# DL2000ID-CD100

**Ultra-stable, high precision (ppm class) fluxgate technology DS Series current transducer for non-intrusive, isolated DC and AC current measurement up to 3000A**

## Features

- 1 ppm linearity
- 6 ppm offset
- Current output
- Fluxgate, closed loop compensated technology with fixed excitation frequency and second harmonic zero flux detection for best in class accuracy and stability
- 100 turns calibration winding available in DSUB 9 connector - For ±50A test and calibration in circuit.
- Green diode for normal operation indication
- Full aluminum body for superior EMI shielding and extended operating temperature range
- Large aperture ϕ68mm for cables and bus bars

## Applications:

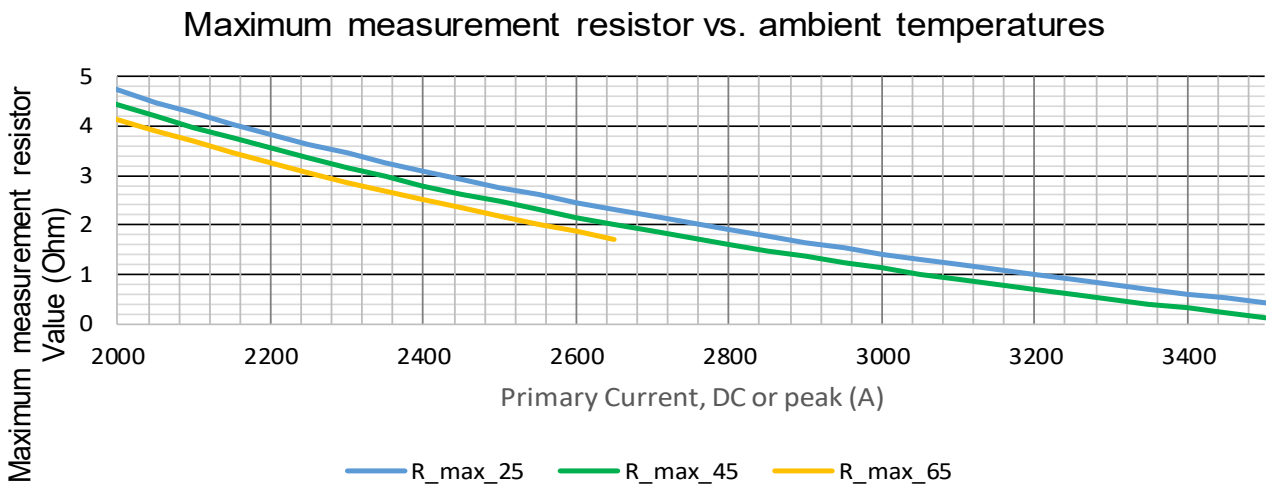
- MPS for particles accelerators
- Gradient amplifiers for MRI devices
- Stable power supplies
- Precision drives
- Batteries testing and evaluation systems
- Power measurement and power analysis
- Current calibration purposes

| Specification highlights | Symbol | Unit | Min | Typ | Max |
|---|---|---|---|---|---|
| Nominal primary AC current | $I_{PN}$ AC | Arms | | | 2000 |
| Nominal primary DC current | $I_{PN}$ DC | A | -3000 | | 3000 |
| Measuring range | $\hat{I}_{PM}$ | A | -3000 | | 3000 |
| Primary / secondary ratio | n1:n2 | | 1:1500 | | 1:1500 |
| Linearity error | $\varepsilon_L$ | ppm | -1 | | 1 |
| Offset current (including earth field) | $I_{OE}$ | ppm | -6 | | 6 |
| DC-10Hz Overall accuracy @25°C (= $\varepsilon_L + I_{OE}$) | acc$\varepsilon$ | ppm | -7 | | 7 |
| AC Maximum gain error 10Hz to 2kHz | $\varepsilon$G | % | | | ±0.01 |
| Operating temperature range | Ta | ℃ | -40 | | 65 |
| Power supply voltages | Uc | V | ±14.25 | | ±15.75 |

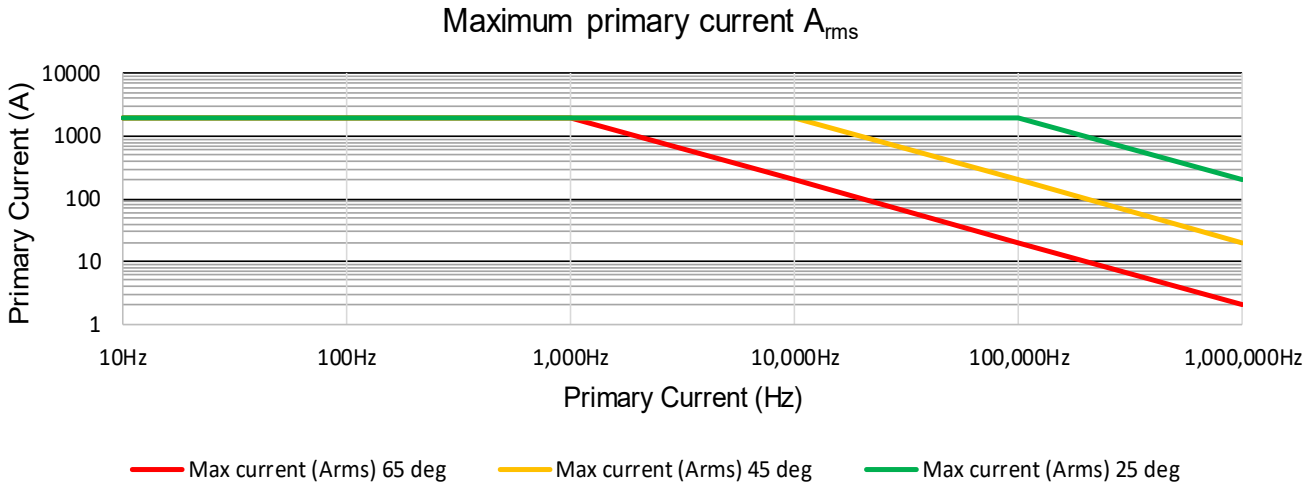
All ppm (or %) values refer to nominal current

## Electrical specifications at Ta=23°C, supply voltage = ± 15V unless otherwise stated

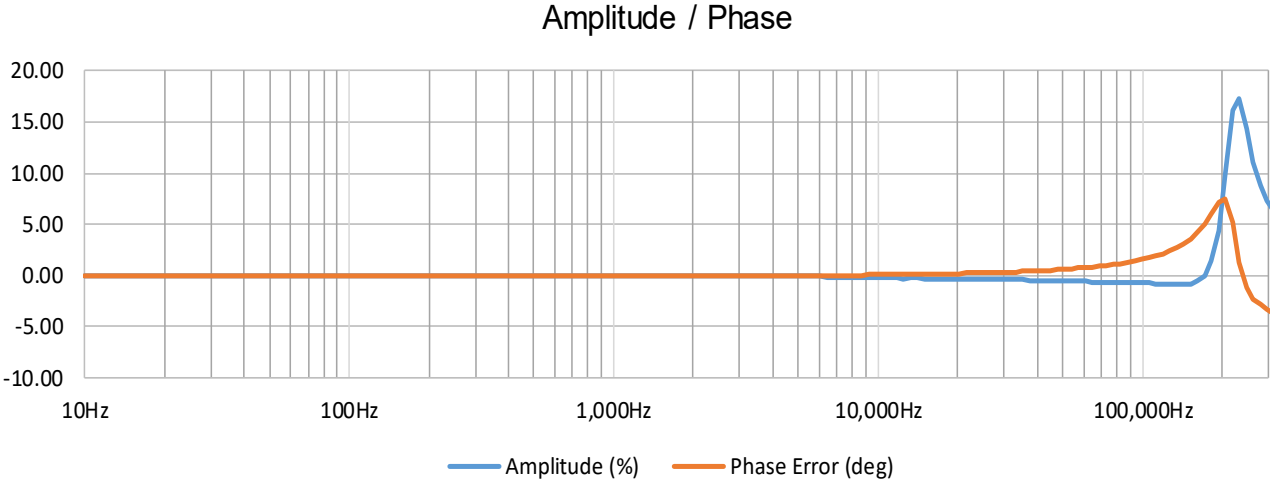
| Parameter | Symbol | Unit | Min | Typ. | Max | Comment |
|---|---|---|---|---|---|---|
| Nominal primary AC current | $I_{PN}$ AC | Arms | | | 2000 | Refer to fig. 1 & 2 for derating |
| Nominal primary DC current | $I_{PN}$ DC | A | -3000 | | 3000 | Refer to fig. 1 for derating |
| Measuring range | $I_{PM}$ | A | -3000 | | 3000 | Refer to fig. 1 & 2 for derating |
| Overload capacity | $\hat{I}_{OL}$ | kA | | | 10 | Non-measured, 100ms |
| Nominal secondary current | $I_{SN}$ | mA | -2000 | | 2000 | At nominal primary DC current |
| Primary / secondary ratio | | | 1:1500 | | 1:1500 | |
| Measuring resistance | $R_M$ | Ω | 0 | | 3 | Refer to fig. 1 for details |
| Linearity error | $\varepsilon_L$ | ppm<br>µA | -1<br>-2 | | 1<br>2 | ppm refers to nominal current<br>µA refers to secondary current |
| Offset current | $I_{OE}$ | ppm<br>µA | -6<br>-12 | | 6<br>12 | ppm refers to nominal current<br>µA refers to secondary current |
| DC-10Hz Overall accuracy @25°C (= εL + IOE ) | accε | ppm | -7 | | 7 | ppm refers to nominal DC current |
| Offset temperature coefficient | $TC_{IOE}$ | ppm/K<br>µA/K | -0.1<br>-0.2 | | 0.1<br>0.2 | ppm refers to nominal current<br>µA refers to secondary current |
| Bandwidth | f(-3dB) | kHz | 300 | | | Small signal, graphs figure 3 |
| Amplitude error 10Hz –2kHz<br>2kHz -10kHz<br>10kHz - 100kHz | εG | % | | | 0.01%<br>1.50%<br>3.00% | % refers to nominal current |
| Phase shift 10Hz –2kHz<br>2kHz -10kHz<br>10kHz - 100kHz | θ | ° | | | 0.04°<br>0.5°<br>3° | |
| Response time to a step current IPN | tr @ 90% | µs | | 1 | | di/dt = 100A/µs |
| Noise 0 - 100Hz<br>0 - 1kHz<br>0 - 10kHz<br>0 - 100kHz | noise | ppm rms | | | 0.02<br>0.10<br>1.20<br>3.50 | Measured on secondary current |
| Fluxgate excitation frequency | $f_{Exc}$ | kHz | | 15.6 | | |
| Induced rms voltage on primary conductor | | µV rms | | | 5 | |
| Power supply voltages | Uc | V | ±14.25 | | ±15.75 | |
| Positive current consumption | Ips | mA | 160 | 170 | 185 | Add Is (if Is is positive) |
| Negative current consumption | Ins | mA | 150 | 160 | 170 | Add Is (if Is is negative) |
| Operating temperature range | Ta | °C | -40 | | 65 | |
| **Stability** | | | | | | |
| Offset stability over time | | ppm/month<br>µA/month | -0.1<br>-0.2 | | 0.1<br>0.2 | ppm refers to nominal current<br>µA refers to secondary current |
| Offset change with vertical external magnetic field | | µA/mT | | 0.2 | 0.8 | (perpendicular to bus bar)<br>µA refers to secondary current |
| Offset change with horizontal external magnetic field | | µA/mT | | 0.8 | 2 | (parallel to bus bar)<br>µA refers to secondary current |
| Offset change with power supply voltage changes | | µA/V | | 0 | 0.04 | µA refers to secondary current |
| Offset change with absolute power supply voltages tracking | | µA/V | | 0.01 | 0.04 | µA refers to secondary current |




## Frequency and ambient temperature derating (Fig. 2)




## Frequency characteristics (Fig. 3)



## Isolation specifications

| Parameter | Unit | Value |
|---|---|---|
| Clearance | mm | 22 |
| Creepage distance | mm | 22 |
| Comparative tracking index (CTI) | V | > 600 |
| Rms voltage for AC isolation test, 50/60 Hz, 1 min<br>- Between primary and (secondary and shield)<br>- Between secondary and shield | kV | <br>14.4<br>0.2 |
| Impulse withstand voltage (1.2/50µs) | kV | 26.3 |
| Rated rms isolation voltage<br>reinforced isolation, overvoltage category III, Pollution degree 2<br>according to<br>- IEC 61010-1<br>- EN50780 | V | <br><br><br>1500<br>1500 |

## Absolute maximum ratings

| Parameter | Unit | Max | Comment |
|---|---|---|---|
| Primary | kA | 10 | Maximum 100ms |
| Power supply | V | ±16.5 | |
| Maximum calibration current | mA | 500 | Continuous - with no primary current present |
| Calibration winding resistance | Ω | 7 | |

## Environmental and mechanical characteristics

| Parameter | Unit | Min | Typ | Max | Comment |
|---|---|---|---|---|---|
| Ambient operating temperature range | °C | -40 | | 65 | |
| Storage temperature range | °C | -40 | | 65 | |
| Relative humidity | % | 20 | | 80 | Non-condensing |
| Mass | kg | | 6.5 | | |
| Connections | Power supplies: D-SUB 9 pins male | | | | |
| Standards | EN 61326-1 EMC<br>EN 61010-1:2010 Safety | | | | |

## Advanced Sensor Protection Circuits “ASPC”

Developed to protect the current transducer from typical fault conditions:

- Unit is un-powered and secondary circuit is open or closed
- Unit is powered and secondary circuit is open or interrupted

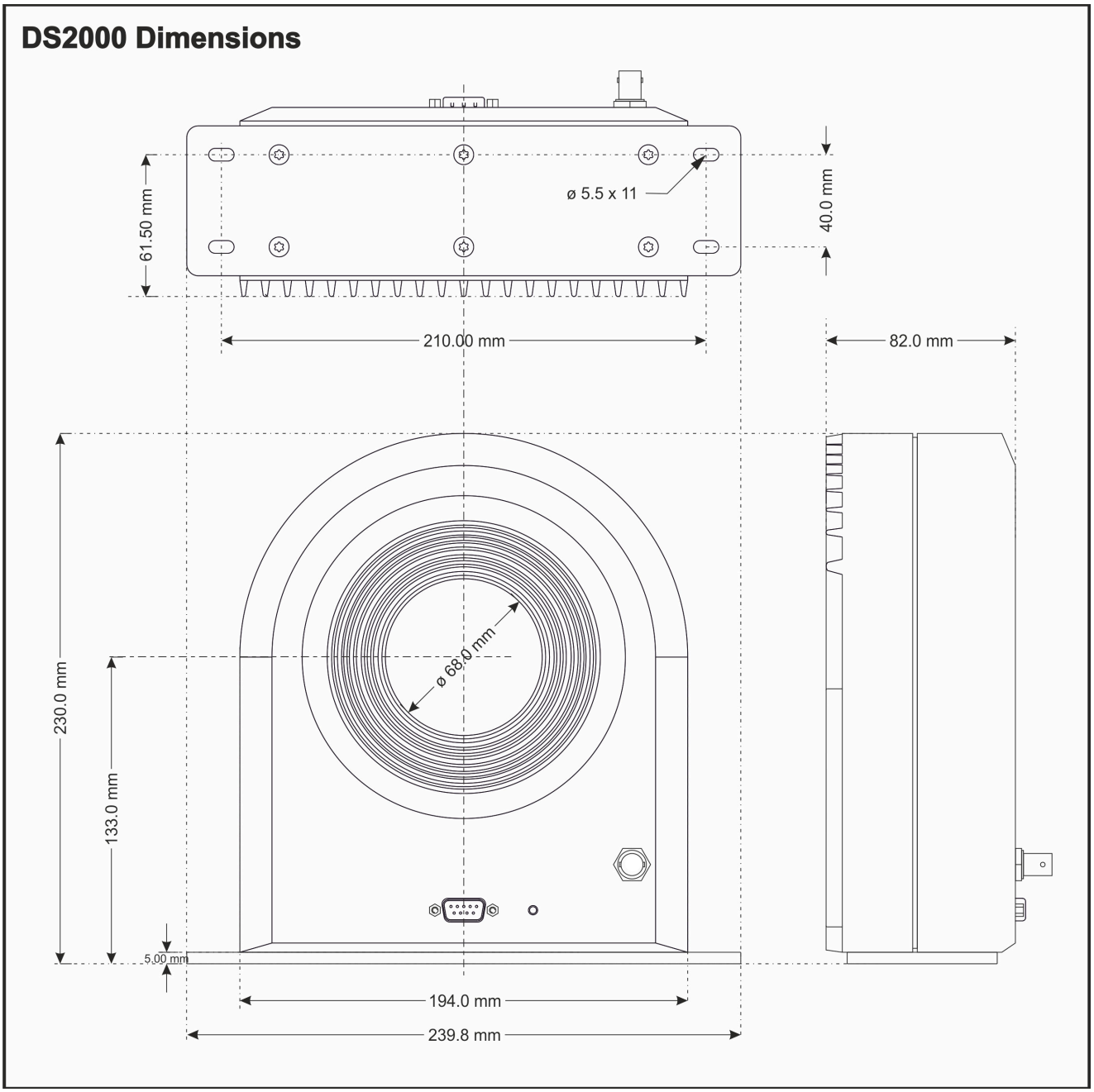
Both DC and AC primary current up to 100% of nominal value can be applied to the current transducers in the above situations without damage to the electronics.
Please notice that the sensor core can be magnetized in all above cases, leading to a small change in output offset current (less than 10ppm)

## Status pins

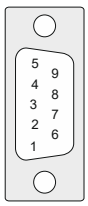
When transducer is operating in normal condition, the status pins (3 and 8) are shorted.

Status pins properties: - forward direction pin 8 to pin 3, maximum forward current 10mA
- maximum forward voltage 60V, maximum reverse voltage 5V

## DS2000 Dimensions




DSUB-9 current output with 1000 turns calibration winding

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- Maximum forward current 10mA
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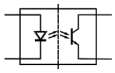
- Maximum reverse voltage 5V



| | |
|---|---|
| 5 | -Vc |
| 9 | +Vc |
| 4 | 0V |
| 8 | Status |
| 3 | Status |
| 7 | Calib + |
| 2 | Calib - |
| 6 | Out+ |
| 1 | Out- |

## Positive current direction

Is identified by an arrow on the transducer body

## Mounting instructions

| | |
|---|---|
| • Base plate mounting | 4 holes ϕ5.5 x 11 |
| | 4 x M5 steel screws / 6N.m |
| • Bottom direct mounting | 6 holes ϕ4.2 x 7 |
| (after unscrewing the base plate) | 6 x M4 steel screw / 4N.m |

# Declaration of Conformity

Danisense A/S

Malervej 10

DK-2630 Taastrup

Denmark

Declares that under our sole responsibility that this product is in conformity with the provisions of the following EC Directives, including all amendments, and with national legislation implementing these directives:

Directive 2014/30/EU

Directive 2014/35/EU

And that the following harmonized standards have been applied

EN 61010-1 (Third Edition):2010, EN 61010-1:2010/A1:2019

EN 61010-2-030:2021/A11:2021

EN 61326-1:2013

All DANISENSE products are manufactured in accordance with RoHS directive 2011/65/EU. Annex II of the RoHS directive was amended by directive 2015/863 in force since 2015, expanding the list of 6 restricted substances (Lead, Hexavalent Chromium, PBB, PBDE and Cadmium)

Danisense follows the provision in EN 63000:2018

| Place | | Date |
|---|---|---|
| Taastrup, Denmark | Henrik Elbæk | 2022-03-15 |