



Addendum to:
41-661.2A

RCL Automatic Reclosing Relay

Effective : April 1990

The resistor and capacitor circuit across the #3 or #4 contact is a high impedance circuit. It provides a suppression function for the dc close application, but should be disconnected for the ac close application because sensitive auxiliary relays in the breaker close circuit may stay picked-up.

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 representative should be contacted.

THIS PAGE RESERVED FOR NOTES



Effective: February 1985

Supersedes I.L. 41-661.2 Dated May 1984

* Denotes Change From Superseded Issue

RCL Automatic Reclosing Relay in FT-21 Case

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 RCL automatic reclosing relay is used for automatic reclosure of a-c or d-c 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 preclosed 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 Fig. 2, the RCL relay consists of a * latching solenoid unit, Y, a synchronous motor driven timing unit, and a telephone relay unit, X.

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

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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.

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 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.

Table I
Y Unit Contact Positions

Plunger Position	Contact Position		
	Y5	Y7	Y13
Reset	Closed	Open	Closed
Latched and De-energized (Intermediate)	Open	Closed	Open
Energized	Open	Closed	Open

OPERATION

Operation of the relay and associated equipment will be described, using the external schematic in Fig. 5, in conjunction with Fig. 4. which

show contact positions as a function of the drum position. Fig. 4 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 Fig. 4, 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.

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 Figs. 5 and 4, the trip circuit of the instantaneous trip 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 Fig. 5, 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

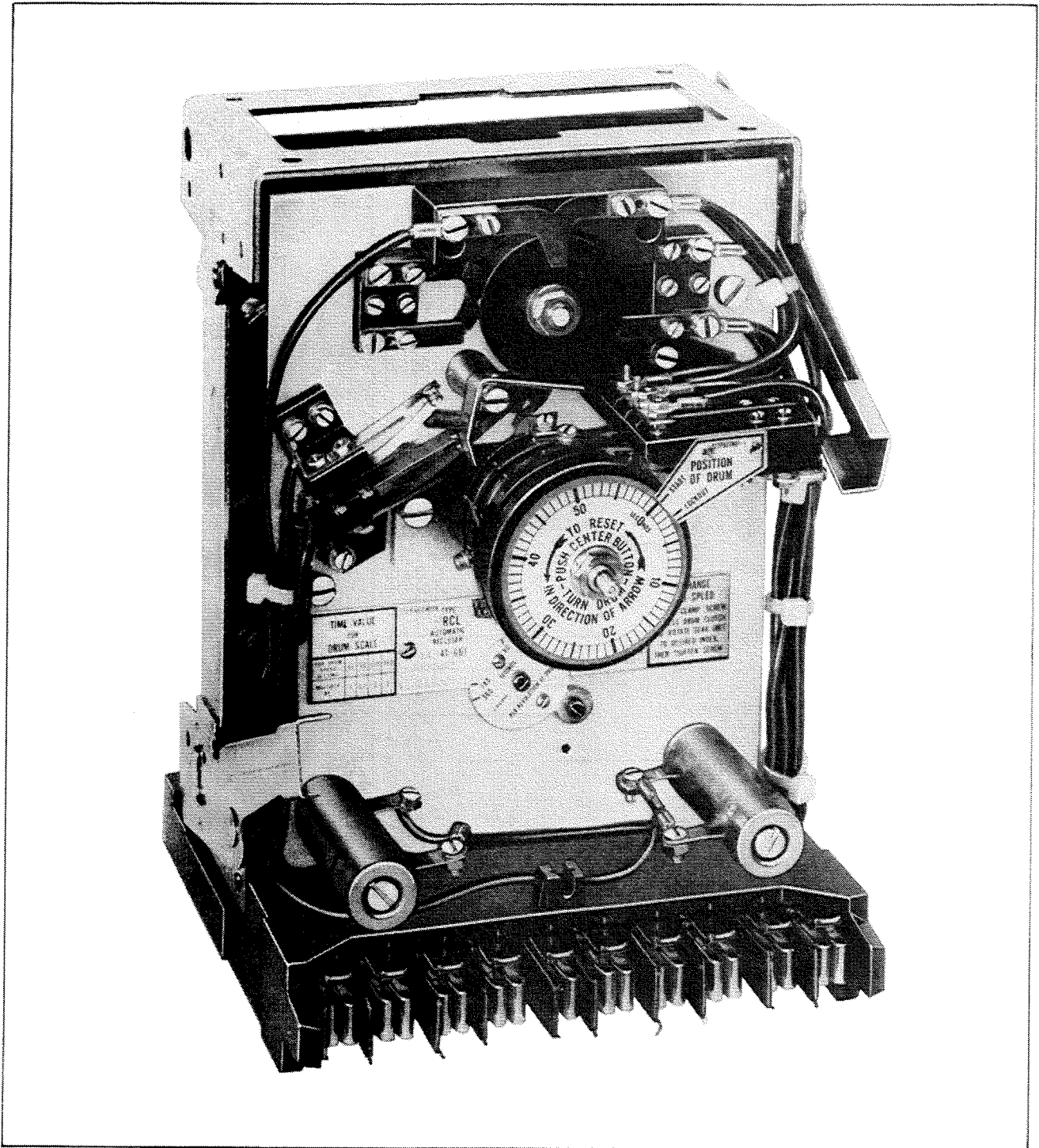


Fig. 1. Type RCL Relay

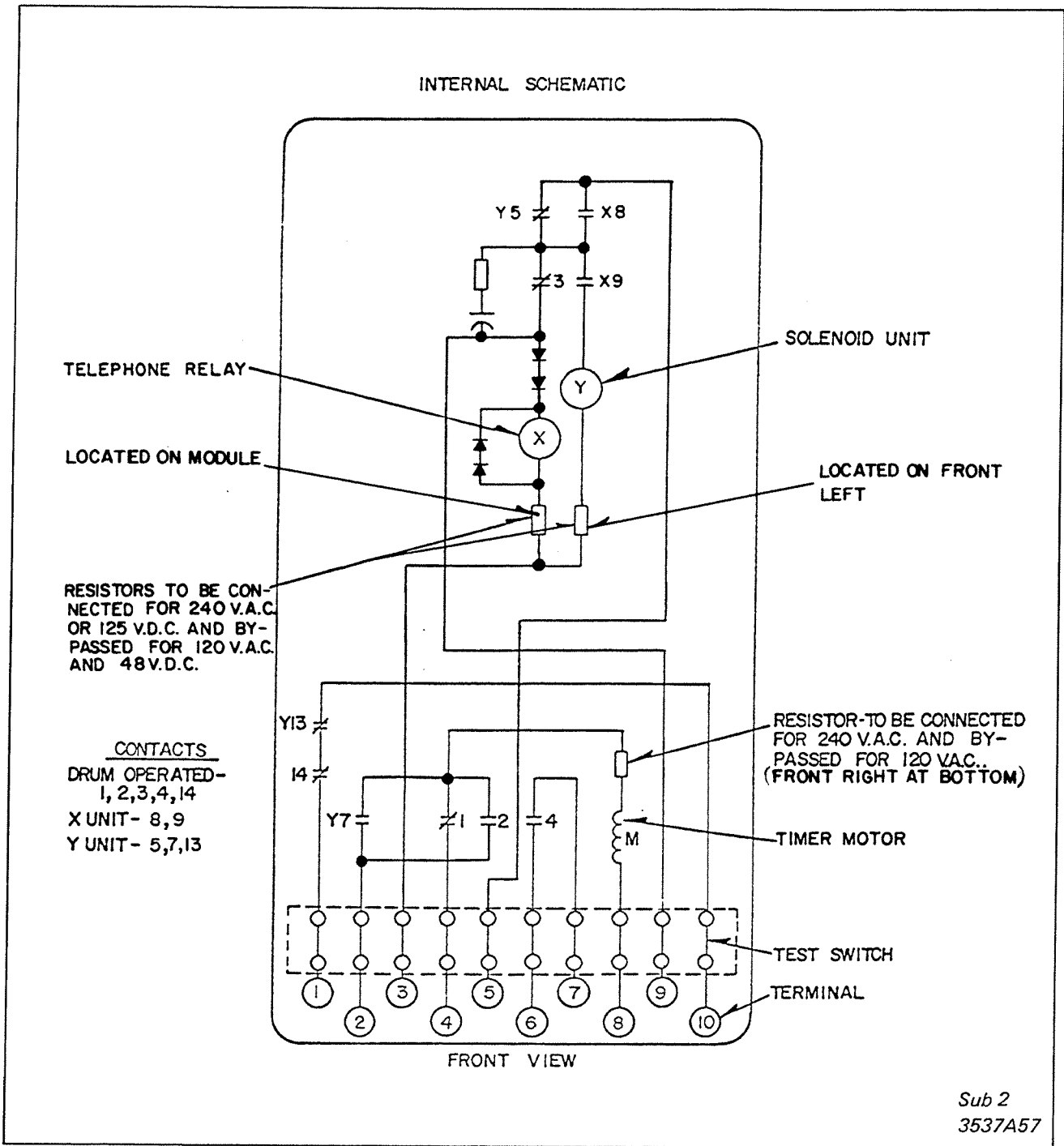
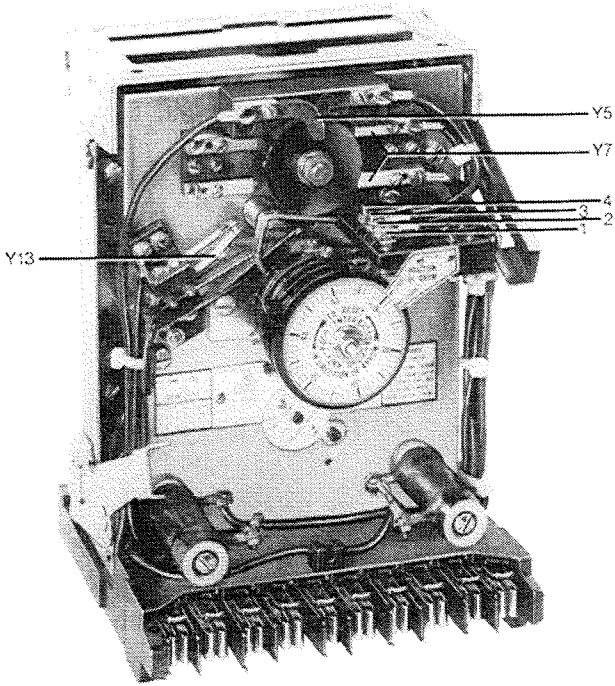
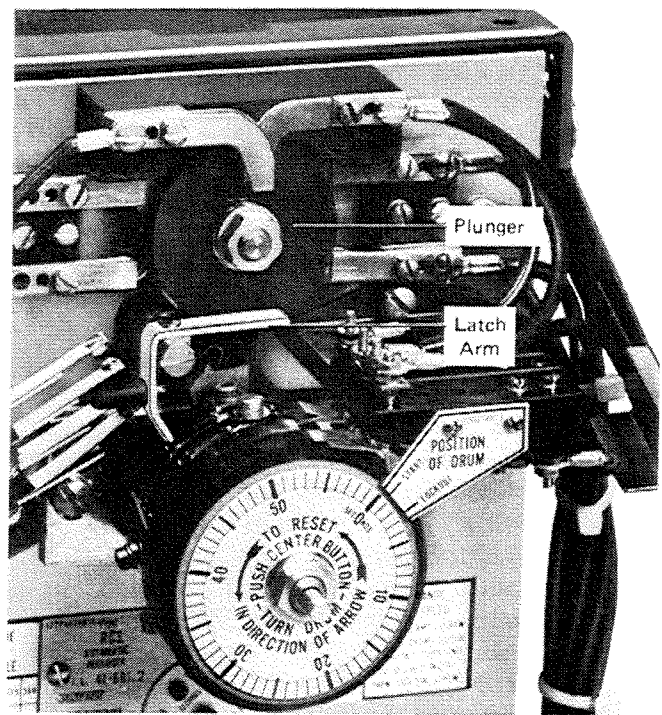


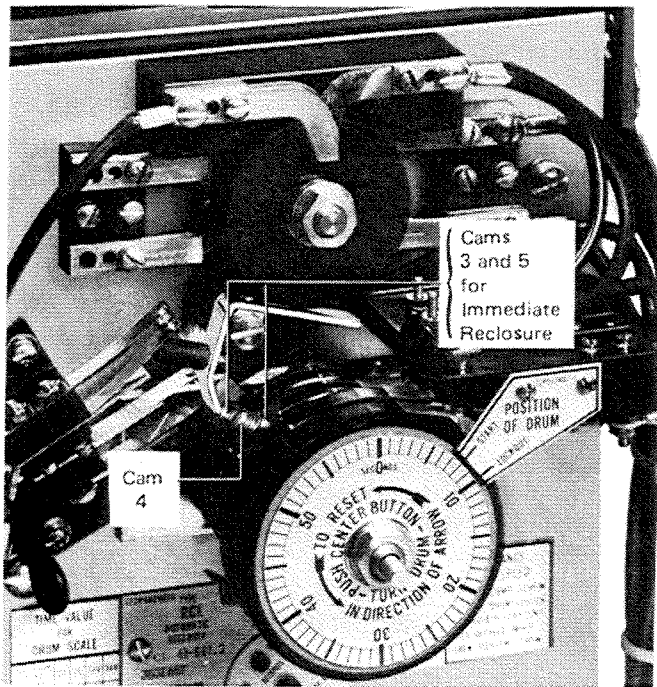
Fig. 2. Internal Schematic of the RCL Relay in Type FT21 Case



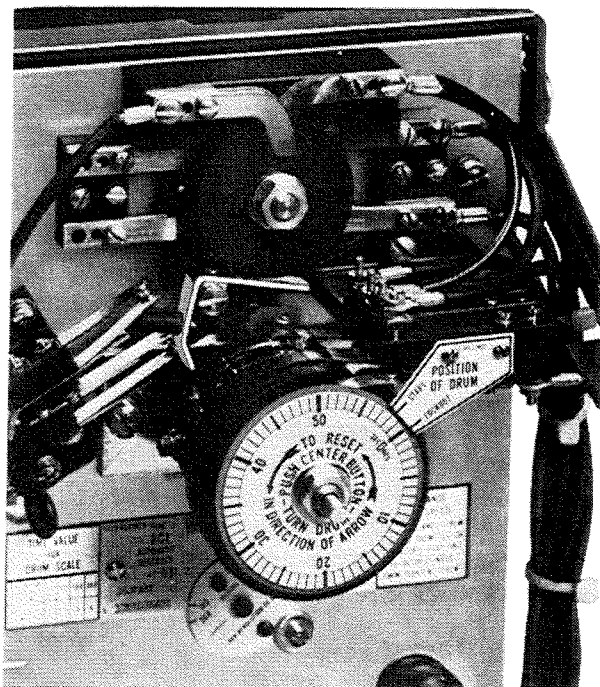
(A) Start Position – Y Unit Reset



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



(C) Preparing for Second Reclosure



(D) Lockout Position

Fig. 3. Cam and Y Unit Contact Positions

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

➊ Refer to Fig. 5. 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, and contact Y5. When the breaker latch checking switch, 52LC, closes, the breaker control relay 52X is immediately energized through the pre-closed 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 contact 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, 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. 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.

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.

CHARACTERISTICS

The standard rating for the relay is:

Motor	120/240 V, 60 hertz
X and Y Units	120/240 V, 60 hertz or 48/125 Vdc
Drum Speeds	60-90-180-360 Sec./Rev.

When 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 hertz. X and Y units can be supplied for a minimum rating of 24 volts d-c, or with a 250 volt rating.

BURDEN DATA

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

Contactor Unit (Device 79X)	
Open position	49 VA
Closed position	33 VA
Solenoid Unit (Device 79Y)	
Open position	151 VA
Closed position	84 VA
Synchronous Motor (Device 79M)	8.5 VA

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 1 minute period and the motor for a 15 minute period without injury.

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 revolu-

tion 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 d-c or 240 volts a-c; the motor, at 240 volts a-c.

COIL RESISTOR RECONNECTION

If the X and Y coils of the standard relay are to be used on 48 volts d-c or 120 volts a-c, the X and Y coil resistor must be bypassed. If the motor is to be energized at 120 volts a-c, 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 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 for applications requiring more cams than are used with the 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 rear mounting stud or studs for the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either the stud or the mounting screws may be utilized for grounding the relay. External toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws or studs, and the relay panel. Ground Wires are affixed to the mounting screws or studs as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal stud furnished with the relay for thick panel mounting. The terminal stud may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

For detail information on the FT case refer to I.L. 41-076.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Readjustment 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.

ROUTINE CHECK

The factory settings of the standard relay are:

Coil Resistors in series with X and Y, and motor:	
X and Y rating	125 Vdc/240 Vac
Motor rating	240 V 60 cycles
Motor speed	1 revolution in
	60 seconds
Contact Settings	See Fig. 4

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 70% of the above a-c ratings (or 80% of d-c rating) or at lower ratings by bypassing the coil resistor or resistors. See that X and Y pick up positively and that proper contact action is obtained.

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.

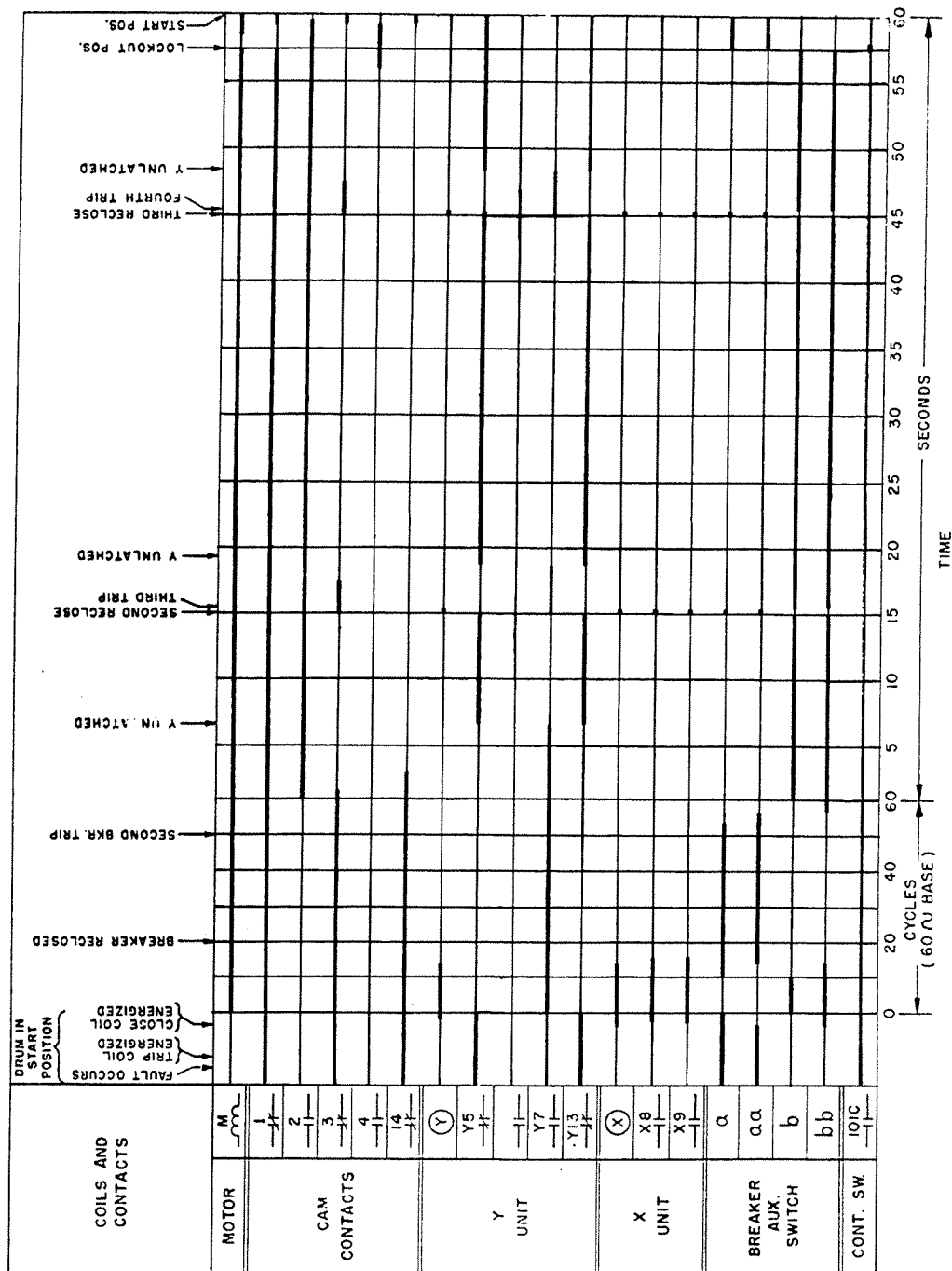
MOTOR LUBRICATION

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. 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.



Sub 1
1492B04

Fig. 4. 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.

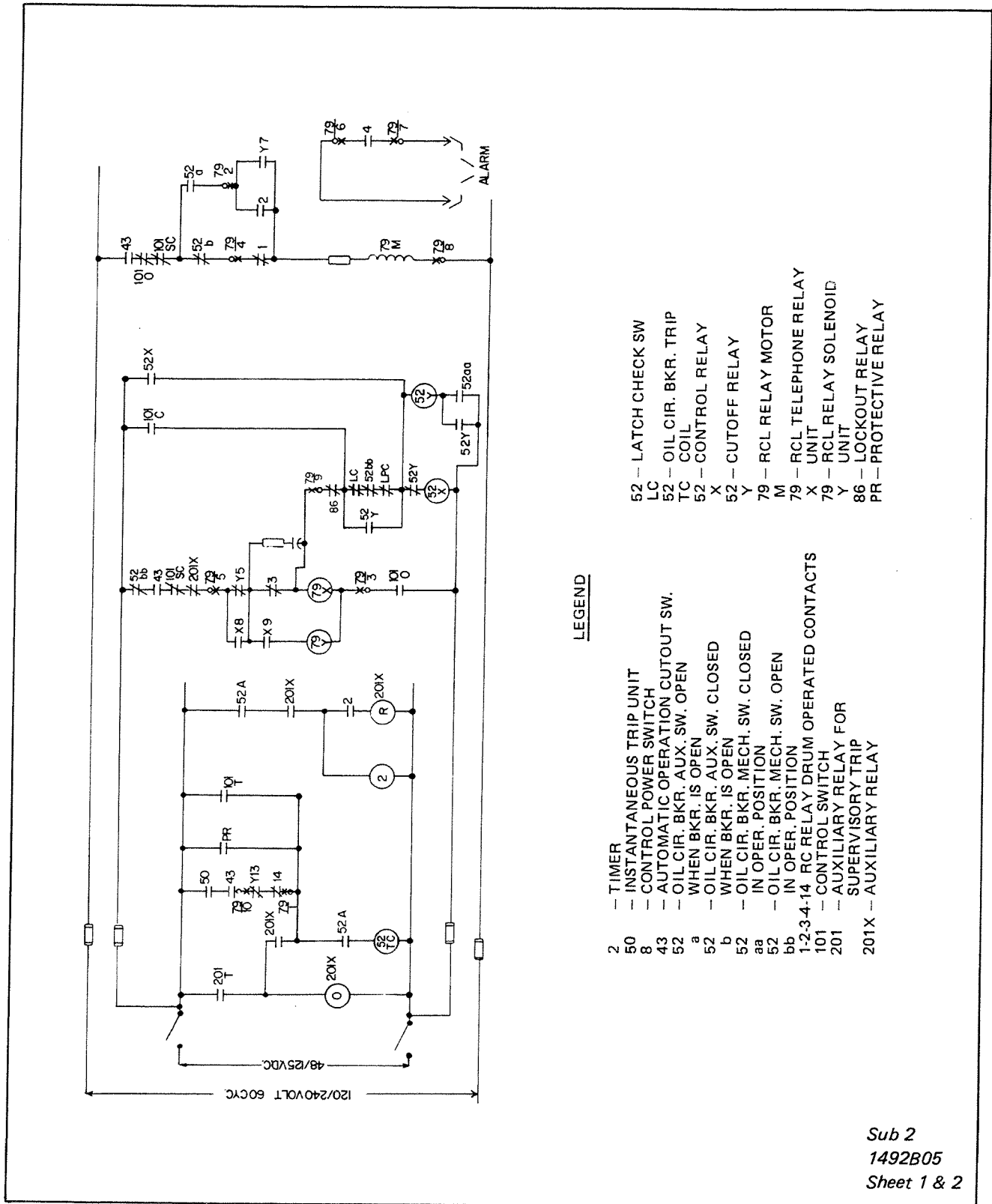


Fig. 5. External Schematic of the Type RCL Relay, without Z Unit, with AC Breaker Control Circuit

Sub 2
1492B05
Sheet 1 & 2

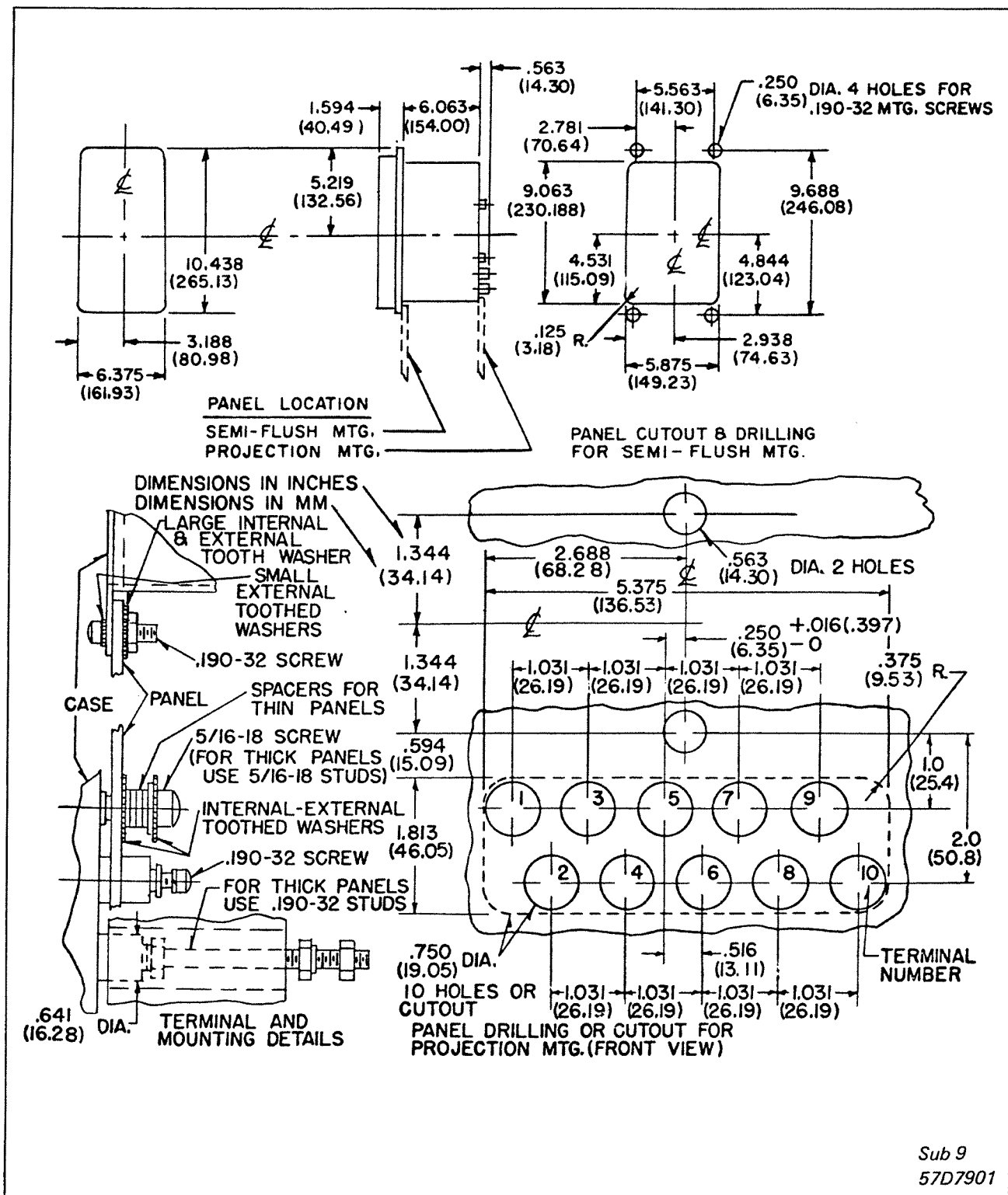


Fig. 6. Outline and Drilling Plan for the Type RC Relay in the FT21 Case

Sub 9
57D7901

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