

Ultra-stable, high precision (ppm class) fluxgate technology DS Series current transducer for non-intrusive, isolated DC and AC current measurement up to 450A



Features

- Linearity error maximum ± 15 ppm
- 1V BNC output connection
- Fluxgate, closed loop compensated technology with fixed excitation frequency and second harmonic zero flux detection for best in class accuracy and stability
- Green diode for normal operation indication
- Full aluminum body for superior EMI shielding and extended operating temperature range
- Large aperture $\phi 27.6$ mm 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 | | | 400 |
| Nominal primary DC current | $I_{PN DC}$ | A | -400 | | 400 |
| Measuring range | I_{PM} | A | -600 | | 600 |
| Nominal output voltage | V_{out} | V | -1 | | 1 |
| Primary / secondary ratio | | V/kA | 2.5000 | | 2.5000 |
| Linearity error (Best fit) | ϵ_L | ppm | -15 | | 15 |
| | V_{OE} | ppm | -15 | | 15 |
| Offset Voltage (including earth field) | V_{OE} | uV | -15 | | 15 |
| | ϵ_C | ppm | -15 | | 15 |
| Ratio error | ϵ_C | ppm | -15 | | 15 |
| DC-10Hz Overall accuracy @25°C (=V _{OE} + ϵ_L + ϵ_C) | acc ϵ | ppm | -45 | | 45 |
| AC Maximum gain error 10Hz to 1kHz | | | | | 0.01% |
| Bandwidth (3dB) | f_{3dB} | kHz | 500 | | |
| Operating temperature range | Ta | °C | -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 | | | 400 | Refer to fig. 2 for derating | |
| Nominal primary DC current | $I_{PN DC}$ | A | -400 | | 400 | | |
| Measuring range | I_{PM} | A | -600 | | 600 | | |
| 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 | 2.5000 | | 2.5000 | | |
| Linearity error | ϵ_L | ppm | -15 | | 15 | ppm refers to nominal current | |
| Bandwidth (3dB) | f_{3dB} | kHz | 500 | | | Small signal, graphs figure 3 | |
| Response time to a step current IPN | $tr@90\%$ | μs | | 1 | | $di/dt = 100A/\mu s$ | |
| Amplitude error | ϵ_G | % | | | 0.01 | % refers to nominal current | |
| 10Hz – 1kHz | | | | | 0.25 | | |
| 1kHz -20kHz | | | | | 2.50 | | |
| Phase shift | θ | ° | | | 0.01 | | |
| 10Hz – 1kHz | | | | | 0.04 | | |
| 1kHz -20kHz | | | | | 1.50 | | |
| Noise | noise | ppm rms | | | 0.02 | Measured on secondary current | |
| | | | | | 0 - 100Hz | | 0.10 |
| | | | | | 0 - 1kHz | | 1.00 |
| | | | | | 0 - 10kHz | | 3.50 |
| Fluxgate excitation frequency | f_{Exc} | kHz | | 32.5 | | | |
| Power supply voltages | U_C | V | ±14.25 | | ±15.75 | | |
| Positive current consumption | I_{ps} | mA | | | 104 | Add $V_O/30$ (A) | |
| Negative current consumption | I_{ns} | mA | | | 96 | Add $V_O/30$ (A) | |
| Operating temperature range | T_a | °C | -40 | | 65 | | |
| Offset error | | | | | | | |
| Initial | V_{OE} | ppm | -15 | | 15 | ppm refers to nominal DC current | |
| Versus temperature | TC_{VOE} | ppm/K | -1 | | 1 | ppm refers to nominal DC current | |
| Versus time | $V_{OE}/time$ | ppm/month | -0.1 | | 0.1 | ppm refers to nominal DC current | |
| Versus supply voltage | | ppm/V | -0.1 | | 0.1 | ppm refers to nominal DC current | |
| Ratio Error | | | | | | | |
| Initial @23°C | ϵ_C | ppm | -15 | | 15 | ppm refers to nominal DC current | |
| Versus temperature | $TC\epsilon_C$ | ppm/K | -2 | | 2 | ppm refers to nominal DC current | |
| Versus time | $\epsilon_C/time$ | ppm/month | -3 | | 3 | ppm refers to nominal DC current | |

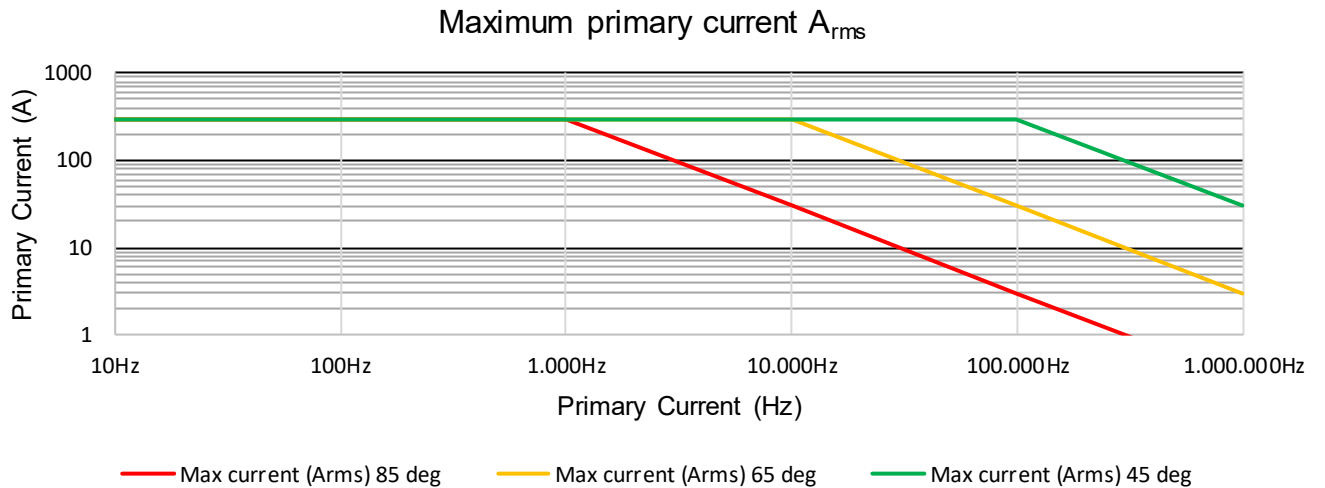


Indicate that caution is necessary when operating the device

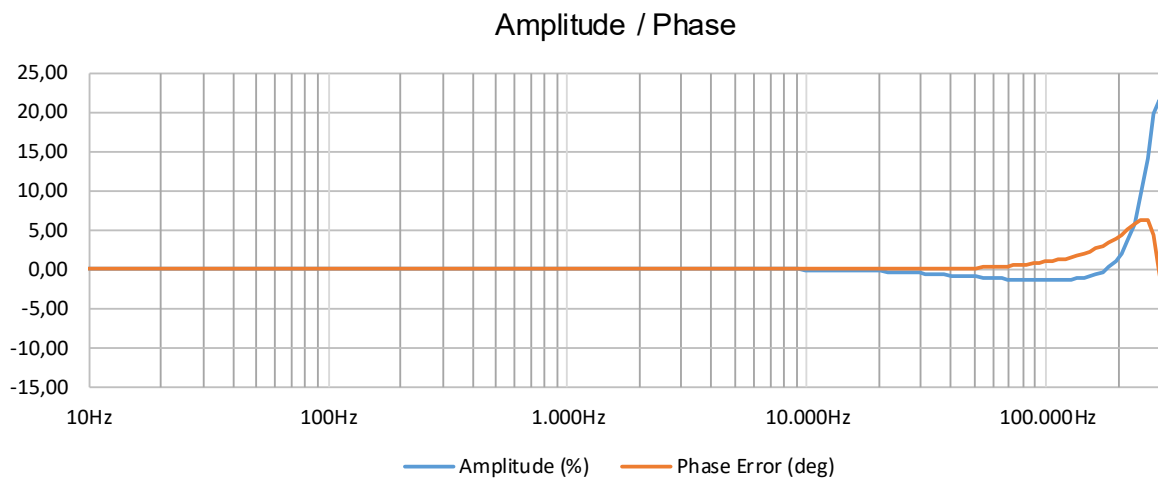


Caution: Intended use is to measure current, and the product should only be used for intended use.

Frequency and ambient temperature derating (Fig. 2)



Frequency characteristics (Fig. 3)



Isolation specifications

| Parameter | Unit | Value |
|---|------|--|
| Clearance | mm | 9.5 |
| Creepage distance | mm | 10.5 |
| Comparative tracking index (CTI) | | > 600 |
| Rms voltage for AC isolation test, 50/60 Hz, 1 min - Between primary and (secondary and shield) - Between secondary and shield | kV | 5.7 0.2 |
| Impulse withstand voltage (1.2/50µs) | kV | 10.4 |
| Continous working voltage with Uninsulated wire <ul style="list-style-type: none"> • Non mains • CAT II (DC and rms) • CAT III (DC and rms) Insulated wire <ul style="list-style-type: none"> • Non mains • CAT II (DC and rms) • CAT III (DC and rms) | V | 1000 600 300 2000 1000 1000 |
| Transient voltage with Uninsulated wire <ul style="list-style-type: none"> • Non mains • CAT II • CAT III Insulated wire <ul style="list-style-type: none"> • Non mains • CAT II • CAT III | V | 4500 6000 6000 6000 6000 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 over-voltages 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 | | 85 | |
| Relative humidity | % | 20 | | 80 | Non-condensing |
| Mass | kg | | 0.6 | | |
| Connections | DSUB9 male and BNC connector | | | | |
| Standards | IEC61010-2-30 IEC61326-1 EMC IEC61010-1:2010 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 | 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. It is recommended to have minimum 1mm ² per ampere in the primary busbar. | | | | |

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)

Status pins

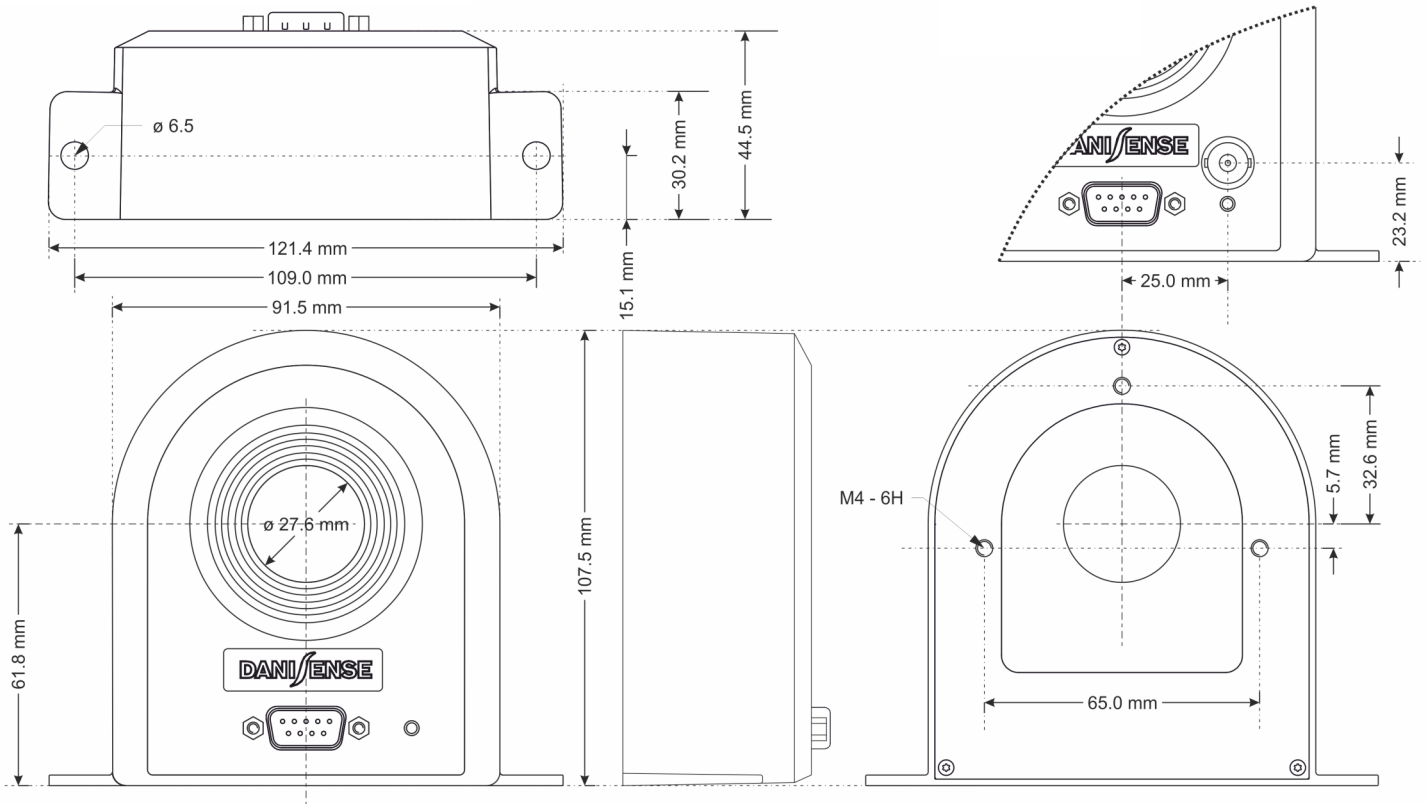
When transducer is operating in normal condition, the status pins (3 and 8) are shorted.

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

Accessories

- 4-channel power supplies unit for connection up to 4 x DL2000 : DSSIU-4-1U
- 6-channel power supplies for connection of up to 6 x DL2000: DSSIU-6-1U
- Transducer cables in 4 lengths (2m - 5m - 10m - 15m - 20m): DSUB2 - DSUB5 - DSUB10 - DSUB15 - DSUB20

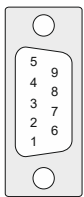
Please visit the Danisense homepage for relevant datasheets.



(general tolerance 0.3mm unless otherwise stat-

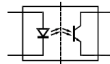
DSUB pin layout

DSUB-9 pinout & BNC connection

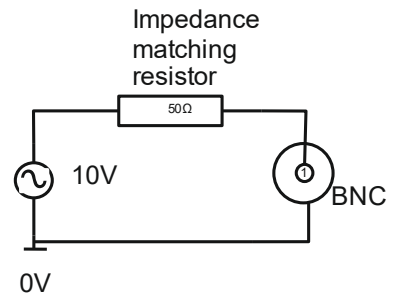


When sensor is operating in normal condition the status pins are shorted.

- 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 transducer body

Mounting instructions

- Base plate mounting
 - 2 holes $\phi 6.5$
 - 2 x M5 steel screws / 6N.m
- Back side panel mounting
 - 3 holes $\phi 4.0 \times 6H$
 - 3 x M4 steel screw / 4N.m

Intended use:

The DS400UB-1V is designed to measure current up to 400A, 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 cables supplied by Danisense
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 Voltmeter, DMM or other sort of analyzer with a voltage input to the transducer BNC connector.
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