VACUUMSCHMELZE	SPECIFICATION	Item no.: T60404-N4646-X100

K-No.: 25033

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: 20.01.2023

Customer: Standard type | Customers Part no.: |

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
- Short response time
- Wide frequency bandwidth
- Compact design
- Reduced offset ripple

Applications
Mainly used for stationary operation in industrial applications:
- AC variabel speed drives and servo motor drives
- Static converters for for DC motor drives
- Battery supplied applications
- Switched Mode Power Supplies (SMPS)
- Power Supplies for welding applications
- Uninterruptable Power Supllies (UPS)

Electrical data – Ratings

I_{PN}	Primary nominal r.m.s. current	100	A
R_M	Measuring resistance V_C=± 12V	10 ... 200	Ω
	V_C=± 15V	40…400	Ω
I_{SN}	Secondary nominal r.m.s. current	100	mA
K_N	Turns ratio	1: 1000	

Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range				
	@ V_C = ±12V, R_M = 10 Ω (t_{max} = 10sec)	±230			A
	@ V_C = ±15V, R_M = 40 Ω (t_{max} = 10sec)	±180			A
X	Accuracy @ I_{PN}, T_A= 25°C		0.1	0.5	%
ε_L	Linearity			0.1	%
I_0	Offset current @ I_P=0, T_A= 25°C		0.04	0.1	mA
t_r	Response time		1		µs
Δt ($I_{P,max}$)	Delay time at di/dt = 100 A/µs		200		ns
f	Frequency bandwidth	DC...200			kHz

General data

		min.	typ.	max.	Unit
T_A	Ambient operating temperature	-40		+85	°C
T_S	Ambient storage temperature	-40		+90	°C
m	Mass		14		g
V_C	Supply voltage	±11.4	±12 or ±15	±15.75	V
I_C	Current consumption		18		mA
	Constructed and manufactored and tested in accordance with EN 61800-5-1 (primary vs. secondary) Reinforced insulation, Insulation material group 1, Pollution degree 2				
S_{clear}	Clearance (component without solder pad)	12			mm
S_{creep}	Creepage (component without solder pad)	12			mm
V_{sys}	System voltage overvoltage category 3	RMS		600	V
V_{work}	Working voltage (table 7 acc. to EN61800-5-1) over voltage category 2	RMS		1000	V
U_{PD}	Rated discharge voltage	peak value		1225	V
Max. potential difference acc to UL 508		RMS		600	V

Maximal continuous and peak currents at defined temperatures

Supply voltage ±12 V:

T_A	85 °C	85 °C	70 °C	55 °C
I_P	60 A	100 A	80 A	100 A
$I_{P,max}$	235 A	149 A	241 A	246 A
R_M	10 Ω	36 Ω	10 Ω	10 Ω

Supply voltage ±15V:

T_A	85 °C	85 °C	70 °C	55 °C
I_P	50 A	75 A	70 A	100 A
$I_{P,max}$	182 A	130 A	184 A	186 A
R_M	40 Ω	70 Ω	40 Ω	40 Ω

Date	Name	Issue	Amendment
20.01.2023	DJ	81	Other instructions on sheet 4 changed. The color of the plastic material… added. Mechanical outline changed (size 4,28 added). Minor change

Hrsg.: R&D-PD NPI D editor	Bearb: DJ designer	MC-PM: FS. check	freig.: SB released

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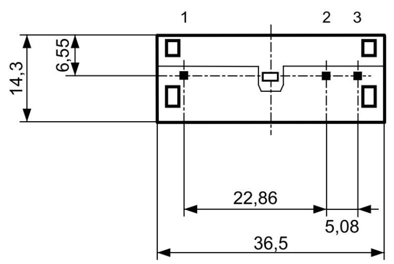
Mechanical outline (mm): General tolerances DIN ISO 2768-c



Tolerances grid distance ±0,2mm

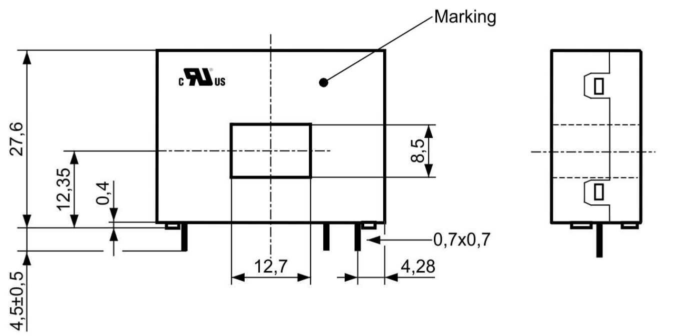
DC = Date Code
F = Factory

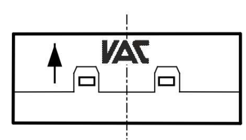
Connections:

1...3: 0,7 x 0,7 mm

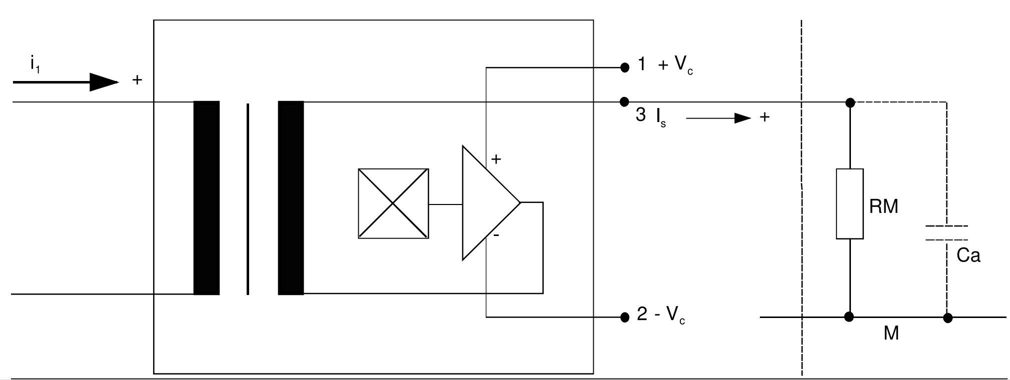
Marking:

UL-sign
4646-X100
F DC





Schematic diagram



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Electrical Data (investigate by a type checking)

		min.	typ.	max.	Unit
V_{Ctot}	Maximum supply voltage (without function) ±15.75 to ±18 V: for 1s per hour			±18	V
R_S	Secondary coil resistance @ T_A=85°C			38.5	Ω
X_{Ti}	Temperature drift of X @ T_A = -40 ... +85 °C			0.1	%
I_{0ges}	Offset current (including I_0, I_{0t}, I_{0T})			0.14	mA
I_{0t}	Long term drift Offset current I_0		0.05		mA
I_{0T}	Offset current temperature drift I_0 @ T_A = -40 ...+85°C		0.05		mA
I_{0H}	Hyteresis current @ I_P=0 (caused by primary current 10 x I_{PN})		0.05	0.1	mA
$\Delta I_0/\Delta V_C$	Supply voltage rejection ratio			0.01	mA/V
i_{oss}	Offset ripple (with1 MHz- filter first order)			0.2	mA
i_{oss}	Offset ripple (with 100 kHz- filter first order)		0.04	0.075	mA
i_{oss}	Offset ripple (with 20 kHz- filter first order)		0.015	0.025	mA
C_k	Maximum possible coupling capacity (primary – secondary)		6		pF

Inspection (Measurement after temperature balance of the samples at room temperature)

$K_N(N_1/N_2)$	(V)	M3011/6	Transformation ratio (I_P=100A, 40-80 Hz)	1 : 1000 ± 0,5	%
I_0	(V)	M3226	Offset current	< 0.1	mA
V_d	(V)	M3014:	Test voltage, rms, 1 s pin 1 – 3 vs. hole	1.8	kV
V_e	(AQL 1/S4)		Partial discharge voltage acc.M3024 (RMS) with V_{vor} (RMS)	1300 1625	V V

Type Testing (Pin 1 - 3 to hole)

V_W	HV transient test according to M3064 (1,2 µs / 50 µs-wave form)		8	kV
V_d	Testing voltage to M3014	(5 s)	3,6	kV
V_e	Partial discharge voltage acc.M3024 (RMS) with V_{vor} (RMS)		1300 1625	V V

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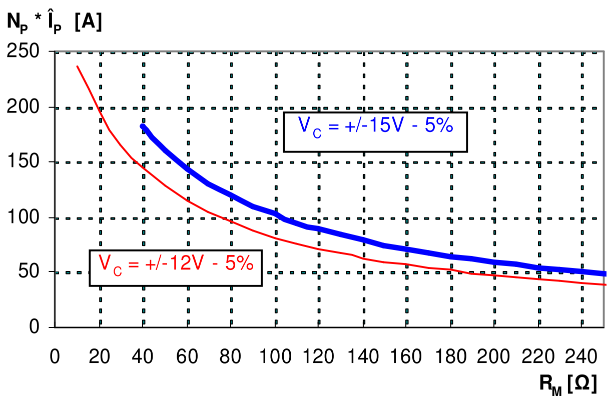
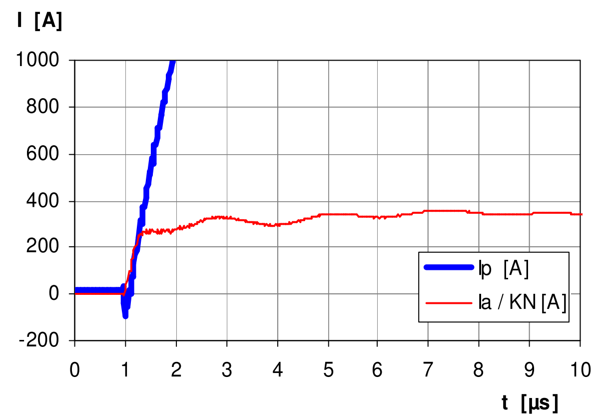
Limit curve of measurable current $\hat{I}_P(R_M)$

@ ambient temperature ≤ 85 °C



Maximum measuring range (µs-range)

Output current behaviour of a 3kA current pulse
@ V_C = ±15V und R_M= 100Ω



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 and be limited by diodes only.

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:

$$t_r' \leq t_r + 3 R_M C_a$$

Other instructions

- Current direction: A positive output current appears at point I_S, by primary current in direction of the arrow.
- Further standards UL 508, file E317483, category NMTR2 / NMTR8
- Temperature of the primary conductor should not exceed 105°C
- The color of the plastic material is not specified and the current sensor can be supplied in different colors (e.g. brown, black, white, natural). This has no effect on the specifications or UL approval

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<u>Explanation of several of the terms used in the tablets (in alphabetical order)</u>

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.

Δt (I_{Pmax}): Delay time between I_{Pmax} and the output current i_a with a primary current rise of di_1/dt = 100 A/µs.

U_{PD} Rated discharge voltage (recurring peak voltage separated by the insulation) proved with a sinusoidal voltage V_e

$U_{PD} = \sqrt{2} * V_e / 1{,}5$

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

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

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}:

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

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:

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

ε_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 ($I_o = 0$).