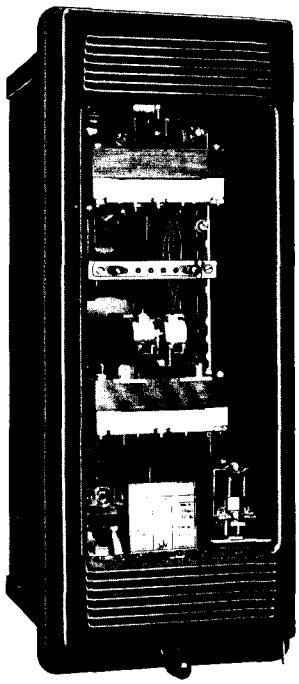
ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

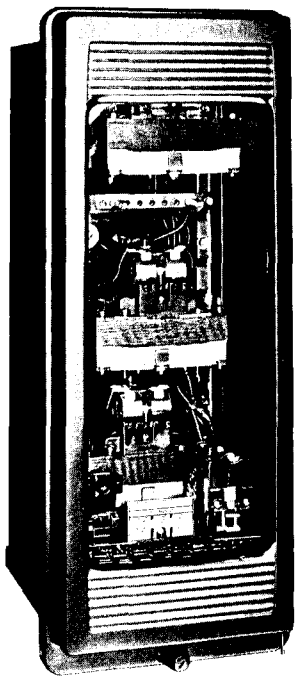
August, 1991
Supersedes DB 41-130C, pages 1-8,
dated February, 1971
Mailed to: E, D, C/41-100A

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

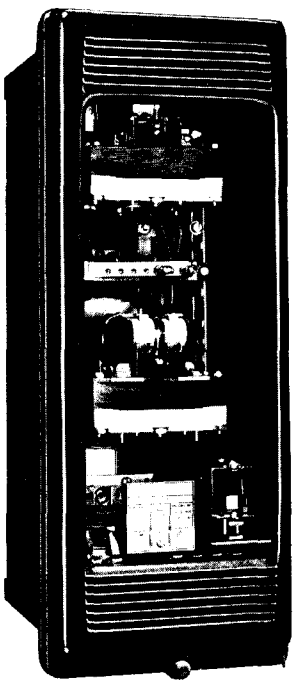
Types KRC, KRD, KRP and KRV Directional Overcurrent Relays



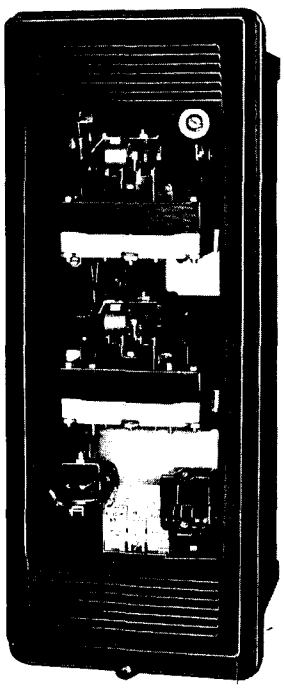
Type KRC



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.

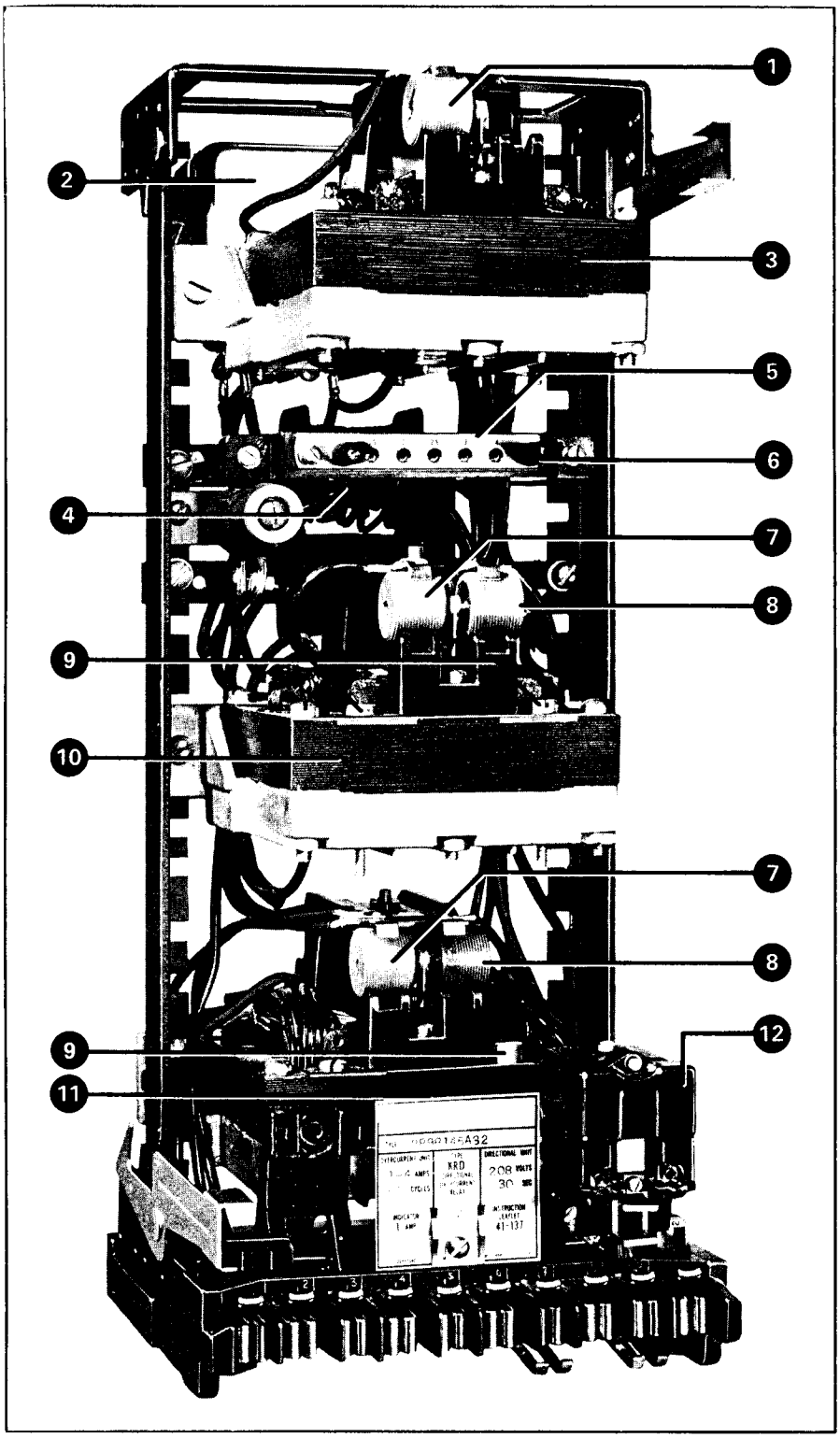
High speed directional phase fault detection is provided by the type KRV relay.

Types Available

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

Construction and Operation

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 (Io) leads the polarizing current (Ip) by approximately 40°.

Type KRD
The KRD 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°. 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°. 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°. 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 assemble 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 electromagnet and the magnetic core. Spurious torques are balanced out by means of two magnetic adjusting plugs.

Overcurrent Unit (I)
KRC, KRD, 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■	Io leading Ip by 40°*
	2-8	..	0.65■	In phase
	4-16	..	1.0■	Io leading Ip 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

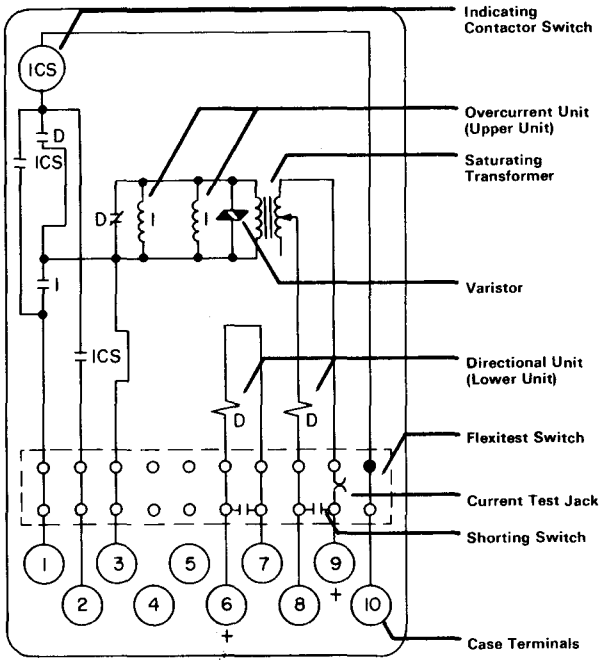


Fig. 6

KRD

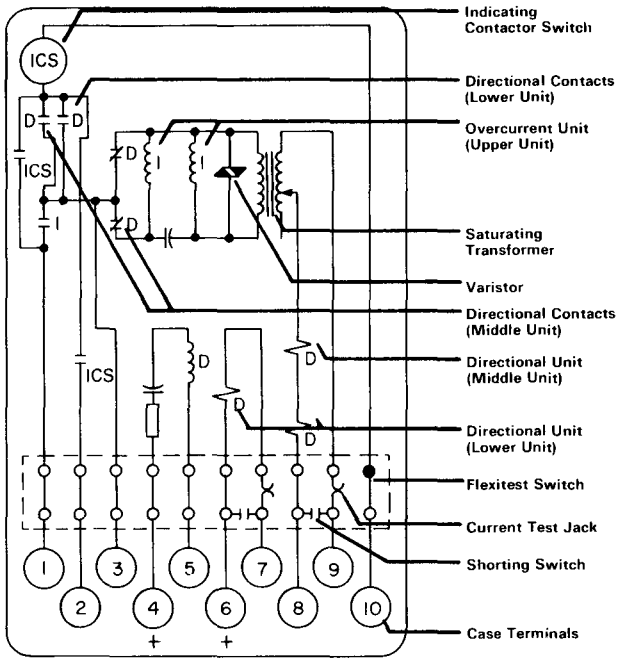


Fig. 7

KRP

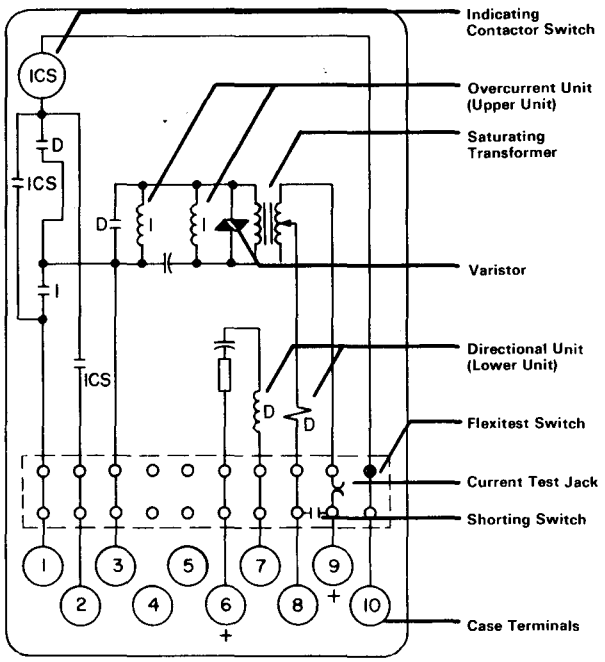
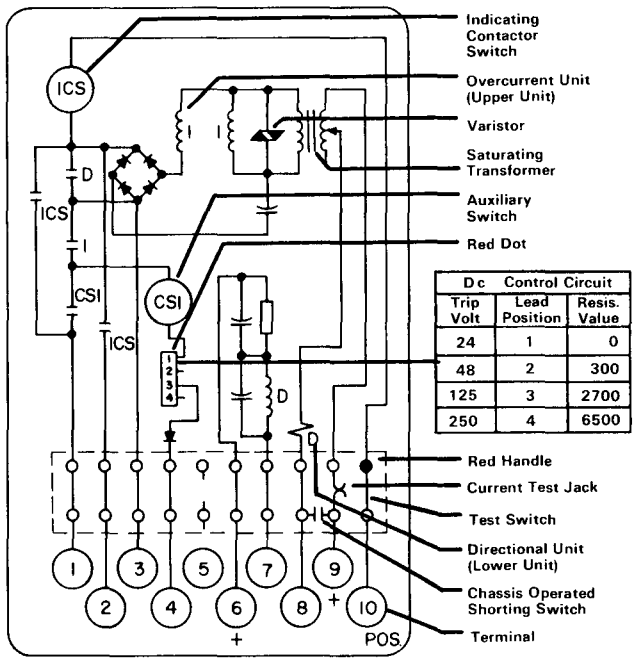


Fig. 8

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

KRV



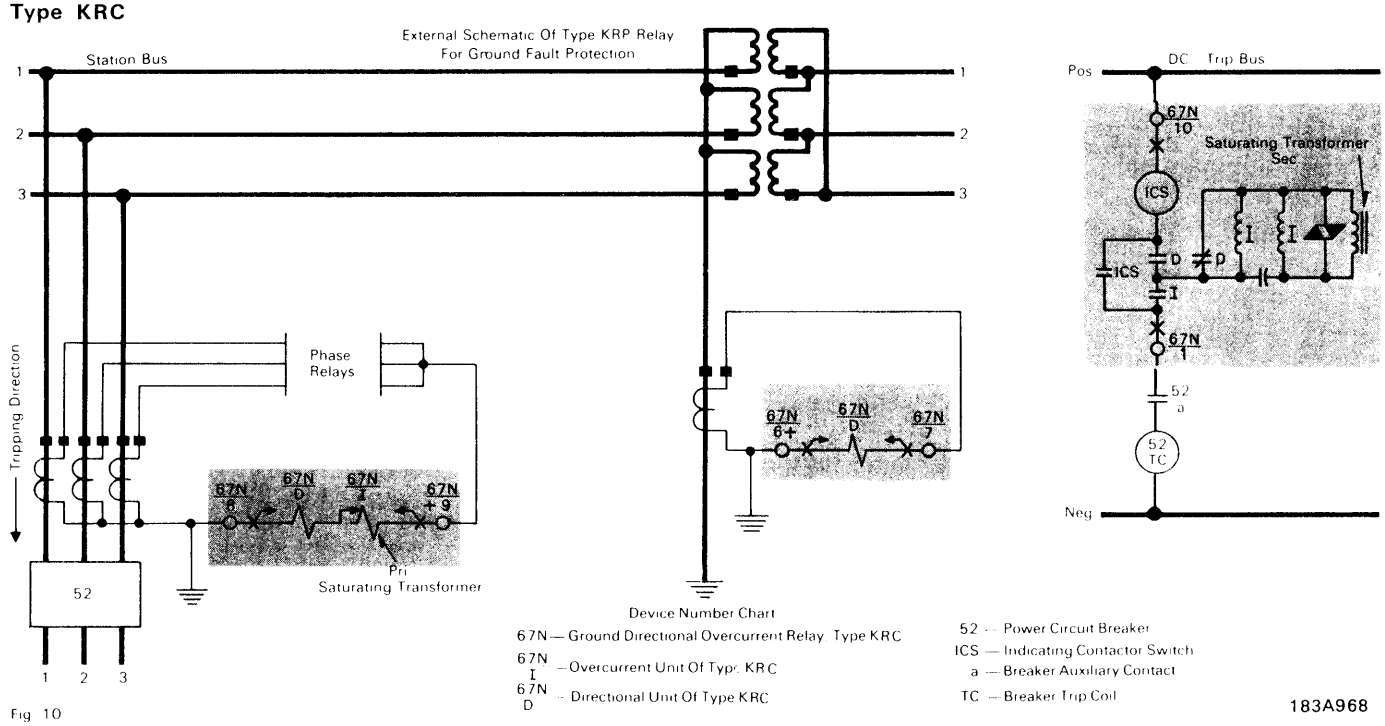
Dc Control Circuit		
Trip Volt	Lead Position	Resis. Value
24	1	0
48	2	300
125	3	2700
250	4	6500

Fig. 9

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

External Wiring

Type KRC



Device Number Chart

67N — Ground Directional Overcurrent Relay, Type KRC
67N I — Overcurrent Unit Of Type KRC
67N D — Directional Unit Of Type KRC

52 — Power Circuit Breaker
ICS — Indicating Contactor Switch
a — Breaker Auxiliary Contact
TC — Breaker Trip Coil

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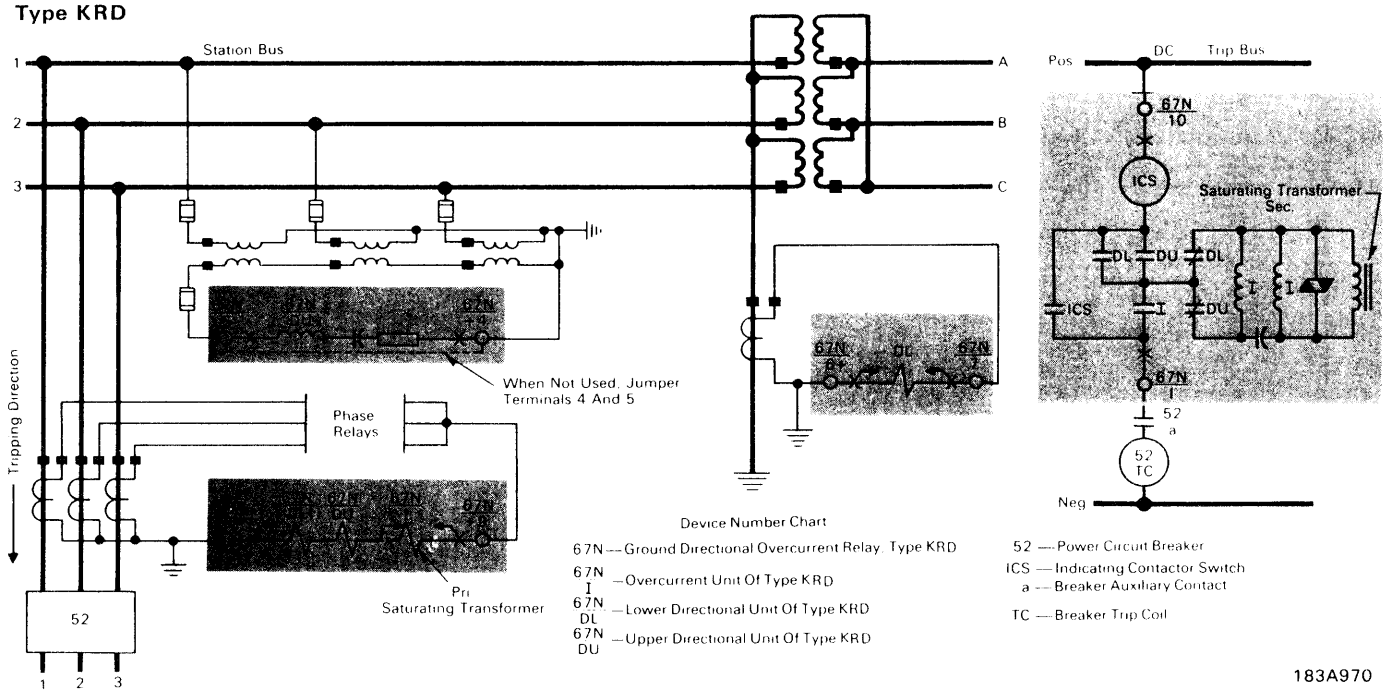
Fig. 10

Type KRD



Device Number Chart

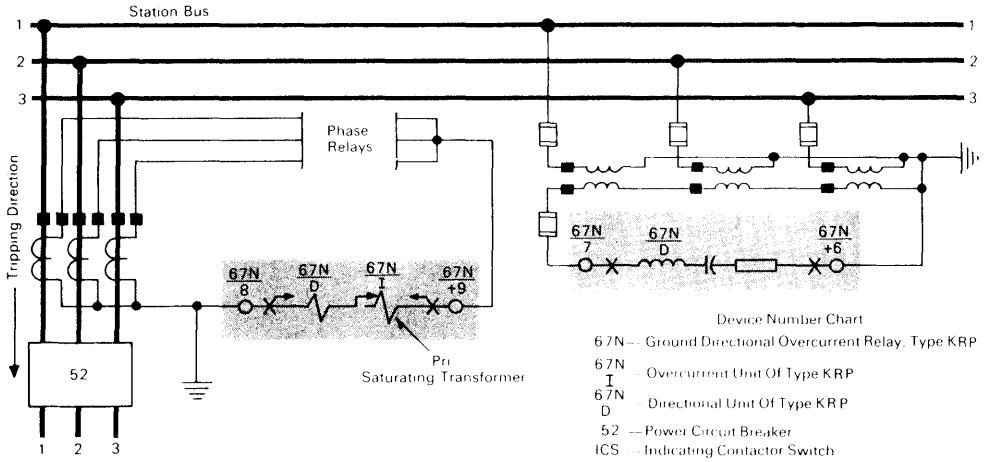
67N — Ground Directional Overcurrent Relay, Type KRD
67N I — Overcurrent Unit Of Type KRD
67N DL — Lower Directional Unit Of Type KRD
67N DU — Upper Directional Unit Of Type KRD

52 — Power Circuit Breaker
ICS — Indicating Contactor Switch
a — Breaker Auxiliary Contact
TC — Breaker Trip Coil

183A970

Fig. 11

Type KRP



Device Number Chart

67N — Ground Directional Overcurrent Relay, Type KRP
67N/I — Overcurrent Unit Of Type KRP
67N/D — Directional Unit Of Type KRP
52 — Power Circuit Breaker
ICS — Indicating Contactor Switch
a — Breaker Auxiliary Contact
TC — Breaker Trip Coil

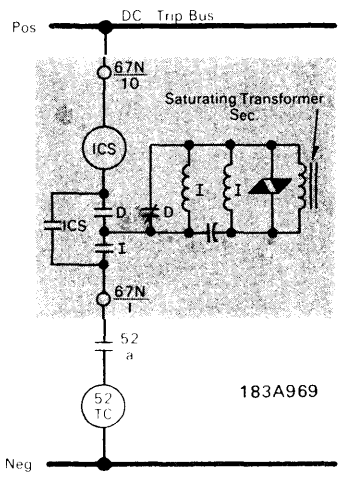
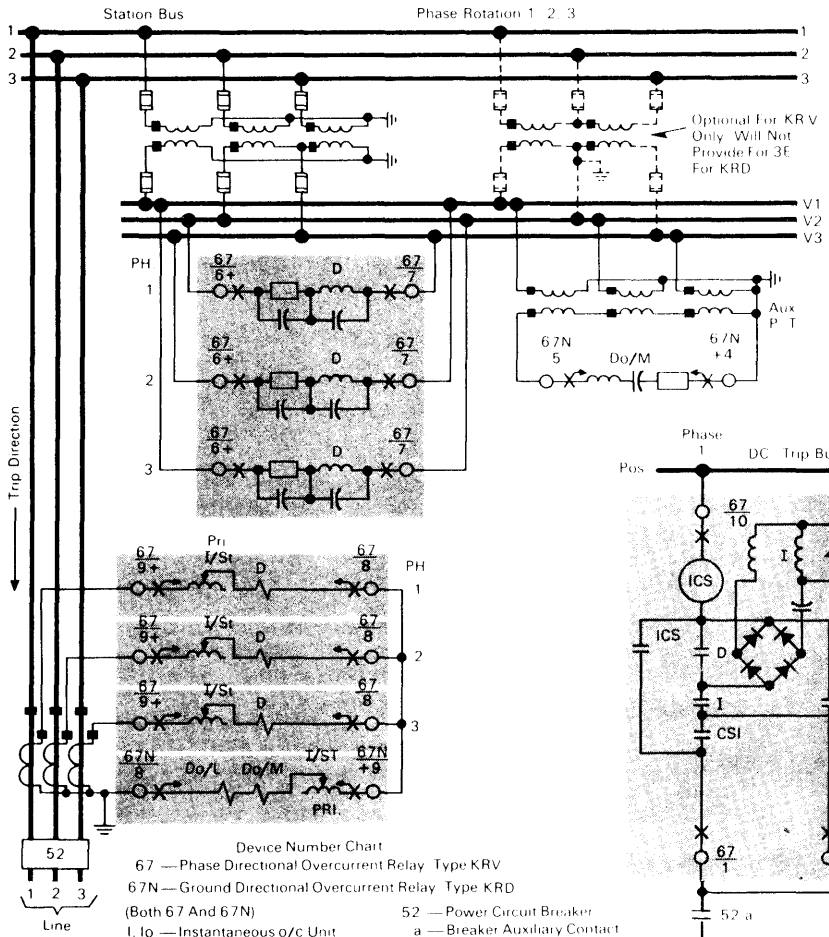
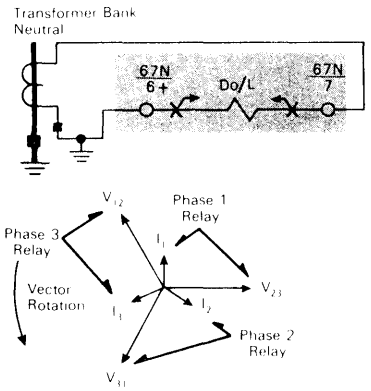


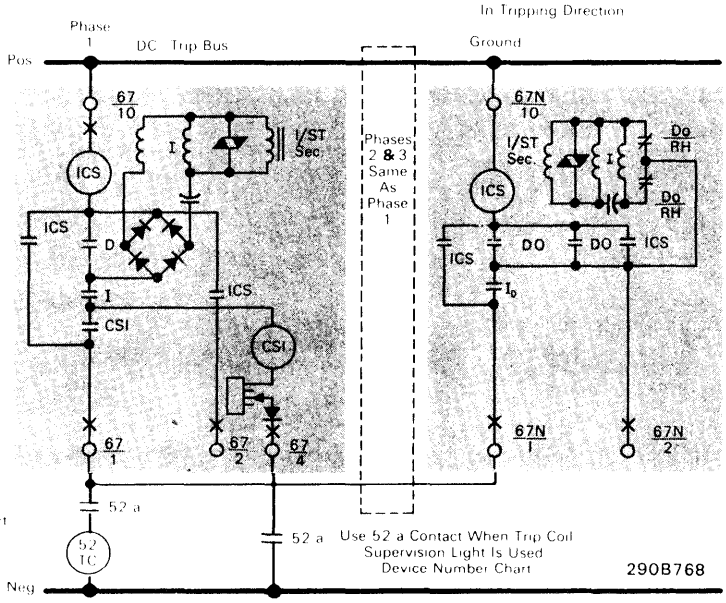
Fig 12

Type KRV





Vectors At 100% P. F. Power In Tripping Direction



Device Number Chart

67 — Phase Directional Overcurrent Relay, Type KRV
67N — Ground Directional Overcurrent Relay, Type KRD
(Both 67 And 67N)
I, Io — Instantaneous o/c Unit
D, Do — Directional Unit
CSI, ICS — Auxiliary Switches
52 — Power Circuit Breaker
a — Breaker Auxiliary Contact
TC — Breaker Trip Coil
I/ST — Saturating Transformer For Inst. o/c Unit

Fig 13

Typical Time Curves

Types KRC and KRD (Current Polarized)

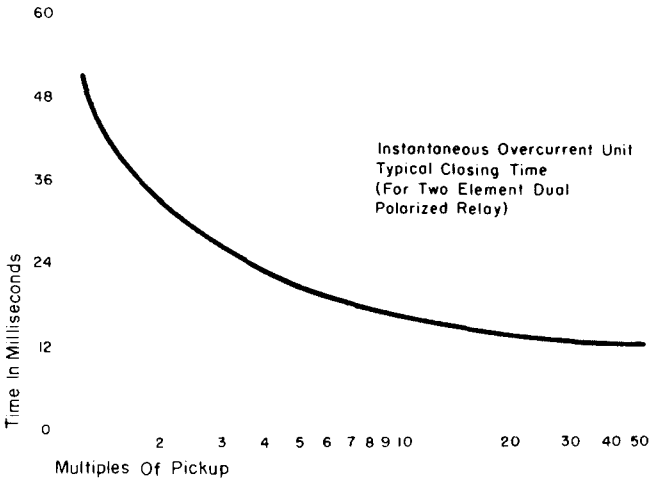


Fig. 14

Type KRV

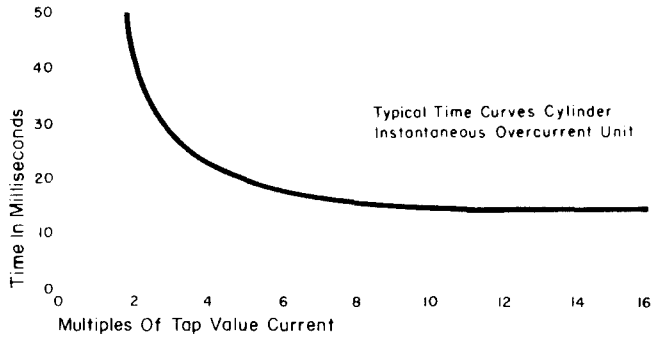


Fig. 16 184A946

Types KRD and KRP (Potential Polarized)

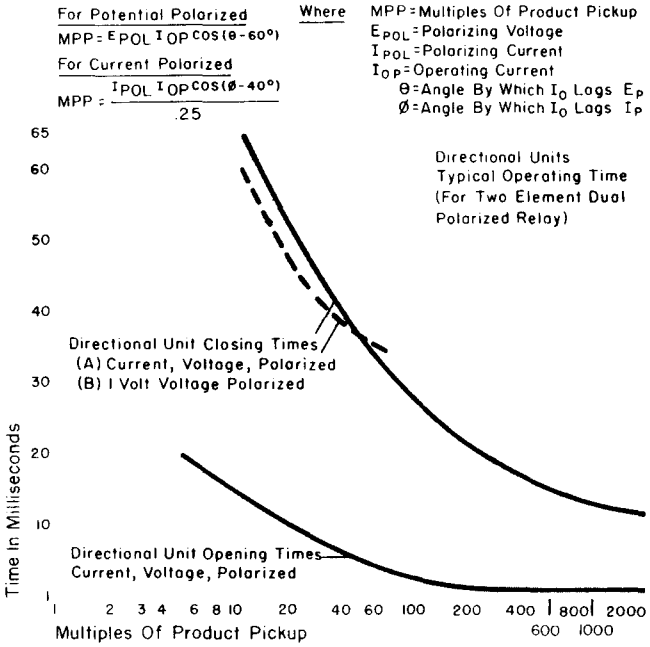


Fig. 15 538108

Shipping Weights and Carton Dimensions

Type	Case Type	Weight: Lbs. Net	Weight: Lbs. Shipping	Domestic Shipping Carton: Inches
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
Contactor Switches: DB 41-081
Other Protective Relays:

Printed in U.S.A.

August, 1991

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 Switch③	CS-1 Auxiliary Switch	Instantaneous Unit Range: Amps: Ac	Voltage Rating (Continuous)	Relay Data: Internal Schematic	Relay Data: Style Number	Case Style
KRC	Ground Fault	1.0 amp	....	0.5-2.0	...	183A022	289B145A17	**FT-31**
	Detection	dc	....	1-4	...		289B145A18	
Instantaneous	Current		....	2-8	...		289B145A19	
	Polarized		....	4-16	...		289B145A20	
Spst-cc	230 amps/1 sec		....	10-40	...		289B145A21	
				20-80			289B145A22	
KRD②	Ground Fault	1.0 amp	....	0.5-2.0	...	183A412	289B145A31	
	Detection	dc	....	1-4	...		289B145A32	
Instantaneous	Dual		....	2-8	...		289B145A33	
	Polarized		....	4-16	...		289B145A34	
	208 volts/30 sec		....	10-40	...		289B145A35	
Spst-cc	also 230 amps/1 sec			20-80			289B145A36	
KRP②	Ground Fault	1.0 amp	....	0.5-2.0	...	183A025	289B145A25	
	Detection	dc	....	1-4	...		289B145A26	
	Voltage		....	2-8	...		289B145A27	
Instantaneous	Polarized		....	4-16	...		289B145A28	
	208 volts/30 sec }		....	10-40	...		289B145A29	
Spst-cc	230 amps/1 sec }			20-80			289B145A30	
		0.2/2.0	....	0.5-2.0	...	188A382	1483B94A09	
		amp dc		1-4			289B145A24	
				2-8			289B145A23	
KRV	Phase Fault	1.0 amp	24 to	0.5-2.0	132 ac	185A456	289B145A09	
	Detection	dc	250 v	1-4			289B145A10	
Instantaneous	Voltage		dc	2-8			289B145A11	
	Polarized			4-16			289B145A12	
Spst-cc	120 volts			10-40			289B145A13	
	60 Hertz			20-80			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.