MANUAL

HighTECH Line | PROTECTION TECHNOLOGY MADE SIMPLE

IRI1 | TIME-OVERCURRENT RELAY

TIME-OVERCURRENT RELAY

Original document

English

Revision: C

Content

1.   Summary

When compared with traditional protection systems the protective relaying with MR- and IR-relays of our HIGH TECH LINE offers several advantages.

All MR protection relays are based on microprocessor technology. They present the generation of our most efficient protection relays, because of their capabilities to process the measuring values digitally and to perform arithmetical and logical operation. Additional advantages such as very low power consumption, adaptability, possibilities for self-supervision, flexible construction, selection of relay characteristics are completely utilized.
 Some IR protection relays are based on microprocessor and some on analog technology. They present our low-priced protection relay generation and are used for all basic protection application.

 The following properties of the IR protection relays, such as:

•   Integration of multiple protection functions into one compact housing,
•   User-friendly setting procedure by means of DIP-switches,
•   Compact design due to SMD-technique,

are their superiority over the traditional protection systems.

For all applications of a more complex nature, e.g. directional earth fault detection and where operating convenience, fault analysis and communication ability are required, MR-relays are used.
 All relays of the HIGH TECH LINE are available for through panel mounting and in 19" racks. Connection terminals are of plug-in type. All IEC/DIN regulations required for the individual application are reliably met by these relays.

2.   Applications

The digital time overcurrent relay IRI1 is a universal protection device for low, medium and high voltage networks. It is used in radial networks and combines the following functions in one unit:

- Independent (Definite) time overcurrent relay,
- Inverse Definite Minimum Time overcurrent relay, (IDMT) with the following selectable characteristics:
    - normal inverse
    - very inverse
    - extremely inverse
- Integrated independent and dependent overcurrent time protection for the earth-fault detection.

Furthermore, the device, providing the above functions, can be employed as back-up protection for differential and distance protection relays.

3. Characteristics and features

- Digital processing of the sampled measuring values
- Digital filtering of the measured values by using discrete Fourier analysis to suppress the high frequency harmonics and transient d.c. components during short circuit
- Selectable protective functions between:
    - definite time overcurrent relay and
    - inverse time overcurrent relay
- Selectable inverse time characteristics according to BS 142 and IEC 255-4:
    - normal inverse
    - very inverse
    - extremely inverse
- Independent for the high set element of phase over-current protection
- Two-step time overcurrent protection for phase current
- One-step time overcurrent protection for earth-fault current
- Extremely wide setting ranges and fine steps for cur-rent and time settings
- Wide operating ranges of the supply voltage (AC/DC)
- Plug-in technology with self-shorting C.T. circuits

4.   Design

4.1   Connections
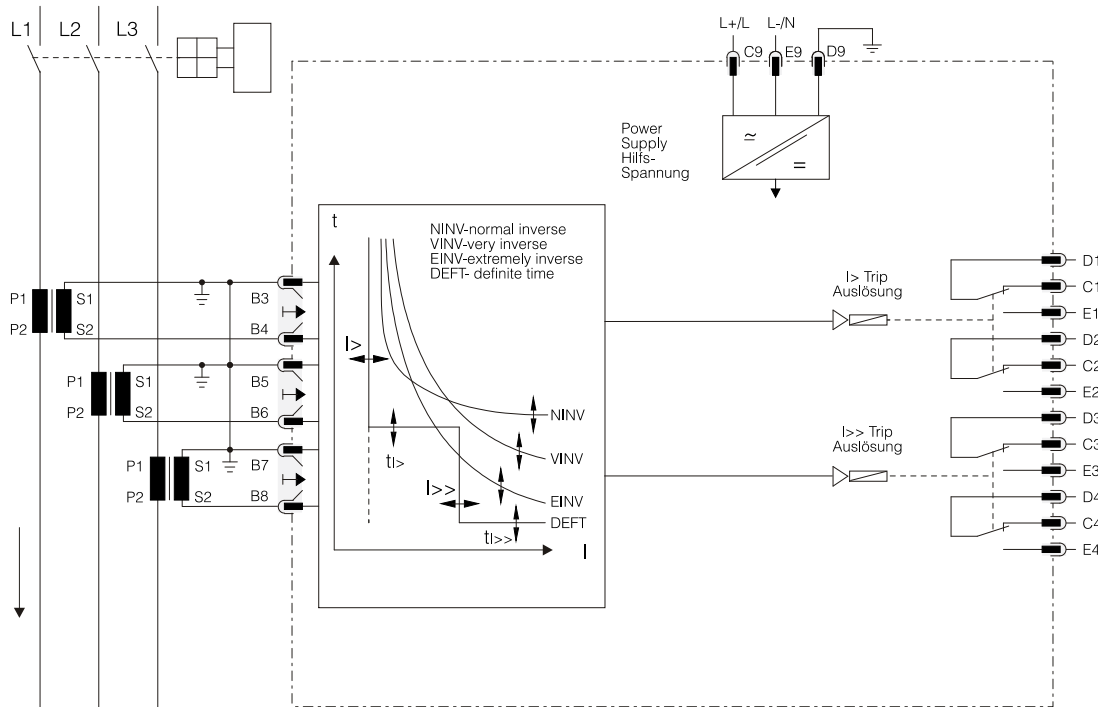
Figure 4.1: Connection diagram IRI1-I
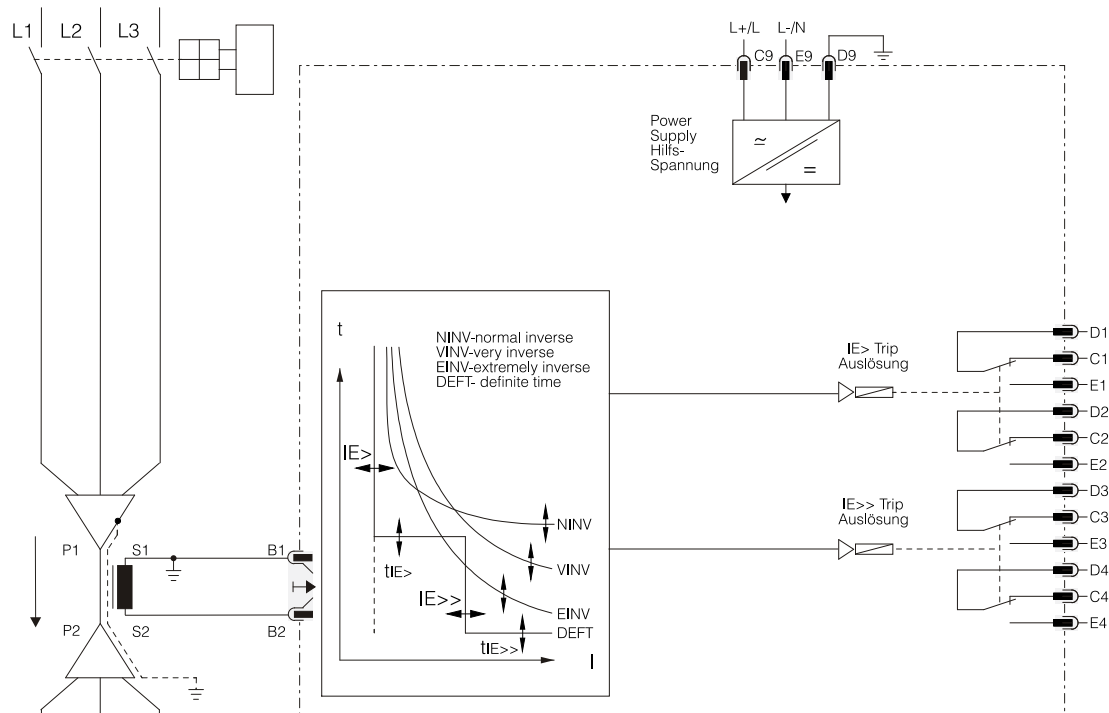
Figure 4.2: Connection diagram IRI1-E0
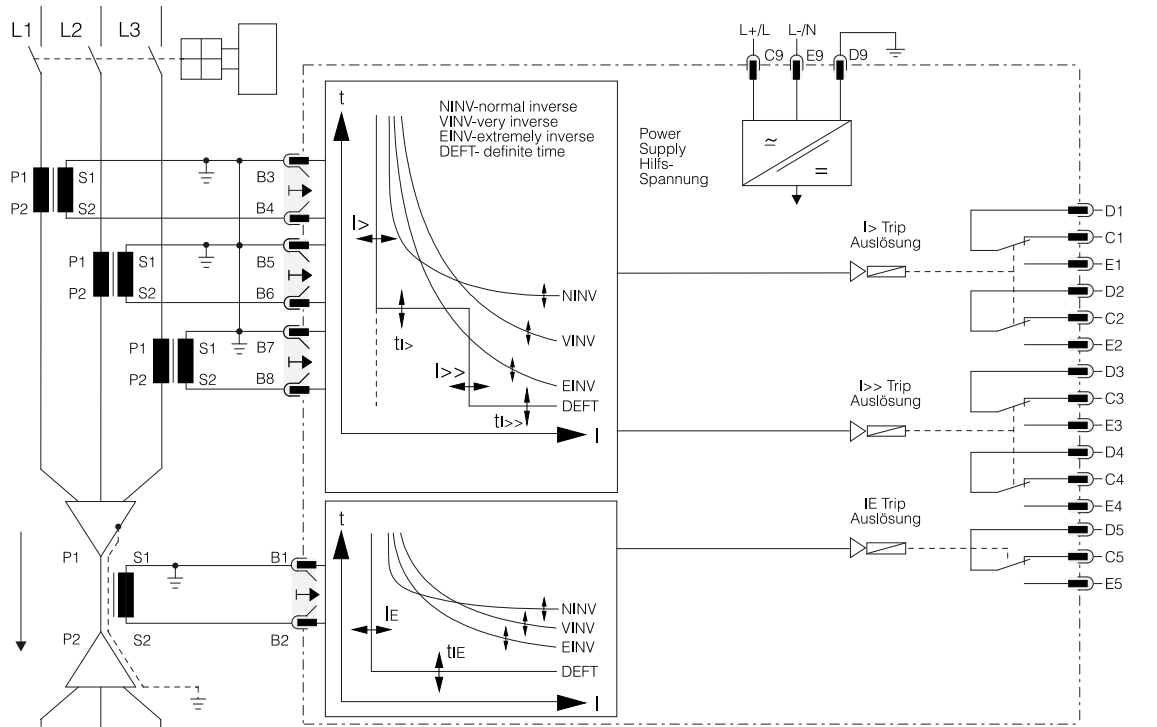
Figure 4.3: Connection diagram IRI1-IE ring core C.T.
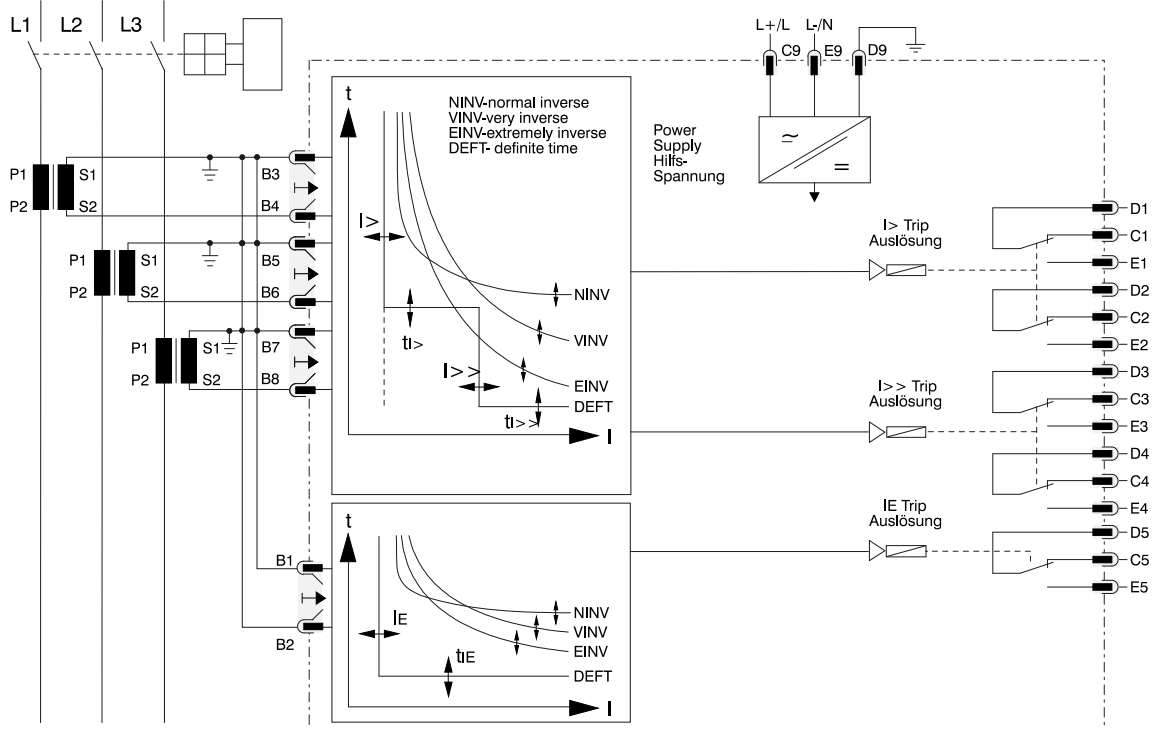
Figure 4.4: Connection diagram IRI1-IE Holmgreen circuit

In the following the IRI1 functional description always refers to the version IRI1-IE. With a few exceptions (no earth-fault detection for the IRI1-I and no phase current measurement for the IRI1-E0) all functions are valid for the other units.

4.1.1 Analog inputs

The analog input signal of the phase currents I_{L1} (B3-B4), I_{L2} (B5-B6), I_{L3} (B7-B8) and the earth current I_E (B1-B2) are fed to the protective device via separate input transformers.
The continuously measured current values are galvanically isolated, analog filtered and finally fed to the analog/digital converter.

4.1.2 Output relays (IRI1-IE)

The IRI1-IE is equipped with one trip relay for low set overcurrent one for high set overcurrent and one trip re-lay for earth-fault detection:

- Tripping I>:   C1, D1, E1; C2, D2, E2
- Tripping I_E: C5, D5, E5
- Tripping I>>:   C3, D3, E3; C4, D4, E4

4.1.3 Output relays (IRI1-I)

The IRI1-I is equipped with one trip relay for low set overcurrent and one for high set overcurrent:

- Tripping I>:   C1, D1, E1; C2, D2, E2
- Tripping I>>:   C3, D3, E3; C4, D4, E4

4.1.4 Output relays (IRI1-E0)

The IRI1-E0 is equipped with one trip relay for earth-fault low set and one for earth-fault high set element:

- Tripping I_E>:   C1, D1, E1; C2, D2, E2
- Tripping I_E>>:   C3, D3, E3; C4, D4, E4

4.2   Front plate

The front plate of the protective device IRI1 comprises the following operation and indication elements:

- DIP-switches for the setting of the tripping values and times – the number depends on the device variant
- LEDs for the fault indication – the number depends on the device variant
- 1 LED ready for service indication
- 1 pushbutton <RESET>
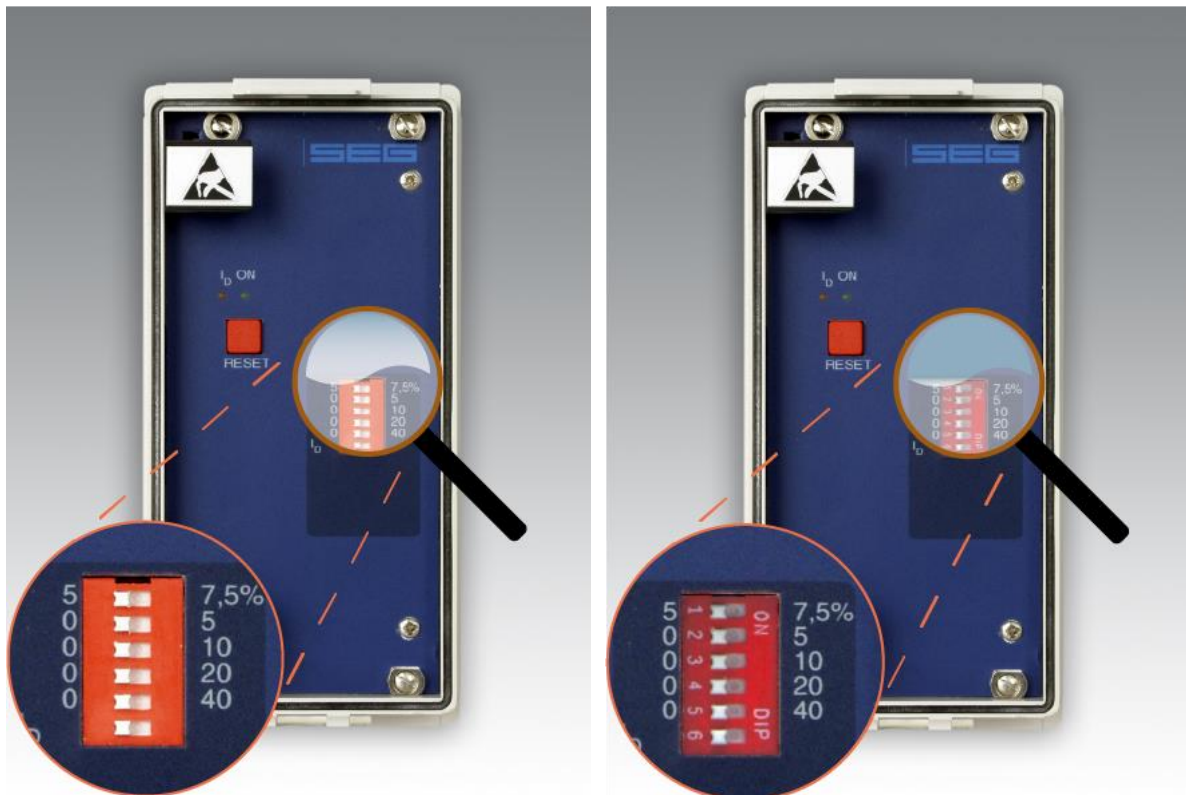
Depending on the year of production the DIP switches may have no labels (left) or may be labeled with digits and the words "DIP" and "ON" (right). Note, however, that always the writings on the blue front plate are applicable! Any writings on the red DIP switch blocks have to be ignored.
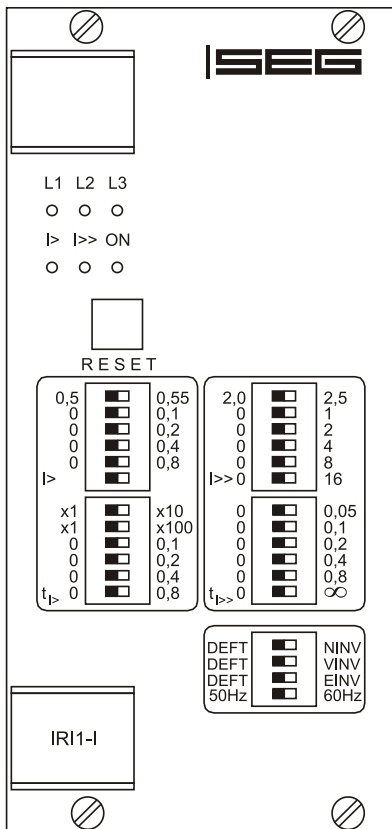
Figure 4.5: Front plate IRI1-I
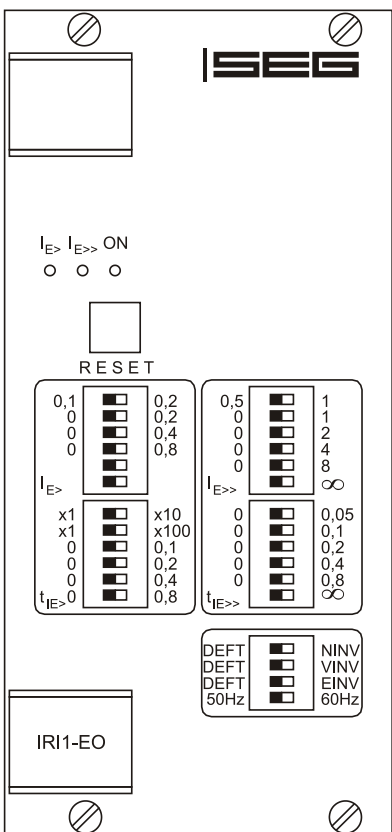
Figure 4.6: Front plate IRI1-E0
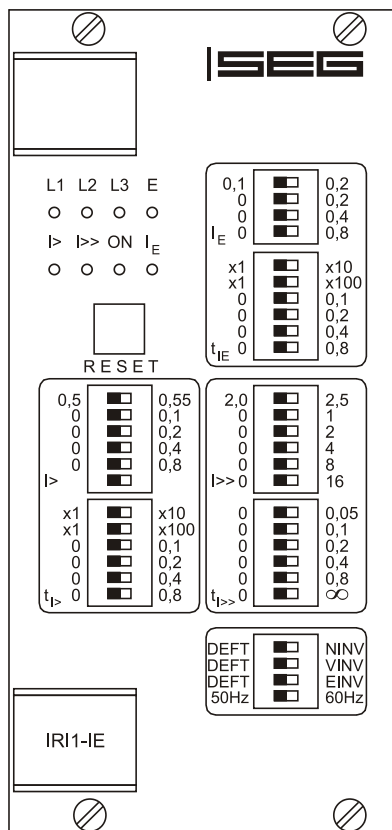
Figure 4.7: Front plate IRI1-IE

4.2.1 LEDs

On the front plate there are max. 8 LEDs. Their functions are indicated by the appropriate inscriptions above them. LED "ON" indicates the readiness for service, the other LEDs are used for the fault indication, type of fault and respective phases.

4.2.2 DIP-switches

The DIP-switch blocks on the front plate serve to adjust the tripping values, tripping times, characteristics and mains frequency.

4.2.3 <RESET>-pushbutton

Pushbutton <RESET> is used for acknowledgement and reset of the LEDs after fault clearance. At corresponding pre-adjustment the trip relay will be reset too.

4.3 Code jumper

At the rear of the front plate, is a coding plug for pre-adjustment for the trip relay function.

The function of the LEDs are not codable. They light up or flash as soon as the threshold is exceeded.

If no coding plug is used the trip relay will reset automatically after clearance of the fault.
If coding plug 1 is used the trip and the LED indication will reset only after pressing <RESET>.

Note:
At delivery of the relay the coding plug is not equipped with a code jumper.
For further information please refer to 6.4.
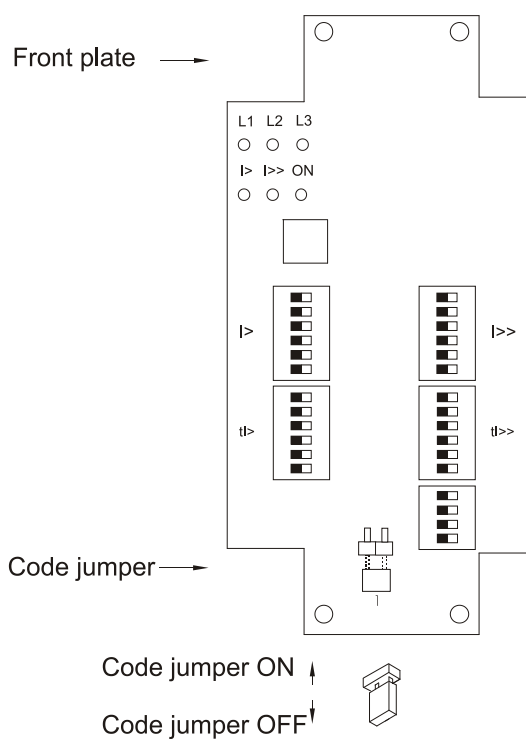
Figure 4.8: Coding plug

5.   Working principle

5.1   Analog circuits

The incoming currents from the main current transformers on the protected objects are converted to voltage signals in proportion to the currents via the input trans-formers and burden. The noise signals caused by inductive and capacitive coupling are suppressed by an analog R-C filter circuit. The analog voltage signals are fed to the A/D-converter of the microprocessor and transformed to digital signals through Sample and Hold circuits. All the processing is carried out on these digitized values. The measuring values are detected with a sampling frequency of 800 Hz, a sampling rate of 1.25 ms for each measurement (at 50 Hz).

5.2   Digital circuits

The protective device is equipped with an efficient microprocessor which is the main processing unit. It digitally carries out all of the operations, from the digitization of the measuring values to the protective tripping.

The relay program is located in an EPROM (Electrical-Programmable-Read-Only-Memory). With this program the microprocessor processes the voltages at the analog inputs and calculates the fundamental components of the current. For the calculation of the current value an efficient digital filter based on the Fourier Transformation (DFFT - Discrete Fast Fourier Transformation) is applied to suppress high frequency harmonics and d.c. components during a short circuit.

The calculated actual current values are continuously compared with the set value which is adjusted using the DIP-switches. When activated, the overcurrent tripping time is determined according to the selected characteristic curve. When the calculated time delay has elapsed, a tripping command is given.

5.3   Requirements for the main current transformers

The current transformers have to be rated in such a way, that the saturation should not occur within the following operating current ranges:

Independent time overcurrent function K1 = 2
Inverse time overcurrent function K1 = 20
High-set function K1 = 1.2 - 1.5

K1 = Current factor related to set value with the current transformer not yet operating in the saturation range.

Moreover, the current transformers have to be rated according to the maximum expected short-circuit currents of the network or the object to be protected.

The lower consumption of the IRI1, i.e. 0.2 VA, has a positive effect on the rating of the current transformers. It implies that, if an electromechanical relay is replaced by IRI1, a high accuracy limit factor is automatically obtained by using the same current transformer.

6.   Operations and settings

6.1   Layout of the operating elements

All DIP-switches required for the setting of parameters are located on the front (see para. 4.2).

6.2   Setting of the parameters by means of DIP-switches

6.2.1   Setting of the tripping characteristic for phase overcurrent and earth-fault element

The following tripping characteristics can be adjusted:

a)   Independent tripping curve:
         DEFT (definite)
b)   Inverse tripping curve:
         NINV (normal inverse)
         VINV (very inverse)
         EINV (extremely inverse)

DEFT ▮ NINV
DEFT ▮ VINV
DEFT ▮ EINV
50 Hz ▮ 60 Hz
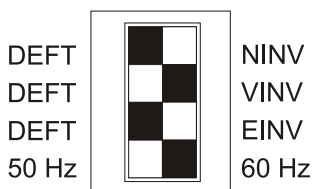
Figure 6.1: Setting of tripping characteristic

By setting DIP-switch (not 50/60 Hz) it is possible to select one of the three dependent tripping curves. If an independent (definite time) overcurrent tripping is required, all three of the DIP-switches must be set to position DEFT. In case of an invalid setting of the DIP-switches an independent tripping characteristic with the smallest possible tripping values and times is automatically selected. This ensures that the object to be protected cannot be overloaded under any circumstances. Setting ranges and characteristics are detailed in chapter 9.

Please note:
The IRI1-IE unit type provides identical tripping characteristics for phase overcurrent and earth-fault element. That means: The phase and earth overcurrent elements have always the same tripping characteristics.

6.2.2 Set value (I>) for the phase overcurrent element

With the aid of DIP - switch set I> it is possible to adjust the pickup value for phase - overcurrent tripping in the range 0.5 - 2.05 x I_N. The trip value is calculated from the sum of the individual settings of all the DIP-switches.

Example:
A tripping value of 1.0 x I_N is required. Therefore switches 2 and 4 are switched to the right.

0.5	0.55
0	0.1
0	0.2
0	0.4
0	0.8
0	Reserve

$I> = 0.5 + 0.1 + 0.4 = 1.0 \times I_N$
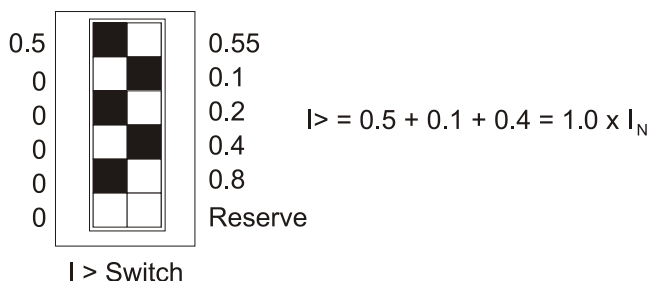
I > Switch

Figure 6.2: DIP-switch example

6.2.3 Setting of the tripping time (tI>) for phase overcurrent element

With the aid of DIP - switch set tI> it is possible to select the tripping time for the phase - overcurrent in the range 0.1 - 150 s. There are four switches available to adjust the set value (switch 3 - 6) and two switches (switch 1 + 2) to select the multiplication factor.

The set value is calculated from the sum of the individual factors (switch 3 - 6) multiplied by the set multiplication factor (switch 1 or 2). 1, 10 and 100 are possible as multiplication factors. If the switches 1 and 2 are both on the right side, the setting is invalid and gives an automatic multiplication factor of 1. If all the switches 3 - 6 are on the left side, the tripping time is equal to the relay operating time (approx. 30 ms).

Example:
A tripping time of 10 s is required. Therefore switches 1, 4 and 6 are switched to the right.

x 1	x 10
x 1	x 100
0	0.1
0	0.2
0	0.4
0	0.8

$t_{I>} = (0.2 + 0.8) \times 10 = 10 \text{ s}$

$t_{I>}$ Switch

Figure 6.3: DIP-switch example

Note:
The multiplication factor (switch 1 + 2) must be set to 1 for dependent tripping characteristics. Then the set value corresponds to the time factor $t_{I>}$ (see dependent characteristic curve chapter 9.5).

6.2.4 Set value (I>>) for high set element of phase overcurrent protection

With the aid of DIP-switch set I>> it is possible to adjust the pickup value for the high set element of phase overcurrent in the range from 2.0 - 33.5 x I_N. The tripping value is calculated as described in chapter 6.2.2.
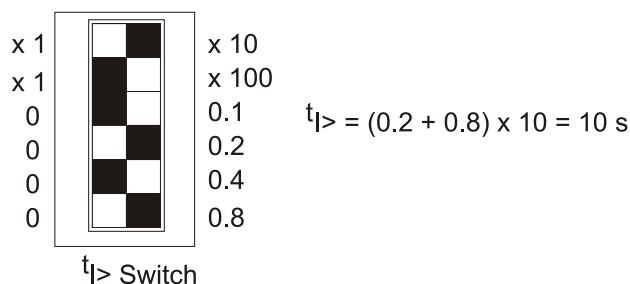
6.2.5 Setting of the tripping time (t_I>>) for high set element of phase over-current protection

With the aid of the DIP-switch t_I>> it is possible to ad-just the tripping time t_I>> for the high set ele-ment of phase overcurrent protection in the range from 0.05 - 1.55 s. The setting time is calculated from the sum of the individual factors of all the DIP-switches switched to the right side. If all the switches are on the left side, the tripping time is equal to the relay operating time (approx. 30 ms).

If switch ∞ is set, the high set element of phase over-current is inhibited, independent of other switch settings.

Independent of the selected tripping characteristic of the overcurrent element I>, the tripping time for the high set element I>> is always definite.

6.2.6 Set value (I_E) for the earth-fault element

See setting procedure as described in paragraph 6.2.2.

6.2.7 Setting of the tripping time (t_E) for earth-fault overcurrent element

See setting procedure as described in paragraph 6.2.3.

6.2.8 Setting of the nominal frequency

For correct digital filtering, the applied FFT - algorithm used for the data calculation, requires the nominal frequency of the system to be protected. The nominal frequency can be adjusted to 50 or 60 Hz by means of the DIP-switch on the front plate.

6.3   Indication of faults

For the fault indication the IRI1 front provides 5 LEDs with the following functions:
LED L1:   fault in phase L1
LED L2:   fault in phase L2
LED L3:   fault in phase L3
LED E :   earth-fault
LED I>:   serves to indicate tripping from a low set phase overcurrent
LED I>>:   serves to indicate tripping from a high set phase overcurrent.
LED IE: serves to indicate tripping from a earth-fault

Example:
In case of a 2-phase short circuit between L1 and L2 the LEDs L1, L2 and I>> light up.

When the relay was energized because of the occurrence of a fault, however, the current had again dropped below before tripping, this energizing is stored and indicated by a slowly flashing corresponding LED. This indication can be reset with pushbutton <SELECT/RESET>.

6.4   Reset

6.4.1 Manual reset

When the pushbutton <RESET> is pressed, on condition that coding plug 1 is used, the trip relay immediately resets and the LEDs I> and I>> extinguish.

6.4.2 Automatic reset

The trip relay will reset automatically after clearance of the fault, if no code jumper is used on coding plug 1.

6.5   Calculation of the setting values

6.5.1 Definite time overcurrent protection

Low set element (I>)
The main criterion for the setting of the overcurrent reference value is the normal maximum operating current which is therefore adjusted to about 20% for power lines, about 50 % for transformers and motors, above the maximum expected load currents. The delay of the trip signal is selected according to the selectivity and time grading, and the system overload capacity of the protected object.

High set element (I>>)
The high set tripping is normally set to act for near-by faults. Very precise fault recognition can be achieved if the impedance of the protected object results in a well-defined fault current. In case of a line-transformer combination, the setting values of the high set element can even be set for faults inside the transformer.
The time delay for I>> is always independent of the fault current.

6.5.2 IDMT Overcurrent protection

Apart from the selection of the tripping characteristic, the pickup value for the phase - current is also adjustable.

Low set element (I>)
The pickup current is determined according to the maximum expected load current. For example:

Current transformer ratio: 400/5 A
Maximum expected load current: 300 A
Overload coefficient: 1.2 (assumed)
Pickup current setting:

$I_S = (300 / 400) \times 1.2 = 0.9 \times I_N$

I_S corresponds to I>.

Time multiplier setting:
The time multiplier setting for inverse time overcurrent is a scale factor for the selected characteristics. The characteristics for two adjacent relays should have a time interval of about 0.3 - 0.4 s.

High set element (I>>)
The high-set current setting is set as a multiplier of the nominal current. The time delay is always independent to the fault current.

7.   Housing

The IRI1 can be supplied in an individual housing for flush-mounting or as a plug-in module for installation in a 19" mounting rack according to DIN 41494. Both versions have plug-in connections. Relays of variant D are complete devices for flush mounting, whereas relays of variant A are used for 19" rack mounting. Housing variant A to be installed in switchboards of protection class IP51. For switchboards of lower protection classes housing variant D can be used.

7.1   Individual housing

The individual housing of the IRI1 is constructed for flush-mounting. The dimensions of the mounting frame correspond to the requirements of DIN 43700 (72 x 144 mm). The cut-out for mounting is 68 x 138 mm.

The front of the IRI1 is covered with a transparent, sealable flap (IP54).

For case dimensions and cut-out refer to "technical data". The individual housing is fixed with the supplied clasps from the rear of the switchboard panel.

7.2   Rack mounting

The IRI1 is in general suitable for installation in a modular carrier according to DIN 41494. The installation dimensions are: 12 TE; 3 HE.

According to requirements, the IRI1-devices can be de-livered mounted in 19" racks.

7.3 Terminal connections

The plug-in module has very compact base with plug connectors and screwed-type connectors.

- max. 15 poles screw-type terminals for voltage and current circuits (terminal connectors series A and B with a short time current capability of 500 A / 1 s).
- 27 poles tab terminals for relay outputs, supply voltage etc.(terminal connectors series C, D and E, max. 6 A current carrying capacity). Connection with tabs 6.3 x 0.8 mm for cable up to max. 1.5 mm^2 or with tabs 2.8 x 0.8 mm for cable up to max. 1 mm^2.

By using 2.8 x 0.8 mm tabs a bridge connection between different poles is possible.
The current terminals are equipped with self-closing short-circuit contacts. Thus, the IRI1-module can be un-plugged even with current flowing, without endangering the current transformers connected.
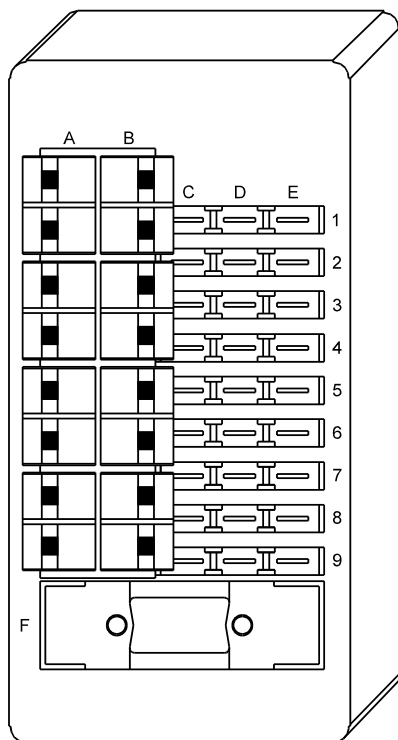

Figure 7.1: Terminal block

8.   Relay testing and commissioning

The following test instructions should help to verify the protection relay performance before or during commissioning of the protection system. To avoid a relay damage and to ensure a correct relay operation, be sure that:

- the auxiliary power supply rating corresponds to the auxiliary voltage on site.
- the rated current and rated voltage of the relay correspond to the plant data on site.
- the current transformer circuits are connected to the relay correctly.
- all signal circuits and output relay circuits are connected correctly.

8.1   Power-On

NOTE!
Prior to switch on the auxiliary power supply, be sure that the auxiliary supply voltage corresponds with the rated data on the type plate.

Switch on the auxiliary power supply to the relay (terminals C9/E9) and check that the LED "ON" on the front lights up green.

8.2   Checking the set values

Check all relay set values and see if they are set correctly as you have desired. Set values can be modified by means of the DIP-switches on the front.

For a correct relay operation, be sure that the frequency DIP-switch (50Hz/60Hz) has been selected correctly according to your system frequency (50 or 60Hz).

8.3   Secondary injection test

8.3.1   Test equipment

- Voltmeter / Ammeter with class 1 or better
- Auxiliary power supply with the voltage corresponding to the rated data on the type plate
- Single-phase current supply unit (adjustable from 0 to $\geq 4 \times I_N$)
- Timer to measure the operating time (Accuracy ±10 ms)
- Switching device
- Test leads and tools

8.3.2 Example of test circuit for IRI1 relays

For testing IRI1 relays, only current input signals are required. Figure 8.1 shows a simple example of a single phase test circuit with adjustable current energizing the IRI1 relay under test.
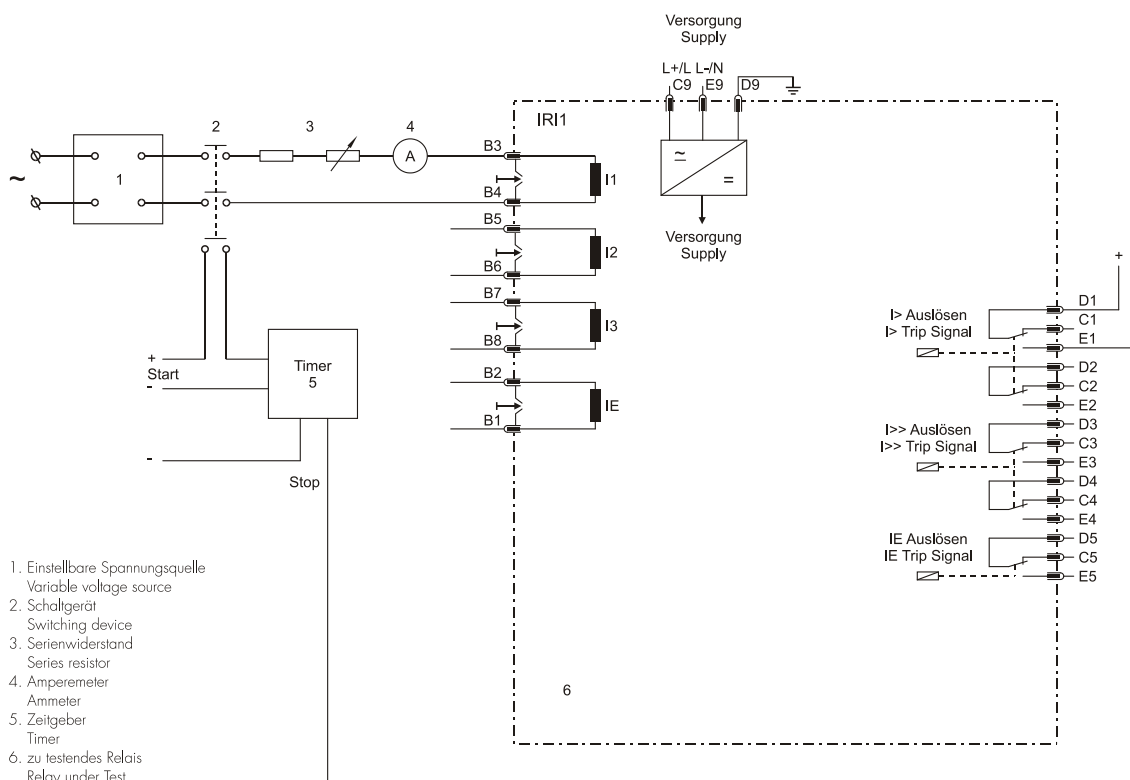

Figure 8.1: Single phase test circuit

8.3.3 Checking the operating and resetting values of the relay

Inject a current which is less than the relay set value I> in the phase 1 of the relay (terminals B3/B4) and gradually increase the current until the relay starts, i.e. at the moment when the LED I> begins to flash. Read the operating current indicated by an ammeter. The deviation must not exceed 5% of the set operating value. By using an RMS-metering instrument, a greater deviation may be observed if the test current contains harmonics. Because the IRI1 relay measures only the fundamental component of the input signals, the harmonics will be rejected by the internal DFFT-digital filter. Whereas the RMS-metering instrument measures the RMS-value of the input signals. Furthermore, gradually decrease the current until the re-lay resets, i.e. the LED I> changes its flashing from a high to a low frequency. (The low flashing frequency means the energizing memory.) Check that the resetting current is greater than 0.97 times the operating current.
Repeat the test by means of injecting current in the other phases and the earth current circuit in the same manner.

8.3.4 Checking the relay operating time

To check the relay operating time, a timer must be connected to the trip output relay contact. The timer should be started simultaneously with the current injection into the current input circuit and stopped by the trip relay contact. Set the current to a value corresponding to twice the operating value and inject the current instantaneously. The operating time measured by the timer should have a deviation of less than ±3% of the set value or ±20 ms.
Repeat the test on the other phases or with the inverse time characteristics in the similar manner. In case of inverse time characteristics the injected cur-rent should be selected according to the characteristic curve, e.g. two times IS. The tripping time may be red from the characteristic curve diagram or calculated with the equations given under "technical data".
Please observe that during the secondary injection test the test current must be very stable, not deviating more than 1%. Otherwise the test results may be wrong.

8.3.5 Checking the high set element of the relay

Set a current to the set operate value of I>>. Inject the current instantaneously and check that the LED I>> be-gins to flash. Repeat the test with injected current around the operate value and seek the operate value in this manner.

Set the desired time delay tI>> of high set element. Inject a current corresponding to twice the operate value of I>> if possible and measure the operate time with timer in the same manner as in chapter 8.3.4.

Note:
During test of the high set element, great care must be taken to ensure that the test currents and their duration do not exceed the current circuit thermal with-stand given in the technical data.

8.4   Primary injection test

Generally, a primary injection test could be carried out in the similar manner as the secondary injection test described above. With the difference that the protected power system should be, in this case, connected to the installed relays under test „on line", and the test currents and voltages should be injected to the relay through the current and voltage transformers with the primary side energized. Since the cost and potential hazards are very high for such a test, primary injection tests are usually limited to very important protective relays in the power system.

8.5   Maintenance

Maintenance testing is generally done on site at regular intervals. These intervals vary among us-ers depending on many factors: e.g. the type of protective relays employed; the importance of the primary equipment being protected; the user's past experience with the relay, etc.
For electromechanical or static relays, maintenance testing will be performed at least once a year according to the experiences. For digital relays like IRI1, this interval can be substantially longer. A testing interval of two years for maintenance will be recommended.
 During a maintenance test, the relay functions including the operating values and relay tripping characteristics as well as the operating times should be tested.

9.   Technical Data

9.1   Measuring input

Rated data:

Nominal current I_N:	1 A or 5 A
Nominal frequency f_N:	50/60 Hz adjustable
Power consumption in current circuit:	at I_N = 1 A 0.2 VA
	at I_N = 5 A 0.1 VA

Thermal withstand capability

in current circuit:	dynamic current withstand (half-wave)	250 x I_N
	for 1 s	100 x I_N
	for 10 s	30 x I_N
	continuously	4 x I_N

9.2   Auxiliary voltage

Rated auxiliary voltages U_H:	working range 16 - 270 V AC / 16 - 360 V DC
Power consumption:	standby approx. 3 W operating approx. 6 W

9.3   General data

Dropout to pickup ratio:	> 97 %
Returning time:	30 ms
Time lag error class index E:	±10 ms
Minimum operating time:	30 ms
Transient overreach at instantaneous operation:	≤5 %

9.4   Setting ranges and steps

9.4.1   Definite time overcurrent protection

		Setting range	step	tolerances
I>	Is	0.5 - 2.05 x I_N	0.05 x I_N	±5 % of set value
	$t_{I>}$	x 1: 0.1 - 1.5 s	0.1 s	±3 % or ±10 ms
		x 10: 1.0 - 15 s	1.0 s	±3 % or ±10 ms
		x 100: 10 - 150 s	10 s	±3 % or ±10 ms
I>>	I	2.0 - 33.5 x I_N	0.5 x I_N	±5 % of set value
	$t_{I>>}$	0.05 - 1.55 s	0.05 s	±3 % or ±10 ms
I_E	Is	0.1 - 1.6 x I_N	0.1 x I_N	±5 % of set value
	t_{IE}	x 1: 0.1 - 1.5 s	0.1 s 1.0 s	±3 % or ±10 ms
		x 10: 1.0 - 15 s	10 s	±3 % or ±10 ms
		x 100: 10 - 150 s		±3 % or ±10 ms
$I_{E>>}$	$I_{E>>}$	0,5 - 16 x I_N	0.5 x I_N	±5 % of set value
(IRI1-E0 only)	$t_{IE>>}$	0.05 - 1.55 s	0.05 s	±3 % or ±10 ms

Table 9.1: Definite time overcurrent protection

9.4.2   Inverse time overcurrent protection

Tripping characteristics according to IEC 255-4 or BS 142

Normal Inverse

$$t = \frac{0.14}{\left(\frac{I}{I_S}\right)^{0.02} - 1} \cdot t_I > [s]$$

Very Inverse

$$t = \frac{13.5}{\left(\frac{I}{I_S}\right) - 1} \cdot t_I > [s]$$

Extremely Inverse

$$t = \frac{80}{\left(\frac{I}{I_S}\right)^2 - 1} \cdot t_I > [s]$$

Where: t   =   tripping time
          tI>   =   time multiplier
          I   =   fault current
          IS   =   setting value of the current

		Setting range	step	tolerances
I>	Is	0.5 - 2.05 x I_N	0.05 x In	±5 % of set value
	$t_{I>}$	0.1 - 1.5	0.1	±5 % for NINV and VINV
				±7.5 % for EINV at 10 x Is
I>>	I	2.0 - 33.5 x I_N	0.5 x I_N	±5 % of set value
	$t_{I>>}$	0.05 - 1.55 s	0.05	±3 % or ±10 ms
	Is	0.1 - 1.6 x I_N	0.1 x I_N	±5 % of set value
	t_{IE}	0.1 - 1.5	0.1	±5 % for NINV and VINV
				±7.5 % for EINV at 10 x IS
$I_{E>>}$	$I_{E>>}$	0,5 - 16 x I_N	0.5 x I_N	±5 % of set value
(IRI1-E0 only)	$t_{IE>>}$	0.05 - 1.55 s	0.05 s	±3 % or ±10 ms

Table 9.2: Inverse time overcurrent protection
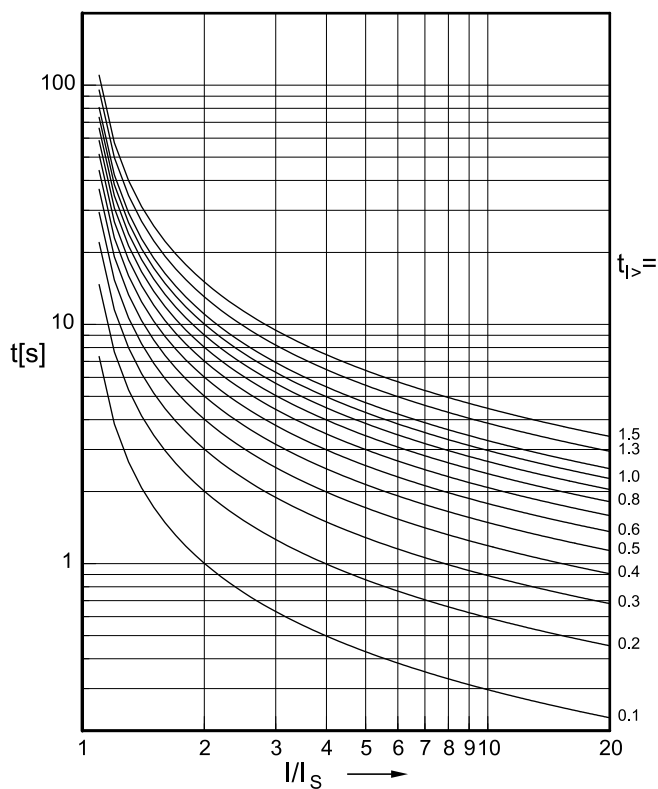
9.5   Tripping characteristics
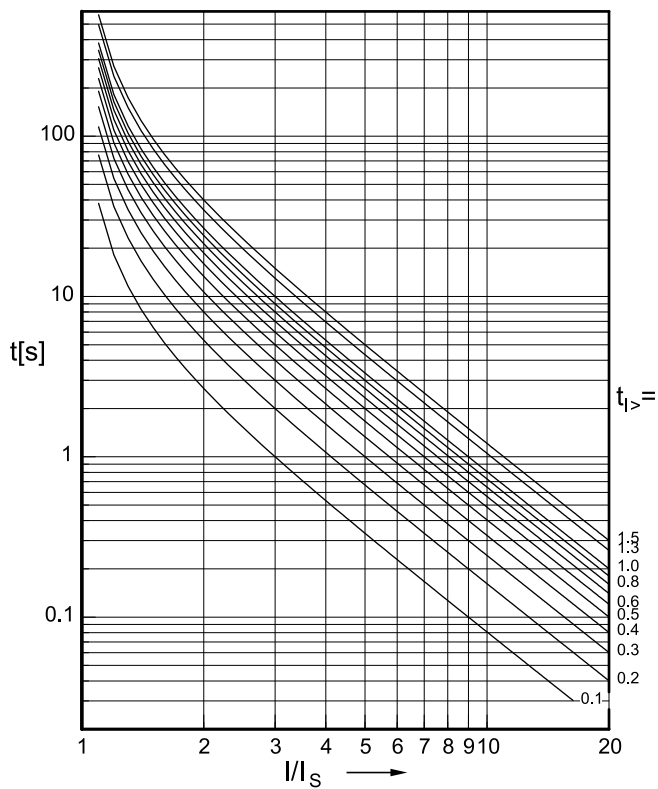

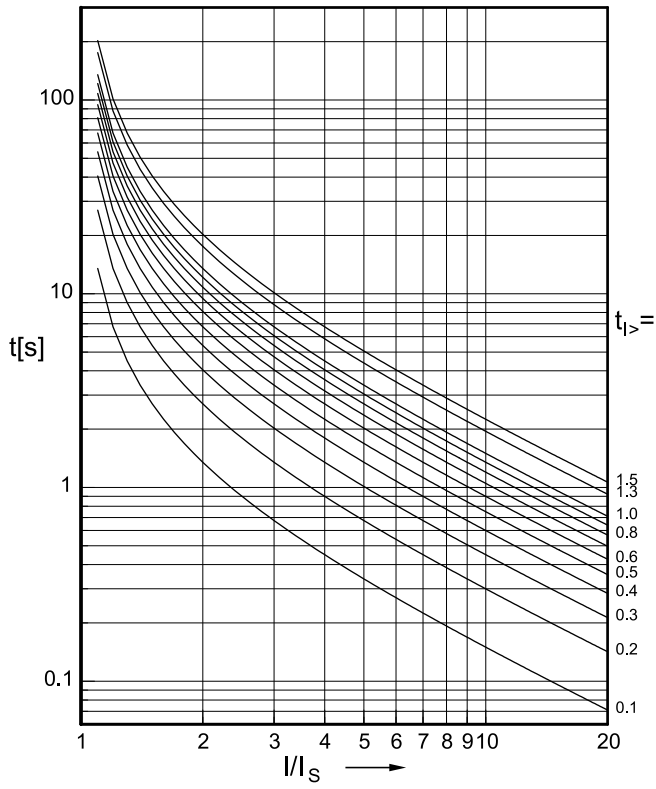*Figure 9.1: Normal inverse*

Figure 9.2: Extremely inverse

Figure 9.3: Very inverse
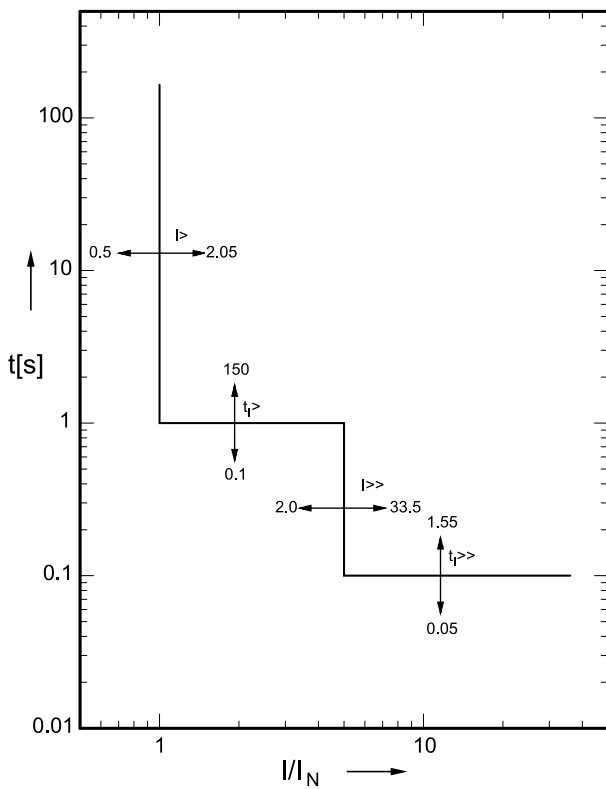

Figure 9.4: Definite time overcurrent relay

9.6   Output relays

The output relays have the following characteristics:
maximum breaking capacity: 250 V AC / 1500 VA / continuous current 6 A

for DC-voltage:

	ohmic	L/R = 40 ms	L/R = 70 ms
300 V DC	0.3 A / 90 W	0.2 A / 63 W	0.18 A / 54 W
250 V DC	0.4 A / 100 W	0.3 A / 70 W	0.15 A / 40 W
110 V DC	0.5 A / 55 W	0.4 A / 40 W	0.2 A / 22 W
60 V DC	0.7 A / 42 W	0.5 A / 30 W	0.3 A / 17 W
24 V DC	6 A / 144 W	4.2 A / 100 W	2.5 A / 60 W

Max. rated making current: 64 A (VDE 0435/0972 and IEC 65/VDE 0860/8.86)
mechanical life span: 30×10^6 operating cycles
electrical life span: 2×10^5 operating cycles at 220 V AC / 6 A
Contact material: silver cadmium oxide (AgCdO)

9.7   System data

Design standard:
Generic standard: EN 50082-2, EN 50081-1
Product standard: EN 60255-6, IEC 255-4, BS 142

Specified ambient service
Storage temperature range: - 40°C to + 85°C
Operating temperature range: - 20°C to + 70°C

Environmental protection class F
as per DIN 40040 and per
DIN IEC 68 2-3:   relative humidity 95 % at 40°C for 56 days

Insulation test voltage, inputs
and outputs between themselves
and to the relay frame as per
EN 60255-6 and IEC 255-5:   2.5 kV (eff.), 50 Hz; 1 min

Impulse test voltage, inputs
and outputs between themselves
and to the relay frame as per
EN 60255-6 and IEC 255-5:   5 kV; 1.2 / 50 µs; 0.5 J

High frequency interference
test voltage, inputs and outputs
between themselves and to the
relay frame as per EN 60255-6
and IEC 255-22-1:   2.5 kV / 1MHz

Electrostatic discharge (ESD) test as
per EN 61000-4-2 and IEC 255-22-1: 8 kV air discharge, 6 kV contact discharge

Electrical fast transient (Burst) test as
per EN 61000-4-8 and IEC 801-4:   4 kV / 2.5 kHz, 15 ms

Power frequency magnetic field
test as per ENV 50141:　　　　　　　electric field strength 10 V/m

Surge immunity EN 61000-4-5:　　　　4 kV

Radio interference suppression
test as per EN 55011:　　　　　　　　limit value class B

Radio interference radiation test
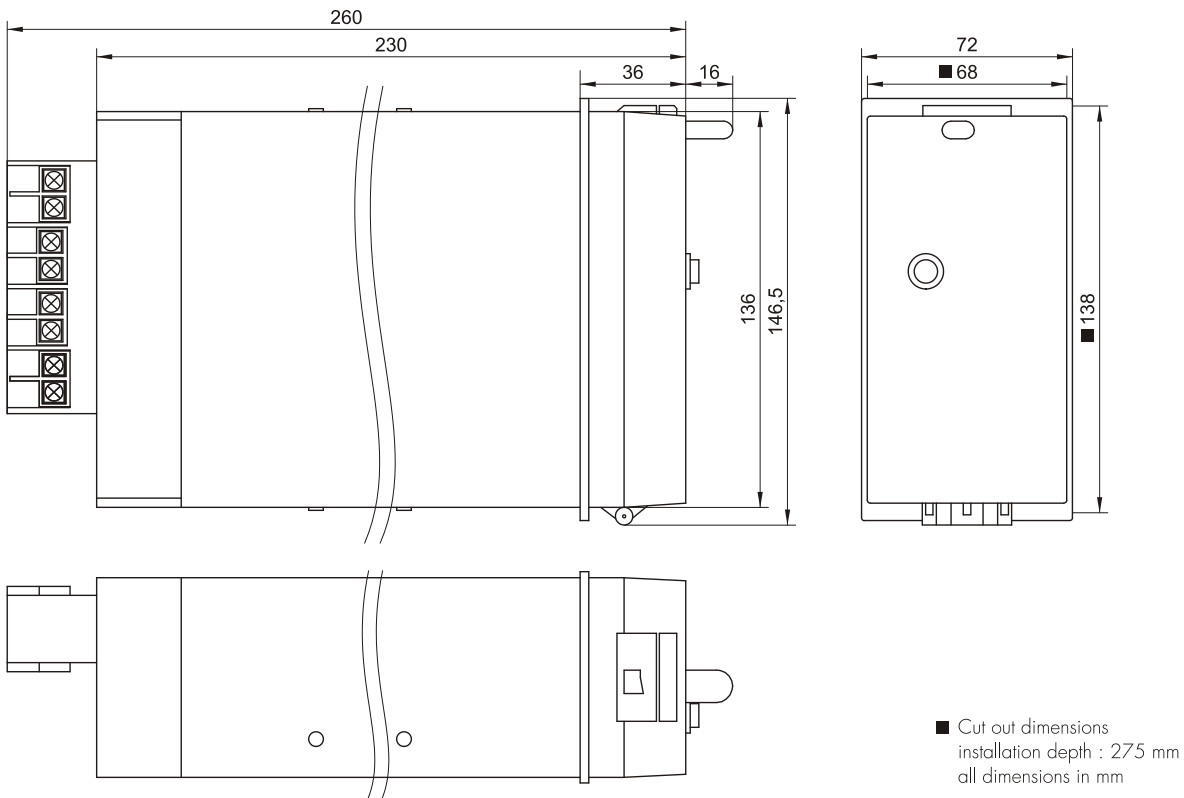as per EN 55011:　　　　　　　　　　limit value class B

Mechanical tests:
Shock:　　　　　　　　　　　　　　　　class 1 acc. to DIN IEC 255 part 21-2
Vibration:　　　　　　　　　　　　　　class 1 acc. to DIN IEC 255 part 21-1
Degree of protection:　　　　　　　　IP54 by enclosure of the relay case and front panel
　　　　　　　　　　　　　　　　　　　(relay version D)
Weight:　　　　　　　　　　　　　　　approx. 1.5 kg

9.8　Dimensional drawing

■ Cut out dimensions
installation depth : 275 mm
all dimensions in mm

Please observe:
A distance of 50 mm is necessary when the units are mounted one below the other for the housing
bonnet to be easily opened. The front cover can be open downwards.

10. Order form

Time overcurrent and earth current relay	*IRI1*		
3-phase measuring Rated current 1 A 5 A	**I1** **I5**		
Earth current measuring Rated current in 1 A earth current path 5 A		**EO1** **EO5**	
Housing (12TE) 19"-rack Flush mounting			**A** **D**

Technical data subject to change without notice !

This technical manual is valid for software version: D01-3.10 (IRI1-I)
                                                          D00-3.10 (IRI1-IE0)
                                                           D02-3.10 (IRI1-E0)

Setting list IRI1

Note!
All settings must be checked at site and should the occasion arise, adjusted to the object / item to be protected.

Project: _____ Job.-no.: _____

Function group: = _____ Location: + _____ Relay code: - _____

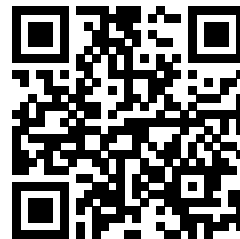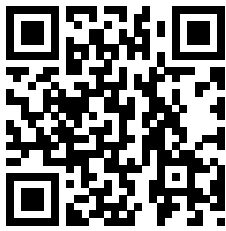Relay functions: _____ Date: _____

Setting of parameters

Parameter		Unit	Default settings	Actual settings
I>	Low set element	x In	0,5	
tI>	Trip delay for low set element	s	0,1	
I>>	High set element	x In	2,0	
tI>>	Trip delay for high set element	s	0,05	
IE>	Earth fault low set element	x In	0,1	
tIE>	Trip delay for earth fault low set element	s	0,1	
IE>>	Earth fault high set element (IRI1-E0 only)	x In	0,5	
tIE>>	Trip delay for earth fault high set element (IRI1-E0 only)	s	0,05	

Setting of code jumpers

Reset manual/auto	
Default setting	**Actual setting**
X	

HighTECH Line

https://docs.SEGelectronics.de/iri1
https://docs.SEGelectronics.de/mr

MANUAL │ IRI1