

**K-No.:** 26358

**1000 A Current Sensor for ±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:** 25.11.2016

**Customer:** Standard Type

**Customer part no.:**
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**Electrical data**

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

<sup>1</sup> connected to sensor output,  $R_M$  for  $I_{P,max}$  see fig. 1 on page 2

**Accuracy – Dynamic performance data**

		min.	typ.	max.	Einheit
$I_{P,max}^2$	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	%
$\epsilon_L$	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	-	$\mu s$
$t_{ra}$	Reaction time @ 10% of $I_{PN}$ ( $di/dt = 1200 A/\mu s$ )	-	-	1	$\mu s$
$f_{BW}$	Frequency bandwidth	DC...100	-	-	kHz

<sup>2</sup> currents with high slew rates can be measured above  $I_{P,max}$  (transformer behavior)

**General data**

		min.	typ.	max.	Einheit
$\vartheta_A$	Ambient operating temperature	-40	-	+85	$^\circ C$
$\vartheta_S$	Ambient storage temperature	-40	-	+85	$^\circ C$
m	Mass	-	550	-	g
$U_C$	Supply voltage	±21.60	±24	±25.2	V
$I_{C0}$	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
* $U_{sys}$	System voltage (determines impulse voltage acc. table 7)	-	-	1000	$V_{RMS}$
* $U_{AC}$	Working voltage (acc. $U_{ACL}$ as limit in table 3)	-	-	1000	$V_{RMS}$
* $U_{PD}$	Rated discharge voltage (acc. table 24 with $U_{PD}=U_{ACP}$ )	-	-	1500	$V_{DC}$
	Max. potential difference acc. to UL 508	-	-	1414	$V_{peak}$
		-	-	1000	$V_{rms}$

\* Constructed and manufactured and tested in accordance with EN 61800-5-1:2007 (Pin 1 - 3 to primary opening)

Reinforced insulation, Insulation material group 1, Pollution degree 2, Overvoltage category III

Datum	Name	Index	Änderung
25.11.16	Ku	83	Typo: Page 2, Table 55°C/1Ω/2880A changed Dwell time from <10min to <3min. minor change.
29.06.16	Ku	83	Sensor optimized. CN-15-730

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**Capability of the sensor for measuring max. peak currents at defined temperatures,  
values for supply voltage  $\pm 22.80 V (\pm 24 V - 5 \%)$ :**

$\vartheta_A$	55 °C	55 °C	55 °C	55 °C	85 °C	85 °C	85 °C	85 °C
$R_M$	1 $\Omega$	5 $\Omega$	20 $\Omega$	50 $\Omega$	1 $\Omega$	5 $\Omega$	20 $\Omega$	50 $\Omega$
$I_{P,max}$	2880A	2610A	1930A	1270A	2610A	2390A	1810A	1220A
Dwell time	< 3min	< 10min	< 10min	< 30min	< 3min	< 3min	< 3min	< 15min

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

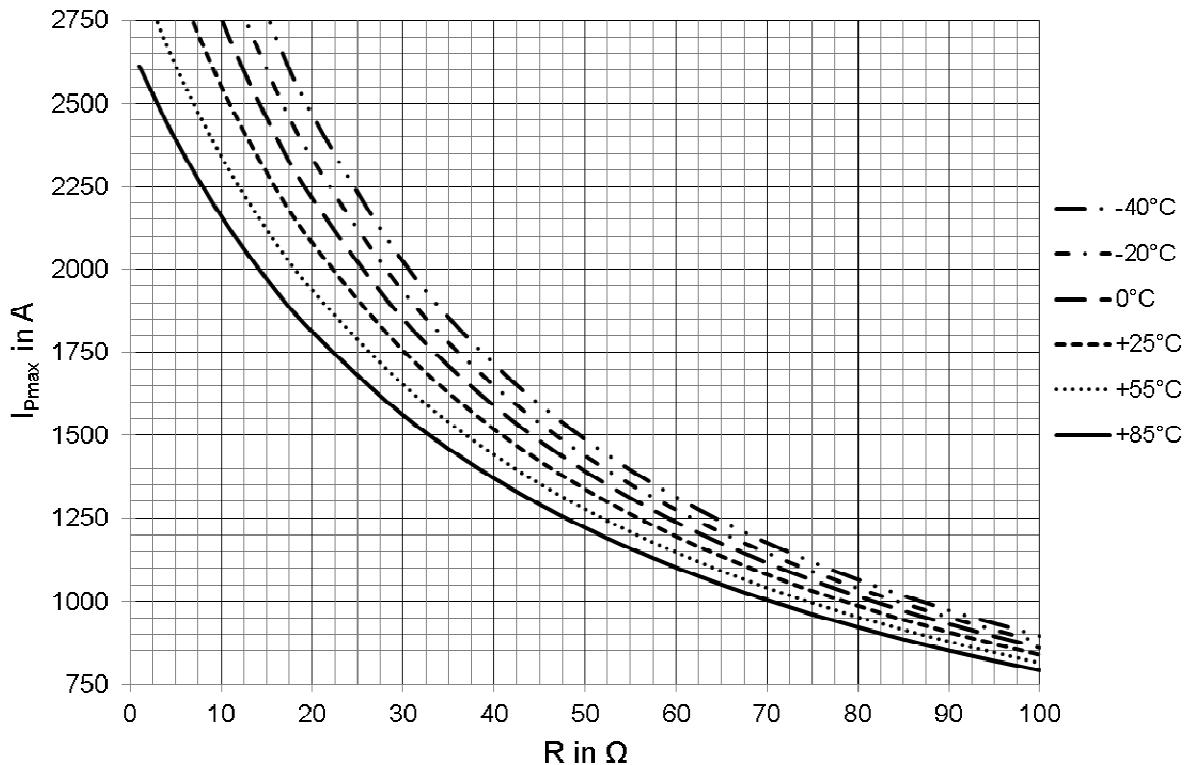


Fig. 1:  $I_{P,max} = f(R_M) @ \vartheta_A$

**Absolute maximum conditions:**

$\vartheta_A$	$\leq 70 \text{ }^\circ\text{C}$	$70 \text{ }^\circ\text{C} < \vartheta_A \leq 85 \text{ }^\circ\text{C}$
$I_P = I_{P,max}$ up to	1800 A <sub>DC</sub>	1200 A <sub>DC</sub>

Stresses above these conditions may cause permanent damage. Exposure to absolute maximum rating conditions for extended periods will degrade device reliability and lifetime expectancy. Functional operation of the device at these or any other conditions beyond those specified in this specification is not permitted.

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**Overload pulse (us-range)**

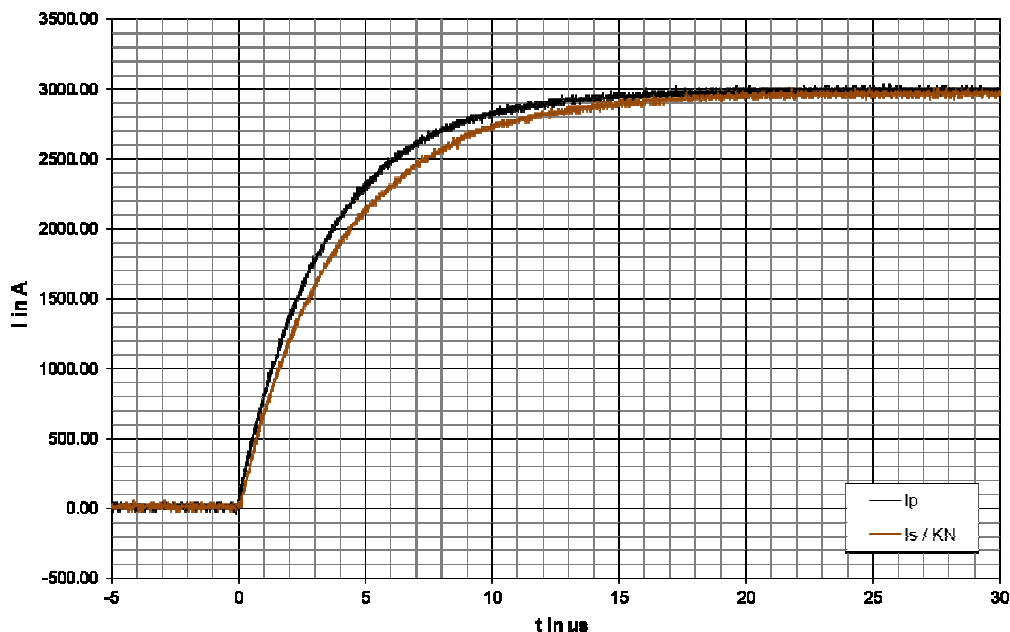
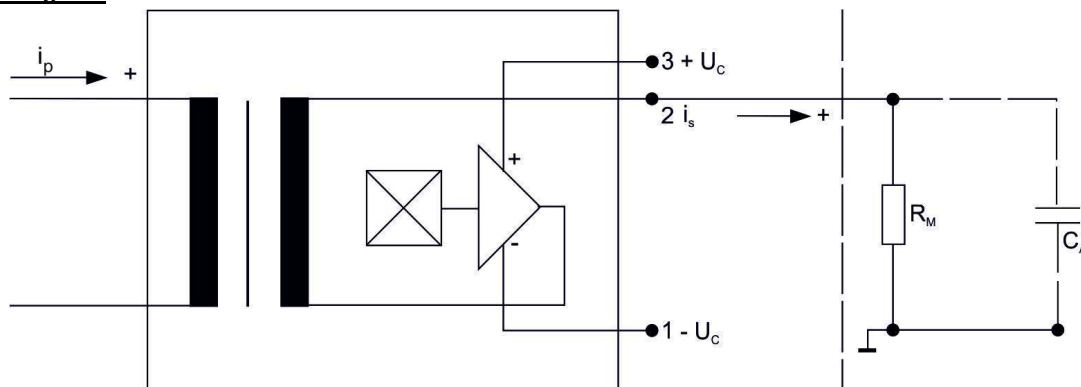


Fig. 2: Output current reaction of a 3kA current pulse with  $R_M = 10\Omega$

**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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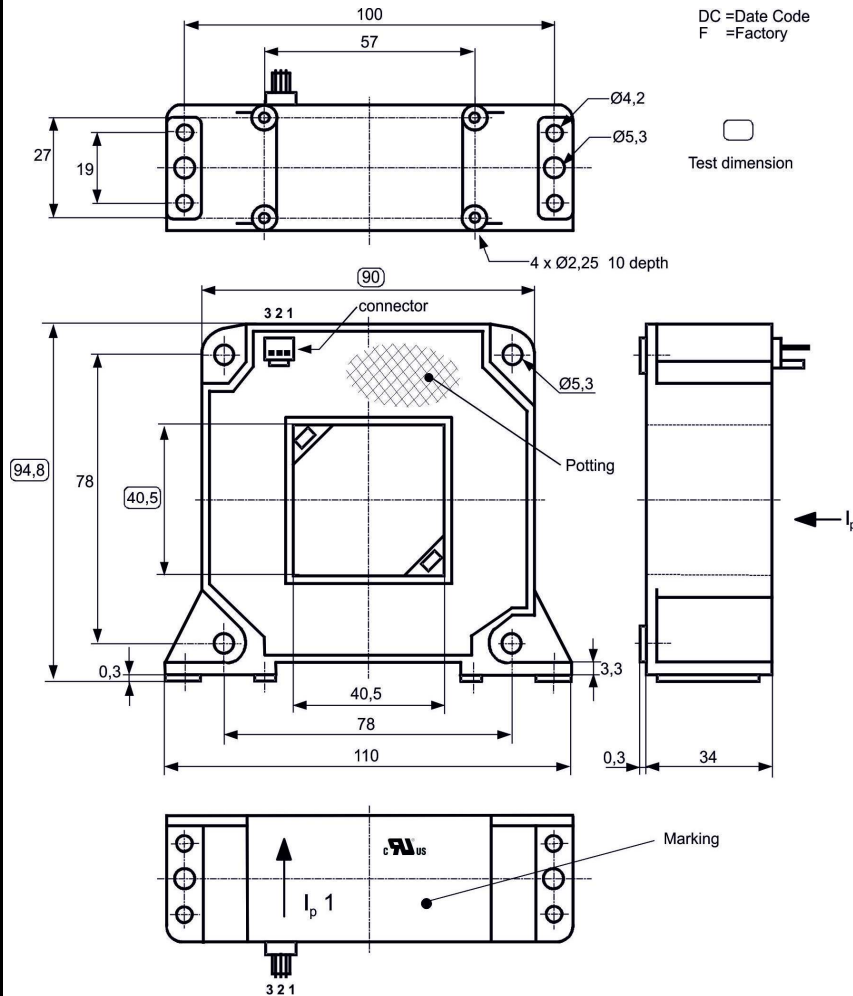
**Mechanical outline (mm)**

General tolerances DIN ISO 2768-c

**Connections:**

Connector:  
JST B3PS

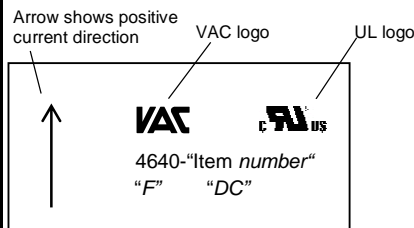
Pin 1:  $-U_C$   
Pin 2:  $I_S$  (output current)  
Pin 3:  $+U_C$



**Marking**

**Explanation:** Item number: see Tab.2 (left column)  
F = Factory code  
DC = Date code

**Example:** Sensor with end number X152  
Produced in Slovakia in April 2015  
→ Part number: 4640-X152  
→ Factory code: SK  
→ Date code: F4



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**Offset ripple reduction**

 The offset ripple can be reduced by an external low pass. The simplest solution is a passive low pass filter of 1st order by connecting a capacitor parallel to the burden resistor  $R_M$  as shown on page 3. The required capacitance can be calculated as follows:

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

In this case the response time is enlarged. It is calculated from:

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

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

$K_N(N_1/N_2)$	(100%) M3011/6	Transformation ratio ( $I_{PN}=3\pm 1000A$ , 40-80 Hz)		1 : 5000 ± 0.4	% (SC)
$I_0$	(100%) M3226	Offset current		< 0.1	mA (SC)
$U_P$	(100%) M3014	Test voltage (1s) Pin 1 - 3 to primary opening	(RMS)	2.2	kV (SC)
$U_{PDE}$	(AQL 1/S4)	Partial discharge voltage (extinction)	(RMS)	1500	V
$U_{PD(rms)} \cdot 1.875$		*acc. table 24	(RMS)	1875	V

**Type Test** (Pin 1 - 3 to primary opening)

$\dot{U}_W$	M3064	HV transient test, *acc. table 18, 19 (1.2 µs / 50 µs-wave form)		12	kV
$U_P$	M3014	Test voltage (5s)	(RMS)	6	kV
$U_{PDE}$		Partial discharge voltage (extinction)	(RMS)	1500	V
$U_{PD(rms)} \cdot 1.875$		*acc. table 24	(RMS)	1875	V
ESD	EN 61000-4-2	contact / surface		±8 / ±15	kV

\* IEC 61800-5-1:2007.

**Applicable documents**

Constructed and manufactured and tested in accordance with EN 61800-5-1:2007

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

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**Explanation to parameters used in this datasheet**

**Accuracy**

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

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

X: Permissible measurement error in the final inspection at RT.  $I_{SB}$  is the DC output current for a DC primary current with the same value as the (positive) rated current  $I_{PN}$  (with  $I_O = 0$ )

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

$X_{Ti}$ : Temperature drift of the rated value orientated output term.  $I_{SN}$  (cf. Notes on  $F_i$ ) in a specified temperature range:  $I_{SB}$  is the secondary current at temperature  $\vartheta_{A1}$  or  $\vartheta_{A2}$

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

$\epsilon_L$ : Linearity fault where  $I_P$  is any input DC and  $I_{Sx}$  the corresponding output term. ( $I_O = 0$ ).

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

**Offset and drift**

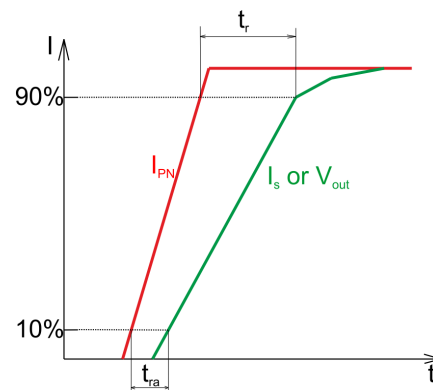
$I_{OH}$ : Zero variation after overloading with a DC of tenfold the rated value ( $R_M = R_{MN}$ )

$I_{Ol}$ : Long term drift of  $I_O$  after 100 temperature cycles in the range -40 to 85 °C.

**Dynamic properties**

$t_{ra}$ : Reaction time, measured as a delay time between a rectangular primary current ( $di/dt \approx 1200A/\mu s$ ) and the output current  $I_S$  at  $I_P = 0.1 \cdot I_{PN}$

$t_r$ : Response time, measured as a delay time between a rectangular primary current and the output current  $I_S$  at  $I_P = 0.9 \cdot I_{PN}$



**Voltage ratings** (according to IEC 61800-5-1:2007)

$U_{PD}$ : Rated discharge voltage (recurring peak voltage separated by the insulation)

$U_{sys}$ : System voltage: RMS value of rated voltage

$U_{AC}$ : Working voltage: RMS voltage which occurs by design in a circuit or across an insulation

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