

Trafomonitor IKI-30

Manual



Content

1. Introduction

- 1.1 General
- 1.2 Product description
- 1.3 Application
- 1.4 Design

2. Handling / Installation

- 2.1 Precautions
- 2.2 Auxiliary Energy Supply
- 2.3 Split-Core CTs

- 2.4 Clamp assignment

- 2.5 Output

- 2.6 Input

3. Indication / Setting

- 3.1 Indication / Reset

- 3.2 Setting of overcurrent behaviour

- 3.3 Inrush rejection

- 3.4 Setting, (DIP, Jumper, ..)

- 3.5 Setting examples

4. Technical Data

5. Function Test / Maintenance

6. Low Power-Magnet-Trip-Coil

1. Introduction

1.1 General

The Trafomonitor IKI-30 is applicable for monitoring and protection of distribution network transformers between 160 kVA and 2500 kVA. By means of split-core CTs overcurrents and short-circuit currents can be detected in the lines.

The device offers an overcurrent stage (ANSI 51), a short circuit stage (ANSI 50), an external fast trip stage and an earth fault stage (ANSI 50N and 51N) as well. The overcurrent stage can be selected as definite minimum time DMT (=UMZ) stage or inverse definite minimum time IDMT (=AMZ) stage. The IDMT-stage offers two curves acc. IEC 60255-3.

By installation of an optional balanced core CT at input E non directed earth-fault currents can be detected (ANSI 50N, 51N). In solidly or resistive terminated networks the earth-fault can be also detected by measuring the unbalance of the current. The device IKI-30 is supplied by the CTs and buffered by a Lithium-cell. Dependent on the desired protection requirements the following types are available:

1.2 Product Description

Types	Classification
IKI-30	Trafomonitor for Overcurrent- and Short-Circuit-Protection (ANSI 50,51)
IKI-30E	Trafomonitor for Overcurrent and Short-Circuit-Protection with additional Earth-Fault-Protection (ANSI 50, 51, 50N, 51N)

1.3 Application

Suitable for Transformer-Nominal Power :

- 160..2500kVA at nominal voltage 5-15kV
- 250..7500kVA at nominal voltage 20-25kV
- 400..12000kVA at nominal voltage 30-36kV

- a) Protection of transformers
Switching device: Power circuit breaker or power breaker
- Overcurrent and Short-Circuit stage are monitored by the Trafomonitor and tripped by the magnetic coil.
 - Substitution for load-breaker- / fuse-combination

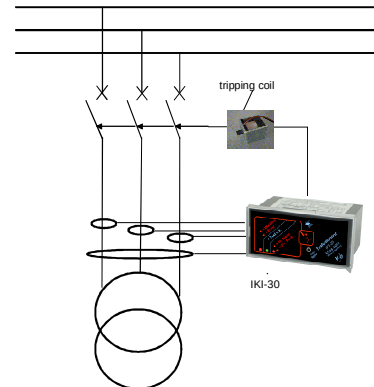


figure 1.3a

- b) Protection of Transformers
Switching device: load-breaker / fuse-combinaton.
- The Trafomonitor controls the overcurrent range up to the rated current of the load breaker and trips the load breaker in case of over current.
 - The overcurrent stage of the Trafomonitor is blocked. When the maximum trip current $I_{>>}$ of the load breaker is exceeded the tripping will be blocked. Hence the fuse must take over the tripping function.

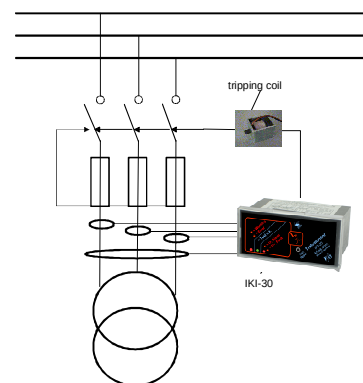


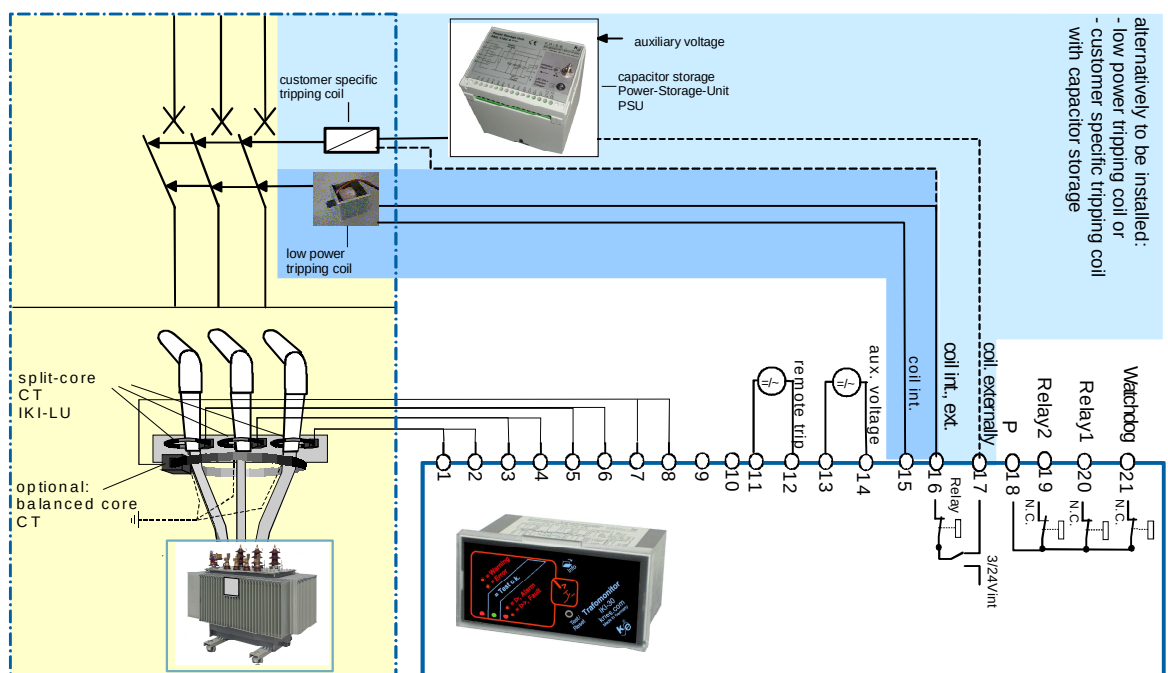
figure 1.3b

1.4 Design of IKI-30

The Trafomonitoring-System consists of:

- Evaluation unit IKI-30
- 3 Split-Core CT; optional: 1 Balanced Core CT for earth-fault detection
- Low-power tripping-coil or standard-coil with capacitor buffer, e.g. PSU

figure 1.4



2. Handling / Installation

2.1 Precautions during installation

During installation of IKI-30 to the split-core CTs the high voltage must be shut down. During installation the five security rules must be fulfilled. Uninstalled current-injected CTs must be short circuited at their signal lead ends.

Split-core CTs are only suitable for installation at touch-proof high voltage cables. For installation at non shielded high-voltage cables separate CTs are available.

2.2 Auxiliary voltage supply

The Trafomonitoring-System works without any external auxiliary voltage supply.

The system is mainly supplied by the CTs.

For	currents $I_n > 5A$:	CTs supply the IKI-30 completely
	currents $1A > I_n > 5A$:	mixed supply between reserve buffer and CT
	currents $I_n < 1A$:	supply from reserve buffer

Reserve buffer: Lithium-battery, designed to supply the IKI-30 ≥ 15 years. After 15 years a battery test is recommended or the battery should be changed. (see chapter 5).
The said life-time covers 200 trippings.

If requested the IKI-30 alternatively can be supplied by any auxiliary voltage 24..230VAC/DC. This must be installed at the clamps 13, 14 and will be also buffered by the reserve buffer.

If the low-power tripping coil is installed at clamps 15,16 it will be supplied from the reserve buffer. If other tripping coils are used at the clamps 16, 17 an capacitive storage unit e.g. type PSU has to be used and an external voltage must be applied.

2.3 Split-Core CTs

For current measuring split-core CTs are used which are adapted to the IKI-30.
The split-core CTs can be installed at the cable after supplementary

2.3.1 Installation of split-core CTs

For mounting and installation of the CTs please note:

- the mounting is independent from current direction
- the poles are not to be earthed

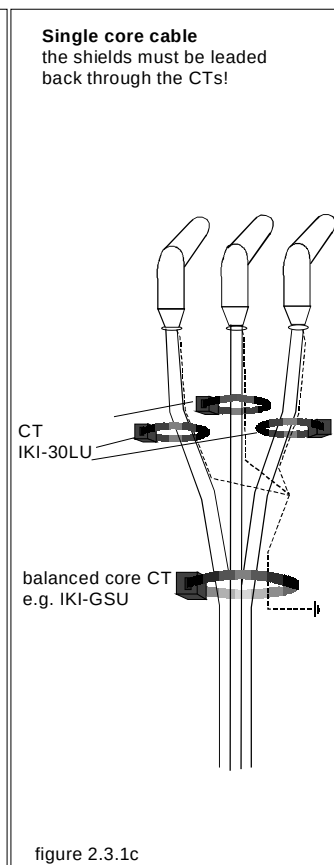
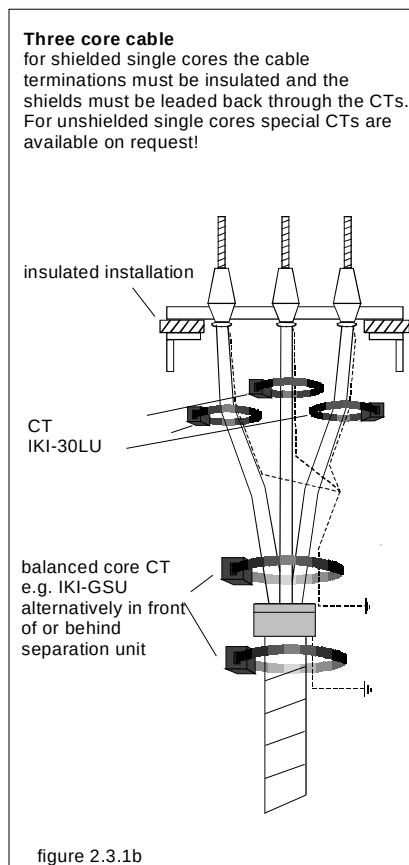
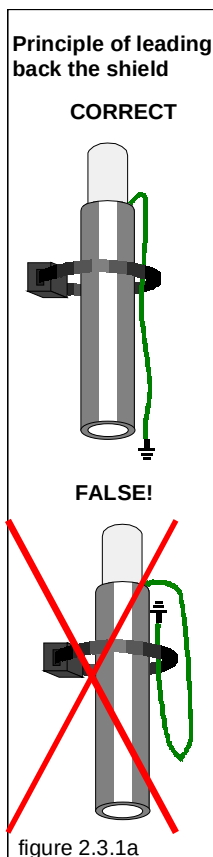


figure 2.3.1

The three split-core CTs (IKI-30LU) are to be mounted at the single-cores of the high voltage cable and installed at the clamps 1-6. The cable shields must be leaded back through the CTs insulated (figure 2.3.1a) so that only the primary current flows through the CT. Dependent on the cable types the terminations must be insulated (figure 2.3.1b).

By means of a balanced core CT at input E (clamps 7, 8) also earth-faults can be detected in networks with Petersen-coil at the termination or insulated termination. The balanced core CT at input E allows an undirected earth-fault detecting.

The balanced core CT covers all three single cores. The common shield of a three core cable or the single shields of single core cables must be led back through the balanced core CT.



2.3.2 CT-Types for Protecting Relay IKI-30

a) Single-Core CT for insulated, screened single core cables

CT	Type	IKI-30LU_xxm
Connecting lead	xx	in meter
Inner diameter	53 mm	
Transformation ratio	10A/ 0,003A	
Power @ burden	0,02VA@10A	
Class	5P30	together with IKI-30
Nominal frequency	50..60 Hz	
Thermal max. current	23kA, 5s	
Thermal max. perm. current	800A	
Insulation voltage	2kV	
Protecting degree	IP 54	

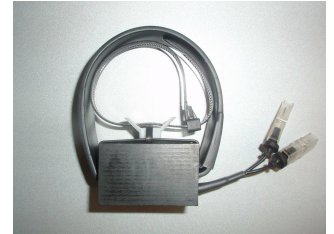


figure 2.3.2a

b) Single-Core CT for insulated, not screened single core cables

CT	Type	IKI-30LU_i_xxm
Connecting lead	xx	in meter
Inner diameter	53 mm	
Transformation ratio	10A/ 0,003A	
Power	0,02VA@10A	
Class	5P30	together with IKI-30
Nominal frequency	50..60 Hz	
Thermal max. current	23kA, 5s	
Therm. max. perm. current	800A	
Insulation voltage	15kV	
Protecting degree	IP 54	



figure 2.3.2b

c) Balanced core CT for insulated screened cable triple

CT	Type	IKI-30GSU_xxm
Connecting lead	xx	in meter
Inner diameter	130 mm	
Transformation ratio	10A/ 0,001A	
Power	0,005VA@10A	
Class	8P20	together with IKI-30
Nominal frequency	50..60 Hz	
Thermal max. current	23kA, 5s	
Thermal max. perm. current	800A	
Insulation voltage	2kV	
Protecting degree	IP 54	



figure 2.3.2c

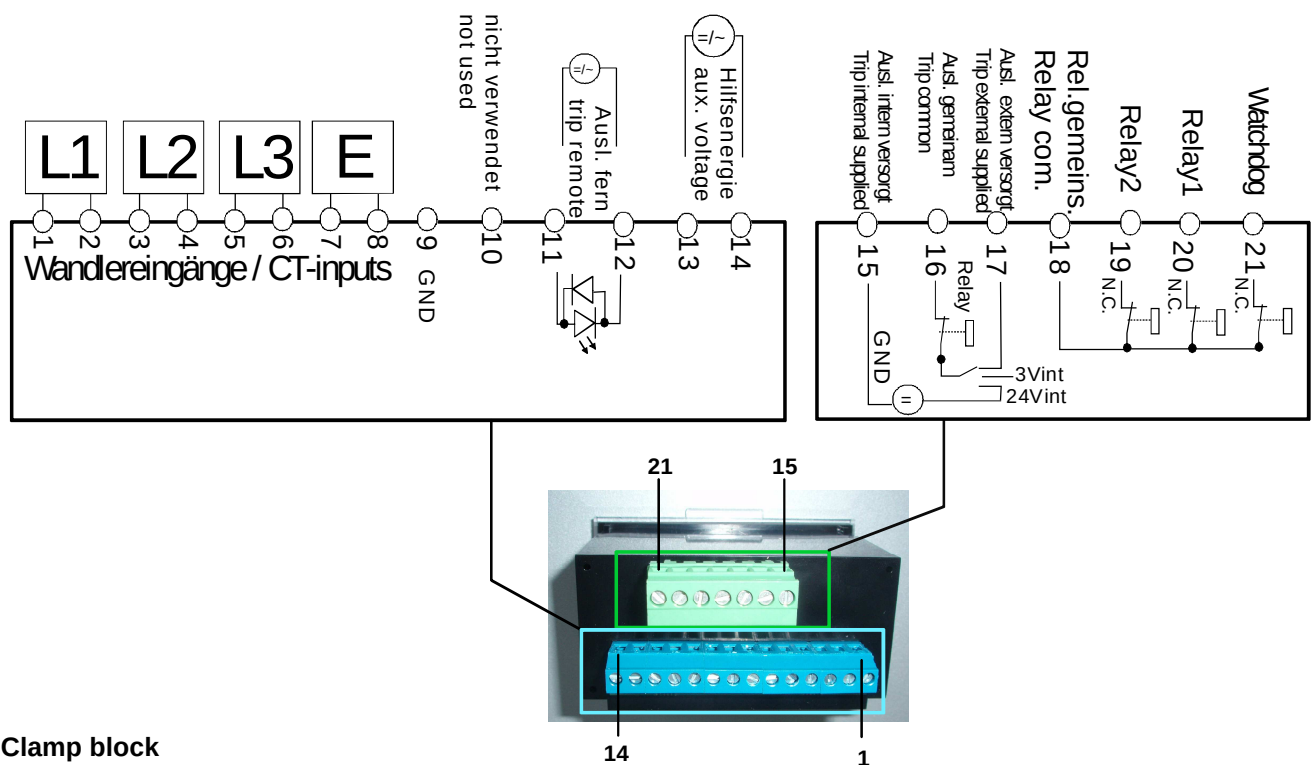
Hint:

The measuring inputs of IKI-30 are adapted for usage with the CT-types IKI-30LU and IKI-30GSU, i.e. the burden of the relay and the output power of the CTs are adjusted to each other. Therefore installation of standard CTs with secondary currents of 1A or 5A are not allowed!

2.4 Clamp assignment

Clamp 1 and 2:	Split-core CT input for I > L1, poles not directed
Clamp 3 and 4:	Split-core CT input for I > L2, poles not directed
Clamp 5 and 6:	Split-core CT input for I > L3, poles not directed
Clamp 7 and 8:	Balanced core CT input E for IE>; poles not directed
Clamp 11 and 12:	Remote tripping input by means of external applied aux. voltage 24..230VAC/DC
Clamp 13 and 14:	Optional installation possibility for external auxiliary voltage 24..230VAC/DC
Clamp 15 and 16:	Output for low-power tripping coil, supplied from IKI-30 either - 3 V-tripping unit (NOTE POLARITY!) with 0,02 Ws without external aux. voltage buffer internal or - 24 V-tripping unit with 0,1 Ws and aux. Voltage at clamps 13,14, buffer internal
Clamp 16 and 17:	Relay output for standard-tripping coil, external supplied, external buffered, n.o.-contact
Clamp 18, 19:	Relay 2 tripping alarm; n.c.-contact, wiping impulse 1 sec.
Clamp 18, 20:	Relay 1 stimulation alarm; n.c.-contact*, permanent contact until stimulation criterion is present
Clamp 18, 21:	Watchdog-Relay; releases in case of internal fault, n.c. contact*

*) remark : relays with n.o. contact available; refer to article numbers at 4.1



Clamp block
at IKI-back side
lower block: 14-poles
upper block: 7-poles

figure 2.4

2.5 Outputs

- Failure indication: Relay 2, contacts 18, 19, n.c. contact*,
1 potential free relay output for remote indication
as wiping contact will be activated if
 $I >$ during $t_{l>}$ or $I >>$ during $t_{l>>}$ is reached.
- Overcurrent indication: Relay 1, contacts 18, 20, n.c. contact*,
1 potential free relay output will be activated during
overcurrent criterion is fulfilled, e.g. to block a primary protection relay
- Watchdog Relay, contacts 18, 21, opens in case of device or system error

- external tripping-output**: contacts 16,17, n.o. contacts, for installation of existing tripping coil
externally supplied and buffered e.g. by capacitor buffer (PSU)
max. contact load 8 A.
- internal tripping-output*: contacts 15, 16, designed as impulse output for direct control of low
power tripping coil (3VDC, 0,02Ws, internally supplied, internally
buffered) or (24V, 0,1Ws externally supplied, internally buffered).

***) relays with n.o. contact available; refer to article numbers at 4.1**

****) In case of a not successful tripping of the fault current an additional tripping is initiated after 100ms.
If the secondary tripping is not successful the device shows the failure. (Error-LED, Watchdog relay
releases, reset must be performed).**

2.6 Input

- Remote tripping input: contacts 11, 12, for external voltage 24..230VAC/DC
(see 4. technical data), external fast tripping.
The fast trip is independent from the adjusted threshold criterions
and blocks for the tripping and activates the tripping output contacts 15,
16, 17.

3. Indication / Settings

3.1 Indication / Reset

a) LED-Indication

I>, Alarm	red single blinking:	during I> is reached, i.e. stimulation condition
I>>, Fault	red, double blinking:	if I> during tI> or I>> during tI>> was reached, i.e. failure condition; indication is buffered
	red and green, double blinking:	Tripping forced by remote tripping input
Test.ok.	green blinking:	fulfilled self test
Error	red, double blinking:	battery test not passed or non successful double tripping tripping-attempt

- b) **Indication-Reset**
- | | |
|-------------------------|---|
| for 'Fault': | after 2h or automatically (if current is restored) or manual with reset-key |
| for 'Warning', 'Error': | manual with reset-key |

3.2 Setting of overcurrent characteristic

IKI-30 allows either inverse definite minimum time IDMT (=AMZ) stage or definite minimum time DMT (=UMZ) stage to be selected. Two IDMT curves are available. **The tripping curve must be chosen in this way that the inrush-point of the transformer is left hand side from the curve, i.e. during inrush the tripping is avoided!**

3.2.1 Procedure in case of DMT (UMZ) stage:

- a) Selection of adjustment current I_s out of 3 ranges 5..20A, 25..100A, 110..260A
- b) Setting of DMT (UMZ) curve setting parameter
- overcurrent stage: $I>/I_s$ (stimulation current I> as ratio to the adjustment current I_s)
 - overcurrent-tripping time: $tI>$
tripping is performed, if the criterion I above 'I>' after delay time tI> is still fulfilled
- c) setting short-circuit stage
- short-circuit stage: $I>>/I_s$ (tripping current as ratio to adjustment current I_s)
 - short-circuit delay time: $tI>>$
tripping is performed, if the criterion I above 'I>>' after delay time tI>> is still fulfilled

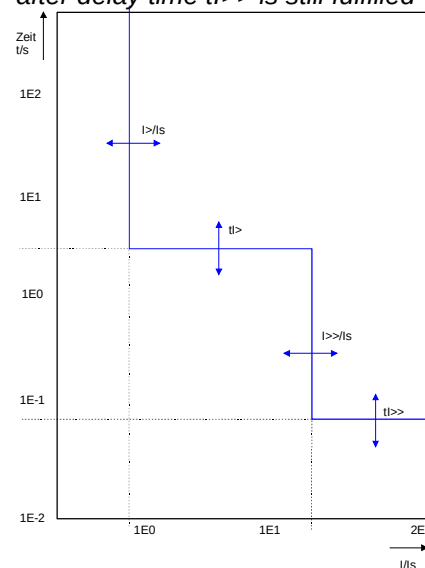


figure 3.2.1

3.2.2 Procedure in case of IDMT (AMZ)-stage:

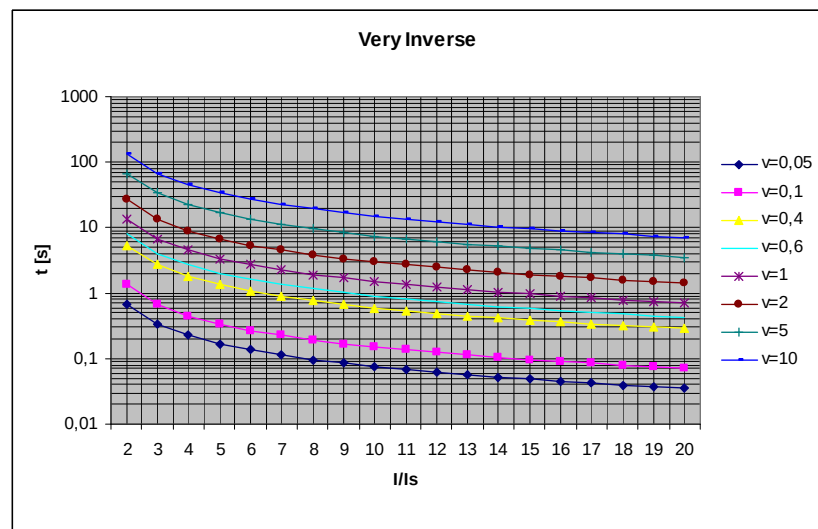
- a) Selection of adjustment current I_s out of 3 ranges 5..20A, 25..100A, 110..260A
 - b) Setting IDMT (AMZ)-Characteristic
 - 2 IDMT (AMZ) -characteristics are available
 - Selection of IDMT (AMZ) characteristic:
 - IDMT1 (AMZ 1): Very Inverse
curve $t = 13,5 / ((I/I_s) - 1) * v$
end point of nominal measuring range: $20 * I_s$
 - IDMT2 (AMZ 2): Extremely Inverse
curve $t = 80 / ((I/I_s)^2 - 1) * v$
end point of nominal measuring range: $20 * I_s$
 - Start point of IDMT (AMZ) curve: overcurrent factor $I > I_s$
 - Position of IDMT (AMZ) curve: Factor v
- Tripping is performed, if criterion I above $f(I)$ after delay time $f(v, t)$ is still fulfilled*
- c) Setting short-circuit curve:
 - Short-circuit curve: $I >> I_s$ (tripping current as ratio to the adjustment current I_s)
 - Short-circuit delay time: $tI >>$

Tripping is performed, if the criterion I above ' $I >>$ ' after delay time $tI >>$ is still fulfilled.

Very Inverse:

$$t = 13,5 * v / ((I/I_s) - 1)$$

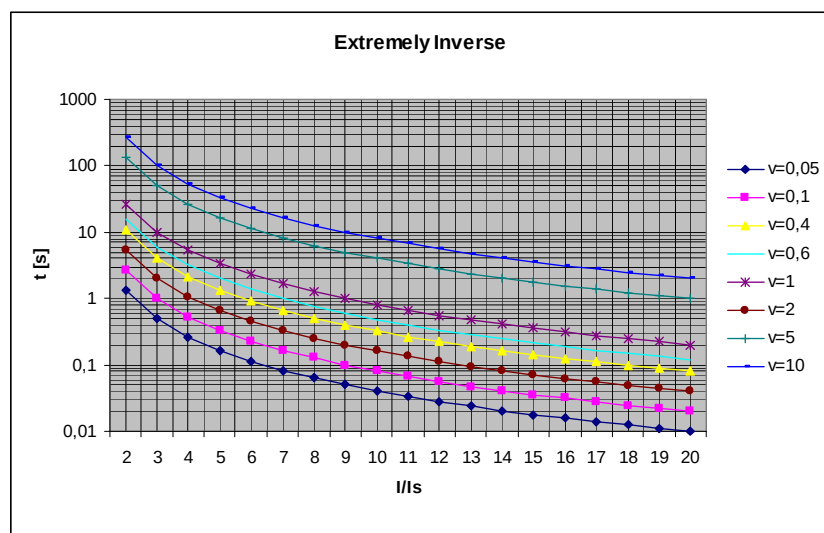
figure 3.2.2a



Extremely Inverse:

$$t = 80 * v / ((I/I_s)^2 - 1)$$

figure 3.2.2b



3.2.3 Procedure in case of optional earth-fault stage:

- a) Setting of DMT (UMZ) characteristic for earth-fault protection
Detection by balanced core CT or Delta-I-Method at solidly or low resistive terminated networks.

Setting parameter:

- Earth-fault-stimulation value: $I_{e>}/I_s$ (stimulation current $I_{e>}$ as ratio to the adjustment current I_s)
- Earth-fault delay time: $t_{le>}$

Tripping is performed, if criterion I above ' $I_{e>}$ ' after delay time $t_{le>}$ is still fulfilled

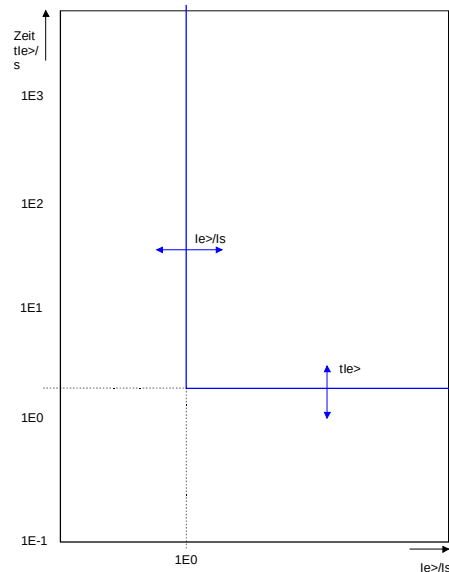


figure 3.2.3

3.3 Inrush rejection

3.3.1 Inrush rejection for IL1.. IL3

The overcurrent $I_{>}$ to observe is often close to or somewhat below the inrush current. During inrush-current the IKI-30 should not trip. Generally overcurrent-tripping time $t_{I>}$ should be chosen higher than the expected inrush time. The short-circuit current value $I_{>>}$, which is switched of in short-circuit delay time $t_{I>>}$, should be always selected considerably over the inrush current value. Values of inrush currents and inrush durations have to be taken from the documentation of the transformer manufacturers. The IKI-30 additionally offers an inrush rejection proceeding, that may be activated by Jumper. If the transformer is switched from power-off state ($I < 2A$, for all three phases) to on state, the inrush rejection proceeding monitors, if overcurrent condition is present for all three phase currents. A three pole clamp short-circuit has to be distinguished from the inrush current. In normal case it is assumed, that a three pole transformer clamp short-circuit features greater current values than the inrush event. The three pole transformer clamp short-circuit is assumed to be 10 times I_s (I_s lies near to I_n and inrush currents may reach values of up to 7 times I_n).

The inrush criterion is fulfilled if the three-phase current meets the following conditions after a currentless state:

- less than 10 times I_s
- less than $I_{>>}$ (if $I_{>>}$ stage active)
- greater than $I_{>}$ and
- longer than $t_{I>}$

In this case, the tripping is rejected. If after 3s the inrush criterion is still fulfilled, then tripping is executed.

The inrush rejection method is activated by Jumper 2.

3.3.2 Inrush-rejection for I_e

In compensated networks it is suggested to select a long time $t_{le>}$ as inrush rejection to ensure that the inrush current is delayed before a tripping may occur. A separate inrush rejection for I_e is not recommended !

In solidly or low-resistive terminated networks an inrush rejection for I_e according to the following criterion is introduced.

If, after a currentless state, the I_0 -current is

- less than $5 \times I_{e>}$
- greater than $I_{e>}$ and
- longer than $t_{le>}$,

then the tripping is rejected. If after 3s the inrush criterion is still fulfilled, then tripping is executed.

The inrush rejection method is activated by Jumper 2.

Figure 3.3a and figure 3.3.b show the correct position of the transformer characteristic between the three pole transformer clamp short-circuit current I_{sc} and the inrush current. Then a separate inrush rejection should not be necessary. In these cases it is assured by the setting that the inrush current does not cause tripping whereas the three pole transformer clamp current is switched off surely.

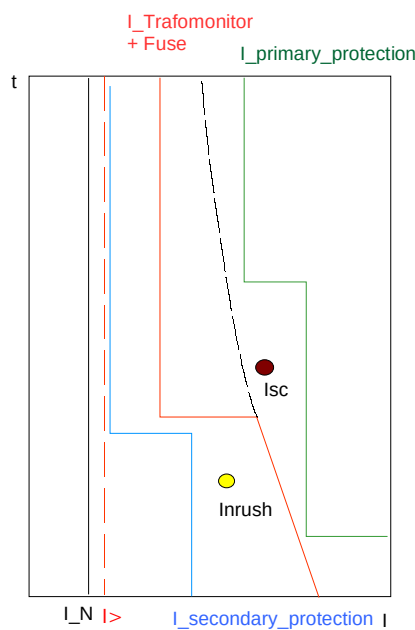


figure 3.3a

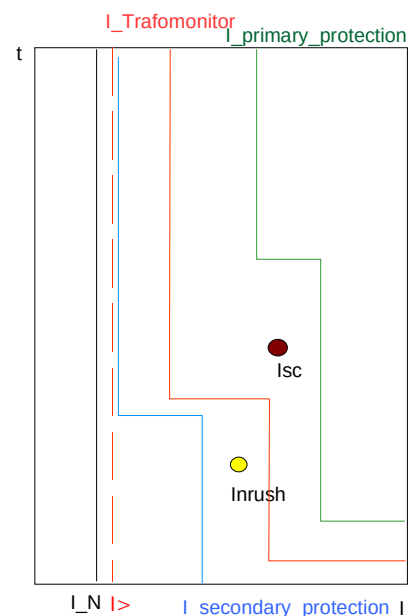


figure 3.3b

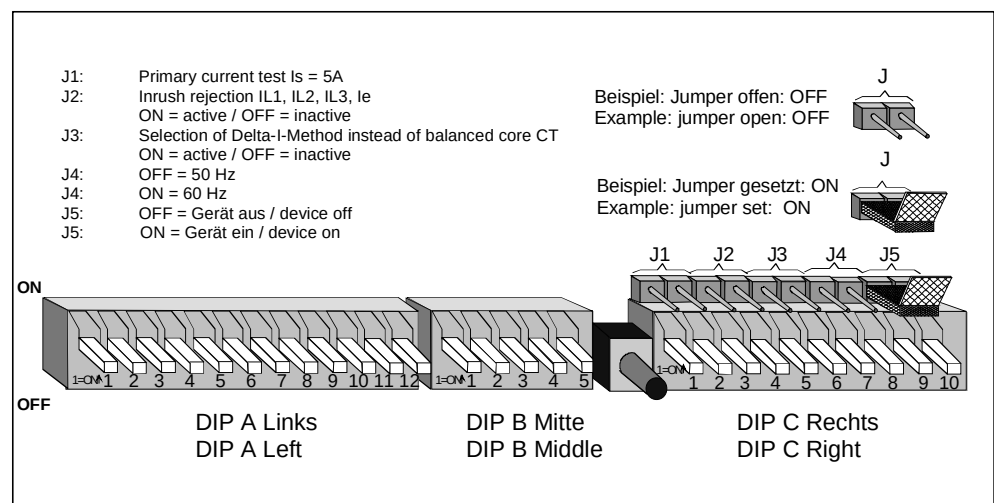
3.4 Setting of jumper and DIP-switches

For setting the front must be opened figure 3.4a

figure 3.4a



figure 3.4b



3.4.1 Setting possibilities

Bereichswahl Is Range of Is	Einstellstrom Is in A Setting current Is in A	Kurzschlussstufe I>>, tI>> Short-circuit stage I>>, tI>>	I>>-Stufe I>>-Stage	Charac- teristic	Verhältn. I>/Is Ratio	UMZ	AMZ	Erdschlussstufe Ie> Earth-fault stage Ie>		
1 2	Is=Ismin+x*S 3 4 5 6	I>>/Is 7 8 9	tI>>/s 10 11 12	I>> 1	Char 2	I>/Is 3 4 5	tI>/s	v /s 1 2 3 4	Ie>/Is 5 6 7	tIe>/s 8 9 10
5..20A, S=1A 0 0	x=0 0 0 0 0	2 0 0 0	0* 0 0 0	blocked** 0	UMZ 0	1,1 0 0 0	0,3	AMZ 1 0,05 0 0 0 0	0,1 0 0 0	0* 0 0 0 0
25..100A, S=5A 0 1	x=1 0 0 0 1	4 0 0 1	0,1 0 0 1	active 1	AMZ 1	1,2 0 0 1	0,4	0,1 0 0 0 1	0,2 0 0 1	0,1 0 0 1
110..260A, S=10A 1 0	x=2 0 0 1 0	5 0 1 0	0,2 0 1 0			1,3 0 1 0	0,5	0,4 0 0 1 0	0,3 0 1 0	0,2 0 1 0
	x=3 0 0 1 1	10 0 1 1	0,4 0 1 1			1,4 0 1 1	0,8	0,6 0 0 1 1	0,5 0 1 1	0,3 0 1 1
	x=4 0 1 0 0	12 1 0 0	0,8 1 0 0			1,5 1 0 0	1,0	1 0 1 0 0	0,8 1 0 0	0,5 1 0 0
	x=5 0 1 0 1	15 1 0 1	1,2 1 0 1			1,8 1 0 1	1,2	2 0 1 0 1	1 1 0 1	1 1 0 1
	x=6 0 1 1 0	18 1 1 0	1,6 1 1 0			2 1 1 0	1,5	5 0 1 1 0	1,5 1 1 0	2 1 1 0
	x=7 0 1 1 1	20 1 1 1	2 1 1 1			3 1 1 1	2	10 0 1 1 1	2 1 1 1	5 1 1 1
	x=8 1 0 0 0						2,5	AMZ 2 0,05 1 0 0 0		
	x=9 1 0 0 1						10	0,1 1 0 0 1		
	x=10 1 0 1 0						20	0,4 1 0 1 0		
	x=11 1 0 1 1						30	0,6 1 0 1 1		
	x=12 1 1 0 0						60	1 1 1 0 0		
	x=13 1 1 0 1						90	2 1 1 0 1		
	x=14 1 1 1 0						180	5 1 1 1 0		
	x=15 1 1 1 1						300	10 1 1 1 1		
Gewählt / Selected		DIP A LINKS DIP A LEFT		DIP B MITTE DIP B MIDDLE					DIP C RECHTS DIP C RIGHT	

* die Eigenzeit von 43ms ist hinzuzurechnen; the inherent system time of 43ms must be added

figure 3.4.1

** bei blocked ist I>>/Is der Wert, ab dem nicht mehr ausgelöst wird / if 'blocked' is selected I>>/Is is the value above no tripping is performed

The setting of the DIP-switches and jumpers is also found at the short-cut information inside the device

Remarks:

- Factory settings of manufacturer:

DIP left: range Is: 5..20A, x=0, I>>/Is: 2, tI>>/s = 0s: 00 0000 000 000
DIP middle: I>> activ, Characteristic = UMZ, I>/Is = 1,1: 1 0 000
DIP right: UMZ tI>/s = 1s, Ie>/Is = 2, tIe>/s = 5s: 0000 111 111
Jumper: J5=ON (device ready) J4=OFF (50 Hz)

- if no balanced core CT for earth-fault detecting is installed at input E (clamp 7,8) it is recommended that input E is short circuited and less sensitive setting should be selected (Ie>/Is=2, tIe>=5s).
- if Ie> < 5A is chosen the setting is corrected to Ie> = 5A by the IKI-30-E
- if Ie> < 20A is chosen and Jumper 3 is activated (i.e. Delta-I-Method is selected) the setting is corrected to Ie> =20A

New DIP-switch or jumper-settings will be taken over into memory by pressing the test-button!

3.4.2 DIP-switch A LEFT

- DIP A left 1,2
Selection of adjustment current Is in three ranges
5..20 A, steps S =1A
25..100A, steps S = 5A
110..260A, steps S= 10A
- DIP A left 3, 4, 5, 6
Selection of the adjustment current Is by factor x,
where Is = Ismin + x * S (Ismin = lower range limit Is)
- DIP A left 7, 8, 9
Selection of short-circuit stage I>> as ratio to Is
- DIP A left 10,11,12
Selection of short-circuit delay time tI>> in sec

3.4.3 DIP-switch B MIDDLE

- a) DIP B Middle 1
Short-circuit stage active (1) or blocked (0)
during blocked short-circuit stage the current resulting from $I_{>>}/I_s$ is the current above no tripping is performed any more, independent from $tI_{>>}$. For load-breaker fuse combinations used together with IKI-30 it can be ensured that currents which are too high for the load-breaker are not any more tripped by the breaker. The tripping then is performed by the fuses.
- b) DIP B Middle 2
Selection of overcurrent time characteristic
UMZ (0): (=DMT) definite minimum time characteristic acc. EN 60255
AMZ (1): (=IDMT) inverse definite minimum time characteristic acc EN 60255
- c) DIP B Middle 3, 4, 5
Ratio $I_{>}/I_s$
This ratio defines
 - for UMZ-Characteristic: the start point of stimulation current
 - for AMZ-Characteristic: the start point of stimulation curve

3.4.4 DIP-switch C RIGHT

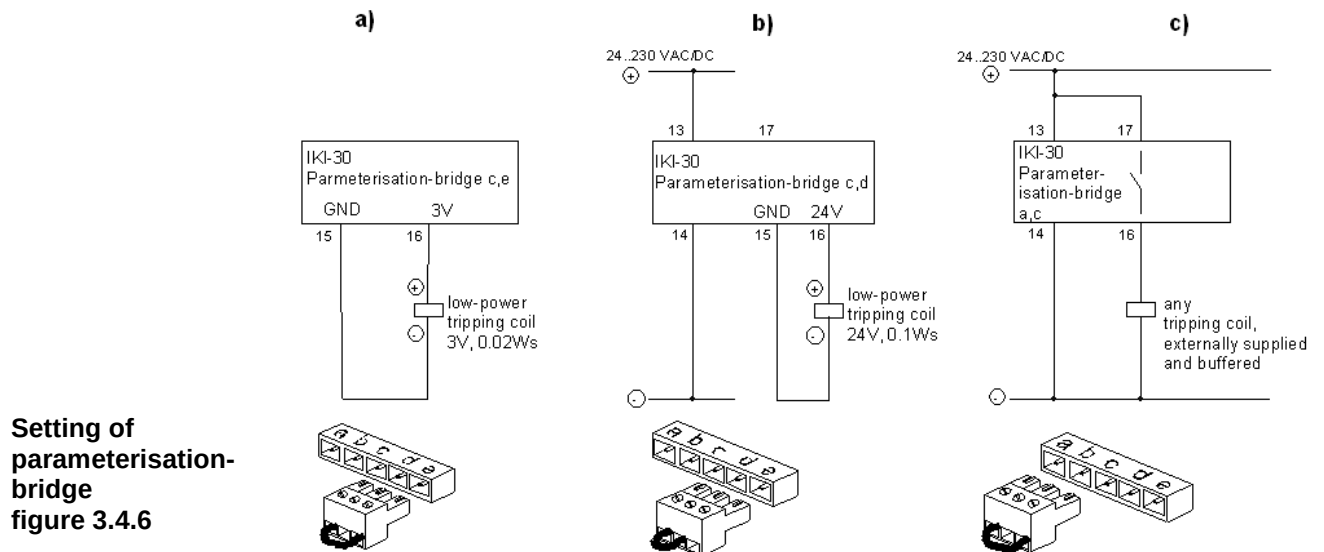
- a) DIP C Right 1, 2, 3, 4
Selection of delay time $tI_{>}$ for selected UMZ-Characteristic
Selection of AMZ-curve 1 or 2 for selected AMZ-Characteristic
Selection of AMZ-curve shifting v between 0,05 and 10 s
- b) DIP C Right 5, 6, 7
Selection of earth-fault stage overcurrent value I_e in relation to I_s
- c) DIP C Right 8, 9, 10
Selection of earth-fault stage delay time $tI_{e>}$

3.4.5 Jumper

- a) **Jumper 1** is used for primary-test mode; please refer to 5.1
- b) **Jumper 2**
with Jumper 2 the inrush rejection is activated for $IL1$, $IL2$, $IL3$ and I_e
- c) **Jumper 3**
with Jumper 3 at IKI-30E the Delta-I-Method can be activated for calculating the earth-fault current $I_{e>}$ from the unbalance of the single core CTs at $L1$, $L2$, $L3$. If Delta-I-Method is chosen the balanced core CT is not required. Delta-I-Method is only recommended for solidly or low resistive terminated networks.
- d) **Jumper 4**
Selection of nominal frequency: 50Hz = off or 60 Hz = on
- e) **Jumper 5**
Start-up: 1 = on

3.4.6 Setting of tripping coil

- a) Low power tripping coil 3V, 0,02Ws at clamp 15,16 from IKI-30 supplied and buffered; parameterisation: bridge c, e
- b) Low power tripping coil, 24V, 0,1Ws at clamp 15,16 supplied by aux.-voltage input 13, 14 and buffered from IKI-30; parameterisation: bridge c, d
- c) Standard tripping coil at clamp 16,17, external buffered e.g. by PSU, externally supplied; parameterisation: bridge a, c.
(the selected tripping coil must be checked for compatibility with the load data of the relays, see technical data)



3.5 Setting examples

3.5.1 Setting example 1:

Given:
Transformer-nominal power: 1250 kVA
Nominal voltage: 12 kV
Allowed overload: 2 x I_n for 5 s

Requested:
Short-circuit fast trip: at $15 \times I_n$ with $t_{l>>} = 0,1s$
Overcurrent characteristic: acc. DMT definite minimum time characteristic (UMZ)
Adjustment current I_s has to be chosen so that optimum adjustment is achieved: this is realised with $I_s = I_n$

calculation I_n : $I_n = 1250kVA / (12kV \cdot \sqrt{3}) = 60 A$
calculation $I_{>}/I_s = I_{>}/I_n$: $I_{>} = 2 \times I_n \rightarrow I_{>}/I_s = 2$
calculation $I_{>>}/I_s$: $I_{>>} = 15 \times I_n \rightarrow I_{>>}/I_s = 15$

setting:

Bereichswahl Is Range of Is	Einstellstrom Is in A Setting current Is in A	Kurzschlussstufe I>> , tI>> Short-circuit stage I>>, tI>>		I>>-Stufe I>>-Stage	Charac- teristic	Verhältn. I>/Is Ratio	UMZ	AMZ	Erdschlussstufe Ie> Earth-fault stage Ie>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	1 2	Is=Ismin+x*S 3 4 5 6	I>>/Is 7 8 9	tI>>/s 10 11 12	I>> 1	Char 2	I>/Is 3 4 5	tI> /s	v /s 1 2 3 4	Ie>/Is 5 6 7	tIe>/s 8 9 10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</

figure 3.5.1

* die Eigenzeit von 43ms ist hinzuzurechnen; the inherent system time of 43ms must be added

** bei blocked ist I>>/Is der Wert, ab dem nicht mehr ausgelöst wird / if 'blocked' is selected I>>/Is is the value above no tripping is performed

3.5.2 Setting example 2:

Given:

Transformer-nominal power: 1250 kVA
Nominal voltage: 12 kV
Allowed overload: 2 x I_n for 5 s

Requested:

Short-circuit fast trip: at 15 x I_n with t_{I>>} = 0,1
Overcurrent characteristic: acc. IDMT (AMZ) Very Inverse

Adjustment current I_s has to be chosen so that optimum adjustment is achieved:

this is realised with I_s=I_n

Chose AMZ1:

IDMT, Very inverse

Calculation I_n:

$$I_n = 1250 \text{ kVA} / (12 \text{ kV} \cdot \sqrt{3}) = 60 \text{ A}$$

Calculation I_{>/I_s} = I_> / I_n

I_> = 2 x I_n -> I_{>/I_s} = 2 (Starting point of AMZ-curve)

Herewith a tripping time of 5s at I_{>/I_s}=2 results

This is given with v=0,4 (see curve at 3.2.2a)

Calculation I_{>>/I_s}:

I_{>>}=15x I_n -> I_{>>/I_s} = 15

Since the AMZ-overcurrent curve for v=0,4 at I_{/I_s}=15 only results in a tripping time of t=0,35s the additional short-circuit stage with I_{>>/I_s} = 15 and t_{I>>}=0,1 must be overlaid.

Setting:

Bereichswahl Is Range of Is	Einstellstrom Is in A Setting current Is in A	Kurzschlussstufe I> , tI> Short-circuit stage I> , tI>		I>>-Stufe I>>-Stage	Charac- teristic	Verhältn. I>/Is Ratio	UMZ	AMZ	Erdschlussstufe Ie> Earth-fault stage Ie>		
1 2	Is=Ismin+x*S 3 4 5 6	I>/Is 7 8 9	tI>/s 10 11 12	I>> 1	Char 2	I>/Is 3 4 5	tI>/s	v /s	1 2 3 4	Ie>/Is 5 6 7	tIe>/s 8 9 10
5..20A, S=1A 0 0	x=0 0 0 0 0	2 0 0 0	0* 0 0 0	blocked** 0	UMZ 0	1,1 0 0 0	0,3	AMZ 1 0,05	0 0 0 0	0,1 0 0 0	0* 0 0 0
25..100A, S=5A 0 1	x=1 0 0 0 1	4 0 0 1	0,1 0 0 1	active 1	AMZ 1	1,2 0 0 1	0,4		0,1 0 0 0 1	0,2 0 0 1	0,1 0 0 1
110..260A, S=10A 1 0	x=2 0 0 1 0	5 0 1 0	0,2 0 1 0			1,3 0 1 0	0,5		0,4 0 0 1 0	0,3 0 1 0	0,2 0 1 0
	x=3 0 0 1 1	10 0 1 1	0,4 0 1 1			1,4 0 1 1	0,8		0,6 0 0 1 1	0,5 0 1 1	0,3 0 1 1
	x=4 0 1 0 0	12 1 0 0	0,8 1 0 0			1,5 1 0 0	1,0		1 0 1 0 0	0,8 1 0 0	0,5 1 0 0
	x=5 0 1 0 1	15 1 0 1	1,2 1 0 1			1,8 1 0 1	1,2		2 0 1 0 1	1 1 0 1	1 1 0 1
	x=6 0 1 1 0	18 1 1 0	1,6 1 1 0			2 1 1 0	1,5		5 0 1 1 0	1,5 1 1 0	2 1 1 0
	x=7 0 1 1 1	20 1 1 1	2 1 1 1			3 1 1 1	2		10 0 1 1 1	2 1 1 1	5 1 1 1
	x=8 1 0 0 0						2,5	AMZ 2 0,05	1 0 0 0		
	x=9 1 0 0 1						10		0,1 1 0 0 1		
	x=10 1 0 1 0						20		0,4 1 0 1 0		
	x=11 1 0 1 1						30		0,6 1 0 1 1		
	x=12 1 1 0 0						60		1 1 1 0 0		
	x=13 1 1 0 1						90		2 1 1 0 1		
	x=14 1 1 1 0						180		5 1 1 1 0		
	x=15 1 1 1 1						300		10 1 1 1 1		
	Gewählt / Selected		DIP A LINKS		DIP B MITTE		DIP B MIDDLE		DIP C RECHTS		DIP C RIGHT
60 0 1	x=7 0 1 1 1	15 1 0 1	0,1 0 0 1	1	AMZ 1	2 1 1 0	-	v=0,4	0 0 1 0		

* die Eigenzeit von 43ms ist hinzuzurechnen; the inherent system time of 43ms must be added

** bei blocked ist I_{>>/I_s} der Wert, ab dem nicht mehr ausgelöst wird / if 'blocked' is selected I_{>>/I_s} is the value above no tripping is performed

figure 3.5.2

4. Technical Data

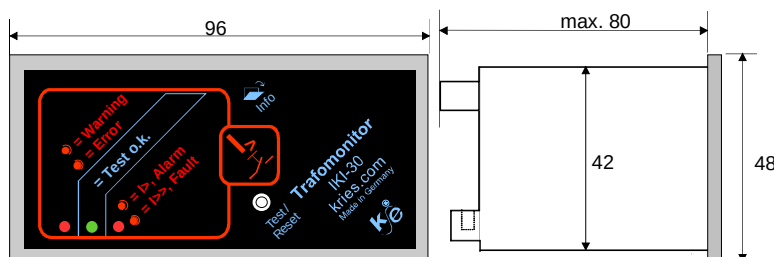
Adjustment current I_s :	3 ranges each with 16 values	- range 1: 5..20A; - range 2: 25..100A; - range 3: 110..260 A
Short-circuit stage $I_{>>}$ (ANSI 50):		
Short-circuit pick-up ratio	$I_{>>}/I_s$	8 values adjustable (2..20)
Short-circuit-delay time	$tI_{>>}$	8 values adjustable (0..2s);
Overcurrent stage $I_{>}$ (ANSI 51):		
- DMT stage (= UMZ)	overcurrent value $I_{>}/I_s$	8 values adjustable (1,1 .. 3)
overcurrent delay time	$tI_{>}$	16 values adjustable (0,3..300 s)
- IDMT1=AMZ1 (IEC very inverse)	starting point $I_{>}/I_s$	8 values adjustable (1,1 .. 3)
IDMT2=AMZ2 (IEC extr. inverse)	starting point $I_{>}/I_s$	8 values adjustable (1,1 ..3)
Curve shift:	v	8 values adjustable (0,05..10s)
Option earth-fault stage		
$I_{e>}$ (ANSI 50N, ANSI 51N):		
Earth-fault pick-up current	ratio $I_{e>}/I_s$	8 values adjustable (0,1..2)
Earth-fault delay time	$tI_{e>}$	8 values adjustable (0..5 s)
Frequency:	50/60 Hz adjustable	
Inherent time:	about 43ms (value is added to $tI_{>>}$) tolerance +-10%	
	ext. remote tripping: max. 43 ms	
Indication-reset:	- 2h or - automatic - manual	after successful primary current restoring with test/reset key
Power supply:	from CTs	during primary current is above 1 A complete supply above 5A
	buffering: internal lithium-battery alternatively: at clamps 13,14	
CT:	input L1, L2 and L3:	24..230VAC/DC, external buffered split-core CT type IKI-30LU inner diameter d=53mm current measuring range 5..600 A balanced core CT for detecting 3*10
	optional input E:	
Measuring range:	5..600 A (operat. cur.-meas. range)	600..5000A (overcurrent-measuring range)
Measuring tolerance:	5..20A: +15% (=0,5% of meas. range)	20..260A: +10% (= 4,3% of meas. range)
Trip-Relay, clamps 15,16, 17	contact load:	230VAC/DC, 8 A
Alarm-Relay, clamps 18-21	contact load:	230VAC/DC, 5 A
Product standard:	IEC 60255-5, IEC 60255-3	
Operating temperature:	-25°C .. +55°C	
Extended temperature range:	-40°C .. +70°C	(To leranz >10% vom Messbereich)
Storage Temperature:	-30°C .. +70 °C	
Housing:	front panel housing	(standard DIN 43700);
Protecting degree:	standard: IP 40	special version: IP 54
Dimensions:	bxhxt = 96 x 48 x 80 mm	
Recommended cut:	bxh = 92 x 45 mm	

4.1 Types and article-numbers

Article-name	Type	Article-#	Article-name	Type
Trafomonitor Relay: Normally Closed, N.C.	IKI-30 1	2500286	CT f. shielded HV-cable; connecting lead: 1.5m, 3m, 5m, 10m	IKI-30LU_xxm
Trafomonitor Relay: Normally Open, N.O.	IKI-30 1	2501286	CT, isolated, f. unshielded HV-cable; connecting lead: 1.5m, 3m, 5m, 10m	IKI-30LU_i_xxm
Trafomonitor with earth-fault stage, Relay: N.C.	IKI-30E 1	2500287	Balanced core CT d=130mm for earth-fault protection; connecting lead: l=1.5m, 3m, 5m, 10m	IKI-30GSU_xxm
Trafomonitor with earth-fault stage, Relay: N.O.	IKI-30E 1	2501287	Wall mountable housing wxhxd = 180x110x137mm	Art-No. 2500994
Interface Cable with USB-connector for download the event-recorder to a PC	IKI-30 USB	2501047		
Low-power tripping coil	IKI-30 TC	2500275		

4.2 Dimensions

figure 4.2



5.2 Battery change:

If the self test acc. 5.1a is not passed i.e. no indication of green LED the battery must be changed. A periodic change of the battery is recommended after 15 years. For this all leads must be disconnected from the clamps and the circuit-board block (upper and lower CB) must be taken out through the opened front panel. Static charges on tools or body should be discharged before contacting the circuit board. For loosen the battery clamps the upper circuit board must be released from the upper circuit board. For this the screw must be loosen acc. figure 5.2a.

Subsequently the battery can be loosen from the screw socket and replaced by a new one figure 5.2b. **note polarity!**

Replacement battery: Type LS 17500, 3.6V, manufacturer Saft

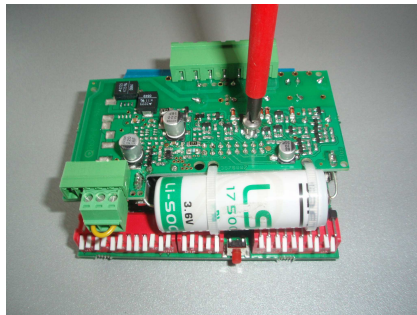


figure 5.2a

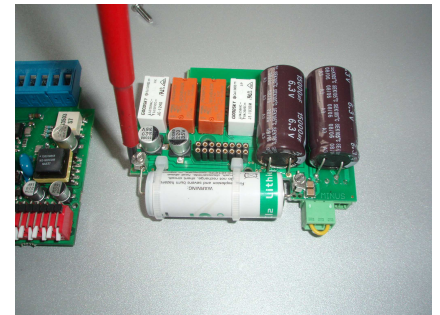


figure 5.2b

6. Low power tripping coil

The low power tripping coil type IKI-30TC was especially designed for application with IKI-30 and is installed at clamps 15,16.

When IKI-30TC is used no external auxiliary voltage is required at clamps 13,14.

