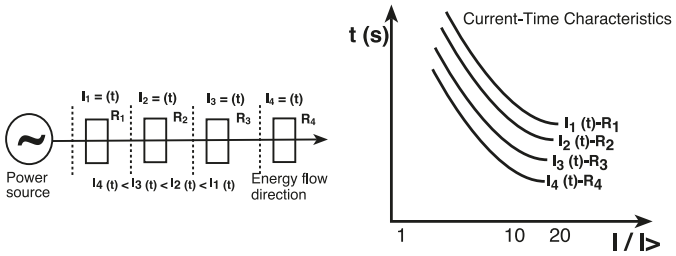
OVER CURRENT RELAYS
CKR SERIES

General
New generation, microprocessor based CKR series overcurrent devices combine inverse time and independent time devices in one unit.
They are used for 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.
The accurate protection by the inverse-time overcurrent devices are accomplished if the following conditions are met:
1) Devices having the same operation characteristics should be used in series with each other.
2) Tripping intervals of the devices used within the system must be adjusted in the form of "current/time steps". Current dependent tripping-time adjustment of the devices should be done in such a way that the "current/time steps" should be reduced as getting away from the source. Thus, the device 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:


I1 = (t)
I2 = (t)
I3 = (t)
I4 = (t)
R1
R2
R3
R4
Power source
I4 (t) < I3 (t) < I2 (t) < I1 (t)
Energy flow direction
t (s)
Current-Time Characteristics
I1 (t)-R1
I2 (t)-R2
I3 (t)-R3
I4 (t)-R4
1
10
20
I / I>
Another important point is that the time adjustment of the device 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 devices include four different inverse-time and four different independent time characteristics. **According to IEC-255, BS-142 these are:**
a- Normal Inverse **e-** Independent Time 1 (2.5 s)
b- Very Inverse **f-** Independent Time 2 (5 s)
c- Extremely Inverse **g-** Independent Time 3 (10 s)
d- Long Time Inverse **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 devices 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 **e-** Moderately Inverse
b- Very Inverse **f-** Independent Time 1 (2.5 s)
c- Extremely Inverse **g-** Independent Time 2 (5 s)
d- Long Time Inverse **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.

Note: CKR-94T overcurrent protection relay has five inverse time and three independent time characteristics.
In addition phases and earth can be selected separately for instant exceed current, time multiplication and current time curve.
1.CKR-91 - CKR 81: Single-phase overcurrent device without earth.
This device protects only single-phase. If three-phase protection is required, three devices should be used. See connection diagram A.
2.CKR-91T - CKR 81T: Earth fault overcurrent device. This device measures the current flowing from the star point to earth. If the lines are is balanced, this current is zero. See connection diagram B1 and B2.
Note: See connection diagram B3 for CKR 91T96-CKR81T96
3.CKR-92T - CKR 82T: Two - phase and earth fault overcurrent device.
See connection diagram C.
4. CKR-93 - CKR 83: Three-phase overcurrent device without earth.
See connection diagram D.
5. CKR-93T - CKR 83T: Three-phase and earth fault overcurrent device. See connection diagram E.

Definitions
"I" : Operating Current : Network current.
"I>" : Operating Current Treshold : The current value which starts the time counting process when it rises above the setting treshold.
"I>>" : Instantaneous Current Treshold : The current value which trips the device when it rises above the setting treshold. The setting is made as multiple of the "I>" value.
"Xt" Time Multiplier : Time multiplier is used to adjust delay time for independent and inverse time applications.

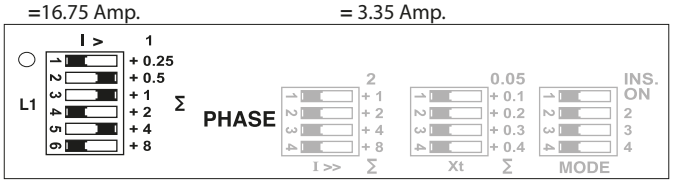
Operating Value : Also called "pick-up" value; is different for dependent and independent operation (Refer to technical data). When the operating current reaches the operating value, NORMAL LED is OFF and
PICK-UP Led is ON, indicating the start of tripping delay.

A- Independent Time Protection
Adjusted "Xt" value is used as a multiplier of selected independent time range. (Refer to time multiplier adjustment menu)
B- Inverse Time Protection
Adjusted "Xt" value is used to calculate the related time delay on the curve. The traced curves are obtained by the related formula and are defined by "Xt" value next to them. (Refer to time multiplier adjustment menu)

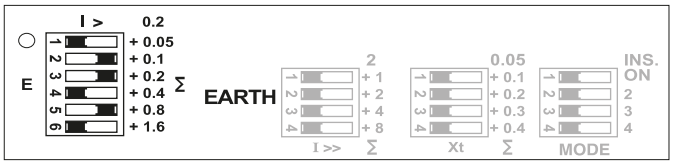
Settings
1. Operating Current Treshold Adjustment (I>)
The operating current treshold "I>" for each phase and neutral can be adjusted from 1A to 16.75 A (for neutral: 0.2A - 3.35A) by means of
dip-switches. The dip switches "I>" include six stages and turned ON by sliding them right. The operating current treshold for all phases is 1A and that for neutral is 0.2A when all switches are in OFF position. The operating current treshold is calculated by adding a value (1 for phases, 0.2 for neutral) to the values marked on the right of the switches.
When all switches are ON the operating current treshold is:

For Phases;
I> = 1+0.25+0.5+1+2+4+8
=16.75 Amp.

For Neutral;
I> = 0.2+0.05+0.1+0.2+0.4+0.8+1.6
= 3.35 Amp.

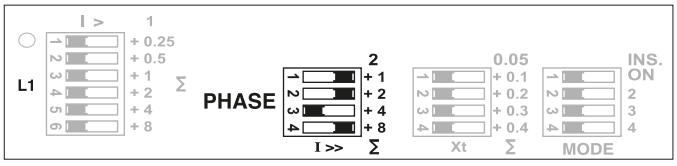


For example, the value of I> is 6.5 A for phases. **I> = 1+0.5+1+4 = 6.5 A.**



For example, the value of I> is 1.3 A for neutral. **I> = 0.2+0.1+0.2+0.8 = 1.3 A.**

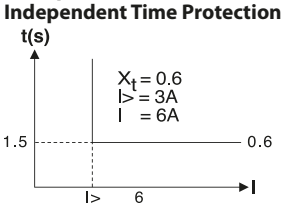
2- Instantaneous Current Treshold Adjustment (I>>)
With, "I>>" dip switch, instantaneous current treshold can be adjusted within 2-17 times operating current treshold. I>> switch includes 4 stages and when all switches are OFF, instantaneous current treshold is double of operating current treshold in other words, instantaneous current treshold is not performed until operating current reaches is double of operating current treshold.
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 is 13 times of operating current treshold **I>>= 2+1+2+8=13**

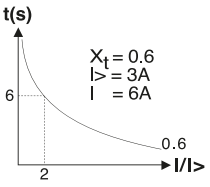
3- Time Multiplier Adjustment (Xt)
Time multiplier can be adjusted, by dip-switch, from 0.05 to 10 with steps of 0.1. Time multiplier is 0.05 when all switches are OFF. When any of the swiches are turned ON (unlike I> and I>> switches) 0.05 (first value) is not added to the sum.
The time multiplier when all switches are ON can be found from:
Xt = 0.1 + 0.2 + 0.3 + 0.4 = 1.0

Example:
Independent Time Protection

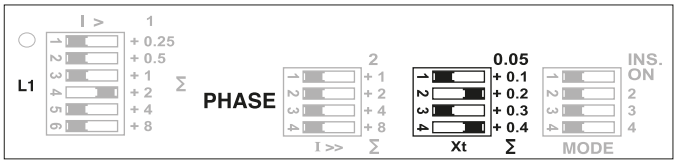


If 2.5sec. is selected as independent time, tripping time will be = 2,5 x 0,6 = 1.5 sec.

Example:
Inverse Time Protection



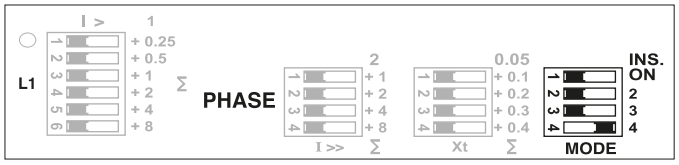
If normal inverse curve is selected, tripping time will be 6 sec.



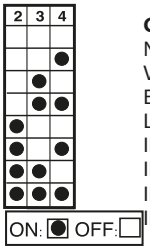
Example: For doing time multiplier to 0.6; $\mathbf{X_t = 0.2+0.4 = 0.6}$

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.



Example : Figure at above defines selecting current-time characteristics to **very** inverse and disable **instantaneous tripping.**



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)

Technical Data

Auxiliary Supply

Rated Voltage (Un) : 24VDC, 110VAC, 110VDC, 220VAC-240VAC*, 85-265V AC (80-300 V DC)
Operating Range : (0.8-1.2) x Un
Operating Value (Pick-up Value) : I x 1.05 (for dependent time) I x 1.01 (for independent time)

Time Circuit and Current Adjustments

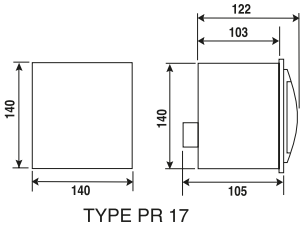
Time Multiplier Adj. : Xt: (0.05 - 1.0), 11 different time selection
Instantaneous Tripping Time: For I > (1.5 x I>> x I>) <100 ms
Rated Current (In) : 5A (phase), 1A (in earth fault)
Overload Current : 3 x In
Operating Current Treshold : 1-16.75A Phase (0.2-3.35) x In
0.2-3.35A Earth (0.2-3.35) x In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

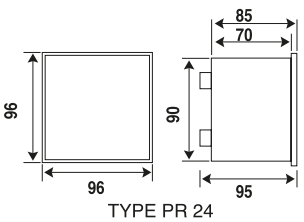
Contacts

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), 335x240x245 (PR 24)
Pcs Per Package : 4 (PR 17), 12 (PR 24)

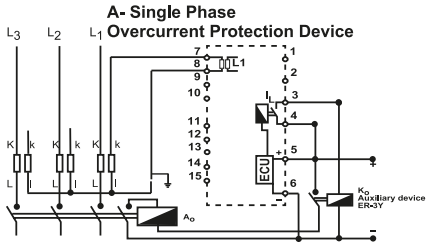
* Different supply voltages available upon request.
* In CKR-81T96 ant CKR91T96 type earth fault devices, there are two operating voltage inputs; 230VAC and 24VDC. Device operates either at 230VAC or 24VDC.

Dimensions

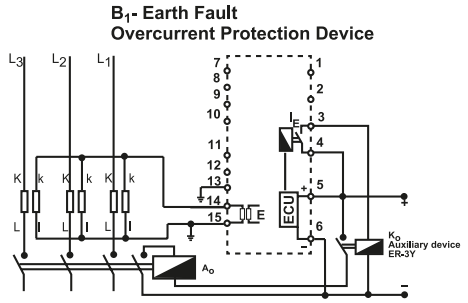


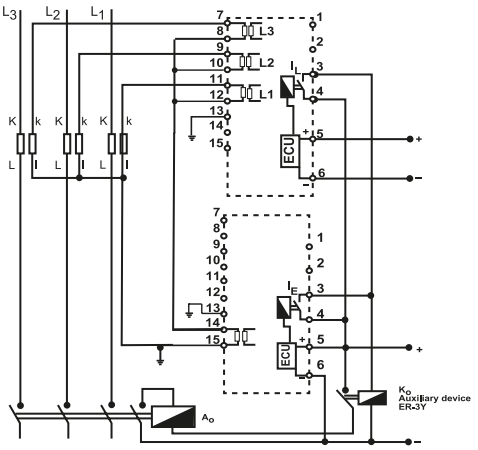


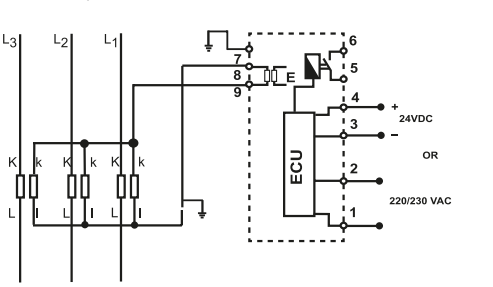
Connection Diagrams



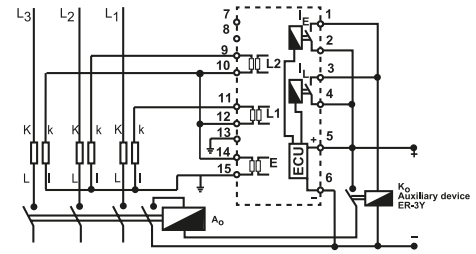
The shown diagrams are only for typical application purposes.



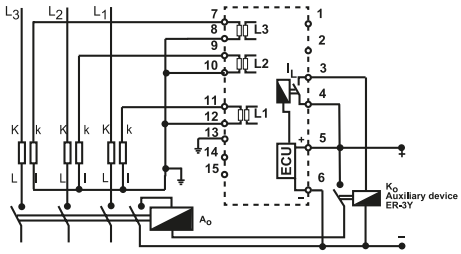




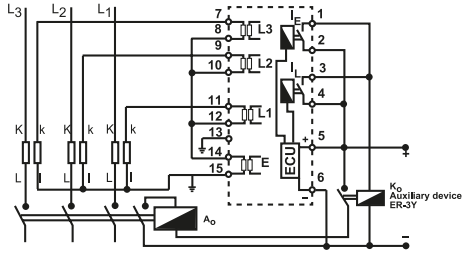
C-Two Phase and Earth Fault Overcurrent Protection Device

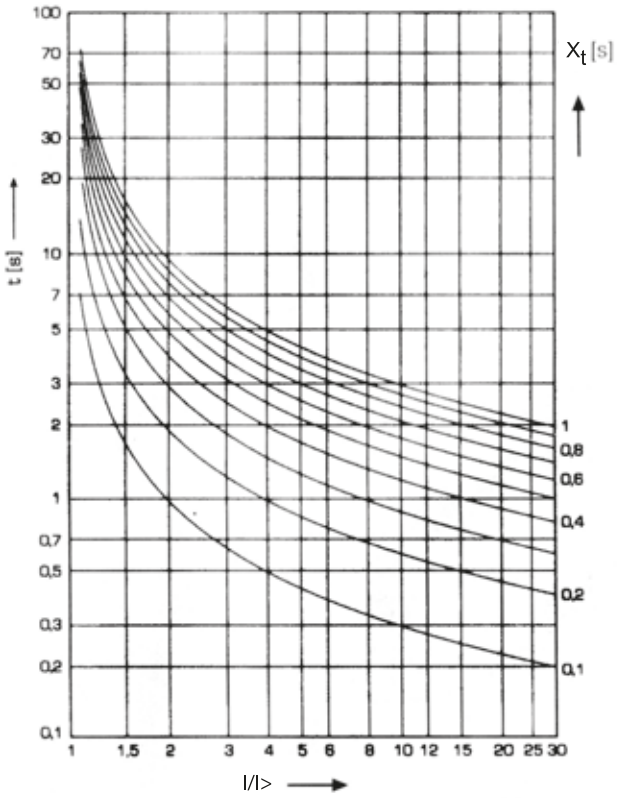


D-Three Phase Overcurrent Protection Device



E-Three Phase and Earth Fault Overcurrent Protection Device

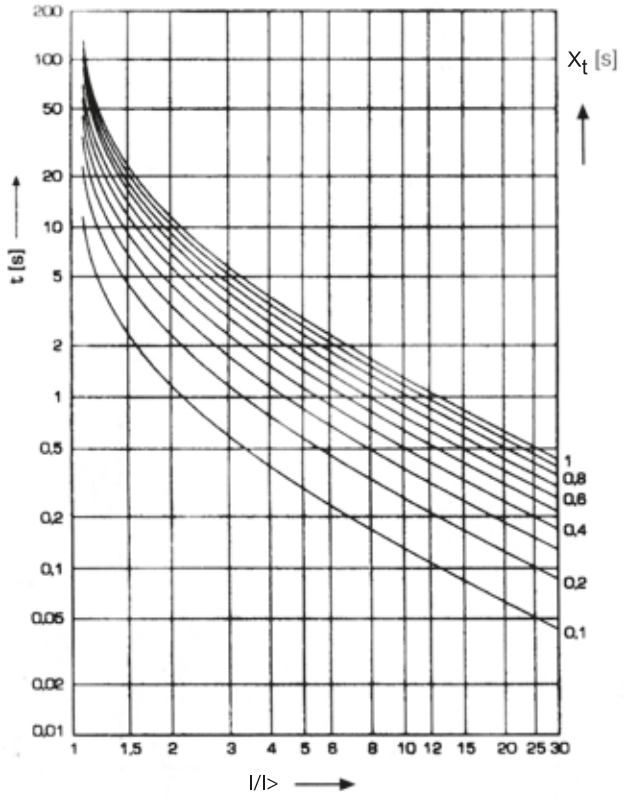




Normal inverse : $t = \frac{0.14}{(I/I>)^{0.02} - 1} \cdot X_t$ [s]

Normal Inverse (X_t = 1.0)

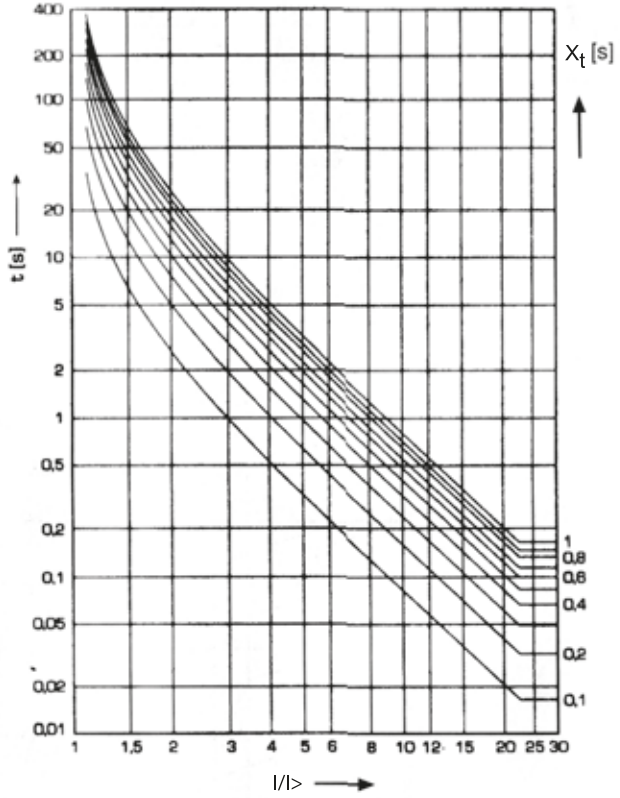
I/I>	2	3	4	5	6	8	10	15	20
t(s)	10	6.3	4.98	4.28	3.84	3.3	2.97	2.52	2.27



Very inverse : $t = \frac{13.5}{(I/I>) - 1} \cdot X_t$ [s]

Very Inverse (X_t = 1.0)

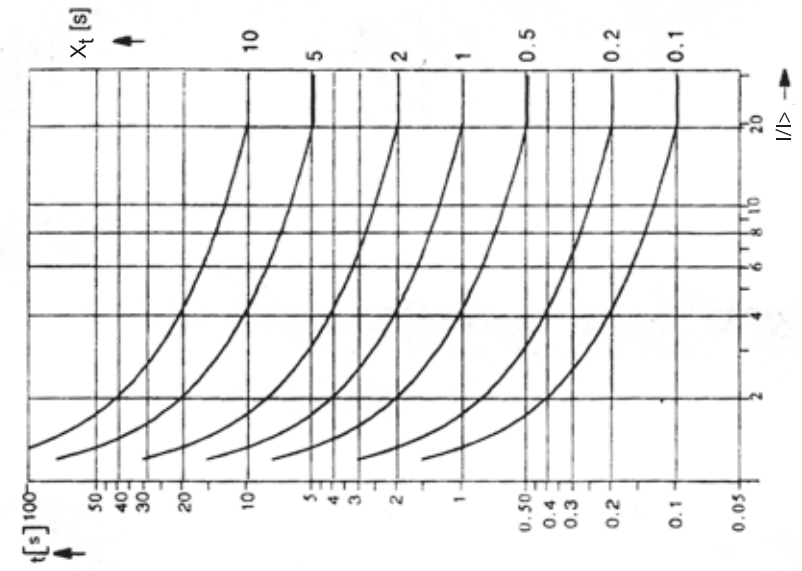
I/I>	2	3	4	5	6	8	10	15	20
t(s)	13.5	6.75	4.5	3.38	2.7	1.93	1.5	0.96	0.71



Extremely inverse : $t = \frac{80}{(I/I>)^2 - 1} \cdot X_t$ [s]

Extremely Inverse (X_t = 1.0)

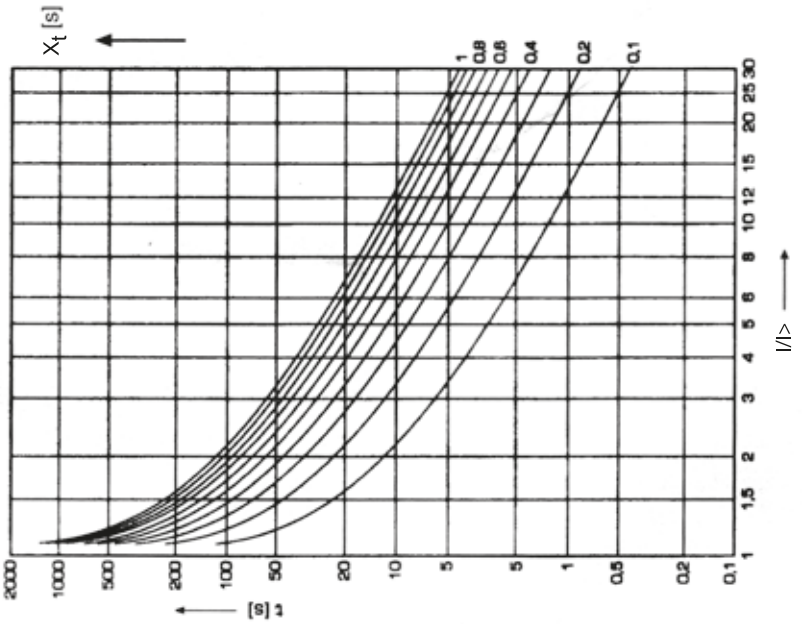
I/I>	2	3	4	5	6	8	10	15	20
t(s)	26.7	10	5.33	3.33	2.29	1.27	0.81	0.36	0.2



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

Moderately Inverse (X_t = 1.0)

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



Long Time inverse $t = \frac{120}{(I/I>)^1 - 1} \cdot X_t$ [s]

Long Time (X_t = 1.0)

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

CE