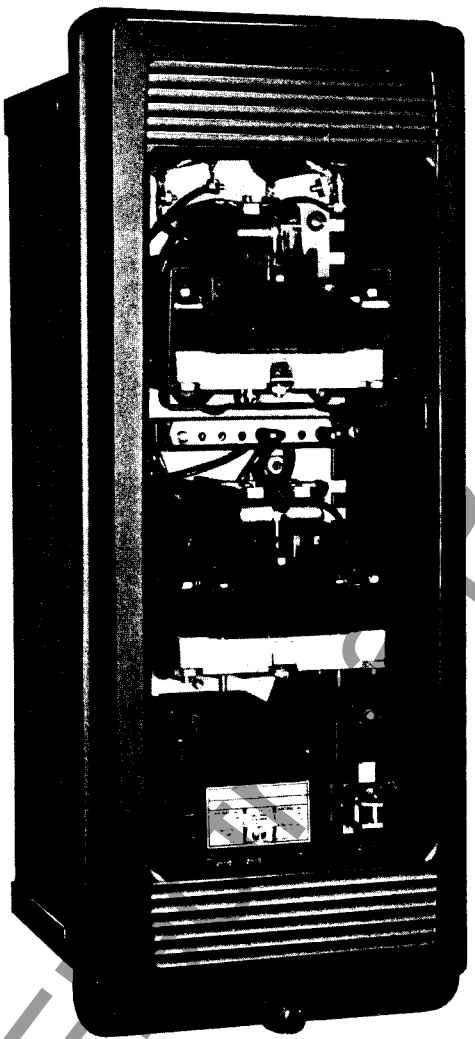
ABB Power T&D Company Inc.
Relay Division
Coral Springs, FL
Allentown, PA

September, 1990
Supersedes DB 41-130D, pages 1-4,
dated July, 1989
Mailed to: E, D, C/41-100A

Device Number: 67N

Types KRD-4 and KRQ Directional Overcurrent Ground Relays



KRD-4

Application

Types KRD-4 and KRQ relays are high-speed, directional overcurrent relays. They are used for the detection of ground faults on transmission lines, feeder transmission lines, and feeder circuits.

They can also be used, without modification, to provide directional ground fault protection in K-Dar carrier relaying schemes.

Type KRD-4

This dual polarized relay can be polarized from a potential source, a local ground source, or from both simultaneously.

The directional unit compares the phase angle relationship between the ground fault current and the polarizing quantity to produce contact-closing torque for faults in the trip direction, and contact-opening torque for faults in the non-trip direction. Relay operation occurs when both the directional unit and the instantaneous overcurrent unit close their contacts. The fault current must therefore be greater than the tap setting of the overcurrent unit.

Type KRQ

The KRQ relay is a high-speed directional overcurrent ground relay in which the directional unit operates on negative sequence current and voltage, and the over-current unit operates on residual or ground current.

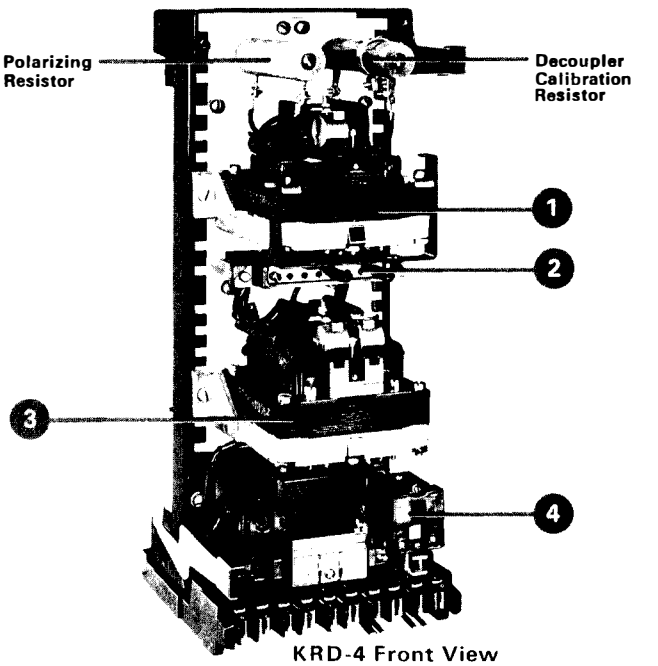
The phase angle between negative sequence voltage and negative sequence current is used for directional discrimination. Negative sequence polarization is applied as follows: (1) where zero sequence voltage or polarizing current is not available or the current is not a reliable source, or (2) where incorrect zero sequence polarization of directional units results from mutual indication between transmission lines.

The negative sequence current and voltage are obtained by means of self-contained negative sequence filters connected between the directional unit and the current and potential transformers.

The KRQ relay is for use at locations where the present equipment or system conditions do not permit the use of the conventional types of directional ground relays operating entirely on residual current and voltage.

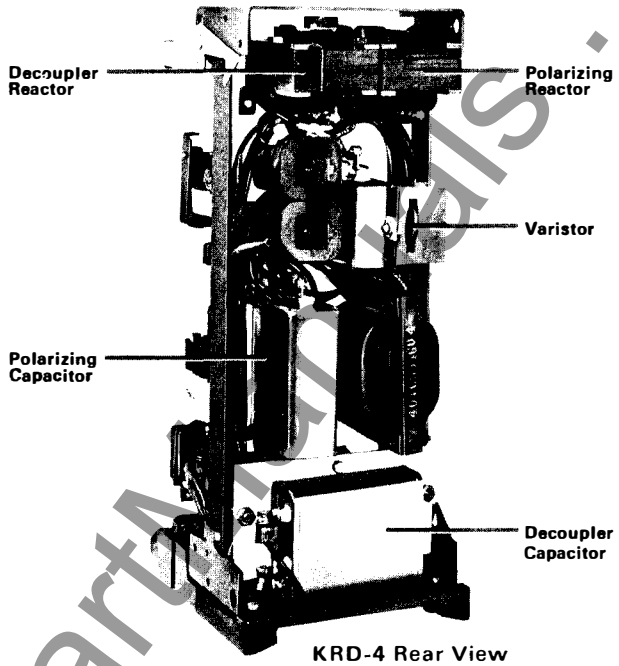
It is applicable for ground protection at undergrounded substations or grounded systems where only two potential transformers are available, or where the potential transformers are on the low-tension side of a wye-delta or delta-wye power transformer bank.

Construction



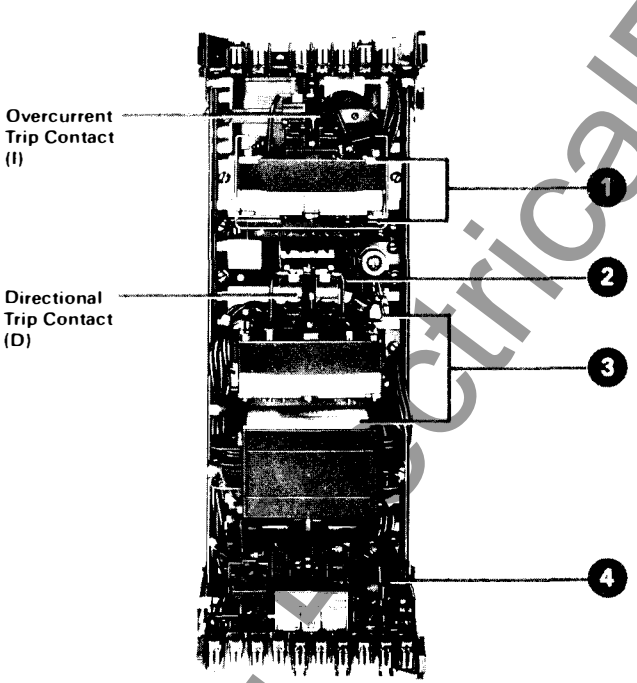
KRD-4 Front View

Fig. 1



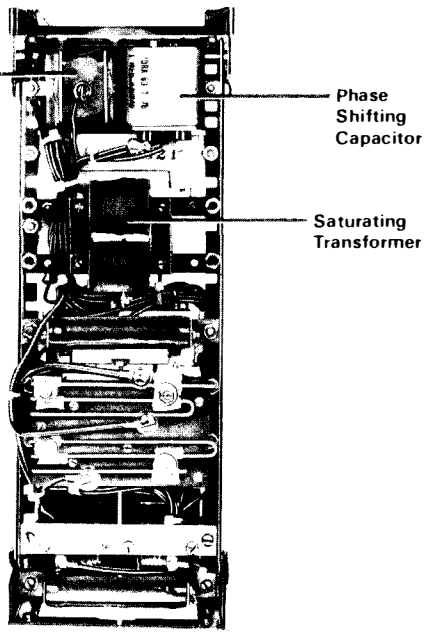
KRD-4 Rear View

Fig. 2



KRQ Front View

Fig. 3



KRQ Rear View

Fig. 4

① Overcurrent Unit (I)

The ground instantaneous overcurrent section consists of an induction cylinder unit with moving and stationary contact, phase shifting capacitor, varistor, saturating transformer with a tapped primary winding and a secondary winding, and a tap block for current pickup settings.

A varistor is connected across the secondary winding to reduce the voltage peaks applied to the induction unit and to the phase shifting capacitor.

② Tap Block

The primary winding is tapped, and these taps are brought out to a tap block for ease in changing the pick up of the overcurrent unit. By using a tapped transformer, the relay can provide approximately the same energy level at a given multiple of pickup current for any tap setting, resulting in one time curve throughout the range of the relay.

③ Directional Unit (D)

KRD-4
The KRD-4's directional unit consists of an induction cylinder unit, phase shifting network, and a die-coupling network.

Since this single unit can be polarized from a potential source, from a local ground source, or from both simultaneously, a simplified trip circuit and one, instead of two, back contacts can be used in the overcurrent torque control circuit.

KRQ
The KRQ directional unit is a product induction cylinder type, which operates on the interaction between the polarizing circuit flux and the operating circuit flux.

④ Indicating Contactor Switch (ICS)

When the dc operated ICS is energized, the moving contacts bridge two stationary contacts, completing the trip circuit.

Characteristics

Current Ranges
Both the KRD-4 and the KRQ relays are available in the following current ranges:

Range: Amps	Taps①					
0.5-2	0.5	0.75	1.0	1.25	1.5	2.0
1-4	1.0	1.5	2.0	2.5	3.0	4.0
2-8	2.0	3.0	4.0	5.0	6.0	8.0
4-16	4.0	6.0	8.0	9.0	12.0	16.0
10-40	10.0	15.0	20.0	25.0	30.0	40.0

① Tap value is the minimum current required to just close the relay.

Torque Angle (KRD-4)
When the relay is potential polarized, maximum torque angle occurs when operating current lags polarizing voltage by approximately 65 degrees.

When current polarized, maximum torque angle occurs when operating current is in phase with the polarizing current.

Trip Circuit
The main contacts of both the KRD-4 and KRQ relays will safely close 30 amperes at 250 volts dc, and the seal-in contacts of the ICS unit will safely carry this current long enough to trip a circuit breaker.

The ICS has a pickup of approximately 1 ampere. Its dc resistance is 0.1 ohms.

Directional Unit Sensitivity

Polarizing Quantity	Minimum Pickup Values		Phase Angle Relationship
	Volts	Amperes	
Voltage	1	0.6	I lagging V by 65 degrees
	1	1.4	I in phase with V
Current	..	0.5	in-phase

Energy Requirements
KRD-4: See Instruction Leaflet 41-137.3.
KRQ: See Instruction Leaflet 41-164.

Further Information
List Prices: PL 41-020
Technical Data: TD 41-025
Instructions:
Type KRD-4, IL 41-137.3
Type KRQ, IL 41-164
Renewal Parts: RPD 41-963
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 KRD-4 and KRQ on page 35, dated November, 1987
Mailed to: E, D, C/41-100A

Type KRD-4 and KRQ Directional Overcurrent Ground Relays

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

Type Time Curve and Contacts	Application	Indicating Contactor Switch③	Current Range: Amps Ac	Relay Data: Internal Schematic	Relay Data: Style Number	Relay Data: Case Size
KRD-4①②	Ground Detection	1.0 amp dc	0.5-2.0	629A509	293B307A09	**FT-31**
			1-4		293B307A10	
Instantaneous			2-8		293B307A11	
	208 volts/30 sec					
Spst-cc		0.2/2.0 amp dc	0.5-2.0	762A542	293B307A12	
			1-4		293B307A13	
			2-8		293B307A14	
			4-16		293B307A16	
			10-40		293B307A15	

Overcurrent, Instantaneous, Directional, Negative Sequence (Device Number: 67N)

Type Time Curve and Contacts	Application	Indicating Contactor Switch③	Current Range: Amps Ac	Relay Data: Internal Schematic	Relay Data: Style Number	Relay Data: Case Size
KRQ	Ground Detection	1.0 amp dc	0.5-2.0	184A546	774B232A13	**FT-42**
			1-4		774B232A09	
Instantaneous			2-8		774B232A10	
			4-16		774B232A11	
			10-40		774B232A12	
		0.2/2.0 amp dc		188A308	774B232A15	
					774B232A17	
					774B232A18	

Potential Polarizing Transformers, Single Phase (Product Bulletin 42-871 for dimensions)④

Volt-amps	Frequency, Hertz	Primary Volts: Line-to-Line	Primary Volts: Line-to-Neutral	Secondary Volts	Compensated at: Volt-amps	Compensated at: Power Factor	Connections Primary/Secondary	Style Number
50	50/60	115	66.5	115	25	100%	Connect wye/broken delta	9626A06G01
		200	115	66.5				9626A06G02
		200	115	115				9626A06G03

① 50-Hertz relays and auxiliaries can be supplied at same price. Order "Similar to Style Number ..... except 50 Hertz".

② See potential polarizing transformers, this page.

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 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.

④ Refer to LVIT Sales, Low Voltage Instrument Transformer Division, Pinetops, NC, for price and shipment.