INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DRC-1 RECLOSING RELAY

APPLICATION

The DRC-1 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-1 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-1 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 figures 1, 2 and 11.

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 figures 3 and 4 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 5 for component and board layout.

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 his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

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Integrator

The integrator is a continuously rated 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 reclose timer.

Alarm Relay and Lockout Indicator

The alarm relay and the lockout indicator will be energized when the integrator is in the lock out 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-1 relay will be described with the aid of Figures 1 and 6. We will assume that the DCR-1 relay is set for two instantaneous and two time delay 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-1 relay through the normally closed contacts of the IT Relay and out terminal 10 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 de-energized, 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_5, because of the closing of the 52b switch between battery positive and terminal 5 and 20 (DRC-1 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_6 through zener diode Z2. This signal is amplified by transistor T_6 and applied to the gate of SCR-2 turning SCR-2 on and placing the 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_5 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 1451C38 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 Q_2. This kept the time delay capacitors short-circuited. With the breaker closed and base drive removed from transistor Q_2, 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 timer sends a signal to SCR-1 to reset the integrator. (Note: If the breaker opens to make terminal 5 positive at precisely the same time SCR-1 in the RESET TIMER turns on to reset the integrator, the stepping switch will run all the way to step 8 which is the "lockout" position.

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Since the DRC-1 Relay was set for two instantaneous operations, a second instantaneous trip 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 2 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 Q2, making Q2 conduct, short circuiting the capacitors in the reset timer time delay circuitry.

When the base drive is removed from transistor Q2, 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-1 relay. Due to the fact that we were only set for two instantaneous tripping 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 timer 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 delay 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 Q2 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

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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, the reset timer is energized through the moving arm of level 1, step 8 and the "Reset Timer" tap block setting. With no base drive into transistor Q2, transistor Q2 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 Q3. Transistor Q3 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 contacts (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 Q2 through a buffer circuit. This positive voltage makes transistor Q2 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-1 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-1 relay can be set to lockout the breaker afer 1, 2, 3, or 4 operations.

✪ POWER REQUIREMENTS

Station Battery – 48 - 125 VDC

SETTINGS

FRONT PANEL SETTING

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 screw in intervals one and two and then the DRC-1 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

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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 6 or to auxiliary test relay per Figure 7.

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-1 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-1 after each reclosure until lockout is reached. The device being controlled by the DRC-1 relay can be tripped open manually or electrically. The reclose timer should be two seconds plus or minus 5%.

3. When at lockout, close the device being controlled by the DRC-1 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 11 of Reset Module 1451C38 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 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.

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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	Connection To energize reset timer if required	Energize reset timer time delay circuit †	Same as step #1 *	Energize reset timer time delay circuit †
Level 2	Pulses integrator to step 1 when 52b closes	✪ Energize Aux relay	Pulses integrator to step 4 when 52b closes	✪ Energize Aux relay	Pulses integrator to step 5 when 52b closes
Level 3 and OPERATIONS TO LOCKOUT TAP BLOCK SETTING	Supplies base drive for Q2 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 one	No connection
Level 5	Make contact between terminals 16 and 17	Make contact between terminals 19 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 coil directly.
■ Instantaneous tripping will not take place in those positions which have a tap screw.

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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	Same as step #1 *	Energizes reset timer time delay circuit †	Same as step #1 *	Energizes reset timer time delay circuit †	Energizes reset timer time delay circuit †
Level 2	✪ Energize Aux relay	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 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 the integrator coil directly.
■ Instantaneous tripping will not take place in those positions which have a tap screw.

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	MANUFACTURER DESIGNATION
	RESISTORS (values in Ohms)	
R1	47,000 1/2W 2%	629A531H72
R2	4.7K 1/2W 2%	629A531H48
R3	118,000 1/2W 1%	837A131H05
R4	174,000 1/2W 1%	837A131H04
R5	232,000 1/2W 1%	837A131H07
R6	453,000 1/2W 1%	836A503H87
R7	665,000 1/2W 1%	837A131H06
R8	2,700 1/2W 5%	184A763H37
R9	1,000 1/2W 5%	184A763H27
R10	10 1/2W 5%	187A290H01
R11	649,000 1/2W 1%	837A131H01
R12	442,000 1/2W 1%	837A131H03
R13	221,000 1/2W 1%	836A503H80
R14	28,700 1/2W 1%	837A131H02
R15	2,670 1/2W 1%	836A503H36
R16	1,200 1/2W 5%	184A763H53
R17	220,000 1/2W 5%	184A763H83
R19	2,700 1/2W 5%	184A763H37
R20	1,000 1/2W 5%	184A763H27
R21	220 1/2W 5%	184A763H11
R22	10,600 250VDC 5%	1267313
R22	5,000 125VDC 5%	1205214
R22	1,400 48VDC 5%	1267292
R23	5,600 250VDC 5%	1267305
R23	2,500 125VDC 5%	1267299
R23	560 48VDC 5%	1267282
R24	100 3W 5%	763A127H20
R25	100 25W (48 VDC)	1207238
R25	500 25W (125VDC)	1202522
R26	7.5 3W	185A209H09
R27	100 3W 5%	763A127H20
R28	100 3W 5%	763A127H20
R29	100 3W 5%	763A127H20
R30	10 1/2W 5%	187A290H01
R31	82,000 1/2W 2%	629A531H78
R32	10,000 1/2W 2%	629A531H56
✪ R33	2,000 25W (250 VDC)	1267296
▪ All resistor values in Ohms		
	CAPACITORS	
C1	100 MFD 6V 5%	184A661H06
C2	100 MFD 6V 5%	184A661H06
C3	To be determined in test	
C4	.25 MFD 200VDC 10%	187A624H02
C5	6.8 MFD 35VDC 20%	184A661H10
C5	(250VDC) .25 MFD 200VDC	187A624H02
C6	10 MFD 150VDC 20%	27D5476H09
C6	(250VDC) 10 MFD 400VDC	862A177H02
C7	.5 MFD 200VDC 10%	187A624H08
C7	(250VDC) .047 MFD 400VDC	763A219H01
C8	150 MFD 6V 5%	184A661H08
C9	To be determined in test	
C10	100 MFD 6V 5%	184A661H06
C11	33 MFD 20V 20%	184A661H11
C12	1 MFD 20%	187A624H04
C12	(250VDC) 1 MFD 400VDC	764A278H02
C13	1 MFD 20%	187A624H04
C13	(250VDC) 1 MFD 400VDC	764A278H02
C14	.047 MFD 50VDC	848A646H07
C15	.047 MFD 200VDC	849A437H04
C16	22 MFD 35VDC	187A508H17

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION		MANUFACTURER DESIGNATION
	TRANSISTORS		
Q2	2N3417		848A851H01
Q3	2N3417		848A851H01
T4	2N3417		848A851H01
T5	2N3417		848A851H01
T6	2N3417		848A851H01
	ZENER – DIODES		
Z1	1N748A		186A797H13
Z2	1N748A		186A797H13
Z3	1N748A		186A797H13
Z4	1N748A		186A797H13
Z5	1N748A		186A797H13
Z6	1N748A		186A797H13
Z7 to Z11	1R200		629A369H01
Z12	1.5KE200		878A619H01
Z13	1N3686B		185A212H06
Z14	1N957B		186A797H06
Z15	(250VDC) 1.5KE200		878A619H01
	THERMISTOR		
TH-1	2D504		185A211H07
	CONTROLLED RECTIFIERS		
SCR-1	K1149-13		184A640H13
SCR-1	(250VDC) K1149-12		184A640H12
SCR-2	K1149-13		184A640H13
SCR-2	(250VDC) K1149-12		184A640H12
	RECTIFIERS		
D3	1N4822		188A342H11
D4	1N4822		188A342H11
D5	1N645A		837A692H03
D6	1N4822		188A342H11
D7	1N4822		188A342H11
D8	1N4822		188A342H11
D9	1N645A		837A692H03
✪ D10, D11, D12	(48 VDC) 1N4822		188A342H11
	MISCELLANEOUS		
I_1	Lockout indication	52410-993	183A825G05
RH-1	Potentiometer	Series 43-250	762A790H04
AR	Alarm relay	250Vdc	541D514H15
AR	Alarm relay	125Vdc	541D514H06
AR	Alarm relay	48Vdc	541D514H08
✪ Aux	Auxiliary relay	48Vdc	541D514H18
✪ Aux	Auxiliary relay	48, 250Vdc	541D514H19
IT	Instantaneous relay	250Vdc	541D514H14
IT	Instantaneous relay	125Vdc	541D514H05
IT	Instantaneous relay	48Vdc	541D514H07
CR	Close relay	250Vdc	541D514H14
CR	Close relay	125Vdc	541D514H05
CR	Close relay	48Vdc	541D514H07
SS	Stepping switch	250Vdc	205C6399G03
SS	Stepping switch	125Vdc	205C399G02
SS	Stepping switch	48Vdc	205C399G01

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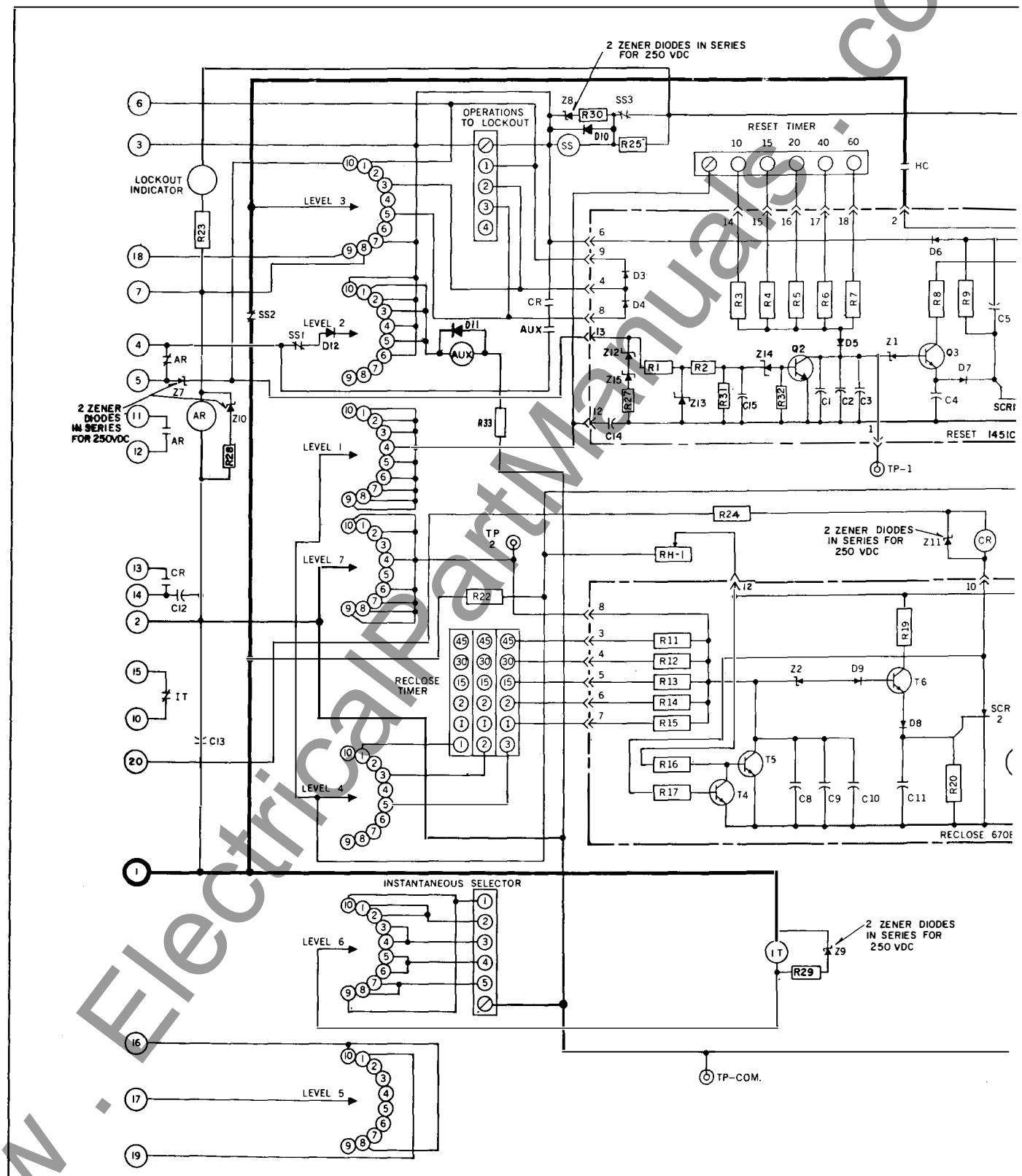

Fig. 2. Internal Schematic of Type DRC-

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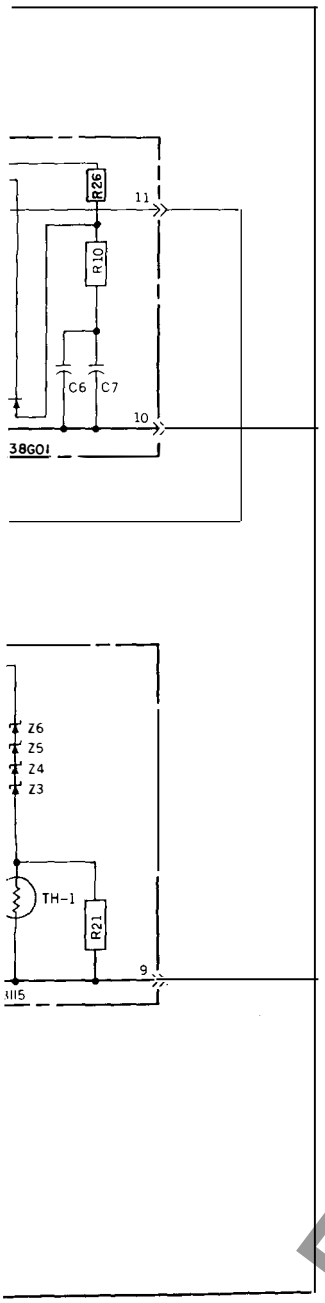

RESISTOR	STYLE NO	REF.
R1	862A378H34	221,000 Ω 1/2W
R17	184A763H83	220.000 Ω 1/2W
R3	837A131H05	118.000 Ω 1/2W
R4	837A131H04	174.000 Ω 1/2W
R5	837A131H07	232.000 Ω 1/2W
R6	836A503H87	453.000 Ω 1/2W
R7	837A131H06	665.000 Ω 1/2W
R8-R19	184A763H37	2.700 Ω 1/2W
R9-R20	184A763H27	1.000 Ω 1/2W
R10-R30	187A290H01	10 Ω 1/2W
R11	837A131H01	649.000 Ω 1/2W
R12	837A131H03	442 000 Ω 1/2W
R13	836A503H80	221 000 Ω 1/2W
R14	837A131H02	28.700 Ω 1/2W
R14 △	629A531H84	15 MEG 1/2W
R15	836A503H36	2.670 Ω 1/2W
R16	184A763H53	12 000 Ω 1/2W
R21	184A763H11	220 Ω 1/2W
R22	1267313	10,600 Ω
R26	185A209H09	7.5 Ω. 3 W
R23	1267305	5600 Ω
R24-R27-R28-R29	763A127H20	100 Ω 3W
R25	1267296	2000 Ω 25 W
R2	629A531H48	4,700 Ω 1/2 W
R31	629A531H78	82,000 Ω 1/2 W
R32	629A531H56	10,000 Ω 1/2 W
R33	185A209H21	5000 Ω - 10 W

CAPACITOR	STYLE	REF
C1 - C2 - C10	184A661H06	100 MFD 6V
C3	TO BE DETERMINED IN TEST	
C4	187A624H02	25MFD. 200VDC
C5	187A624 H02	.250 MFD 200VDC
C6	862A177H02	10 MFD 400VDC
C7	763A219H01	.047 MFD 400VDC
C8	184A661H08	150 MFD 6V
C9	TO BE DETERMINED IN TEST	
C11	184A661H11	33MFD 20V
C12-C13	764A278H02	1 MFD 400 VDC
C14	848A646H07	.047 MFD 50VDC
C15	849A437H04	.047 MFD 200VDC
~~C16~~	~~187A508H17~~	~~22 MFD 35VDC~~

TRANSISTOR		
T4 TO T6	848A851H02	2N3417
Q2-Q3	848A851H02	2N3417

THERMISTOR	STYLE NO.	REF.
TH-1	185A211H07	2D504

ZENER DIODE	STYLE NO.	REF.
Z1 TO Z6	186A797H13	1N748A
Z7 TO Z11	629A369H01	1R200
Z12-Z15	878A619H01	1.5KE200
Z13	185A212H06	1N3686B
Z14	186A797H06	1N957B

SILICON CONTROLLED SW.	STYLE NO.	REF.
SCR-1 SCR-2	184A640H12	K1149-12

RECTIFIER	STYLE NO	REF.
D3-D4-D6-D7-D8-D10-D11-D12	188A342H11	1N4822
D5 - D9	837A692H03	1N645A

MISC.	STYLE NO.	REF.
POT. (RH)	762A790H04	SERIES 43
TEL RELAY (CR)	541D514H15	250VDC
TEL-RELAY (IT)(AR)	541D514H14	250 VDC
TEL-RELAY(AUX)	541D514H19	250VDC
STEPPING SW.	205C399G03	250 VDC
AMBER LITE	183A825G05	52410-993

△= RECLOSE TIME 10 TO 50 SEC.

(1) = RED HANDLE ON FT CASE.
HC INDICATES "HOMING CONTACT" ON STEPPING SWITCH.
SS-1, SS-2 & SS-3 INDICATES "SELF STEPPING CONTACTS" ON STEPPING SWITCH.

Sub. 5
(1321D75)

Relay in FT-32 Case. (250 Vdc)

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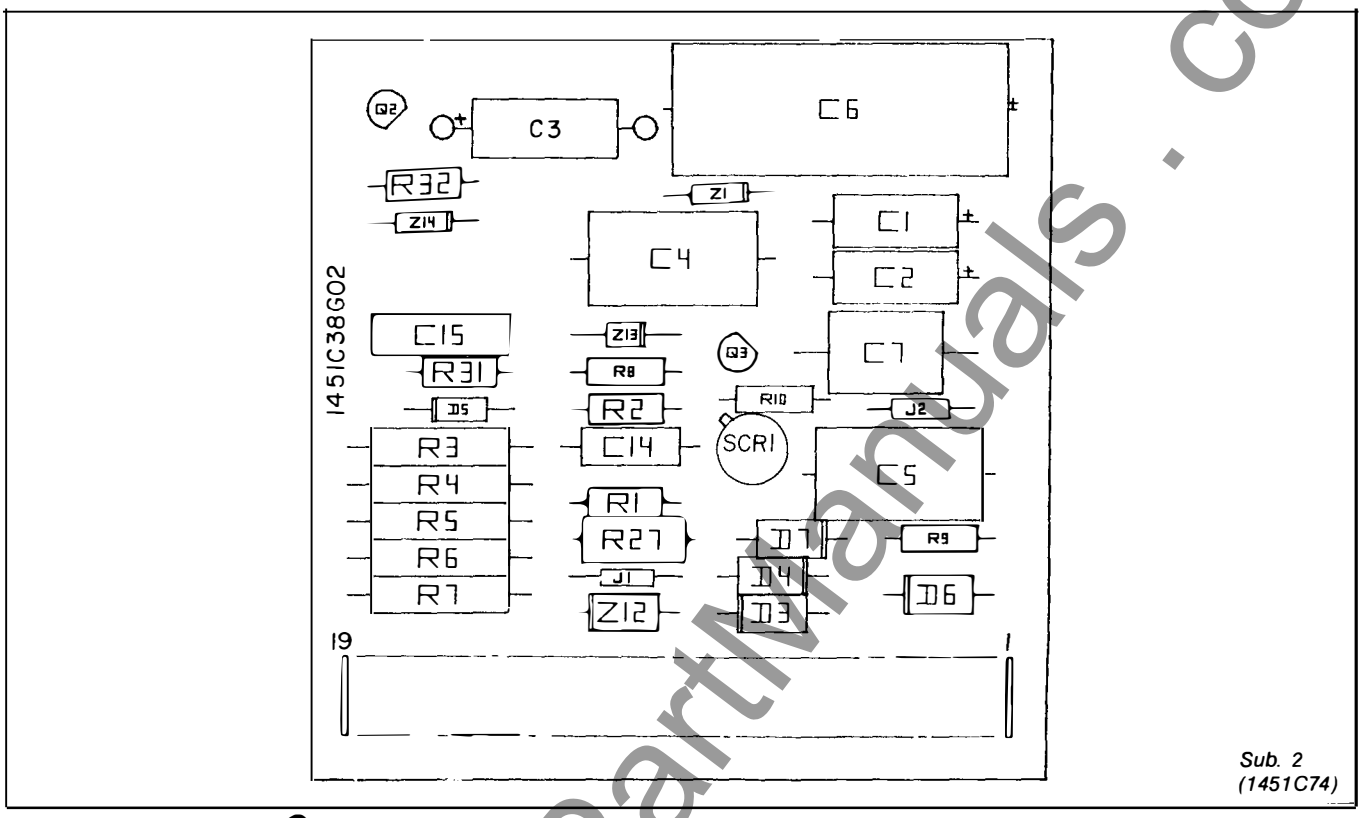

Fig. 3. Component Location of Reset Circuit Board of Type DRC-1 Relay.

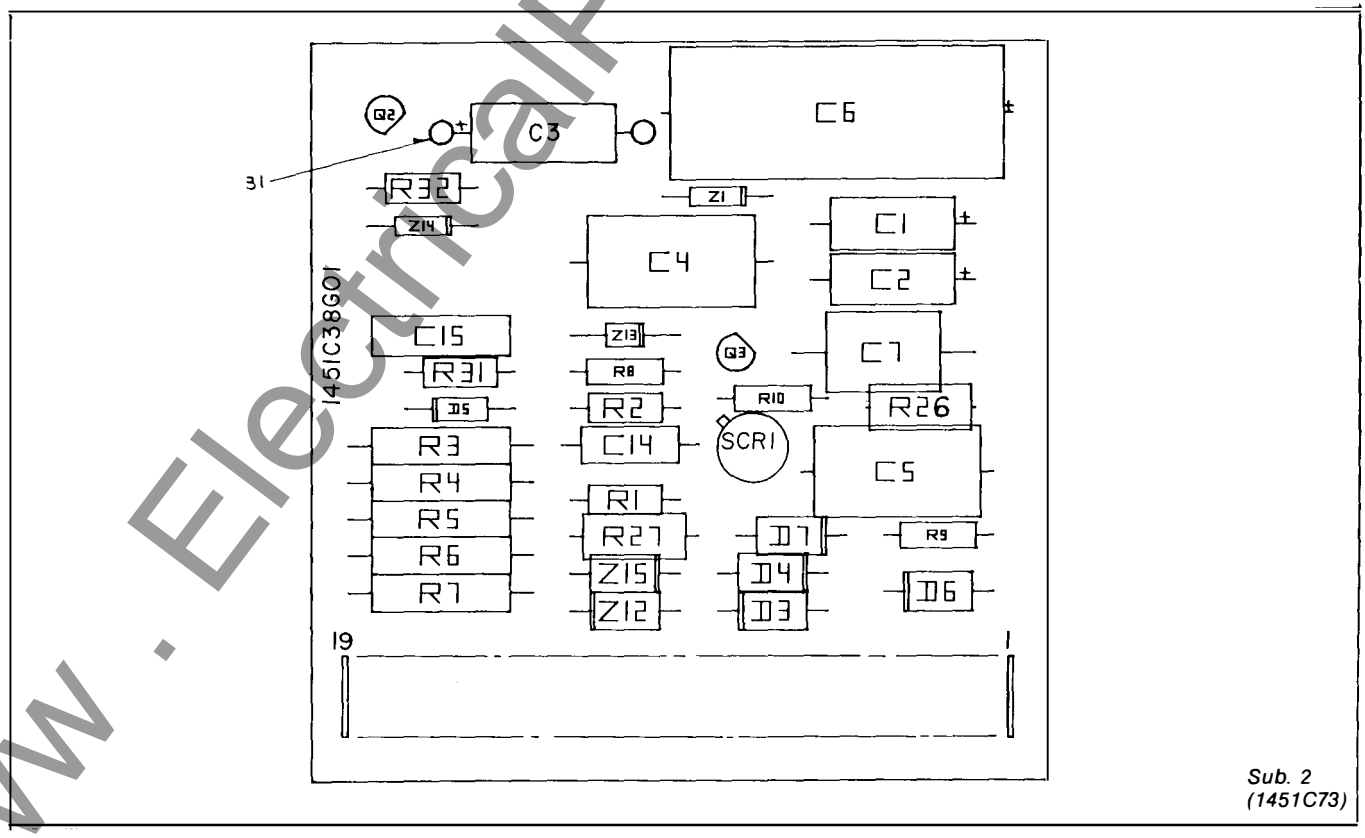

Fig. 4. Component Location of Reset Circuit Board of Type DRC-1 Relay. (250 Vdc)

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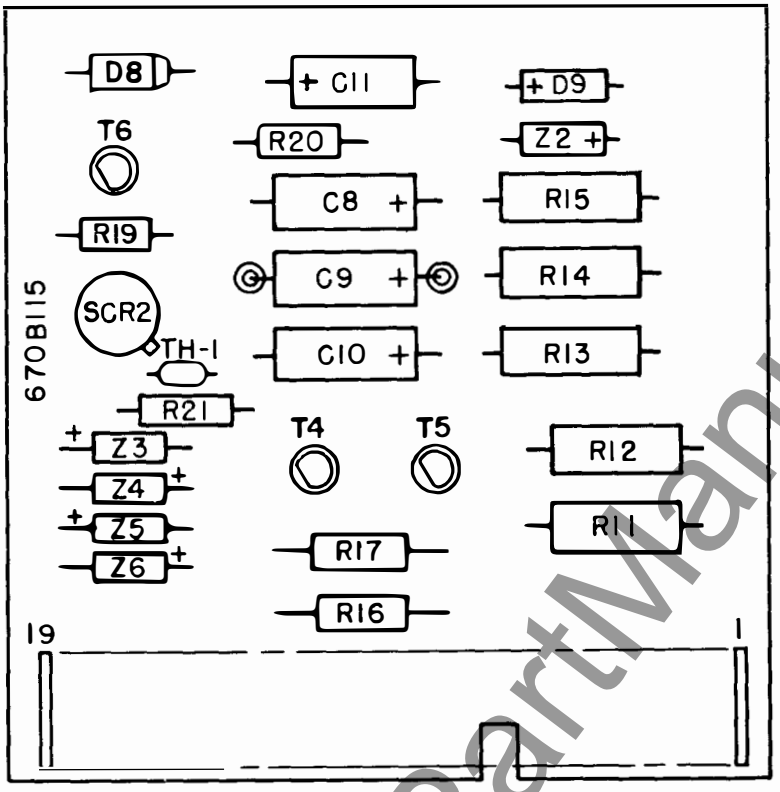
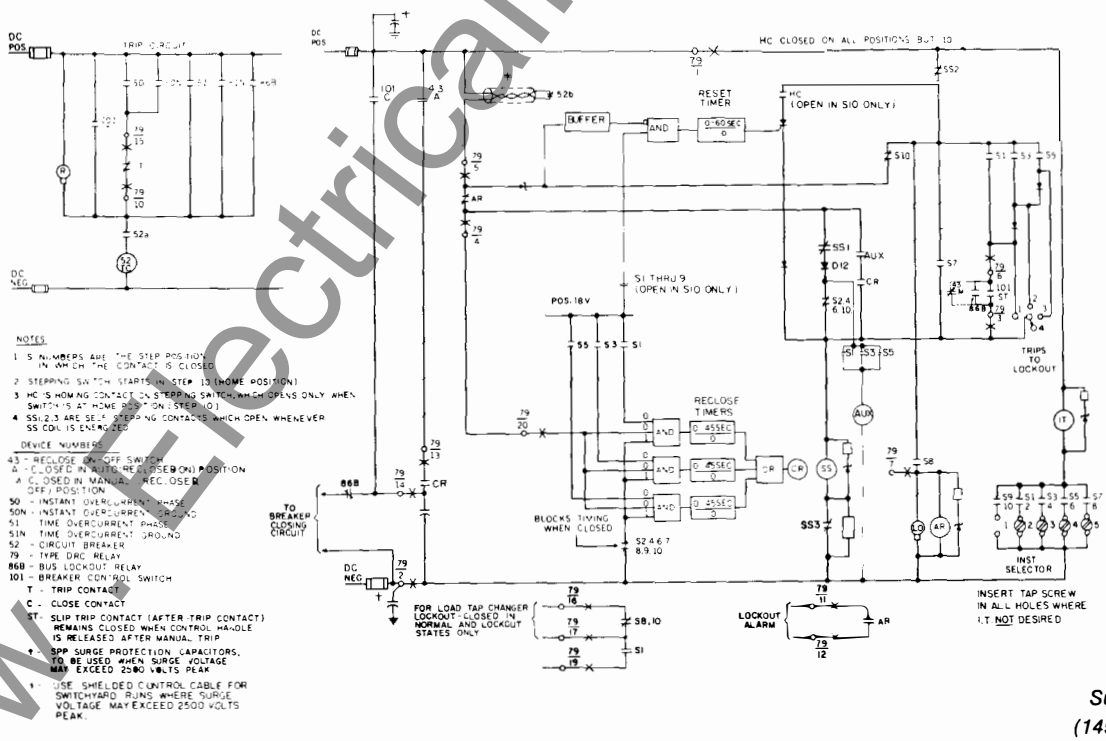


Sub 3
(837A292)

Fig. 5. Component Location of Reclose Circuit Board of Type DRC-1 Relay.



Sub. 7
(1457C19)

✪ *Fig. 6. External Schematic of Type DRC-1 Relay.*

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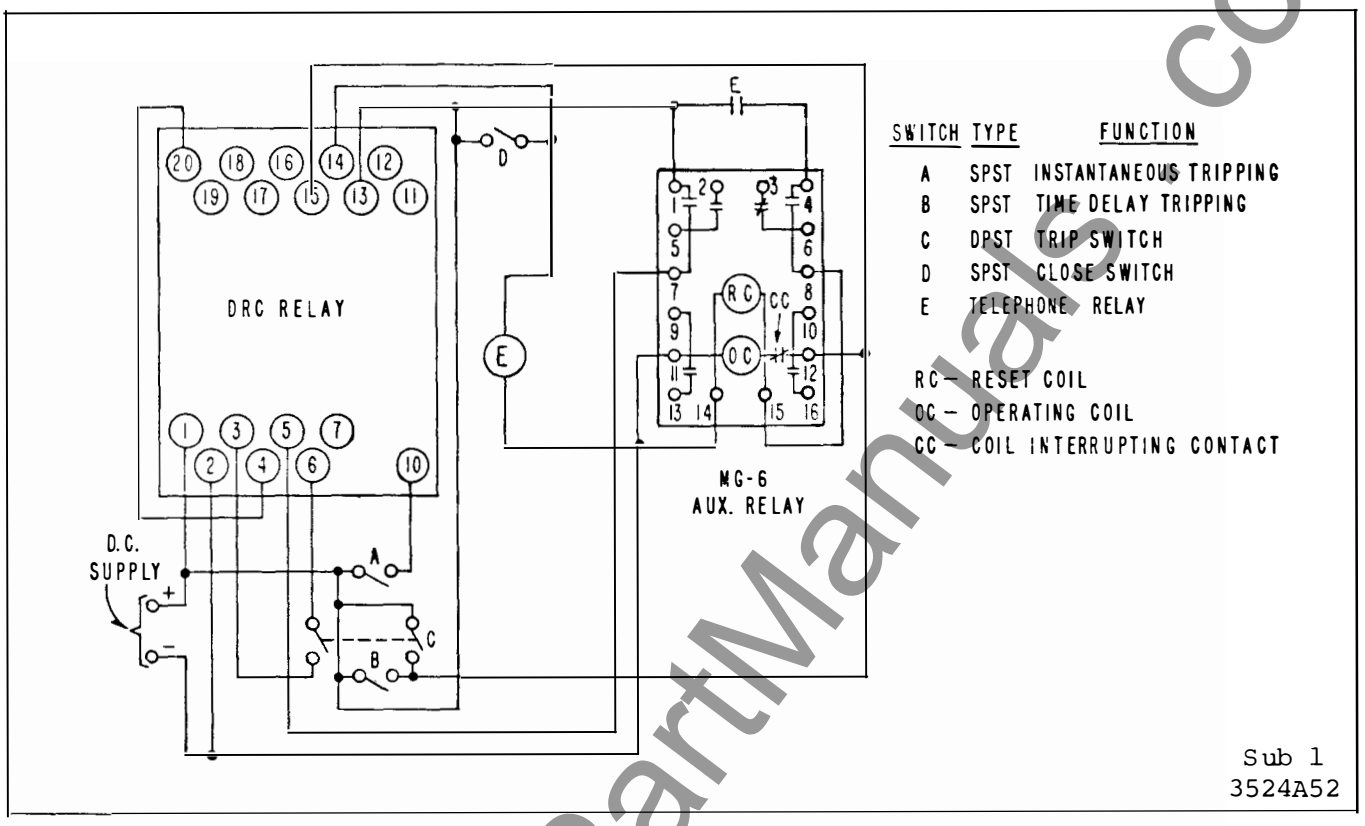
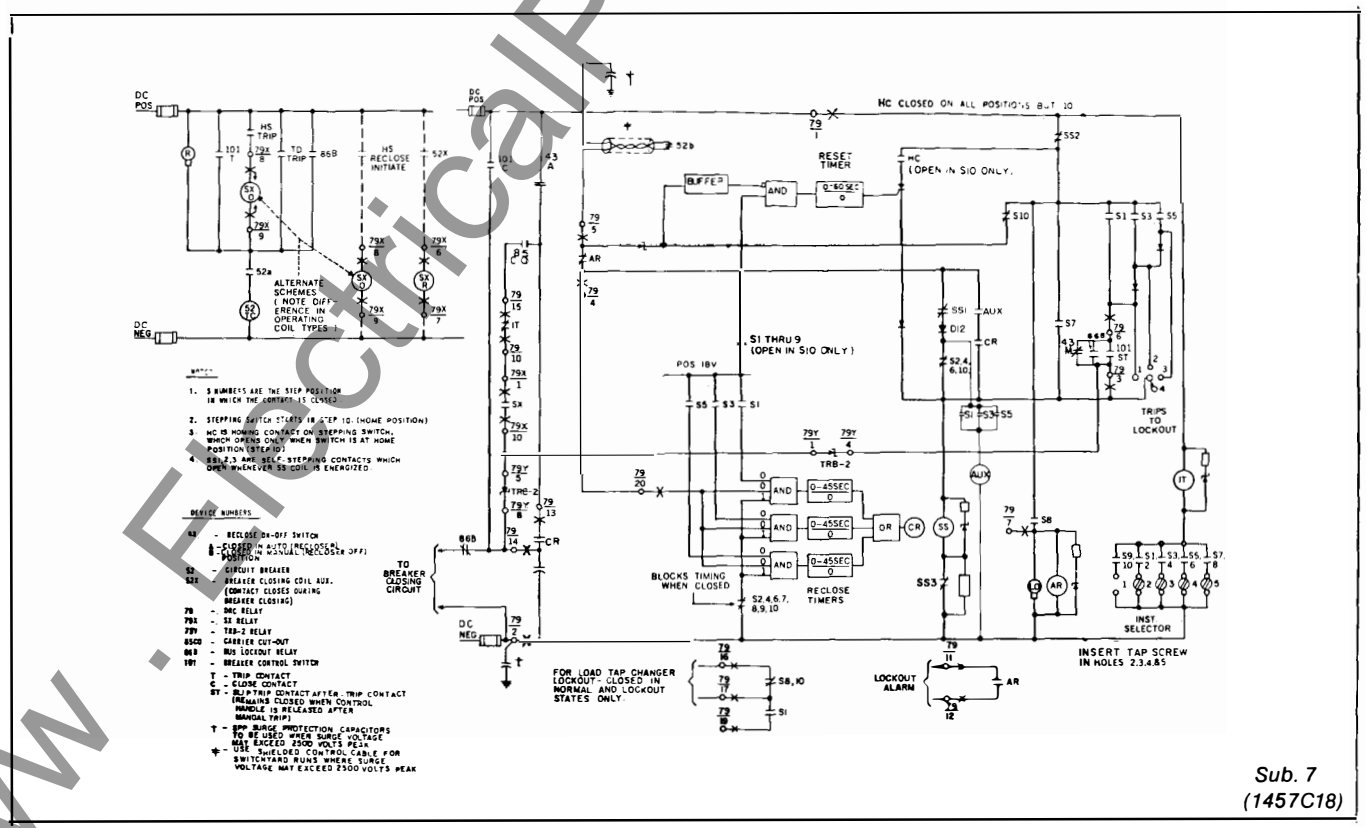


Fig. 7. Diagram of Test Connection for DRC-1 Relay.



✪ *Fig. 8. External DC Schematic for DRC-1 with SX.*

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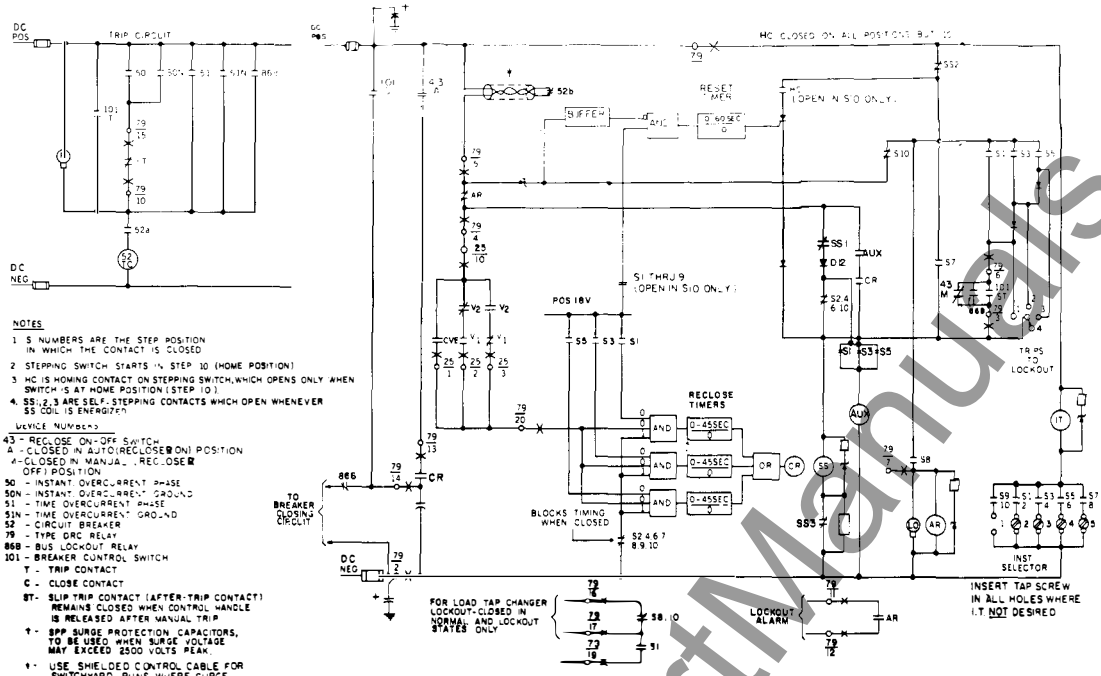
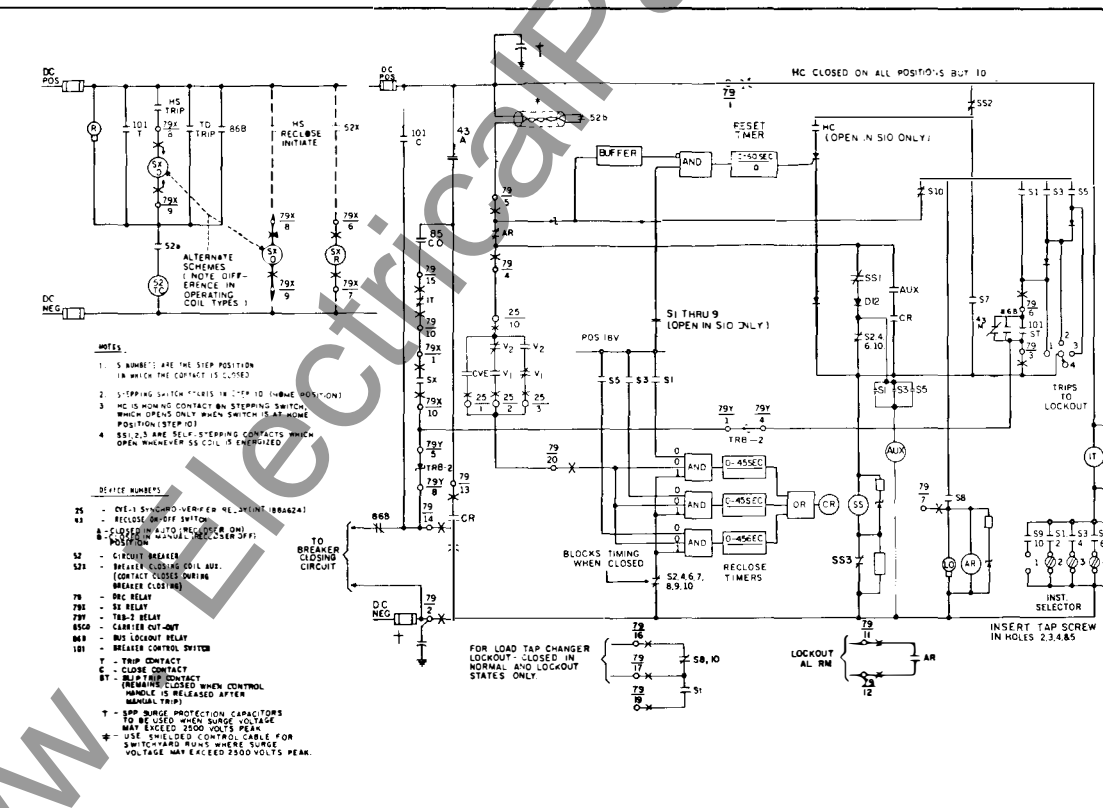


Sub. 6
(1457C20)

Fig. 9. External DC Schematic for DRC-1 with CVE-1.



Sub. 7
(1457C21)

Fig. 10. External DC Schematic for DRC-1 with SX and CVE-1.

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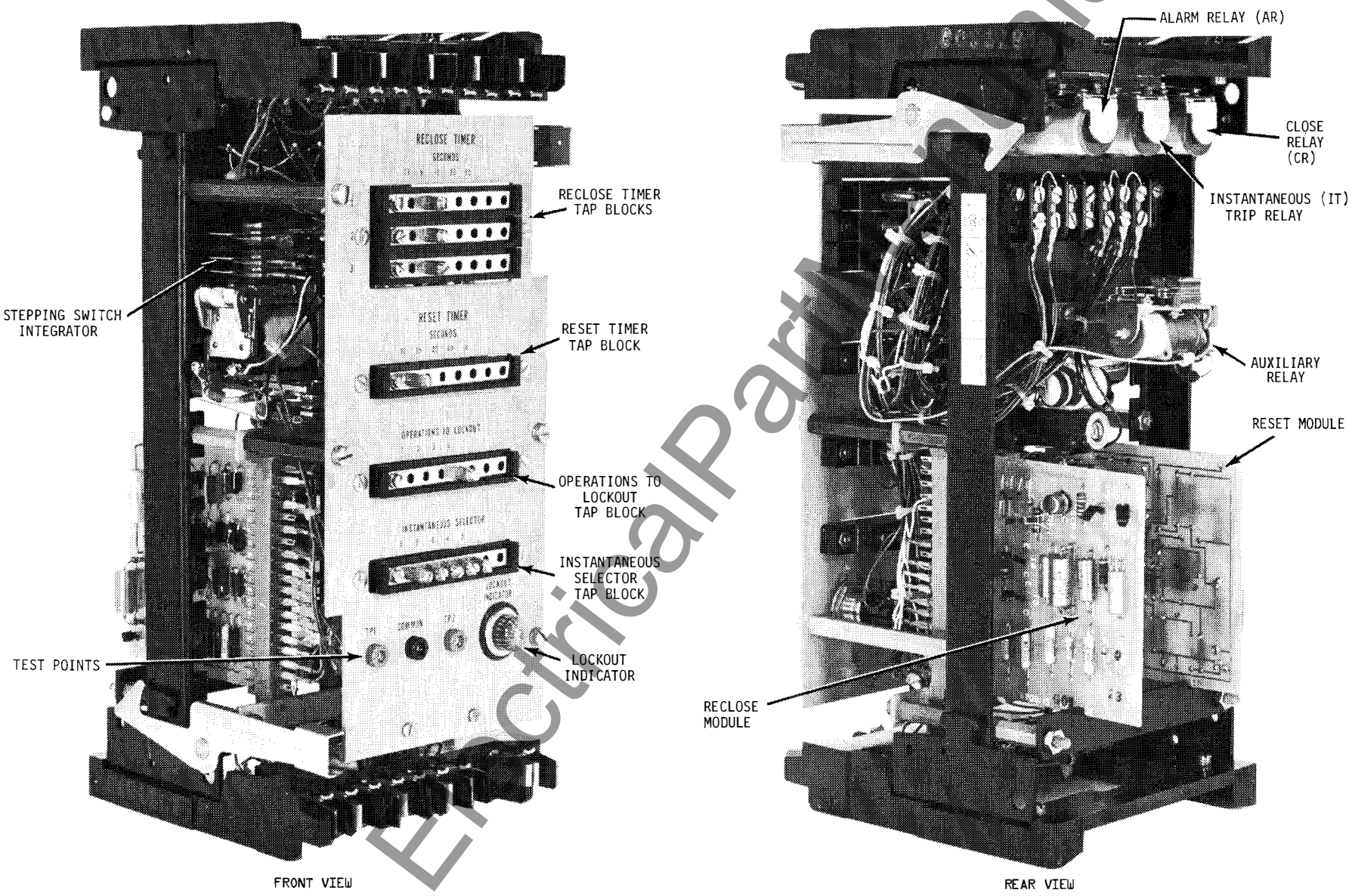

Fig. 11. Type DRC-1 Relay.

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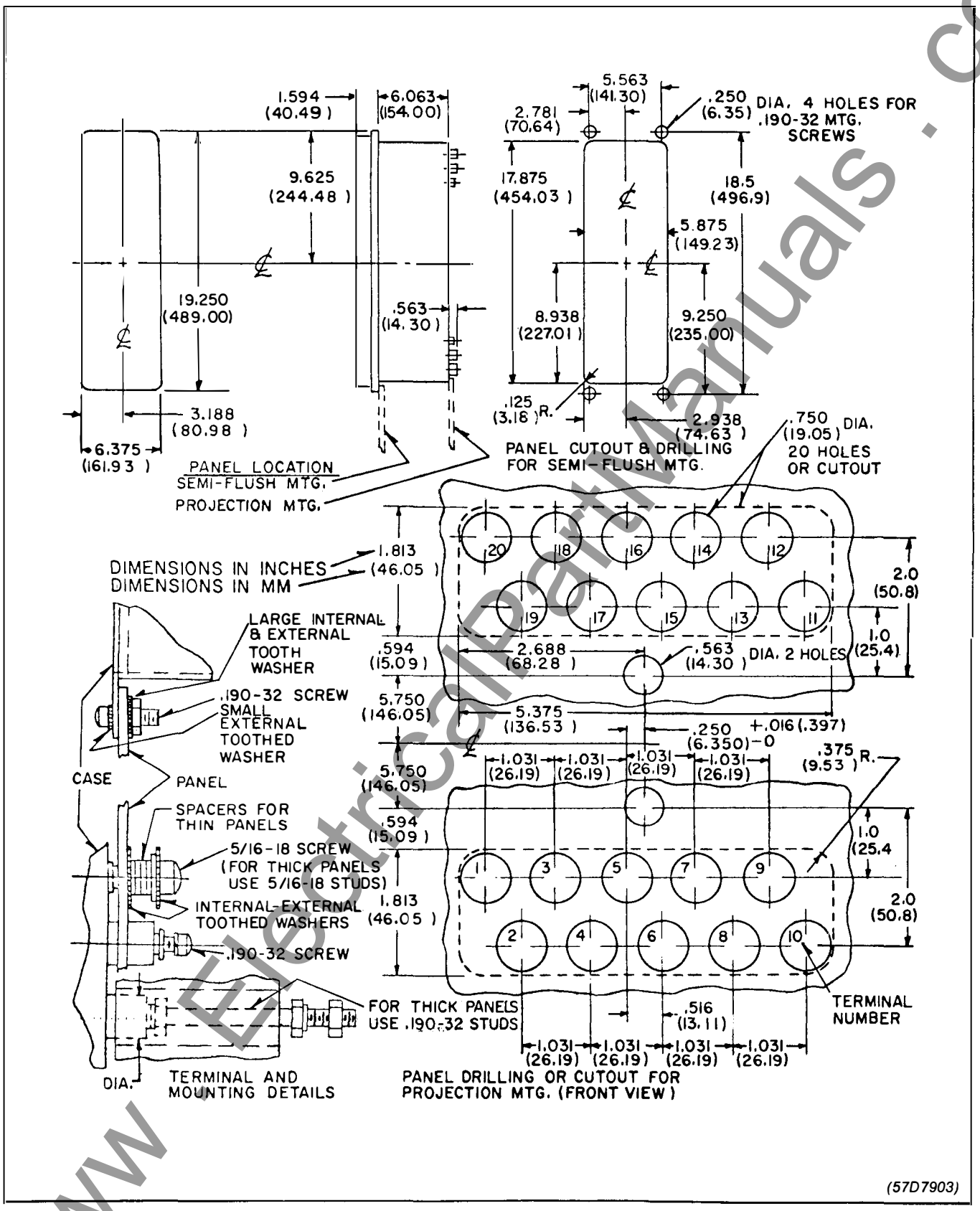

Fig. 12. Outline and Drilling for the Type DRC-1 Relay in the FT-32 Case.

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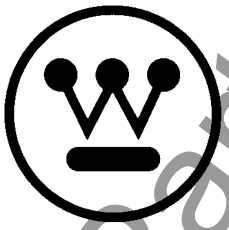

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **CORAL SPRINGS, FL.**

Printed in U.S.A.

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INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DRC-1 RECLOSING RELAY

APPLICATION

The DRC-1 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-1 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-1 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 figures 1, 2 and 11.

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 figures 3 and 4 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 5 for component and board layout.

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 his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-667.3, DATED OCTOBER 1978
✪ DENOTES CHANGED SINCE PREVIOUS ISSUE.

EFFECTIVE JULY 1979

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Integrator

The integrator is a continuously rated 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 reclose timer.

Alarm Relay and Lockout Indicator

The alarm relay and the lockout indicator will be energized when the integrator is in the lock out 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-1 relay will be described with the aid of Figures 1 and 6. We will assume that the DCR-1 relay is set for two instantaneous and two time delay 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-1 relay through the normally closed contacts of the IT Relay and out terminal 10 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 de-energized, 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_5, because of the closing of the 52b switch between battery positive and terminal 5 and 20 (DRC-1 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_6 through zener diode Z2. This signal is amplified by transistor T_6 and applied to the gate of SCR-2 turning SCR-2 on and placing the 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_5 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 1451C38 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 Q_2, this kept the time delay capacitors short-circuited. With the breaker closed and base drive removed from transistor Q_2, 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 timer sends a signal to SCR-1 to reset the integrator.

Since the DRC-1 Relay was set for two instantaneous operations, a second instantaneous trip 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,

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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 2 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 Q2, making Q2 conduct, short circuiting the capacitors in the reset timer time delay circuitry.

When the base drive is removed from transistor Q2, 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-1 relay. Due to the fact that we were only set for two instantaneous tripping 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 timer 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 delay 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 Q2 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

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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, the reset timer is energized through the moving arm of level 1, step 8 and the "Reset Timer" tap block setting. With no base drive into transistor Q2, transistor Q2 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 Q3. Transistor Q3 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 contacts (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 Q2 through a buffer circuit. This positive voltage makes transistor Q2 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 possition (step 10). The DRC-1 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-1 relay can be set to lockout the breaker afer 1, 2, 3, or 4 operations.

ENERGY REQUIREMENTS

Station Battery – 48 - 125 VDC

SETTINGS

FRONT PANEL SETTING

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 screw in intervals one and two and then the DRC-1 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

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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 6 or to auxiliary test relay per Figure 7.

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-1 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-1 after each reclosure until lockout is reached. The device being controlled by the DRC-1 relay can be tripped open manually or electrically. The reclose timer should be two seconds plus or minus 5%.

3. When at lockout, close the device being controlled by the DRC-1 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 II of Reset Module 1451C38 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 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.

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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	Connection To energize reset timer if required	Energize reset timer time delay circuit †	Same as step #1 *	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 Q2 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 one	No connection
Level 5	Make contact between terminals 16 and 17	Make contact between terminals 19 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 coil directly.
■ Instantaneous tripping will not take place in those positions which have a tap screw.

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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	Same as step #1 *	Energizes reset timer time delay circuit †	Same as step #1 *	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 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 the integrator coil directly.
■ Instantaneous tripping will not take place in those positions which have a tap screw.

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	MANUFACTURER DESIGNATION
	RESISTORS (values in Ohms)	
R1	47,000 1/2W 2%	629A531H72
R2	4.7K 1/2W 2%	629A531H48
R3	118,000 1/2W 1%	837A131H05
R4	174,000 1/2W 1%	837A131H04
R5	232,000 1/2W 1%	837A131H07
R6	453,000 1/2W 1%	836A503H87
R7	665,000 1/2W 1%	837A131H06
R8	2,700 1/2W 5%	184A763H37
R9	1,000 1/2W 5%	184A763H27
R10	10 1/2W 5%	187A290H01
R11	649,000 1/2W 1%	837A131H01
R12	442,000 1/2W 1%	837A131H03
R13	221,000 1/2W 1%	836A503H80
R14	28,700 1/2W 1%	837A131H02
R15	2,670 1/2W 1%	836A503H36
R16	1,200 1/2W 5%	184A763H53
R17	220,000 1/2W 5%	184A763H83
R19	2,700 1/2W 5%	184A763H37
R20	1,000 1/2W 5%	184A763H27
R21	220 1/2W 5%	184A763H11
R22	10,600 250VDC 5%	1267313
R22	5,000 125VDC 5%	1205214
R22	1,400 48VDC 5%	1267292
R23	5,600 250VDC 5%	1267305
R23	2,500 125VDC 5%	1267299
R23	560 48VDC 5%	1267282
R24	100 3W 5%	763A127H20
R25	100 25W (48 VDC)	1207238
R25	500 25W (125VDC)	1202522
R26	7.5 3W	185A209H09
R27	100 3W 5%	763A127H20
R28	100 3W 5%	763A127H20
R29	100 3W 5%	763A127H20
R30	10 1/2W 5%	187A290H01
R31	82,000 1/2W 2%	629A531H78
R32	10,000 1/2W 2%	629A531H56
▪ All resistor values in Ohms		
	CAPACITORS	
C1	100 MFD 6V 5%	184A661H06
C2	100 MFD 6V 5%	184A661H06
C3	To be determined in test	
C4	.25 MFD 200VDC 10%	187A624H02
C5	6.8 MFD 35VDC 20%	184A661H10
C5	(250VDC) .25 MFD 200VDC	187A624H02
C6	10 MFD 150VDC 20%	27D5476H09
C6	(250VDC) 10 MFD 400VDC	862A177H02
C7	.5 MFD 200VDC 10%	187A624H08
C7	(250VDC) .047 MFD 400VDC	763A219H01
C8	150 MFD 6V 5%	184A661H08
C9	To be determined in test	
C10	100 MFD 6V 5%	184A661H06
C11	33 MFD 20V 20%	184A661H11
C12	1 MFD 20%	187A624H04
C12	(250VDC) 1 MFD 400VDC	764A278H02
C13	1 MFD 20%	187A624H04
C13	(250VDC) 1 MFD 400VDC	764A278H02
C14	.047 MFD 50VDC	848A646H07
C15	.047 MFD 200VDC	849A437H04
C16	22 MFD 35VDC	187A508H17

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION		MANUFACTURER DESIGNATION
	TRANSISTORS		
Q2	2N3417		848A851H01
Q3	2N3417		848A851H01
T4	2N3417		848A851H01
T5	2N3417		848A851H01
T6	2N3417		848A851H01
	ZENER – DIODES		
Z1	1N748A		186A797H13
Z2	1N748A		186A797H13
Z3	1N748A		186A797H13
Z4	1N748A		186A797H13
Z5	1N748A		186A797H13
Z6	1N748A		186A797H13
Z7 to Z11	1R200		629A369H01
Z12	1.5KE200		878A619H01
Z13	1N3686B		185A212H06
Z14	1N957B		186A797H06
Z15	(250VDC) 1.5KE200		878A619H01
	THERMISTOR		
TH-1	2D504		185A211H07
	CONTROLLED RECTIFIERS		
SCR-1	K1149-13		184A640H13
SCR-1	(250VDC) K1149-12		184A640H12
SCR-2	K1149-13		184A640H13
SCR-2	(250VDC) K1149-12		184A640H12
	RECTIFIERS		
D3	1N4822		188A342H11
D4	1N4822		188A342H11
D5	1N645A		837A692H03
D6	1N4822		188A342H11
D7	1N4822		188A342H11
D8	1N4822		188A342H11
D9	1N645A		837A692H03
D10	(48 VDC) 1N4822		188A342H11
	MISCELLANEOUS		
I1	Lockout indication	52410-993	183A925G05
RH-1	Potentiometer	Series 43-250	762A790H04
AR	Alarm relay	250Vdc	541D514H15
AR	Alarm relay	125Vdc	541D514H06
AR	Alarm relay	48Vdc	541D514H08
IT	Instantaneous relay	250Vdc	541D514H14
IT	Instantaneous relay	125Vdc	541D514H05
IT	Instantaneous relay	48Vdc	541D514H07
CR	Close relay	250Vdc	541D514H14
CR	Close relay	125Vdc	541D514H05
CR	Close relay	48Vdc	541D514H07
SS	Stepping switch	250Vdc	205C6399G03
SS	Stepping switch	125Vdc	205C399G02
SS	Stepping switch	48Vdc	205C399G01

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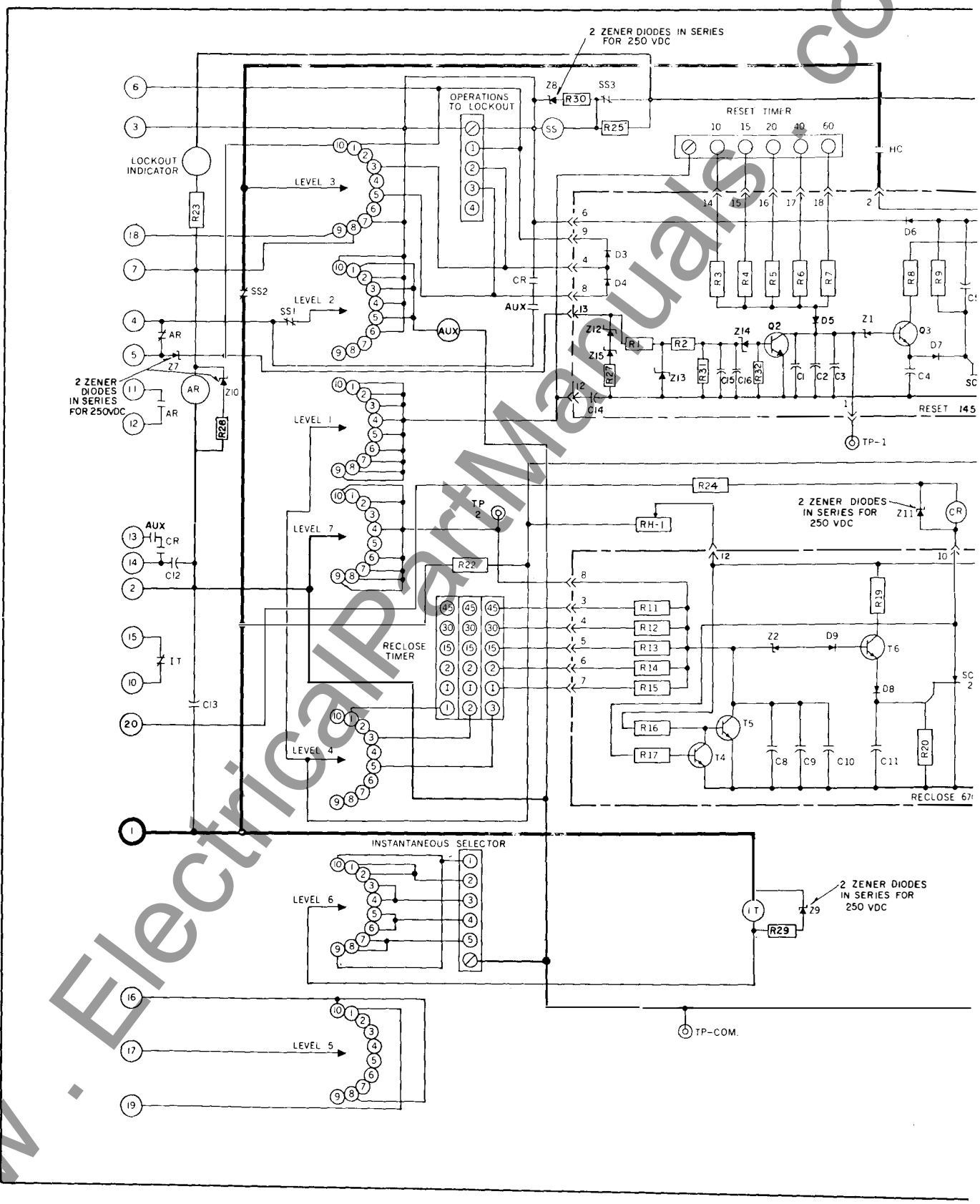

Fig. 2. Internal Schematic of Type DR

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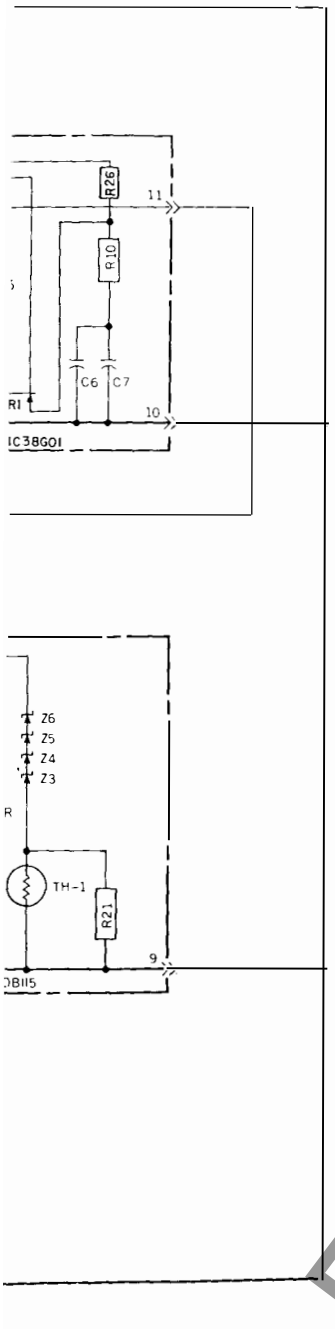

RESISTOR	STYLE NO.	REF.
R1	862A378H34	221,000 Ω 1/2W
R17	184A763H37	220,000 Ω 1/2W
R3	837A131H05	118,000 Ω 1/2W
R4	837A131H04	174,000 Ω 1/2W
R5	837A131H07	237,000 Ω 1/2W
R6	837A131H08	464,000 Ω 1/2W
R7	837A131H05	261,000 Ω 1/2W
R8-R19	184A763H27	2,700 Ω 1/2W
R9-R20	184A763H27	1,000 Ω 1/2W
R10-R30	837A129H01	10 Ω 1/2W
R11	837A131H01	464,000 Ω 1/2W
R12	837A131H03	442,000 Ω 1/2W
R13	836A501H60	22,000 Ω 1/2W
R14	837A131H02	28,700 Ω 1/2W
R18 Δ	629A531H84	15 MEG 1/2W
R15	836A503H38	2,670 Ω 1/2W
R16	184A763H53	12,000 Ω 1/2W
R21	184A763H11	220 Ω 1/2W
R22	1267313	10,600 Ω
R26	185A209H09	7.5Ω. 3W
R23	1267305	5600 Ω
R24-R27-R28-R29	76A427H20	100 Ω 3W
R25	1267296	2000 Ω 25W
R2	629A531H48	4,700 Ω 1/2W
R31	629A531H78	82,000 Ω 1/2W
R32	629A531H56	10,000 Ω 1/2W

CAPACITOR	STYLE	REF.
C1 - C2 - C10	184A651H06	100 MFD 6V
C3	TO BE DETERMINED IN TEST	
C4	187A624H02	25MFD 200VDC
C5	187A624 H02	.250MFD 200VDC
C6	862A177H02	10 MFD 400VDC
C7	763A219H01	.047 MFD 400VDC
C8	184A651H08	150 MFD 6V
C9	TO BE DETERMINED IN TEST	
C11	184A651H11	33MFD 20V
C12-C13	764A278H02	1 MFD 400VDC
C14	848A646H07	.047 MFD 50VDC
C15	849A437H04	.047 MFD 200VDC
C16	187A508H17	22 MFD 35VDC

TRANSISTOR		
T4 TO T6	848A851H02	2N3417
Q2-Q3	848A851H02	2N3417

THERMISTOR	STYLE NO.	REF.
TH-1	185A211H07	20504

Z1-Z2 DIODE	STYLE NO.	REF.
Z1 TO Z6	186A737H13	1N748A
Z7 TO Z11	629A369H01	1R200
Z12-Z15	878A619H01	1.5KE200
Z13	185A212H06	IN3686B
Z14	186A797H06	IN957B

SILICON CONTROLLED SW.	STYLE NO.	REF.
SCR1 SCR2	184AE140H12	X1149-12

RECTIFIER	STYLE NO.	REF.
D1-D4-D5-D7-D8	188A342H01	1N4822
D6 - D9	837A692H03	IN645A

MISC.	STYLE NO.	REF.
POT (RH)	76A430H04	SERIES 43
TEL RELAY (AR)	541D614H15	250 VDC
TEL RELAY (LT)(CR)	541D514H14	250 VDC
TEL-RELAY(AUX)	541D514H15	250VDC
STEPPING SW	205C339G03	250 VDC
AMBER LITE	183A825G05	52410-993

Δ = RECLOSE TIME 10 TO 50 SEC

(1) = RED HANDLE ON FT CASE
HC INDICATES "HOMING CONTACT" ON STEPPING SWITCH
SS-1, SS-2 & SS-3 INDICATES "SELF STEPPING CONTACTS" ON STEPPING SWITCH.

Sub 2
(1321D75)

...1 Relay in FT-32 Case. (250 Vdc)

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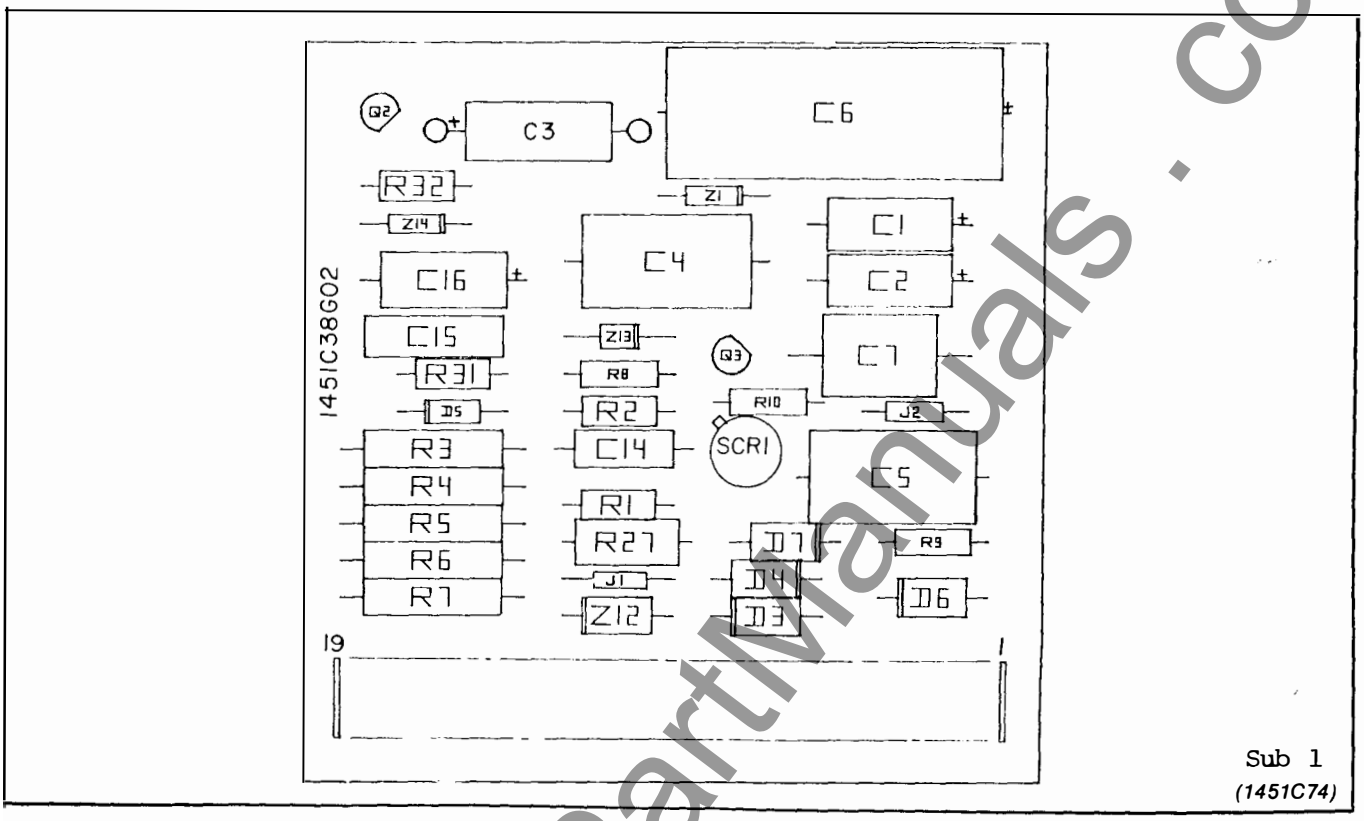

Fig. 3. Component Location of Reset Circuit Board of Type DRC-1 Relay.

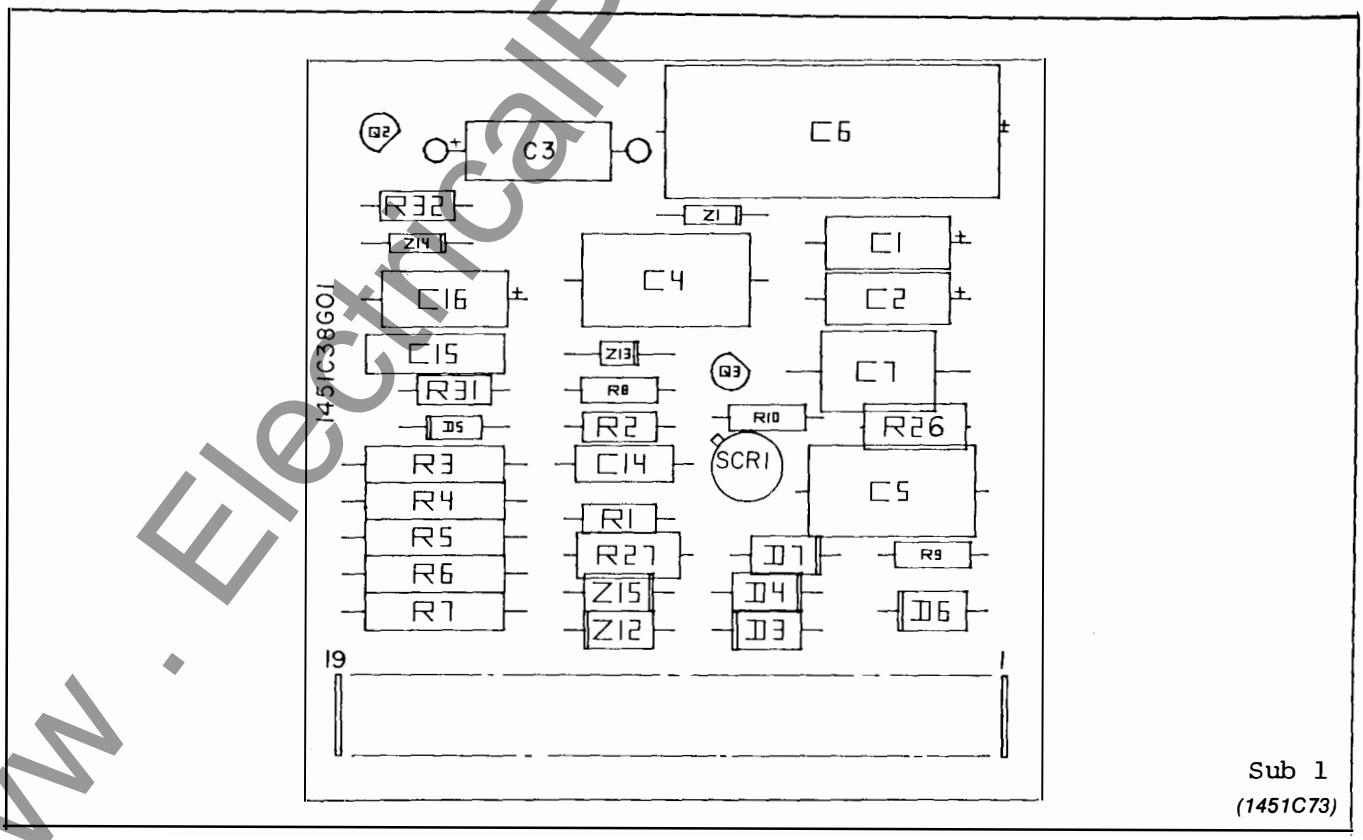

Fig. 4. Component Location of Reset Circuit Board of Type DRC-1 Relay. (250 Vdc)

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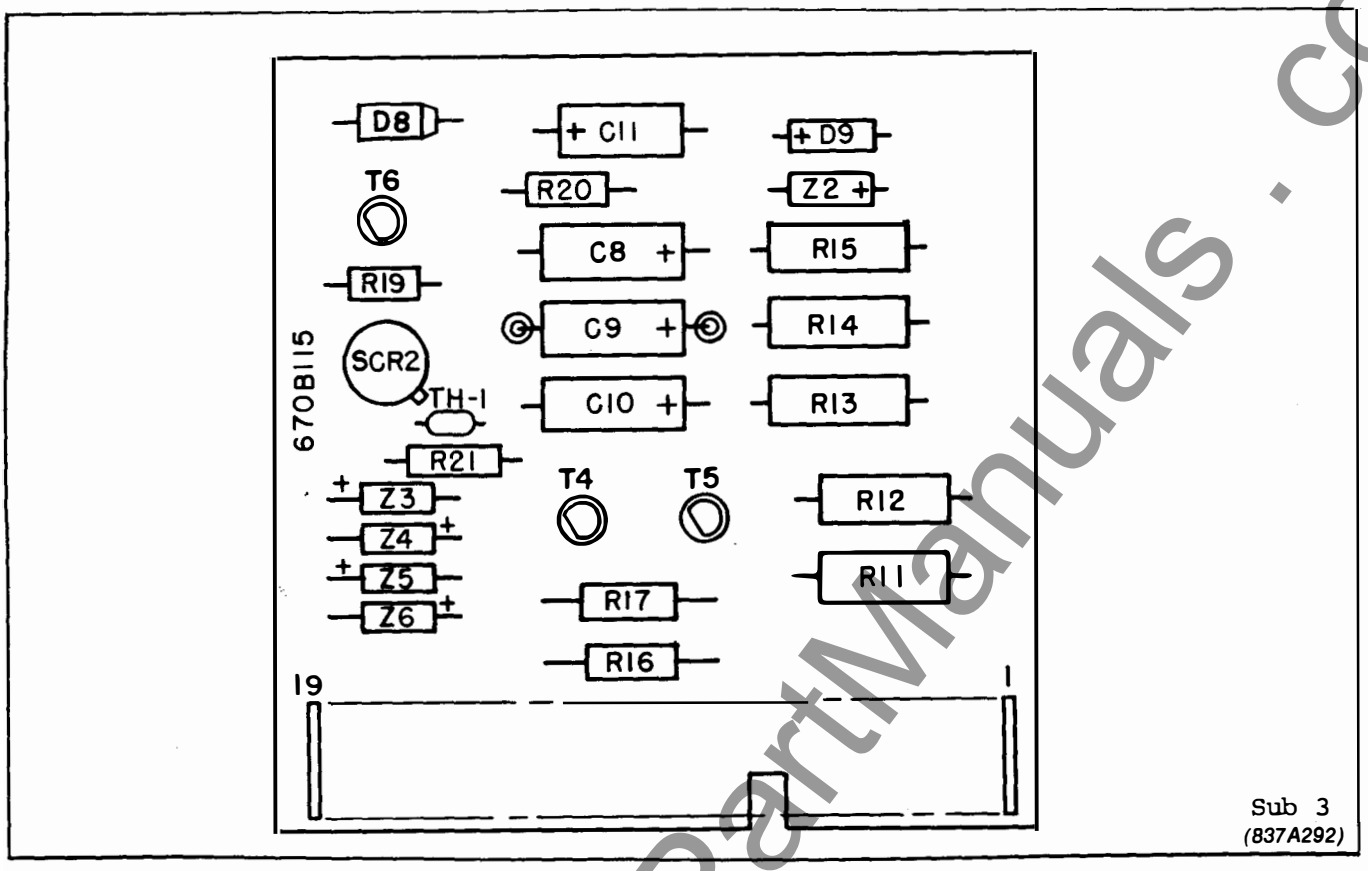

Fig. 5. Component Location of Reclose Circuit Board of Type DRC-1 Relay.

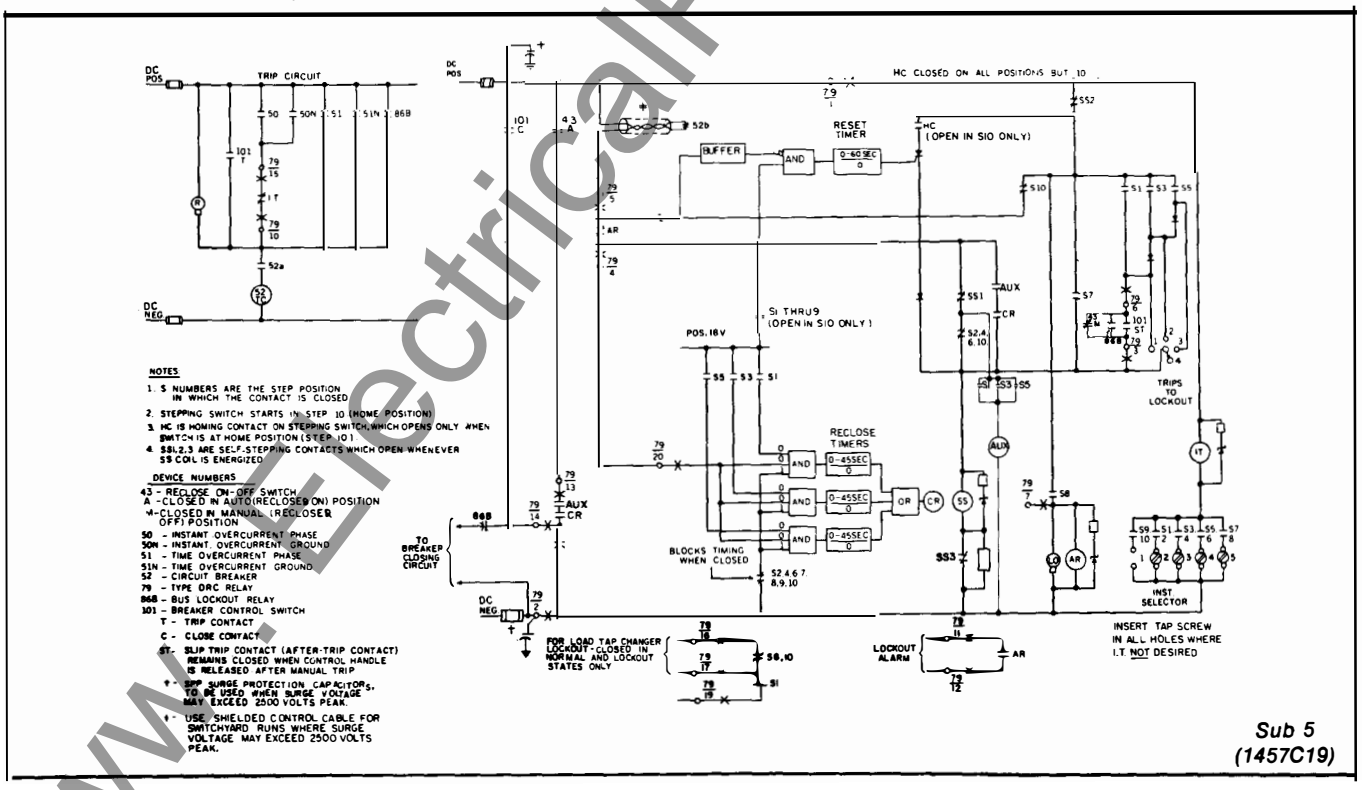

Fig. 6. External Schematic of Type DRC-1 Relay.

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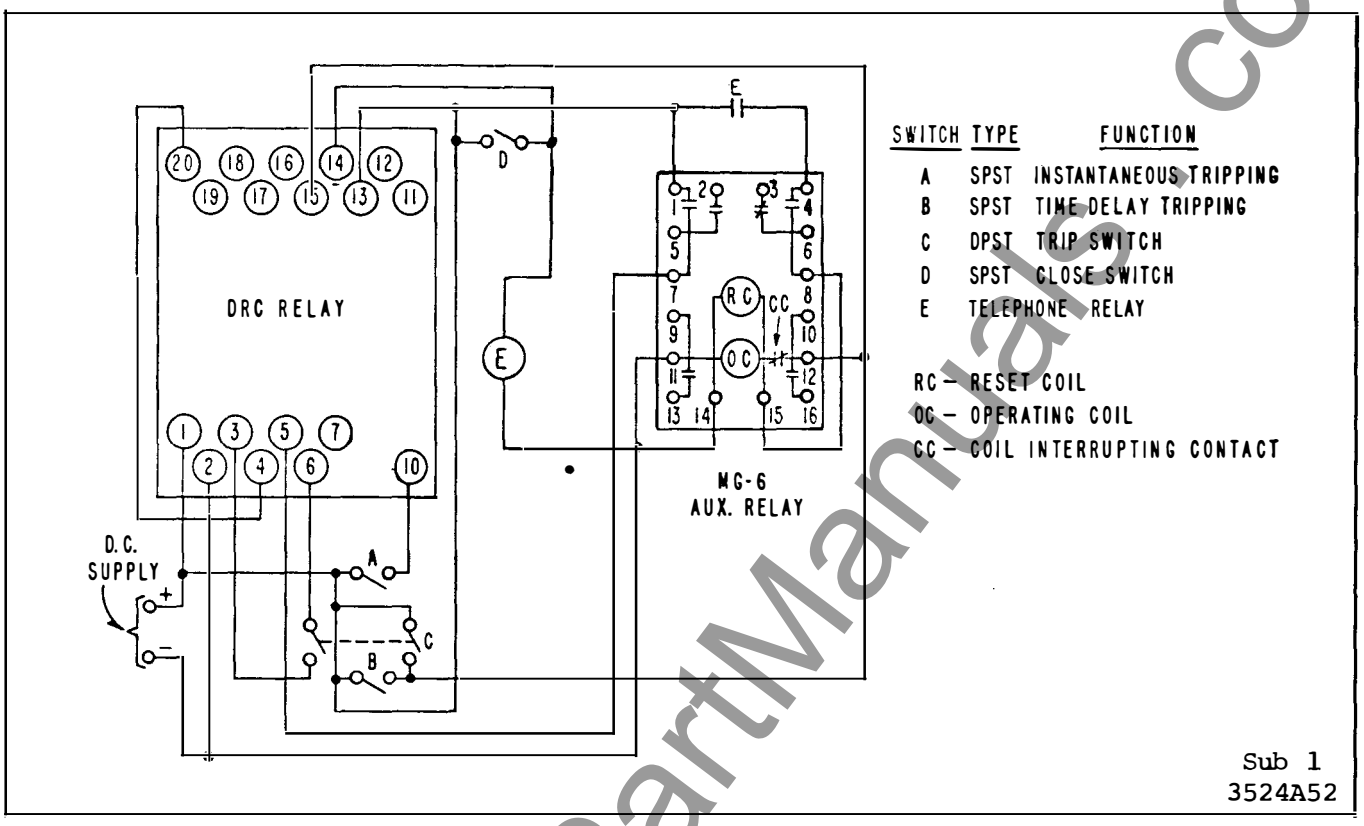

Fig. 7. Diagram of Test Connection for DRC-1 Relay.

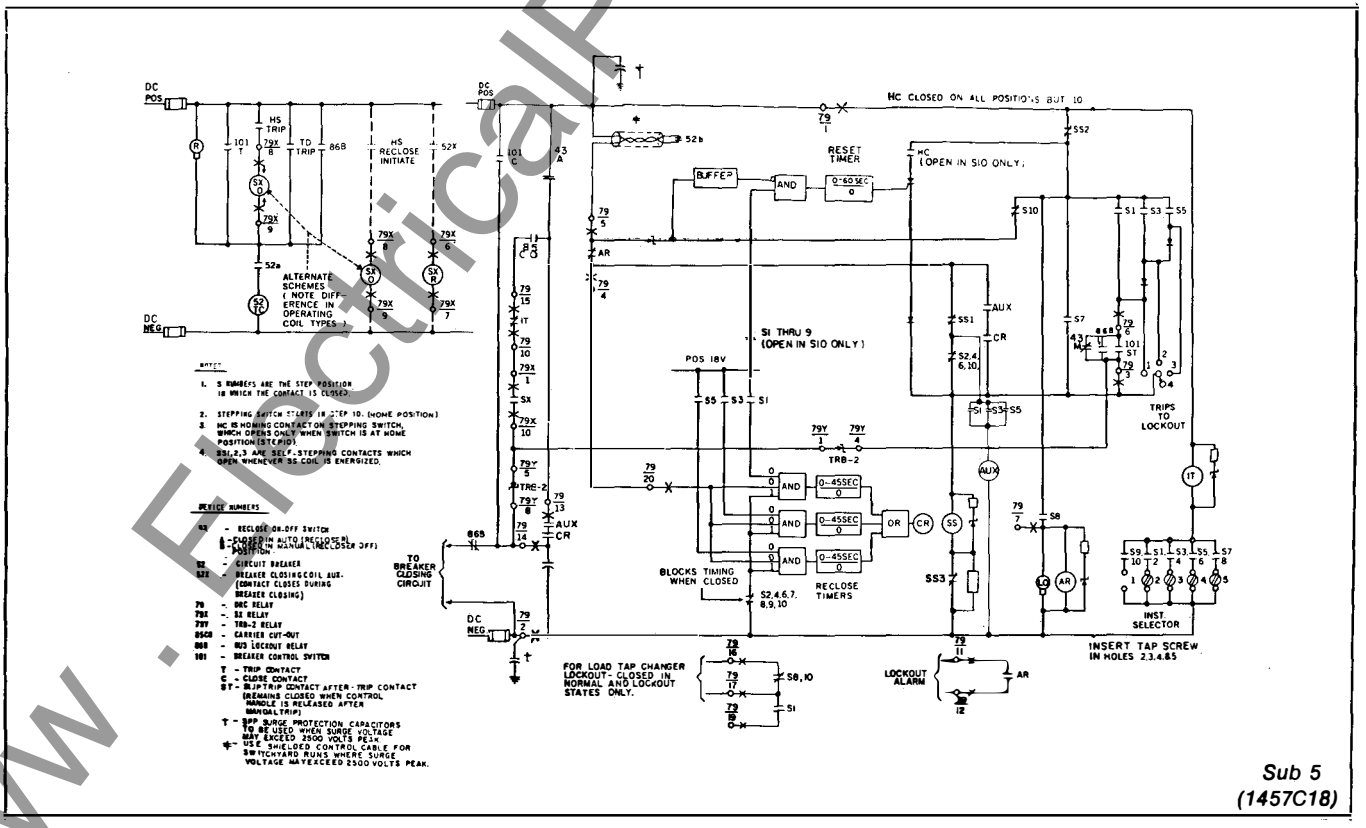

Fig. 8. External DC Schematic for DRC-1 with SX.

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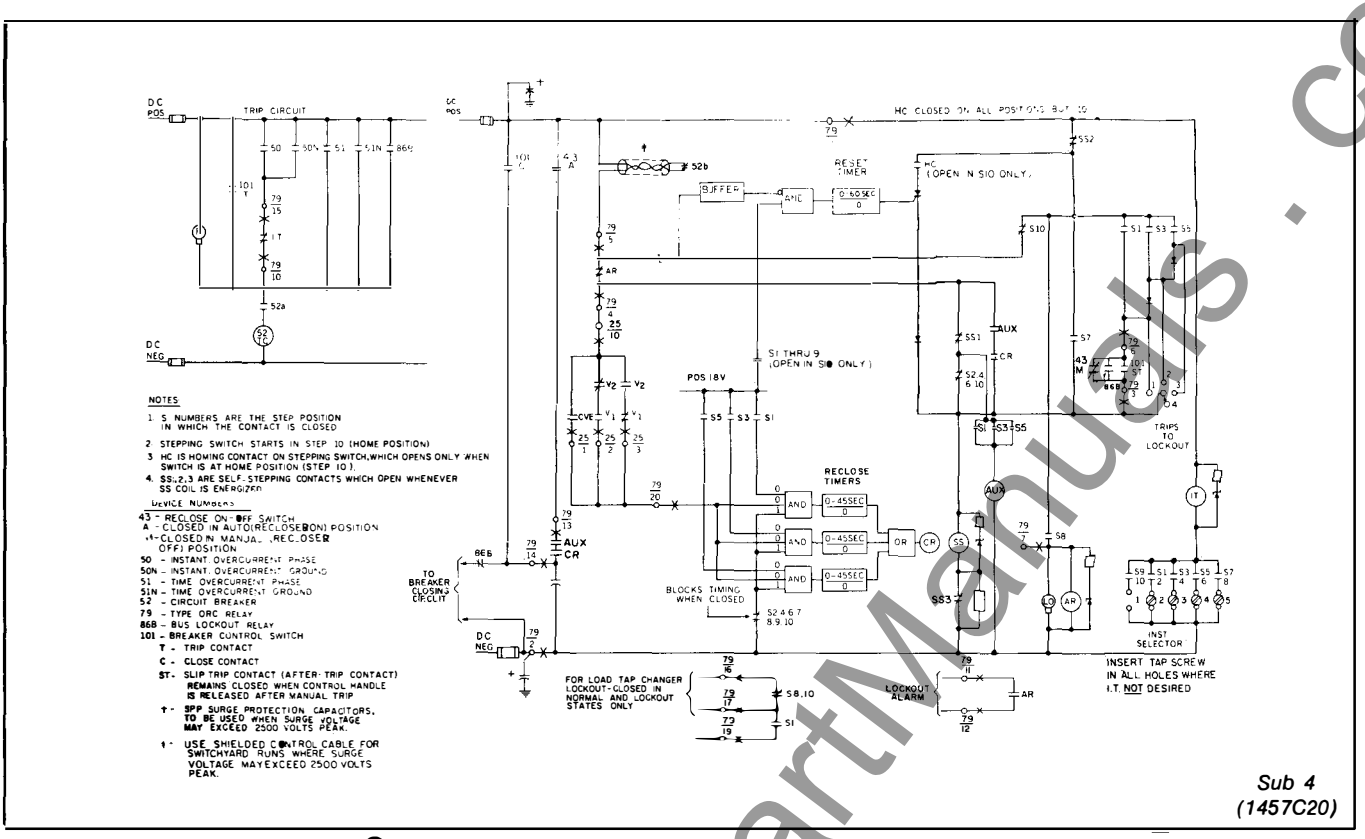
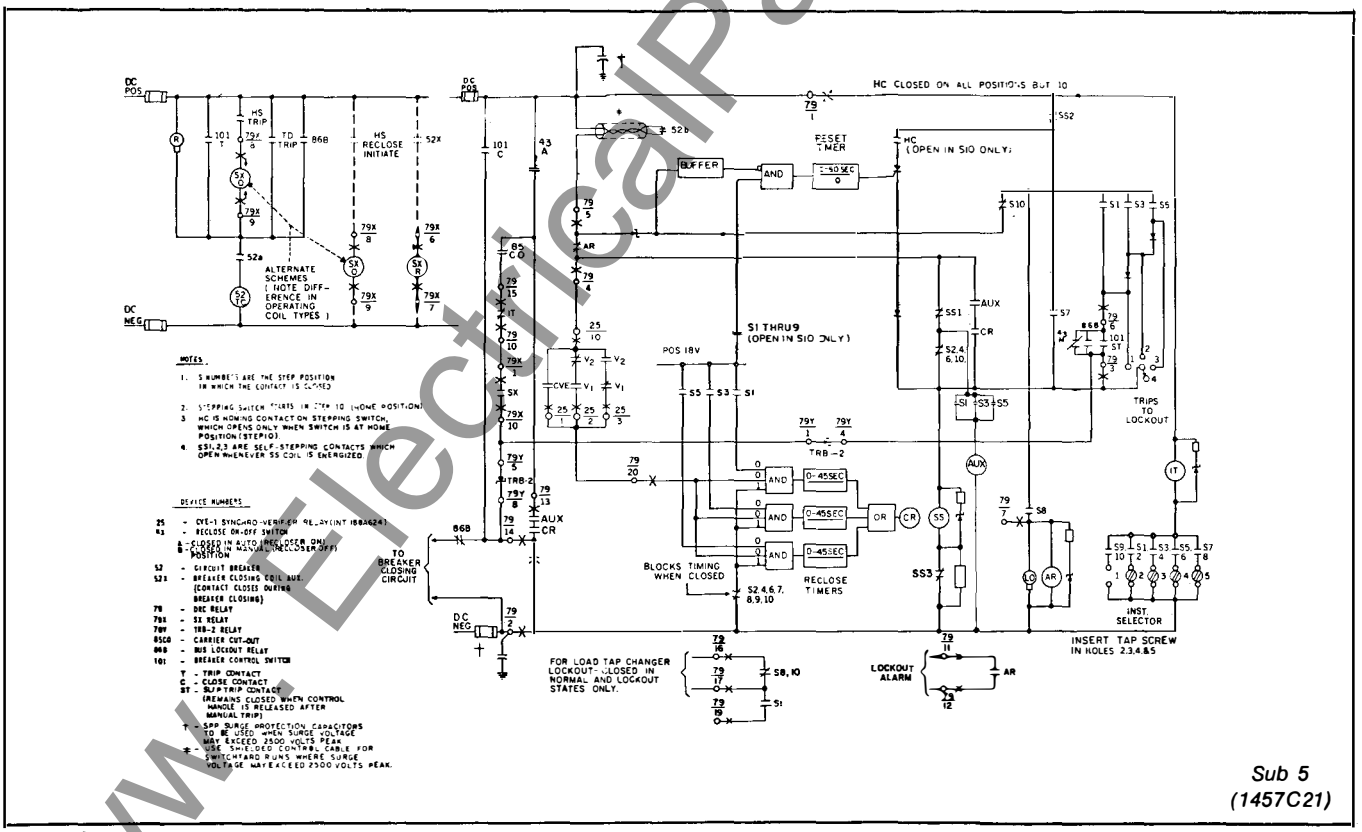


Sub 4
(1457C20)

Fig. 9. External DC Schematic for DRC-1 with CVE-1.



Sub 5
(1457C21)

Fig. 10. External DC Schematic for DRC-1 with SX and CVE-1.

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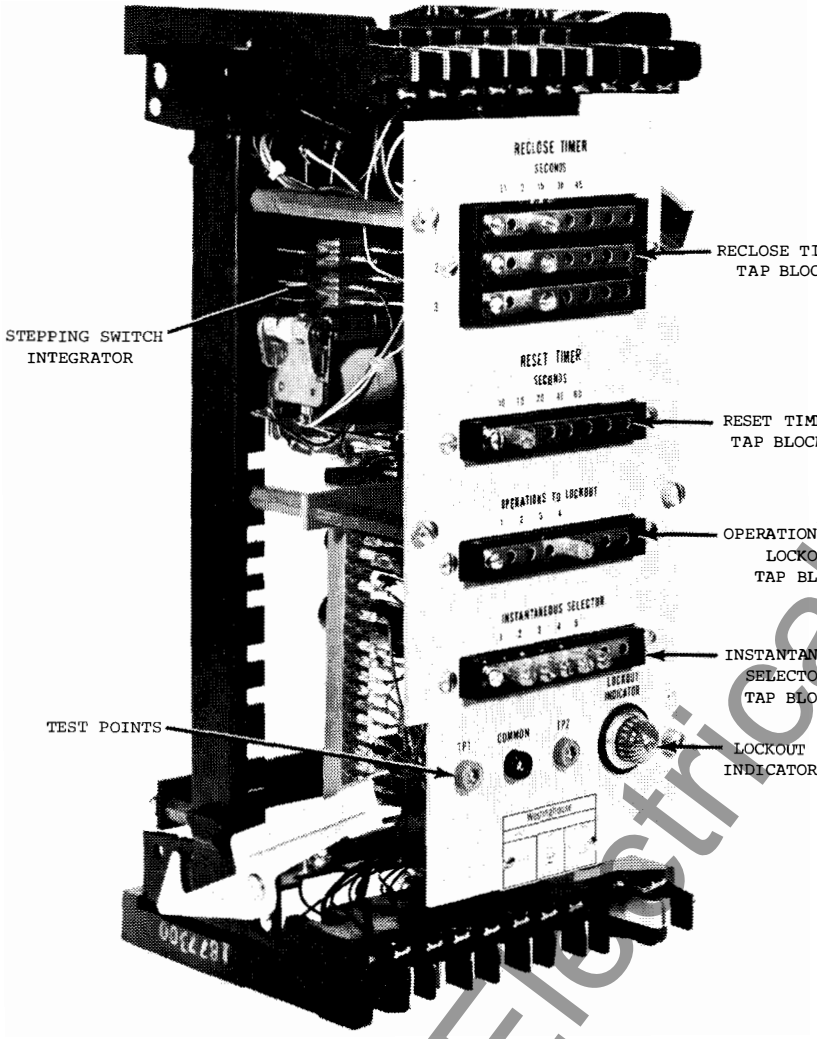
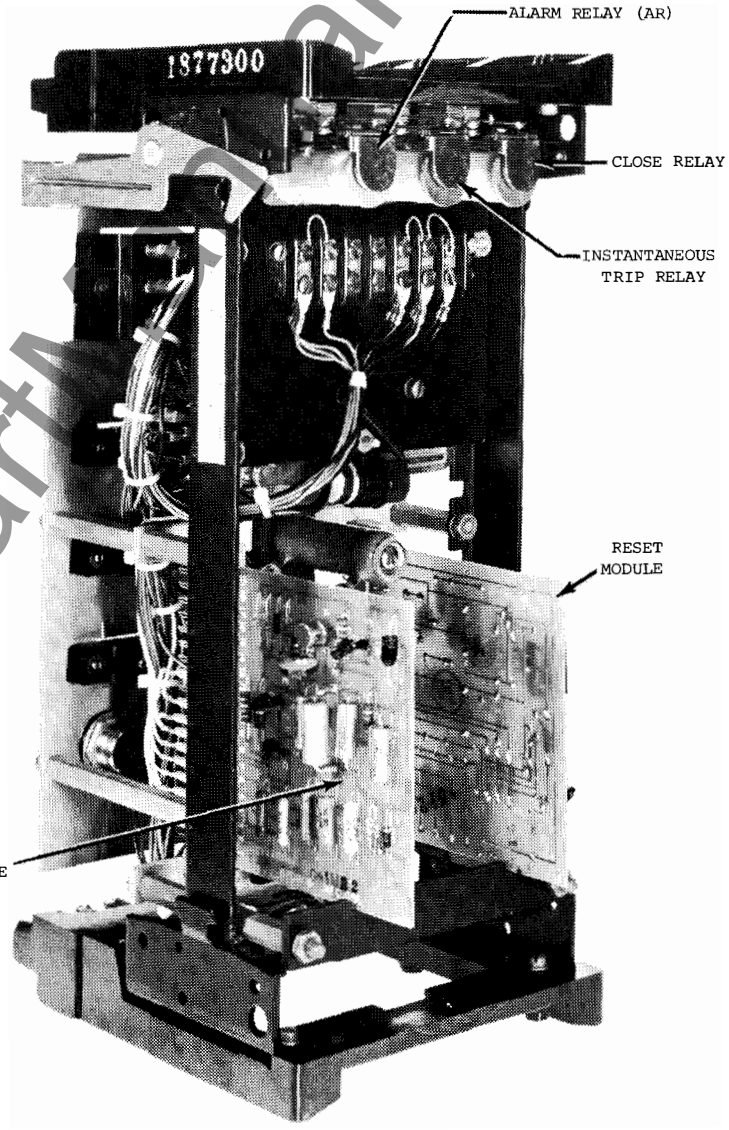


FRONT VIEW



REAR VIEW

Fig. 11. Type DRC-1 Relay.

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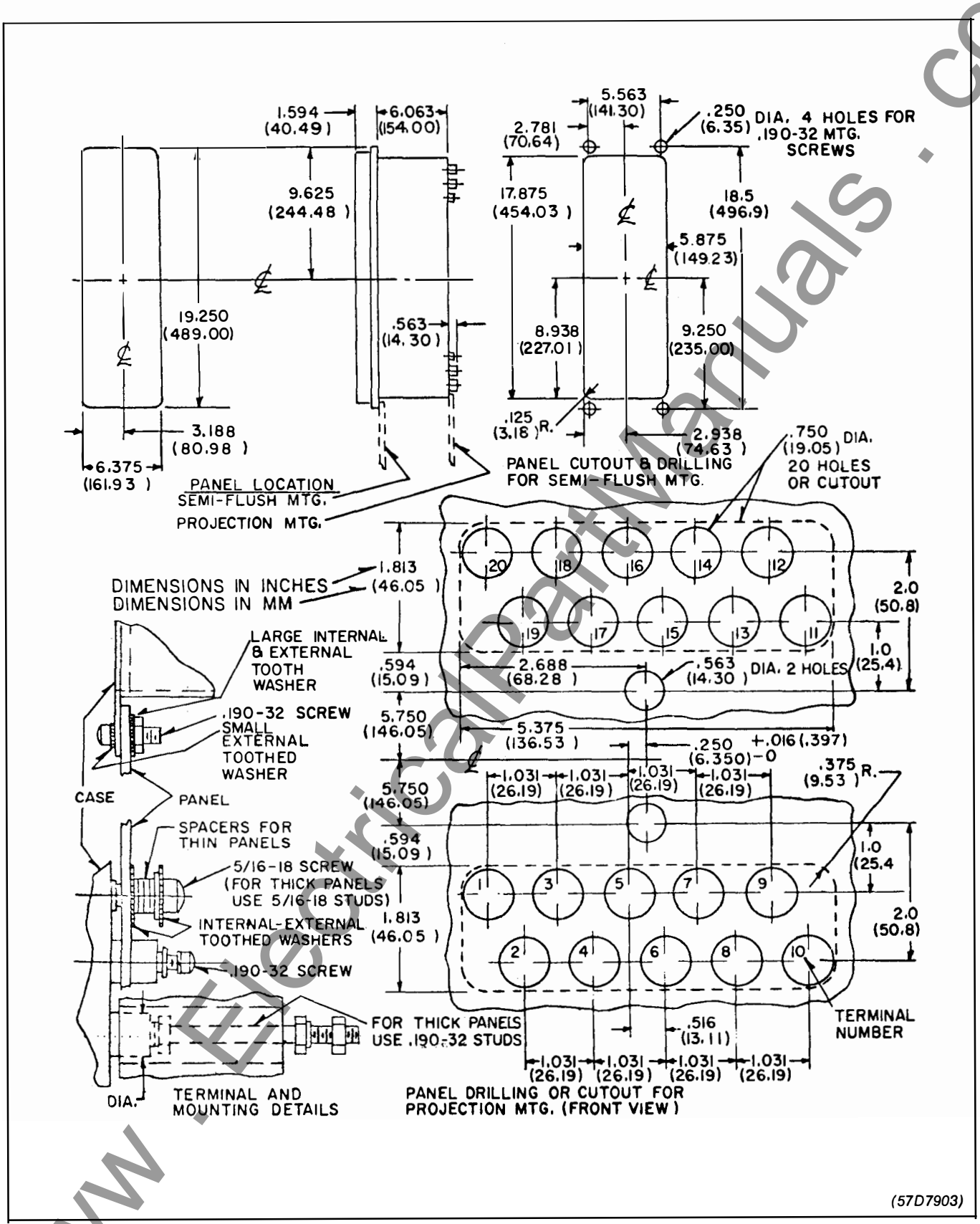

Fig. 12. Outline and Drilling for the Type DRC-1 Relay in the FT-32 Case.

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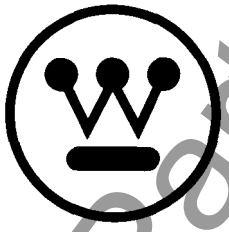

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WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **CORAL SPRINGS, FL.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DRC-1 RECLOSING RELAY

APPLICATION

The DRC-1 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 disturbution 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-1 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-1 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 figures 1, 2 and 11.

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 figures 3 and 4 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 5 for component and board layout.

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 his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

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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	Connection To energize reset timer if required	Energize reset timer time delay circuit †	Same as step #1 *	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 Q2 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 one	No connection
Level 5	Make contact between terminals 16 and 17	Make contact between terminals 19 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 coil directly.
■ Instantaneous tripping will not take place in those positions which have a tap screw.

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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	Same as step #1 *	Energizes reset timer time delay circuit †	Same as step #1 *	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 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 the integrator coil directly.

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

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	MANUFACTURER DESIGNATION
	RESISTORS (values in Ohms)	
R1	47,000 1/2W 2%	629A531H72
R2	4.7K 1/2W 2%	629A531H48
R3	118,000 1/2W 1%	837A131H05
R4	174,000 1/2W 1%	837A131H04
R5	232,000 1/2W 1%	837A131H07
R6	453,000 1/2W 1%	836A503H87
R7	665,000 1/2W 1%	837A131H06
R8	2,700 1/2W 5%	184A763H37
R9	1,000 1/2W 5%	184A763H27
R10	10 1/2W 5%	187A290H01
R11	649,000 1/2W 1%	837A131H01
R12	442,000 1/2W 1%	837A131H03
R13	221,000 1/2W 1%	836A503H80
R14	28,700 1/2W 1%	837A131H02
R15	2,670 1/2W 1%	836A503H36
R16	1,200 1/2W 5%	184A763H53
R17	220,000 1/2W 5%	184A763H83
R19	2,700 1/2W 5%	184A763H37
R20	1,000 1/2W 5%	184A763H27
R21	220 1/2W 5%	184A763H11
R22	10,600 250VDC 5%	1267313
R22	5,000 125VDC 5%	1205214
R22	1,400 48VDC 5%	1267292
R23	5,600 250VDC 5%	1267305
R23	2,500 125VDC 5%	1267299
R23	560 48VDC 5%	1267282
R24	100 3W 5%	763A127H20
R25	100 25W (48 VDC)	1207238
R25	500 25W (125VDC)	1202522
R26	7.5 3W	185A209H09
R27	100 3W 5%	763A127H20
R28	100 3W 5%	763A127H20
R29	100 3W 5%	763A127H20
R30	10 1/2W 5%	187A290H01
R31	82,000 1/2W 2%	629A531H78
R32	10,000 1/2W 2%	629A531H56
▪ All resistor values in Ohms		
	CAPACITORS	
C1	100 MFD 6V 5%	184A661H06
C2	100 MFD 6V 5%	184A661H06
C3	To be determined in test	
C4	.25 MFD 200VDC 10%	187A624H02
C5	6.8 MFD 35VDC 20%	184A661H10
C5	(250VDC) .25 MFD 200VDC	187A624H02
C6	10 MFD 150VDC 20%	27D5476H09
C6	(250VDC) 10 MFD 400VDC	862A177H02
C7	.5 MFD 200VDC 10%	187A624H08
C7	(250VDC) .047 MFD 400VDC	763A219H01
C8	150 MFD 6V 5%	184A661H08
C9	To be determined in test	
C10	100 MFD 6V 5%	184A661H06
C11	33 MFD 20V 20%	184A661H11
C12	1 MFD 20%	187A624H04
C12	(250VDC) 1 MFD 400VDC	764A278H02
C13	1 MFD 20%	187A624H04
C13	(250VDC) 1 MFD 400VDC	764A278H02
C14	.047 MFD 50VDC	848A646H07
C15	.047 MFD 200VDC	849A437H04
C16	22 MFD 35VDC	187A508H17

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ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	MANUFACTURER DESIGNATION
	TRANSISTORS	
Q2	2N3417	848A851H01
Q3	2N3417	848A851H01
T4	2N3417	848A851H01
T5	2N3417	848A851H01
T6	2N3417	848A851H01
	ZENER – DIODES	
Z1	1N748A	186A797H13
Z2	1N748A	186A797H13
Z3	1N748A	186A797H13
Z4	1N748A	186A797H13
Z5	1N748A	186A797H13
Z6	1N748A	186A797H13
Z7 to Z11	1R200	629A369H01
Z12	1.5KE200	878A619H01
Z13	1N3686B	185A212H06
Z14	1N957B	186A797H06
Z15	(250VDC) 1.5KE200	878A619H01
	THERMISTOR	
TH-1	2D504	185A211H07
	CONTROLLED RECTIFIERS	
SCR-1	K1149-13	184A640H13
SCR-1	(250VDC) K1149-12	184A640H12
SCR-2	K1149-13	184A640H13
SCR-2	(250VDC) K1149-12	184A640H12
	RECTIFIERS	
D3	1N4822	188A342H11
D4	1N4822	188A342H11
D5	1N645A	837A692H03
D6	1N4822	188A342H11
D7	1N4822	188A342H11
D8	1N4822	188A342H11
D9	1N645A	837A692H03
D10	(48 VDC) 1N4822	188A342H11
	MISCELLANEOUS	
I_1	Lockout indication 52410-993	183A825G05
RH-1	Potentiometer Series 43-250	762A790H04
AR	Alarm relay 250Vdc	541D514H15
AR	Alarm relay 125Vdc	541D514H06
AR	Alarm relay 48Vdc	541D514H08
IT	Instantaneous relay 250Vdc	541D514H14
IT	Instantaneous relay 125Vdc	541D514H05
IT	Instantaneous relay 48Vdc	541D514H07
CR	Close relay 250Vdc	541D514H14
CR	Close relay 125Vdc	541D514H05
CR	Close relay 48Vdc	541D514H07
SS	Stepping switch 250Vdc	205C6399G03
SS	Stepping switch 125Vdc	205C399G02
SS	Stepping switch 48Vdc	205C399G01

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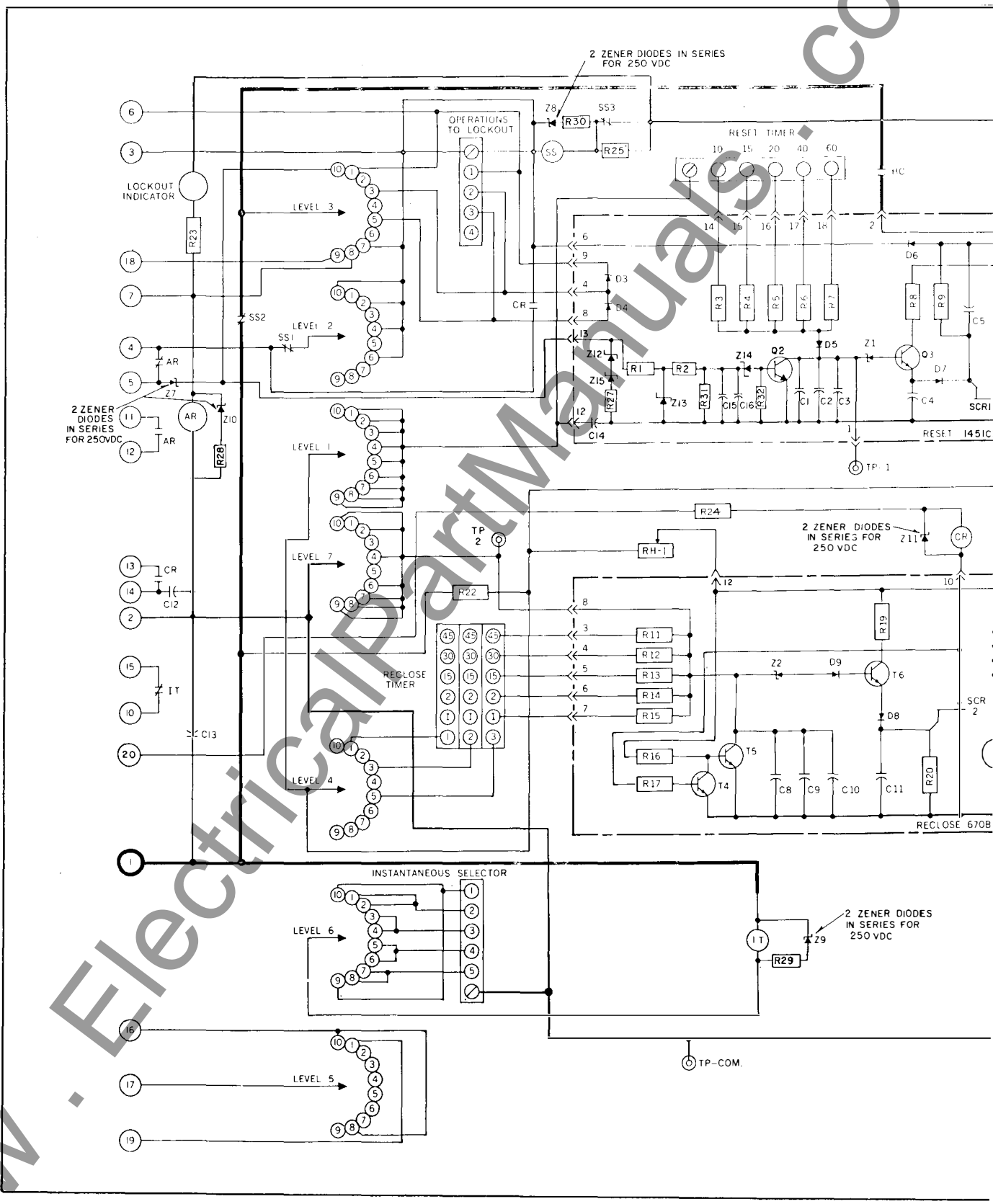

Fig. 2. Internal Schematic of Type DR

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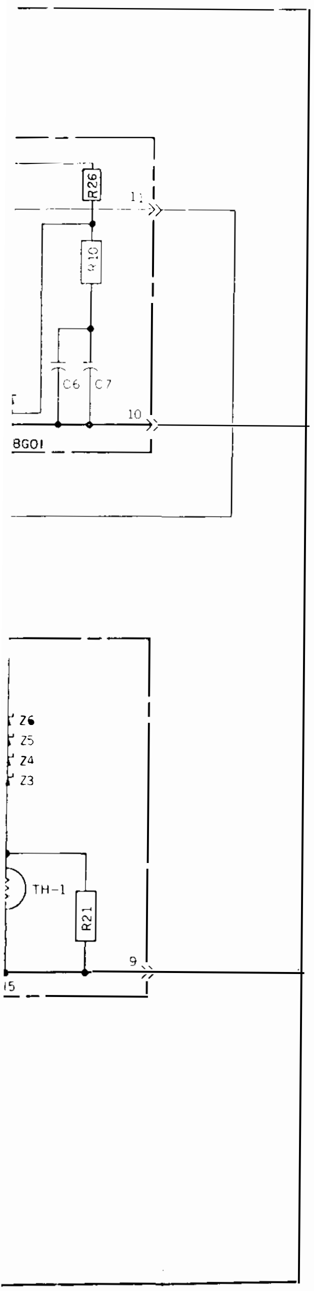

RESISTOR	STYLE NO.	REF.
R1	862A378H34	221,000 Ω 1/2W
R17	184A763H[illegible]	220,000 Ω 1/2W
R3	837A13[illegible]	116,000 Ω 1/2W
R4	837A131H04	174,000 Ω 1/2W
R5	837A131H07	232,000 Ω 1/2W
R6	836A503H[illegible]	453,000 Ω 1/2W
R7	837A13[illegible]	[illegible],000 Ω 1/2W
[illegible]	184A763H37	2,700 Ω 1/2W
R3-R20	184A763H27	1,000 Ω 1/2W
R10-R30	187A240H01	10 Ω 1/2W
R11	837A13[illegible]	649,000 Ω 1/2W
R12	837A131H03	442,000 Ω 1/2W
R13	836A503H40	221,000 Ω 1/2W
R14	837A13[illegible]	26,700 Ω 1/2W
R15 △	629A531H85	5 MEG 1/2W
R16	836A503H35	2,670 Ω 1/2W
R16	184A763H53	12,000 Ω 1/2W
R2	184A763H[illegible]	220 Ω 1/2W
R22	1267313	10,600 Ω
R26	185A209H09	7.5 Ω 3 W
R23	1267305	5600 Ω
R24-R27-R28-R29	763A127H30	100 Ω 3W
R25	1267296	2000 Ω 25 W
R2	629A531H48	4,700 Ω 1/2 W
R31	629A531H78	82,000 Ω 1/2 W
R32	629A531H56	10,000 Ω 1/2 W
CAPACITOR	STYLE	REF
C1 - C2 - C10	184A661H06	100 MFD 6V
C4	TO BE DETERMINED IN TEST	
C5	187A624H02	25MFD. 200VDC
C3	187A624 H02	.250 MFD 200VDC
C6	862A177H02	10 MFD 400VDC
C7	763A219H01	.047 MFD 400VDC
C8	184A661H06	150 MFD 6V
C9	TO BE DETERMINED IN TEST	
C11	184A661H1[illegible]	33MFD 20V
C12-C13	764A278H02	1 MFD 400 VDC
C14	848A646H07	.047 MFD 50VDC
C15	849A437H04	.047 MFD 200VDC
C16	187A508H17	22 MFD 35VDC
TRANSISTOR		
T4 TO T6	848A851H02	2N3417
Q2-Q3	848A851H02	2N3417
THERMISTOR	STYLE NO	REF.
TH-1	185A211H07	2D504
ZENER DIODE	STYLE NO.	REF
Z1 TO Z6	186A737H13	1N748A
Z7 TO Z11	629A369H01	1R200
Z12-Z15	878A619H01	1.5KE200
Z13	185A212H06	1N3686B
Z14	186A797H06	1N957B

SILICON CONTROLLED SW	STYLE NO	REF
SCR-1 SCR-2	184A640H12	K1149-12
RECTIFIER	STYLE NO	REF.
D3-D4-D6-D7-D9	188A342H[illegible]	1N4822
D8 - D3	837A692H03	1N645A
MISC.	STYLE NO	REF.
POT. (RH)	762A790H04	SERIES 43
TEL RELAY (AR)	541D514H15	250VDC
TEL RELAY (IT)(CR)	541D514H14	250 VDC
STEPPING SW	2050299G03	250 VDC
AMBER LITE	183A825G05	52410-993

△ = RECLOSE TIME 10 TO 50 SEC.

(1) = RED HANDLE ON FT CASE.

HC INDICATES "HOMING CONTACT" ON STEPPING SWITCH.

SS-1, SS-2 & SS-3 INDICATES "SELF STEPPING CONTACTS" ON STEPPING SWITCH.

Sub 1

(1321D75)

C-1 Relay in FT-32 Case. (250 Vdc)

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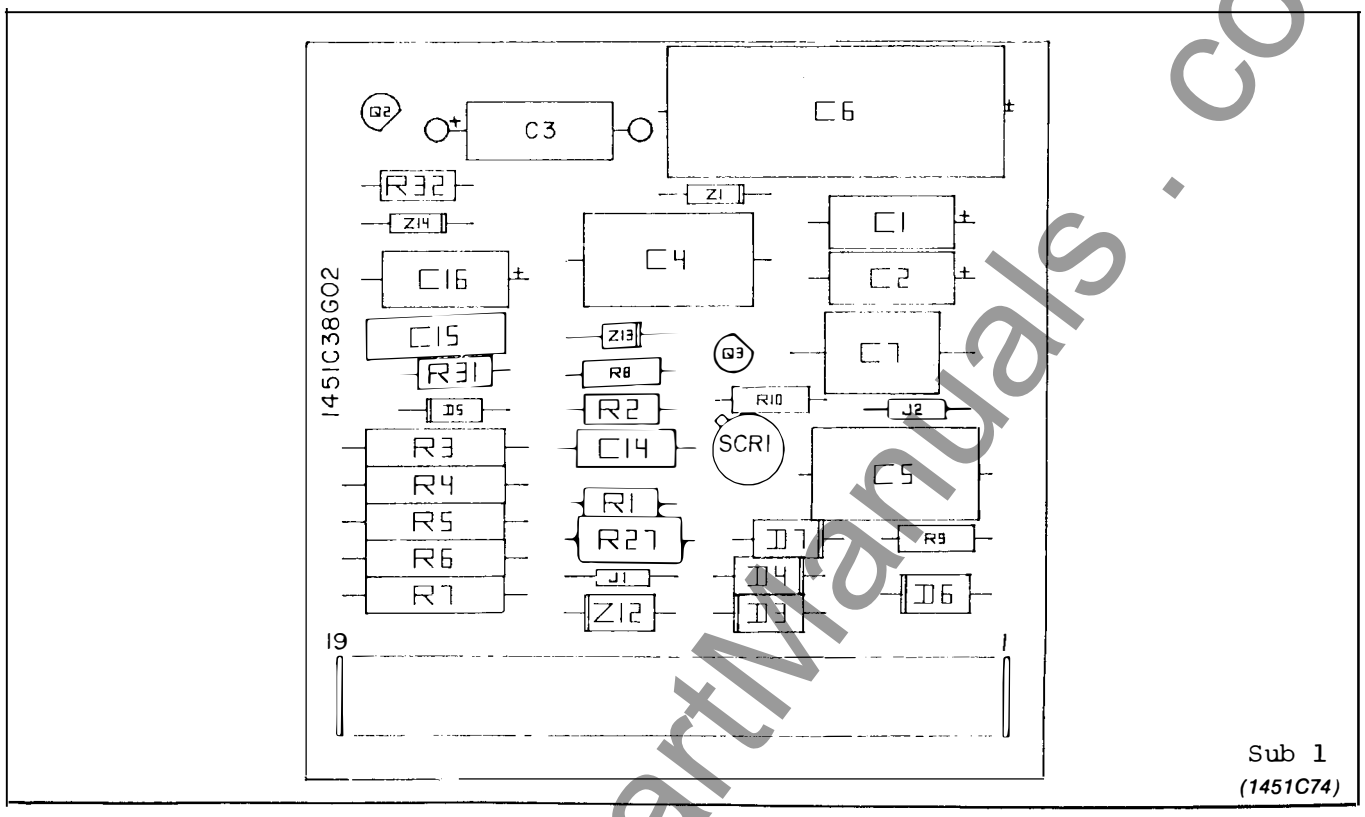

Fig. 3. Component Location of Reset Circuit Board of Type DRC-1 Relay.

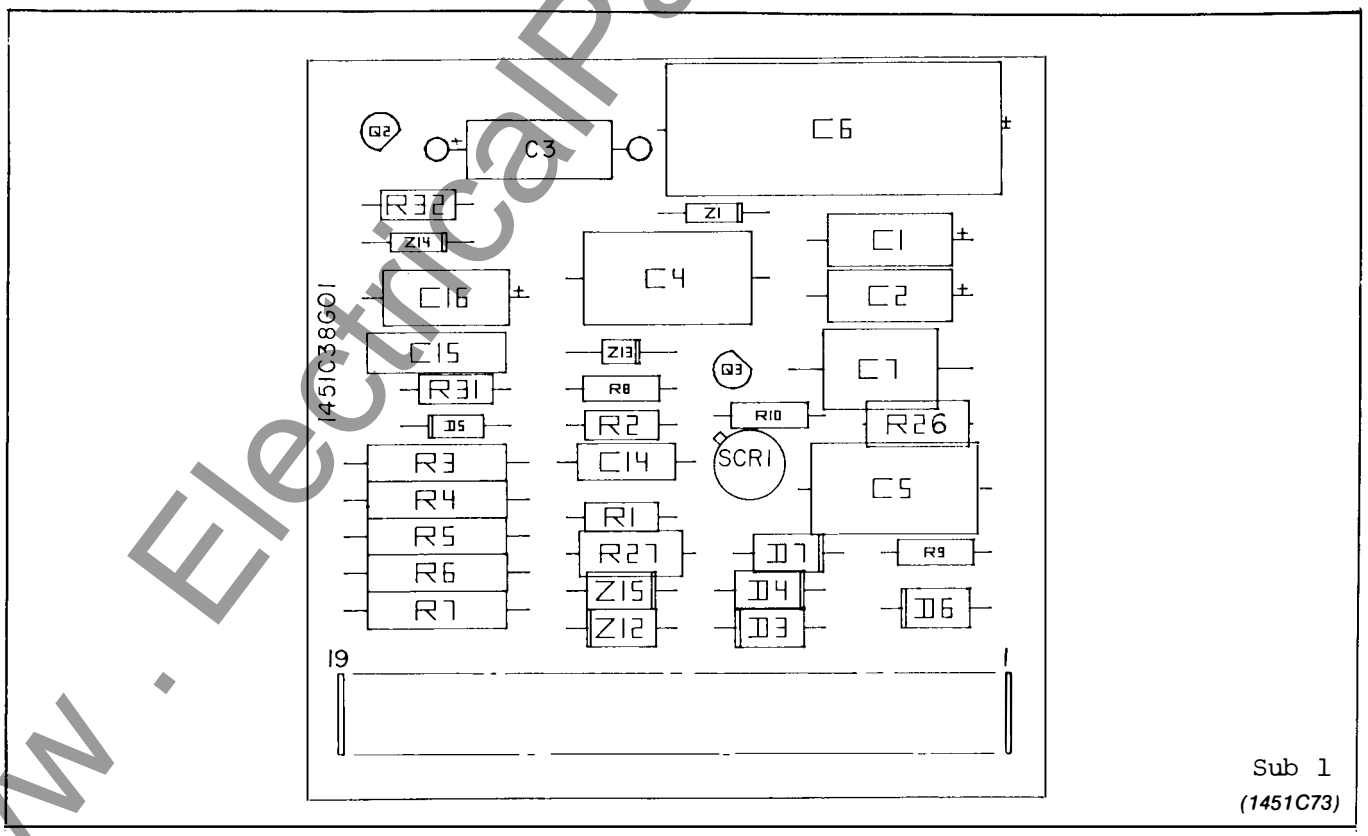

Fig. 4. Component Location of Reset Circuit Board of Type DRC-1 Relay. (250 Vdc)

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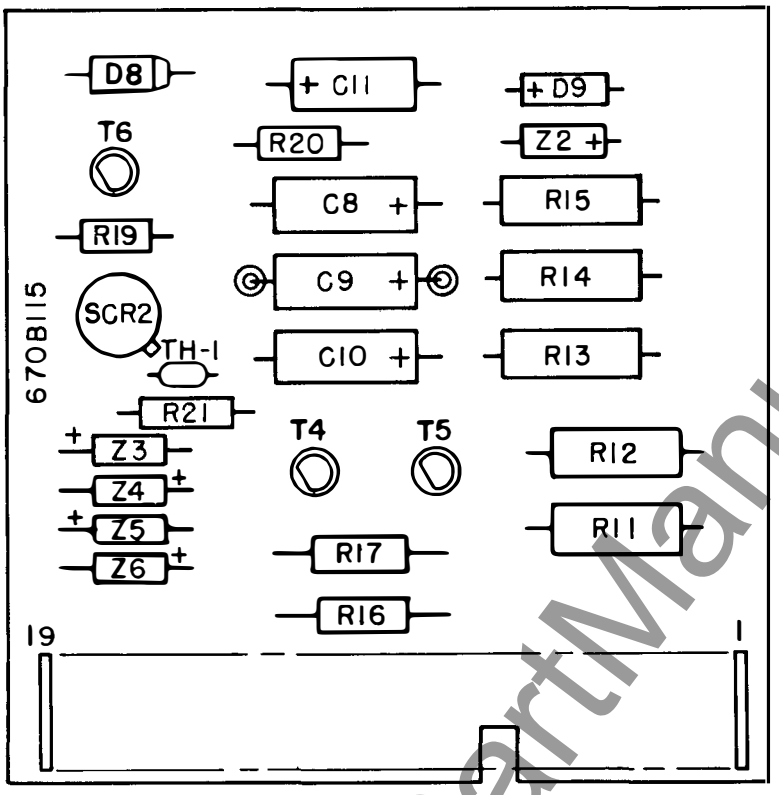

Fig. 5. Component Location of Reclose Circuit Board of Type DRC-1 Relay.

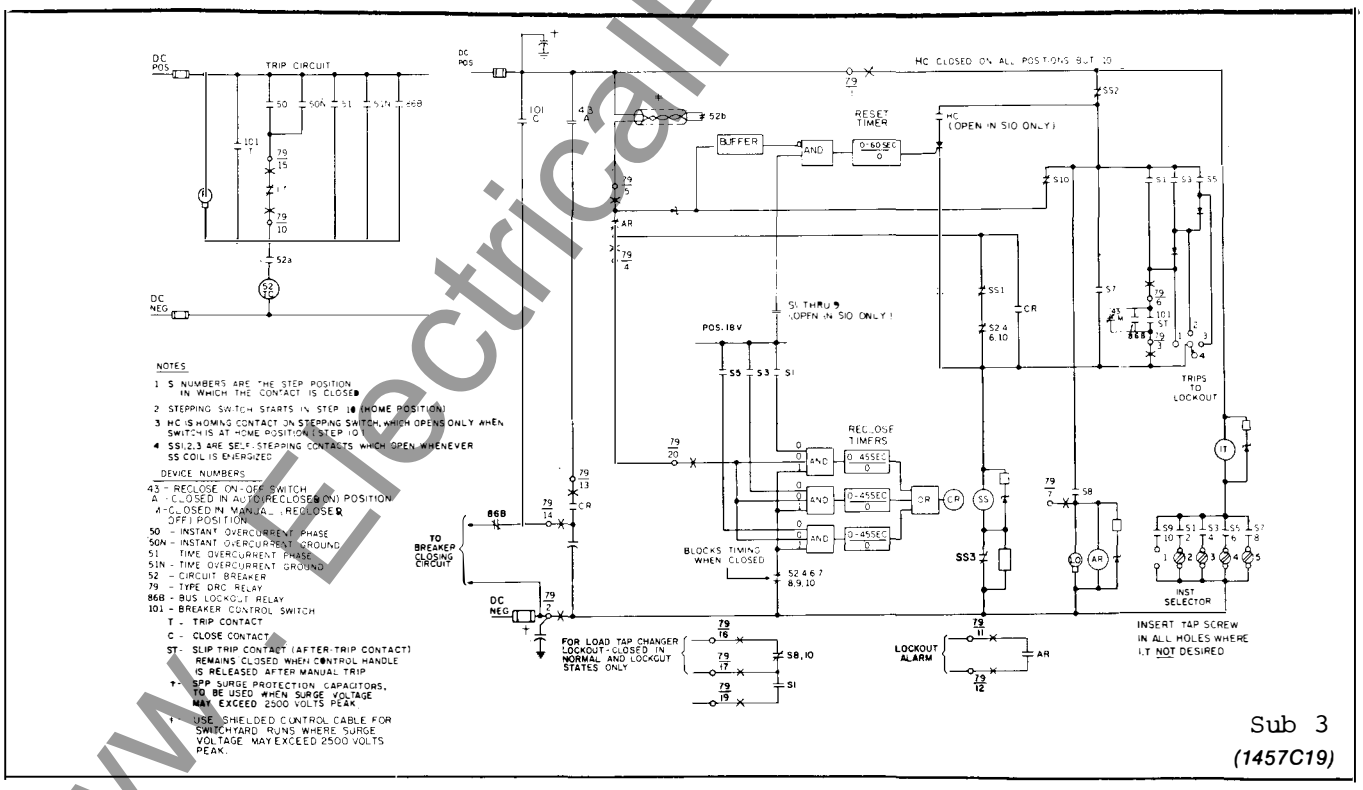

Fig. 6. External Schematic of Type DRC-1 Relay.

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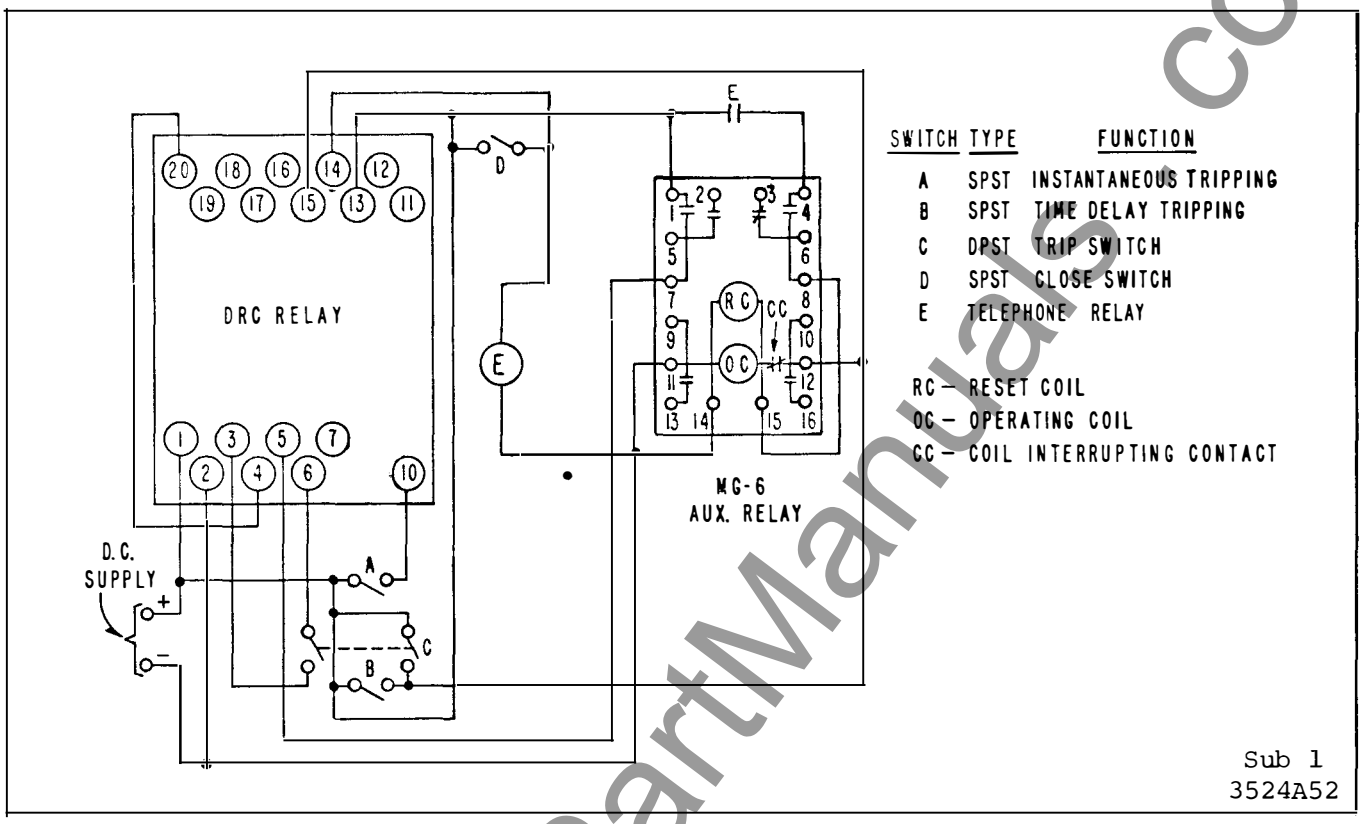

Fig. 7. Diagram of Test Connection for DRC-1 Relay.

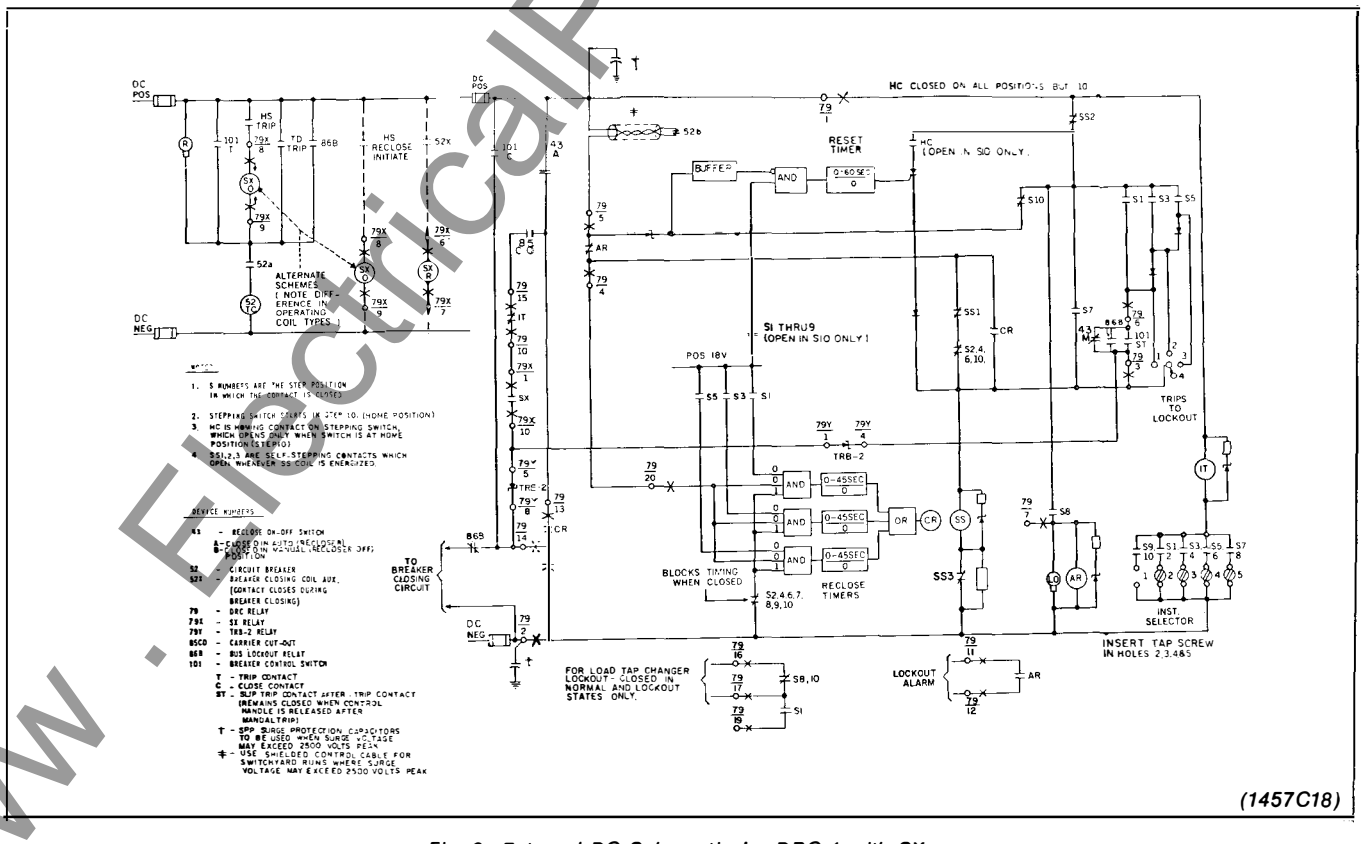

Fig. 8. External DC Schematic for DRC-1 with SX.

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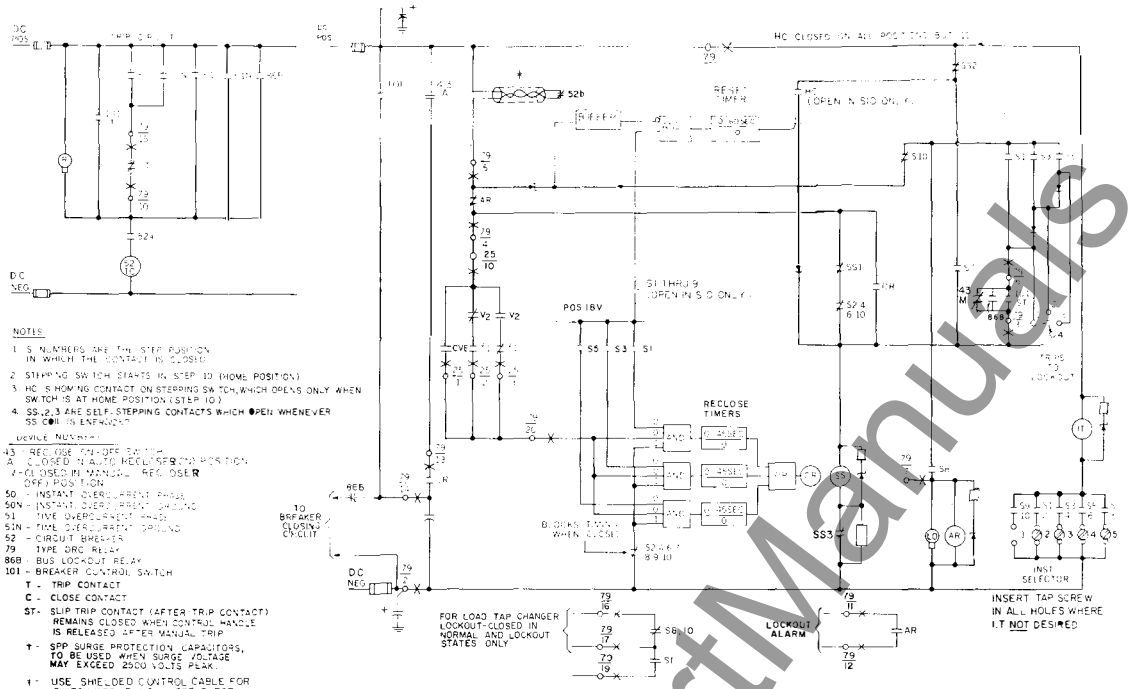

Fig. 9. External DC Schematic for DRC-1 with CVE-1.

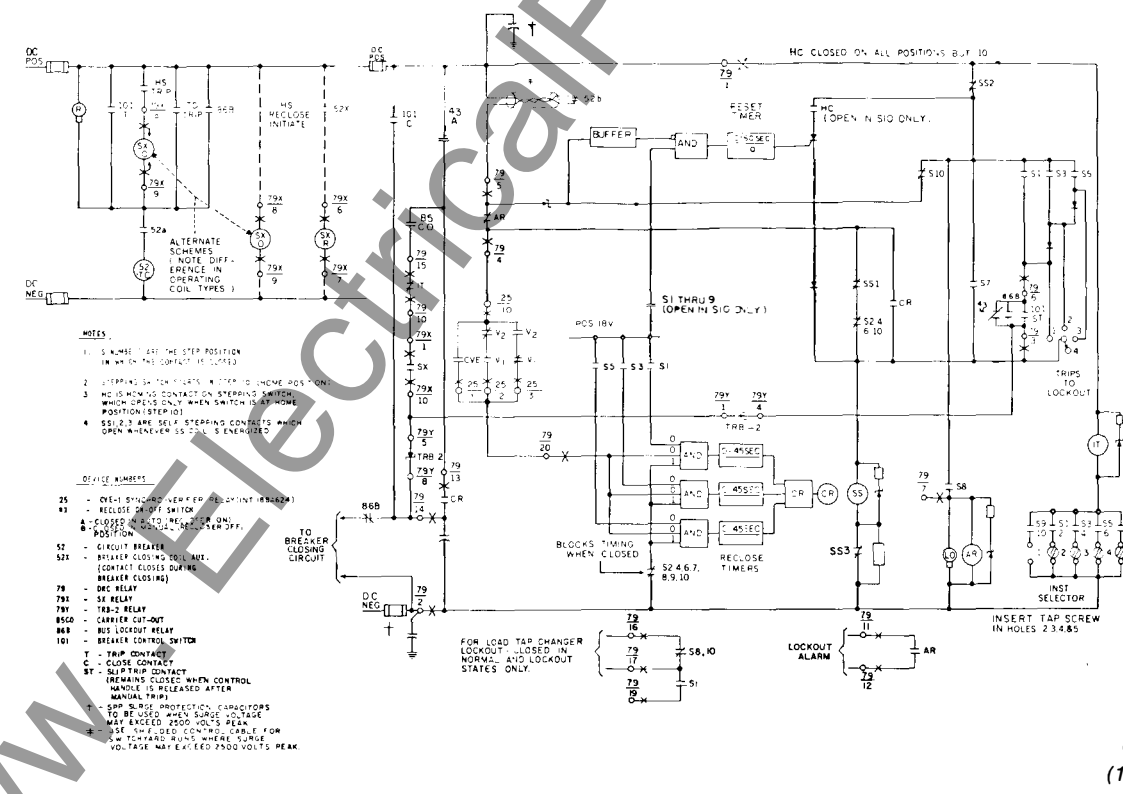

Fig. 10. External DC Schematic for DRC-1 with SX and CVE-1.

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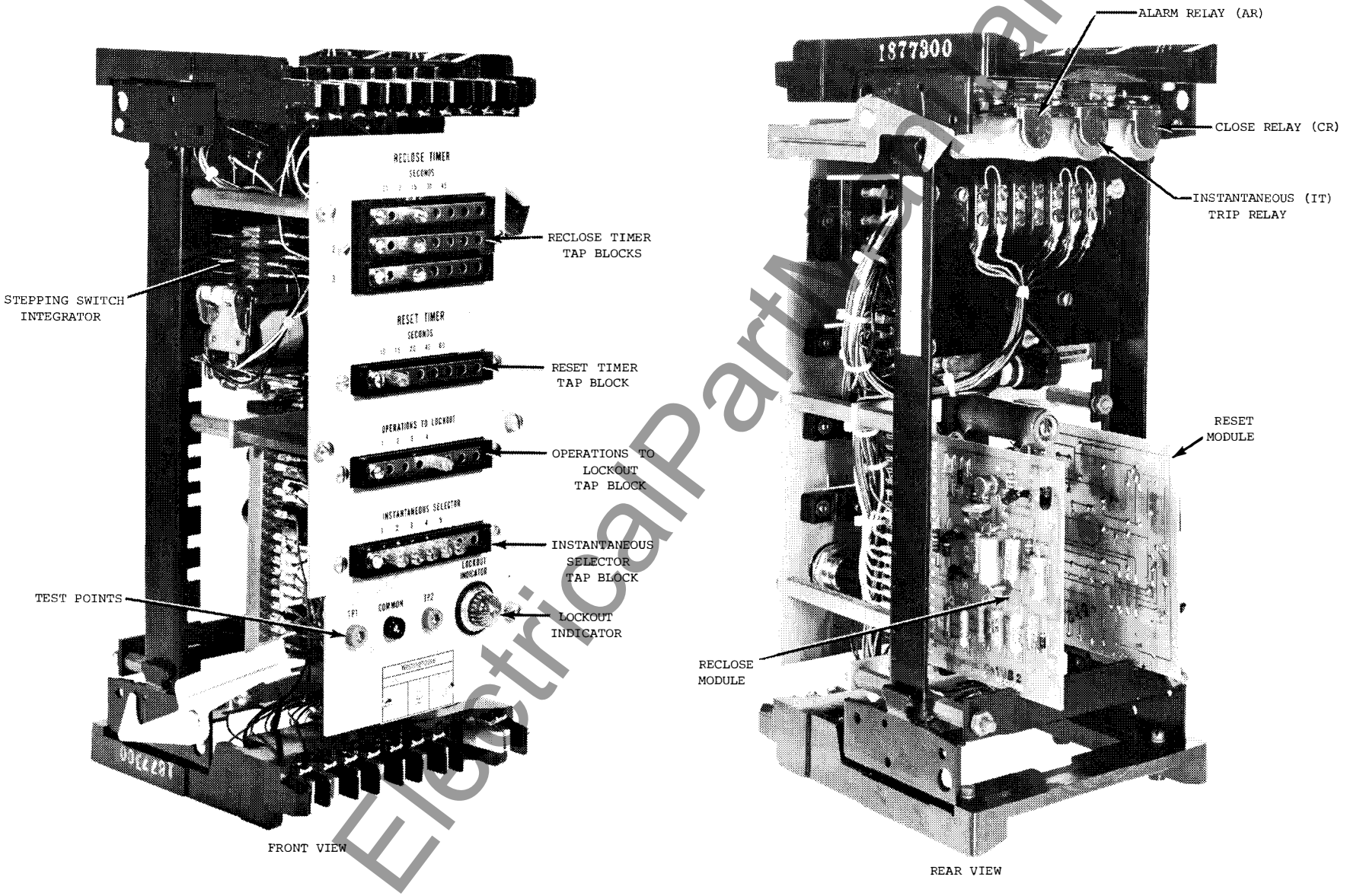

Fig. 11. Type DRC-1 Relay.

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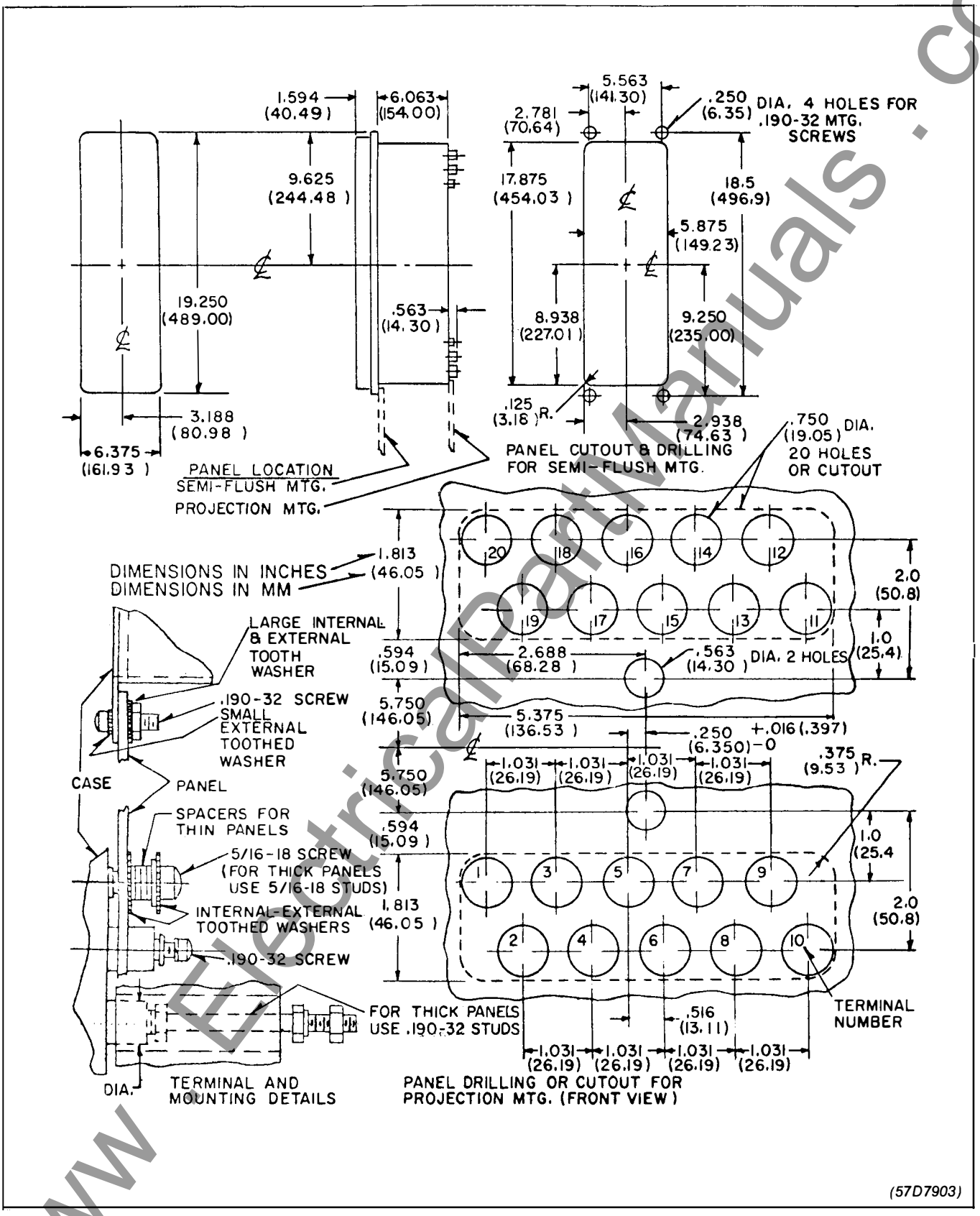

Fig. 12. Outline and Drilling for the Type DRC-1 Relay in the FT-32 Case.

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