

K-No.: 26358

 1000 A Current Sensor for $\pm 24V$ - Supply Voltage
 for electric current measurement:
 DC, AC, pulsed, mixed ..., with a galvanic isolation between
 primary circuit (high power) and secondary circuit (electronic circuit)

Date: 10.04.2014

Customer: Standard Type

Customer part no.:
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Electrical data

I_{PN}	Primary nominal r.m.s. current	1000	A
R_M^*	Measuring resistance	0 ... 100	Ω
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 @ $R_M = 10 \Omega$; $T_A = 25^\circ C$	2500			A
	@ $R_M = 10 \Omega$; $T_A = 85^\circ C$	2150			A
X	Accuracy @ I_{PN} , $T_A = -40 \dots +85^\circ C$			0.4	%
ϵ_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		μs
$\Delta t (I_{P,max})$	Delay time at $di/dt = 1200 A/\mu s$			1	μs
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	± 21.60	± 24	± 25.2	V
I_{CO}	Current consumption for $I_P = 0A$		27		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 - 3 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.	82	Completion of data sheet: X, V_C , „max. Potential...“ (page1), Values for supply voltage (page2), maximum continuous currents at defined Temperatures (page2), UL-sign (page4). Applicable documents added, V_d 6kV (page5). CN-987

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Maximal peak currents at defined temperatures Values for supply voltage $\pm 22.80 V (\pm 24 V - 5 \%)$

T_A	55 °C	55 °C	55 °C	55 °C
R_M	1 Ω	5 Ω	20 Ω	50 Ω
$I_{P,max}$	2880A	2610A	1930A	1270A

T_A	85 °C	85 °C	85 °C	85 °C
R_M	1 Ω	5 Ω	20 Ω	50 Ω
$I_{P,max}$	2610A	2390A	1810A	1220A

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 _{rms}	1200 A _{rms}

Limit curve of measurable current $\hat{I}_P=f(R_M)$ Values for supply voltage $\pm 22.80 V (\pm 24 V - 5 \%)$

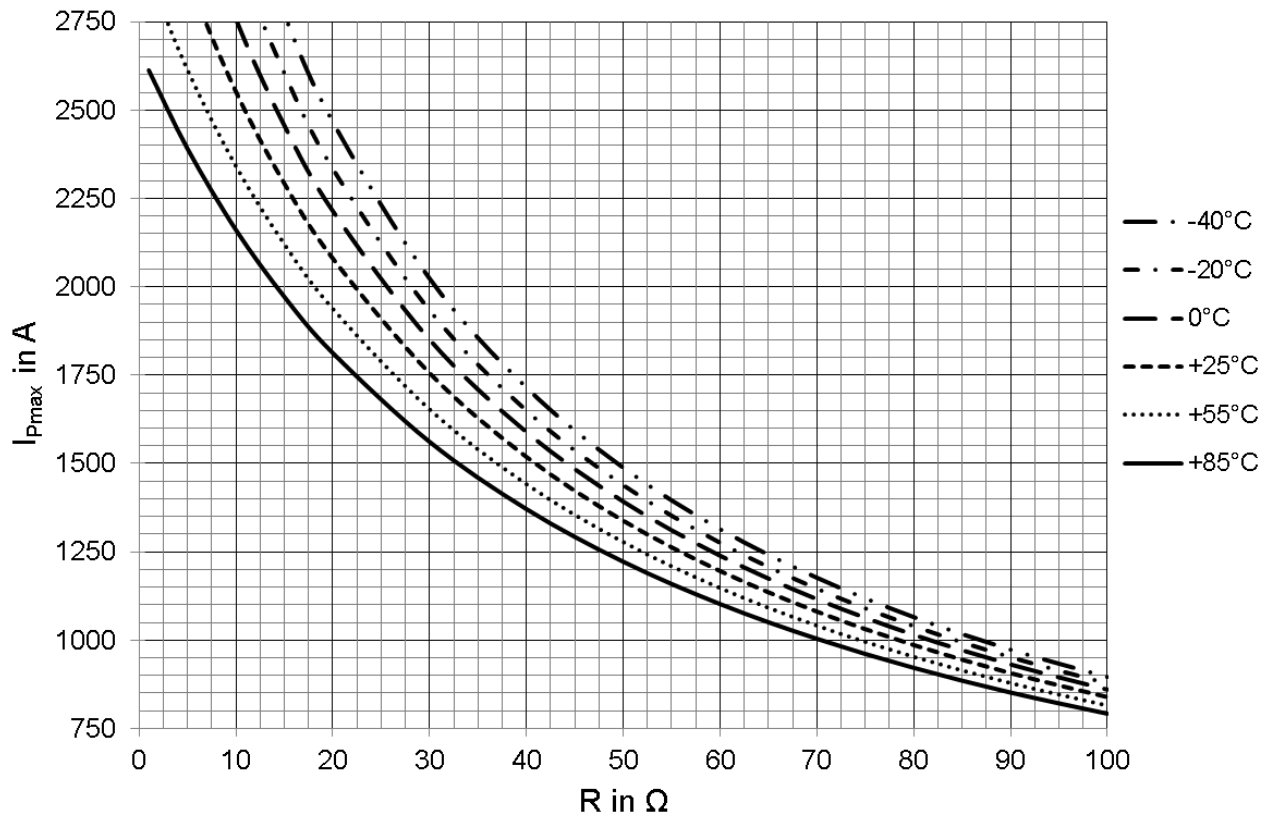


Fig. 1: $I_{P,max} = f(R_M) @ T_A$

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Overload puls (μs -range)

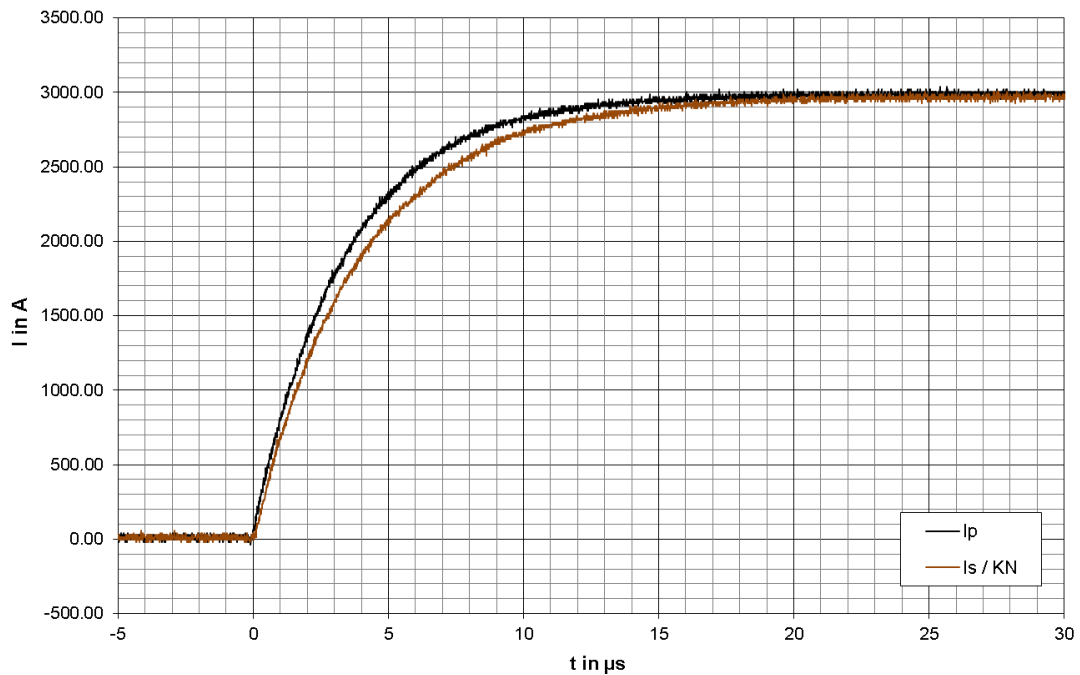
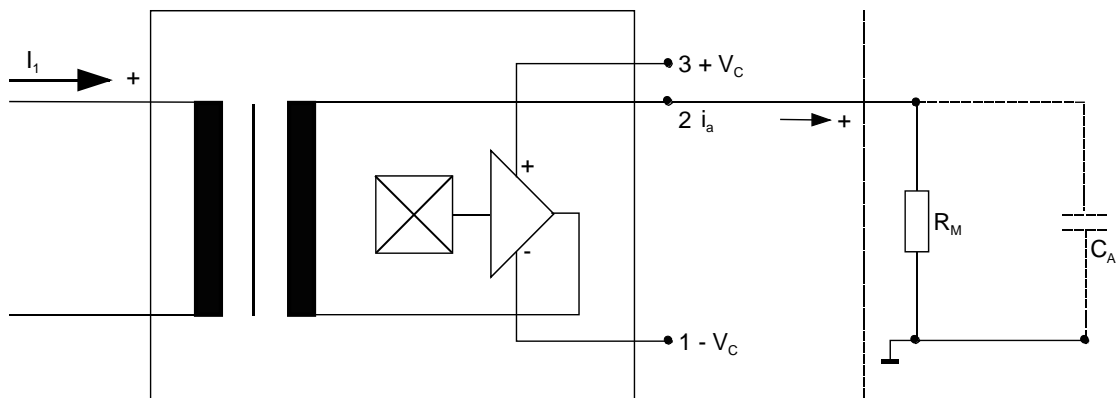


Fig. 2: Output current reaction of a 3kA current pulse with $R_M = 10\Omega$

Schematic diagram:



The polarity of the supply voltage is very important!
With the wrong polarity, the current sensor will be damaged after a few seconds!

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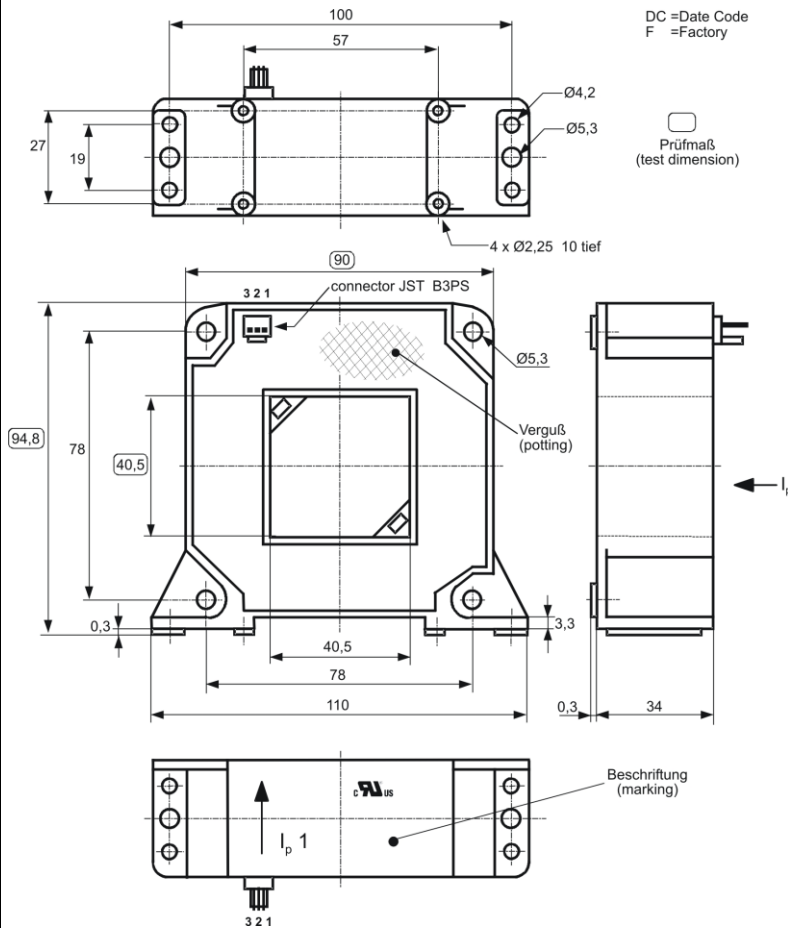
Maßbild (mm): Freimaßtoleranz DIN ISO 2768-c
Mechanical outline General tolerance

Anschlüsse:
Connections:
Connector:
Molex JST B3PS

Pin 1: -V_C
Pin 2: I_{Out}
Pin 3: +V_C

Beschriftung
(marking):

↑ **VAC** UL-sign
4640-X151
F DC



¹ I_p: 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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Inspection¹⁾ (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_o	(V)	M3226	Offset current	< 0.1	mA
$V_{P,eff}$	(V)	M3014	Test voltage, rms, 1s Pin 1 - 3 to Primary	2.2	kV (SC)
V_e	(AQL 1/S4)		Partial discharge voltage acc. M3024 (RMS) with V_{vor} (RMS)	1500 1875	V V

Type Testing (Pin 1 - 3 to primary)

Designed according standard EN 61800 with insulation material group 1

V_w		HV transient test according (to M3064) (1,2 μs / 50 μs -wave form)		12	kV
V_d		Testing voltage acc. M3014 (RMS)	(5 s)	6	kV
V_e		Partial discharge voltage acc. M3024 (RMS) with V_{vor} (RMS)		1500 1875	V 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_0 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.
- Δt (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 ($I_0 = 0$)
- 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:

$$X_{Ti} = 100 \cdot \left| \frac{I_{SB}(T_{A2}) - I_{SB}(T_{A1})}{I_{SN}} \right|$$
- ε_L:** Linearity fault defined by

$$\epsilon_L = 100 \cdot \left| \frac{I_P}{I_{PN}} - \frac{I_{Sx}}{I_{SN}} \right|$$

 Where I_P is any input DC and I_{Sx} the corresponding output term. I_{SN} : see notes of F_i ($I_0 = 0$).

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