

Ultra-stable, high precision (ppm class) fluxgate technology DS Series current transducer for non-intrusive, isolated DC and AC current measurement up to 2000A



**Features**

- 20 ppm linearity
- 15 ppm offset
- 10V output in BNC connector @ 2000A
- Fluxgate, closed loop compensated technology with fixed excitation frequency and second harmonic zero flux detection for best in class accuracy and stability
- Industry standard DSUB 9 pin connection
- Green diode for normal operation indication
- Full aluminum body for superior EMI shielding and extended operating temperature range
- Aperture  $\phi 68\text{mm}$  for large 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	$I_{PN AC}$	A <sub>rms</sub>			1414
Nominal primary DC current	$I_{PN DC}$	A	-2000		2000
Measuring range	$\hat{I}_{PM}$	A	-2200		2200
Primary / secondary ratio		V/kA	5.0000		5.0000
Linearity error	$\epsilon_L$	ppm	-20		20
Offset current (including earth field)	$I_{OE}$	ppm	-15		15
DC-10Hz Overall accuracy @25°C (= $\epsilon_L + I_{OE}$ )	acc $\epsilon$	ppm	-35		35
AC Maximum gain error 10Hz to 1kHz	$\epsilon_G$	%			$\pm 0.01$
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			1414	Refer to fig. 2 for derating	
Nominal primary DC current	$I_{PN DC}$	A	-2000		2000		
Measuring range	$I_{PM}$	A	-2200		2200		
Overload capacity	$\hat{I}_{OL}$	A			10000	Non-measured, 100ms	
Nominal output voltage	$I_{SN}$	Vout	-10		10	At nominal primary DC current	
Primary / secondary ratio	Ratio	V/kA	5.0000		5.0000		
Linearity error	$\epsilon_L$	ppm μV	-20 -200		20 200	ppm refers to nominal current	
Offset offset (including earth field)	$V_{OE}$	ppm μV	-15 -150		15 150	ppm refers to nominal current	
DC-10Hz Overall accuracy @25°C (= $\epsilon_L + IOE$ )	acc $\epsilon$	ppm	-35		35	ppm refers to nominal DC current	
Offset temperature coefficient	$TC_{IOE}$	ppm/K μV/K	-0.1 -10		0.1 10	ppm refers to nominal current	
Bandwidth	f(-3dB)	kHz	300			Small signal, graphs figure 3	
Amplitude error	$\epsilon_G$	%			10Hz – 1kHz	0.01%	% refers to nominal current
					1kHz - 10kHz	0.50%	
					10kHz - 100kHz	3.00%	
Phase shift	$\theta$	°			10Hz – 1kHz	0.01°	
					1kHz - 10kHz	0.1°	
					10kHz - 100kHz	3.0°	
Response time to a step current $I_{PN}$	$t_r @ 90\%$	μs		1		di/dt = 100A/μs	
Noise	noise	ppm rms			0 - 100Hz	0.02	Measured on secondary current
					0 - 1kHz	0.06	
					0 - 10kHz	0.6	
					0 - 100kHz	1.2	
Fluxgate excitation frequency	$f_{Exc}$	kHz		15.63			
Induced rms voltage on primary conductor		μVrms			5		
Power supply voltages	$U_c$	V	±14.25		±15.75		
Positive current consumption	$I_{ps}$	mA	160	165	190	Add $I_s$ (if $I_s$ is positive)	
Negative current consumption	$I_{ns}$	mA	150	160	170	Add $I_s$ (if $I_s$ is negative)	
Operating temperature range	$T_a$	°C	-40		65		
<b>Stability</b>							
Offset stability over time		ppm / month	-1		1	ppm refers to nominal current μA refers to secondary current	
Offset change with vertical external magnetic field		μV/mT		2	8	(perpendicular to bus bar) μA refers to secondary current	
Offset change with horizontal external magnetic field		μV/mT		8	20	(parallel to bus bar) μA refers to secondary current	

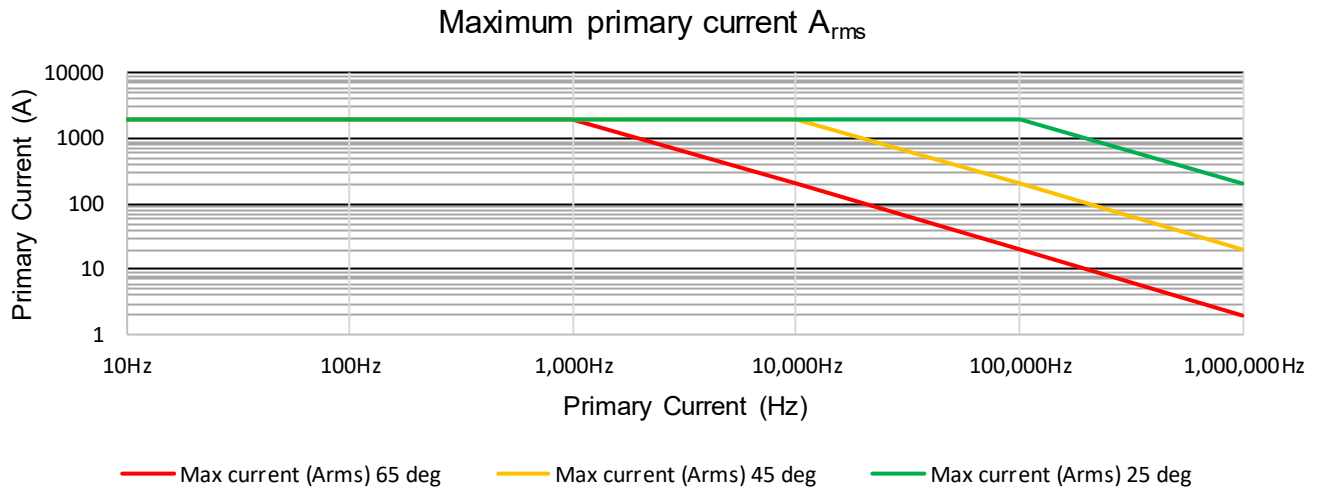


Indicate that caution is necessary when operating the device

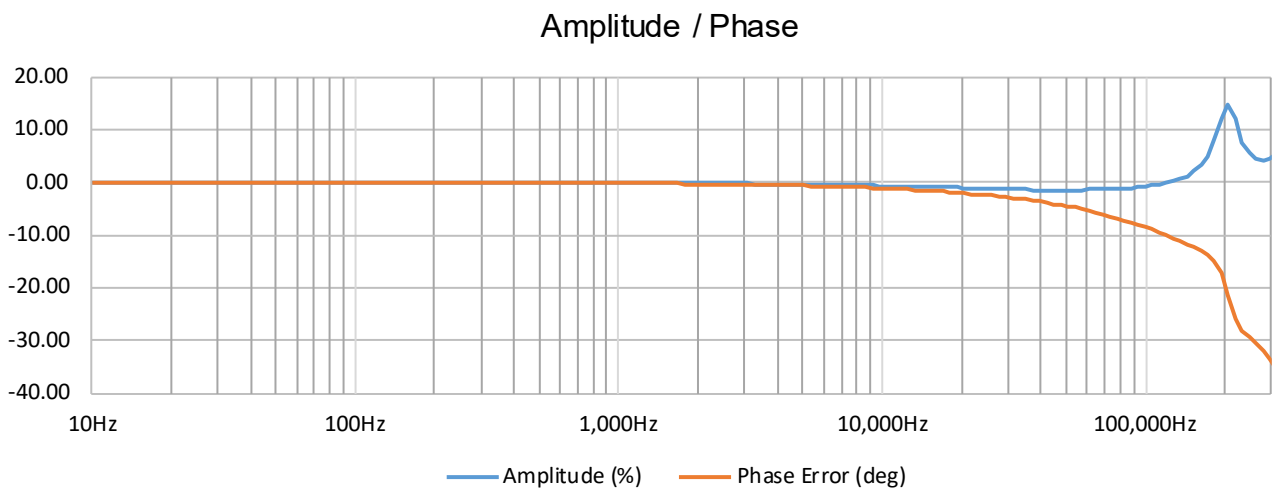


**Caution:** Intended use is to measure current, and the product should only be used for intended use.

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



**Frequency characteristics (Fig. 3)**



**Isolation specifications**

Parameter	Unit	Value
Clearance	mm	22
Creepage distance	mm	22
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	14.4 0.2
Impulse withstand voltage (1.2/50µs)	kV	26.3
Continous working voltage with uninsulated wire • Non mains • CAT II (DC and rms) • CAT III (DC and rms) Insulated wire • Non mains • CAT II (DC and rms) • CAT III (DC and rms)	V	1000 1000 1000 2000 1000 1000
Transient voltage with uninsulated wire • Non mains • CAT II • CAT III Insulated wire • Non mains • CAT II • CAT III	V	9600 9600 9600 12800 12800

**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		85	
Relative humidity	%	20		80	Non-condensing
Mass	kg		5.9		
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 <sup>2</sup> 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

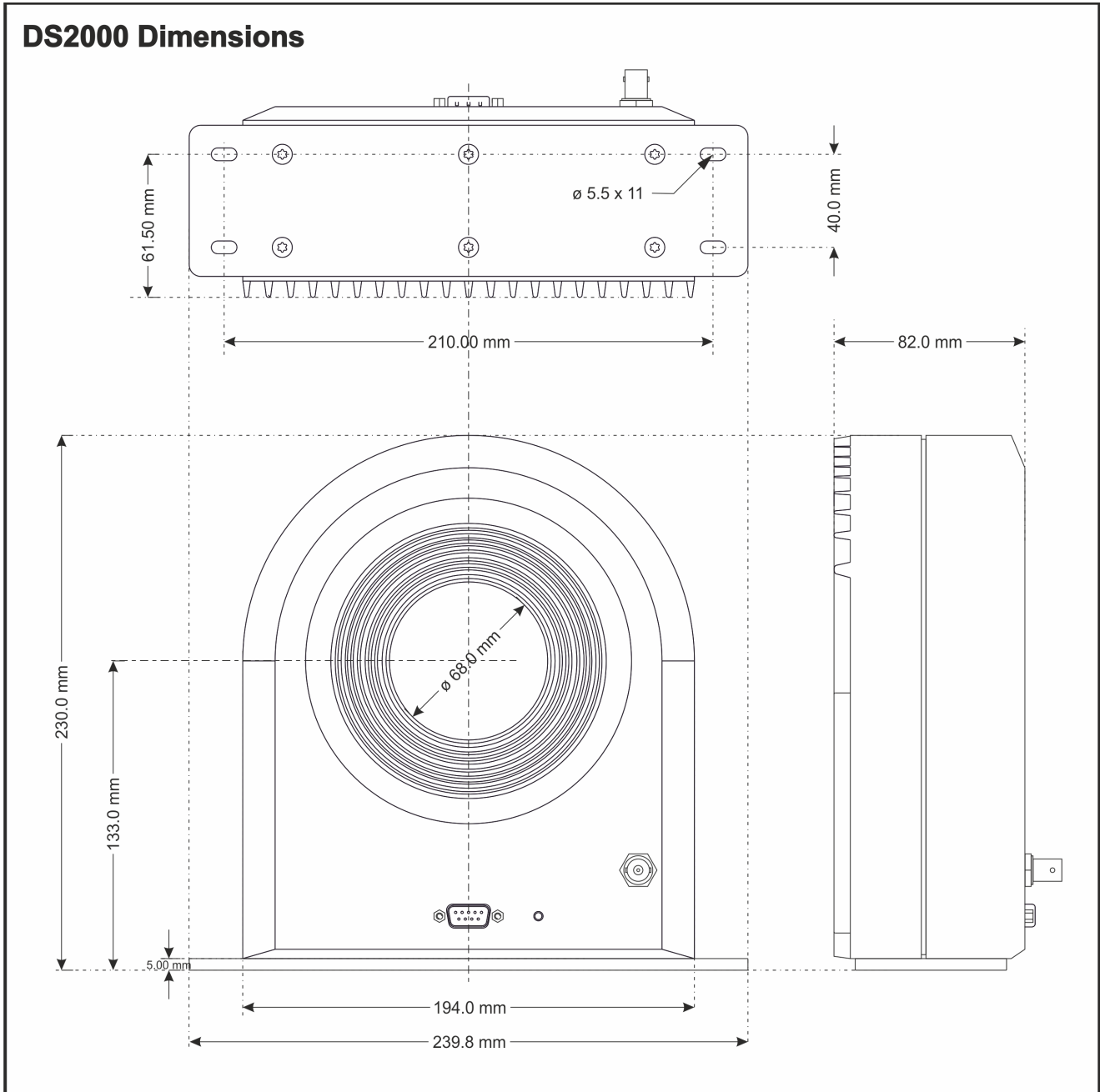
When transducer is operating in normal condition, the status pins (3 and 8) are shorted.

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

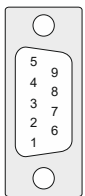
## Accessories

- 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): DSUB2 - DSUB5 - DSUB10

Please visit the Danisense homepage for relevant datasheets.

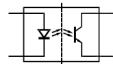


DSUB-9 pinout & BNC connection

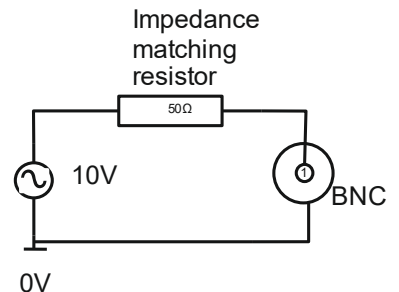


When sensor is operating in normal condition the status pins are shorted.

- 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
  - 4 holes f5.5 x 11
  - 4 x M5 steel screws / 6N.m
- Bottom direct mounting (after unscrewing the base plate)
  - 6 holes f4.2 x 7
  - 6 x M4 steel screw / 4N.m

**Intended use:**

The DL2000UB-10V is designed to measure current up to 2000A., 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 equipment may be impaired.

## **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

Taastrup, Denmark

Henrik Elbæk

Date

2022-03-15