INSTRUCTIONS

GEK- 36767

INSTANTANEOUS D.C. UNDERVOLTAGE RELAY

TYPE PJV

MODEL 12PJV11BK(-)E

GENERAL ELECTRIC

CONTENTS

DESCRIPTION

The PJV11BK relay is a DC operated single unit instantaneous undervoltage device. It is intended for application on D.C. systems to detect short circuits that reduce the system voltage below the drop out setting on the relay. The PJV11BK relay comes in an SI-E non-drawout case. However, the standard plug is available which permits disconnection of the contact circuits from the front of the relay. The outline and mounting dimensions for the relay are given in Figure 3. The outline for the external resistor that is required and furnished with the relay is given in Figure 8. The internal connection diagram is shown in Figure 2.

APPLICATION

The PJV11BK relay is designed to provide high speed undervoltage detection on D.C. systems. The coil circuit of this relay should be connected to the portion of the D.C. system being monitored without regard to polarity. The contacts should be used to initiate the desired action on low voltage. When applying this relay, Table 3 should be consulted to insure that the relay will pick-up for normal system voltage when it is set to drop out at the desired value.

RATINGS AND BURDENS

CONTACT RATINGS

The contacts are rated at 5 amperes for continuous duty and at 30 amperes for tripping duty. The interrupting ratings are given in Table 1.

TABLE 1

INTERRUPTING RATINGS

AC VOLTS	AMPS	
	INDUCTIVE	NON-INDUCTIVE
115	2	5
230	1	2
460	0.5	1

DC VOLTS	AMPS	
	INDUCTIVE	NON-INDUCTIVE
24	1.0	5
48	0.5	2
125	0.3	1
250	0.15	0.3

COIL CIRCUIT RATINGS AND BURDENS

These relays are supplied with an external resistor which is to be wired in series with the operating coil. Ratings and burdens given for this relay are for the operating coil wired in series with the external resistor. Table 2 gives the continuous voltage rating, calibrating range, burden, external resistor resistance, and operating coil resistance for these relays.

TABLE 2

RATING VOLTS DC	CAL. RANGE DROPOUT VOLTS	BURDEN WATTS AT RATED VOLTS	COIL OHMS	EXTERNAL RESISTOR OHMS
700	280 - 580	67	345	7000

CHARACTERISTICS

OPERATING PRINCIPLES

These plunger relays operate on the principle of electromagnetic attraction. The contacts are opened or closed by an armature which is drawn up vertically into a solenoid.

An external resistor is included as part of these relays to be connected in series with the operating coil. This external resistor has a resistance that is much higher than that of the operating coil. This type of circuit prevents self heating and variations in ambient temperature from having an appreciable effect on relay operating voltage. The high resistor value makes changes in operating coil resistance with temperature insignificant in terms of the total circuit resistance.

PICKUP AND DROPOUT DEFINITIONS

Pickup voltage is defined as the voltage at which the normally open contacts will close when gradually increasing voltage is applied to the relay. Dropout voltage is the voltage at which the normally closed contacts will close when the applied voltage is gradually decreased from some level of voltage above pickup voltage. Reset voltage is the voltage at which the relay will assume its de-energized position. A normally open contact defined as a contact which is open when the relay is completely de-energized.

RELAY CALIBRATION

These relays are calibrated at the factory for dropout volts. Table 2 shows the calibrating ranges for the various operating coil - external resistor combinations used in these relays. Dropout is set by adjusting the vertical position of the armature on the plunger rod. The four factory dropout voltage calibrations appear on the top of the nameplate and correspond to the scribed marks on the calibrating tube.

To set the relay to dropout at one of the factory calibrated voltages, the adjustable armature should be set so that its bottom edge just lines with the corresponding scribed marking with the relay plunger in its de-energized position. The scribed mark highest on the calibrating tube (closest to the coil) corresponds to the lowest dropout voltage calibration listed on the nameplate and so on. The factory dropout calibrations are the voltage ±5 percent at which the relay will dropout when the applied voltage is gradually reduced.

When these relays are properly adjusted, they will dropout in one smooth motion to the reset position. That is, with applied voltage gradually reduced, the relay will reset within two percent of the voltage at which the normally open contacts open.

PICKUP VOLTAGE

Dropout voltage and pickup voltage are not independently adjustable. The relays will pickup at a percentage of dropout voltage that is a function of the dropout voltage setting. For D.C. operated relays with two normally open or one normally open and one normally closed contact, pickup will occur at some voltage which is less than 145 percent of set dropout voltage.

This percentage will decrease as the dropout voltage setting is increased as shown in table 3.

TABLE 3

PICKUP VOLTAGE AS A FUNCTION OF DROPOUT VOLTAGE SETTING
FOR RELAYS WITH 2 N.O. OR 1 N.O. AND 1 N.C. CONTACT

VOLTAGE RATING	DROPOUT VOLTAGE CALIBRATION POINTS	PICKUP VOLTAGE AT CALIBRATION POINT MAXIMUM	PICKUP VOLTAGE AT CALIBRATION POINT TYPICAL
700	280	415	350
	380	530	450
	480	620	540
	580	680	650

For relays with two normally closed contacts, pickup will be approximately 160 percent of set dropout voltage.

DROPOUT TIME

Figure 4 shows a typical dropout time characteristic curve for these relays. Figure 5 shows a typical pickup time curve.

CONSTRUCTION

PLUNGER UNIT

All of the PJV relays are of the same plunger type construction. (Refer to Fig. 6). The adjustable armature is mounted on the threaded portion of a plunger rod which carries the moving contacts upward as the armature is operated. The armature is drawn upward into the coil by the flux created in the rectangular magnet frame and a cylindrical pole piece inside the coil. Guides for the plunger rod are provided at the top by a hole in the pole piece, and at the bottom by the fit of the molded contact carrier inside the calibration tube. Openings in the sides of the calibration tube allow access to the armature to adjust pickup. The normally closed fixed contacts are similar to the normally open fixed contacts except they are mounted below the moving contact instead of above it, and the backstop arm is omitted.

OUTLINE DIAGRAM AND INTERNAL CONNECTIONS DIAGRAM

Figure 2 of this instruction book shows the internal connections diagram for the PJV11BK relay. Figure 4 shows the outline and panel drilling diagram. Figure 8 shows the outline of the external resistor.

CASE

The case for the PJV11BK relay has two special high voltage studs which connect directly to the operating coil. These insulated studs pass directly through the rear of the case. The relay cannot be drawn out of its case without removing the connections to and dis-assembling these high voltage studs.

The contact circuits of the relay are brought out through the standard case studs labeled one through ten on the internal connections and the outline diagram.

The electrical connections between the case studs and the cradle mounted relay unit are made through spring backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The contact circuits are disconnected when this plug is removed, but the operating coil is not disconnected by removing this plug.

Figure 7 shows the high voltage stud assembly which connects to the operating coil. This assembly consists of two threaded studs which are mounted on a compound plate attached to the cradle. Each threaded stud is surrounded by two insulating brushings, one inside the case and one outside the case. The bushing that fits through from outside the case passes entirely through the inside diameter of the bushing that is inside the case.

The diameter of the portion of the bushing that is outside the case is such that the cradle cannot be drawn out without first disconnecting the leads to the high voltage studs and then pulling the insulating bushings off of the studs.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit. This cradle is held firmly in the case with a latch at the top and the bottom and by a guide pinat the back of the case. The cases and cradles 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 thumbscrews, holds the connecting plug in place.

To draw out the relay unit the cover is first removed, and the connecting plug drawn out. The external connections to the high voltage studs are then disconnected and the insulating bushings are then pulled off the rear of the studs. The relay unit can then be easily drawn out after the latches have been released. To replace the relay unit, the reverse order is followed making certain that the insulating bushings have been replaced on the high voltage studs. These bushings do not allow the removal of the relay unit with the external connections intact.

The case is suitable for either surface or semi-flush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case. Each cover screw has provision for a sealing wire.

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 Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay in order that none of the parts are injured 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

Immediately upon receipt of a relay an inspection and acceptance test should be made to insure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed.

VISUAL INSPECTION

Check that the nameplate stamping to insure that the model number, rating and calibration range of the relay received agree with the requisition.

Examine the relay by visual inspection that there are no broken or cracked molded parts or other signs of physical damage, and that all screws are tight. Also check to see that the flexible moving contact leads extend striaght back from the contacts and have not been deformed.

MECHANICAL INSPECTION

It is recommended that the following mechanical adjustments be checked:

1. Operate the plunger on each unit by hand and allow it to reset to insure that the unit is free from friction or binds. If two normally open contacts are present, observe that with one contact just making there is less than 1/64 inch gap on the other contact.

2. The wipe on a normally open or closed contact should be approximately 3/64 inch. The normally open contact gap with the armature fully reset should be approximately 3/32 inch for either contact arrangement. Backstops should be present above all normally open contacts only. The gap between the backstop and contact brush at the tip should be approximately 1/16 with the armature reset.

ELECTRICAL TESTS

1. DROPOUT AND PICKUP - The units are normally supplied from the factory with the bottom of the armature aligned with the top mark on the calibration tube. This corresponds to the minimum dropout calibration point given on the nameplate. It should be sufficient to check dropout and pickup of each unit at this setting.

To test the relay for proper operation, it is preferable to connect the relay in series with the external resistor to a variable D.C. supply. A contact indicating light or ohmmeter connected to a normally open contact will indicate on pick-up. Similarly, an indication on a normally-closed contact indicates drop-out when the voltage is lowered from the picked-up condition. Reset must be checked visually.

To simply check for operation but not for calibration, a D.C. supply of not over 35 volts can be connected directly to the relay without the resistor.

Check for smooth operation of plunger when operating the relay.

INSTALLATION PROCEDURE

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 on a vertical surface. The outline and panel diagram is shown in Figure 3. The outline diagram for the external resistor is shown in Figure 8.

CONNECTIONS

Internal connection diagram is shown in Figure 2.

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.

ADJUSTMENTS

The plunger unit should be manually operated to make sure that the assembly is working smoothly and not binding.

It is desirable that the final setting of the required dropout voltage be performed with the relay in its case and mounted in its permanent location and with the relay wired to the external resistor with which it will be used.

The required dropout voltage may be set as follows. With the relay de-energized turn the bottom of the knurled armature to the approximate position on the tube corresponding to the desired dropout setting. With a variable source of D.C. voltage apply sufficient voltage to the relay to pick it up. Gradually decrease the applied voltage and note the voltage at which the relay drops out.

If dropout is too low, turn the armature to ride lower in the calibrating tube; if dropout is too high, turn the armature to ride lower. Once dropout voltage is set, check pickup voltage by gradually increasing the applied voltage with the unit dropped out. Pickup voltage should be as described in the Characteristics section.

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. Unless otherwise dictated by unusual environmental conditions, it is recommended that the following points be checked at an interval of from one to two years.

MECHANICAL CHECKS

Manually operate the voltage unit armature and allow it to reset to make sure that there is no excessive friction or tendency to bind.

Check to see that the contacts have approximately 3/64 inch wipe and that the normally open contact gap is approximately 3/32 inch with the armature reset. Check to see that the back stops on the normally open contact are approximately 1/16 inch above the stationary contact tips.

Examine the contact surfaces for signs of tarnishing or corrosion. Silver contacts should be cleaned with a burnishing tool, which consists of a flexible strip of metal, with an etched, roughened surface. Burnishing tools designed especially for cleaning relay contacts can be obtained from the factory. Do not use knives, files or abrasive paper or cloth of any kind to clean relay contacts.

ELECTRICAL CHECKS

Check the dropout and pickup voltage of the relay as described in the installation section.

It is not recommended that the relay be readjusted when minor setting variations from the previous that are noted, as long as the relay is still within limits. Such deviation can be introduced by differences in test equipment or by human error.

SERVICING

1. Friction - If there is any tendency to bind or excessive friction is present, check to see that the armature does not have a tendency to rotate and bind as the relay operates. If it does, the flexible leads to the moving contacts are not formed properly. Also check that no foreign matter is present between the armature and calibrating tube.

2. Moving Contact Leads - The flexible moving contact leads should be formed to keep the moving assembly centrally located. If these moving contact leads have been deformed, they should be reshaped as follows:

   The lead should have a right angle bend when it leaves the tail of the moving contact button. This bend should be vertical with the lead going down for a normally open contact and up for a normally closed contact. The lead should then flow in a smooth arc to the terminal screw on the molded base. The whole lead should lie in a vertical plane and not blow out horizontally. Binding will stop when the leads are formed correctly providing the relay is not binding due to foreign matter or bent moving parts.

3. See the acceptance tests and installation sections for contact gap and wipe adjustments. Gaps and wipes are adjusted by forming or bending the stationary contacts.

4. Fixed Contact Initial Tension

   The stationary contact normally rests on a member called the contact stop arm. Initial tension is the face applied to the contact tip which is necessary to part the contact from its stop arm. This face may be measured with a gram gauge.

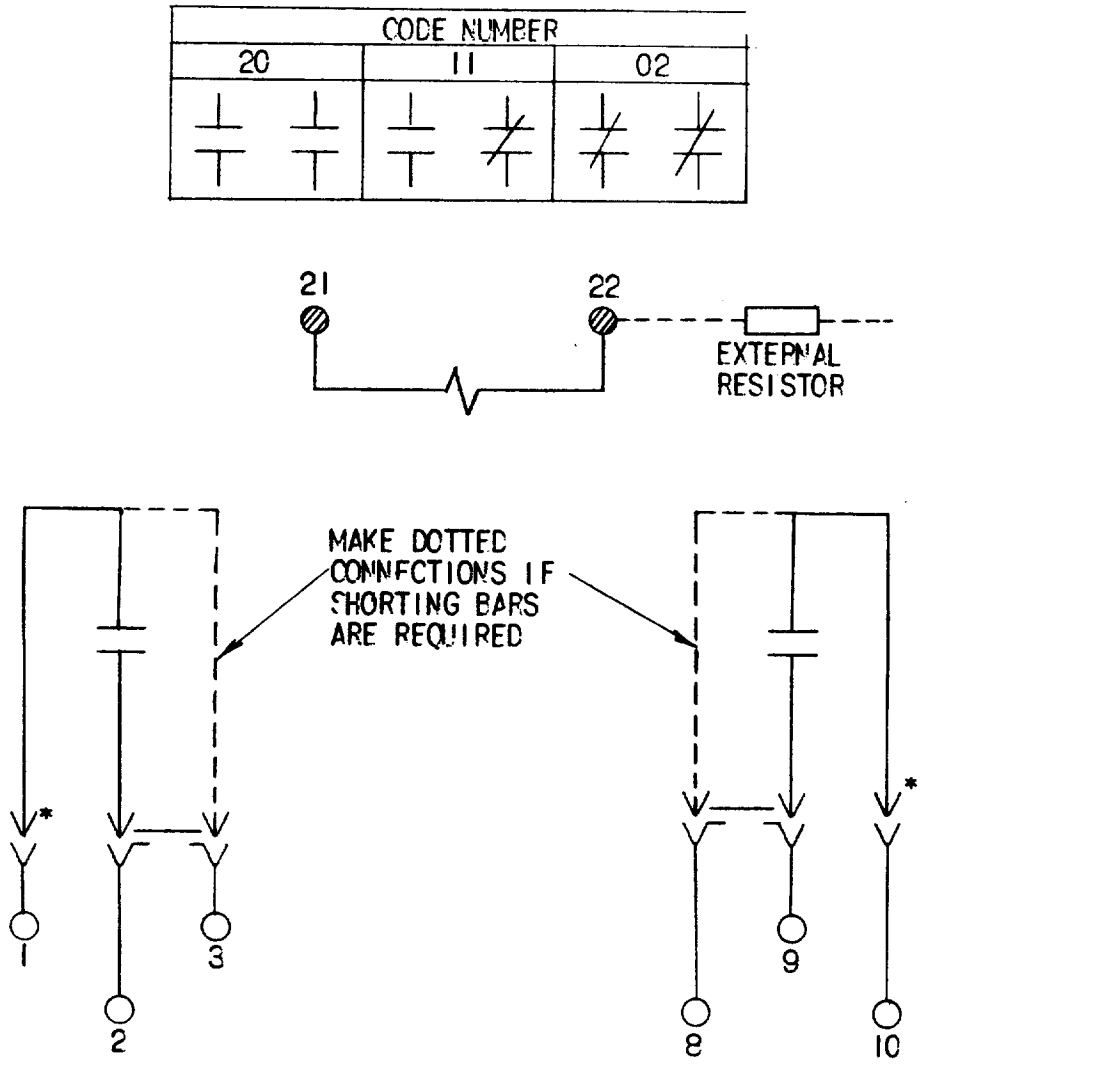
   If contacts are replaced or readjusted for wipe or gap, initial tension should be checked. When only one normally closed contact is used, the initial tension on this contact should be about 14 grams. In this arrangement the normally open contact should have about five grams initial tension. For all other contact codes, all contacts should have about five grams initial tension.

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, specify quantity required, name of part wanted, and give complete nameplate data, including serial number. If possible, give the General Electric Company requisition number on which the relay was furnished.

FIG. 1 (Photo Not Available) Type PJV11BK(-)E Relay Out Of Case-Front View



NOTE: HIGH VOLTAGE STUDS (21 & 22) PROJECT THROUGH REAR OF CASE. LEADS AND BUSHINGS MUST BE REMOVED FROM THESE STUDS BEFORE CRADLE CAN BE WITHDRAWN.

* SHORT FINGERS

FIG. 2 (0246A3667-1) Internal Connections Diagram For Model PJV11BK(-)F

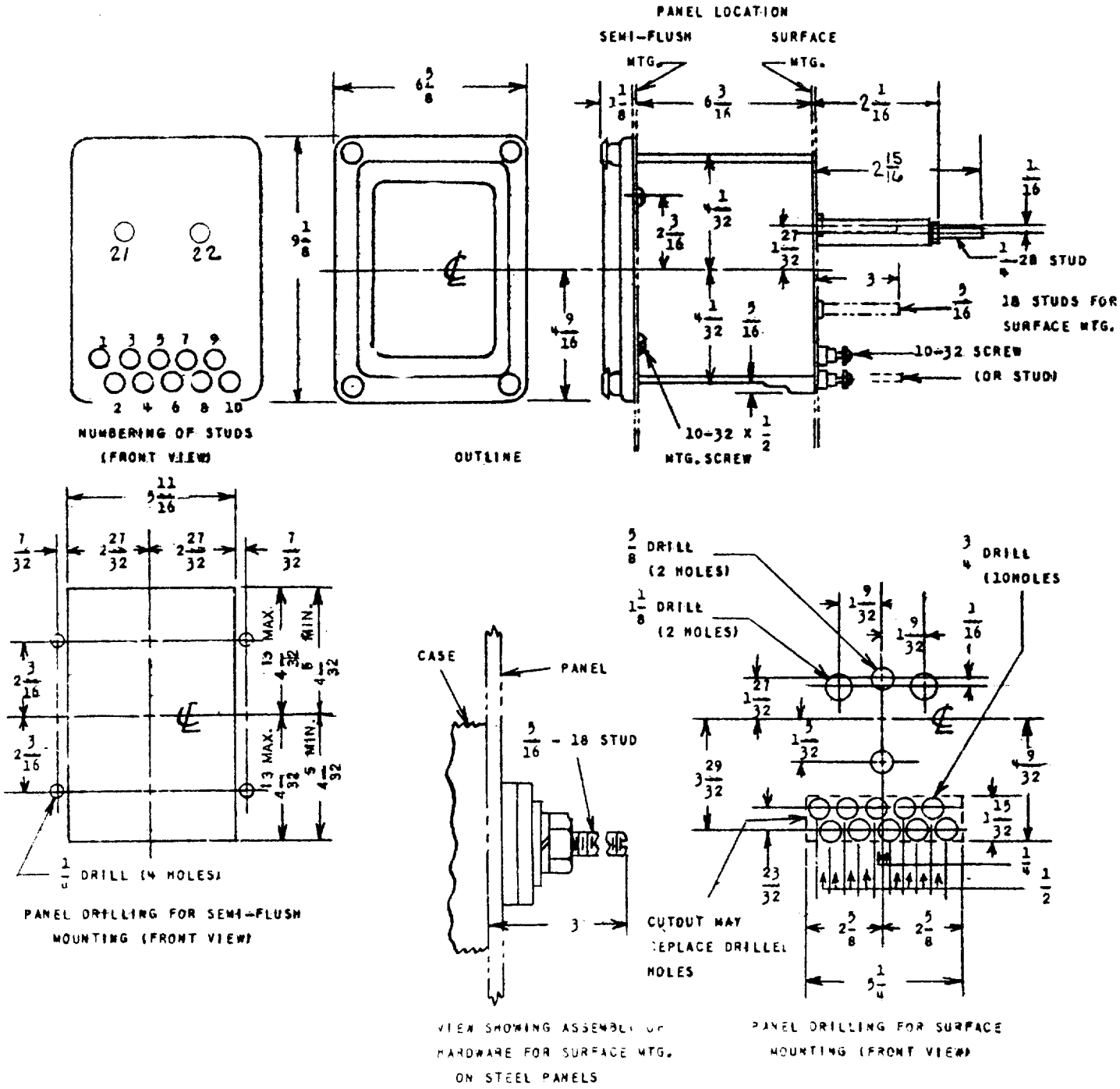


FIG. 3 (0246A6515-0) Outline And Panel Drilling Diagram For PJV11BK(-)E

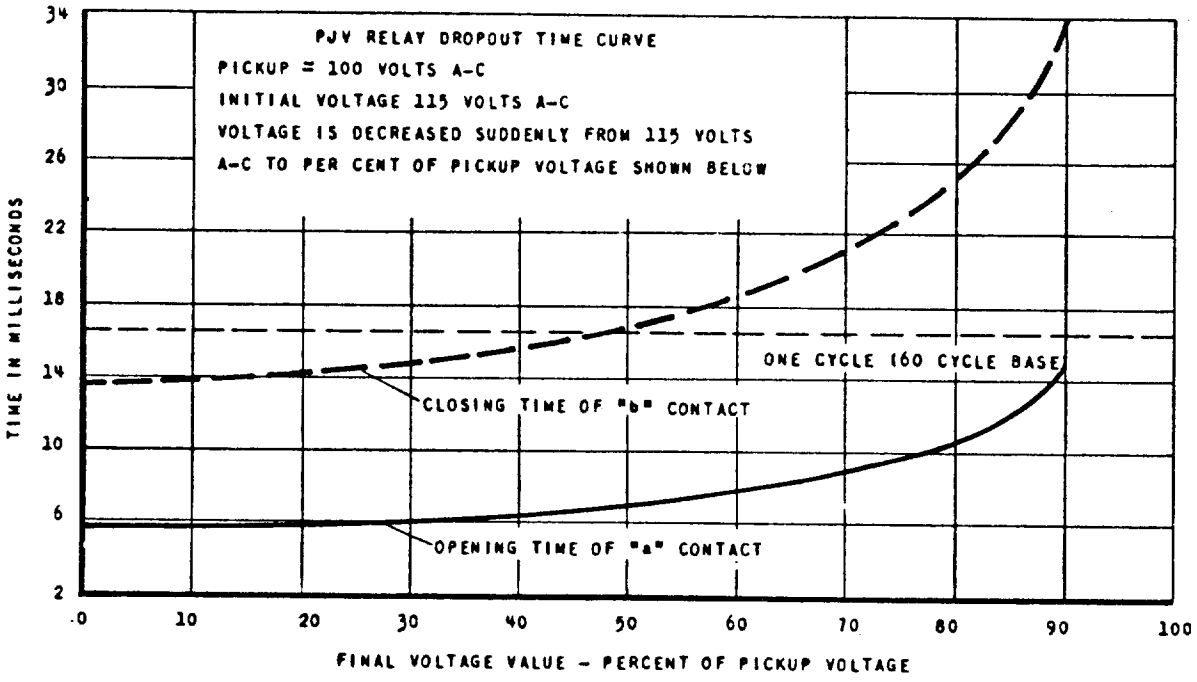


FIG. 4 (K-6375898-1) Typical Dropout Time Characteristic For PJV11BK(-)E

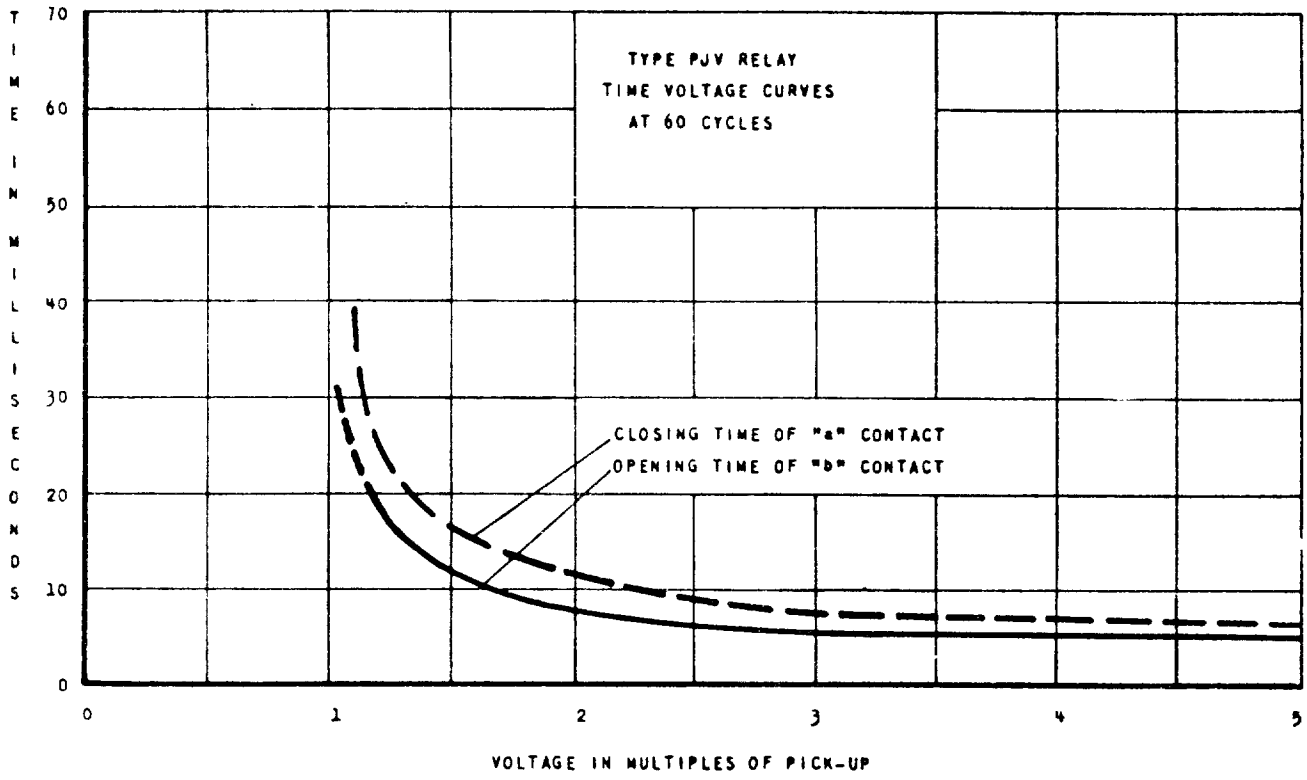


FIG. 5 (K-6375897-1) Typical Pickup Time-Voltage Characteristic For PJV11BK(-)E

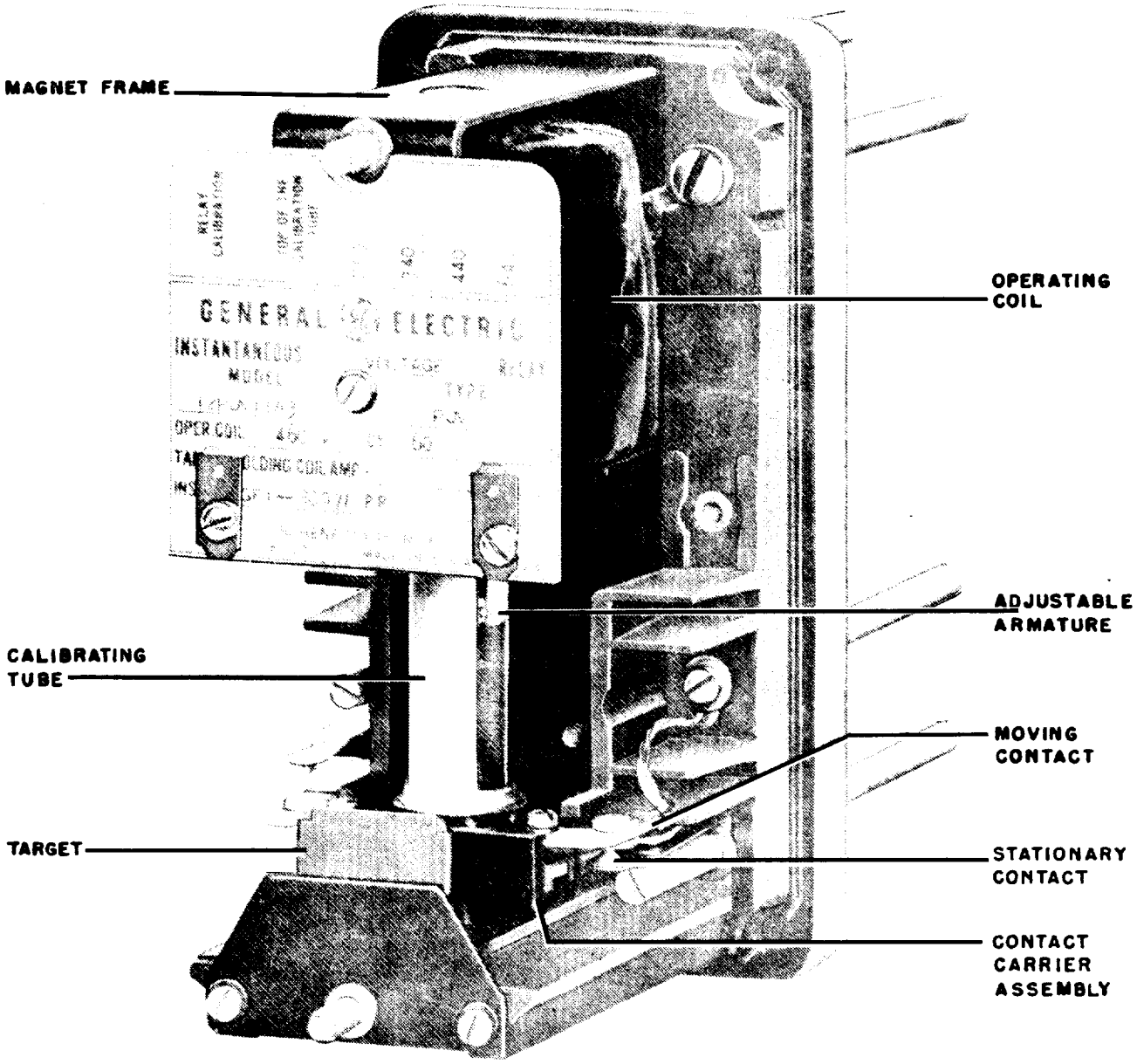


FIG. 6 (8009444) Typical Plunger Voltage Unit Used In These Relays

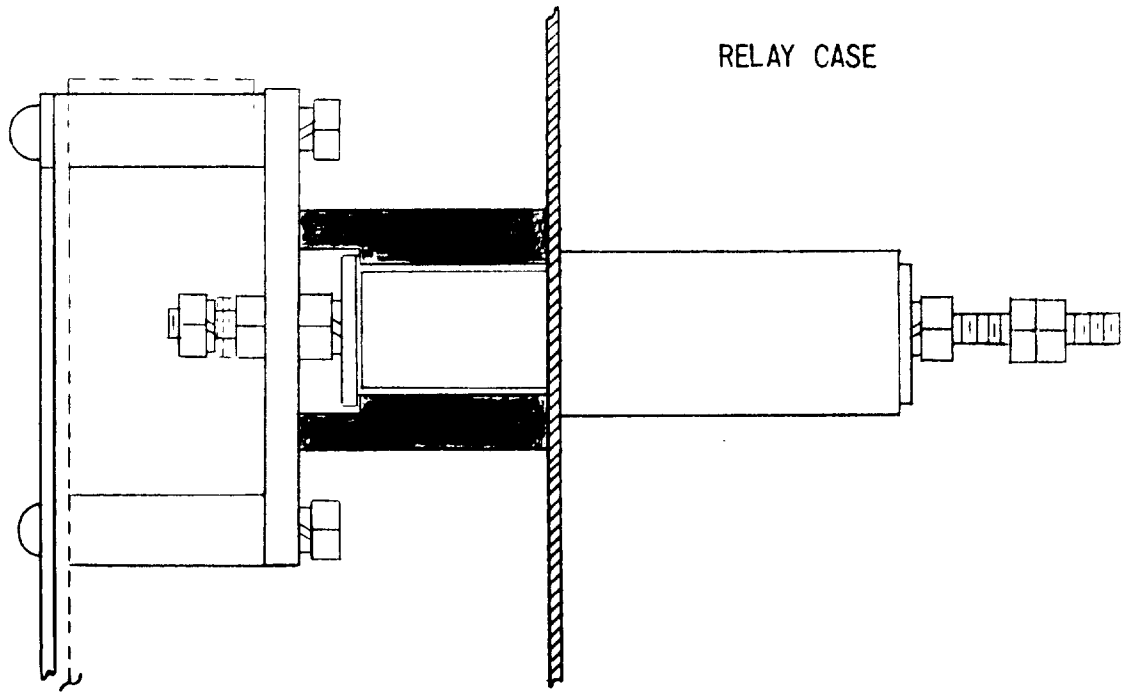


FIG. 7 (0257A3242-0) Diagram Of High Voltage Stud Assembly

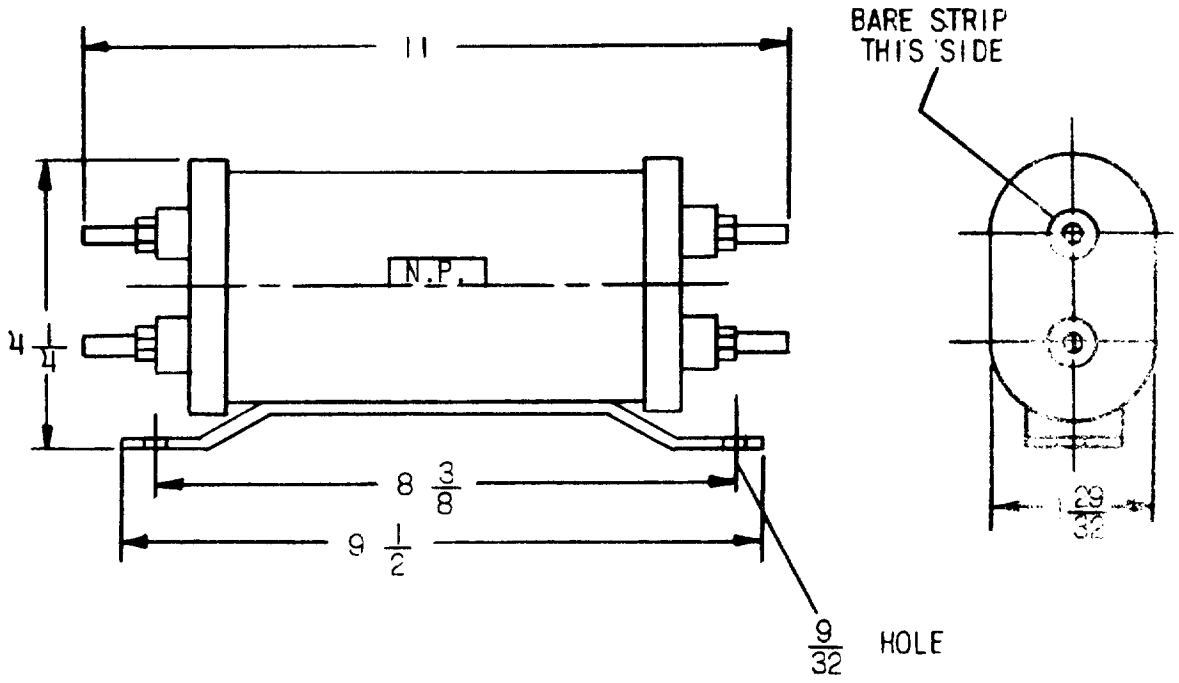


FIG. 8 (403A119-1) Outline For External Resistor

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