INSTRUCTIONS

RECLOSING RELAYS

TYPE HGA18L(-)A

GENERAL ELECTRIC

CONTENTS

RECLOSING RELAYS

TYPE HGA18L(-)A

DESCRIPTION

The relays covered by these instructions are self-resetting, "single-shot" reclosing relays which are intended to initiate immediate reclosure of a power circuit breaker that has been tripped by protective relays. The relays will operate to initiate a reclosure following tripping of the breaker only if a predetermined time has elapsed since a previous successful reclosure.

These relays are designed for use where a single, immediate reclosure of circuit breakers is desired. In the event that the breaker reopens immediately after reclosure, indicating a continuation of abnormal conditions, the apparatus remains locked out. The relays are suited for use in applications where the requirements of continuity of service do not justify subsequent time reclosures, such as Type SLR relays provide.

The basic operating elements of the HGA18L(-)A relays, which are designed for operation from a DC voltage source are a Type HGA hinge-type unit with a two-winding coil, a timing capacitor and two resistors.

The operation of these relays can best be explained with the aid of the typical external connection diagram in Figure 1. With the associated circuit breaker closed, auxiliary switch 52/b will be open, and the timing capacitor (79/CAP) will be charged to full rated DC voltage through the closed contact of 52/CS and the charging resistor. When the breaker trips, closure of the 52/b contact will discharge the capacitor through the operating coil (79/OC) of the HGA unit. That unit will then pick up and seal-in by means of its holding coil (79/HC), and will energize the breaker closing circuit via the output contact 79 between terminals 1 and 2 of the relay case.

When the breaker recloses, the 52/b contact will open, de-energizing the holding coil and causing the relay to reset. The timing capacitor will then commence to recharge. The reset time of the relay is defined as the time required for the capacitor to recharge to the point where its stored energy will be sufficient to pick up the HGA unit if the 52/b contact should again discharge the capacitor through the 79/OC coil. If the breaker remains closed for a time longer than the reset time, the relay will be ready to initiate a reclosure if the breaker is again tripped. However, if a subsequent opening of the breaker occurs in a time shorter than the reset time of the relay, the stored energy in the capacitor will not be sufficient to pick up the HGA unit and the reclosing relay will be locked out.

APPLICATION

The Type HGA18L(-)A reclosing relays are usually applied with transmission line circuit breakers for a single high-speed reclosure. If this single reclosure attempt is unsuccessful, then it is desired to lock out the breaker. The external connections for such an application are shown in Figure 1 where two 52/b contacts are available, or in Figure 2, when only one 52/b contact is available. Note in Figure 2 that when only a single 52/b contact is used, an external blocking diode is required to avoid a sneak circuit.

A capacitor discharge resistor is provided between terminals 6 and 9 of the relay case to provide a means of disabling the reclosing relay by use of an external contact if desired. For example, the user may wish to permit a reclosure following a high-speed pilot trip, but cancel reclosing following a delayed backup trip. This external reclose-cancel contact should be an electrically separate contact (i.e., "dry" contact) to avoid the possibility of a sneak circuit introduced by protective relay circuits.

GENERAL CONSIDERATIONS

The following general points must be considered when applying automatic reclosing relays:

Interrupting Rating of the Power Circuit Breaker

The derating factor applicable to the interrupting rating of the power circuit breaker should be checked prior to the application of a reclosing relay or the selection of a reclosing cycle.

Closing Control Circuits

When automatic reclosing is used, it is essential that the closing circuits with solenoid mechanisms ensure complete closure of the breaker, even though the auxiliary switch on the breaker mechanism opens before the closure is complete.

Latch-checking Switches

To ensure successful operation of a breaker being reclosed by a Type HGA18 relay, the breaker mechanism must be equipped with a latch-checking switch if the mechanism is trip-free. This switch ensures that the mechanism latch is properly set for reclosure before the closing circuit is completed. Latch-checking switches are not required for non-trip free mechanisms.

Control Switches

A control switch (typically model 16SB1B9) should be provided with automatic reclosing schemes using the Type HGA18 reclosing relays. This switch includes contacts to prevent the breaker from being automatically reclosed after it has been tripped by the control switch. The breaker must be reclosed by means of the switch before the automatic reclosing feature will be restored.

Undervoltage Devices

Where undervoltage devices are involved on the circuit fed by the breaker, it is usually necessary to coordinate the reclosing time and the trip time of the undervoltage device to ensure that the desired results are obtained. Where the undervoltage device is involved in a throw-over scheme, the initial reclosure usually should be faster. Where motor control is involved, it may or may not be desirable for the initial reclosure to be faster. Each application should be checked to determine the required coordination.

Associated Protective Relays

If high-speed reclosing is to be successful, the protective relays that tripped the breaker obviously must reopen their contacts before the breaker recloses. Some of the superseded types of induction time-overcurrent relays are not suitable for use with high-speed reclosing. If distance relays are supplied from line-side potential, their contacts should be supervised by the contacts of instantaneous fault detectors to ensure that the trip circuit is open before the breaker recloses.

RATINGS

The Type HGA18L(-)A relay is available standard 125 volt DC ratings. Reset times of 3 to 1) seconds are available.

The current-closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The contacts have a current-carrying rating of 12 amperes continuously, or 30 amperes for one minute. Interruption ratings (non-inductive circuits) for various voltages are given in Table I below.

TABLE I

	DC				AC	
Volts	24	48	125	250	115	230
Amperes	3	1.5	0.6	0.25	20	10

CHARACTERISTICS

After the relay has operated to reclose a breaker, the relay will not operate aging if the breaker does not remain closed for at least the "reset time." This is the resetting time of the relay, and is explained more thoroughly under ACCEPTANCE TESTS.

Normal burden data is not applicable to the HFA18 as the operating coil is energized only momentarily during the reclosing operation.

CONSTRUCTION

The HGA18L(-)A relay consists of a Type HGA unit, a apacitor and one or two resistors mounted in a drawout case. The single-ended, S1, drawout case is suitable for either surface or semiflush mounting. An assortment of hardware is provided to accomodate either. The cover attaches to the case and also carries the reset mechanism when one is required. Each cover screw has provision for a sealing wire.

The case has studs or screw connections at the bottom only for the external connections. The electrical connections between the relay units and the case studs are made through spring-backed contact fingers mounted in stationary molded inner and outer blocks, between which nests a removable connecting plug to complete the circuit. The outer block, attached to the case, has studs for the external connections, and the inner block has terminals for the internal connections.

The relay mechanism is mounted in a steel framework called a cradle, which is a complete unit with all leads being terminated at the inner block. The cradle is locked in the case by means of latches at the top and bottom, and a guide pin at the back of the case. The case and cradle are so constructed that the relay cannot be inserted in the case upside down. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thubmscrews, holds the connecting plug in place.

To draw out the relay unit, first remove the cover and draw out the plug. Release the latches, and the relay unit can be drawn out easily. To replace the relay unit, follow the reverse order.

A separate testing plug can be inserted in place of the connecting plug to test the realy in place on the panel, either from its own source of voltage, or from another source. Or, the relay unit can be drawn out and replaced by another unit which has already been tested in the laboratory.

The cover is provided with a mechanical interlock which prevents replacing the cover unless the connecting plug is in place.

Contact circuits of the Type HGA relays are closed or opened by moving contact arms controlled by a hinge-type armature, which in turn is actuated by the operating coil and restrained by an adjustable control spring. The lengths of contact and armature gaps are adjusted by means of screw contacts and locknuts in the front fixed contact positions. Armature gap (and back contact wipe) can also be controlled by the screws and locknuts located on the moving contact arms. The latter features make it possible to reduce the pickup energy and pickup time to relatively low values. Only one normally closed contact (not electrically connected) is used since the weak control spring tension would not give sufficient contact pressure on two normally closed contacts. The coil consists of an operating and a holding winding which is connected in separate circuits. The holding winding is connected in series with a normally open contact of the relay.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as 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 sustained in transit. If damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are damaged or the adjustments disturbed.

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.

ACCEPTANCE TESTS

MECHANICAL INSPECTION

Remove the relay from its case and check that there are no broken or cracked molded parts or other signs of physical damage, and that all the screws are tight. Check that the armature operates freely. Be sure that the nameplate information agrees with the requisition.

In its normal position, the control spring will be anchored in the front hole of the anchor pin and in the next to the top notch of the armature tail; however, see directions for adjusting the spring under **SERVICING.**

The contact wipe, measured by the gap between the armature and the pole piece when the normally open contacts justmake, should be 0.02 inch. The minimum recommended contact gap is 1/16-inch.

Check the wiring against the internal connections diagram (Figure 3). Use a bell set or ohmmeter to check that the contact circuits make in the picked up position.

TIME CHECK

These relays are designed to close their contacts only if a predetermined time interval has elapsed since the previous contact closure. The time interval is determined by the time required to charge the capacitor to a high enough energy level to pick up the relay operating coil.

A test circuit for the Type HGA18 relay is shown in Figure 4.

Rated voltage should be applied to terminals 8 and 10 for all time checks, since the applied voltage has considerable effect on the time needed for the relay to reset.

Starting with zero charge on capacitor C, close switch S-2, starting the timer and charging capacitor C. When the timer indicates the resetting time, S-1 is closed and the relay should pick up. The timer will record the exact charging time.

If it is permissible to open the controlled circuit breaker momentarily, the relay resetting time may be determined by the "cut and try" method. That is, it should reclose the breaker immediately when it is first tripped, and again after waiting for the number of seconds equal to the "reset time" of the relay under test.

TARGET UNITS

Check that the target operates at 80 percent or less of its rating.

HOLDING COIL

Check the resistance of the holding coil with an ohmmeter. Holding coil resistance for relays rated 48 volts DC and below should be 270 ohms, plus or minus 15 percent. The resistance of all other holding coils should be 7,250 ohms, plus 15 percent.

Check that the holding coil holds the armature closed after the relay is operated electrically.

INSTALLATION PROCEDURE

INTRODUCTION

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

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Figure 5.

The internal connection diagram for the relay is shown in Figure 3. Typical external connections diagrams are shown in Figures 1 and 2. Note that terminals #3 and #10 must have the same polarity of applied voltage. If this polarity is reversed, the holding coil will not hold in the armature of the relay unit.

If the relay is not mounted on a steel panel that adequately grounds the relay case, the case should be grounded through a mounting stud or screw with a conductor not less than #12 B&S gage copper wire or its equivalent.

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system, it is important that a periodic test program be followed. The interval between periodic checks will vary depending upon environment, type of relay and the user's experience with periodic testing. Until the user has accumulated enough

experience to select the test interval best suited to his individual requirements, it is suggested that the points listed under **ACCEPTANCE TESTS** be checked at an interval of from one to two years or on the same schedule as the associated protective relays.

CONTACT CLEANING

A flexible burnishing tool should be used for cleaning relay contacts. This is a flexible strip of metal with an etched-roughened surface, which in effect resembles a superfine file. The polishing action of this file is so delicate that no scratches are left on the contacts, yet it cleans off any corrosion thoroughly and rapidly. The flexibility of the tool insures the cleaning of the actual points of contact. Knives, files, abrasive paper or cloth of any kind should never be used to clean relay contacts.

The burnishing tool described above can be obtained from the factory.

SERVICING

Although the relay has been adjusted at the factory, a check may show that adjustments have been disturbed. The following adjustments can be made to restore the desired operation.

The contact wipe, measured by the gap between the armature and pole piece when the normally open contacts just make, should be 0.02 inch. This gap may be obtained by means of the adjusting screws in the moving contact arms. Locknuts on these screws should be tightened after any adjustment.

Minimum recommended contact gap is 1/16 inch. This can be set by turning the right-hand contact screw in until the normally open contacts are just making, backing it off three and three-quarters turns, and then locking it securely in position by means of the locknut. If the contact gaps are made shorter, the interrupting ratings listed no longer apply.

Resetting time of the relay is the time required for the capacitor to store sufficient energy to operate or pick up the relay unit. Steady-state DC voltage required to pick up the relay unit is considerably less than the capacitor voltage required. Control spring tension of the relay may be changed for slight adjustments of the resetting time. This is done by changing the position of the spring in the notches on the armature tail, or by shifting it from one hole to the other of the anchor pin. If it is not possible to increase reset time to 15 seconds by adjusting the spring, it is permissible to increase the armature gap by means of the back contact until the required charging time is obtained. The contact gap in this case will be approximately 1/8 inch.

The charging resistor, R1, and capacitor were selected to provide the normal resetting time at rated voltage; however, longer or shorter resetting time may be obtained by changing the values of these components. For longer times use the capacitor; for shorter times, change the resistor. The new value of resistance or capacitance may be selected using the following formulae:

$$R1A = \frac{T_2}{T_1} R1$$

and

$$C_2 = \frac{C_1}{T_1} (T_2 - T_1)$$

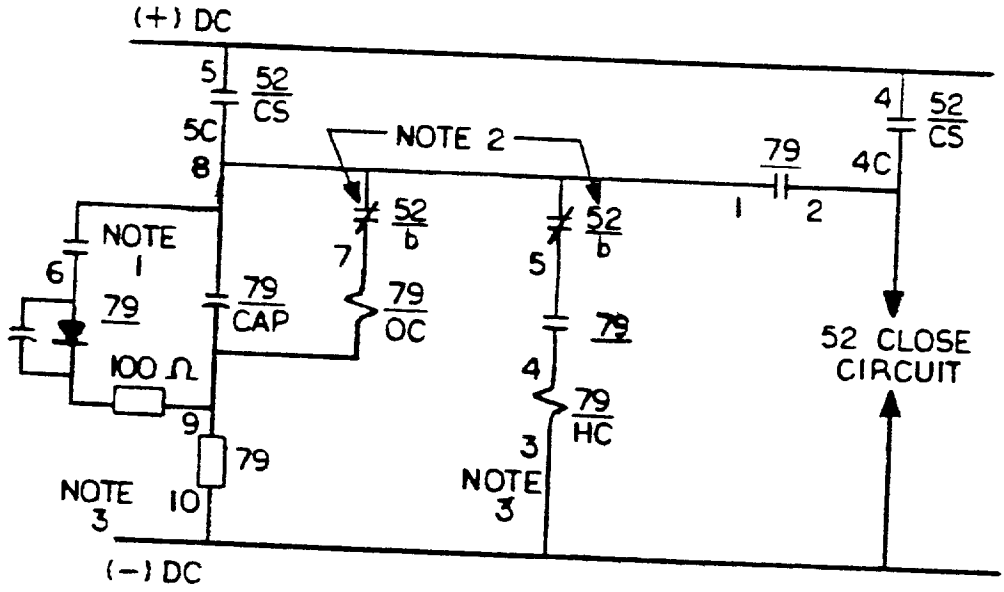
where:

R1 = resistance (in ohms) in relay as shipped
R1A = resistance (in ohms) required for desired resetting time
T_1 = rated resetting time (in seconds) of relay
T_2 = desired resetting time (in seconds)
C_1 = capacitance in microfarads in relay as shipped
C_2 = added capacitance in microfarads across terminals 8 and 9.

RENEWAL PARTS

Sufficient quantities of renewal parts should be kept in stock for 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. Specify the name of the part wanted, quantity required, and complete nameplate data, including the model number of the relay. Catalog numbers for renewal parts are shown in Renewal Parts Bulletin No. GEF-2623.



52/CS 16SB1B9

		CLOSE	NOR AFT CLOSE	NOR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

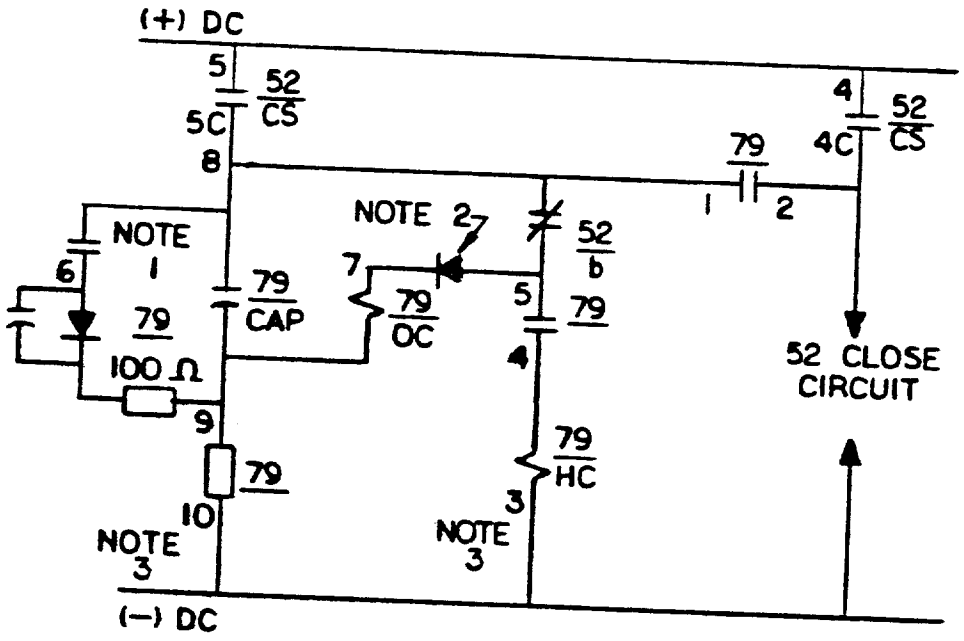
79 - HGA1BL (203A8566)
OC - OPERATE COIL
HC - HOLDING COIL
CAP - CAPACITOR

NOTE 1: DISABLING CONTACT TO BE SUPPLIED BY USER

NOTE 2: TWO BREAKER b SWITCHES ARE NECESSARY TO AVOID A SNEAK CIRCUIT. WHEN ONLY ONE b SWITCH IS AVAILABLE SEE DRAWING 0285A8287

NOTE 3: TERMINALS 3 AND 10 MUST BE OF SAME D-C POLARITY.

Figure 1 (0285A8286-0) Typical External Connections of Type HGA18L(-)A Relay Where Two 52/b Contactes are Available



52/CS 16SB189		CLOSE	NOR AFT CLOSE	NOR AFT TRIP	TRIP
1 2	1				X
	2				X
3 4	3		X	X	
	4	X			
5 6	5	X	X		
	6	X	X		

79 - HGA18L (0203A8566)

OC - OPERATING COIL
HC - HOLDING COIL

CAP - CAPACITOR

RECTIFIER 295B233

G12(48 OR 125 V DC)
G13(250V DC)

NOTE 1: DISABLING CONTACT TO BE SUPPLIED BY USER

NOTE 2: RECTIFIER IS NECESSARY TO AVOID SNEAK CIRCUIT WHEN USING ONE BREAKER b SWITCH FOR INITIATION SEE ALSO DRAWING 0285A8286

NOTE 3: TERMINALS 3 AND 10 MUST BE OF SAME D·C POLARITY

Figure 2 (0285A8287-0) Typical External Connections of Type HGA18L(-)A Relay using One 52/b Contact and a Blocking Diode

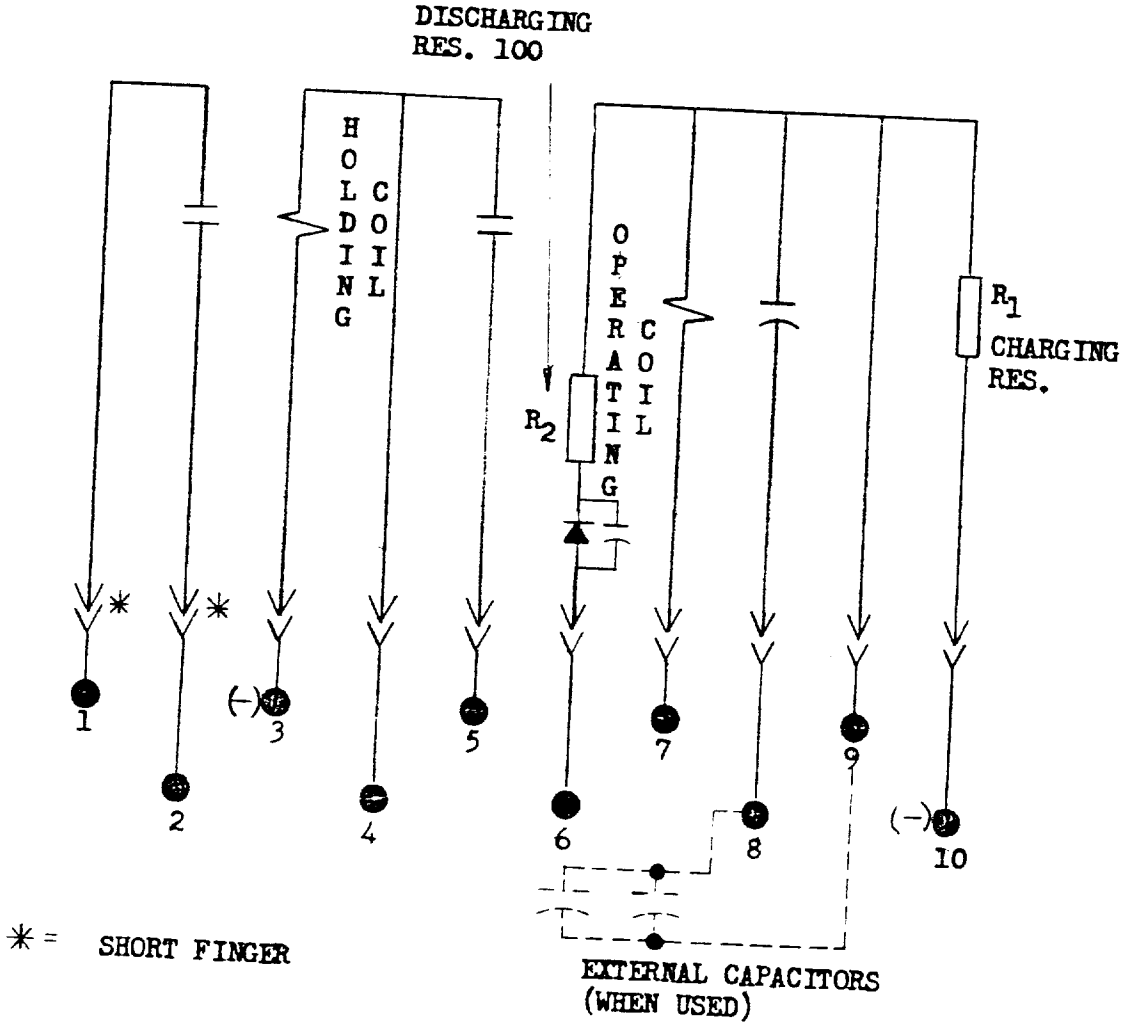


Figure 3 (0203A8566-3) Internal Connections Diagram for Type HGA18L(-)A Relay (Front View)

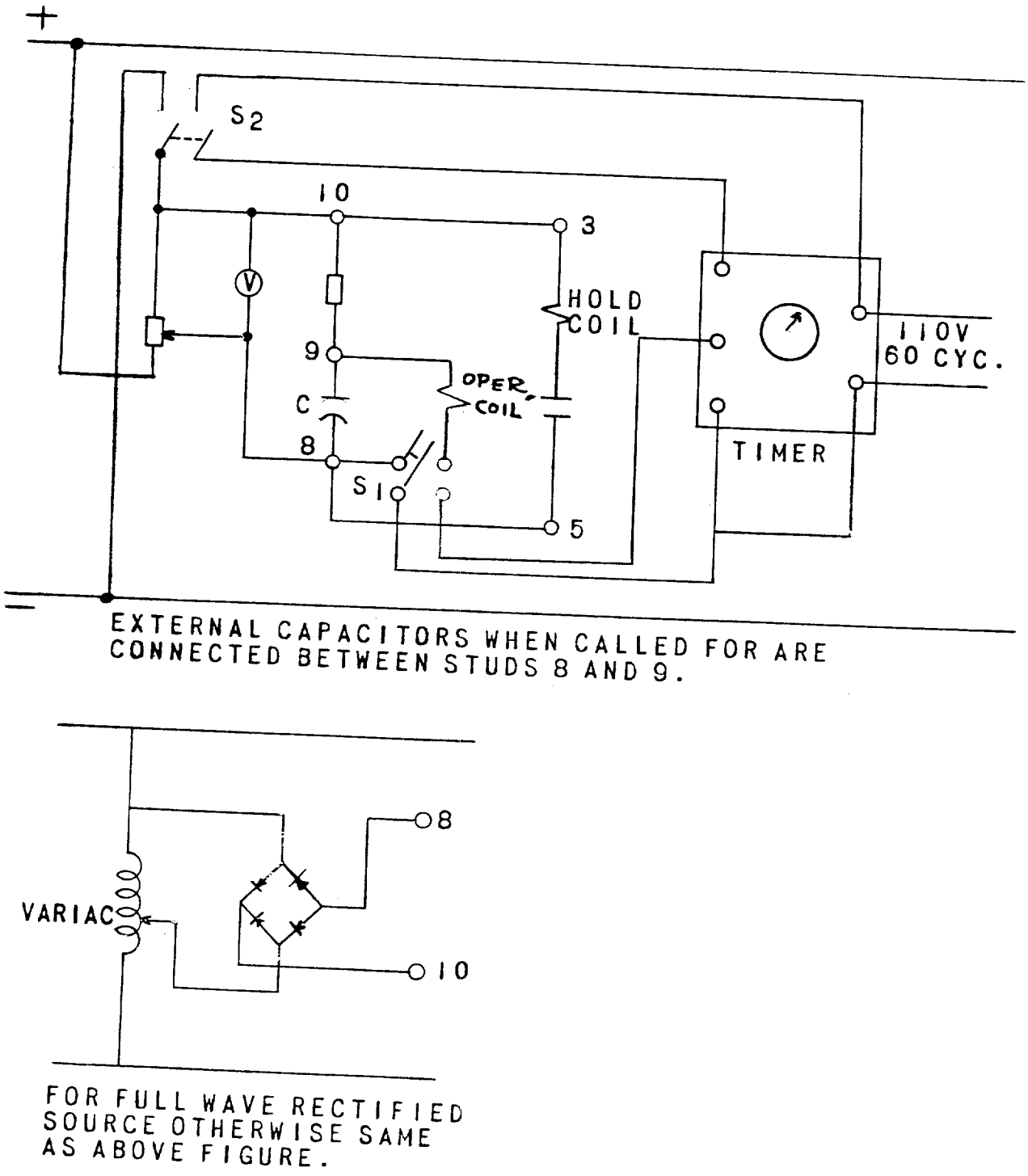
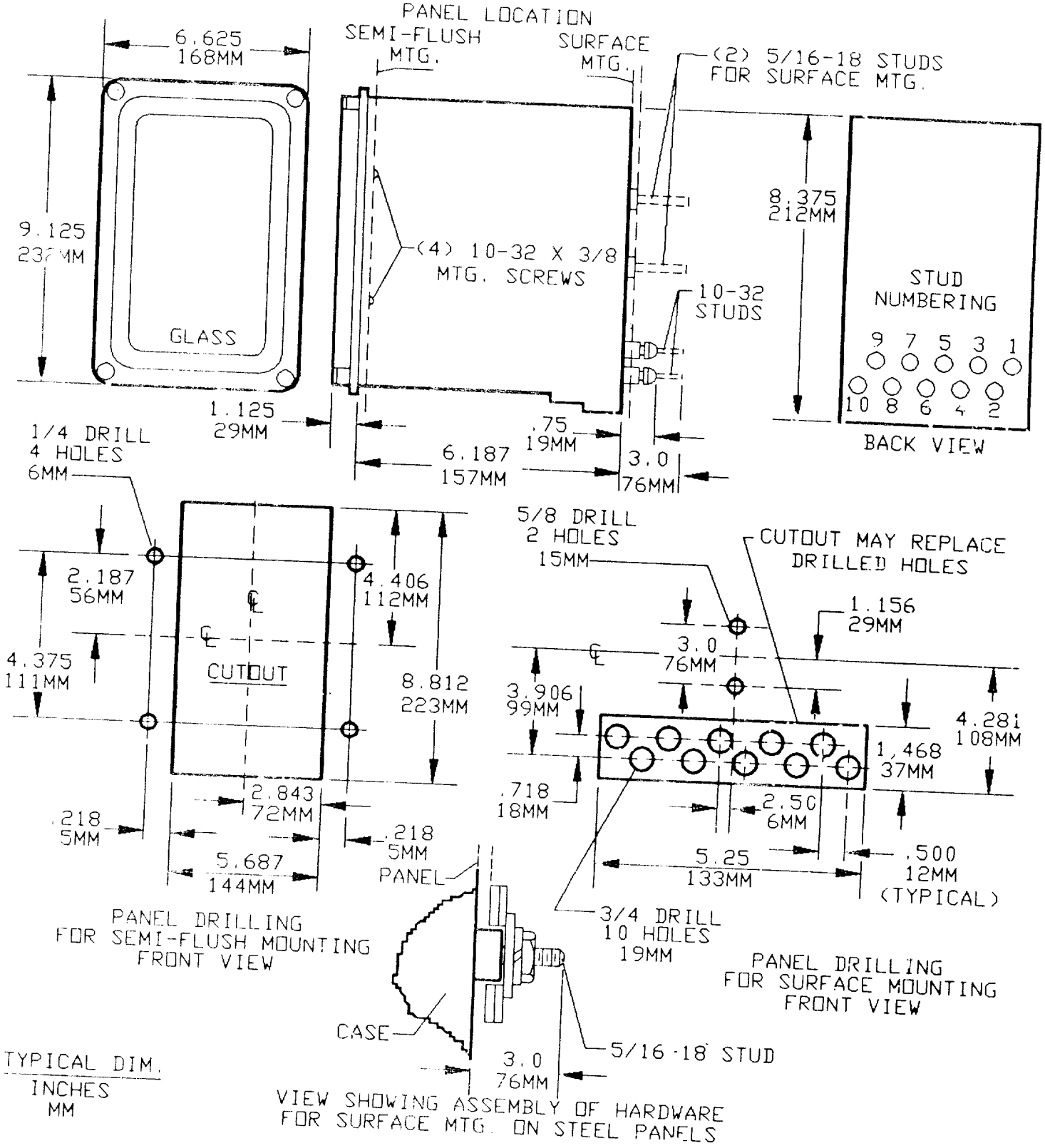


Figure 4 (6400546-4) Testing Connections Diagram for Type HGA18L(-)A Relay



* Figure 5 (6209271 [8]) Outline and Panel Drilling Dimensions for Type HGA18L(-) Relay

* Revised since last issue

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