

K-No.: 24616
50 A Current Sensor
Date: 28.01.2008

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)

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 – Ratings¹⁾

| | | | |
|-----------------------|--------------------------------------------|-----------------------|--------------|
| I_{PN} | Primary nominal r.m.s. current | 50 | 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 | 50 | mA |
| K_N | Turns ratio | 1...3 : 1000 | |

Accuracy – Dynamic performance data¹⁾

| | | min. | typ. | max. | Unit |
|-------------------------------|---------------------------------------------------------------------------|----------|------|------|------|
| I_{P,max} | Max. measuring range | | | | |
| | @ V _C = ±12V, R _M = 10 Ω (t _{max} = 10sec) | ±112 | | | A |
| | @ V _C = ±15V, R _M = 22 Ω (t _{max} = 10sec) | ±128 | | | A |
| X | Accuracy @ I _{PN} , T _A = 25°C | | 0.1 | 0.5 | % |
| ε_L | Linearity | | | 0.1 | % |
| I₀ | 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 data¹⁾

| | | min. | typ. | max. | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------|------------|--------|------|
| T_A | Ambient operating temperature | -40 | | +85 | °C |
| T_S | Ambient storage temperature | -40 | | +90 | °C |
| m | Mass | | 13.5 | | g |
| V_C | Supply voltage | ±11.4 | ±12 or ±15 | ±15.75 | V |
| I_C | Current consumption | | 18,5 | | mA |
| Constructed and manufactured 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 | Issue | Amendment |
|----------|------|-------|-----------------------------|
| 28.01.08 | Le | 81 | Date changed. Insignificant |

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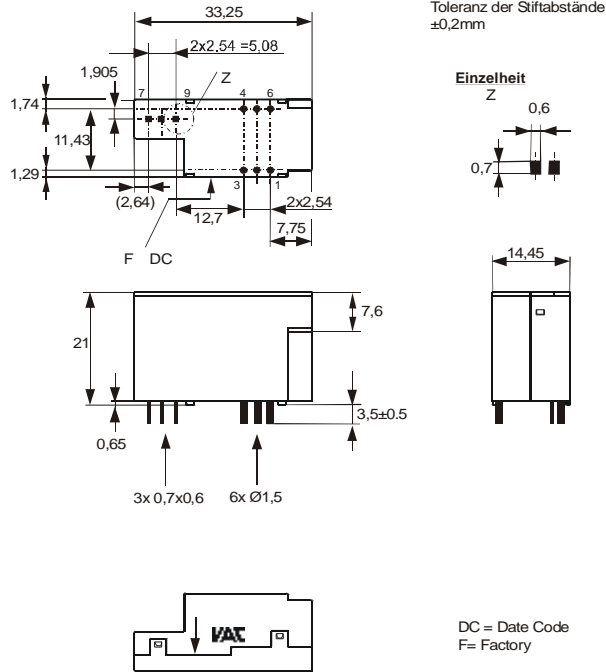
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Mechanical outline (mm):

General tolerances DIN ISO 2768-c

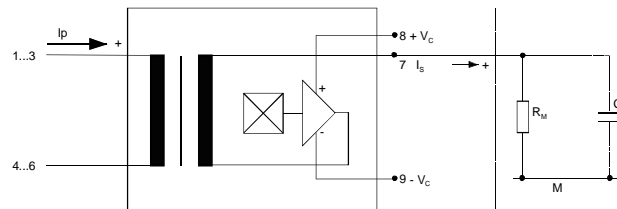


Connections:
1...6: Ø 1,5 mm
7...9: 0,6x0,7 mm

Marking:

VAC
4646X410
F DC

Schematic diagram



Possibilities of wiring for $V_C = \pm 15V$ (@ $T_A = 85^\circ C, R_M = 22 \Omega$)

| 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 [mW] | wiring |
|---------------------------|-------------------------------------|-----------------------------------------------------|------------------------------------------|----------------------|----------------------------------|--------|
| 1 | 50 | 128 | 50 | 1:1000 | 0,12 | |
| 2 | 20 | 64 | 40 | 2:1000 | 0,54 | |
| 3 | 15 | 43 | 45 | 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.

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Electrical Data (investigate by a type checking)

| | | min. | typ. | max. | Unit |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----------|------------|
| V_{Ctot} | Maximum supply voltage (without function) $\pm 15.75 \dots \pm 18$ V: for 1s per hour | | | ± 18 | V |
| R_S | Secondary coil resistance @ $T_A=85^\circ\text{C}$ | | | 88 | Ω |
| R_p | Primary coil resistance per turn @ $T_A=25^\circ\text{C}$ | | | 0.36 | m Ω |
| X_{Ti} | Temperature drift of X @ $T_A = -40 \dots +85^\circ\text{C}$ | | | 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 @ $T_A = -40 \dots +85^\circ\text{C}$ | | 0.05 | | mA |
| I_{0H} | Hysteresis current @ $I_p=0$ (caused by primary current $3 \times I_{PN}$) | | 0.04 | 0.1 | mA |
| $\Delta I_0/\Delta V_C$ | Supply voltage rejection ratio | | | 0.01 | mA/V |
| i_{loss} | Offset ripple* (with 1 MHz- filter first order) | | | 0.15 | mA |
| i_{loss} | Offset ripple* (with 100 kHz- filter first order) | | 0.03 | 0.05 | mA |
| i_{loss} | Offset ripple* (with 20 kHz- filter first order) | | 0.007 | 0.01 | mA |
| C_k | Maximum possible coupling capacity (primary – secondary) | | 4 | | pF |
| | Mechanical Stress according to M3209/3 Settings: 10 – 2000 Hz, 1 min/Decade, 2 hours An exceptionally high rate of on/off – switching of the supply voltage accelerates the aging process of the sensor. | | | 10g | |

Inspection (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) | $1 \dots 3 : 1000 \pm 0.5$ % |
| I_0 | (V) | M3226 | Offset current | < 0.1 mA |
| $V_{P,eff}$ | (V) | M3014 | Test voltage, rms, 1s Pin 1 - 6 to Pin 7 - 9 | 2.5 kV |
| V_e | (AQL 1/S4) | | Partial discharge voltage acc. M3024 (RMS) with V_{vor} (RMS) | 1500 V 1875 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) (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) with V_{vor} (RMS) | | | 1500 1875 | V V |

| Datum | Name | Index | Änderung |
|----------|------|-------|-----------------------------------------------------------------------|
| 28.01.08 | Le | 81 | Page 3: write error in X_{ges} (I_{PN}). changed. Insignificant |

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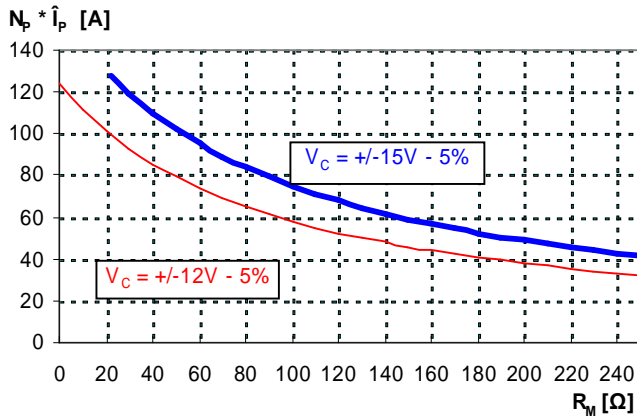
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ME

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

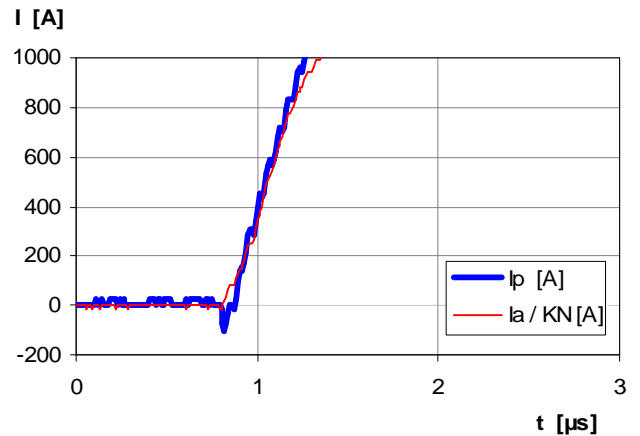
Limit curve of measurable current $\hat{I}_p(R_M)$

@ ambient temperature $T_A \leq 85^\circ\text{C}$



Maximum measuring range (μs-range)

Output current behaviour of a 3kA current pulse
@ $V_C = \pm 15\text{V}$ und $R_M = 25\Omega$



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.

Offsetripple reduction

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:

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

Applicable documents

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

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Explanation of several of the terms used in the tablets (in alphabetical order)

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_0 after overloading with a DC of tenfold the rated value ($R_M = R_{MN}$)

I_{0t} : Long term drift of I_0 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 $di_1/dt = 100 A/\mu s$.

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

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

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 ($I_0 = 0$)

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

Where I_P is any input DC and I_{Sx} the corresponding output term. I_{SN} : see notes of F_i ($I_0 = 0$).

This "Additional information" is no declaration of warranty according BGB §443.

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- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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