SEG electronics

MANUAL

WI Line | PROTECTION TECHNOLOGY
MADE SIMPLE

WIC1 | CT POWERED TIME OVERCURRENT AND
EARTH CURRENT RELAY

CT POWERED TIME OVERCURRENT AND EARTH CURRENT RELAY

Original document

English

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Contents

1. Comments on the manual

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 SEG Electronics 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

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

The warranty expires after a device has been opened by others than SEG Electronics GmbH specialists.

Warranty and liability conditions stated in SEG Electronics GmbH General Terms and Conditions are not supplemented by the explanations mentioned above.

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

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

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

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

CAUTION — **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 electrostatic-sensitive, some components more than others. To protect these components from electrostatic 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.**

1.4   Safety Information

DANGER
Ignoring the following safety messages can result in death or serious injury or physical damage.

DANGER
Only qualified electricians may install, commission, work or operate this device.
All national standards – if applicable – must be followed.

DANGER
Even when the auxiliary voltage is switched off, it is likely that there are still hazardous voltages at the component connections.
Upon opening the device, it is likely that some parts with high voltages become accessible. Touching these is dangerous to life.
The device must be carefully grounded. See 5.6.3 "Earthing".

WARNING
The device contains components that are sensitive to electrostatic discharge. Therefore, any unnecessary touching of electronic parts must be avoided.
The terminal block for connection to the current transformers is not a shorting block.
Therefore, always short-circuit current transformers before loosening the terminals.

NOTICE
The WIC1 does not contain any parts that are serviceable or adjustable by the user.
The housing is hermetically sealed and cannot be opened without causing damage.
For more information see 3.1 "General information".
Any unauthorized opening of the device will void the warranty.

2. Introduction

The protection relays of the WI-LINE are offering time over current protective functions and optional 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;   Comments on the manual *(this chapter)*
Chapter 2;   Introduction
Chapter 3;   Handling, Installation and Outside Dimensions
Chapter 4;   Operating instructions
Chapter 5;   Technical Data, Characteristics and Features
Chapter 7;   Commissioning and Maintenance
Chapter 8;   Product-Specific Features
Chapter 9;   Annex; Dimensional drawing and flag indicator, Order form and commissioning
                  form

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>
> **This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the SEG Electronics GmbH documentation website:**
>
> **http://www.segelectronics.de**
> **If your publication is not there, please contact your customer service representative to get the latest copy.**

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 SEG Electronics GmbH 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 realizing 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) – (Option)

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 (styrofoam).

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°C up to +85°C. The storage place should be dry.

3.1.3 Electrostatic discharge

The electronic components used in the relay are very sensitive to electrostatic discharge, but they are 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 ø drill holes, the relay is directly mounted onto the mounting plate. Detailed drawing with all measurements can be found in 9.1 "Dimensional drawing relay".

3.3   Outside dimensions

All WIC1 types are of standardized design.

Weight WIC1:   700g
Dimensions: (Width x Height x Depth)   125x170x40mm

3.4   Connection Diagram for WIC1
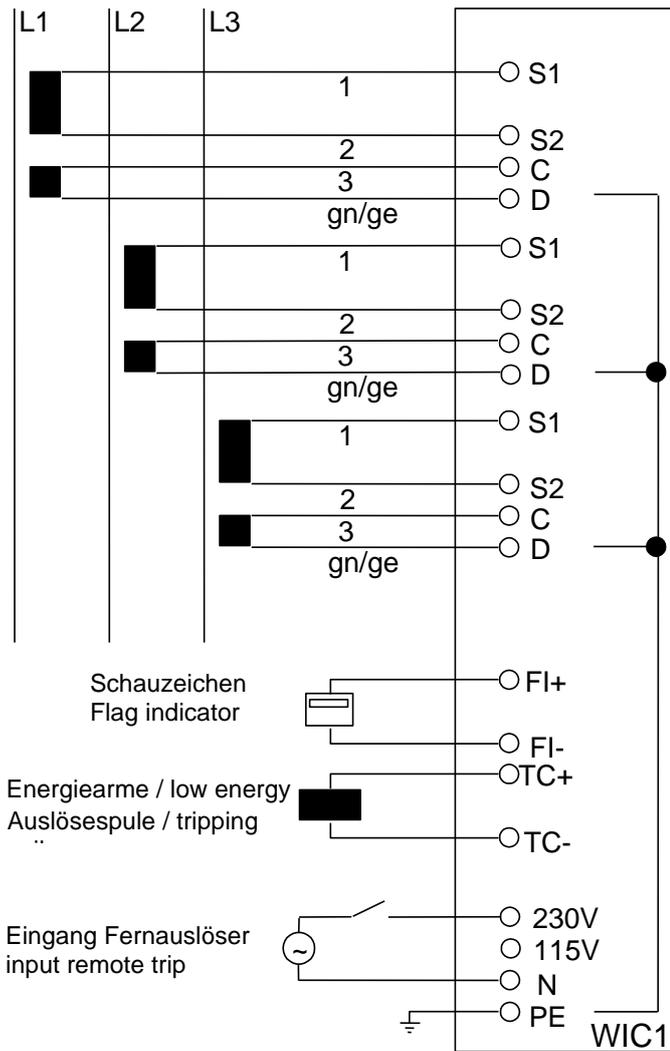
Figure 3.1: Connection diagram WIC1

3.5   Connection Diagram for the Flag Indicator WI-SZ
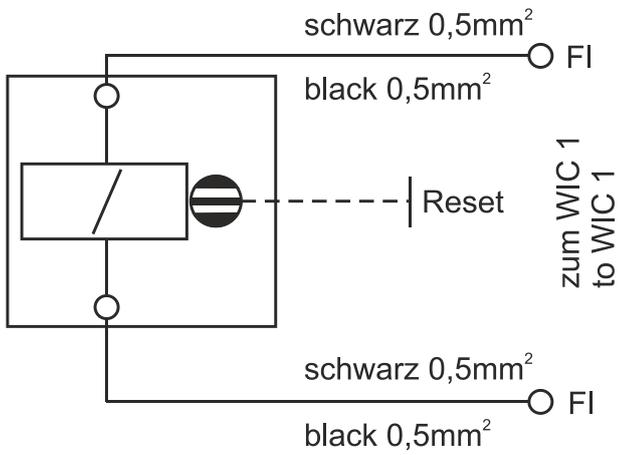
Figure 3.2: Connection diagram WI-SZ4 flag indicator
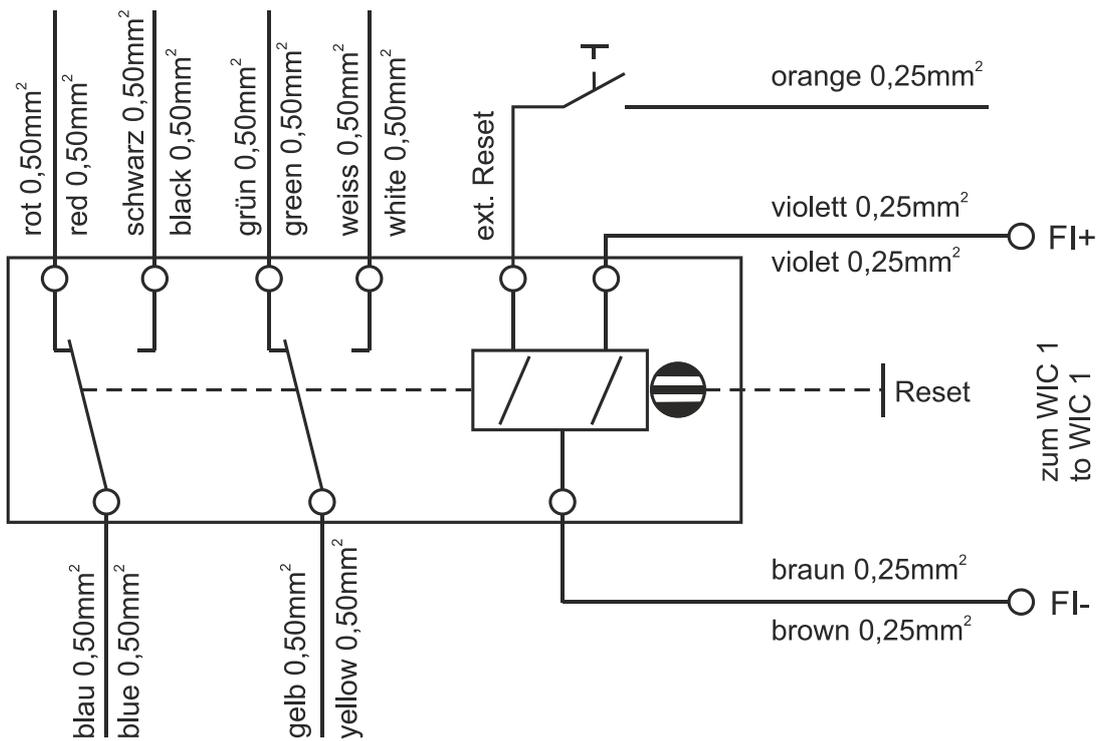
Figure 3.3: Connection diagram WI-SZ5 flag indicator

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 6 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-Soft2" at hand.

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 (not available in WIC1-2F).

The WIC1 is provided with an input for remote tripping to which 115 VAC or 230 VAC can be connected, see 5.6.1 "Remote trip input".

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

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. The factory setting for this password is: `seg`
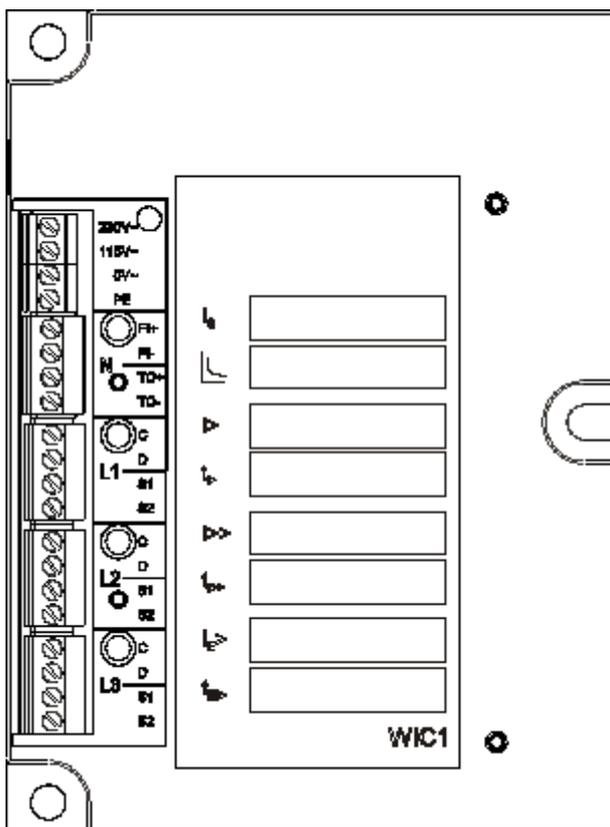
Figure 4.1: WIC1-1

4.2.2 WIC1-4

When compared to WIC1-1, the WIC1-4 provides an additional operator interface at its front panel.
The functionality is the same as for the WIC1-1.
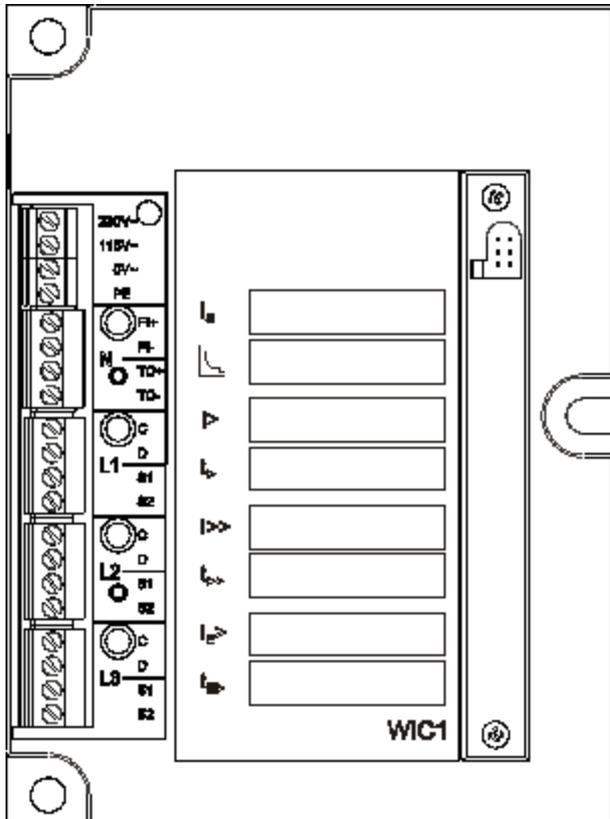
Figure 4.2: WIC1-4

Note!
For the operating software "WI-Soft2" a separate description is available.

4.2.3 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 coarser than this is the case with parameter setting via software.

For the relay version WIC1-2 setting of parameters via interface is not possible anymore, 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	$t_{IE>}$: Tripping time of the definite time earth over current element.
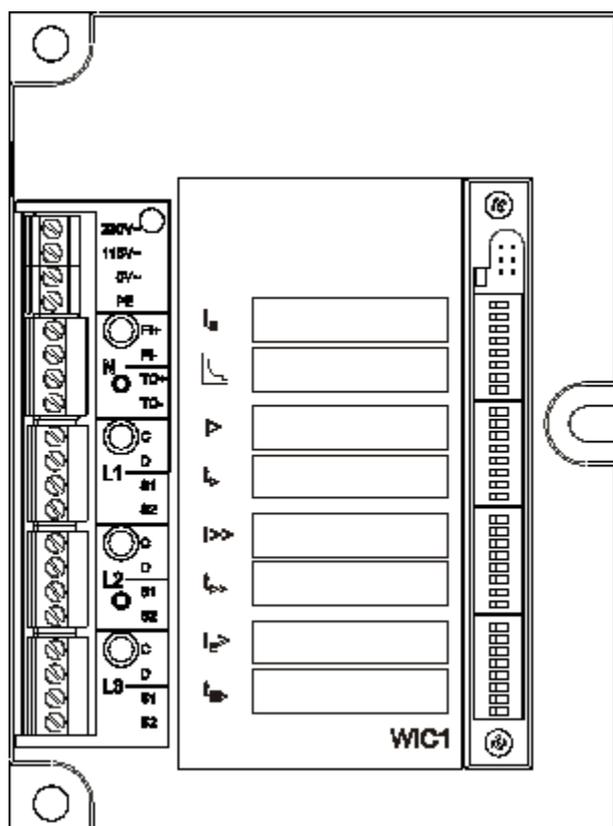
Figure 4.3: WIC1-2

4.2.4 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 coarser than is the case with parameter settings via software.
For the relay version WIC1-3 setting of parameters via interface is not possible anymore, 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.
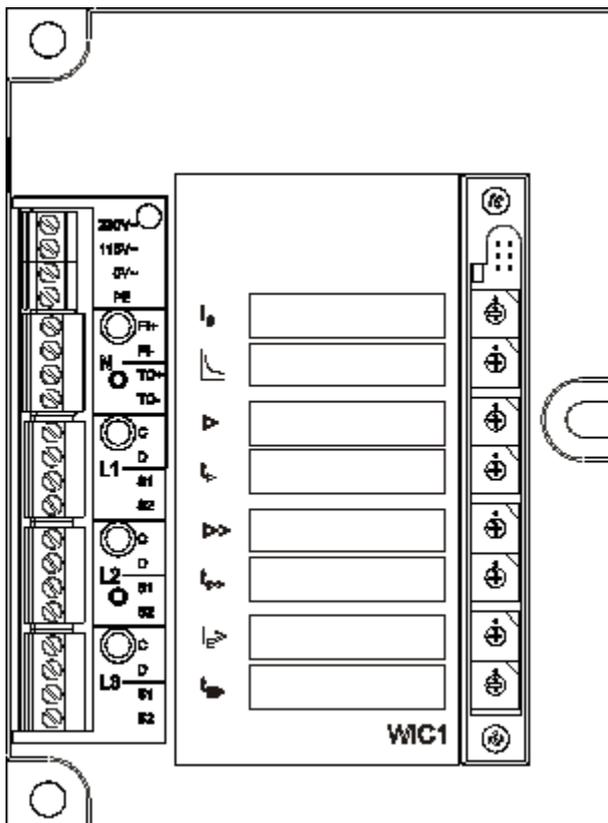
Figure 4.4: WIC1-3

4.3   CTs for the WIC1

There are different wide-range CTs for the protection system WIC1, each available in two construction types. Both types are electrically equivalent. (See also 9.3 "Order form".)

Short Name	Construction type 1	Construction type 2	Primary current range IS		Max. measurable short-circuit current	Thermal Withstand
			IS_{min}	IS_{max}	$(20 \cdot IS_{max} = 70 \cdot IS_{min})$	Primary current max.:
WE2	WIC1**WE2**AS1	WIC1-CT2-5P	16 A	$\cdots$ 56 A	1120 A	
W2	WIC1**W2**AS1	WIC1-CT2-10P	16 A	$\cdots$ 56 A	1120 A	
W3	WIC1**W3**AS1	WIC1-CT3	32 A	$\cdots$ 112 A	2240 A	20 kA for 1 second
W4	WIC1**W4**AS1	WIC1-CT4	64 A	$\cdots$ 224 A	4480 A	
W5	WIC1**W5**AS1	WIC1-CT5	128 A	$\cdots$ 448 A	8960 A	
W6	WIC1**W6**AS1	–	256 A	$\cdots$ 896 A	17920 A	

The optimum CT is selected depending on the rated primary power and voltage of the system. A detailed discussion can be found in chapter 6.2 "Selection of the CT transformation voltage ratio".

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 6 "Description of the Application".

Current transformer WE2
In case of small values of the primary currents, there is a special "E"-labeled CT available that features a mixed core based on MU metal and offers an optimized characteristics of transmission: **WE2**.

It is typical of self-powered protection relays such as the WIC1 that small primary currents cause a non-linear transmission characteristic of the relay. The "E" CTs improve the accuracy of the whole system if the primary current values are less than 20 A (WE2).

A worse accuracy can often be accepted for an application without earth current protection so that the W2 (i.e. without „E") represents an inexpensive alternative.

If a higher accuracy is needed, or in case of a required earth current protection element it is recommended to always use an "E"-type CT (i.e. prefer WE2 over W2), because in the lower operation range this CT type is more precise than the W2.

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 x IS = 1.1 x 40 A = 44 A
Setting I>>: 10 x IS = 10 x 40 A = 400 A
Setting IE>: 0.2 x IS = 0.2 x 40 A = 8 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
WE2	16 – 56 A	0.2 A
W2	16 – 56 A	0.2 A
W3	32 – 112 A	0.4 A
W4	64 – 224 A	0.8 A
W5	128 – 448 A	1.6 A
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) (Please note, DIP 4 is without function for the WIC1-2F) 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
W2	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**	**40**	**44**	**48**	**52**	**56**
W3	**32**	**36**	**40**	**44**	**48**	**52**	**56**	**60**	**64**	**68**	**72**	**80**	**88**	**96**	**104**	**112**
W4	**64**	**72**	**80**	**88**	**96**	**104**	**112**	**120**	**128**	**136**	**144**	**160**	**176**	**192**	**208**	**224**
W5	**128**	**144**	**160**	**176**	**192**	**208**	**224**	**240**	**256**	**272**	**288**	**320**	**352**	**384**	**416**	**448**
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 WIC1-1 and WIC1-4 devices. Here the parameters can only be set via a serial interface.

Current	Arithmetic averages measurement	
Threshold values	I>	0.9 to 2.5 x IS in steps of 0.05 x I_S when adjusting via interface
	I>>	1 to 20 x IS 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.
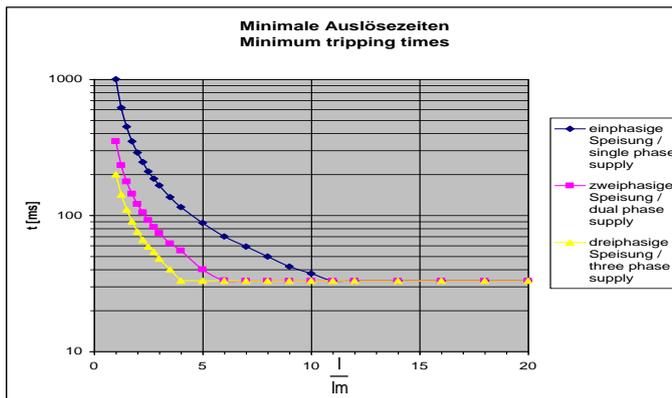
Im = Minimum current (chapter 5.1.1)

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

Time correction	of current 0	≤ 45ms
	of current > Im	≥ 35ms
Disengaging time	< 30ms	

* The starting point of the characteristic should be in the area of the rated CT current , e. g. W2 = 16 – 56 A. If over the parameter I> the starting point is set higher, then the relay cut 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

tI> = 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   This time setting table is valid for WIC1-2/3 Revisions G000 to G008
              (The Revision is printed on the Type sticker that is glued on the housing.)
*2   This time setting table is valid for all other Revisions of the WIC1-2/3,
              in particular Rev. G009 to Rev. G016, Rev. NEW, Rev. A, Rev. B, …

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

tI>> = 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   Internal calculated cumulative current formation
                 $I_{E>}$ 0.2 to 2.5 x IS in steps of 0.05 x IS
                                   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

IE> = 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 Is	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

tIE> = 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

⚠ WARNING

The earth current tripping is blocked if actually measured phase current exceeds 5x Is (rated current)
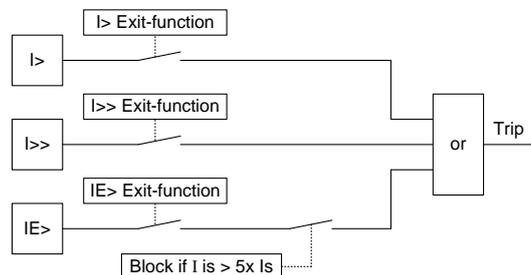
In theory the I> overcurrent and I>> short circuit function can be disabled. If the I> stage is disabled and the I>> value is set to >5x Is the earth current stage can't trip if a measured current is higher than 5x Is.

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.

Is = smallest possible rated current (W2=16A, W3=32A, W4=64A, W5=128A, W6=256A)
Characteristic: Definite Time
I> = 0.9 x In
tI> = 0.04s
I>> = 1.00 x In
tI>> = 0.04s
IE> = 0.20 x IN
tIE> = 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 x I_S
$t_{I>>}$ =   0.04 s
With earth fault element
$I_{E>}$ =   2.5 x 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
*   tI>> = 40 ms

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

*   The watchdog 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 SEG Electronics GmbH protocol is used.
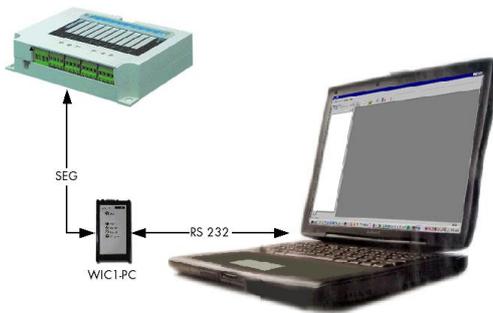
Figure 5.1: WIC1, WIC1PC2 and Notebook   *Figure 5.2: WIC1, WIC1PC3 and Notebook*
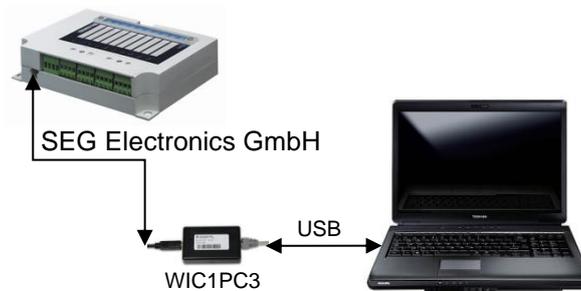
5.5.2   WIC1PC2 adapter

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. Manufacturer of both terminal types is Phönix.
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.
Terminal PE is the central earthing point for the protective system.

Input voltage range:
- 115 Volt terminal: if operated at max. 4000 m (above sea-level): 115 V ± 15%

- 230 Volt terminal: if operated at max. 2000 m (above sea-level):
  230 V ± 15%   (i.e. 195,5 V … 264,5 V),
  if operated above 2000 m (to max. 3000 m above sea-level):
  230 V −15% / +1%   (i.e. 195,5 V … 232,5 V)
  if operated above 3000 m (to max. 3500 m above sea-level):
  215 V −9% / +0%   (i.e. 195,5 V … 215 V)
  An operation above 3500 m (above sea-level) is outside the specifications and therefore not permitted.

Tripping delay: ≤ 1 s *
    * The tripping time can be slightly longer for a cold restart of the WIC1 if an input voltage is fed in that is considerably below 115 V.

5.6.2   Impulse output for the tripping coil

The low-energy trip 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 ≥ 0.1 Ws
Voltage: ≥ 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 flag indicator

The low-energy trip coil of the flag indicator is connected to terminals FI+ and FI-- of the second terminal block. The 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: ≥ 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 pickup value

5.7.2   Environmental Conditions

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

Max. altitude for operation: 2000 m (above sea-level)
up to 3500 m (above sea-level) is permissible if
the changed input voltages in 5.6.1 "Remote trip input" are fulfilled

5.7.3   Accuracy

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

Earth fault element*:   ≤ 5% of the setting value in the range of I_E> x I_S
≤ 5% of the I_S in the range of I_E> x I_S

*=Option, only available in device types that offer earth current protection.

Measuring accuracy for phase current   at 0°C to +50°C
with CT WE2, W3, W4, W5 or W6: I_{Ph} > Is: ≤ 5% of I_{Ph}
with CT W2:   14.4 A ≤ I_{Ph} < 20 A: ≤ 12.5% of I_{Ph}
20 A ≤ I_{Ph} < 28,8 A: ≤ 7.5% of I_{Ph}
I_{Ph} ≥ 28.8 A: ≤ 5% of I_{Ph}

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

Measuring accuracy for earth current   ≤ 2x Accuracy of phase current

CT Type (see 9.3 "Order form")	Applying Accuracy Measuring Range
WE2	14.4 – 1152 A
W2	14.4 – 1152 A
W3	28.8 – 2304 A
W4	57.6 – 4608 A
W5	115.2 – 9216 A
W6	230.4 – 18432 A

5.7.4   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   ±4 kV, 2.5 kHz
DIN EN 61000-4-4 [03/96]   other inputs and outputs   ±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

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

5.7.5 Safety-Related Tests

Overvoltage category:	IEC 60255-27 [11/14]	III
Pollution degree:	IEC 60255-27 [11/14]	3
Protection class:	IEC 60255-27 [11/14]	II
Test of withstand alternating voltage for 1 min:	IEC 60255-27 [11/14]	4 kV / 1 kV
Test of lightning surge voltage 1.2/50 µs, 0.5 J	IEC 60255-27 [11/14]	7.2 kV / 5 kV / 1 kV
Inflammability:	IEC 60255-27 [11/14]	rated
Single Defect Condition:	IEC 60255-27 [11/14]	rated

5.7.6 Ambient conditions

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

Shock and continuous shock test
DIN EN 60255-21-2 [05/96]   10/20 gn
Class 2

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

Classification
DIN EN 60068-1 [03/95]   Climate category   40/085/56

Test Ad: Cold
DIN EN 60068-2-1 [03/95]   Temperature   -40°C
                                                Period of stress   16 h

Test Bd: Dry heat
DIN EN 60068-2-2 [08/94]   Temperature   +85°C
                                                Rel. humidity   <50%
                                                Period of stress   72 h

Test Ca: Humid heat (constantly)
DIN IEC 60068-2-3 [12/86]   Temperature   +40°C
                                                Rel. humidity   93%
                                                Period of stress   56 h

Test Db :Humid heat (cyclic)
DIN IEC 60068-2-30 [09/86]   Temperature   +85°C
                                                Rel. humidity   95%
                                                Cyclen (12 + 12-hours)   2

Class of protection   Relay housing   IP 40
                                                Electronics   IP 65
                                                Terminals   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.

⚠ DANGER

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.

Types W2 … W5

NOTICE

The diameter A of the CT whole is 50 mm for the types WIC1WE2AS1 and WIC1W2AS1 to WIC1W5AS1.
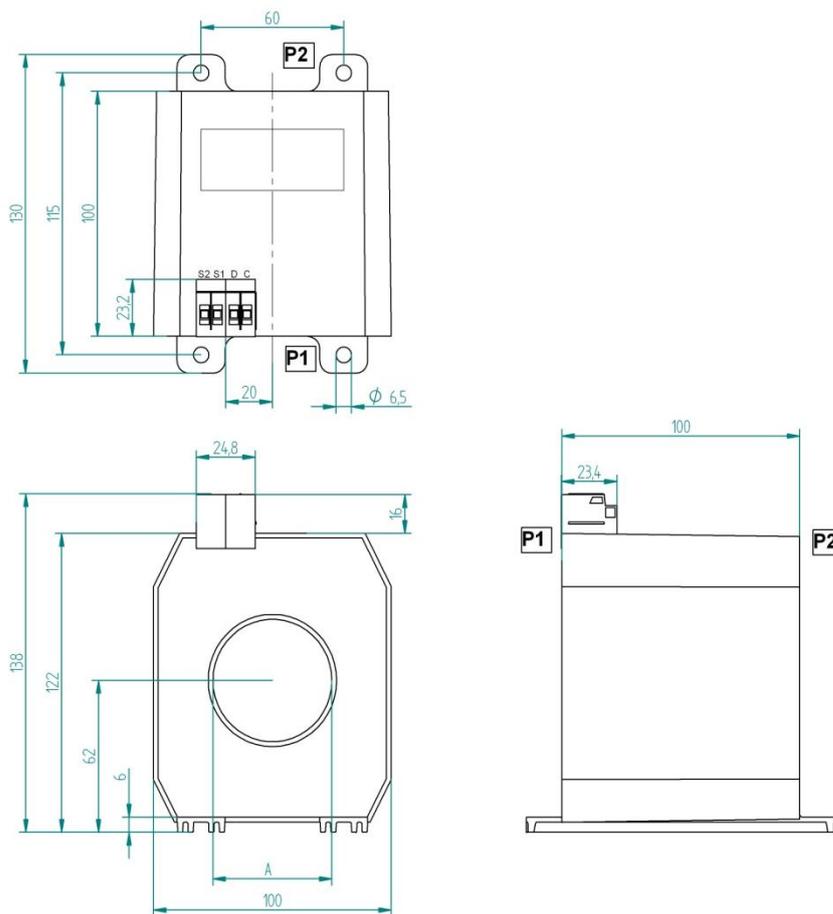
Figure 5.3: Type WIC1-W2AS1 – WIC1-W5AS1 as panel mounting
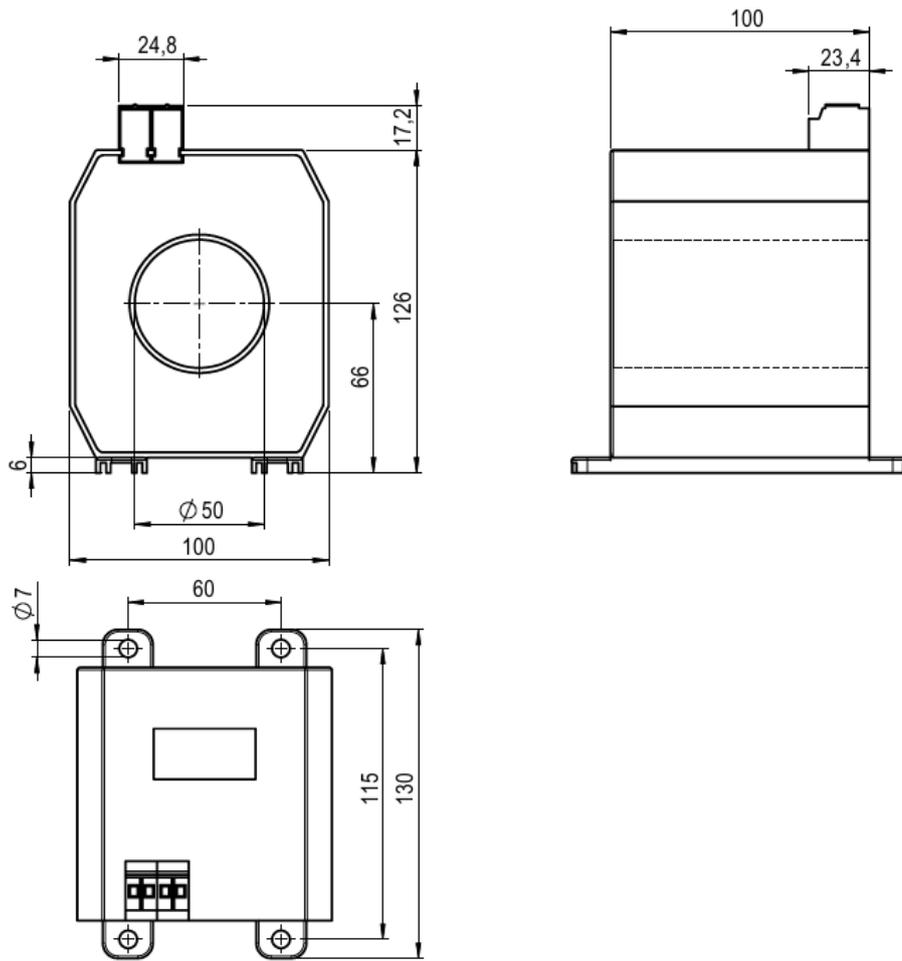
Figure 5.3: Type WIC1-CT2 – WIC1-CT5 as panel mounting

Type: WIC1W6AS1

Fenstergröße / window size
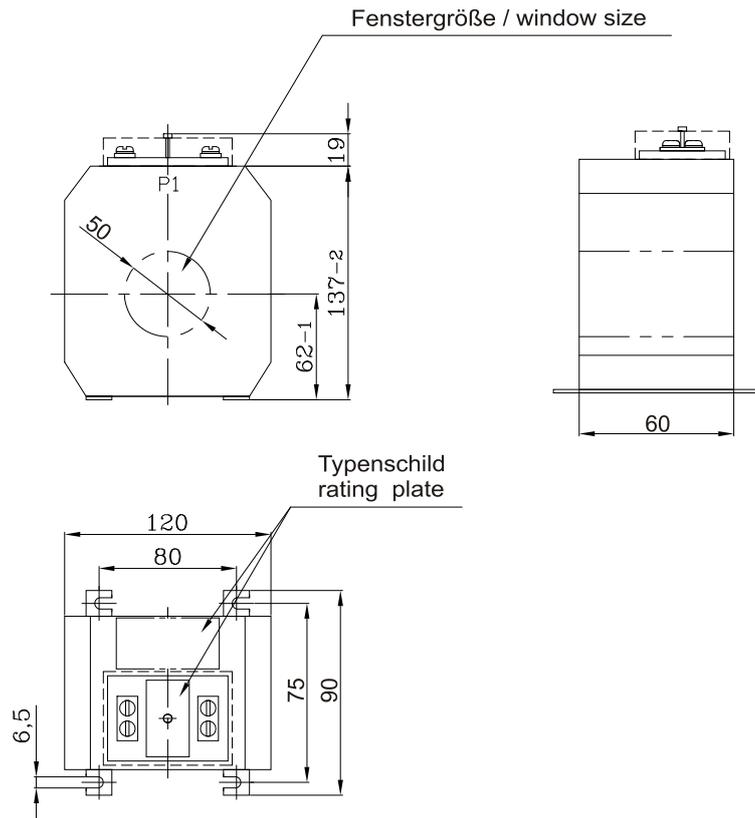
Figure 5.4: Type WIC1W6AS1 as panel mounting
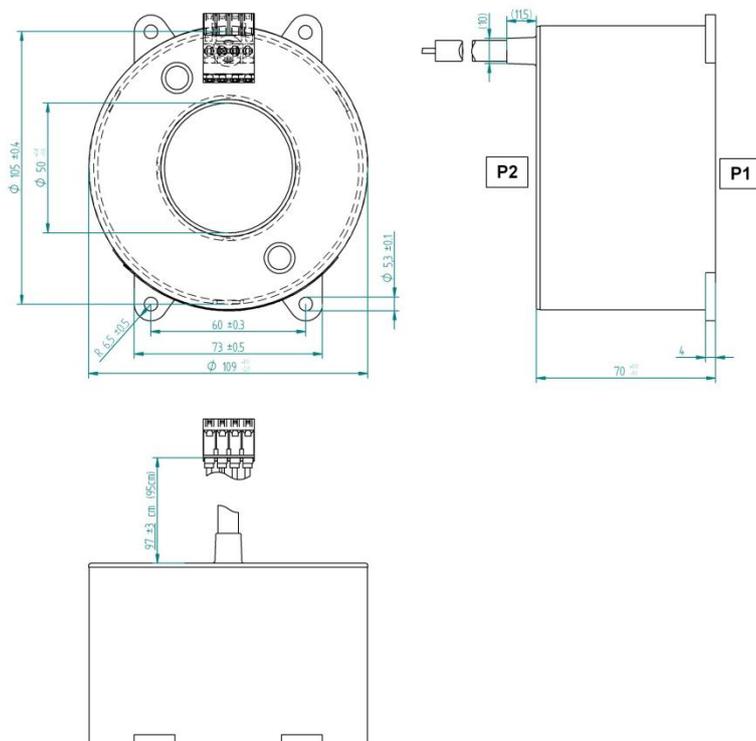
Figure 5.5: Type WIC1-WxH1 as plug on type

5.8   Characteristics and times

5.8.1   Characteristic curves
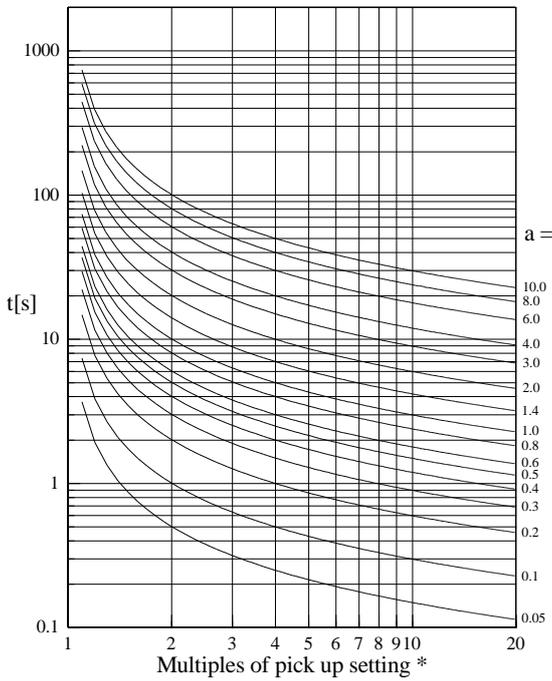
Figure 5.5: Normal Inverse

NOTICE   *Multiples of pick up setting = Is * I>*
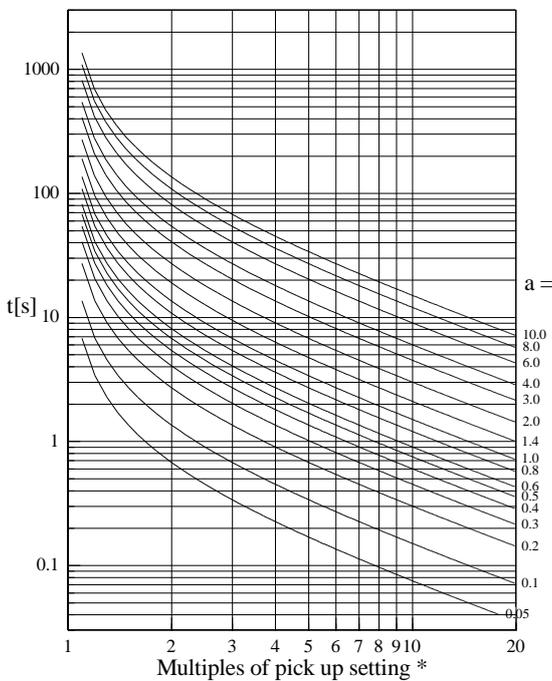
Figure 5.6: Very Inverse

NOTICE   *Multiples of pick up setting = Is * I>*
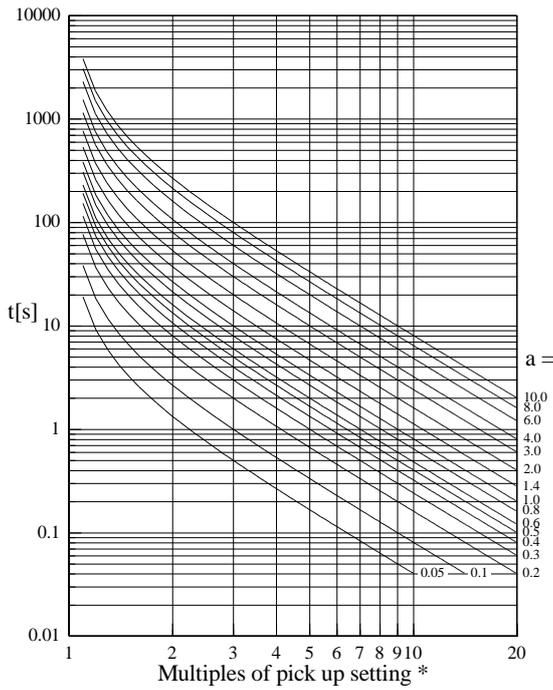
Figure 55.7: Extremely Inverse

NOTICE   *Multiples of pick up setting = Is * I>
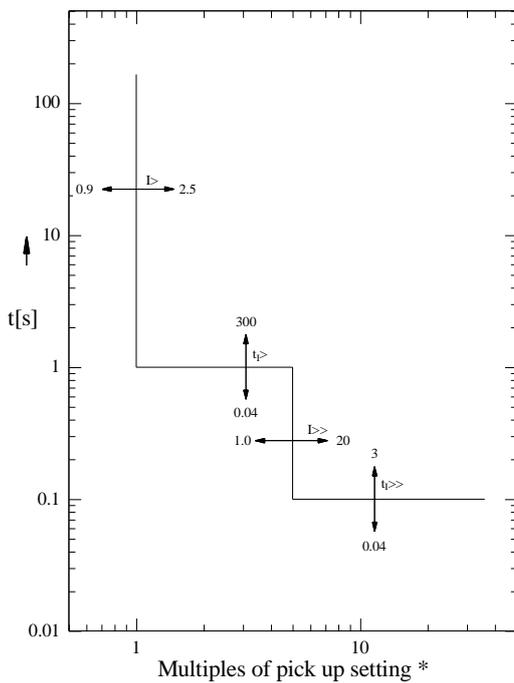
Figure 5.8: Definite Time

NOTICE   *Multiples of pick up setting = Is * I>
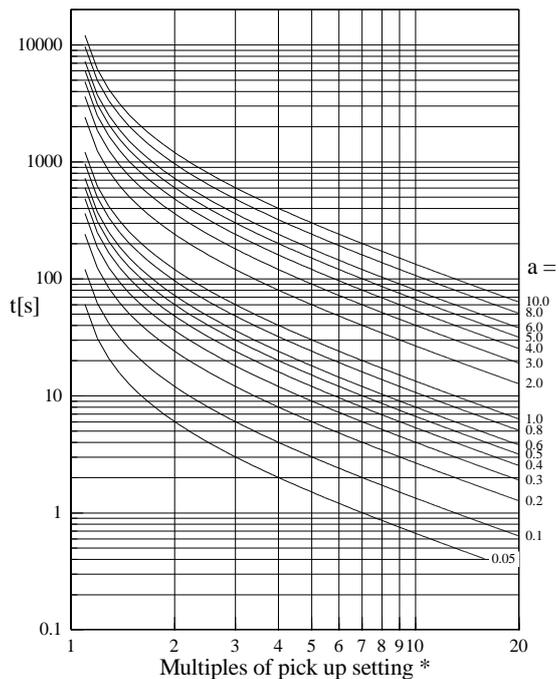
Figure 5.9: Long time inverse

NOTICE   *Multiples of pick up setting = Is * I>
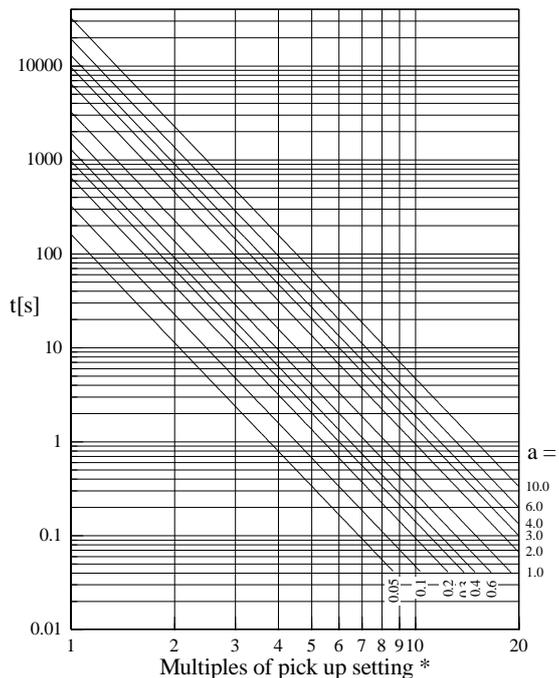
Figure 5.10: HV-fuse

NOTICE   *Multiples of pick up setting =
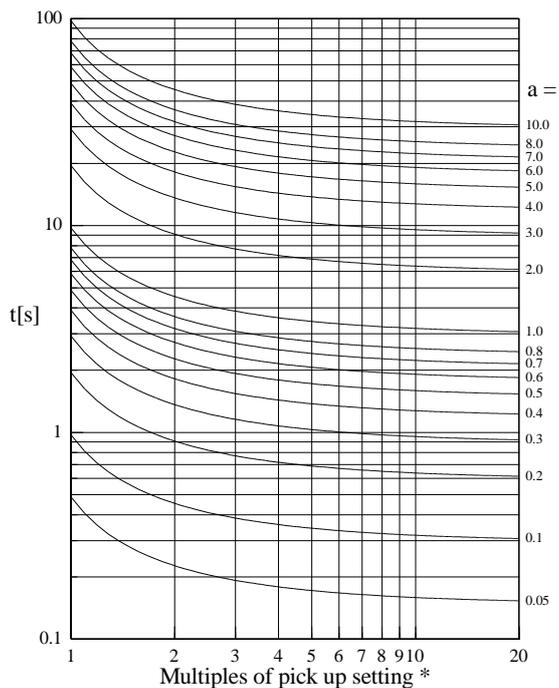
Figure 5.2: RI-Inverse

NOTICE   *Multiples of pick up setting =
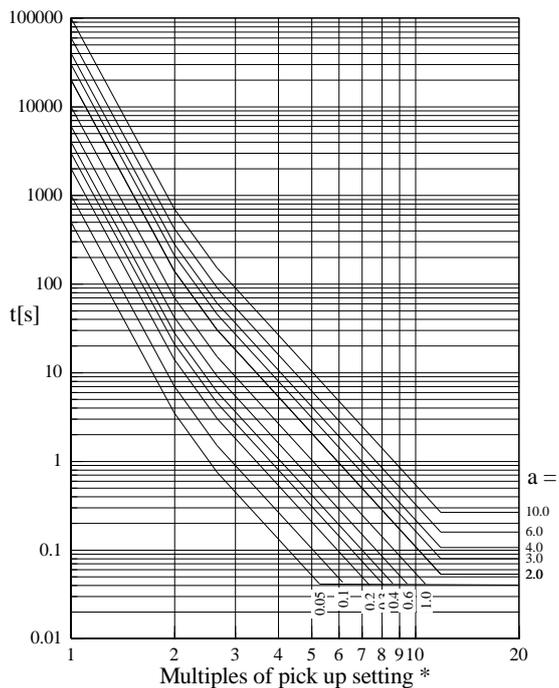
Figure 5.3: FR-fuse

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:

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

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

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

$$\frac{I}{I_S \times I_>} = 2 - 2.66 \rightarrow t = 10^{\left(log\left(\frac{I}{I_S \times I_>}\right) \cdot (-5.4) + 2.47\right)} \cdot \left(\frac{a}{0.1}\right)(s)$$

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

5.8.3 Flag Indicators

WI1SZ4

Technical Data

Coil: 24V DC ±10%

- can be set electrically
- can be reset mechanically

Connector assignment

Coil connection	Core color	mm²	Function
	black	0.25	Gnd/Set
	black	0.25	Gnd/Set

Cable connection length: 1m

WI1SZ5:

Technical Data

Coil:	24V DC ±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	mm²	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

6. Description of the Application

6.1   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.
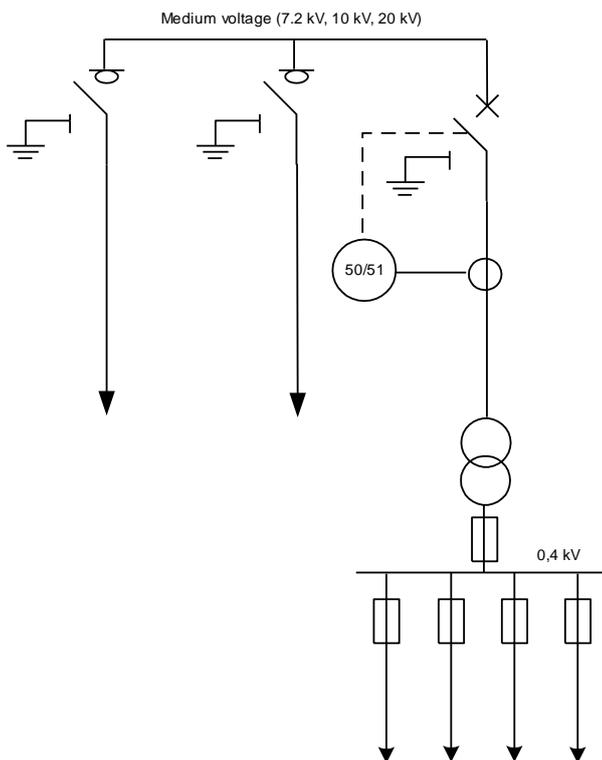
Figure 5.1: Basic circuit diagram of a standard switchboard with 2 feeders and 1 outgoing transformer panel

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.

6.2   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:

$$I_N = \frac{S_N}{\sqrt{3}U_N}$$

Example:
SN = 1600 kVA
UN = 10 kV
-→ I_N = 92.5 A

According to the table in 4.3 "CTs for the WIC1", the CTs **W3** and **W4** are suitable for this rated current. (See the tables in chapter 4.3 "CTs for the WIC1".)

Further conditions that have to be taken into account with respect to the selection of the CTs.
- 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 selected CT:
  - **W3**:   112 A $\times$ 20 = 2240 A, or
  - **W4**:   224 A $\times$ 20 = 4480 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.
- 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 Is the calculated rated current is preset in the protection relay.

According to Table 5.1, IS currents of 88 A can be set 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 10 s. The setting value for I> is calculated as follows:

WIC1-1:

I> = 1.1 x Is with Is = 92.5 A

WIC1-2 and WIC1-3:

$$I >= \frac{1.1 \cdot I_{NT}}{I_S} = \frac{1.1 \cdot 92.5\ A}{88\ A} = 1.16 \cdot I_S$$

By means of the switches, however, only 1.15 x Is or 1.2 x Is can be set for parameter I>. Therefore it is up to the user to choose either 1.15 x Is or 1.2 x Is

The different rated primary currents of all standard transformer sizes at various rated mains voltages are compiled in chapter 8.2 "Current transformer".

6.3   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 Is 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 Is.

I> = Pick up value of the over current element
With this parameter the pickup 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 pickup value of the overcurrent element. Exceed the measured current the factor Is × I> the WIC1 will pick up.
At the use of an inverse time characteristic the parameter I> specified the starting point of the characteristic curve. Means, that the factor Is × I> is the starting point of the characteristic curve at one times of $1 \times \frac{I}{I_S \times I_>}$.

$t_{I>}$ =   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 pickup still exists at the time elapsed.
By the use of an inverse characteristic (see 5.8.1 "Characteristic curves") the factor a shifts the characteristic curve.

I>> = Pick up value of the short circuit element
With this parameter the pickup value of the short current element is set. Exceed the measured current the factor IS × 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 pickup still exists at the time elapsed.

$I_{E>}$ = Pick up value of the earth fault element
With this parameter the pickup value of the earth fault element is set. Exceed the measured current the factor IS × IE> 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 pickup still exists 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 (IS)	72A
Selected CT ratio	WIC1-W3, 32 A – 112 A
Characteristic	Normal Inverse N-INV
Starting point of the characteristic	I> x IS
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 A
I> = 1.4
„a" (tI>) = 0.2
I>> = 14 (1kA/72A = 13.88)
tI>> = 0.1s

Estimation of the tripping time from the characteristic curve

Starting point of the curve = 1.4 x 72 A = 100.8 A, this correspond to = 1 x I/I_S x I>.
Primary testing current = 150 A, here for a factor as follows is calculated I/IS x I> = 150 A/100.8 A = 1.488
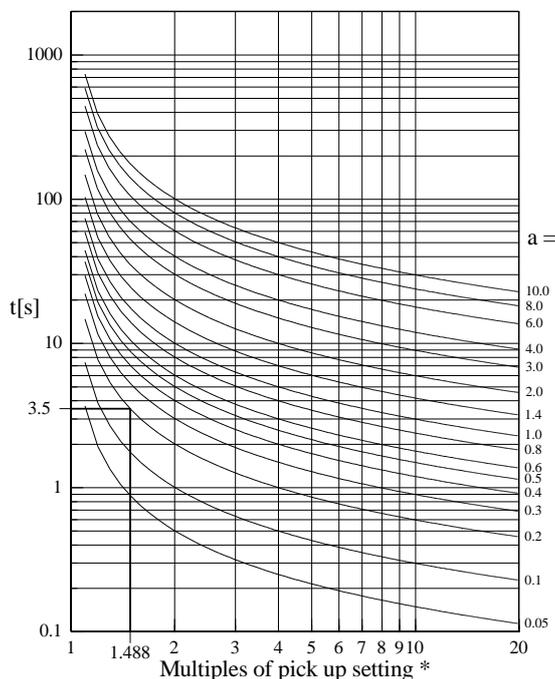
*Multiples of pick up setting =

NOTICE   *Multiples of pick up setting = Is * I>

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

7. Commissioning and Maintenance

7.1.1 Important note

⚠ WARNING	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).

7.2 Accessories for commissioning work

For commissioning of the protection system the following accessories should be available:
- For WIC1-1 and WIC1-4: an adapter **WIC1PC3,** and a PC with software
- Secondary testing system (see chapter 7.3ff)
- Screwdriver; cross slot type, size 1; 3mm slot
- Setting parameters

7.3   Criteria to be taken into account for protection devices fed by CTs

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.

Power consumption per phase of the WIC1

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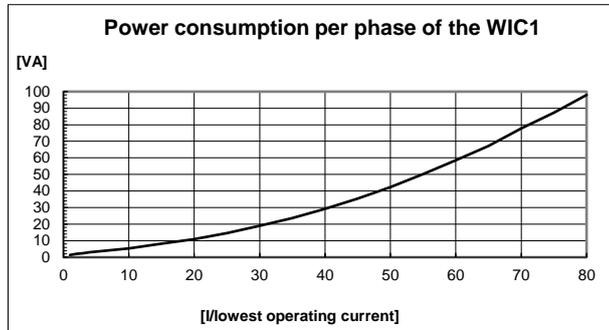
Figure 6.1: Power consumption of one phase over the entire measuring range of the WIC1

Power consumption per phase of the WIC1

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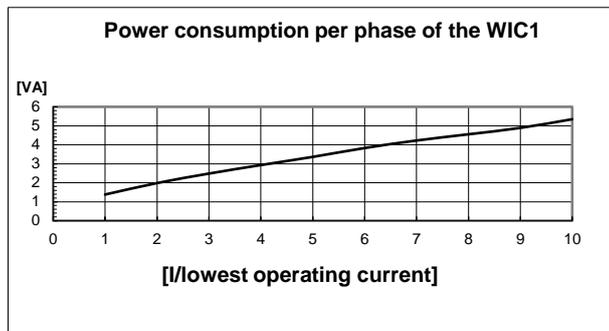
Figure 6.2: Power absorbed by one phase over the range 0.1 – 10 lowest operating current

Lowest operating current = lower rated current x 0,9. The operating current is chosen by Is * I>.

W2:   14.4 A (Is = 16 A)
W3:   28.8 A (Is = 32 A)
W4:   57.6 A (Is = 64 A)
W5:   115.2 A Is = 128)
W6:   230.4 A (Is = 256 A)
Is = lowest rated current

7.4   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 a 1 kHz cycle.
This can have an effect on the feeding source.

7.5 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 7.7).
- Sufficient output power for the switching points to be tested (see chapter 7.7.2 and 7.7.3).
- The highest possible test current for testing via the test winding is at 22.4 A. A test
  system with an output current up to 10 A 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.

7.6 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.

7.6.1 Wiring checks

Wiring has to be checked with the circuitry shown in the diagram below.
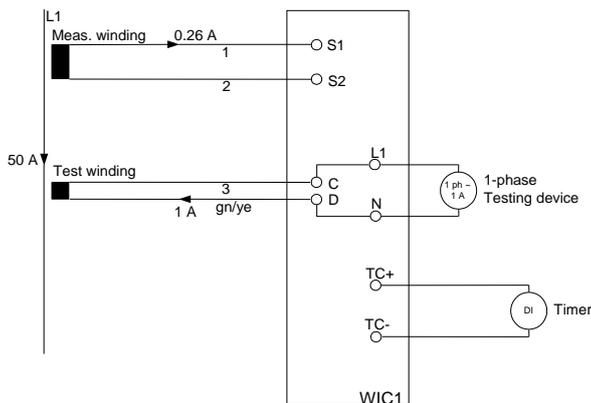
*Figure 6.3: Connection of a single-phase testing device (phase L1) with CT type **W2***

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 **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 Ω up to1 kΩ. This prevents false measurements when tests are repeated in short intervals because the energy store cannot be discharged.

7.6.2 WIC1 adjustment

The protection parameters are to be adjusted according to chapter 5 of this instruction. The set parameters can be registered directly on the sticker affixed on the relay.

7.7 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 different standard CT types available for the WIC1.

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

Table 7.1:Ratio of test current in relation to the primary current

7.7.1 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 switch I_S	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
W2	16	18	20	22	24	26	28	30	32	34	36	40	44	48	52	56
Test current 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
W3	32	36	40	44	48	52	56	60	64	68	72	80	88	96	104	112
Test current 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
W4	64	72	80	88	96	104	112	120	128	136	144	160	176	192	208	224
Test current 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
W5	128	144	160	176	192	208	224	240	256	272	288	320	352	384	416	448
Test current 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
W6	256	288	320	352	384	416	448	480	512	544	576	640	704	768	832	896
Test current 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 7.2: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>.

7.7.2 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 switch I>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Setting 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 7.3: Test current via CD winding with the I> step and the different Is setting values

7.7.3 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 switch I>>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Setting xIs	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 7.4: Test current via CD winding with the I>> step and the different Is setting values

7.8 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> 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 (Is x I>, then the test can be performed with a single-phase power source.

7.8.1 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 switch IE>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Setting 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 x Is 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 x Is on.

7.9   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 xIs
> 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 5.1.2 "Phase time over current protection".

Test step 3): Test of the over-current step I>:
Settings: I> =   1.05 x Is
                             tI> =   EXIT
                             I>> =   4.00 x Is
                             tI>> =   0.10s
                             IE> =   EXIT
                             tIE> =   0.2s

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

Test step 4): Test of the trip delay tI>
Settings: I> =   1.05 x Is
                             tI> =   1.00s

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

Test step 5)*: Test of the earth current step IE>
Settings: I> =   EXIT
                             tI> =   1.00s
                             I>> =   4.00 x Is
                             tI>> =   0.10s
                             IE> =   0.9 x Is
                             tIE> =   EXIT

*= only applicable to devices that offer earth current protection

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

Test step 6: Test of the trip delay tIE>
Settings: IE> =   0.9 x Is
                             tIE> =   0.2s

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 >= 0.9 x Is. See chapter 7.8.

7.10 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 7.2.

7.10.1 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:

Fault	Cause of failure	Remedy
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

7.10.2 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.

8. Product-Specific Features

8.1 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 A*
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.

8.1.1 Earthing

For earthing the WIC connection terminal PE is used.

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

8.2 Current transformer

Listed CT ranges in relation to the transformer rated currents

W2 — columns are U[kV], rows are S[kVA]

S[kVA] \ U[kV]	3.00	3.30	4.20	5.50	6.00	6.60	10.00	11.00	12.00	13.80	15.00	15.50	17.50	20.00	21.00	22.00	24.00
50.00																	
75.00	14.43																
100.00	19.25	17.50															
125.00	24.06	21.87	17.18														
160.00	30.79	27.99	21.99	16.80	15.40												
200.00	38.49	34.99	27.49	20.99	19.25	17.50											
250.00	48.11	43.74	34.37	26.24	24.06	21.87	14.43										
315.00	60.62	55.11	43.30	33.07	30.31	27.56	18.19	16.53	15.16								
400.00	76.98	69.98	54.99	41.99	38.49	34.99	23.09	20.99	19.25	16.73	15.40	14.90					
500.00	96.23	87.48	68.73	52.49	48.11	43.74	28.87	26.24	24.06	20.92	19.25	18.62	16.50	14.43			
630.00	121.24	110.22	86.60	66.13	60.62	55.11	36.37	33.07	30.31	26.36	24.25	23.47	20.78	18.19	17.32	16.53	15.16
800.00		139.96	109.97	83.98	76.98	69.98	46.19	41.99	38.49	33.47	30.79	29.80	26.39	23.09	21.99	20.99	19.25
1000.00			137.46	104.97	96.23	87.48	57.74	52.49	48.11	41.84	38.49	37.25	32.99	28.87	27.49	26.24	24.06
1250.00				131.22	120.28	109.35	72.17	65.61	60.14	52.30	48.11	46.56	41.24	36.08	34.37	32.80	30.07
1600.00						139.96	92.38	83.98	76.98	66.94	61.58	59.60	52.79	46.19	43.99	41.99	38.49
2000.00							115.47	104.97	96.23	83.67	76.98	74.50	65.98	57.74	54.99	52.49	48.11
2500.00								131.22	120.28	104.59	96.23	93.12	82.48	72.17	68.73	65.61	60.14
3150.00										131.79	121.24	117.33	103.92	90.93	86.60	82.67	75.78
4000.00													131.97	115.47	109.97	104.97	96.23

W3 — columns are U[kV], rows are S[kVA]

S[kVA] \ U[kV]	3.00	3.30	4.20	5.50	6.00	6.60	10.00	11.00	12.00	13.80	15.00	15.50	17.50	20.00	21.00	22.00	24.00
125.00	30.79																
160.00	38.49	34.99															
200.00	48.11	43.74	34.37														
250.00	60.62	55.11	43.30	33.07	30.31												
315.00	76.98	69.98	54.99	41.99	38.49	34.99											
400.00	96.23	87.48	68.73	52.49	48.11	43.74	28.87										
500.00	121.24	110.22	86.60	66.13	60.62	55.11	36.37	33.07	30.31								
630.00	153.96	139.96	109.97	83.98	76.98	69.98	46.19	41.99	38.49	33.47	30.79	29.80					
800.00	192.45	174.95	137.46	104.97	96.23	87.48	57.74	52.49	48.11	41.84	38.49	37.25	32.99	28.87			
1000.00	249.56	218.69	171.83	131.22	120.28	109.35	72.17	65.61	60.14	52.30	48.11	46.56	41.24	36.08	34.37	32.80	30.07
1250.00		279.93	219.94	167.96	153.96	139.96	92.38	83.98	76.98	66.94	61.58	59.60	52.79	46.19	43.99	41.99	38.49
1600.00			274.93	209.95	192.45	174.95	115.47	104.97	96.23	83.67	76.98	74.50	65.98	57.74	54.99	52.49	48.11
2000.00				262.43	240.56	218.69	144.34	131.22	120.28	104.59	96.23	93.12	82.48	72.17	68.73	65.61	60.14
2500.00						275.55	181.87	165.33	151.55	131.79	121.24	117.33	103.92	90.93	86.60	82.67	75.78
3150.00							230.94	209.95	192.45	167.35	153.96	148.99	131.97	115.47	109.97	104.97	96.23
4000.00																	

W4 — columns are U[kV], rows are S[kVA]

S[kVA] \ U[kV]	3.00	3.30	4.20	5.50	6.00	6.60	10.00	11.00	12.00	13.80	15.00	15.50	17.50	20.00	21.00	22.00	24.00
250.00	60.62																
315.00	76.98	69.98															
400.00	96.23	87.48	68.73														
500.00	121.24	110.22	86.60	66.13	60.62												
630.00	153.96	139.96	109.97	83.98	76.98	69.98											
800.00	192.45	174.95	137.46	104.97	96.23	87.48	57.74										
1000.00	240.56	218.69	171.83	131.22	120.28	109.35	72.17	65.61	60.14								
1250.00	307.92	279.93	219.94	167.96	153.96	139.96	92.38	83.98	76.98	66.94	61.58	59.60					
1600.00	384.90	349.91	274.93	209.95	192.45	174.95	115.47	104.97	96.23	83.67	76.98	74.50	65.98	57.74			
2000.00	481.13	437.39	343.66	262.43	240.56	218.69	144.34	131.22	120.28	104.59	96.23	93.12	82.48	72.17	68.73	65.61	60.14
2500.00		551.11	433.01	330.66	303.11	275.55	181.87	165.33	151.55	131.79	121.24	117.33	103.92	90.93	86.60	82.67	75.78
3150.00			549.86	419.89	384.90	349.91	230.94	209.95	192.45	167.35	153.96	148.99	131.97	115.47	109.97	104.97	96.23
4000.00																	

W5 — columns are U[kV], rows are S[kVA]

S[kVA] \ U[kV]	3.00	3.30	4.20	5.50	6.00	6.60	10.00	11.00	12.00	13.80	15.00	15.50	17.50	20.00	21.00	22.00	24.00
500.00	121.24																
630.00	153.96	139.96															
800.00	192.45	174.95	137.46														
1000.00	240.56	218.69	171.83	131.22	120.28												
1250.00	307.92	279.93	219.94	167.96	153.96	139.96											
1600.00	384.90	349.91	274.93	209.95	192.45	174.95	115.47										
2000.00	481.13	437.39	343.66	262.43	240.56	218.69	14434	131.22	120.28								
2500.00	606.22	551.11	433.01	330.66	303.11	275.55	181.87	165.33	151.55	131.79	121.24	117.33					
3150.00	769.80	699.82	549.86	419.89	384.90	349.91	230.94	209.95	192.45	167.35	153.96	148.99	131.97	115.47			
4000.00																	

W6 — columns are U[kV], rows are S[kVA]

S[kVA] \ U[kV]	3.00	3.30	4.20	5.50	6.00	6.60	10.00	11.00	12.00	13.80	15.00	15.50	17.50	20.00	21.00	22.00	24.00
1000.00	240.56																
1250.00	307.92	279.93															
1600.00	384.90	349.91	274.93														
2000.00	481.13	437.39	343.66	262.43	240.56												
2500.00	577.35	524.86	412.39	314.92	288.68	262.43											
3000.00																	
4000.00	769.80	699.82	549.86	419.89	384.90	349.91	230.94										
5000.00	962.25	874.77	687.32	524.86	481.13	437.39	288.68	262.43	240.56								
7500.00	1443.38	1312.16	1030.98	787.30	721.69	656.08	433.01	393.65	360.84	313.78	288.68	279.36	247.44				
10000.00	1924.50	1749.55	1374.64	1049.73	962.25	874.77	577.35	524.86	481.13	418.37	384.90	372.48	329.91	288.68	274.93	262.43	240.56

9. Annex

## 9.1   Dimensional drawing relay
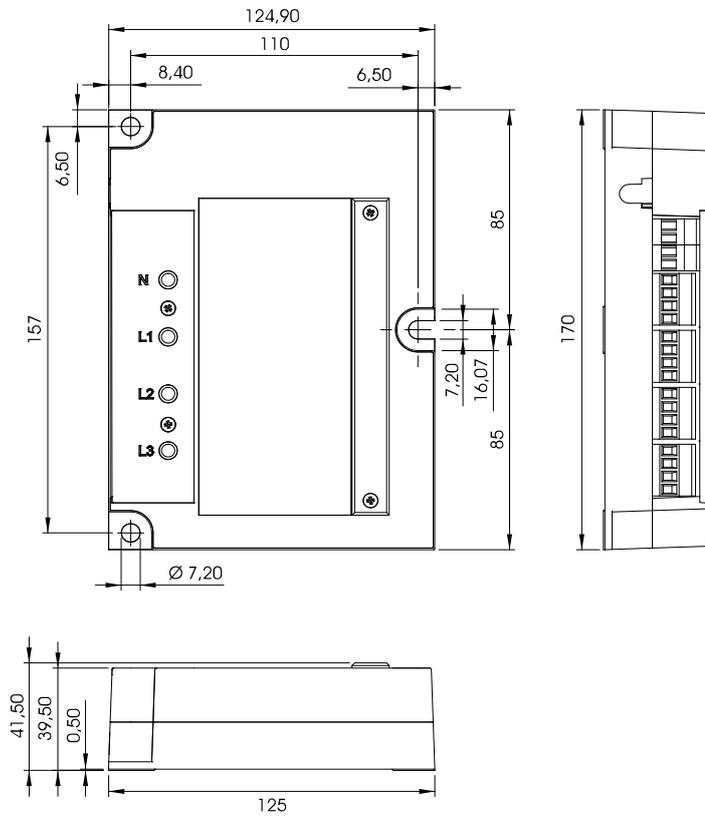
Figure 8.1: Dimensional drawing

9.2   Dimensional drawing flag indicator
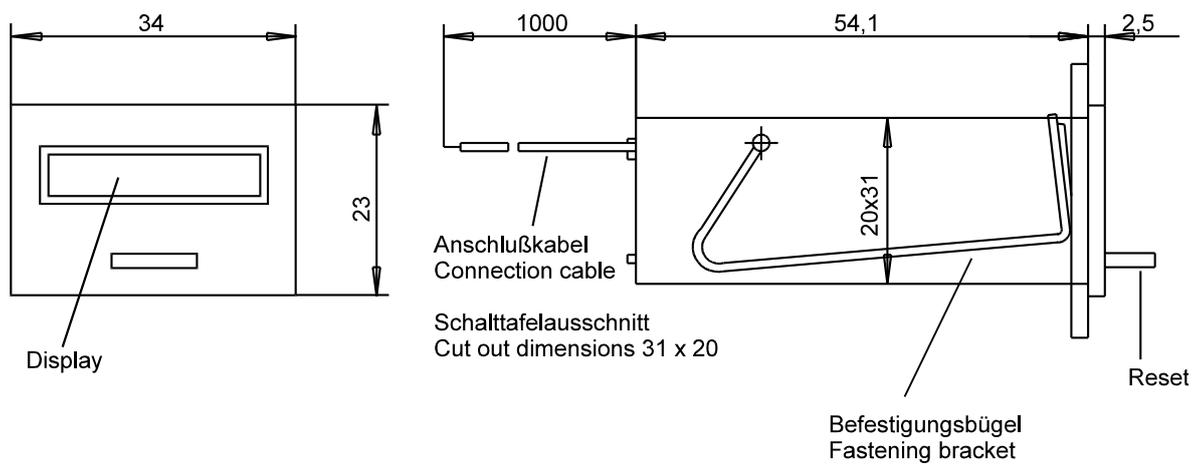
Figure 89.2: Flag indicator WI1SZ4 / WI1SZ5

9.3   Order form

Multi characteristic time over current relay	WIC1				
3-phase current measuring I>;I>> self powered – parameter setting via serial interface – parameter setting via DIP switches – parameter setting via HEX switches – Parameter setting via interface, with LED and second operator interface	**1** **2** **3** **4**				
Connection mode – plug in screw terminal		**P**			
With additional earth current supervision* I_{E>} – standard 0.2 to 2.5 x I_S (calculated) – without earth fault supervision			**E** *****		
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**	

Accessories	WIC1	
PC adapter with USB port	**PC3**	
Watchdog test unit	**TU**	

Current transformer (1 piece)			Order Code	
(Short name + Primary Current Range + Accuracy Class)			Construction type 1	Construction type 2
WE2	16 – 56 A	5P80	**WIC1-CT2-5P**	**WIC1WE2AS1**
W2	16 – 56 A	10P80	**WIC1-CT2-10P**	**WIC1W2AS1**
W3	32 – 112 A	5P80	**WIC1-CT3**	**WIC1W3AS1**
W4	64 – 224 A	5P80	**WIC1-CT4**	**WIC1W4AS1**
W5	128 – 448 A	5P80	**WIC1-CT5**	**WIC1W5AS1**
W6	256 – 896 A	5P80	**–**	**WIC1W6AS1**

Please observe the note in chapter 4.3.

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

Note: CT housing in accordance with the customer requirement.

9.4   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	
tI>	Tripping time for DMT characteristic	s	0.04	
a	Multiplier for IMT characteristic	s	--	
I>>	Pickup value for short-circuit element	x IS	1	
tI>>	Tripping time for short-circuit element	s	0.04	
IE>*	Pickup value for earth fault element (only type E)	x IS	0.2	
tIE>*	Tripping time for earth fault element	s	0.1	

Signature Checker: _____ Signature customer: _____

*=Option

WI Line

https://docs.segelectronics.de/wic1g1