INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

D-C. TO A-C. INVERTER

APPLICATION

The d-c to a-c inverter is an intermediate auxiliary device used to convert battery power into 115 volt, 60 cycle, power. Its principal application is as a source of 60 cycle power for a-c synchronous motors of timing devices. Its output voltage closely approaches a sine wave form, which is required for certain small synchronous motors. Its capacity is limited by the design restrictions found necessary in securing such a wave form, however, and it will not supply more than one or two motors. The inverter is not intended for continuous duty, and the d-c input should be disconnected except at the times when the motor is required to operate.

For applications where the d-c voltage is 250 volts, S#937838 Resistor (1825 ohms total, tap at 350 ohms) is used as a potentiometer to supply 125 volts to the inverter. The inverter is connected across the high resistance section as shown in the diagram.

INSTALLATION

The inverter is arranged for rear of panel mounting using either the strap-mounting provided or by removing the strap and using screws through the panel and into the base inserts.

Mount the inverter so the face of the terminal board is vertical with the name plate on top. Mounting in any other position may cause erratic operation.

The resistor across the a-c output terminals, as shown in the accompanying diagram, maintains the output voltage within permissible variations from no load to a maximum of 3 V.A. In the event greater output is desired the resistor should be removed. In no case, however, should the load on the inverter exceed 8 V.A. When the load exceeds the maximum permissible amount, the wave form becomes distorted and the contacts spark and burn.

The frequency of the output voltage will vary slightly with the loading, but from no-load to maximum load the frequency should not be more than two cycles above or one cycle below 60 cycles.

The inverter will start at a voltage which is 70% or less of the nameplate d-c voltage rating.

MAINTENANCE

The only moving parts in the inverter are the vibrator contacts. These contacts are

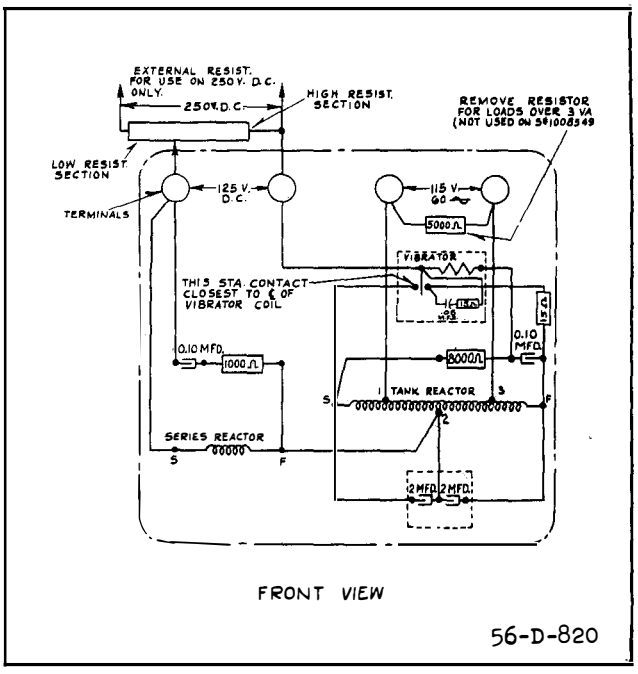

***Fig. 1—Internal Connection of the D-C. to A-C. Inverter.**

SUPERSEDES I. L. 41-856

EFFECTIVE JUNE 1957

*** Denotes change from superseded issue.**

made of a special silver alloy, and, for infrequent operation, such as is normally required of the inverter, they should not need cleaning or adjustment. A contact life of several hundred hours may be expected, and the inverter should be used only for applications where the total of the operating periods will not exceed this life in a reasonable length of service. The adjustment of the contact gaps and springs affects the wave form, and to some extent the frequency, of the output; and the original adjustment should not be disturbed.

* If for any reason it appears that the contacts should be dressed, contact burnisher S#182A836H01 should be used. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the silver contact.

When checking the operation of the inverter a high-resistance voltmeter (1000-ohms/volt or higher) should be used to measure the output voltage. If the voltage of the DC supply is appreciably higher than the 125 volt rating of the inverter, a series resistor should not be used to reduce the voltage on the input terminals. This would produce a rapidly fluctuating voltage at the terminals, because of the intermittent current taken, and the output would differ considerably from the output obtained with a constant DC voltage on the input terminals. If the DC source is higher than the inverter rating, a low resistance potentiometer should be used so that the fluctuation of the input voltage will be kept to a low value. The input voltage fluctuations can be reduced further by connecting a large capacitor across the input terminals.

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

D-C Voltage	Burden on A-C Side	Drain From Battery
125	7.5 V.A.	25 Watts
250	7.5 V.A.	80 Watts*

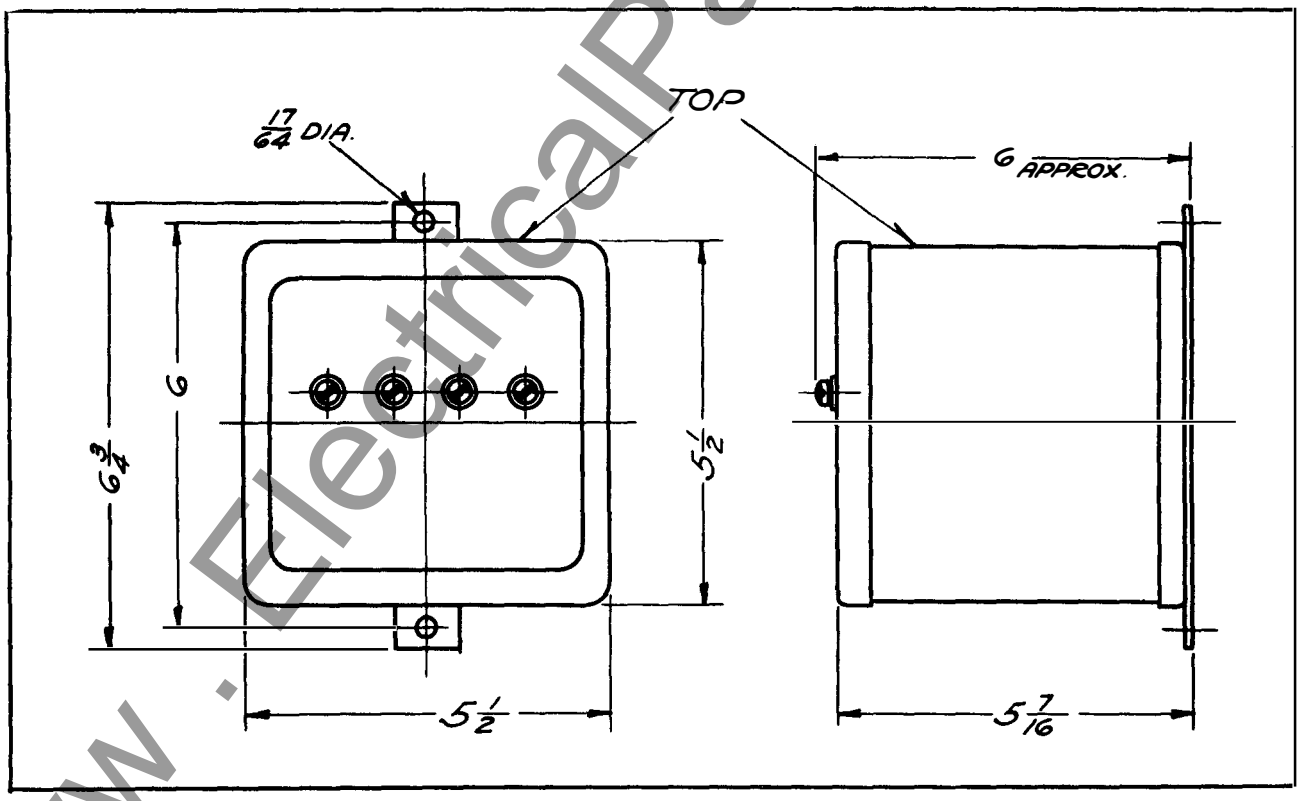

Fig. 2—Outline and Drilling Plan of the D-C. to A-C. Inverter.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

D-C. TO A-C. INVERTER

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The frequency of the output voltage will vary slightly with the loading, but from no load to maximum load the frequency should not be more than two cycles above or one cycle below 60 cycles.

The inverter will start at a voltage which is 70% or less of the nameplate d-c voltage rating.

MAINTENANCE

The only moving parts in the inverter are the vibrator contacts. These contacts are made of a special silver alloy, and, for infrequent operation, such as is normally required of the inverter, they should not need cleaning or adjustment. A contact life of several hundred hours may be expected, and the inverter should be used only for applications where the total of the operating periods will not exceed this life in a reasonable length of service. The adjustment of the contact gaps and springs

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

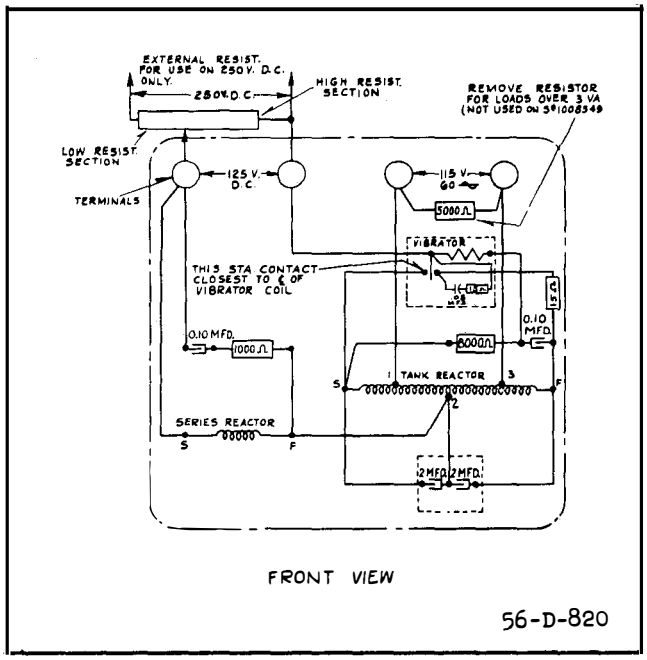

Fig. 1. Internal Connection of the D-C. to A-C. Inverter.

affects the wave form, and to some extent the frequency, of the output; and the original adjustment should not be disturbed.

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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

D-C Voltage	Burden on A-C Side	Drain From Battery
125	7.5 V.A.	25 Watts
250	7.5 V.A.	80 Watts*

*Includes external potentiometer resistor

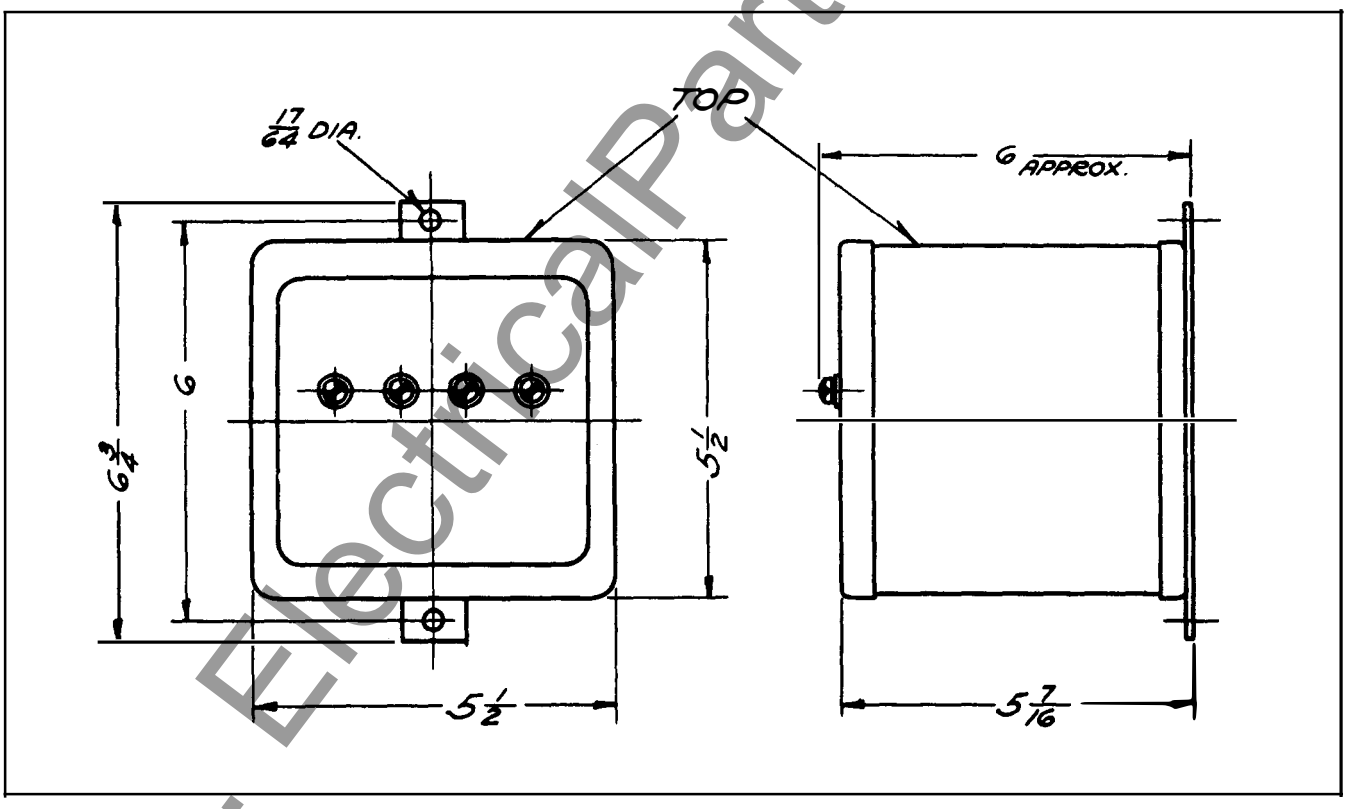

Fig. 2 – Outline and Drilling Plan of the D-C. to A-C. Inverter.

WESTINGHOUSE ELECTRIC CORPORATION
RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**
Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE KA-1 AUXILIARY RELAY

TYPE KA-1 AUXILIARY RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing 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 KA-1 is an auxiliary relay used in the type KD directional comparison tripping system. The KA-1 relay provides a circuit for high speed tripping, controls the transfer tripping signal for the remote line terminals, and supplies necessary coordination during power reversal conditions.

CONSTRUCTION

The type KA-1 relay consists of three time-delay auxiliary relay units, five silicon diodes, and one non-directional high-speed ground fault overcurrent unit.

Auxiliary Units X, X1, and X2

The auxiliary units X, X1, and X2 are telephone-type relays. In these relays, an electromagnet attracts a right-angle iron bracket which in turn operates a set of make or break contacts.

Units X and X1 have a capacitor and resistor network connected across their operating coils to provide correct timing under variable control voltage conditions (-20, +15 percent or rated voltage).

The units X1 and X2 are of slow-release type. The delay in release is obtained by a copper slug located at the end opposite from the armature. When the coil becomes deenergized, the change in flux through the slug results in an electromotive force and associated current in it.

This current produces a flux which aids the main flux and delays the release of the armature. When the coil is energized, the operation of the relay is not appreciably delayed because the armature is operated by flux not linking the slug.

Tripping Diodes D1 and D2

Tripping diodes D1 and D2 are medium-power silicon rectifiers.

Blocking Diodes D3, D4, D5

Blocking diodes D3, D4, and D5 are Zener type diodes having a one watt, 200 volt rating (JEDEC No. 1N3051).

Overcurrent Unit (I_{OS})

The overcurrent unit is a product induction cylinder type unit. The time phase relationship of the two air gap fluxes necessary for the development of torque is achieved by means of a capacitor connected in series with one pair of pole windings.

Mechanically, the overcurrent unit is composed of four basic components: a die-cast aluminum frame, an electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a locking nut. The bearing can be replaced, if necessary without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition there are two locating pins. The locating pins are used to accurately position the lower pin bearing which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is secured to the frame by four mounting screws.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

When the current in the overcurrent unit exceeds the pick-up value the contacts open.

A transformer and varistor assembly is used in conjunction with the overcurrent unit. The transformer is of the saturating type which limits the energy to the overcurrent unit and reduces the burden on the operating CT.

The primary of the transformer is tapped and brought out to a tap block for ease in changing the pick-up current of the relay. The use of a tapped transformer provides approximately the same energy level at a given multiple of pick-up current for any tap setting, resulting in one time curve throughout the range of the relay.

A varistor is connected across the secondary of the saturating transformer. The varistor reduces the voltage peaks applied to the overcurrent unit and phase shifting capacitor.

Operation Indicator

The operation indicator is a small dc operated clapper type device. A magnetic armature is attracted to the magnetic core upon energization of the device. During this operation two fingers of the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from outside the case by a push rod located at the bottom of the cover.

OPERATION

Relaying System

This relaying scheme makes use of a channel separate from the power line as a means of signal transmission. Therefore, either a blocking or a tripping signal can be utilized for relaying. The tripping signal is preferable, since it effects high-speed tripping, particularly in cases where a tapped line terminal has weak source of fault current. In the event of channel failure, undesirable tripping cannot take place since the microwave signal must be received over the channel to initiate high-speed tripping.

Directional Comparison Trip Scheme with a Receiver Contact and an Alarm Contact

In this scheme, the tripping relays, as in the directional comparison carrier blocking scheme, are set to operate for a fault anywhere on the protected line, and they reach beyond the line at the remote line terminals. Fast relay operation is obtained since all faults will be within the relay characteristic. For short lines there is no problem in setting the tripping relays to see faults in the protected zone.

The transmitter and receiver used in the directional comparison trip system are of the frequency-shift type. The

transmitter sends a holding signal unless a fault detecting relay operates the magnetic keyer that shifts the transmitter frequency to the tripping frequency. The receiver equipment contains receiver relay, 94, that is operated by the discriminator crystal output directly, and the alarm relay, 74, separate from the receiver relay.

As shown on dwg. 184A311, the tripping path for internal phase faults is provided through Z2 (ØØ) and Z2 (3Ø) units of the type KD relay. For ground faults, tripping is through D_o and I_o of the ground relay. For both phase and ground faults, tripping will be through the X contact of the X auxiliary unit and the receiver relay, 94. The receiver relay contact closes only upon the reception of the trip frequency from the opposite line terminal. The local protective relays plus the transfer trip receiver relay contact, 94, form the basis of the scheme. For external faults, the protective relay at one line terminal will not operate and a transfer trip will not be transmitted. Thus, tripping is prevented at all the line terminals.

The testing of the comparison trip system is accomplished in the following way. The transmitter is shifted to the trip-permissive frequency by closing the test switch. At the remote station contact 74 will close to energize unit X. The normally open contact of X closes, shifting the remote transmitter to the tripping frequency. This will close local 94 contact, lighting the indicating lamp (IL), indicating a positive channel test. The testing procedure leaves the tripping circuit operative, and an incorrect operation (should an external fault occur) is prevented by the opening of one or more of the Z3 or I_{os} contacts. This leaves the magnetic keyer under the control of only the protective relays. Upon complete loss of signal, alarm relay, 74 drops out, sounding an alarm.

Directional Comparison Scheme with Single Receiver Contact (no alarm contact)

In the specific application where receiver equipment has only one output relay, the function of the receiver alarm relay contact 74 is performed by receiver contact 94.

Auxiliary Unit X

The auxiliary unit X is operated by receiver alarm relay contact, 74. This contact closes upon loss of the hold-frequency signal. This occurs whenever the remote transmitter sends a tripping signal or fails to send any signal.

The unit X performs the following functions:

a. For internal faults, it provides (through its normally-closed contact) a high speed tripping path. The X relay has a 1.1 cycle minimum pick-up time, hence, the time delay of the circuit is such that a high-speed trip

operation is not blocked by operation of the receiver alarm relay 74.

b. For external faults which may be followed by a sudden reversal of power flow, the X unit opens the trip circuit at the local line terminal so that there will be no race between the 94 contact opening and the fault detecting relay contacts closing. The receiver alarm relay 74 opens on loss of holding frequency to pick-up the X unit before the reversal takes place.

c. The third function of the X unit is to provide a tripping signal for the opposite line terminal when either the local breaker is open or the system produces no fault current with the breaker open. Since neither the Z3 (ØØ), the Z3 (3Ø) nor the I_{os} contacts will open with no fault current at the local terminal, the X contact closes, to pick up the magnetic keyer which transmitts a trip signal to the line terminal requiring the trip signal.

The Auxiliary Unit X1

The unit X1 is operated by the fault detecting relays. Its normally open contacts perform the following functions:

a. One X1 contact acts as safety valve and parallels the X contact in the trip circuit to provide a time delay trip should the X contact open prematurely.

b. During a breaker trip, the tripping signal is continued for 3-5 cycles, through the 52b and second set of X1 contacts to insure that the signal is not prematurely removed.

c. The third set of contacts of X1 controls the operation of X2.

The Auxiliary Unit X2

The unit X2, that is operated by X1 contacts, is used to reset unit X after an internal fault is cleared at all line terminals. This is necessary; otherwise, the X contact in series with Z3 (ØØ), Z3 (3Ø), and I_{os}, might continue to key the trip signal indefinitely. However, after X1 drops out when the breaker opens, X2 does not drop out for 8-10 cycles. This is long enough for the trip signal to be transmitted, and for alarm relay 74 to open its contact at all line terminals so that X will not pick up again.

Tripping Diodes D1 and D2

Tripping diode D1 is used to separate the ground relay circuit from the phase circuits.

Tripping diode D2 is used to prevent selected trip circuits, (e.g. 101T contact) from operating the magnetic keyer.

Blocking Diodes D3, D4, D5

Blocking diode D3 is used to prevent false tripping when the magnetic keyer is operated by the ground relay directional unit alone, or by closing of the normally open X contact. Blocking diode D4 is used to prevent a sneak path for tripping through X contact in magnetic keyer circuit and I_o contact of the ground relay.

Blocking diode D5 in use with a single receiver contact is used for the separation of normally open contacts, X and X1 in the repeater and signal continuing circuits but does not provide for tripping permissive signal after backup relay operation. This function if desired, can be provided by the TRB static unit.

Blocking diode D5 in use with two receiver contacts is used for the following purposes:

a. To provide a trip permissive signal upon operation of the protected line back up relays in case of failure of the local Zone 2 distance relay or the directional overcurrent relay.

b. To eliminate a sneak tripping circuit that may be set up upon closing of any one of the contacts controlling the operation of the magnetic keyer.

Overcurrent Unit (I_{os})

The I_{os} contact of the high-speed non-directional overcurrent unit is used in series with Z3 (ØØ), Z3 (3Ø) and X contacts to form the repeat circuit that effects single end feed tripping. If an internal fault is not detected at the local station because of the breaker being open or because of insufficient fault current, the local transmitter will retransmit the received signal when the X contact closes as a result of the receipt of the trip signal from the remote station. Thus, the remote breaker is allowed to trip at high speed.

In case an external fault should occur during the test of the system, I_{os} contact will open the magnetic keyer circuit, thus preventing false tripping at the remote terminal.

CHARACTERISTICS

The characteristics of the various units of the relays are as follows:

	48V Avg. Ohms	125V Avg. Ohms	250V Avg. Ohms
Operation Indicator (1 amp.)	0.1	0.1	0.1
X Unit Coil	1800	1800	1800
X Series Resistor	-	7500+	20,000+
X 1 Unit Coil	1300	1300	1300
X 1 Series Resistor	-	2800+	7300+
X 2 Unit Coil	3300	3300	3300
X 2 Series Resistor	-	5000+	13,000+

+ Adjusted Value

The pickup and operating values of these units are given under "Adjustments and Maintenance".

The time characteristic of the overcurrent unit is shown on curve 471061.

The overcurrent unit is available in the following current ranges:

Range	Taps					
0.5 - 2 amps.	0.5	0.75	1.0	1.25	1.5	2.0
1 - 4	1.0	1.5	2.0	2.5	3.0	4.0

The tap value is the minimum current required to just open the relay contact. For pickup settings in between taps place the tap screw in the next lower tap hole and adjust the spring until the contacts just open at the desired pickup current.

SETTINGS

Auxiliary Units

The auxiliary units X, X1 and X2 require a setting for the correct control voltage. For 48 V DC voltage, the series resistors for X1 and X2 are by-passed by connecting the lead to the rear terminal of the resistor. The 48 V DC setting for X unit is obtained by connecting the lead to the rear adjustable terminal of the corresponding series resistor. For 125 V DC or 250 V DC rated relays, the connection is made to the adjustable tap terminal on the series resistor.

Overcurrent Unit

The setting required for the overcurrent unit is made by inserting the tap screw in the tap to give the required pickup.

Caution

Since the tap block connector screw carries operating current, be sure that the screw is turned tight. In order to avoid opening the current transformer circuits when changing taps under load, connect the spare tap screw in the desired tap position before removing the other tap screw from the original tap position. The I_{OS} overcurrent unit at each line terminal is set on a lower tap than the tripping unit at the opposite end of the line.

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 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 terminals 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.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay no customer adjustments, other than those covered under "SETTINGS", should be required.

Acceptance Check

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

Overcurrent Unit

With the tap screw in the desired tap hole, pass rated alternating current through the relay terminals. The contact should pick up within ±5% of tap value.

Operation Indicator

Apply direct current to the relay terminals. The operation indicator should pick up and drop the indicator target between 1 ampere and 1.2 amperes dc.

Auxiliary Units X, X2, X3

Apply rated voltage to each auxiliary unit relay terminals and observe contact action. If desired, the timing of the operation can be checked as outlined under calibration procedure.

Routine Maintenance

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

All contacts should be periodically cleaned. A contact burnisher S# 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.

NOTE: When making a dielectric test on the relay, the high voltage may be applied at the relay terminals, from all circuits to ground, between coil and contact circuits, and between isolated coil circuits. However, the test voltage should not be applied across relay contacts and rectifier circuits.

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order.

Auxiliary Units X, X1, and X2

The operating time of units X, X1, and X2 should be checked with an electronic timer. When adjusting the series resistor, loosen the adjustment band to avoid injury to the resistance wire. The series resistor for each unit is located below the corresponding unit.

Auxiliary Unit X (Left-Hand Unit)

For 125 V DC or 250 V DC control voltage, the coil of the relay should be connected in series with the resistor. Adjust the resistance to measure:

7,500 ohms for 125 V DC
20,000 ohms for 250 V DC

With the armature closed, adjust the air gap to be .002" - .003." Contact gaps should measure from .020" to .035." The coil is energized across terminals 5 & 6 for two receiver contacts and terminals 5 & 11 for single receiver contact.

Check for the specified 1.0 to 2.0 cycle dropout time across terminals 11 and 15 for two receiver contacts and terminals 15 & 18 for single receiver contact. If necessary, the dropout time can be adjusted by changing the air gap. After final adjustment, the air gap should be a minimum of .002." Check pick up time across terminals 3 and 20 by applying first 80% and then 115% of

rated voltage. It should fall within the specified limits of 1.1 to 1.5 cycles. If necessary, make further adjustment to achieve correct timing by slightly increasing or decreasing the series resistance.

Auxiliary Unit X1 (Middle Unit)

For 125 V DC and 250 V DC control voltage, the coil of the relay should be connected in series with the resistor. Adjust the resistance to measure:

2,800 ohms for 125 V DC operation
7,300 ohms for 250 V DC operation

With the armature closed, adjust the gap to the .002" - .004". Contact gaps should measure from .020" to .035". Check for the specified 3.0 to 5.0 cycles dropout time by energizing the relay between terminals 2 and 20, and measuring the contact dropout time between terminals 12 and 15 or 7 and 8 for two receiver contacts. In the case of a single receiver contact, time the relay between terminals 12 & 14, or 7 & 8. If necessary, the dropout time can be adjusted by changing the air gap. After final adjustment the air gap should be a minimum of .002". Check the pick up time first with 80% and then with 115% of rated voltage. It should fall within the specified limits of 1.0 and 2.0 cycles. If necessary, make further adjustment to achieve correct timing by slightly increasing or decreasing the series resistance.

Auxiliary Unit X2 (Right-Hand Unit)

For 125 V DC or 250 V DC control voltage, the coil of the relay should be connected in series with the resistor. Adjust the resistor to measure:

5,000 ohms for 125 V DC
13,000 ohms for 250 V DC

Adjust the armature air gap until the dropout time is between 8-10 cycles. This is checked by energizing the coil between terminals 6 & 7 and measuring time response across terminals 4 and 5. The final air-gap with the armature closed should be minimum .0015". Check the pick up time with 80% of rated voltage. It should be below 1.5 cycles. If necessary, make further adjustments to achieve correct timing by slightly increasing or decreasing series resistance.

D1 and D2 Tripping Diode Check for Two Receiver Contacts

Check operation of D1 diode across the terminals 1 & 20, and the D2 diode across terminals 9 and 10, as follows (for single receiver contact, use terminals 14 and 18 and 15 and 20):

A. Forward Voltage Drop

Pass 10 amperes dc in terminal 1, out terminal 20 for D1, and in terminal 9, out terminal 10 for D2 with positive polarity on terminal 1 for D1, and terminal 9 for D2.

Using a high resistance voltmeter, measure the voltage across terminals 1 & 20 for D1, and terminals 9 and 10 for D2. It should be less than 1.5 volts.

B. Leakage Current for 48/125 V DC Relays

Apply 125 V DC with 10,000 ohm resistor in series to terminals 1 and 20, with positive polarity on terminal 20 for D1, and to terminals 9 and 10 with positive polarity on terminal 10 for D2. Measure the leakage current with a dc milliammeter. It should be less than 4 milliamperes.

For 48/250 V DC Relays

Same procedure as for 48/125 V DC relays except apply 250 V DC.

D3, D4, D5 - Blocking Diode Check (For 48, 125, and 250 Volt Relays)

a. Reverse Characteristic:

Breakdown voltage is the value of voltage at which the current just exceeds 0.25 milliamperes and should be between 160 and 240 volts for each diode. The breakdown voltage is determined by slowly increasing voltage until reverse current exceeds 0.25 milliamperes and starts to increase rapidly. Do not exceed 3 milliamperes reverse current.

b. Forward Characteristic:

With 200 milliamperes flowing in forward direction, the forward voltage across each diode should not exceed 1.5 volts.

Overcurrent Unit

The upper bearing screw should be screwed down until there is approximately 1/64" clearance between it and the top of the shaft bearing. Securely lock in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

With the moving contact in the normally closed position, i.e. against the right side of the bridge, screw in the stationary contact until both contacts just close. Then screw in the stationary contact approximately one-half turn farther to provide the correct amount of follow.

The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring type action in holding the stationary contact in position.

With the tap screw in the desired tap hole, pass rated ac through the relay terminals.

The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

Adjust the spring until the contacts just open. With this adjustment, the pickup of the relay for any other tap setting should be within ±5% of tap value.

If settings in between taps are desired, place the tap screw in the next lower tap hole and adjust the spring until the contacts just open at the desired pickup current.

ENERGY REQUIREMENTS

Burden Data Operating Current Circuit - 60 Cycles

Range Amps.	Taps	Volt Amperes Tap Value Current	Power Factor Angle Ø	Volt Amperes at 5 Amperes	Power Factor Angle Ø
.5-2	.5	.37	39°	24	46°
	.75	.38	36	13	37
	1	.39	35	8.5	34
	1.25	.41	34	6.0	32
	1.5	.43	32	4.6	31
	2	.45	30	2.9	28
1-4	1	.41	36°	9.0	36°
	1.5	.44	32	5.0	32
	2	.47	30	3.0	29
	2.5	.50	28	2.1	27
	3	.53	26	1.5	26
	4	.59	24	.93	24

RATINGS OF OVERCURRENT UNIT

RANGE	CONTINUOUS AMPS	ONE SECOND RATING AMPS.
.5-2	5	100
1-4	5	140

Operation Indicator

The operation indicator should pick up and drop the indicator target when the current is between 1 and 1.2 amperes dc.

Make sure that the target drops freely when the unit operates.

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.

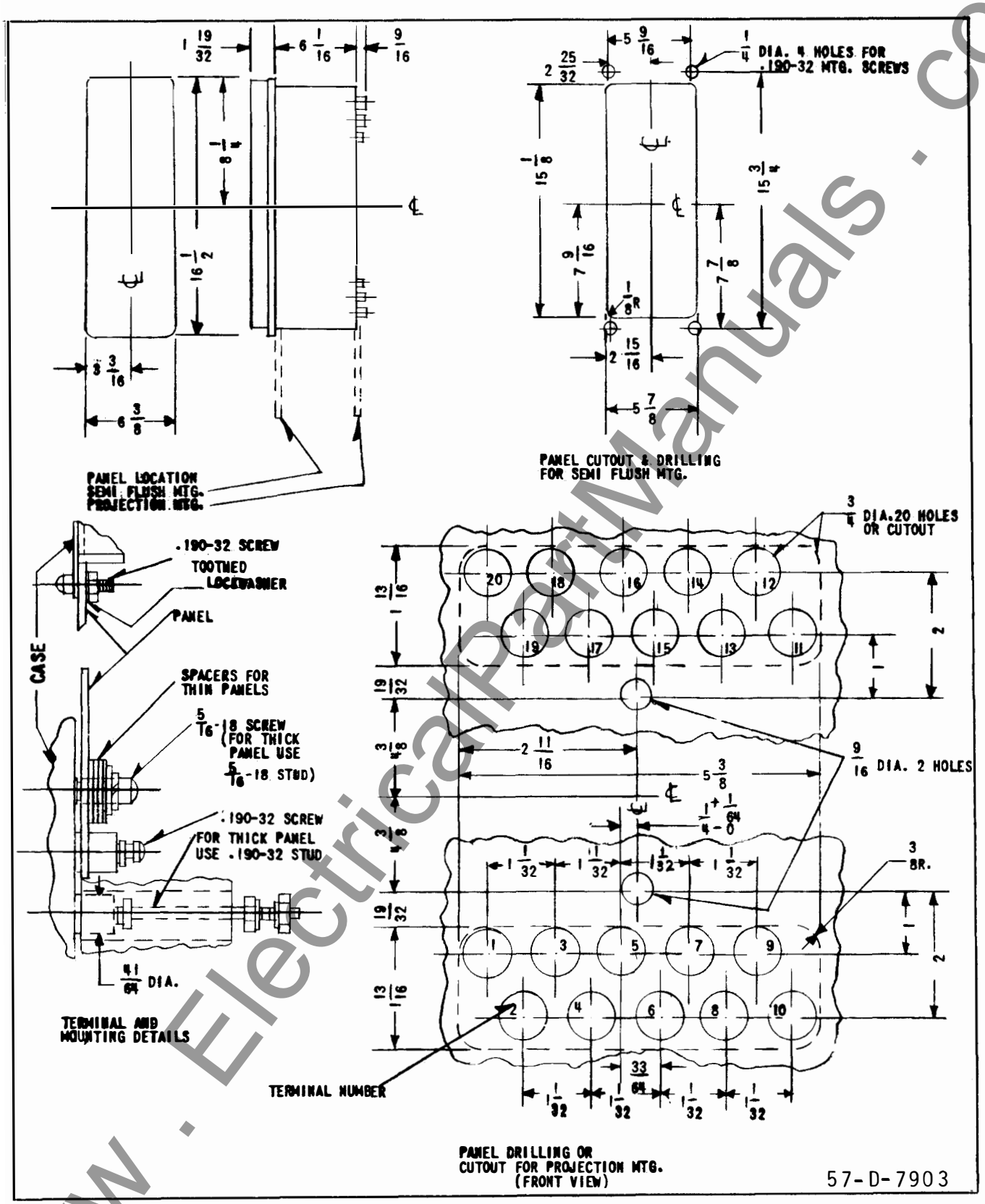

Fig. 1 Outline and Drilling Plan.

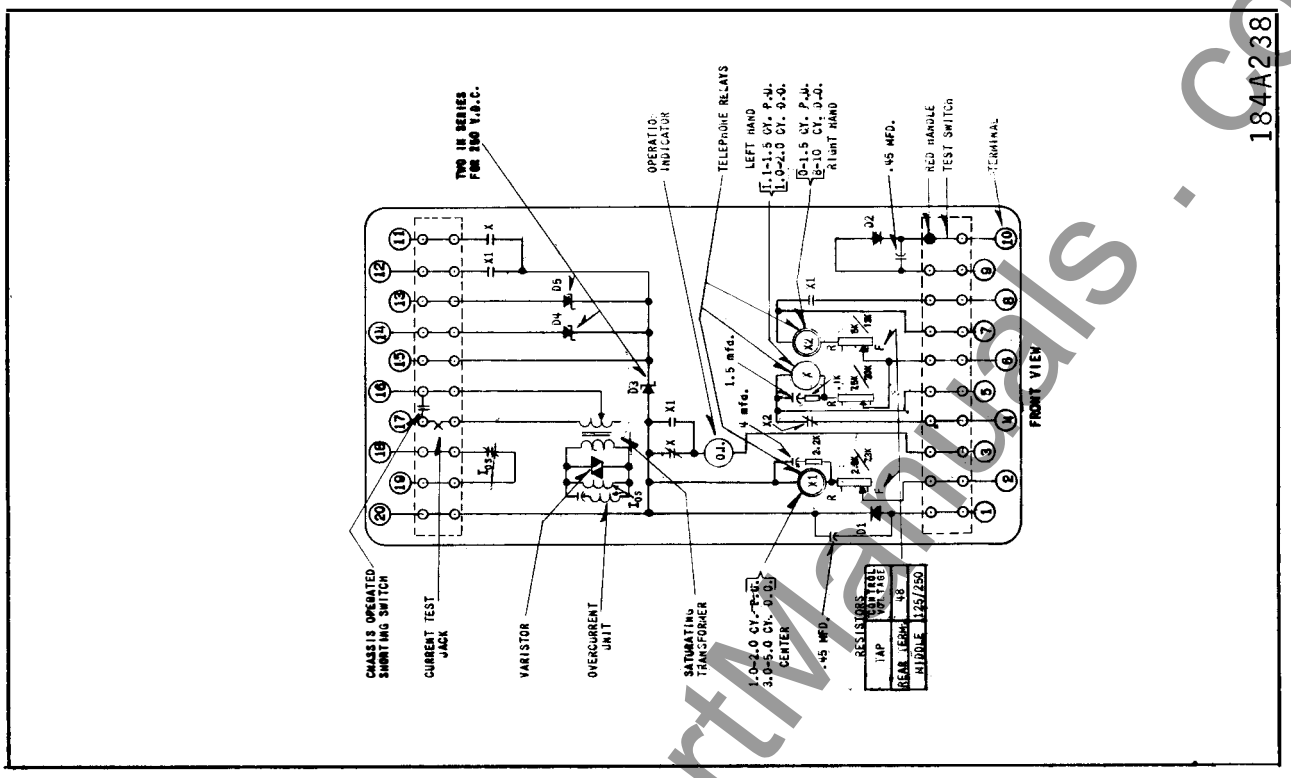

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Fig. 2 Internal Schematic with Two Receiver Contacts

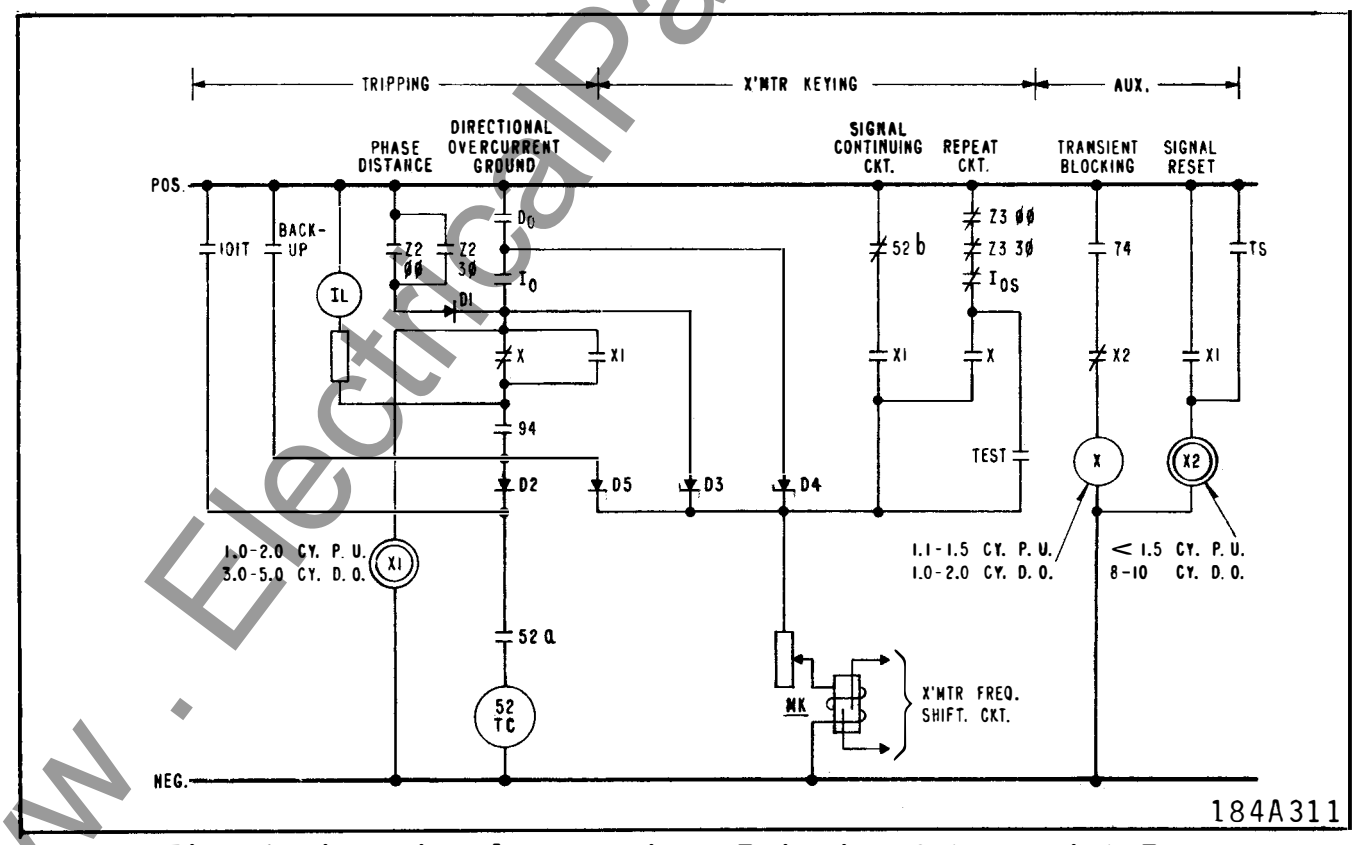

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Fig. 3 Directional Comparison Tripping Scheme with Two Receiver Contacts.

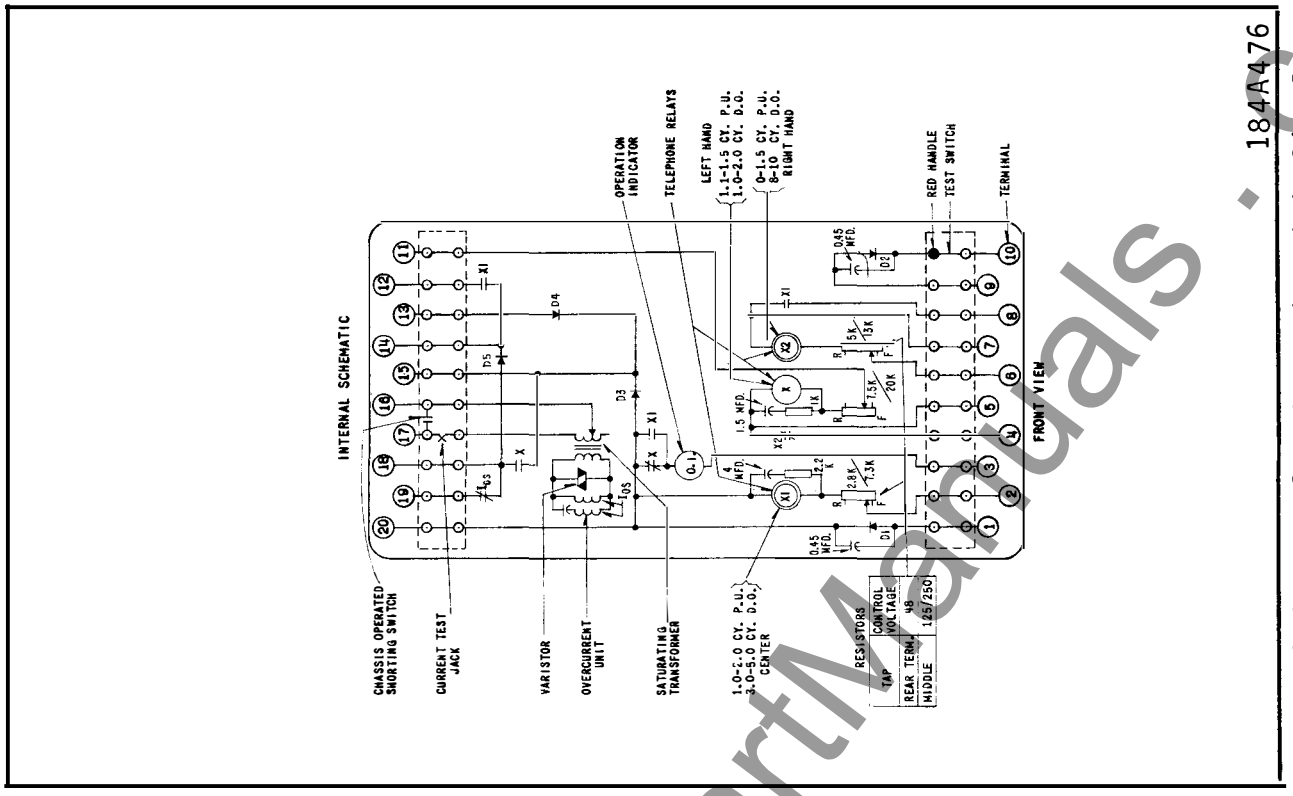

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Fig. 4 Internal Schematic with Single Receiver Contact

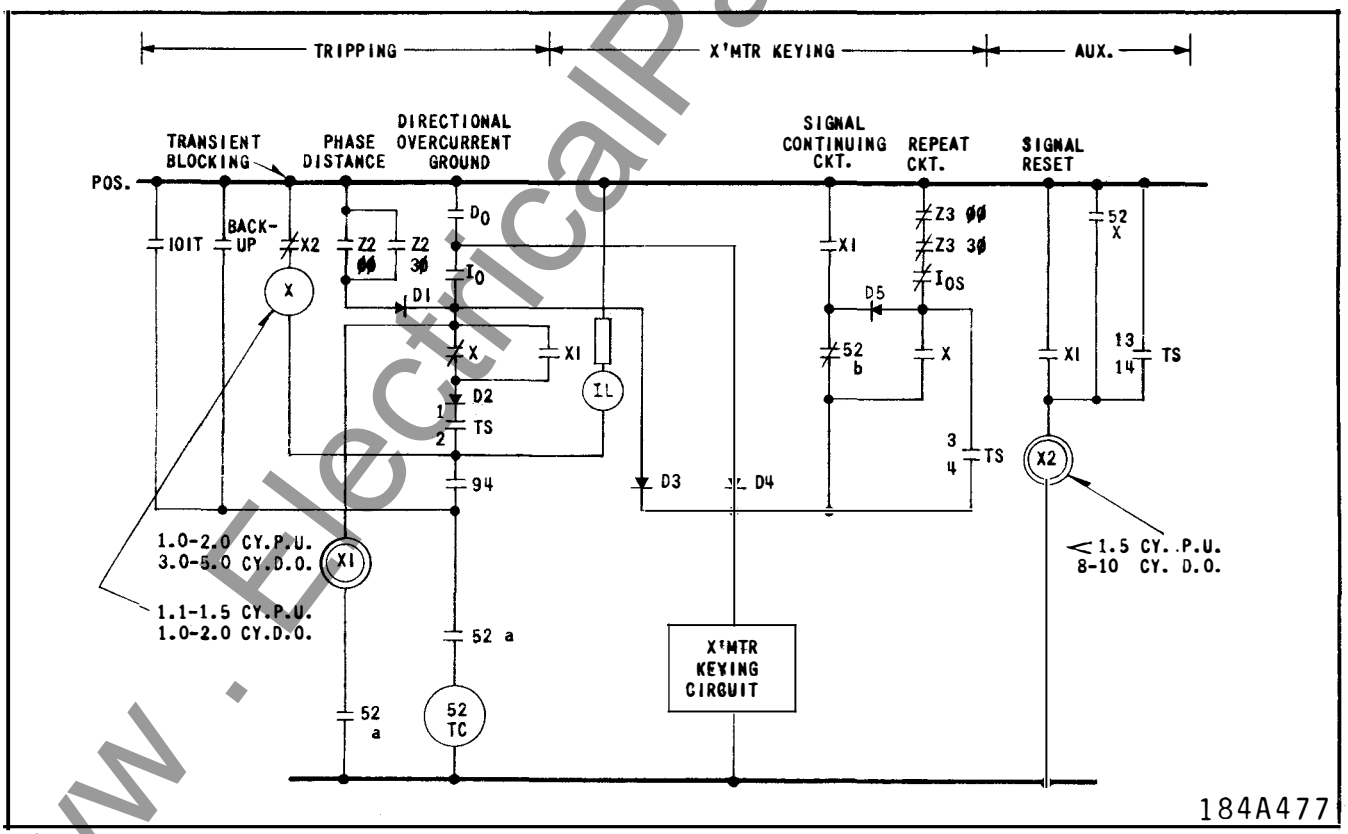

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Fig. 5 Directional Comparison Tripping Scheme with Single Receiver Contact

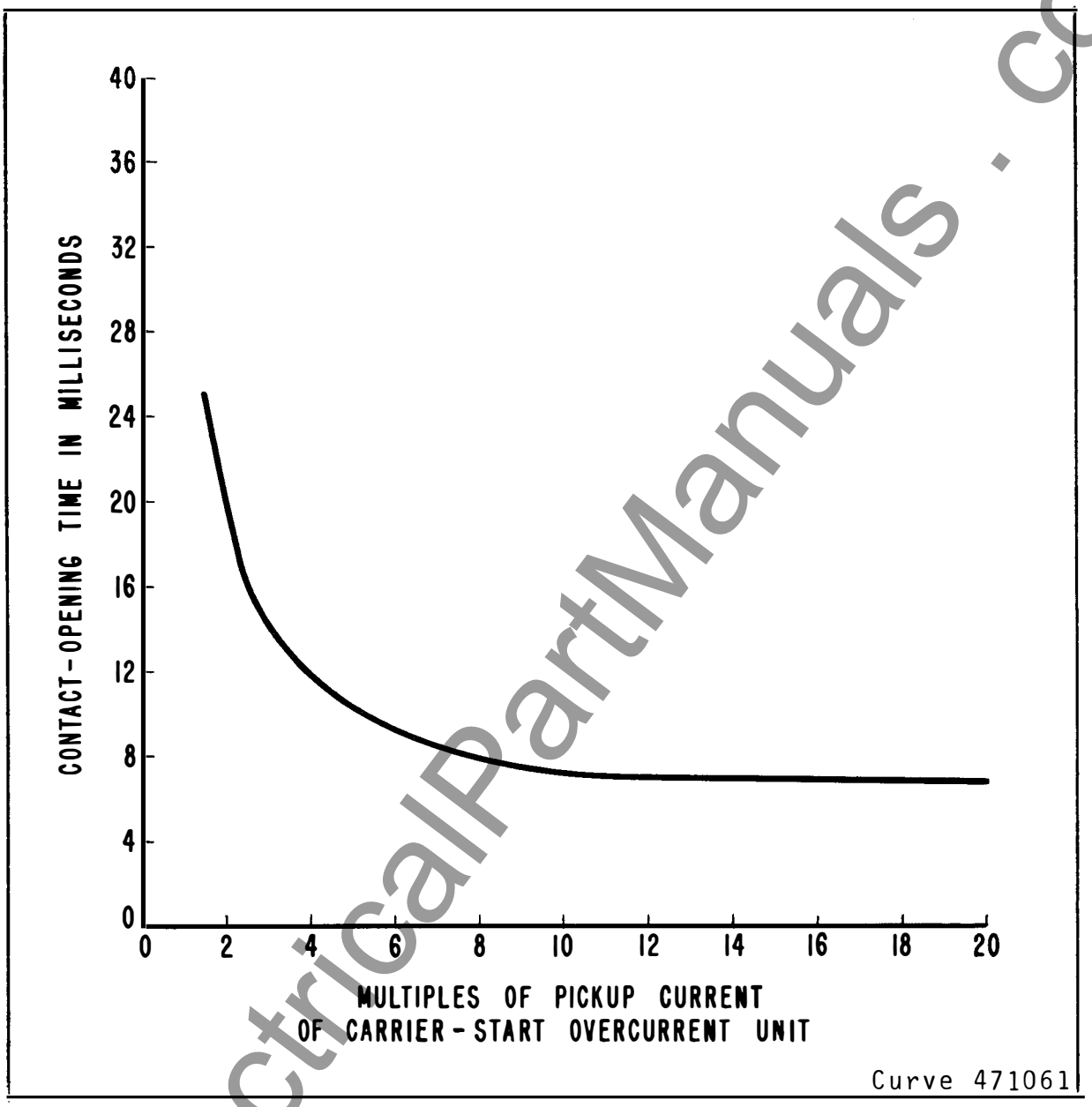

Fig. 6 Time Curve of Overcurrent Unit (I_{os})

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

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