INSTRUCTIONS

GEK-45384

BATTERY CLAMP

TYPE SDA50A

GENERAL ELECTRIC

DESCRIPTION

The type SDA50A battery clamp is intended to provide protection against transient voltages on the station battery leads. When supplied as part of a static relay terminal, the type SDA50 will be mounted with the user terminal blocks. The outline and mounting dimensions are shown in Figure 1, and the internal connection diagram is shown in Figure 2.

The function of the battery clamp is twofold. The first is to absorb transients which may appear between the battery leads. This is accomplished without allowing a significant voltage change between either lead and the relay surge ground. Second, it prevents an incoming surge voltage from causing either the positive or negative battery lead to be elevated more than a limited potential difference from the relay ground. The positive battery supply lead cannot assume a positive potential greater than battery voltage, or a negative potential of more than one volt relative to relay surge ground; and the negative battery supply lead cannot assume a negative potential greater than battery voltage, or a positive potential or more than one volt relative to relay surge ground.

APPLICATION

The SDA battery clamp is intended for use on station or substation control batteries to prevent transient overvoltages. Transient protection is desireable whenever electronic equipment for protection, communication, instrumentation, or control is connected to the station battery, in order to prevent incorrect operaton or damage such equipment.

One battery clamp should be connected to each control battery in a given location. If a control battery is connected to circuits in a remote control room or control house a second battery clamp should be applied to the battery bus at the remote location. The battery clamp should be connected to the main battery DC bus, rather than on branch fuses to a specific equipment, to avoid disconnection of the clamp when a specific equipment is out of service. The ground connections from the SDA should be made as directly as possible to the control house ground with a copper conductor #12 AWG or larger. This ground connection should not be routed with signal or control wiring.

BATTERY CLAMP CHARACTERISTICS

A. Normal Operating Conditions

Under normal operating conditions in most stations, the battery voltage is divided by ground indicating lamps, or by the other high impedance devices, so that each battery lead is on half of the battery voltage relative to the Relay Surge Ground. The battery clamp, which is connected to the supply circuits as shown in Figure 3A, rest with capacitors C_1, C_2, C_3 and C_4 charged to one half of battery voltage. Diodes D_1 and D_2 have this voltage impressed across them in the reverse or blocking direction. The resistor-potentiometer combination provides for fine adjustment of ground potential relative to (+) or (-) DC with a $\pm$ 10% variation around half rated D.C. voltage.

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.

In certain applications it is not desirable to use the resistor divider circuit, R1, R2, P1 to establish mid point battery potential for a ground connection. The terminal block on the case has two screws which complete connections to the resistor divider circuit. If the shorting bar screws are both opened, the resistor divider is removed from the station battery connections.

B. Voltage Sources - Solenoids

The voltage induced in a solenoid operating coil when the current through the coil is interrupted is determined only by the rate at which the coil current is forced to decay. If the interrupting contact parts rapidly enough, and if the insulation surrounding the contact is weak, this induced voltage may be sufficient to establish an arc to ground. The voltage drop across the arc will be relatively low and constant. If the battery clamp is not used, the remaining impedance in the arc current path is the battery ground lamp. Figure 3B illustrates these conditions.

The collapsing magnetic field of the coil tends to maintain the original magnitude of current flowing in the coil turns, and this current must be driven through the high impedance of the ground lamp. The result is a large voltage swing on the battery leads with respect to ground. The polarity of this voltage causes the lead to which the coil is directly connected to assume a potential with respect to ground which is opposite from normal.

C. Battery Clamp Operation

If the conditions described in Section B and shown in Figure 3B exist, the negative battery lead might be driven as much as 1.5KV positive with respect to ground (or the positive lead driven negative with respect to ground). Placing a low impedance, such as the forward impedance of a rectifier, between the lead and ground, in parallel with the ground lamp will limit the voltage swing of that lead. This is shown in Figure 3C.

With this connection, the solenoid current has a low impedance path through which to flow to dissipate the energy in its magnetic field. The induced voltage is thereby kept low, and the battery lead is held within one volt of ground potential, one volt being the approximate voltage drop across the rectifier. Since one battery lead is clammped at ground, the maximum value that the other lead can assume is either plus or minus battery voltage depending upon which lead is grounded. If a rectifier is placed between each lead and ground, both leads will be clamped at ground potential. The rectifier diodes are protected against high frequency transients by capacitors C3 and C4.

D. Low Energy Transients Between Battery Leads

In the previous paragraphs, it was assumed that the battery leads were held by the battery at a constant potential difference. Because these leads have self-inductance, a current flow in them results in stored energy that must be dessipated when the current is interrupted. Since the induction is small, the total stored energy is low, but the voltage of self-inductance when the current is interrupted rapidly may be very high. However, this energy can be absorbed by the battery clamp capacitors C1 and C2 with only a small change in the voltage between the leads. The stored energy is thereby transferred to the capacitors and ultimately dissipated in the load circuit without a significant voltage change between the relay surge ground and either of the battery leads at the location of the ground lamps.

RATINGS

Type SDA50A1	48/125 VDC	15 Amperes
Type SDA50A2	250 VDC	15 Amperes

CONSTRUCTION

The Type SDA50A is packaged in a metal enclosure designed to be mounted on a flat surface. The outline and mounting dimensions are shown in Figure 1. A 12 point terminal block is mounted on the front for electrical connections. Two copper bus bars exit on the sides of the enclosure. The bus bar on the right hand side as viewed from the front with terminal 1 at the top is the ground bus bar. The other bus bar is used for series connection of surge packages when the SDA50A is mounted in the relay equipment rack. There are no connections to this bus bar inside the SDA50A.

TESTING

Testing of the Type SDA50A is straight forward, and can be done using an ohmmeter to verify that the internal components are neither shorted nor open, refer to the internal connections diagram Figure 2.

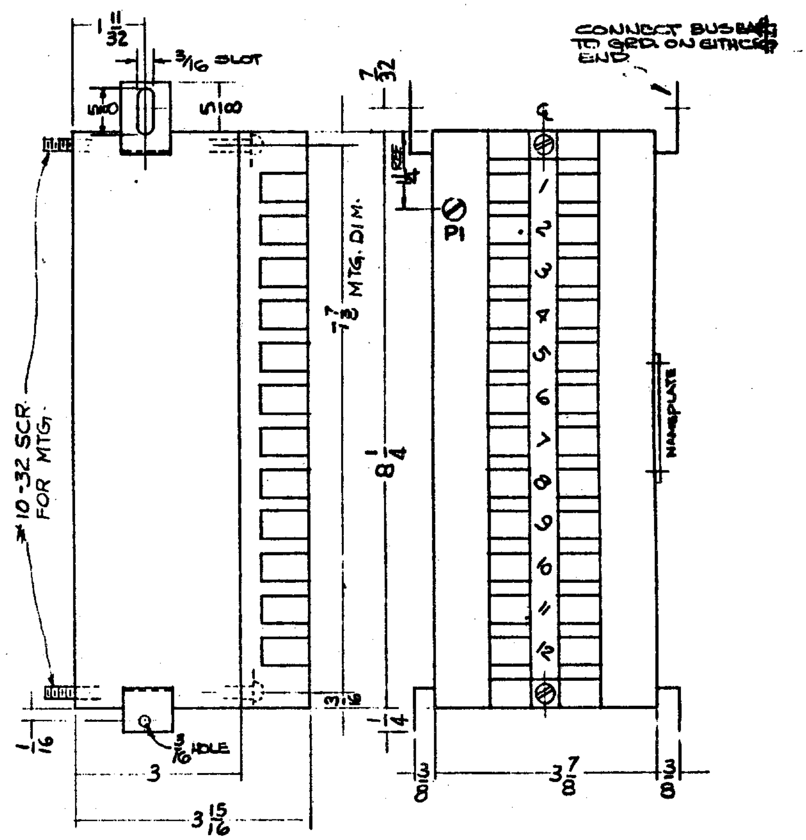
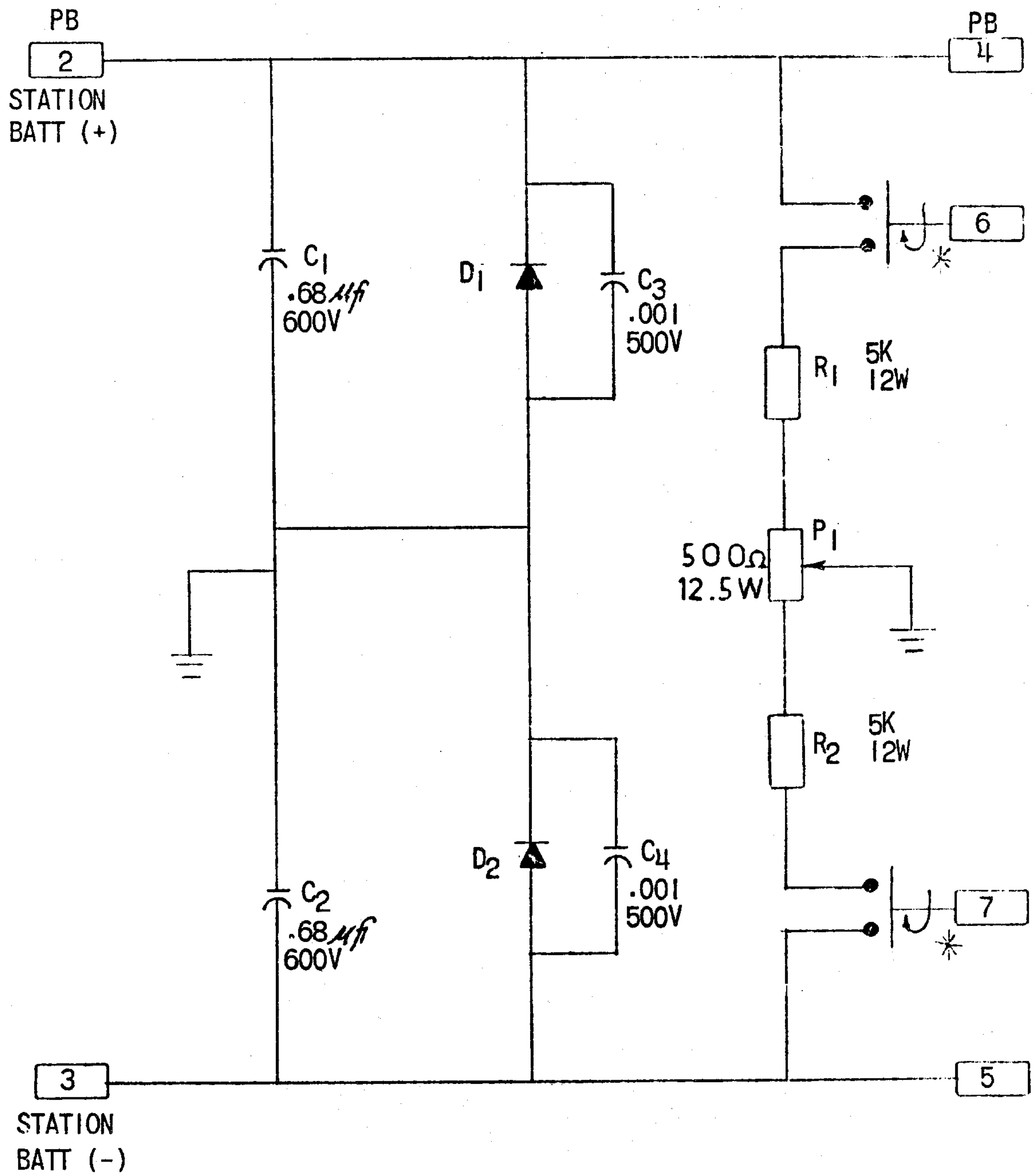


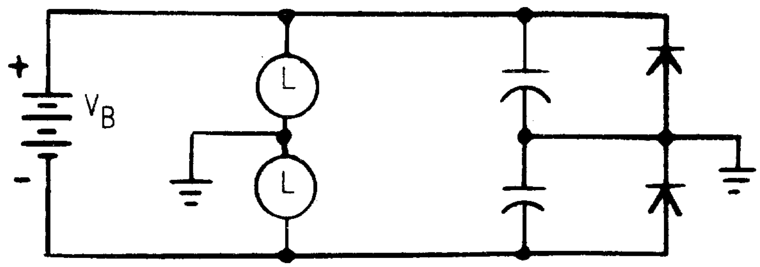
FIG. 1 (0227A2137-1) Outline And Mounting Dimensions For The SDA50A Relay.



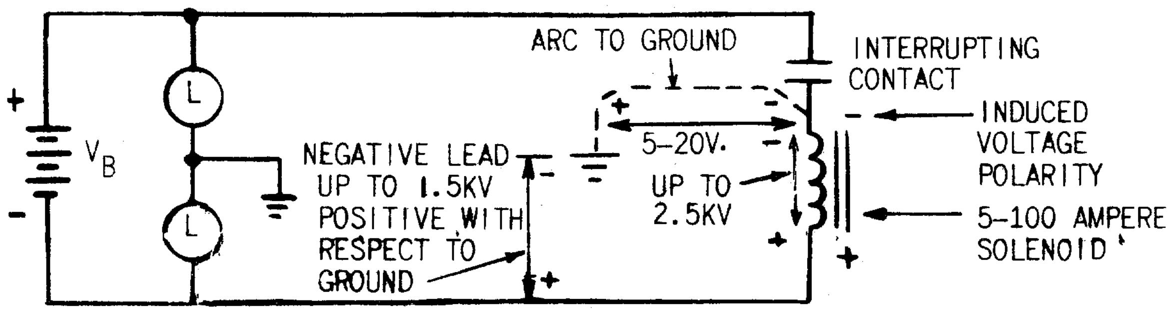
* DISCONNECTS ON THE NUMBER 6 AND 7 POSITION OF TERMINAL BLOCKS ARE FOR OPTIONAL CONNECTION TO RESISTOR DIVIDER

⏚ BUS BAR, RIGHT SIDE, FRONT VIEW, WITH TERMINAL 1 AT TOP

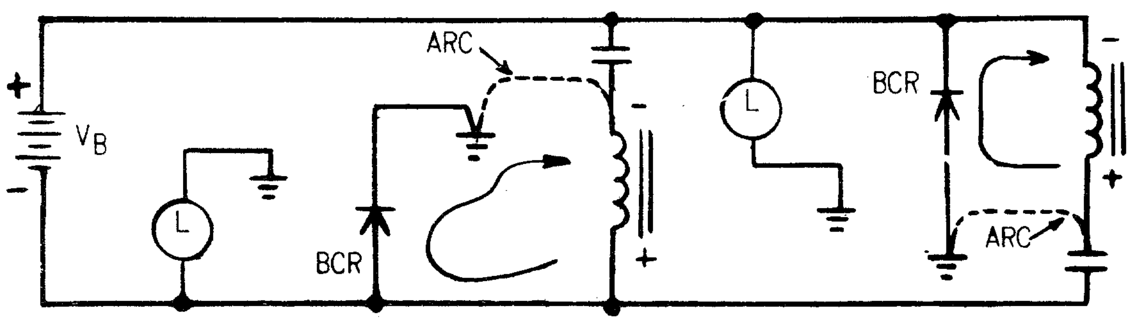
FIG. 2 (0227A2136-2) Internal Connection Diagram for the SDA50A Relay



(A) NORMAL OPERATING CONDITIONS



(B) ARC-OVER TO GROUND DURING SOLENOID CURRENT INTERRUPTION WITHOUT BATTERY CLAMP RECTIFIERS



(C) CONDITIONS DURING ARC-OVER TO GROUND WITH BATTERY CLAMP RECTIFIERS (BCR) CONNECTED

FIG. 3 (0148A4062-1) Battery Clamp Surge Current Condition.

Meter and Control
Business Department

ST-12/93 (200)

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