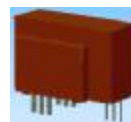


K-No.: 24618

**50/100 A Current Sensor**

For the electronic measurement of currents:  
DC, AC, pulsed, mixed ..., with a galvanic  
isolation between the primary circuit  
(high power) and the secondary circuit  
(electronic circuit)



Date: 28.01.2008

Customer: Standard type

Customers Part no.:

Page 1 of 2

**Description**

- Closed loop (compensation)  
Current Sensor with magnetic field probe
- Printed circuit board mounting
- Casing and materials UL-listed

**Characteristics**

- Excellent accuracy
- Very low offset current
- Very low temperature dependency and offset current drift
- Very low hysteresis of offset current
- Low response time
- Wide frequency bandwidth
- Compact design
- Reduced offset ripple

**Applications**

Mainly used for stationary operation in industrial applications:

- AC variable speed drives and servo motor drives
- Static converters for DC motor drives
- Battery supplied applications
- Switched Mode Power Supplies (SMPS)
- Power Supplies for welding applications
- Uninterruptable Power Supplies (UPS)

**Electrical data – Ratings<sup>1)</sup>**

|          |                                                                                                                                                                |                         |                      |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|
| $I_{PN}$ | Primary nominal r.m.s. current<br>@ $V_C = \pm 15V$ , $R_M \geq 0 \Omega$<br>@ $V_C = \pm 12V$ , $R_M \geq 0 \Omega$ or $V_C = \pm 15V$ , $R_M \geq 16 \Omega$ | 50<br>100               | A<br>A               |
| $R_M$    | Measuring resistance $V_C = \pm 12V$<br>$V_C = \pm 15V$                                                                                                        | 0 ... 200<br>16 ... 400 | $\Omega$<br>$\Omega$ |
| $I_{SN}$ | Secondary nominal r.m.s. current                                                                                                                               | 25/50                   | mA                   |
| $K_N$    | Turns ratio                                                                                                                                                    | 1...3 : 2000            |                      |

**Accuracy – Dynamic performance data<sup>1)</sup>**

|                            |                                                                                                                                                    | min.                   | typ. | max. | Unit   |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|------|--------|
| $I_{P,max}$                | Max. measuring range<br>@ $V_C = \pm 12V$ , $R_M = 10 \Omega$ ( $t_{max} = 10sec$ )<br>@ $V_C = \pm 15V$ , $R_M = 16 \Omega$ ( $t_{max} = 10sec$ ) | $\pm 145$<br>$\pm 175$ |      |      | A<br>A |
| X                          | Accuracy @ $I_{PN}$ , $T_A = 25^\circ C$                                                                                                           |                        | 0.1  | 0.5  | %      |
| $\epsilon_L$               | Linearity                                                                                                                                          |                        |      | 0.1  | %      |
| $I_0$                      | Offset current @ $I_P = 0$ , $T_A = 25^\circ C$                                                                                                    |                        | 0.02 | 0.08 | mA     |
| $t_r$                      | Response time                                                                                                                                      |                        | 500  |      | ns     |
| $\Delta t$ ( $I_{P,max}$ ) | Delay time at $di/dt = 100 A/\mu s$                                                                                                                |                        | 200  |      | ns     |
| f                          | Frequency bandwidth                                                                                                                                | DC...200               |      |      | kHz    |

**General data<sup>1)</sup>**

|                                                                                                                                                                            |                                               | min.       | typ.                 | max.        | Unit       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------|----------------------|-------------|------------|
| $T_A$                                                                                                                                                                      | Ambient operating temperature                 | -40        |                      | +85         | $^\circ C$ |
| $T_S$                                                                                                                                                                      | Ambient storage temperature                   | -40        |                      | +90         | $^\circ C$ |
| m                                                                                                                                                                          | Mass                                          |            | 13,5                 |             | g          |
| $V_C$                                                                                                                                                                      | Supply voltage                                | $\pm 11.4$ | $\pm 12$ or $\pm 15$ | $\pm 15.75$ | V          |
| $I_C$                                                                                                                                                                      | Current consumption                           |            | 18.5                 |             | mA         |
| Constructed and manufactured and tested in accordance with EN 61800-5-1 (Pin 1 - 6 to Pin 7 – 9)<br>Reinforced insulation, Insulation material group 1, Pollution degree 2 |                                               |            |                      |             |            |
| $S_{clear}$                                                                                                                                                                | clearance (component without solder pad)      | 10.2       |                      |             | mm         |
| $S_{creep}$                                                                                                                                                                | creepage (component without solder pad)       | 10.2       |                      |             | mm         |
| $V_{sys}$                                                                                                                                                                  | System voltage overvoltage category 3         | RMS        |                      | 600         | V          |
| $V_{work}$                                                                                                                                                                 | Working voltage (table 7 acc. to EN61800-5-1) | RMS        |                      | 1020        | V          |
| $U_{PD}$                                                                                                                                                                   | Rated discharge voltage                       | peak value |                      | 1400        | V          |

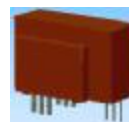
| Date     | Name | Issue | Amendment                   |
|----------|------|-------|-----------------------------|
| 28.01.08 | Le   | 81    | Date changed. Insignificant |

|                       |                        |                        |                         |                          |
|-----------------------|------------------------|------------------------|-------------------------|--------------------------|
| Hrsg.: KB-E<br>editor | Bearb.: SA<br>designer | KB-E BE: Len.<br>check | KB-PM IA: KRe.<br>check | freig.: Heu.<br>released |
|-----------------------|------------------------|------------------------|-------------------------|--------------------------|

**K-No.:** 24618

**50/100 A Current Sensor**

For the electronic measurement of currents:  
DC, AC, pulsed, mixed ..., with a galvanic  
Isolation between the primary circuit  
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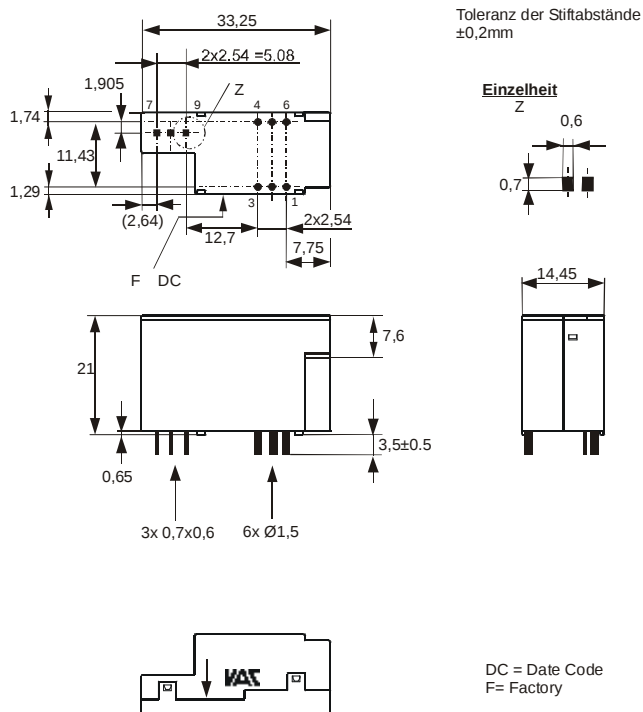

**Date:** 28.01.2008

**Customer:** Standard type

**Customers Part no.:**
**Page** 2 **of** 2

**Mechanical outline (mm):**

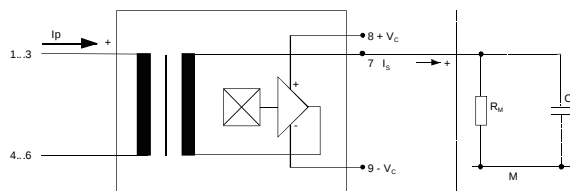
General tolerances DIN ISO 2768-c


**Connections:**

1...6: Ø 1,5 mm  
7...9: 0,6x0,7 mm

**Marking:**

**VAC**  
4646X412  
F DC

**Schematic diagram**

**Possibilities of wiring for V<sub>C</sub> = ±15V<sup>1)</sup>** (@ T<sub>A</sub> = 85°C, R<sub>M</sub> = 25 Ω)

| primary windings<br>N <sub>P</sub> | primary current<br>RMS I <sub>P</sub> [A] | primary current<br>maximal I <sub>P,max</sub> [A] | output current<br>RMS I <sub>S</sub> (I <sub>P</sub> ) [mA] | turns ratio<br>K <sub>N</sub> | primary resistance<br>R <sub>P</sub> [mW] | wiring |
|------------------------------------|-------------------------------------------|---------------------------------------------------|-------------------------------------------------------------|-------------------------------|-------------------------------------------|--------|
| 1                                  | 100                                       | 175                                               | 50                                                          | 1:2000                        | 0.12                                      |        |
| 2                                  | 35                                        | 82                                                | 35                                                          | 2:2000                        | 0.54                                      |        |
| 3                                  | 25                                        | 58                                                | 37,5                                                        | 3:2000                        | 1.1                                       |        |

<sup>1)</sup> preliminary data

Temperature of the primary conductor should not exceed 100°C.

Additional information is obtainable on request.

This specification is no declaration of warranty acc. BGB §443 dar.

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designer

KB-E BE: Len.  
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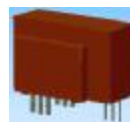
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K-No.: 24618

## 50/100 A Current Sensor

For electronic current measurement:  
DC, AC, pulsed, mixed ..., with a galvanic  
isolation between primary circuit  
(high power) and secondary circuit



Date: 28.01.2008

Customer:

Customers Part No.:

Page 1 of 3

### Electrical Data (investigate by a type checking)<sup>1)</sup>

|                         |                                                                                                                                                                                                                   | min. | typ.  | max.  | Unit       |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|------------|
| $V_{Ctot}$              | Maximum supply voltage (without function)<br>±15.75 bis ±18 V: for 1s per hour                                                                                                                                    |      |       | ±18   | V          |
| $R_S$                   | Secondary coil resistance @ $T_A=85^\circ\text{C}$                                                                                                                                                                |      |       | 145   | $\Omega$   |
| $R_p$                   | Primary coil resistance per turn @ $T_A=25^\circ\text{C}$                                                                                                                                                         |      |       | 0.36  | m $\Omega$ |
| $X_{Ti}$                | Temperature drift of X @ $T_A = -40 \dots +85^\circ\text{C}$                                                                                                                                                      |      |       | 0.1   | %          |
| $I_{0ges}$              | Offset current (including $I_0$ , $I_{0t}$ , $I_{0T}$ )                                                                                                                                                           |      |       | 0.1   | mA         |
| $I_{0t}$                | Long term drift Offset current $I_0$                                                                                                                                                                              |      | 0.03  |       | mA         |
| $I_{0T}$                | Offset current temperature drift $I_0$ @ $T_A = -40 \dots +85^\circ\text{C}$                                                                                                                                      |      | 0.03  |       | mA         |
| $I_{0H}$                | Hysteresis current @ $I_p=0$ (caused by primary current $3 \times I_{PN}$ )                                                                                                                                       |      | 0.02  | 0.05  | mA         |
| $\Delta I_0/\Delta V_C$ | Supply voltage rejection ratio                                                                                                                                                                                    |      |       | 0.01  | mA/V       |
| $i_{loss}$              | Offset ripple* (with 1 MHz- filter first order)                                                                                                                                                                   |      |       | 0.15  | mA         |
| $i_{loss}$              | Offset ripple* (with 100 kHz- filter first order)                                                                                                                                                                 |      | 0.017 | 0.025 | mA         |
| $i_{loss}$              | Offset ripple* (with 20 kHz- filter first order)                                                                                                                                                                  |      | 0.005 | 0.007 | mA         |
| $C_k$                   | Maximum possible coupling capacity (primary – secondary)                                                                                                                                                          |      | 5     |       | pF         |
|                         | Mechanical Stress according to M3209/3<br>Settings: 10 – 2000 Hz, 1 min/Decade, 2 hours<br>An exceptionally high rate of on/off – switching of the supply voltage<br>accelerates the aging process of the sensor. |      |       | 10g   |            |

### Inspection<sup>1)</sup> (Measurement after temperature balance of the samples at room temperature)

|                |            |         |                                                                    |                      |
|----------------|------------|---------|--------------------------------------------------------------------|----------------------|
| $K_N(N_1/N_2)$ | (V)        | M3011/6 | Transformation ratio ( $I_p=3 \times 10A$ , 40-80 Hz)              | 1...3 : 2000 ± 0.5 % |
| $I_0$          | (V)        | M3226   | Offset current                                                     | < 0.05 mA            |
| $V_{P,eff}$    | (V)        | M3014   | Test voltage, rms, 1s<br>Pin 1 - 6 to Pin 7 - 9                    | 2.5 kV               |
| $V_e$          | (AQL 1/S4) |         | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS) | 1500 V<br>1875 V     |

### Type Testing (Pin 1 - 6 to Pin 7 – 9)

Designed according standard EN 61800 with insulation material group 1

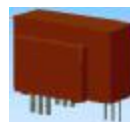
|       |                                                                                             |       |              |        |
|-------|---------------------------------------------------------------------------------------------|-------|--------------|--------|
| $V_W$ | HV transient test according (to M3064)<br>(1,2 $\mu\text{s}$ / 50 $\mu\text{s}$ -wave form) |       | 8            | kV     |
| $V_d$ | Testing voltage acc. M3014 (RMS)                                                            | (5 s) | 5            | kV     |
| $V_e$ | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS)                          |       | 1500<br>1875 | V<br>V |

|                       |                        |       |                                                                       |
|-----------------------|------------------------|-------|-----------------------------------------------------------------------|
| Datum                 | Name                   | Index | Änderung                                                              |
| 28.01.08              | Le                     | 81    | Page 3: write error in $X_{ges}$ ( $I_{PN}$ ). changed. Insignificant |
| Hrsg.: KB-E<br>editor | Bearb.: SA<br>designer |       | KB-E BE: Len.<br>check                                                |
|                       |                        |       | KB-PM IA:KRe.<br>check                                                |
|                       |                        |       | freig.: Heu.<br>released                                              |

K-No.: 24618

### 50/100 A Current Sensor

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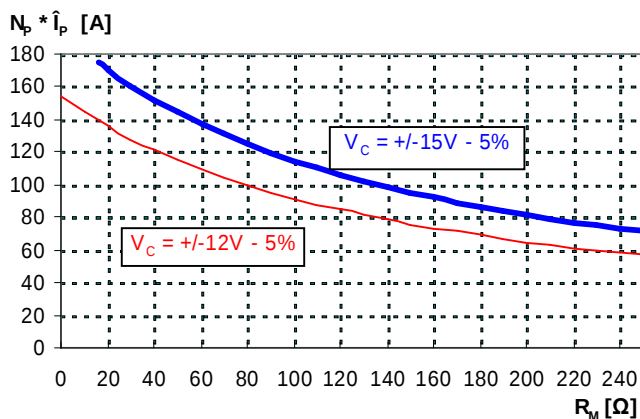
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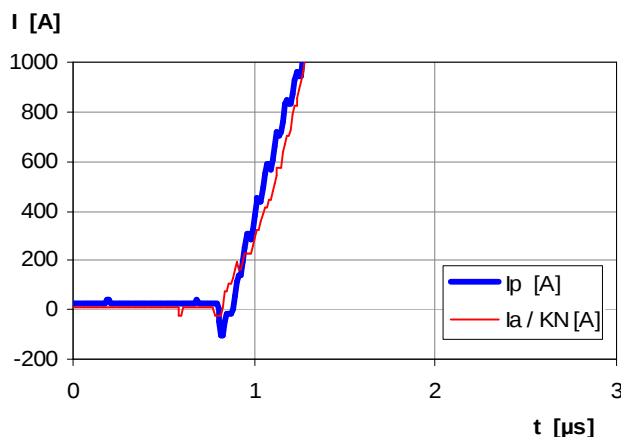
#### Limit curve of measurable current $\hat{I}_P(R_M)$ <sup>1)</sup>

@ ambient temperature  $T_A \leq 85^\circ\text{C}$



#### Maximum measuring range (μs-range) <sup>1)</sup>

Output current behaviour of a 3kA current pulse  
@  $V_C = \pm 15V$  und  $R_M = 25\Omega$



Fast increasing currents (higher than the specified  $I_{p,max}$ ), e.g. in case of a short circuit, can be transmitted because the currents are transformed directly.

The offset ripple can be reduced by an external low pass. Simplest solution is a passive low pass filter of 1st order with

$$f_g = \frac{1}{2p \cdot R_M \cdot C_a}$$

In this case the response time is enlarged.

It is calculated from:

$$t'_r \leq t_r + 2,5R_M C_a$$

#### Applicable documents

Current direction: A positive output current appears at point  $I_s$ , by primary current in direction of the arrow.

Constructed and manufactured and tested in accordance with EN 61800.

Housing and bobbin material UL-listed: Flammability class 94V-0.

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designer

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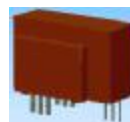
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$I_{0H}$ : Zero variation of  $I_0$  after overloading with a DC of tenfold the rated value ( $R_M = R_{MN}$ )

$I_{0t}$ : Long term drift of  $I_0$  after 100 temperature cycles in the range -40 bis 85 °C.

$t_r$ : Response time (describe the dynamic performance for the specified measurement range), measured as delay time at  $I_P = 0,9 \cdot I_{Pmax}$  between a rectangular current and the output current.

$\Delta t (I_{Pmax})$ : Delay time (describe the dynamic performance for the rapid current pulse rate e.g short circuit current) measured between  $I_{Pmax}$  and the output current  $i_a$  with a primary current rise of  $di_1/dt = 100 A/\mu s$ .

$X_{ges}(I_{PN})$ : The sum of all possible errors over the temperature range by measuring a current  $I_{PN}$ :

$$X_{ges} = 100 \cdot \left| \frac{I_S(I_{PN})}{K_N \cdot I_{PN}} - 1 \right| \%$$

$X$ : Permissible measurement error in the final inspection at RT, defined by

$$X = 100 \cdot \left| \frac{I_{SB}}{I_{SN}} - 1 \right| \%$$

where  $I_{SB}$  is the output DC value of an input DC current of the same magnitude as the (positive) rated current ( $I_0 = 0$ )

$X_{Ti}$ : Temperature drift of the rated value orientated output term.  $I_{SN}$  (cf. Notes on F<sub>i</sub>) in a specified temperature range, obtained by:

$$X_{Ti} = 100 \cdot \left| \frac{I_{SB}(T_{A2}) - I_{SB}(T_{A1})}{I_{SN}} \right| \%$$

$\epsilon_L$ : Linearity fault defined by  $e_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{I_{Sx}}{I_{SN}} \right| \%$

Where  $I_P$  is any input DC and  $I_{Sx}$  the corresponding output term.  $I_{SN}$ : see notes of F<sub>i</sub> ( $I_0 = 0$ ).

This "Additional information" is no declaration of warranty according BGB §443.

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designer

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check

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Электрон  
Связь**

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