—Adjust the stop screw on top of the switch so that the plunger insulating bushing just clears the Micarta angle giving separation between this angle and the moving contact of approximately 1/32" to 1/16". Bend down the contact spring so that a firm contact is made, but not so strong that the minimum pick-up of slightly less than 4 amperes d-c. cannot be obtained. On the standard-energy relays, the tap screw must be set on the minimum tap. On low-energy relays having a separate transformer, it makes no difference what tap is used. To adjust the minimum pickup point, the main contacts should be closed by moving the disk with the fingers.

OPERATION INDICATOR (CIRCUIT OPENING RELAYS)—Adjust the indicator to operate at 4 amperes a-c.

SUMMARY

The table on page **7** and notes above summarize the varieties covered by this instruction leaflet.

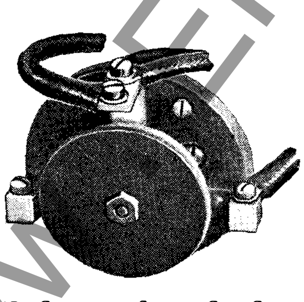


Fig. 17—Contactor Switch Coil Connected in Trip Circuit. The Target Operates on 2.25 Amperes or More

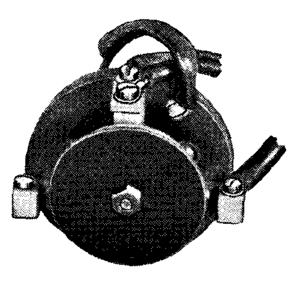


Fig. 18—Contactor Switch Coil Disconnected from Trip Circuit. All the Current Passes Through the Target Coil so That it Will Operate on .2 Amperes or More

*Curves Figs. 7 to 11 inclusive show the timing in greater detail than possible on the name plate. The Calibration is intended to be on the basis of the cool or normal operating condition inasmuch as overloads can only be of short duration. Any testing at currents in excess of coil ratings requires special equipment and great care as overheating of the coils changes the calibration.

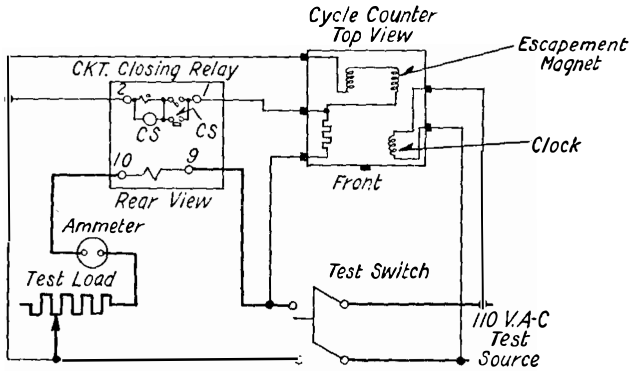


FIG. 19—DIAGRAM OF TEST CONNECTIONS FOR THE CIRCUIT CLOSING RELAY

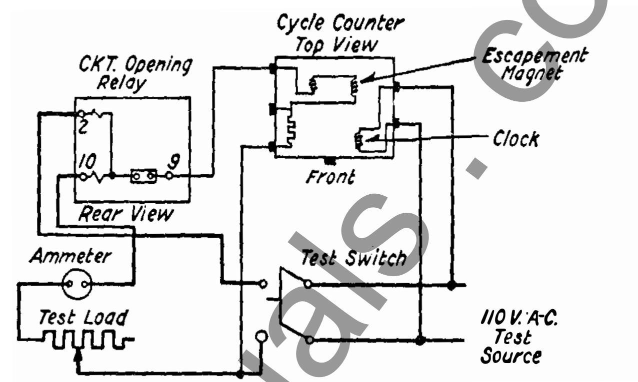


FIG. 20—DIAGRAM OF TEST CONNECTIONS FOR THE CIRCUIT OPENING RELAY

These relays may have either single or double circuit closing contacts for tripping either one or two breakers, or may have circuit-opening contacts for tripping the breakers by current from the current transformers. Some of these relays are supplied in the special forms listed elsewhere in this leaflet. The relays above have been supplied in the old round type case, Figure 24 in the new standard rectangular case, Figures 22 and 23. The three-element non-geared relays have been supplied in a large rectangular case and all relays in the new standard rectangular case.

INDEX OF VARIETIES

Type	Energy	Time	Approx. #10 Lever Time	Gearing	Torque Compensator	Wiring	Curve
CO-COA	Std.	Definite time	2 Sec.	Non-geared	Yes	per Fig. #2-3	per Fig. #7
CO	Std.	Definite time	4 Sec.	Non-geared	Yes	per Fig. #2-3	
CO	Low	Inverse	2 Sec.	Geared	No	per Fig. #1	per Fig. #8
CO	Low	Inverse	4 Sec.	Geared	Yes	per Fig. #2-3	
CO	Low	Very Inverse	1+ Sec.	Geared	No	per Fig. #1	per Fig. #9
CO	Std.	Definite time	40 Sec.	Geared	Yes	per Fig. #2-3	per Fig. #11
COH	...	Inverse	18 Cyc.	Non-geared	No	per Fig. #1	per Fig. #10

Three element relay characteristics are the same as in single element forms

ATTACHMENTS TO THE RELAY

INSTANTANEOUS TRIP (RECTANGULAR CASE RELAYS ONLY)—This element is a small solenoid switch the coil of which is in series with overcurrent coil. It functions to energize the breaker trip coil instantaneously, when the fault current is exceptionally heavy. The three stationary contacts are in parallel with the main trip contacts and make possible double instantaneous trip on double-relays. The position of the Micarta disk at the bottom of the element with reference to the calibrated guide indicates the minimum overcurrent required to operate the element. This disk should be lowered or raised to the proper position by means of the two nuts on either side of the disk. The nominal range of adjustment is 1 to 4, for example 10 to 40 amperes, and it has an accuracy of about 10%.

The drop-out value is varied by raising or lowering the core screw at the top of the switch, and after the final adjustment is made, the core screw should be securely locked in place with the lock nut. It should be adjusted for about ⅔ of the minimum pick-up.

This element will not fit in the round-type case.

INSTANTANEOUS TRIP (ROUND CASE RELAYS)—The instantaneous attachment has only one pair of contacts. However, it can be used in a double-trip relay if the circuit breaker trip coil draws 2.5 amperes or more so that the d-c. contactor switch will be operated and close the contacts to both circuits. Compare the diagram in Figures 1 and 3.

The instantaneous attachment is usually applied to the relay while it is being manufactured but it can be attached to any of the old induction-type relays. No special mounting arrangements are required—it fits under one of the screws holding the permanent magnets. (See Fig. 23).

The 25-cycle attachment is slightly different from that shown in the illustration and has a piece of felt under the contacts to damp out the vibrations.

LOCK-OUT ATTACHMENT (ROUND CASE RELAY ONLY)—When it is desired to prevent a relay from tripping a circuit breaker when the current is too high—above its interrupting capacity—the lock-out attachment is provided. It is similar to the instantaneous attachment in appearance and method of adjusting but its contacts are in series with the main contacts and are normally closed. These contacts must be given special care because they are in series with the main tripping circuit and may prevent proper relay operation if they become dirty.

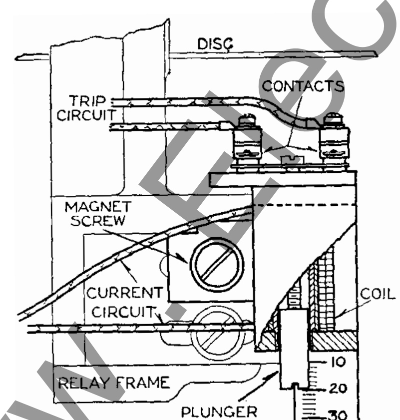
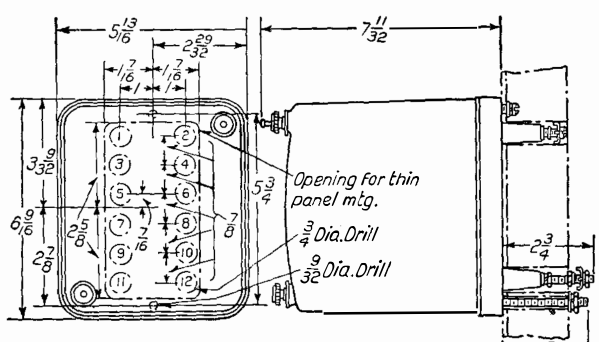


FIG. 21—ADJUSTMENT DETAILS AND METHOD OF MOUNTING THE INSTANTANEOUS ATTACHMENT IN ROUND TYPE RELAYS



Projection Mounting

FIG. 22—OUTLINE AND DRILLING PLAN FOR THE STANDARD PROJECTION TYPE CASE. TERMINALS 1, 2, 9, AND 10 ARE USED FOR SINGLE-TRIP CIRCUIT CLOSING RELAY, WITH 3 ADDED FOR THE DOUBLE-TRIP RELAY. TERMINALS 2, 9, AND 10 ARE USED IN THE CIRCUIT OPENING RELAY

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.

BURDENS AND THERMAL CAPACITIES

DEFINITE MINIMUM TIME CO RELAYS AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Ampere	V. A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One Second Rating (Amperes)
2/6	2	108	17	60° lag	4	140
	2.5	68	17	60° lag	5	140
	3	47	17	60° lag	5	140
	3.5	35	17	60° lag	6	140
	4	26	17	60° lag	7	140
	5	17	17	60° lag	8	140
	6	12	17	60° lag	10	140
4/15	4	26	17	60° lag	8	250
	5	17	17	60° lag	8	250
	6	12	17	60° lag	9	250
	8	6.5	17	60° lag	10	250
	10	4.5	17	60° lag	12	250
	12	3	17	60° lag	13	250
	15	2	17	60° lag	15	250

INVERSE TIME CO RELAYS AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One Second Rating (Amperes)
0.5/2.5	0.5	200	2	66° lag	2	70
	0.6	140	2	66° lag	2	70
	0.8	78	2	66° lag	2	70
	1.0	50	2	66° lag	3	70
	1.5	22	2	66° lag	3	70
	2.0	12.5	2	66° lag	4	70
	2.5	8	2	66° lag	5	70
2/6	2	12.4	2	66.4° lag	8	250
	2.5	8	2	66.4° lag	8	250
	3	5.6	2	66.4° lag	8	250
	3.5	4.1	2	66.4° lag	8	250
	4	3.1	2	66.4° lag	9	250
	5	2	2	66.4° lag	9	250
	6	1.3	2	66.4° lag	10	250
4/15	4	3.1	2	66.4° lag	16	250
	5	2	2	66.4° lag	16	250
	6	1.4	2	66.4° lag	16	250
	8	0.8	2	66.4° lag	17	250
	10	0.5	2	66.4° lag	18	250
	12	0.3	2	66.4° lag	19	250
	15	0.2	2	66.4° lag	20	250

VERY INVERSE TIME CO RELAYS AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One Second Rating (Amperes)
0.5/2.5	0.5	125	1.25	66.4° lag	2	100
	0.6	87	1.25	66.4° lag	2	100
	0.8	49	1.25	66.4° lag	2	100
	1.0	31	1.25	66.4° lag	3	100
	1.5	14	1.25	66.4° lag	3	100
	2.0	8	1.25	66.4° lag	4	100
	2.5	5	1.25	66.4° lag	5	100
2/6	2	8	1.25	66.4° lag	8	250
	2.5	5	1.25	66.4° lag	8	250
	3	3.5	1.25	66.4° lag	8	250
	3.5	2.5	1.25	66.4° lag	8	250
	4	1.9	1.25	66.4° lag	9	250
	5	1.25	1.25	66.4° lag	9	250
	6	0.9	1.25	66.4° lag	10	250
4/15	4	1.9	1.25	66.4° lag	16	250
	5	1.25	1.25	66.4° lag	16	250
	6	0.9	1.25	66.4° lag	16	250
	8	0.5	1.25	66.4° lag	17	250
	10	0.3	1.25	66.4° lag	18	250
	12	0.2	1.25	66.4° lag	19	250
	15	0.15	.1.25	66.4° lag	20	250

LONG TIME CO RELAYS AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One Second Rating (Amperes)
4/15	4	26	17	60° lag	8	250
	5	17	17	60° lag	8	250
	6	12	17	60° lag	9	250
	8	6.5	17	60° lag	10	250
	10	4.5	17	60° lag	12	250
	12	3	17	60° lag	13	250
	15	2	17	60° lag	15	250

SHORT TIME COH RELAYS AT 60 CYCLES

Ampere Range	Tap	V.A. at 5 Amperes	V.A. at Tap Current	Power Factor	Continuous Rating (Amperes)	One Second Rating (Amperes)
0.5/2.5	0.5	400	4	60° lag	2	56
	0.6	280	4	60° lag	2	56
	0.8	156	4	60° lag	2	56
	1.0	100	4	60° lag	3	56
	1.5	44	4	60° lag	3	56
	2.0	25	4	60° lag	4	56
	2.5	16	4	60° lag	5	56
2/6	2	25.0	4	60° lag	8	250
	2.5	....	4	60° lag	8	250
	3	....	4	60° lag	8	250
	3.5	....	4	60° lag	8	250
	4	....	4	60° lag	9	250
	5	....	4	60° lag	9	250
	6	2.78	4	60° lag	10	250
4/15	4	6.3	4	60° lag	16	250
	5	4.0	4	60° lag	16	250
	6	3.0	4	60° lag	16	250
	8	1.6	4	60° lag	17	250
	10	1.0	4	60° lag	18	250
	12	0.7	4	60° lag	19	250
	15	0.4	4	60° lag	20	250

BURDENS AT TAP CURRENT ON 25 AND 50 CYCLES

	25 Cycles V.A.	25 Cycles Power Factor	50 Cycles V.A.	50 Cycles Power Factor
Definite Minimum Time CO..	16	53° lag	17	60° lag
Inverse Time CO..........	2	60° lag	2	60° lag
Very Inverse Time CO.......	1.25	60° lag	1.25	66.4° lag
Long Time CO.............	16	53° lag	17	60° lag
Short Time COH...........	4	53° lag	4	60° lag

CONTACT CIRCUIT CONSTANTS

Resistance of 1.0 Ampere Target..........................0.16 ohms
Resistance of Contactor Switch..........................0.25 ohms
Resistance of Total.....................................0.41 ohms

Resistance of 0.2 Ampere Target..........................2.8 ohms
Resistance of Contactor Switch..........................0.25 ohms
Resistance of Total.....................................3.05 ohms

Resistance of Universal Target...........................2.8 ohms
Resistance of Contact Switch.............................0.25 ohms
Resistance of Target and Contactor in Parallel..............0.23 ohms

CONTACT RATING

The main contacts will close 30 amperes at 125 volts d-c. and the auxiliary contactor switch will carry this current long enough to trip the breaker. The trip circuit must be opened by an "A" switch on the circuit breaker, therefore the relay contacts are not required to interrupt the trip current.

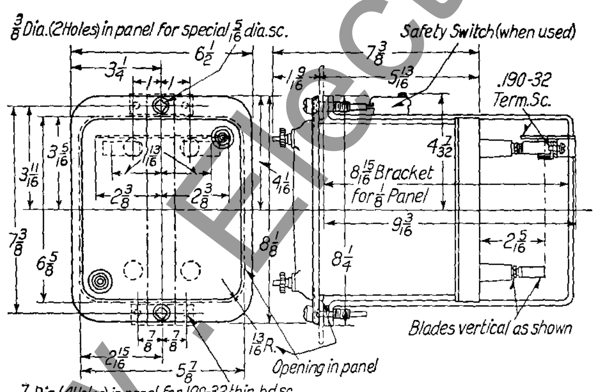


Fig. 23—Outline Plug-in Semi-Flush Mounting

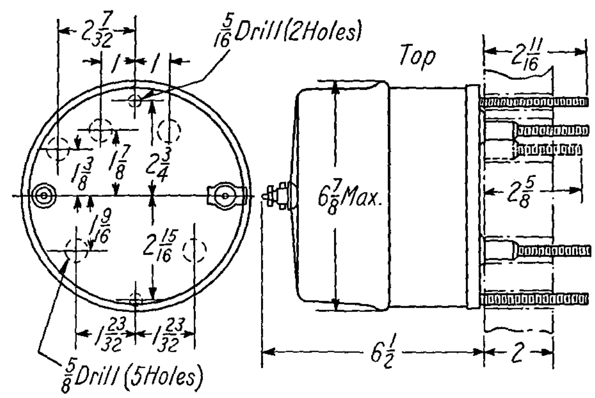


Fig. 24—Outline and Drilling Plan for the Circuit Closing. Double-Trip Types CO and COH Relays in the Round Case, Omit the Unsymmetrical Left Terminal for Single-Trip Relays. The Type COA Relay Case is 6 31/32 Inches Deep, Instead of 6½ Inches. Omit the Lower Left Terminal for the Circuit Closing Relay

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