INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CJ-7 LINE-TO-NEUTRAL AND LINE-TO-LINE CAPACITOR SWITCHING RELAY

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 CJ-7 line-to-neutral relay, for use with line-to-neutral potential polarizing sources and the CJ-7 line-to-line relay, for use with line-to-line potential polarizing sources are the master relays for single-step VAR control for capacitor switching. Fixed time-delay is provided to avoid unwanted switching operations due to momentary fluctuations in VARS, or to provide coordination with other voltage regulating devices. The fixed time-delay may be changed by substituting a different time-delay unit having the desired time interval.

Note that the scale for the line-to-neutral relay is marked in VARS per phase. However the line-to-line relay is marked in $\sqrt{3}$ times the VARS per phase due to the ratio between the line to line voltage to line-to-neutral voltage ($\frac{VLL}{VLN} = \sqrt{3}$).

To set the relay scale operate point for the line-to-line relay, the desired system VAR correction should be divided by $\sqrt{3}$. The three phas system VAR correction should be divided by 3 for the line-to-neutral relay setting. This would be in terms of system CT and PT secondary current and voltage.

CONSTRUCTION

The relay consists of an induction disc type VAR sensing unit, a type SX toggle unit, a counter, and two socket mounted thermally operated time-delay relays. The line-to-neutral and line-to-line relays differ only in their respective potential circuits. The line-to-neutral relay derives its proper phase relation from an adjustable resistor, in parallel with a capacitor. The line-to-line relay uses a series resistor for the same function.

VAR Sensing Unit (90)

The electromagnet is an "E" type laminated structure with a voltage coil mounted on the center leg, and current coils

wound on the outer legs. The fluxes produced by the current coils react with the main pole voltage flux to produce a torque proportional to VARS on the disc.

SX Toggle Unit (90X)

The toggle unit consists of two electromagnets, with a common armature having two pins resting in a groove in the molded base. The other end of the armature is held in one of two positions by means of a toggle spring which produces the toggle action. The spring is protected by a lock pin which may be left in after installation. The moving contacts are mounted at one end of the armature and the stationary contacts are mounted on either side.

Time Delay Units (2), (62)

The time-delay units have sealed-in-glass elements and are mounted in standard radio-type octal sockets. They have a single set of contacts, which are normally open and are operated by a heater winding acting upon a bimetal arm. The construction is such that the contact gap and the time-delay are not affected by variations in ambient temperature. The time-delay of a given unit is non-adjustable. Units of various time-delay values are available for direct substitution. The usual time-delay is 60 seconds.

OPERATION

When the VAR unit 90-R contact closes to the right-hand side (indicating that the lagging reactive power is greater than desired) the heater of the 2 (raise) time-delay unit is energized through the 90X-L (lower) contact of the SX unit. If the 90-R contact remains closed until the 2 (raise) time delay unit contacts close, the energizing circuit for the 90X-R (raise) coil is completed. The 90X-L contacts open de-energizing the time-delay unit, and the 90X-R contacts close energizing the counter and the close coil which connects the capacitor bank to the line.

If the leading reactive power rises sufficiently to maintain the 90-L contact of the voltage unit closed for the required time, the time-delay 62 (lower) contact closes and completes the circuit for the 90X-L coil. The 90X-R contacts open de-energizing the 62 (lower) time-delay unit and the counter, and the 90X-L contacts close energizing the trip coil which disconnects the capacitor bank from the line. The equipment then is ready to go through another similar cycle.

CHARACTERISTICS

The type CJ-7 line-to-neutral and the CJ-7 line-to-line relays have stationary contacts that can be set around a calibrated scale between the limits of 250 leading and 500 lagging VARS. The moving contacts will assume a position corresponding to the VARS applied to the relay and will stay in that position until the VARS change. If the VARS change either gradually or suddenly, the contact will assume a new position corresponding to the change unless the travel is limited by the setting of the adjustable contacts.

The VAR sensing unit has inverse timing; that is, the greater the change in VARS the faster the relay contact will travel. However, the time-delay of the VAR unit usually is only a few seconds and is negligible as compared to the delay of the thermally-operated unit. If the torque on the VAR unit is barely sufficient to close the contacts, the contact resistance at this light pressure may reduce the volrage on the time-delay unit sufficiently to cause a substantial increase in the time. If the VARS change is 2 to 5 VARS greater than that required to barely close the VAR unit contacts, this effect is negligible. However, the time delay units themselves have a tolerance of ± 15% of the nominal delay, and the nominal value applies when these units are energized at their 117 volt rating. Variations from this value affect the timing approximately inversely as the square of the voltage. Because of these factors, precise time-delays should not be expected.

The SX toggle unit contacts will carry 5 amperes continuously. They will interrupt non-inductive circuits carrying 20 amperes at 115 volts a-c, 10 amperes at 230 volts a-c, 2 amperes at 125 volts d-c, or 0.75 amperes at 250 volts d-c.

SETTINGS

There are two independent relay settings. These are the lagging and leading VAR contact setttings as described under "Characteristics."

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

four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

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.

Acceptance Check

The following check is recommended to insure that the relay is in proper working order:

A. VAR Sensing Unit (Line-to-Neutral and Line-to-Line Relays)

1. Contacts - Set the left-hand adjustable contact in the center of the scale and adjust the VARS until the moving contact just makes. Set the left-hand contact back out of the way and bring the right-hand contact up until the contacts just make. The pointer should be within ± 1/32" of where the left-hand pointer was.

2. Zero Setting Check - Energize the relay at 120 volts, 2.5 amps, and proper phase angle (unity P.F. for line-to-neutral relay or 30° current lagging for line-to-line relay). There should be no torque on the disc.

3. Calibration Check - With unity P.F for the line-to-neutral relay and 30° current lagging for the line-to-line relay, check the scale markings by setting either of the two contacts at a value marked on the scale, the alternately apply this reactive power plus and minus 5 VARS. Contacts should make and break respectively.

4. Operating Time - The time delay of the thermally operated units shouldbe 60 seconds, plus or minus 15% at 117 volts.

B. SX Toggle Unit (Line-to-Neutral and Line-to-Line Relays)

1. Calibration Check - If correctly adjusted, the unit will operate without chattering through its own contacts at 80% of rated voltage.

Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher #182A836H01 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.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order (See "Acceptance Check").

A. VAR Sensing Unit (Line-to-Line and Line-to-Neutral Relays)

1. Contacts - Apply sufficient VARS to the relay, to make the disc float in the center of its travel. Move both of the adjustable contacts until they just make with the moving contacts. If the two contact pointers do not meet at the same point on the scale, adjust the follow on both adjustable contacts. Approximately the same follow should be in each of the adjustable stationary contacts.

2. Zero Setting Check - With the relay de-energized, determine the position of the disc. Apply 120 volts at 2.5 amperes and proper phase angle (unity P.F. for line-to neutral relay and 30° current lagging for the line-to-line relay), and move the slide on the adjustable resistor until the disc returns to its original position.

3. Calibration Check - The adjustment of the spring tension in calibrating the relay is most conveniently made with the damping magnet removed.

Set either of the adjustable stationary contacts in the center and apply this reactive power to the relay. (Using unity P.F. for line-to-neutral relay and 30° current lagging for line-to-line relay). Wind up the spiral spring by means of the spring adjuster until the stationary contact and moving contact just make.

Check the other scale markings by setting the adjustable contact on these markings and applying the corresponding VARS to the relay. The contacts should make within plus or minus 5 VARS of scale marking.

B. SX Toggle Unit (Line-to-Neutral and Line-to-Line Relays)

If the SX Toggle Unit has been dismantled, it is necessary to check the toggle action and the contact follow after reassembling it. Set the gap between the lower pole pieces at 11/64". The contact follow should be set at .037". This may be obtained by adjusting the stationary contacts to just make when there is an .020" gap between the residual pin in the armature, and the upper pole pieces. The adjusting screw assembly should be pushed down until there is enough tension to cause the residual pin to rest against the pole piece. With the lock nut tightened, adjust the adjusting screw until there is equal toggle pressure on each side. This may be done mechanically with a gram gage or electrically by applying a voltage to the coils.

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

VAR Sensing Unit: (LINE-TO-NEUTRAL RELAY)

	Burden (Volt-Amps)	Current Rating 1 Sec.	1 Min.	Continuous	Freq.
Current Coil	1.5/67°@ 2.5 Amps.	370 Amps.	40 Amps.	12.7 Amps.	60
	1.75/ 65°@ 2.5 Amps.	"	"	"	50
Potential Circuit	5.6/0° @ 120 Volts	--	--	--	60
	6.0/0° @ 120 Volts				50

VAR Sensing Unit: (LINE-TO-LINE RELAY)

	Burden (Volt-Amps)	Current Rating 1 Sec.	1 Min.	Continuous	Freq.
Current Coil	1.5/67°@ 2.5 Amps.	370 Amps.	40 Amps.	12.7 Amps.	60
	1.75/65°@ 2.5 Amps.	"	"	"	50
Potential Circuit	5.2/30°@ 120 Volts	--	--	--	60
	6.0/30°@ 120 Volts				50

SX TOGGLE UNIT (LINE-TO-NEUTRAL AND LINE-TO-LINE RELAYS)

Burden

VA = 31.8 /46° @ 120 volts (Rated for Intermittent Duty)

TIME DELAY UNIT (LINE-TO-NEUTRAL AND LINE-TO-LINE RELAYS)

VA = .5 / 0° @ 117 volts

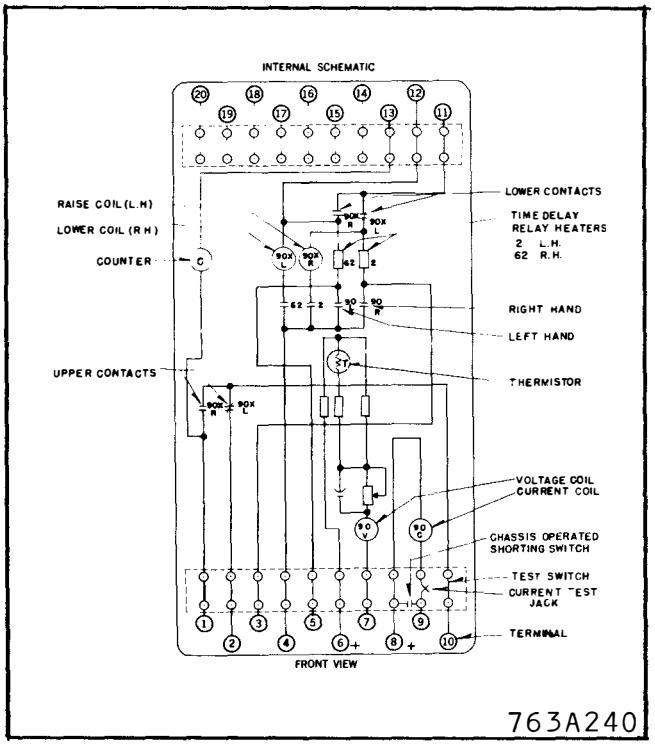

Fig. 1 Internal Schematic (L-N Relay)

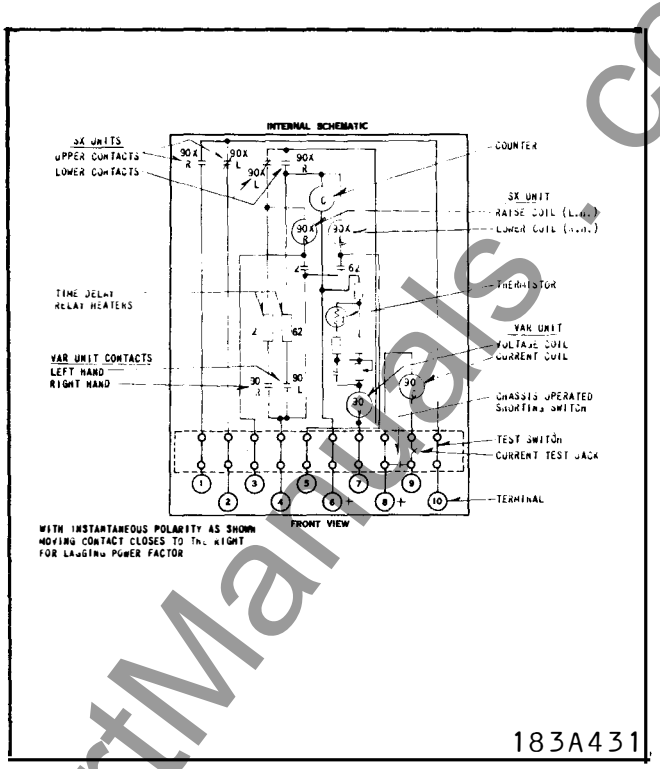

Fig. 1a Internal Schematic (L-N Relay)

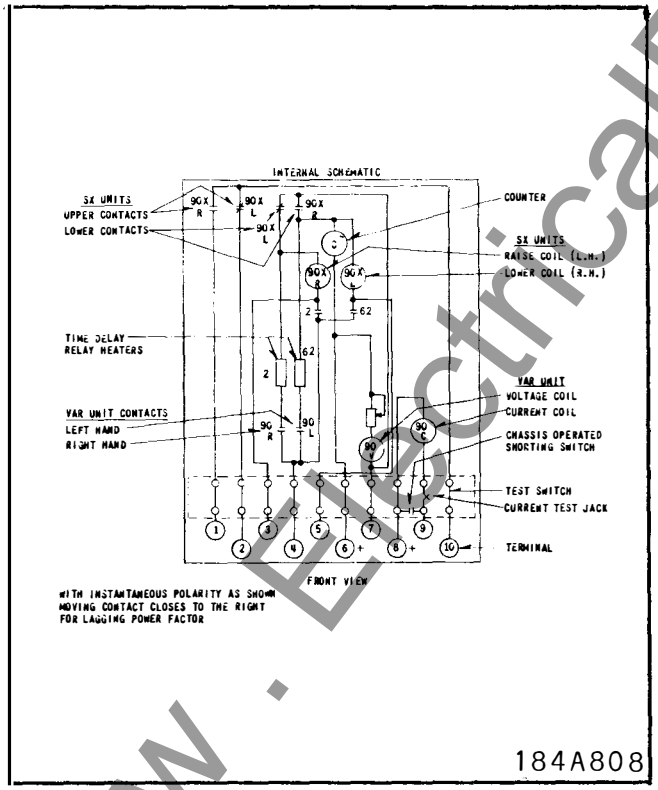

Fig. 1b Internal Schematic (L-L Relay

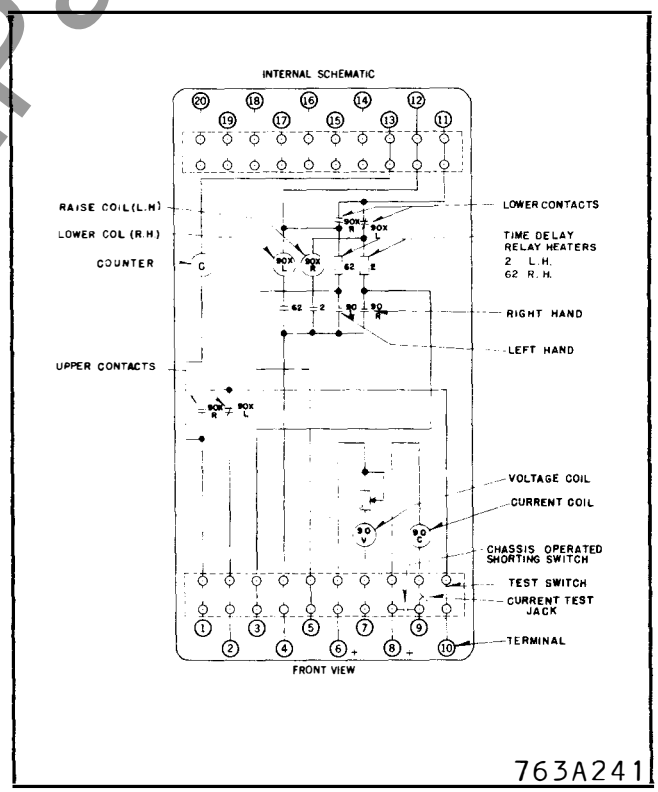

Fig. 1c Internal Schematic (L-L Relay)

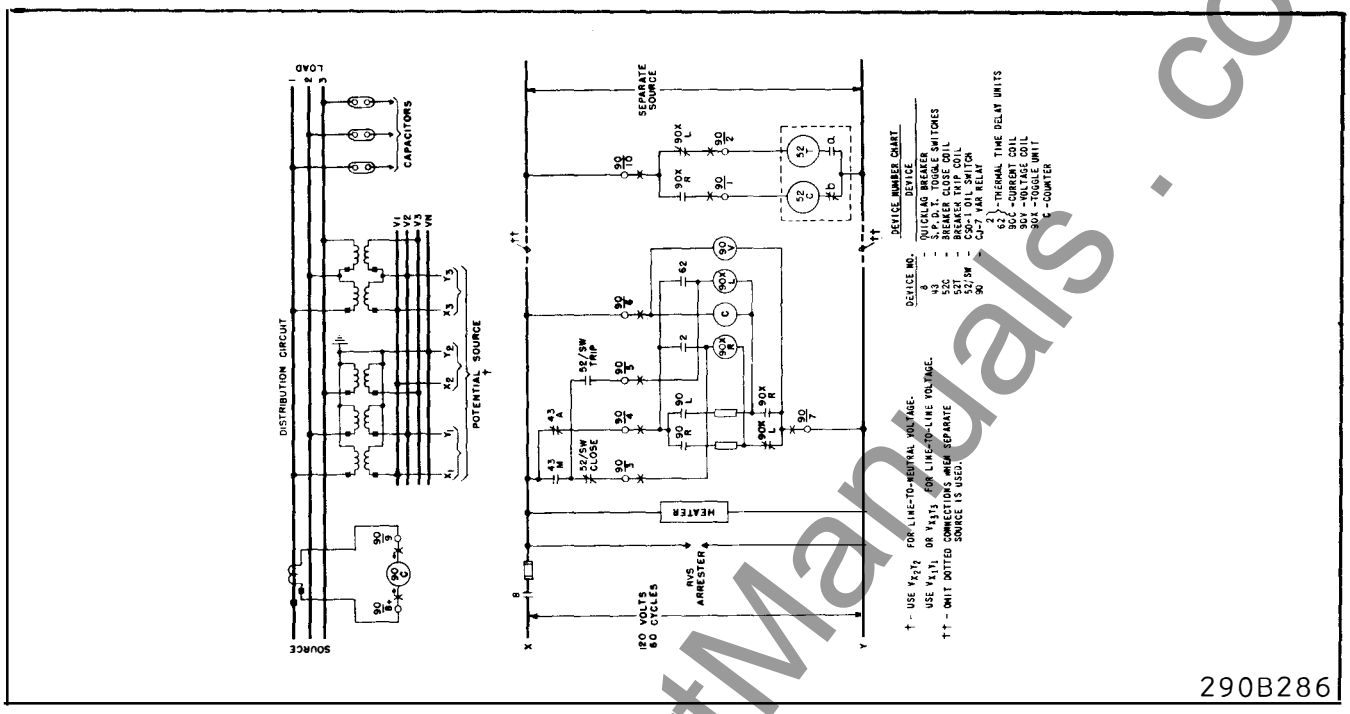

Fig. 2 External Schematic (L-N & L-L Relay)

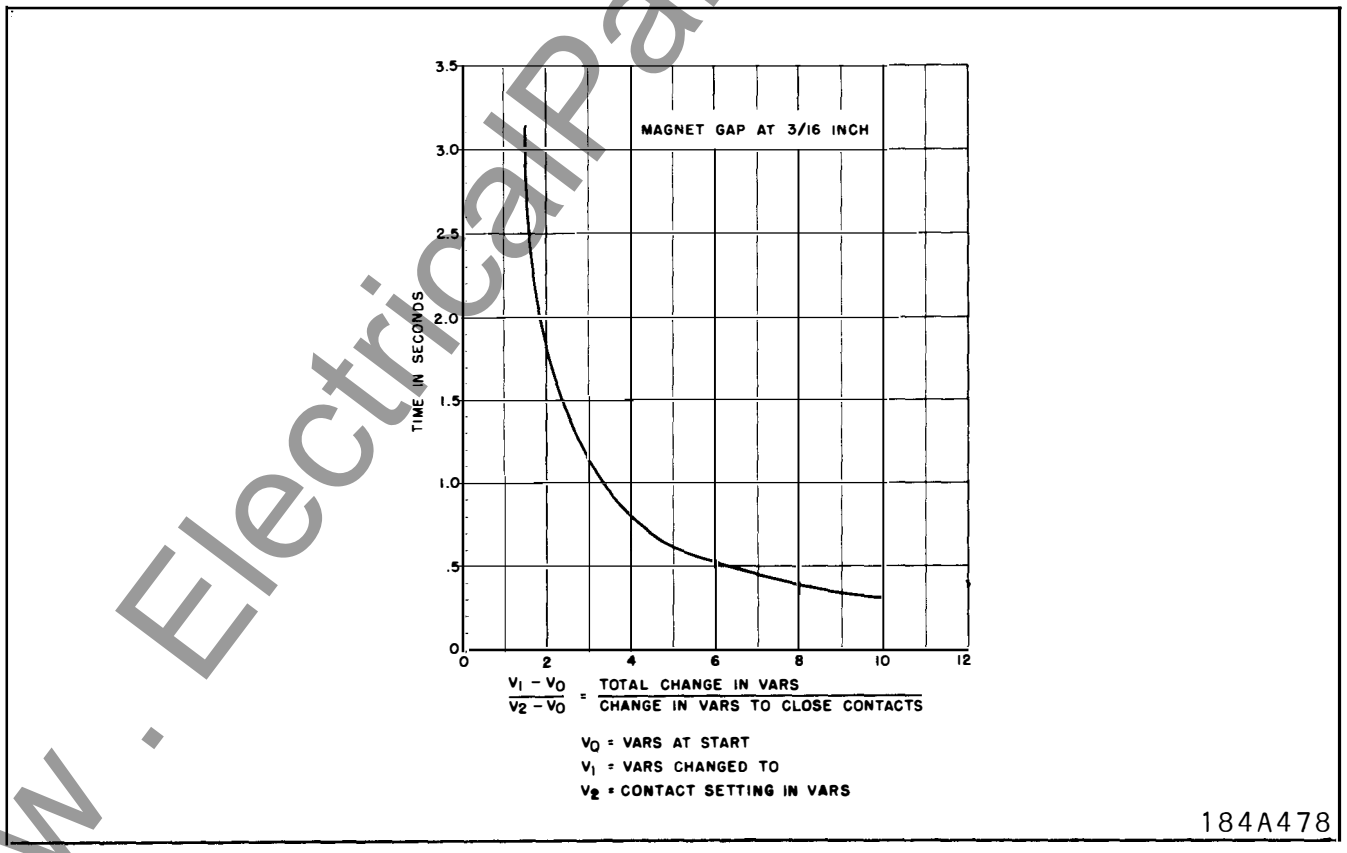

Fig. 3 Typical Timing Curve (L-N & L-L Relays)

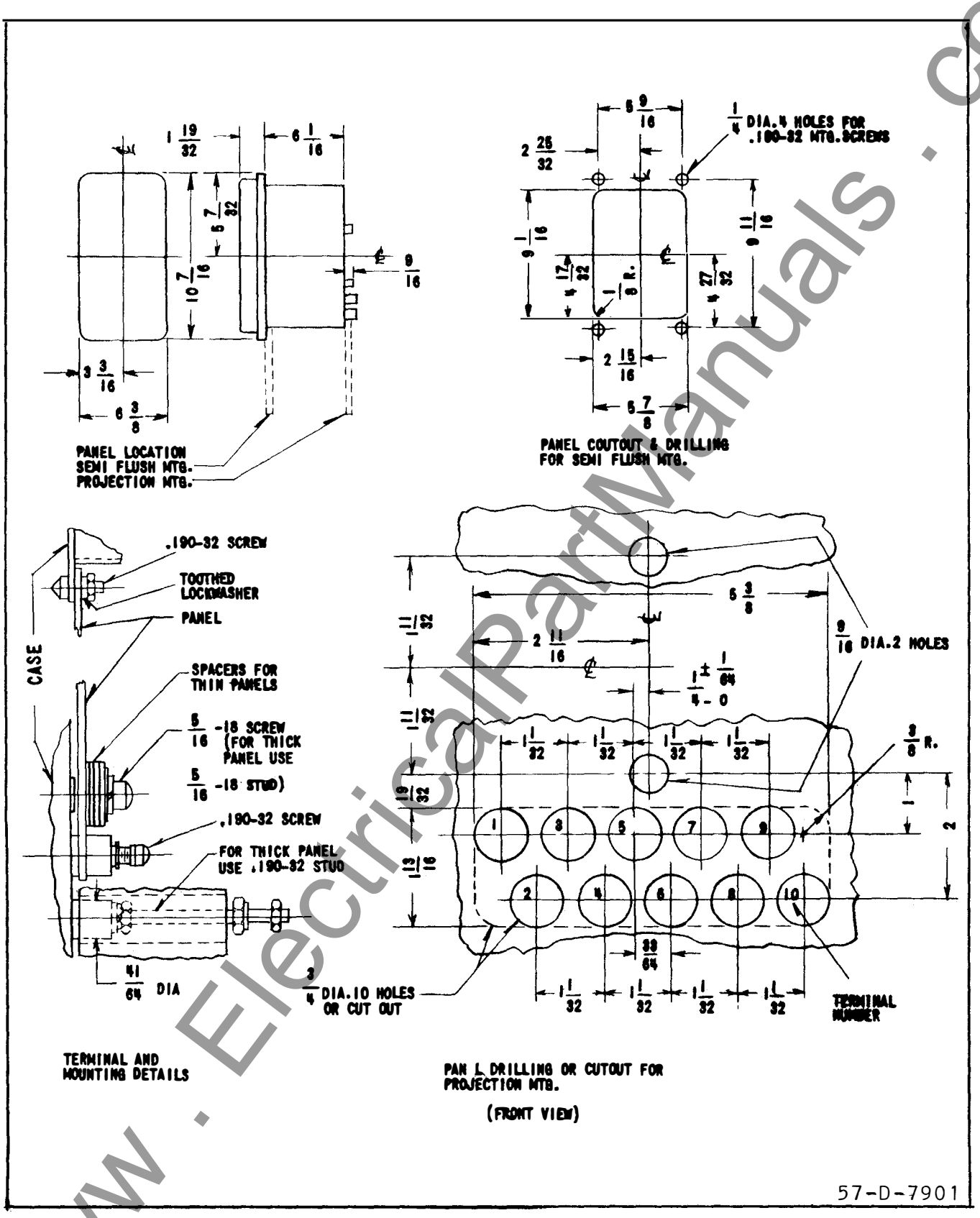

Fig. 4 Outline & Drilling (FT-21 Case)

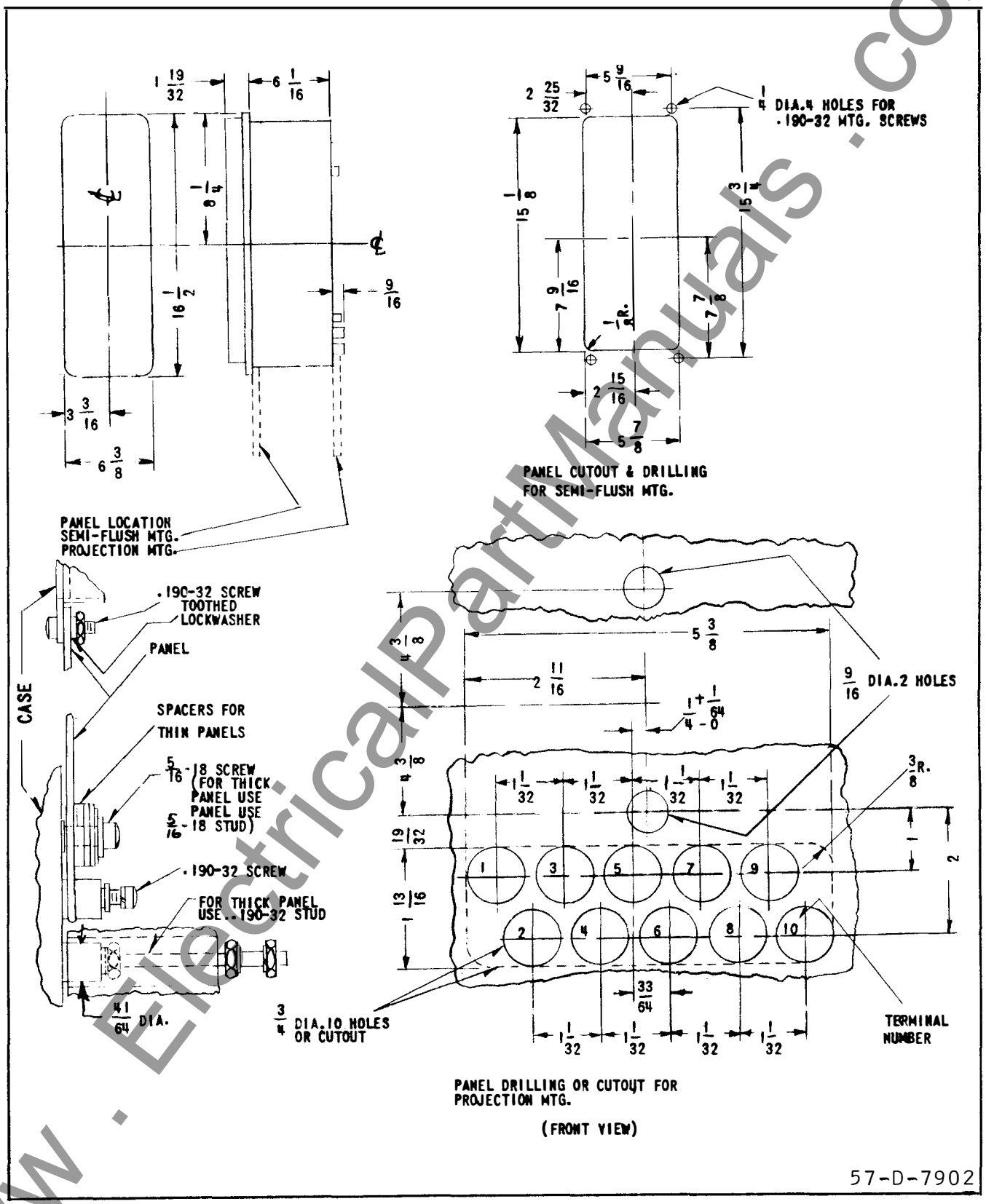

Fig. 5 Outline & Drilling (FT-32 Case)

WESTINGHOUSE ELECTRIC CORPORATION

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