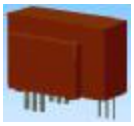
| VACUUMSCHMELZE | SPECIFICATION | Item no.: T60404-N4646-X400 |
|---|---|---|

K-No.: 24578

**25 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: 07.02.2008

Customer: Standard type | Customers Part no.: | Page 1 of 2

## 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
- Low 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[1)]

| | | | |
|---|---|---|---|
| $I_{PN}$ | Primary nominal r.m.s. current | 25 | A |
| $R_M$ | Measuring resistance $V_C$=± 12V | 10 ... 200 | Ω |
| | $V_C$=± 15V | 22 … 400 | Ω |
| $I_{SN}$ | Secondary nominal r.m.s. current | 25 | mA |
| $K_N$ | Turns ratio | 1…3 : 1000 | |

## Accuracy – Dynamic performance data[1)]

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $I_{P,max}$ | Max. measuring range | | | | |
| | @ $V_C$ = ±12V, $R_M$ = 10 Ω ($t_{max}$ = 10sec) | ±120 | | | A |
| | @ $V_C$ = ±15V, $R_M$ = 22 Ω ($t_{max}$ = 10sec) | ±130 | | | A |
| X | Accuracy @ $I_{PN}$, $T_A$= 25°C | | 0.1 | 0.5 | % |
| $\varepsilon_L$ | Linearity | | | 0.1 | % |
| $I_0$ | Offset current @ $I_P$=0, $T_A$= 25°C | | 0.02 | 0.1 | mA |
| $t_r$ | Response time | | 500 | | ns |
| Δt ($I_{P,max}$) | Delay time at di/dt = 100 A/µs | | 200 | | ns |
| f | Frequency bandwidth | DC...200 | | | kHz |

## General data[1)]

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $T_A$ | Ambient operating temperature | -40 | | +85 | °C |
| $T_S$ | Ambient storage temperature | -40 | | +90 | °C |
| m | Mass | | 12 | | g |
| $V_C$ | Supply voltage | ±11.4 | ±12 or ±15 | ±15.75 | V |
| $I_C$ | Current consumption | | 18,5 | | mA |
| | Constructed and manufactored and tested in accordance with EN 61800-5-1 (Pin 1 - 6 to Pin 7 – 9) Reinforced insulation, Insulation material group 1, Pollution degree 2 | | | | |
| $S_{clear}$ | clearance (component without solder pad) | 10.2 | | | mm |
| $S_{creep}$ | creepage (component without solder pad) | 10.2 | | | mm |
| $V_{sys}$ | System voltage overvoltage category 3 | RMS | | 600 | V |
| $V_{work}$ | Working voltage (table 7 acc. to EN61800-5-1) | RMS | | 1020 | V |
| $U_{PD}$ | Rated discharge voltage | peak value | | 1400 | V |

| Date | Name | Isuue | Amendment |
|---|---|---|---|
| 07.02.08 | Le | 82 | Write error: 50 A Current sensor changed into 25 A current sensor. Insignificant. |
| | | | |

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|---|---|---|---|---|---|---|

| VACUUMSCHMELZE | **SPECIFICATION** | **Item no.:** | **T60404-N4646-X400** |
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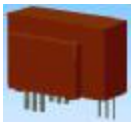
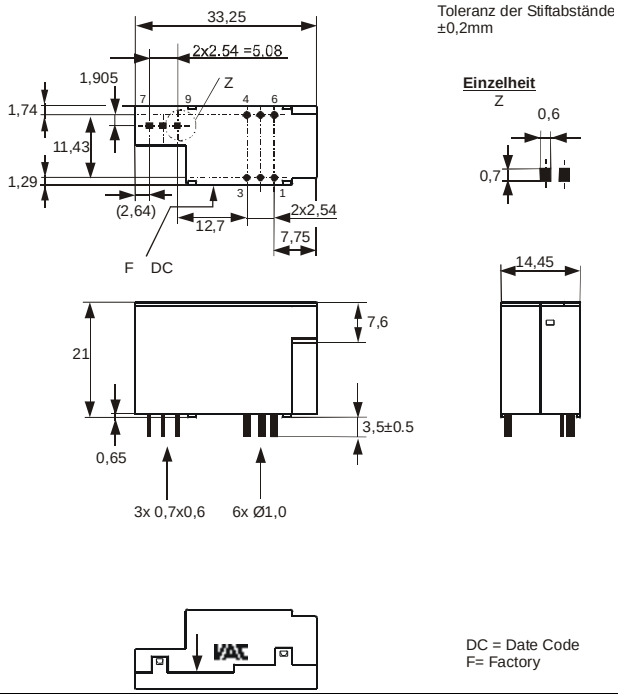
| K-No.: 24578 | **25 A Current Sensor**<br>For the electronic measurement of currents:<br>DC, AC, pulsed, mixed ..., with a galvanic<br>Isolation between the primary circuit<br>(high power) and the secondary circuit<br>(electronic circuit) |  | Date: 07.02.2008 |
|---|---|---|---|
| Customer: Standard type | Customers Part no.: | | Page 2 of 2 |

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

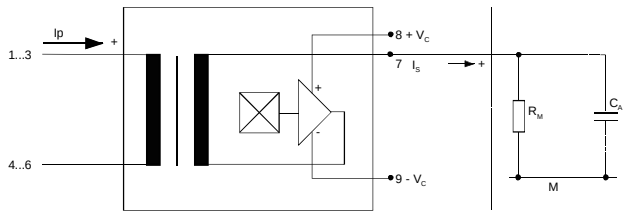



Connections:
1...6: ∅ 1,0 mm
7...9: 0,6x0,7 mm

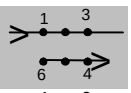
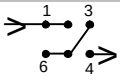
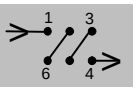
Marking:

VAC
4646X400
F DC

**Schematic diagram**




**Possibilities of wiring for $V_C$ = ±15V** [1)] (@ $T_A$ = 85°C, $R_M$ = 22 Ω)

| primary windings $N_P$ | primary current RMS $I_P$ [A] | primary current maximal $\hat{I}_{P,max}$ [A] | output current RMS $I_S$ ($I_P$) [mA] | turns ratio $K_N$ | primary resistance $R_P$ [mΩ] | wiring |
|---|---|---|---|---|---|---|
| 1 | 25 | 130 | 25 | 1:1000 | 0,12 |  |
| 2 | 10 | 65 | 20 | 2:1000 | 0,54 |  |
| 3 | 8 | 43 | 24 | 3:1000 | 1,1 |  |

Temperature of the primary conductor should not exceed 100°C.
Additional information is obtainable on request.
This specification is no declaration of warranty acc. BGB §443 dar.

| Hrg KB-E<br>editor | Bearb: Le<br>designer | | | KB-PM IA: KRe.<br>check | | freig.: Heu.<br>released |
|---|---|---|---|---|---|---|

| VACUUMSCHMELZE | Additional Information | Item No.: T60404-N4646-X400 |
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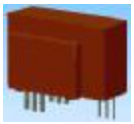
| K-No.: 24578 | **25 A Current Sensor**<br>For electronic current measurement:<br>DC, AC, pulsed, mixed ..., with a galvanic isolation between primary circuit (high power) and secondary circuit |  | Date: 07.02.2008 |
|---|---|---|---|

| Customer: | Customers Part No.: | Page 1 of 3 |
|---|---|---|

## Electrical Data (investigate by a type checking) [1)]

| | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|
| $V_{Ctot}$ | Maximum supply voltage (without function)<br>±15.75 … ±18 V: 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 ... +85 °C | | | 0.1 | % |
| $I_{0ges}$ | Offset current (including $I_0$, $I_{0t}$, $I_{0T}$) | | | 0.15 | 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 3 x $I_{PN}$) | | 0.04 | 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) | | | 0,15 | mA |
| $i_{oss}$ | Offset ripple* (with 100 kHz- filter first order) | | 0.03 | 0.05 | mA |
| $i_{oss}$ | Offset ripple* (with 20 kHz- filter first order) | | 0.007 | 0.015 | mA |
| $C_k$ | Maximum possible coupling capacity (primary – secondary) | | 4 | | pF |
| | Mechanical Stress according to M3209/3<br>Settings: 10 – 2000 Hz, 1 min/Decade, 2 hours<br>An exceptionally high rate of on/off – switching of the supply voltage accelerates the aging process of the sensor. | | | 10g | |

## Inspection [1)] (Measurement after temperature balance of the samples at room temperature)

| | | | | | |
|---|---|---|---|---|---|
| $K_N(N_1/N_2)$ | (V) | M3011/6 | Transformation ratio ($I_P$=3*10A, 40-80 Hz) | 1…3 : 1000 ± 0.5 | % |
| $I_0$ | (V) | M3226 | Offset current | < 0.1 | mA |
| $V_{P,eff}$ | (V) | M3014 | Test voltage, rms, 1s<br>Pin 1 - 6 to Pin 7 - 9 | 2.5 | kV |
| $V_e$ | (AQL 1/S4) | | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS) | 1300<br>1625 | V<br>V |

## Type Testing (Pin 1 - 6 to Pin 7 – 9)

Designed according standard EN 61800 with insulation material group 1

| | | | | |
|---|---|---|---|---|
| $V_W$ | HV transient test according (to M3064)<br>(1,2 µs / 50 µs-wave form) | | 8 | kV |
| $V_d$ | Testing voltage acc. M3014 (RMS) | (5 s) | 5 | kV |
| $V_e$ | Partial discharge voltage acc. M3024 (RMS)<br>with $V_{vor}$ (RMS) | | 1500<br>1875 | V<br>V |

| Datum | Name | Index | Änderung |
|---|---|---|---|
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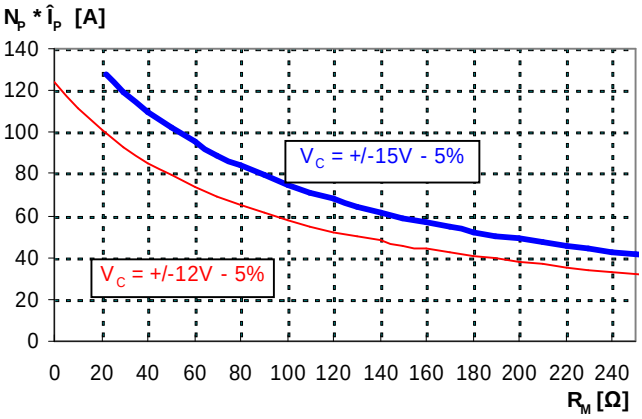
|---|---|---|---|---|---|---|

ME

A=km
1=St
2=kg
3=g
4=l
5=m
6=m²
7=m³
8=mm
9:Paar

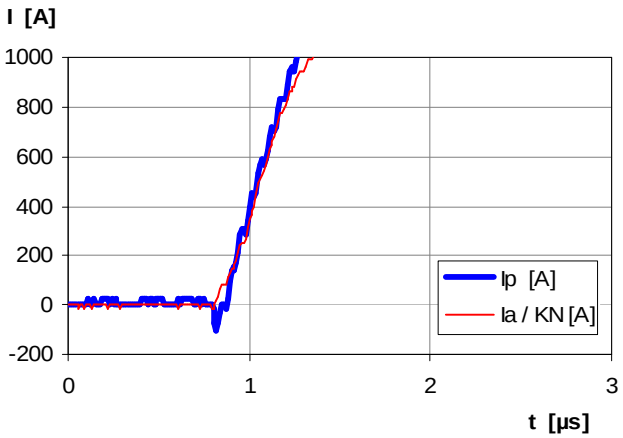
## Limit curve of measurable current $\hat{I}_P(R_M)$ 1)

@ ambient temperature $T_A \leq 85$ °C




## Maximum measuring range (µs-range) 1)

Output current behaviour of a 3kA current pulse
@ $V_C$ = ±15V und $R_M$= 25Ω




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.

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

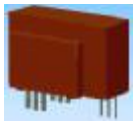
$$f_g = \frac{1}{2p \cdot R_M \cdot C_a}$$

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

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

## Applicable documents

Current direction: A positive output current appears at point $I_S$, by primary current in direction of the arrow.
Constructed and manufactored and tested in accordance with EN 61800.
Housing and bobbin material UL-listed: Flammability class 94V-0.





ME

A=km
1=St
2=kg
3=g
4=l
5=m
6=m²
7=m³
8=mm
9:Paar

$I_{0H}$: Zero variation of $I_o$ 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 (describe the dynamic performance for the specified measurement range), measured as delay time at $I_P = 0{,}9 \cdot I_{Pmax}$ between a rectangular current and the output current.

$\Delta t\ (I_{Pmax})$: Delay time (describe the dynamic performance for the rapid current pulse rate e.g short circuit current) measured between $I_{Pmax}$ and the output current $i_a$ with a primary current rise of $di_1/dt = 100$ A/µs.

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

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

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:

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

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

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

This “Additional information“ is no declaration of warranty according BGB $443.