



# INSTALLATION • OPERATION • MAINTENANCE I N S T R U C T I O N S

## TYPE DRC RECLOSING RELAY

### APPLICATION

The DRC is a multi shot reclosing relay for initiating the closing of a circuit breaker following protective relay operation.

Experience indicates the vast majority of circuit faults are of a temporary nature. High speed tripping and high speed reclosure minimize damage and system disturbance. Only sufficient dead time for arc deionization need be allowed before reclosing.

Another important function of a reclosing relay when used in distribution circuits is to allow instantaneous tripping to protect a fuse for temporary faults and, by cutting out the instantaneous trip prior to the next reclosure, to allow the fuse to operate, minimizing the outage area for permanent faults.

The DRC provides:

1. Up to 3 reclosures to lockout.
2. Flexible tripping sequence, all instantaneous, all time delay or any combination in any sequence of time delay and instantaneous.
3. Static timing and semi-static control.
4. Reclose timing adjustment 0-45 seconds.
5. Lockout alarm contact and indication.
6. Adjustable reset initiation 10 to 60 seconds following successful reclosure.
7. Immediate return to "Home" (or reset) position following reset initiation.
8. Optional instantaneous trip following manual closing from lockout position.



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## CONSTRUCTION & OPERATION

The type DRC Relay is composed of (1) an integrator (2) reclose timer printed circuit board (3) reset timer printed circuit board (4) alarm relay (5) instantaneous trip relay (6) close relay and (7) lockout indication. All timing functions are accomplished through the use of semiconductor components. The identification of all components and their locations is shown in figure 1.

### Reset Timer Board

Reset timer -- The reset timer is controlled by the integrator and the auxiliary switches on the breaker. The front panel settings allow a choice of 5 different times for the resetting interval. The time delay circuit is of the quick reset type. This enables the reset times to always be consistent with times indicated on the front panel. Refer to figure 2 for component location and board layout.

### Reclose Timer Board

The reclose timer is controlled by the integrator. The front panel setting allows a choice of 5 different times for each interval of reclosing. The time delay circuit is of the quick reset type which allows a specific timing circuit to be used for all reclosing intervals. Refer to figure 3 for component location and board layout.

### Integrator

The integrator is a stepping switch that responds to signals from the reset timer board, 52b contact, close relay and sequences the relay through its preset functions.

### Close Relay

The operation of the close relay is controlled by the operation of a breaker auxiliary switch and the reclose timer.

### Alarm Relay and Lockout Indicator

The Alarm relay and the lockout indicator will be energized when the integrator is in the lockout position.

### Instantaneous Trip Relay

Operation of this relay is controlled by the integrator and the settings on the instantaneous tap block.

### Theory of Operation

Operation of the DRC relay will be described with the aid of



Figures 1 and 4. We will assume that the DRC relay is set for two instantaneous and two time delayed operations and that a permanent fault occurs on the line being protected.

Device 50 picks up and sends a trip signal to terminal 15 of the DRC relay through the normally dead contacts of the IT Relay out terminal 10 to the breaker and the breaker opens.

When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed AR relay contacts, the normally closed integrator contacts (SS1) and level 2 Step 10 of the integrator. As the armature of the integrator picks up, the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS1 contacts open and the coil is deenergized, the spring moves the take-off arm to step 1.

The reclose timer is now energized through the take-off arm of level 4, step 1 and interval one of the RECLOSE TIMER tap block. With the input removed from the base of transistor T5, because of the closing of the 52b switch between battery positive and terminal 5 and 20 (DRC relay), the resistor-capacitor timing circuit commences to charge to a voltage that will be sufficient to allow current to flow into the base of transistor T6 through zener diode Z2. This signal is amplified by transistor T6 and applied to the \*gate of SCR-2 turning SCR-2 on and placing the close relay across the battery positive through the 52b contact (terminal 5, terminal 20). The CR contacts energize the closing circuit, which closes the main contacts for the breaker and prepares the breaker for another tripping operation. When terminal 20 loses its positive voltage, due to the opening of the 52b, the close relay drops out. The CR contacts also energized the stepping switch coil which compresses a spring. When the 52b contact opens, the coil is de-energized, the spring moves the take-off arm to step 2.

When the breaker has closed, terminal 20 goes to zero and base current is applied to transistor T5 discharging the time delay capacitors (C8, C9 & C10) on the reclose timer (board 670B115 on Fig. 1), thus setting it up for the next reclosing interval.

The reset timer (board 670B113 on Fig. 1) was energized through step 2, the take-off arm of level 1 and the RESET TIMER tap block. The time delay capacitors (C1 to C3) were kept in-operative by terminal 5 being highly positive and supplying base drive for transistor T2. This kept the time delay capacitors short-circuited. With the breaker closed and base drive removed from transistor T2, the time delay capacitors will start to charge up and attempt to turn on SCR-1 and reset the integrator to its home position (step 10). Device 50 will trip open the breaker before the reset time sends a signal to SCR-1 to reset the integrator.



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Since the DRC Relay was set for two instantaneous faults, another instantaneous fault takes place in a similar manner to that which was described for the previous operation. When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed AR relay contacts, the normally closed integrator contacts (SS1) and level 2 step 10 of the integrator. As the armature of the integrator picks up, the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS contacts open and the coil is de-energized, the spring moves the take-off arm to step 3.

To insure consistent reclose time if set for more than one instantaneous reclosure, the positive side of the reclose timer's time delay capacitors is short-circuited by the integrator take-off arm of level 7 on the previous step 10 and 2 and subsequent steps 4 and 6.

The reclose timer's resistor-capacitor time delay circuit is now energized through the moving arm of level 4, step 3 and the setting on the RECLOSE TIMER tap block interval 2 and will operate in accordance with that setting. After a predetermined time delay SCR-2 turns on the close relay is energized. The close relay contacts energize the close circuit, and the stepping switch coil. This prepares the stepping switch for its move to step 4 by compressing its spring. Energizing the close circuit closes the breaker. The 52b contact opens removing the battery voltage from terminal 5. This allows the close relay to drop out and de-energizes the stepping switch coil allowing it to move to step 4.

During the time that the reclose timer was operating, the reset timer was held inoperative by the positive voltage on terminal 5. This voltage supplies base drive for transistor T2, making T2 conduct, short circuiting the capacitors in the reset timer time delay circuitry.

When the base drive is removed from transistor T2, the reset timer attempts to time out and reset the integrator to the home position (step 10). Device 50 again senses the fault and the trip signal gets as far as terminal 15 of the DRC relay. Due to the fact that we were only set for two instantaneous operations a tap screw was placed in positions 3 & 4 of the instantaneous selector. This energizes the IT relay opening the IT normally closed contacts and no more instantaneous operations can take place.

Device 51 also senses the fault and after a time delay sends a trip signal to the breaker trip coil.

This again places the station battery across the trip coil opening the breaker. Again the operation of the 52b contact in conjunction with the wiring of level 2 moves the stepping switch to Step 5.



The reclose timer is energized through the moving arm of level 4, step 5 and interval three of the RECLOSE TIMER tap block. After the predetermined time delay, SCR-2 turns on picking up the close relay. The close relay contacts energize the closing circuit, which closes the breaker main contacts, and prepares the stepping switch to move to step 6. When the 52b contact opens the potential at terminal 5 drops to zero and de-energizes the close relay. The stepping switch moves to Step 6.

The reset timer is energized through the moving arm of level 1, and step 6 and it will attempt to reset the integrator to its home position (step 10).

The fault reappears and device 51 goes through another time delayed operation as no instantaneous operation was preset on the INSTANTANEOUS SELECTOR tap block. The breaker opens and the 52b contact again energizes the stepping switch coil through level 2, step 6 and the normally close SS1 contacts. This moves the stepping switch to step 7. The internal wiring of level 3 step 7 moves the stepping switch to step 8. This is the "lockout" step. The reclose timer is kept inoperative by the action of level 7. This level places a short circuit across capacitors C8, C9 and C10.

The reset timer is energized through the moving arm of level 1, step 8 and the RESET TIMER tap block setting. The time delay capacitors are short circuited due to the base drive applied to transistor T2 by the positive voltage on terminal 5. The relay will remain in this condition until the breaker is manually or electrically closed.

Close the breaker utilizing the 101 switch, the reset timer will attempt to time out and reset the integrator to its home position (step 10). Assuming the fault still exists, the breaker will trip out time delayed unless no tap screw has been placed in the number 5 position of the INSTANTANEOUS SELECTOR tap block (under this condition an instantaneous operation will take place). When the 52b goes positive again, terminal 5 will go positive, but no signal reaches the stepping switch coil as terminal 5 is connected to the AR relay normally closed contacts. At this point the AR relay is energized and its normally closed contacts are open. Therefore, the stepping switch remains at lockout.

Since the relay was at step 8 after the last operation, the relay will remain at "lockout" until it is manually or electrically closed. If we now assume that the fault has been cleared and the breaker is closed in, terminal 9 becomes positive and energizes the reset timer through the moving arm of level 1, step 8 and the "Reset Timer" tap block setting. With no base drive into transistor T2, transistor T2 will not conduct allowing the time delay capacitors C1 to C3 to charge up to a voltage of sufficient magnitude to make Z1 conduct current into the base of transistor T3. Transistor T3 amplifies the signal which is applied to the gate of SCR-1. SCR-1 turns on placing the integrator coil across the regulated voltage through the integrator contacts (SS2) and the homing contact (HC).



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As the armature pulls in, the integrator contact(SS2) opens, allowing the integrator to move to step 9. SCR-1 fires again which moves the stepping switch to Step 10. All circuits are de-energized except for step 10, level 3 which feeds a positive voltage to the base of transistor T2 through resistor R1 in the reset timer. This positive voltage makes transistor T2 conduct, discharging the reset timer's time delay capacitors (C1 to C3) and keeps the capacitors discharged when the integrator is at its home position (step 10). The homing contact (HC), a cam operated switch, is open at step 10 and keeps the integrator coil from being energized when at the integrator's home position. The lockout indicator and alarm relay were energized by level 3, step 8, and will remain energized until the integrator is returned to its home position (step 10). The DRC relay is now reset and ready to go through a full sequence in line with the settings made at the beginning of this description.

## CHARACTERISTICS

### Tripping Sequences

The tripping sequences can be all instantaneous, all time delayed or any combination of instantaneous and time delayed as desired.

### Reset Time

The reset timer can be set for 10, 15, 20, 40 and 60 seconds resetting time.

### Reclose Time

The reclose timer can be set for instantaneous, 2, 15, 30, and 45 seconds reclosing time for each reclosing interval or any combination of the aforementioned times.

### Operations to Lockout

The DRC relay can be set to lockout the breaker after 1, 2, 3, or 4 operations.

## ENERGY REQUIREMENTS

Station Battery - 48 - 125 VDC

## SETTINGS

### FRONT PANEL SETTINGS

#### 1. Reclosing Timer

Tap screws may be placed in different numbered (reclosing times) taps for all three intervals or in the same number for



INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS

INTEGRATOR	STEP 10 HOME POSITION	STEP 1	STEP 2	STEP 3	STEP 4
Level 1 and RESET TIMER TAP BLOCK SETTING	No connection	No connection	Energize re- set timer time delay circuit †	No connection	Energize re- set timer time delay circuit †
Level 2	Pulses inte- grator to step 1 when 52b closes	No connection	Pulses inte- grator to step 3 when 52b closes	No connection	Pulses inte- grator to step 5 when 52b closes
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Supplies base drive for T2 to keep reset timer inop- erative	Pulses inte- grator to step 2 when set for one operation to lockout	No connection	Pulses inte- grator to step 4 when set for 1 or 2 operations to lockout	No connection
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	No connection	Energizes reclose timers time delay cir- cuit through interval one	No connection	Energizes reclose timers time delay cir- cuit through interval two	No connection
Level 5	Make contact between ter- minals 16 and 17	Make contact between ter- minals 10 and 17	No connection	No connection	No connection
Level 6 and INST. TAP SETTING	Picks up IT relay with tap screw in position 1 ■	Picks up IT relay with tap screw in position 2 ■	Same as Step #1 ■	Picks up IT relay with tap screw in position 3 ■	Same as Step #3 ■
Level 7	Short cir- cuits re- close timer time delay capacitors	No connection	Same as Step #10	No connection	Same as Step #10

† If fault is cleared, reset timer will time out and energize the integrator coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS (cont'd)

INTEGRATOR	STEP 5	STEP 6	STEP 7	STEP 8 Lockout Pos.	STEP 9
Level 1 and RESET TIMER TAP BLOCK SETTING	No. Connection	Energizes Reset timer time delay circuit +	No. Connection	Energizes reset timer time delay circuit +	Energizes reset timer time delay circuit +
Level 2	No Connection	Pulses in- tegrator to step 7 when 52b closes	No Connection	No Connection	No Connection
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Pulses inte- grator to step 6 when set for 1,2 or 3 opera- tions to lockout	No Connection	Pulses inte- grator to step 8	Energizes lockout in- dicator, alarm relay and terminal 7	Energizes terminal 18 with battery positive
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	Energizes reclose timers time delay cir- cuits thru interval 3	No Connection	No Connection	No Connection	No Connection
Level 5	No Connection	No Connection	No Connection	make contact between ter- minals 16 and 17	No Connection
Level 6 and INST. TAP BLOCK SETTING	Picks up IT relay with tap screw in Position 4 ■	Same as Step #5 ■	Picks up IT relay with tap screw in position 5 ■	Same as Step #7 ■	Same as Step #1 ■
Level 7	No Connection	Same as Step #10	Same as Step #10	Same as Step #10	Same as Step #10

+ If fault is cleared, reset timer will time out and energize coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



all intervals. A tap screw must be in each interval, otherwise the breaker will not close on that interval. When operating on less than 4 operations to lockout, the reclosing intervals will be dropped starting with the third interval first; i.e., for 3 operations to lockout the breaker will reclose in accordance with the tap screws in intervals one and two and then the DRC relay will proceed to lockout. The number above the tap indicates the time duration of the reclosing interval.

## 2. Reset Timer

Place tap screw in proper tap to obtain the desired reset time. The number above the tap indicates the time duration of the reset interval.

## 3. Operations to lockout

Place tap screw in desired tap for obtaining 1 to 4 operations to lockout. The number above tap indicates the number of operations that will occur before lockout is reached.

## 4. Instantaneous operation

Do not place tap screws in the desired taps for obtaining instantaneous operation. The numbers above the taps indicate which of the sequence of trips that would be instantaneous.

- \* For instantaneous operations on the first two trips, tap screws should not be placed in the taps numbered 1 and 2. Time delayed trips will occur on all positions that do have a tap screw. A tap screw must be placed in position 5 when time delayed tripping is desired during manual closing of the breaker.

## ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments other than those covered under "SETTINGS" should be required.

### Acceptance Check

The following check is recommended to insure that the relay is in proper working order. Before proceeding, connect relay to breaker as per Figure 4 or to auxiliary test relay per Figure 5.

1. a) Instantaneous tap screws in positions 3, 4, and 5.  
b) Operation to lockout tap screw in position 4.  
c) Reset timer tap screw in 10 second position.
2. Trip open the breaker on the test relay and observe if the DRC relay opens and closes the breaker or test relay in line with



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the settings made in paragraph 1. It will be necessary to trip open the device being controlled by the DRC after each reclosure until lockout is reached. The device being controlled by the DRC relay can be tripped open manually or electrically. The reclose times should be two seconds plus or minus 5%.

3. When at lockout, close the device being controlled by the DRC relay and simultaneously start a stop watch. Time the interval that elapses before the integrator resets. The integrator will be resetting when the lockout light on the front panel of the relay goes out. This time should equal the front panel Reset Timer setting plus or minus 10%.

#### Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other intervals as may be indicated by experience to be suitable to the particular application.

#### 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. (See Acceptance Check).

##### 1. RH-1 Calibration

Place VTVM from terminal 8 to common test point. Adjust RH-1 (rear sub-base) so that 18 VDC can be seen on the VTVM when terminals 1 and 2 are energized with rated voltage.

2. No other calibration necessary.

#### 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.



ELECTRICAL PARTS LIST

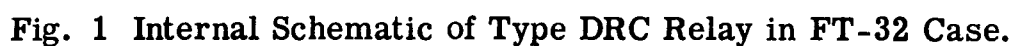
Circuit Symbol	Function	Description	Manufacturer Designation
		<u>RESISTORS</u> ■	
R1	Base Drive T2	82,000 1/2W 5%	184A763H73
R2	Base Drive T1	220,000 1/2W 5%	184A763H83
R3	Timing 10 seconds	118,000 1/2W 1%	837A131H05
R4	Timing 15 seconds	174,000 1/2W 1%	837A131H04
R5	Timing 20 seconds	232,000 1/2W 1%	837A131H07
R6	Timing 40 seconds	453,000 1/2W 1%	836A503H87
R7	Timing 60 seconds	665,000 1/2W 1%	837A131H06
R8	Collector T3	2,700 1/2W 5%	184A763H37
R9	Bias SCR-1	2,200 1/2W 5%	184A763H35
R10	Current Limiter	220 1/2W 5%	184A763H11
R11	Timing 45 seconds	649,000 1/2W 1%	837A131H01
R12	Timing 30 seconds	442,000 1/2W 1%	837A131H03
R13	Timing 15 seconds	221,000 1/2W 1%	836A503H80
R14	Timing 2 seconds	28,700 1/2W 1%	837A131H02
R15	Timing Inst.	2,670 1/2W 1%	836A503H36
R16	Base Drive T5	1,200 1/2W 5%	184A763H53
R17	Base Drive T4	22,000 1/2W 5%	184A763H83
R18	Base Drive T5	3,300 1/2W 5%	184A763H63
R19	Collector T6	2,700 1/2W 5%	184A763H37
R20	Bias SCR-2	2,200 1/2W 5%	184A763H35
R21	Temp. Compensation	220 1/2W 5%	184A763H11
R22	Power Supply Bleeder	5,000 125VDC 5%	1205214
R22	Power Supply Bleeder	1,400 48VDC 5%	1267292
R23	Indicator Bleeder	2,500 125VDC 5%	1267299
R23	Indicator Bleeder	560 48VDC 5%	1267282
■ All resistor values in Ohms			
		<u>CAPACITORS</u>	
C1	Reset timing	100 MFD 6V 5%	184A661H06
C2	Reset timing	100 MFD 6V 5%	184A661H06
C3	Reset timing	5%	To be determined in test
C4	Reset filter	.25 MFD 200VDC 10%	187A624H02
C5	Reset filter	.25 MFD 200VDC 10%	187A624H02
C6	B+ filter	10 MFD 150VDC 20%	27D5476H09
C7	B+ filter	.25 MFD 200VDC 10%	187A624H05
C8	Reclose timing	150 MFD 6V 5%	184A661H08
C9	Reclose timing	5%	to be determined in test
C10	Reclose timing	100 MFD 6V 5%	184A661H06
C11	Reclose filter	33 MFD 20V 20%	184A661H11
C12	Reclose filter	1 MFD 20%	184A662H04



# ELECTRICAL PARTS LIST (cont'd)

Circuit Symbol	Function	Description	Manufacturer Designation
		TRANSISTORS	
T1	Base shorting	2N2349	762A585H13
T2	Reset cap. discharge	2N2349	762A585H13
T3	Reset amplifier	2N2349	762A585H13
T4	Base shorting	2N2349	762A585H13
T5	Reclose cap. discharge	2N2349	762A585H13
T6	Reclose amplifier	2N2349	762A585H13
		ZENER - DIODES	
Z1	Level detector	1N748A	186A797H13
Z2	Level detector	1N748A	186A797H13
Z3	Voltage regulator	1N748A	186A797H13
Z4	Voltage regulator	1N748A	186A797H13
Z5	Voltage regulator	1N748A	186A797H13
Z6	Voltage regulator	1N748A	186A797H13
		THERMISTOR	
TH-1	Temperature comp.	2D504	185A211H07
		CONTROLLED RECTIFIERS	
SCR-1	Reset output	C6B	184A640H11
SCR-2	Reclose output	C6B	184A640H11
		RECTIFIERS	
D1	Transient Suppression	1N1095	407C703H09
D2	Voltage Blocking	1N1095	497C703H09
D3	Operations to lockout	1N1095	407C703H09
D4	Operations to lockout	1N1095	407C703H09
D5	Temperature compensation T155	1N1095	183A790H09
D6	Voltage blocking	1N1095	407C703H09
D7	Voltage blocking	1N1095	407C703H09
D8	Voltage blocking	1N1095	407C703H09
D9	Temperature compensation T155	1N1095	183A790H09
D10	Transient suppression	1N1095	407C703H09
D11	Transient Suppression	1N1095	407C703H09
D12	Transient suppression	1N1095	407C703H09
		MISCELLANEOUS	
I1	Lockout indication	52410-993	183A825G05
RH-1	Voltage calibrator	Series 43-250 ~	762A790H04
AR	Alarm relay	125 Vdc	541D514H06
AR	Alarm relay	48 Vdc	541D514H08
IT	Instantaneous relay	125 Vdc	541D514H05
IT	Instantaneous relay	48 Vdc	541D514H07
CR	Close relay	125 Vdc	541D514H05
CR	Close relay	48 Vdc	541D514H07
SS	Stepping switch	125 Vdc	407C749H04
SS	Stepping switch	48 Vdc	407C749H05







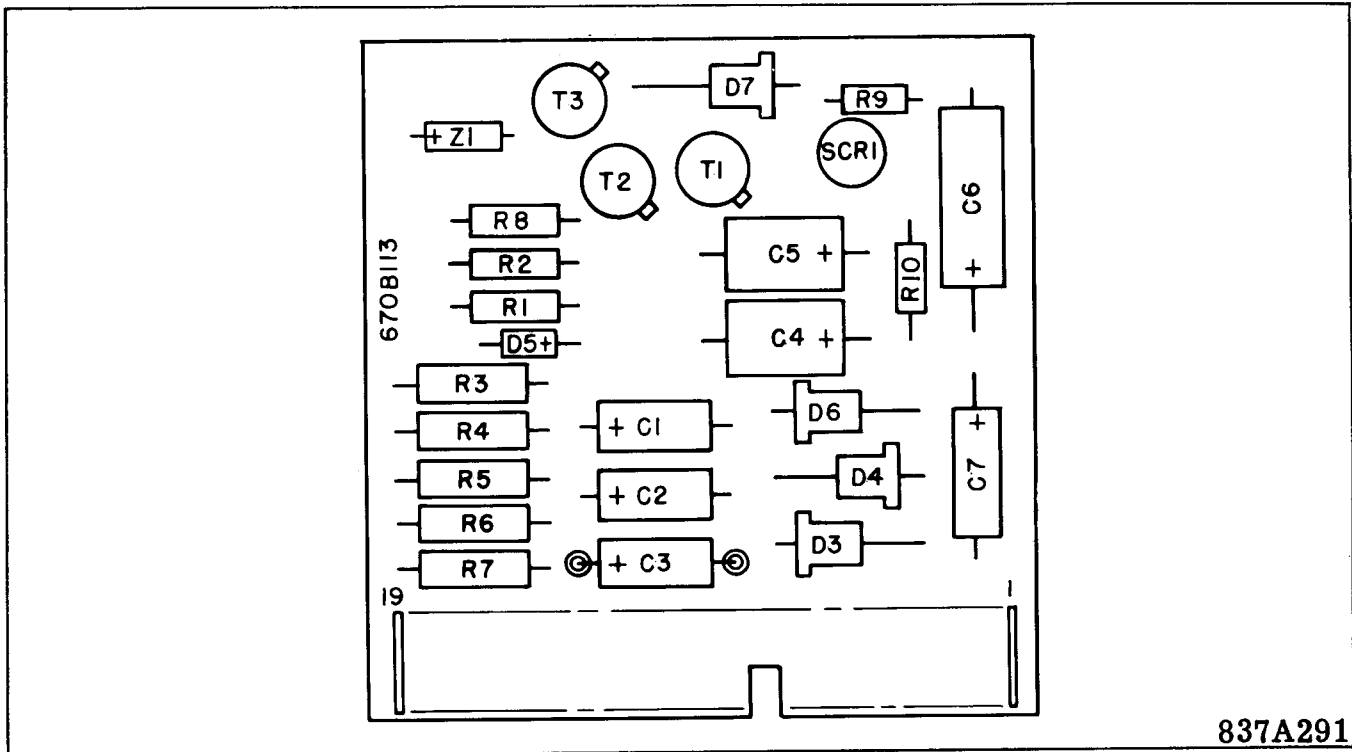


Fig. 2 Component Location of Reset Circuit Board of Type DRC Relay.

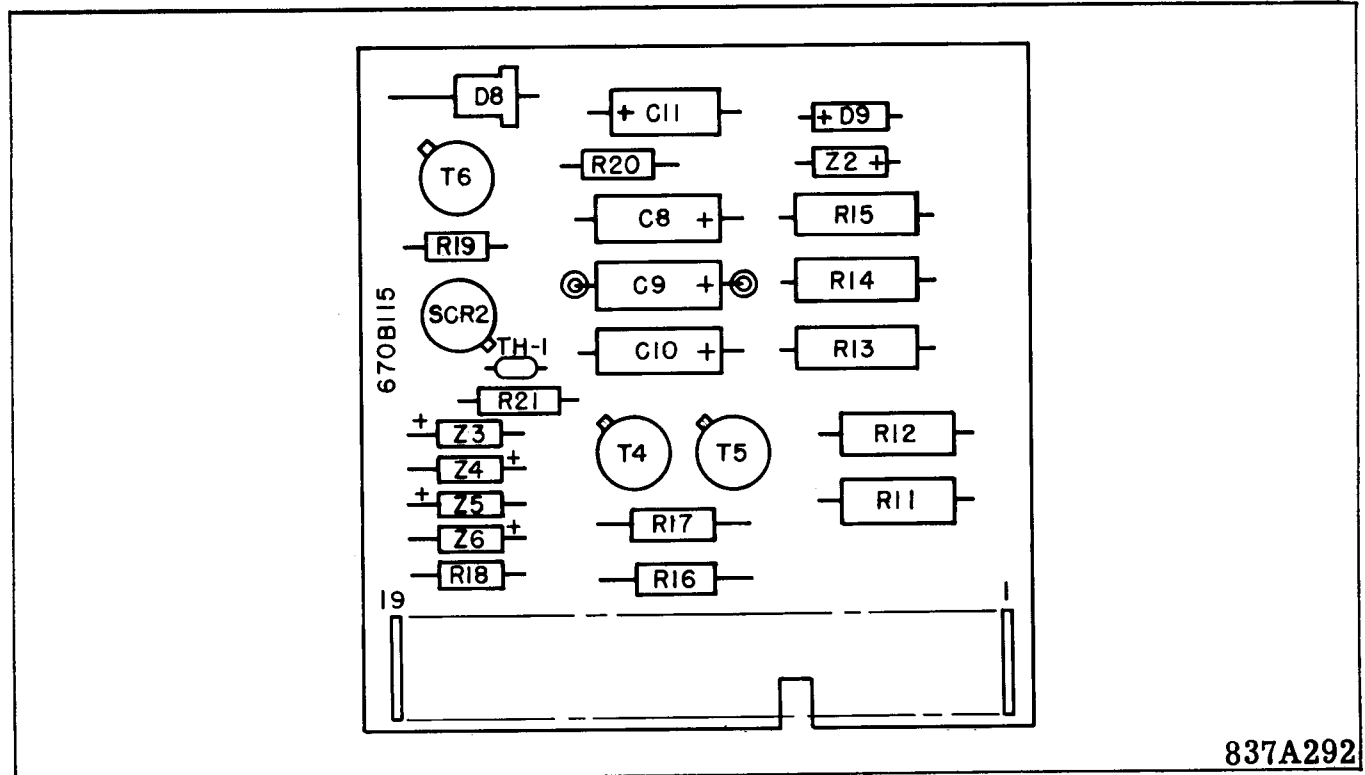


Fig. 3 Component Location of Reclose Circuit Board of Type DRC Relay.



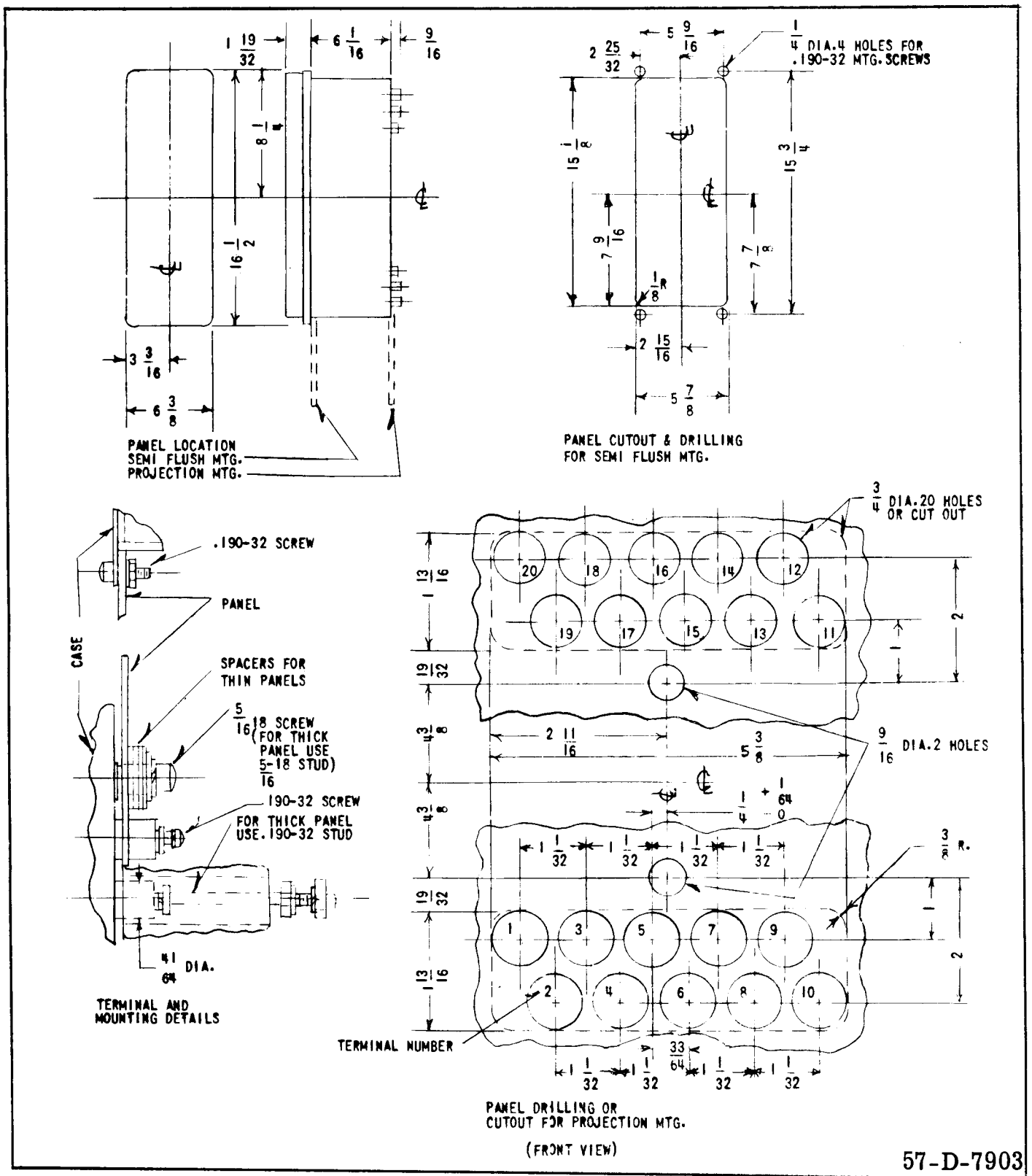
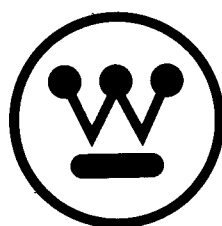


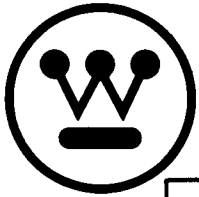
Fig. 6 Outline and Drilling for the Type DRC Relay in the FT-32 Case.





**WESTINGHOUSE ELECTRIC CORPORATION**  
**RELAY-INSTRUMENT DIVISION**  
**NEWARK, N. J.**  
Printed in U.S.A.





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### Integrator

The integrator is a stepping switch that responds to signals from the reset timer board, 52b contact, close relay and sequences the relay through its preset functions.

### Close Relay

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### Alarm Relay and Lockout Indicator

The Alarm relay and the lockout indicator will be energized when the integrator is in the lockout position.

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Operation of this relay is controlled by the integrator and the settings on the instantaneous tap block.

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Device 50 picks up and sends a trip signal to terminal 15 of the DRC relay through the normally dead contacts of the IT Relay out terminal 10 to the breaker and the breaker opens.

When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed AR relay contacts, the normally closed integrator contacts (SS1) and level 2 Step 10 of the integrator. As the armature of the integrator picks up, the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS1 contacts open and the coil is deenergized, the spring moves the take-off arm to step 1.

The reclose timer is now energized through the take-off arm of level 4, step 1 and interval one of the RECLOSE TIMER tap block. With the input removed from the base of transistor T<sub>5</sub>, because of the closing of the 52b switch between battery positive and terminal 5 and 20 (DRC relay), the resistor-capacitor timing circuit commences to charge to a voltage that will be sufficient to allow current to flow into the base of transistor T<sub>6</sub> through zener diode Z2. This signal is amplified by transistor T<sub>6</sub> and applied to the gate of SCR-2 turning SCR-3 on and placing the close relay across the battery positive through the 52b contact (terminals 5, terminal 20). The CR contacts energize the closing circuit, which closes the main contacts for the breaker and prepares the breaker for another tripping operation. When terminal 20 loses its positive voltage, due to the opening of the 52b, the close relay drops out. The CR contacts also energized the stepping switch coil which compresses a spring. When the 52b contact opens, the coil is de-energized, the spring moves the take-off arm to step 2.

When the breaker has closed, terminal 20 goes to zero and base current is applied to transistor T<sub>5</sub> discharging the time delay capacitors (C<sub>8</sub>, C<sub>9</sub> & C<sub>10</sub>) on the reclose timer (board 670B115 on Fig. 1), thus setting it up for the next reclosing interval.

The reset timer (board 670B113 on Fig. 1) was energized through step 2, the take-off arm of level 1 and the RESET TIMER tap block. The time delay capacitors (C<sub>1</sub> to C<sub>3</sub>) were kept in-operative by terminal 5 being highly positive and supplying base drive for transistor T<sub>2</sub>. This kept the time delay capacitors short-circuited. With the breaker closed and base drive removed from transistor T<sub>2</sub>, the time delay capacitors will start to charge up and attempt to turn on SCR-1 and reset the integrator to its home position (step 10). Device 50 will trip open the breaker before the reset time sends a signal to SCR-1 to reset the integrator.



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Since the DRC Relay was set for two instantaneous faults, another instantaneous fault takes place in a similar manner to that which was described for the previous operation. When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed AR relay contacts, the normally closed integrator contacts (SS1) and level 2 step 10 of the integrator. As the armature of the integrator picks up, the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS contacts open and the coil is de-energized, the spring moves the take-off arm to step 3.

To insure consistent reclose time if set for more than one instantaneous reclosure, the positive side of the reclose timer's time delay capacitors is short-circuited by the integrator take-off arm of level 7 on the previous step 1 and 2 and subsequent steps 4 and 6.

The reclose timer's resistor-capacitor time delay circuit is now energized through the moving arm of level 4, step 3 and the setting on the RECLOSE TIMER tap block interval 2 and will operate in accordance with that setting. After a predetermined time delay SCR-2 turns on and the close relay is energized. The close relay contacts energize the close circuit, and the stepping switch coil. This prepares the stepping switch for its move to step 4 by compressing its spring. Energizing the close circuit closes the breaker. The 52b contact opens removing the regulated voltage from terminal 5. This allows the close relay to drop out and de-energizes the stepping switch coil allowing it to move to step 4.

During the time that the reclose timer was operating, the reset timer was held inoperative by the positive voltage on terminal 5. This voltage supplies base drive for transistor T2, making T2 conduct, short circuiting the capacitors in the reset timer time delay circuitry.

When the base drive is removed from transistor T2, the reset timer attempts to time out and reset the integrator to the home position (step 10). Device 50 again senses the fault and the trip signal gets as far as terminal 15 of the DRC relay. Due to the fact that we were only set for two instantaneous operations a tap screw was placed in positions 3 & 4 of the instantaneous selector. This energizes the IT relay opening the IT normally closed contacts and no more instantaneous operation can take place.

Device 51 also senses the fault and after a time delay sends a trip signal to the breaker trip coil.

This again places the station battery across the trip coil opening the breaker. Again the operation of the 52b contact in conjunction with the wiring of level 2 moves the stepping switch to Step 5.



The reclose timer is energized through the moving arm of level 4, step 5 and interval three of the RECLOSE TIMER tap block. After the predetermined time delay, SCR-2 turns on picking up the close relay. The close relay contacts energize the closing circuit, which closes the breaker main contacts, and prepares the stepping switch to move to step 6. When the 52b contact opens the potential at terminal 5 drops to zero and de-energizes the close relay. The stepping switch moves to Step 6.

The reset timer is energized through the moving arm of level 1, and step 6 and it will attempt to reset the integrator to its home position (step 10).

The fault reappears and device 51 goes through another time delayed operation as no instantaneous operation was preset on the INSTANTANEOUS SELECTOR tap block. The breaker opens and the 52b contact again energizes the stepping switch coil through level 2, step 6 and the normally close SS1 contacts. This moves the stepping switch to step 7. The internal wiring of level 3 step 7 moves the stepping switch to step 8. This is the "lockout" step. The reclose timer is kept inoperative by the action of level 7. This level places a short circuit across capacitors C8, C9 and C10.

The reset timer is energized through the moving arm of level 1, step 8 and the RESET TIMER tap block setting. The time delay capacitors are short circuited due to the base drive applied to transistor T2 by the positive voltage on terminal 5. The relay will remain in this condition until the breaker is manually or electrically closed.

Close the breaker utilizing the 101 switch, the reset timer will attempt to time out and reset the integrator to its home position (step 10). Assuming the fault still exists, the breaker will trip out time delayed unless no tap screw has been placed in the number 5 position of the INSTANTANEOUS SELECTOR tap block (under this condition an instantaneous operation will take place). When the 52b goes positive again, terminal 5 will go positive, but no signal reaches the stepping switch coil as terminal 5 is connected to the AR relay normally closed contacts. At this point the AR relay is energized and its normally closed contacts are open. Therefore, the stepping switch remains at lockout.

Since the relay was at step 8 after the last operation, the relay will remain at "lockout" until it is manually or electrically closed. If we now assume that the fault has been cleared and the breaker is closed in, terminal 9 becomes positive and energizes the reset timer through the moving arm of level 1, step 8 and the "Reset Timer" tap block setting. With no base drive into transistor T2, transistor T2 will not conduct allowing the time delay capacitors C1 to C3 to charge up to a voltage of sufficient magnitude to make Z1 conduct current into the base of transistor T3. Transistor T3 amplifies the signal which is applied to the gate of SCR-1. SCR-1 turns on placing the integrator coil across the regulated voltage through the integrator contacts (SS2) and the homing contact (HC).



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As the armature pulls in, the integrator contact(SS2) opens, allowing the integrator to move to step 9. SCR-1 fires again which moves the stepping switch to Step 10. All circuits are de-energized except for step 10, level 3 which feeds a positive voltage to the base of transistor T2 through resistor R1 in the reset timer. This positive voltage makes transistor T2 conduct, discharging the reset timer's time delay capacitors (C1 to C3) and keeps the capacitors discharged when the integrator is at its home position (step 10). The homing contact (HC), a cam operated switch, is open at step 10 and keeps the integrator coil from being energized when at the integrator's home position. The lockout indicator and alarm relay were energized by level 3, step 8, and will remain energized until the integrator is returned to its home position (step 10). The DRC relay is now reset and ready to go through a full sequence in line with the settings made at the beginning of this description.

## CHARACTERISTICS

### Tripping Sequences

The tripping sequences can be all instantaneous, all time delayed or any combination of instantaneous and time delayed as desired.

### Reset Time

The reset timer can be set for 10, 15, 20, 40 and 60 seconds resetting time.

### Reclose Time

The reclose timer can be set for instantaneous, 2, 15, 30, and 45 seconds reclosing time for each reclosing interval or any combination of the aforementioned times.

### Operations to Lockout

The DRC relay can be set to lockout the breaker after 1, 2, 3, or 4 operations.

## ENERGY REQUIREMENTS

Station Battery - 48 - 125 VDC

## SETTINGS

### FRONT PANEL SETTINGS

#### 1. Reclosing Timer

Tap screws may be placed in different numbered (reclosing times) taps for all three intervals or in the same number for



INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS

INTEGRATOR	STEP 10 HOME POSITION	STEP 1	STEP 2	STEP 3	STEP 4
Level 1 and RESET TIMER TAP BLOCK SETTING	No connection	No connection	Energize re- set timer time delay circuit †	No connection	Energize re- set timer time delay circuit †
Level 2	Pulses inte- grator to step 1 when 52b closes	No connection	Pulses inte- grator to step 3 when 52b closes	No connection	Pulses inte- grator to step 5 when 52b closes
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Supplies base drive for T2 to keep reset timer inop- erative	Pulses inte- grator to step 2 when set for one operation to lockout	No connection	Pulses inte- grator to step 4 when set for 1 or 2 operations to lockout	No connection
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	No connection	Energizes reclose timers time delay cir- cuit through interval one	No connection	Energizes reclose timers time delay cir- cuit through interval two	No connection
Level 5	Make contact between ter- minals 16 and 17	Make contact between ter- minals 10 and 17	No connection	No connection	No connection
Level 6 and INST. TAP SETTING	Picks up IT relay with tap screw in position 1 ■	Picks up IT relay with tap screw in position 2 ■	Same as Step #1 ■	Picks up IT relay with tap screw in position 3 ■	Same as Step #3 ■
Level 7	Short cir- cuits re- close timer time delay capacitors	No connection	Same as Step #10	No connection	Same as Step #10

† If fault is cleared, reset timer will time out and energize the integrator coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS (cont'd)

INTEGRATOR	STEP 5	STEP 6	STEP 7	STEP 8 Lockout Pos.	STEP 9
Level 1 and RESET TIMER TAP BLOCK SETTING	No. Connection	Energizes Reset timer time delay circuit +	No. Connection	Energizes reset timer time delay circuit +	Energizes reset timer time delay circuit +
Level 2	No Connection	Pulses in- tegrator to step 7 when 52b closes	No Connection	No Connection	No Connection
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Pulses inte- grator to step 6 when set for 1,2 or 3 opera- tions to lockout	No Connection	Pulses inte- grator to step 8	Energizes lockout in- dicator, alarm relay and terminal 7	Energizes terminal 18 with battery positive
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	Energizes reclose timers time delay cir- cuits thru interval 3	No Connection	No Connection	No Connection	No Connection
Level 5	No Connection	No Connection	No Connection	make contact between ter- minals 16 and 17	No Connection
Level 6 and INST. TAP BLOCK SETTING	Picks up IT relay with tap screw in Position 4 ■	Same as Step #5 ■	Picks up IT relay with tap screw in position 5 ■	Same as Step #7 ■	Same as Step #1 ■
Level 7	No Connection	Same as Step #10	Same as Step #10	Same as Step #10	Same as Step #10

+ If fault is cleared, reset timer will time out and energize coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



all intervals. A tap screw must be in each interval, otherwise the breaker will not close on that interval. When operating on less than 4 operations to lockout, the reclosing intervals will be dropped starting with the third interval first; i.e., for 3 operations to lockout the breaker will reclose in accordance with the tap screws in intervals one and two and then the DRC relay will proceed to lockout. The number above the tap indicates the time duration of the reclosing interval.

## 2. Reset Timer

Place tap screw in proper tap to obtain the desired reset time. The number above the tap indicates the time duration of the reset interval.

## 3. Operations to lockout

Place tap screw in desired tap for obtaining 1 to 4 operations to lockout. The number above tap indicates the number of operations that will occur before lockout is reached.

## 4. Instantaneous operation

Do not place tap screws in the desired taps for obtaining instantaneous operation. The numbers above the taps indicate which of the sequence of trips that would be instantaneous. For instantaneous operations on the first two trips, tap screws should not be placed in the taps numbered 1 and 2. Time delayed trips will occur on all positions that do have a tap screw. A tap screw must be placed in position 5 when time delayed tripping is desired during manual closing of the breaker.

# ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments other than those covered under "SETTINGS" should be required.

## Acceptance Check

The following check is recommended to insure that the relay is in proper working order. Before proceeding, connect relay to breaker as per Figure 4 or to auxiliary test relay per Figure 5.

1. a) Instantaneous tap screws in positions 3, 4, and 5.  
 b) Operation to lockout tap screw in position 4.  
 c) Reset timer tap screw in 10 second position.
2. Trip open the breaker on the test relay and observe if the DRC relay opens and closes the breaker or test relay in line with



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the settings made in paragraph 1. It will be necessary to trip open the device being controlled by the DRC after each reclosure until lockout is reached. The device being controlled by the DRC relay can be tripped open manually or electrically. The reclose times should be two seconds plus or minus 5%.

3. When at lockout, close the device being controlled by the DRC relay and simultaneously start a stop watch. Time the interval that elapses before the integrator resets. The integrator will be resetting when the lockout light on the front panel of the relay goes out. This time should equal the front panel Reset Timer setting plus or minus 10%.

#### Routine Maintenance

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other intervals as may be indicated by experience to be suitable to the particular application.

#### 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. (See Acceptance Check).

##### 1. RH-1 Calibration

Place VTVM from terminal 8 to common test point. Adjust RH-1 (rear sub-base) so that 18 VDC can be seen on the VTVM when terminals 1 and 2 are energized with rated voltage.

2. No other calibration necessary.

#### 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.



ELECTRICAL PARTS LIST

Circuit Symbol	Function	Description	Manufacturer Designation
		RESISTORS	
R1	Base Drive T2	82,000 1/2W 5%	184A763H73
R2	Base Drive T1	220,000 1/2W 5%	184A763H83
R3	Timing 10 seconds	118,000 1/2W 1%	837A131H05
R4	Timing 15 seconds	174,000 1/2W 1%	837A131H04
R5	Timing 20 seconds	232,000 1/2W 1%	837A131H07
R6	Timing 40 seconds	453,000 1/2W 1%	836A503H87
R7	Timing 60 seconds	665,000 1/2W 1%	837A131H06
R8	Collector T3	2,700 1/2W 5%	184A763H37
R9	Bias SCR-1	2,200 1/2W 5%	184A763H35
R10	Current Limiter	220 1/2W 5%	184A763H11
R11	Timing 45 seconds	649,000 1/2W 1%	837A131H01
R12	Timing 30 seconds	442,000 1/2W 1%	837A131H03
R13	Timing 15 seconds	221,000 1/2W 1%	836A503H80
R14	Timing 2 seconds	28,700 1/2W 1%	837A131H02
R15	Timing Inst.	2,670 1/2W 1%	836A503H36
R16	Base Drive T5	1,200 1/2W 5%	184A763H53
R17	Base Drive T4	22,000 1/2W 5%	184A763H83
R18	Base Drive T5	3,300 1/2W 5%	184A763H63
R19	Collector T6	2,700 1/2W 5%	184A763H37
R20	Bias SCR-2	2,200 1/2W 5%	184A763H35
R21	Temp. Compensation	220 1/2W 5%	184A763H11
R22	Power Supply Bleeder	5,000 125VDC 5%	1205214
R22	Power Supply Bleeder	1,400 48VDC 5%	1267292
R23	Indicator Bleeder	2,500 125VDC 5%	1267299
R23	Indicator Bleeder	560 48VDC 5%	1267282
All resistor values in Ohms			
		CAPACITORS	
C1	Reset timing	100 MFD 6V 5%	184A661H06
C2	Reset timing	100 MFD 6V 5%	184A661H06
C3	Reset timing	5%	To be determined in test
C4	Reset filter	.25 MFD 200VDC 10%	187A624H02
C5	Reset filter	.25 MFD 200VDC 10%	187A624H02
C6	B+ filter	10 MFD 150VDC 20%	27D5476H09
C7	B+ filter	.25 MFD 200VDC 10%	187A624H05
C8	Reclose timing	150 MFD 6V 5%	184A661H08
C9	Reclose timing	5%	to be determined in test
C10	Reclose timing	100 MFD 6V 5%	184A661H06
C11	Reclose filter	33 MFD 20V 20%	184A661H11
C12	Reclose filter	1 MFD 20%	184A662H04



# ELECTRICAL PARTS LIST (cont'd)

Circuit Symbol	Function	Description	Manufacturer Designation
		TRANSISTORS	
T1	Base shorting	2N2349	762A585H13
T2	Reset cap. discharge	2N2349	762A585H13
T3	Reset amplifier	2N2349	762A585H13
T4	Base shorting	2N2349	762A585H13
T5	Reclose cap. discharge	2N2349	762A585H13
T6	Reclose amplifier	2N2349	762A585H13
		ZENER - DIODES	
Z1	Level detector	1N748A	186A797H13
Z2	Level detector	1N748A	186A797H13
Z3	Voltage regulator	1N748A	186A797H13
Z4	Voltage regulator	1N748A	186A797H13
Z5	Voltage regulator	1N748A	186A797H13
Z6	Voltage regulator	1N748A	186A797H13
		THERMISTOR	
TH-1	Temperature comp.	2D504	185A211H07
		CONTROLLED RECTIFIERS	
SCR-1	Reset output	C6B	184A640H11
SCR-2	Reclose output	C6B	184A640H11
		RECTIFIERS	
D1	Transient Suppression	1N1095	407C703H09
D2	Voltage Blocking	1N1095	497C703H09
D3	Operations to lockout	1N1095	407C703H09
D4	Operations to lockout	1N1095	407C703H09
D5	Temperature compensation T155	1N1095	183A790H09
D6	Voltage blocking	1N1095	407C703H09
D7	Voltage blocking	1N1095	407C703H09
D8	Voltage blocking	1N1095	407C703H09
D9	Temperature compensation T155	1N1095	183A790H09
D10	Transient suppression	1N1095	407C703H09
D11	Transient Suppression	1N1095	407C703H09
D12	Transient suppression	1N1095	407C703H09
		MISCELLANEOUS	
I1	Lockout indication	52410-993	183A825G05
RH-1	Voltage calibrator	Series 43-250 ~	762A790H04
AR	Alarm relay	125 Vdc	541D514H06
AR	Alarm relay	48 Vdc	541D514H08
IT	Instantaneous relay	125 Vdc	541D514H05
IT	Instantaneous relay	48 Vdc	541D514H07
CR	Close relay	125 Vdc	541D514H05
CR	Close relay	48 Vdc	541D514H07
SS	Stepping switch	125 Vdc	407C749H04
SS	Stepping switch	48 Vdc	407C749H05



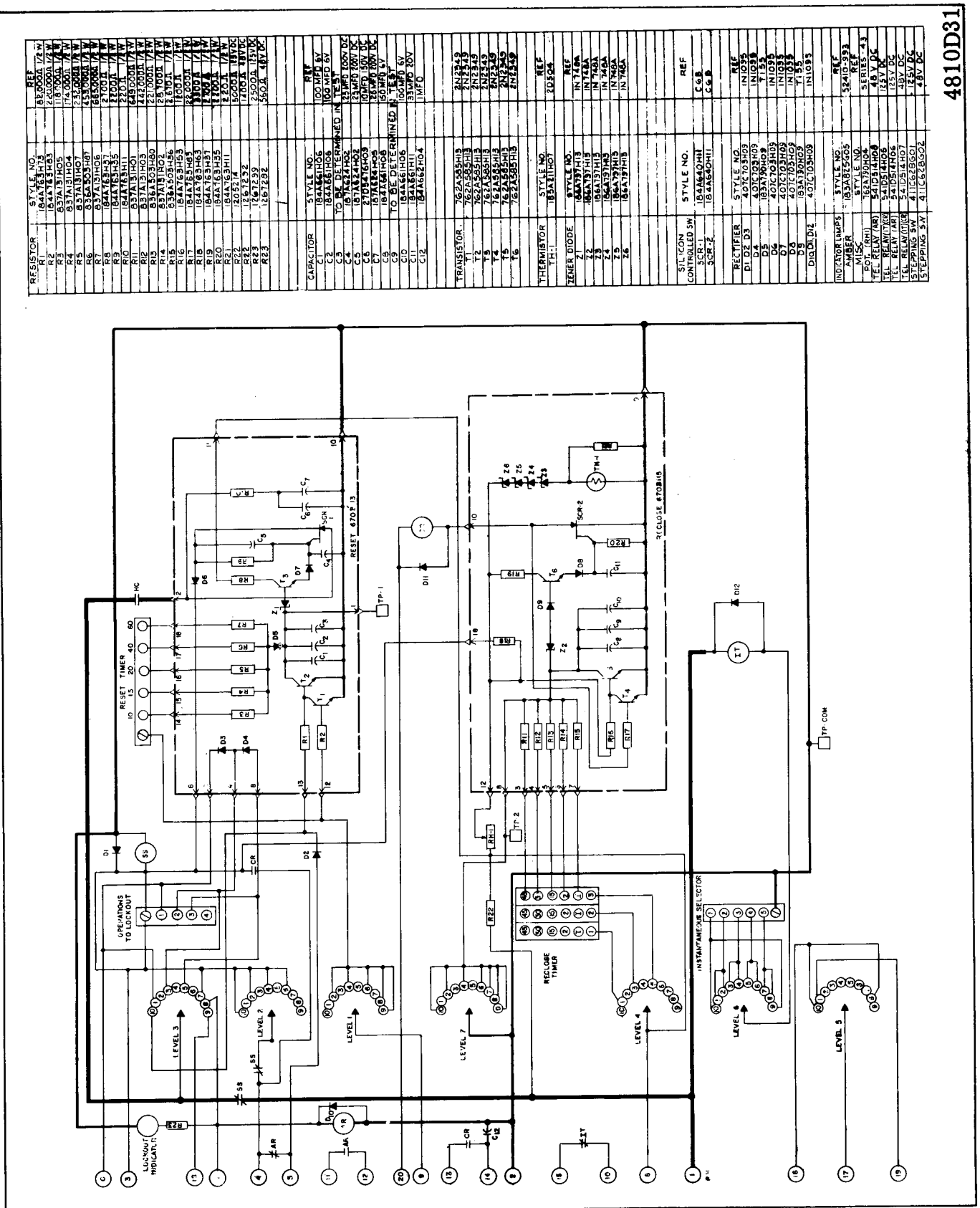
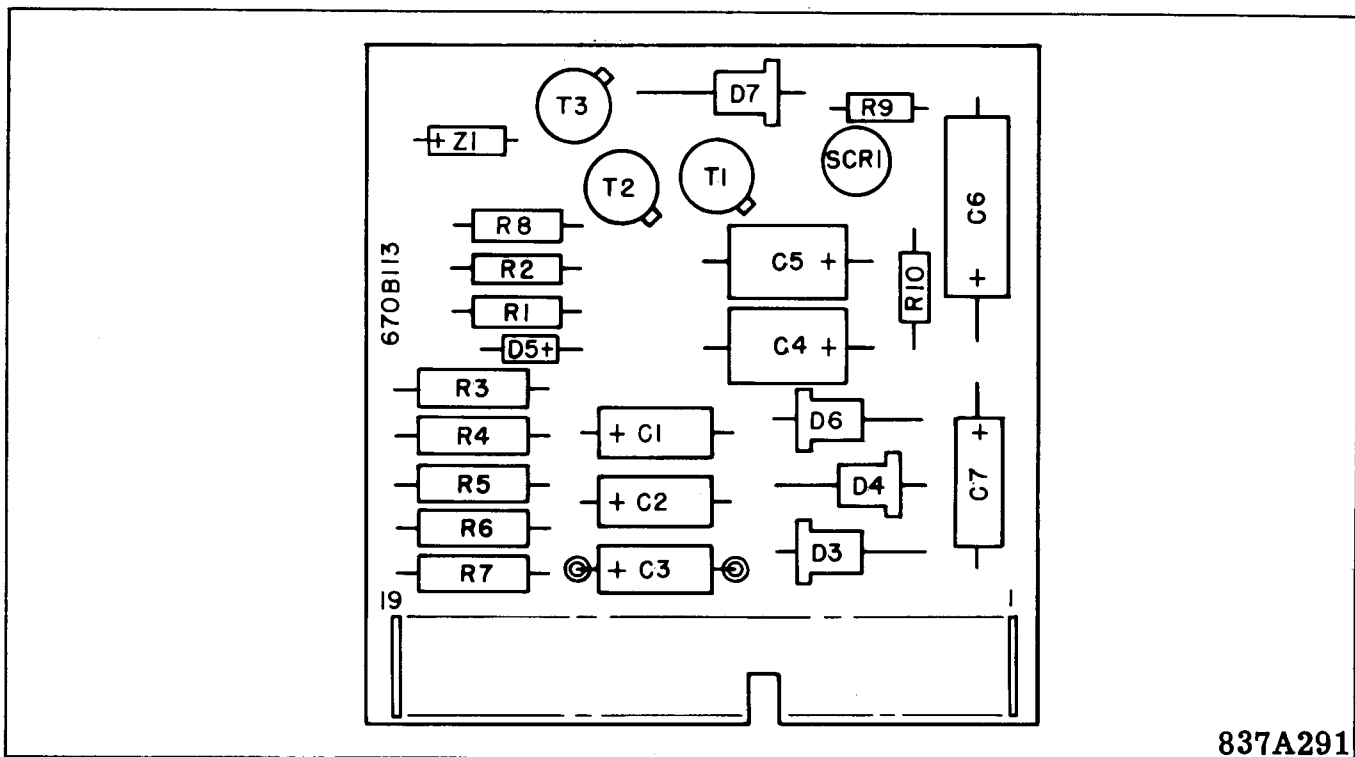


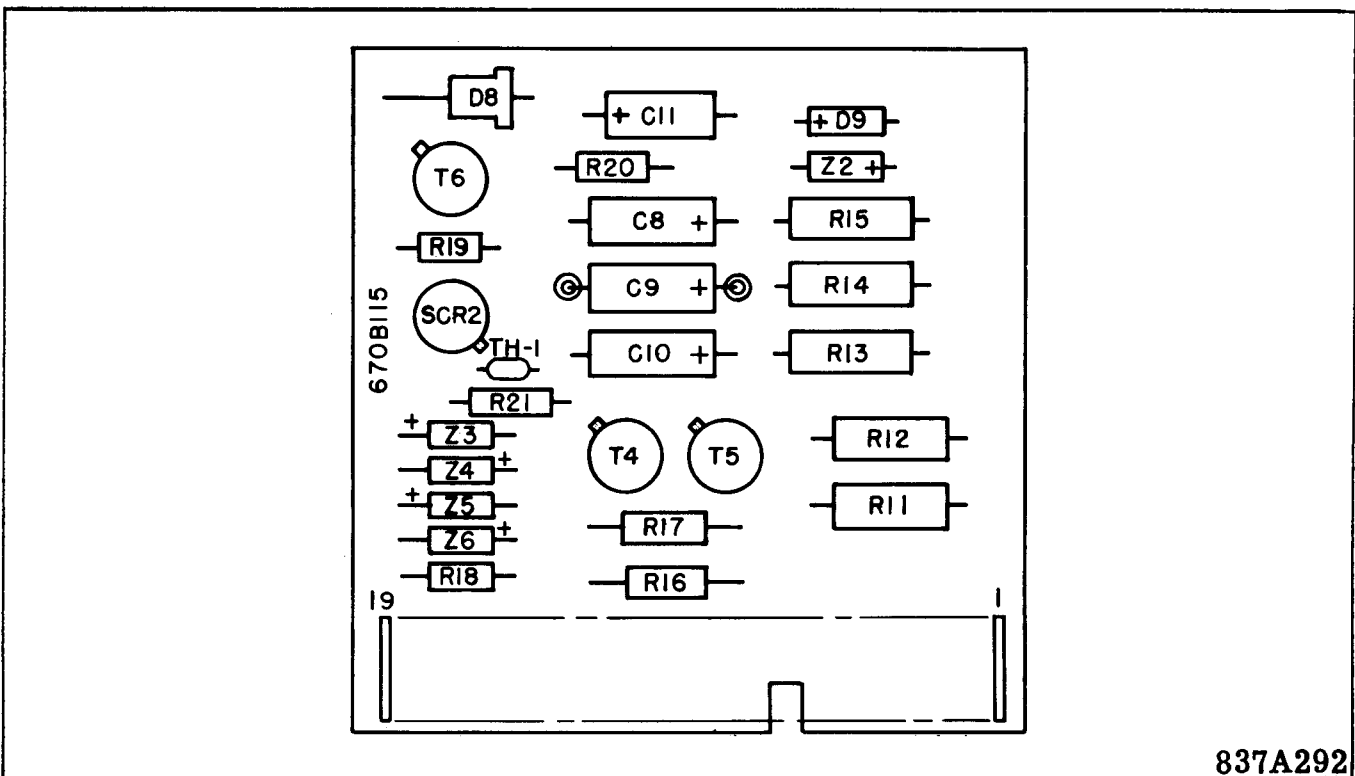
Fig. 1 Internal Schematic of Type DRC Relay in FT-32 Case.





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Fig. 2 Component Location of Reset Circuit Board of Type DRC Relay.



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Fig. 3 Component Location of Reclose Circuit Board of Type DRC Relay.



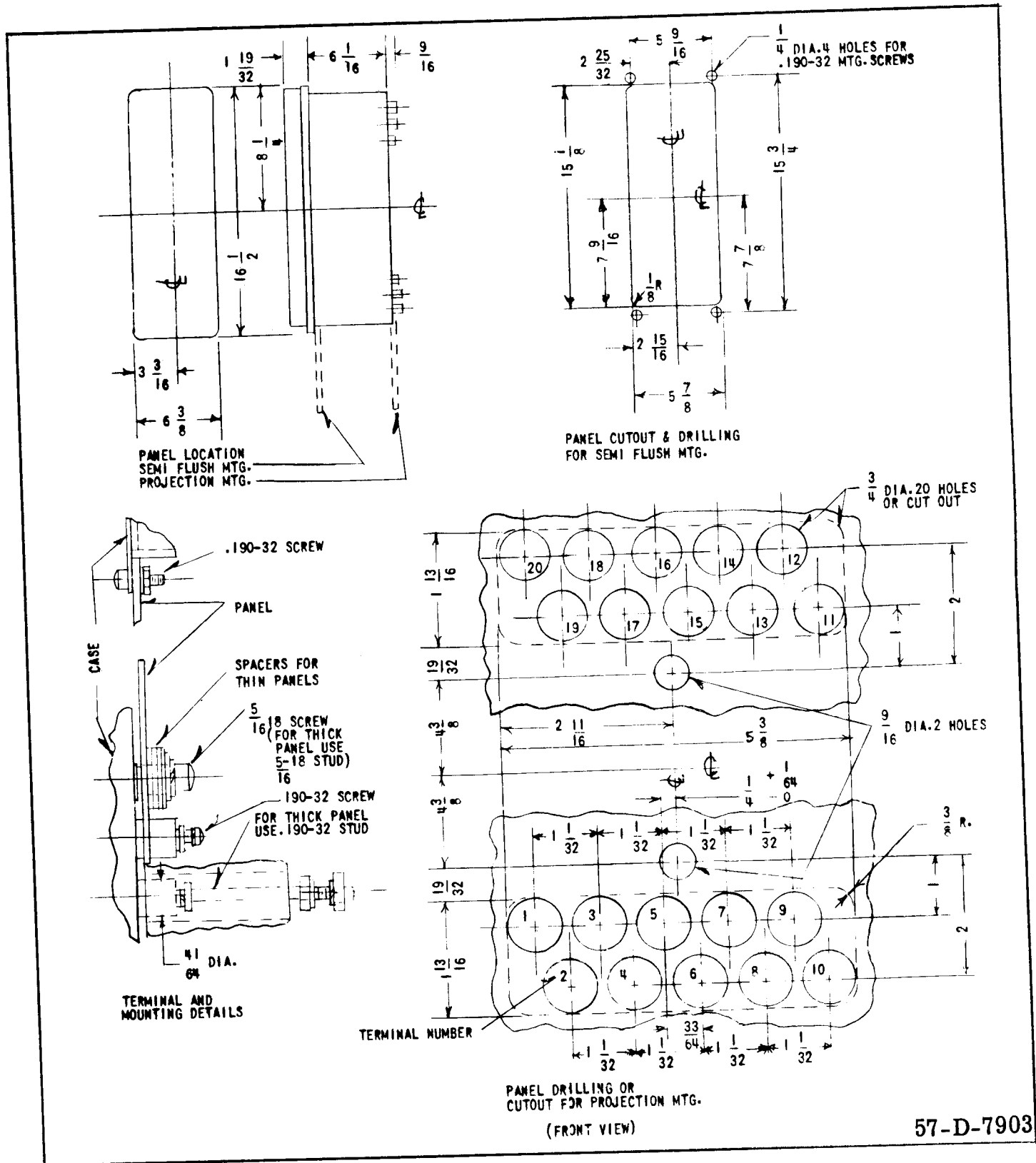
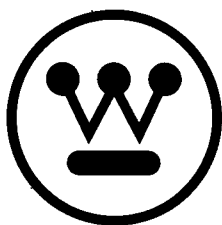


Fig. 6 Outline and Drilling for the Type DRC Relay in the FT-32 Case.



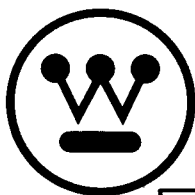


**WESTINGHOUSE ELECTRIC CORPORATION**  
**RELAY-INSTRUMENT DIVISION**

**NEWARK, N. J.**

Printed in U.S.A.





# INSTALLATION • OPERATION • MAINTENANCE I N S T R U C T I O N S

## TYPE DRC RECLOSING RELAY

### APPLICATION

The DRC is a multi shot reclosing relay for initiating the closing of a circuit breaker following protective relay operation.

Experience indicates the vast majority of circuit faults are of a temporary nature. High speed tripping and high speed reclosure minimize damage and system disturbance. Only sufficient dead time for arc deionization need be allowed before reclosing.

Another important function of a reclosing relay when used in distribution circuits is to allow instantaneous tripping to protect a fuse for temporary faults and, by cutting out the instantaneous trip prior to the next reclosure, to allow the fuse to operate, minimizing the outage area for permanent faults.

The DRC provides:

1. Up to 3 reclosures to lockout.
2. Flexible tripping sequence, all instantaneous, all time delay or any combination in any sequence of time delay and instantaneous.
3. Static timing and semi-static control.
4. Reclose timing adjustment 0-45 seconds.
5. Lockout alarm contact and indication
6. Adjustable reset initiation 10 to 60 seconds following successful reclosure.
7. Immediate return to "Home" (or reset) position following reset initiation.
8. Optional instantaneous trip following manual closing from lockout position.

### CONSTRUCTION & OPERATION

The Type DRC Relay is composed of (1) an integrator (2) reclose timer printed circuit board (3) reset timer printed circuit board (4) alarm relay (5) instantaneous trip relay (6) close relay and (7) lock-

out indication. All timing functions are accomplished through the use of semiconductor components. The identification of all components and their locations is shown in figure 1.

#### Reset Timer Board

Reset timer — The reset timer is controlled by the integrator and the auxiliary switches on the breaker. The front panel settings allow a choice of 5 different times for the resetting interval. The time delay circuit is of the quick reset type. This enables the reset times to always be consistent with times indicated on the front panel. Refer to figure 2 for component location and board layout.

#### Reclose Timer Board

The reclose timer is controlled by the integrator. The front panel setting allows a choice of 5 different time for each interval of reclosing. The time delay circuit is of the quick reset type which allows a specific timing circuit to be used for all reclosing intervals. Refer to figure 3 for component location and board layout.

#### Integrator

The integrator is a stepping switch that responds to signals from the reset timer board, 52b contact, close relay and sequences the relay through its preset functions.

#### Close Relay

The operation of the close relay is controlled by the operation of a breaker auxiliary switch and the reclose timer.

#### Alarm Relay and Lockout Indicator

The Alarm relay and the lockout indicator will be energized when the integrator is in the lockout position.

#### Instantaneous Trip Relay

Operation of this relay is controlled by the



integrator and the settings on the instantaneous tap block.

### Theory of Operation

Operation of the DRC relay will be described with the aid of Figures 1 and 4. We will assume that the DRC relay is set for two instantaneous and two time delayed operations and that a permanent fault occurs on the line beyond being protected.

Device 50 picks up and sends a trip signal to terminal 15 of the DRC relay through the normally dead contacts of the IT Relay out terminal 10 to the breaker and the breaker opens.

When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed integrator contacts (SS1) and level 2 Step 10 of the integrator. As the armature of the integrator picks up the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS1 contacts open and the coil is deenergized, the spring moves the take-off arm to step 1.

The reclose timer is now energized through the take-off arm of level 4, step 1 and interval one of the RECLOSE TIMER tap block. With the input removed from the base of transistor T<sub>5</sub>, because of the closing of the 52b switch between battery positive and terminal 5 and 20 (DRC relay), the resistor-capacitor timing circuit commences to charge to a voltage that will be sufficient to allow current to flow into the base of transistor T<sub>6</sub> through zener diode Z2. This signal is amplified by transistor T<sub>6</sub> and applied to the \*gate of SCR-2 turning SCR-2 on and placing the close relay across the battery positive through the 52b contact (terminal 5, terminal 20). The CR contacts energize the closing circuit, which closes the main contacts for the breaker and prepares the breaker for another tripping operation. When terminal 20 loses its positive voltage, due to the opening of the 52b, the close relay drops out. The CR contact also energized the stepping switch coil which compresses a spring. When the 52b contact opens, the coil is de-energized, the spring moves the take-off arm to step 2.

When the breaker has closed, terminal 20 goes to zero and base current is applied to transistor T<sub>5</sub>

discharging the time delay capacitors (C8, C9 & C10) on the reclose timer (board 670B115 on Fig. 1), thus setting it up for the next reclosing interval.

The reset timer (board 670B113 on Fig. 1) was energized through step 2, the take-off arm of level 1 and the RESET TIMER tap block. The time delay capacitors (C1 to C3) were kept inoperative by terminal 5 being highly positive and supplying base drive for transistor T<sub>2</sub>. This kept the time delay capacitors short-circuited. With the breaker closed and base drive removed from transistor T<sub>2</sub>, the time delay capacitors will start to charge up and attempt to turn on SCR-1 and reset the integrator to its home position (step 10). Device 50 will trip open the breaker before the reset time sends a signal to SCR-1 to reset the integrator.

Since the DRC Relay was set for the two instantaneous faults another instantaneous fault takes place in a similar manner to that which was described for the previous operation. When the 52b contact in series with terminal 5 closes, battery positive is placed across the integrator coil through the 52b contact, the normally closed AR relay contacts, the normally closed integrator contacts (SS1) and level 2 step 10 of the integrator. As the armature of the integrator picks up, the normally closed contacts of the integrator (SS1) open, stopping current flow. The integrator armature compresses a spring when the coil is energized.

When the SS contacts open and the coil is de-energized, the spring moves the take-off arm to step 3.

To insure consistent reclose time if set for more than one instantaneous reclosure, the positive side of the reclose timer's time delay capacitors is short circuited by the integrator take-off arm of level 7 on the previous step 10 and 2 and subsequent steps 4 and 6.

The reclose timer's resistor-capacitor time delay circuit is now energized through the moving arm of level 4, step 3 and the setting on the RECLOSE TIMER tap block interval 2 and will operate in accordance with that setting. After a predetermined time delay SCR-2 turns on the close relay is energized. The close relay contacts energize the close circuit, and the stepping switch coil. This prepares the stepping switch for its move to step 4 by compressing its spring. Energizing the close circuit closes the breaker. The 52b contact opens removing



the battery voltage from terminal 5. This allows the close relay to drop out and de-energizes the stepping switch coil allowing it to move to step 4.

During the time that the reclose timer was operating, the reset timer was held inoperative by the positive voltage on terminal 5. This voltage supplies base drive for transistor T2, making T2 conduct, short circuiting the capacitors in the reset timer time delay circuitry.

When the base drive is removed from transistor T2, the reset timer attempts to time out and reset the integrator to the home position (step 10). Device 50 again senses the fault and the trip signal gets as far as terminal 15 of the DRC relay. Due to the fact that we were only set for two instantaneous operations a tap screw was placed in positions 3 & 4 of the instantaneous selector. This energizes the IT relay opening the IT normally closed contacts and no more instantaneous operations can take place.

Device 51 also senses the fault and after a time delay sends a trip signal to the breaker trip coil.

This again places the station battery across the trip coil opening the breaker. Again the operation of the 52b contact in conjunction with the wiring of level 2 moves the stepping switch to Step 5.

The reclose timer is energized through the moving arm of level 4; step 5 and interval three of the RECLOSE TIMER tap block. After the predetermined time delay, SCR-2 turns on picking up the close relay. The close relay contacts energize the closing circuit, which closes the breaker main contacts, and prepares the stepping switch to move to step 6. When the 52b contact opens the potential at terminal 5 drops to zero and de-energizes the close relay. The stepping switch moves to Step 6.

The reset timer is energized through the moving arm of level 1, and step 6 and it will attempt to reset the integrator to its home position (step 10).

The fault reappears and device 51 goes through another time delayed operation as no instantaneous operation was preset on the INSTANTANEOUS SELECTOR tap block. The breaker opens and the 52b contact again energizes the stepping switch coil through level 2, step 6 and the normally close SS1 contacts. This moves the stepping switch to step 7. The internal wiring of level 3 step 7 moves the stepping switch to step 8. This is the "lockout" step. The reclose timer is kept inoperative by the

action of level 7. This level places a short circuit across capacitors C8, C9 and C10.

The reset timer is energized through the moving arm of level 1, step 8 and the RESET TIMER tap block setting. The time delay capacitors are short circuited due to the base drive applied to transistor T2 by the positive voltage on terminal 5. The relay will remain in this condition until the breaker is manually or electrically closed.

Close the breaker utilizing the 101 switch, the reset timer will attempt to time out and reset the integrator to its home position (step 10). Assuming the fault still exists, the breaker will trip out time delayed unless no tap screw has been placed in the number 5 position of the INSTANTANEOUS SELECTOR tap block (under this condition an instantaneous operation will take place). When the 52b goes positive again, terminal 5 will go positive, but no signal reaches the stepping switch coil as terminal 5 is connected to the AR relay normally closed contacts. At this point the AR relay is energized and its normally closed contacts are open. Therefore, the stepping switch remains at lockout.

Since the relay was at step 8 after the last operation, the relay will remain at "lockout" until it is manually or electrically closed. If we now assume that the fault has been cleared and the breaker is closed in, terminal 9 becomes positive and energizes the reset timer through the moving arm of level 1, step 8 and the "Reset Timer" tap block setting. With no base drive into transistor T2, transistor T2 will not conduct allowing the time delay capacitors C1 to C3 to charge up to a voltage of sufficient magnitude to make Z1 conduct current into the base of transistor T3. Transistor T3 amplifies the signal which is applied to the gate of SCR-1. SCR-1 turns on placing the integrator coil across the regulated voltage through the integrator contacts (SS2) and the homing contact (HC). As the armature pulls in, the integrator contact (SS2) opens, allowing the integrator to move to step 9. SCR-1 fires again which moves the stepping switch to step 10. All circuits are de-energized except for step 10, level 3 which feeds a positive voltage to the base of transistor T2 through resistor R1 in the reset timer. This positive voltage makes transistor T2 conduct, discharging the reset timer's time delay capacitors (C1 to C3) and keeps the capacitors discharged when the integrator is at its home position (step 10). The homing contact (HC), a cam operated switch, is open at step 10 and keeps the integrator coil from being energized



## TYPE DRC RECLOSING RELAY

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when at the integrator's home position. The lockout indicator and alarm relay were energized by level 3, step 8, and will remain energized until the integrator is returned to its home position (step 10). The DRC relay is now reset and ready to go through a full sequence in line with the settings made at the beginning of this description.

### CHARACTERISTICS

#### Tripping Sequences

The tripping sequences can be all instantaneous, all time delayed or any combination of instantaneous and time delayed as desired.

#### Reset Time

The reset timer can be set for 10, 15, 20, 40 and 60 seconds resetting time.

#### Reclose Time

The reclose timer can be set for instantaneous, 2, 15, 30 and 45 seconds reclosing time for each reclosing interval or any combination of the aforementioned times.

#### Operations to Lockout

The DRC relay can be set to lockout the breaker after 1, 2, 3 or 4 operations.

### ENERGY REQUIREMENTS

Station Battery - 48 - 125 VDC

### SETTINGS

#### FRONT PANEL SETTINGS

##### 1. Reclosing Timer

Tap screws may be placed in different numbered (reclosing times) taps for all three intervals or in the same number for all intervals. A tap screw must be in each interval, otherwise the breaker will not close on that interval. When operating on less than 4 operations to lockout, the reclosing intervals will be dropped starting with the third interval first; i.e., for 3 operations to lockout the breaker will reclose in accordance with the tap screws in intervals one and two and then the DRC relay will proceed to lockout. The number above the tap indicates the time duration of the reclosing interval.

##### 2. Reset timer

Place tap screw in proper tap to obtain the desired reset time. The number above the tap indicates the time duration of the reset interval.

##### 3. Operations to lockout

Place tap screw in desired tap for obtaining 1 to 4 operations to lockout. The number above tap indicates the number of operations that will occur before lockout is reached.

##### 4. Instantaneous operation

Do not place tap screws in the desired taps for obtaining instantaneous operation. The numbers above the taps indicate which of the sequence of trips that would be instantaneous.

\* For instantaneous operations on the first two trips, tap screws should not be placed in the taps numbered 1 and 2. Time delayed trips will occur on all positions that do have a tap screw. A tap screw must be placed in position 5 when time delayed tripping is desired during manual closing of the breaker.

### ADJUSTMENTS & MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments other than those covered under "SETTINGS" should be required.

#### Acceptance Check

The following check is recommended to insure that the relay is in proper working order. Before proceeding, connect relay to breaker as per Figure 4 or to auxiliary test relay per Figure 5.

1. a) Instantaneous tap screws in positions 3, 4 and 5.  
b) Operation to lockout tap screw in position 4.  
c) Reset timer tap screw in 10 second position.
2. Trip open the breaker on the test relay and observe if the DRC relay opens and closes the breaker or test relay in line with the settings made in paragraph 1. It will be necessary to trip open the device being controlled by the DRC after each reclosure until lockout is reached. The device being controlled by the DRC relay can be tripped open manually or



electrically. The reclose times should be two seconds plus or minus 5%.

3. When at lockout, close the device being controlled by the DRC relay and simultaneously start a stop watch. Time the interval that elapses before the integrator resets. The integrator will be resetting when the lockout light on the front panel of the relay goes out. This time should equal the front panel Reset Timer setting plus or minus 10%.

#### **Routine Maintenance**

All relays should be inspected periodically and the time of operation should be checked at least once every year or at such other intervals as may be indicated by experience to be suitable to the particular application.

### **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. (See Acceptance Check).

#### **1. RH-1 Calibration**

Place VTVM from terminal 8 to common test point. Adjust RH-1 (rear sub-base) so that 18 VDC can be seen on the VTVM when terminals 1 and 2 are energized with rated voltage.

2. No other calibration necessary.

### **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.



## INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS

INTEGRATOR	STEP 10 HOME POSITION	STEP 1	STEP 2	STEP 3	STEP 4
Level 1 and RESET TIMER TAP BLOCK SETTING	No connection	No connection	Energize reset timer time delay circuit †	No connection	Energize reset timer time delay circuit †
Level 2	Pulses integrator to step 1 when 52b closes	No connection	Pulses integrator to step 4 when 52b closes	No connection	Pulses integrator to step 5 when 52b closes
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Supplies base drive for T2 to keep reset timer inoperative	Pulses integrator to step 2 when set for one operation to lockout	No connection	Pulses integrator to step 4 when set for 1 or 2 operations to lockout	No connection
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	No connection	Energize reclose timers time delay circuit through interval one	No connection	Energizes reclose timers time delay circuit through interval two	No connection
Level 5	Make contact between terminals 16 and 17	Make contact between terminals 10 and 17	No connection	No connection	No connection
Level 6 and INST. TAP	Pick up IT relay with tap screw in position 1 ■	Picks up IT relay with tap screw in position 2 ■	Same as Step #1	Picks up IT relay with tap screw in position 3 ■	Same as Step #3
Level 7	Short circuits reclose timer time delay capacitors	No connection	Same as Step #10	No connection	Same as Step #10

† If fault is cleared, reset timer will time out and energize the integrator coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



## INTEGRATOR LEVEL AND STEP FUNCTIONS PLUS TAP BLOCK SETTINGS (Cont'd.)

INTEGRATOR	STEP 5	STEP 6	STEP 7	STEP 8 Lockout Pos.	STEP 9
Level 1 and RESET TIMER TAP BLOCK SETTING	No connection	Energizes reset timer time delay circuit †	No connection	Energizes reset timer time delay circuit †	Energizes reset timer time delay circuit †
Level 2	No connection	Pulses integrator to step 7 when 52b closes	No connection	No connection	No connection
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Pulses integrator to step 6 when set for 1, 2, 3 operations to lockout	No connection	Pulses integrator to step 8	Energizes lockout indicator, alarm relay and terminal 7	Energizes terminal 18 with battery positive
Level 4 and RECLOSE TIMER TAP BLOCK SETTING	Energizes reclose timers time delay circuits thru interval 3	No connection	No connection	No connection	No connection
Level 5	No connection	No connection	No connection	Make contact between te terminal 16 and 17	No connection
Level 6 and INST. TAP BLOCK SETTING	Picks up IT relay with tap screw in Position 4 ■	Same as Step #4 ■	Picks up IT relay with tap screw in position 5 ■	Same as Step #7 ■	Same as Step #1 ■
Level 7	No connection	Same as Step Step #10	Same as Step #10	Same as Step #10	Same as Step #10

† If fault is cleared, reset timer will time out and energize coil directly.

■ Instantaneous tripping will not take place in those positions which have a tap screw.



## ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	FUNCTION	DESCRIPTION	MANUFACTURER DESIGNATION
RESISTORS ■			
R1	Base Drive T2	82,000 1/2W 5%	184A763H73
R2	Base Drive T1	220,000 1/2W 5%	184A763H83
R3	Timing 10 seconds	118,000 1/2W 1%	837A131H05
R4	Timing 15 seconds	174,000 1/2W 1%	837A131H04
R5	Timing 20 seconds	232,000 1/2W 1%	837A131H07
R6	Timing 40 seconds	453,000 1/2W 1%	836A503H87
R7	Timing 60 seconds	665,000 1/2W 1%	837A131H06
R8	Collector T3	2,700 1/2W 5%	184A763H37
* R9	Bias SCR-1	1K 1/2W 5%	184A763H27
* R10	Current Limiter	10 1/2W 5%	187A290H01
R11	Timing 45 seconds	649,000 1/2W 1%	837A131H01
R12	Timing 30 seconds	442,000 1/2W 1%	837A131H03
R13	Timing 15 seconds	221,000 1/2W 1%	836A503H80
R14	Timing 2 seconds	28,700 1/2W 1%	837A131H02
R15	Timing Inst.	2,670 1/2W 1%	836A503H36
R16	Base Drive T5	1,200 1/2W 5%	184A763H53
R17	Base Drive T4	220,000 1/2W 5%	184A763H83
R19	Collector T6	2,700 1/2W 5%	184A763H37
R20	Bias SCR-2	1K 1/2W 5%	184A763H27
R21	Temp. Compensation	220 1/2W 5%	184A763H11
R22	Power Supply Bleeder	5,000 125VDC 5%	1205214
R22	Power Supply Bleeder	1,400 48VDC 5%	1267292
R23	Indicator Bleeder	2,500 125VDC 5%	1267299
R23	Indicator Bleeder	560 48VDC 5%	1267282

■ All resistor values in Ohms

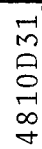
CAPACITORS			
C1	Reset timing	100 MFD 6V 5%	184A661H06
C2	Reset timing	100 MFD 6V 5%	184A661H06
C3	Reset timing		To be determined in test
C4	Reset filter	.25 MFD 200VDC 10%	187A624H02
C5	Reset filter	.25 MFD 200VDC 10%	187A624H02
C6	B+ filter	10 MFD 150VDC 20%	27D5476H09
* C7	B+ filter	.5 MFD 200VDC 10%	187A624H08
C8	Reclose timing	150 MFD 6V 5%	184A661H08
C9	Reclose timing		To be determined in test
C10	Reclose timing	100 MFD 6V 5%	184A661H06
C11	Reclose filter	33 MFD 20V 20%	184A661H11
* C12	Reclose filter	1 MFD 20%	184A624H04
* C13	B+ filter	1 MFD 20%	184A624H04



## ELECTRICAL PARTS LIST (Con'd.)

CIRCUIT SYMBOL	FUNCTION	DESCRIPTION	MANUFACTURER DESIGNATION
<b>TRANSISTORS</b>			
T1	Base shorting	2N3417	848A851H01
T2	Reset cap. discharge	2N3417	848A851H01
T3	Reset amplifier	2N3417	848A851H01
T4	Base shorting	2N3417	848A851H01
T5	Reclose cap. discharge	2N3417	848A851H01
T6	Reclose amplifier	2N3417	848A851H01
<b>ZENER - DIODES</b>			
Z1	Level detector	1N748A	186A797H13
Z2	Level detector	1N748A	186A797H13
Z3	Voltage regulator	1N748A	186A797H13
Z4	Voltage regulator	1N748A	186A797H13
Z5	Voltage regulator	1N748A	186A797H13
Z6	Voltage regulator	1N748A	186A797H13
Z7 to Z11	Transient suppression	1R200	629A369H01
<b>THERMISTOR</b>			
TH-1	Temperature comp.	2D504	185A211H07
<b>CONTROLLED RECTIFIERS</b>			
SCR-1	Reset output	K1149-13	184A640H13
SCR-2	Reclose output	K1149-13	184A640H13
<b>RECTIFIERS</b>			
D3	Operations to lockout	1N4822	188A342H11
D4	Operations to lockout	1N4822	188A342H11
D5	Temperature compensation	T155	183A790H09
D6	Voltage blocking	1N4822	188A342H11
D7	Voltage blocking	1N4822	188A342H11
D8	Voltage blocking	1N4822	188A342H11
D9	Temperature compensation	T155	183A790H09
<b>MISCELLANEOUS</b>			
I1	Lockout indication	52410-993	183A825G05
RH-1	Voltage calibrator	Series 43-250	762A790H04
AR	Alarm relay	125 Vdc	541D514H06
AR	Alarm relay	48 Vdc	541D514H08
IT	Instantaneous relay	125 Vdc	541D514H05
IT	Instantaneous relay	48 Vdc	541D514H07
CR	Close relay	125 Vdc	541D514H05
CR	Close relay	48 Vdc	541D514H07
SS	Stepping switch	125 Vdc	411C628G01
SS	Stepping switch	48 Vdc	411C628G02





**Fig. 1. Internal Schematic of Type DRC Relay in FT-32 Case.**



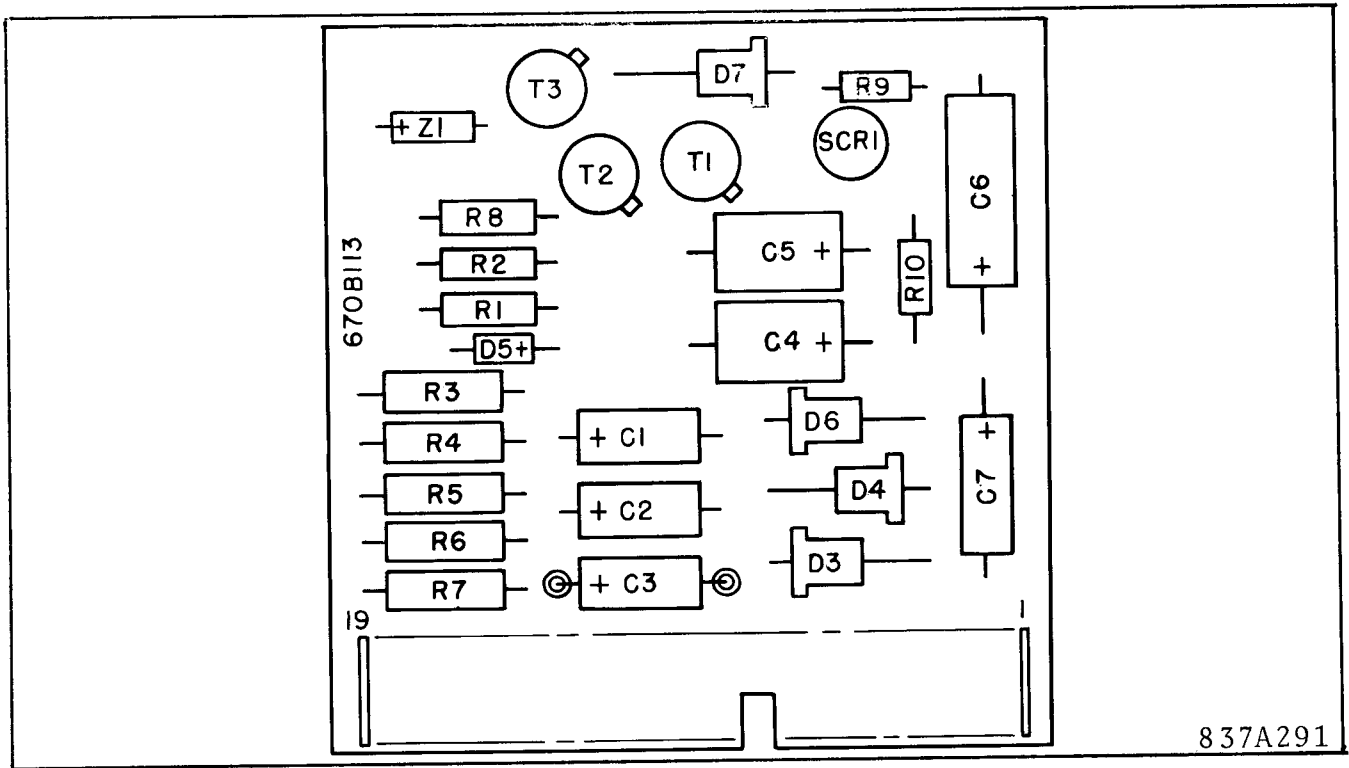


Fig. 2. Component Location of Reset Circuit Board of Type DRC Relay.

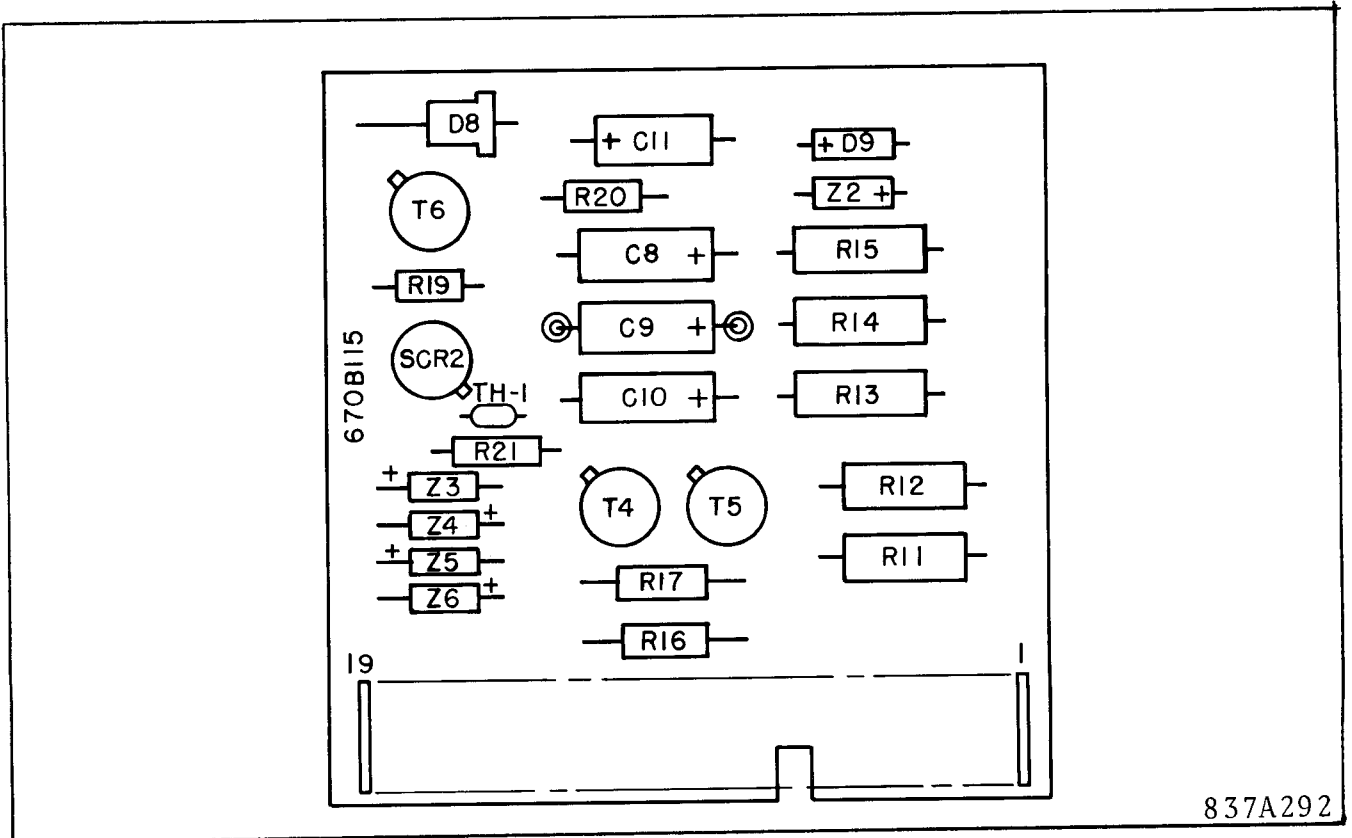
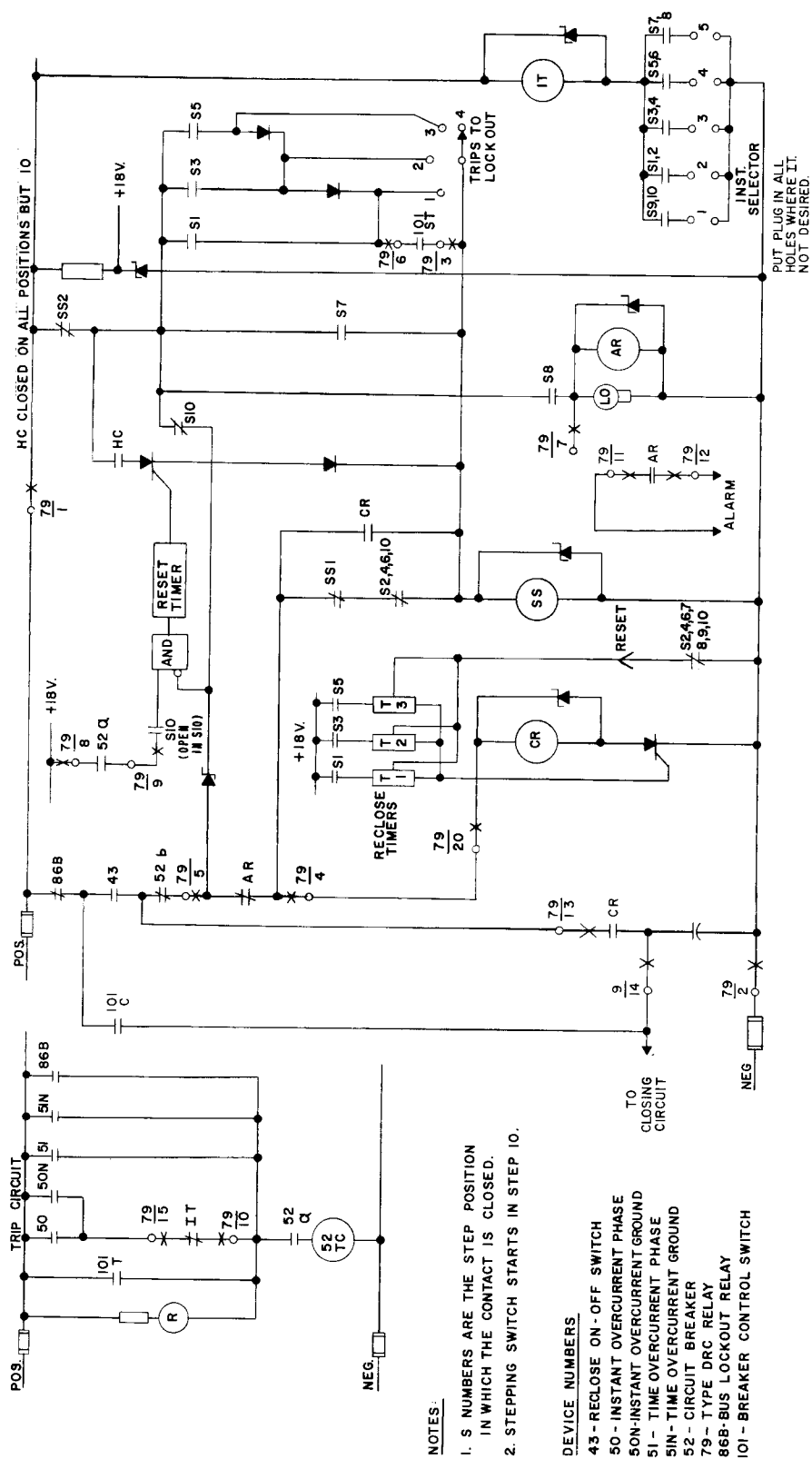


Fig. 3. Component Location of Reclose Circuit Board of Type DRC Relay.





**Fig. 4. External Schematic of Type DRC Relay.**

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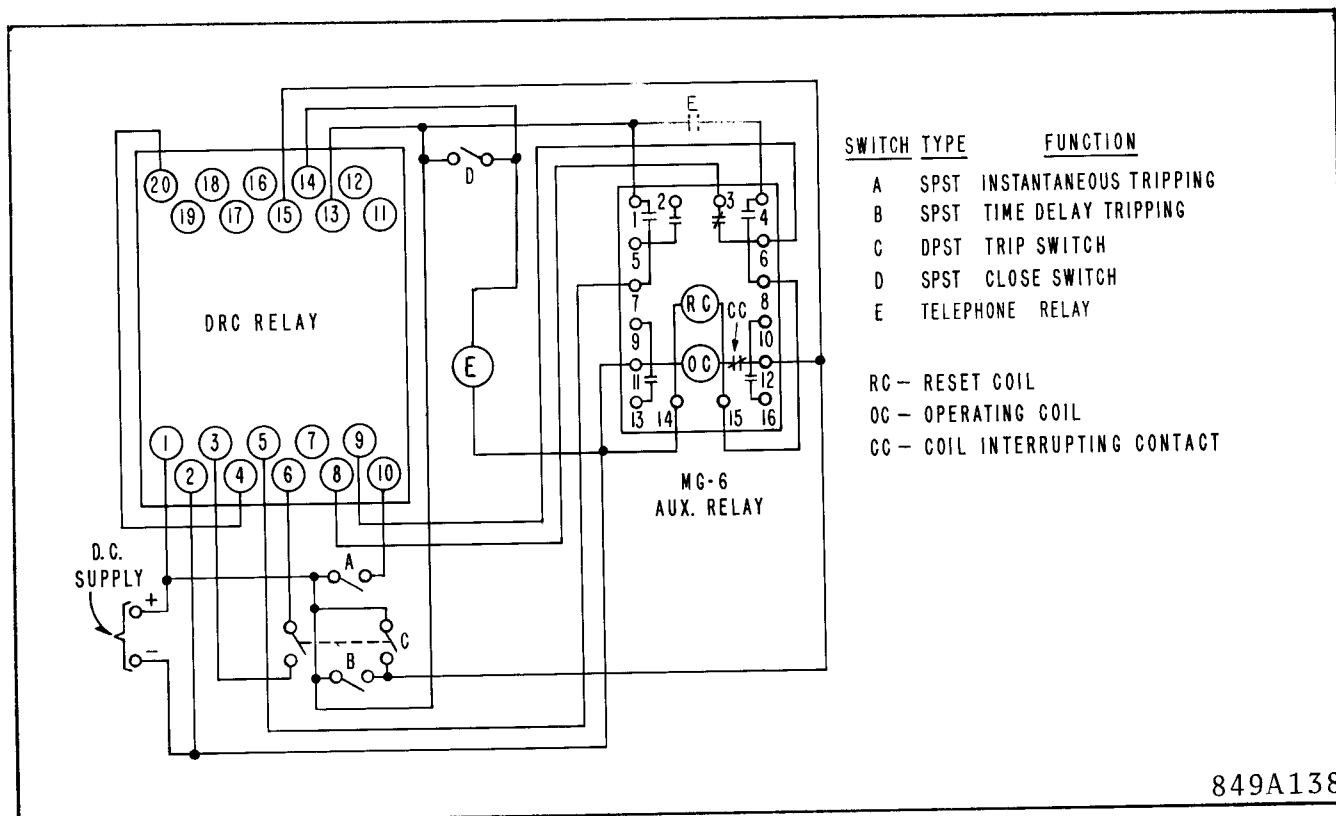


Fig. 5. Diagram of Test Connections for DRC Relay



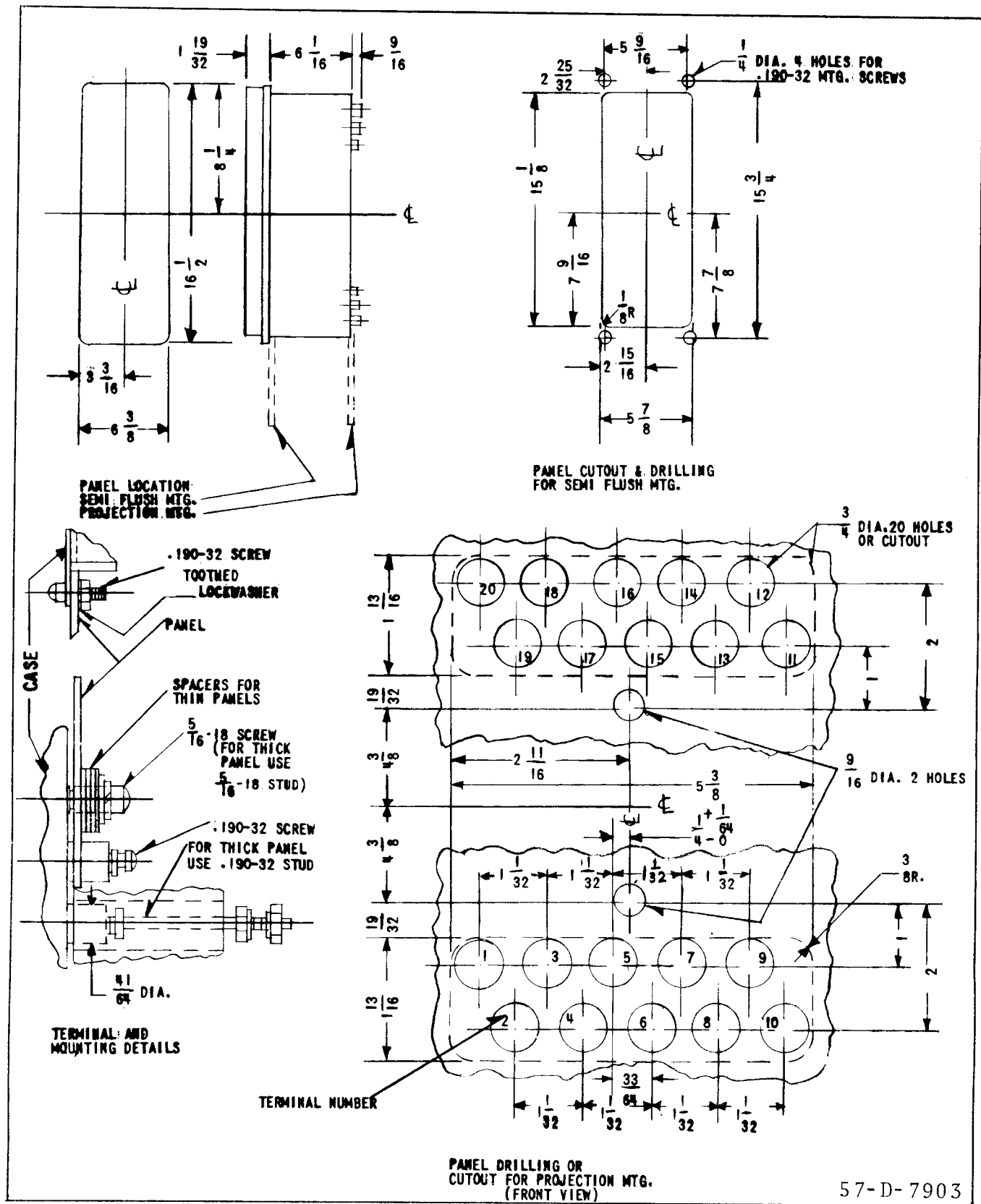


Fig. 6. Outline and Drilling for the Type DRC Relay in the FT-32 Case.









**WESTINGHOUSE ELECTRIC CORPORATION**  
**RELAY-INSTRUMENT DIVISION**

**NEWARK, N. J.**

Printed in U.S.A.