



ABB Power T&D Company Inc.  
Relay Division  
Coral Springs, FL  
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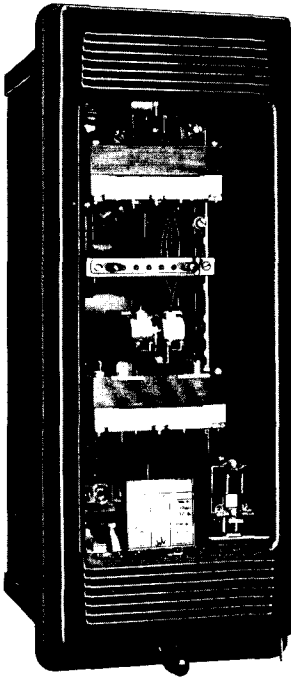
Descriptive Bulletin  
**41-133E**

Page 1

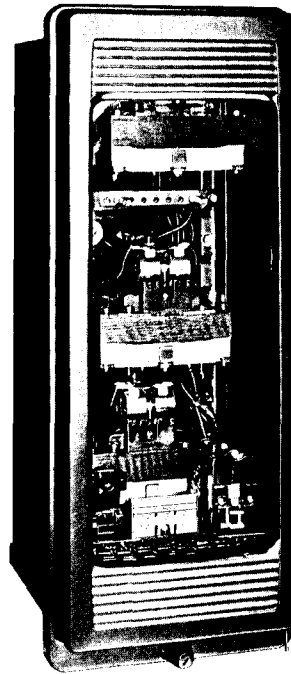
August, 1991  
Supersedes DB 41-130C, pages 1-8,  
dated February, 1971  
Mailed to: E, D, C/41-100A

For Phase and Ground Fault Detection on  
Transmission Lines and Feeder Circuits  
**Device Number: 67N**, Types KRC, KRD, KRP  
**Device Number: 67**, Type KRV

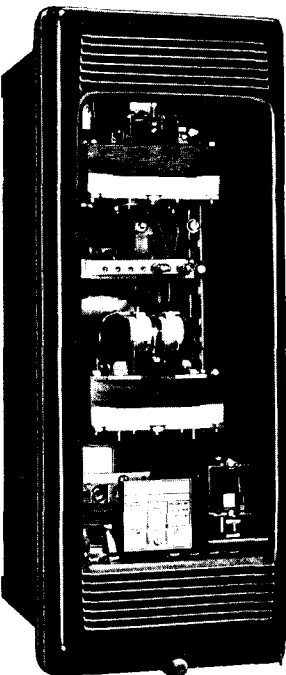
## Types KRC, KRD, KRP and KRV Directional Overcurrent Relays



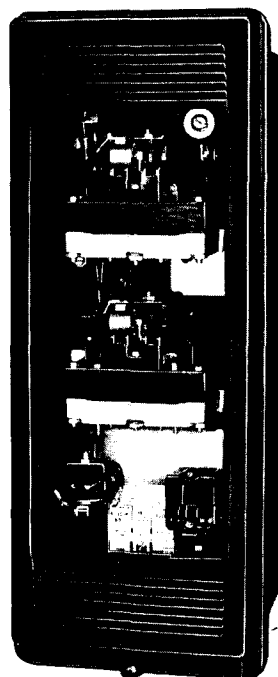
Type KRC



Type KRD



Type KRP



Type KRV

### Application

Types KRC, KRD and KRP are single-phase high-speed, directionally controlled overcurrent relays designed to protect transmission lines and feeder circuits from damage due to ground faults.

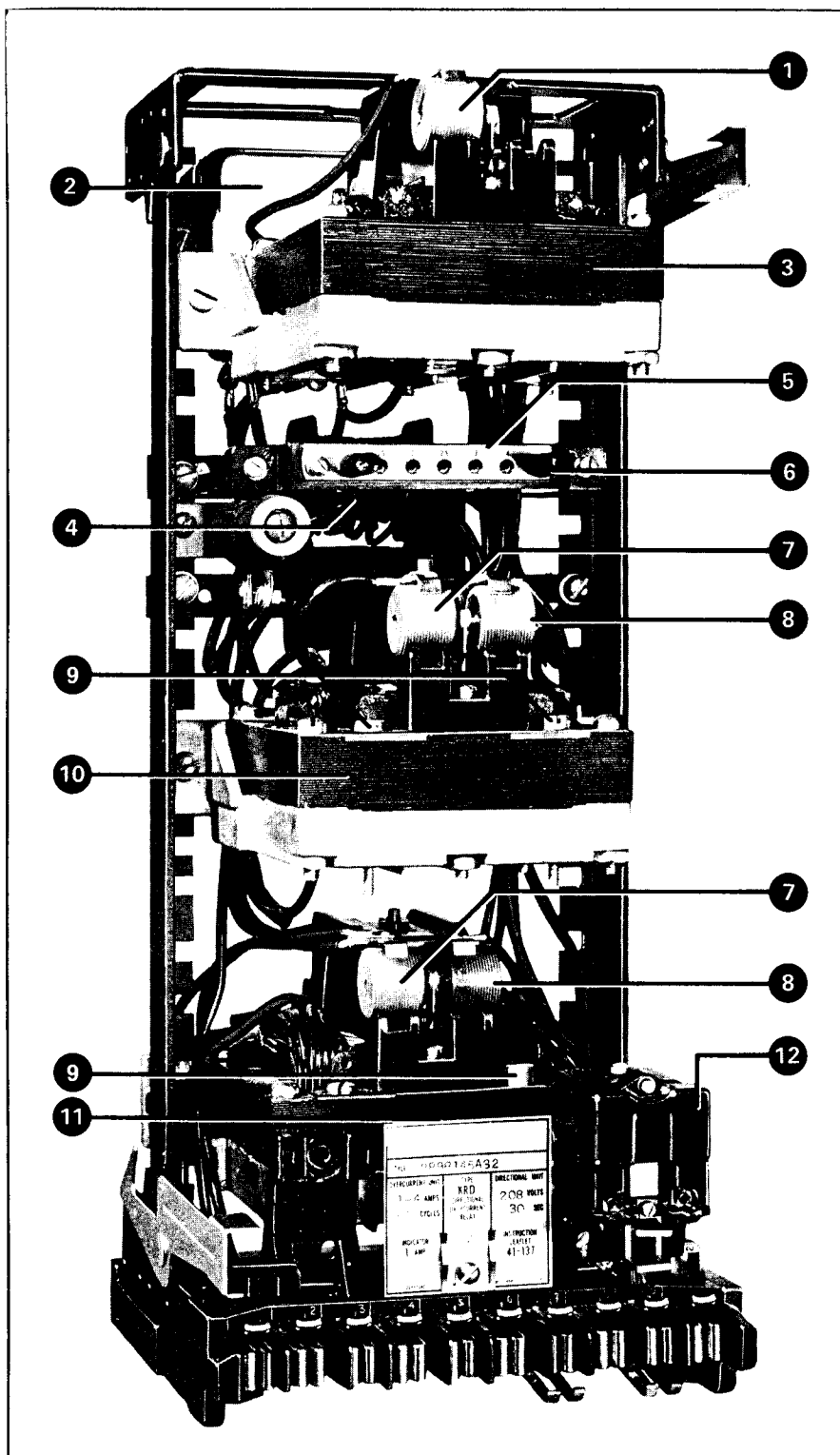
They can also be used, without modification, to provide directional ground fault detection with the K-Dar carrier or microwave relaying schemes.

High speed directional phase fault detection is provided by the type KRV relay.

### Types Available

Type	Directional Unit Polarization
KRC	Residual Current
KRD	Residual Current and Voltage
KRP	Residual Voltage
KRV	Line Voltage

- 1 Overcurrent Trip Contact (I)
- 2 Overcurrent Unit Phase Shifter
- 3 High-speed Overcurrent Unit
- 4 Saturating Transformer
- 5 Overcurrent Unit Tap Block
- 6 Spare Tap Screw
- 7 Directional Trip Contact (D)
- 8 Directional Torque Control Contact (D)
- 9 Magnetic Adjusting Plugs
- 10 Voltage Polarized Directional Unit
- 11 Current Polarized Directional Unit
- 12 Indicating Contactor Switch (ICS unit)



## Type KRC

The KRC relay is current polarized as shown in figure 10, page 6. Maximum torque on the directional unit occurs when the operating current ( $I_o$ ) leads the polarizing current ( $I_p$ ) by approximately  $40^\circ$ .

## Type KR D

The KR D relay is dual polarized (see figure 11). It utilizes the current polarized directional unit of the KRC and the potential polarized unit of the KRP relay.

## Type KRP

Type KRP is potential polarized as shown in figure 12. It has its maximum torque when the residual current lags the polarizing voltage by approximately  $60^\circ$ . The maximum torque angle is shifted by means of an internally mounted capacitor-resistor combination as shown in figure 8.

## Type KRV

Type KRV is potential polarized from line voltage as shown in figure 13. Maximum torque on the directional unit occurs when the operating current leads the polarizing voltage by  $30^\circ$ . By connecting the directional unit, using phase current in one phase and polarizing potential across the other two phases, the maximum torque occurs when the fault current lags its 100 percent PF position by approximately  $60^\circ$ . This connection is shown in figure 9.

## Directional Unit (D)

Consists of a die-cast aluminum frame which supports an electro-magnet, a single-pole double-throw moving contact assembly, and a molded bridge. The electromagnet has two series-connected polarizing coils mounted opposite one another; and two series connected operating coils mounted on alternate opposing sides. The moving contact assembly shaft is supported on both ends by jewel bearings. A moving aluminum cylinder with a molded insulating hub supports the moving contact assembly and rotates in the air gap between the electro-magnet and the magnetic core. Spurious torques are balanced out by means of two magnetic adjusting plugs.

## Overcurrent Unit (I)

### KRC, KR D, KRP Ground Relays

This is a cylinder-design unit similar in construction to the directional unit, except that it has one circuit closing contact. Each pair of pole windings is energized by ground current from the operating circuit. In order to develop the necessary rotational torque, a capacitor is series-connected with one pair of pole windings to obtain the desired time-phase relationship between the current in the two pairs of coils. As shown in figures

6, 7, 8, and 9, one of the directional unit contacts is connected across one pair of pole windings of the overcurrent unit. This contact shunts the operating current around the pole windings, preventing the unit from developing rotational torque. However, when the directional unit picks up under fault conditions, the short on the overcurrent unit coils is removed; allowing the overcurrent unit to rotate almost simultaneously with the directional unit, thereby providing high-speed operation.

A saturating transformer is used to feed the overcurrent unit. It limits the energy applied to the unit at high current values. The primary winding of the saturating transformer has taps connected to a tap block to facilitate changing the current pickup values of the unit.

Tap value current is the minimum current required to just close the relay contacts. This tapped transformer arrangement supplies the same amount of energy to the overcurrent unit for any tap setting, at a given multiple of tap current. Thus, the relays have one operating time current curve (see figures 14 and 15) throughout their entire range.

A non-linear resistor (varistor) is connected across the secondary winding of the transformer and overcurrent coils to reduce the voltage peaks applied to the capacitor and overcurrent unit.

### KRV Phase Relay

The KRV's cylinder-design directional unit is similar to the ground relay instantaneous overcurrent unit, except that it receives its energy from the phase current transformer. As shown in figure 9 the capacitor phase shifting circuit is controlled by one of the contacts on the CS-1 switch, which in turn is operated by the directional unit. Contact closing torque is produced in the overcurrent unit when the directional unit closes its contact and operates the CS-1 switch.



### Directional Unit Sensitivity

Relay Type	Ampere Rating	Minimum Pickup Values†		Phase Angle Relationship
		Volts	Amperes	
KRC KRD (current unit)	.5-2 1-4	..	0.5■	I <sub>o</sub> leading I <sub>p</sub> by 40°*
	2-8	..	0.65■	In phase
	4-16	..	1.0■	I <sub>o</sub> leading I <sub>p</sub> by 40°*
	10-40	..	1.3■	In phase
KRP KRD (voltage unit)	.5-2 1-4	1	2.0	I lagging V by 60°*
	2-8	1	4.0	I in phase with V
	4-16	1	4.0	I lagging V by 60°*
	10-40	1	8.0	I in phase with V
KRV	.5-2 1-4	1.2	2.0	I leading V by 30°
	2-8	1.2	2.0	I leading V by 30°
	4-16	1.2	4.0	I leading V by 30°
	10-40	1.2	8.0	I leading V by 30°
	20-80	1.2	8.0	I leading V by 30°

† Energization quantities are input quantities at the relay terminals.

\* Maximum torque angle.

■ In each winding.

### Directional Unit Polarizing Circuit Burden

Relay Type	Rating		Volt Amps†	Power Factor Angle●
	Amps (1 sec.)	Volts (30 sec.)		
KRC	230	...	1.45	8° lag
KRD (current unit)	230	...	1.45	8° lag
KRD (voltage unit)	...	208	11.2	28° lead
KRP	...	208	11.2	28° lead
KRV	...	...	12.5	15° lead

† Burden of voltage polarized units taken at 120 volts; current polarized units taken at 5 amperes.

● Degrees current leads or lags voltage at 120 volts on voltage polarized units and 5 amperes on current polarized units.

### Overcurrent Unit: Amperes

Range	Taps
0.5 - 2.5	0.5 - 0.75 - 1 - 1.25 - 1.5 - 2
1 - 4	1 - 1.5 - 2 - 2.5 - 3 - 4
2 - 8	2 - 3 - 4 - 5 - 6 - 8
4 - 16	4 - 6 - 8 - 9 - 12 - 16
10 - 40	10 - 15 - 20 - 24 - 30 - 40
20 - 80	20 - 30 - 40 - 48 - 60 - 80

## Internal Wiring KRC

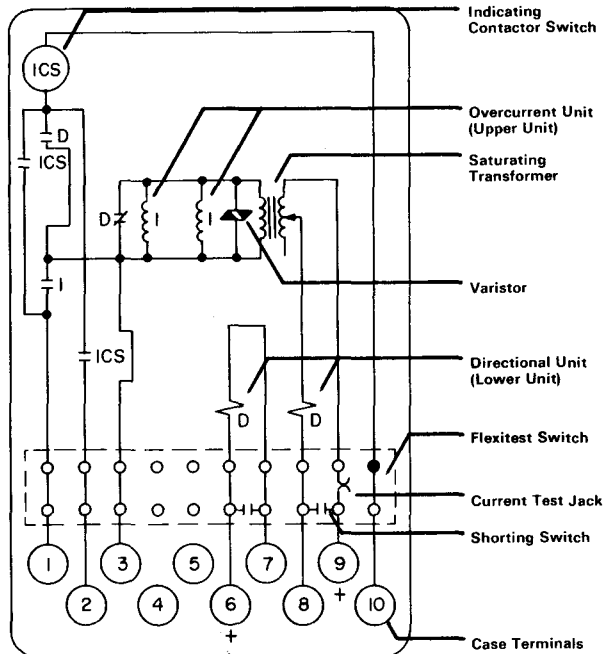


Fig. 6

## KRD

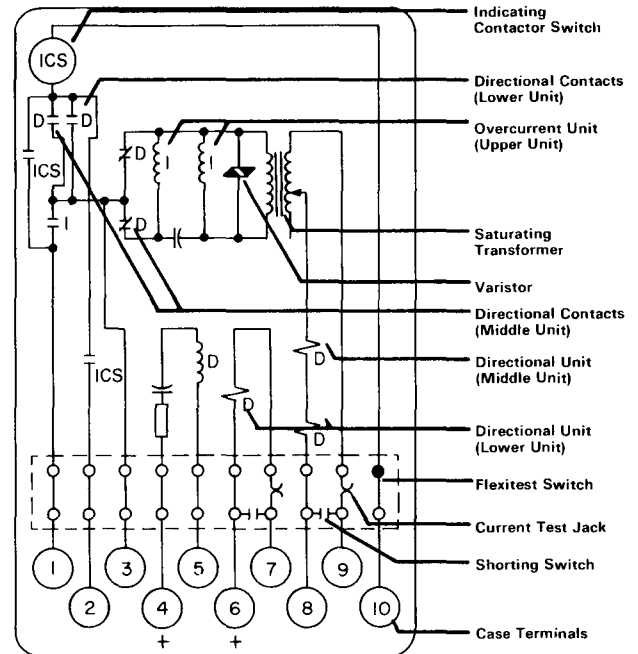


Fig. 7

## KRP

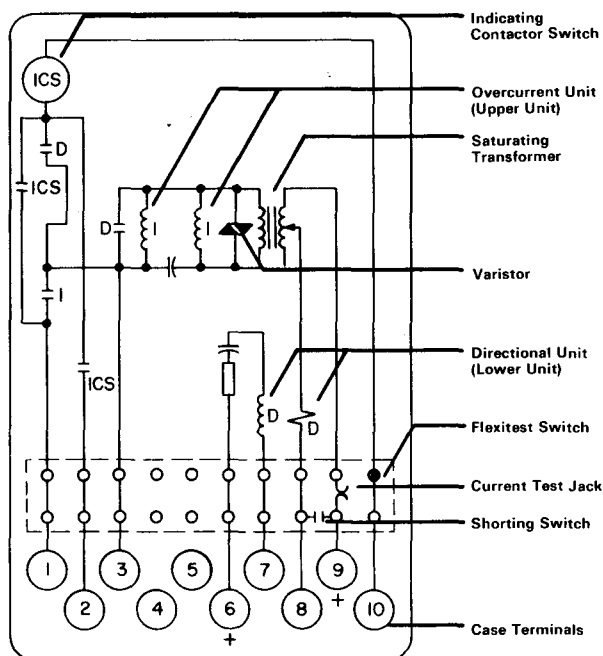


Fig. 8

■ With Relative Instantaneous Polarity As Shown, The Directional Unit Contacts Close.

## KRV

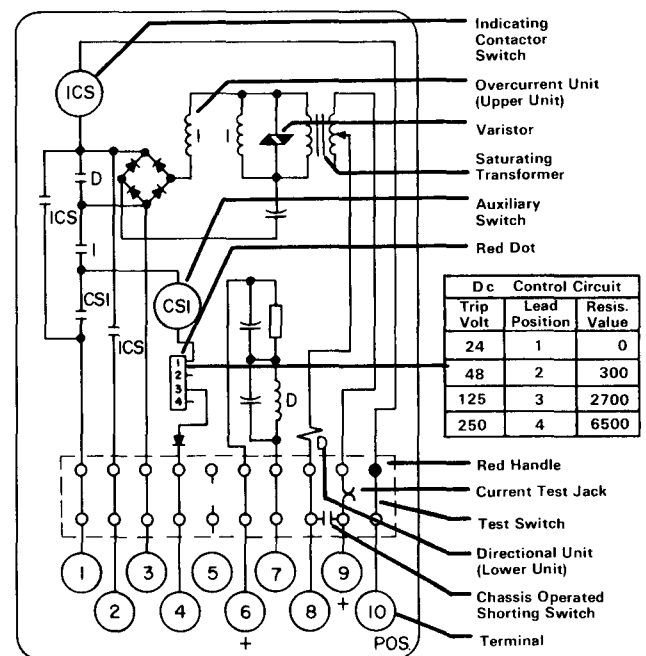


Fig. 9

With Relative Instantaneous Polarity As Shown, The Directional Unit Contacts Close.

Dc Trip Volt	Control Circuit Lead Position	Resis. Value
24	1	0
48	2	300
125	3	2700
250	4	6500

## Type KRC

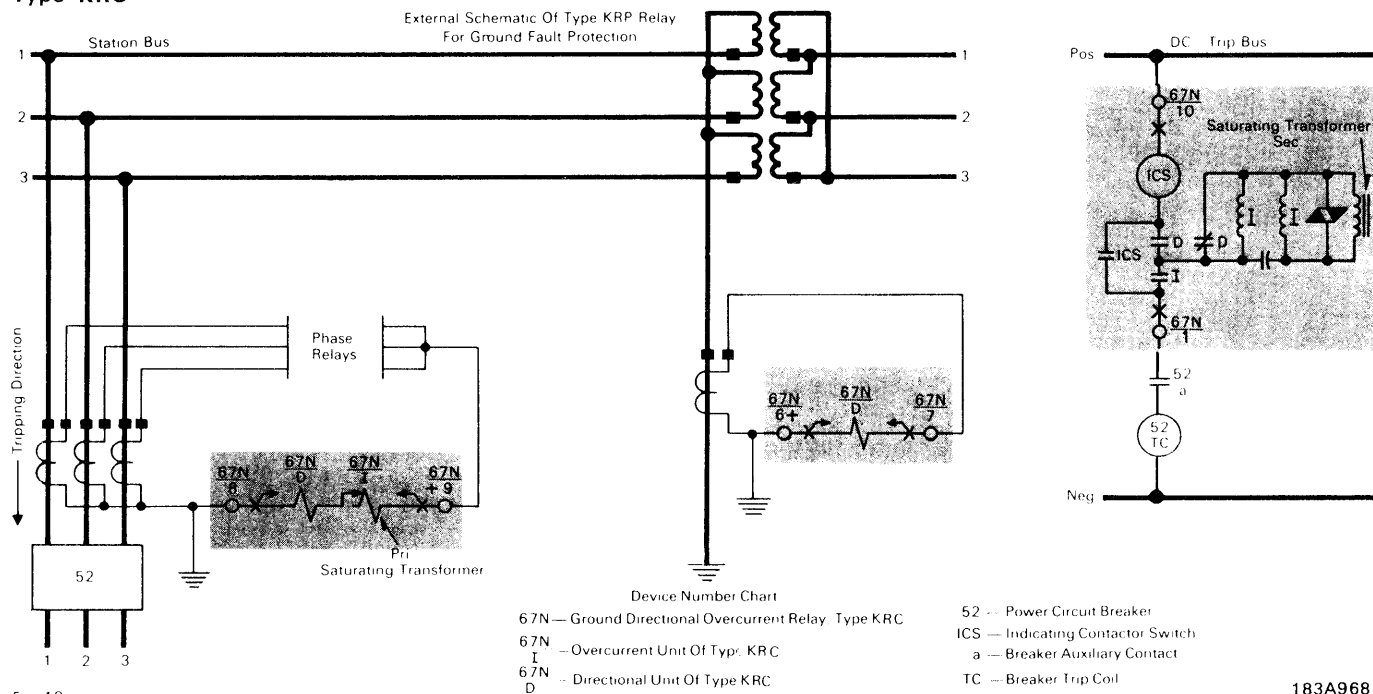


Fig. 10

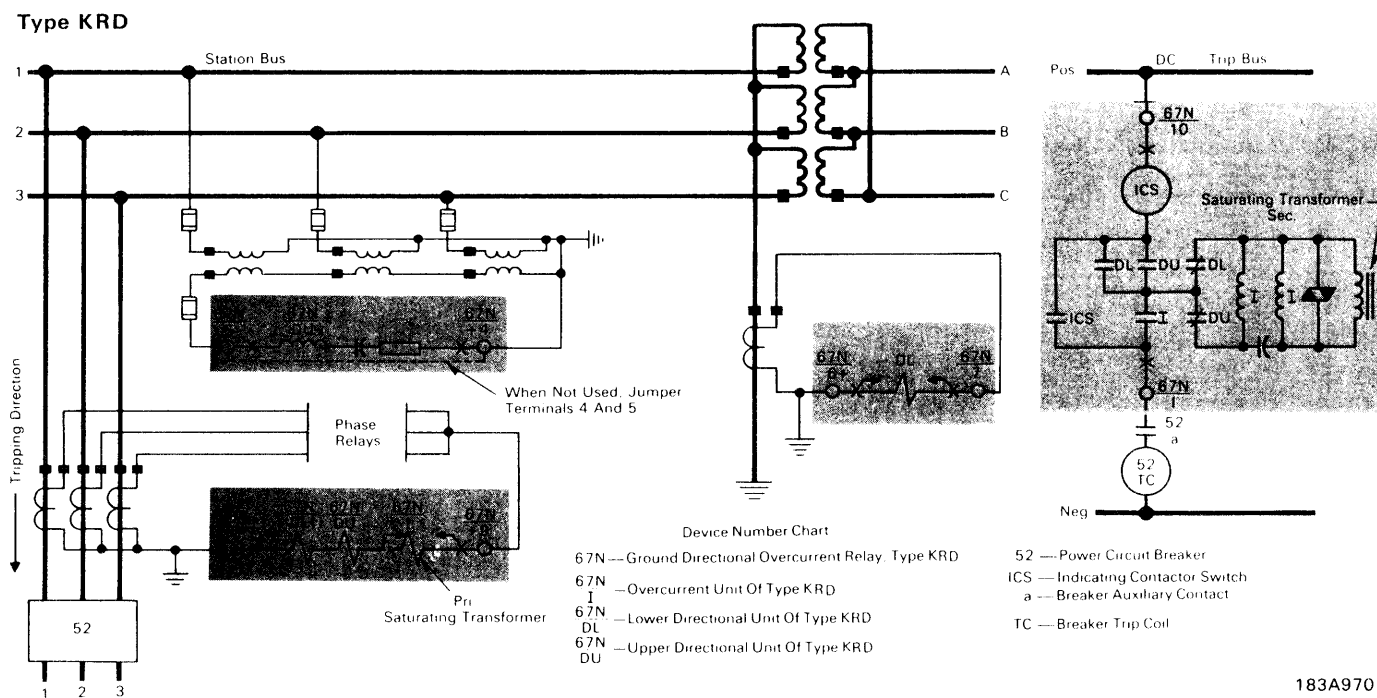


Fig. 11

## Type KRP

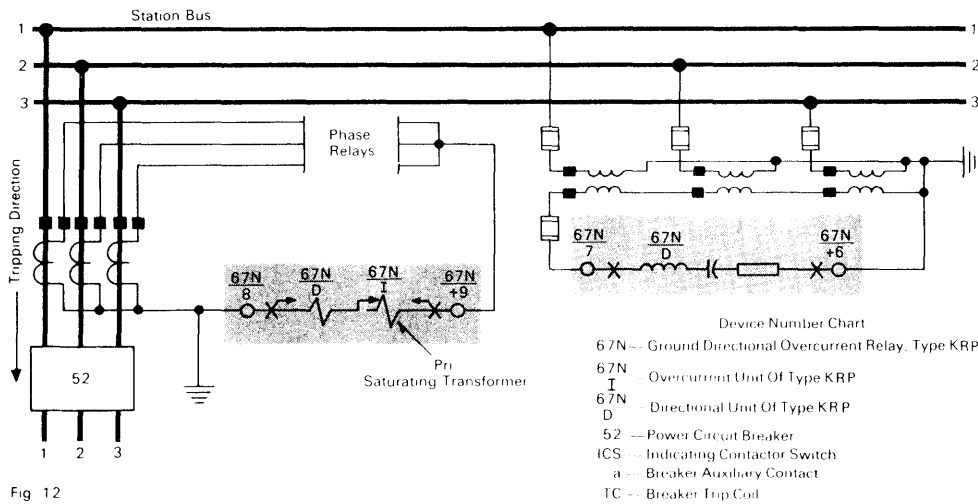
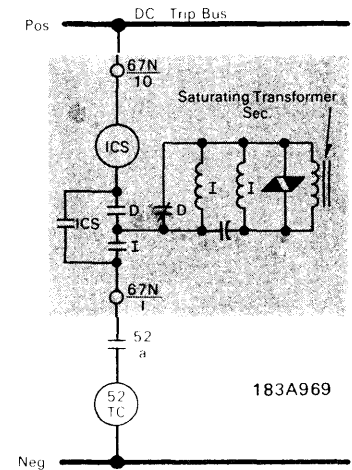


Fig 12



### Type KRV

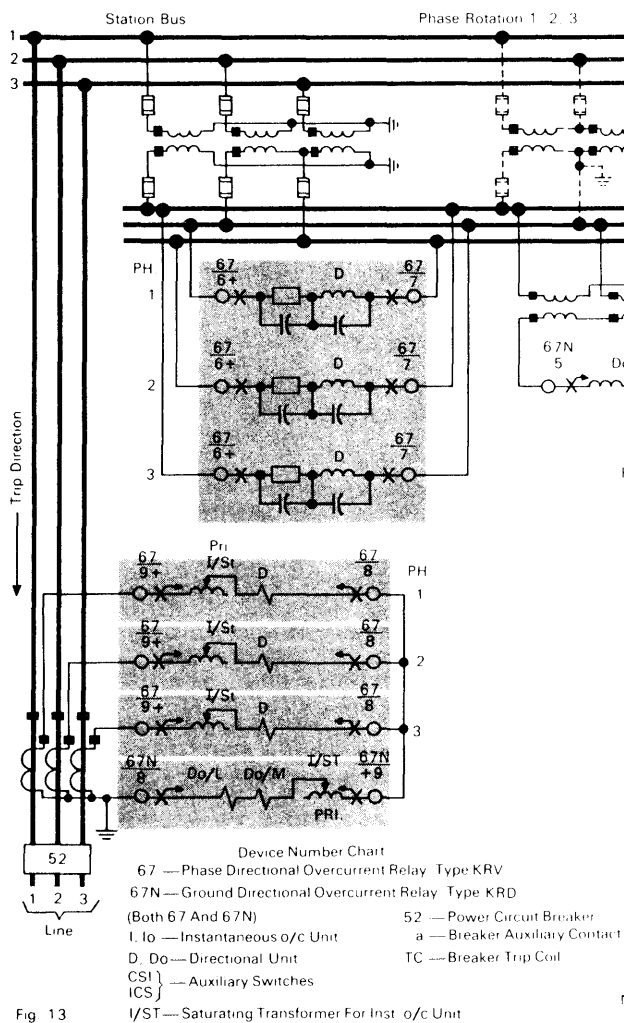
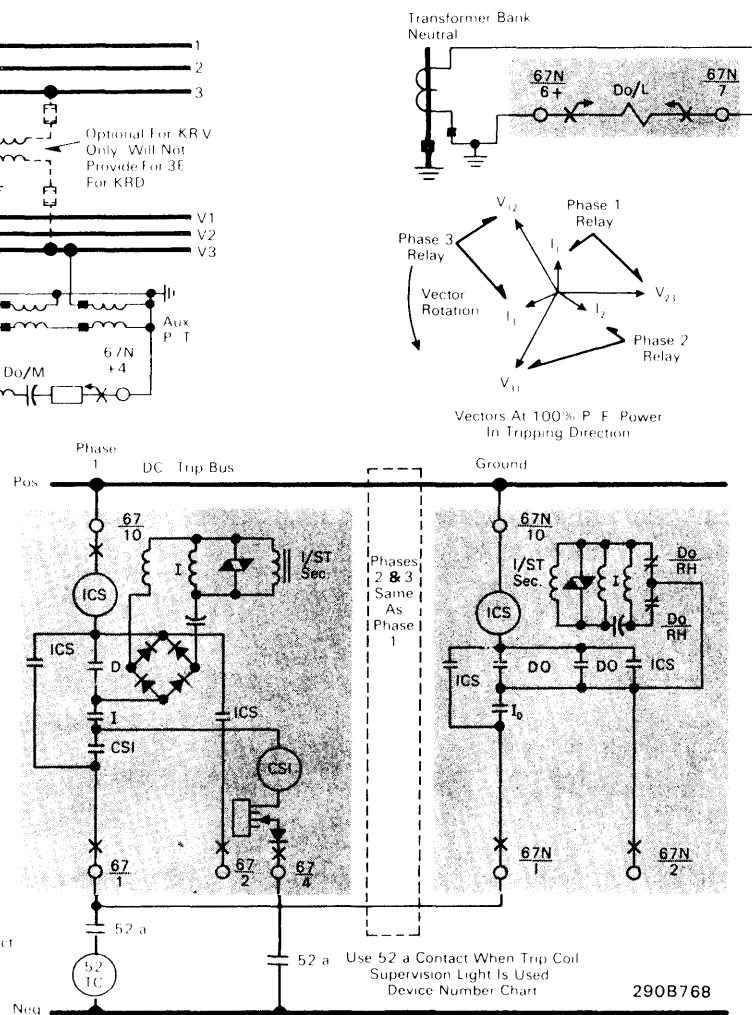


Fig. 13





## Typical Time Curves

### Types KRC and KRD (Current Polarized)

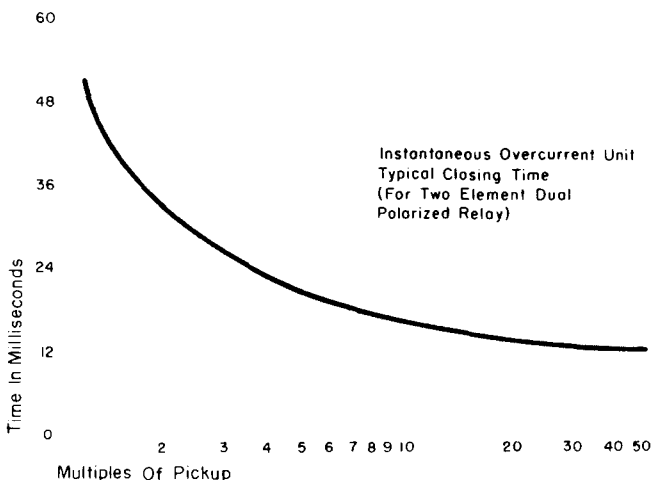


Fig. 14

### Type KRV

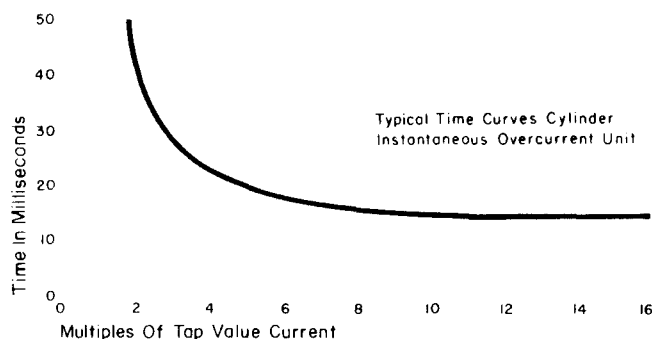


Fig. 16

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## Types KRD and KRP (Potential Polarized)

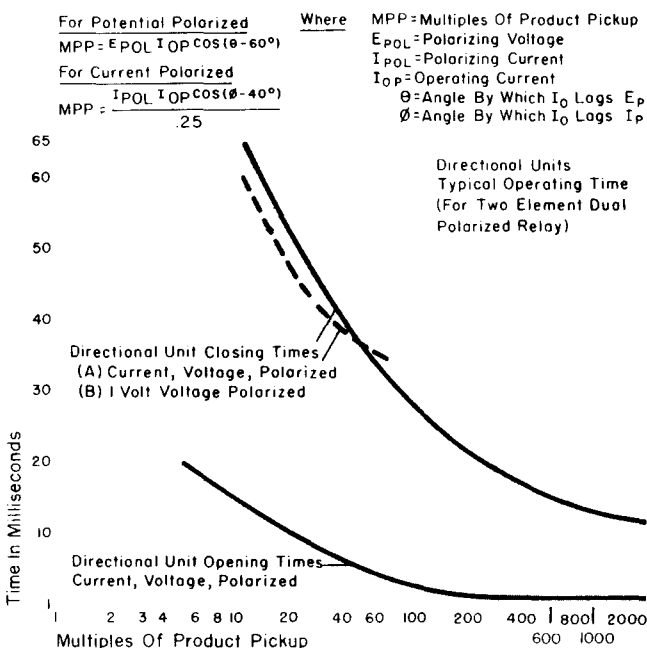


Fig. 15

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## Shipping Weights and Carton Dimensions

Type	Case Type	Weight: Lbs.		Domestic Shipping Carton: Inches
		Net	Shipping	
KRC, KRP, KRV	FT-31	16	20	8 x 10 x 21
KRD		19	23	

### Further Information:

List Prices: PL 41-020

Technical Data: TD 41-025

Instructions:

Types KRC, KRD, KRP, IL 41-137

Type KRV, IL 41-137.1

Renewal Parts:

Types KRC, KRD, KRP, RPD 41-962

Types KRD-4, KRD-5, RPD 41-963

Type KRV, RPD 41-964

Flexitest Case Dimensions: DB 41-076

Contact Switches: DB 41-081

Other Protective Relays:





August, 1991  
Supersedes TD 41-020, Types KRC, KRD,  
KRP and KRV, on page 34,  
dated November, 1987  
Mailed to: E, D, C/41-100A

For Phase and Ground Fault Detection on  
Transmission Lines and Feeder Circuits

## Types KRC, KRD, KRP and KRV Directional Overcurrent Relays

### Overcurrent, Instantaneous, Directional Single Phase Overcurrent Unit (Device Number: 67 and 67N)

Type, Time Curve and Contacts	Application	Indicating Contactor Switch <sup>③</sup>	CS-1 Auxiliary Switch	Instantaneous Unit Range: Amps: Ac	Voltage Rating (Continuous)	Relay Data Internal Schematic	Style Number	Case Style
<b>KRC</b>  Instantaneous  Spst-cc	Ground Fault Detection	1.0 amp dc	....	0.5-2.0	...	183A022	289B145A17	<b>FT-31</b>
			....	1-4	...		289B145A18	
	Current		....	2-8	...		289B145A19	
	Polarized		....	4-16	...		289B145A20	
	230 amps/1 sec		....	10-40 20-80	...		289B145A21 289B145A22	
<b>KRD</b> <sup>②</sup>  Instantaneous  Spst-cc	Ground Fault Detection	1.0 amp dc	....	0.5-2.0	...	183A412	289B145A31	
			....	1-4	...		289B145A32	
	Dual		....	2-8	...		289B145A33	
	Polarized		....	4-16	...		289B145A34	
	208 volts/30 sec also 230 amps/1 sec		....	10-40 20-80	...		289B145A35 289B145A36	
<b>KRP</b> <sup>②</sup>  Instantaneous  Spst-cc	Ground Fault Detection	1.0 amp dc	....	0.5-2.0	...	183A025	289B145A25	
			....	1-4	...		289B145A26	
	Voltage		....	2-8	...		289B145A27	
	Polarized		....	4-16	...		289B145A28	
	208 volts/30 sec		....	10-40	...		289B145A29	
	230 amps/1 sec		....	20-80	...		289B145A30	
			0.2/2.0 amp dc	0.5-2.0 1-4 2-8	...	188A382	1483B94A09 289B145A24 289B145A23	
<b>KRV</b>  Instantaneous  Spst-cc	Phase Fault Detection	1.0 amp dc	24 to 250 v dc	0.5-2.0	132 ac	185A456	289B145A09	
				1-4			289B145A10	
	Voltage			2-8			289B145A11	
	Polarized			4-16			289B145A12	
	120 volts 60 Hertz			10-40 20-80			289B145A13 289B145A14	

② See potential polarizing transformers, page 49.

③ ICS: Indicating Contactor Switch (dc current operated)  
having seal-in contacts and indicating target which are  
actuated when the ICS coil is energized at or above  
pickup current setting. Suitable for dc control voltages up  
to and including 250 volts dc. Two current ranges are  
available:  
(1) 0.2/2.0 amps dc, with tapped coil.  
(2) 1.0 amp dc, without taps.

Rating of ICS unit used in specific types of relays is shown  
in price tables. All other ratings must be negotiated.

When ac current is necessary in a control trip circuit, the  
ICS unit can be replaced by an ACS unit.

The ACS unit may be supplied in place of an ICS unit at  
no additional cost. Specify system voltage rating on order.