DEIF

-power in control

# TECHNICAL DOCUMENTATION



# Summation current transformers, type KSU/SUSK


誥鑫企業有限公司
ARITH COMPANY LTD.
地 址： 台北市復興北路427巷30號
電 話： (02)2717-5038
傳 真： (02)2717-5039
e-mail: taipei@arith.com.tw
網 址： http://www.arith.com.tw


Document no.: 4921210113A

# Low voltage current transformers for industrial applications

| Summation current transformers | | |
|---|---|---|
| **KSU** – page 6 | **Summation current transformer**<br>Transformer width<br>Transformer depth | 127mm<br>57mm |
| **SUSK** – page 7 | **Summation current transformer**<br>Transformer width<br>Transformer depth | 156mm<br>65mm |

# Accessories for low voltage current transformers

# Guidance when ordering summation current transformers

Summation current transformers are suitable for the summation of several synchronized alternating currents with similar phases but with differing load phase shifts. It is also possible to have the summation of currents with varied nominal voltages of similar phase positions. These measurements cannot be used for tariff applications, as the existing voltage differences are recorded as errors.

With the counter connection of the main transformer to the summation current transformer, it is possible to receive secondary currents which are proportional to the differences of the primary input currents.

The built-in technical know-how enables the summation current transformers to add secondary currents of varying nominal transmissions from the main transformer.

The secondary connections of each main transformer are connected to the allocated primary inputs of the summation current transformers.

The number of windings of individual partially wound primary circuits of the summation current transformer is proportionally aligned to the ratio of the primary nominal current of the corresponding main transformer, and to the sum of the nominal currents of all the summation current transformers being connected to the main transformer.

For the visual display of the current, a measuring unit can be used with a measuring range similar to the secondary nominal current of the summation current transformers.

It is irrelevant for the main transformers with similar nominal transmission ratios, to which primary circuit of the summation current transformer the connection is made.

With main transformers of different nominal transmission ratios, care must be taken to adhere to the assigned connection to the terminals of the summation current transformers.
Is the current flow in the main transformer interrupted, the secondary circuit of the main transformer must neither be short-circuited nor be connected to the summation current transformer, or to the main transformer.

Summation current transformers with unallocated primary circuits must remain open for a later connection to an additional main transformer. The secondary output current of the summation current transformer is in this instance lower than the secondary nominal current of the summation current transformer by a quantity equal to the ratio of the primary nominal current of this "missing" main transformer and the sum of all the primary nominal currents of the main transformer.

The nominal secondary current of a main transformer must be equal to the nominal primary current of the input allocation of the summation current transformer.

# Guidance when ordering summation current transformers

Please find below an example for the correct selection of measuring components for summation current transformers.

**Example:**

| | | |
|---|---|---|
| Actual situation: | 3 transmission ratios | 1000 / 5 VA |
| | | 800 / 5 VA |
| | | 600 / 5 VA |
| | Overall current | 2400 / 5 VA |

Burden:
– 1 current meter
– 1 power recorder

Looking for: 1 summation current transformer and the VA power of an individual main transformer

Required active performance of the summation current transformer:

| | |
|---|---|
| Current meter | 1.5 VA |
| Performance recorder | 7.0 VA |
| Measurement conductor loss | 1.5 VA |
| consumption Po summation ct | 4.0 VA |
| Interim result | 14.0 VA |

The individual transformer must provide it's VA share from this 14.0 VA corresponding to its ratio to the "total transmission".

Consideration must also be given to the respective power loss between the main transformer and the summation transformer plus other possible losses.

1. Main transformer 1000 / 5 $\frac{1000}{2400} \times 14.0 = 5.83$ VA + additional possible losses

2. Main transformer 800 / 5A $\frac{800}{2400} \times 14.0 = 4.67$ VA + additional possible losses

3. Main transformer 600 / 5A $\frac{600}{2400} \times 14.0 = 3.50$ VA + additional possible losses

The VA values of the main transformers are to be rounded up to the corresponding VA values in our charts.

**The ratio of the primary current of a main transformer to the sum of the primary currents of all main current transformers the ratio must not exceed 1:8.**

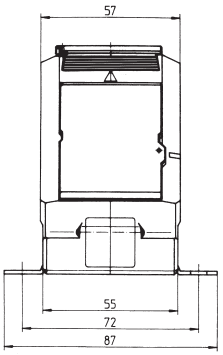
**Important indication to the power measuring**

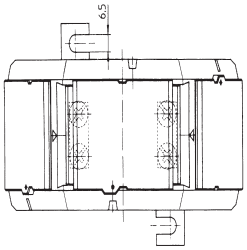
Too many rising deviation can prevent the measuring transformer acting as a current transformer from fulfilling its protective function with regard to the connected measuring units, as in normal operation its functions is well below its saturation limit, and in the event of over currents, the saturation limit is reached considerably later and takes the function almost as a protection current transformer.

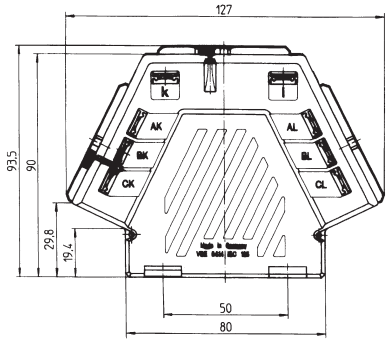
If there is too much of a decrease, the measuring transformer, as a result of the continuous excess demands will reach the saturation limit too soon and indirectly function as a switch, rendering a measuring impossible.

# Summation current transformer KSU 2...3

| Secondary current | | | 5A | | 1A | |
|---|---|---|---|---|---|---|
| | | | Accuracy class | | Accuracy class | |
| | | | 1 | 0.5 | 1 | 0.5 |
| Type | Primary current A | Burden VA | Art.-no. | Art.-no. | Art.-no. | Art.-no. |
| 2 | 1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 20 | ✓ | | ✓ | |
| | | 25 | ✓ | | ✓ | |
| | | 30 | ✓ | | ✓ | |
| 3 | 1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |
| 2 | 5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 20 | ✓ | | ✓ | |
| | | 25 | ✓ | | ✓ | |
| | | 30 | ✓ | | ✓ | |
| 3 | 5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |

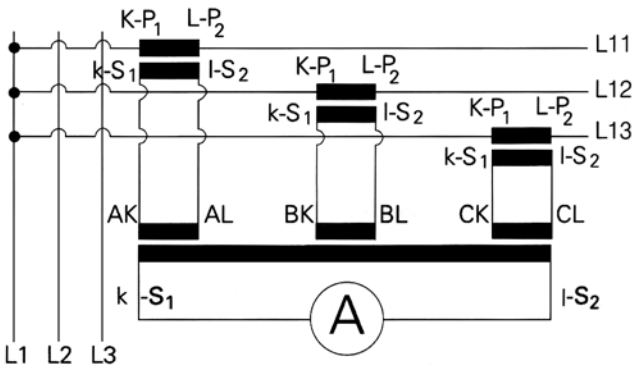


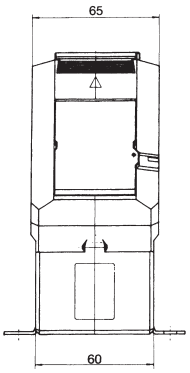



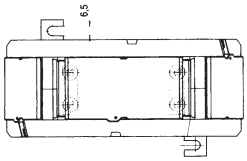

| Connection example for different ratios | | |
|---|---|---|
| AK-AL | = | 1000/5 |
| BK-BL | = | 800/5 |
| CK-CL | = | 600/5 |

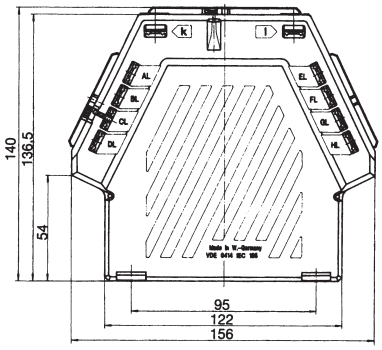
| | |
|---|---|
| Primary conductor | |
| Round conductor | |
| Transformer width | 127mm |
| Transformer depth | 57mm |
| Snap-on mounting | |
| Sealed shutter<br>2 pieces primary | Available<br>See "Accessories" |



# Summation current transformer SUSK 3...8



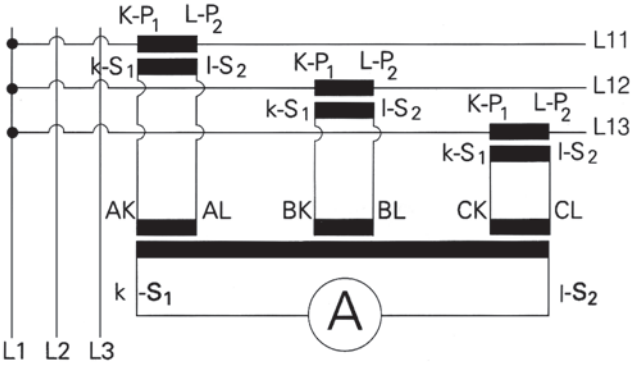



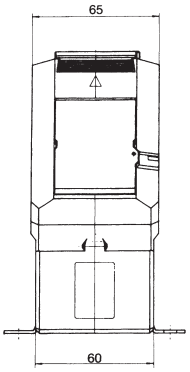

| Secondary current | | | 5A | | 1A | |
|---|---|---|---|---|---|---|
| Type | Primary current A | Burden VA | Accuracy class 1 Art.-no. | Accuracy class 0.5 Art.-no. | Accuracy class 1 Art.-no. | Accuracy class 0.5 Art.-no. |
| 3 | 5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |
| 4 | 5+5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 25 | ✓ | | ✓ | |
| | | 30 | ✓ | | ✓ | |
| 5 | 5+5+5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |
| 6 | 5+5+5+5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |
| 7 | 5+5+5+5+5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |
| 8 | 5+5+5+5+5+5+5+5 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | | ✓ | |

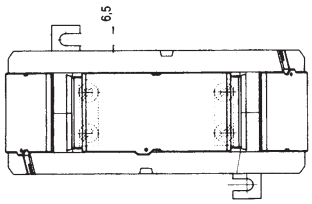
| | |
|---|---|
| Primary conductor | |
| Round conductor | |
| Transformer width | 156mm |
| Transformer depth | 65mm |
| Snap-on mounting | |
| Sealed shutter secondary no. | Available See "Accessories" |
| Current transformer for tariff applications | See "Accessories" |

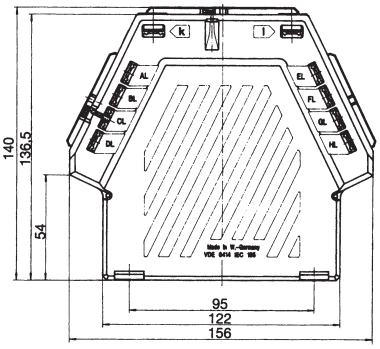
Connection diagram



# Summation current transformer SUSK 3...8



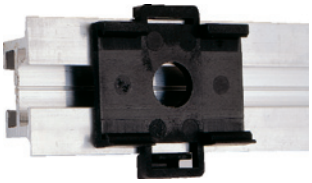




| Secondary current | | | 5A | | 1A | |
|---|---|---|---|---|---|---|
| Type | Primary current A | Burden VA | Accuracy class 1 Art.-no. | Accuracy class 0.5 Art.-no. | Accuracy class 1 Art.-no. | Accuracy class 0.5 Art.-no. |
| 3 | 1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | ✓ | | |
| 4 | 1+1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 25 | ✓ | ✓ | | |
| | | 30 | ✓ | ✓ | | |
| 5 | 1+1+1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | ✓ | | |
| 6 | 1+1+1+1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | ✓ | | |
| 7 | 1+1+1+1+1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | ✓ | | |
| 8 | 1+1+1+1+1+1+1+1 | 5 | ✓ | ✓ | ✓ | ✓ |
| | | 10 | ✓ | ✓ | ✓ | ✓ |
| | | 15 | ✓ | ✓ | ✓ | ✓ |
| | | 30 | ✓ | ✓ | | |

| | |
|---|---|
| Primary conductor | |
| Round conductor | |
| Transformer width | 156mm |
| Transformer depth | 65mm |
| Snap-on mounting | |
| Sealed shutter secondary no. | Available See "Accessories" |
| Current transformer for tariff applications | See "Accessories" |

| Connection example for different ratios | | |
|---|---|---|
| AK-AL | = | 1000/5 |
| BK-BL | = | 800/5 |
| CK-CL | = | 600/5 |
| DK-DL | = | 400/5 |
| EK-EL | = | 400/5 |
| FK-FL | = | 300/5 |
| GK-GL | = | 300/5 |
| HK-HL | = | 300/5 |

# Snap-on mountings



| Snap-on mounting for tube-, plug-in, protection- and tariff transformers | |
|---|---|
| For use with DEIF current transformers | Art.-no. |
| ASR 22.3; ASK 21.3, 31.3, 318.3, 41.3, ; WSK 30, SASR 22.3, EASR 22.3, 21.3, EASK 31.3 | ✓ |
| ASK 31.4, 31.4 2U/3U, EASK 31.4 | ✓ |
| ASK 31.5, 31.5 2U, WSK 40 N, SASK 31.5, EASK 31.5, 31.5 2U | ✓ |
| ASK 41.4, 412.4, 41.4 2U/3U, 412.4 2U/3U WSK 40, SASK 41.4, EASK 41.4, 41.4 2U | ✓ |
| ASR 14.3, 20.3, 201.3 | ✓ |
| ASR 21.3, ASK 205.3, SASK 21.3 | ✓ |

# Copper tubes

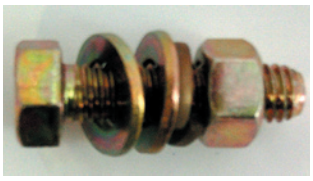
| Copper tube | | | | |
|---|---|---|---|---|
| Length | Outside Ø | Inner Ø | Max. current | Art.-no. |
| 34 | 22.5 | 16.5 | 600A | ✓ |
| 36 | 22.5 | 16.5 | 600A | ✓ |
| different lengths available upon request | | | | |
| 34 | 22.5 | 12.5 | 600A | ✓ |
| 36 | 22.5 | 12.5 | 600A | ✓ |
| different lengths available upon request | | | | |
| 34 | 22.5 | 8.5 | 600A | ✓ |
| 36 | 22.5 | 8.5 | 600A | ✓ |
| different lengths available upon request | | | | |
| 32 | 21 | 12.5 | 600A | ✓ |
| 34 | 21 | 12.5 | 600A | ✓ |
| different lengths available upon request | | | | |
| 32 | 21 | 8.5 | 600A | ✓ |
| 34 | 21 | 8.5 | 600A | ✓ |
| different lengths available upon request | | | | |

# Mounting angle for 3-phase current transformer set

| Mounting angle for triple set (2 pcs) plug-in, protection- and tariff transformers | |
|---|---|
| For use with DEIF current transformers | Art.-no. |
| ASK 421.4; 41.4; 412.4; WSK 40; WSK 40 N | ✓ |
| ASK 41.5 | ✓ |

# Mounting kit

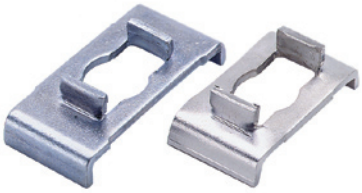
| Mounting kit | |
|---|---|
| Screw M 12 × 40 | Art.-no. |
| with voltage taps M5 | ✓ |
| with voltage taps M5 and locking piston bus bar 30mm | ✓ |
| with voltage taps M5 and locking piston bus bar 40mm | ✓ |
| with voltage taps M5 and locking piston bus bar 50mm | ✓ |
| standard | ✓ |
| standard with locking piston bus bar 30mm | ✓ |
| standard with locking piston bus bar 40mm | ✓ |
| standard with locking piston bus bar 50mm | ✓ |



# Secondary cap

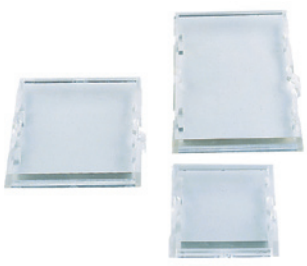
| Secondary cap |
|---|
| Art.-no. |
| ✓ |

# Locking pistons



| | Dimensions [mm] | | | Art.-no. |
|---|---|---|---|---|
| copper bus bar | 30 × 6 | 30 × 8 | 30 × 10 | ✓ |
| copper bus bar | 40 × 6 | 40 × 8 | 40 × 10 | ✓ |
| copper bus bar | 50 × 6 | 50 × 8 | 50 × 10 | ✓ |

# Sealed shutters



| Sealed shutter for tube-, plug-in, protection- and tariff current transformers | |
|---|---|
| For use with DEIF current transformers | Art.-no. |
| ASR 22.3; ASK 21.3; 31.3; 318.3; 41.3; 103.3(2x); 123.3(2x); WSK 30, SASK 22.3, 21.3,EASR 22.3, 21.3, EASK 31.3, 123.3(2x) | ✓ |
| ASK 31.4; 31.4 2U/3U, 31.5; 31.5 2U, 421.4; 41.4; 41.4 2U/3U, 412.4; 412.4 2U/3U, WSK 40, 40 N, 60, 70.6 N, KSU 2…3, SUSK 3..8 primär, SASK 31.5, 421.4, 41.4, EASK 31.4,31.5, 31.5 2U, 41.4, 41.4 2U, ESUSK 2…8 primär. | ✓ |
| ASK 541.4; 51.4,51.4 2U/3U, 561.4; 61.4, 61.4 2U/3U, 63.4; 63.6, 81.4, 81.4 2U/3U, 101.4, 101 2U/3U, 105.6; 105.6N; 127.4; 127.6; 128.4; 129.10, SUSK 3..8 sekundär, SASK 541.4, 51.4, 61.4, 63.6, 105.6, EASK 541.4, 51.4, 51.4 2U, 61.4, 63.6, 81.4, 105.6, ESUSK 2...8 sekundär | ✓ |
| WSK 70.6 | ✓ |
| ASK 31.6; 41.6; 51.6; 61.6, SASK 31.6, 41.6, 51.6, EASK 31.6, 41.6, 51.6, 61.6 | ✓ |
| WSK 31.5, EWSK 31.5 | ✓ |

Current transformers are special transformers for the proportional transformation of high currents into directly measurable values. Their construction and physical operating principle enables a galvanic separation of the primary circuit from the measured circuit, thereby providing a protection for sequentially connected instruments in the event of a fault.

**Rated limit current [$I_{PL}$]**

value of the lowest primary current where, by the secondary measuring burden, the total deviation of the current transformer for measuring purposes is equal to or greater than 10%.

**Rated current intensity [$I_N$]**

is the noted specified value of the primary and secondary current on the rating plate.
Standardized primary nominal currents have the following values: 5A, 10A, 15A, 20A, 25A, 30A, 40A, 50A, 60A, 75A, 100A with a decadic multiple of the previously mentioned value to a max. of 7500A. Standardized secondary nominal currents have the values 5A and 1A.

**Rated power**

the value of the apparent power (in a VA specified power factor), which the current transformer is intended to supply to the secondary circuit and rated burden at the rated secondary current.

**Earthing of secondary terminals**

according to VDE 0141, section 5.3.4., current- and voltage transformers have to be earthed, starting from $U_m$ = 3.6kV. With low voltage (up to $U_m$ – 1.2kV) no earthing is required, as long as the transformer housings have no visible exposed metal surfaces.

**Phase displacement error [δ]**

signifies the phase shift of the primary current and the secondary current. The direction of the indicator is arranged in such a way, that with an optimum produced current transformer the phase displacement error is equal to zero (IEV 321-01-23 modified).
The phase displacement error is to be regarded as positive when the indicator of the secondary current is ahead compared to the indicator of the primary current. The phase displacement error is specified in minutes or hundredths of a radiant. Note: Strictly speaking this definition is only valid for sinus type currents.

**Accuracy class**

the denotation for a current transformer whose measuring deviation remains below the prescribed operating condition.

**Total measuring deviation (Current error)**

is the effective value in stationary position, and the difference between:

a) the momentary value of the primary current and

b) the momentary value of the measuring transmission of the multiplied actual secondary current, whereby the positive indicators of the primary and secondary current correspond to the accord for the connection denotation. The total deviation F1 is generally rendered in the percentages of the effective value of the primary current, as per the following mathematical equation.

$$FI = \frac{100}{Ip}\sqrt{\frac{1}{T}\int_{O}^{T}(K_N\, i_S - i_P)^2\, dt}$$

$F_I$ = total measuring deviation in %
$i_P$ = momentary value of the primary current
$K_N$ = rated measuring transmission
$i_S$ = momentary value of the secondary current
$I_P$ = effective value of the primary current
T = duration of period

**Max. voltage for electrical equipment $U_m$**

this denotes the highest constant permitted value for phase to phase voltage for which the current transformers isolation is rated.

**Burden**

the impedance of the secondary current is declared in ohms and power factor. The burden is usually expressed as the apparent power in voltamperes, absorbed at a specified power-factor and at the rated secondary current.

**Rated burden**

the value of the burden upon which the accurate requirements of this specifications are based.

**Rated surge current [$I_{DYN}$]**

peak value of the primary current, whose electro-mechanical impact is resisted by the current transformer with short circuited secondary winding. The value of the nominal search current IDYN has to be 2.5 × $I_{TH}$. Only when there is a deviation from this value, the rating plate has to state $I_{DYN}$ .

**Actual transformation ration**

is the ratio of the primary nominal current to the secondary current. It is specified as an unabridged break on the rating plate.

**Open circuit voltage of current transformers**

Current transformers, which are not directly encumbered with a burden, are generally secondarily short circuited. A secondary open current transformer operates like a loaded one with an almost infinitely high burden. The curve shape of the secondary current is extremely deformed and under certain conditions voltage surges occur which can be harmful to human beings. The amount of the induced "loss motion" depends on the core cross-section and the number of secondary turns. For DEIF current transformers of lower ratings and with a nominal transmission ratio up to 500/5, the peak value of this voltage is $\hat{U} \leq 200$ V. For reasons of hazard protection and to prevent magnetization of the iron core, an open secondary circuit is to be avoided.

**Bus bar cross section**

The openings of our individual plug-in transformers for the acceptance of primary bus bars or their cross-sections – even when supplied with copper bus bars – are not decisive for the dimensioning of the bus bar units. The cross section of the bus bar is permitted to be smaller over a short distance in the transformer area, provided the adjacent bus bar cross sections are dimensioned in such a manner that any possible excess heat can easily be absorbed.

**Special configurations**

| | |
|---|---|
| Saturation transformers | upon request |
| Tropicalized versions | upon request |
| Primary nominal currents deviating from the standard series | upon request |
| Secondary change-over units | refer to the relevant types of ct's |
| Deviating frequency (16 ⅔Hz up to 400Hz) | upon request |
| Resin hardened for extreme mechanical demands (shakeproof) | upon request |

**Current error**

is the percentage deviation of the nominal transmission multiplied by the secondary current from that of the primary current. The current error is calculated positively, should the actual value of the secondary current exceed the nominal value.

$F_I$ = current error in %
$I_S$ = secondary current in A (effective value)
$I_P$ = primary current in A (effective value)
$K_N$ = rated measuring ratio

$$F_I = \frac{I_S K_N - I_P}{I_P} \; 100\%$$

**Thermal nominal continuous rated current [$I_D$]**

is the primary current which allows the continuous operation of the current transformer. When using this current value, the temperature of the secondary wiring must not exceed the prescribed values mentioned in the actual technical norms. These values are in direct relation to the isolation material class. Should a thermal rated current be defined which is larger than the primary rated current, the preference values of 120%, 150% and 200% should reflect those of the primary rated current.

**Thermal rated short-time current [$I_{TH}$]**

This value indicates the effective value of the primary current which the current transformers can withstand with short circuited secondary winding.
Other rated measuring values as 1s, e.g. 0.5s, 2s and 3s are acceptable. The thermal short time rated current Ith has to be stated for each current transformer.

**Over-current rated limiting factor (FS)**

is the ratio of the limit rated current to the primary rated current.
Note 1: It ought to be noted that the actual over-load rated current is influenced by the burden.
Note 2: Should the primary winding of the current transformer be short-circuited, the safety is greatest, when the value of the over-load current limit factor "FS" is small.
The excess current limiting factor is indicated on the rating plate of a measuring transformer with a nominal value after the letters "FS".

The specification "FS 5" signifies that the total measurement deviation of the current transformer with 5 times the primary nominal current arising from the magnetic saturation of the iron core amounts at least at to 10%.

**Important:**

All DEIF current transformers are in accordance with DIN EN 60044/1 for a thermal nominal current of $I_d = 1.0 \times I_N$.

# Configuration of DEIF low voltage current transformers

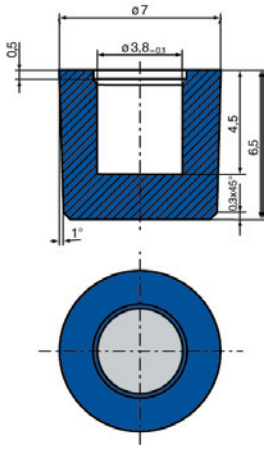
All at DEIF manufactured low voltage current transformers correspond to
DIN VDE 0414/1; DIN 42600; and DIN EN 60044/1 edition 12/2003 as well as regulation VBG 4.

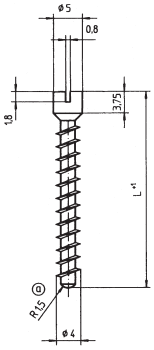
**Characteristics of the current transformers:**

- unbreakable plastic housings
- black polycarbonate
- flame resistant
- self-extinguishing
- transformer housings are ultrasonically welded
- nickel-plated secondary terminals with plus-minus nickel-plated screw M 5×10mm
- integrated secondary locking caps

Foot angle and bus bar mounting screws with isolating protection caps (protection-proof) are supplied free of charge. All transformers are suitable for use on massive primary conductors as well as on flexible isolated copper strips.

Isolating protecting cap





Bus bar mounting screw, screw length (L)
25, 32, 36, 46, 54, 80mm, torque 0.5Nm

**General technical specifications:**

| | |
|---|---|
| Nominal frequency | 50Hz and 60Hz ($16^2/_3$Hz up to 400Hz upon request) |
| Isolation class | E |
| Thermal nominal short-time current | $I_{th} = 60 \times I_N$ |
| Maximum operating voltage | $U_m \leq 0.72$kV |
| Over-current limiting factor | FS 5 up to 1500A nominal current |
| | FS 10 from 1600A nominal current |
| Secondary nominal current | 5A or 1A |
| Operating temperature | -5°C ≤ ≤ +55°C |
| Storage temperature | -25°C ≤ ≤ +70°C |

## Error limit values for measuring transformers for classes 0.2 … 3 according to DIN IEC 60044/1

| Class accuracy | Current error ± $\delta_F$ by | | | | | Phase displacement error ± $\delta_F$ by | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.2 $I_N$ 1.0 $I_N$ | 0.2 $I_N$ | 0.1 $I_N$ | 0.05 $I_N$ | 0.01 $I_N$ | 1.2 $I_N$ 1.0 $I_N$ | 0.2 $I_N$ | 0.1 $I_N$ | 0.05 $I_N$ | 0.01 $I_N$ |
| | % | % | % | % | % | min | min | min | min | min |
| 0.2 | 0.2 | 0.35 | | 0.75 | | 10 | 15 | | 30 | |
| 0.2s | 0.2 | 0.2 | | 0.35 | 0.75 | 10 | 10 | | 15 | 30 |
| 0.5 | 0.5 | 0.75 | | 1.5 | | 30 | 45 | | 90 | |
| 0.5s | 0.5 | 0.5 | | 0.75 | 1.5 | 30 | 30 | | 45 | 90 |
| 1 | 1 | 1.5 | | 3 | | 60 | 90 | | 180 | |
| 3 | 3 | | | | | 120.0* | | | | |

* by 0.5 $I_N$ and thermal nominal continuous current

## Error limit values for cur Error limit values for current transformers for protection applications rent transformers for protection applications

| Class accuracy | Current error ± $F_i$ by | | | | Phase displacement error ± $F_i$ by | | | |
|---|---|---|---|---|---|---|---|---|
| | 1.0 IN and thermal nominal continuous current | 0.5 $I_N$ | 0.2 $I_N$ | 0.05 $I_N$ | 1.0 $I_N$ and thermal nominal continuous current | 0.5 $I_N$ | 0.2 $I_N$ | 0.05 $I_N$ |
| | % | % | % | % | | | | |
| 5 P … | 1 | | 1.5 | 3 | 60 | | 90 | 120 |
| 10 P … | 3 | 3 | | | 120 | 120 | | |

Current error Fg at nominal error current limit and nominal burden class 5P … ≤ 5%
class 10P … ≤ 10%

## Maximum permissible current of copper bus bars Dimensions and current values according to DIN 43671

| Bus bar cross section | 1 bus bar | 2 bus bars | 3 bus bars |
|---|---|---|---|
| 20 × 10 | 427A | 825A | 1180A |
| 30 × 05 | 379A | 672A | 896A |
| 30 × 10 | 573A | 1060A | 1480A |
| 40 × 05 | 482A | 836A | 1090A |
| 40 × 10 | 715A | 1290A | 1770A |
| 50 × 10 | 852A | 1510A | 2040A |
| 60 × 10 | 985A | 1720A | 2300A |
| 80 × 10 | 1240A | 2110A | 2790A |
| 100 × 10 | 1490A | 2480A | 3260A |
| Bus bar surface | | Clear | |

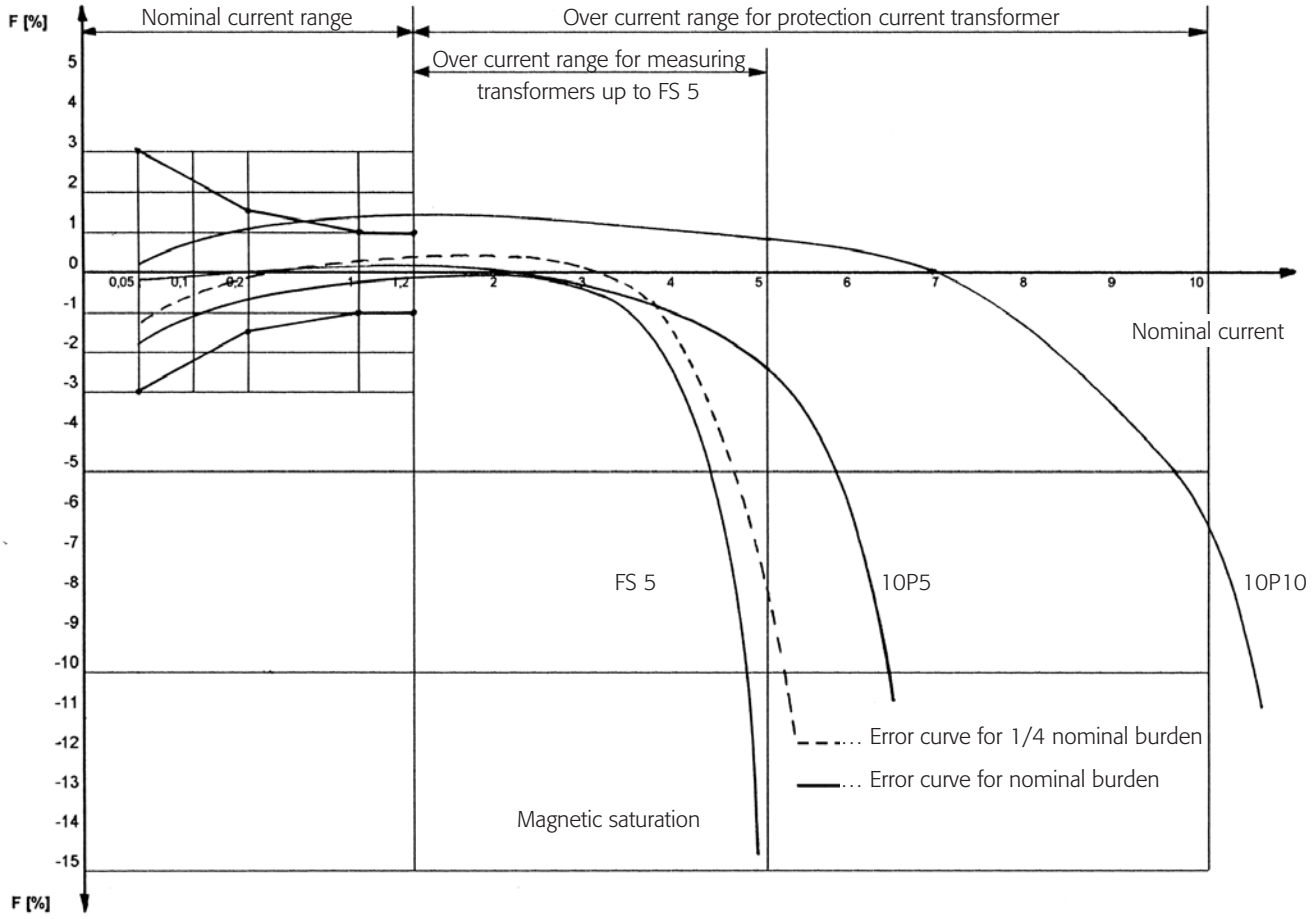
Above values are valid for continuous current burden at approx. 30°C ambient temperature.

# Markings of the current transformers connection terminals

The connections of all primary windings are marked with capital letters “K-P1”, and “L-P2”.
The connections of all secondary windings are marked with the corresponding lower case letters “k-s1” and “l-s2”.
By current transformers with a multiple secondary tappings the winding end is marked “l”, followed by the prefix letter “l1” , the tappings with a decreasing number of windings are sequencially numbered “2”, “3” etc.

By current transformers with a multiple of independent primary windings, the terminals of the individual windings are distinguishable from the additional capital letters set before “K” and “L” and the additional capital letters
“A”, “B”, “C” etc.; i.e. “AK” – “AL” for the highest primary circuit, “BK” – “BL” for the second primary circuit etc.;
or on each terminal pair the transmission or the ratio transmission of the individual primary windings to each other is to be specified.

# Error curves of low voltage current transformers



# Power requirements of measuring units and relays

Two main requirements are cited by the user for the principle demands of current transformers:
- a high degree of measuring precission in the range of nominal current
- a protection function in the over-load range

In order to fulfill these demands it is necessary for the assumed nominal power of a current transformer to fully achieve the actual power requirements of the prescribed measurements. In ascertaining the actual power requirements, consideration is to be given to power losses of the appliances to be connected, as well as to the losses of the measuring conductor.

## Power requirements of typical measuring units

| | | | | |
|---|---|---|---|---|
| Current meter soft ironed up to 100mm Ø | | 0.700 | – | 1.500 VA |
| Rectifier current meter | | 0.001 | – | 0.250 VA |
| Multi-range current meter | | 0.005 | – | 5.000 VA |
| Current recorder | | 0.300 | – | 9.000 VA |
| Bimetal current meter | | 2.500 | – | 3.000 VA |
| Power meter | | 0.200 | – | 5.000 VA |
| Power recorder | | 3.000 | – | 12.000 VA |
| Power factor meter | | 2.000 | – | 6.000 VA |
| Power factor recorder | | 9.000 | – | 16.000 VA |
| Energy meter (current path) | | 0.400 | – | 1.000 VA |
| Relay | N-relay | | | 14.000 VA |
| | Over current relay | 0.200 | – | 6.000 VA |
| | Over current time relay | 3.000 | – | 6.000 VA |
| | Direction relay | | | 10.000 VA |
| | Bimetal relay | 7.000 | – | 11.000 VA |
| | Distance relay | 1.000 | – | 30.000 VA |
| | Differential relay | 0.200<br>1.000 | – | 2.000 VA<br>15.000 VA |
| Transformer current trip switch | | 5.000 | – | 150.000 VA |
| Controler | | 5.000 | – | 180.000 VA |

**Power consumption of copper wires**

$P = \frac{I^2 \times 2l}{q_{cu} \times 56}$ [VA]  I = secondary nominal current  l = distance in m  $q_{cu}$ = wire cross section inmm²

Comment: With a joint three phase current return conductor the values of P are halved.

## Chart for values referring to 5A

| Nominal cross section | 1m | 2m | 3m | 4m | 5m | 6m | 7m | 8m | 9m | 10m |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.5mm² | 0.36 | 0.71 | 1.07 | 1.43 | 1.78 | 2.14 | 2.50 | 2.86 | 3.21 | 3.57 |
| 4.0mm² | 0.22 | 0.45 | 0.67 | 0.89 | 1.12 | 1.34 | 1.56 | 1.79 | 2.01 | 2.24 |
| 6.0mm² | 0.15 | 0.30 | 0.45 | 0.60 | 0.74 | 0.89 | 1.04 | 1.19 | 1.34 | 1.49 |
| 10.0mm² | 0.09 | 0.18 | 0.27 | 0.36 | 0.44 | 0.54 | 0.63 | 0.71 | 0.80 | 0.89 |

## Chart for values referring to 1A

| Nominal cross section | 10m | 20m | 30m | 40m | 50m | 60m | 70m | 80m | 90m | 100m |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0mm² | 0.36 | 0.71 | 1.07 | 1.43 | 1.78 | 2.14 | 2.50 | 2.86 | 3.21 | 3.57 |
| 2.5mm² | 0.14 | 0.29 | 0.43 | 0.57 | 0.72 | 0.86 | 1.00 | 1.14 | 1.29 | 1.43 |
| 4.0mm² | 0.09 | 0.18 | 0.27 | 0.36 | 0.45 | 0.54 | 0.63 | 0.71 | 0.80 | 0.89 |
| 6.0mm² | 0.06 | 0.12 | 0.18 | 0.24 | 0.30 | 0.36 | 0.42 | 0.48 | 0.54 | 0.60 |
| 10.0mm² | 0.04 | 0.07 | 0.11 | 0.14 | 0.18 | 0.21 | 0.25 | 0.29 | 0.32 | 0.36 |