



INSTALLATION • OPERATION • MAINTENANCE INSTRUCTIONS

TYPE RC AUTOMATIC RECLOSING RELAY

CAUTION Before putting relays into service, remove all blocking which may have been 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.

APPLICATION

The type RC automatic reclosing relay is used for automatic reclosure of AC or DC electrically operated circuit breakers after they have been opened by overcurrent or other protective relay action. The relay may be adjusted to provide several reclosures at predetermined time intervals, so that in case the breaker does not remain closed after the first reclosure additional reclosures will be made. The first reclosure usually is an instantaneous reclosure through pre-closed contacts since system operating experience has shown that the majority of faults are of a temporary nature, such as lightning flashovers, and will not be re-established after interruption of the fault current. Consequently, service interruption can be minimized by the use of an instantaneous reclosure. However, the first reclosure may be delayed if desired.

In case the circuit breaker does not remain closed after the first reclosure, the relay will make additional reclosures at suitably graded intervals. It is common practice to make two additional reclosures, but the relay may be adjusted to make any number up to a total of six reclosures if desired. If the breaker does not remain closed after the final reclosure, the timing drum stops in the "Lockout" position, and any further attempts at reclosure must be made by manual operation of the control switch. However, if the breaker remains closed after any automatic reclosure, or, subsequently, after manual reclosure, the relay timing drum will advance to and stop at the "Start" position, where the relay is in readiness for another cycle of automatic reclosures following the next tripping of the breaker.

For any automatic reclosing application, the de-rating factors for breaker interrupting ability should

be checked when choosing any particular reclosing cycle. Also, when using instantaneous first reclosure it is necessary that the protective relays open their contacts within 10 cycles or less after the breaker is tripped in order that the trip circuit will be de-energized before reclosure takes place.

CONSTRUCTION

As shown in figure 1, the RC relay consists of a latching solenoid unit, Y, a synchronous motor driven timing unit and an instantaneous auxiliary unit, X. An additional instantaneous unit, Z, is also provided when specified.

Timing Unit

The timing unit contains a synchronous motor and gear train mounted behind the front sub-base. The gear train drives a drum with cams, which actuate contacts 1, 2, 3, 4 and 14. Cam 5 actuates the Y unit latch to reset the Y unit and close the Y13 contact. Cams #1 and #2, which operate contacts 1 and 2 respectively, are notched and are not intended to be adjusted in the field. Cam #3 is a series of flat springs secured by screws, which can be located at any point on the periphery of the drum. Cams #4 and #5 consist of screws which can be set at any point on the periphery of the drum. Cam #14 is a single micarta block, located to the rear of the cam #5 position and held by a #5 cam screw.

The gear train reduction ratio is adjustable. The drum speed dial contains indices, which are lined up with an index mark to mesh the proper gears for the desired drum speed. A clamping screw is provided at the edge of this dial. A push rod is located on the front of the drum to demesh the drum and permit free manual drum rotation.

The dial on the timing drum has 60 divisions (second intervals with 60 second drum speed). The edges of the #3, 4 and 5 cam slots have 12 equally spaced white marks corresponding to 5 second intervals with a 60 second drum speed.

SUPERSEDES I.L. 41-661B

*Denotes change from superseded issue.

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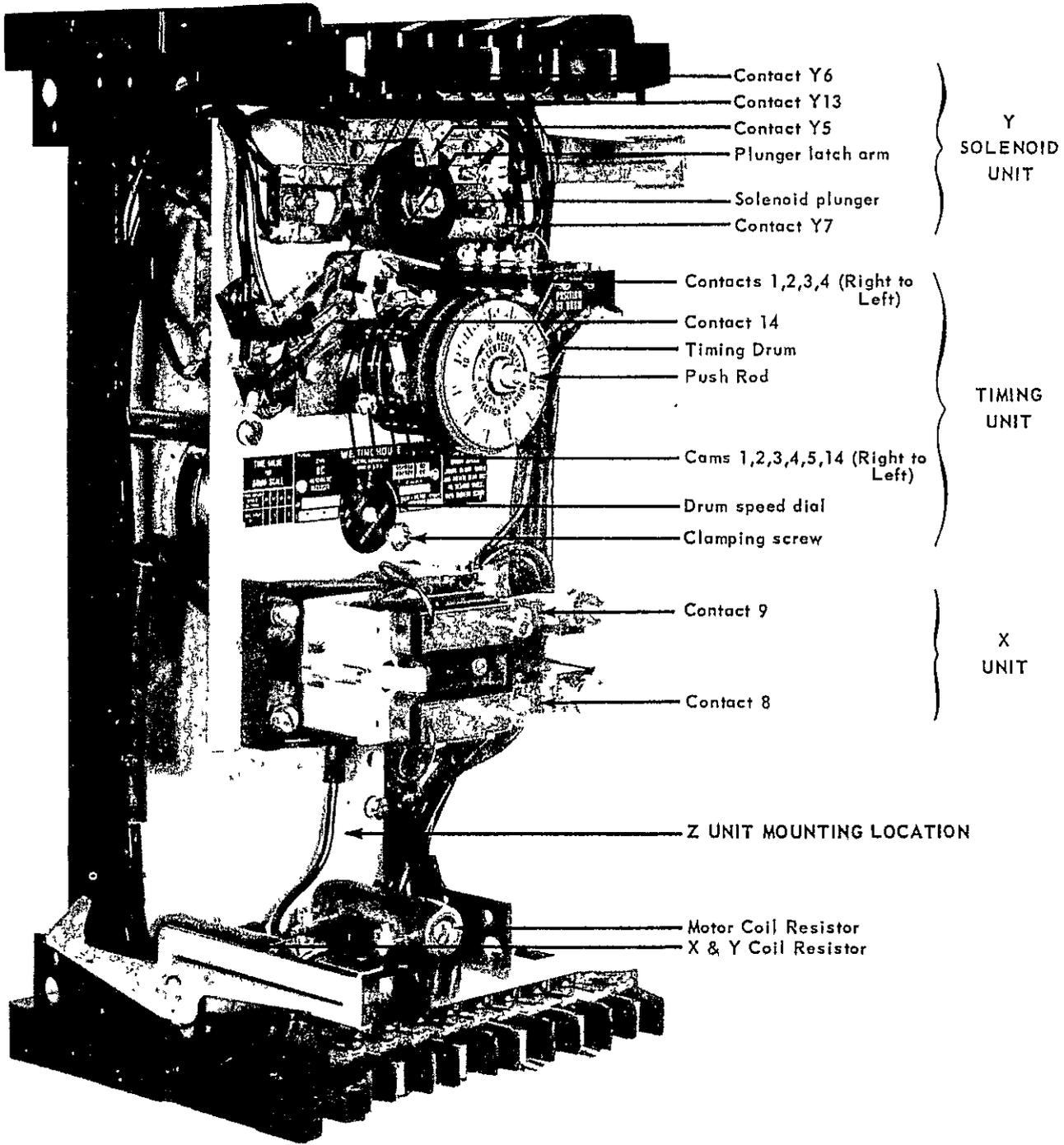


Fig. 1. Type RC Relay, Without "Z" Unit, Without Case.

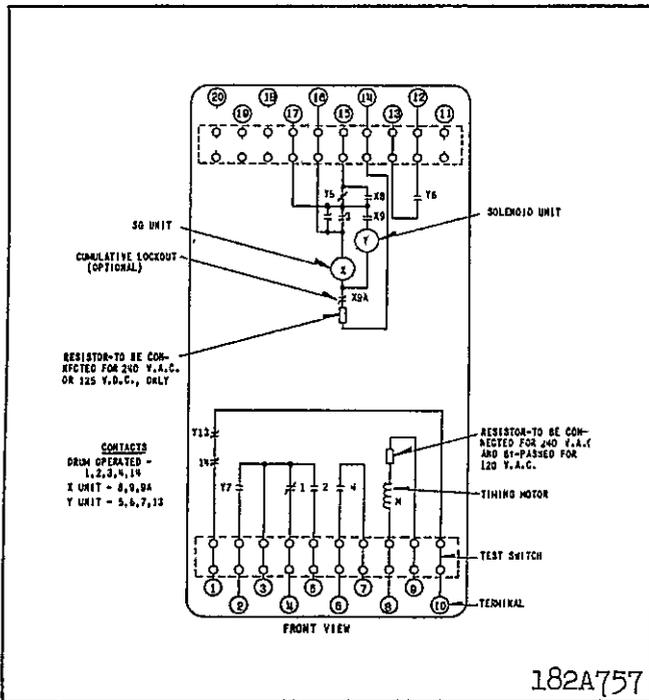


Fig. 2. Internal Schematic of the RC Relay, Without Z Unit, in Type FT32 Case.

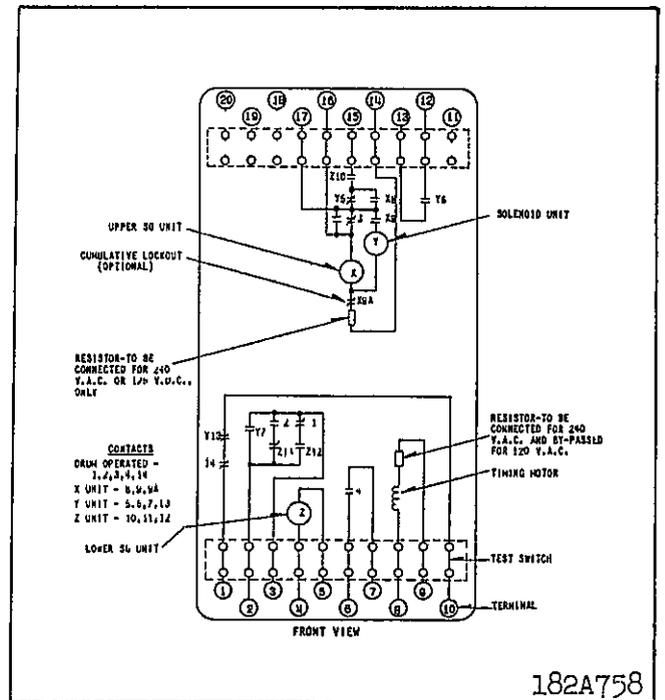


Fig. 3. Internal Schematic of the RC Relay, With Z Unit, in Type FT32 Case.

Y Solenoid Unit

The Y unit coil is located to the rear of the front sub-base. When energized a plunger is attracted toward the rear of the relay against a spring. A micarta disc on the front end of the plunger actuates contacts Y5, Y6 and Y7. As the disc moves to the rear it releases the latch arm. When released the latch arm is rotated counterclockwise by the tension of the moving contact spring of contact Y13 and a small helical spring. This rotation blocks the full reset when Y is de-energized. Thus, the Y unit has three positions as shown in Table I. The Y unit, is reset by the #5 cam on the timing drum, which rotates the latch arm clockwise against the tension of the Y13 moving contact spring.

Instantaneous X Unit and Optional Cumulative Lockout

The X unit is a clapper type auxiliary relay similar to the type SG with two make contacts, X8 and X9. The X unit also operates a ratchet mechanism, when supplied, to count the number of breaker operations. After a preset number of counts the ratchet will open the cumulative lockout contact, 9A. The ratchet teeth are numbered so that remaining operations before lockout can be visually determined. The relay case cover must be removed to reset the ratchet.

Instantaneous Z Unit (When used)

The Z unit is a clapper type auxiliary relay (standard SG) with one make contact, Z10, and make-break contacts, Z11 and Z12.

Table I

Y UNIT CONTACT POSITIONS

PLUNGER POSITION	CONTACT POSITION			
	Y5	Y6	Y7	Y13
Reset	Closed	Open	Open	Closed
Latched and De-energized (Intermediate)	Open	Open	Closed	Open
Energized	Open	Closed	Closed	Open

OPERATION

Operation of the relay and associated equipment will be described, using the external schematic in figure 7, in conjunction with figures 4 and 5, which show contact positions as a function of the drum position. Figure 5 is based on the factory cam adjustment—immediate, 15 and 45 second reclosures, with one drum revolution in 60 seconds. It is further assumed in figure 5 that the instantaneous trip is locked out after the first reclosure, and the fault is not cleared prior to lockout.

Motor Control

Motor energization is controlled by cams 1 and 2. In the start position the motor is energized through #1 and 52b contacts when the breaker opens. As the drum moves away from the start position, #2 contact closes to energize the motor through the 52a contact during the time that the breaker is closed. If the breaker is closed at the lockout position the drum will continue to rotate until the #2 contact opens at the start position. If the breaker is open, the drum will stop in the lockout position, since the #1, 52a and Y7 contacts are all open at this point.

Contact Y7 keeps the motor energized when the breaker remains closed after an immediate reclosure until the #2 contact can close. For this condition, 52b opens before the drum can rotate sufficiently to close the #2 contact. Contact Y7 has no significance during subsequent reclosing operations.

Closing Sequencing

The number of reclosures and the time at which they occur is determined by the location of the #3 cam screws, which close the #3 contact.

Instantaneous Trip Lockout

As shown in figures 5 and 7, the trip circuit of the instantaneous trips units is opened by Y13 and 14 contacts from the time of the first reclosure until the drum returns to the start position. During the initial reclosing, contact Y13 is opened and remains open until the Y unit is completely reset at 6 seconds. The purpose of contact Y13 is to keep the trip circuit open until cam contact, 14, can be opened by the drum rotation. Contact Y13 has no significance during subsequent reclosing operations.

X-Y Anti-Pump Circuit

Referring to figure 7, when the breaker close circuit is energized through 52bb, Y5 and #3 contacts, the 79X coil is also energized. Then, X8 and X9 contacts seal around the Y5 contact and energize

79Y coil, respectively. Contact Y5 opens and remains open until the Y unit is completely reset at 6 seconds. As the breaker closes, 52bb contact opens, de-energizing the X and Y coils. Should the breaker immediately trip again, contacts Y5 and X8 will be open to prevent premature energization of the breaker close circuit.

Complete Operating Sequence

Fault-Trip -- Immediate Reclosure

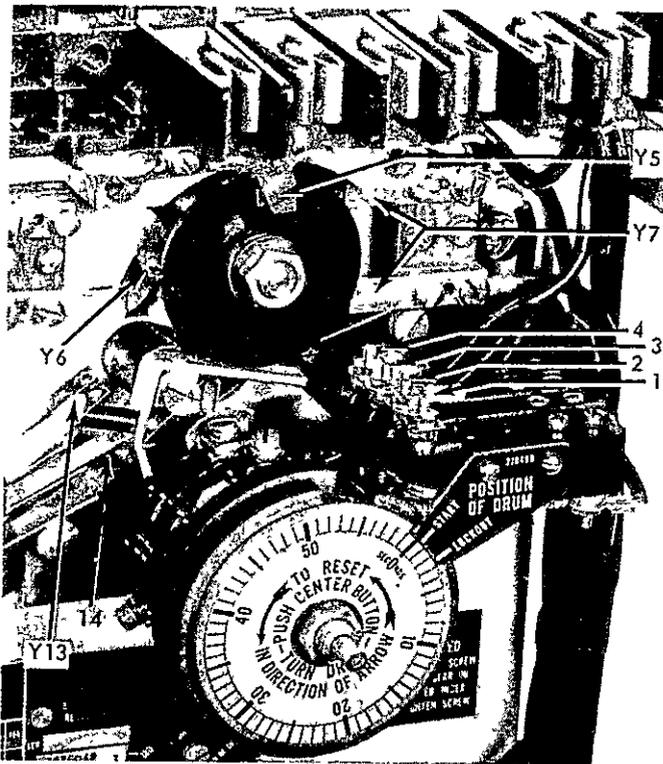
Refer to figure 7. With the timing drum in the "Start" position, a #3 cam spring will be holding contact #3 closed. The breaker switch contacts 52b and 52bb close, energizing the motor 79M through contact #1, and the drum begins to rotate. At the same time the coil of the contactor unit, 79X, is energized through drum contact #3, contact Y5, and integrating lockout contact 9A, when used. When the breaker latch checking switch, 52LC, closes, the breaker control relay 52X is immediately energized through the preclosed contacts Y5 and 3. This in turn energizes the closing coil of the breaker, 52C. Simultaneously, contactor unit, 79X, seals in through its contact X8, while its other contact, X9, energizes the coil of solenoid unit 79Y to open contacts Y5 and Y13 and close contacts Y6 and Y7. As the circuit breaker closes, the breaker auxiliary switches 52b and 52bb open, and 52a closes. Opening 52bb de-energizes 79X and 79Y. The latter then resets against its latch to open contact Y6 and remains in this position, thus leaving contacts Y5 and Y13 open and contact Y7 closed until the latch is released. Before the latch is released, the drum-operated contact, 14, will be opened and will remain open until the drum returns to the "Start" position.

Preparing for Second Reclosure

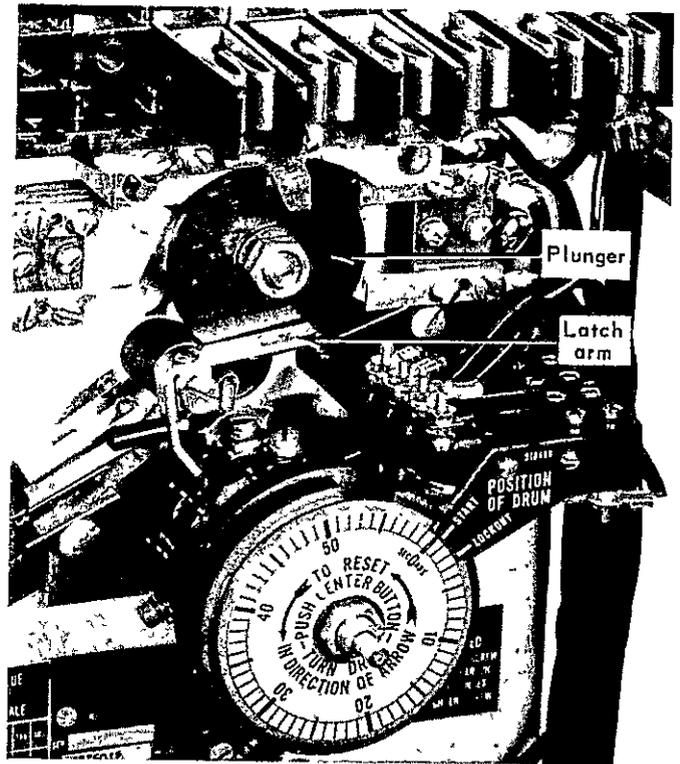
The drum continues to rotate, since the motor is energized through Y7. When the breaker trips the second time, no immediate operation occurs. At about one second, #2 cam contact closes to set up the motor circuit when the breaker is subsequently reclosed. At about the three second drum position contact #3 opens. At about 6 seconds, the Y unit latch is released by the #5 cam, resetting the Y unit. The relay is now ready for another reclosure as soon as contact #3 is closed by the #3 cam spring. The drum will continue to rotate, since the motor is energized through 52b and #1 contacts.

Second and Third Reclosures

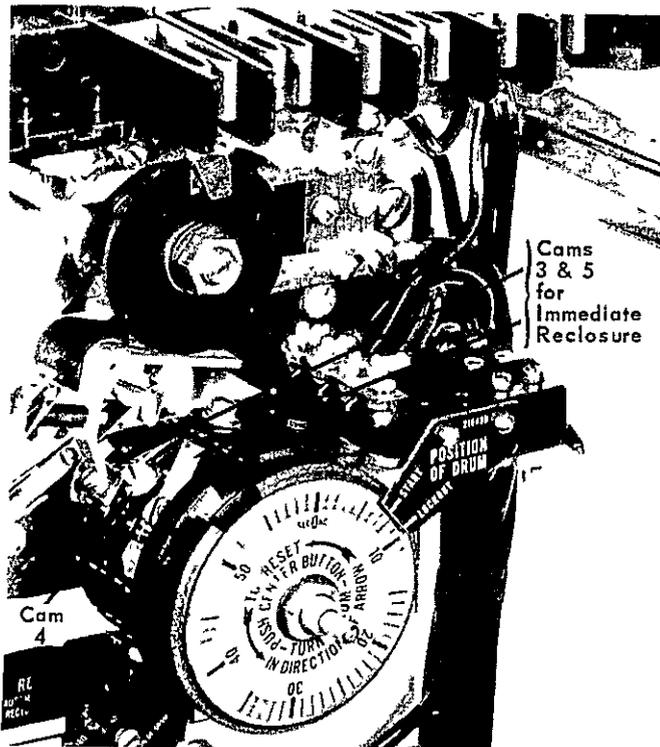
At 15 and 45 seconds the #3 contact closes to reclose the breaker. After each reclose, the Y unit is unlatched by the action of cam #5.



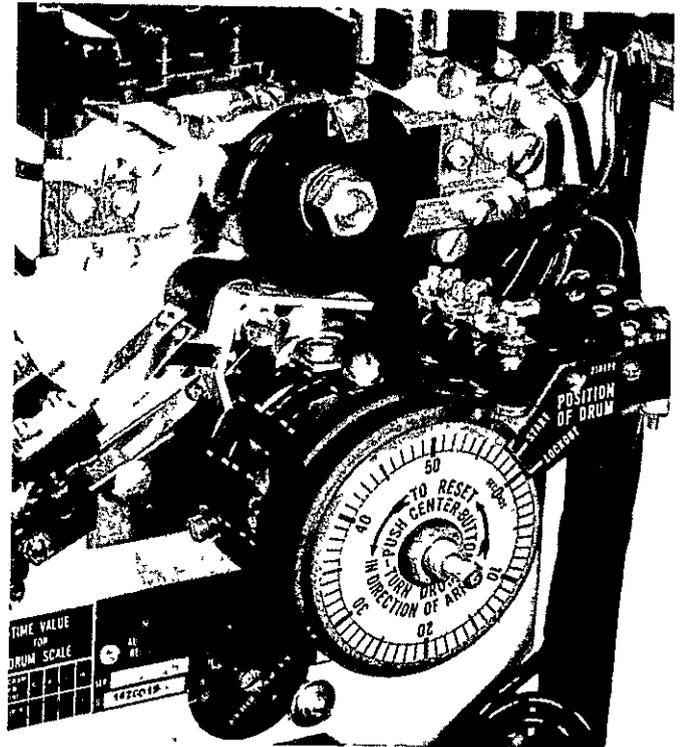
(A) Start Position - Y Unit Reset



(B) During Immediate Reclosing - Y Unit Reset to Latch



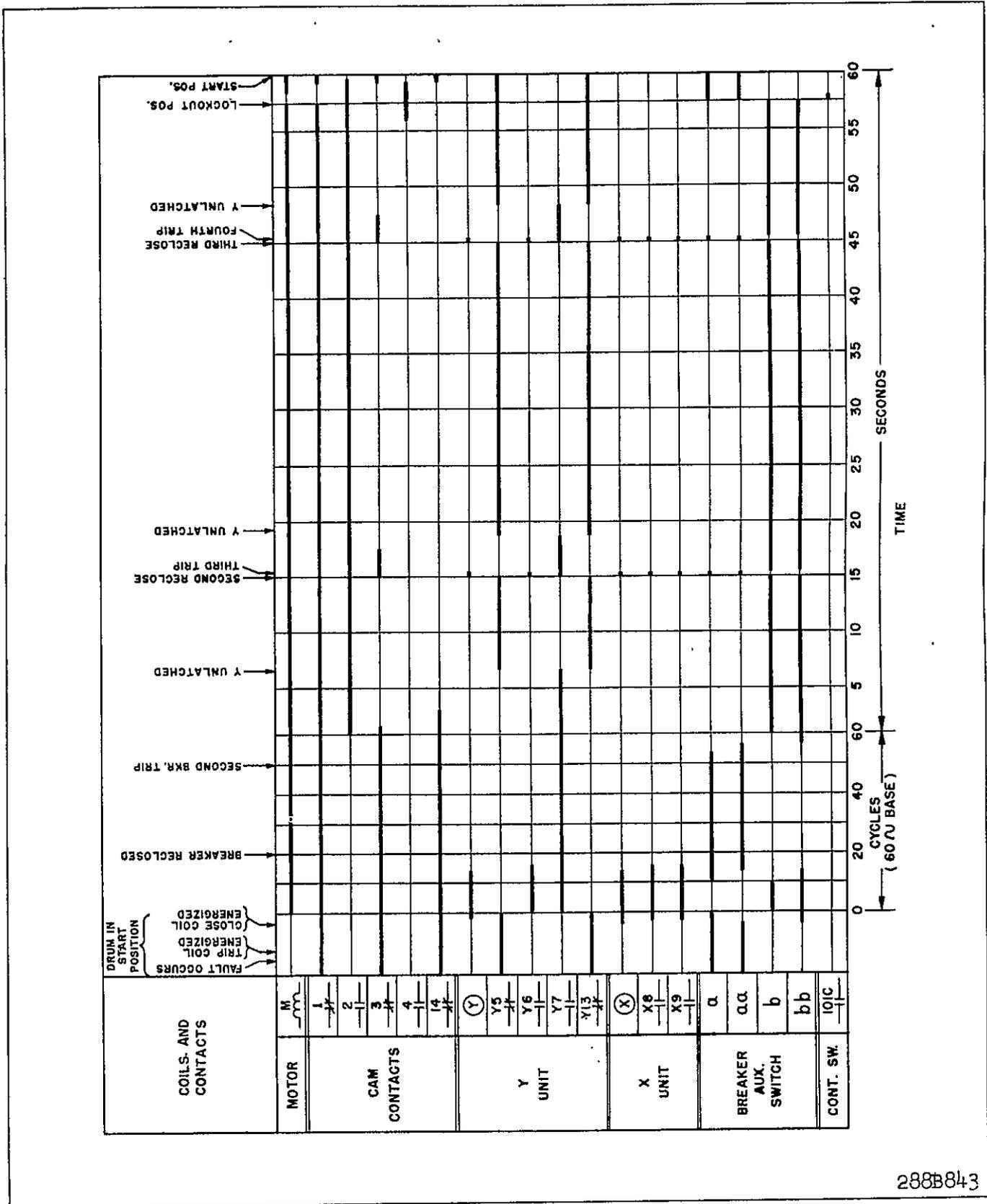
(C) Preparing for Second Reclosure



(D) Lockout Position

Fig. 4. Cam and Y Unit Contact Positions.

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* Fig. 5. Contact Position Development - One Immediate and Two Time Delay Reclosures. Heavy Line Indicates Contact Closed or Coil Energized. One Revolution in 60 Seconds. Permanent Fault. Instantaneous Trip Lockout After First Reclosure.

Lockout

When the drum reaches the lockout position, the motor is de-energized, since cam contact #1 opens (assuming the breaker is open). The breaker must then be closed by the control switch. If the breaker then remains closed the drum will rotate to the "Start" position, where the motor is de-energized by the #2 cam contact.

Optional Arrangements

Alternate operating arrangements are described below.

Reclosing Through Contact Y6

As shown in figures 6, 7 and 8 the close circuit can be energized through contact Y6, where an independent contact is required or where a reclosing delay is desired. Y6 closes approximately 6 cycles after 79X is energized.

Lockout Alarm

A #4 cam screw can be set to close the #4 contact in the lockout position. By jumpering terminals 4 and 6 and connecting terminal 7 to an alarm circuit, an alarm will be sounded when the breaker locks out.

Additional Instantaneous Tripping

Contact #4 can be set to reestablish the instantaneous trip circuit after the last reclosure and prior to lockout, if the instantaneous trip pickup is about equal to the time-overcurrent unit pickup. In this case reestablishment of the instantaneous trip insures breaker lockout if the fault current is near pickup value. The instantaneous trip circuit can alternately be reestablished each time the Y unit is reset by short circuiting the #14 contact with a jumper.

Selective One-Shot Instantaneous Reclosing

By eliminating the #3 cam in the start position and by using terminals 16 and 17 with an external device, selective, instantaneous reclosing can be obtained. When the contact of the external device closes, reclosing will occur in the same manner as if #3 contact closed. Further reclosing by this means can be prevented by using either the Y13 and Y14 contact circuit or by using the #4 contact circuit. In the latter case, the #4 cam is set for contact closure in the start position.

Relays with Z Unit

As shown in figure 8 the Z unit is energized by a 52b contact. Z unit contacts perform the same

functions as 52a and 52b contacts. The use of this unit reduces the number of control wires required.

Motor Operation from DC

An external inverter is available for operation of the motor from either 125 or 250 volts dc. The DC terminals of the inverter are connected in place of terminals 8 and 9 in figure 7. Terminals 8 and 9 are then connected to the AC terminals of the inverter. This arrangement permits the use of an intermittently rated inverter, since the DC terminals are not continuously energized.

CHARACTERISTICS

The standard rating for the relay is:

- Motor 120/240 V., 60 cycles
- X and Y Units 120/240 V., 60 cycles
or 48/125 V. D. C.
- Z Unit (when used) . . . 125 V. D. C.
- Drum Speeds 60-90-180-360
Sec./Rev.

Where the motor is to be operated at 240 volts a resistor in the bottom right side is connected in series with the motor coil. Relays are available for operation on 50 cycles. X & Y units can be supplied for a minimum rating of 24 volts dc, or with a 250 volt rating.

Burden Data

The maximum burdens for the various units of the standard RC relay when energized from a 120 V. 60 cycle supply are listed below:

- Contactor Unit (Device 79X)
 - Open position 49 v. a.
 - Closed position 33 v. a.
- Solenoid Unit (Device 79Y)
 - Open position 151 v. a.
 - Closed position 84 v. a.
- Synch, Motor (Device 79M) 8.5 v. a.
- Auxiliary Unit (Device 79Z)
 - When used
 - Closed position 10.5 v. a. at 120 V
60 Cycle
3.5 watts at
125 V. D. C.

The burdens of the X and Y units occur only momentarily during the reclosing cycle but the motor is energized throughout the reclosing cycle. The X and Y units can be energized for a 5 minute period and the motor for a 15 minute period without injury. The Z unit can be energized continuously.

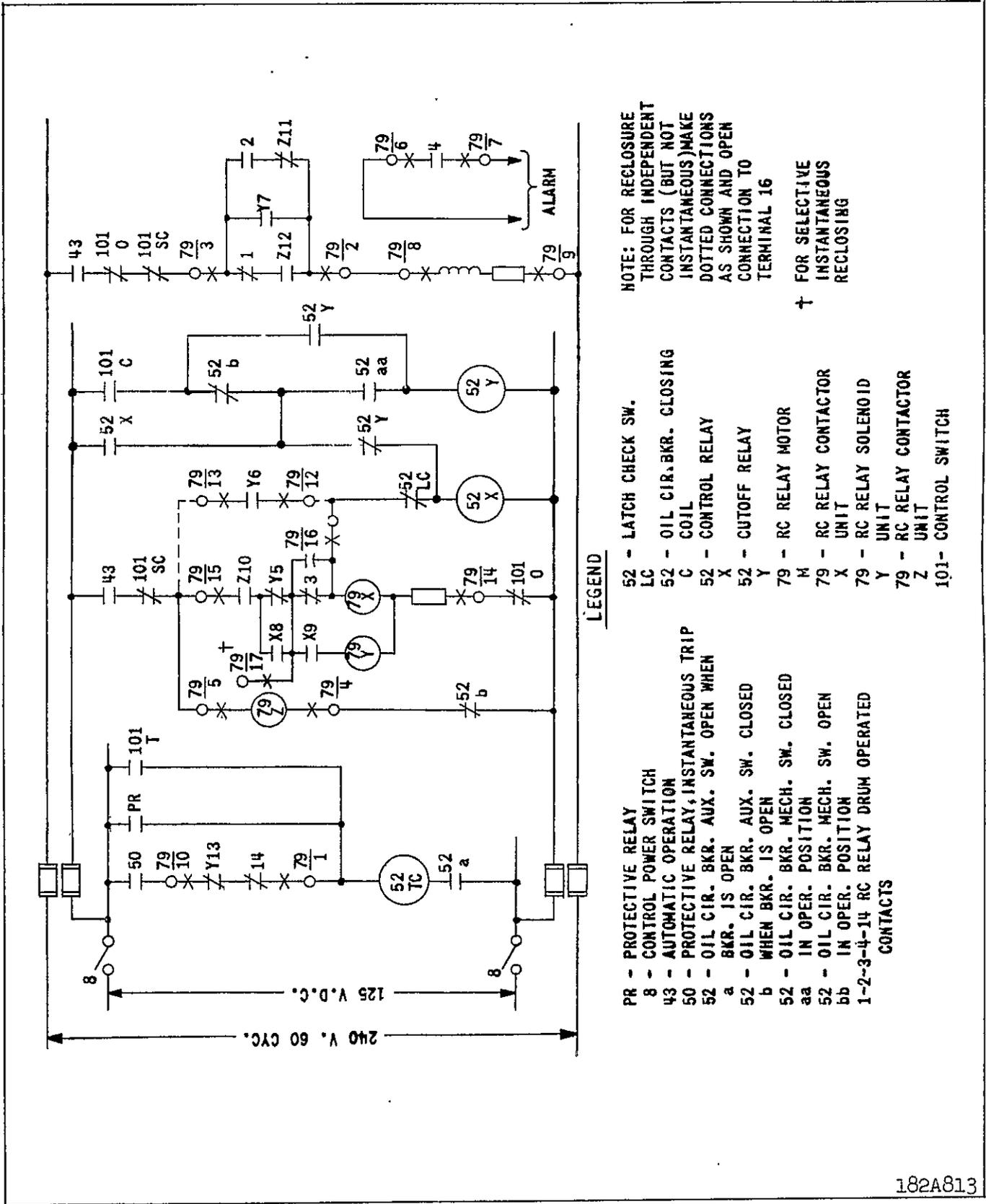


Fig. 8. External Schematic of the Type RC Relay, With Z Unit, With DC Breaker Control Circuit.

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SETTINGS

No settings are necessary unless factory settings do not meet the application requirements. The factory settings are for three reclosures—immediate, 15 and 45 seconds, with a drum revolution in 60 seconds. Contact #4 is set to close in the lockout position. Contact #14 is set to close in the start position for instantaneous trip lockout after the first reclosure. The standard relay is shipped with the X and Y coil and motor coil resistors connected. With these connections the X and Y coils may be used at 125 volts dc or 240 volts ac; the motor, at 240 volts ac.

Coil Resistor Reconnection

If the X and Y coils of the standard relay are to be used on 48 volts dc or 120 volts ac, the X and Y coil resistor must be bypassed. If the motor is to be energized at 120 volts ac, the motor coil resistor must be bypassed.

Drum Speed

To change the drum speed, loosen the clamping screw at the edge of the drum speed dial, depress the push rod on the drum, and rotate the motor and gear assembly to the desired speed position, by pushing on one or more of the posts between the motor and gear mounting plates. Then tighten the clamping screw. Select the fastest drum speed which will accommodate the desired reclose timing.

Reclose Sequence

The #3 cam springs (which initiate reclosing) can be set at any point from the start position, to the 50th scale division, by loosening the cam spring screw and sliding the cam to the desired position. The cams may not be spaced closer than 10 scale divisions. If a closer spacing is used there is not sufficient time to open the #3 contact and then unlatch the Y unit. Thus, the maximum number of reclosures is six at the 0, 10, 20, 30, 40 and 50 scale division points. A cam spring may not be placed past the 50th scale division. Otherwise insufficient time is available to allow the Y unit to unlatch and #5 cam screw to travel clear of the latch before the lockout position. A thin headed screw is located in the #3 groove near the start position. This screw acts as a stop to prevent a #3 cam spring setting which would close the #3 contact with the drum in the in the lockout position.

After the #3 cam springs have been set, the #5 cam screws must be located to unlatch the Y unit after each #3 contact closure. The #5 screws should not rotate the Y unit latch arm until the #3 contact has opened. In addition, the #5 cam screws must

be clear of the Y unit latch arm before the next #3 contact closure.

Hardware is shipped with each relay to provide additional cams than those used with factory settings.

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 by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a 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.

Caution

If the circuit breaker does not have a latch check switch, reclosing should be delayed by use of the Y6 contact either to directly energize the close circuit, or to energize an external auxiliary relay. Using the Y6 contact will delay reclosing about 2 cycles after 52bb contact closes with X & Y energized by ac voltage; 4 cycles, with X & Y energized by dc voltage.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Re-adjustment after receipt by the customer will be necessary only as required by the reclosing cycle requirements and the supply voltages of a particular application as described under "Settings." In reassembling the relay after repairs, or in checking the adjustments at regular maintenance periods, the instructions below should be followed.

Acceptance Check

The factory settings of the standard relay are:

Coil Resistors in series with X and Y,
and motor

X and Y rating 125 volts dc/240
volts ac

Motor rating 240 volts 60 cycles

Motor speed 1 revolution in
60 seconds

Contact Settings See figure 5

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The following checks may be performed to determine if the relay, as received from the factory, is in serviceable condition.

Energize the X, Y and motor coils with 50% of the above ac ratings (or 80% of dc rating) or at lower ratings by bypassing the coil resistor or resistors. Energize the Z coil at 80% of pickup. See that X and Y pick up positively and that proper contact action is obtained. The correct adjustment of the X unit is as follows: Set the distance from the front end of the armature mold to the metal yoke to 1/2 inch. Set the X8 contact gap at 3/64" and the X9 gap at 3/32". With the above adjustment X9 should have a minimum of 1/32" contact follow. Y unit contact action is detailed under "Construction."

Determine the time required for one drum revolution. The time in seconds should correspond to the drum speed dial marking $\pm 3.5\%$. Observe drum cam action during this interval or by manually rotating the drum with the push rod depressed.

Routine Maintenance

All contacts should be periodically cleaned with a fine file. A contact burnisher S#182A836HO1 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.

Motor Lubrication

The motor bearing contains a supply of special lubricant sufficient for from three to five years service. This lubricant does not congeal at low temperatures and permits satisfactory operation of the motor at ambient temperatures of 30° F to -40° F, such as sometimes may occur in outdoor installations. This oil is available in 1 oz. bottles as S#1723639.

To lubricate the motor, withdraw the drum speed dial assembly after removing the clamping screw and the black screws. Then, gently work the motor and gear assembly loose from the rear chassis mounting plate and lower it under the front chassis mounting plate. (When used, the Z unit must be removed). Remove the gear plate of the motor and gear assembly and, then, the knurled oil cap. Saturate the wool with S#1723639 oil. Reassemble.

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 date.

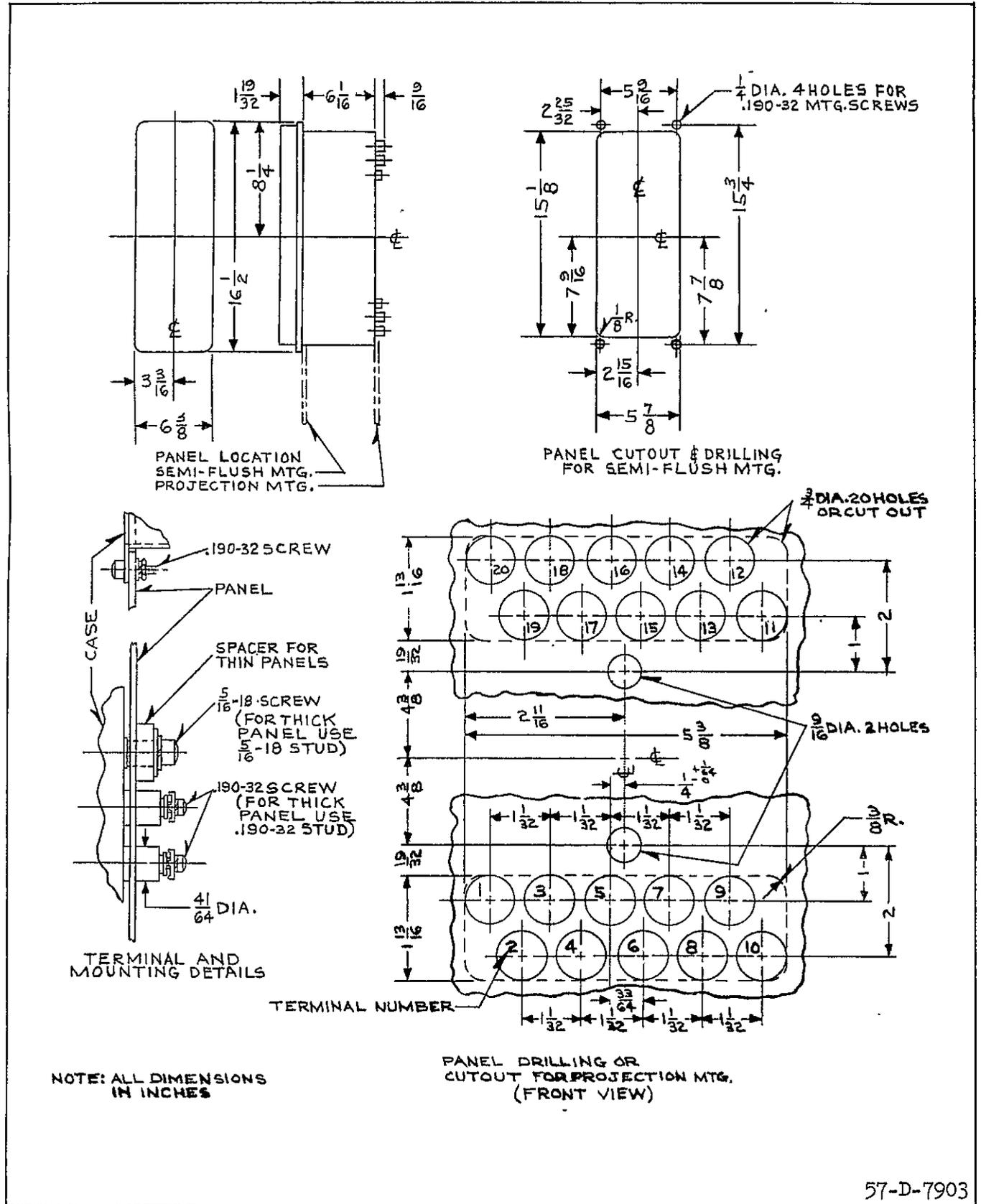


Fig. 9. Outline and Drilling Plan for the Type RC Relay in the Type FT32 Case.

