INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE SGRU-52 RECLOSING RELAY

APPLICATION

The SGRU-52 Reclosing Relay provides for adjustable time delay reclosure of an electrically-operated circuit breaker, and automatically resets itself if the breaker remains closed for a predetermined adjustable time interval. If the breaker retrips before the end of this interval, the resetting operation of the relay is interrupted until the breaker is manually closed. Thus, the reclosing relay is applicable to either attended or non-attended stations.

CONSTRUCTION AND OPERATION

The SGRU-52 is a completely static relay consisting of a Reclose circuit board and a Reset circuit board. The Reset circuit board contains (1) a timing circuit, (2) a flip-flop control circuit, (3) a close relay circuit, (4) a flip-flop set circuit, and (5) lockout indication. The Reclose board contains a reclose time delay circuit with permit and block inputs. All components except the dropping resistor, lockout indicator, and the close relay are mounted on a printed circuit board. All components are identified on the internal schematic in Figure 3.

Timing Circuit

The timing circuit is a unijunction relaxation oscillator consisting of unijunction transistor Q5, capacitor C2, and resistors R10 and R30. After a preset time interval controlled by the adjustable time dial potentiometer R39, the relaxation oscillator fires and feeds an output pulse to the flip-flop control circuit.

Flip-Flop Control Circuit

The flip-flop control circuit consists of transistors Q6 and Q7, and resistors R20 to R29. The flip-flop circuit resets when pulsed by the timing circuit and thereby activates the close relay circuit by turning transistor Q9 off.

Close Relay Circuit

The close relay circuit consists of transistors Q9, Q10 and Q11, resistors R32 to R38, and the close relay. The turn-off of transistor Q9 by the flip-flop control circuit switches transistors Q10 and Q11 to the on state to activate the close relay.

Flip-Flop Set Circuit

The flip-flop set circuit consisting of transistors Q8 and Q1, resistors R30 and R31, and capacitor C7, sets the flip-flop control circuit and the reclose time delay circuit when the breaker closes, opening the 52b contact. Transistors Q1 and Q8 switch to the on state and discharge capacitor C7 through C8 to turn transistor Q7 off and transistor Q15 on to set the flip-flop and the reclose time delay circuits simultaneously.

Lockout Indicator Circuit

The lockout indicator circuit is controlled by the state of the flip-flop control circuit. Consisting of amplifier transistors Q3 and Q4, the amber light is lit when the flip-flop is in the set state, and the relay isl locked out if the breaker is open at this time.

Reclose Time Delay Circuit

The reclose time delay circuit consists of a flip-flop arrangement of transistors Q12 and Q13, capacitor C13 which charges through the time dial setting potentiometer R66, zener diode Z10, and transistors Q16 and Q17.

Theory of Operation

The following description is made with reference to Figure 3.

Let us assume that the breaker is open and normal voltage is applied to the relay. Under these conditions, transistors Q2, Q6, Q9, Q13 and Q17 are on. When the breaker is closed, the 52b contact opens and removes the shorting of the base drive to transistor Q1 turning it on. The turn on of Q1 shorts the base drive to Q2 turning it off, which causes diode D3 to be reverse biased. This removes the

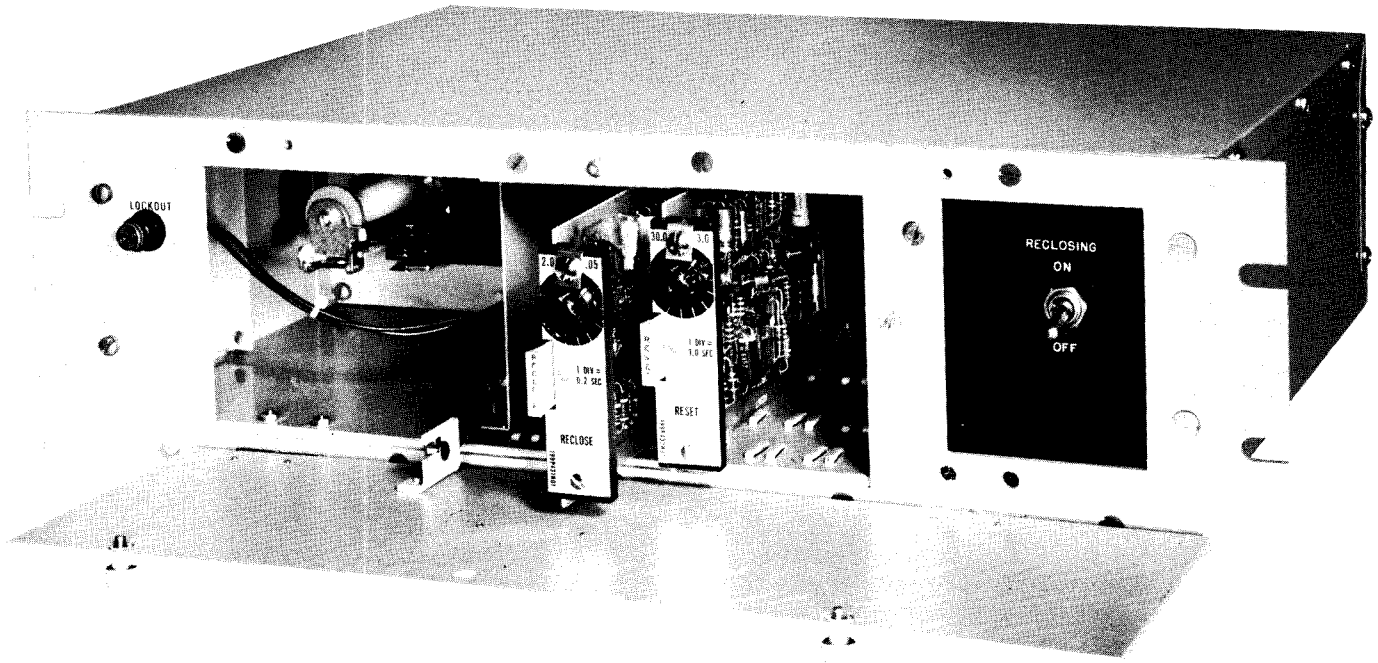


Fig. 1. Type SGRU-52 Reclosing Relay (Front View).

short-circuit from capacitor C2 allowing it to charge through R10 and potentiometer R39 to the firing voltage of unijunction transistor Q5. The time required for C2 to charge and fire Q5 is controlled by potentiometer R39 set to a calibrated time dial. When Q5 fires, C2 discharges through Q5 and R20 to cause a voltage rise across R20. This causes the voltage on the emitter of Q6 to rise above its base voltage, turning it off and flip-flop transistor Q7 on. This is the reset state of the flip-flop. The turn off of transistor Q6 turns Q3 on and Q4 off to deenergize the lockout indicator. When Q7 turns on, its collector voltage drops to a low level and removes the base drive to Q9 turning it off. The low collector voltage of Q7 also disables the timing circuit by forward biasing D6 and providing a path for current of flow through Q7 so that capacitor C2 cannot charge up to a point where it will again fire unijunction Q5. When the turn on of transistor Q7 turns transistor Q9 off, the on transistor Q17 provides a shorting path for the rise in potential of the collector of Q9 that would normally supply base drive for transistor Q10 to turn on and activate the rest of the close relay circuit.

If a fault appears on the protected line and a protective relay opens the breaker, the 52b contacts make up. If at this time a positive going "Permit" pulse is applied to the reclose time delay circuit, the breaker will close after the preset time delay has elasped. This is accomplished by the positive going pulse turning normally off transistor Q12 on, placing the base of Q13 to ground potential, turning it off, and thereby removing the short from capacitor C13 allowing it to charge through potentiometer R66. Time variation is controlled by the dial setting of R66. The voltage level on capacitor C13 reaches a point where zener diode Z10 breaks down and allows base current to flow into Q16. This causes Q16 to go from the normally off to the normally on state, depriving Q17 of base drive, turning it off. This removes the short from the base of Q10 allowing it to turn on. The turn on of Q10 allows base current to flow from Q11 turning it on. The switching on of Q11 energize the close relay, closing the normally open contact to the positive battery supply. This provides a path from battery positive, through the close relay contact, to energize and immediately reclose the breaker.

The reclosing of the breaker reopens the 52b contact, switching transistors Q1 and Q8 on. The flip-flop control circuit and the reclose time delay circuit are then set by capacitor C7 discharging through Q8 and R27 to turn transistor Q7 off, and through Q8 and R59 and R54 to turn transistors Q15, Q14 and Q13 on. With Q7 turned off, Q9 is supplied with base drive switching it on, and Q10 and Q11 off. With transistor Q11 turned off, the close relay is de-energized and its contact reopens. With the turn off of Q7 and the setting of the control flip-flop, Q6 is turned on and the lockout indicator circuit is energized by Q6 shorting out the base drive to Q3, turning it off and switching Q4 on to energize the amber lockout indicator.

When the 52b contacts reopened and switched transistor Q1 on, the base drive to Q2 was shorted, and Q2 turned off to reverse bias diode D3 and allow capacitor C2 to again charge through R39 and R10. Let us assume that a protective relay operates to trip the breaker before capacitor C2 has charged to the firing level of Q5. When the breaker opens, the 52b contact closes, switching Q1 off and Q2 on, forward biasing diode D3. This short circuits capacitor C2 through Q2 and removes the charge that had started to build up. Since the charge on C2 had not reached a level to fire Q5, the control flip-flop has not changed state, the close relay circuit remains off, and the lockout indicator remains on. The breaker will remain locked out until manually closed.

If at any time during the reclosing cycle a signal is applied to the block input of the reclose board, the relay will not reclose until the block signal is removed and a permit signal is applied to activate the reclose circuitry.

The reclose timer can only time when the breaker is open, since the circuitry associated with transistor Q1 shorts the Reclose timer capacitor C13 through diodes D15 and D2 to negative, allowing the reclose timer to time only when Q1 is in the off state (52bl contact closed-breaker open). Likewise, the reclose timer cannot time when the SGRU-52 is in the lockout state, since transistor Q4 shorts reclose timer capacitor C13 through diode D15 and D26 to negative, allowing the reclose timer to time only when the SGRU-52 relay is reset.

CHARACTERISTICS

Voltage Rating

The SGRU-52 is rated for 48 or 125 volts d-c. Unless otherwise specified, the relays are connected for 125-volt operation when shipped.

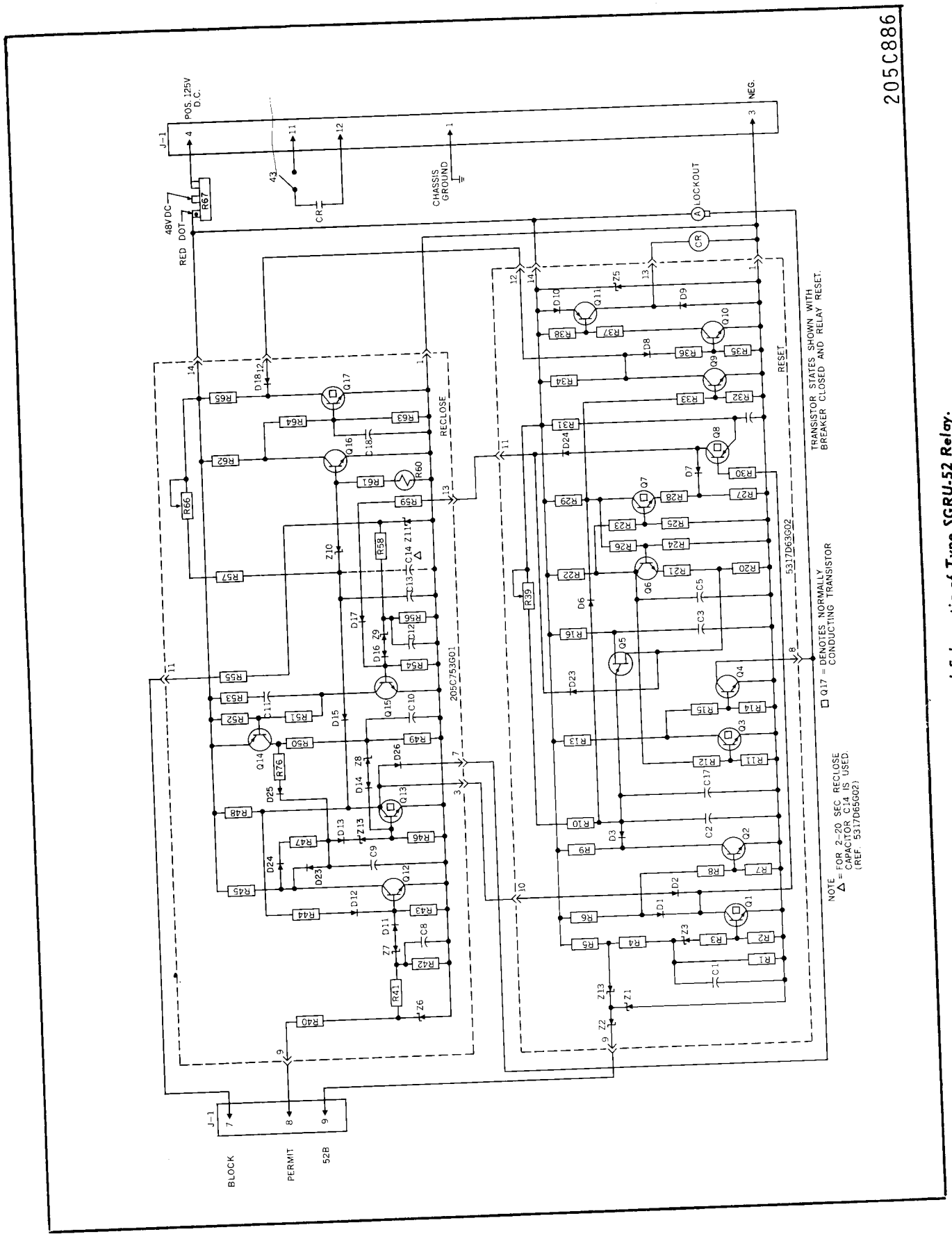


Fig. 3. Internal Schematic of Type SGRU-52 Relay.

Temperature Range

The SGRU-52 is designed to operate over a temperature range from −20°C to +55°C with timing variations of not more than ±5%.

Energy Requirements

55 milliamperes at rated voltage.

SETTINGS

Reset Time Setting

The reset time is controlled by front-mounted potentiometer R39 which has a calibrated time dial. The reset time is variable from 3 to 30 seconds.

Reclose Time Setting

The reclose time is controlled by front-mounted potentiometer R66 which has a calibrated time dial. The reclose time is variable from 0 to 2 seconds or 2 to 20 seconds depending on the style of the relay.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory, and no further adjustment should be required.

CAUTION: The Reset Board should not be removed when the relay is energized due to the fact that the D.C. supply regulating zener diode is located on the Reset Board. Removing this board with the power on will allow the D.C. voltage to rise to a higher voltage which could cause destruction of some components.

Acceptance Test

The following check is recommended to insure that the relay is in proper working order. All checks can best be performed by connecting the SGRU-52 as shown in Figure 5.

Place the cal-operate switch in the operate position. Push PB-1 and wait until the time set on the reset timer has elapsed and the lockout indicator turns off. Push PB-2 to trip relay B. Push the Permit switch and the B relay should close after the time set on the reclose timer has elapsed. After relay B closes, if PB-2 is pushed to again trip relay B within the reset time setting (before the lockout indicator turns off), the B relay should trip and remain locked out.

Calibration Check

The following procedures may be used to accurately check the time dial calibrations. Using Figure 5, the tester can accurately check the calibrations by using a timer as shown.

(1) Reclose Time Delay

With the cal-operate switch in the cal position, apply rated voltage. Push PB-1 and wait for the lockout indicator to turn off. Push PB-2 to trip the relay. Push the Permit switch to start the timer. The CR contacts should close to stop the timer after the time set on the reclose timer dial has elapsed.

(2) Reset Time Delay

Pull out the Reclose board. Apply rated voltage. Push PB-1 to start the timer. The CR contacts should close to stop the timer after the time set on the reset timer time dial has elapsed.

Routine Maintenance

All relays should be checked at least once every year or at such other intervals as may be dictated by experience to be suitable to the particular application.

Trouble Shooting

Use the following procedure to locate the source of trouble in the event of improper relay operation.

(1) Inspect all wires and connections.

(2) Check resistances as listed in the Electrical Parts List.

(3) Check voltages or waveforms as listed under Electrical Checkpoints using a vacuum tube voltmeter and/or an oscilloscope.

Electrical Checkpoints

Apply rated voltage through a switch to relay terminals 3 and 4. Terminal 4 is positive.

Set the reset time dial for 15 seconds, and the reclose time dial for 2 seconds.

Apply rated voltage to the relay to test the circuit board supply voltage. Thereafter, the circuit boards may be removed and 20 volts d-c applied to board terminals 1 and 14. Terminal 14 is positive, and terminal 1 is negative.

Apply voltage before each testpoint check and interrupt it after each check. Take test point readings before and after the reset time shown on the time dial.

Use the following table to determine the correct voltages or waveforms at the indicated point. Refer to Figures 6 and 7 for circuit board component layouts.

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.

CIRCUIT	TEST POINT	NORMAL INDICATIONS		COMPONENTS CHECKED
		BEFORE RESET	AFTER RESET	
Circuit Board Supply Voltage	Board Terminal 14	20 V ± 1.0 V	20 V ± 1.0 V	Z5, R67
RESET CIRCUIT BOARD				
Timing Circuit	Junction of R10 and C2	Slow Voltage Rise to Approx. 15 Volts	Approx. 1.4 V	Q2, Q5, C2, C3, R39, D3, D6
Flip-Flop Control	Junction of R22 and R23	Approx. 1 V	Approx. 15 V	Q6, Q7, C5
	Junction of R26 and R29	Approx. 15 V	Approx. 1 V	
Close Relay Circuit	Junction of R34 and D8	Approx. 0 V	Approx. 8 V	Q9
	Junction of Q11 and D9	Approx. 0 V	Approx. 20 V	Q10, Q11, D9

CIRCUIT	TEST POINT	NORMAL INDICATIONS		COMPONENTS CHECKED
		BEFORE PERMIT Δ	AFTER PERMIT Δ	
RECLOSE CIRCUIT BOARD				
Reclose Time Delay Circuit	Junction of D15 and R48	Approx. 0 V	Approx. 15 V	Q12, Q13
	Junction of C13 and Z10	Approx. .5 V	Slow Voltage Rise to Approx. 6.8 or 8.8 Volts	Z10, D15, C13, R57
	Junction of D18 and R65	Approx. 0 V	Time Delayed Approx. 20 V	Q16, Q17
		BEFORE BLOCK Δ	AFTER BLOCK Δ	
	Junction of Z8 and R50	Approx. 0 V	Approx. 10 V Pulse	Q15, Q14, Z8, D14

Δ + 20-volt d-c Permit signal applied to Reclose circuit board terminal 9; 20-volt d-c Block signal applied to Reclose circuit board terminal 11.

All measurements made between indicated points and d-c negative.

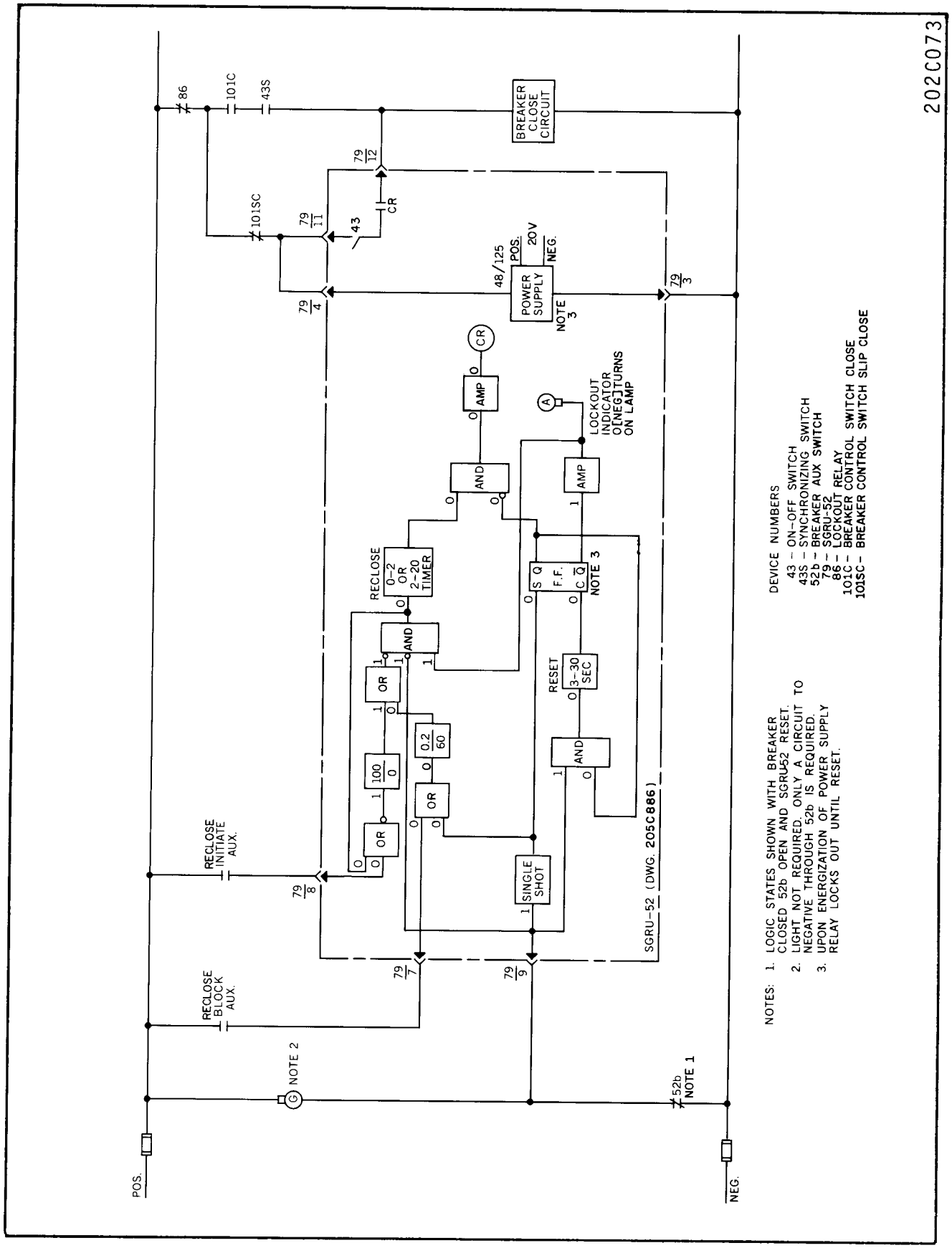


Fig. 4. External Schematic of Type SGRU-52 Relay.

ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER	CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
	RESISTORS				
R1	82,000 ½W 5%	184A763H73	R37	10,000 ½W 5%	184A763H51
R2	10,000 ½W 5%	184A763H51	R38	10,000 ½W 5%	184A763H51
R3	4,700 ½W 5%	184A763H43	R39	1 meg. ohm, series 63M	862A649H03
R4	4,700 ½W 5%	184A763H43	R40	47,000 ½W 2%	629A531H72
R5	20,000 ½W 5%	184A763H58	R41	4,700 ½W 2%	629A531H48
R6	3,900 ½W 5%	184A763H41	R42	82,000 ½W 2%	629A531H78
R7	10,000 ½W 5%	184A763H51	R43	27,000 ½W 5%	184A763H61
R8	22,000 ½W 5%	184A763H59	R44	33,000 ½W 5%	184A763H63
R9	33,000 ½W 5%	184A763H63	R45	15,000 ½W 5%	184A763H55
R10	100,000 ½W 1%	836A503H72	R46	27,000 ½W 5%	184A763H61
R11	20,000 ½W 5%	184A763H58	R47	15,000 ½W 2%	629A531H60
R12	180,000 ½W 5%	184A763H81	R48	15,000 ½W 5%	184A763H55
R13	2,000 ½W 5%	184A763H34	R49	82,000 ½W 5%	184A763H73
R14	10,000 ½W 5%	184A763H51	R50	820 ½W 5%	184A763H25
R15	20,000 ½W 5%	184A763H58	R51	10,000 ½W 5%	184A763H51
R16	680 ½W 5%	184A763H23	R52	10,000 ½W 5%	184A763H51
R20	47 ½W 5%	187A290H17	R53	4,700 ½W 5%	184A763H43
R21	330 ½W 5%	184A763H15	R54	10,000 ½W 2%	629A531H56
R22	10,000 ½W 5%	184A763H51	R55	47,000 ½W 2%	629A531H72
R23	33,000 ½W 5%	184A763H63	R56	82,000 ½W 2%	629A531H78
R24	10,000 ½W 5%	184A763H51	R57	2,000 (0-2 sec.) 1%	836A503H33
R25	10,000 ½W 5%	184A763H51	R57	18,200 (2-20 sec.) 1%	836A503H55
R26	33,000 ½W 5%	184A763H63	R58	4,700 ½W 2%	629A531H48
R27	47 ½W 5%	187A290H17	R59	1,000 ½W 5%	184A763H27
R28	330 ½W 5%	184A763H15	R60	1D051 20K Thermister	185A211H05
R29	10,000 ½W 5%	184A763H51	R61	15,000 ½W 5%	184A763H55
R30	2,000 ½W 5%	184A763H34	R62	33,000 ½W 5%	184A763H63
R31	30,000 ½W 5%	184A763H62	R63	10,000 ½W 5%	184A763H51
R32	10,000 ½W 5%	184A763H51	R64	33,000 ½W 5%	184A763H63
R33	180,000 ½W 5%	184A763H81	R65	33,000 ½W 5%	184A763H63
R34	68,000 ½W 5%	184A763H71	R66	250,000 Series 63M	862A649H01
R35	10,000 ½W 5%	184A763H51	R67	1,900 tapped at 510 25W 5%	11D951H10
R36	33,000 ½W 5%	184A763H63	R76	1,000 ½W 2%	629A531H32

ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
CAPACITORS		
C1	.047 mfd, 200V, 5%	849A437H04
C2	22 mfd, 100V, 10%	862A177H04
C3	1.5 mfd, 35V, 10%	187A508H09
C5	.01 mfd, 200V, 10%	768A278H10
C7	4.7 mfd. 25V, 20%	184A661H12
C8	.047 mfd, 200V, 5%	849A437H04
C9	6.8 mfd, 35V, 5%	184A661H21
C10	.47 mfd, 25V, 20%	187A50[illegible] H05
C11	1.5 mfd, 35V, 10%	187A508H09
C12	.047 mfd, 200V, 5%	849A437H04
C13	(0-2 sec.) 22mfd, 100V, 10%	862A177H04
C13	(2-20 sec.) 68mfd, 60V, 10%	862A177H03
C14	(2-20 sec.) 68mfd, 60V, 10%	862A177H03
C17	1.5 mfd, 35V, 5%	187A508H18
TRANSISTORS		
Q1 to Q4	2N3417	848A851H02
Q5	4JX5E695	629A435H02
Q6 to Q7	2N3417	848A851H02
Q8	2N3645	848A441H01
Q9 to Q10	2N3417	848A851H02
Q11	2N3645	849A441H01
Q12 to Q13	2N3417	848A851H02
Q14	2N3645	849A441H01
Q15 to Q17	2N3417	848A851H02

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
ZENER DIODES		
Z1	2N3686B	185A212H06
Z2	1R200	629A369H01
Z3	1N758	186A797H01
Z5	HW20B	185A212H14
Z6	1N3686B	185A212H06
Z7	1N957B	186A797H06
Z8	1N758	186A797H01
Z9	1N957B	186A797H06
Z10	(0-2 sec.) 1N957B	186A797H06
Z10	(2-20 sec.) 1N960B	186A797H10
Z11	1N3686B	185A212H06
DIODES		
D1 to D10	T1-55	183A790H09
D11	1N645A	837A692H03
D12 to D15	T1-55	183A790H09
D16	1N645A	837A692H03
D17 to D18	T1-55	183A790H09
D23 to D26	T1-55	183A790H09
MISCELLANEOUS		
CR	Close Relay	541D231H22
IND.1	Lockout Indicator	862A634G01

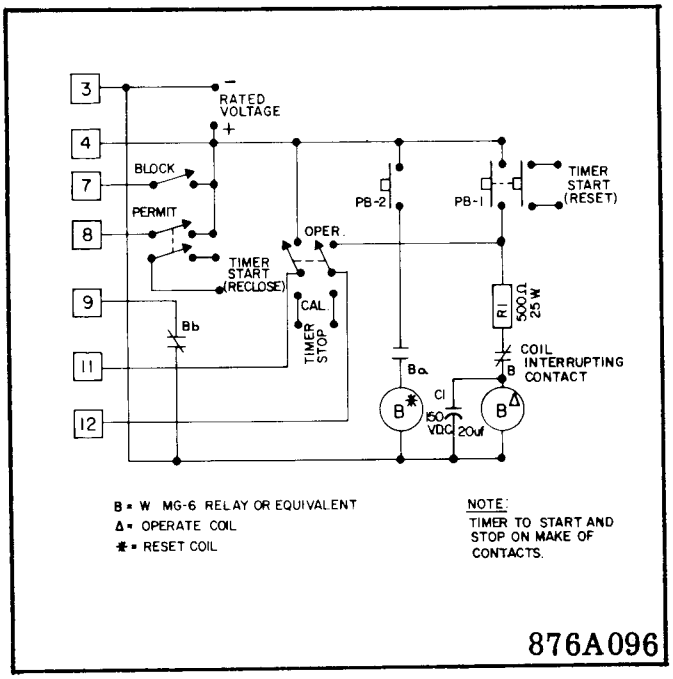


Fig. 5. Test Circuit of Type SGRU-52 Relay.

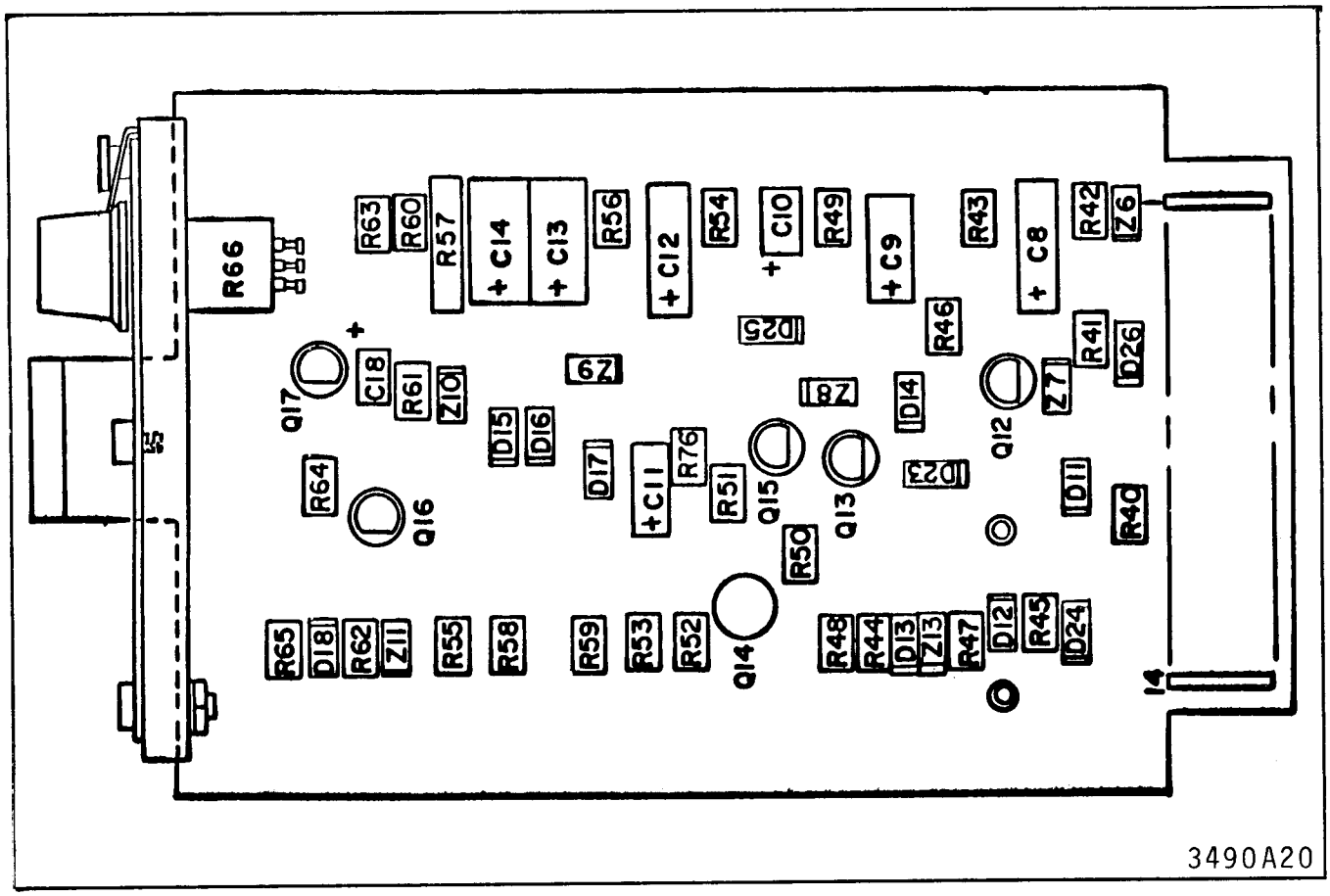


Fig. 6. Component Location of Reclose Printed Circuit Board for Type SGRU-52 Relay.

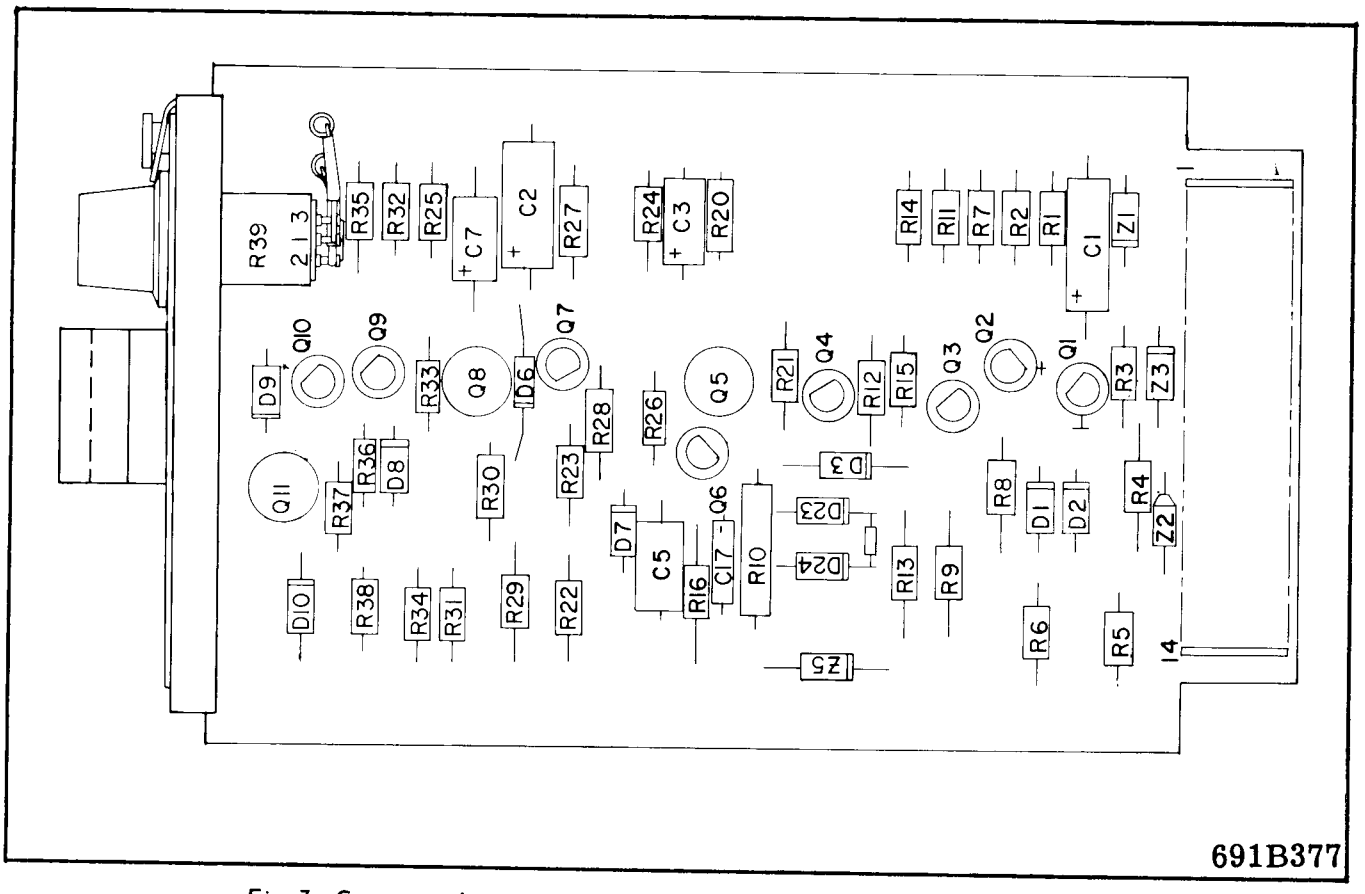
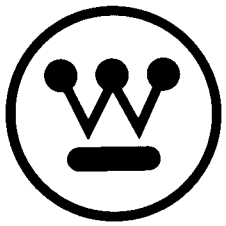


Fig. 7. Component Location of Reset Printed Circuit Board for Type SGRU-52 Relay.



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION

NEWARK, N. J.

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE SGRU-52 RECLOSING RELAY

APPLICATION

The SGRU-52 Reclosing Relay provides for adjustable time delay reclosure of an electrically-operated circuit breaker, and automatically resets itself if the breaker remains closed for a predetermined adjustable time interval. If the breaker retrips before the end of this interval, the resetting operation of the relay is interrupted until the breaker is manually closed. Thus, the reclosing relay is applicable to either attended or non-attended stations.

CONSTRUCTION AND OPERATION

The SGRU-52 is a completely static relay consisting of a Reclose circuit board and a Reset circuit board. The Reset circuit board contains (1) a timing circuit, (2) a flip-flop control circuit, (3) a close relay circuit, (4) a flip-flop set circuit, and (5) lockout indication. The Reclose board contains a reclose time delay circuit with permit and block inputs. All components except the dropping resistor, lockout indicator, and the close relay are mounted on a printed circuit board. All components are identified on the internal schematic in Figure 3.

Timing Circuit

The timing circuit is a unijunction relaxation oscillator consisting of unijunction transistor Q5, capacitor C2, and resistors R10 and R30. After a preset time interval controlled by the adjustable time dial potentiometer R39, the relaxation oscillator fires and feeds an output pulse to the flip-flop control circuit.

Flip-Flop Control Circuit

The flip-flop control circuit consists of transistors Q6 and Q7, and resistors R20 to R29. The flip-flop circuit resets when pulsed by the timing circuit and thereby activates the close relay circuit by turning transistor Q9 off.

Close Relay Circuit

The close relay circuit consists of transistors Q9, Q10 and Q11, resistors R32 to R38, and the close relay. The turn-off of transistor Q9 by the flip-flop control circuit switches transistors Q10 and Q11 to the on state to activate the close relay.

Flip-Flop Set Circuit

The flip-flop set circuit consisting of transistors Q8 and Q1, resistors R30 and R31, and capacitor C7, sets the flip-flop control circuit and the reclose time delay circuit when the breaker closes, opening the 52b contact. Transistors Q1 and Q8 switch to the on state and discharge capacitor C7 through C8 to turn transistor Q7 off and transistor Q15 on to set the flip-flop and the reclose time delay circuits simultaneously.

Lockout Indicator Circuit

The lockout indicator circuit is controlled by the state of the flip-flop control circuit. Consisting of amplifier transistors Q3 and Q4, the amber light is lit when the flip-flop is in the set state, and the relay isl locked out if the breaker is open at this time.

Reclose Time Delay Circuit

The reclose time delay circuit consists of a flip-flop arrangement of transistors Q12 and Q13, capacitor C13 which charges through the time dial setting potentiometer R66, zener diode Z10, and transistors Q16 and Q17.

Theory of Operation

The following description is made with reference to Figure 3.

Let us assume that the breaker is open and normal voltage is applied to the relay. Under these conditions, transistors Q2, Q6, Q9, Q13 and Q17 are on. When the breaker is closed, the 52b contact opens and removes the shorting of the base drive to transistor Q1 turning it on. The turn on of Q1 shorts the base drive to Q2 turning it off, which causes diode D3 to be reverse biased. This removes the

SUPERSEDES I.L. 41-668.21, dated February 1973
* Denotes change from superseded issue.

EFFECTIVE NOVEMBER 1975

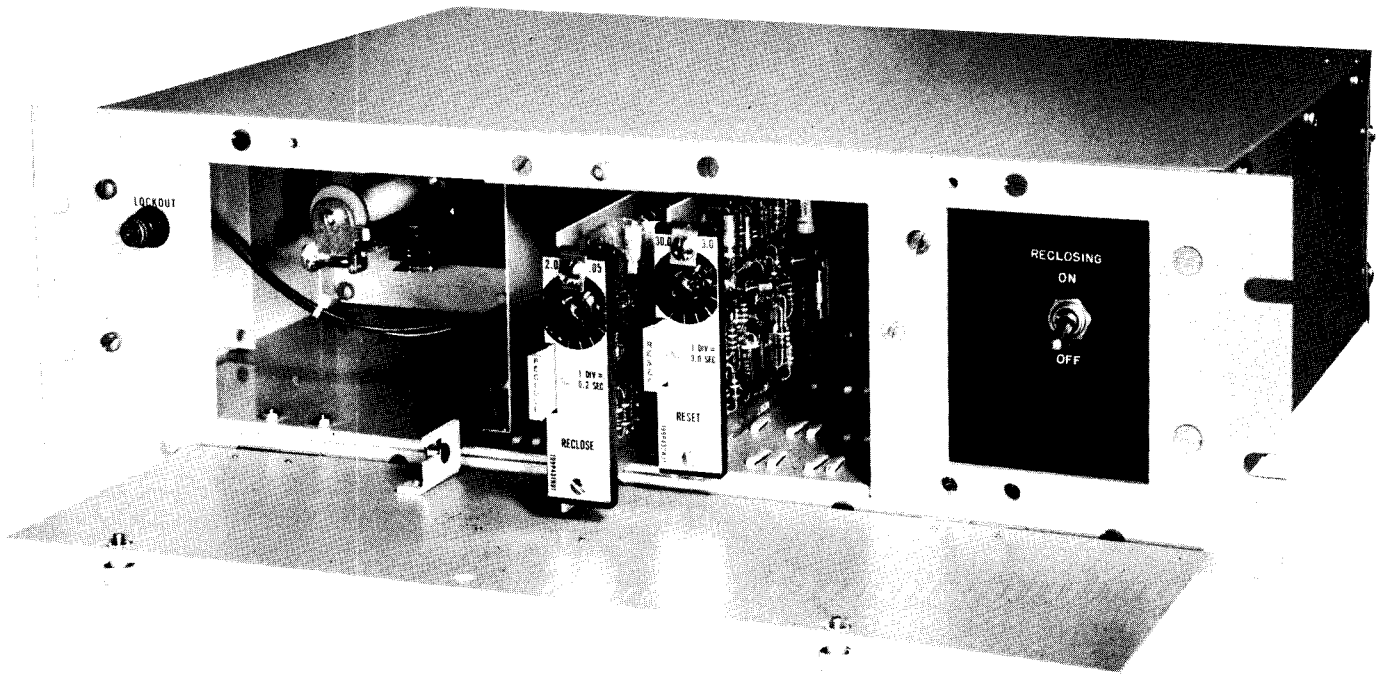


Fig. 1. Type SGRU-52 Reclosing Relay (Front View).

short-circuit from capacitor C2 allowing it to charge through R10 and potentiometer R39 to the firing voltage of unijunction transistor Q5. The time required for C2 to charge and fire Q5 is controlled by potentiometer R39 set to a calibrated time dial. When Q5 fires, C2 discharges through Q5 and R20 to cause a voltage rise across R20. This causes the voltage on the emitter of Q6 to rise above its base voltage, turning it off and flip-flop transistor Q7 on. This is the reset state of the flip-flop. The turn off of transistor Q6 turns Q3 on and Q4 off to deenergize the lockout indicator. When Q7 turns on, its collector voltage drops to a low level and removes the base drive to Q9 turning it off. The low collector voltage of Q7 also disables the timing circuit by forward biasing D6 and providing a path for current of flow through Q7 so that capacitor C2 cannot charge up to a point where it will again fire unijunction Q5. When the turn on of transistor Q7 turns transistor Q9 off, the on transistor Q17 provides a shorting path for the rise in potential of the collector of Q9 that would normally supply base drive for transistor Q10 to turn on and activate the rest of the close relay circuit.

If a fault appears on the protected line and a protective relay opens the breaker, the 52b contacts make up. If at this time a positive going "Permit" pulse is applied to the reclose time delay circuit, the breaker will close after the preset time delay has elasped. This is accomplished by the positive going pulse turning normally off transistor Q12 on, placing the base of Q13 to ground potential, turning it off, and thereby removing the short from capacitor C13 allowing it to charge through potentiometer R66. Time variation is controlled by the dial setting of R66. The voltage level on capacitor C13 reaches a point where zener diode Z10 breaks down and allows base current to flow into Q16. This causes Q16 to go from the normally off to the normally on state, depriving Q17 of base drive, turning it off. This removes the short from the base of Q10 allowing it to turn on. The turn on of Q10 allows base current to flow from Q11 turning it on. The switching on of Q11 energize the close relay, closing the normally open contact to the positive battery supply. This provides a path from battery positive, through the close relay contact, to energize and immediately reclose the breaker.

The reclosing of the breaker reopens the 52b contact, switching transistors Q1 and Q8 on. The flip-flop control circuit and the reclose time delay circuit are then set by capacitor C7 discharging through Q8 and R27 to turn transistor Q7 off, and through Q8 and R59 and R54 to turn transistors Q15, Q14 and Q13 on. With Q7 turned off, Q9 is supplied with base drive switching it on, and Q10 and Q11 off. With transistor Q11 turned off, the close relay is de-energized and its contact reopens. With the turn off of Q7 and the setting of the control flip-flop, Q6 is turned on and the lockout indicator circuit is energized by Q6 shorting out the base drive to Q3, turning it off and switching Q4 on to energize the amber lockout indicator.

When the 52b contacts reopened and switched transistor Q1 on, the base drive to Q2 was shorted, and Q2 turned off to reverse bias diode D3 and allow capacitor C2 to again charge through R39 and R10. Let us assume that a protective relay operates to trip the breaker before capacitor C2 has charged to the firing level of Q5. When the breaker opens, the 52b contact closes, switching Q1 off and Q2 on, forward biasing diode D3. This short circuits capacitor C2 through Q2 and removes the charge that had started to build up. Since the charge on C2 had not reached a level to fire Q5, the control flip-flop has not changed state, the close relay circuit remains off, and the lockout indicator remains on. The breaker will remain locked out until manually closed.

If at any time during the reclosing cycle a signal is applied to the block input of the reclose board, the relay will not reclose until the block signal is removed and a permit signal is applied to activate the reclose circuitry.

The reclose timer can only time when the breaker is open, since the circuitry associated with transistor Q1 shorts the Reclose timer capacitor C13 through diodes D15 and D2 to negative, allowing the reclose timer to time only when Q1 is in the off state (52bl contact closed-breaker open). Likewise, the reclose timer cannot time when the SGRU-52 is in the lockout state, since transistor Q4 shorts reclose timer capacitor C13 through diode D15 and D26 to negative, allowing the reclose timer to time only when the SGRU-52 relay is reset.

CHARACTERISTICS

Voltage Rating

The SGRU-52 is rated for 48 or 125 volts d-c. Unless otherwise specified, the relays are connected for 125-volt operation when shipped.

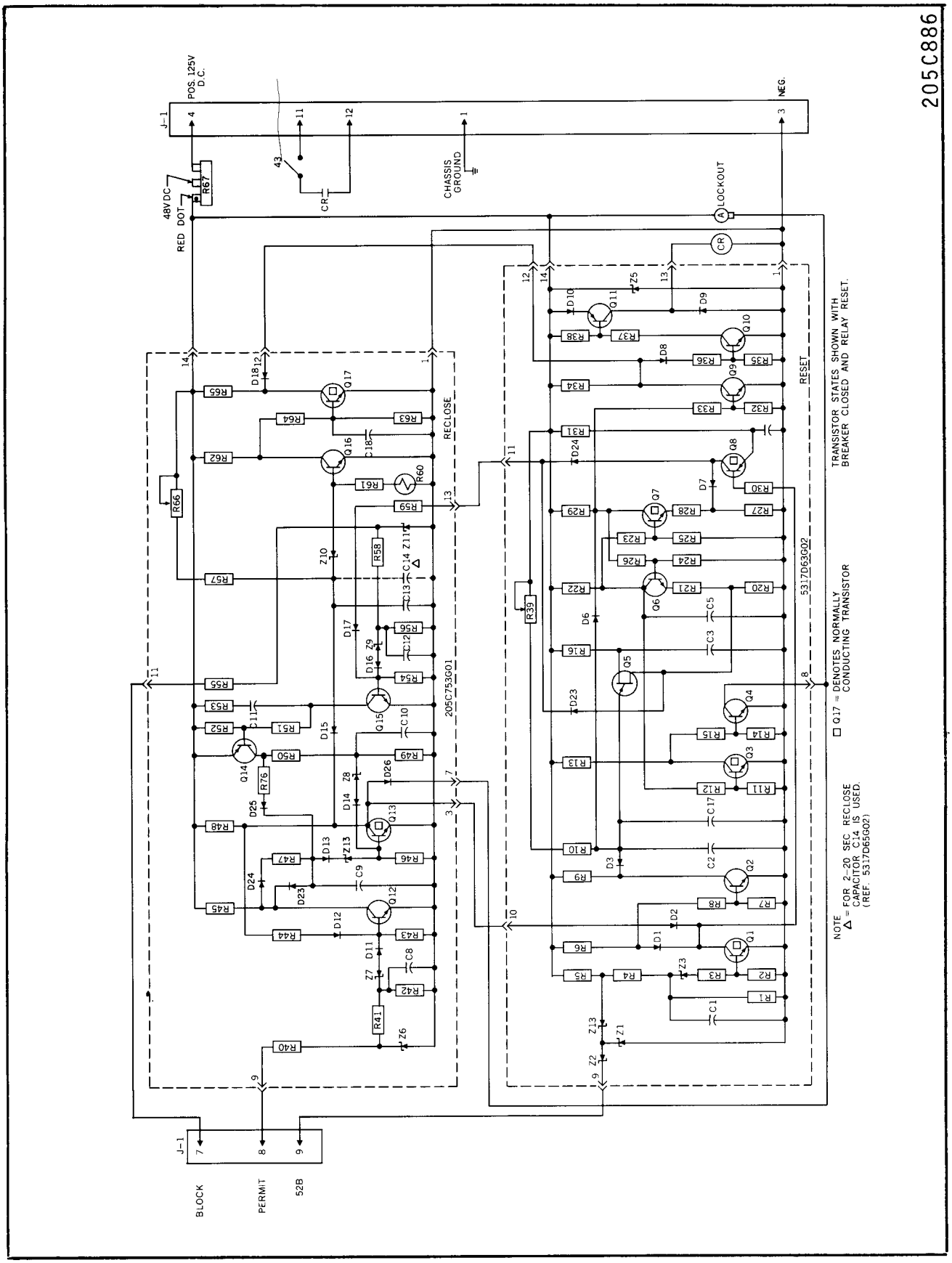


Fig. 3. Internal Schematic of Type SGRU-52 Relay.

Temperature Range

The SGRU-52 is designed to operate over a temperature range from −20°C to +55°C with timing variations of not more than ±5%.

Energy Requirements

55 milliamperes at rated voltage.

SETTINGS

Reset Time Setting

The reset time is controlled by front-mounted potentiometer R39 which has a calibrated time dial. The reset time is variable from 3 to 30 seconds.

Reclose Time Setting

The reclose time is controlled by front-mounted potentiometer R66 which has a calibrated time dial. The reclose time is variable from 0 to 2 seconds or 2 to 20 seconds depending on the style of the relay.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory, and no further adjustment should be required.

CAUTION: The Reset Board should not be removed when the relay is energized due to the fact that the D.C. supply regulating zener diode is located on the Reset Board. Removing this board with the power on will allow the D.C. voltage to rise to a higher voltage which could cause destruction of some components.

Acceptance Test

The following check is recommended to insure that the relay is in proper working order. All checks can best be performed by connecting the SGRU-52 as shown in Figure 5.

Place the cal-operate switch in the operate position. Push PB-1 and wait until the time set on the reset timer has elapsed and the lockout indicator turns off. Push PB-2 to trip relay B. Push the Permit switch and the B relay should close after the time set on the reclose timer has elapsed. After relay B closes, if PB-2 is pushed to again trip relay B within the reset time setting (before the lockout indicator turns off), the B relay should trip and remain locked out.

Calibration Check

The following procedures may be used to accurately check the time dial calibrations. Using Figure 5, the tester can accurately check the calibrations by using a timer as shown.

(1) Reclose Time Delay

With the cal-operate switch in the cal position, apply rated voltage. Push PB-1 and wait for the lockout indicator to turn off. Push PB-2 to trip the relay. Push the Permit switch to start the timer. The CR contacts should close to stop the timer after the time set on the reclose timer dial has elapsed.

(2) Reset Time Delay

Pull out the Reclose board. Apply rated voltage. Push PB-1 to start the timer. The CR contacts should close to stop the timer after the time set on the reset timer time dial has elapsed.

Routine Maintenance

All relays should be checked at least once every year or at such other intervals as may be dictated by experience to be suitable to the particular application.

Trouble Shooting

Use the following procedure to locate the source of trouble in the event of improper relay operation.

(1) Inspect all wires and connections.

(2) Check resistances as listed in the Electrical Parts List.

(3) Check voltages or waveforms as listed under Electrical Checkpoints using a vacuum tube voltmeter and/or an oscilloscope.

Electrical Checkpoints

Apply rated voltage through a switch to relay terminals 3 and 4. Terminal 4 is positive.

Set the reset time dial for 15 seconds, and the reclose time dial for 2 seconds.

Apply rated voltage to the relay to test the circuit board supply voltage. Thereafter, the circuit boards may be removed and 20 volts d-c applied to board terminals 1 and 14. Terminal 14 is positive, and terminal 1 is negative.

Apply voltage before each testpoint check and interrupt it after each check. Take test point readings before and after the reset time shown on the time dial.

Use the following table to determine the correct voltages or waveforms at the indicated point. Refer to Figures 6 and 7 for circuit board component layouts.

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.

CIRCUIT	TEST POINT	NORMAL INDICATIONS		COMPONENTS CHECKED
		BEFORE RESET	AFTER RESET	
Circuit Board Supply Voltage	Board Terminal 14	20 V ± 1.0 V	20 V ± 1.0 V	Z5, R67
RESET CIRCUIT BOARD				
Timing Circuit	Junction of R10 and C2	Slow Voltage Rise to Approx. 15 Volts	Approx. 1.4 V	Q2, Q5, C2, C3, R39, D3, D6
Flip-Flop Control	Junction of R22 and R23	Approx. 1 V	Approx. 15 V	Q6, Q7, C5
	Junction of R26 and R29	Approx. 15 V	Approx. 1 V	Q6, Q7, Q5
Close Relay Circuit	Junction of R34 and D8	Approx. 0 V	Approx. 8 V	Q9
	Junction of Q11 and D9	Approx. 0 V	Approx. 20 V	Q10, Q11, D9

CIRCUIT	TEST POINT	NORMAL INDICATIONS		COMPONENTS CHECKED
		BEFORE PERMIT Λ	AFTER PERMIT Λ	
RECLOSE CIRCUIT BOARD				
Reclose Time Delay Circuit	Junction of D15 and R48	Approx. 0 V	Approx. 15 V	Q12, Q13
	Junction of C13 and Z10	Approx. .5 V	Slow Voltage Rise to Approx. 6.8 or 8.8 Volts	Z10, D15, C13, R57
	Junction of D18 and R65	Approx. 0 V	Time Delayed Approx. 20 V	Q16, Q17
		BEFORE BLOCK Λ	AFTER BLOCK Λ	
	Junction of Z8 and R50	Approx. 0 V	Approx. 10 V Pulse	Q15, Q14, Z8, D14

Λ + 20-volt d-c Permit signal applied to Reclose circuit board terminal 9; 20-volt d-c Block signal applied to Reclose circuit board terminal 11.

All measurements made between indicated points and d-c negative.

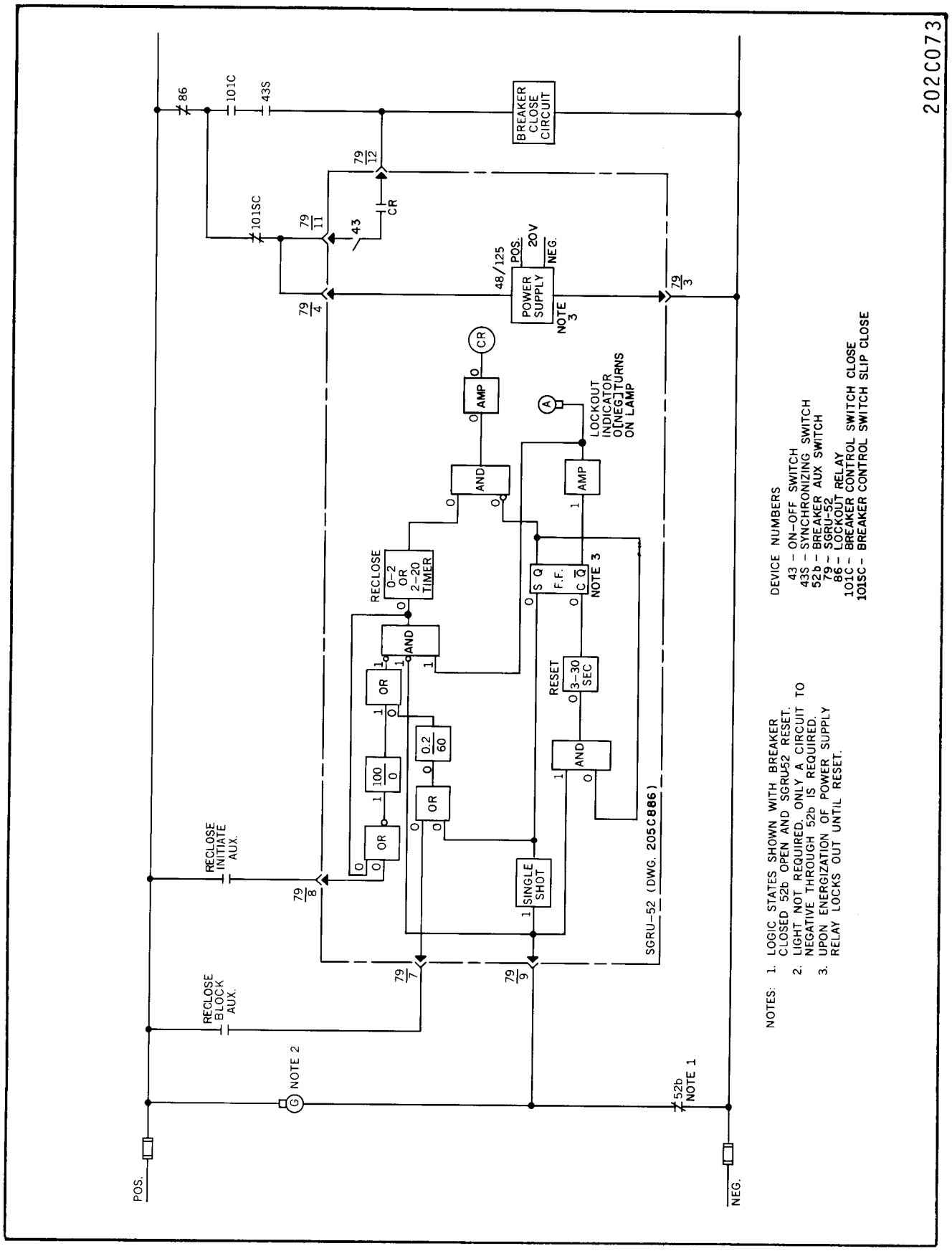


Fig. 4. External Schematic of Type SGRU-52 Relay.

ELECTRICAL PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER	CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
	RESISTORS				
R1	82,000 ½W 5%	184A763H73	R37	10,000 ½W 5%	184A763H51
R2	10,000 ½W 5%	184A763H51	R38	10,000 ½W 5%	184A763H51
R3	4,700 ½W 5%	184A763H43	R39	1 meg. ohm, series 63M	862A649H03
R4	4,700 ½W 5%	184A763H43	R40	47,000 ½W 2%	629A531H72
R5	20,000 ½W 5%	184A763H58	R41	4,700 ½W 2%	629A531H48
R6	3,900 ½W 5%	184A763H41	R42	82,000 ½W 2%	629A531H78
R7	10,000 ½W 5%	184A763H51	R43	27,000 ½W 5%	184A763H61
R8	22,000 ½W 5%	184A763H59	R44	33,000 ½W 5%	184A763H63
R9	33,000 ½W 5%	184A763H63	R45	15,000 ½W 5%	184A763H55
R10	100,000 ½W 1%	836A503H72	R46	27,000 ½W 5%	184A763H61
R11	20,000 ½W 5%	184A763H58	R47	15,000 ½W 2%	629A531H60
R12	180,000 ½W 5%	184A763H81	R48	15,000 ½W 5%	184A763H55
R13	2,000 ½W 5%	184A763H34	R49	82,000 ½W 5%	184A763H73
R14	10,000 ½W 5%	184A763H51	R50	820 ½W 5%	184A763H25
R15	20,000 ½W 5%	184A763H58	R51	10,000 ½W 5%	184A763H51
R16	680 ½W 5%	184A763H23	R52	10,000 ½W 5%	184A763H51
R20	47 ½W 5%	187A290H17	R53	4,700 ½W 5%	184A763H43
R21	330 ½W 5%	184A763H15	R54	10,000 ½W 2%	629A531H56
R22	10,000 ½W 5%	184A763H51	R55	47,000 ½W 2%	629A531H72
R23	33,000 ½W 5%	184A763H63	R56	82,000 ½W 2%	629A531H78
R24	10,000 ½W 5%	184A763H51	R57	2,000 (0-2 sec.) 1%	836A503H33
R25	10,000 ½W 5%	184A763H51	R57	18,200 (2-20 sec.) 1%	836A503H55
R26	33,000 ½W 5%	184A763H63	R58	4,700 ½W 2%	629A531H48
R27	47 ½W 5%	187A290H17	R59	1,000 ½W 5%	184A763H27
R28	330 ½W 5%	184A763H15	R60	1D051 20K Thermister	185A211H05
R29	10,000 ½W 5%	184A763H51	R61	15,000 ½W 5%	184A763H55
R30	2,000 ½W 5%	184A763H34	R62	33,000 ½W 5%	184A763H63
R31	30,000 ½W 5%	184A763H62	R63	10,000 ½W 5%	184A763H51
R32	10,000 ½W 5%	184A763H51	R64	33,000 ½W 5%	184A763H63
R33	180,000 ½W 5%	184A763H81	R65	33,000 ½W 5%	184A763H63
R34	68,000 ½W 5%	184A763H71	R66	250,000 Series 63M	862A649H01
R35	10,000 ½W 5%	184A763H51	R67	1,900 tapped at 510 25W 5%	11D951H10
R36	33,000 ½W 5%	184A763H63	R76	1,000 ½W 2%	629A531H32

ELECTRICAL PARTS LIST

	CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
	CAPACITORS		
	C1	.047 mfd, 200V, 5%	849A437H04
*	C2	22 mfd, 100V, 5%	862A177H04
	C3	1.5 mfd, 35V, 10%	187A508H09
	C5	.01 mfd, 200V, 10%	768A278H10
*	C7	4.7 mfd, 35V, 10%	184A661H12
	C8	.047 mfd, 200V, 5%	849A437H04
	C9	6.8 mfd, 35V, 5%	184A661H21
*	C10	.47 mfd, 35V, 20%	187A508H05
	C11	1.5 mfd, 35V, 10%	187A508H09
	C12	.047 mfd, 200V, 5%	849A437H04
*	C13	(0-2 sec.) 22 mfd, 100V, 5%	862A177H04
*	C13	(2-20 sec.) 68 mfd, 60V, 5%	862A177H03
*	C14	(2-20 sec.) 68 mfd, 60V, 5%	862A177H03
	C17	1.5 mfd, 35V, 5%	187A508H18
	TRANSISTORS		
	Q1 to Q4	2N3417	848A851H02
	Q5	4JX5E695	629A435H02
	Q6 to Q7	2N3417	848A851H02
	Q8	2N3645	848A441H01
	Q9 to Q10	2N3417	848A851H02
	Q11	2N3645	849A441H01
	Q12 to Q13	2N3417	848A851H02
	Q14	2N3645	849A441H01
	Q15 to Q17	2N3417	848A851H02

CIRCUIT SYMBOL	DESCRIPTION	WESTINGHOUSE STYLE NUMBER
ZENER DIODES		
Z1	2N3686B	185A212H06
Z2	1R200	629A369H01
Z3	1N758	186A797H01
Z5	HW20B	185A212H14
Z6	1N3686B	185A212H06
Z7	1N957B	186A797H06
Z8	1N758	186A797H01
Z9	1N957B	186A797H06
Z10	(0-2 sec.) 1N957B	186A797H06
Z10	(2-20 sec.) 1N960B	186A797H10
Z11	1N3686B	185A212H06
DIODES		
D1 to D10	T1-55	183A790H09
D11	1N645A	837A692H03
D12 to D15	T1-55	183A790H09
D16	1N645A	837A692H03
D17 to D18	T1-55	183A790H09
D23 to D26	T1-55	183A790H09
MISCELLANEOUS		
CR	Close Relay	541D231H22
IND.1	Lockout Indicator	862A634G01

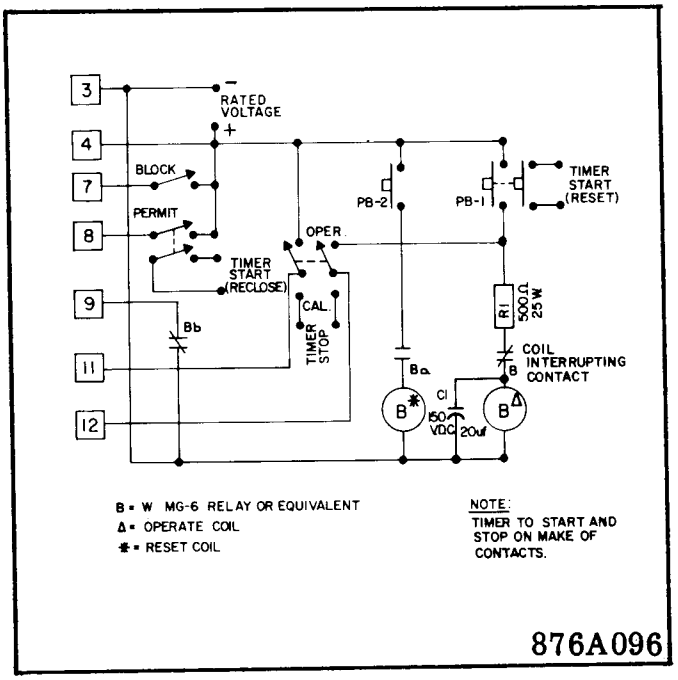


Fig. 5. Test Circuit of Type SGRU-52 Relay.

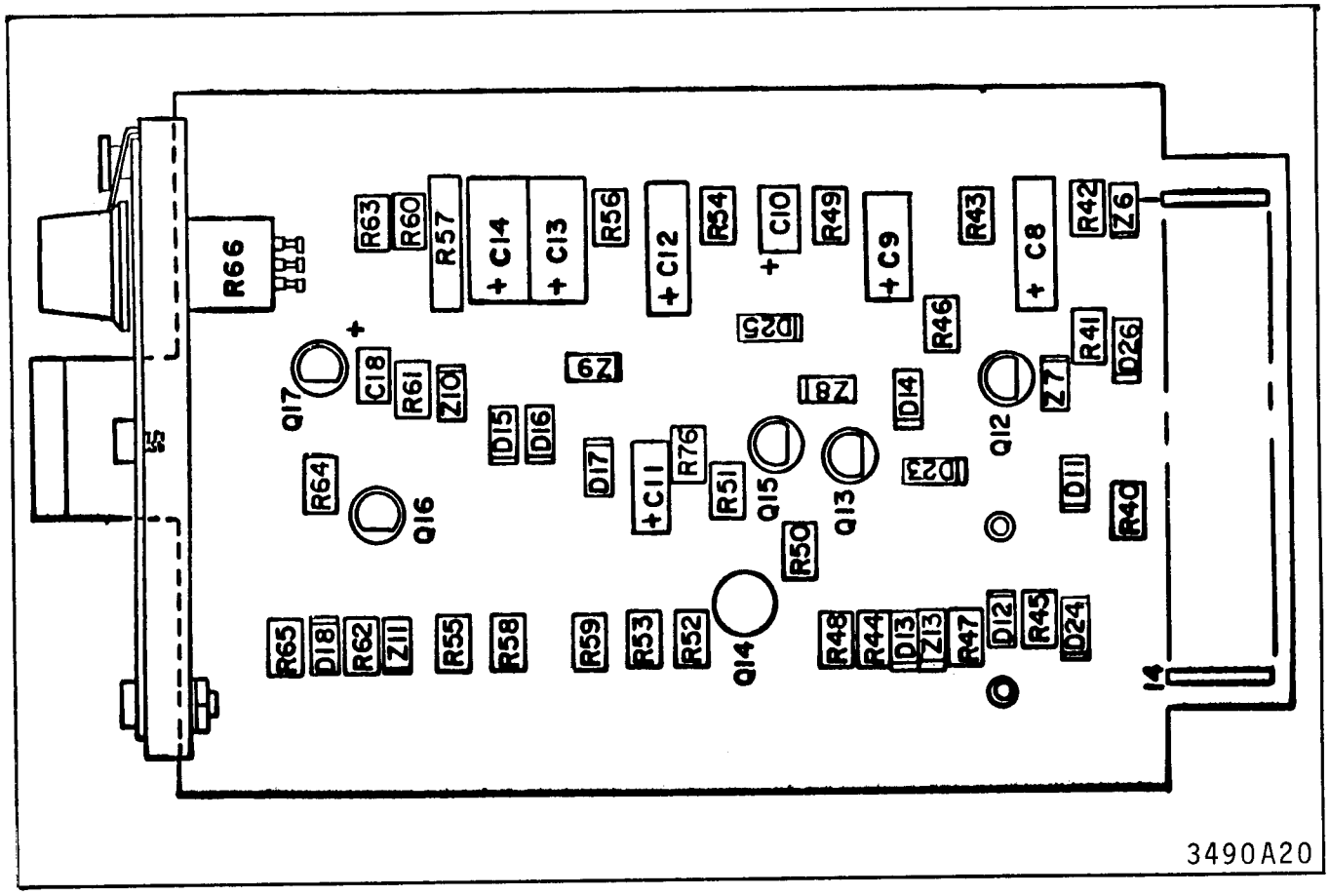


Fig. 6. Component Location of Reclose Printed Circuit Board for Type SGRU-52 Relay.

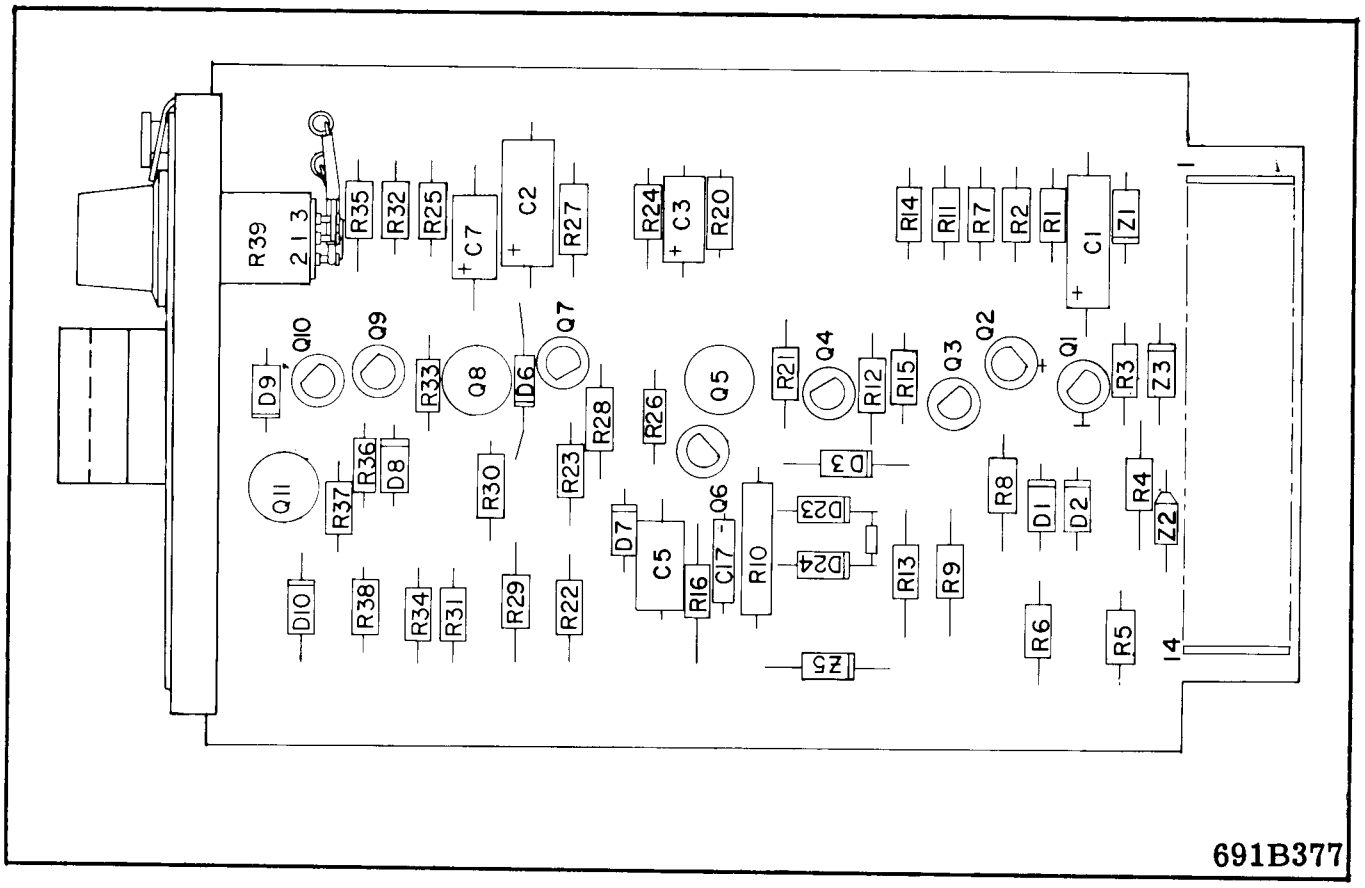
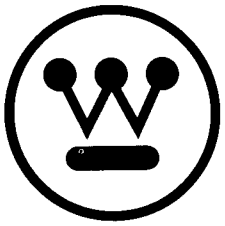


Fig. 7. Component Location of Reset Printed Circuit Board for Type SGRU-52 Relay.



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.