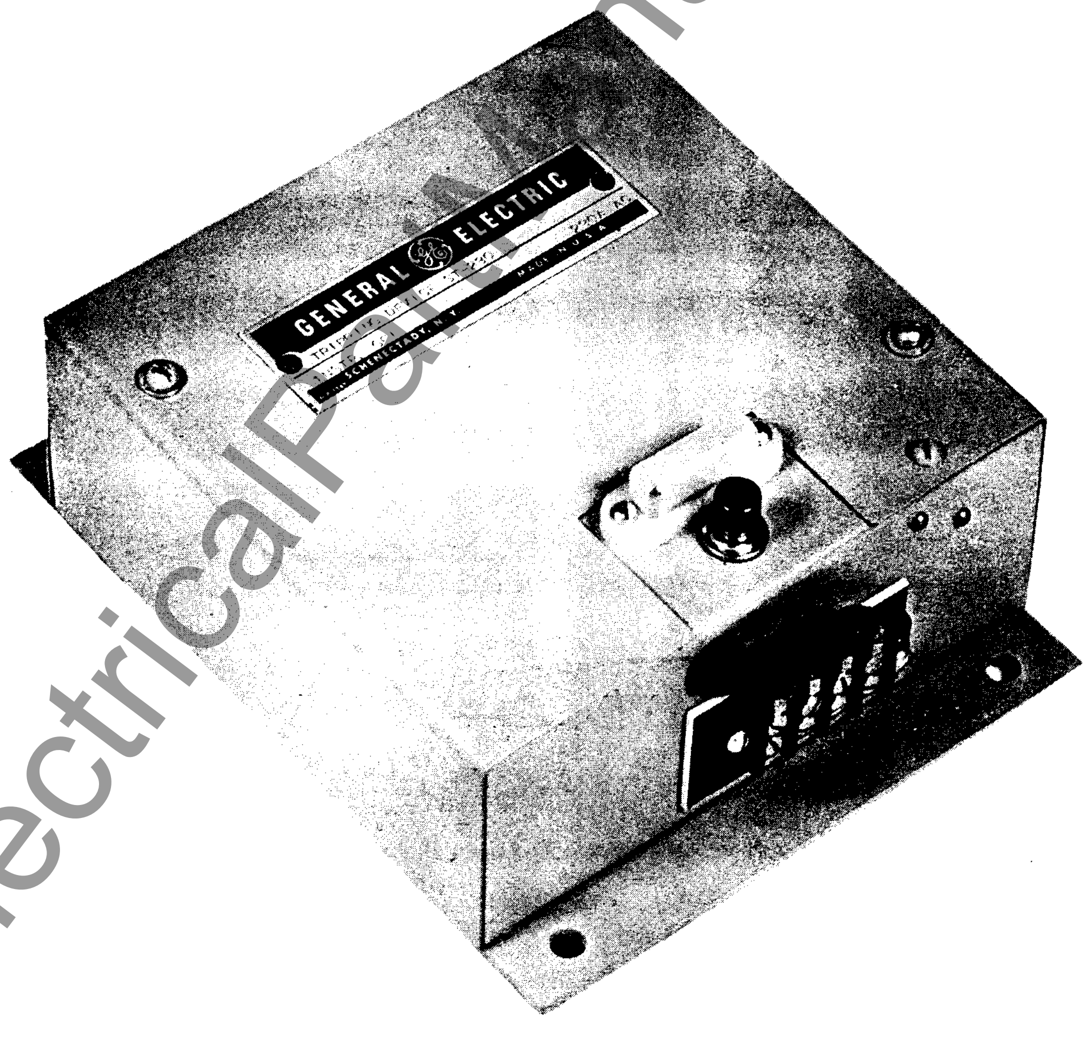
INSTRUCTIONS

GEI-77065C
SUPERSEDES GEI-77065B
GEI-77015E

ST-230
AUTO-CHARGED TRIP DEVICE



ST-230-1
ST-230-2

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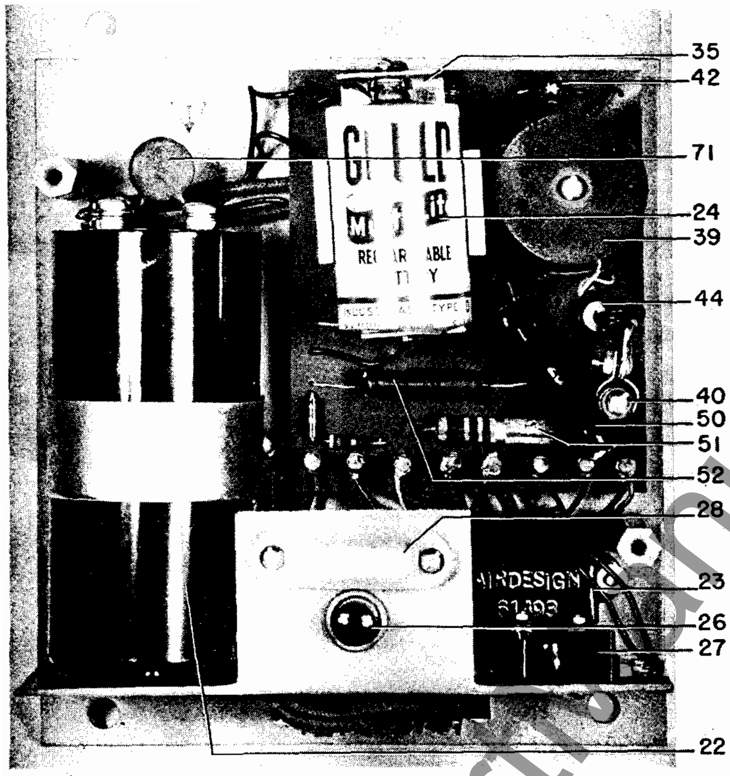

Fig. 1 (8027899) Unit With Cover Removed

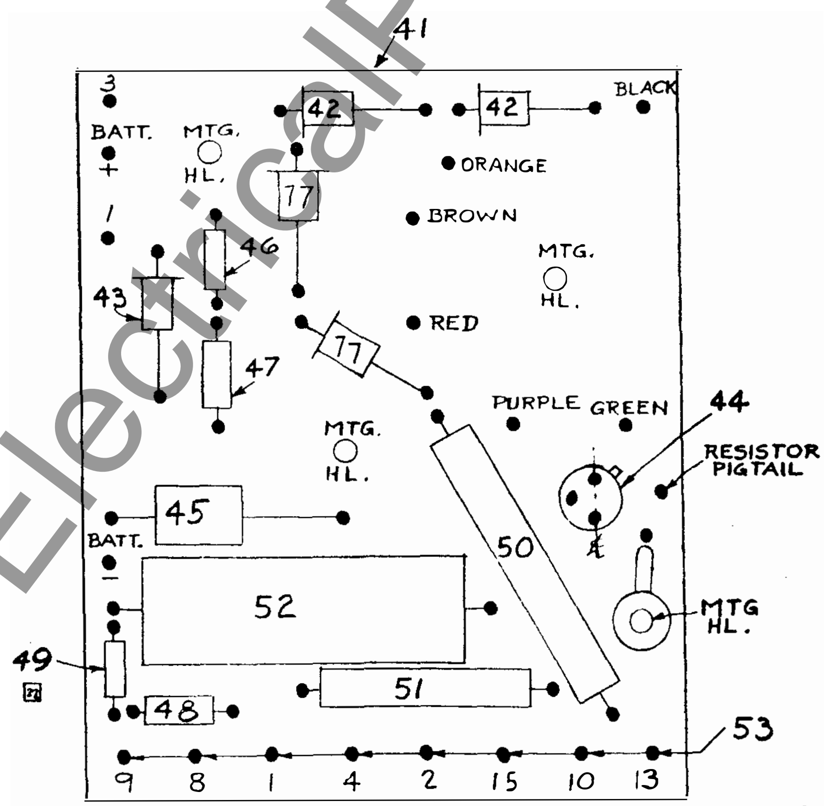

Fig. 2 (828C810) Circuit Board Block Diagram

ST-230

AUTO-CHARGED TRIP DEVICE

The auto-charged trip device is a high speed, capacitor type circuit breaker tripping unit. It differs from the conventional capacitor trip device in that it has a self-contained, standby power source which is capable of supplying the capacitor losses and maintaining the unit at full operating voltage for several days.

The device is primarily for use with circuit breakers which require some form of a-c power for their closing operation, i.e., circuit breakers having either a stored energy closing mechanism with an a-c operated release coil or an a-c solenoid operated closing mechanism. It may also be used with circuit breakers employing other means of closing, however it might be necessary to observe certain operating procedures as outlined under "Operation and Checking".

In addition to circuit breaker tripping, the unit may be used to operate hand or electric reset devices such as lockout relays.

It is recommended that each circuit breaker or other device be provided with its individual auto-charged trip unit. Exceptions to these recommendations are particular combinations of circuit breakers and lockout relays which tests have indicated can be operated reliably from a single tripping unit.

OPERATION AND CHECKING

The operation of the unit can best be understood by referring to the Schematic diagram, Fig. 3. Assume the cover interlock switch (27) is in its normal operating position.

Upon the application of an a-c source to the unit, the energy storage capacitor (22) is charged in a matter of cycles through the current limiting resistor (50) and rectifiers (42) to approximately the peak voltage of the a-c supply. Power is also applied to the rechargeable battery (24) through the battery charging transformer, rectifier and dropping resistor (23), (43) and (51) respectively. As the battery becomes charged the voltage across its terminals gradually rises to approximately 1.35V where it will level off and remain as long as the charging circuit continues to function.

When the circuit breaker is closed, completing the circuit between terminals 1 and 4, the d-c conversion circuit (39), (40), (42), (44), (46) and (47) is connected across the battery. As described below, this circuit will supply the losses to the energy storage capacitor by gradually raising the voltage above the peak value of the a-c source to somewhere between 380 and 405V.

Should the a-c source fail, the d-c conversion circuit will continue to operate from the battery. If the failure persists, the voltage across the energy storage capacitor will gradually drop to a value approximately 15V below that which was maintained when the a-c source was present, where it will become stable. This is due to the battery voltage dropping from its floating value of 1.35V to its operating value of 1.2V. The unit will be evidenced by a gradual and continuing decrease in the voltages across the storage capacitor and battery.

Referring to the Schematic Fig. 3, the conversion circuit consisting of (39), (40), (42), (44), (46) and (47) operates as follows:-

When first energized, the base of the transistor (44) is biased negative with respect to its emitter through the divider, (46) and (47). This causes current to flow in the transistor from its emitter to collector through the green-purple winding of the transformer (39). Current flowing in this winding produces flux which induces voltages in the other two windings. No current flows through the black-red winding due to the blocking action of the rectifiers (42). The voltage induced in the brown-orange winding is such as to drive the base of the transistor still further negative with respect to its emitter, causing more current to flow from emitter to collector into the green-purple transformer winding. This in turn produces more flux in the transformer which induces more voltage in the other windings. Thus the transistor is turned fully on and remains so until the transformer core saturates. When this happens there is no further change in flux, consequently the voltage induced in the transformer windings disappears. This produces less current flow between the transistor's emitter and base which in turn reduces the current

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.

flow through the collector into the green-purple transformer winding. As a result, the flux in the transformer core is reduced. This in turn induces a voltage in the brown-orange winding which opposes the bias from the divider (46) and (47). The collapsing flux in the transformer core thus drives the base of the transistor positive with respect to its emitter, turning it off. The transistor remains off until the flux in the transformer core reaches its residual state at which time it starts to turn "on" again, to repeat the cycle. As the flux in the transformer core collapses, a voltage is induced in the black-red winding which causes current to flow through the rectifiers (42) into the energy storage capacitor. The unit normally oscillates at approximately 3KC.

The design of the transformer (39), is such that the energy transferred from the battery to the capacitor (22), is just sufficient to supply the capacitor losses at a voltage between 380 and 405V.

At the lower voltages, where the capacitor losses are less, the excess energy transferred from the battery is stored in the capacitor and will appear as an increase in voltage across its terminals. Where it is desired to use the unit with a circuit breaker that requires no a-c power for closing, i.e., a circuit breaker equipped with a manually released stored energy closing mechanism, provisions should be made to temporarily by-pass the breaker "a" switch shown connected between terminals 1 and 4 in Fig. 3. This switch should be closed sufficiently in advance of breaker closing to allow the unit to accumulate an operating charge from the battery.

The operation of the unit is completely automatic and requires only an occasional check to determine if it is functioning properly. A neon light and push button is supplied on the front panel of the unit. The light will glow when the button is pressed, if the voltage across the capacitor is above the minimum required to operate the breaker. This shows the readiness of the unit to trip the breaker but does not indicate the a-c source is available. Attention should be paid not to operate the neon light's push button for long periods of time, for the testing circuit (26, (28), (48) and (49) can reduce the capacitor voltage considerably. A constant visible check of the a-c line is generally provided by the indicating lights usually mounted on the metal-clad door or control panel.

The battery furnished with the unit is of the rechargeable sealed nickel cadmium type. Under normal operating conditions, when a-c power is supplied to the unit, the battery will be subjected to a floating charge. Under this condition the battery voltage will gradually rise to approximately 1.35V where it will stabilize. Under discharge conditions with no a-c power available, its voltage will stabilize at approximately 1.2V. A voltage of 0.9V or less indicates the battery is discharged. Should this condition occur, it will take several days for the unit to recharge the battery from the a-c source. It is therefore recommended that the battery be removed from the unit and be recharged with a high rate charger. During this operation a standard "D" size flashlight cell be substituted in the unit. Charging rate of the rechargeable battery should not exceed 0.3 amperes for any extended period of time.

INSTALLATION

Before putting the unit into service it should be examined carefully to make sure that it has not been damaged during shipment. The supply voltage should be checked to make sure it is of the proper value and frequency (190-250V, 50/60 cycles). The battery should be examined to make sure it is seated in its clip and is making good contact with the circuit terminators. (Bend the ends of the clip which carry the terminators toward each other if necessary.)

The device uses a half-wave rectifier circuit to charge the energy storage capacitor from the a-c operating source. With this type of circuit it is necessary that no load be placed across the energized capacitor. If this should be done; no charge can be built up across the capacitor and the rectifiers and current limiting resistor (42) and (50), Fig. 3, will be subjected to prolonged excessive current. Under normal operations the condition described above would not occur, since when the a-c source is applied either the capacitor is charged due to the battery and its associated circuitry, or the circuit breaker is open thus removing all load from the capacitor. There is ample time during a circuit breaker closing operation for the capacitor to become charged since it requires approximately 3 cycles for the unit to assimulate 90 percent of full charge.

During testing of the unit with its associated circuit breaker care should be exercised not to have the tripping circuit completed when applying a-c voltage to a discharged unit. Further, supervision of the trip coil in the usual manner with the red indicating light should be avoided.

The energy storage capacitor used in this unit is a special high grade, low leakage, industrial type electrolytic capacitor. One characteristic of all electrolytic capacitors is that they tend to change form when left de-energized for extended periods. Although these units have been completely formed at the factory, they may have been idle for a considerable time. It is therefore recommended that immediately prior to putting a unit into operation it be energized from the 230V a-c source for a period of approximately 2 hours or more. The procedure will insure that the unit is operating at a maximum efficiency before going into service.

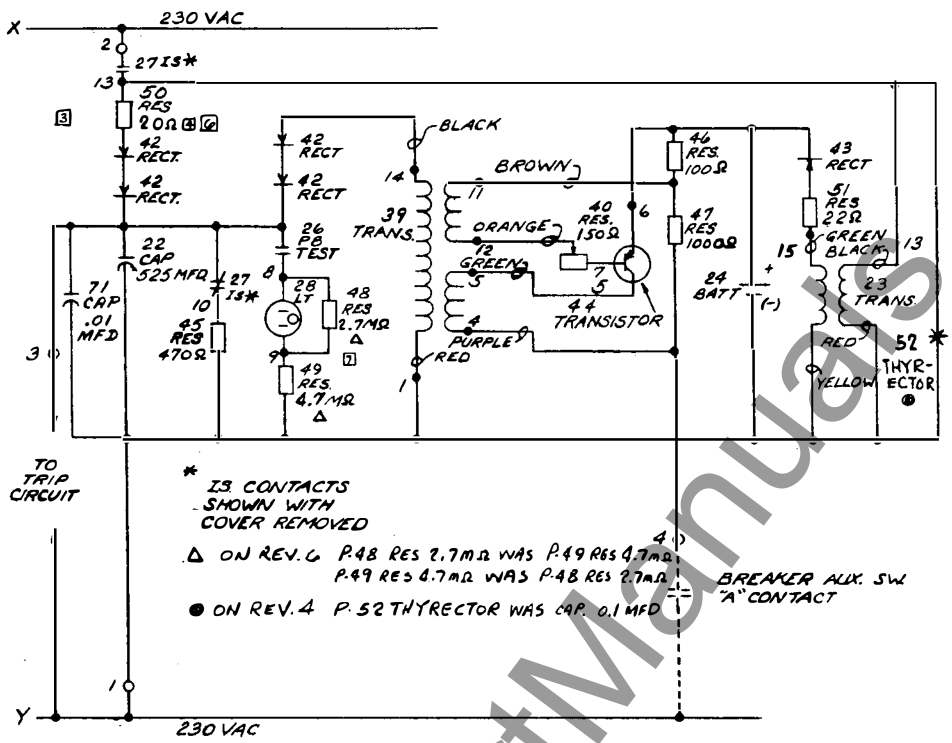

Fig. 3 (121A7466) Connection Diagram

MAINTENANCE

The unit has been completely checked and adjusted at the factory and it is advisable not to disturb these adjustments. If for any reason it should become necessary to readjust the unit, the procedures listed below should be followed:

When the cover of the unit is removed, the interlock switch (27), Fig. 1, disconnects the a-c power and discharges the energy storage capacitor. To fully check the unit it will be necessary to energize the components by returning this switch to its normal operating position. Masking tape or a simple "U" clamp fabricated from thin sheet metal should suffice to hold the switch in this position, with the cover removed. Care should be exercised not to touch any of the components when the interlock switch is depressed, as voltage in excess of 350V d-c is available on many of the components. A wire jumper should also be placed between the terminals 1 and 4 if the breaker is open or removed from the housing.

VOLTAGE AND CURRENT MEASUREMENTS

All d-c voltage measurements should be made with a vacuum tube voltmeter which has a minimum input impedance of 11 megohms. The voltmeter should not be left connected to the circuit any longer than is required to obtain a reading. Before attempting to check a unit, it should be energized from the a-c source for at least two hours to insure that the energy storage capacitor is completely formed and the unit has stabilized. Changes in operating conditions, such as the removal or application of a-c power, etc., should be followed by a 1/2 hour waiting period before readings are taken to allow the unit to completely readjust itself to the new conditions.

The current measurements should be taken with a milliammeter having an internal resistance of about 0.5 ohms. The 500 MA scale of the Simpson model 260 VOM has approximately this resistance. Readings taken with meters of higher or lower internal resistance will differ from those given.

1. The a-c input voltage can be measured at terminals 1 and 2 and should be from 190 to 250 V a-c.

2. The d-c output voltage should be measured at terminals 1 and 3. With a-c power applied to the unit and with the d-c conversion circuit energized (jumper between terminals 1 and 4), and the battery voltage at its floating value (1.35V), the output voltage should be between 380 and 450 V d-c. This voltage will be approximately 15V lower when the a-c power

is removed and the battery has stabilized at its operating voltage of 1.2 volts.

3. To check the battery charging circuit, remove the battery from the unit. Externally connect a milliammeter in series with the battery and reconnect to the unit. Currents in the range 20 to 40 MA should be indicated depending on the condition of the battery and the line voltage variation.

4. The purpose of the battery and the conversion circuit is to maintain the capacitor at its normal operating charge when the a-c line is de-energized. To do this efficiently the conversion circuit should be adjusted to take just enough energy from the battery to supply the capacitor losses at the normal capacitor operating voltage. This condition may be checked by connecting a suitable milliammeter in series with the battery. With the a-c power removed, the milliammeter should read 20 to 25 MA. The slide wire resistor (40), Fig. 1, provides a means for adjusting the circuit to this current level.

REPAIRS

If it becomes necessary to replace any of the soldered components the work should be done by someone familiar with printed circuit soldering. A fine pointed low wattage soldering iron is recommended. Do not heat any of the connections more than is necessary to loosen or resolder the leads. Prolonged heat may loosen the bonded foil and damage the circuit board.

Before removing the leads of any component note the connection points and place the leads of the new part in exactly the same location. Check the circuit thoroughly referring to Figs. 2 and 3 before returning the board to the unit. Check all parts of the unit using the procedure described in Voltage And Current Measurements before putting the unit into service.

RENEWAL PARTS

REFERENCED IN FIGS. 1 AND 2

REF. NO.	CATALOG NO.	DESCRIPTION
22	0456A0864 P-0102	Capacitor
23	0108B1958 G-001	Transformer
24	0456A0864 P-0078	Battery
26	0456A0864 P-0081	Push Button
27	0456A0864 P-0095	Interlock Switch
28	0456A0864 P-0031	Indicator Light
35	0828C842 G-003	Battery Holder
39	0107B9381 G-001	Transformer
40	0456A0864 P-0082	Adjustable Resistor
41	0688C560 P-0001	Circuit Board
42	0456A0864 P-0036	Rectifier
43	0456A0864 P-0083	Rectifier
44	0456A0864 P-0084	Transistor
45	0456A0864 P-0085	Resistor
46	0456A0864 P-0086	Resistor
47	0456A0864 P-0087	Resistor
48	0456A0864 P-0089	Resistor
49	0456A0864 P-0088	Resistor
50	0456A0864 P-0034	Resistor
51	0456A0864 P-0090	Resistor
52	0456A0864 P-0107	Thyrector
71	0456A0864 P-0094	Capacitor

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