

Ultra-stable, high precision (ppm class) fluxgate technology DM Series current transducer for non-intrusive, isolated DC and AC current measurement up to 1800A



### Features

Ø45mm aperture enabling large isolated cables and the possibility to measure leakage current at high precision.

15 ppm linearity

10 ppm offset

1V output

Fluxgate, closed loop compensated technology with crystal driven excitation frequency for increased stability

Industry standard DSUB 9 pin connection

Full aluminum body for superior EMI shielding and extended operating temperature range

### Applications

Power measurement and power analysis

Stable power supplies

MPS for particles accelerators

Gradient amplifiers for MRI devices

Precision drives

Batteries testing and evaluation systems

Current calibration purposes

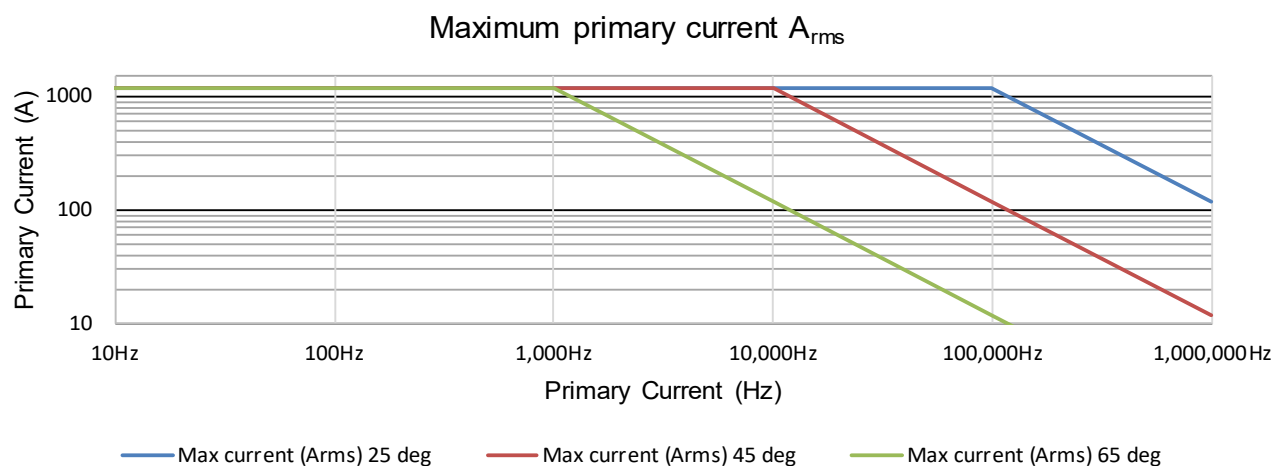
| Specification highlights   | Symbol        | Unit | Min         | Typ. | Max           |
|--|---------------|------|-------------|------|---------------|
| Nominal primary AC current                                       | $I_{PN AC}$   | Arms |             |      | 1200          |
| Nominal primary DC current                                       | $I_{PN DC}$   | A    | -1200       |      | 1200          |
| Nominal output voltage   | $V_{out}$     | V    | -1          |      | 1             |
| Measuring range  | $I_{PM}$      | A    | -1800       |      | 1800          |
| Primary / secondary ratio  |               | V/kA | 0.8333      |      | 0.8333        |
| Linearity error (Best fit)                                       | $\epsilon_L$  | ppm  | -15         |      | 15            |
| Offset Voltage (including earth field)                           | $V_{OE}$      | ppm  | -10         |      | 10            |
| Ratio error  | $\epsilon_C$  | ppm  | -10         |      | 10            |
| DC-10Hz Overall accuracy @25°C ( $=V_{OE}+\epsilon_L + I_{OE}$ ) | $acc\epsilon$ | ppm  | -35         |      | 35            |
| AC Maximum gain error 10Hz to 1kHz                               |               |      |             |      | 100ppm(0.01%) |
| Bandwidth (3dB)  | $f_{3dB}$     | kHz  | 400         |      |               |
| Operating temperature range                                      | $T_a$         | °C   | -40         |      | 65            |
| Power supply voltages  | $U_c$         | V    | $\pm 14.25$ |      | $\pm 15.75$   |

All ppm (or %) values refer to nominal current

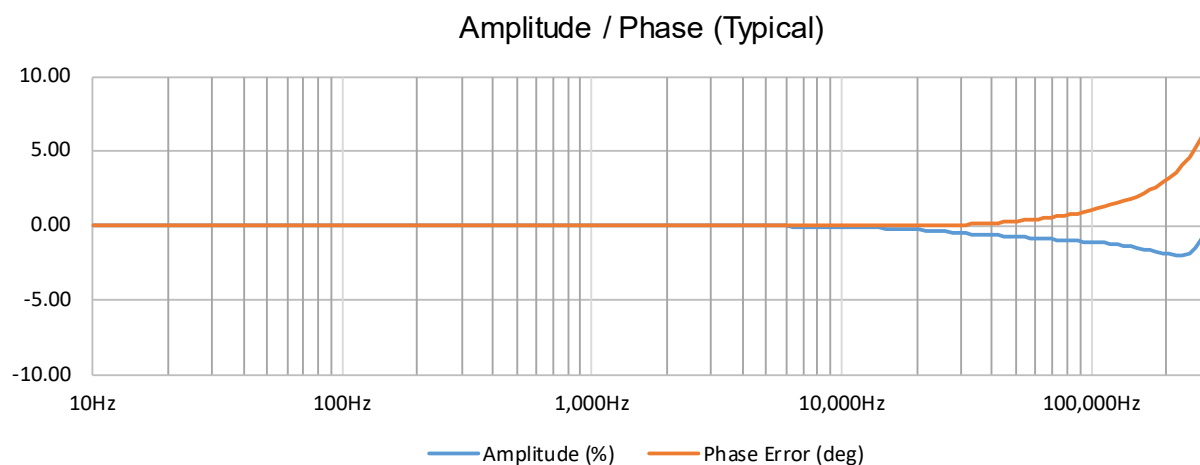
## Electrical specifications at Ta=23°C, supply voltage = ± 15V unless otherwise stated

| Parameter                                | Symbol            | Unit      | Min    | Typ.  | Max    | Comment                          |
|--|-------------------|-----------|--------|-------|--------|----------------------------------|
| Nominal primary AC current               | $I_{PN\ AC}$      | Arms      |        |       | 1200   | Refer to fig. 2 for derating     |
| Nominal primary DC current               | $I_{PN\ DC}$      | A         | -1200  |       | 1200   |                                  |
| Measuring range                          | $I_{PM}$          | A         | -1800  |       | 1800   | Refer to fig. 2 for derating     |
| Overload capacity                        | $\hat{I}_{OL}$    | A         |        |       | 1500   | Non-measured, 100ms              |
| Nominal voltage output                   | $V_O$             | V         | -1     |       | 1      | At nominal primary DC current    |
| Primary / secondary ratio                |                   | V/kA      | 0.8333 |       | 0.8333 |                                  |
| Linearity error                          | $\epsilon_L$      | ppm       | -15    |       | 15     | ppm refers to nominal current    |
| Bandwidth (3dB)                          | $f_{3dB}$         | kHz       | 400    |       |        | Small signal, graphs figure 3    |
| Response time to a step current $I_{PN}$ | $tr@90\%$         | $\mu s$   |        | 1     |        | $di/dt = 100A/\mu s$             |
| Amplitude error                          |                   |           |        |       |        |                                  |
| 10Hz–3kHz                                | $\epsilon_G$      | %         |        |       | 0.01   | % refers to nominal current      |
| 3kHz-50kHz                               |                   |           |        |       | 1.00   |                                  |
| 50kHz-300kHz                             |                   |           |        |       | 20.00  |                                  |
| Phase shift                              |                   |           |        |       |        |                                  |
| 10Hz–3kHz                                | $\theta$          | °         |        |       | 0.01   |                                  |
| 3kHz-50kHz                               |                   |           |        |       | 0.50   |                                  |
| 50kHz-300kHz                             |                   |           |        |       | 10.00  |                                  |
| Noise                                    |                   |           |        |       |        |                                  |
| 0 - 100Hz                                | noise             | ppm rms   |        |       | 0.15   |                                  |
| 0 - 1kHz                                 |                   |           |        |       | 0.2    |                                  |
| 0 - 10kHz                                |                   |           |        |       | 0.3    |                                  |
| 0 - 100kHz                               |                   |           |        |       | 2      |                                  |
| Noise                                    |                   |           |        |       |        |                                  |
| 0 - 100Hz                                | noise             | ppm p-p   |        |       | 0.8    |                                  |
| 0 - 1kHz                                 |                   |           |        |       | 1      |                                  |
| 0 - 10kHz                                |                   |           |        |       | 1.7    |                                  |
| 0 - 100kHz                               |                   |           |        |       | 8      |                                  |
| Fluxgate excitation frequency            | $f_{Exc}$         | kHz       |        | 31.25 |        |                                  |
| Power supply voltages                    | $U_c$             | V         | ±14.25 |       | ±15.75 |                                  |
| Positive current consumption             | $I_{ps}$          | mA        | 135    | 140   | 145    | Add $V_O \cdot 0.8$ (A)          |
| Negative current consumption             | $I_{ns}$          | mA        | 120    | 130   | 135    | Add $V_O \cdot 0.8$ (A)          |
| Operating temperature range              | $T_a$             | °C        | -40    |       | 65     |                                  |
| <b>Offset error</b>                      |                   |           |        |       |        |                                  |
| Initial                                  | $V_{OE}$          | ppm       | -10    |       | 10     | ppm refers to nominal DC current |
| Versus temperature                       | $TC_{VOE}$        | ppm/K     | -0.1   |       | 0.1    | ppm refers to nominal DC current |
| Versus time                              | $V_{OE}/time$     | ppm/month | -0.3   |       | 0.3    | ppm refers to nominal DC current |
| Versus supply voltage                    |                   | ppm/V     | -0.1   |       | 0.1    | ppm refers to nominal DC current |
| <b>Ratio Error</b>                       |                   |           |        |       |        |                                  |
| Initial @23°C                            | $\epsilon_C$      | ppm       | -10    |       | 10     | ppm refers to primary current    |
| Versus temperature                       | $TC\epsilon_C$    | ppm/K     | -1     |       | 1      | ppm refers to primary current    |
| Versus time                              | $\epsilon_C/time$ | ppm/month | -3     |       | 3      | ppm refers to primary current    |

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



**Frequency characteristics (Fig. 3)**



## Isolation specifications

| Parameter   | Unit | Value  |
|---|------|--|
| Clearance   | mm   | 12   |
| Creepage distance   | mm   | 12   |
| Comparative tracking index (CTI)  |      | > 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   | 5.7<br>0.2                                       |
| Impulse withstand voltage (1.2/50µs)  | kV   | 10.4   |
| Continuous working voltage with uninsulated wire <ul style="list-style-type: none"> <li>Non mains</li> <li>CAT II (DC and rms)</li> <li>CAT III (DC and rms)</li> </ul> Insulated wire <ul style="list-style-type: none"> <li>Non mains</li> <li>CAT II (DC and rms)</li> <li>CAT III (DC and rms)</li> </ul> | V    | 1000<br>600<br>300<br><br>2000<br>1000<br>1000   |
| Transient voltage with uninsulated wire <ul style="list-style-type: none"> <li>Non mains</li> <li>CAT II</li> <li>CAT III</li> </ul> Insulated wire <ul style="list-style-type: none"> <li>Non mains</li> <li>CAT II</li> <li>CAT III</li> </ul>  | V    | 4500<br>6000<br>6000<br><br>6000<br>6000<br>8000 |

**Caution:** Do not connect the transducer to signals or use for measurements within Measurement Category IV, or for measurements on MAINS circuits or on circuits derived from Overvoltage Category IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances, temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.

**Caution:** When using insulated wires all wiring must be insulated for the highest voltage used.

## Absolute maximum ratings

| Parameter    | Unit | Max   | Comment       |
|--------------|------|-------|---------------|
| Primary      | kA   | 4.5   | Maximum 100ms |
| Power supply | V    | ±16.5 |               |

## Environmental, safety and mechanical specifications

| Parameter                           | Unit   | Min | Typ | Max  | Comment                        |
|-------------------------------------|--|-----|-----|------|--------------------------------|
| Altitude                            | m  |     |     | 2000 |                                |
| Usage                               |  |     |     |      | Designed for indoor use        |
| Transient voltages                  |  |     |     |      | Up to overvoltage category III |
| Poution Degree                      |  |     |     | 2    |                                |
| Ambient operating temperature range | °C   | -40 |     | 65   |                                |
| Storage temperature range           | °C   | -40 |     | 65   |                                |
| Relative humidity                   | %  | 20  |     | 80   | Non-condensing                 |
| Mass                                | kg   |     | 2.0 |      |                                |
| Connections                         | DSUB9 male and BNC connector   |     |     |      |                                |
| Standards                           | IEC61010-2-30, IEC61326-1 EMC and EC61010-1:2010 3rd Edition   |     |     |      |                                |
| External devices                    | External devices connected to current transducers must comply with the standards IEC61010-1, IEC60950 or IEC62368-1 and be energy-limited circuitry  |     |     |      |                                |
| Cleaning                            | The transducer should only be cleaned with a damp cloth. No detergent or chemicals should be used.   |     |     |      |                                |
| Temperature                         | <p>When multiple primary turns are used or high primary currents are applied the temperature around the transducer will increase, please monitor to ensure that the maximum ratings are not exceeded.</p> <p>It is recommended to have minimum 1mm<sup>2</sup> per ampere in the primary busbar.</p> |     |     |      |                                |

## 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

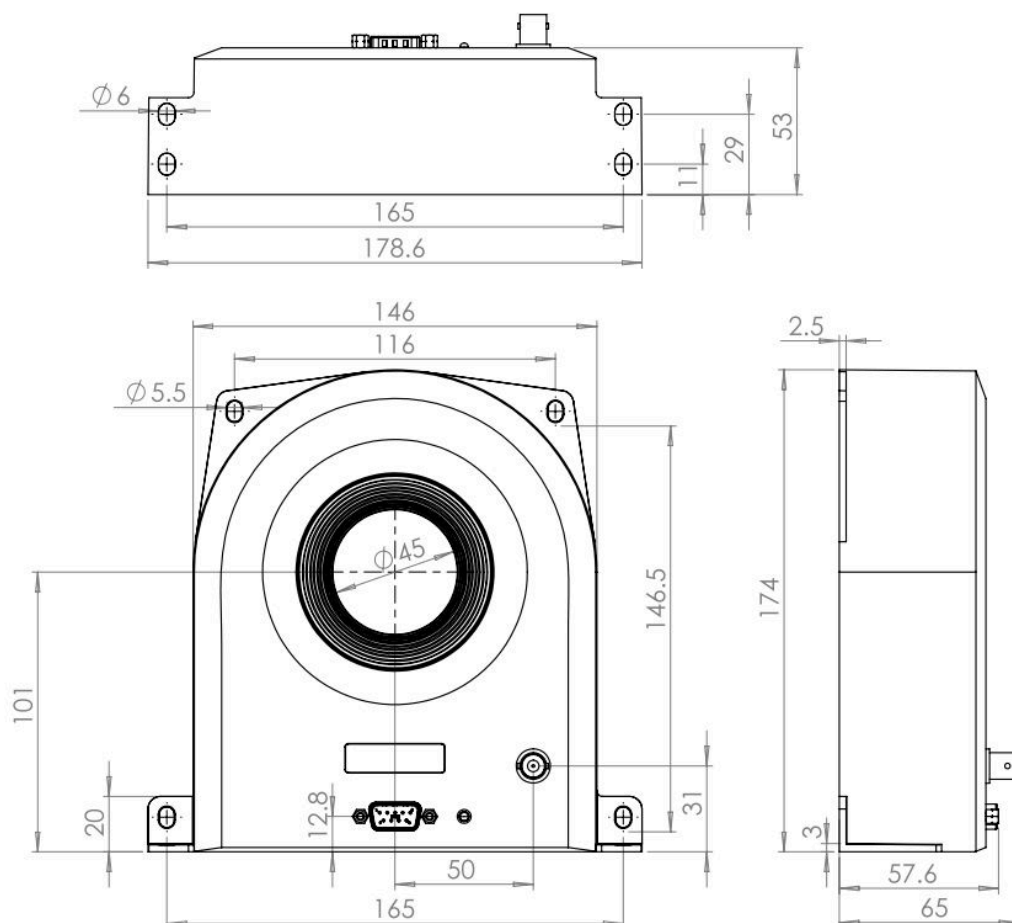
Both DC and AC primary current up to 100% of nominal value can be applied to the current transducers in the above situations without damage to the electronics.

Please notice that the transducer core can be magnetized in all above cases, leading to a small change in output offset current (less than 10ppm)

## Accessories

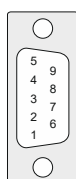
- 4-channel power supplies unit for connection up to 4xDM1200 : [DSSIU-4](#)
- 6-channel power supplies unit for connection up to 6xDM1200 : [DSSIU-6](#)
- Transducer cables in 5 lengths (2m - 5m - 10m - 15m - 20m): [DSUB2 - DSUB5 - DSUB10 - DSUB15 - DSUB20](#)
- Transducer cable 3m for connection to end-user's power supply: [Transducer cable for lab PS](#)  
(with access to current output via  $\phi 4$  banana jacks)

Please visit Danisense homepage for relevant datasheets



## DSUB pin layout

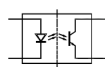
### DSUB-9 pinout & BNC connection



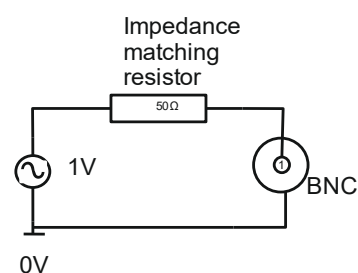
When sensor is operating in normal condition the status pins are shorted.

Status pin properties.

- Forward direction pin 8 to pin 3
- Maximum forward current 10mA
- Maximum forward voltage 60V
- Maximum reverse voltage 5V



- |   |   |            |
|---|---|------------|
| 5 | ● | -Vc        |
| 9 | ● | +Vc        |
| 4 | ● | 0V         |
| 8 | ● | Status     |
| 3 | ● | Status     |
| 7 | ● | NC         |
| 2 | ● | NC         |
| 6 | ● | Do not use |
| 1 | ● | Do not use |



## Positive current direction

Is identified by an arrow on the transducers red isolation piece in the center

## Mounting

Base plate mounting: 4 slotted holes  $\varnothing 6$  mm

Back plate mounting: 4 slotted holes  $\varnothing 6$  mm

Fastening torque: 6 Nm

**Intended use:**

The DS1200UB-10V is designed to measure current up to 1320A, and be powered by a DSSIU-4-1U or DSSIU-6-1U.

**Instruction for use:**

1. Do not power up the device before all cables are connected.
2. Only use Danisense cables to ensure correct impedance levels.
3. Place the primary conductor through the aperture of the transducer
4. If the DSSIU-4(6)-1U is intended for desk use, mount the rubber feet which are part of the package.
5. If the DSSIU-4(6)-1U is intended for Rack mounting, use the screw kit for mounting and do not mount the rubber feet.
6. Connect a DSUB cable between DSSIU-4(6)-1U and each sensor
7. Connect a low impedance amperemeter, measuring resistor or power analyzer on the secondary output (4mm red and black connectors)
8. Ensure that no calibration connectors are attached when measuring primary current. Always avoid to create a calibration short circuit, between + and — calibration connection.
9. There is a risk of electrical shock if an uninsulated busbar with high voltages is touching the metal enclosure of the transducer. Please ensure before powering up the system that no primary busbar can touch the metal enclosure.
10. When all connection are secured - connect mains power
11. Apply primary current

**Safety Instructions:**

DO NOT TRY TO DISASSEMBLE THE UNIT.

If the green transducer diode is not operating when the system is powered up, disconnect power and contact Danisense for further instruction.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## **Declaration of Conformity**

Danisense A/S  
Malervej 10  
DK-2630 Taastrup  
Denmark

Declares that under our sole responsibility the products listed in Appendix A are 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

EN 61010-2-030:2010

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

Appendix A describes the products covered by this Declaration of Conformity.



Place

Taastrup, Denmark

Henrik Elbæk

Date

2022-03-15