

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  $\phi 68\text{mm}$  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

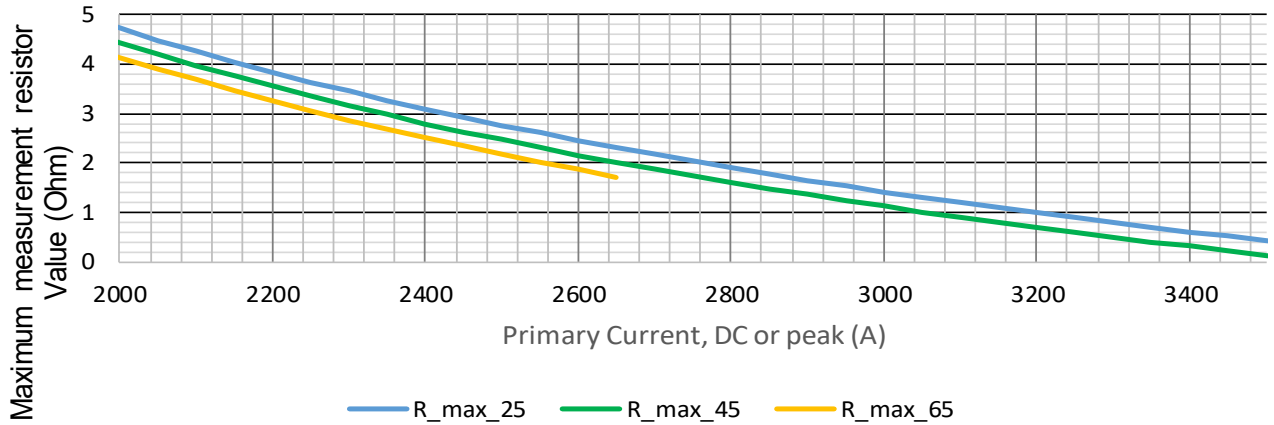
Specification highlights	Symbol	Unit	Min	Typ	Max
Nominal primary AC current	$I_{PN AC}$	A rms			2000
Nominal primary DC current	$I_{PN DC}$	A	-3000		3000
Measuring range	$\hat{I}_{PM}$	A	-3000		3000
Primary / secondary ratio	n1: n2		1:1500		1:1500
Linearity error	$\epsilon_L$	ppm	-1		1
Offset current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

All ppm (or %) values refer to nominal current

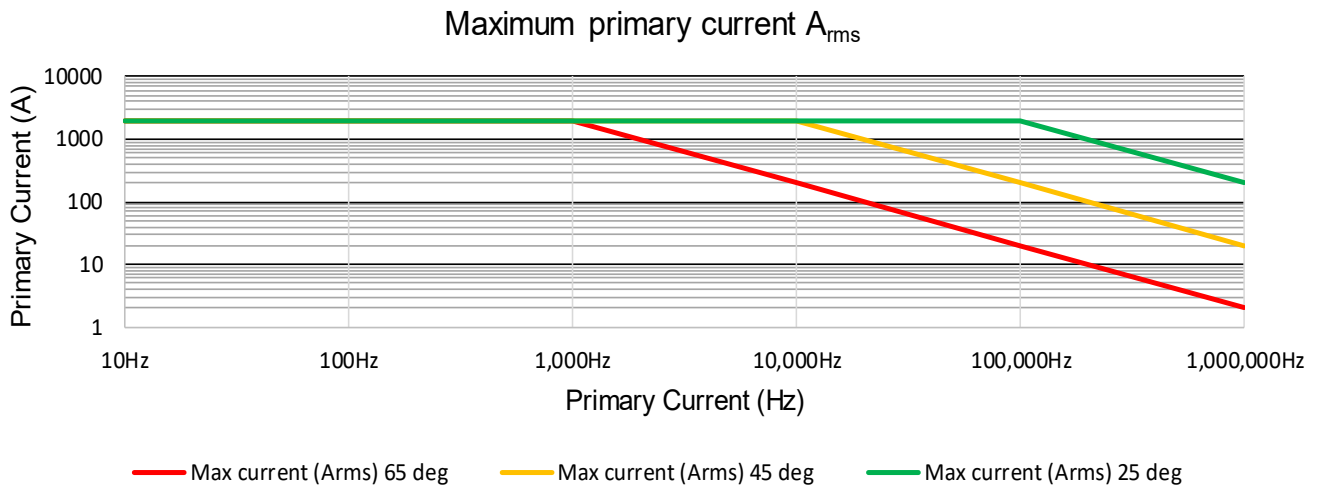
## Electrical specifications at Ta=23°C, supply voltage = ± 15V unless otherwise stated

Parameter	Symbol	Unit	Min	Typ.	Max	Comment
Nominal primary AC current	$I_{PN AC}$	Arms			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	$R_M$	$\Omega$	0		3	Refer to fig. 1 for details
Linearity error	$\epsilon_L$	ppm $\mu A$	-1 -2		1 2	ppm refers to nominal current $\mu A$ refers to secondary current
Offset current	$I_{OE}$	ppm $\mu A$	-6 -12		6 12	ppm refers to nominal current $\mu A$ refers to secondary current
DC-10Hz Overall accuracy @25°C (= $\epsilon_L$ + IOE )	acc $\epsilon$	ppm	-7		7	ppm refers to nominal DC current
Offset temperature coefficient	$TC_{IOE}$	ppm/K $\mu A/K$	-0.1 -0.2		0.1 0.2	ppm refers to nominal current $\mu A$ refers to secondary current
Bandwidth	$f(-3dB)$	kHz	300			Small signal, graphs figure 3
Amplitude error	$\epsilon_G$	%			10Hz -2kHz	0.01%
2kHz -10kHz					1.50%	
10kHz - 100kHz					3.00%	
Phase shift	$\theta$	°			10Hz -2kHz	0.04°
2kHz -10kHz					0.5°	
10kHz - 100kHz					3°	
Response time to a step current IPN	$tr @ 90\%$	$\mu s$		1		$di/dt = 100A/\mu s$
Noise	noise	ppm rms			0 - 100Hz	0.02
0 - 1kHz					0.10	
0 - 10kHz					1.20	
0 - 100kHz					3.50	
Fluxgate excitation frequency	$f_{Exc}$	kHz		15.6		
Induced rms voltage on primary conductor		$\mu V$ rms			5	
Power supply voltages	$U_c$	V	±14.25		±15.75	
Positive current consumption	$I_{ps}$	mA	160	170	185	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/mon $\mu A/month$	-0.1 -0.2		0.1 0.2	ppm refers to nominal current $\mu A$ refers to secondary current
Offset change with vertical external magnetic field		$\mu A/mT$		0.2	0.8	(perpendicular to bus bar) $\mu A$ refers to secondary current
Offset change with horizontal external magnetic field		$\mu A/mT$		0.8	2	(parallel to bus bar) $\mu A$ refers to secondary current
Offset change with power supply voltage changes		$\mu A/V$		0	0.04	$\mu A$ refers to secondary current
Offset change with absolute power supply voltages tracking		$\mu A/V$		0.01	0.04	$\mu A$ refers to secondary current

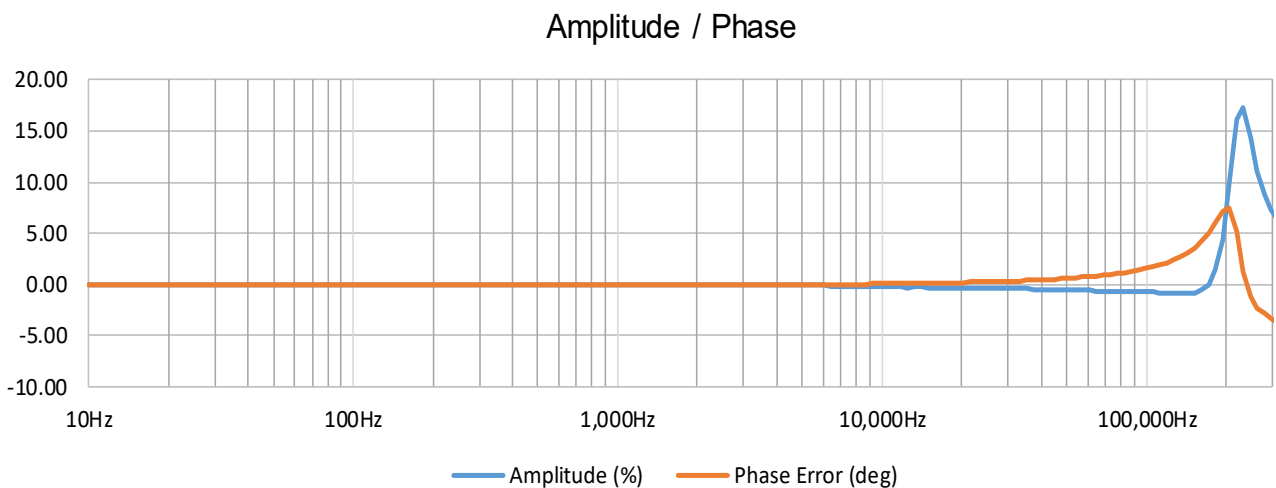
Maximum measurement resistor vs. ambient temperatures



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 - Between primary and (secondary and shield) - Between secondary and shield	kV	14.4 0.2
Impulse withstand voltage (1.2/50µs)	kV	26.3
Rated rms isolation voltage reinforced isolation, overvoltage category III, Pollution degree 2 according to  - IEC 61010-1 - EN50780	V	1500 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 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

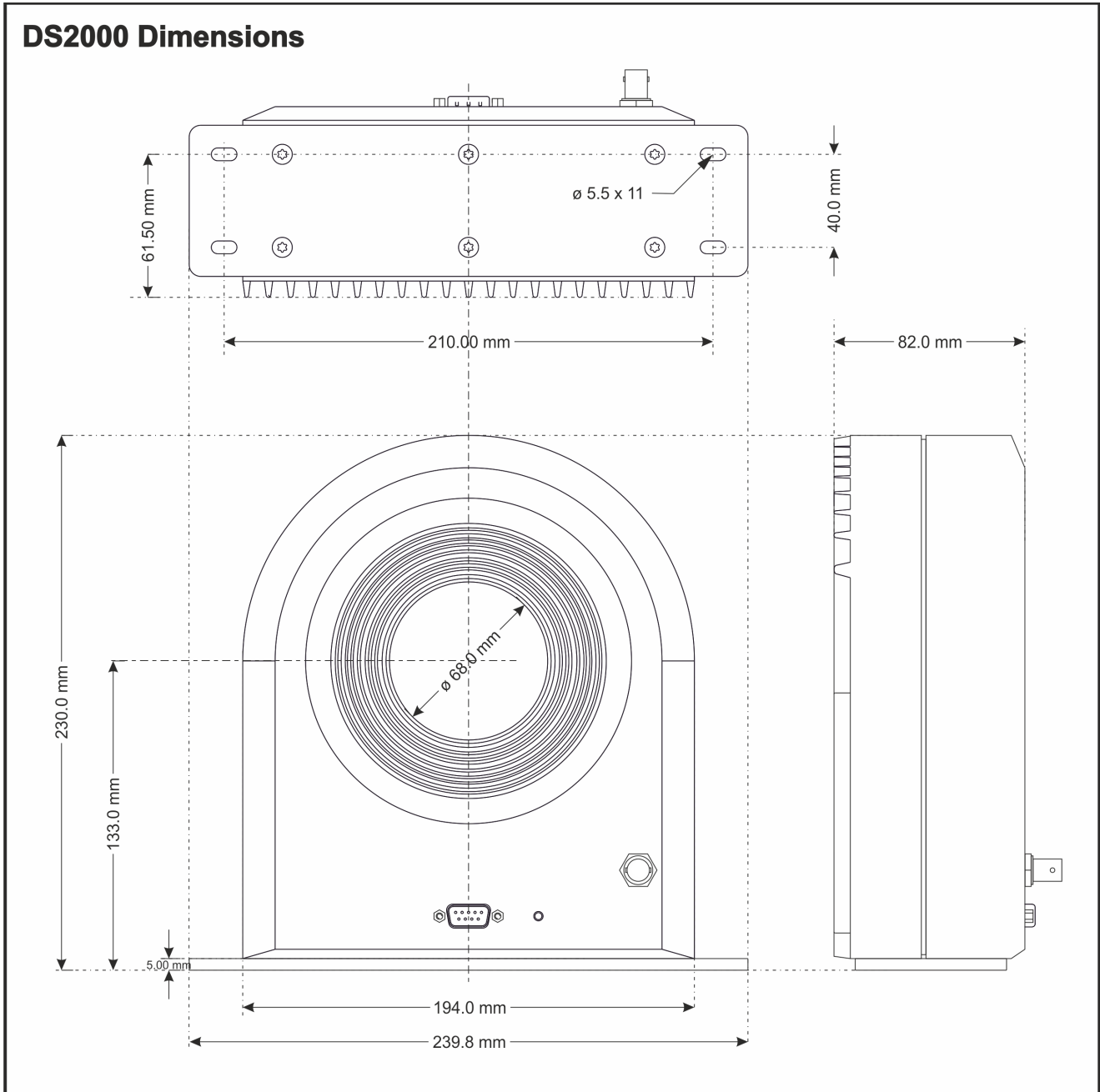
Both DC and AC primary current up to 100% of nominal value can be applied to the current transducers in the above situations without damage to the electronics.

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)

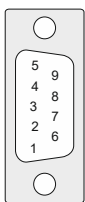
### **Status pins**

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



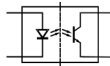
DSUB-9 current output with 1000 turns calibration winding



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 —●— Calib +
- 2 —●— Calib -
- 6 —●— Out+
- 1 —●— Out-

**Mounting instructions**

**Positive current direction**

Is identified by an arrow on the transducer body

- Base plate mounting
  - 4 holes  $\phi$ 5.5 x 11
  - 4 x M5 steel screws / 6N.m
- Bottom direct mounting
  - (after unscrewing the base plate)
  - 6 holes  $\phi$ 4.2 x 7
  - 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

Taastrup, Denmark



Henrik Elbæk

Date

2022-03-15