



## **WIC1 – CT Powered Time Overcurrent And Earth Current Relay**

**Manual WIC1 (Revision C)**

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# 1. Comments on the manual

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This manual explains in general the tasks of device planning, parameter setting, installation, commissioning, operation and maintenance of the WIC1 device.

The manual serves as working basis for:

- Engineers in the protection field,
- commissioning engineers,
- people dealing with setting, testing and maintenance of protection and control devices,
- as well as trained personnel for electrical installations and power stations.

All functions concerning the type code will be defined. Should there be a description of any functions, parameters or inputs/outputs which do not apply to the device in use, please ignore that information.

All details and references are explained to the best of our knowledge and are based on our experience and observations.

This manual describes the (optionally) full featured versions of the devices.

All technical information and data included in this manual reflect their state at the time this document was issued. We reserve the right to carry out technical modifications in line with further development without changing this manual and without previous notice. Hence no claim can be brought based on the information and descriptions this manual includes.

Text, graphic and formulae do not always apply to the actual delivery scope. The drawings and graphics are not true to scale. We do not accept any liability for damage and operational failures caused by operating errors or disregarding the directions of this manual.

No part of this manual is allowed to be reproduced or passed on to others in any form, unless *Woodward Kempen GmbH* have approved in writing.

This user manual is part of the delivery scope when purchasing the device. In case the device is passed on (sold) to a third party, the manual has to be handed over as well.

Any repair work carried out on the device requires skilled and competent personnel who need to be well aware especially of the local safety regulations and have the necessary experience for working on electronic protection devices and power installations (provided by evidence).

## 1.1 Information Concerning Liability and Warranty

*Woodward Kempen GmbH* does not accept any liability for damage resulting from conversions or changes carried out on the device or planning (projecting) work, parameter setting or adjustment changes done by the customer.

The warranty expires after a device has been opened by others than *Woodward Kempen* specialists.

Warranty and liability conditions stated in *Woodward Kempen GmbH* General Terms and Conditions are not supplemented by the above mentioned explanations.

## 1.2 IMPORTANT DEFINITIONS

The signal definitions shown below serve the safety of life and limb as well as for the appropriate operating life of the device.



**DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



**NOTICE** is used to address practices not related to personal injury.



**CAUTION**, without the safety alert symbol, is used to address practices not related to personal injury.

## 1.3 Electrostatic Discharge Awareness

### CAUTION

All electronic equipment is electro static-sensitive, some components more than others. To protect these components from electro static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).
2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.
4. Do not remove any printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:

Do not touch any part of the PCB except the edges.

- Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
- When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules.

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## 2. Introduction

Woodward protection relays of the WI-LINE are offering time over current protective functions and earth fault protective functions in the well-proven technique for CT powered protection relays. As combination of a compact protection relay and related core-type transformer, the WIC1 system was especially developed for compact MV switchboards with circuit breakers.

### 2.1 How to use this instruction

In this instruction the technical description of all WIC1 versions is included. The user is given a comprehensive insight into the various applications, the selection, installation, setting of parameters and putting into operation of the WIC1.

This instruction is divided into the following sections:

Chapter 1;	Introduction
Chapter 2;	Handling, installation and outside dimensions
Chapter 3;	Operating instructions
Chapter 4;	Technical data, characteristics and features
Chapter 5;	Commissioning and maintenance
Chapter 6;	Product specific features
Chapter 7;	Annex; Dimensional drawing and flag indicator, Order form and commissioning form



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### 2.2 Introductory remarks on the WIC1

The requirements on MS distribution stations with circuit breakers call for a robust protection relay which is optimized accordingly and an integral part of the respective switchboard. The WIC1 is a time over current relay Woodward has developed specifically for such requirements.

The WIC1 is a CT-powered protection relay with minimal space requirement which complies with the highest demands on a digital protection device. Simple but safe wiring, high electromagnetic interference immunity, uncomplicated adjustment and the ability to scale to different power quantities of the switchboard, helping the switchgear manufacturer to minimize costs. By developing the WIC1 we are also able to present a protective system with a guaranteed maintenance-free period of 25 years, the same as for the switchboard.



## 2.3 Product description

The WIC1 is a CT-powered protection relay with inverse time and definite time protection characteristics and is specifically designed for switchboards with CBs and small rated output currents.

Together the specific CTs and the WIC1 form a joint protective system. A low-energy coil is needed for realising trip of the CB.

Parameter setting can be done in different user-friendly ways. By means of casting all electronic components incl. the housing are safely protected against climatic and mechanic influences.

In the WIC1 the following protection functions are realized:

- 3 phase definite time over current and short-circuit protection with variable tripping times (ANSI 50/51)
- 3 phase over current protection with selectable inverse time characteristics and definite time short-circuit current element (ANSI 50/51)
- definite time earth over current protection by internal calculation (ANSI 50N/51N)

## 3. Handling, Installation and Outside Dimensions

### 3.1 General information

#### 3.1.1 Upkeep of the relay

As a rule protection relays are of robust construction and the WIC1 in particular allows operation under extreme environmental conditions. But despite these facts, the WIC1 should be handled with the necessary care during installation and commissioning. Immediately after receipt of the relay it should be checked for possible damage inflicted during transportation. Any transport damage has to be notified to the transport firm handling the consignment.

Those relays which are not installed immediately should be stored in their original package (styro-foam).

#### 3.1.2 Storage

If the relay is not used directly it has to be stored in its original packing. Permissible temperatures during storing are  $-40^{\circ}\text{C}$  up to  $+85^{\circ}\text{C}$ . The storage place should be dry.

#### 3.1.3 Electrostatic discharge

The electronic components used in the relay react very sensitive to electrostatic discharge but they are absolute safely placed inside the plastic housing. Additionally all electronic components are well protected by means of casting. Hence it is practical impossible that components are damaged by ESD.

There are no setting or calibrating appliances inside the housing, which would call for opening the device by the user. The housing is hermetically sealed and cannot be opened without causing damage.

### 3.2 Installation of the relay

By using the three 7mm  $\square$  drill holes, the relay is directly mounted onto the mounting plate. Detailed drawing with all measurements can be found under 8.1.

### 3.3 Outside dimensions

All WIC1 types are of standardized design.

Weight:

700g

Dimensions: (Width x Height x Depth)

125x170x40mm

### 3.4 Connection Diagram

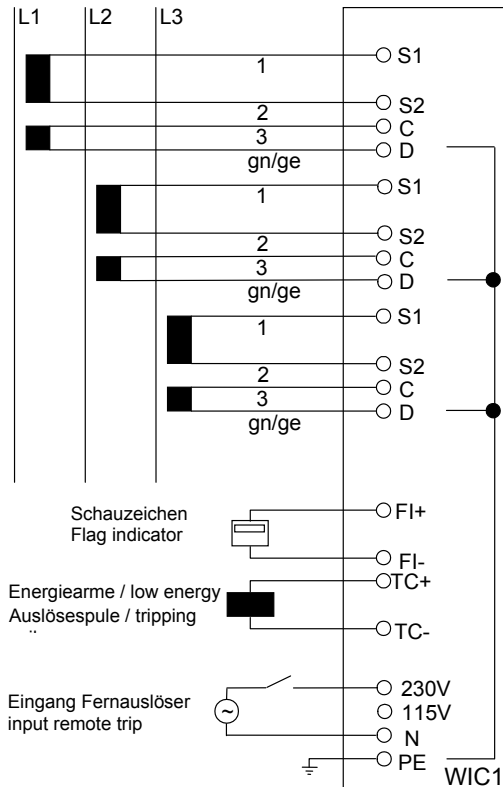


Figure 3.1: Connection diagram

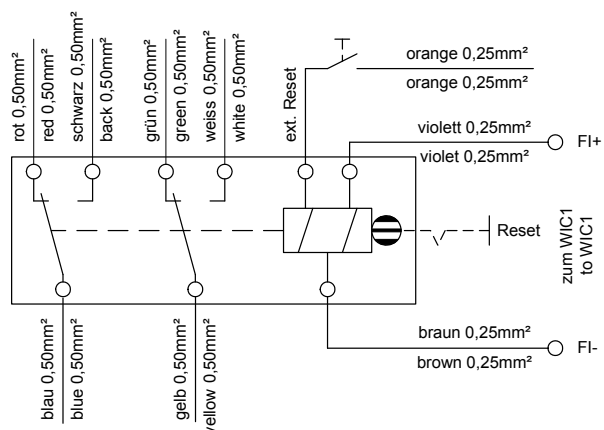


Figure 3.2: Connection diagram WI-SZ5 flag indicator

## 4. Operating instructions

### 4.1 General information on the WIC1

All available versions of the WIC1 relay are a high-tech and cost-optimized protection for MV switchboards. Specifically in compact switchboards, the WIC1 protection system in combination with a circuit breaker can replace the combination of load-break-switch with HV fuses. Thereby in particular the overload protection for the attached unit is improved clearly.

When power distribution networks are extended more and more high powered transformers are used and here HV fuses are inadmissible. For such applications the WIC1 protection system is an optimal replacement.

All WIC1 versions are provided with three analogue measuring inputs (3x phase current). The current measuring inputs are specially adjusted to the CTs allocated to the WIC1 protection system. There are 4 different CT ratios available for the protection system WIC1 which are conditional on the rated system current. The successive development towards the application time over current protection makes the system very user friendly. Setting of parameters as well as reading of tripping values is done via the integrated interface. For this the user has one PC adapter and the software "WIC-Soft1" at hand. The software is available in two versions, i.e. for installation on a WINDOWS PC and also for standard Palm Top Computers.

As an alternative to the adjustment via interface it is also possible to do this by means of DIP switches (for relay version WIC1-2) or by HEX switches (for relay version WIC1-3).

Cumulative current formation for earth current detection is programmed in the relay. The earth current is calculated from the three phase currents.

The WIC1 is provided with an input for remote tripping to which 115 VAC or 230 VAC can be connected. Tripping is realized via the electric impulse output after max. 1s.

A mechanical flag indicator WI1-SZ4 can be installed for optical signaling occurrence of trip conditions.

Furthermore it is possible to signal a trip event potentially free via the flag indicator WI1-SZ5. For this purpose the flag indicator is equipped with two changeover contacts.

For versions WIC1-2/-3 activation of the relay is signaled by a LED which is above the switches and protected by the clear plastic cover.

In order to simplify protective tests, the WIC1 has test sockets for connection of measuring lines of a three-phase testing device which are used for feeding the CT test winding. Through this the entire protection system (CTs, protection devices, tripping coil) incl. the wiring can be tested.

## 4.2 User interface

### 4.2.1 WIC1-1/WIC1-4

Pursuant to the intended maintenance-free design and for reducing cost there is no user interface with LED indicators and display. The setting values of the protective functions can be recorded directly at the protection relay.

For the basic version WIC1-1 the adjustment of protective functions can only be done via the communication interface which is placed above the terminal blocks at the left of the device.

The adjustment can take place by means of PC. For the short-circuit element here a separate password is needed. Factory setting this is "SEG".

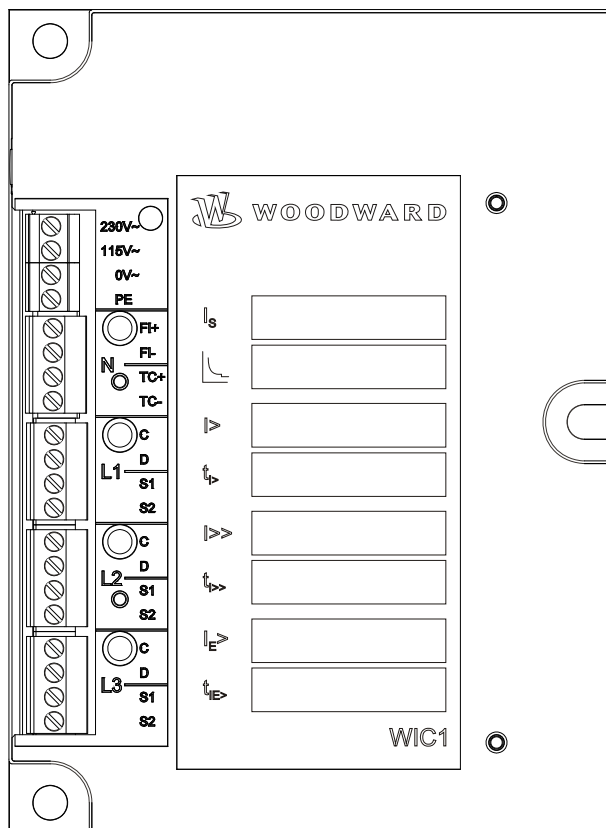


Figure 4.1: WIC1-1

When compared to WIC1-1, the WIC1-4 provides an additional operator interface at its front panel. Position and function are the same as for all other unit versions.

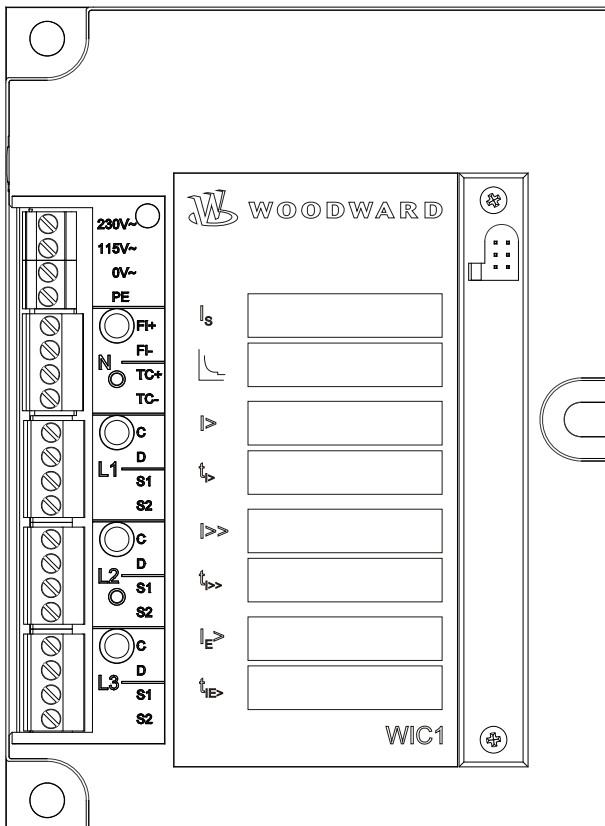


Figure 4.2: WIC1-4

#### Note!

For the operating software “WIC-Soft1” a separate description is available.

### 4.2.2 WIC1-2

For the relay version WIC1-2 the adjustment of protective functions can be done via DIP switches; there are 4 DIP switches for binary coded setting of one protective parameter.

Because there are only 16 steps available for setting the individual protective parameters, scaling is more coarse than this is the case with parameter setting via software.

For the relay version WIC1-2 setting of parameters via interface is not possible any more, but it is possible to read-out the stored fault values as well as the setting values of the WIC1.

The interface for this version can be found at the left of the relay and additionally above the DIP switch block.

Switch block; Switch No.	Setting parameter
1; 1-4	$I_S$ : Rated CT current
1; 5-8	Choice of characteristics
2; 1-4	$I_{>}$ : Pick-up value of the definite time over current element or start value of the inverse time characteristic.
2; 5-8	$t_{I>}$ : Tripping time of the definite time over current element or factor "a" of the inverse time characteristic
3; 1-4	$I_{>>}$ : Pick-up value of the short-circuit element
3; 5-8	$t_{I>>}$ : Tripping time of the short-circuit element
4; 1-4	$I_{E>}$ : Pick-up value of the definite time earth over current element
4; 5-8	$t_{I E>}$ : Tripping time of the definite time earth over current element.

If there is no earth fault function, the DIP switch block 4 is not incorporated.

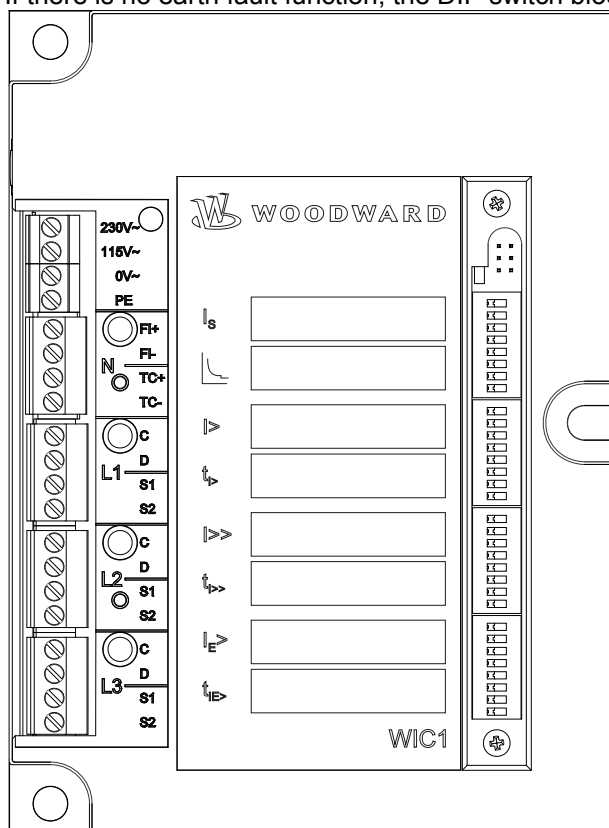


Figure 4.3: WIC1-2

### 4.2.3 WIC1-3

For the relay version WIC1-3 the adjustment of protective functions can be done via HEX switches at the protection relay.

Because there are only 16 steps available for setting the individual protective parameters, scaling is more coarse than this is the case with parameter setting via software.

For the relay version WIC1-3 setting of parameters via interface is not possible any more, but it is possible to read-out the stored fault values as well as the setting values of the WIC1.

The interface for this version can be found at the left of the relay and additionally above the HEX switch block.

The following parameters can be set for the relay version with integrated earth fault protection function.

Switch	Setting parameter
1	$I_S$ : Rated CT current
2	Choice of characteristics
3	$I_{>}$ : Pick-up value of the definite time over current element or start value of the inverse time characteristic
4	$t_{I>}$ : Tripping time of the definite time over current element or time factor "a" of the inverse time characteristic
5	$I_{>>}$ : Pick-up value of the short-circuit element
6	$t_{I>>}$ : Tripping time of the short-circuit element
7	$I_{E>}$ : Pick-up value of the definite time earth over current element
8	$t_{IE>}$ : Tripping time of the definite time earth over current element

If there is no earth fault function, the HEX switches 7 and 8 are not incorporated.

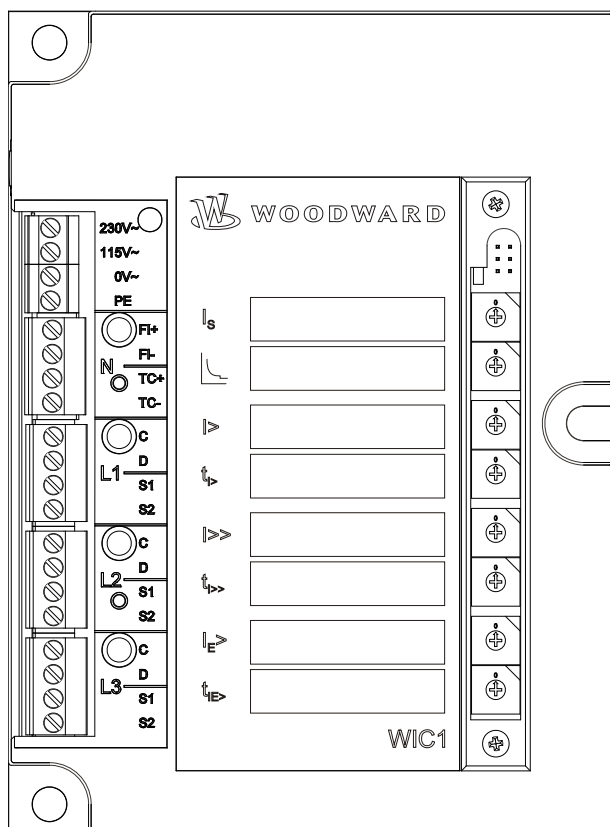


Figure 4.4: WIC1-3



### 4.3 CTs for the WIC1

There are five different wide-range CTs for the protection system WIC1. Dependent on the rated primary power and voltage of the system, the following CTs can be offered:

CT Type	Rated CT current IS
<b>WIC1-WE1</b>	<b>8 – 28 A</b>
<b>WIC1-W1</b>	<b>8 – 28 A</b>
WIC1-WE2	16 – 56 A
WIC1-W2	16 – 56 A
WIC1-W3	32 – 112 A
WIC1-W4	64 – 224 A
WIC1-W5	128 – 448 A
WIC1-W6	256 – 896 A

The protection relay can be set to the respective operating current of the switchboard by parameter Is. Reference on the calculation of the protective setting values resulting from this is made in chapter “Description of Application”.

#### Current transformer WIC1-WE1, WIC1-WE2

In case of small values of the primary currents the user can choose for two current transformers with equal ratings but different characteristics of transmission: WE1 or W1 and WE2 or W2.

It is typical reaction of self-powered protection relays such as WIC1 that there will be a non-linear transmission characteristic of the relay in case of small primary currents. This will effect on the accuracy of the whole system if the current transformer is a W1 or W2 type and primary current values are less then 20 A.

Generally less accuracy will be accepted for phase current protection so that the CT W1 and CT W2 represents an inexpensive solution.

If there will be required a higher accuracy or in case of an active earth current protection element it is re-commended to use a WE1/WE2 mixed core type CT based on MU metal. In the lower operation range this CT type is more precise than the ordinary W2 type.

## 5. Technical Data, Characteristics and Features

### 5.1 Protective functions

#### 5.1.1 Minimal operating current and rated primary current

In order to operate reliably, the WIC1 – as all CT-powered protection relays – needs a minimal current flowing constantly in one of the phases. This minimal current is the smallest rated CT current (IS) x 0.9 listed in table.

The real rated current of the operating component to be protected is adjusted by parameter IS. All further settings at the protection relay refer to the adjusted IS. This is to be described in the following example;

Boundary condition:

Setting IS = 40 A, CT type W3, 32 to 112 A

Setting I>:  $1.1 \times IS = 1.1 \times 40 \text{ A} = 44 \text{ A}$

Setting I>>:  $10 \times IS = 10 \times 40 \text{ A} = 400 \text{ A}$

Setting IE>:  $0.2 \times IS = 0.2 \times 40 \text{ A} = 8 \text{ A}$

Depending on the CT type, an adjustment for relay version WIC1-1 is possible in the following scaling:

CT Type	Rated CT current	Step
WIC1-WE1	8 – 28 A	0.1 A
WIC1-W1	8 – 28 A	0.1A
WIC1-WE2	16 – 56 A	0.2 A
WIC1-W2	16 – 56 A	0.2 A
WIC1-W3	32 – 112 A	0.4 A
WIC1-W4	64 – 224 A	0.8 A
WIC1-W5	128 – 448 A	1.6 A
WIC1-W6	256 – 896 A	3.2 A

### NOTICE

only for setting via serial interface

For relay versions WIC1-2 and WIC1-3 the following rated CT currents are adjustable either by DIP switches 1-4 (switch block 1) or HEX switch 1:

DIP 1-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
WIC1-W1	8	9	10	11	12	13	14	15	16	17	18	20	22	24	26	28
WIC1-W2	16	18	20	22	24	26	28	30	32	34	36	40	44	48	52	56
WIC1-W3	32	36	40	44	48	52	56	60	64	68	72	80	88	96	104	112
WIC1-W4	64	72	80	88	96	104	112	120	128	136	144	160	176	192	208	224
WIC1-W5	128	144	160	176	192	208	224	240	256	272	288	320	352	384	416	448
WIC1-W6	256	288	320	352	384	416	448	480	512	544	576	640	704	768	832	896

### NOTICE

\* All values are primary values in Ampere

Table 5.1

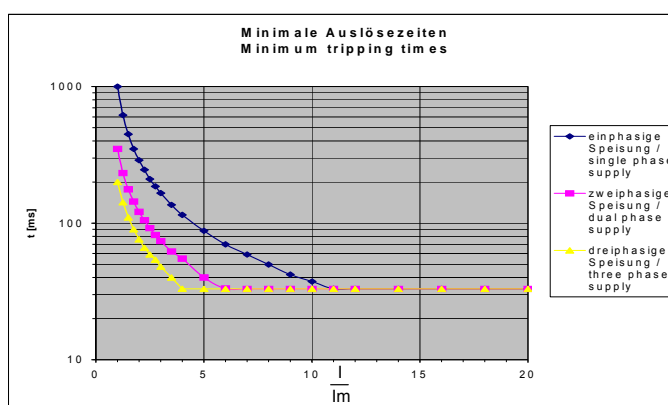
### 5.1.2 Phase time over current protection

The following setting ranges and gradings apply for the WIC1-1. Here the parameters can only be set via a serial interface.

Current	Arithmetic averages measurement
Threshold values	$I >$ 0.9 to 2.5 x $I_S$ in steps of 0.05 x $I_S$ when adjusting via interface $I >>$ 1 to 20 x $I_S$ in steps of 0.1 x $I_S$ when adjusting via interface
Tripping time for the definite time over current element	$tI >$ 0.04s to 300s in the following steps when adjusting via interface 0.04s - 1s in 0.01 s steps 1s - 5s in 0.1s steps 5s - 20s in 0.5s steps 20s - 100s in 2s steps 100s - 300s in 5s steps
IMT characteristics*:	Normal Inverse (N-INV) Very Inverse (V-INV) Extremely Inverse (E-INV) Long Time Inverse (L-INV) RI-Inverse (RI-INV) Fuse characteristic of a HV fuse Fuse characteristic of a full range fuse (FR-Fuse)
Time factor	0.05 to 10 in steps of 0.05 when adjusting via interface
Tripping times for the definite time short-circuit element	$tI >>$ 0.04s to 3s in the following steps when adjusting via interface 0.04s - 1s in 0.01 s steps 1s - 3s in 0.02 s steps

#### NOTICE

The min. tripping time when switched on to a failure is subject to the fault current level. See the following diagram. The diagram shows the tripping time under worst conditions like ageing, temperature.



$I_m$  = Minimum current (chapter 4.1.1)

With the WIC1 protection system minimal tripping times of 40 ms can be achieved.

Time correction	of current 0	$\leq 45\text{ms}$
	of current $> I_m$	$\geq 35\text{ms}$
Disengaging time	$< 30\text{ms}$	

\* The starting point of the characteristic should be in the area of the rated CT current, e. g.  $W2 = 16 - 56\text{ A}$ . If over the parameter  $I >$  the starting point is set higher, then the relay cuts the characteristics at 20 x upper rated current.

For relay versions WIC1-2 and WIC1-3 the adjustment of values is done according to the tables listed below:

Characteristic curve = HEX-Switch 2/DIP-Switch 1 (5 - 6)

DIP 1-5	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-6	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-7	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 2	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Characteristic	DEFT	N-INV	V-INV	E-INV	LI-INV	RI-INV	HV-Fuse	FR-Fuse	X	X	X	X	X	X	X	X

I> = HEX-Switch 3/DIP-Switch 2 (1 - 4)

DIP 2-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 2-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 2-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 2-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 3	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
x Is	0.9	0.95	1	1.05	1.1	1.15	1.2	1.3	1.4	1.5	1.6	1.8	2	2.25	2.5	Exit

tl> = HEX-Switch 4/DIP-Switch 2 (5 - 8)

DIP 2-5	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 2-6	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 2-7	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 2-8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 4	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
time (s) *1	0.04	1	2	3	4	5	6	8	10	15	30	60	120	180	240	300
Time (s) *2	0.04	0.3	0.6	1	2	3	4	6	8	10	15	30	60	120	210	300
Factor "a"	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1	2	3	4	5	6	8	10

\*1 The time setting table is valid for WIC1-2/3 up to device version no. G008

\*2 The time setting table is valid for WIC1-2/3 onward from device version no. G009

I>> = HEX-Switch 5/DIP-Switch 3 (1 - 4)

DIP 3-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 3-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 3-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 3-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 5	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
x Is	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	Exit

tl>> = HEX-Switch 6/DIP-Switch 3 (5 - 8)

DIP 3-5	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 3-6	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 3-7	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 3-8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 6	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
time (s)	0,04	0,07	0,1	0,15	0,2	0,25	0,3	0,4	0,6	0,8	1,0	1,4	1,8	2,2	2,6	3,0

### 5.1.3 Earth current protection

Current  $I_{E>}$  Internal calculated cumulative current formation  
0.2 to 2.5 x  $I_S$  in steps of 0.05 x  $I_S$   
when adjusting via the interface for the WIC1-1

Tripping time  $t_{IE>}$  0.1s to 20s in steps of 0.01 when adjusting via  
the interface for the WIC1-1

$I_{E>}$  = HEX-Switch 7/DIP-Switch 4 (1 - 4)

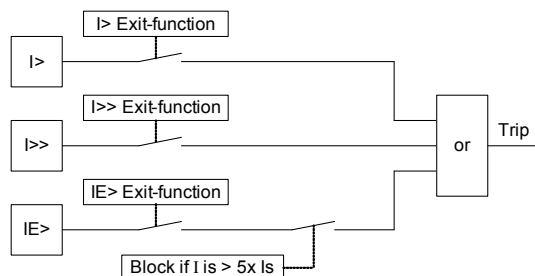
DIP 4-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 4-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 4-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 4-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 7	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
x $I_S$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0	2.5	Exit

$t_{IE>}$  = HEX-Switch 8/DIP-Switch 4 (5 – 8)

DIP 4-5	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 4-6	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 4-7	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 4-8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX 8	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
time (s)	0.1	0.2	0.4	0.6	0.8	1	1.5	2	2.5	3	3.5	4	6	8	10	20



The earth current tripping is blocked if actually measured phase current exceeds 5x  $I_S$  (rated current)



In theory the  $I>$  overcurrent and  $I>>$  short circuit function can be disabled. If the  $I>$  stage is disabled and the  $I>>$  value is set to  $>5x I_S$  the earth current stage can't trip if a measured current is higher than  $5x I_S$ .

The function is implemented due to accuracy of earth current calculation in combination with the lowest setting of earth current element.

## 5.2 Default Settings

All WIC1 relay versions are set in our works at the smallest possible setting values.

$I_S$  = smallest possible rated current (W1=8, W2=16A, W3=32A, W4=64A, W5=128A, W6=256A)

Characteristic: Definite Time

$I>$  = 0.9 x  $I_N$

$t_{I>}$  = 0.04s

$I>>$  = 1.00 x  $I_N$

$t_{I>>}$  = 0.04s

$I_{E>}$  = 0.20 x  $I_N$

$t_{I_{E>}}$  = 0.10s

### 5.3 Routine safety check

In case of misadjustment of the relay, e.g. selection of non-assigned switch positions, the relay operates with the following setting values.

$I_S$  = upper rated CT current  
 Characteristic = DEFT  
 $I_{>}$  = Deactivated (Exit)  
 $t_{I>}$  = 0.04 s  
 $I_{>>}$  =  $20 \times I_S$   
 $t_{I>>}$  = 0.04 s  
 With earth fault element  
 $I_{E>}$  =  $2.5 \times I_S$   
 $t_{IE>}$  = 0.1 s

A circuitry is integrated to give an additional back-up protection in case of processor or storage errors. By this circuitry a short-circuit protection with the following trip values is guaranteed:

- $I_{>>}$  = 20 times highest rated CT current
- $t_{I>>}$  = 40 ms

The relay option WIC1-xxx-W works with an additional backup-protection when

- The watch-dog of the microcontroller responded,
- 0.8 times lowest rated CT current is flowing,
- the energy storage is charged (charging time is 1s at lower rated CT current),

### 5.4 Fault value memory

A fault value memory is integrated in the WIC1 where data of the latest fault occurrence is stored. The stored information can only be read out via the PC interface. The following fault references are available:

- the protective element causing the trip or an externally triggered trip
- values of the trip current in the individual phases or earth fault currents (with E type)

## 5.5 Communication

### 5.5.1 Communication via PC adapter

For connection to the RS 232 interface of a PC a WIC1PC2 adapter is needed.

For connection to the USB interface of a PC a WIC1-PC3 adapter is needed.

Through these adapters the galvanic isolation between protection device and the PC is reached and it supplies the WIC1 with the necessary energy. For communication a proprietary Woodward protocol is used.



Figure 5.1: WIC1, WIC1PC2 and Notebook

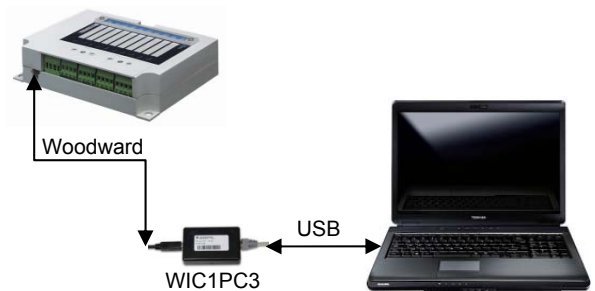


Figure 5.2: WIC1, WIC1PC3 and Notebook

### 5.5.2 WIC1PC2 adapter

To connect the WIC1-PC to a serial interface, a 9-pole standard zero-modem-cable is needed. The lockable opening at the housing of WIC1 and the 6-pole plug are of matching design.

A 9V battery is integrated in the PC adapter. During reading out and writing of parameters the WIC1 is fed by the PC adapter

The battery charging level is indicated by LED on the PC adapter. As soon as the adapter is connected with the PC and the battery charging level is high enough, the LED lights up. Dropping of the battery voltage is indicated by LED.

The data exchange between PC/Palm Top and WIC1 is signaled by lighting up of the LED "Tx" and "Rx" resp. Transmit/Receive.

### 5.5.3 WIC1PC3 Adapter

To connect the WIC1PC3 to a USB interface, a USB cable with type A connector and type B connector is needed. The cable is included in delivery.

The USB port supplies the WIC1 via a DC/DC converter

## 5.6 Inputs and outputs

The terminals for connection of the CT, the tripping coil of the external trip input as well as the flag indicator output are provided at the left side of the WIC1. Dependent on the relay type either screw-type terminals or screw-type plug-in terminals in 4-block arrangement are used. Make of both terminal types is Phoenix.

A cover serves as protection against accidental contact and prevents unintended loosening of the plug in terminal connections. Terminal marking is durable embossed in the housing.

### 5.6.1 Remote trip input

To the four terminals of the top terminal block 230V~; 115V~; 0V~ and PE the relevant aux. voltage for the remote trip input is connected. This input is electrically isolated and can be loaded continuously.

Terminal PE is the central earthing point for the protective system.

Technical Data:

Input voltage range:           230 V  $\pm$  15%  
  115 V  $\pm$  15%

Tripping delay:                  $\leq$  1 s

### 5.6.2 Impulse output for the tripping coil

The energy-low tripping coil of the circuit breaker is connected to terminals TC+ and TC- of the second terminal block. The trip energy is provided by a capacitor store integrated in the protection relay. Length of the trip impulse is 50ms; the pause between the individual pulses depends on the impedance of the tripping coil and the current level. Pulsing is continued until the activation threshold is undershot.

Technical Data:

Trip energy:                     $E \geq 0.1$  Ws  
Voltage:                          $\geq 24$  V DC

#### CAUTION

It is not allowed to connect any active voltage to the trip coil output

### 5.6.3 Earthing

The fourth terminal (PE) of the top terminal block is the central earth connection point of the protection system.

### 5.6.4 Impulse output for the relay

The energy-low tripping coil of the circuit breaker is connected to terminals FI+ and FI- of the second terminal block. The trip energy is provided by a capacitor store integrated in the protection relay. Length of the trip impulse is 50ms; the pause between the individual pulses depends on the impedance of the flag indicator and the current level. Pulsing is continued until the activation threshold is undershot.

Technical Data:

Energy:                          $E \geq 0.01$  Ws  
Voltage:                          $\geq 24$  V DC

#### CAUTION

It is not allowed to connect any active voltage to the trip coil output



### 5.6.5 Measuring inputs for the CTs

The measuring inputs of the WIC1 protection system are matching the allocated CTs. Also the power requirement of the relay and the CT output power match.

**The connection of common CTs with secondary currents of 1 A or 5 A is inadmissible!**

## 5.7 Technical Data

### 5.7.1 Common Data

Frequency:	45 Hz to 65 Hz
Nominal:	50/60 Hz
Thermal load capacity:	Permanently: 2.5 x highest rated CT current
	1s 25 kA CT primary current
	3s 20 kA CT primary current
Dynamic load capacity:	62.5 kA CT primary current
Disengaging ratio:	95% of the pick up value

### 5.7.2 Temperature Range

Temperature range when stored:	-40°C to +85°C
Temperature range when in operation:	-40°C to +85°C

### 5.7.3 Accuracy

Tripping times:	DMT: $\pm 1\%$ of the setting value absolutely $\pm 10$ ms
	IMT: dependent on the current level and chosen characteristic, absolutely $\pm 10$ ms

Earth fault element:	$\leq 5\%$ of the setting value in the range of $IE > x IS$
	$\leq 5\%$ of the IS in the range of $IE > x IS$

Measuring accuracy for phase current	at 0°C to +50°C
with CT WE1, WE2, W3, W4 or W5:	$I_{Ph} > I_s: \leq 5\%$ of $I_{Ph}$
with CT W1:	7.2 A $\leq I_{Ph} < 10$ A: $\leq 12.5\%$ of $I_{Ph}$
	10 A $\leq I_{Ph} < 14.4$ A: $\leq 7.5\%$ of $I_{Ph}$
	$I_{Ph} \geq 14.4$ A: $\leq 5\%$ of $I_{Ph}$
with CT W2:	14.4 A $\leq I_{Ph} < 20$ A: $\leq 12.5\%$ of $I_{Ph}$
	20 A $\leq I_{Ph} < 28.8$ A: $\leq 7.5\%$ of $I_{Ph}$
	$I_{Ph} \geq 28.8$ A: $\leq 5\%$ of $I_{Ph}$

Measuring accuracy for phase current	at -40°C to +85°C
Additional temperature influence:	$\leq 2.5\%$ of $I_{Ph}$

Measuring accuracy for earth current	$\leq 2x$ Accuracy of phase current
--------------------------------------	-------------------------------------

The accuracies apply to all CT types available from the smallest adjustable primary currents up to a primary current of 20 x the highest rated CT current selectable.

CT Type	Applying Accuracy Measuring Range
WIC1-WE1	7.2 – 288* A
WIC1-W1	7.2 – 288* A
WIC1-WE2	14.4 – 1152 A
WIC1-W2	14.4 – 1152 A
WIC1-W3	28.8 – 2304 A
WIC1-W4	57.6 – 4608 A
WIC1-W5	115.2 – 9216 A
WIC1-W6	230.4 – 18432 A

- Selectable up to a primary current of 20 x the highest rated current

### 5.7.4 Insulation voltage withstand

Test of withstand alternating voltage for 1 min:	IEC 60255-5	2.5 kV
Test of lightning surge voltage 1.2/50 $\mu$ s, 0.5 J	IEC 60255-5	5 kV

### 5.7.5 EMC

#### *Interference immunity against discharges of static electricity*

DIN EN 60255-22-2 [05/97]	Air discharge	8 kV
DIN EN 61000-4-2 [03/96]	contact discharge	6 kV
Class 3		

#### *Interference immunity against high-speed transient interference quantities*

DIN IEC 60255-22-4 [10/93]	power supply, mains inputs	$\pm 4$ kV, 2.5 kHz
DIN EN 61000-4-4 [03/96]	other inputs and outputs	$\pm 2$ kV, 5 kHz
Class 4		

#### *Interference immunity against 1 MHz burst disturbance tests*

DIN EN 60255-22-6 [11/94]	differential mode	2.5 kV, 1 MHz
DIN IEC 60255-22-1 [05/91]	common mode	1 kV, 2 s

#### *Interference immunity against surge immunity test*

DIN EN 61000-6-2 [03/00]		4 kV/2 kV
DIN EN 61000-4-5 [09/96]		

#### *Interference immunity against high-frequent electromagnetic fields*

DIN EN 61000-4-3 [08/97]		10 V/m
Class 3		

#### *Interference immunity against magnetic fields of energy based frequency*

DIN EN 61000-4-8 [05/94]	continuously	100 A/m
Class 5	3 s	1000 A/m

#### *Interference immunity against line conducted interference quantities induced by high-frequent fields*

DIN EN 61000-4-6 [04/97]		10 V/m
Class 3 (0.15-230 MHz)		

#### *Interference immunity against surge voltage*

DIN EN 61000-4-5 [09/96]	within a current circuit	2 kV
Class 4	current circuit to earth	4 kV

#### *Measuring of the radio interference voltage*

DIN EN 55011 [10/97]		Limit. value class B
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#### *Measuring of the radio interference radiation*

DIN EN 55011 [10/97]		Limit. value class B
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### 5.7.6 Ambient conditions

*Vibration and continuous vibration test*  
DIN EN 60255-21-1 [05/96]  
Class 2

1/2 gn

*Shock and continuous shock test*  
DIN EN 60255-21-2 [05/96]  
Class 2

10/20 gn

*Earthquake test*  
DIN EN 60255-21-3 [11/95]  
Class 2

2 gn

*Classification*  
DIN EN 60068-1 [03/95]

Climate category

40/085/56

*Test Ad: Cold*  
DIN EN 60068-2-1 [03/95]

Temperature  
Period of stress

-40°C  
16 h

*Test Bd: Dry heat*  
DIN EN 60068-2-2 [08/94]

Temperature  
Rel. humidity  
Period of stress

+85°C  
<50%  
72 h

*Test Ca: Humid heat (constantly)*  
DIN IEC 60068-2-3 [12/86]

Temperature  
Rel. humidity  
Period of stress

+40°C  
93%  
56 h

*Test Db :Humid heat (cyclic)*  
DIN IEC 60068-2-30 [09/86]

Temperature  
Rel. humidity  
Cyclen (12 + 12-hours)

+85°C  
95%  
2

*Class of protection*

Relay housing  
Electronics  
Terminals

IP 40  
IP 65  
IP 20

### 5.7.7 Outside dimension of CTs

The structural forms of the CTs depend on the switchboard construction, i.e. they are in compliance with specific customer needs. We have various standard designs. For further information please contact your sales partner.



#### Note

The current transformers shown below are dimensioned for nominal voltages <1000 V. This means, for application in MV-switchboards <36 kV these current transformers may only be used with insulated primary conductors for example cables with appropriate insulation resistance against earth. These current transformers are not allowed to be used for non-insulated primary conductors > 1000 V against earth.

Type: WIC1-WxAS1

### NOTICE

The diameter A of the CT whole is 45 mm at type WIC1W1AS1

The diameter A of the CT whole is 50 mm at types WIC1W2AS1 to WIC1W5AS1

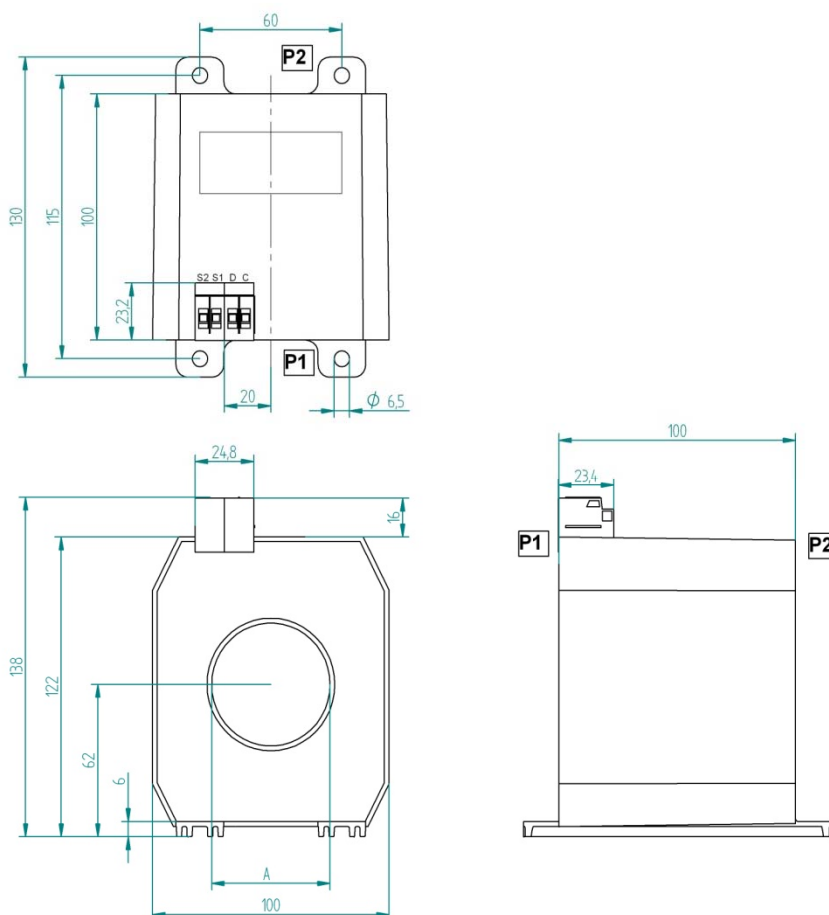


Figure 5.3: Type WIC1-W2AS1 – WIC1-W5AS1 as panel mounting

## Type: WIC1-W6AS1

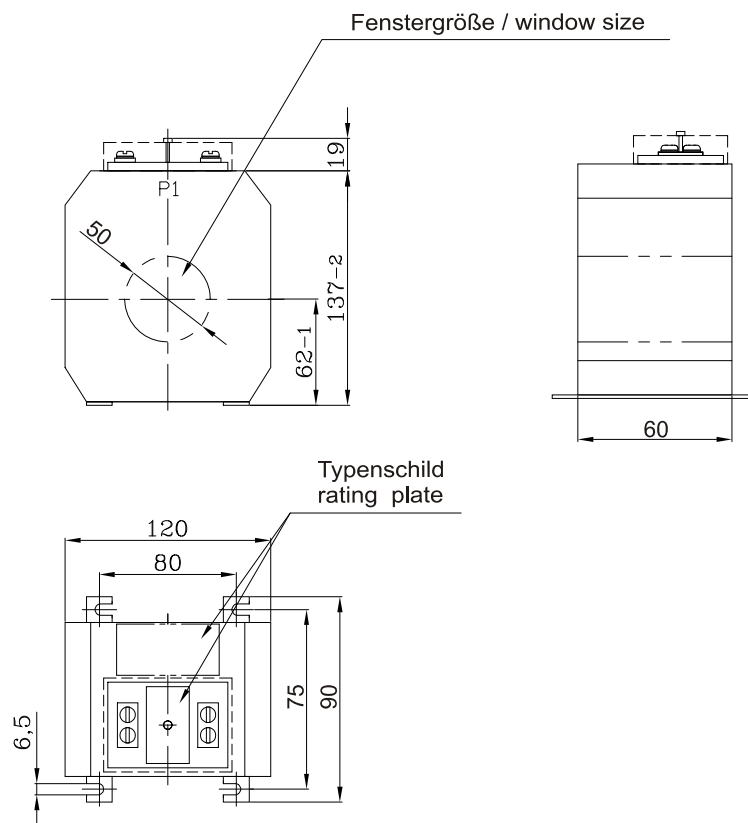


Figure 5.4: Type WIC1-W6AS1 as panel mounting

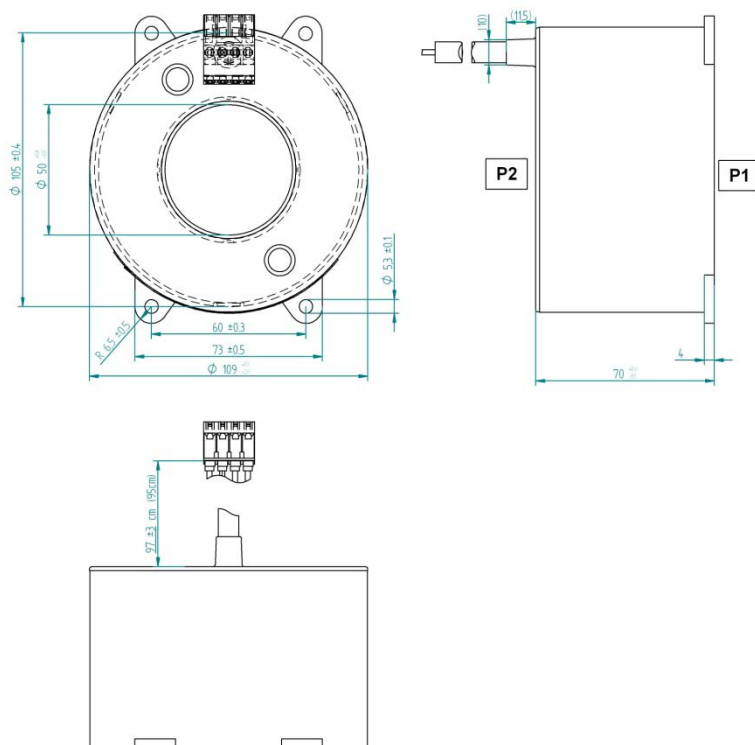


Figure 5.5: Type WIC1-WxH1 as plug on type

## 5.8 Characteristics and times

### 5.8.1 Characteristic curves

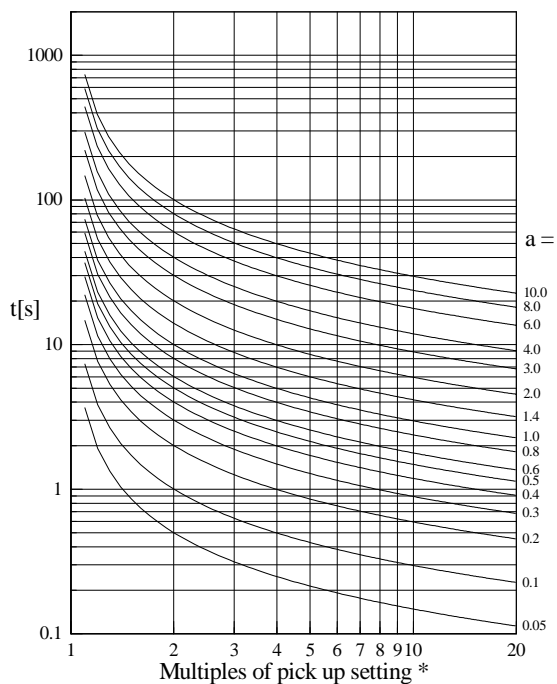


Figure 5.5: Normal Inverse

**NOTICE**

\*Multiples of pick up setting =  $I_s * I_d$

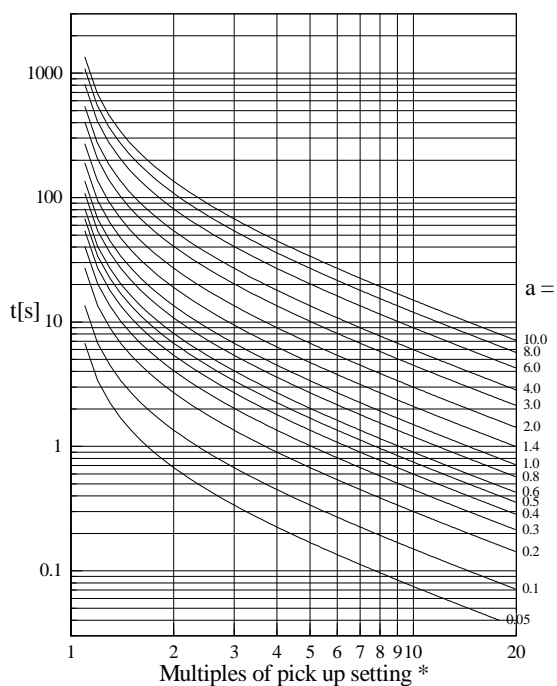


Figure 5.6: Very Inverse

**NOTICE**

\*Multiples of pick up setting =  $I_s * I_d$

\*Multiples of pick up setting =

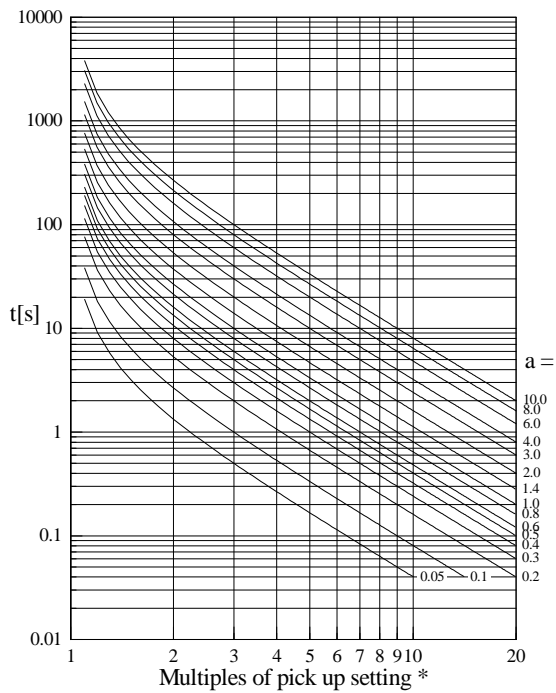


Figure 55.7: Extremely Inverse

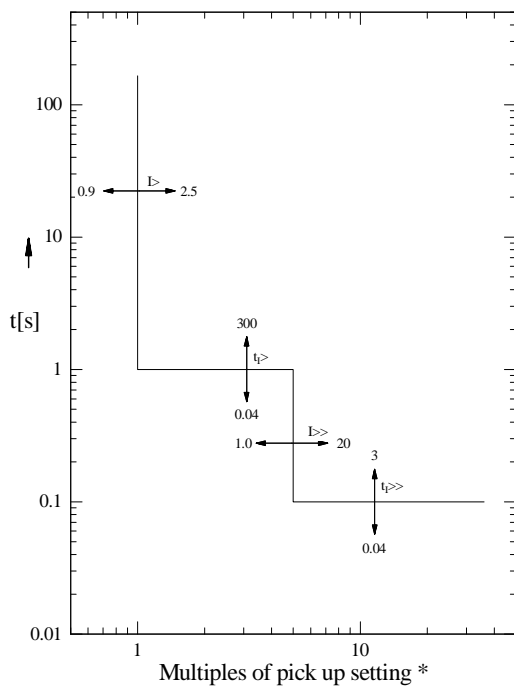
**NOTICE**\*Multiples of pick up setting =  $I_s * I_{>}$ 

Figure 5.8: Definite Time

**NOTICE**\*Multiples of pick up setting =  $I_s * I_{>}$



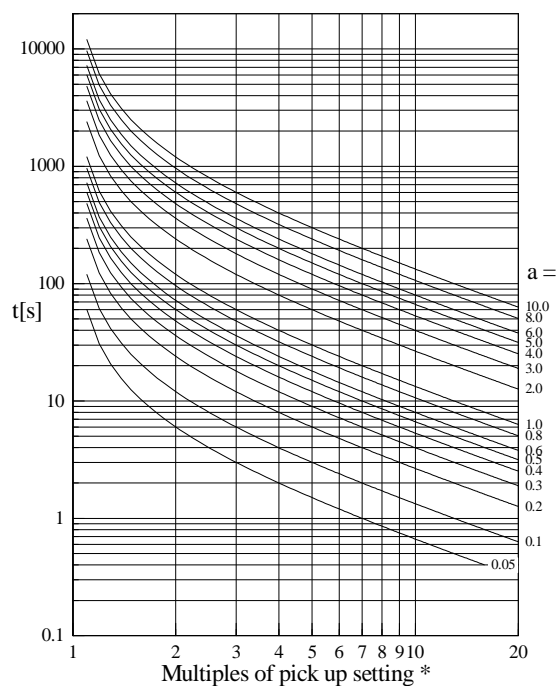


Figure 5.9: Long time inverse

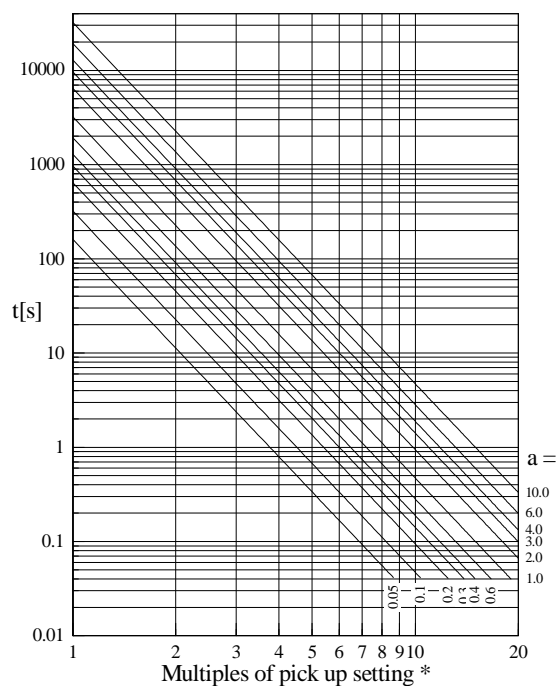
**NOTICE**\*Multiples of pick up setting =  $I_s \cdot I >$ 

Figure 5.10: HV-fuse

**NOTICE**

\*Multiples of pick up setting =

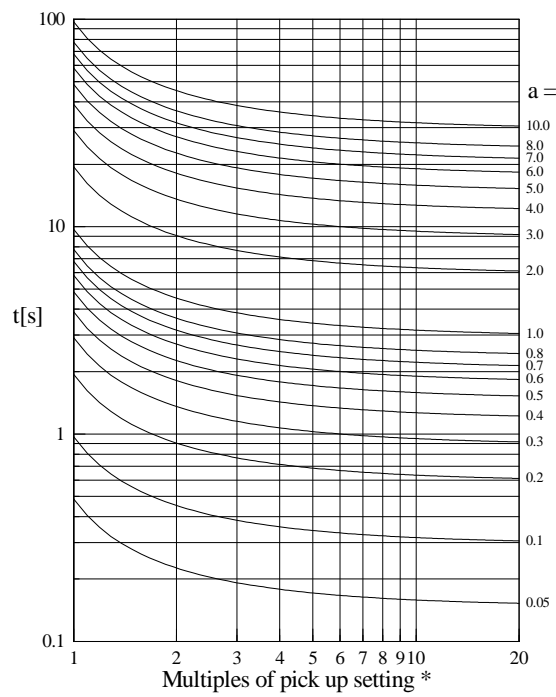


Figure 5.2: RI-Inverse

**NOTICE**

\*Multiples of pick up setting =

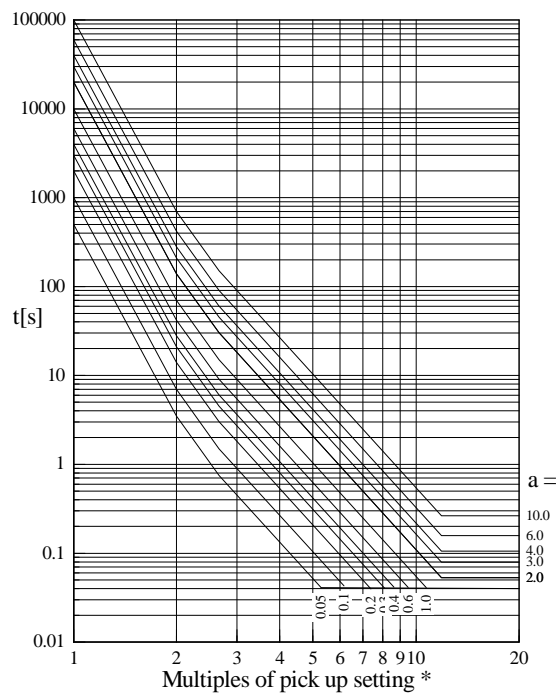


Figure 5.3: FR-fuse

**NOTICE**

\*Multiples of pick up setting =

## 5.8.2 Calculation formula for IMT characteristics

Normal Inverse:

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

Very Inverse:

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

Extremely Inverse:

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

Long time inverse:

$$t = \frac{120}{\left(\frac{I}{I_S \times I_{>}}\right) - 1} \cdot a[s]$$

RI-Inverse Time:

$$t = \frac{1}{0.339 - \frac{0.236}{\left(\frac{I}{I_S \times I_{>}}\right)}} \cdot a[s]$$

HV-Fuse:

$$t = 10^{\left(\log\left(2 \cdot \frac{I}{I_S \times I_{>}}\right) \cdot (-3.832) + 3.66\right)} \cdot \frac{a}{0.1} [s]$$

FR-Fuse

$$\frac{I}{I_S \times I_{>}} = 1 - 2 \rightarrow t = 10^{\left(\log\left(\frac{I}{I_S \times I_{>}}\right) \cdot (-7.16) + 3.0\right)} \cdot \left(\frac{a}{0.1}\right) (s)$$

$$\frac{I}{I_S \times I_{>}} = 1 - 2.66 \rightarrow t = 10^{\left(\log\left(\frac{I}{I_S \times I_{>}}\right) \cdot (-5.4) + 2.47\right)} \cdot \left(\frac{a}{0.1}\right) (s)$$

$$\frac{I}{I_S \times I_{>}} > 2.66 \rightarrow t = 10^{\left(\log\left(\frac{I}{I_S \times I_{>}}\right) \cdot (-4.24) + 1.98\right)} \cdot \left(\frac{a}{0.1}\right) (s)$$

### 5.8.3 Flag Indicators

#### WI1-SZ4

##### Technical Data

Coil: 24V DC  $\pm 10\%$

- can be set electrically
- can be reset mechanically

Connector assignment

Coil connection	Core color	mm <sup>2</sup>	Function
	black	0.25	Gnd/Set
	black	0.25	Gnd/Set

Cable connection length: 1m

#### WI1-SZ5:

##### Technical Data

Coil: 24V DC  $\pm 10\%$   
 Contact rating 230V AC/3A  
 230V DC/0.12A  
 115V DC/0.2A  
 24V DC/2A

- Flag indicator with two potential free contacts
- can be set and reset electrically
- can be reset mechanically

Connector assignment:

Coil connection	Core color	mm <sup>2</sup>	Function
	brown	0.25	(-) Gnd
	violet	0.25	(+) Set
	orange	0.25	(+) Reset
changeover contact 1	white	0.50	NO contact
	yellow	0.50	changeover contact
	green	0.50	NC contact
changeover contact 2	black	0.50	NO contact
	blue	0.50	changeover contact
	red	0.50	NC contact

Cable connection length: 1m

## 5.9 Description of application

### 5.10 Foreword

As CT-powered protection relay the WIC1 is mainly used in MV switchboards with circuit breakers, protecting distribution transformers in local and industrial networks. Due to its small size the WIC1 is very well suited for the use in compact switchboards.

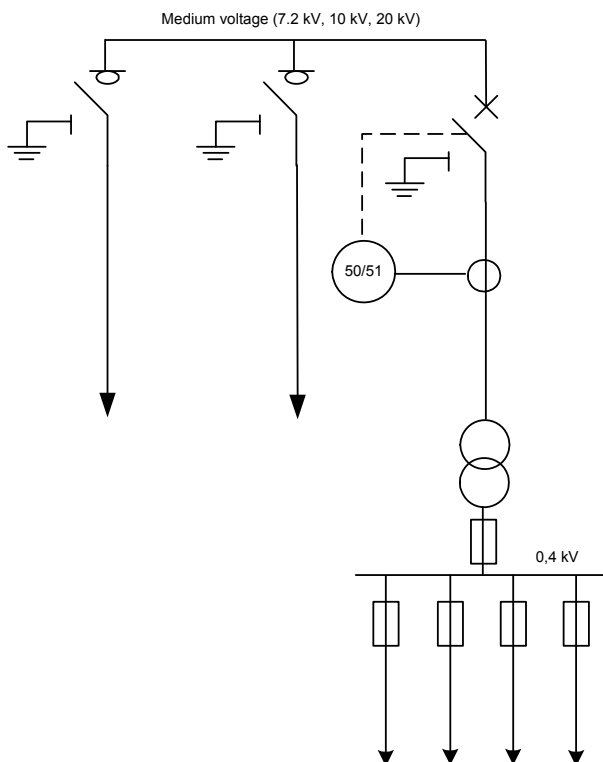


Figure 5.4: Basic circuit diagram of a standard switchboard with 2 feeders and 1 outgoing transformer panel

The ability of the protection system WIC1 to adapt to different primary currents makes it possible that it is used for all standard rated transformer loads and the different MV operational voltages.

## 5.11 Selection of the CT transformation voltage ratio

Selection of the CT suitable for the WIC1 depends on the rated current of the transformer to be protected and is calculated acc. to the following formula:

Example:

SN = 1600 kVA

UN = 10 kV

->  $I_N = 92.5 \text{ A}$

CTs WIC1-W3 and WIC1-4 are suitable for this rated current.

Marginal conditions, which should be regarded additionally with the selection of the CT's.

1. Short-circuit transient characteristic  
The WIC1 can measure a short-circuit current of a circuit up to 20 times of the upper rated CT current. This means for the CT selected above, W3:  $112 \text{ A} \cdot 20 = 2240 \text{ A}$  or , W4:  $224 \text{ A} \cdot 20 = 4480 \text{ A}$ . If the short-circuit current of a circuit is approx. 3 kA, for example, because of the location, then the preference should be given to the W4 CT, so that the current can be measured cleanly by the WIC1.
2. Operating current.  
Furthermore please pay attention to the operating current of the protection object. The operating current should be in the rated CT current range. The WIC1 system can be loaded continuously up to 2.5 times of the upper rated CT current. This has no effect on the measurement of the overload. But due to the limitation of the measurement to 20 times the upper rated CT current, the short-circuit protection is limited.

With parameter  $I_s$  the calculated rated current is preset in the protection relay.

According to table 4.1  $I_s$  currents of 88A can be adjusted for both CT types in relay versions WIC1-2 and WIC1-3.

In the example shown below, the transformer can be operated with 1.1 times the rated current for 10s. The setting value for  $I_>$  is calculated as follows:

### WIC1-1:

$I_> = 1.1 \times I_s$  with  $I_s = 92.5 \text{ A}$

### WIC1-2 and WIC1-3:

$$I_> = \frac{1.1 \cdot I_{NT}}{I_s} = \frac{1.1 \cdot 92.5 \text{ A}}{88 \text{ A}} = 1.16 \cdot I_s$$

By means of the switches, however, only  $1.15 \times I_s$  or  $1.2 \times I_s$  can be set for parameter  $I_>$ . Therefore it is up to the user to choose either  $1.15 \times I_s$  or  $1.2 \times I_s$

The different rated primary currents of all standard transformer sizes at various rated mains voltages are compiled in chapter 7.2.

## 5.12 Adjustment instruction for inverse characteristic

In the introduction phase of the WIC1 it came to understanding problems during the adjustment of the protection relay, in particular when using inverse characteristics. In the following now the connections are for this described.

### Notion definition:

#### **$I_s$ = Setting value of the load current**

With the parameter  $I_s$  the operating current of the protected equipment is set. Due to the application of wide range CT's the use of only one CT for a wide primary current range is applicable. All further setting parameter are related to the parameter  $I_s$ .

#### **$I_{>}$ = Pick up value of the over current element**

With this parameter the pick up value of the over current element is set. Here for it is to distinguish between the use of an defined time characteristic or inverse time characteristic.

At the use of a defined time characteristic the parameter  $I_{>}$  specified the pick up value of the over-current element. Exceed the measured current the factor  $I_s \square I_{>}$  the WIC1 will pick up.

At the use of a inverse time characteristic the parameter  $I_{>}$  specified the starting point of the characteristic curve. Means, that the factor  $I_s \square I_{>}$  is the starting point of the characteristic curve at one times of .

$t_{i>} =$  Delay time of the over current element by use of DEFT

$a =$  Time multiplier of the characteristic curve by the use of INV

This parameter serve to delay the trip of the WIC1 after a pick up occurs. By the use of a defined time characteristic the WIC1 trips when the pick up still exist at the time elapsed.

By the use of a inverse characteristic the factor  $a$  shift the characteristic curve (see diagram).

#### **$I_{>>}$ = Pick up value of the short circuit element**

With this parameter the pick up value of the short current element is set. Exceed the measured current the factor  $I_s \square I_{>>}$  the WIC1 will pick up.

$t_{i>>} =$  Tripping time of the short circuit element

This parameter serve to delay the trip of the WIC1 after a pick up occurs. The WIC1 trips when the pick up still exist at the time elapsed.

#### **$I_{E>}$ = Pick up value of the earth fault element**

With this parameter the pick up value of the earth fault element is set. Exceed the measured current the factor  $I_s \square I_{E>}$  the WIC1 will pick up.

$t_{iE>} =$  Tripping time of the earth fault element

This parameter serve to delay the trip of the WIC1 after a pick up occurs. The WIC1 trips when the pick up still exist at the time elapsed.

## Estimation of the tripping time at inverse characteristics

The setting and estimation by the use of an inverse characteristic will be explained at the following example.

### Boundary condition:

Operating current of the load ( $I_S$ )	72 A
Selected CT ratio	WIC1-W3, 32 A – 112 A
Characteristic	Normal Inverse N-INV
Starting point of the characteristic	$I > \times I_S$
Over current ( $I >$ ):	1.4
Factor „a“ ( $tI >$ )	0.2
Short current ( $I >>$ )	1 kA
Delay time for $I >>$	100 ms
Primary test current value	150 A

### Setting of the WIC1:

$$I_S = 72 \text{ A}$$

$$I > = 1.4$$

$$„a“ (tI >) = 0.2$$

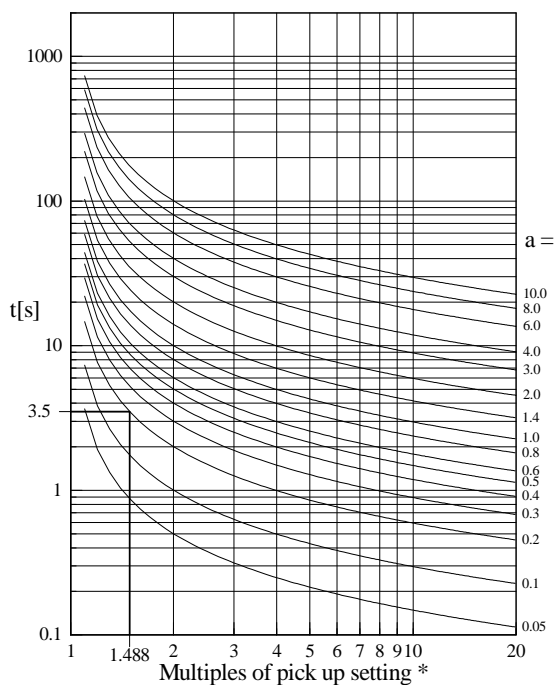
$$I >> = 14 \text{ (1 kA/72 A = 13.88)}$$

$$tI >> = 0.1 \text{ s}$$

### Estimation of the tripping time from the characteristic curve

Starting point of the curve =  $1.4 \times 72 \text{ A} = 100.8 \text{ A}$ , this correspond to =  $1 \times I/I_S \times I >$ .

Primary testing current = 150 A, here for a factor as follows is calculated  $I/I_S \times I > = 150 \text{ A}/100.8 \text{ A} = 1.488$



\*Multiples of pick up setting =

**NOTICE**

\*Multiples of pick up setting =  $I_S \times I >$

From the curve a tripping time of 3.5s is estimated.



## 6. Commissioning and Maintenance

### 6.1.1 Important note



Putting into operation and the relevant tests should only be carried out by skilled personnel. We do not accept any liability for damage caused by improper handling of the protection system, or of the primary side of the equipment. Pay attention to check that over the primary circuit no second current flow way is possible. (Grounding of the feeder).

### 6.2 Accessories for commissioning work

For commissioning of the protection system the following accessories should be available:

- For WIC1-1 a –WIC1PC adapter and a PC or with software
- Secondary testing system (see chapter 5.3ff)
- Screwdriver; cross slot type, size 1; 3mm slot
- Setting parameters

### 6.3 Criteria to be taken into account for protection devices fed by CT's

With this kind of current supply it has to be taken into account that the CT has to feed more power than this is the case for protection devices with an additional aux. voltage source. Furthermore it has to be noted that – with reference to the entire measuring range of the protection devices – the input impedance of the individual phases is not linear. The necessary power for testing the WIC1 is shown on the following graphs.

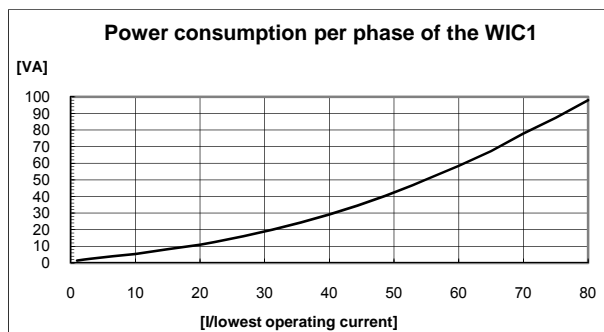


Figure 6.1: Power consumption of one phase over the entire measuring range of the WIC1

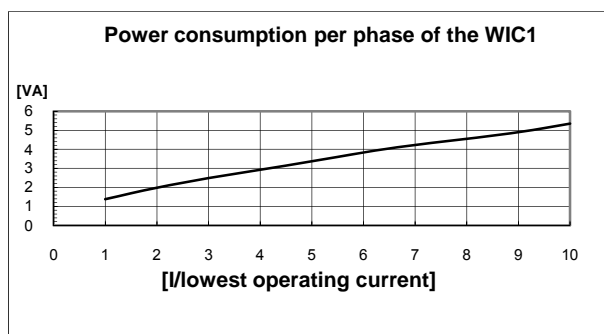


Figure 6.2: Power absorbed by one phase over the range 0.1 – 10 lowest operating current

Lowest operating current = lower rated current x 0,9. The operating current is chosen by  $I_s \cdot I >$ .

WIC1-W1xx: 7.2 A ( $I_s = 8$  A)  
 WIC1-W2xx: 14.4 A ( $I_s = 16$  A)  
 WIC1-W3xx: 28.8 A ( $I_s = 32$  A)  
 WIC1-W4xx: 57.6 A ( $I_s = 64$  A)  
 WIC1-W5xx: 115.2 A ( $I_s = 128$ )  
 WIC1-W6xx: 230.4 A ( $I_s = 256$  A)  
 $I_s$  = lowest rated current

## 6.4 Special features for the WIC1 test

The WIC1 receives its supply energy out of the measuring circuit. Conditional on the circuit logic the WIC1 changes its measuring load in a cyclic way and that in an 1kHz cycle. This can have an effect on the feeding source.

## 6.5 Selection of the secondary test system

When selecting the secondary test system the following particulars should be taken into account.

- Secondary test system to be used as power source.
- Three phases for the earth current test, one phase for the phase current test (see chapter 5.8).
- Sufficient output power for the switching points to be tested (see fig. 5.1 and 5.2).
- The highest possible test current for testing via the test winding is at 22.4amps. A test system with an output current up to 10amps should be enough.
- A timer for measuring the time 0 – 300s. The time signal can be measured via the WIC1 outputs TC+/TC- or FI+/FI- as positive edge of a 24V signal.

## 6.6 Checks during commissioning

When putting into operation, the wiring and setting of the protection relay should be checked. Here the person doing the commissioning work is assisted by the integrated test windings of the WIC1 protection system, which are on the front of the relay. Hence any wiring jobs as well as actions in the cable connection area can be disregarded.

### 6.6.1 Wiring checks

Wiring has to be checked with the circuitry shown in the diagram below.

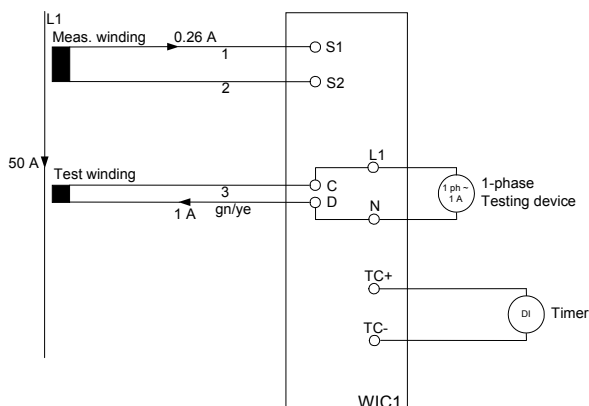


Figure 6.3: Connection of a single-phase testing device (phase L1) with CT WIC1-W2

The testing current is fed via sockets L1, L2, L3 and N. The test winding is rated such that the fed current of 1A balances a primary current of 50A (CT type WIC1-W2). The timer should be connect parallel to the tripping coil or the flag indicator. If there is no tripping coil or flag indicator available when the test is performed, an input resistor should be connected to the timer. The resistance of a timer should be in the range of 20  $\Omega$  up to 1 k $\Omega$ . This prevents false measurements when tests are repeated in short intervals because the energy store cannot be discharged.

## 6.6.2 WIC1 adjustment

The protection parameters are to be adjusted according to chapter 4 of this instruction. The set parameters can be registered directly on the sticker affixed on the relay.

## 6.7 Functional Test

There are two methods to carry out the tests: Primary test and secondary test.

When the primary test method is used, the test current is impressed via the primary winding.

When the secondary test method is used, the test current is impressed via the CD test winding. There are four different standard CT types available for the WIC1.

CT Type	Induced Current	Primary Current	Transformation Ratio
WIC1-WE1	1A	25A	25:1
WIC1-W1	1A	25A	25:1
WIC1-WE2	1A	50A	50:1
WIC1-W2	1A	50A	50:1
WIC1-W3	1A	100A	100:1
WIC1-W4	1A	200A	200:1
WIC1-W5	1A	400A	400:1
WIC1-W6	1A	800A	800:1

Table 6.1: ratio of test current in relation to the primary current

## 6.7.1 Test Currents

The transformation ratio of primary currents to secondary currents of the CTs are equally proportionate as the test current via the CD winding to the secondary current. This means, no matter which CT type is in operation, for the secondary test always the same test values are used.

DIP 1-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX-Schalter Is	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
WIC1-W1	8	9	10	11	12	13	14	15	16	17	18	20	22	24	26	28
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12
WIC1-W2	16	18	20	22	24	26	28	30	32	34	36	40	44	48	52	56
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12
WIC1-W3	32	36	40	44	48	52	56	60	64	68	72	80	88	96	104	112
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12
WIC1-W4	64	72	80	88	96	104	112	120	128	136	144	160	176	192	208	224
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12
WIC1-W5	128	144	160	176	192	208	224	240	256	272	288	320	352	384	416	448
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12
WIC1-W6	256	288	320	352	384	416	448	480	512	544	576	640	704	768	832	896
Teststrom CD	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.80	0.88	0.96	1.04	1.12

Table 6.21: Test values via CD winding with the different CT types

This means when Is is multiplied with the setting value of the relevant protection element of I>, I>> or IE> it equals the test current via the test winding. The CT type is of no consequence. The following tables show all setting values for the protection steps I>, I>> and IE>.

## 6.7.2 Switching points for the overcurrent steps

DIP 1-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX-Schalter I>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Einstellwert I>	0.90	0.95	1.00	1.05	1.10	1.15	1.20	1.30	1.40	1.50	1.60	1.80	2.00	2.25	2.50	EXIT
Is = Hex „0“	0.288	0.304	0.320	0.336	0.352	0.368	0.384	0.416	0.448	0.480	0.512	0.576	0.640	0.720	0.800	-
Is = Hex „1“	0.324	0.342	0.360	0.378	0.396	0.414	0.432	0.468	0.504	0.540	0.576	0.648	0.720	0.810	0.900	-
Is = Hex „2“	0.360	0.380	0.400	0.420	0.440	0.460	0.480	0.520	0.560	0.600	0.640	0.720	0.800	0.900	1.000	-
Is = Hex „3“	0.396	0.418	0.440	0.462	0.484	0.506	0.528	0.572	0.616	0.660	0.704	0.792	0.880	0.990	1.100	-
Is = Hex „4“	0.432	0.456	0.480	0.504	0.528	0.552	0.576	0.624	0.672	0.720	0.768	0.864	0.960	1.080	1.200	-
Is = Hex „5“	0.468	0.494	0.520	0.546	0.572	0.598	0.624	0.676	0.728	0.780	0.832	0.936	1.040	1.170	1.300	-
Is = Hex „6“	0.504	0.532	0.560	0.588	0.616	0.644	0.672	0.728	0.784	0.840	0.896	1.008	1.120	1.260	1.400	-
Is = Hex „7“	0.540	0.570	0.600	0.630	0.660	0.690	0.720	0.780	0.840	0.900	0.960	1.080	1.200	1.350	1.500	-
Is = Hex „8“	0.576	0.608	0.640	0.672	0.704	0.736	0.768	0.832	0.896	0.960	1.024	1.152	1.280	1.440	1.600	-
Is = Hex „9“	0.612	0.646	0.680	0.714	0.748	0.782	0.816	0.884	0.952	1.020	1.088	1.224	1.360	1.530	1.700	-
Is = Hex „A“	0.648	0.684	0.720	0.756	0.792	0.828	0.864	0.936	1.008	1.080	1.152	1.296	1.440	1.620	1.800	-
Is = Hex „B“	0.720	0.760	0.800	0.840	0.880	0.920	0.960	1.040	1.120	1.200	1.280	1.440	1.600	1.800	2.000	-
Is = Hex „C“	0.792	0.836	0.880	0.924	0.968	1.012	1.056	1.144	1.232	1.320	1.408	1.584	1.760	1.980	2.200	-
Is = Hex „D“	0.864	0.912	0.960	1.008	1.056	1.104	1.152	1.248	1.344	1.440	1.536	1.728	1.920	2.160	2.400	-
Is = Hex „E“	0.936	0.988	1.040	1.092	1.144	1.196	1.248	1.352	1.456	1.560	1.664	1.872	2.080	2.340	2.600	-
Is = Hex „F“	1.008	1.064	1.120	1.176	1.232	1.288	1.344	1.456	1.568	1.680	1.792	2.016	2.240	2.520	2.800	-

Table 6.3: Test current via CD winding with the I> step and the different Is setting values

### 6.7.3 Switching points for the short-circuit step

DIP 1-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX-Schalter I>>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Einstellwert xls	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	EXIT
Is = Hex „0“	0.32	0.64	0.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20	3.84	4.48	5.12	5.76	6.40	-
Is = Hex „1“	0.36	0.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60	4.32	5.04	5.76	6.48	7.20	-
Is = Hex „2“	0.40	0.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.80	5.60	6.40	7.20	8.00	-
Is = Hex „3“	0.44	0.88	1.32	1.76	2.20	2.64	3.08	3.52	3.96	4.40	5.28	6.16	7.04	7.92	8.80	-
Is = Hex „4“	0.48	0.96	1.44	1.92	2.40	2.88	3.36	3.84	4.32	4.80	5.76	6.72	7.68	8.64	9.60	-
Is = Hex „5“	0.52	1.04	1.56	2.08	2.60	3.12	3.64	4.16	4.68	5.20	6.24	7.28	8.32	9.36	10.40	-
Is = Hex „6“	0.56	1.12	1.68	2.24	2.80	3.36	3.92	4.48	5.04	5.60	6.72	7.84	8.96	10.08	11.20	-
Is = Hex „7“	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00	7.20	8.40	9.60	10.80	12.00	-
Is = Hex „8“	0.64	1.28	1.92	2.56	3.20	3.84	4.48	5.12	5.76	6.40	7.68	8.96	10.24	11.52	12.80	-
Is = Hex „9“	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80	8.16	9.52	10.88	12.24	13.60	-
Is = Hex „A“	0.72	1.44	2.16	2.88	3.60	4.32	5.04	5.76	6.48	7.20	8.64	10.08	11.52	12.96	14.40	-
Is = Hex „B“	0.80	1.60	2.40	3.20	4.00	4.80	5.60	6.40	7.20	8.00	9.60	11.20	12.80	14.40	16.00	-
Is = Hex „C“	0.88	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80	10.56	12.32	14.08	15.84	17.60	-
Is = Hex „D“	0.96	1.92	2.88	3.84	4.80	5.76	6.72	7.68	8.64	9.60	11.52	13.44	15.36	17.28	19.20	-
Is = Hex „E“	1.04	2.08	3.12	4.16	5.20	6.24	7.28	8.32	9.36	10.40	12.48	14.56	16.64	18.72	20.80	-
Is = Hex „F“	1.12	2.24	3.36	4.48	5.60	6.72	7.84	8.96	10.08	11.20	13.44	15.68	17.92	20.16	22.40	-

Table 6.4: Test current via CD winding with the I>> step and the different Is setting values

## 6.8 Special features for earth current tests

### Functional description:

In the WIC1 the earth current is calculated and cannot be measured. It is established from the geometrical amount of the three phase current values, more or less a numerical Holmgreen. If, for instant, a single-phase test current is impressed, the measuring value (tripping value) in the earth current path equals the current in the tested phase. If, with a phase shift of 120° a three-phase test current is impressed, the measuring value in the earth current path equals zero.

### Requirement on the test system:

The WIC1 is powered by the instrument transformer. In order to guarantee reliable tripping a minimal current of 0.9 x lowest nominal CT current (0.9 x lowest  $I_N$  setting) has to flow in one of the phases. If the setting of the earth current  $IE>$  is lower than the smallest possible switching point for the phase current, then the switching point for earth current tripping can only be tested by a three-phase power source. In case the set switching point for earth current is higher than the smallest possible switching point for overcurrent tripping ( $I_N \times I_N$ ), then the test can be performed with a single-phase power source.

### 6.8.1 Switching points for the earth current step

DIP 1-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
DIP 1-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
DIP 1-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
DIP 1-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
HEX-Schalter IE>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Einstellwert IE>	0.2*	0.3*	0.4*	0.5*	0.6*	0.7*	0.8*	0.9	1	1.2	1.4	1.6	1.8	2.0	2.5	EXIT
Is = Hex „0“	0,064															
	0,096	0,128	0,160	0,192	0,224	0,256	0,288	0,320	0,384	0,448	0,512	0,576	0,640	0,800	-	
Is = Hex „1“	0,072	0,108	0,144	0,180	0,216	0,252	0,288	0,324	0,360	0,432	0,504	0,576	0,648	0,720	0,900	-
Is = Hex „2“	0,080	0,120	0,160	0,200	0,240	0,280	0,320	0,360	0,400	0,480	0,560	0,640	0,720	0,800	1,000	-
Is = Hex „3“	0,088	0,132	0,176	0,220	0,264	0,308	0,352	0,396	0,440	0,528	0,616	0,704	0,792	0,880	1,100	-
Is = Hex „4“	0,096	0,144	0,192	0,240	0,288	0,336	0,384	0,432	0,480	0,576	0,672	0,768	0,864	0,960	1,200	-
Is = Hex „5“	0,104	0,156	0,208	0,260	0,312	0,364	0,416	0,468	0,520	0,624	0,728	0,832	0,936	1,040	1,300	-
Is = Hex „6“	0,112	0,168	0,224	0,280	0,336	0,392	0,448	0,504	0,560	0,672	0,784	0,896	1,008	1,120	1,400	-
Is = Hex „7“	0,120	0,180	0,240	0,300	0,360	0,420	0,480	0,540	0,600	0,720	0,840	0,960	1,080	1,200	1,500	-
Is = Hex „8“	0,128	0,192	0,256	0,320	0,384	0,448	0,512	0,576	0,640	0,768	0,896	1,024	1,152	1,280	1,600	-
Is = Hex „9“	0,136	0,204	0,272	0,340	0,408	0,476	0,544	0,612	0,680	0,816	0,952	1,088	1,224	1,360	1,700	-
Is = Hex „A“	0,144	0,216	0,288	0,360	0,432	0,504	0,576	0,648	0,720	0,864	1,008	1,152	1,296	1,440	1,800	-
Is = Hex „B“	0,160	0,240	0,320	0,400	0,480	0,560	0,640	0,720	0,800	0,960	1,120	1,280	1,440	1,600	2,000	-
Is = Hex „C“	0,176	0,264	0,352	0,440	0,528	0,616	0,704	0,792	0,880	1,056	1,232	1,408	1,584	1,760	2,200	-
Is = Hex „D“	0,192	0,288	0,384	0,480	0,576	0,672	0,768	0,864	0,960	1,152	1,344	1,536	1,728	1,920	2,400	-
Is = Hex „E“	0,208	0,312	0,416	0,520	0,624	0,728	0,832	0,936	1,040	1,248	1,456	1,664	1,872	2,080	2,600	-
Is = Hex „F“	0,224	0,336	0,448	0,560	0,672	0,784	0,896	1,008	1,120	1,344	1,568	1,792	2,016	2,240	2,800	-

Table 6.5: Test current via the CD winding with the IE> step and the different Is setting values

\* When the earth current setting is  $< 0.9 \times I_N$  a three-phase test system has to be used for correct testing. With a single-phase test the trip is only triggered from  $0.9 \times I_N$  on.

## 6.9 Test procedure by way of example

When testing the WIC1, the tests of the individual equipment should be carried out from the highest setting value to the smallest one. The order ought to be:

- 1) short circuit I>>
- 2) over current I>
- 3) earth current IE>

In here the complete test can only be exemplified with free defined switching points. For the test a single-phase power source has to be used.

General setting:

Is = Nominal Current of the equipment conditional on the used CT, on which all switching points of I>>, I> and IE> are based.

CHAR = either Definite Time or Inverse Characteristic – dependent on the requirement.

Device versions WIC1-1 and WIC1-4 are adjusted via the serial interface by way of a PC. Device versions WIC1-2 are adjusted by way of the DIP switches. Device versions WIC1-3 are adjusted by way of the Hex switches.

Here the test will be performed with the following settings:

Is = 1.15  
 Char = Definite Time  
 I> = 1.05 x Is  
 tI> = 1.00s  
 I>> = 4.00 x Is  
 tI>> = 0.10s  
 IE> = 0.9 x Is  
 tIE> = 0.2s

Test step 1): Test of the short circuit step I>>. For this the following parameters have to be blocked:

I> = EXIT  
 tI>> = EXIT  
 IE> = EXIT

The single-phase test current has to be increased slowly until the relay or the LED indicator trips (applies only for relay types WIC1-2/3/4). The tripping current can be controlled by the fault value memory. Since the WIC1 is operating phase-selectively, each phase can be tested separately.

Test step 2): Test of the trip delay tI>>

Settings: I>> = 4.00 x Is  
 tI>> = e.g. 0.10s

During the single-phase test the switching point of the I>> has to be rapidly changed from 90% to 120%. The tripping time is ascertained by an external timer. The jump is to be used as start impulse. The trip impulse coming from the flag indicator or the tripping coil serves as stop signal. If a 90% or 120% jump is not possible with the test instrument, then the jump should be from 0 to 120% of the I>>. Dependent on the test parameter for I>> and the set tripping time for tI>>, the charging and boot time needed by the relay has to be deducted. See chapter 4.1.2 Phase Over-Current Time Protection.

Test step 3): Test of the over-current step  $I_{>}$ :

Settings:  $I_{>} = 1.05 \times I_s$   
 $tI_{>} = \text{EXIT}$   
 $I_{>>} = 4.00 \times I_s$   
 $tI_{>>} = 0.10\text{s}$   
 $IE_{>} = \text{EXIT}$   
 $tIE_{>} = 0.2\text{s}$

Test to be carried out as described under "Test step 1".

Test step 4): Test of the trip delay  $tI_{>}$

Settings:  $I_{>} = 1.05 \times I_s$   
 $tI_{>} = 1.00\text{s}$

Test to be carried out as described under „Test step 2“.

Test step 5): Test of the earth current step  $IE_{>}$

Settings:  $I_{>} = \text{EXIT}$   
 $tI_{>} = 1.00\text{s}$   
 $I_{>>} = 4.00 \times I_s$   
 $tI_{>>} = 0.10\text{s}$   
 $IE_{>} = 0.9 \times I_s$   
 $tIE_{>} = \text{EXIT}$

Test to be carried out as described under „Test step 1“.

Test step 6): Test of the trip delay  $tIE_{>}$

Settings:  $IE_{>} = 0.9 \times I_s$   
 $tIE_{>} = 0.2\text{s}$

Test to be carried out as described under „Test step 2“.

## NOTICE

Tests on the earth current path can only be performed with a single-phase power source if the switching point for the  $IE_{>}$  setting is  $\geq 0.9 \times I_s$ . See chapter 5.8.



## 6.10 Maintenance

The entire protection system WIC1 is designed for a maintenance-free period of 25 years, hence there are no specific jobs necessary to be done during the operating life of the relays. Very often, a periodical check of the protective adjustments is required by the end user. Such checks are left to the choice of the user and can be carried out as described under 6.2.

### 6.10.1 Faults

Should, however, faults occur despite the special design of the protection system and the comprehensive quality control, the possibility for fault clearance by the user is only limited. For possible faults and their clearance please see the following table:

<b>Fault</b>	<b>Cause of failure</b>	<b>Remedy</b>
Wrong measuring and tripping values	Test winding short-circuited	Secondary side of test winding always to be operated openly (except when relays are tested)
Wrong measuring and tripping values	Earthing of a winding terminal of the measuring winding	No winding terminal of the measuring winding to be earthed! Earthing is done internally and brought out at terminal PE
Low-energy tripping coil does not trip	Coil polarized with permanent magnet wrong connected to TC+ and TC-	Wiring to be checked

### 6.10.2 Repair work

The WIC1 is a hermetically sealed relay and so it is not possible to do any repair work at your end. Due to the optimized cost structure, however, repair in our works is also not beneficial. During the warranty period the protection relay is exchanged by us free of charge, provided the failure was not caused by external influences. Should such a situation occur, please contact our local sales agent.

## 7. Product Specific Features

### 7.1 Assignment of terminals

The protection relay is equipped with 20 screw-type terminals, make Phoenix and 4 test sockets.

The 2 different relay versions are defined by the kind of terminal used:

WIC1-xP            plug-in terminals for connection of CTs and trip circuits

Terminal marking	Description
230 V	Remote trip input for auxiliary voltage 230 V AC
115 V	Remote trip input for auxiliary voltage 115 V AC
N	Remote trip input N (earth)
PE	Centre earthing point WIC1
TC+	Electric pulse output +pole
TC-	Electric pulse output, -pole
FI+	Flag indicator output, +pole
FI-	Flag indicator output, -pole
S1	CT measuring winding connection L1
S2	CT measuring winding connection L1
C	CT test winding connection L1
D	CT test winding connection L1
S1	CT measuring winding connection L2
S2	CT measuring winding connection L2
C	CT test winding connection L2
D	CT test winding connection L2
S1	CT measuring winding connection L3
S2	CT measuring winding connection L3
C	CT test winding connection L3
D	CT test winding connection L3
Socket L1	Connection for input test current L1
Socket L2	Connection for input test current L2
Socket L3	Connection for input test current L3
Socket N	Connection for input test current N (earth)

The terminals 230 V, 115 V, N and PE are provided as fixed terminals.

#### 7.1.1 Earthing

For earthing the WIC connection terminal PE is used.



The measuring winding (terminals S1 and S2) of the CTs must not be earthed, otherwise the measurement results are distorted, ensuring in erratic behaviour of the relay. Connection D of the respective test winding can externally be connected with terminal PE.

Listed CT ranges in relation to the transformer rated currents

## 8. Annex

### 8.1 Dimensional drawing relay

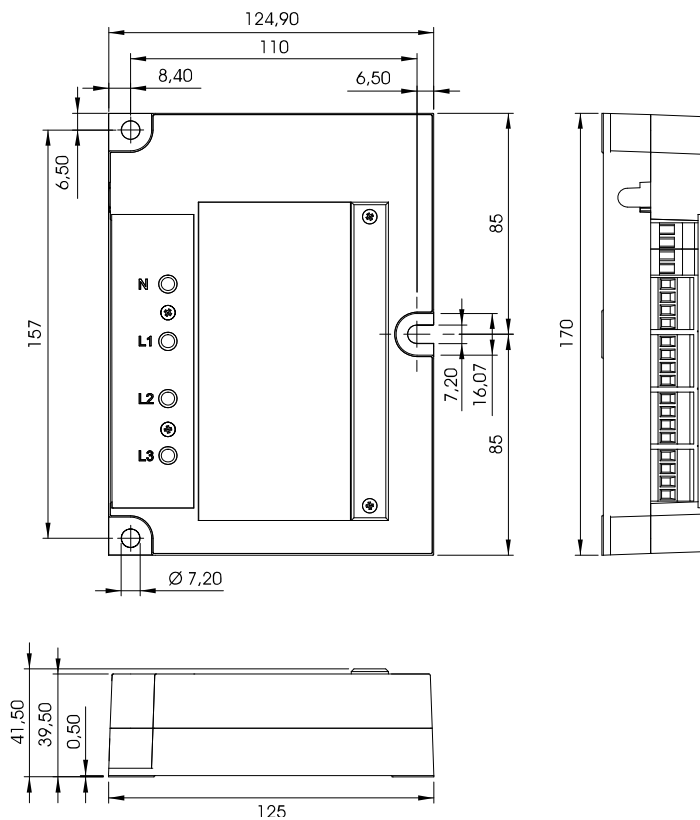


Figure 8.1: Dimensional drawing

### 8.2 Dimensional drawing flag indicator

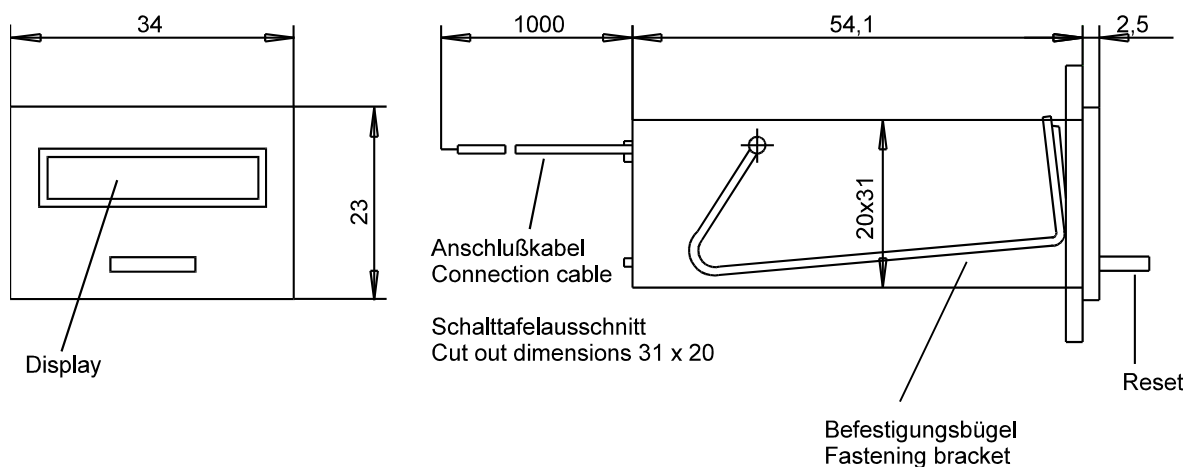


Figure 8.2: Flag indicator WI1-SZ4/WI1-SZ5

### 8.3 Order form

Multi characteristic time over current relay		WIC1		P	E	
3-phase current measuring I>;I>> self powered						
– parameter setting via serial interface		1				
– parameter setting via DIP switches		2				
– parameter setting via HEX switches		3				
– Parameter setting via interface, with LED and second operator interface		4				
Connection mode						
– plug in screw terminal						
With additional earth current supervision* I <sub>E&gt;</sub>						
– standard 0.2 to 2.5 x I <sub>S</sub> (calculated)						
With backup-protection (Trip when micro controller is fault)						
Standard with I>> trip at 20 times highest rated CT current						
– Trip at 0.8 times lowest rated CT current and full energy storage						
						* -W

\* Please leave box empty if option is not desired

Flag indicators	WI1	
Small type, front 34 x 23 mm, connection lead 1m	SZ4	
Small type, front 34 x 23 mm, connection lead 1m with bi-stable signal contact 230V AC, 3A	SZ5	

Accessoires	WIC1	
PC adapter with USB port	PC3	
Watchdog test unit	TU	

Current transformer (1 piece)			WIC1	
8 – 28 A	SVA 100 100-45	5P40	W1AS1	On request
8 – 28 A	SVA 100 100-45	5P40	WE1AS1	
16 – 56 A	SVA 100-100-50	10P80	W2AS1	
16 – 56 A	SVA 100-100-50	5P80	WE2AS1	
32 – 112 A	SVA 100-100-50	5P80	W3AS1	
64 – 224 A	SVA 100-100-50	5P80	W4AS1	
128 – 448 A	SVA 100-100-50	5P80	W5AS1	
256 – 896 A	GSA 120-60-50	5P80	W6AS1	

Please observe the note in chapter 4.7.7.

**Further designs e.g. supporting type, plug-on type etc. on request.**

Note: CT housing in accordance with the customer requirement.

## 8.4 Commissioning form

List of adjustments for WIC1

Project: \_\_\_\_\_ Order No.: \_\_\_\_\_

Functional group: \_\_\_\_\_ Location: \_\_\_\_\_ Component Identification: \_\_\_\_\_

Relay Function: \_\_\_\_\_ Date: \_\_\_\_\_

### Parameter Setting

Function		Unit	Default Setting	Actual Setting
	CT Type		W2	
IS	Rated CT current	A	16	
Char	Trip characteristic		DEFT	
I>	Pickup value for DMT characteristic or start value of the IMT characteristic	x IS	0.9	
tl>	Tripping time for DMT characteristic	s	0.04	
a	Multiplier for IMT characteristic	s	--	
I>>	Pickup value for short-circuit element	x IS	1	
tl>>	Tripping time for short-circuit element	s	0.04	
IE>	Pickup value for earth fault element (only type E)	x IS	0.2	
tlE>	Tripping time for earth fault element	s	0.1	

Signature Checker: \_\_\_\_\_ Signature customer: \_\_\_\_\_



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