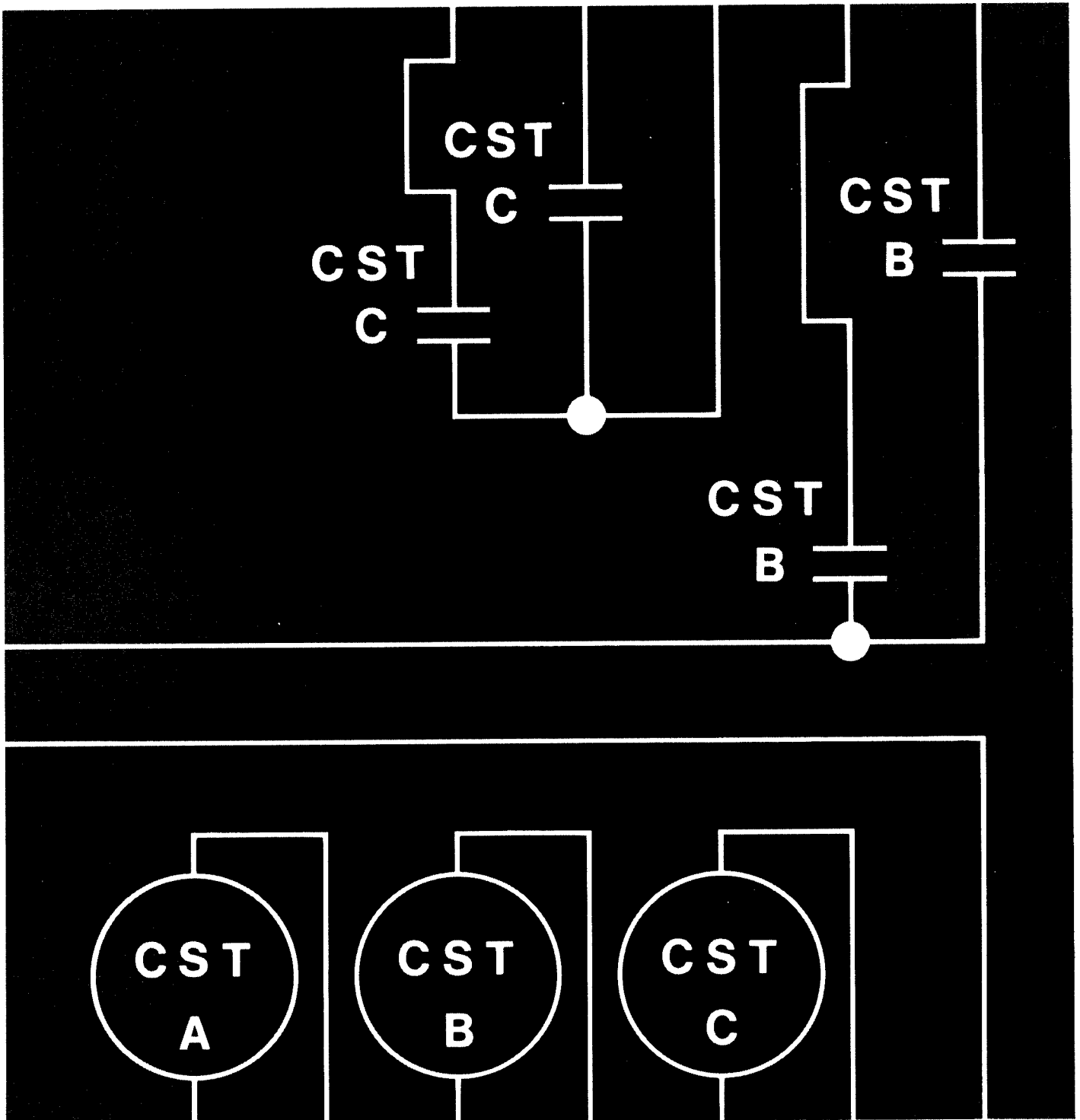


September, 1990
Supersedes DB 41-750C, pages 1-12,
dated December, 1987
Mailed to: E, D, C/41-900A

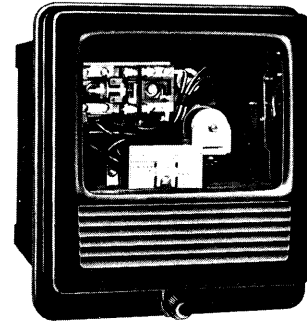
For Ac or Dc Voltage or Dc Current Operation
Device Number: 79, Type SX
Device Number: 94, Type TR-1

Types SX, TR-1, TRB-1, TRB-2, TRB-3, TRB-4 Auxiliary Relays



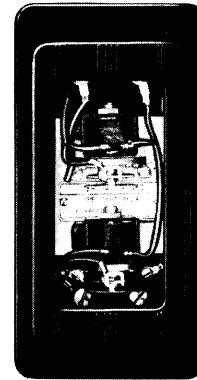
Selector Guide

Type	Typical Applications	Operation Activated By:	Basic Operation and Construction Features	Pages
SX	High speed selective reclosing. Energization of multiple control circuits. Flexibility of contact arrangement; such as opening and closing several circuits simultaneously.	Ac or dc voltage, or dc current	High speed toggle type. Positive toggle action keeps contact closed until reset coil is energized. With or without time delay on reset. Spst, spdt, dpdt contacts.	3-5
TR-1	Energization of multiple control circuits.	Dc current.	Has four contacts available for trip circuits Non-adjustable.	6-9
TRB-1	Blocking valve to allow trip current flow in one direction only.	Dc voltage	Energized by protective relay.	10-12
	Test unit for HU and HU-1 transformer differential relay harmonic restraint circuit.	Ac 60 Hertz source		
TRB-2 TRB-3 TRB-4	Solid state tripping units.	Dc voltage.	Blocking zeners.	10-12



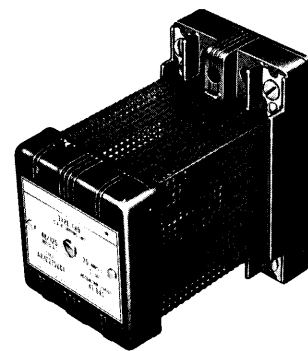
Type SX

Fig.1



Types TR-1

Fig.2



Types TRB-1, 2, 3, 4

Fig.3

Type SX, Ac or Dc Voltage Operated, or Dc Current Operated (With or Without time Delay on Reset)

Type SX relay is a toggle type relay intended for auxiliary service where the relay contacts should operate and not reset until reset coil is energized. An automatic time delay on reset of 5 to 15 cycles may be obtained using relays supplied with a telephone type relay unit (X).

In a typical application, the type SX relays are used to provide selective reclosing where the breaker is instantaneously reclosed only after it is tripped by the carrier or instantaneous trip relays. The typical connections of this scheme are shown in Fig. 12. The instantaneous or carrier trip circuit No. 1, and operates the series operating coil of the type SX relay. This closes the type SX relay contact to initiate reclosing. All the other trip circuit paths are combined in trip circuit No. 2 which bypasses the type SX relay operating coil.

The type SX relay stays operated until the reset coil is energized. After the reclosure is completed, a switch on the breaker auxiliary contactor energizes the reset coil for subsequent operations.

The SX relay is available in the Flexititest® FT-11 (single unit) or FT-22 (double unit) case, or the small glass projection case (single unit).

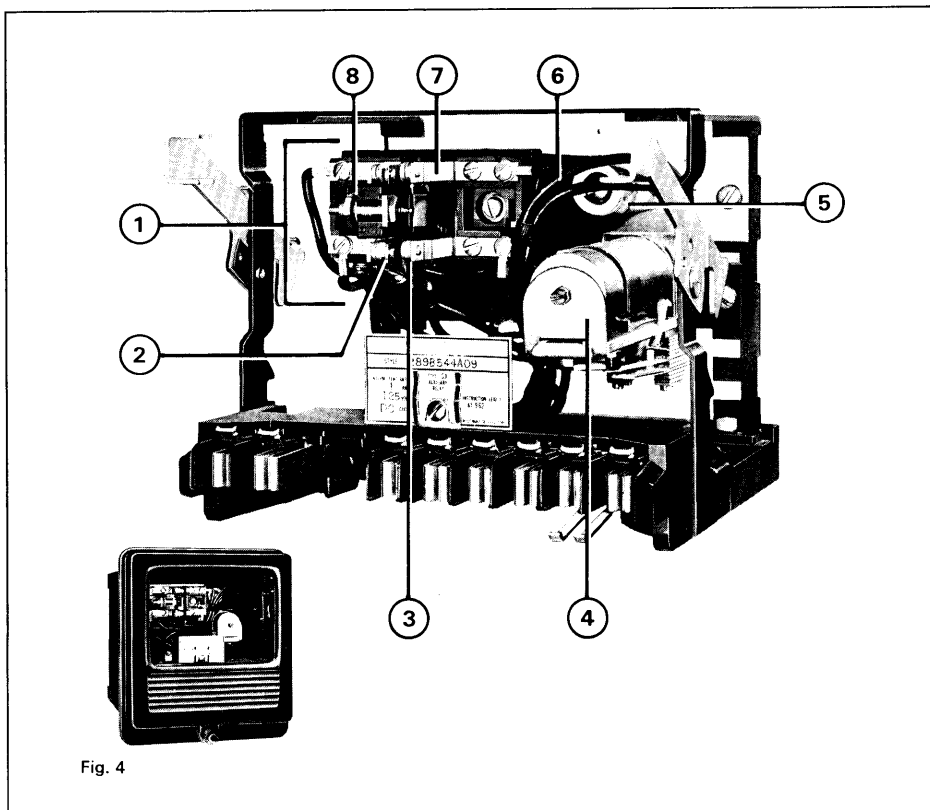


Fig. 4

1 Toggle Element

When the operating coil is energized, its armature is toggled to the right, with the moving contact closing against the right-hand stationary contact. This contact position is maintained until the reset coil is energized.

2 Moving Contact

3 Stationary Contact

4 Telephone Relay

Provides an adjustable time delay on reset over a range of 5 to 15 cycles.

5 Resistor

6 Operate Coil

7 Hinged Armature

8 Reset Coil

Characteristics

Contacts

The SX relay is supplied with double-pole double-throw (dpdt) contacts.

Operate and Reset Coils

Operate and reset coils are available in any combination of the following ratings:
Ac: 120 or 240 volts, 50 or 60 hertz (for intermittent duty only).
Dc: 125 or 250 volts, or for 1, 5, or 10 amperes dc (continuous duty).

Toggle Unit

The toggle unit operates at 80% of rated voltage, or 90% of its rated current.

Selective Reclosing Relays

Relays used for selective reclosing are usually provided with a 1-ampere operating coil having 1-watt power consumption. This coil is used in order to keep the resistance in series with the trip coil at as low a value as possible.

Operating Time

When energized from a dc source through a resistance load and using a 1-ampere coil, operating time is as follows:
At Rated Current27 ms
At 300% of Rated Current8 ms
At 2000% of Rated Current5 ms
When energized from a 120 volt, 60 hertz source, operating time is less than 16 ms.
When energized from a 125 volt dc source, operating time is less than 33 ms.

Burden Data

DC
At Rated Voltage5.5 watts
At Rated Current1.0 watts
Ac (120 Volts, 60 Hertz)
Open Gap20 volt-amperes
Closed Gap16 volt-amperes

Continuous Rating5 amperes

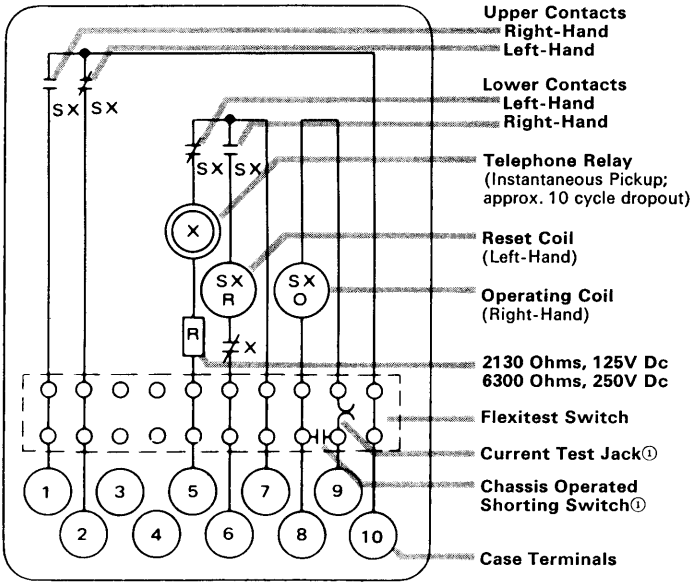
Ac Contact Interrupting Capacity (Non-Inductive)

At 120 Volts20 amperes
At 240 Volts10 amperes

Dc Contact Interrupting

Capacity625 watts

Type SX, Internal Wiring
Flexitest Case Types (Front View)
Single Unit, Spdt Contacts, Time Delay Reset,
Current Actuated, FT-11 Case



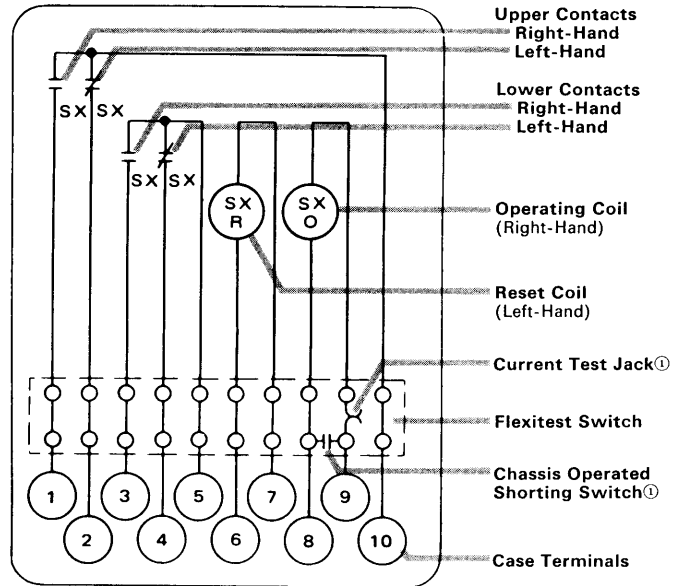
(Contacts shown in the reset position)

①For selective reclosing scheme only.

Fig. 5

Sub. 2
184A180

Single Unit, Dpdt Contacts,
Current Actuated, FT-11 Case



(Contacts shown in the reset position)

①For selective reclosing scheme only.

Fig. 6

Sub. 1
184A178

Contact Legend

- Cc: Circuit Closing
- Co: Circuit Opening
- Spst: Single-Pole Single-Throw
- Spdt: Single-Pole Double-Throw
- Dpdt: Double-Pole Double-Throw

Small Glass Projection Case Types (Rear View)

Independent cc Contacts

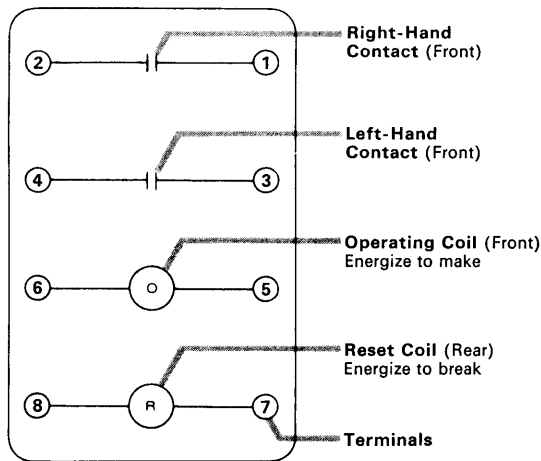
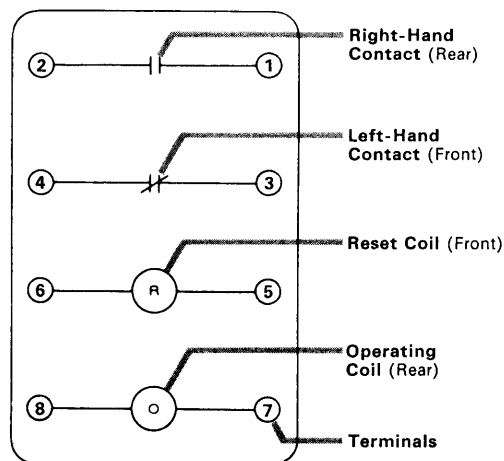


Fig. 9

Independent 1 Make, 1 Break Contacts

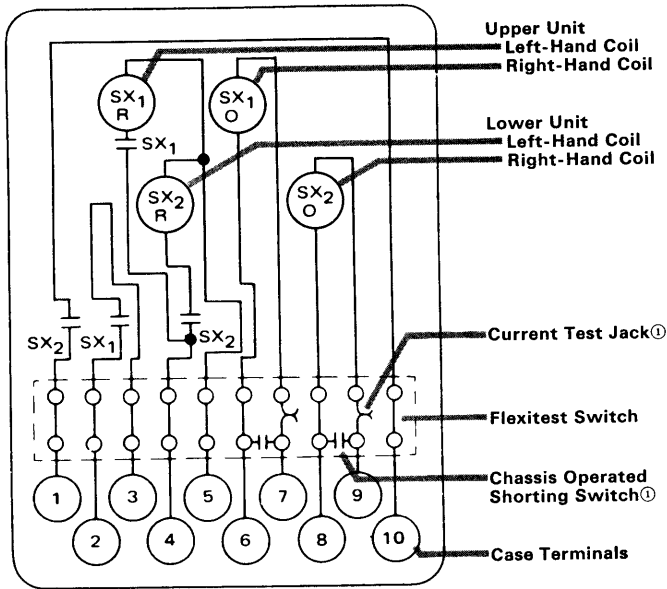


(Contacts shown in the reset position)

Fig. 10

Sub. 2
184A254

**Double Unit, Contacts Selective Reclosing,
Current Actuated For Dc Operation, FT-11 Case**



① For selective reclosing scheme only.

Fig. 7

Sub. 2
184A214

**Double Unit, Dpdt Contacts
Voltage Actuated, FT-22 Case**

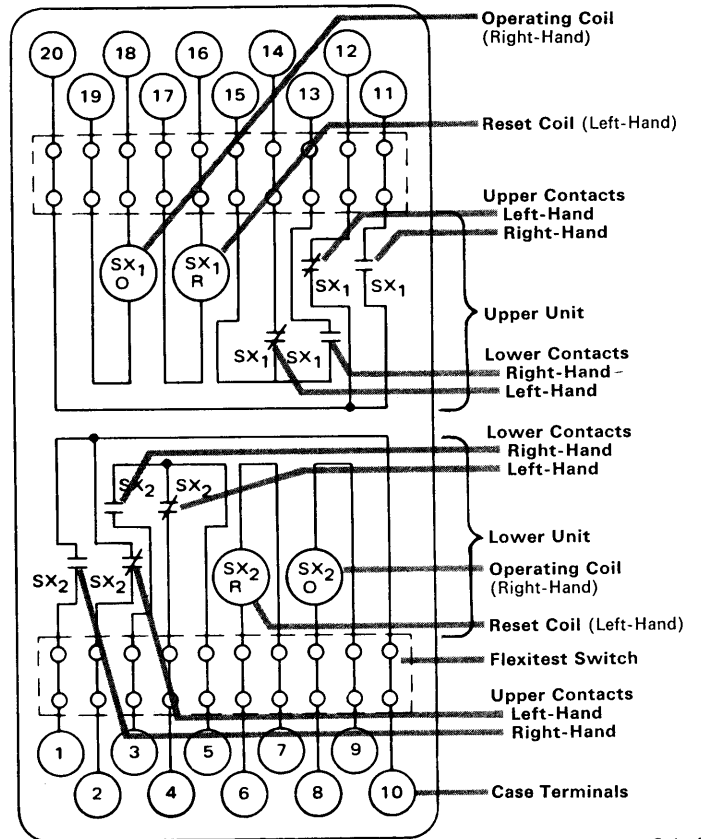
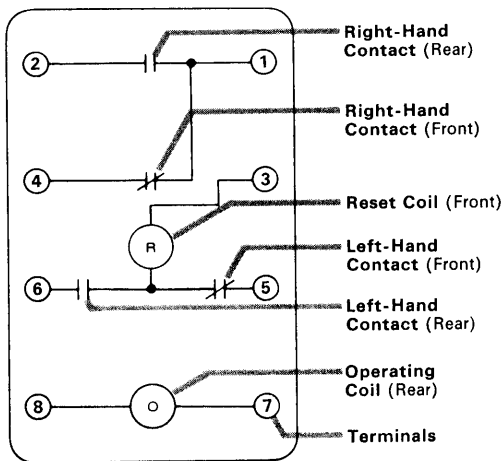


Fig. 8

Sub. 1
184A213

**Independent Make-Break Contact
and Reset Coil Interrupting Contact**

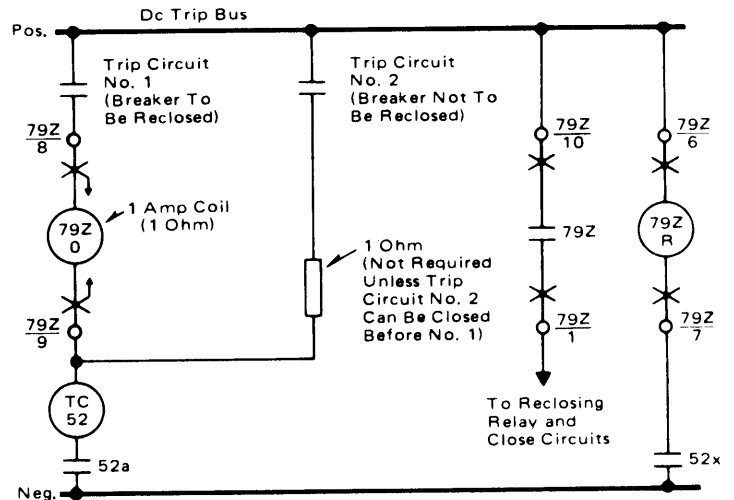


(Contacts shown in the reset position)

Fig. 11

Sub. 2
184A354

Type SX External Wiring



Device Number Chart

- 79Z—Auxiliary Reclosing Toggle Relay, Type SX
- 52—Power Circuit Breakers
- a—Breaker Auxiliary Contact
- TC—Breaker Trip Coil

Fig. 12

Sub. 1
184A253

Type TR-1 Auxiliary Tripping and Indicating Relay

Type TR-1

This is an auxiliary relay energized by protective relays to trip two circuit breakers. Sufficient contacts are provided to seal in both trip circuits until the breaker auxiliary switches operate.

Operation indication can be provided by targets which drop whenever the switch units within the relay operate.

Construction and Operation

Type TR-1

The TR-1 is available with one or two direct-current double-trip Indicating Contactor Switch (ICS) units.

Upon operation of the relay, the ICS indicator targets drop to indicate the relay's operation. The targets are manually reset by means of a push rod located in the bottom of the cover.

The TR-1 is also available with one or two dc non-indicating contactor switches with coils in series.

The coils of the contactor switch units (either indicating or non-indicating) are connected in series and energized through the trip contacts of the protective relays. The contacts of one unit seal in the trip circuit and trip one breaker. The contacts of the other switch are for tripping a second breaker.

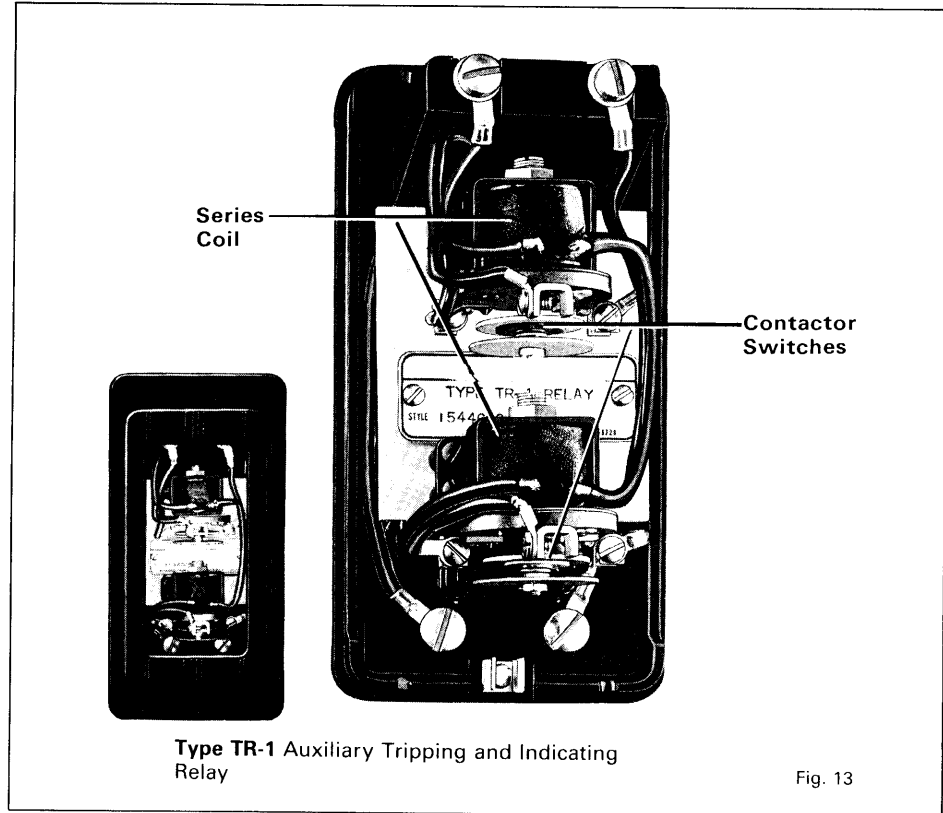
It is necessary to add resistance in the ICS unit coil circuit to limit current in these coils. This is accomplished by connecting the coils in series with an external resistor.

For the 1 ampere ICS unit relay, 22 ohms are used for a 125 volt dc trip circuit, and 44 ohms for a 250 volt dc trip circuit.

For the 0.2/2.0 ampere ICS unit relay, a 100 ohm mid-tap resistor is used for a 125 volt dc trip circuit, and a 200 ohm mid-tap resistor for a 250 volt dc trip circuit.

With these resistance values, the operating time of the relay is approximately 12.5 ms.

The relay case may be either the Flexitest FT-11 or the molded base type with glass window cover.



ICS Unit Characteristics

Tap Rating: Amps Dc	Tap	Coil Rating: Amps Dc		Trip Circuit Constants (Ohms dc Resistance)
		1 Second	Continuous	
1.0	—	140	5	0.1
0.2/2.0	0.2	11.5	0.4	6.5
	2.0	88.0	3.2	0.15

External Resistors, Outline Dimensions (Inches)

22 Ohms

Style Number 1164 990

40 Ohms for 48 Volts Dc, Style Number 290B664G48

100 Ohms for 125 Volts Dc, Style Number 1955 870

200 Ohms for 250 Volts Dc, Style Number 1955 871

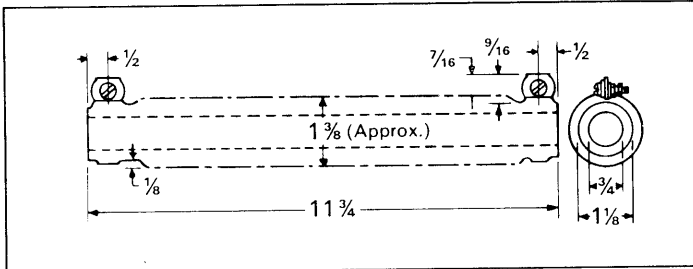


Fig. 14

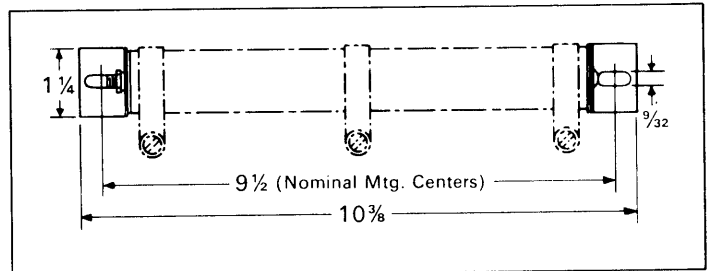


Fig. 15

Typical Wiring Diagrams

FOR 1.0 AMP ICS TAP

$$I = \frac{E}{R} = \frac{125}{22.2} = 5.63 \text{ AMPS}$$

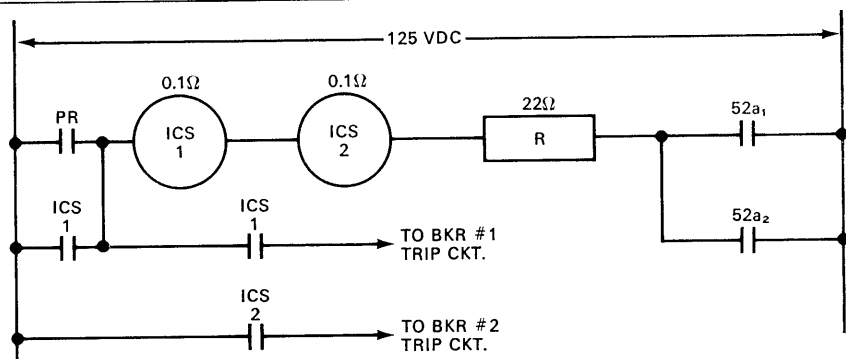


Figure 16

FOR 0.2 AMP ICS TAP

$$I = \frac{E}{R} = \frac{125}{113} = 1.11 \text{ AMPS}$$

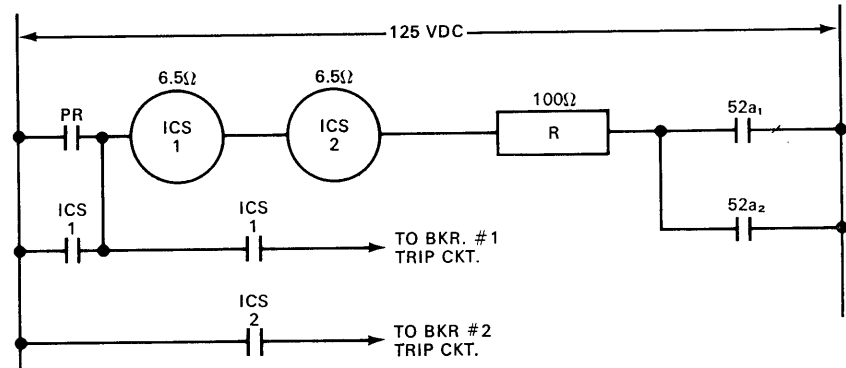


Figure 17

FOR 2.0 AMP ICS TAP

$$I = \frac{E}{R} = \frac{125}{25.3} = 4.95 \text{ AMPS}$$

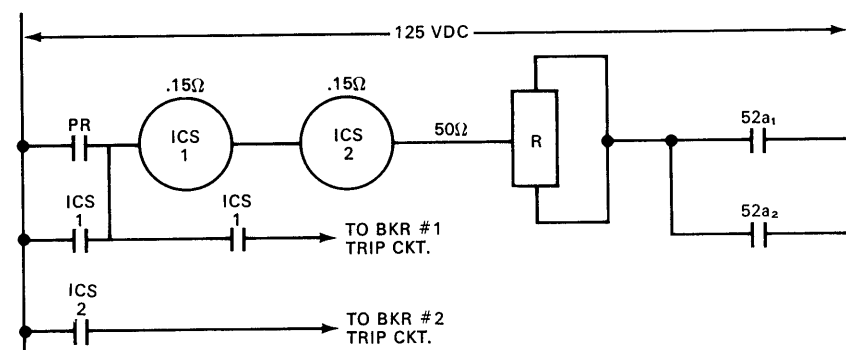


Figure 18

Type TR-1 Internal Wiring
Flexitest Case Type (Front View)
Type TR-1, Double Element,
2 cc Contacts Per Element, FT-11 Case

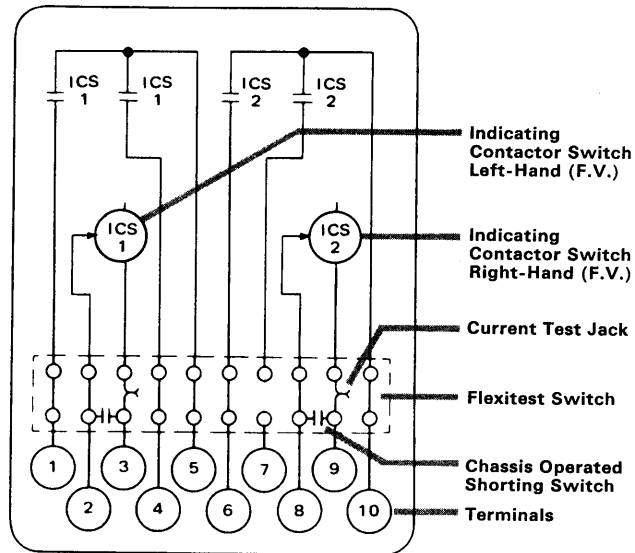


Fig. 19

Sub. 2
 183A356

Internal Schematic of Type TR-1 Relay with one
0.2-2.0 ampere ICS unit in molded base, glass
window cover, case.

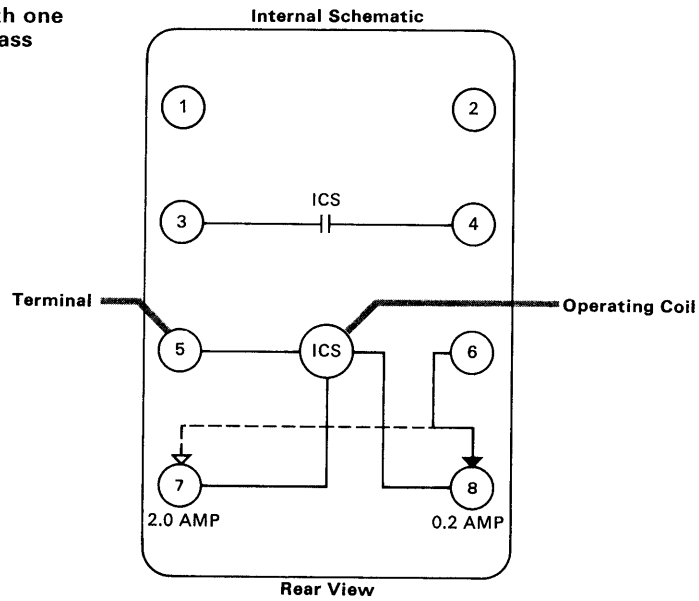


Fig. 20

836A926

Molded Base Types (Rear View)
Type TR-1, Single Trip, 2 cc Contacts,
Projection Mounted

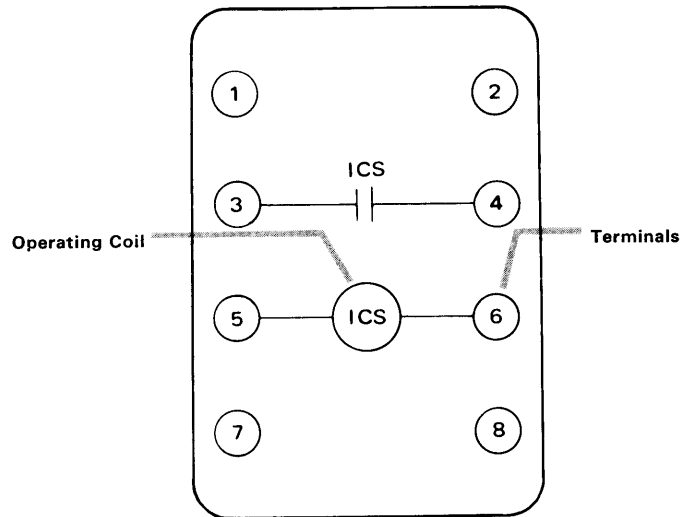


Fig. 21

Sub. 1
837A026

Type TR-1, 2 cc Contacts,
Semi-Flush Mounted

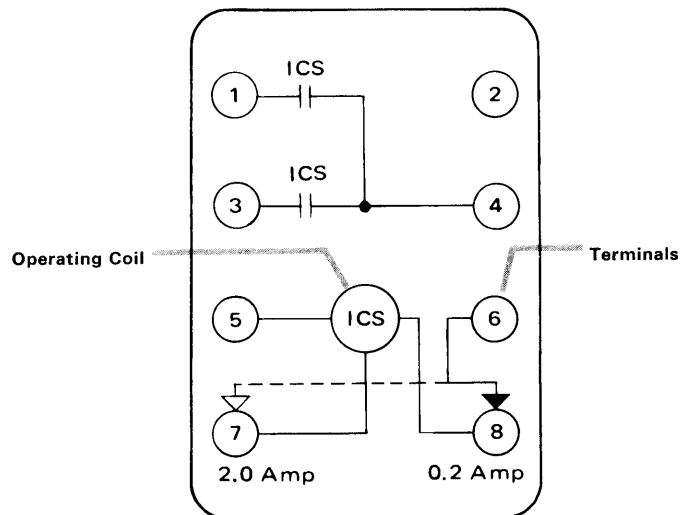


Fig. 22

Sub. 1
836A799

Type TR-1, 2 Element, 2 cc Contacts Per Element
Projection or Flush Mounted

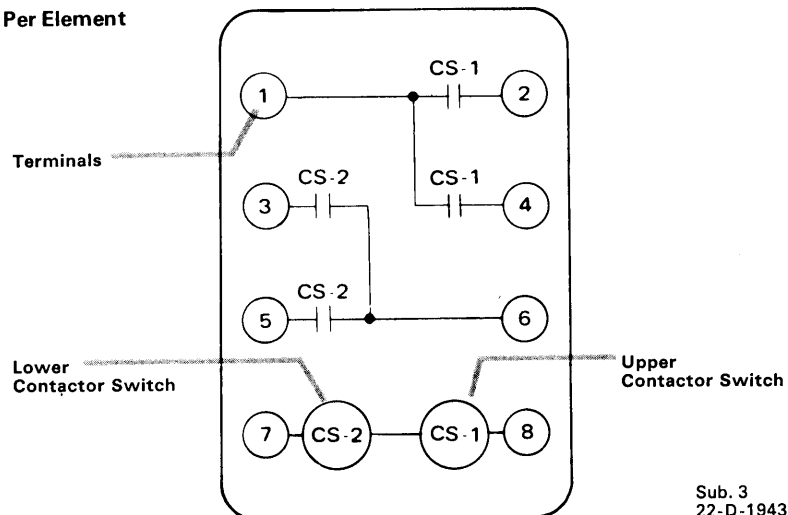


Fig. 23

Sub. 3
22-D-1943

Types TRB-2, TRB-3, TRB-4, Solid State Tripping Units

Type TRB-1, Blocking Valve and Type TRB-1 Test Unit

TRB-2, TRB-3, and TRB-4 solid state tripping units are auxiliary devices energized by protective relays. They provide for selective and double tripping of circuit breakers where the total trip current of the two breakers is within the relay contact rating (usually 30 amperes dc).

The TRB-1 blocking valve is an auxiliary device which is applied as a directional valve in a relaying scheme.

The TRB-1 test unit is primarily applied as a second harmonic generator for testing the harmonic restraint unit of HU and HU-1 transformer differential relays.

- ① Capacitor
- ② Silicon Rectifier
- ③ Terminal
- ④ Zener Diodes

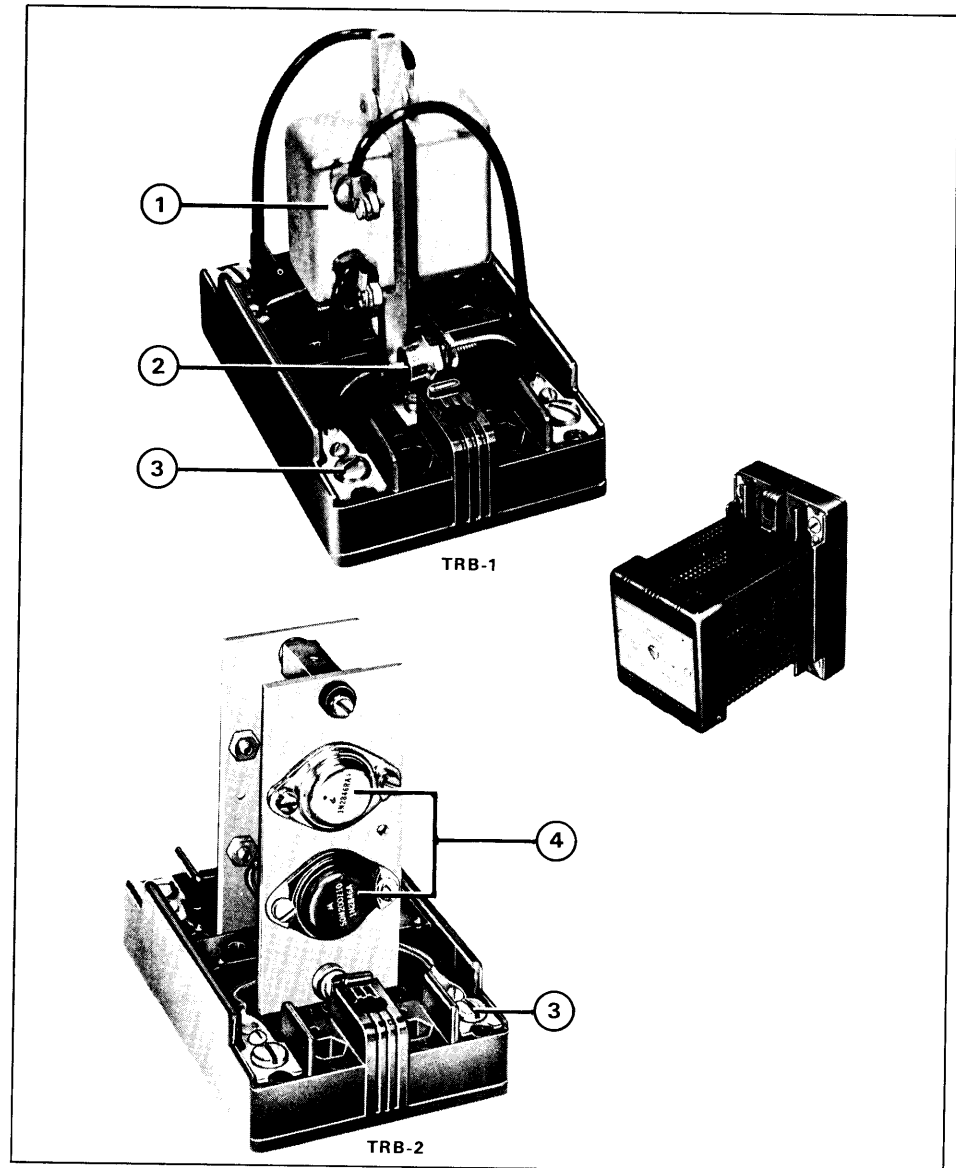
**Construction and Operation
TRB-2, TRB-3, TRB-4**

These units consist of the requisite number of 50 watt Zener diodes mounted on brass plates contained within a short metal cage and mounted on a small molded base.

Transient voltages induced into the diode circuit in excess of their reverse blocking rating can be tolerated without damage to the diodes. This feature results from the Zener characteristic which allows current to flow in the reverse direction and limits voltage across the diode.

TRB-2

The TRB-2 consists of two 50-watt Zener diode circuits which are completely independent of each other. It is used to selectively trip two circuit breakers by their respective protective relays, and also allow tripping of both circuit breakers by a common protective relay.



TRB-3

This relay contains three Zener diodes, two of which have a common anode and separate cathode terminals. The third Zener diode is completely independent of the other two.

TRB-4

TRB-4 units contain four Zener diodes in two independent circuits, each of which has two diodes with a common anode terminal and separate cathode terminals.

TRB-1 Blocking Valve

This unit consists of a single silicon rectifier and one capacitor mounted in a small molded case. It is energized through the protective relay trip contacts, in such a way that trip current is allowed to flow in one direction and is blocked in the opposite direction.

TRB-1 Test Unit

Consists of a single silicon rectifier mounted in a small molded case which is energized by an ac 60 hertz source. See figure 30.

Internal Wiring Diagrams (Front View)

TRB-1 Test Unit

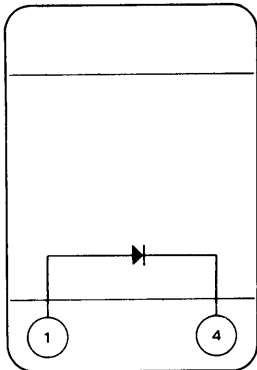
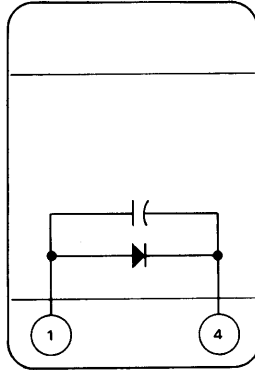


Fig. 24

TRB-1 Blocking Valve



Sub. 2
184A234

Fig. 25

**TRB-2 Zener Tripping Unit
125 Volts Dc**

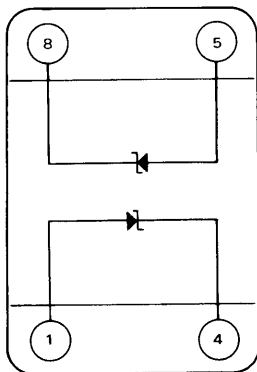
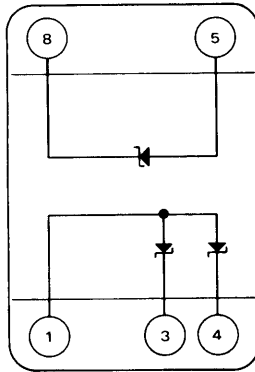


Fig. 26

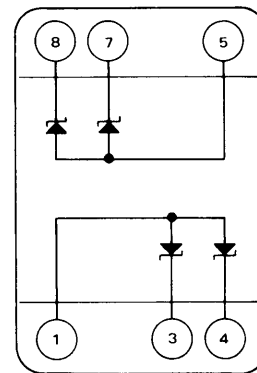
**TRB-3 Zener Tripping Unit
125 Volts Dc**



Sub. 1
187A696

Fig. 27

**TRB-4 Zener Tripping Unit
125 Volts Dc**



Sub. 1
187A697

Fig. 28

Sub. 1
187A698

Characteristics

TRB-1

Type	Rated Circuit Volts	Diodes per Case	Maximum Volts	Leakage Current			Maximum Forward Voltage Drop
				At Maximum Volts		At Circuit Volts	
				Nominal At 25°C	Maximum At 150°C	Nominal at 25°C	
TRB-1 Blocking Valve	48/125 dc	1	300	2 microamperes	1.75 milliamperes	1 microampere	1.25
	250 dc	1	600	2 microamperes	1 milliamperes	1 microampere	1.25
TRB-1 Test Unit	120 ac	1	300	—	—	—	—

TRB-2, TRB-3, TRB-4

Type	Rated Circuit Volts	Diodes Per Case	Maximum Reverse Leakage Current	Zener Reverse Voltage	Maximum Zener Current	Maximum Forward Voltage Drop
TRB-2	125 dc	2	4 milliamperes	200 ± 10%	75 milliamperes	1.5
	250 dc	4	4 milliamperes	400 ± 10%	75 milliamperes	3.0
TRB-3	125 dc	3	4 milliamperes	200 ± 10%	75 milliamperes	1.5
TRB-4	125 dc	4	4 milliamperes	200 ± 10%	75 milliamperes	1.5

Current Rating (All Types) 1-Second: 30 amperes dc, Continuous: 5 amperes dc

**Type TRB-2
Typical External Wiring Diagram**

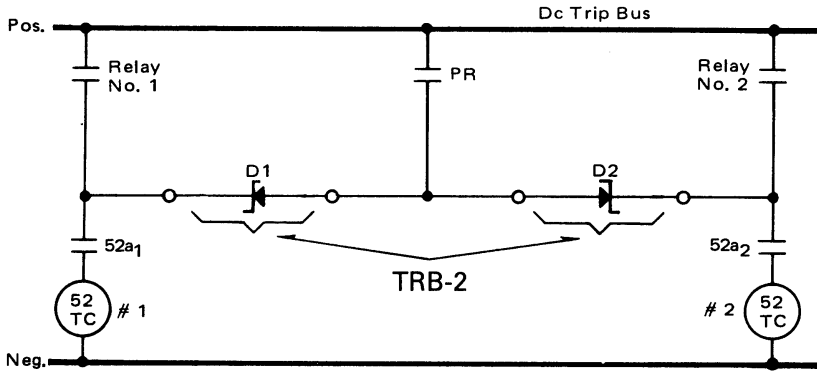


Fig. 29

187A713

Typical HU and HU-1 Test Setup Using Type TRB-1 Unit

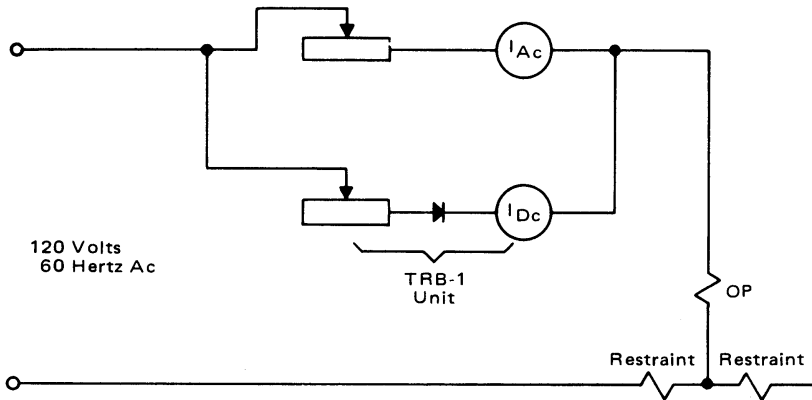


Fig. 30

Sub. 1
184A237

Shipping Weights and Carton Dimensions

Relay Type	Case Type	Approx. Weights: Lbs. (kg)		Domestic Shipping Carton Dimensions: Inches (mm)
		Net	Shipping	
SX Single or Double Unit SX Double Unit SX	FT-11	6 (2.7 kg)	9 (4.1 kg)	10 x 10 x 13 (229 x 229 x 254)
	FT-22	7 (3.2 kg)	10 (4.5 kg)	10 x 13 x 13 (229 x 305 x 330)
	Small Glass Projection	3 (1.4 kg)	6 (2.7 kg)	8½ x 9½ x 10 (216 x 241 x 254)
TR-1	FT-11	6 (2.7 kg)	9 (4.1 kg)	10 x 10 x 13 (229 x 229 x 254)
TR-1	Molded Base With Glass Window Cover	1 (0.5 kg)	2 (0.9 kg)	8½ x 9½ x 10 (216 x 241 x 254)
TRB TRB-1 TRB-2 TRB-3 TRB-4	Molded Case	1 (0.5 kg)	2 (0.9 kg)	12½ x 7 x 7 (318 x 178 x 178) (4 in one carton)

Further Information:

List Prices: PL 41-020
Technical Data: TD 41-025
Instructions:

Type SX, IL 41-962.2
Type TR-1, IL 41-758.2, IL 41-758
Type TRB-1, IL 41-841
Type TRB-2, TRB-3, TRB-4,
IL 41-842

Renewal Parts:

Type SX, RPD 41-991
Flexitest Case Dimensions: DB 41-076
Contactor Switches: DB 41-081

Other Protective Relays:

Application Selector Guide, TD 41-016



December, 1990
Supersedes TD 41-020, Types SX, TR-1,
TRB-1, TRB-2, TRB-3, TRB-4 on
pages 136, 137, 144, dated November, 1987
Mailed to: E, D, C/41-900A

For Ac or Dc Voltage or Dc Current Operation

Types SX, TR-1, TRB-1, TRB-2 TRB-3, TRB-4 Auxiliary Relays

General Purpose

High Speed Toggle Type, Current or Voltage Operated (Device Number: 79Z)

No Time Delay on Reset

Small Glass Case Type

Type	Units Per Case	Contacts	Operating Coil Rating	Reset Coil Rating	Small Glass Projection Case	
					Internal Schematic	Style Number
SX	1	2 circuit closing Independent	120 volts, 60 Hertz	120 volts, 60 Hertz	184A255	289B900A09
			240 volts, 60 Hertz	240 volts, 60 Hertz		
			48 volts dc	48 volts dc		
			125 volts dc	125 volts dc		
			250 volts dc	250 volts dc		
			1.0 amp dc	125 volts dc		
		1.0 amp dc	250 volts dc	837A038	289B900A14	
		289B900A15				
		1 circuit closing 1 circuit opening Independent	120 volts, 60 Hertz	120 volts, 60 Hertz	184A254	289A900A17
			240 volts, 60 Hertz	240 volts, 60 Hertz		
			48 volts dc	48 volts dc		
			125 volts dc	125 volts dc		
250 volts dc	250 volts dc					
1.0 amp dc	125 volts dc					
2.0 amps dc	125 volts dc	289B900A23				
1 circuit closing 1 circuit opening Common contacts with reset coil cutoff Contact	1.0 amp dc	120 volts, 60 Hertz	184A354	289B900A26		
	1.0 amp dc	240 volts, 60 Hertz				
	1.0 amp dc	48 volts dc				
	1.0 amp dc	125 volts dc				
	1.0 amp dc	250 volts dc				
	48 volts dc	48 volts dc				
	125 volts dc	125 volts dc				
	250 volts dc	250 volts dc				
	289B900A27					
	289B900A28					

With or Without Time Delay on Reset
Flexitest Case Type

Type	Units Per Case	Contacts	Operating Coil Rating	Reset Coil Rating	Time Delay on Reset [Ⓢ]	Relay Data				
						Internal Schematic	Style Number	Case Size		
SX	1	Spdt	1.0 amp dc	48 volts dc	Yes	184A180	289B544A12	FT-11		
			1.0 amp dc	125 volts dc		184A180	289B544A09			
			1.0 amp dc	250 volts dc		184A180	289B544A21			
			5 amp dc	125 volts dc		184A180	289B544A10			
			125 volts dc	125 volts dc		184A181	289B544A11			
			Dpdt	1.0 amp dc		48 volts dc	No		184A178	289B459A18
				1.0 amp dc		125 volts dc			184A178	289B459A15 [Ⓢ]
				1.0 amp dc		250 volts dc			184A178	289B459A19
				5.0 amps dc		125 volts dc			184A178	289B459A16
		125 volts dc		125 volts dc	184A179	289B459A17				
		120 volts, 60 Hertz		120 volts, 60 Hertz	184A179	289B459A20				
		5 amps dc 1 amp dc 48 volts dc	48 volts dc	184A178	289B459A21					
			120 volts ac	184A178	289B459A22					
			125 volts dc	184A179	289B459A23					
		2	2	Spst (per unit)	1.0 amp dc	48 volts dc	No	184A214	289B546A12	FT-11
					1.0 amp dc	125 volts dc		184A214	289B546A09	
					1.0 amp dc	250 volts dc		184A214	289B546A13	
					5.0 amps dc	125 volts dc		184A214	289B546A10	
125 volts dc	125 volts dc				187A740	289B546A11				
250 volts dc	250 volts dc				187A740	289B546A14				
Dpdt (per unit)	48 volts dc				48 volts dc	184A213		289B547A11		
	125 volts dc				125 volts dc					
	250 volts dc				250 volts dc					
	289B547A09									
	289B547A10									
	289B547A10									

Ⓢ Denotes item available from stock.

Ⓢ 5 to 15 cycles (factory set at 10 cycles on a 60 Hz base).



Auxiliary

Dc Current, Non-Adjustable, Molded Base, Glass Window Cover (Device Number: 94)

Type	Circuit Closing Contacts Per Unit	Elements	Ratings; Amps Dc		Relay Data		
			CS	ICS	Internal Schematic	Style Number Projection	Semi-Flush
TR-1	Single	1	None	0.2-2 ^②	836A926		290B311A25 ^⑥
	Double	1	None	0.2-2 ^②	836A799		290B311A26
	Single	1	None	1.0 ^③	837A026	290B311A27	
	Double	1	None	1.0 ^③	3502A41		290B311A28
	Double	1	1.0 ^④	None	184A741		1726 850
	Double	1	2.0 ^④	None	184A741	1961 049	
	Double	2	1.0 ^④	None	182A938	1961 246 ^③	1726 820 ^③
	Double	2	2.0 ^④	None	22D1943	1544 670	1544 669
	Single	2	2.0 ^④	None	31D5224		1727 494
	Double	2	1.0 ^④	None	22D1943	290B311A20	290B311A13

Dc Current, Non-Adjustable (Device Number: 94)

Type	Contacts	Elements	Rating: Amps Dc		Relay Data	
			CS	ICS	Internal Schematic	Style Number
FT-11 Flexitest Case	Two circuit closing per element	2	None	0.2-2 ^②	183A356	1955 703 ^⑥
		2	None	1.0 ^③	184A062	1961 148

Static Tripping Units (Device Number: 94)

Type ^④	Application	Diodes Per Case	Unit Reference Number	Voltage Rating: Dc Volts	Maximum Reverse Volts	Relay Data	
						Internal Schematic	Style Number
TRB-1	Test Unit (HU)	1	304-F	120 ac	300	184A234	407C275G03
	Blocking diode	1	304-F 304-M	48/125 250	300 600	184A415 184A415	184A414G12 ^⑥ 184A414G13 ^⑥
TRB-2	Blocking and Tripping Zeners	2	IN-2846A	48/125	...	187A696	408C003G01 ^⑥
		4	IN-2846RA IN-2846A }	250	...	187A617	408C003G02
TRB-3		3	IN-2846A	48/125	...	187A697	408C003G03
TRB-4		4	IN-2846A	48/125	...	187A698	408C003G04

⑥ Denotes item available from stock.

When used as an auxiliary relay,

- ① 1 and 2 amp dc: 125 volts dc use one style RW220AKS02^⑥ series resistor 22 ohms.
250 volts dc use two style RW220AKS02^⑥ series resistors 22 ohms.
- ② 0.2-2.0 amp dc: 125 volts dc use one style 1955 870^⑥ series resistor 100 ohms.
250 volts dc use two style 1955 870^⑥ series resistors 100 ohms.
- ③ Independent contactor switch circuits.
- ④ TRB-1 relays are rated 5 amps dc continuously, and 30 amps dc for one second.

ABB Power T&D Company Inc.
Relay Division
4300 Coral Ridge Drive
Coral Springs, FL 33065
954-752-6700



ABB Power T&D Company Inc.
Relay Division
7036 Snowdrift Road, Suite 2
Allentown, PA 18106
610-395-7333