

**K-No.:** 26333

**1000 A Current Sensor for  $\pm 15V$ - Supply Voltage**
**Date:** 10.04.2014

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

**Customer:** Standard Type

**Customer part no.:**
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**Electrical Data – Ratings**

|          |                                  |           |          |
|----------|----------------------------------|-----------|----------|
| $I_{PN}$ | Primary nominal r.m.s. current   | 1000      | A        |
| $R_M^*$  | Measuring resistance             | 0 ... 100 | $\Omega$ |
| $I_{SN}$ | Secondary nominal r.m.s. current | 200       | mA       |
| $K_N$    | Turns ratio                      | (1): 5000 |          |

 \* for  $I_{P,max}$  see fig. 1 on page 2

**Accuracy – Dynamic performance data**

|                        |   | min.     | typ. | max. | Einheit |
|------------------------|---|----------|------|------|---------|
| $I_{P,max}^*$          | Max. measuring range @ $R_M = 10 \Omega$ ; $T_A = 25^\circ C$ | 1580     |      |      | A       |
|                        | @ $R_M = 10 \Omega$ ; $T_A = 85^\circ C$                      | 1340     |      |      | A       |
| X                      | Accuracy @ $I_{PN}$ , $T_A = -40 \dots +85^\circ C$           |          |      | 0.4  | %       |
| $\epsilon_L$           | Linearity   |          |      | 0.1  | %       |
| $I_0$                  | Offset current @ $I_P = 0$ , $T_A = 25^\circ C$               |          |      | 0.1  | mA      |
| $I_{0H}$               | Hysteresis current  |          |      | 0.1  | mA      |
| $t_r$                  | Response time @ 80% of $I_{PN}$                               |          | < 1  |      | $\mu s$ |
| $\Delta t (I_{P,max})$ | Delay time at $di/dt = 1200 A/\mu s$                          |          |      | 1    | $\mu s$ |
| f                      | Frequency bandwidth   | DC...100 |      |      | kHz     |

 \*currents with high slew rates can be measured above  $I_{P,max}$ 
**General data**

|               |  | min.        | typ.     | max.        | Einheit    |
|---------------|--|-------------|----------|-------------|------------|
| $T_A$         | Ambient operating temperature            | -40         |          | +85         | $^\circ C$ |
| $T_S$         | Ambient storage temperature              | -40         |          | +85         | $^\circ C$ |
| m             | Mass                                     |             | 550      |             | g          |
| $V_C$         | Supply voltage                           | $\pm 13.50$ | $\pm 15$ | $\pm 15.75$ | V          |
| $I_{C0}$      | Current consumption for $I_P = 0A$       |             | 25       |             | mA         |
| $I_{CN}$      | Current consumption for $I_{PN} = 1000A$ |             | 190      |             | mA         |
| * $S_{clear}$ | Clearance                                | 20          |          |             | mm         |
| * $S_{creep}$ | Creepage                                 | 20          |          |             | mm         |

 \* Constructed and manufactured and tested in accordance with EN 61800-5-1 (Pin 1 - 4 to primary opening)  
 Reinforced insulation, Insulation material group 1, Pollution degree 2

|              |                         |                               |            |      |   |
|--------------|-------------------------|-------------------------------|------------|------|---|
| * $V_{sys}$  | System voltage          | overvoltage category 3        | RMS        | 1000 | V |
| * $V_{work}$ | Working voltage         | (tabel 7 acc. to EN61800-5-1) | RMS        | 1500 | V |
| * $U_{PD}$   | Rated discharge voltage |                               | peak value | 1500 | V |

 Max. potential difference acc. to UL 508 RMS 1000  $V_{AC}$ 

| Datum    | Name | Index | Änderung  |
|----------|------|-------|---|
| 10.04.14 | KRe. | 83    | Completion of data sheet: X, $V_C$ , „max. Potential...“ (page1), Values for supply voltage (page2), maximum continuous currents at defined Temperatures (page2), Applicable documents added and $V_d$ from 4.4 $\rightarrow$ 6kV (page 5) CN-985 |

|                       |                             |                      |                        |
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**Maximum peak currents at defined temperatures Values for supply voltage  $\pm 14.25 V (\pm 15 V -5 \%)$**

|             |            |            |             |             |
|-------------|------------|------------|-------------|-------------|
| $T_A$       | 55 °C      | 55 °C      | 55 °C       | 55 °C       |
| $R_M$       | 1 $\Omega$ | 5 $\Omega$ | 20 $\Omega$ | 50 $\Omega$ |
| $I_{P,max}$ | 1780A      | 1620A      | 1200A       | 790A        |

|             |            |            |             |             |
|-------------|------------|------------|-------------|-------------|
| $T_A$       | 85 °C      | 85 °C      | 85 °C       | 85 °C       |
| $R_M$       | 1 $\Omega$ | 5 $\Omega$ | 20 $\Omega$ | 50 $\Omega$ |
| $I_{P,max}$ | 1620A      | 1480A      | 1120A       | 750A        |

**Maximum continuous currents at defined temperatures**

|                         |                       |  |
|-------------------------|-----------------------|--|
| $T_A$                   | $\leq 70\text{ °C}$   | $70\text{ °C} < T_a \leq 85\text{ °C}$ |
| $I_P = I_{P,max}$ up to | 1800 A <sub>rms</sub> | 1200 A <sub>rms</sub>                  |

**Limit curve of measurable current  $\hat{I}_P=f(R_M)$  Values for supply voltage  $\pm 14.25 V (\pm 15 V -5 \%)$**

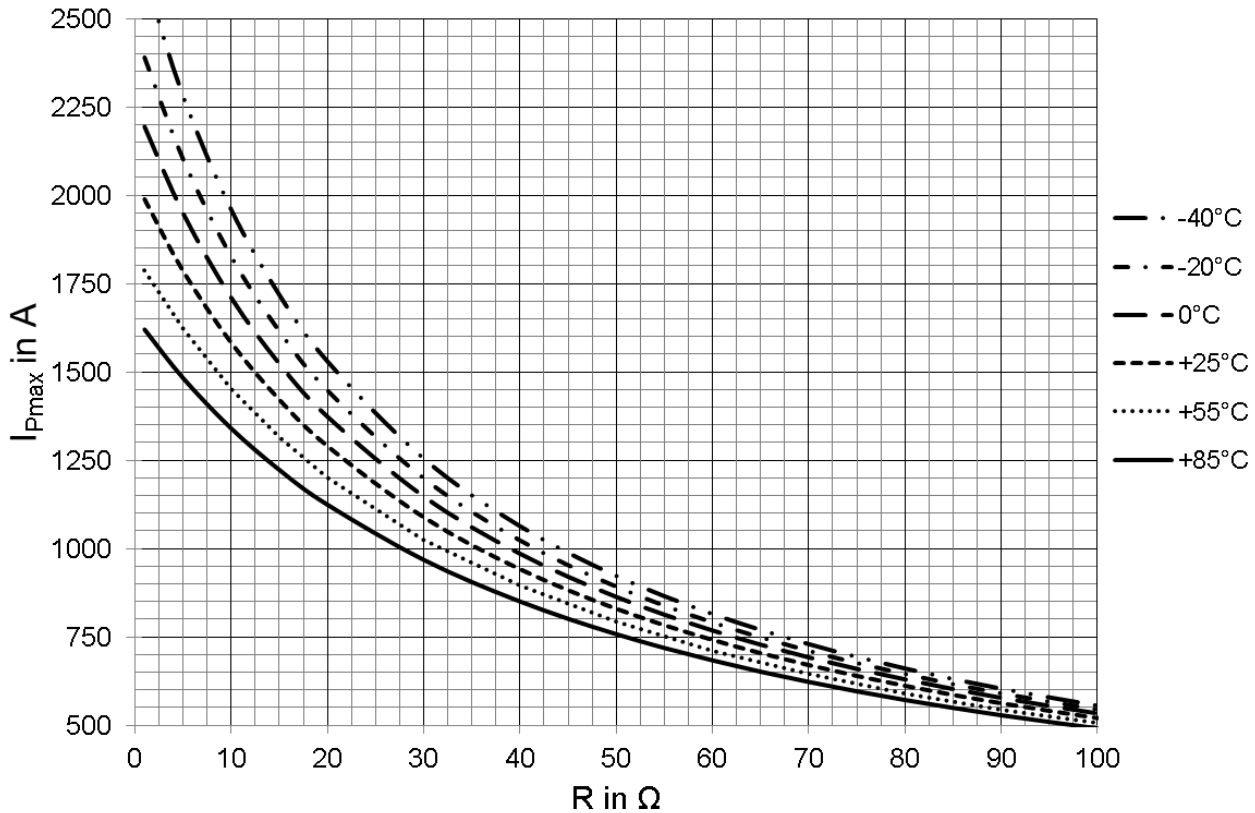


Fig. 1:  $I_{P,max} = f(R_m) @T_A$

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**Overload puls ( $\mu s$ -range)**

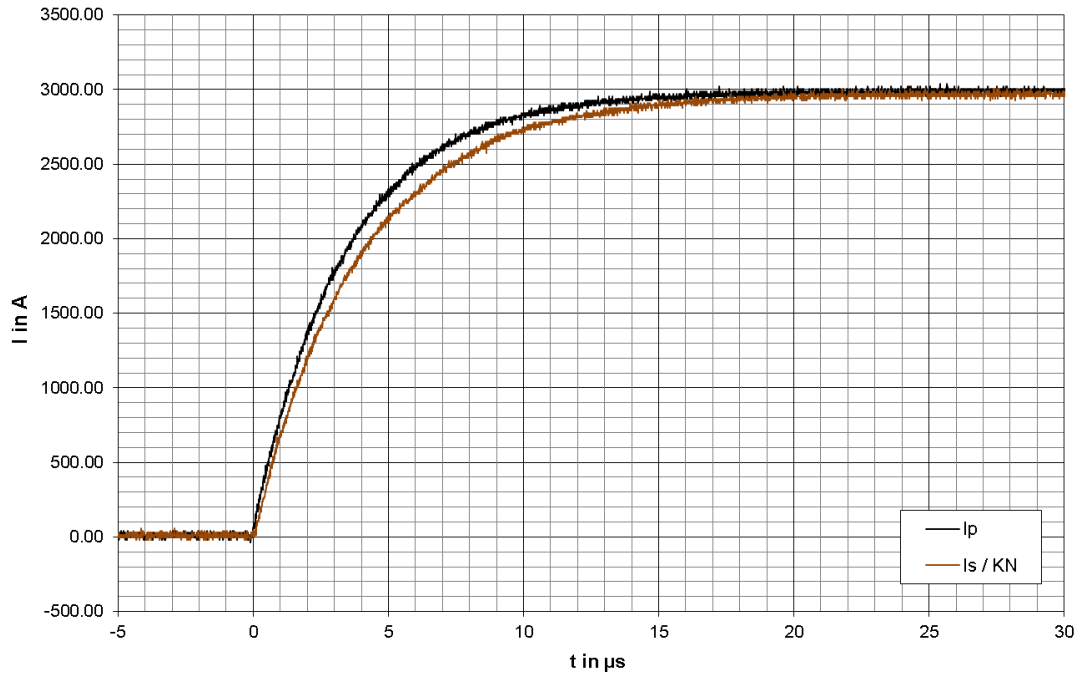
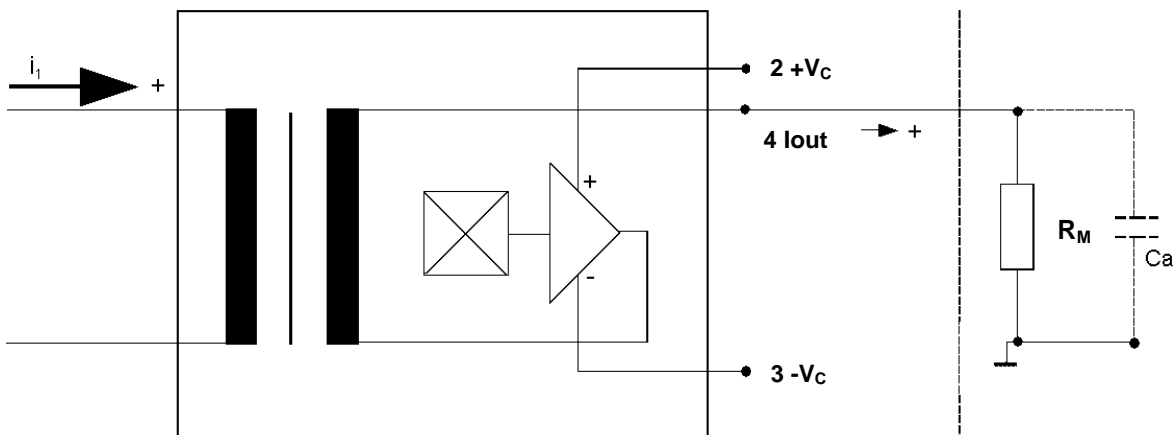


Fig. 2: Output current reaction of a 3kA current pulse with  $R_M = 10\Omega$

**Schematic diagram:**



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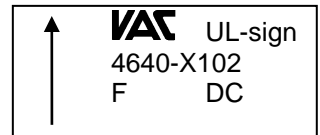
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Maßbild (mm): Freimaßtoleranz DIN ISO 2768-c  
Mechanical outline General tolerance

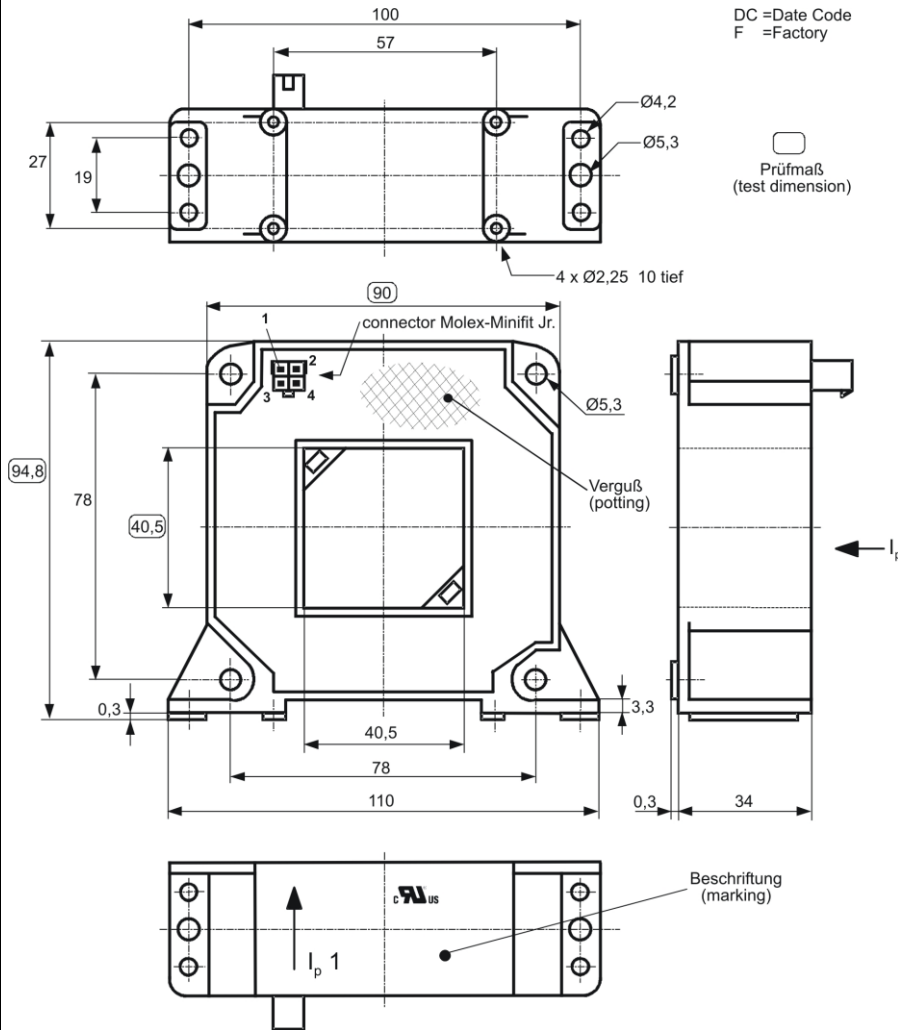
Anschlüsse:  
Connections:  
**Connector:**  
Molex Minifit(4Pin)

Pin 1: n.c.  
Pin 2: +V<sub>C</sub>  
Pin 3: -V<sub>C</sub>  
Pin 4: I<sub>out</sub>

Beschriftung  
(marking):



<sup>1</sup> I<sub>p</sub>: positive current  
direction



**Offset ripple reduction**

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

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

In this case the response time is enlarged.

It is calculated from:

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

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**Inspection<sup>1)</sup>** (Measurement after temperature balance of the samples at room temperature; SC = significant characteristic)

|                |            |         |  |                    |         |
|----------------|------------|---------|--|--------------------|---------|
| $K_N(N_1/N_2)$ | (V)        | M3011/6 | Transformation ratio ( $I_P=3*1000A$ , 40-80 Hz)                   | 1 : 5000 $\pm$ 0.4 | %       |
| $I_0$          | (V)        | M3226   | Offset current   | < 0.1              | mA      |
| $V_{P,eff}$    | (V)        | M3014   | Test voltage, rms, 1s<br>Pin 1 - 4 to Primary                      | 2.2                | kV (SC) |
| $V_e$          | (AQL 1/S4) |         | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS) | 1500<br>1875       | V<br>V  |

**Type Testing** (Pin 1 - 4 to primary)

Designed according standard EN 61800 with insulation material group 1

|       |  |   |       |              |        |
|-------|--|---|-------|--------------|--------|
| $V_W$ |  | HV transient test according (to M3064)<br>(1,2 $\mu s$ / 50 $\mu s$ -wave form) |       | 12           | kV     |
| $V_d$ |  | Testing voltage acc. M3014 (RMS)  | (5 s) | 6            | kV     |
| $V_e$ |  | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS)              |       | 1500<br>1875 | V<br>V |

**Applicable documents**

Constructed and manufactured and tested in accordance with EN 61800.

Further standards: UL 508 ; file E317483, category NMTR2 / NMTR8

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**Explanation of several of the terms used in the tablets (in alphabetical order)**

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

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

$t_r$ : Response time, measured as delay time at  $I_P = 0,8 \cdot I_{Pmax}$  between a rectangular current and the output current.

$\Delta t (I_{Pmax})$ : Delay time between  $I_{Pmax}$  and the output current  $i_a$  with a primary current rise of  $di_1/dt = 1200 A/\mu s$ .

$U_{PD}$  Rated discharge voltage (recurring peak voltage separated by the insulation) proved with a sinusoidal voltage  $V_e$   
 $U_{PD} = \sqrt{2} \cdot V_e / 1,5$

$V_{vor}$  Defined voltage is the RMS value of a sinusoidal voltage with peak value of  $1,875 \cdot U_{PD}$  required for partial discharge test in IEC 61800-5-1

$$V_{vor} = 1,875 \cdot U_{PD} / \sqrt{2}$$

$V_{sys}$  System voltage RMS value of rated voltage according to IEC 61800-5-1

$V_{work}$  Working voltage voltage according to IEC 61800-5-1 which occurs by design in a circuit or across insulation

$X_{ges}(I_{PN})$ : 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 ( $I_o = 0$ )

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

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

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

Where  $I_P$  is any input DC and  $I_{Sx}$  the corresponding output term.  $I_{SN}$ : see notes of  $F_i$  ( $I_o = 0$ ).

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