ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL 33065

Instruction Leaflet
I.L. 41-766.4C

Types SVF, SVF-1, SVF-3, SVF-31 Relays Constant Dropout or Pickup Voltage Value from 20 to 60 Hertz

Effective: June 1995
Supersedes I.L. 41-766.4B dated January 1977
(|) Denotes Changes since previous issue

CAUTION

Before putting protective relays into service, remove all blocking inserted for the purpose of securing the parts during shipment. Make sure that all moving parts operate freely. Inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

1. APPLICATIONS

Where dropout independent of frequency is required, the SVF and SVF-1 instantaneous undervoltage relays are recommended. Dropout is adjustable over the range of 24-36 and 30-45 volts for the SVF-1 and SVF relays respectively with a maximum dropout variation of 5% between 20 and 60 hertz. Where the relay is required to operate only during balanced 3 phase conditions, the single phase SVF or SVF-1 is suitable. Where balanced conditions may not exist when relay operation is required, the 3 phase relay design type SVF-3 or SVF-31 is recommended.

For supervising initiation of bus transfer, where the undervoltage relay is measuring the residual voltage of the motor load, the 3 phase SVF-3 or SVF-31 is recommended, since one or more phase voltages may be reduced by a fault on the supply circuit prior to transfer.

1.1. Contents

This IL covers the following four types of relays: SVF, SVF-1, SVF-3 and SVF-31.

1. SVF is a single phase relay with a dropout voltage value adjustable from 30 to 45 volts for a relay rated 120 volts.
2. SVF-1 is a single phase relay with a dropout voltage adjustable from 24 to 36 volts for a relay rated 120 volts.
3. SVF or SVF-1 relays with a pickup voltage adjustable from 50 to 150 volts are also covered.
4. SVF-3 is a three phase relay with a dropout voltage value adjustable from 30 to 45 volts phase-to-phase, for the relay rated 120 volts.
5. SVF-31 is a three phase relay with a dropout voltage value adjustable from 18 to 30 volts phase-to-phase, for the relay rated 120 volts.
6. SVF-3 or SVF-31 relays with a pickup voltage value adjustable from 50 to 150 volts are also covered.
7. Relays with rated voltage other than 120 volts will have dropout ranges proportioned to the 120 volt values.

2. CONSTRUCTION

The single phase SVF and SVF-1 relays consist of an SV or SV-1 voltage unit respectively, a reactor, a series resistor and a full wave rectifier. The resistor and reactor are proportioned to maintain a constant effective ampere turn to the SV or SV-1 from 20 to 60 hertz.

The three phase SVF-3 and SVF-31 relays consist of an SV or SV-1 voltage unit respectively, three external series resistors, three full wave bridges rectifiers,

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding this particular installation, operation or maintenance of this equipment, the local ABB Power T&D Company Inc. representative should be contacted.

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and two capacitors. The full wave bridges plus the filter capacitors provide a steady dc voltage to the SV or SV-1 unit of the relay from 20 to 60 hertz.

3. OPERATION

3.1. Voltage Unit (SV or SV-1)

The types SV and SV-1 voltage units operate on the solenoid principle. A U-shaped iron frame, mounted on the moulded base supports the coil and serves as the external magnetic path for the coil.

The coil surrounds a core and flux shunt, the upper end of the core is threaded and projects through the upper side of the frame to which it is fastened by a nut. A tube threaded on the outside at its lower end is assembled in the core, and the threaded ends extends below the core. A Fluorosint®* bushing, which is the lower bearing for the plunger shaft, is assembled in the lower end of this threaded tube. It is held in place by two split spring sleeves, one above and one below the bearing. The split sleeves must be compressed to insert them in the tube and they will remain at any position in which they are placed. The bearing for the upper end of the plunger shaft is a Fluorosint® bushing which is pressed in the upper end of the core. This bearing is visible when the plunger is in the energized position. The plunger itself does not touch the walls of the tube in which it moves.

A flux shunt which surrounds the core is screwed on the tube, and its lower end projects below the relay frame. The position of this shunt determines the dropout setting of the relay. The lower end of the shunt is beveled and knurled, so that it can be grasped by the fingers and turned to change the setting. A calibrated scale plate is mounted adjacent to the shunt. A groove just above the knurl in the lower end of the shunt serves as an index mark, and the relay pick-up setting is indicated by the calibration scale marking which is adjacent to the groove.

The construction of the plunger, core and flux shunt (which differ in details in the various types of these relays) causes the plunger to float in its energized position without being held against a stop.

The shunt is held in any desired position by pressure from a curved arm made of sheet spring steel, which is fastened to the bottom of the coil frame at the rear of the shunt. This spring arm is shaped to extend around the shunt to the front of the relay, and in its normal position it exerts sufficient pressure against the shunt to prevent any creeping of the shunt or undesired change of setting. The front end of the spring arm has a bent over tab on which thumb pressure may be applied to move the arm out of contact with the shunt while the position of the latter is being changed.

The stationary contacts are assembled on slotted brackets. These are held in position on the base by filister-head screws which are threaded into the terminal inserts. Lock washers are assembled inside the moulded terminal bushings between the inserts and the base as a safeguard against loosening of the screws. By rotating the bracket on its mounting screw and moving it along its slot, the contact assembly can be made either normally closed or normally open. The moving contacts are mounted on a Micarta insulation plate which is secured to the threaded end of the plunger shaft by a nut. The rear portion of the plate is slotted and a post screwed to the frame passes through this slot to prevent the plate from rotating. The moving contacts are double-faced so that they can “make” or “break” and are connected to the base terminals by flexible leads. All contacts are pure silver.

4. CHARACTERISTICS AND SETTINGS

The types SVF and SVF-1 single phase and SVF-3 and SVF-31 three phase relays are supplied with dropout voltages constant between 20 and 60 hertz, and have a scale calibrated in dropout volts. See Table 1. These relays are designed for operation on a supply having a nominal value of 120 volts. The scale markings are determined by reducing the voltage gradually from 120 volts. The characteristics of the relays are such that at any setting, the relay will drop out at the same value of voltage (within 5%) for any frequency between 20 and 60 hertz. The pickup voltages will vary somewhat on various relays.

The insensitivity of the single phase relays to frequency is obtained primarily by operating the voltage unit on full-wave rectified ac. To compensate for the tendency of the voltage unit to respond to instanta-

* *Trademark of the Polymer Corporation*

Table 1:

Relay	120 Volt Relay Dropout Voltage Range ± 5%	Typical Pickup Values Less than	Typical Operate Time* ms	Typical Reset Time†	Burden‡ Per Phase Volt Amps
SVF	30-45	75	10	70	60 Hz 17 ∠27°lag 25 Hz 18.5
SVF-1	24-36	90	10	70	60 Hz 17 ∠27°lag 25 Hz 18.5
SVF-3	30-45	95	15-25	75-60	4.9 ∠0°
SVF-31	18-30	100	15-25	75-60	4.9 ∠0°

* Time to open the normally closed contacts.
† Time to close the normally closed contacts.
‡ Values of volt-amperes are average for various plunger and shunt positions.

neous voltage values and, therefore, to drop out at higher rms voltages as the frequency decreases, a reactor is used in the ac circuit. The effect of the reactor is to cause the rectified current to increase slightly as the frequency decreases, thus keeping the dropout point at approximately the same rms voltage value throughout the frequency range. The series resistor in the ac supply renders negligible the effect of the relay coil temperature on the operating point. Because of residual magnetism, when the voltage is educed from 120 volts, the dropout point may be slightly higher than it is when reduced from the pickup values.

5. INSTALLATION

the relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically my means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detailed FT case information refer to I.L. 41-076.

6. ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

6.1. SV UNIT CHECK AND MAINTENANCE

Several factors may affect the dropout ratio of the relay. The factor most likely to be encountered in service is friction. This may be due to dirt or foreign material between the plunger shaft and its bearings, or to leads so misshaped that they tend to rotate or tilt the moving contact insulation plate with appreciable force.

In order to remove the plunger and shaft assembly, it is necessary to remove the set-screw and nut at the top of the shaft. The spool-shaped bushing assembled on the upper end of the plunger shaft has a portion of its center section machined off so that the shaft is exposed at this point and can be prevented from turning by gripping shaft and bushing with a pair of long-nosed pliers while removing the set screw

and nut. Then by pressing down with the fingers on the upper end of the shaft, the lower split sleeve which retains the lower bearing will be forced out of the threaded tube, the bearing will drop out freely, and the upper split sleeve will be forced out far enough to permit grasping it for removal. The shaft and plunger assembly then can be removed.

The shaft bearing surfaces should not be cleaned or polished with any abrasive material, as the abrasive particles might become imbedded in the shaft and cause difficulty later. The plunger shaft and bearings may be cleaned by wiping them carefully with a clean, lint less cloth. Use no lubricant on the plunger shaft or bearings when reassembling the relay, since this will eventually become gummy and prevent proper operation. ***it is recommended that the shaft be cleaned at intervals of approximately two years***. When replacing the lower bearing and the split sleeves, the shorter sleeve (assembled below the bearing) should be pushed in until it is flush with the end of the threaded tube.

The moving contact leads pass through insulation sleeves assembled on the shanks of the terminal clips which are attached to the base terminals. These sleeves are notched at their upper ends, and the notches are toward the center of the relay. The leads are bent at approximately a right angle where they pass out through the notches, which aids in preventing them from coming into contact with the stationary contacts brackets.

Although the moving contact leads are very flexible, if the leads have been pulled out of their original shape by handling they may exert sufficient side pressure on the shaft bearing or twisting force against the guide post to cause appreciable friction and wear. If this condition continues for a long period of time, the resulting wear may affect the relay calibration or the dropout ratio noticeably. In the extreme cases the wear may progress to a degree which may occasionally cause failure of the plunger to drop down when the relay is de-energized.

Correct shaping of the leads is not difficult, and they may be checked readily by ***removing the guide post and the nut at the top of the shaft***. The plunger should be held in the raised position, either by energizing the relay or by pressing lightly against the collar under the insulation plate after raising the plunger manually. Release the plate and if in several trials the plate comes to rest with the center line of the contacts approximately parallel to the side of the base, its mounting hole fairly well centered, the plate not tip appreciably, and the leads have a safe clearance to the stationary contact brackets, the leads are properly shaped.

If this check shows that re-shaping is necessary, it may be possible to obtain sufficient correction by bending the leads sharply where they emerge from the insulation sleeves. One or two pairs of tweezers are convenient tools for reshaping the leads. If it is necessary to re-coil the leads, they should be wound around a rod having a diameter of approximately 5/32". The coils then should be stretched out just enough to avoid side pull or twisting force on the plunger assembly.

7. SV UNIT CONTACT SETTINGS (All Relays)

The normally open contact gap should be set at 5/32", and the follow (travel after contact closure) should be 1/32" maximum. The moving contact can be held in position by placing a 5/32" spacer between the shaft collar and the top of the core.

The normally closed contacts should have a 1/32" follow in the de-energized (reset) position. When normally open contacts are changed to normally closed, the pickup value may be changed by a few percent.

When the contacts are both normally open or both normally closed, an effort should be made to have both contacts make at the same time.

Contact position should not be used as a means of altering the ratio of dropout to pickup.

8. CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order.

8.1. SV Unit Electrical Check

Apply dc voltage to the coil terminals.

1. For the single phase relay disconnect one lead from the rectifier bridge to the coil terminal and

connect a variable dc voltage supply to the coil terminals.

2. For the three phase relay open the Flexitest switches and connect a variable dc voltage supply to terminals 9 and 6.

The SV unit shunt should be capable of a dc pickup adjustment of 11 volts minimum to 33 volts maximum. At 33 volts the dropout value should be greater than 10 volts and less than 14 volts for the SVF-1 and SVF-31 relays. At 33 volts the dropout value should be not less than 22 volts for the SVF and SVF-3 relays.

Reconnect all wires that have been removed.

8.2. Relay Calibration

CAUTION

If the three phase relay is being tested out of the case, the proper resistors per the schematic, must be connected into the circuit before proceeding.

8.2.1. SVF Single Phase Relay

Set the index mark on the shunt to the 30 volt mark (approximately 3/4" below the frame). Apply 120 volts 60 hertz and adjust the resistor for a dropout value of 30 volts 60 hertz, (approximately 500 ohms). Reduce the voltage from 120 volts to the dropout value when checking the dropout setting. If a new scale is being calibrated, mark the 35, 40, and 45 volt points. The dropout value at 25 hertz should not vary more than 5% from the 60 hertz value.

The pickup value for the 45 volt setting must be less than 80 volts.

8.2.2. SVF-3 Three Phase Relay

Apply 3 phase, 120 volts 60 hertz phase-to-phase to the relay case or to the relay with the appropriate resistors in series. Calibrate as per the single phase values for the SVF.

The pickup value for the 45 volt setting must be 96 volts ac or less.

8.2.3. SVF-1 Single Phase Relay

Set the index mark on the shunt to the 24 volt mark, (approximately 3/4" below the frame). Apply 120 volts 60 hertz and adjust the resistor for a dropout value of 24 volts 60 hertz, (approximately 600 ohms). Reduce the voltage from 120 volts to the dropout value when checking the dropout setting. If a new scale is being calibrated, mark the 24, 30 and 36 volt points. The dropout value at 25 hertz should not vary more than 5% from the 60 hertz value.

The pickup value for the 36 volt setting must be less than 90 volts.

8.2.4. SVF-31 Three Phase Relay

Apply 3 phase 120 volts 60 hertz, phase-to-phase, to the relay case or to the relay with the appropriate resistors in series. check and calibrate for the 18, 24 and 30 volt dropout values.

The pickup value for the 30 volt setting must be 100 volts ac phase-to-phase or less.

9. RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

Figure 1. Type SVF-31 Three Phase Relay (Front View)

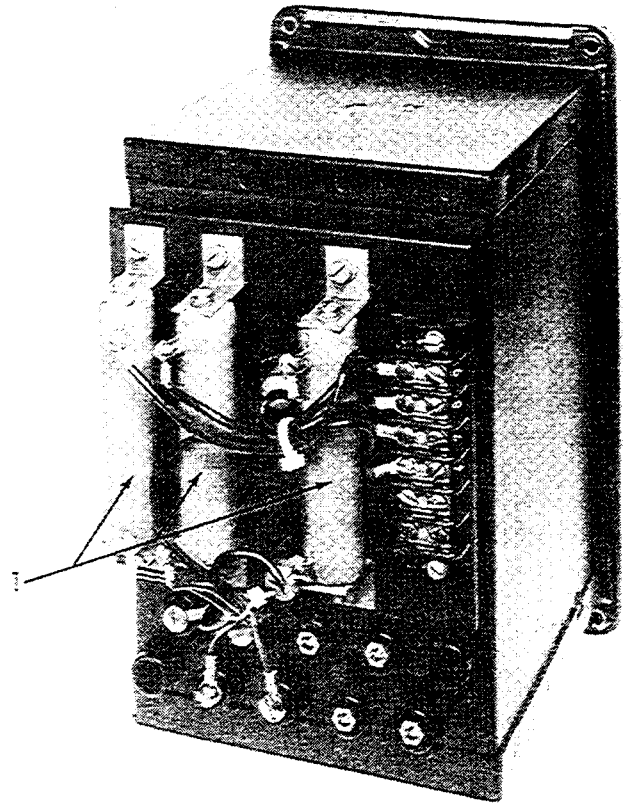

Figure 2. Type SVF-31 Three Phase Relay (Rear Vies)

1-External Resistor Assembly

(Note: For Types of SVF and SVF-1 Single Phase Relay a single resistor and reactor are mounted inside case).

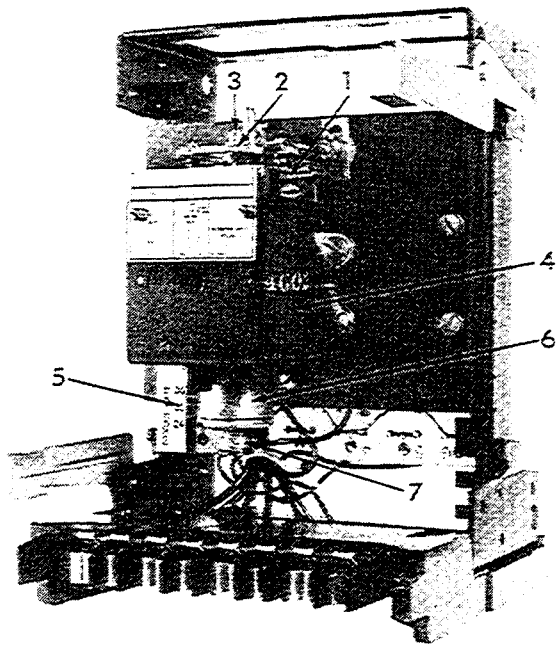

Figure 3. Type SVF-31 Three Phase Relay without case (Front View)

1-Two independent reversible stationary contacts.
2-Moving Contact arm with two contacts.
3-Plunger.
4-Coil.
5-Calibrated Scale.
6-Adjustable Magnetic Shunt.
7-Core Screw.

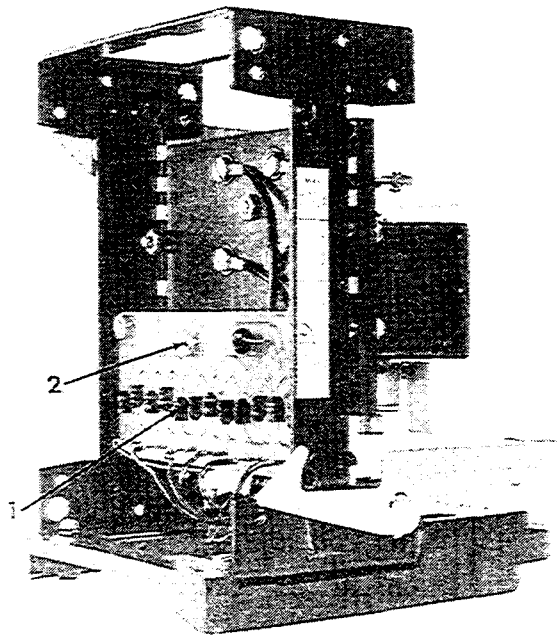

Figure 4. Type SVF-31 Three Phase Relay without case (Rear View).

1-Diodes *2-Capacitor*

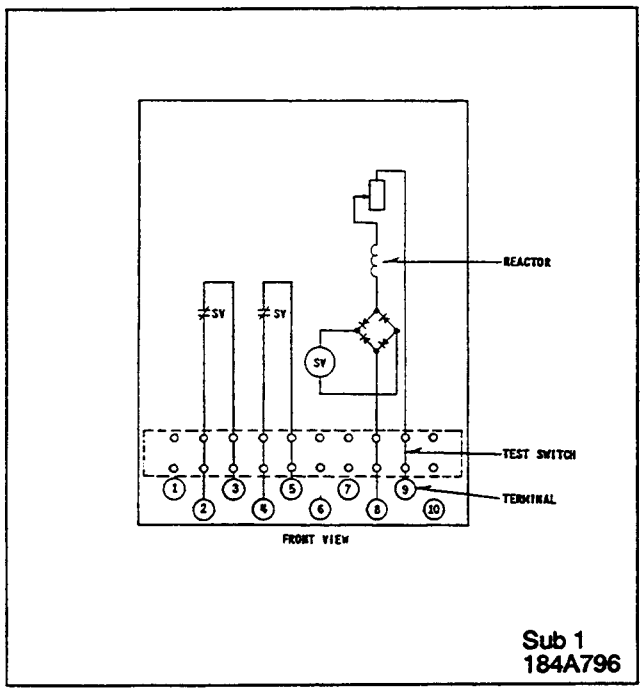

Figure 5. Internal Schematic of the Type SVF and SVF-1 Undervoltage Single Phase Relays, with two circuit opening contacts without chassis shorting switches.

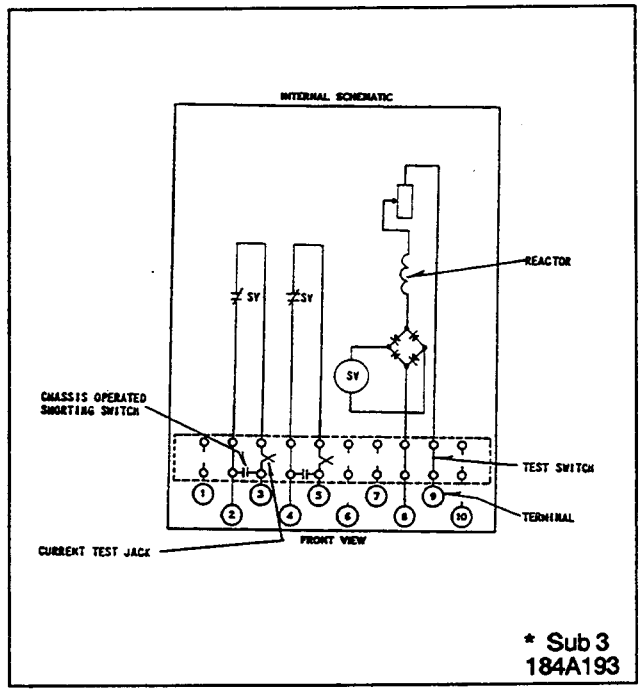

Figure 6. Internal Schematic of the type SVF and SVF-1 Undervoltage Single Phase Relays, with two circuit opening contacts with chassis shorting switches.

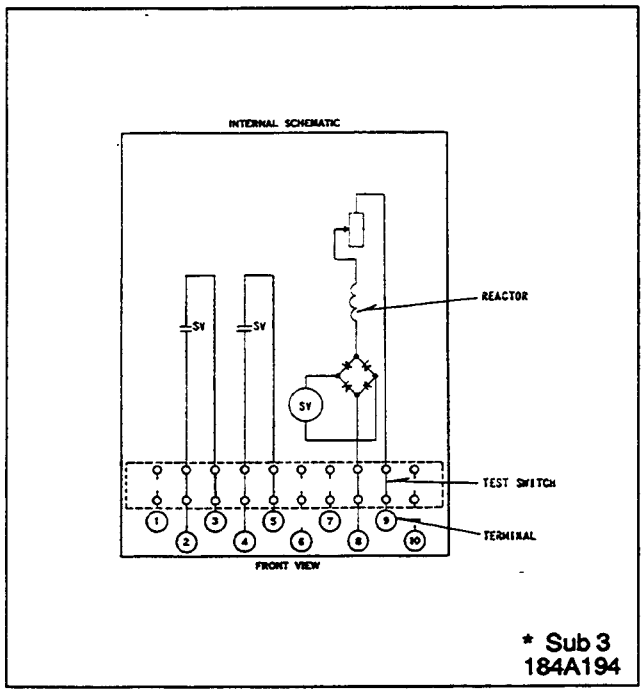

Figure 7. Internal Schematic of the type SVF and SVF-1 Overvoltage Single Phase Relays, with two circuit closing contacts.

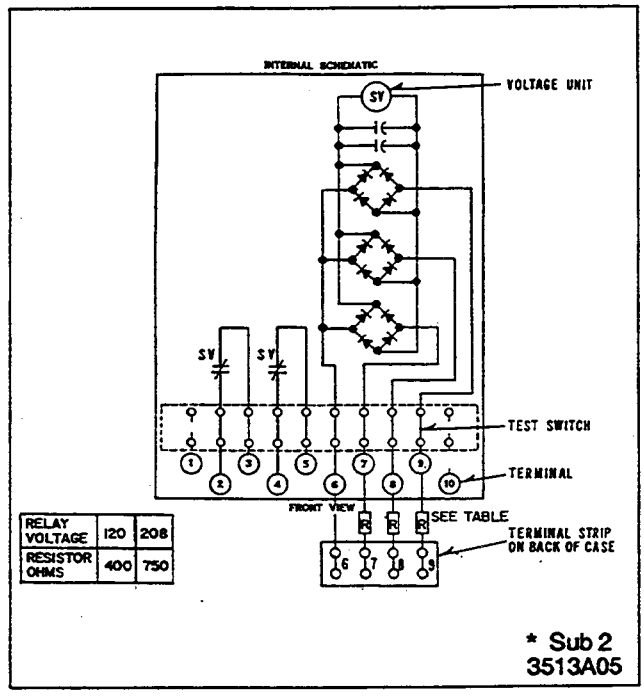

Figure 8. Internal Schematic of the Type SVF and SVF-31 Undervoltage Three Phase Relays, with two circuit opening contacts without chassis shorting switches.

* Denotes Change

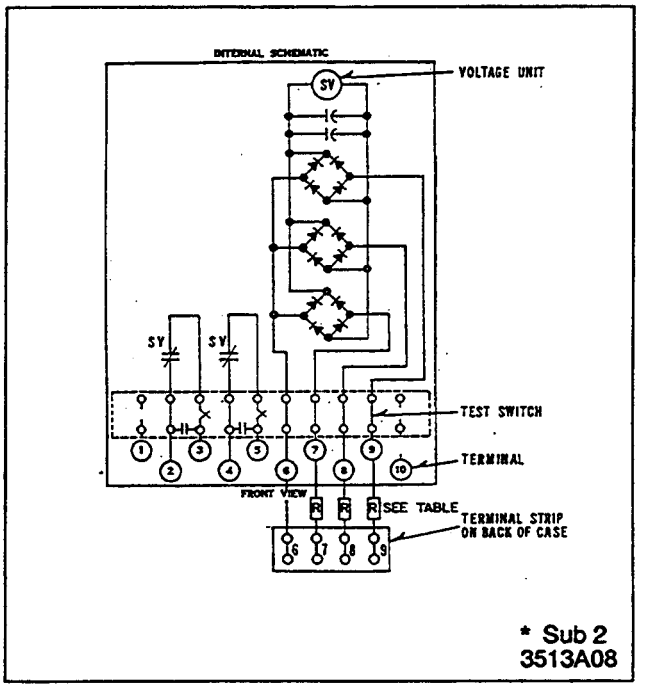

Figure 9. Internal Schematic of the Type SVF-3 and SVF-31 Undervoltage Three Phase Relays, with two circuit contacts with chassis shorting switches.

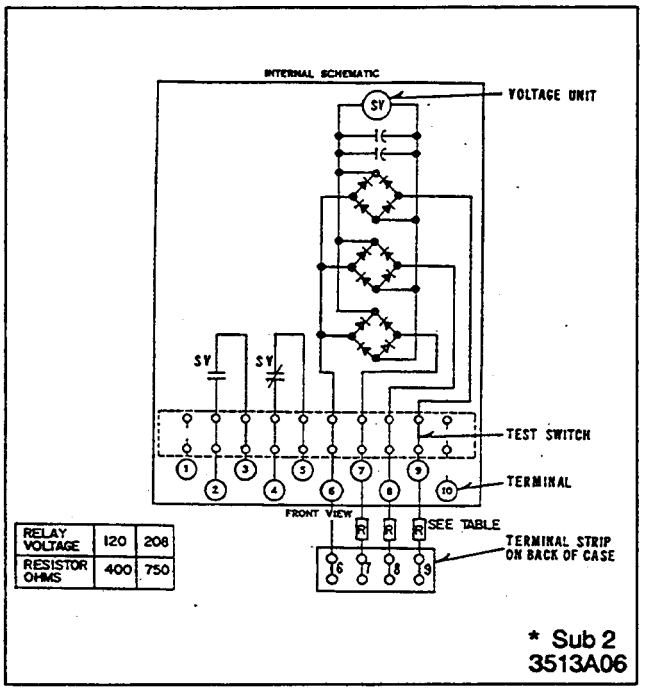

Figure 10. Internal Schematic of the Type SVF-3 and SVF-31 Undervoltage Three Phase Relays, with one circuit opening and one circuit closing contact.

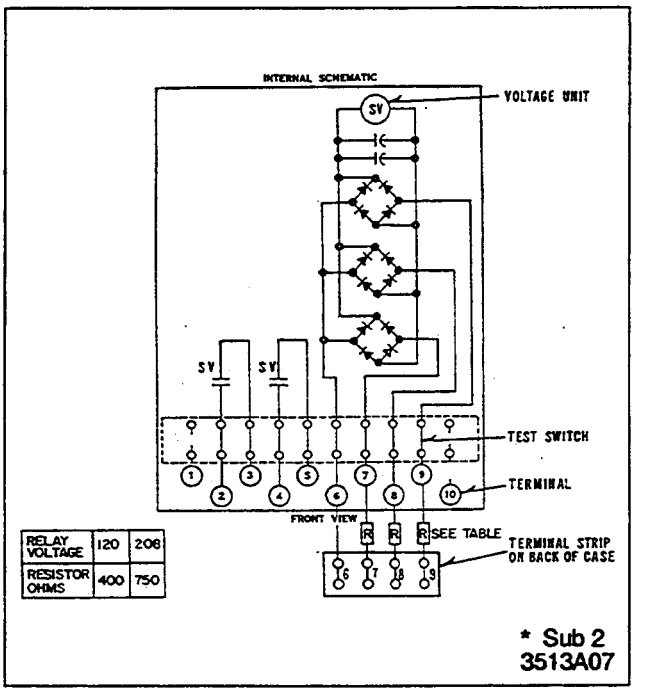

Figure 11. Internal Schematic of the Type SVF-3 and SVF-31 Overvoltage Three Phase Relays, with two circuit closing contacts.

* Denotes Change

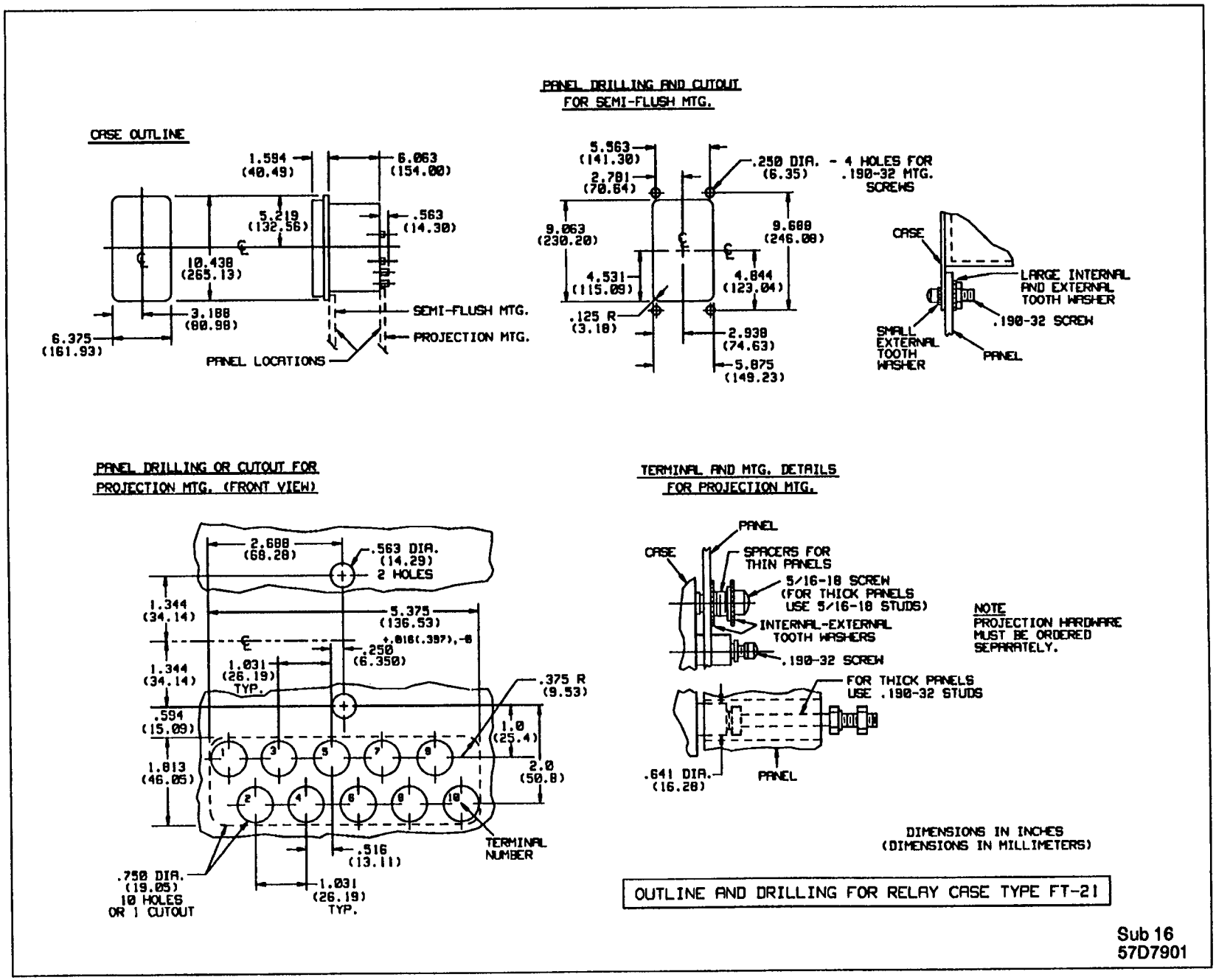

Figure 12. Outline and Drilling Plan for Type SVF and SVF-1 Single Phase Relays in Type FT 21 Case.

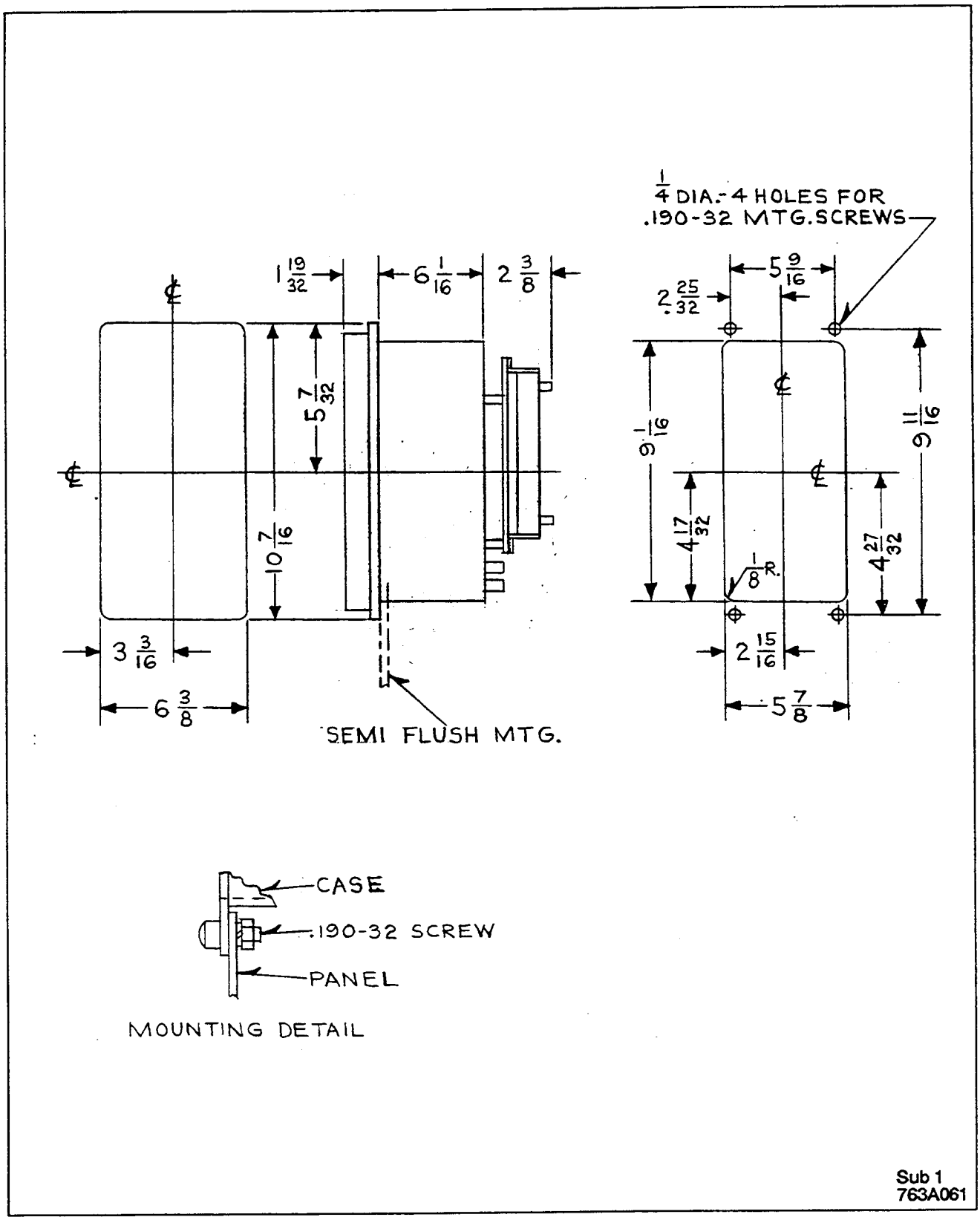

Figure 13. Outline and Drilling Plan for Type SVF-3 and SVF-31 Three Phase Relays in Type FT 21 Case (Semi-flush mounting).