



INSTRUCTIONS

GEK-86073
Insert Booklet GEH-2058

RESET AUXILIARY RELAY

TYPE HEA

MODEL 12HEA61BB

INTRODUCTION

This instruction book, together with insert booklet GEH-2058, forms the instructions for the 12HEA61BB relay.

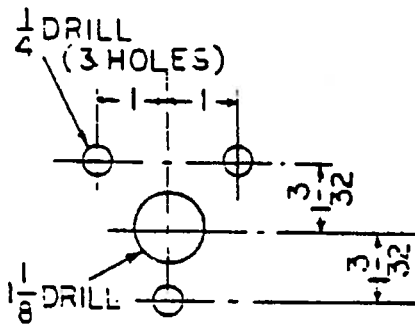
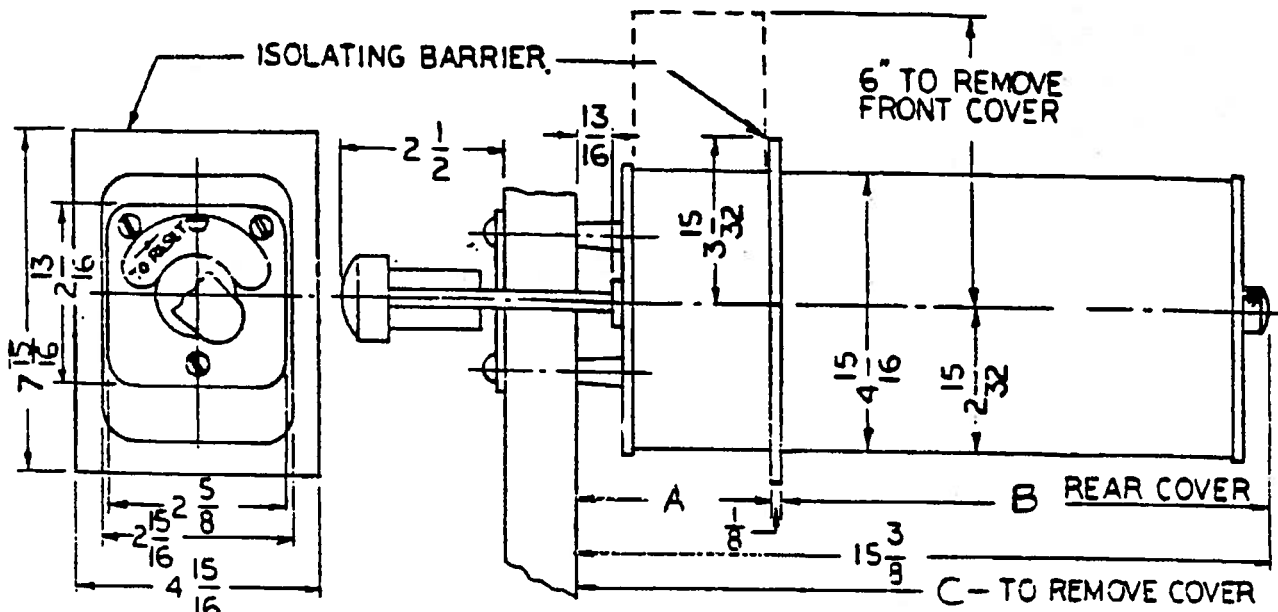
DESCRIPTION

The Type 12HEA61BB relay is similar to the Type 12HEA61B, except it has an isolation barrier separating two groups of contact stages.

Refer to Figure 1 of this supplement for the internal connections, outline, panel drilling and escutcheon engraving.

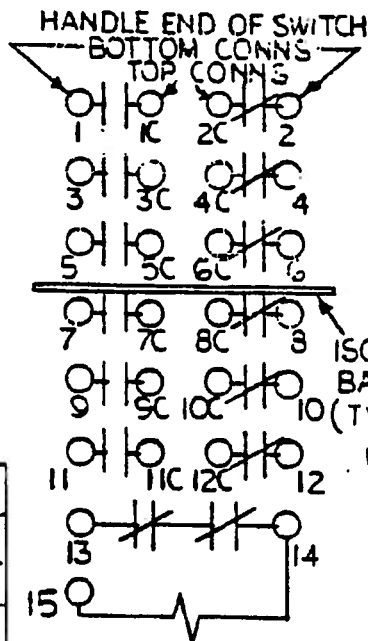
These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEC and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.



PANEL DRILLING
FRONT VIEW

| ISOLATING BARRIER AFTER STAGE | A | B | C |
|-------------------------------|-------|--------|--------|
| 1 | 3 1/2 | 11 3/4 | 27 1/2 |
| 2 | 4 1/4 | 11 | 26 3/4 |
| 3 | 5 | 10 1/4 | 26 |
| 4 | 5 3/4 | 9 1/2 | 25 1/4 |
| 5 | 6 1/2 | 8 3/4 | 24 1/2 |



NOTE: BARRIER IS MOUNTED BEHIND STAGE OF 2ND FORM NUMBER OF RELAY, 12HEAGIBB (3) (BEHIND 3RD STAGE)

INTERNAL CONN'S
NOTE: ALL CONTACTS SHOWN IN RESET POSITION.
CONTACTS 13 & 14 SHOWN IN RESET POSITION.

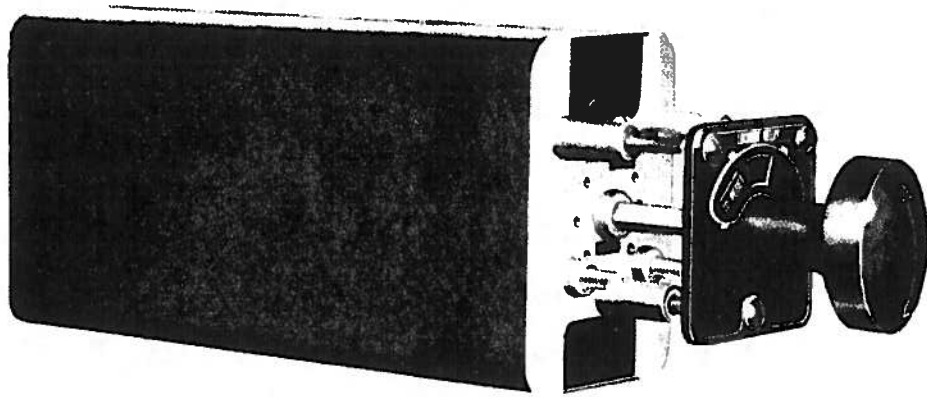
Figure 1 (0285A7 190) Internal Connections, Outline and Panel Drilling Diagram



INSTRUCTIONS

AUXILIARY RELAYS

HAND RESET WITH Target
Types HEA61
HEA62



GE Protection and Control
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Since the last edition, a change has been made in item 5 under
MAINTENANCE PERIODIC TESTS

AUXILIARY RELAYS - HAND RESET

TYPES HEA61
HEA62

DESCRIPTION

The Type HEA relay is a high speed, multi-contact, hand reset, auxiliary relay provided with a mechanical target which indicates whether it is in the tripped or reset position. Table I lists the differences among the various relays covered by these instructions.

TABLE I

| MODEL | FIG. | NO. OF CONTACTS | SPECIAL FEATURES AND REMARKS |
|----------|------|----------------------|-------------------------------|
| HEA61A | 6 | 6 + 2 FOR TRIP COIL | ----- |
| HEA61B | 7 | 10 + 2 FOR TRIP COIL | ----- |
| HEA61C | 8 | 16 + 2 FOR TRIP COIL | ----- |
| HEA61CRD | 8A | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY DOWN |
| HEA61CRL | 8B | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY LEFT |
| HEA61CRR | 8C | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY RIGHT |
| HEA61CRU | 8D | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY UP |
| HEA61M | 9** | 2 + 2 FOR TRIP COIL | ----- |
| HEA61V | 10** | 14 + 2 FOR TRIP COIL | ----- |
| HEA62A | 11 | 6 + 2 FOR TRIP COIL | ----- |
| HEA62B | 12 | 10 + 2 FOR TRIP COIL | ----- |
| HEA62C | 13 | 16 + 2 FOR TRIP COIL | ----- |
| HEA62CRD | 13A | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY DOWN |
| HEA62CRL | 13B | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY LEFT |
| HEA62CRR | 13C | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY RIGHT |
| HEA62CRU | 13D | 16 + 2 FOR TRIP COIL | RIGHT ANGLE DRIVE RELAY UP |

** All HEA62 relays have a diode and resistor inserted across the coil circuit. See Fig. 1B.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

APPLICATION

The Type HEA relays are applicable where it is desired that a number of operations be performed simultaneously. Some of the functions that can be performed by these relays are: trip the main circuit breaker of a system, operate an auxiliary breaker, open a neutral line breaker, trip main and auxiliary field discharge breakers, and operate other relays which, in turn, perform various functions. Another important use of the Type HEA relay is in conjunction with differential relays which protect transformers, rotating apparatus, buses, etc. A typical application is illustrated in Fig. 5.

OPERATING CHARACTERISTICS

The time required to trip the relay from the point of energization of the coil to the closing of the normally open contacts is shown in Fig. 4. The opening time of the normally closed contacts is approximately the same as the closing time of the normally open contacts.

RATINGS

The Type HEA relays are available for all standard coil voltage ratings (intermittent) up to 250 volts DC and 460 volts AC.

The current-closing rating of the contacts is 50 amperes for voltages not exceeding 600 volts. The contacts have a current-carrying capacity of 20 amperes continuously or 50 amperes for one minute. The interrupting rating of the contacts varies with the inductance of the circuit. The values (in amperes) given in Table II, for DC inductive circuits, are based on the average trip coil currents.

TABLE II CONTACT INTERRUPTION RATING

| CIRCUIT VOLTS | NON-INDUCTIVE CIRCUIT | | | INDUCTIVE CIRCUIT | | |
|------------------|-----------------------|-------------|-------------|--------------------|-------------|-------------|
| | NUMBER OF CONTACTS | | | NUMBER OF CONTACTS | | |
| | 1 | 2 IN SERIES | 4 IN SERIES | 1 | 2 IN SERIES | 4 IN SERIES |
| 24 DC | 6.0 | 30.0 | | 4.0 | 20.0 | 30.0 |
| 48 DC | 5.0 | 25.0 | 40.0 | 3.0 | 15.00 | 25.0 |
| 125 DC | 2.6 | 11.0 | 25.0 | 2.0 | 6.25 | 9.5 |
| 250 DC | 0.75 | 2.0 | 8.0 | 0.7 | 1.75 | 6.5 |
| 600 DC | 0.25 | 0.45 | 1.35 | 0.15 | 0.35 | 1.25 |
| 115 AC | 40.00 | 50.0 | | 24.0 | 50.0 | |
| 220 AC | 25.00 | 50.0 | | 12.0 | 25.0 | 40.0 |
| 440 AC | 12.00 | 25.0 | | 5.0 | 12.0 | 20.0 |
| 550 AC | 6.00 | 12.0 | | 4.0 | 10.0 | 15.0 |

BURDENS

The burden data of the Type HEA relay is listed in Table III.

TABLE III BURDENS

| INTERMITTENT RATING | FREQ | COIL RES. OHMS 25°C | AC INRUSH (CURRENT AMPS) | MINIMUM RATING OF TARGET COIL IN EXTERNAL PROTECTIVE RELAY | |
|---------------------|--------|------------------------|-----------------------------|--|---|
| | | | | UNIVERSAL TARGET SEAL-IN (CURRENT AMPS) | SEPARATE TARGET & SEAL-IN (CURRENT AMPS) |
| 12 | DC | 0.4 | | 2.0 | |
| 24 | DC | 1.2 | | 2.0 | 1.0 |
| 32 | DC | 2.4 | | 2.0 | |
| 48 | DC | 4.5 | | 2.0 | 1.0 |
| 62.5 | DC | 7.3 | | 2.0 | |
| 125 | DC | 23 | | 0.2 | 1.0 |
| 220 | DC | 88 | | 0.2 | 0.2 |
| 250 | DC | 103 | | 0.2 | 0.2 |
| 115 | 60 CYC | 2.4 | 25 | 2.0 | |
| 208 | 60 CYC | 9.7 | | 2.0 | |
| 230 | 60 CYC | 9.7 | 14 | 0.2 | |
| 460 | 60 CYC | 38.5 | | | |

CONSTRUCTION AND CIRCUITRY

The contact section of this relay is built from parts of the Type SB-1 control and transfer switch (see Fig. 1 and 1A).

The operating shaft is held in the reset position by a positive latch. It is released through the action of the operating coil when it attracts the hinged-armature element.

The mechanical target on the escutcheon plate assembly indicated black when the relay is in the reset position and yellow when in the tripped position. To reset the relay after being tripped, the handle is turned clockwise as indicated by the arrow on the escutcheon plate.

In addition to the 2, 6, 10, 14 or 16 sets of contacts as provided, each relay is equipped with two normally closed contacts connected in series for opening the operating coil circuit.

INSTALLATION

RECEIVING

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,

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examine it for any damage sustained 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.

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.

INSTALLATION AND WIRING PRACTICES

Careful attention to the wiring and installation of the relay is as important as the proper selection of the relay. Attention to the wiring at the installation and maintaining of the wiring through the life of the relay will result in fewer field problems. The following are recommendations for installation and wiring practices to follow for HEA relays.

The installation of a relay to a panel requires only two items; the holes in the panel for screws and shaft, and the space behind the relay to remove the cover.

The cover should not be removed from the relay during installation to prevent possible damage to shunts and/or latching mechanism.

The front support is designed with cutouts for wires; the top for wires going to fixed contacts, the bottom for wires going to moving contacts. Wiring coming to and from these cutouts should be cabled together by lacing or ties, then clamped to the mounting structure so that no distortion of the switch can occur from tight cables or pulling on the cable.

Covers for relays are available in one size. The standard cover for the HEA relay (4-3/4 inches) is for 24 wires out the top and 24 wires out the bottom. The wire openings are 1-3/4 inches wide by one inch high.

The design of the wire opening is for Type SIS #14 Vulkene insulated switchboard wires (0.150 outside diameter each) General Electric C.I. 57275.

Multiple wires to one terminal should not exceed two #14 wires. When larger than #14 wire is used, a limit of one wire per terminal is recommended. The maximum wire size is #10.

No wires should enter the top cutout and cross down to the lower side of the relay. In doing this, the wire would be outside the barrier and when the cover is installed, would be pushed in against the shunts and prevent proper action of the moving contact. No wires can be outside the barrier width without taking unnecessary risk of relay failure.

The terminal screw is a 10-32 NF2 x 7/16 long binder head, nickel-plated brass screw. The diameter of the head is 13/32 inch. This is the maximum outside diameter of any #10 crimp-type terminal used to terminate wires. When the shank of the crimp-type terminal requires insulation, the type with insulated shanks should be used. Shanks of crimp terminals should be bent slightly up away from the fixed contacts to avoid possibility of gap interference.

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Never use tape wrapped around the shank and wire insulation. The tape may eventually unwrap and could possibly position itself in the contact gap preventing the relay from operating properly.

Moving contacts have the terminal screws positioned at 45 degrees and facing away from the relay axis. This position should never be changed at time of installation. The reason for this is that if the moving contact terminal is turned in the opposite direction from which the screw is pointed, the contact will open up and be loose on the hexagon barrier boss. This, in turn, affects the action and gap of the moving contact by stretching the shunt. The terminal should never be changed from the position in which it is received from the factory.

The terminal screws are tightened to 15-20 inch-pounds torque. When applying this torque to tighten the terminal screw on the moving contact, caution should be exercised not to exceed 20 pounds force in the direction the screw is being driven. It is also important that a correct fitting screwdriver be used to prevent relay contact damage and screw head distortion.

MOUNTING

The relay should be mounted on a vertical surface. The relay may be mounted on panels up to two inches thick. If the panel thickness is not specified when ordering, the relay will be furnished for panels up to 3/16 inch thick. The "x 2" after the group number identifies the panel thickness (12HEA61A 224x2). By changing the "x 2" to "x 4" the relay will be suitable for 1/4 inch panel. The number after the "x" equals increments of 1/16 inch, up to 32 for two inches.

The outline and panel drilling diagrams for the various types of HEA relays are shown in Figs. 6 to 13D, inclusive.

CONNECTIONS

The internal connection diagrams for the various types of HEA relays are shown in Figs. 6 to 13D, inclusive. When connecting switchboard wires to the coil circuit, be sure they are kept away from the arc path which occurs when the relay contacts interrupt the coil circuit.

NOTE 1: When connecting wires to all types of switches, excessive thrust must not be applied to the heads of the screws as the switch contacts may become distorted permitting rotation on the switch barrier supports. Likewise the connected wires must not be pulled away from the switch contacts when forming a wiring harness.

NOTE 2: It is also important that a correct fitting screwdriver be used to prevent switch contact damage and screw head distortion.

MAINTENANCE

PERIODIC TESTS

During any scheduled outage of the equipment and preferably at yearly intervals, the relay should be tripped electrically to insure that it is in good operating condition and that all the circuits are complete so that the breakers can be tripped.

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Remove cover, visually inspect relay and trip manually by applying force on the armature (Step 7 below).

This electrical test may be performed at 70 percent of rated voltage by inserting the proper value of series resistance in the coil circuit as listed in Table IV being careful to apply the test voltage only long enough to trip the relay.

TABLE IV

| VOLTS DC | 12 | 24 | 32 | 48 | 62.5 | 110 | 125 | 220 | 250 |
|---------------------------------|-----|-----|-----|-----|------|-----|------|------|------|
| OHM RESIS- TANCE FOR TEST | 0.2 | 0.5 | 1.0 | 2.0 | 3.0 | 7.0 | 10.0 | 38.0 | 40.0 |

The following check list gives recommendations to insure the relay functions properly.

1. Before installation customer should read this instruction book, GEH-2058. A publication, GET-7293, is also available.
2. Check nameplate for correct model number and voltage rating.
3. Check for proper coil and resistance (Table III).
4. Be sure coil is connected properly using both coil contacts for double break action.
5. Each of the coil contacts should have 1/4 inch $\pm 1/32$ " contact gap when open.
6. Check that rollers spin freely on latching assembly.
7. Relay should trip by hand with a 0.025 shim between armature and pole piece.
8. If tripping voltage is too high (should trip at 70 percent of rated voltage), add 0.015 shim (V-6149118) under pole piece, then repeat No. 7.
9. Wait 30 seconds between operations for continued operation test.
10. In resetting relay, the handle should not be forced against the latch to see if latching has occurred; instead the handle should be released immediately after resetting so you do not prevent or delay tripping.
11. Do not try to reset with trip circuit still energized.
12. Be sure the wires do not interfere with the latching mechanism and are within outer edges of barriers.
13. Be sure tie bolts are tight (25 inch-pounds).

SERVICING

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched 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 insures the cleaning of the actual points of contact.

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

RENEWAL PART INSTALLATION

To remove the moving contact, position the relay so that the contact is open. Remove binding head screw and round head screw (Fig. 2) which hold the shunt to the terminal, press in, on the top of the contact, to release the torque at its lower end (Fig. 3) and pull the contact upward and off.

The moving contact has a shoe that is assembled between the contact spring and the contact. When assembling a new moving contact, the end of the moving contact support must be inserted between the shoe and the moving contact. Then the contact may slide down into place and the screws may be replaced. When replacing the round head screw be sure the lockwasher is replaced and be careful to avoid creasing the thin metal strips of the shunt. Operate the relay and observe whether the contacts meet squarely and simultaneously. The contacts can be adjusted by bending slightly with smooth faced pliers. After adjustment there should be a 1/32 inch minimum gap, with the contacts closed, between the moving contact and the moving contact support (Fig. 2).

Damage to a fixed contact requires replacement of the complete assembly of fixed contacts and support. Remove screws, change assemblies and replace screws. Check alignment of contacts.

To remove a defective coil, disconnect the leads from contacts, then remove staked screw in bottom of pole piece. Slide coil from under guard and armature being careful not to lose shim under pole piece. Remove pole piece and position in replacement coil. Position shim under pole piece and slide coil assembly under armature and guard. Replace screw and re-store. Check new coil per Items 3 through 12 on check list.

When cams, barriers, moving contact supports, etc., need to be replaced, it is recommended that the relay be returned to the factory for repair and return.

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, specifying the quantity required and describing the parts.

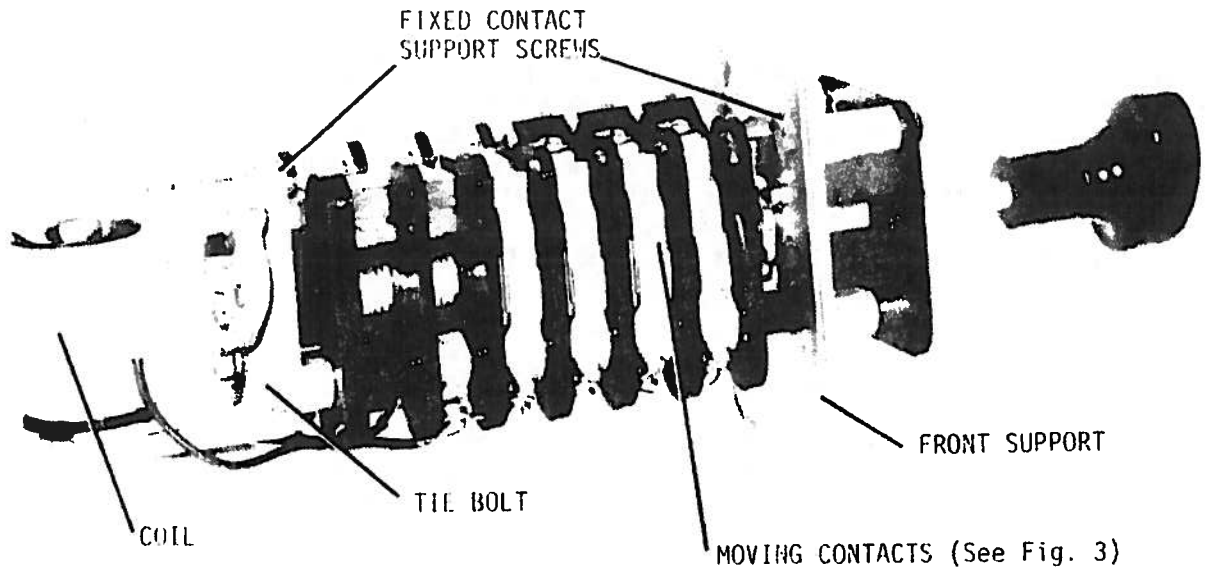


Fig. 1 (8031895) Six Contact HEA61 Relay in Tripped Position, with Cover Removed

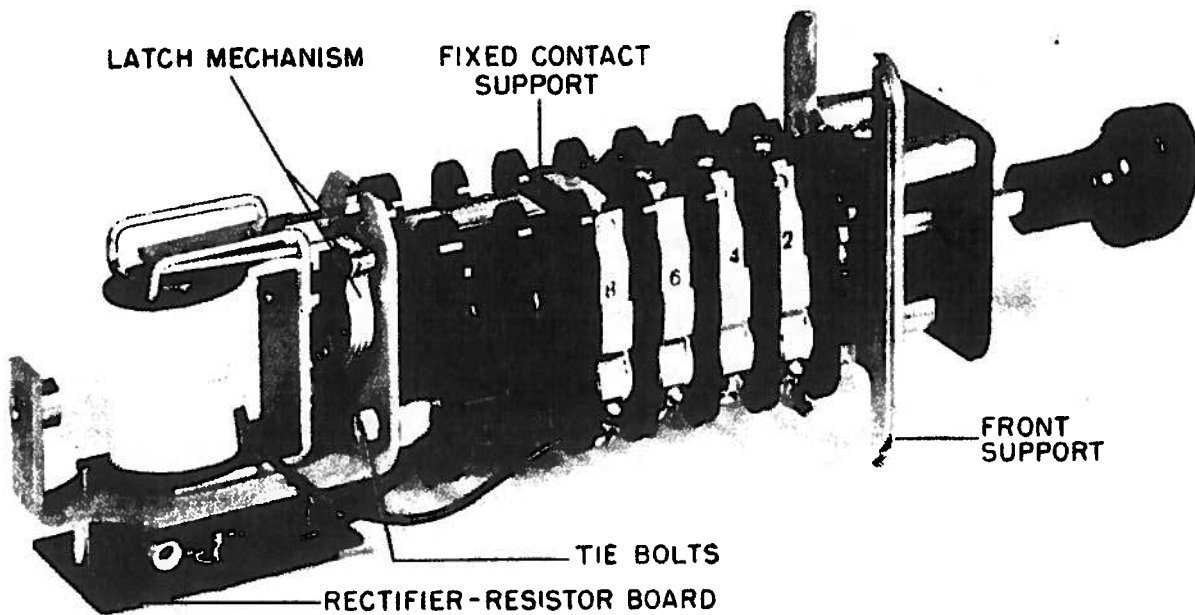


Fig. 1A (8028243) Type HEA62 with Diode-Resistor Board

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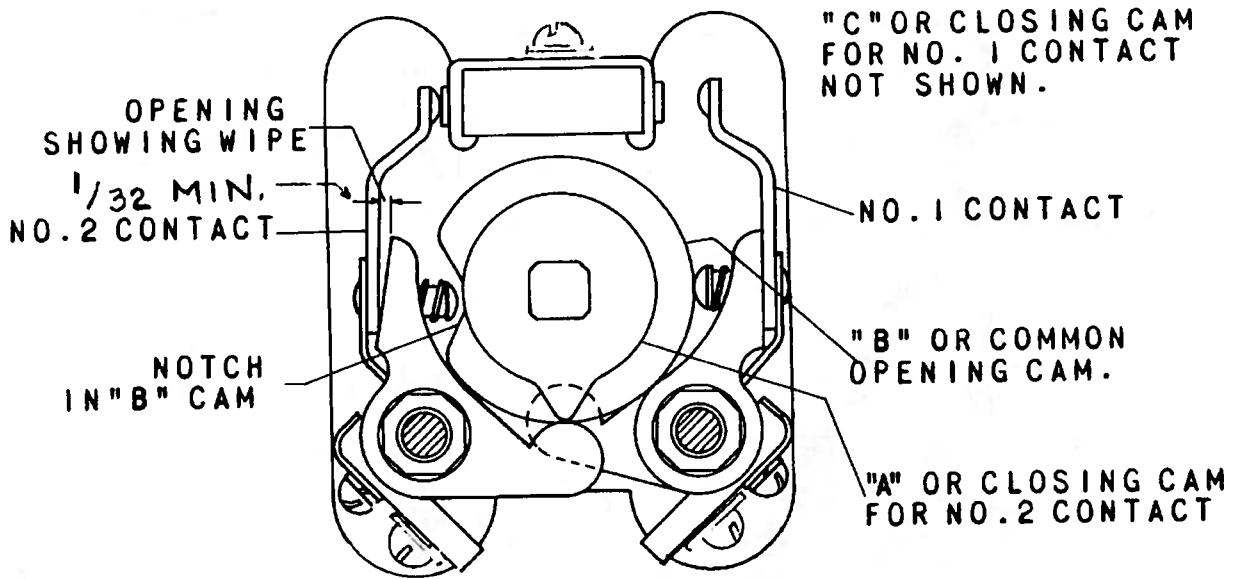


Fig. 2 (6507946-2) Typical Section Showing Operation of Cams - Front View

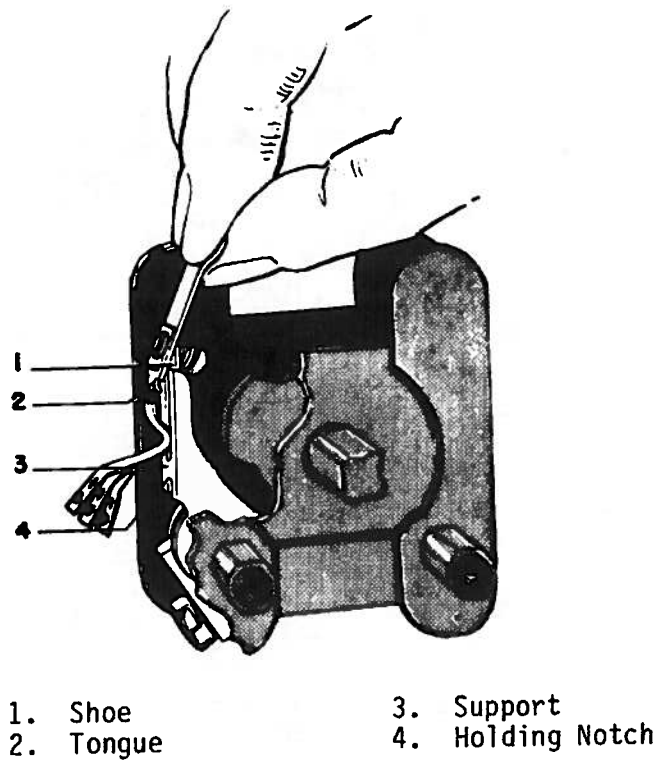


Fig. 3 (8918418) Removing and Replacing Moving Contact

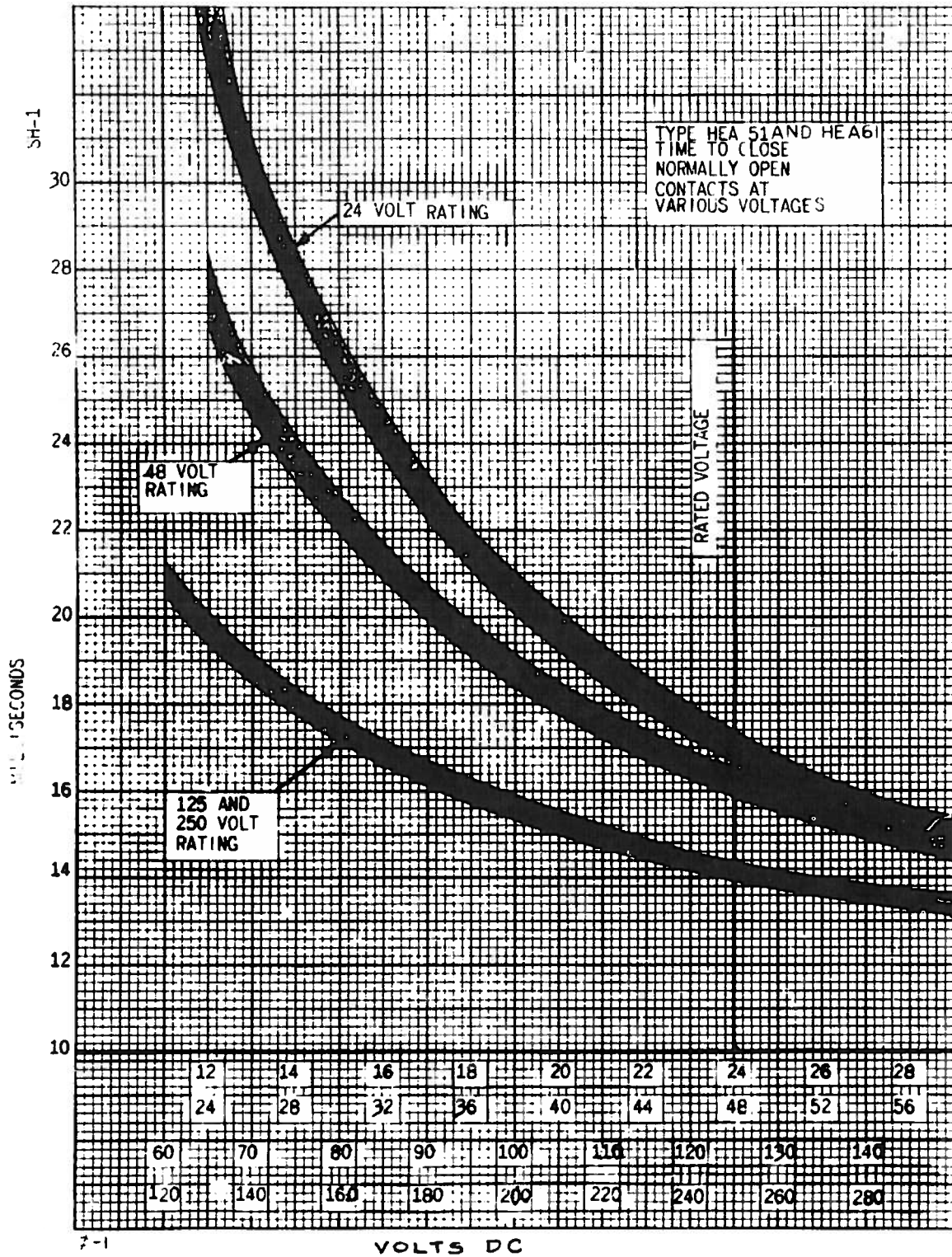


Fig. 4 (0127A9510-1) Typical Time-voltage Characteristics of Type HEA61 Relay

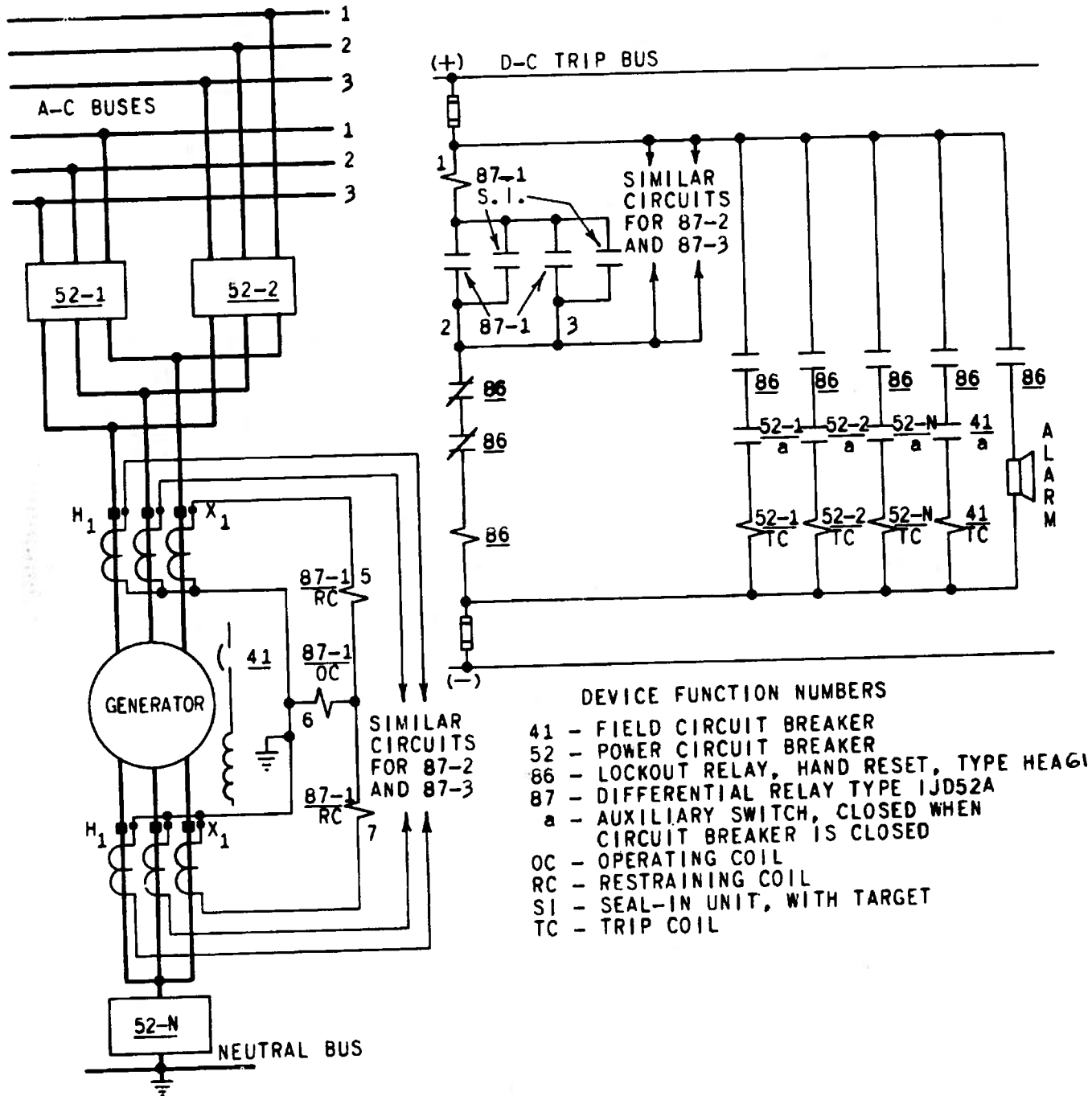
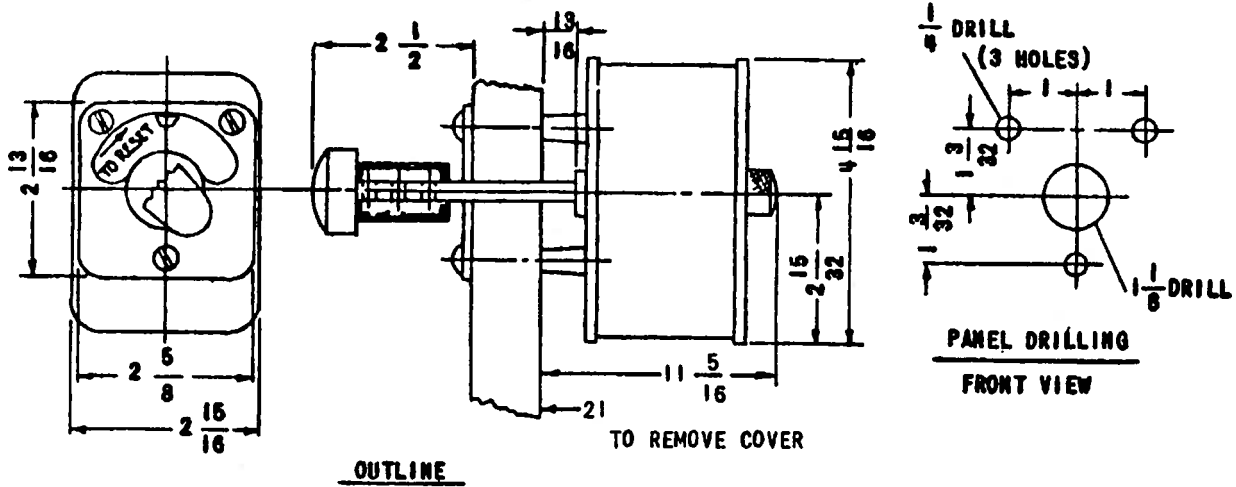


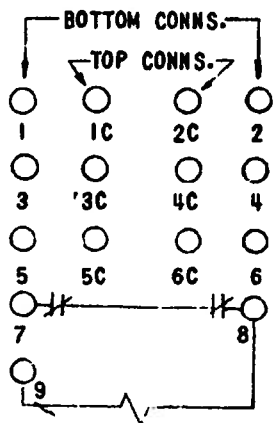
Fig. 5 (0165A7690-0) Typical Application of Type HEA Relays as Auxiliary Device in the Differential Protection of a Generator

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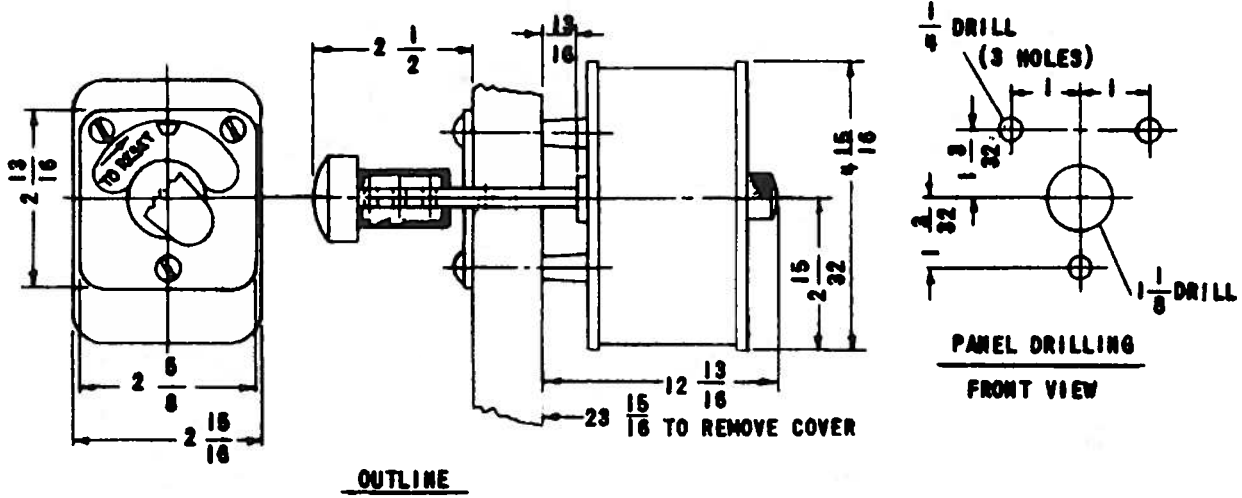
| CYCLES | RELAY FORM NUMERAL | | | | | | | | | | | | | | | | CONTACT ARRANGEMENT | | |
|-------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-------|-------|-----|-----|-----|-----|---------------------|--------|--------|
| | DC | DC | DC | DC | DC | DC | DC | DC | 50/60 | 25 | 50/60 | 50/60 | 25 | 50 | 60 | DC | DC | OPEN | CLOSED |
| VOLTS | 250 | 125 | 48 | 24 | 60 | 32 | 12 | 220 | 115 | 230 | 230 | 85 | 460 | 115 | 208 | 275 | 145 | | |
| MODEL 12HEA61A | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | NONE | 1 TO 6 |
| | 211 | 221 | 231 | 241 | 251 | 261 | 271 | 281 | 291 | 301 | 311 | 321 | 331 | 341 | 351 | 361 | 371 | 1 | 2 TO 6 |
| | 212 | 222 | 232 | 242 | 252 | 262 | 272 | 282 | 292 | 302 | 312 | 322 | 332 | 342 | 352 | 362 | 372 | 1 & 2 | 3 TO 6 |
| | 213 | 223 | 233 | 243 | 253 | 263 | 273 | 283 | 293 | 303 | 313 | 323 | 333 | 343 | 353 | 363 | 373 | 1 TO 3 | 4 TO 6 |
| | 214 | 224 | 234 | 244 | 254 | 264 | 274 | 284 | 294 | 304 | 314 | 324 | 334 | 344 | 354 | 364 | 374 | 1 TO 4 | 5 & 6 |
| | 215 | 225 | 235 | 245 | 255 | 265 | 275 | 285 | 295 | 305 | 315 | 325 | 335 | 345 | 355 | 365 | 375 | 1 TO 5 | 6 |
| | 216 | 226 | 236 | 246 | 256 | 266 | 276 | 286 | 296 | 306 | 316 | 326 | 336 | 346 | 356 | 366 | 376 | 1 TO 6 | NONE |

HANDLE END OF SWITCH

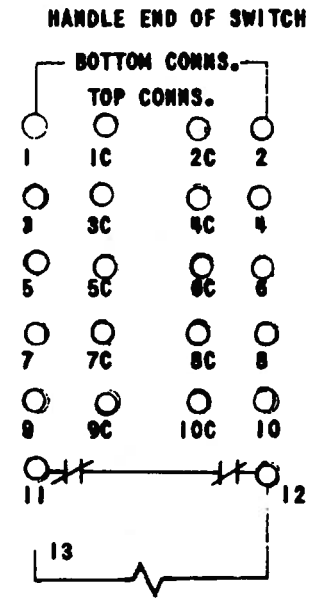


NOTE: CONTACTS 7 & 8 SHOWN IN RESET POSITION

Fig. 6 (0165A7675-4) Outline, Panel Drilling and Internal Connections for HEA61A Relay



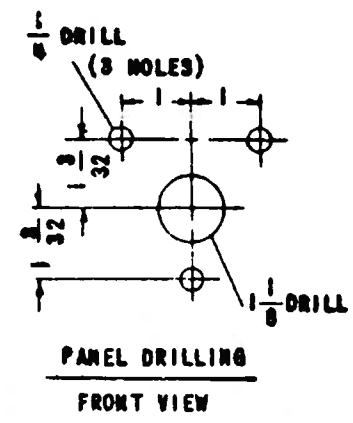
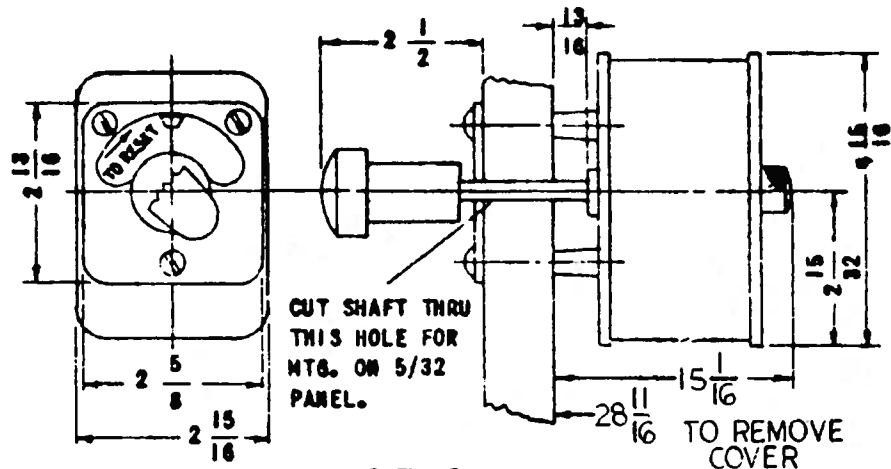
| CYCLES | RELAY FORM NUMERAL | | | | | | | | | | | CONTACT ARRANGEMENT | |
|-------------------|--------------------|-----|-----|-----|-----|-----|-----|-------|-------|-----|-----|---------------------|----------|
| | DC | DC | DC | DC | DC | DC | DC | 50/60 | 50/60 | DC | | RESET | POSITION |
| | VOLTS | 250 | 125 | 48 | 24 | 32 | 280 | 220 | 115 | 230 | 460 | 12 | OPEN |
| MODEL 12HEA61B | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 350 | 370 | 410 | 430 | NONE | 1 TO 10 |
| | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 351 | 371 | 411 | 431 | 1 | 2 TO 10 |
| | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 412 | 432 | 1 & 2 | 3 TO 10 |
| | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 353 | 373 | 413 | 433 | 1 TO 3 | 4 TO 10 |
| | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 354 | 374 | 414 | 434 | 1 TO 4 | 5 TO 10 |
| | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 355 | 375 | 415 | 435 | 1 TO 5 | 6 TO 10 |
| | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 356 | 376 | 416 | 436 | 1 TO 6 | 7 TO 10 |
| | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 357 | 377 | 417 | 437 | 1 TO 7 | 8 TO 10 |
| | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 358 | 378 | 418 | 438 | 1 TO 8 | 9 & 10 |
| | 219 | 239 | 259 | 279 | 299 | 319 | 339 | 359 | 379 | 419 | 439 | 1 TO 9 | 10 |
| | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 420 | 440 | 1 TO 10 | NONE |



INTERNAL CONNECTIONS

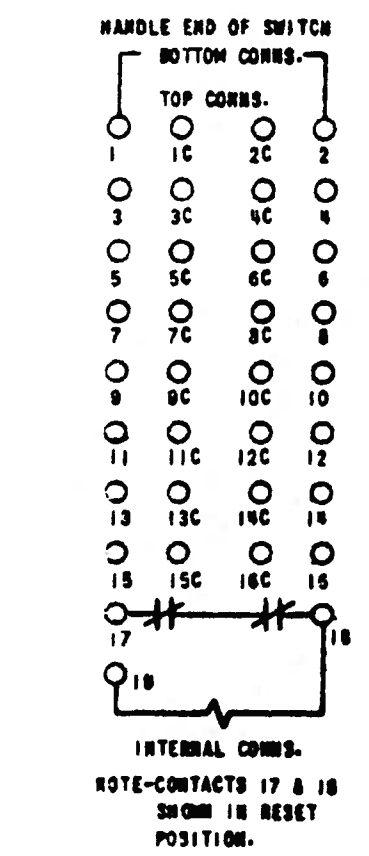
NOTE-CONTACTS 11 & 12 SHOWN IN RESET POSITION.

Fig. 7 (0165A7676-3) Outline, Panel Drilling and Internal Connections for HEA61B Relay



OUTLINE

| COIL | HERTZ | VOLTS | 4.5 | | 1.2 | | 68 | | 2.4 | | 38.5 | | 9.7 | | 148 | | 7.3 | | 24 | | 17.3 | | CONTACT ARRANGEMENT | RESET POSITION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------|-------|-------|-----|-----|-----|-----|-----|-----|-------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|---------------------|----------------|------|--------|-----|-----|------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | | DC | | DC | | DC | | 50/60 | | DC | | DC | | DC | | DC | | DC | | DC | | | | OPEN | CLOSED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 103 | 23 | 250 | 125 | 250 | 270 | 211 | 231 | 251 | 271 | 290 | 310 | 330 | 350 | 370 | 390 | 410 | 430 | 450 | 470 | | | | | 490 | 510 | NONE | 1 TO 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODEL 12HEA61C | DC | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 392 | 412 | 432 | 452 | 472 | 492 | 512 | 532 | 552 | 572 | 592 | 612 | 632 | 652 | 672 | 692 | 712 | 732 | 752 | 772 | 792 | 812 | 832 | 852 | 872 | 892 | 912 | 932 | 952 | 972 | 992 | 1012 | 1032 | 1052 | 1072 | 1092 | 1112 | 1132 | 1152 | 1172 | 1192 | 1212 | 1232 | 1252 | 1272 | 1292 | 1312 | 1332 | 1352 | 1372 | 1392 | 1412 | 1432 | 1452 | 1472 | 1492 | 1512 | 1532 | 1552 | 1572 | 1592 | 1612 | 1632 | 1652 | 1672 | 1692 | 1712 | 1732 | 1752 | 1772 | 1792 | 1812 | 1832 | 1852 | 1872 | 1892 | 1912 | 1932 | 1952 | 1972 | 1992 | 2012 | 2032 | 2052 | 2072 | 2092 | 2112 | 2132 | 2152 | 2172 | 2192 | 2212 | 2232 | 2252 | 2272 | 2292 | 2312 | 2332 | 2352 | 2372 | 2392 | 2412 | 2432 | 2452 | 2472 | 2492 | 2512 | 2532 | 2552 | 2572 | 2592 | 2612 | 2632 | 2652 | 2672 | 2692 | 2712 | 2732 | 2752 | 2772 | 2792 | 2812 | 2832 | 2852 | 2872 | 2892 | 2912 | 2932 | 2952 | 2972 | 2992 | 3012 | 3032 | 3052 | 3072 | 3092 | 3112 | 3132 | 3152 | 3172 | 3192 | 3212 | 3232 | 3252 | 3272 | 3292 | 3312 | 3332 | 3352 | 3372 | 3392 | 3412 | 3432 | 3452 | 3472 | 3492 | 3512 | 3532 | 3552 | 3572 | 3592 | 3612 | 3632 | 3652 | 3672 | 3692 | 3712 | 3732 | 3752 | 3772 | 3792 | 3812 | 3832 | 3852 | 3872 | 3892 | 3912 | 3932 | 3952 | 3972 | 3992 | 4012 | 4032 | 4052 | 4072 | 4092 | 4112 | 4132 | 4152 | 4172 | 4192 | 4212 | 4232 | 4252 | 4272 | 4292 | 4312 | 4332 | 4352 | 4372 | 4392 | 4412 | 4432 | 4452 | 4472 | 4492 | 4512 | 4532 | 4552 | 4572 | 4592 | 4612 | 4632 | 4652 | 4672 | 4692 | 4712 | 4732 | 4752 | 4772 | 4792 | 4812 | 4832 | 4852 | 4872 | 4892 | 4912 | 4932 | 4952 | 4972 | 4992 | 5012 | 5032 | 5052 | 5072 | 5092 | 5112 | 5132 | 5152 | 5172 | 5192 | 5212 | 5232 | 5252 | 5272 | 5292 | 5312 | 5332 | 5352 | 5372 | 5392 | 5412 | 5432 | 5452 | 5472 | 5492 | 5512 | 5532 | 5552 | 5572 | 5592 | 5612 | 5632 | 5652 | 5672 | 5692 | 5712 | 5732 | 5752 | 5772 | 5792 | 5812 | 5832 | 5852 | 5872 | 5892 | 5912 | 5932 | 5952 | 5972 | 5992 | 6012 | 6032 | 6052 | 6072 | 6092 | 6112 | 6132 | 6152 | 6172 | 6192 | 6212 | 6232 | 6252 | 6272 | 6292 | 6312 | 6332 | 6352 | 6372 | 6392 | 6412 | 6432 | 6452 | 6472 | 6492 | 6512 | 6532 | 6552 | 6572 | 6592 | 6612 | 6632 | 6652 | 6672 | 6692 | 6712 | 6732 | 6752 | 6772 | 6792 | 6812 | 6832 | 6852 | 6872 | 6892 | 6912 | 6932 | 6952 | 6972 | 6992 | 7012 | 7032 | 7052 | 7072 | 7092 | 7112 | 7132 | 7152 | 7172 | 7192 | 7212 | 7232 | 7252 | 7272 | 7292 | 7312 | 7332 | 7352 | 7372 | 7392 | 7412 | 7432 | 7452 | 7472 | 7492 | 7512 | 7532 | 7552 | 7572 | 7592 | 7612 | 7632 | 7652 | 7672 | 7692 | 7712 | 7732 | 7752 | 7772 | 7792 | 7812 | 7832 | 7852 | 7872 | 7892 | 7912 | 7932 | 7952 | 7972 | 7992 | 8012 | 8032 | 8052 | 8072 | 8092 | 8112 | 8132 | 8152 | 8172 | 8192 | 8212 | 8232 | 8252 | 8272 | 8292 | 8312 | 8332 | 8352 | 8372 | 8392 | 8412 | 8432 | 8452 | 8472 | 8492 | 8512 | 8532 | 8552 | 8572 | 8592 | 8612 | 8632 | 8652 | 8672 | 8692 | 8712 | 8732 | 8752 | 8772 | 8792 | 8812 | 8832 | 8852 | 8872 | 8892 | 8912 | 8932 | 8952 | 8972 | 8992 | 9012 | 9032 | 9052 | 9072 | 9092 | 9112 | 9132 | 9152 | 9172 | 9192 | 9212 | 9232 | 9252 | 9272 | 9292 | 9312 | 9332 | 9352 | 9372 | 9392 | 9412 | 9432 | 9452 | 9472 | 9492 | 9512 | 9532 | 9552 | 9572 | 9592 | 9612 | 9632 | 9652 | 9672 | 9692 | 9712 | 9732 | 9752 | 9772 | 9792 | 9812 | 9832 | 9852 | 9872 | 9892 | 9912 | 9932 | 9952 | 9972 | 9992 |

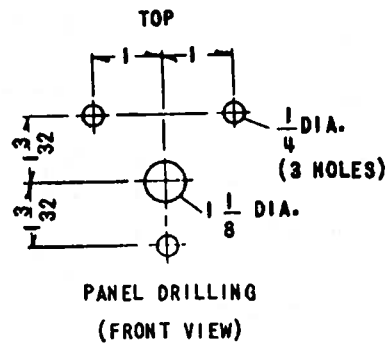
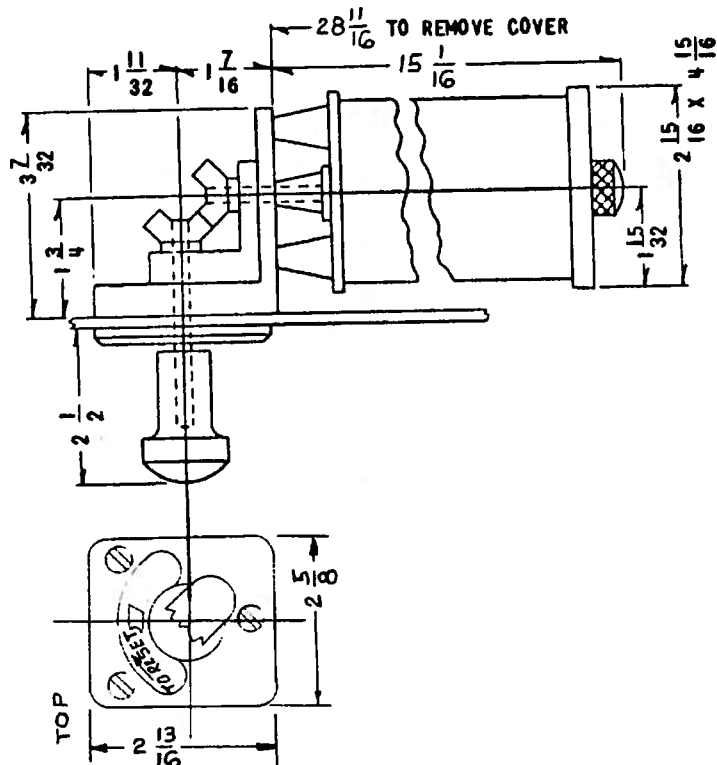


NOTE-CONTACTS 17 & 18 SHOWN IN RESET POSITION.

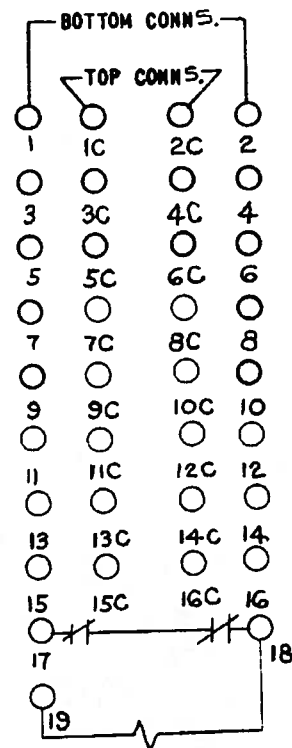
DUPLICATE OF LOST TRACING

Fig. 8 (0165A7677-4) Outline, Panel Drilling and Internal Connections for HEA61C Relay

GEH-2058



HANDLE END OF SWITCH

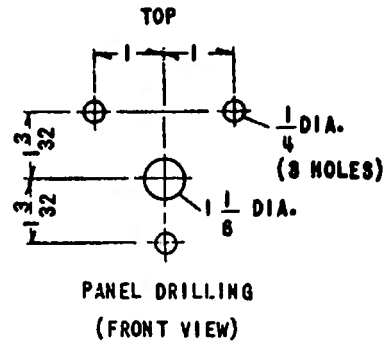
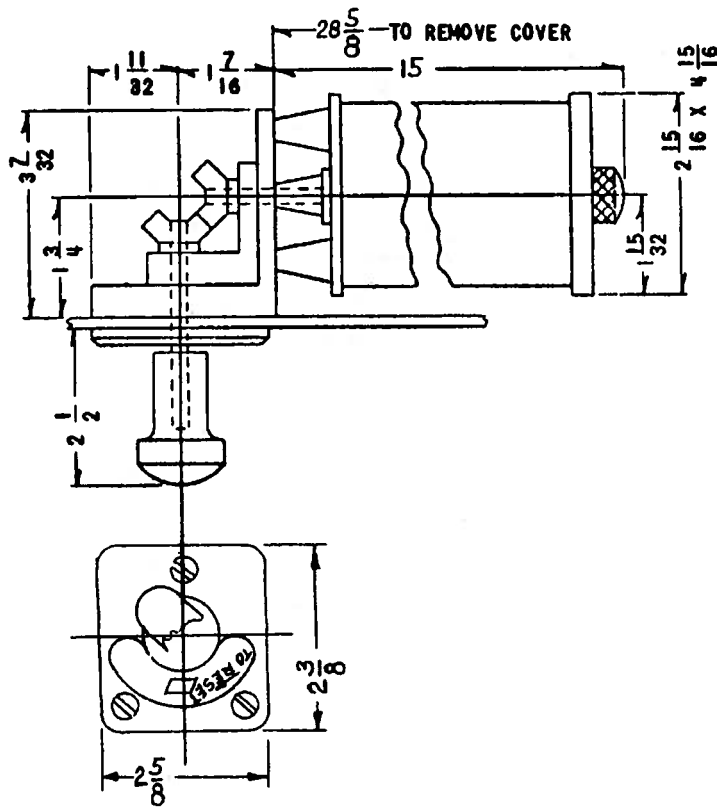


INTERNAL CONNECTIONS
NOTE-CONTACTS 17 & 18
SHOWN IN RESET
POSITION.

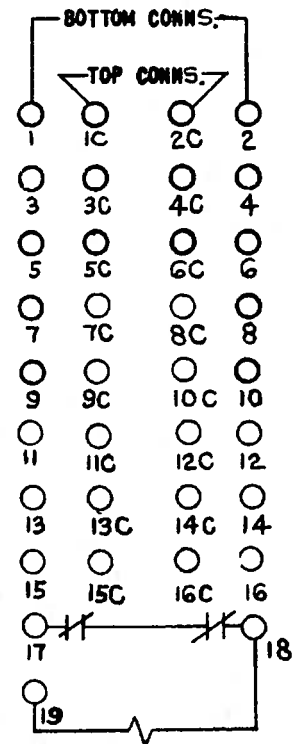
| CYCLES | RELAY FORM NUMBER | | | | | | | | CONTACT ARRANGEMENT | | |
|-------------------|-------------------|-----|-----|-----|-----|-------|-----|-----|---------------------|-----------------|----------|
| | DC | DC | DC | DC | DC | 50/60 | | DC | RESET | CLOSED POSITION | |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 115 | 460 | 230 | 275 | OPEN | CLOSED |
| MODEL 12-HEAGICRD | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 350 | 370 | NONE | 1 TO 16 |
| | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 351 | 371 | 1 | 2 TO 16 |
| | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 1 & 2 | 3 TO 16 |
| | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 353 | 373 | 1 TO 3 | 4 TO 16 |
| | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 354 | 374 | 1 TO 4 | 5 TO 16 |
| | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 355 | 375 | 1 TO 5 | 6 TO 16 |
| | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 356 | 376 | 1 TO 6 | 7 TO 16 |
| | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 357 | 377 | 1 TO 7 | 8 TO 16 |
| | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 358 | 378 | 1 TO 8 | 9 TO 16 |
| | 219 | 239 | 259 | 279 | 299 | 319 | 339 | 359 | 379 | 1 TO 9 | 10 TO 16 |
| | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 1 TO 10 | 11 TO 16 |
| | 221 | 241 | 261 | 281 | 301 | 321 | 341 | 361 | 381 | 1 TO 11 | 12 TO 16 |
| | 222 | 242 | 262 | 282 | 302 | 322 | 342 | 362 | 382 | 1 TO 12 | 13 TO 16 |
| | 223 | 243 | 263 | 283 | 303 | 323 | 343 | 363 | 383 | 1 TO 13 | 14 TO 16 |
| | 224 | 244 | 264 | 284 | 304 | 324 | 344 | 364 | 384 | 1 TO 14 | 15 TO 16 |
| | 225 | 245 | 265 | 285 | 305 | 325 | 345 | 365 | 385 | 1 TO 15 | 16 16 |
| 226 | 246 | 266 | 286 | 306 | 326 | 346 | 366 | 386 | 1 TO 16 | NONE | |

Fig. 8A (0195A9035-1) Outline, Panel Drilling and Internal Connections for Relay HEA61CRD

GEH-2058



HANDLE END OF SWITCH

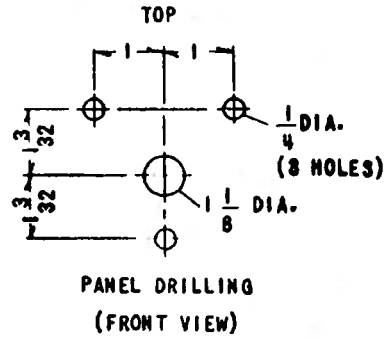
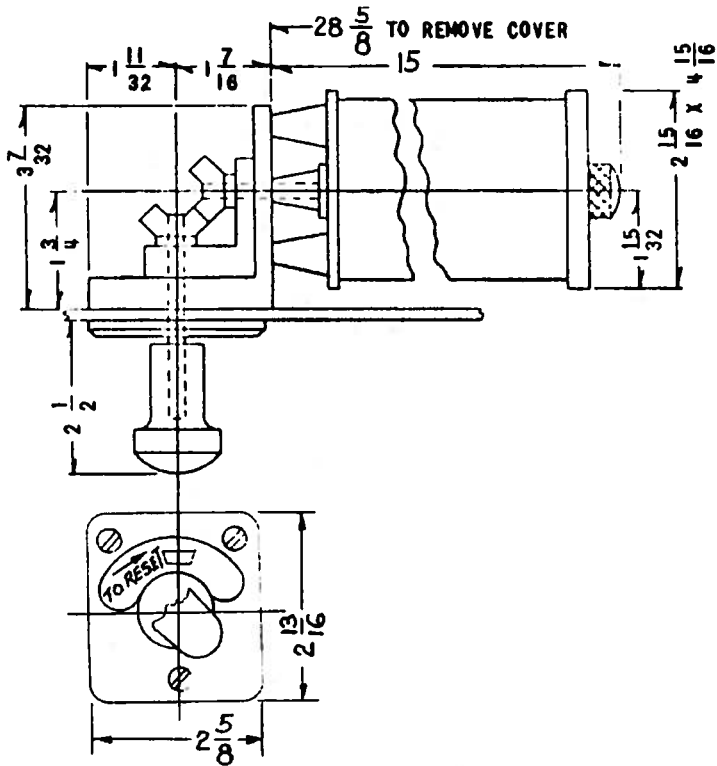


INTERNAL CONNECTIONS
NOTE - CONTACTS 17 & 18
SHOWN IN RESET
POSITION.

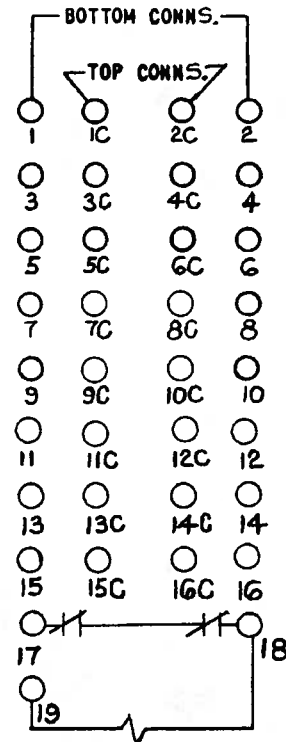
| | | RELAY FORM NUMBER | | | | | | | | CONTACT ARRANGEMENT | | |
|-------------------|-------|-------------------|-----|-----|-----|-----|-------|-----|-----|---------------------|----------|----------|
| | | DC | DC | DC | DC | DC | 50/60 | | | RESET | POSITION | |
| CYCLES | VOLTS | 250 | 125 | 48 | 24 | 220 | 115 | 460 | 230 | 275 | OPEN | CLOSED |
| MODEL 12 HEA61CRL | | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 350 | 370 | NONE | 1 TO 16 |
| | | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 351 | 371 | | 2 TO 16 |
| | | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 1 & 2 | 3 TO 16 |
| | | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 353 | 373 | 1 TO 3 | 4 TO 16 |
| | | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 354 | 374 | 1 TO 4 | 5 TO 16 |
| | | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 355 | 375 | 1 TO 5 | 6 TO 16 |
| | | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 356 | 376 | 1 TO 6 | 7 TO 16 |
| | | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 357 | 377 | 1 TO 7 | 8 TO 16 |
| | | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 358 | 378 | 1 TO 8 | 9 TO 16 |
| | | 210 | 239 | 259 | 279 | 299 | 319 | 339 | 359 | 379 | 1 TO 9 | 10 TO 16 |
| | | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 1 TO 10 | 11 TO 16 |
| | | 221 | 241 | 261 | 281 | 301 | 321 | 341 | 361 | 381 | 1 TO 11 | 12 TO 16 |
| | | 222 | 242 | 262 | 282 | 302 | 322 | 342 | 362 | 382 | 1 TO 12 | 13 TO 16 |
| | | 223 | 243 | 263 | 283 | 303 | 323 | 343 | 363 | 383 | 1 TO 13 | 14 TO 16 |
| | | 224 | 244 | 264 | 284 | 304 | 324 | 344 | 364 | 384 | 1 TO 14 | 15 TO 16 |
| | | 225 | 245 | 265 | 285 | 305 | 325 | 345 | 365 | 385 | 1 TO 15 | 16 TO 16 |
| | 226 | 246 | 266 | 286 | 306 | 326 | 346 | 366 | 386 | 1 TO 16 | NONE | |

Fig. 88 (0195A9033-1) Outline, Panel Drilling and Internal Connections for Relay HEA61CRL

GEH-2058



HANDLE END OF SWITCH

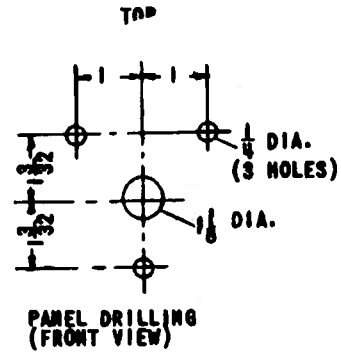
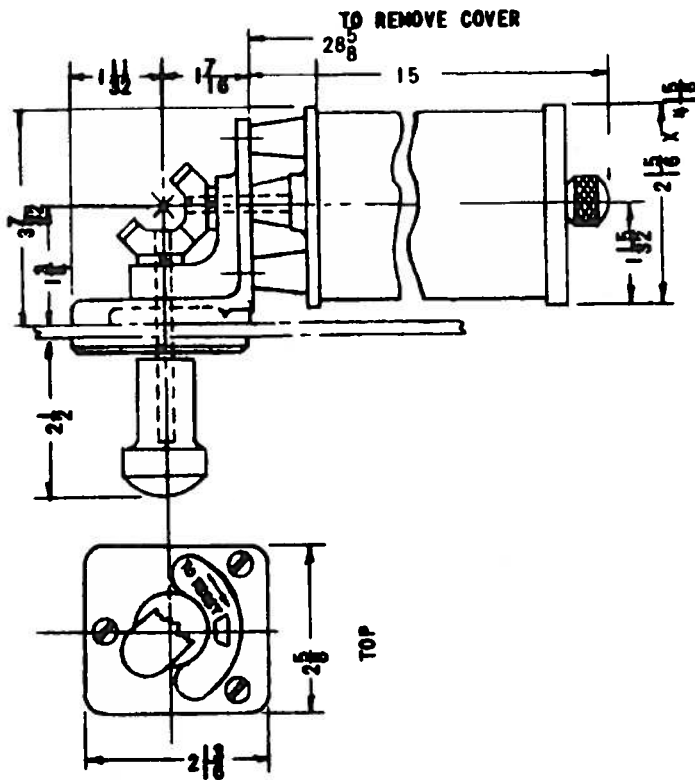


INTERNAL CONNECTIONS
NOTE - CONTACTS
17 & 18 SHOWN IN
RESET POSITION.

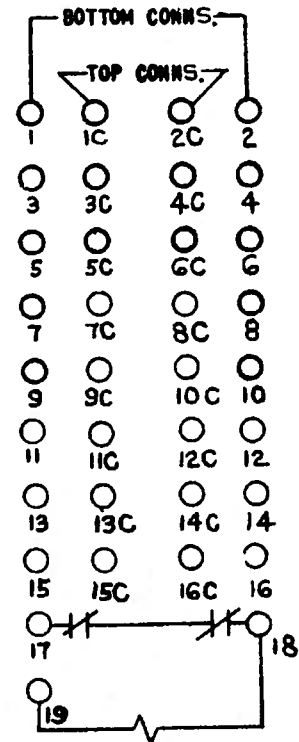
| CYCLES | RELAY FORM NUMBER | | | | | | | | CONTACT ARRANGEMENT | | |
|-------------------|-------------------|-----|-----|-----|-----|-------|-----|-----|---------------------|----------|----------|
| | DC | DC | DC | DC | DC | 50/60 | | | RESET | POSITION | |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 115 | 460 | 230 | 275 | OPEN | CLOSED |
| MODEL 12 HEAG1CRR | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 350 | 370 | NONE | 1 TO 16 |
| | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 351 | 371 | 1 | 2 TO 16 |
| | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 1 & 2 | 3 TO 16 |
| | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 353 | 373 | 1 TO 3 | 4 TO 16 |
| | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 354 | 374 | 1 TO 4 | 5 TO 16 |
| | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 355 | 375 | 1 TO 5 | 6 TO 16 |
| | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 356 | 376 | 1 TO 6 | 7 TO 16 |
| | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 357 | 377 | 1 TO 7 | 8 TO 16 |
| | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 358 | 378 | 1 TO 8 | 9 TO 16 |
| | 219 | 239 | 259 | 279 | 299 | 319 | 339 | 359 | 379 | 1 TO 9 | 10 TO 16 |
| | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 1 TO 10 | 11 TO 16 |
| | 221 | 241 | 261 | 281 | 301 | 321 | 341 | 361 | 381 | 1 TO 11 | 12 TO 16 |
| | 222 | 242 | 262 | 282 | 302 | 322 | 342 | 362 | 382 | 1 TO 12 | 13 TO 16 |
| | 223 | 243 | 263 | 283 | 303 | 323 | 343 | 363 | 383 | 1 TO 13 | 14 TO 16 |
| | 224 | 244 | 264 | 284 | 304 | 324 | 344 | 364 | 384 | 1 TO 14 | 15 TO 16 |
| | 225 | 245 | 265 | 285 | 305 | 325 | 345 | 365 | 385 | 1 TO 15 | 16 16 |
| 226 | 246 | 266 | 286 | 306 | 326 | 346 | 366 | 386 | 1 TO 16 | NONE | |

Fig. 8C (0195A9034-1) Outline, Panel Drilling and Internal Connections for Relay HEA61CRR

GEH-2058

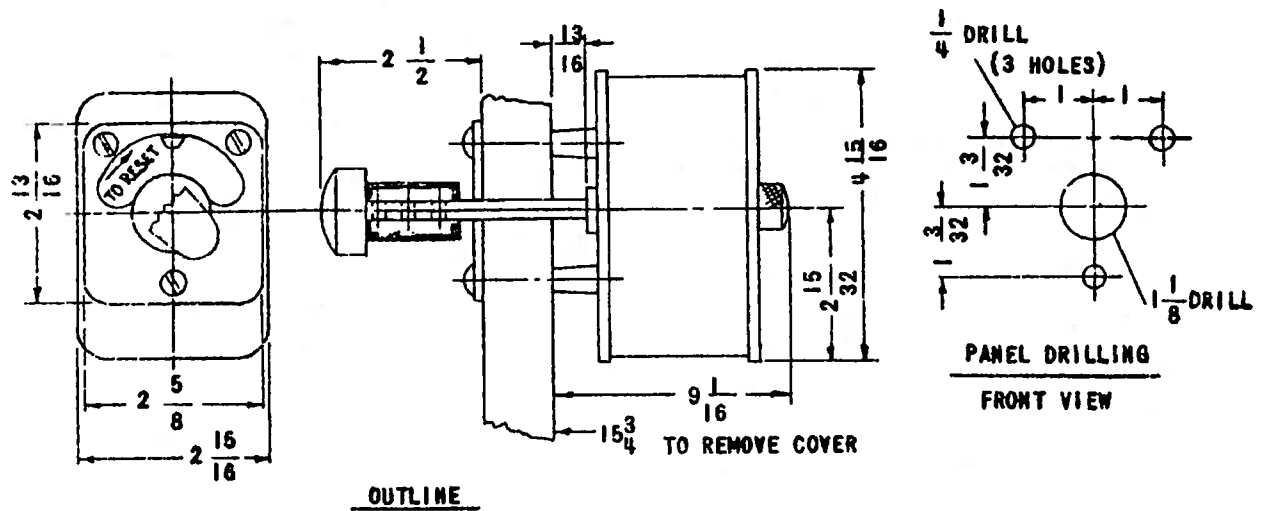


HANDLE END OF SWITCH

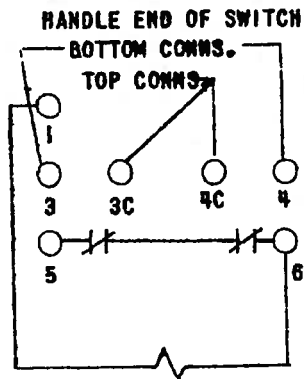


| | | RELAY FORM NUMBER | | | | | | | | CONTACT ARRANGEMENT | | |
|-------------------|-------|-------------------|-----|-----|-----|-----|-------|-----|-----|---------------------|----------|----------|
| | | DC | DC | DC | DC | DC | 50/60 | | DC | RESET | POSITION | |
| CYCLES | DC | 250 | 125 | 48 | 24 | 220 | 115 | 460 | 230 | 275 | OPEN | CLOSED |
| | VOLTS | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 350 | 370 | NONE | 1 TO 16 |
| MODEL 12 HEA61CRU | | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 351 | 371 | 1 | 2 TO 16 |
| | | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 352 | 372 | 1 & 2 | 3 TO 16 |
| | | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 353 | 373 | 1 TO 3 | 4 TO 16 |
| | | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 354 | 374 | 1 TO 4 | 5 TO 16 |
| | | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 355 | 375 | 1 TO 5 | 6 TO 16 |
| | | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 356 | 376 | 1 TO 6 | 7 TO 16 |
| | | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 357 | 377 | 1 TO 7 | 8 TO 16 |
| | | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 358 | 378 | 1 TO 8 | 9 TO 16 |
| | | 219 | 239 | 259 | 279 | 299 | 319 | 339 | 359 | 379 | 1 TO 9 | 10 TO 16 |
| | | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 1 TO 10 | 11 TO 16 |
| | | 221 | 241 | 261 | 281 | 301 | 321 | 341 | 361 | 381 | 1 TO 11 | 12 TO 16 |
| | | 222 | 242 | 262 | 282 | 302 | 322 | 342 | 362 | 382 | 1 TO 12 | 13 TO 16 |
| | | 223 | 243 | 263 | 283 | 303 | 323 | 343 | 363 | 383 | 1 TO 13 | 14 TO 16 |
| | | 224 | 244 | 264 | 284 | 304 | 324 | 344 | 364 | 384 | 1 TO 14 | 15 TO 16 |
| | | 225 | 245 | 265 | 285 | 305 | 325 | 345 | 365 | 385 | 1 TO 15 | 16 16 |
| | | 226 | 246 | 266 | 286 | 306 | 326 | 346 | 366 | 386 | 1 TO 16 | NONE |

Fig. 8D (0195A9036-0) Outline, Panel Drilling and Internal Connections for Relay HEA61CRU



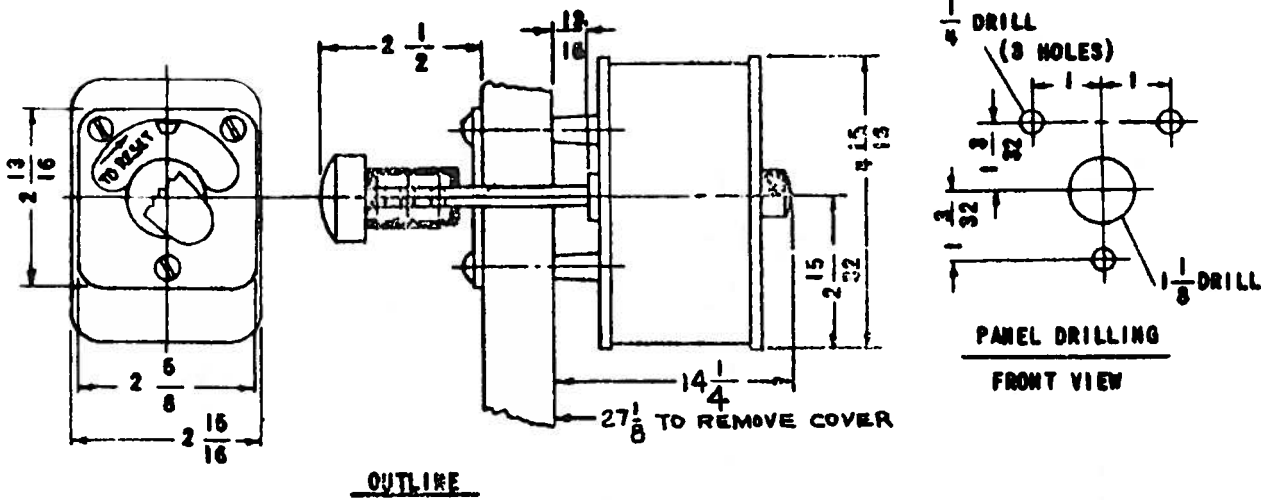
| CYCLES | RELAY FORM NUMERAL | | | | | | | | | | | | | | CONTACT ARRANGEMENT | | |
|----------|--------------------|-----|----|----|----|----|----|-----|-------|-----|-----|-------|-----|-----|---------------------|-------|----------|
| | DC | DC | DC | DC | DC | DC | DC | DC | 50/60 | 25 | DC | 50/60 | DC | | | RESET | POSITION |
| | 250 | 125 | 48 | 24 | 60 | 32 | 12 | 220 | 115 | 230 | 230 | 110 | 460 | 275 | | OPEN | CLOSED |
| MODEL | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | | 3 & 4 | NONE |
| 124EA61M | 11 | 21 | 31 | 41 | 51 | 61 | 71 | 81 | 91 | 101 | 111 | 121 | 131 | 141 | | 3 | 4 |
| | 12 | 22 | 32 | 42 | 52 | 62 | 72 | 82 | 92 | 102 | 112 | 122 | 132 | 142 | | NONE | 3 & 4 |



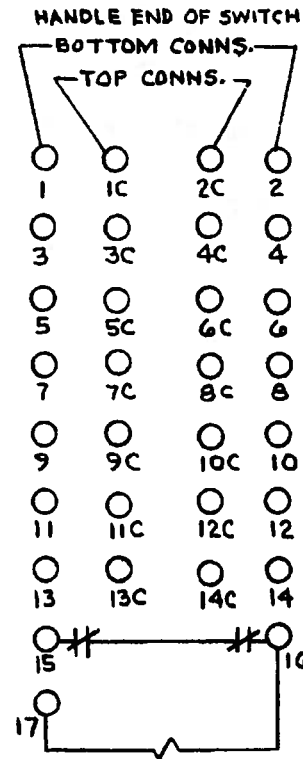
INTERNAL CONNECTIONS

NOTE-CONTACTS 5 & 6 SHOWN IN RESET POSITIONS.

Fig. 9 (0165A7681-2) Outline, Panel Drilling and Internal Connections for HEA61M Relay

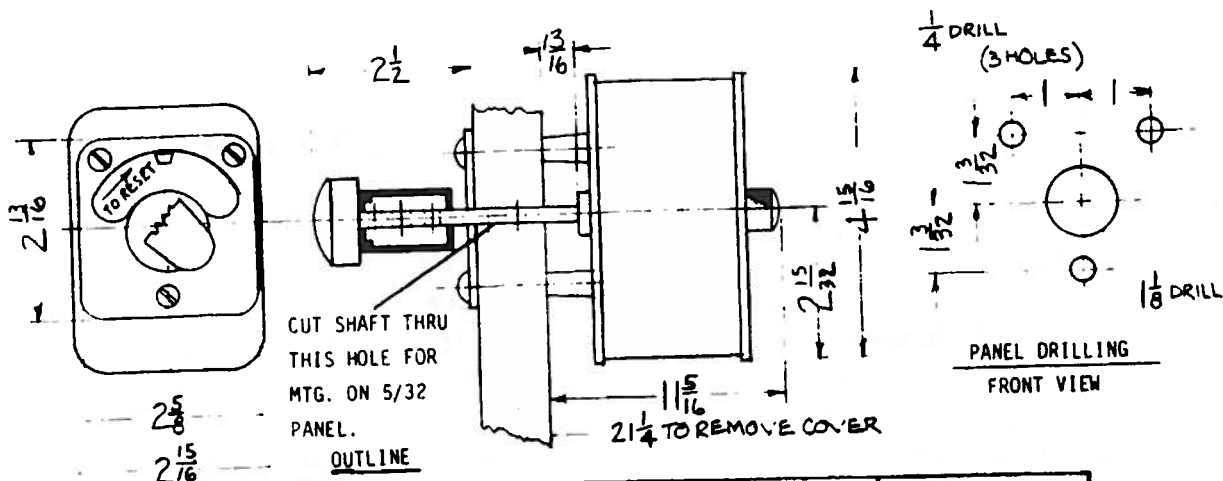


| CYCLES | RELAY FORM NUMERAL | | | | | | | | CONTACT ARRANGEMENT RESET POSITION | |
|----------------|--------------------|-----|----|----|-------|-------|-----|--|------------------------------------|----------|
| | DC | DC | DC | DC | 50/60 | 50/60 | DC | | OPEN | CLOSED |
| VOLTS | 250 | 125 | 48 | 24 | 115 | 230 | 220 | | | |
| MODEL 12HEAG1V | 10 | 30 | 50 | 70 | 90 | 110 | 130 | | NONE | 1 TO 14 |
| | 11 | 31 | 51 | 71 | 91 | 111 | 131 | | 1 | 2 TO 14 |
| | 12 | 32 | 52 | 72 | 92 | 112 | 132 | | 1 & 2 | 3 TO 14 |
| | 13 | 33 | 53 | 73 | 93 | 113 | 133 | | 1 TO 3 | 4 TO 14 |
| | 14 | 34 | 54 | 74 | 94 | 114 | 134 | | 1 TO 4 | 5 TO 14 |
| | 15 | 35 | 55 | 75 | 95 | 115 | 135 | | 1 TO 5 | 6 TO 14 |
| | 16 | 36 | 56 | 76 | 96 | 116 | 136 | | 1 TO 6 | 7 TO 14 |
| | 17 | 37 | 57 | 77 | 97 | 117 | 137 | | 1 TO 7 | 8 TO 14 |
| | 18 | 38 | 58 | 78 | 98 | 118 | 138 | | 1 TO 8 | 9 TO 14 |
| | 19 | 39 | 59 | 79 | 99 | 119 | 139 | | 1 TO 9 | 10 TO 14 |
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | | 1 TO 10 | 11 TO 14 |
| | 21 | 41 | 61 | 81 | 101 | 121 | 141 | | 1 TO 11 | 12 TO 14 |
| | 22 | 42 | 62 | 82 | 102 | 122 | 142 | | 1 TO 12 | 13 TO 14 |
| | 23 | 43 | 63 | 83 | 103 | 123 | 143 | | 1 TO 13 | 14 |
| | 24 | 44 | 64 | 84 | 104 | 124 | 144 | | 1 TO 14 | NONE |



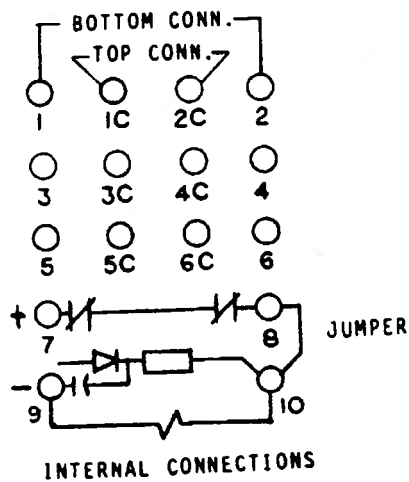
INTERNAL CONNECTIONS
 NOTE: CONTACTS 15 & 16
 SHOWN IN RESET POSITION.

Fig. 10 (0165A7686-2) Outline, Panel Drilling, and Internal Connections for Relay HEA61V



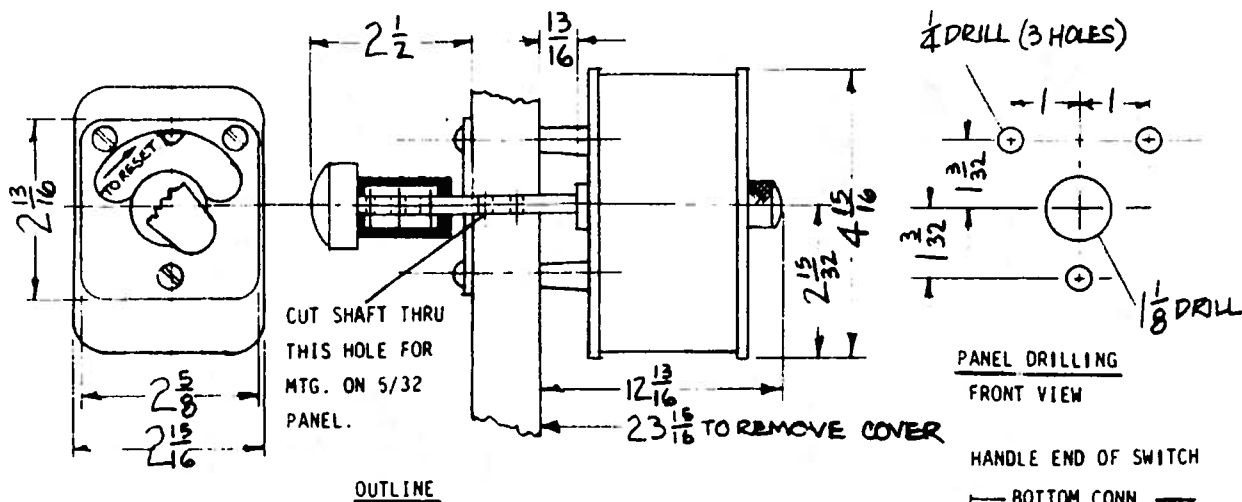
| FREQ | RELAY GROUP NUMBERS | | | | | | | | | CONTACT ARRANGEMENT RESET POSITION | |
|-----------------|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|------------------------------------|--------|
| | DC | DC | DC | DC | DC | DC | DC | DC | DC | OPEN | CLOSED |
| VOLTS | 250 | 125 | 48 | 24 | 60 | 32 | 12 | 220 | 275 | OPEN | CLOSED |
| MODEL 0165A0726 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 360 | NONE | 1 TO 6 |
| | 211 | 221 | 231 | 241 | 251 | 261 | 271 | 281 | 361 | 1 | 2 TO 6 |
| | 212 | 222 | 232 | 242 | 252 | 262 | 272 | 282 | 362 | 1 & 2 | 3 TO 6 |
| | 213 | 223 | 233 | 243 | 253 | 263 | 273 | 283 | 363 | 1 TO 3 | 4 TO 6 |
| | 214 | 224 | 234 | 244 | 254 | 264 | 274 | 284 | 364 | 1 TO 4 | 5 TO 6 |
| | 215 | 225 | 235 | 245 | 255 | 265 | 275 | 285 | 365 | 1 TO 5 | 6 |
| | 216 | 226 | 236 | 246 | 256 | 266 | 276 | 286 | 366 | 1 TO 6 | NONE |

HANDLE END OF SWITCH

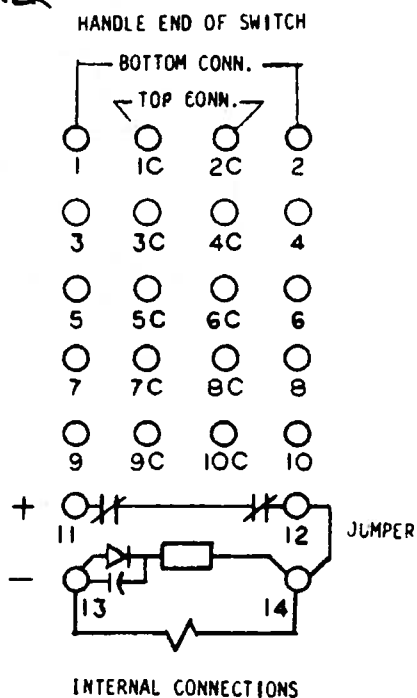


NOTE - CONTACTS 7 & 8 SHOWN IN RESET POSITION

Fig. 11 (0178A7111-4) Outline, Panel Drilling and Internal Connections for HEA62A Relay



| | | RELAY GROUP NUMBERS | | | | | | | CONTACT ARRANGEMENT RESET POSITION | |
|-----------------|-----|---------------------|-----|-----|-----|-----|-----|---------|------------------------------------|---------|
| FREQ | DC | DC | DC | DC | DC | DC | DC | DC | OPEN | CLOSED |
| VOLTS | 250 | 125 | 48 | 24 | 32 | 230 | 220 | 12 | OPEN | CLOSED |
| MODEL 0165A0727 | 210 | 230 | 250 | 270 | 290 | 310 | 330 | 430 | NONE | 1 TO 10 |
| | 211 | 231 | 251 | 271 | 291 | 311 | 331 | 431 | 1 | 2 TO 10 |
| | 212 | 232 | 252 | 272 | 292 | 312 | 332 | 432 | 1 & 2 | 3 TO 10 |
| | 213 | 233 | 253 | 273 | 293 | 313 | 333 | 433 | 1 TO 3 | 4 TO 10 |
| | 214 | 234 | 254 | 274 | 294 | 314 | 334 | 434 | 1 TO 4 | 5 TO 10 |
| | 215 | 235 | 255 | 275 | 295 | 315 | 335 | 435 | 1 TO 5 | 6 TO 10 |
| | 216 | 236 | 256 | 276 | 296 | 316 | 336 | 436 | 1 TO 6 | 7 TO 10 |
| | 217 | 237 | 257 | 277 | 297 | 317 | 337 | 437 | 1 TO 7 | 8 TO 10 |
| | 218 | 238 | 258 | 278 | 298 | 318 | 338 | 438 | 1 TO 8 | 9 TO 10 |
| | 219 | 239 | 259 | 279 | 299 | 319 | 339 | 439 | 1 TO 9 | 10 |
| 220 | 240 | 260 | 280 | 300 | 320 | 340 | 440 | 1 TO 10 | NONE | |



NOTE - CONTACTS 11 & 12 IN RESET POSITION.

Fig. 12 (0178A7112-4) Outline, Panel Drilling and Internal Connections for HEA62B Relay

GEH-2058

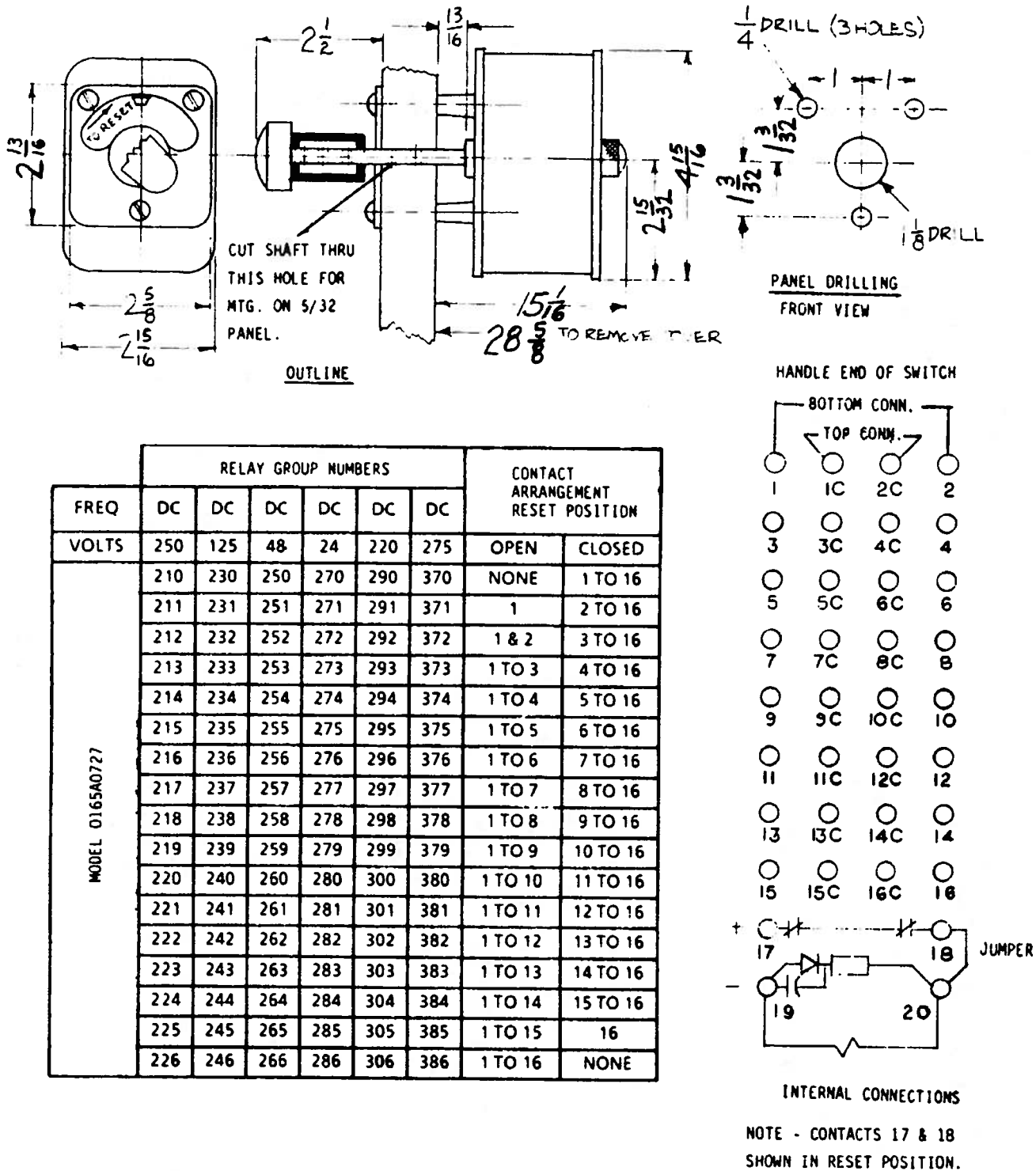
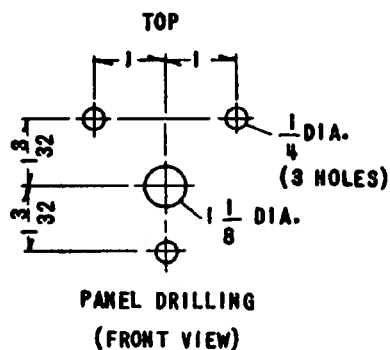
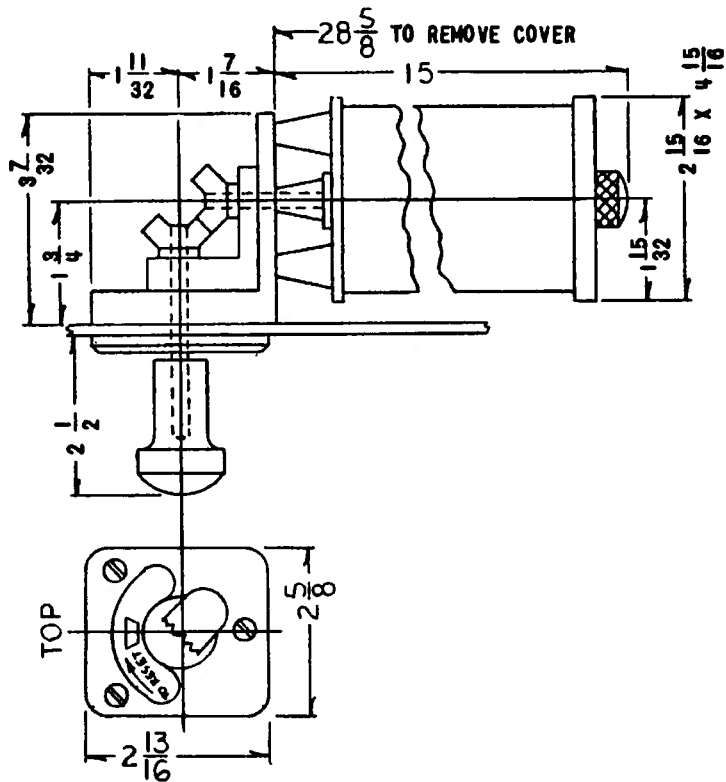
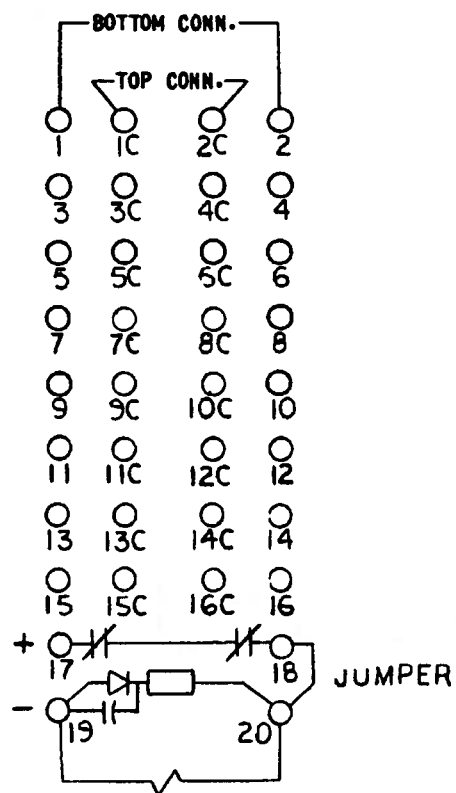


Fig. 13 (0178A7113-4) Outline, Panel Drilling and Internal Connections for HEA62C Relay

GEH-2058



HANDLE END OF SWITCH

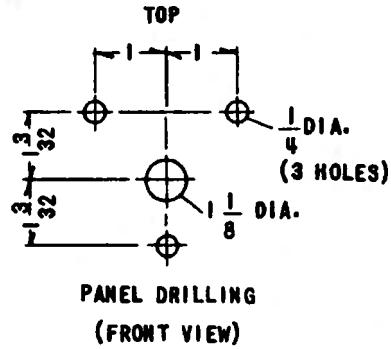
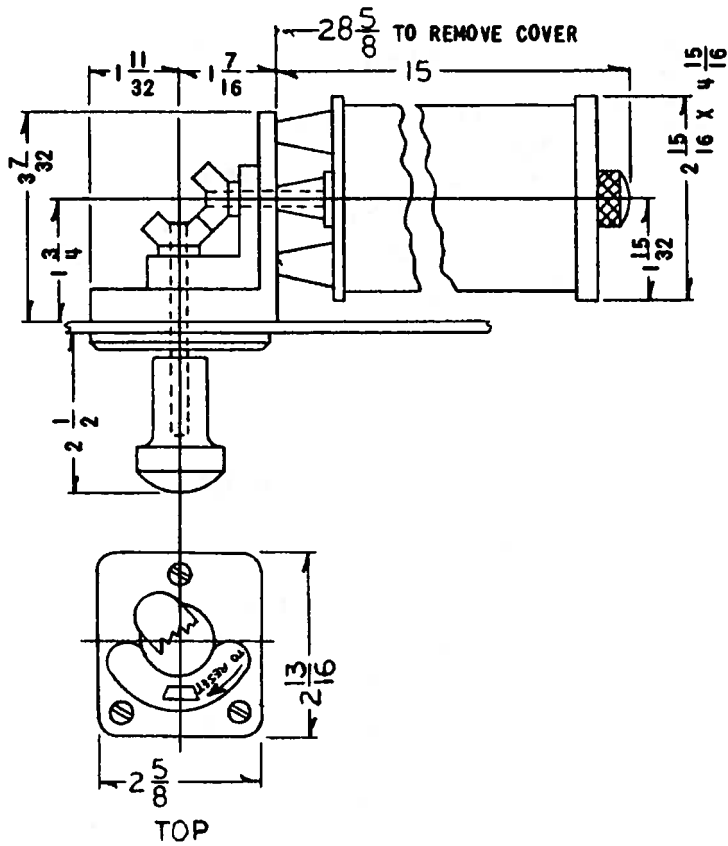


| FREQ. | RELAY GROUP NUMBER | | | | | | | CONTACT ARRANGEMENT | |
|----------------------|--------------------|-----|-----|-----|-----|-----|------|---------------------|----------|
| | DC | DC | DC | DC | DC | DC | DC | RESET | POSITION |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 275 | 62.5 | OPEN | CLOSED |
| MODEL 12HEA62 CRD | 210 | 230 | 250 | 270 | 290 | 370 | 390 | NONE | 1 TO 16 |
| | 211 | 231 | 251 | 271 | 291 | 371 | 391 | 1 | 2 TO 16 |
| | 212 | 232 | 252 | 272 | 292 | 372 | 392 | 1 & 2 | 3 TO 16 |
| | 213 | 233 | 253 | 273 | 293 | 373 | 393 | 1 TO 3 | 4 TO 16 |
| | 214 | 234 | 254 | 274 | 294 | 374 | 394 | 1 TO 4 | 5 TO 16 |
| | 215 | 235 | 255 | 275 | 295 | 375 | 395 | 1 TO 5 | 6 TO 16 |
| | 216 | 236 | 256 | 276 | 296 | 376 | 396 | 1 TO 6 | 7 TO 16 |
| | 217 | 237 | 257 | 277 | 297 | 377 | 397 | 1 TO 7 | 8 TO 16 |
| | 218 | 238 | 258 | 278 | 298 | 378 | 398 | 1 TO 8 | 9 TO 16 |
| | 219 | 239 | 259 | 279 | 299 | 379 | 399 | 1 TO 9 | 10 TO 16 |
| | 220 | 240 | 260 | 280 | 300 | 380 | 400 | 1 TO 10 | 11 TO 16 |
| | 221 | 241 | 261 | 281 | 301 | 381 | 401 | 1 TO 11 | 12 TO 16 |
| | 222 | 242 | 262 | 282 | 302 | 382 | 402 | 1 TO 12 | 13 TO 16 |
| | 223 | 243 | 263 | 283 | 303 | 383 | 403 | 1 TO 13 | 14 TO 16 |
| | 224 | 244 | 264 | 284 | 304 | 384 | 404 | 1 TO 14 | 15 & 16 |
| | 225 | 245 | 265 | 285 | 305 | 385 | 405 | 1 TO 15 | 16 |
| | 226 | 246 | 266 | 286 | 306 | 386 | 406 | 1 TO 16 | NONE |

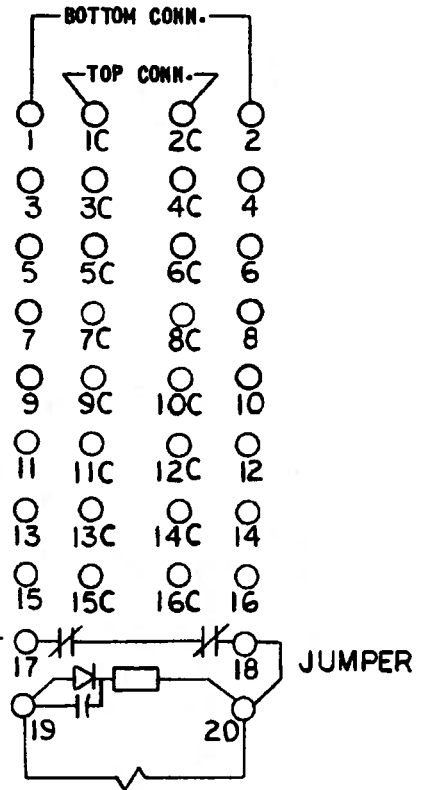
INTERNAL CONNECTIONS
NOTE-CONTACTS 17 & 18
SHOWN IN RESET
POSITION

Fig. 13A (0246A2251-1) Outline, Panel Drilling and Internal Connections for Relay HEA62CRD

GEH-2058



HANDLE END OF SWITCH

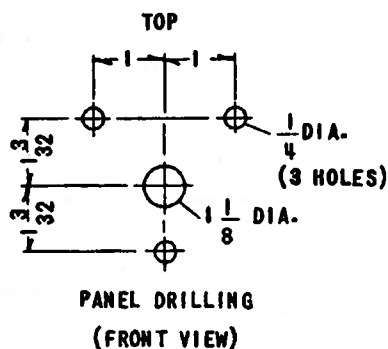
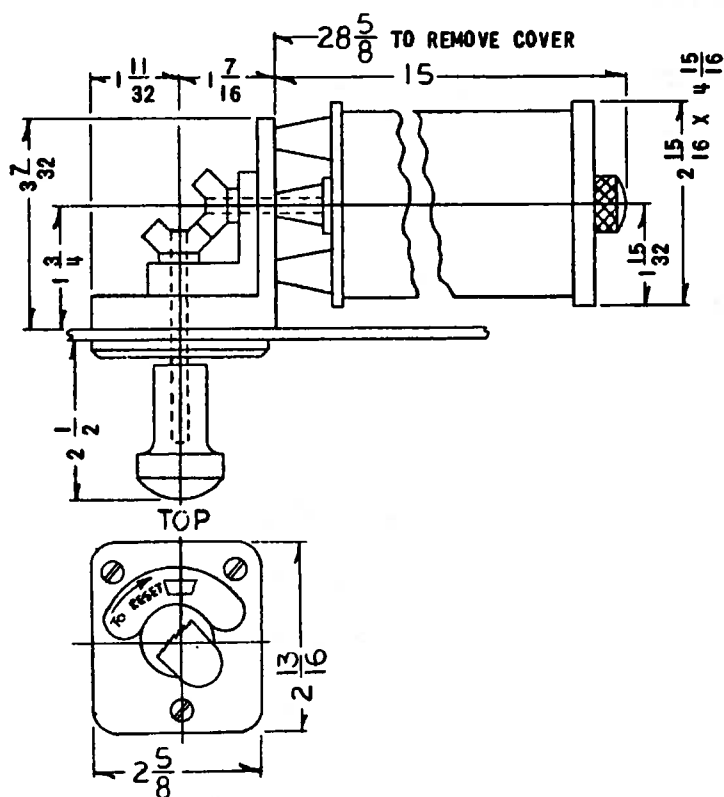


| FREQ. | RELAY GROUP NUMBER | | | | | | | CONTACT ARRANGEMENT | |
|---------------------|--------------------|-----|-----|-----|-----|-----|---------|---------------------|----------|
| | DC | DC | DC | DC | DC | DC | DC | RESET | POSITION |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 275 | 62.5 | OPEN | CLOSED |
| MODEL 12HEA62CRL | 210 | 230 | 250 | 270 | 290 | 370 | 390 | NONE | 1 TO 16 |
| | 211 | 231 | 251 | 271 | 291 | 371 | 391 | 1 | 2 TO 16 |
| | 212 | 232 | 252 | 272 | 292 | 372 | 392 | 1 & 2 | 3 TO 16 |
| | 213 | 233 | 253 | 273 | 293 | 373 | 393 | 1 TO 3 | 4 TO 16 |
| | 214 | 234 | 254 | 274 | 294 | 374 | 394 | 1 TO 4 | 5 TO 16 |
| | 215 | 235 | 255 | 275 | 295 | 375 | 395 | 1 TO 5 | 6 TO 16 |
| | 216 | 236 | 256 | 276 | 296 | 376 | 396 | 1 TO 6 | 7 TO 16 |
| | 217 | 237 | 257 | 277 | 297 | 377 | 397 | 1 TO 7 | 8 TO 16 |
| | 218 | 238 | 258 | 278 | 298 | 378 | 398 | 1 TO 8 | 9 TO 16 |
| | 219 | 239 | 259 | 279 | 299 | 379 | 399 | 1 TO 9 | 10 TO 16 |
| | 220 | 240 | 260 | 280 | 300 | 380 | 400 | 1 TO 10 | 11 TO 16 |
| | 221 | 241 | 261 | 281 | 301 | 381 | 401 | 1 TO 11 | 12 TO 16 |
| | 222 | 242 | 262 | 282 | 302 | 382 | 402 | 1 TO 12 | 13 TO 16 |
| | 223 | 243 | 263 | 283 | 303 | 383 | 403 | 1 TO 13 | 14 TO 16 |
| | 224 | 244 | 264 | 284 | 304 | 384 | 404 | 1 TO 14 | 15 & 16 |
| | 225 | 245 | 265 | 285 | 305 | 385 | 405 | 1 TO 15 | 16 |
| 226 | 246 | 266 | 286 | 306 | 386 | 406 | 1 TO 16 | NONE | |

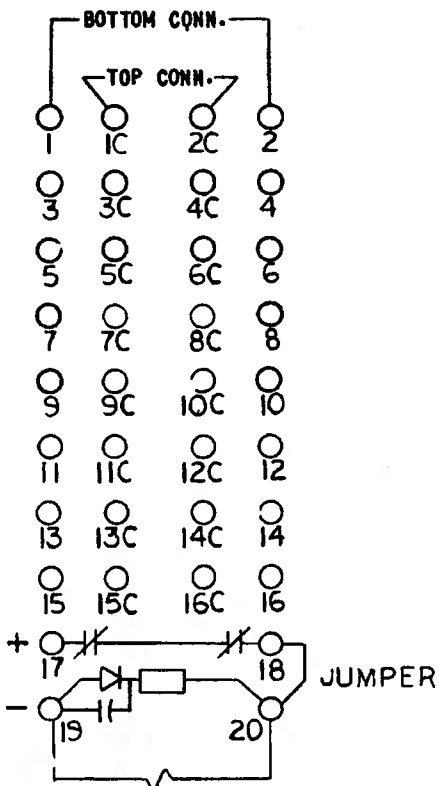
INTERNAL CONNECTIONS
NOTE-CONTACT 17 & 18
SHOWN IN RESET
POSITION

Fig. 13B (0246A2252-1) Outline, Panel Drilling and Internal Connections for Relay HEA62CRL

GEH-2058



HANDLE END OF SWITCH

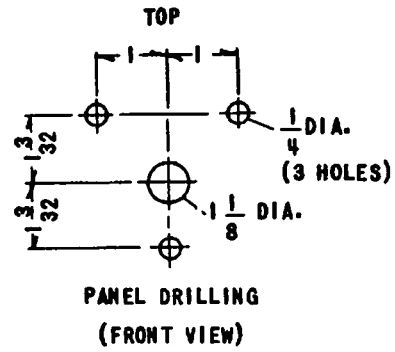
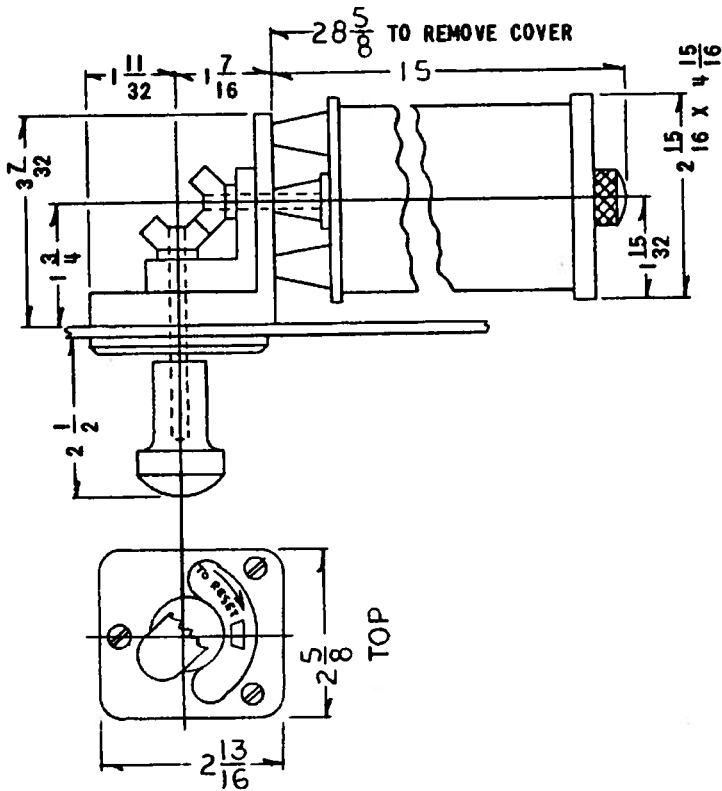


| FREQ. | RELAY GROUP NUMBER | | | | | | | CONTACT ARRANGEMENT | |
|---------------------|--------------------|-----|-----|-----|-----|-----|---------|---------------------|----------|
| | DC | DC | DC | DC | DC | DC | DC | RESET | POSITION |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 275 | 62.5 | OPEN | CLOSED |
| MODEL 12HEA62CRR | 210 | 230 | 250 | 270 | 290 | 370 | 390 | NONE | 1 TO 16 |
| | 211 | 231 | 251 | 271 | 291 | 371 | 391 | 1 | 2 TO 16 |
| | 212 | 232 | 252 | 272 | 292 | 372 | 392 | 1 & 2 | 3 TO 16 |
| | 213 | 233 | 253 | 273 | 293 | 373 | 393 | 1 TO 3 | 4 TO 16 |
| | 214 | 234 | 254 | 274 | 294 | 374 | 394 | 1 TO 4 | 5 TO 16 |
| | 215 | 235 | 255 | 275 | 295 | 375 | 395 | 1 TO 5 | 6 TO 16 |
| | 216 | 236 | 256 | 276 | 296 | 376 | 396 | 1 TO 6 | 7 TO 16 |
| | 217 | 237 | 257 | 277 | 297 | 377 | 397 | 1 TO 7 | 8 TO 16 |
| | 218 | 238 | 258 | 278 | 298 | 378 | 398 | 1 TO 8 | 9 TO 16 |
| | 219 | 239 | 259 | 279 | 299 | 379 | 399 | 1 TO 9 | 10 TO 16 |
| | 220 | 240 | 260 | 280 | 300 | 380 | 400 | 1 TO 10 | 11 TO 16 |
| | 221 | 241 | 261 | 281 | 301 | 381 | 401 | 1 TO 11 | 12 TO 16 |
| | 222 | 242 | 262 | 282 | 302 | 382 | 402 | 1 TO 12 | 13 TO 16 |
| | 223 | 243 | 263 | 283 | 303 | 383 | 403 | 1 TO 13 | 14 TO 16 |
| | 224 | 244 | 264 | 284 | 304 | 384 | 404 | 1 TO 14 | 15 & 16 |
| | 225 | 245 | 265 | 285 | 305 | 385 | 405 | 1 TO 15 | 16 |
| 226 | 246 | 266 | 286 | 306 | 386 | 406 | 1 TO 16 | NONE | |

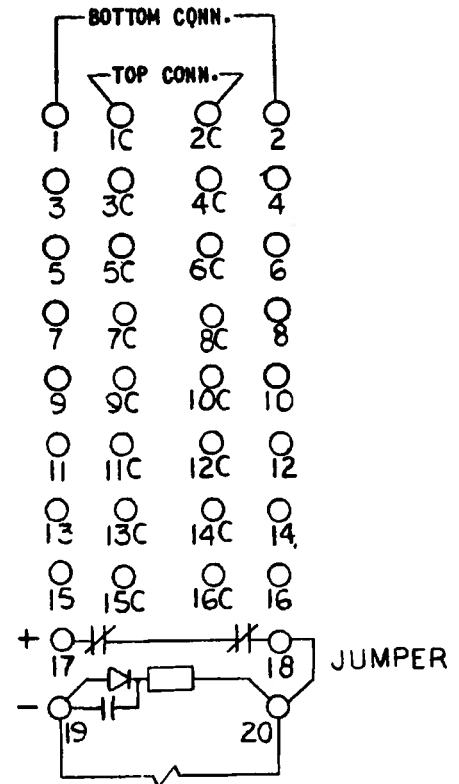
INTERNAL CONNECTIONS
NOTE-CONTACT 17 & 18
SHOWN IN RESET
POSITION.

Fig. 13C (0246A2253-1) Outline, Panel Drilling and Internal Connections for Relay HEA62CRR

GEH-2058



HANDLE END OF SWITCH



| FREQ. | RELAY GROUP NUMBER | | | | | | | | CONTACT ARRANGEMENT | |
|---------------------|--------------------|-----|----|-----|-----|-----|------|-------|---------------------|--------|
| | DC | DC | DC | DC | DC | DC | DC | RESET | POSITION | |
| | | | | | | | | | OPEN | CLOSED |
| VOLTS | 250 | 125 | 48 | 24 | 220 | 275 | 62.5 | NONE | 1 TO 16 | |
| MODEL 12HEA62CRU | 21 | 02 | 30 | 250 | 270 | 290 | 370 | 390 | 1 TO 16 | |
| | 21 | 11 | 23 | 125 | 127 | 129 | 137 | 139 | 1 TO 16 | |
| | 21 | 22 | 23 | 25 | 27 | 29 | 37 | 39 | 1 & 2 TO 16 | |
| | 21 | 32 | 33 | 253 | 273 | 293 | 373 | 393 | 1 TO 3 TO 4 TO 16 | |
| | 21 | 42 | 34 | 254 | 274 | 294 | 374 | 394 | 1 TO 4 TO 5 TO 16 | |
| | 21 | 52 | 35 | 255 | 275 | 295 | 375 | 395 | 1 TO 5 TO 6 TO 16 | |
| | 21 | 62 | 36 | 256 | 276 | 296 | 376 | 396 | 1 TO 6 TO 7 TO 16 | |
| | 21 | 72 | 37 | 257 | 277 | 297 | 377 | 397 | 1 TO 7 TO 8 TO 16 | |
| | 21 | 82 | 38 | 258 | 278 | 298 | 378 | 398 | 1 TO 8 TO 9 TO 16 | |
| | 21 | 92 | 39 | 259 | 279 | 299 | 379 | 399 | 1 TO 9 TO 10 TO 16 | |
| | 22 | 02 | 40 | 260 | 280 | 300 | 380 | 400 | 1 TO 10 TO 11 TO 16 | |
| | 22 | 12 | 41 | 261 | 281 | 301 | 381 | 401 | 1 TO 11 TO 12 TO 16 | |
| | 22 | 22 | 42 | 262 | 282 | 302 | 382 | 402 | 1 TO 12 TO 13 TO 16 | |
| | 22 | 32 | 43 | 263 | 283 | 303 | 383 | 403 | 1 TO 13 TO 14 TO 16 | |
| | 22 | 42 | 44 | 264 | 284 | 304 | 384 | 404 | 1 TO 14 TO 15 & 16 | |
| | 22 | 52 | 45 | 265 | 285 | 305 | 385 | 405 | 1 TO 15 TO 16 | |
| | 22 | 62 | 46 | 266 | 286 | 306 | 386 | 406 | 1 TO 16 NONE | |

INTERNAL CONNECTIONS
NOTE-CONTACTS 17 & 18
SHOWN IN RESET
POSITION

Fig. 13D (0246A2250-1) Outline, Panel Drilling and Internal Connections for Relay HEA62CRU



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