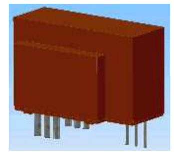
VAC VACUUMSCHMELZE	**Specification**	**Item no.: T60404-N4648-X400**

K-No.: 26392

25A 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: 05.03.2018

Customer: Standard type | Customers Part no: |

Description

- Closed loop (compensation) Current Sensor with magnetic 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 variable speed drives and servo motor drives
- static converters for DC motor drives
- Battery supplied applications
- Switched Mode Power Supplies (SMPS)
- Power supplies for welding applications
- Uninterruptable Power Supplies (UPS)

Electrical data - Ratings

I_{PN}	Primary nominal RMS current		25	A
R_M	Measuring resistance	V_C=±12V	10…200	Ω
		V_C=±15V	22…400	Ω
I_{SN}	Secondary nominal RMS current		25	mA
K_N	Transformation ratio		1…3:1000	

Accuracy – Dynamic performance data

		min.	typ.	max.	Unit
$I_{P,max}$	Max. measuring range				
	@V_C=±12V, R_M = 10Ω (t_{max} = 10sec)	±120			A
	@V_C=±15V, R_M = 22Ω (t_{max} = 10sec)	±130			A
X	Accuracy @ I_{PN}, θ_A = 25°C		0.1	0.5	%
ε_L	Linearity			0.1	%
I_O	Offset current @ I_P = 0A, θ_A = 25°C		0.02	0.1	mA
t_r	Response time		500		µs
t_{ra}	Reaction time at di/dt = 100 A/µs		200		µs
f_{BW}	Frequency bandwidth	DC…200			kHz

General data

		min.	typ.	max.	Unit
ϑ_A	Ambient operation temperature	-40		85	°C
ϑ_S	Ambient storage temperature	-40		90	°C
m	Mass		12		g
V_C	Supply voltage	±11.4	±12/±15	±15.75	V
I_C	Supply current at I_P = 0A and RT		15		mA
*s_{clear}	Clearance (component without solder pad)	10.2			mm
*s_{creep}	Creepage (component without solder pad)	10.2			mm
*U_{sys}	System voltage			600	V_{RMS}
*U_{AC}	Working voltage			1000	V_{RMS}
*U_{PD}	Rated discharge voltage			1414	V_S
	Max. Potential difference acc. to UL 508			600	V_{AC}

* Constructed, manufactured and tested in accordance with IEC 61800-5-1:2007 (primary to secondary)
Reinforced insulation, Insulation material group 1, Pollution degree 2, Overvoltage category III

Date	Name	Issue	Amendment
05.03.2018	KRe	81	Sheet 4) other instruction changed (PCBA is covered with conformal coating added). CN-18-044
13.08.2015	DJ	81	Marking with UL-sign, General data, routine-tests, Type-tests and Page 5 reworked. CN-15-419

Hrg.: R&D-PD NPI editor	Bearb.: DJ designer		KB-PM: Sn. check			freig.: Pr. released

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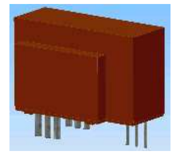
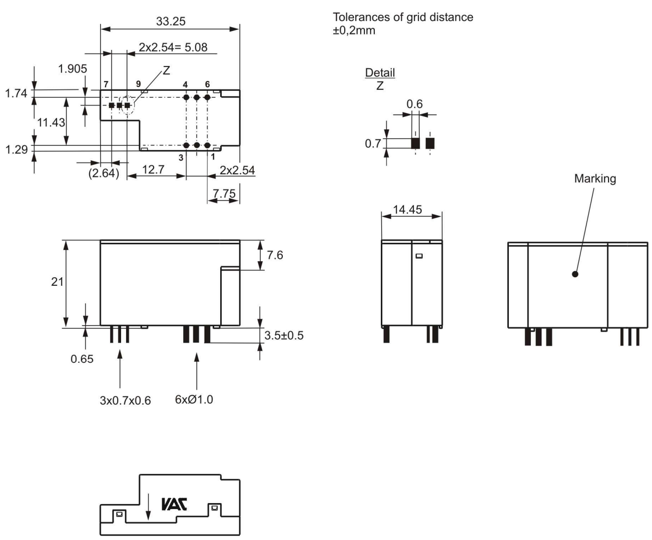


Mechanical outline (mm):

General tolerances DIN ISO 2768-c



Connections:

Pin Nr. 1-6:	Ø1,0mm
Pin Nr. 7-9:	0,7 x 0,6mm

Marking:

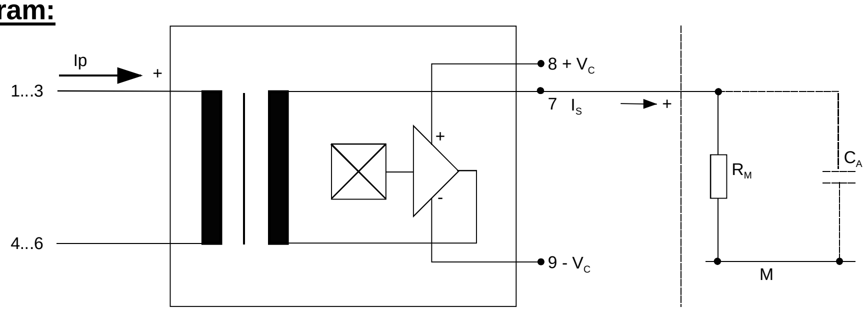
4648-X400
F DC

Explanation:

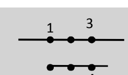
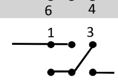
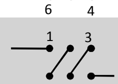
DC = Date Code
F = Factory

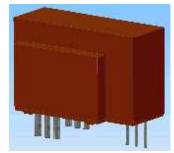
Current direction: A positive output current appears at point I_S, if primary current flows in direction of the arrow.

Schematic diagram:



Possibility of wiring for V_C = ±15V (@ θ_A = 85°C, R_M = 22Ω)

Primary-windings N_P	Primary current RMS I_P [A]	Primary current peak $\hat{I}_{P,max}$ [A]	Output current RMS I_S (I_P) [mA]	Transformation-ratio K_N	Primary-resistance R_P [mΩ]	circuit
1	25	130	25	1:1000	0,3	
2	10	65	20	2:1000	1,35	
3	8	43	24	3:1000	2,4	



Electrical data (investigate by a type checking)

		min.	typ.	max.	Unit
$V_{C,tot}$	maximum supply voltage (without function) ±15,75V to ±18V: for 1s per hour			±18	V
R_S	Secondary coil resistance @ T_A = 85°C			88	Ω
R_P	Primary coil resistance per turn @ T_A = 25°C			1	mΩ
X_{TI}	Temperature drift of X @ T_A = -40°C ... 85°C			0.1	%
$I_{O,ges}$	Offset current (including I_O, I_{Ot}, I_{OT})			0.15	mA
I_{Ot}	Long term drift offset current von I_O		0.05		mA
I_{OT}	Offset current temperature drift I_O @ T_A = -40°C … 85°C		0.05		mA
I_{OH}	Hysteresis current @ I_P = 0A (caused by I_P = 3 x I_{PN})		0.04	0.1	mA
$\Delta I_O/\Delta V_C$	Supply voltage rejection ratio			0.01	mA/V
i_{OSS}	Offsetripple* (with 1 MHz-Filter, first order)			0.4	mA
i_{OSS}	Offsetripple* (with 100 kHz-Filter, first order)		0.025	0.15	mA
i_{OSS}	Offsetripple* (with 20 kHz-Filter, first order)		0.001	0.04	mA
C_k	Maximum possible coupling capacity (primary - secondary)			6	pF
	Mechanical stress according to M3209/3 Settings: 10-2000Hz, 1min/oct, 2 hours			10	g

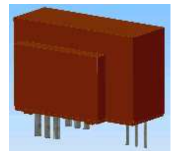
Routine-Tests: (Measurement after temperature balance of the samples at room temperature, SC = significant characteristic)

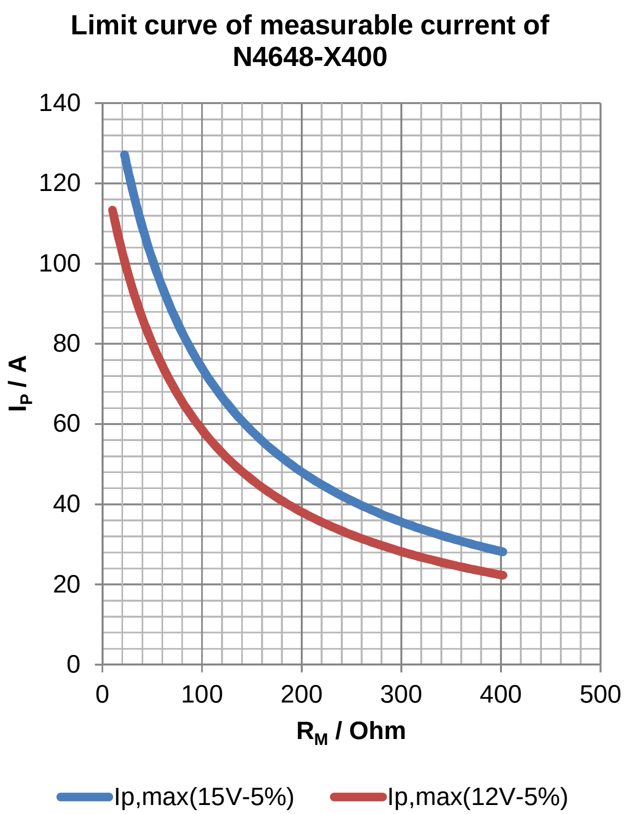
K_N (SC)	(100%) M3011/6:	Transformation ratio	3:1000 ± 0,5 %	
I_O	(100%) M3226:	Offset current	< 0.1	mA
U_P	(100%) M3014:	Test voltage, 1s	2.5	kV_{RMS}
U_{PDE} U_{PD}*1.875	(AQL 1/S4) M3024:	Partial discharge voltage (extinction) *acc. table 24	1.5 1.875	kV_{RMS}

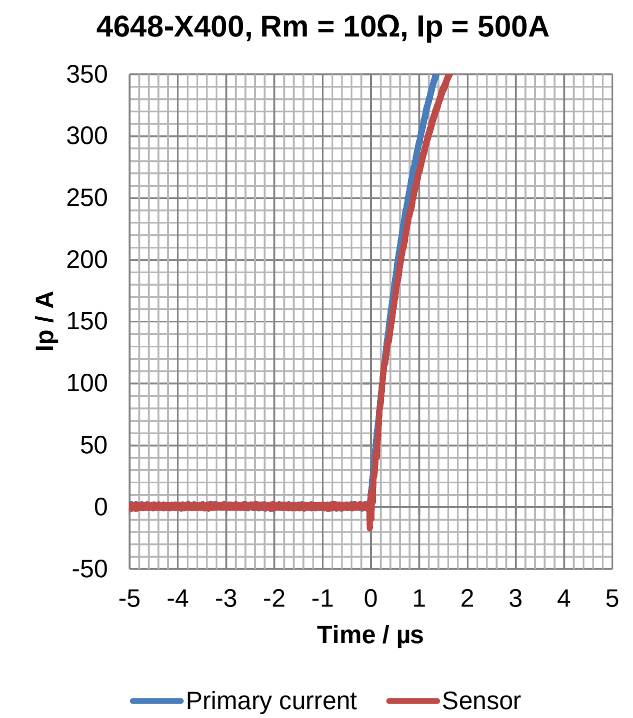
Type-Tests: (Precondition acc. to M3236)

$\hat{U}_W$	HV transient test acc. table 18,19 (1,2µs / 50µs-Waveform)	8	kV
U_P	Test voltage acc. to M3014, 5s	5	kV_{RMS}
U_{PDE} U_{PD}*1.875	Partial discharge voltage (extinction) *acc. table 24	1.5 1.875	kV_{RMS}

*IEC 61800-5-1:2007







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.

*Possible way to reduce the Offset ripple by a Low-Pass-Filter

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

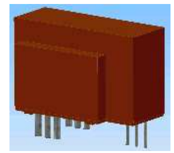
$$f_g = \frac{1}{2 * \pi * R_M * C_a}$$

In this case the response time is enlarged:

$$t_r' \leq t_r + 2{,}5 R_M C_a$$

Other instructions

- An exceptionally high rate of on/off – switching of the power supply voltage accelerates the aging process of the sensor
- Constructed, manufactured and tested in accordance with IEC 61800-5-1:2007.
- Temperature of the primary conductor should not exceed 100°C.
- Housing and bobbin material UL-listed: Flammability class 94V-0.
- PCBA is covered with conformal coating



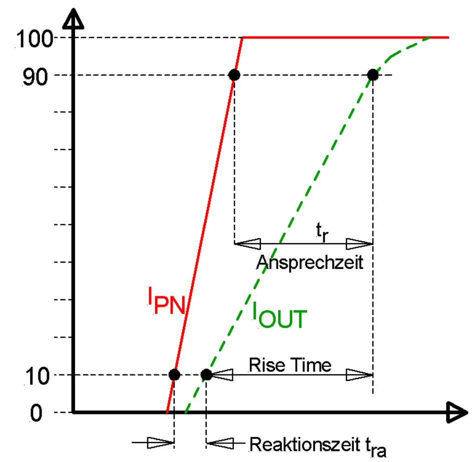
Explanation of several terms used in the tables:

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

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

t_r: Response time, measured as a delay time at I_P = 0.9 * I_{Pmax} between a rectangular primary current and the output current.

t_{ra} Reaction time, measured as a delay time at I_P = 0.1 * I_{Pmax} between a rectangular primary current and the output current. (with di/dt = 100A/µs)



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

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

X: Permissible measurement error in the final inspection at RT, defined by

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

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} in a specified temperature range, obtained by:

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

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

Where I_P is any input DC current and I_{SX} the corresponding output term. (I_O = 0).