

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: 17.02.2016

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	Ω
I_{SN}	Secondary nominal r.m.s. current	200	mA
K_N	Turns ratio	(1): 5000	

¹ 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	%
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
t_{ra}	Reaction time @ 10% of I_{PN} ($di/dt = 1200 A/\mu s$)	-	-	1	μs
f_{BW}	Frequency bandwidth	DC...100	-	-	kHz

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

General data

		min.	typ.	max.	Einheit
ϑ_A	Ambient operating temperature	-40	-	+85	$^\circ C$
ϑ_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
17.02.16	Ku	82	Data sheet reworked. CN-516

Hrsg.: KB-E editor	Bearb.: Ku. designer	KB-PM: KRe. check	freig.: Berton released
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**Capability of the sensor for measuring max. peak currents at defined temperatures,
values for supply voltage $\pm 22.80 V (\pm 24 V - 5 \%)$:**

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

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

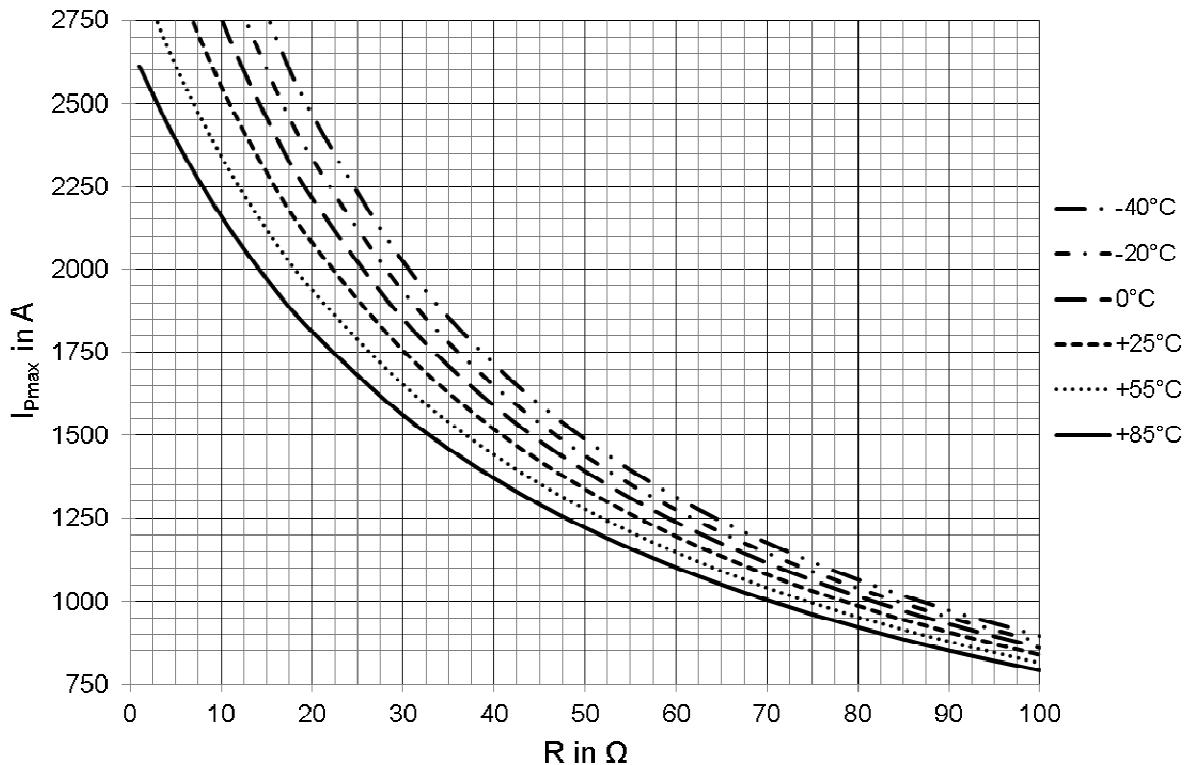


Fig. 1: $I_{P,max} = f(R_M) @ \vartheta_A$

Absolute maximum conditions:

ϑ_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 _{DC}	1200 A _{DC}

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)

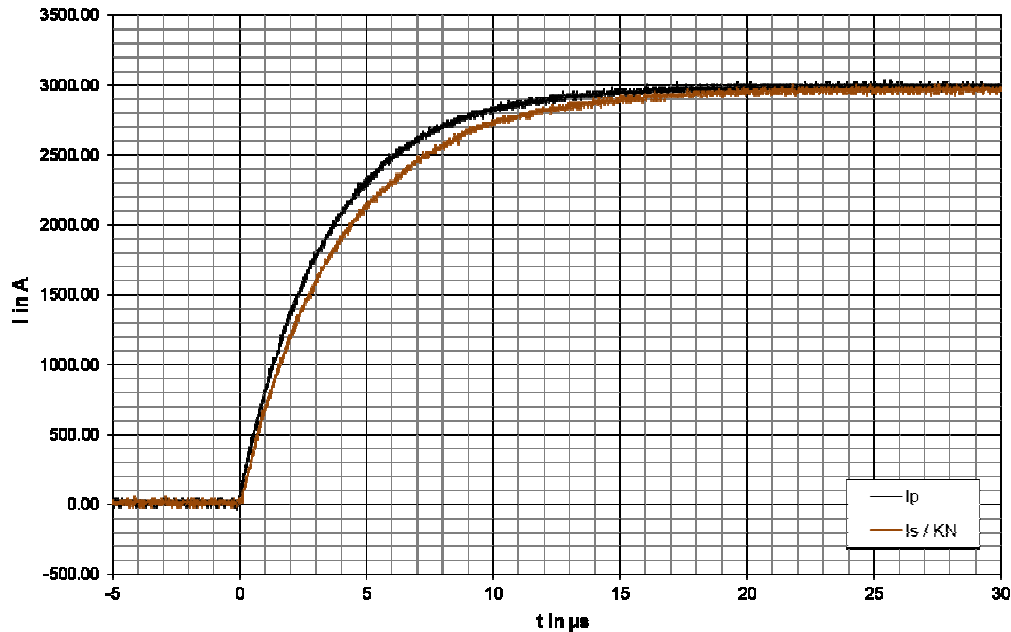
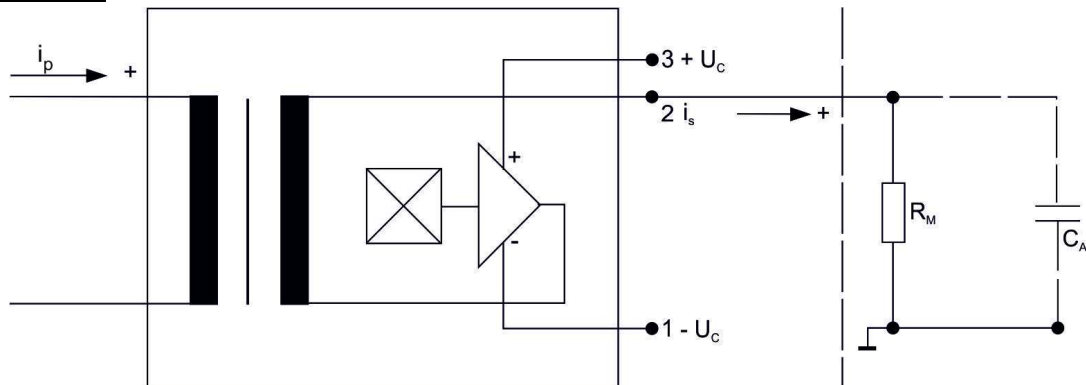


Fig. 2: Output current reaction of a 3kA current pulse with $R_M = 10\Omega$

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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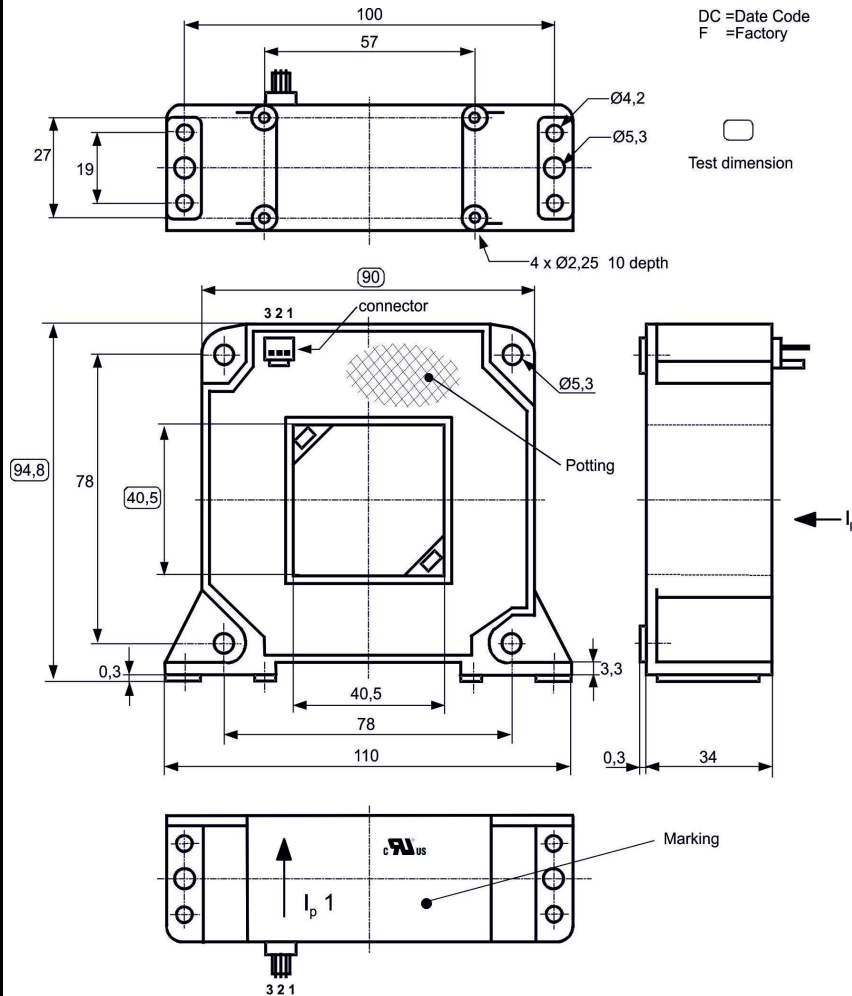
Mechanical outline (mm)

General tolerances DIN ISO 2768-c

Connections:

Connector:
JST B3PS

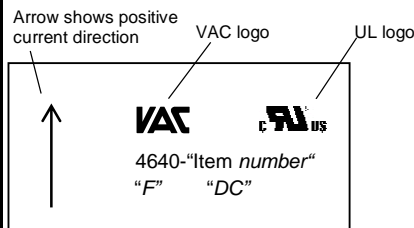
Pin 1: $-U_C$
Pin 2: I_S (output current)
Pin 3: $+U_C$



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 Test¹⁾ (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}:

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

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 θ_{A1} or θ_{A2}

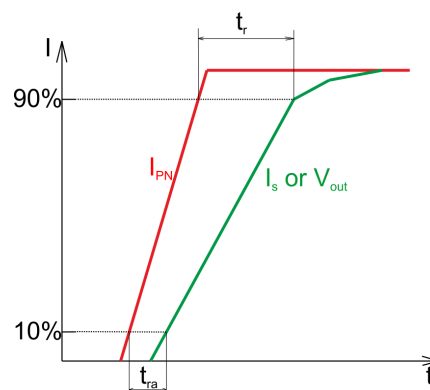
$$X_{TI} = 100 \cdot \left| \frac{I_{SB}(\theta_{A2}) - I_{SB}(\theta_{A1})}{I_{SN}} \right|$$

ε_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 ≈ 1200A/μs) and the output current I_S at I_P = 0.1 * 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 * 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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