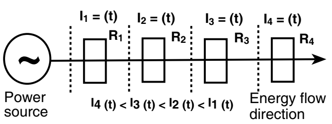
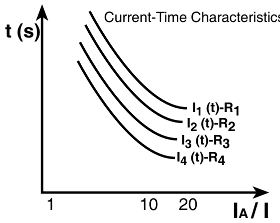
NEW GENERATION OVERCURRENT PROTECTION DEVICES
CKR SERIES

General

New generation, microprocessor based CKR series overcurrent relays combine both inverse time and independent time relays in one unit.
These relays are used for the purpose of protecting the equipments such as transformers, motors, generators, and power lines in energy distribution systems against short circuits and grounding faults.
The most important point to achieve the uppermost protection is to apply "selective protection". The main purpose of selective protection is locating and disconnecting the faulty circuit from the network as soon as possible but leaving the rest of the network active.
During selective protection, the whole energy system including the future expansions must be taken into consideration. Realization of this selective protection necessitates the coordination of the protection relays included in the distribution line; which in turn entails the conditions stated below as regards to inverse-time overcurrent relays. The accurate protection by the inverse-time overcurrent relays can be accomplished provided that the following conditions are met:
1) Relays having the same operation characteristics should be used in series with each other.
2) Tripping intervals of the relays used within the system must be adjusted in the form of "current/time steps". Current dependent tripping-time adjustment of the relays should be done in such a way that the "current/time steps" should be reduced as getting away from the source. Thus, the relay at the end of the line (R4 in the following figure) should have the shortest tripping time. This situation can be best observed from the schematics and time-current characteristics below:





Another important point is that the time adjustment of the relay closest to the source must be done very accurately. The time delay should be as long as possible to provide selectivity and as short as possible to protect the power supply on time.

Types

1. CKR- 9XX series overcurrent protection relays include four different inverse-time and four different independent time characteristics. According to IEC-255, BS-142 these are:
a- Normal Inverse
b- Very Inverse
c- Extremely Inverse
d- Long Time Inverse
e- Independent Time 1 (2.5 s)
f- Independent Time 2 (5 s)
g- Independent Time 3 (10 s)
h- Independent Time 4 (15 s)
The instantaneous tripping current, the time multiplication factor, and current-time characteristics adjustment both for the phases and neutral can be selected separately.

2. CKR- 8XX series overcurrent protection relays include five different inverse-time and three different independent time characteristics. According to IEC-255, BS-142 and ANSI C.112, these are:
a- Normal Inverse
b- Very Inverse
c- Extremely Inverse
d- Long Time Inverse
e- Moderately Inverse
f- Independent Time 1 (2.5 s)
g- Independent Time 2 (5 s)
h- Independent Time 3 (15 s)
The instantaneous tripping current, the time multiplication factor, and current-time characteristics adjustment both for the phases and neutral are common

1.CKR-91 - CKR 81: Single-phase overcurrent relay with no earth.
This overcurrent relay protects only single-phase. If three-phase protection is required, three relays should be used. See connection diagram A.

2.CKR-91T - CKR 81T: Earth fault overcurrent relay. This relay measures the current flowing from the star point to earth. If the line is balanced this current is zero while the balance is destroyed when one of the phases is connected to earth. See connection diagram B1 and B2.
Note: See connection diagram B3 for CKR 91T96-CKR81T96

3.CKR-92T - CKR 82T: T hase and earth fault overcurrent relay. This overcurrent relay is used to combine the two-phase protection and earth-fault protection in one device. See connection diagram C.

4. CKR-93 - CKR 83: Three-phase overcurrent relay. This overcurrent relay is used to protect the phases with only one relay.
See connection diagram D.

5. CKR-93T - CKR 83T: Three-phase and earth fault overcurrent relay. This overcurrent relay is used to combine the three-phase protection and earth-fault protection in one device. See connection diagram E.

Operation Principles

The current information fed through main current transformers is transferred to the electronic circuits by the built in current transformers. The delayed tripping-current "I>" adjustment (Set current) is done by means of the current adjustment circuit connected to the seconder side of these built in current transformers. By using the "dip switches" on the front panel, independent current adjustments can be done for the phases and neutral separately. By means of the warning LEDs of each input, one can detect which phase/neutral includes the fault. In addition, The fault information is stored by a memory function even if the input power to the relay is OFF. The AC voltage related with the faulty current at the current circuit is converted to a DC signal and transferred to the microprocessor. This measured value is then compared with the set current value. If measured value exceeds the setting value, the "NORMAL" led will turn off immediately and when the measured value will reach the 1.05 times of the set value the "PICK-UP" led will turn on and time counting process, starts. If the current falls below 0.95 of the set value, the tripping process is resetted, the led: "PICK-UP" turns off and the led:"NORMAL" turns on. When the time counter reaches to a value determined by the related current-time characteristics, the LED associated with faulty input turns on. If a higher overcurrent is detected from another input during this tripping time, associated with current-time characteristics, the time related with this overcurrent "I>>" and the remaining tripping time are compared and the relay is energized at the end of the smaller interval. If the faulty current is greater than the instantaneous set current, the relay is de-energized without delay for the completion of the tripping time (if dip-switch: "INSTANTANEOUS" is ON). When this dip-switch is OFF, instantaneous relay tripping is not performed. At the phase faults, only phase relay is turned OFF while both the phase and neutral relays are turned OFF in the case of earth faults. The test button on the front panel is to test the functioning of the relay. When this button is pressed, the relay behaves as if all inputs experience an overcurrent. The RESET button is used to erase the recent fault information from the memory.

*In CKR 81T96 and CKR 91T96 type earth fault relays,Test function is operational by pressing test button only if "test enable" switch is on (test on).

Adjustments

1. The Selection of Set-Current

The set currents "I>" for each phase and neutral can be adjusted from 1A to 16.75 A (for neutral: 0.2A - 3.35A) by means of dip-switches. The dip switches "I>" include six stages and turned ON by pushing them right. The set-current for all phases is 1A and that for neutral is 0.2A when all switches are in OFF position. The set-current is calculated by adding a value (1 for phases, 0.2 for neutral) to the values written on the right of the switches. The set-current when all switches are ON:
For Phases:
Iset = 1 + 0.25 + 0.5 + 1 + 2 + 4 + 8 = 16.75 A.
For example, to adjust Iset=6.5 A, the switches:2,3,5 are to be turned ON

Iset = 1 + 0.5 + 1 + 4 = 6.5 A

For neutral;
Iset = 0.2 + 0.05 + 0.1 + 0.2 + 0.4 + 0.8 +1.6 = 3.35 A

For example, to adjust Iset=1.3 A, the switches: 2,3,5 are to be turned ON.

Iset = 0.2 + 0.1 +0.2 +0.8 = 1.3 A

2- Selection of Instantaneous Current

With, "I>>" dip switch, this current can be adjusted within 2-17 times set current. I>> switch includes 4 stages. Instantaneous overcurrent change-over ratio is twice the set current when all switches are OFF. In other words, instantaneous change-over is not performed until the operating current reaches twice the set current. The instantaneous change-over current (when all switches are ON) is given by:
I>> = 2 + 1 + 2 + 4 + 8 = 17
For example, to adjust the instantaneous current as 13 times the set current the switches: 1,2,4 are to be turned ON, i.e.,
I>> = 2 + 1 + 2 + 8 = 13 .

3- Selection of Time Factor

Time factor can be adjusted, by dip-switch, from 0.05 to 10 with steps of 0.1. Time factor is 0.05 when all switches are OFF. When any of the swiches are turned ON (unlike I> and I>> switches) 0.05 (first value) is not added to the sum.
The time factor when all switches are ON can be found from:
Xt = 0.1 + 0.2 + 0.3 + 0.4 = 1.0
For example, to adjust the time factor to 0.6, the switches 2 and 4 are to be turned ON, i.e., and if the independent time 1 (2.5sec.) is selected Xt = 0.2 + 0.4 = 0.6 from then 2.5x0.6=1.5sec.

4- Mode Selection

Mode dip switch includes 4 stages and the first one controls the instantaneous tripping ON or OFF. With the other three switches, 8 different current-time characteristics can be selected. The current-time characteristics corresponding to dip-switch positions are given on the following table.

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2	3	4	CKR-9XX	CKR-8XX
			NORMAL INVERSE	NORMAL INVERSE
		●	VERY INVERSE	VERY INVERSE
	●		EXTREMELY INVERSE	EXTREMELY INVERSE
	●	●	LONG TIME INVERSE	LONG TIME INVERSE
●			INDEPENDENT TIME 1 (2.5 s)	MODERATELY INVERSE
●		●	INDEPENDENT TIME 2 (5 s)	INDEPENDENT TIME 1 (2.5 s)
●	●		INDEPENDENT TIME 3 (10 s)	INDEPENDENT TIME 2 (5 s)
●	●	●	INDEPENDENT TIME 4 (15 s)	INDEPENDENT TIME 3 (15 s)

ON: ● OFF: □

Technical Data

Auxiliary Supply

Rated Voltage (Un) : 24VDC, 110VDC, 220VAC-240VAC*
Operating Range : (0.8-1.2) x Un
Operating Value : I x 1.05 (for dependent time)
(I x 1.01 for ındependent time)

Time Circuit and Current Adjustments

Time Adjustment : t: (0.05 - 1.0), 11 different time selection
Instantaneous Tripping Time: For I > (1.5 x I>> x Iset) <100 ms
Rated Current (In) : 5A (phase), 1A (in earth fault)
Overload Current : 3 x In
Delayed Tripping Current: 1-16.75A Phase (0.2-3.35) x In
0.2-3.35A Earth (0.2-3.35) x In
Adjustment Tolerance : %7.5 or 40msn
Instantaneous Tripping Adjustment: k x [I>], k:2-17

Contacts

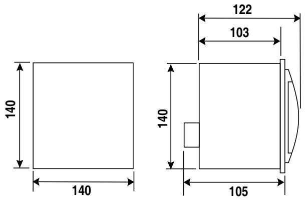
Phase : 1 NO 10A/1400VA (normally open)
Neutral : 1 NO 10A/1400VA (normally open)
Ambient Temperature : -5°C ; +50°C
Insulation : complies with IEC-255
a) Between ground and all terminals : 2kV/50 or 60 Hz, 1 min
b) Between current terminal and all terminals : 2kV/50 or 60 Hz, 1 min

High Frequency Disturbance
Non-affected Noise Level: 2.5 and 1kV-1MHz.
RFI : 150 & 450 MHz, 5W transmitter @25cm, all sides.
Dimensions : Type PR 17, Type PR 24
Protection Class : IP 51
Installation : Flush-mounting with rear connectors.
Weight : 1.3 kg.(PR 17), 0.6kg (PR 24)
Package Dimensions : 370 x 370 x 200 (PR 17), 360x245x250 (PR 24)
Pcs Per Package : 4 (PR 17), 16 (PR 24)

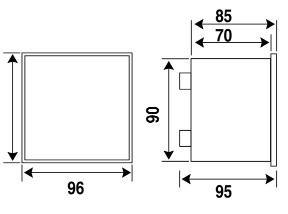
* Different supply voltages available upon request.

* In CKR-81T96 ant CKR91T96 type earth fault relays, there are two operating voltage inputs; 230VAC and 24VDC. Device operates either at 230VAC or 24VDC.

Dimensions



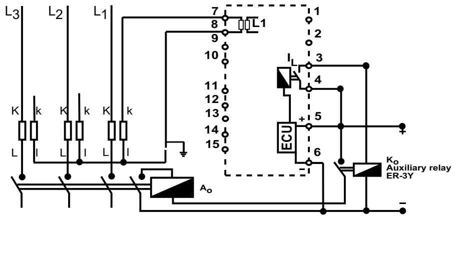
TYPE PR 17



TYPE PR 24

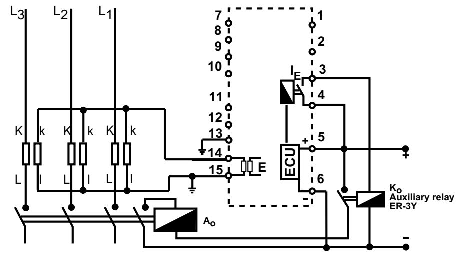
Connection Diagrams

A- Single Phase Overcurrent Protection Relay

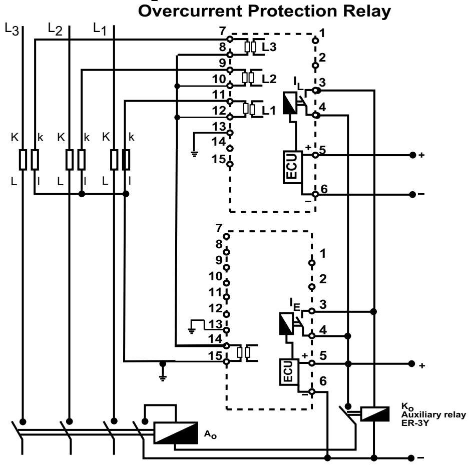


The shown diagrams are only for typical application purposes.

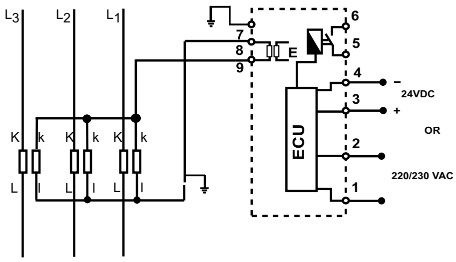
B_1- Earth Fault Overcurrent Protection Relay



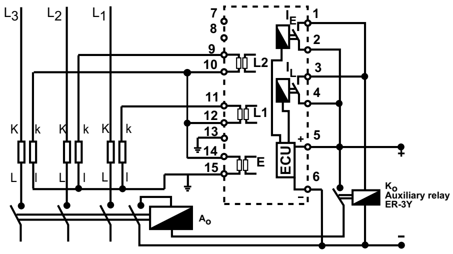
B_2- Earth Fault Overcurrent Protection Relay



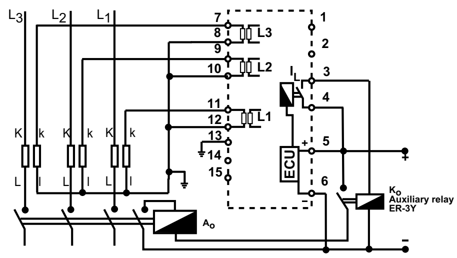
B_3- Earth Fault Overcurrent Protection Relay



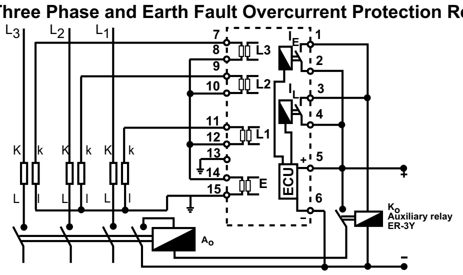
C-Two Phase and Earth Fault Overcurrent Protection Relay



D-Three Phase Overcurrent Protection Relay



E-Three Phase and Earth Fault Overcurrent Protection Relay



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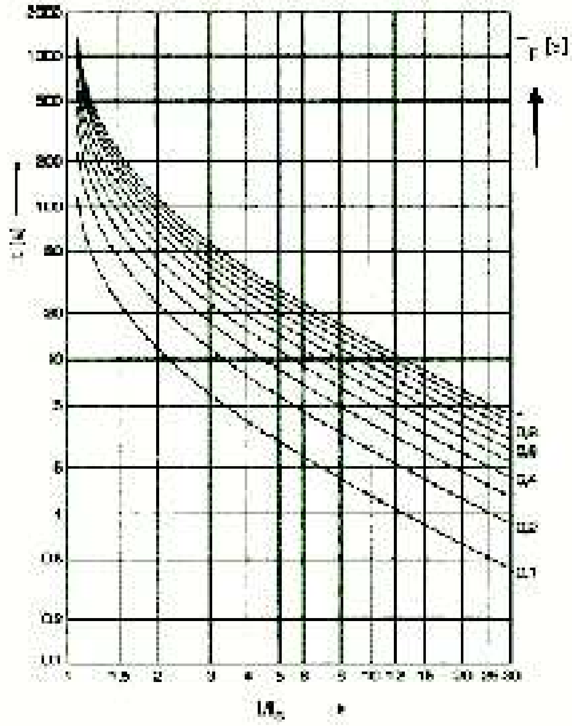
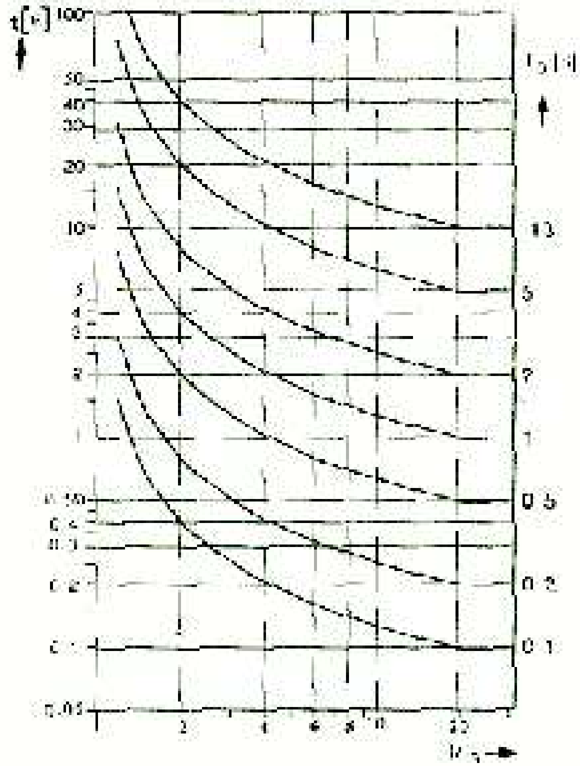




Long Time Inverse $t = \frac{120}{(I/I_s)^1 - 1} \cdot Tp$ [s]

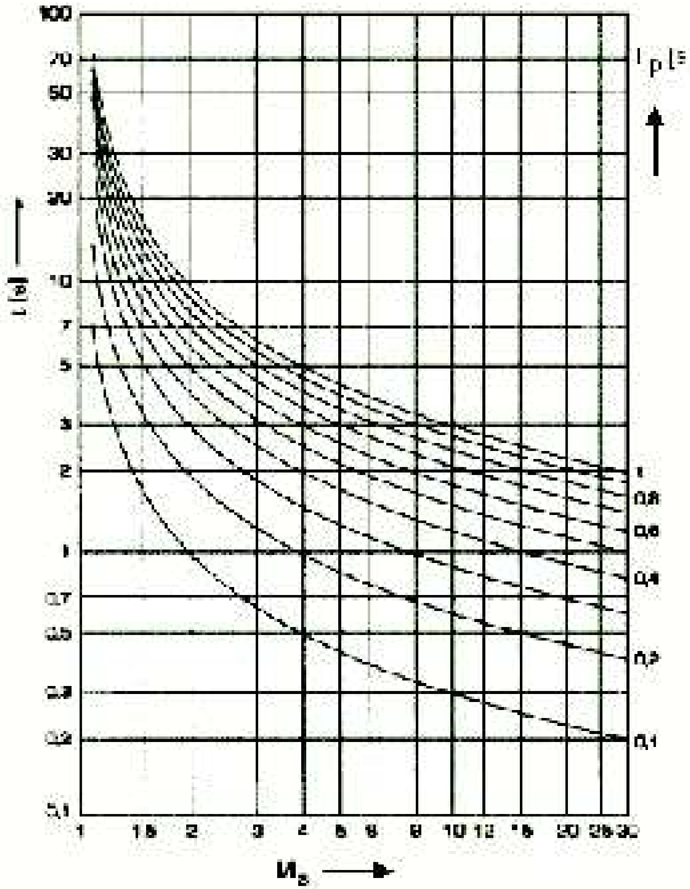
Long Time (X_s = 1.0)

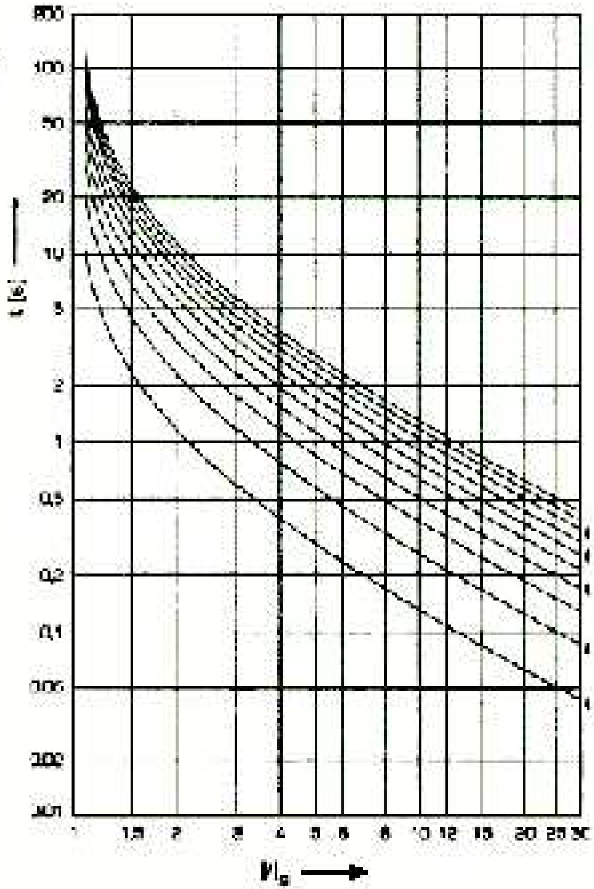
I/Is	2	3	4	5	6	8	10	15	20
t(sec)	120	60	40	30	24	17.1	13.3	8.57	6.32

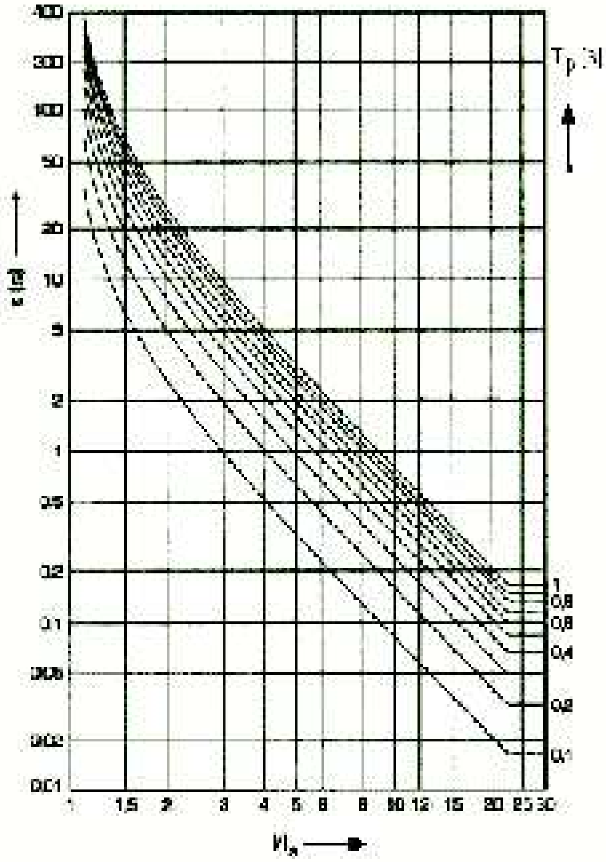
Moderately Inverse $t = \left(\frac{0.054196}{(I/I_s)^{0.02} - 1} + 0.09328 \right) \cdot Tp$ [s]

Moderately Inverse (X_s = 1.0)

I/Is	2	3	4	5	6	8	10	15	20
t(sec)	3.98	2.53	2.02	1.75	1.58	1.37	1.24	1.07	0.97







Normal inverse : $t = \dfrac{0.14}{(I/I_s)^{0.02}-1} \cdot T_p$ [s]

Very inverse : $t = \dfrac{13.5}{(I/I_s)-1} \cdot T_p$ [s]

Extremely inverse : $t = \dfrac{80}{(I/I_s)^{2}-1} \cdot T_p$ [s]

Normal inverse (X_q = 1.0)

I/Is	2	3	4	5	6	8	10	15	20
t(sec)	10	6.3	4.98	4.28	3.84	3.3	2.97	2.52	2.27

Very inverse (X_q = 1.0)

I/Is	2	3	4	5	6	8	10	15	20
t(sec)	13.5	6.75	4.5	3.38	2.7	1.93	1.5	0.96	0.71

Extremely inverse (X_q = 1.0)

I/Is	2	3	4	5	6	8	10	15	20
t(sec)	26.7	10	5.33	3.33	2.29	1.27	0.81	0.36	0.2