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Power Automation & Protection Division
Coral Springs, FL
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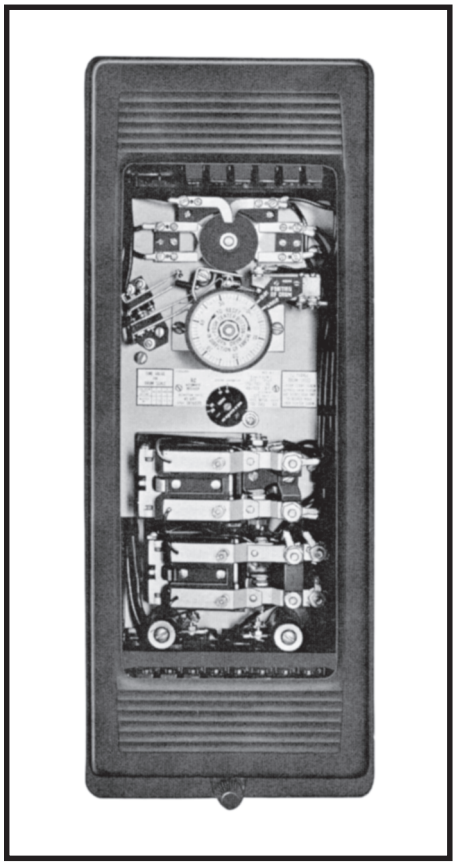
For Ac Circuit Breakers With
Ac and Dc Control Schemes
Device Number : 79

Type RC and RCL Automatic Reclosing Relays



AUTOMATIC RECLOSING RELAY TYPE RC

APPLICATION

The majority of faults which occur on power systems are of a temporary nature, such as those due to lightning flashovers occurring between phase wires, across insulators or from phase to ground. Consequently, opening a faulted circuit of this nature clears the circuit and allows it to be immediately reclosed, permitting a minimum interruption of service.

Operating procedure on most systems is to reclose a circuit at least once following a fault and in some cases several reclosures are attempted. The RC relay can be used for practically any reclosing scheme.

Factors to Consider

Protective relay Operation: For instantaneous reclosure, contacts must open within 10 cycles or less after breaker is tripped to insure the relay circuit is de-energized before reclosing breaker. Otherwise, undesired breaker tripout occurs.

Mechanically Trip Free Breakers: Latch checking switch should be provided to make certain that the breaker closing mechanism is securely latched to breaker operating road before closing coil is energized.

De-rating Factors: ANSI/IEEE de-rating factors for breaker interrupting ability should be checked when choosing reclosing cycle. When necessary, a cumulative lock-out device can be provided to prevent further automatic reclosure of the breaker after predetermined number of operations.

Control Voltage: Even though the RC relay operates on either ac or dc control circuits, an ac supply must be provided to operate the relay timing motor. Inverter can be supplied where dc is the only supply available. See Descriptive Bulletin 41-082.

Service Interruptions: When using instantaneous reclosure, reclosing scheme should include suitable under-voltage time delay, field removal or synchronous motor unloading devices. This will permit minimum interruption of power and allow full advantage to be taken of instantaneous reclosure.

Standard Symbols

Type RC:	**79M**	Relay motor
	X	Relay contactor unit (X-unit)
	Y	Relay solenoid unit (Y-unit)
	Z	Relay contactor unit (Z-unit)
	1-14	Contacts
	X9A	Cumulative lockout contact (special feature)

Ac Oil Circuit Breaker

52a Breaker auxiliary switch contact, open when breaker is open

aa Breaker auxiliary switch contact, closed when breaker operating mechanism is in energized or operated position

b Breaker auxiliary switch contact, closed when breaker is open

bb Breaker auxiliary switch contact, closed when breaker mechanism is in de-energized or non-operated position

C Breaker closing coil

LC Latch check switch on breaker operating mechanism, closed when mechanism linkage is in latched position

T Breaker trip coil X Breaker circuit relay

Y breaker cutoff relay

101 manually Controlled Multi-Contact Control Switch

101/C Contacts closed when switch is in CLOSE position

101/CTO Contacts closed in all positions except when switch handle is pulled forward

101/O Contacts open when switch is either CLOSE or TRIP position and close in normal center position

101SC Contacts close when switch is in CLOSE position and remain closed until switch is in TRIP position

CS/T Contact closed when switch is in TRIP position

PR Protective Relay, Time element contact

50 Protective Relay, Instantaneous trip Contact

8 Manually-Operated Power Supply Switch

43 Manually-Operated Transfer Switching Device

TYPE RC MULTI-SHOT WITH AUTOMATIC RESET

The Type RC automatic reclosing relay is used for automatic reclosure of ac or dc electrically operated circuit breakers after they have been opened by overcurrent or other protective relay action. The relay may be adjusted to provide several reclosures at predetermined time intervals, so that in case the breaker does not remain closed after the first reclosure additional reclosures will be made. The first reclosure is usually an instantaneous reclosure through preclosed contacts since system operating experience has shown that the majority of faults are temporary. Consequently, service interruption can be minimized by the use of an instantaneous reclosure. However, the first reclosure may be delayed if desired.

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

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

TYPE RCL MULTI-SHOT WITH AUTOMATIC RESET

The Type RCL relay is identical in application and functionality to Type RC discussed above except the RCL is not available with the Z-unit option. Also Type RCL is supplied in the smaller FT-21 case for installations where mounting space is a concern.

Construction

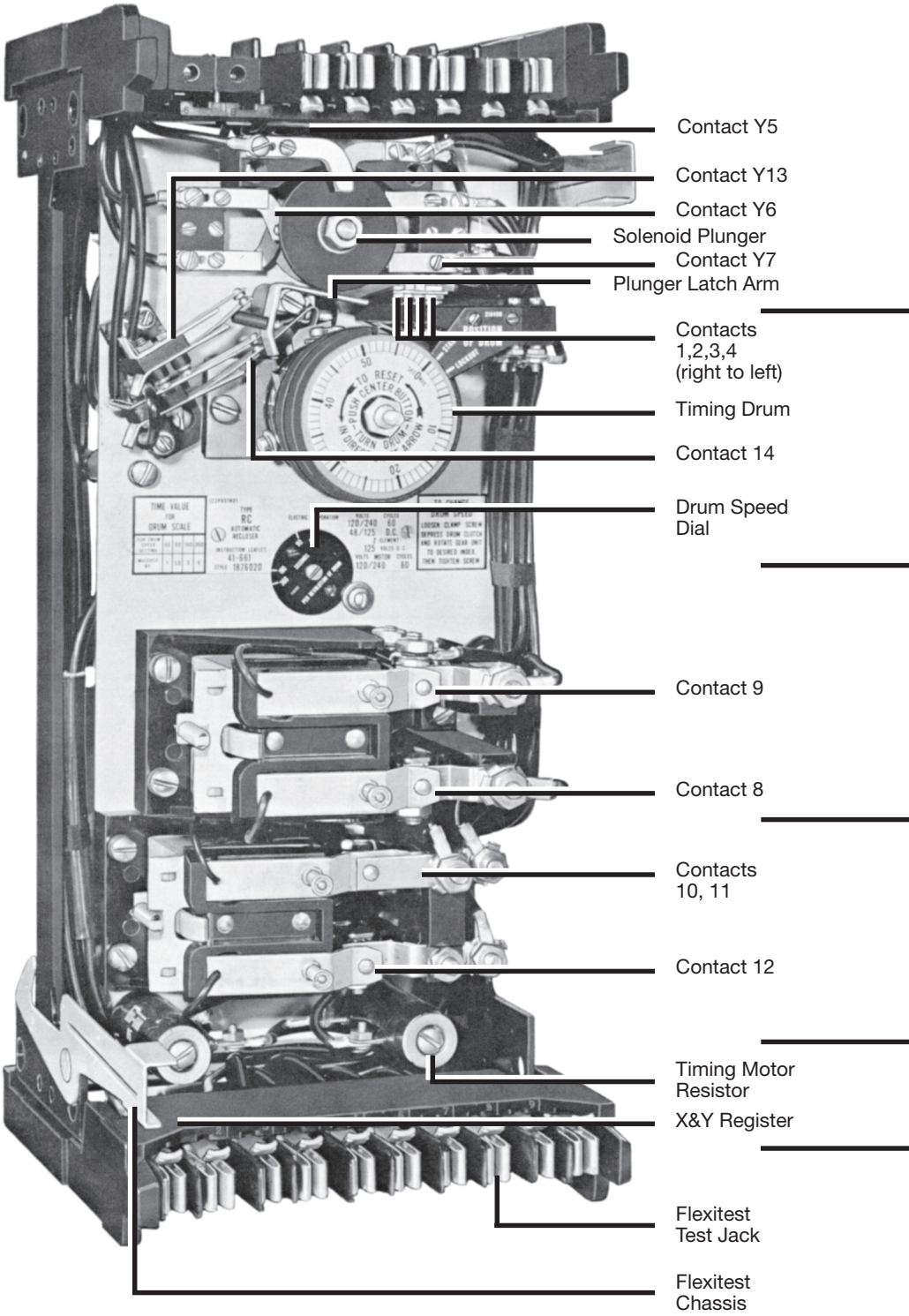


Figure 1

Y Solenoid Unit

The solenoid plunger has a voltage coil which will pick-up on 50% of its rated voltage on ac and 80% on dc. A copper shading ring on the inner face of the core screw prevents chattering of the plunger when ac is applied to the unit coil. Contact Y-6 will carry 3 amperes continuously and open 0.4 ampere at 125 volts dc.

Timing Unit

The timing unit consists of the timing drum, contact cams and associated contacts. The drum is driven by a synchronous motor through a gear train that allows selectable drum rotation speeds of 60, 90, 180 or 360 seconds per revolution. The indexed cam face permits the contact operating screws to be set at desired time intervals for the reclosing cycle. Contacts can be set for time-delay or instantaneous first reclosure. Minimum time delay setting between successive reclosures is six scale divisions of the timing drum. Minimum setting of #3 contact for time delay initial reclosure is one and one half seconds on 60 second drum speed.

X Contactor Unit

The X unit is similar to an open-type SG relay except that it is equipped with a voltage coil which will pick-up on 50% of rated ac voltage or 80% of dc rating. To prevent residual magnetism from causing restraint of armature drop-out after the coil is de-energized, the electromagnet core is plated with a non-magnetic material which provides a separation effect between armature and core.

Z Contactor Unit

When existing breaker installations are converted to automatic reclosing operation, a Z unit can be provided to avoid adding control wires. It consists of an open type SG relay unit with a continuously rated coil. Double throw contacts replace one "a", one "b" and one "bb" auxiliary switch contacts in the control scheme.

Resistors

Removable Flexitest chassis provides a ready access to all operating mechanism units and contacts for inspection or test purposes.

Flexitest Case

Series resistors are provide to operate the motor on 240 volts ac and to operate the X and Y units on 125 volts dc or 240 volts ac.

Timing Drum Assembly

The four stationary contacts of the drum assembly are similar in construction and are easily removable. Pure silver contacts with sufficient contact follow assure good contact operation with a minimum of maintenance.

The two front notched cams are adjusted at the factory to assure accurate operation of the No. 1 and No. 2 drum-actuated contacts. The periphery of the remaining three cams have a continuous grooves into which are inserted nuts which are free to slide to any position within the groove. Screws are inserted into the movable nuts and act as the contact actuating device.

A Micarta® block mounted on the rear of the No. 5 drum acts as a cam to actuate the No. 14 instantaneous trip lock-out contact.

Drum speed is selected by rotating the gear train assembly so as to mesh the proper gears for desired drum speed as indicated on the speed dial (Fig 1).

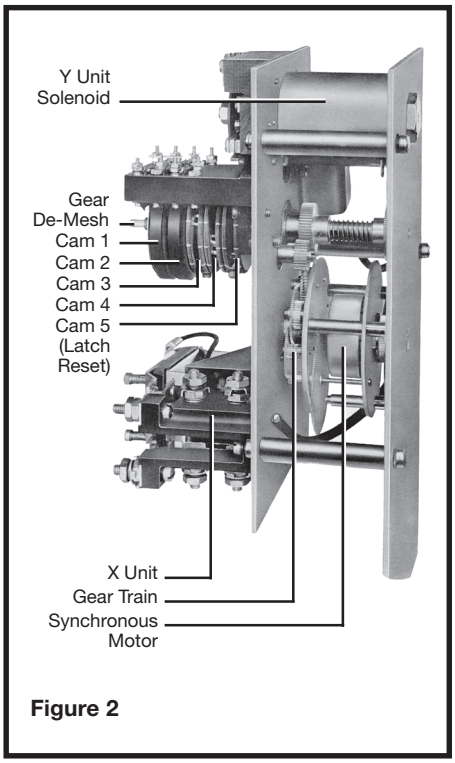


Figure 2

Internal Wiring

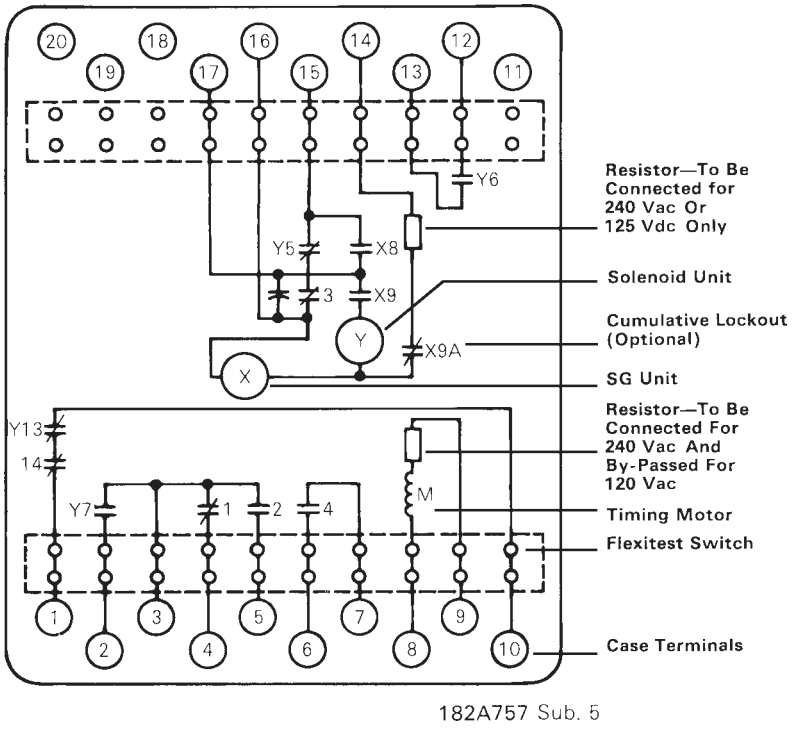


Figure 3: RC Reclosing Relay without Z Unit in FT-32 Case.

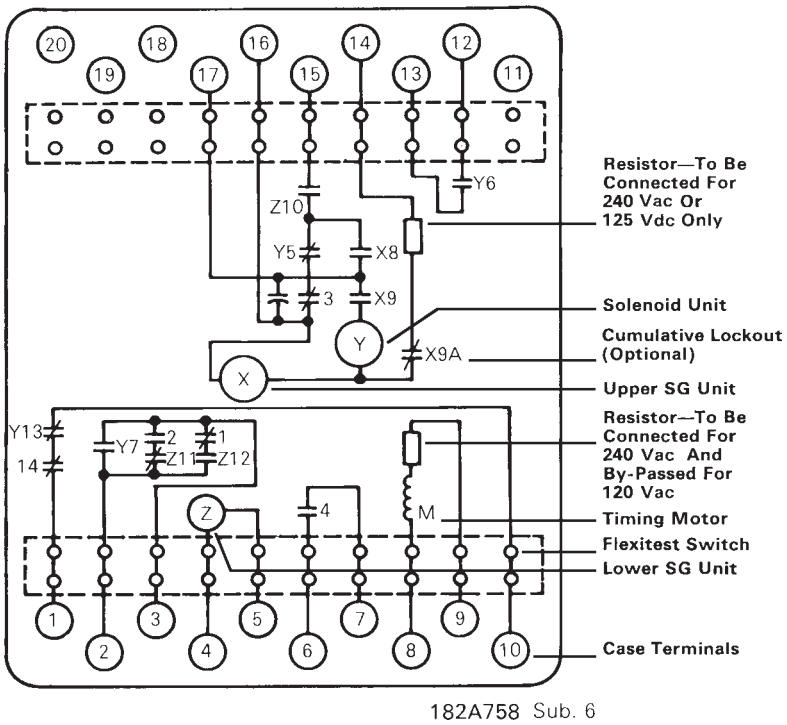


Figure 4: RC Reclosing Relay with Z Unit in FT-32 Case.

Figure 5: External Schematic of Type RC Reclosing Relay without Z Unit, Used in Ac Breaker Control Unit.

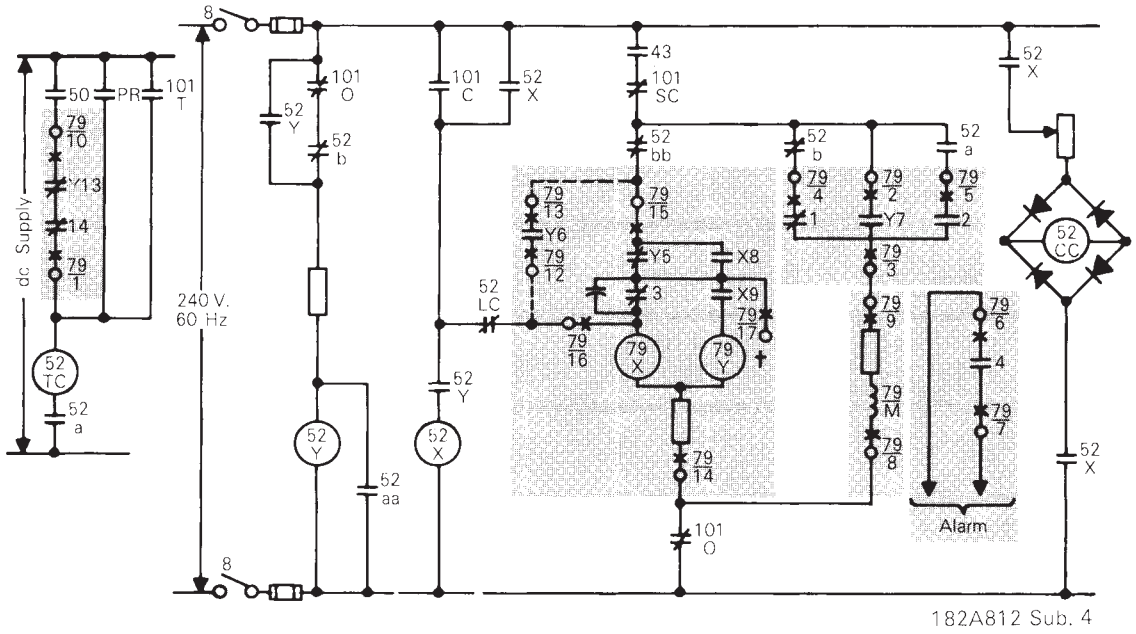


Figure 6: External Schematic of Type RC Reclosing Relay with Z Unit, Used in Ac Breaker Control Unit.

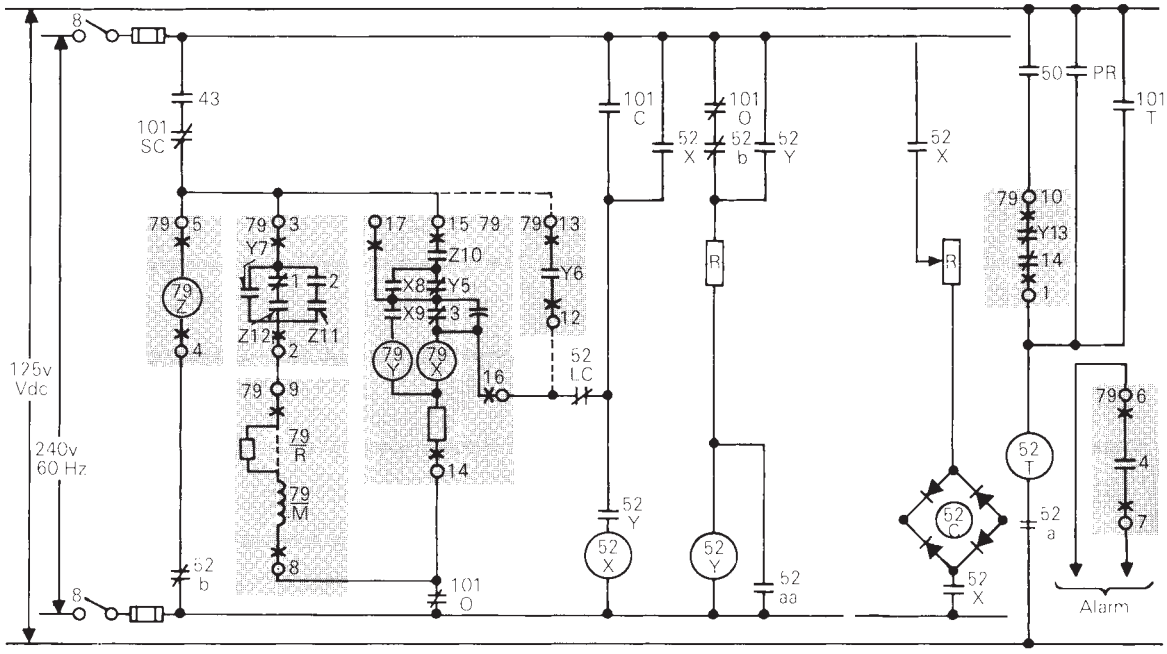


Figure 7: External Schematic of Type RC Reclosing Relay without Z Unit, Used in Dc Breaker Control Unit.

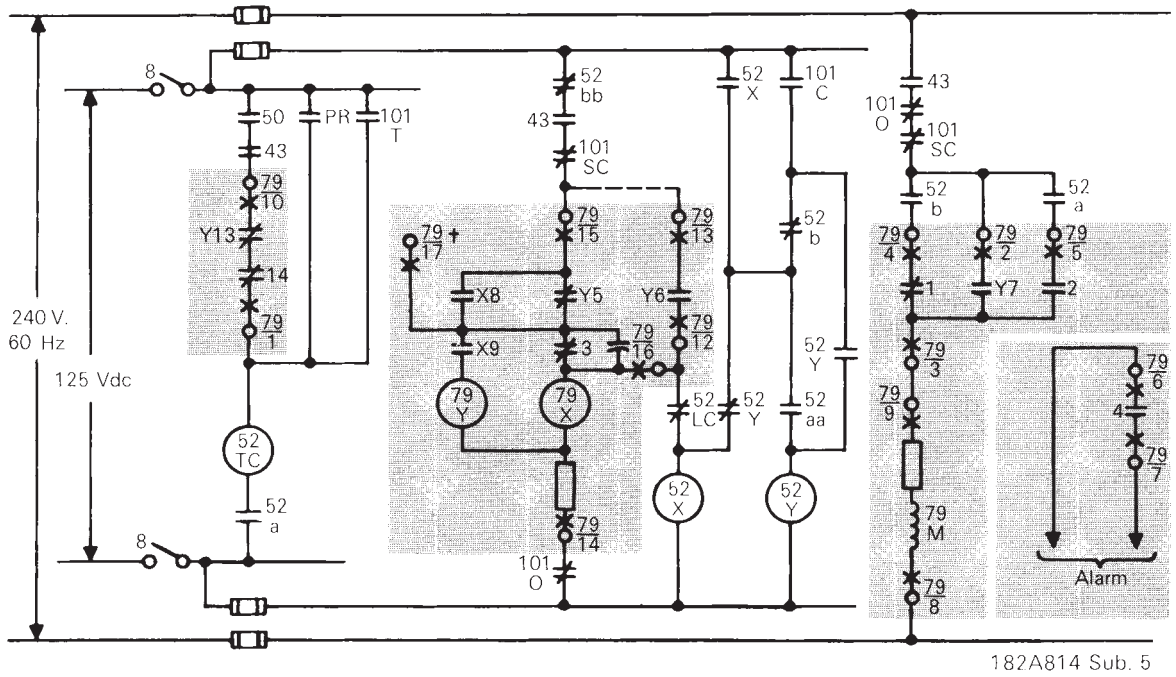
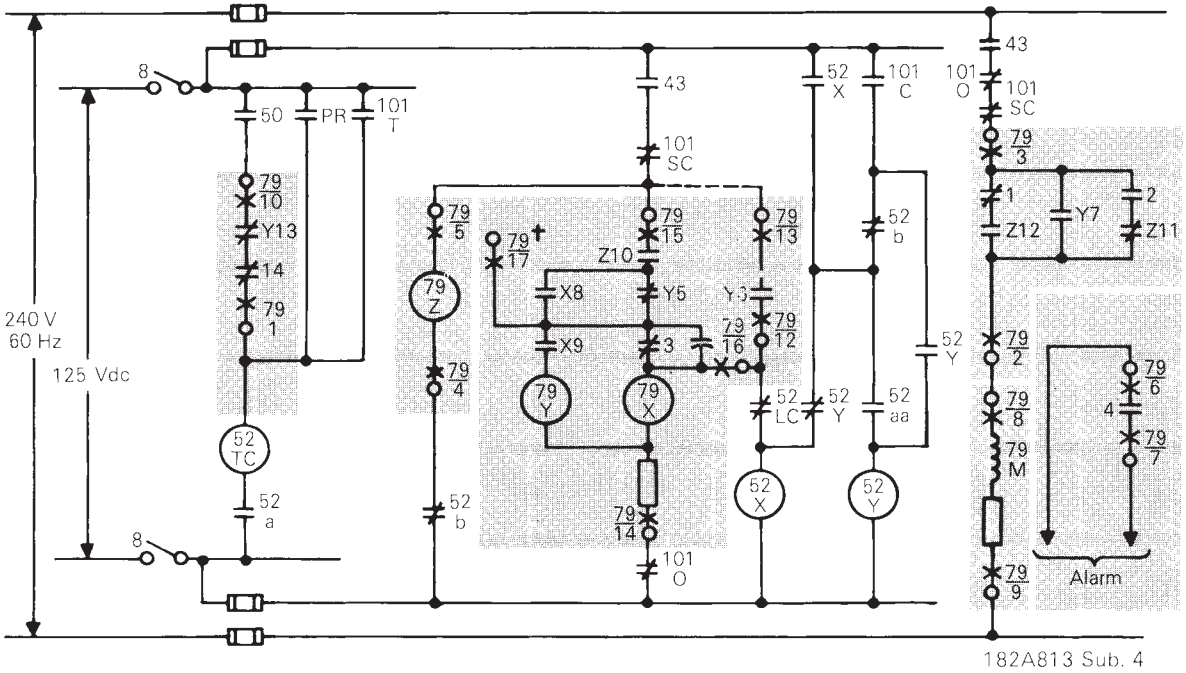


Figure 8: External Schematic of Type RC Reclosing Relay with Z Unit, Used in Dc Breaker Control Unit.



Conditional Reclosing

Application of a standard design RC relay to provide selective single shot automatic reclosing at unattended substation is discussed below. This relaying scheme, Figure 9, provides automatic reclosing of a circuit breaker on a previously faulted line at remote station, as soon as the line is successfully energized at another terminal.

The RC relay contact arrangement is set up so that the reclosing relay motor is stopped before the relay reaches the "lockout" position. Thus, it provides for one final reclosing operation after the faulted line is cleared and successfully energized on one side of the breaker.

In the event that dead-line live-bus reclosing is unsuccessful a synchro-verifier relay supervises closing of the breaker and initiates resetting of the reclosing relay to its "start" position, as soon as line trouble is cleared and the line is energized from an attended station.

Reclosing is completed when:

(1) Line and bus are in synchronism
(2) Bus is alive and line is dead
(3) Line is alive and bus is dead

Selective One Shot Instantaneous Reclosure

Referring to Figure 9, closing of high speed protective relay contact HS will energize coil 79Z-0 and trip coil 52T. 52T trips the breaker; 52a contact opens, 52b contact closes picking up 79-Z coil, closing the Z10 and Z12 contacts. 79X-0 contact closes to set up the instantaneous reclosing circuit through the breaker close coil. (Circuit via 43, 101/SC, 79-Z10, 79-Y5, terminal 17, 79Z-SX, 79Y13, 79-14, to the breaker close circuit. Breaker 52X contact energizes breaker close coil 52C).

Note that the above instantaneous reclosing is selective. It is always initiated by the high speed contact (HS), not the time-delay contact (BU) of the protective relay.

Instantaneous reclosing is attempted only when the line has been disconnected at both ends by high-speed relay operation, thus assuring that both ends of the line section are open.

Further instantaneous reclosing is blocked by the opening of contacts Y-5, &-13 or 14.

79-Y coil is energized as follows: contact 43, 101/SC, Z-10, Y-5, 79Z-SX, Y-13, 79X coil, contact 101/0. Closing of contacts X-8 and X-9 energizes 79-Y coil to open contacts Y-5 and Y-13, which blocks further instantaneous reclosing.

Conditional Time Reclosure

Future time reclosing will be only be made if one of the following conditions exist:

(a) Line and bus in synchronism:
If the line and bus remain in synchronism, the CVE-1 contact will close to energize the closing coil.

(b) Bus is alive and line is dead:
The bus voltage, Unit V_1, will be de-energized and the Unit V_2 will be de-energized. The breaker close circuit will be energized through the N.O. contact of V_1 and the N.C. contact of V_2.

(c) line is alive and bus is dead:
V_2 N.O. and V_1 N.C. contacts provide the closing path.

In the above three cases, the reclosing relay multiple-contact drum will start to rotate when the reclosing relay motor is energized.

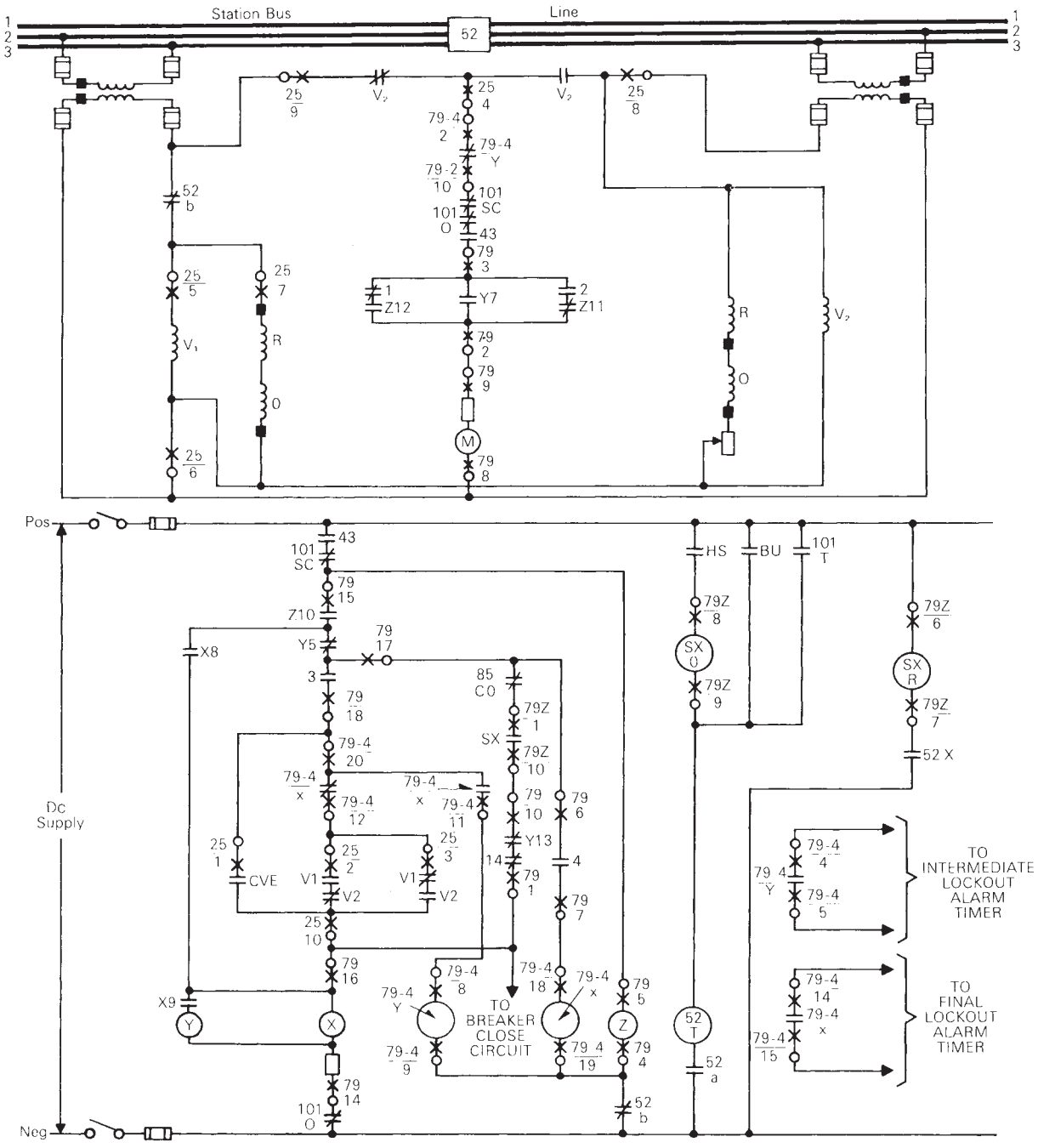
During a time-delay reclosure operation: when 79-3 cam contact closes, coil X is energized through contact circuit 43, 101/SC, Z10, Y5, 8, 101/0 to close contacts X8 and X9. X8 seals in coil X and X9 contact energizes Y coil.

Also during this time, the breaker close circuit is energized.

The RC relay No. 4 is arranged on the rotating drum so that it is closed just prior to the last (3) contact closure. Thus, when drum contact 4 is closed, coil 79-4X will be energized and back contact 79-4X in series with the voltage closing contacts will open to lock out the reclosing relay on a permanent line fault. Synchronism-check reclosure will then be allowed through the 3 contact after the fault has been removed and the line has been energized from the remote end.

If the breaker is manually closed by control switch contact 52b opens and de-energizes 79-4Y which allows the motor (M) to rotate the drum to the start position. 79-2 contact opens to stop the motor.

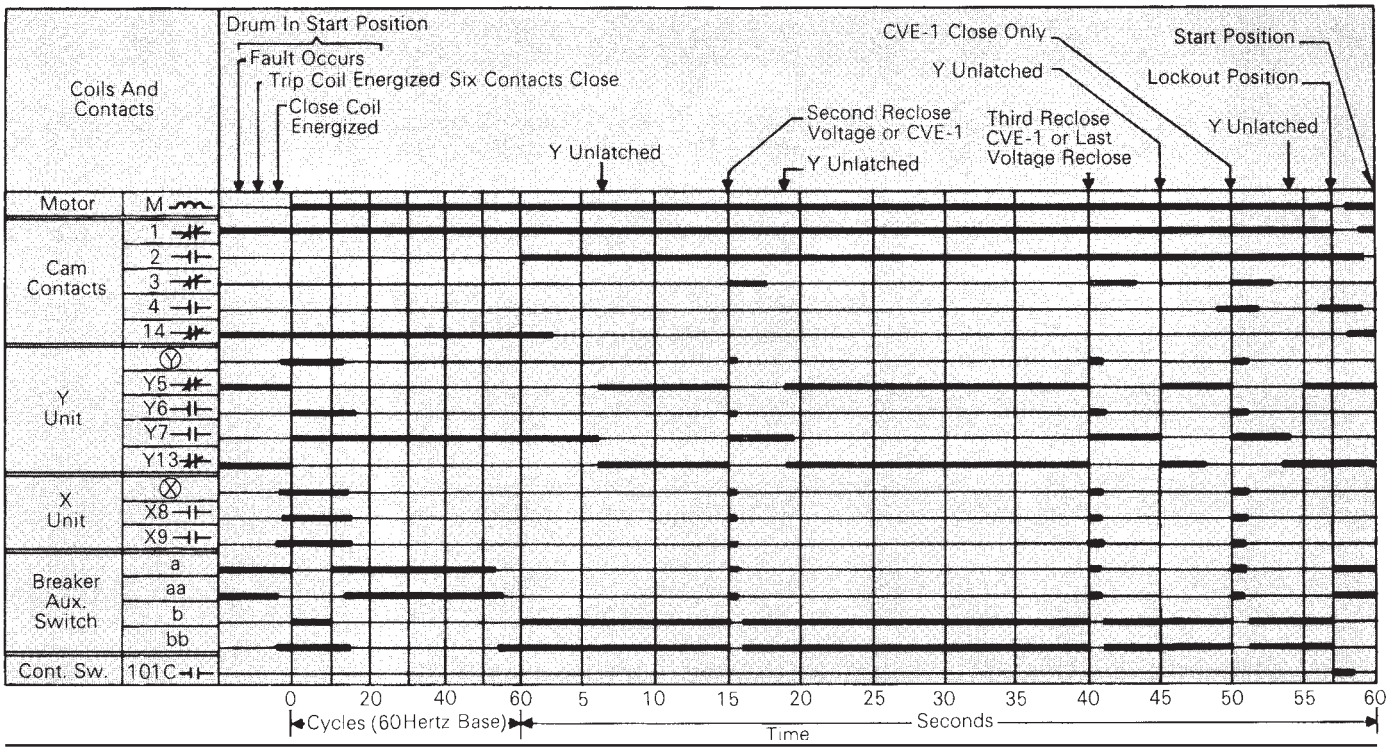
Figure 9: Automatic Reclosing with RC and CVE-1 Relays.



Device Number Chart

25—CVE-1 Relay
43—Recloser Sw.
52—Circuit Bkr.
79—RC Relay
79Z—SX Relay
79-4—SG Relay (2 Unit)
HS—H. S. Protective Relay
BU—Backup Protective Relay
85CO—Carrier Cont. Sw.
101—Control Switch

Figure 9: Contact Position Development - Heavy Line Indicates Contacts Closed or Coil Energized.



408C823 Sub. 2

Characteristics

Relay Type	Unit	**Burden**						**Pickup Values in % of Ratings**		**Thermal Capacity**
		60 Hertz Supply				Dc Supply				
		Volt-Amperes				Volts	Watts	On Ac	On Dc	
		Open Position		Closed Position		Closed				
		120 V Ac	240 V Dc	120 V Ac	240 V Dc	Position				
RC	X Unit	49	..	33	..	…	…	50	80	5 minutes
	Y Unit	151	..	84	..	…	…	50	80	5 minutes
	Z Unit	17	..	10.5	..	125	8.5	80	80	Continuous
	Timer Motor	8.5	..	8.5	..	…	…	80	..	15 minutes

Burdens of the X and Y units occur only momentarily during reclosing cycle: these units are for intermittent duty only. The motor is energized for the duration of the reclosing cycle.

For 208 volts phase-to-phase, use standard 240 volt relay.

Note: On 208 volt, 60 hertz applications, pickup values are as follows:
(a) X and Y coils - 60% ac of rating
(b) timing motor- 90% of rating

Shipping Weights and Dimensions

Relay Type	Case	Weight. Lb.		Domestic Shipping Carton. In.
		Net	Shipping	
RC	Flexitest FT-32	22	27	13 x 13 x 21

Further Information

List Prices: PL 41-020
Technical Date: TD 41-025
Instructions: IL 41-661.1 and IL 41-661.2
Renewal Parts: RPD 41-661A1
Flexitest Case Dimensions: DB 41-076
Dc to Ac Inverter: DB 41-082

Multiple Reclosure, Automatic Reset (Device Number:79)

Type	Contacts	Ratings: Volts			Relay Data		
		Timer ④	Auxiliary Units		Internal Schematic	Style Number	Case Size
			X and Y	Z (Coils)			
RC	cc and co	120/240 ac	120/240 ac and 48/125 dc	None	3536A64	1346D28A01 Ⓢ	**FT-32**
				48 dc	3536A66	1346D28A12	
				125 dc	3536A66	1346D28D09 Ⓢ	
				120 ac	3536A66	1346D28A20	
				240ac	3536A66	1346D28A19 Ⓢ	
		24 dc		None	3536A64	1346D28A03	
		250 dc		None	3536A64	1346D28A02	
RCL	cc and co	120/240 ac	120/240 ac and 48/125 dc	None	3537A57	1351D35A01	**FT-21**
			24 dc	None	9640A56	1351D35A03	
			250 dc	None	9640A56	1351D35A02	

Motor Ratings: for 125 or 250 volts volt dc timer motor operation, order dc to ac inverter (see DB 41-082). Potentiometer required on 250 volt dc operation.

Ⓢ Denotes item available from stock.

④ From on to six closing attempts with adjustable speed from instantaneous to 80, 90, 180 or 360 seconds before lockout depending on the adjustment selected. Reset is not independently adjustable and is determined by the operating time selected.

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