INSTRUCTIONS

HIGH SPEED NON-DIRECTIONAL OVERCURRENT RELAY

TYPE CHC21A

TYPE CHC21C

GENERAL ELECTRIC

TABLE OF CONTENTS

TYPE CHC21

OVERCURRENT RELAY

INTRODUCTION

The Type CHC21A and CHC21C relays are high-speed, non-directional, overcurrent relays that are designed specifically for use as combined phase and ground current detectors in circuit breaker failure backup schemes. However, they may be used wherever a non-directional instantaneous overcurrent function is required.

DESCRIPTION

The relay consists of an induction cup type unit that is responsive to both phase and ground currents; and a telephone type relay that provides four or five electrically separate contact circuits. Two of these contact circuits have targets wired in series. See Figure 1 and Figure 2.

The CHC21A auxiliary relay has four (4) normally open contacts, whereas the CHC21C has five (5). Figures 3 and 4 show the internal connection diagrams. The type CHC21 relay is mounted in an M2 drawout case.

APPLICATION

The CHC21 relay may be applied wherever a high-speed current operated device is required. However, the relay's continuous current carrying capability and the four or five electrically separated contact outputs make it particularly well suited for application as a current detector in circuit breaker failure backup schemes. Since in these applications the CHC21 may be called upon to carry fault current for a significant fraction of a second before the backup breakers clear the fault, the short time and continuous current capabilities of the relay should be checked, in the section under **RATINGS.** Typical external connections are shown in Figures 5 and 6. From these diagrams it will be noted that the relay receives phase 1, phase 3, and the CT neutral ($3I_0$) currents.

Since the individual phase and ground currents all act on the single cup unit, the current required tp operate the relay will depend upon the type of fault and which phase or phases are faulted. However, the PICK UP SETTING is defined as the current required to operate the relay when only <u>one</u> phase current, either I_1 in studs 3-4 or I_3 in studs 7-8, is applied to the relay. It is obvious then, that the PICK UP SETTING is defined for either a phase 1-to-phase 2 or phase 3-to-phase 3 fault, since only one phase current is supplied to the relay for these faults.

For faults that involve more than just phase 1 or phase 3 currents to the relay, the current required to operate will be less than the PICK UP SETTING. For example, a phase 1-to-phase 3 fault or a three phase fault will operate the relay if the current in the involved phases is 0.707 or more of the PICK UP SETTING. The discussion in the section on OPERATING PRINCIPLES indicates how this is determined.

For faults involving ground the third circuit receives $3I_0$ via studs 14 and 15. The relay is designed to operate when a fraction of the PICK UP SETTING alone is applied to this circuit. This fraction depends on the relay model selected. The nameplate of the relay gives two ranges of pickup, one for phase currents (I_1 or I_3) and the second for ground currents ($3I_0$). It should be recognized that since both these circuits operate on the same cup unit they are not independently adjustable. For example, in a relay where the phase current range is given as 2.0 - 8.0 amperes and the ground current range is 0.5 - 2.0 amperes, a 2.0 ampere PICK UP SETTING (as defined above) will require 2 amperes in studs 3-4 or 7-8, or 0.5 amperes of $3I_0$ in studs 14-15. For an 8 ampere PICK UP SETTING, 2 amperes of $3I_0$ alone in studs 14-15 will operate the relay. For intermediate PICK UP SETTINGS the $3I_0$ required to operate the relay will be proportional as indicated in the following equation:

$$3I_0 \text{ Required to Operate Relay} = \frac{G_m}{P_m} \text{ (PICK UP SETTING)} \qquad (1)$$

where: P_m = the minimum of the phase current range (in this example 2.0)
G_m = the minimum of the ground current range (in this case 0.5)

For phase 2-to-ground faults only the $3I_0$ circuit will receive current so the amount of current required to operate the relay is given by equation (1) above. For phase 1 or phase 3-to-ground faults a phase circuit as well as the ground circuit will receive current. Thus, the relay will require less $3I_0$ current in order to operate than indicated by the above equation.

The pickup and dropout times can be found in the section on **CHARACTERISTICS.**

CALCULATION OF SETTINGS

When setting the pick up of this relay it is only necessary to ensure that it will pick up for the phase current produced by the minimum phase-to-phase fault and the $3I_0$ produced by the minimum single-phase-to-ground fault.

It will than operate for any other fault within the same distance from the relay assuming that the generating capacity and system configuration remain the same.

Since the phase and ground sensitivities are not independently adjustable, the PICK UP SETTING must be based on the limiting factor. For example, consider a CHC21A relay with a phase current range of 1.0-4.0 amperes and a ground current range or 0.5-2.0 amperes. Assume that the minimum phase-to-phase fault current for which the relay must operate is 2.0 amperes and that the minimum $3I_0$ for which it must operate is 0.75 amperes.

From equation (1) in the section on **APPLICATION,** it will be determined that for a 2.0 ampere phase PICK UP SETTING, the 3I0 required to operate the relay will be

$$3I_0 = \frac{0.5}{1.0} \times 2.0 = 1.0 \text{ amperes}$$

Since the requirement is that the relay must operate for 0.75 amperes of ground current ($3I_0$), this setting is not sensitive enough. In order to provide a 0.75 ampere sensitivity to $3I_0$, the phase PICK UP SETTING must be

$$0.75 \times \frac{1.0}{0.5} = 1.5 \text{ amperes}$$

Such a setting is obtained by passing 1.5 rms amperes of sine wave current through studs 3 and 4 or studs 7 and 8 adjusting the control spring so that the contacts of the cup unit just close. It may also be obtained by passing 0.75 amperes of current through studs 14 and 15.

RATINGS

INDUCTION CUP UNIT

The continuous current rating for this unit is shown in Figure 7 as a characteristic which indicates the magnitudes of current that the unit can carry in both the phase and ground windings. Either independently or in combination with each other.

The short time (one second) ratings are shown in Table A.

TABLE A

CIRCUIT WINDINGS	PICK-UP RANGE	AMPS ONE SECOND	HZ
PHASE	1-4	120	60
	2-8	240	60
GROUND	0.5-2	60	60
	1-4	120	60
	2-8	240	60

The contacts of this unit require no specific rating since they in their function have the capacity to carry the currents called for by the auxiliary relay circuits.

AUXILIARY TELEPHONE TYPE RELAY "A"

The coil circuit voltage ratings are on a continuous basis.

The contacts can carry three amperes continuously or 30 amperes for two seconds.

The current interrupting capabilities are shown in Table B.

TABLE B

VOLTS	INDUCTIVE (††)	NON-INDUCTIVE
48 DC	1.0 AMPS	3.0 AMPS
125 DC	0.5 AMPS	1.5 AMPS
250 DC	0.25 AMPS	1.0 AMPS

†† Inductance based on average trip coil

TARGET UNIT

The DC control circuits normally use coils with current ratings as shown in Table C.

The contacts have capability of closing 30 amperes for tripping duty.

TABLE C

TARGET COIL RATINGS		
CONDITIONS	NOMINAL TAP RATING (AMPS)	
	0.2	2.0
Continuous Rating	0.3 Amps	3.5 Amps
DC Resistance	7.0 Ohms	0.13 Ohms
Tripping Duty	5.0 Amps	30.0 Amps

BURDENS

The 60 Hz burdens of the phase windings, studs 3 and 4 or 7 and 8, at 5 amperes are shown in Table D.

TABLE D

P.U. RANGE	R	X	Z
1-4	0.60	0.90	1.08
2-8	0.24	0.36	0.43

The 60 Hz burden of the ground winding, studs 14 and 15 at currents equal to the top of the adjustable range are shown in Table E.

TABLE E

P.U. RANGE	AT AMPERES	R	X	Z
0.5-2	2	3.50	3.30	4.75
1-4	4	0.85	0.83	1.19
2-8	8	0.21	0.21	0.30

CHARACTERISTICS

OPERATING PRINCIPLES

The overcurrent unit in this relay is an induction cup device for use in alternating current circuits. The stator has eight (8) laminated poles projecting inward and arrange symmetrically around a central laminated core. In the annular air gap between the poles and core is a cylindrical rotatable member having the form of a cap. The cup assembly is affixed to a shaft with bearings at both ends to contain the cup centrally within the air gap.

All eight (8) poles have current coils which produce torque proportional to the square of the current flowing through them. The side poles have current windings for both the phase and ground circuits. The corner poles in addition to having current windings also have potential windings which are shorted by capacitor. This shorted potential winding causes the flux from the corner pole to be phase shifted relative to the flux from the side poles. The developed torque is a function of the product of these corner and side pole fluxes.

The internal and typical external connection diagrams show the relay terminal connection I_1 and I_3 phase winding circuits as well as the I_N ground circuit.

PICK-UP CALCULATIONS

The application section defined the pickup setting for either the phase or ground winding. The following is the general equation to show how the overcurrent unit developes torque as related to the phase and ground currents. See Figure 5.

$$T = K\left(I_1^2 + I_3^2 + \frac{K_P}{K_G} I_N^2 - K_P\right)$$

where:

K = Design constant
K_P = Square of the phase winding pick-up
K_G = Square of the ground winding pick-up
I_1 = Magnitude of phase 1 current
I_3 = Magnitude of phase 3 current
I_N = Magnitude of residual current ($3I_0$)

The following are examples of calculations for some phase and ground faults conditions.

Consider a relay set at 2 amp phase winding pick-up and a 0.5 amp ground winding pickup, that is current in terminals 3-4 or 7-8 will produce a 2 amp pick-up, and current in terminals 14-15 will produce a 0.5 amp pickup.

K_P then = $(2)^2 = 4$

K_G then = $(0.5)^2 = 0.25$

Determine the pick-up currents for the following faults. Note, at pick-up T = Zero.

Case 1 Phase 2 to Ground Fault ($I_1 = I_3 = 0$)

$$T = K\left(0 + 0 + \frac{4}{0.25} IN^2 - 4\right) = 0$$

$I_N = 0.5$ or I_N = Pickup

Case 2 Phase 1 to Phase 2 Fault ($I_3 = I_N = 0$)

$$T_2 = K\left(I_1^2 + 0 + 0 - 4\right) = 0$$

$I_1 = 2$ or I_1 = Pickup

Case 3 Phase 1 to Phase 3 Fault ($I_1 = I_3 = I$)

$$T = K\left(I_2 + I_2 + 0 - 4\right) = 0$$

$I = 1.414$ or $I = 0.707 \times$ Pickup

Case 4 Three Phase Fault ($I_1 = I_3 = I$)

$$T = K\left(I_2 + I_2 + 0 - 4\right) = 0$$

$I = 1.414$ or $I = 0.707 \times$ Pickup

PICKUP AND DROPOUT CHARACTERISTICS

The moving contact assemblies on these cup type relays are restrained from closing by an adjustable spiral assembly located just above the moving contact.

The current required to just close the contact, i.e., not causing the stationary contact to deflect or wipe-in, will be equal to the dropout value, since an incremental decrease in current will cause the contact to open.

In the application of these relays in breaker-failure schemes, the current supplied to the relay may hover just at the pickup value, hence can cause the contacts to be in the state of alternating opening and closing.

Under the aforementioned circumstances with the contacts drawing the current required to operate the telephone relay, the contacts could at some point be arcing continuously with the possibility of them welding closed.

To circumvent this possibility of welding, a holding coil assembly is arranged such that the contact upon making will cause the stationary contact to wipe in slightly, furthermore the current must be reduced to approximately 80% of the pick-up before the contacts part. At drop-out current the contact opens fully breaking the arc.

The relays are normally set at the minimum value of their adjustable range. As the pickup is increased the spring restraint force increases as I^2, hence decreases the chances of having the contact sustain an arc.

PICKUP AND DROPOUT TIME CHARACTERISTICS

Figure 8 and Figure 9 show the maximum pickup and dropout time current curves for the overcurrent unit which included the operating time of the auxiliary telephone relay "A".

The operating current is in terms of multiples of the pickup current whether it be phase, ground or a combination of both.

The dropout time, Figure 9, applies to all pickup settings.

CONSTRUCTION

Refer to photographs, Figures 1 and 2 which identifies the components of the relay.

The pickup of the cup type overcurrent unit is controlled by a spiral spring assembly which is affixed to an adjustable ring with holes that facilitates its setting. The ring resets in a molded part and can be securely clamped by a threaded hex stud. The maximum pick-up value of the adjustable range can be obtained with a control spring wind-up of about one turn.

The holding coil assembly has been set at the factory and should require no further adjustments, however, should the need arise the matter is covered under maintenance.

The capacitor mounted on the front plate is in the ground circuit. The capacitors at the rear are in the phase circuits.

The relay components are mounted in a cradle assembly which is latched into a drawout case when the relay is in operation but it can easily be removed when desired. To do this, the relay is first disconnected by removing the connection plug which completes the electrical connections between the case block and the cradle block. To test the relay in its case this connection block can be replaced by a test plug. The cover, which is attached to the front of the relay case, contains the target reset mechanism and an interlock arm which prevents the cover from being replaced until the connection plugs have been inserted.

The relay case is suitable for either semi-flush for surface mounting on all panels up to two inches thick and appropriate hardware is available. However, panel thickness must be indicated on the relay order to ensure that proper hardware will be included. For outline and drilling dimensions, see Figure 10. Every circuit in the drawout case has an auxiliary brush, as shown in Figure 11 to provide adequate overlap when the connecting plug is withdrawn or inserted. Some circuits are equipped with shorting bars and on these circuits it is especially important that the auxiliary brush makes contact as indicated to be sure the current is connected to the C.T. circuit before the shorting bar parts.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage substained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Sales Office.

Reasonable care should be exercised in unpacking the relay. If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

Also check the nameplate stamping to make sure that the model number and the rating of the relay received agree with the requisition.

ACCEPTANCE TESTS

MECHANICAL CHECKS

OVERCURRENT UNIT

Inspect the relay for imperfections due to oversight or damage in transient, such as loose screws in assemblies, or in terminal to cradle block, foreign particles, cracked molded parts etc.

Inspect unit for proper shaft end play, contact gap and wipe:

End Play - 0.015" to 0.020"
Contact Gap - 0.020", one turn of contact barrel is equal to 1/32"
Contact Wipe - 0.005" to 0.010"

Check to see that the following cup unit locking assemblies are secure:

Upper Pivot Screw
Adjusting Ring Clamp
Clutch Locking Nut
Inner Core Locking Nut
Contact Barrel Locking Screw
Contact Stop Nut

TELEPHONE RELAY

The normally open contacts should have a gap of 0.015" minimum and the normally closed contacts should have at least 15 grams pressure.

The normally open contacts should make with at least 0.005" wipe. The normally closed contacts should open to a gap of 0.015" minimum.

The normally closed contacts should deflect at least 0.005" before opening.

Make sure that there is at least 0.002" air gap, via residual pin, between the armature and the pole face when the relay is operated by hand.

All normally open contacts should make contact at approximately the same time.

TARGET UNITS

Operate the armature by hand and note that the bridging, contacts make about the same time and with some wiping action before the armature comes to rest against the pole piece. During this operation the target should come into view and latch up

before the total travel is exhausted. The rest lever should reset the target with some extra travel after the target resets.

ELECTRICAL TESTS

OVERCURRENT PICKUP TESTS

When the relays leave the factory, the units are set to pick-up at the minimum value of the rated range of pickup. See test connections found in Figure 12.

The phase pickup values, i.e., current in studs 3-4 or 7-8, should be within 5% of the rated values as stamped on the nameplate. In general one circuit will be set at the rated value with the other circuit pickup being equal to the rated value or somewhat lower.

The ground circuit pick-up, i.e., current in studs 14-15 should be within ±10% of the rated value.

With currents in studs 3-7 with 4 and 8 shorted, i.e., phase 1 to phase 3 fault, or three phase fault the pick-up should be 0.707 times the phase pickup value. See Test Connections diagram found in Figure 12.

With current applied to studs 4 and 14 shorted should find the pickup slightly less than the stud 15-15 pickup.

The maximum pickup can be checked by winding up the control spring about one full turn. The control spring adjusting ring and its locking mechanism is shown in the photograph in Figure 1.

DROPOUT TESTS ON OVERCURRENT UNIT

The relays are set at the factory to dropout at a current level about 80% of pickup, when the pickup is set at the "minimum value" of the rated range of current, and rated DC is applied to studs 9-10. If the dropout current is not within these limits, see procedure for setting the dropout current under **MAINTENANCE**.

TELEPHONE RELAY

Apply an adjustable source of direct current (DC) across studs 9-10.

Block the overcurrent unit contacts closed. The relay should pick up at 80% of its rating or less. At rated voltage the pickup and dropout time should be 6 milliseconds or less.

TARGET UNIT

These units should operate at their rated tap value or less.

INSTALLATION

LOCATION

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted in a vertical surface. The outline and panel drilling for either surface or semi-flush panel mounting is shown in Figure 10.

One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gage copper wire or its equivalent.

CONNECTIONS

Internal connection diagrams for the relays are shown in Figures 3 and 4.

ADJUSTMENTS

The relays are calibrated at the factory and should not require any further adjustment. If it is desirable to check the operating units, follow the procedure outlined under **MAINTENANCE.**

INSPECTION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under **MAINTENANCE.**

MAINTENANCE

The relays are adjusted at the factory, and it is advisable not to disturb the adjustments. If for any reason they have been disturbed, the following points should be observed in restoring them

SHAFT AND BEARING

The lower jewel screw can be removed from the unit by means of an offset screw driver or end wrench. The jewel may be tested for cracks by exploring its surface with the point of a fine needle.

The lower jewel bearing should be screwed all the way until its head engages the end of the threaded core. The upper bearing should be adjusted to allow about 1/64 inch end play of the shaft.

To check the clearance between the iron core and the inside of the rotor cup, press down on the contact near the shaft, and thereby depress the spring mounted jewel until the cup strikes the iron. The shaft cup should move about 1/16 inch.

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etch-roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches

are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool ensures the cleaning of the actual points of contact.

Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increasing arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described is inclined in the standard relay tool kit obtainable from the factory.

CONTACT ADJUSTMENT

Should it be necessary to change the stationary contact, remove the contact barrel as a complete unit after loosening the screw at the front of the contact block. Unscrew the cap. The contact spring may then be removed.

The moving contact may be removed by loosening the screw which secures it to the arm and removing it from under the screw head.

The contact gap may be adjusted by slightly loosening the screw at the front of the contact block, and should be loose enough only to allow the contact barrel to rotate in its sleeve. The contact gap should be 0.020". One turn of the barrel is equal to 0.032" or 2/3 turn of barrel.

CALIBRATING PROCEDURE

For telephone relay and targets see **ACCEPTANCE TEST.**

Refer to test connection diagram, Figure 12 for tests on the cup or overcurrent unit.

MECHANICAL ADJUSTMENTS TO THE CONTACT AND HOLDING COIL ASSEMBLY FOR INITIAL SETTINGS BEFORE ELECTRICAL TESTS.

1. Loosen the screw in the contact barrel support so that the barrel is snug in the support but can readily be rotated by hand. Then, back barrel out as far as it will go.

2. Look into the relay from the left-hand side while holding the moving contact to the left to observe how the armature at the rear is lining up with the pole faces on the holding coil assembly. The width of the armature and the pole pieces should be in line with one another. If they are not, loosen the hex studs which secure the holding coil assembly to the base, and rotate the assembly to obtain the desired line-up, then retighten the hex stud.

3. Now view the relay from the front, holding the moving contact to the left. In this position the rear end of the moving assembly should be resting against the pole pieces. With the armature in this position, rotate the contact barrel until it just touches the contact on the moving assembly, then rotate two full turns in the same direction. This will be a trial setting, and it will serve as a BENCH MARK that the air gap between the armature and the holding coil pieces is approximately 1/16" (the threads on the barrel are 32 per inch).

4. Let the moving contact come to rest against the back stop, then adjust the stop screw until the contacts JUST make. At this point back out the stop

screw 2/3 of a turn and lock. This will provide for a contact gap very close to 0.020" since the threads on the tap screw are also 32 per inch.

ELECTRICAL TEST FOR MINIMUM PICKUP AND DROPOUT SETTING

The function of the holding coil is to prevent the contacts from arcing when the relay is operating at its minimum pickup value. With a drop current setting in the order of 80%, the holding action is such that the stationary contact tends to wipe in slightly and holds closed till the dropout level is reached; at which point it breaks clean. Without this effect the contact could sit and fry and perhaps weld closed if the unit was working at the just closed level of current.

1. Supply current to studs 3-4

2. Apply rated DC voltage to studs 9-10

3. Check and set pick-up to the minimum value of the rated range by rotating the adjusting ring which is connected to the control spring. When the contacts make note whether there is some wipe-in action of the come on the stationary contact. If there is no wipe-in action the air gap between the armature at the rear of the moving assembly, and the holding coil frame is too large.

Proceed as follows:

(a) Back out the barrel about 1/2 turn and move in the stop screw also 1/2 turn to maintain the air gap.

(b) Check again for wipe-in at pick-up.

(c) If good wipe-in is present, carefully reduce the current to determine the dropout value.

(d) The desired action; is good wipe-in with a dropout value close to 80% of the picked value. Shifting the barrel and stop screw plus control spring adjustments will be necessary to obtain the proper setting.

(e) With the final setting the holding coil air gap must be at least 0.015" with the moving assembly in the fully picked up position.

CLUTCH SETTING

Set the clutch to just slip at a value equal to ten times (10x) the minimum pickup setting, i.e., 20 amps for 2-8 amp range.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

It is recommended that a mechanical inspection and an operation test be performed at least annually. The interval of time for periodic checks on relays may vary depending upon the importance of the relay in the protective scheme and its environment, such as extreme heat, moisture, and fumes.

The periodic checks in general are aimed to detect the two factors that can render the relay inoperative, i.e., friction and contaminated contacts.

OVERCURRENT UNIT

With regard to the overcurrent units, a test for the minimum pickup value will check whether the unit has undergone any changes in the circuit structures as well as revealing any undue friction. Small incremental changes in current to cause the moving assembly to move away from the back stop toward the contact will reveal any tendency of binding. The actual pickup value, if within limits will give assurance that no changes have occurred in the circuit structure. Comparing pickup values with its history of previous periodic checks is particularly useful in detecting whether the pickup value is tending to rise over the years, thereby giving an indication of impending trouble.

Slightly discolored contacts need not be cleaned, however, if the contact becomes badly discolored, they should be dressed with a contact burnishing tool. This tool is a flexible strip of metal with an etched surface, resembling a super fine file. The use of knife-type tools or coarse abrasive paper may leave an undesirable roughened surface.

AUXILIARY TELEPHONE RELAY "A"

All normally open contacts should have a contact gap of at least 0.015 inches.

Operate the closing armature by hand and note that the closing contacts make and deflect at least 0.005 inches before the end of the armature travel.

TARGET UNITS

The unit used in the relays with DC ratings are current operated devices, rated 0.2/2.0 amperes. These units should pick up at a value equal to or less than the tap rating. Upon picking up, the target should drop. Both tap ratings should be checked. In the process of transferring to the other tap, do not remove the screw from the tap being used first, rather, remove one of the screws from the opposite stationary contact and insert this in the other current tap. Then replace it with the screw used in the first tap. This procedure keeps the stationary contacts in their original position thereby preserving proper contact alignment.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company and specify quantity required, name of the part wanted, and the complete model number of the relay for which the part is required.

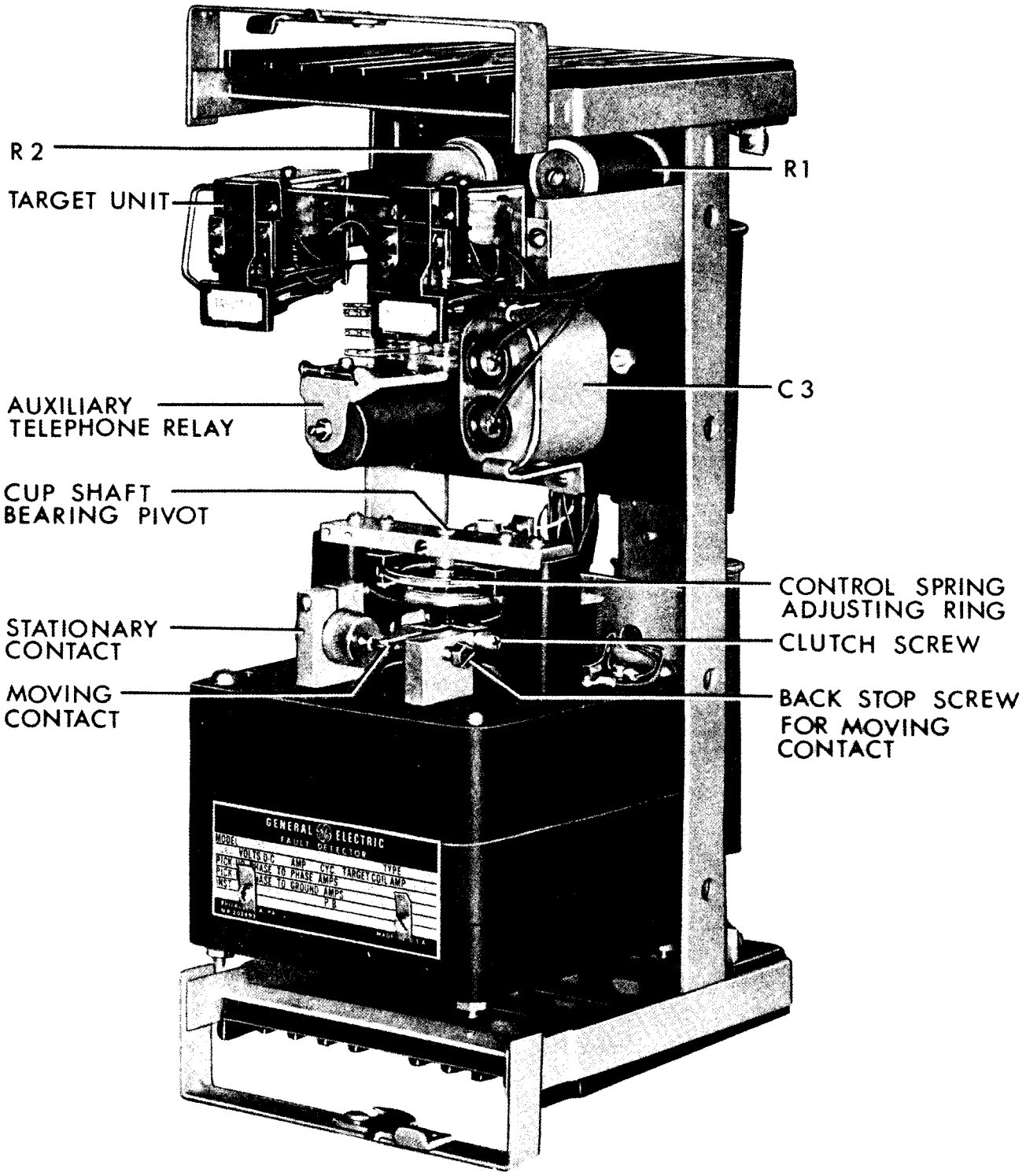


Figure 1 (Photo-8041418) Relay Type CHC21A Removed from Case
(Approximately 3/4 Front View)

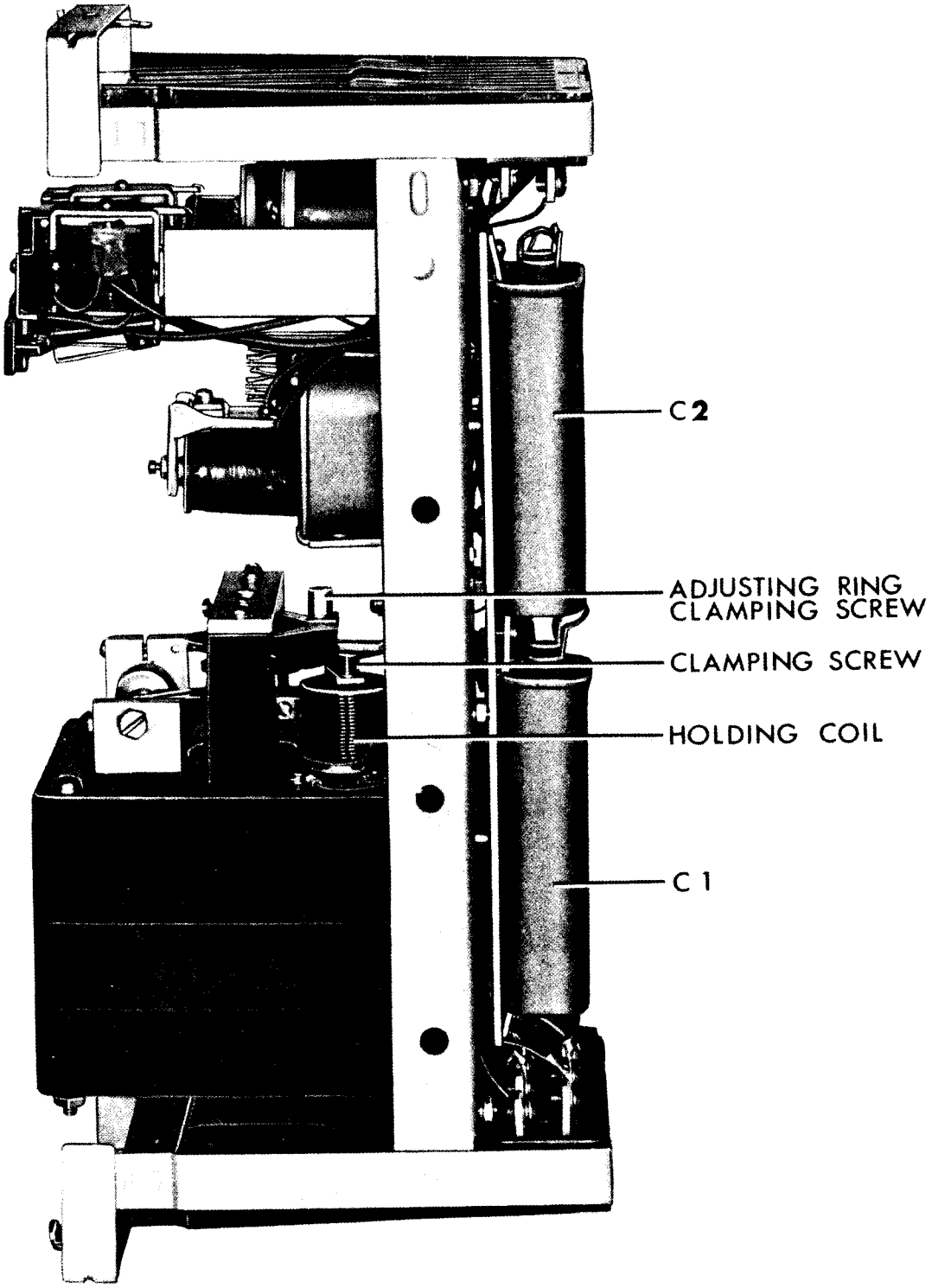
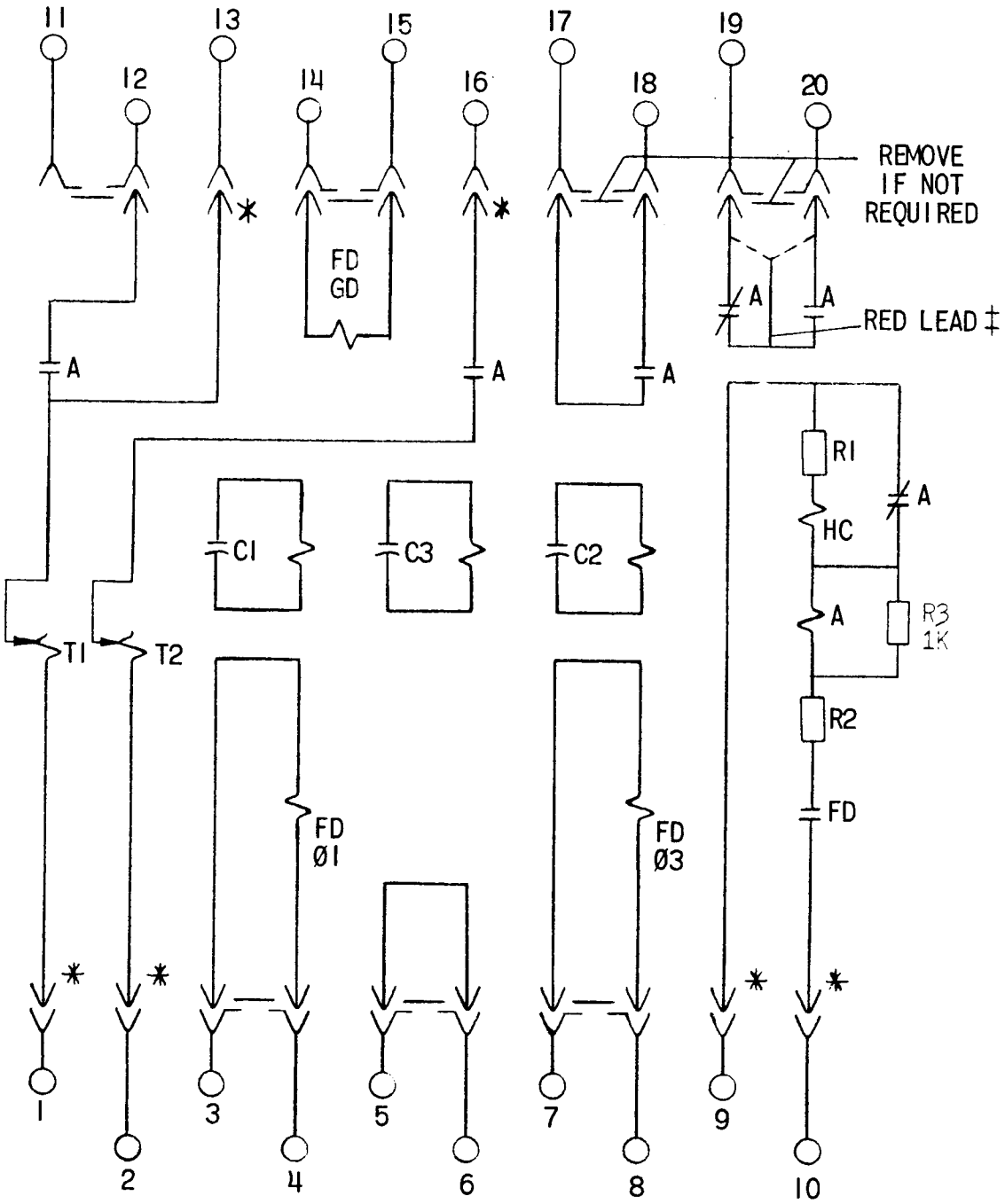


Figure 2 (Photo-8041417) Relay Type CHC21A Removed from Case (Side View)

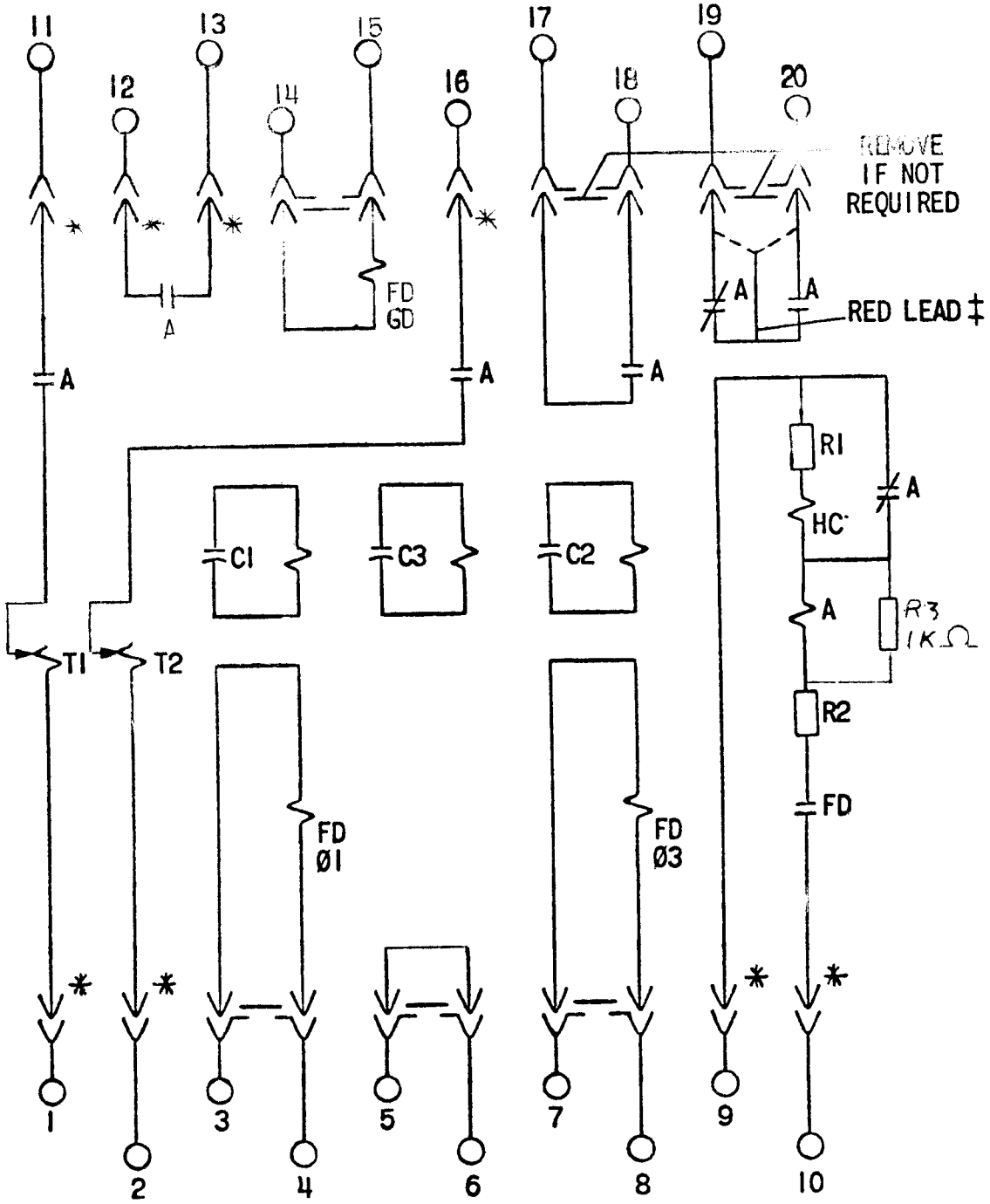


A	TELEPHONE RELAY
FD	CUP UNIT FAULT DETECTOR
‡	CONNECT TO OBTAIN EITHER NORMALLY OPEN OR NORMALLY CLOSED CONTACT.
HC	HOLDING COIL

* SHORT FINGER

VOLTS	R1 OHMS	R2 OHMS
250	2000	600
125	1000	300
48	300	50
220	1700	600

*Figure 3 (0227A7097-6) Internal Connection Diagram for CHC21A

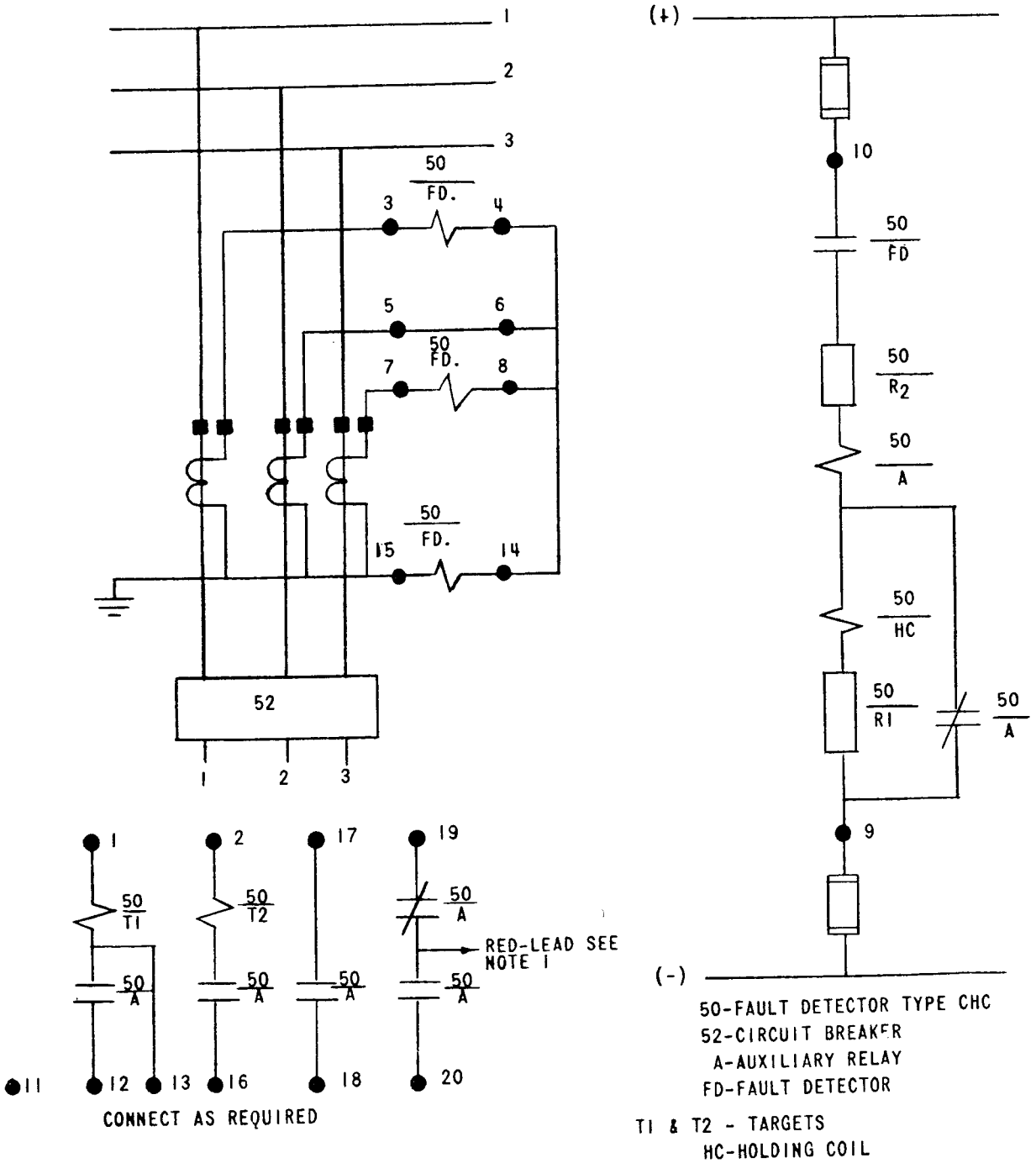


A	TELEPHONE RELAY
FD	CUP UNIT FAULT DETECTOR
‡	CONNECT TO OBTAIN EITHER NORMALLY OPEN OR NORMALLY CLOSED CONTACT.
HC	HOLDING COIL

* SHORT FINGER

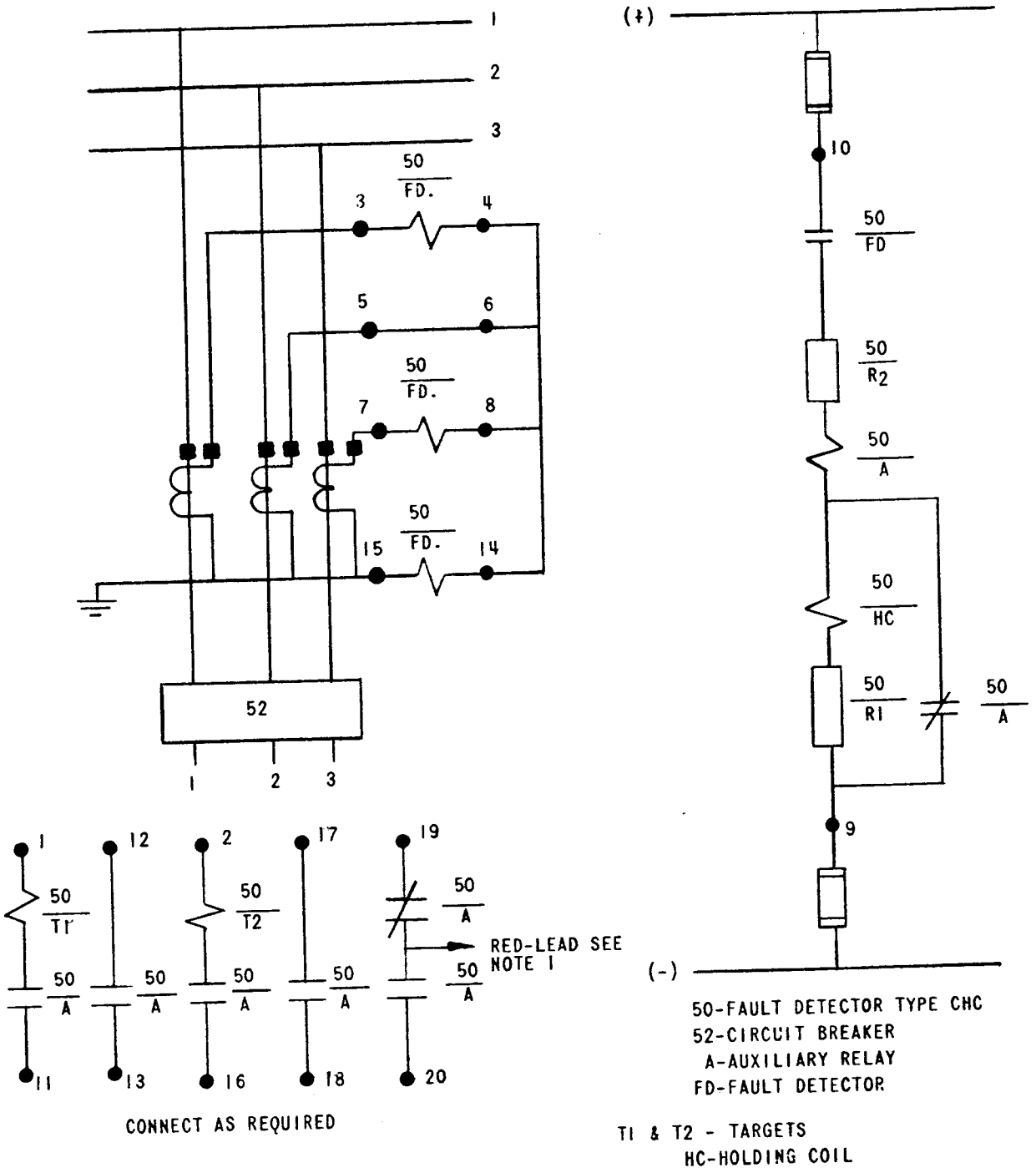
VOLTS	RI OHMS	R2 OHMS
250	2000	600
125	1000	300
48	300	50

Figure 4 (0246A2266-5) Internal Connection Diagram for CHC21C



NOTE 1-RED LEAD AVAILABLE. WHEN CONNECTED TO STUD 19. CONTACT BETWEEN STUDS 19 & 20 IS NORMALLY OPEN. WHEN CONNECTED TO STUD 20. CONTACT BETWEEN STUDS 19 & 20 IS NORMALLY CLOSED.

Figure 5 (0246A2254-2) External Connection for CHC21A



NOTE 1-RED LEAD AVAILABLE. WHEN CONNECTED TO STUD 19, CONTACT BETWEEN STUDS 19 & 20 IS NORMALLY OPEN. WHEN CONNECTED TO STUD 20, CONTACT BETWEEN STUDS 19 & 20 IS NORMALLY CLOSED.

Figure 6 (0246A2289-1) External Connection Diagram for CHC21C

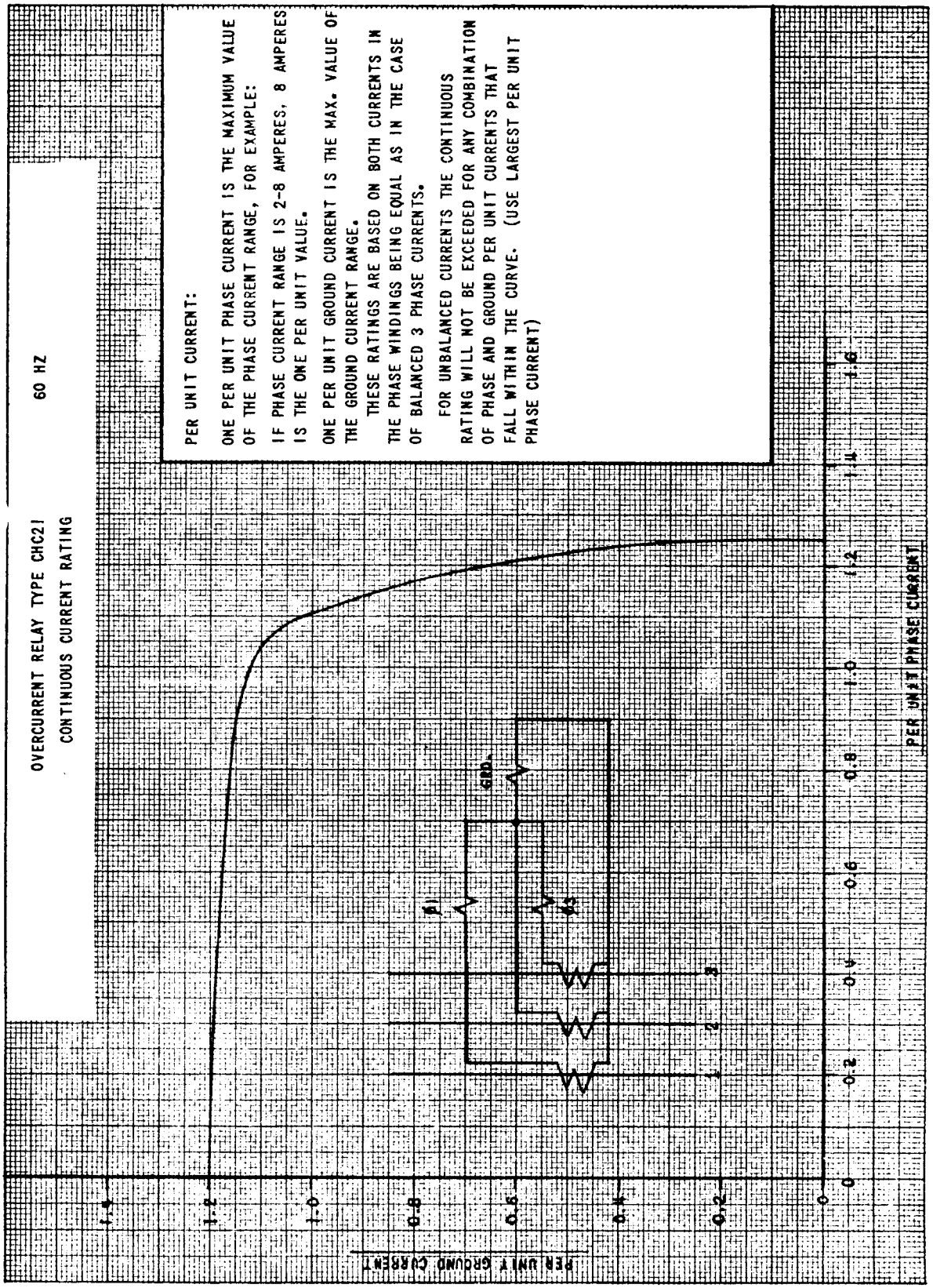


Figure 7 (0246A3751-1) Continuous Current Ratings on Type CHC21 Relays

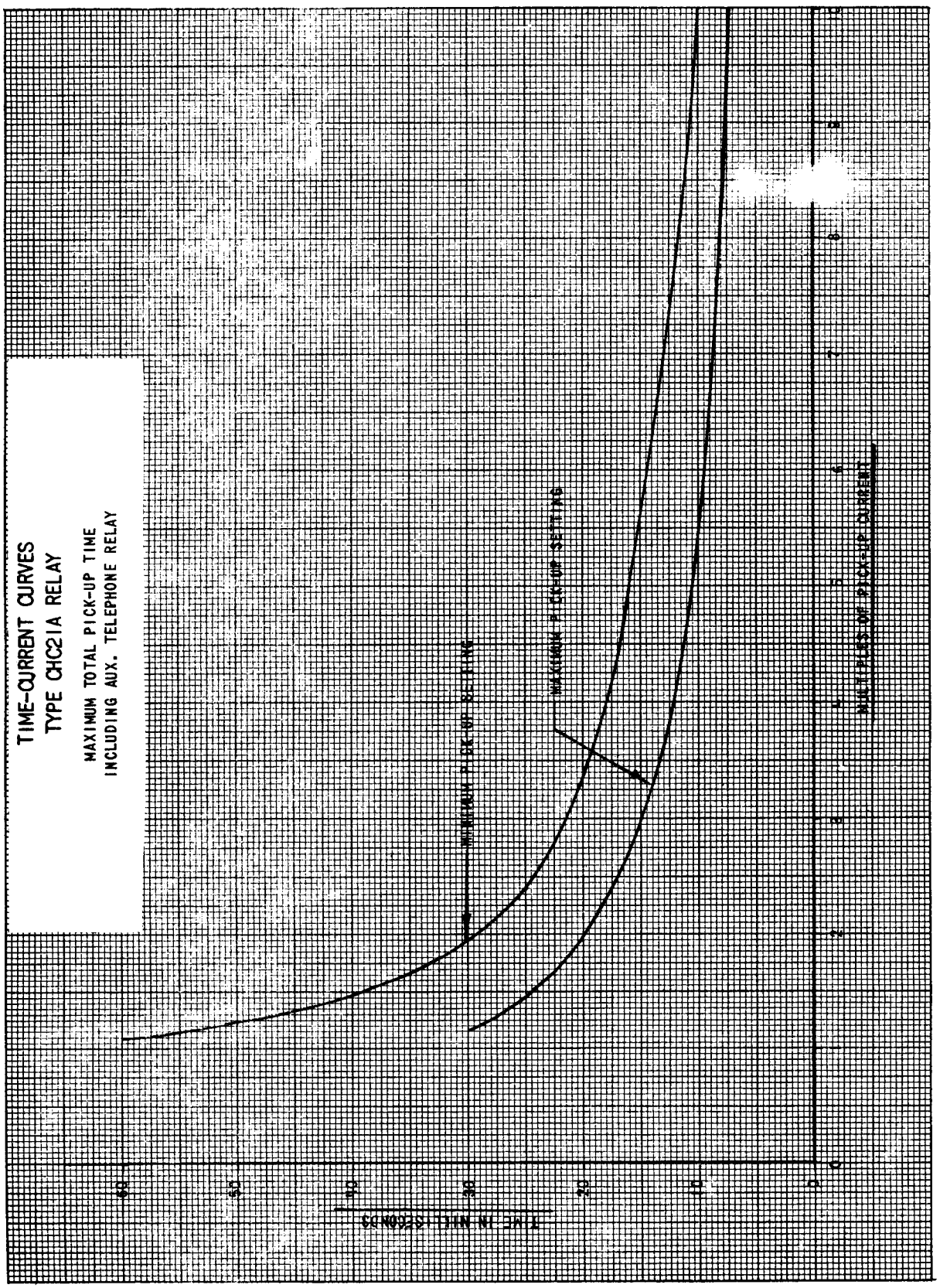


Figure 8 (0246A3844) Pick-up Time Characteristics on Type CHC21 Relays

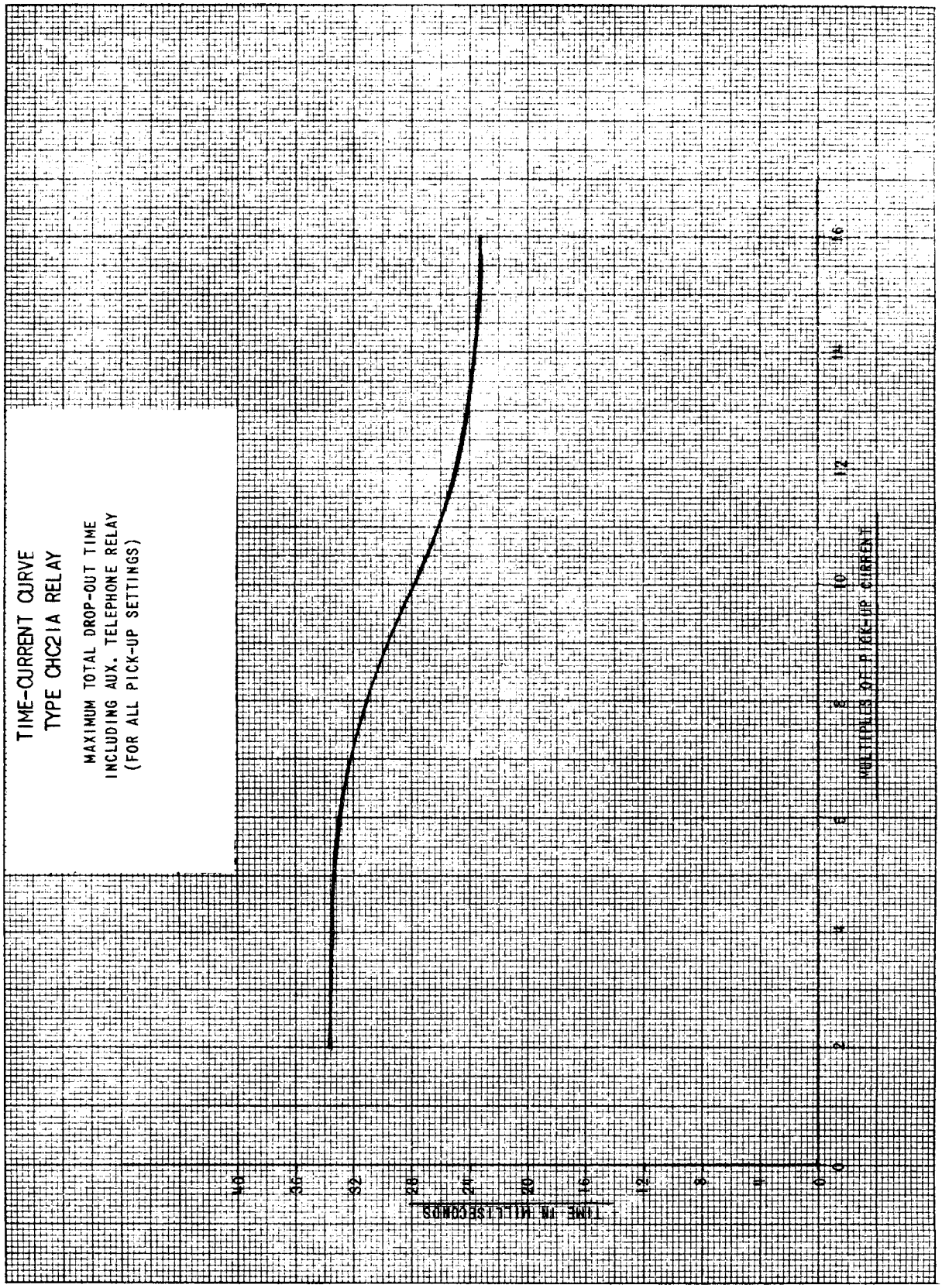
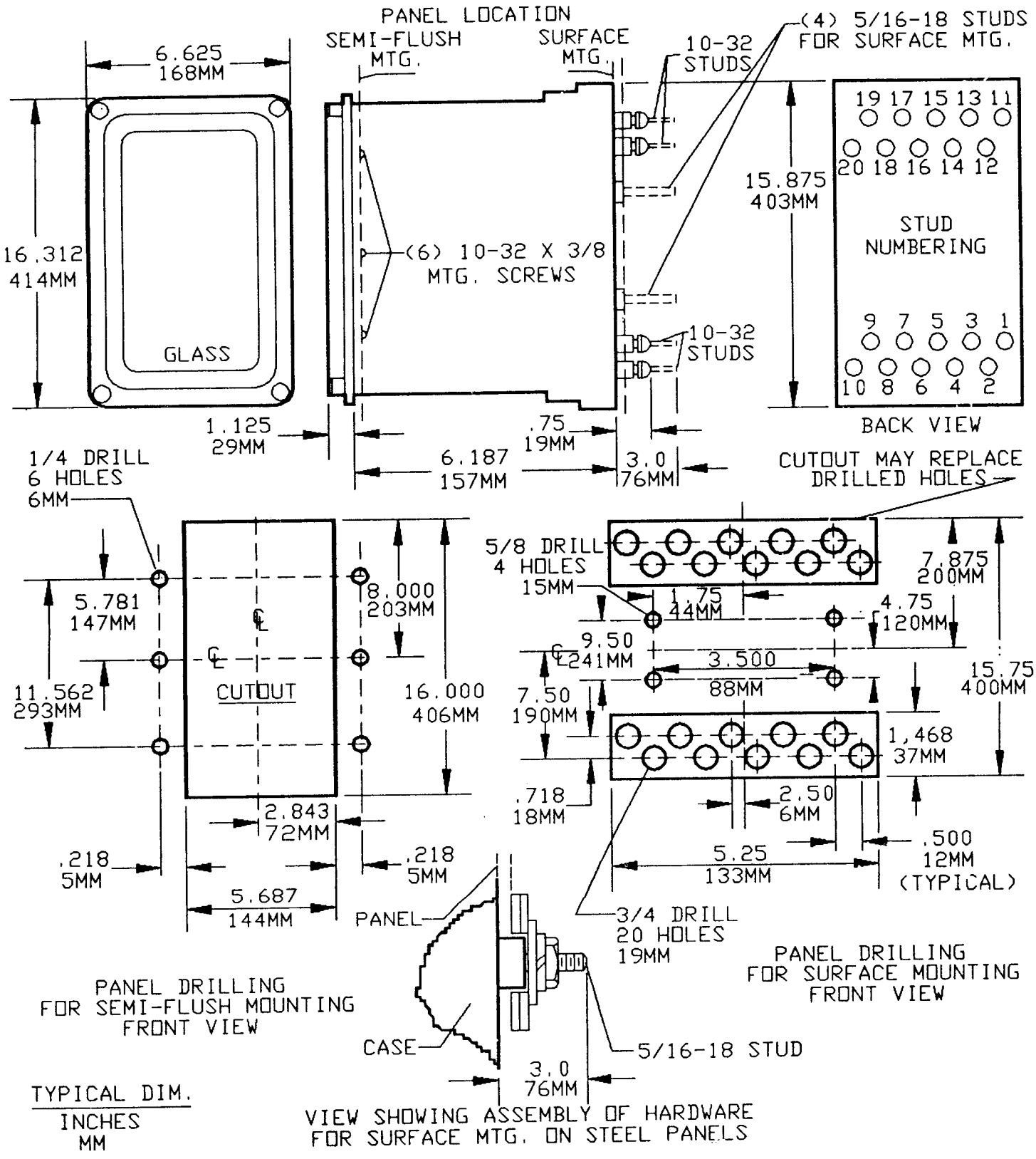
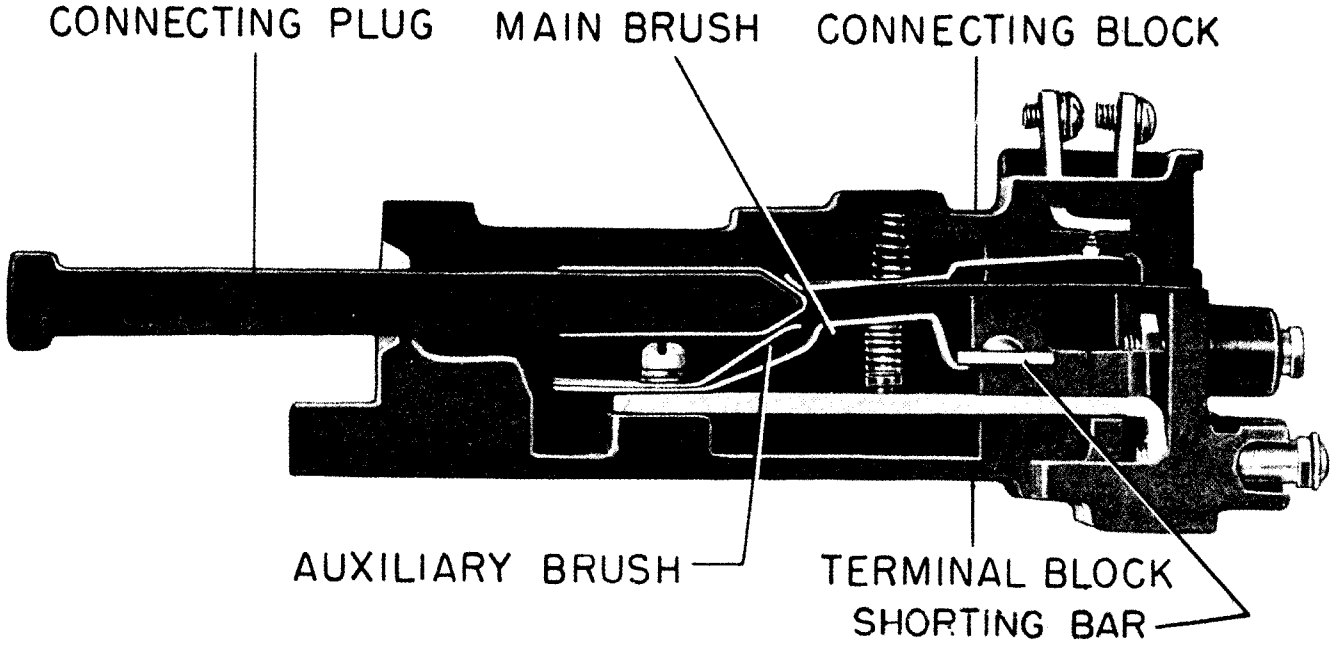


Figure 9 (0246A3845) Dropout Time Characteristics on Type CHC21 Relays



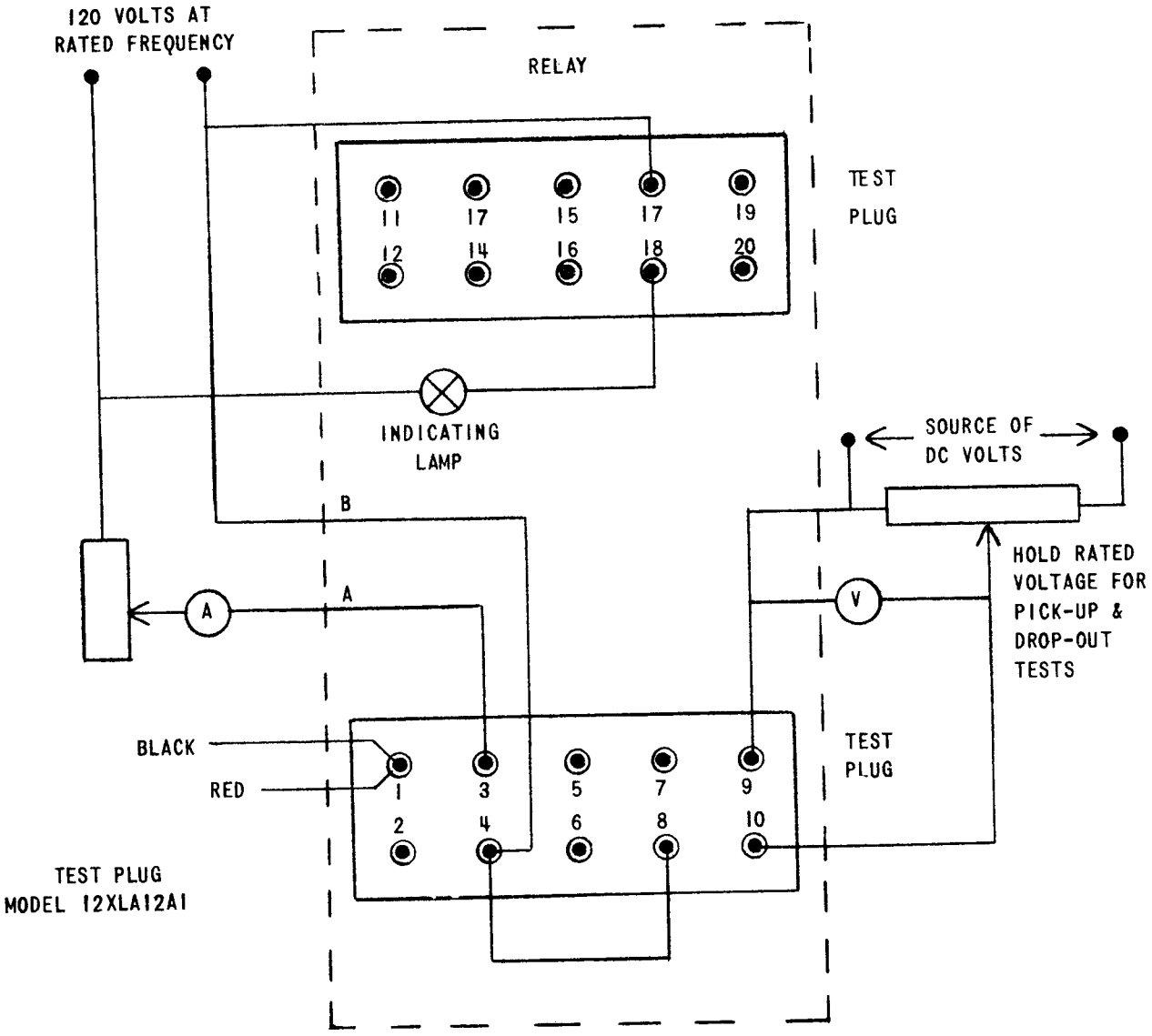
* Figure 10 (K-6209274 [6]) Outline and Panel Drilling Dimensions for Type CHC21 Relays

* Indicates revision



NOTE: AFTER ENGAGING AUXILIARY BRUSH, CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Figure 11 (8025039) Cross Section Drawout Case Showing Position of Auxiliary Brush



TEST	CONNECT LEAD A&B TO TERMINALS AS NOTED BELOW	
	A	B
PHASE - 1 - WINDING	3	4
PHASE - 3 - WINDING	7	8
PHASE 1 & 3 WINDINGS	3	7
GROUND WINDING	14	15

Figure 12 (0246A6814) Test Connection Diagram for Checking Pick-up and Dropout Currents

Meter and Control
Business Department

(8/91) (200)

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Protection and Control
205 Great Valley Parkway
Malvern, Pennsylvania 19355-0715