

Ultra-stable, high precision (ppm class) fluxgate technology DS Series current transducer for non-intrusive, isolated DC and AC current measurement up to 440A



**Features**

- Linearity error maximum  $\pm 15$  ppm
- 10V 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			280
Nominal primary DC current	$I_{PN DC}$	A			400
Nominal output voltage	$V_{out}$	V	-10		10
Measuring range	$I_{PM}$	A	-440		440
Primary / secondary ratio		V/kA	25,0000		25,0000
Linearity error (Best fit)	$\epsilon_L$	ppm	-15		15
Offset Voltage (including earth field)	$I_{OE}$	ppm	-15		15
	$V_{OE}$	uV	-150		150
AC Maximum gain error 10Hz to 1kHz					0.01%
Bandwidth (3dB)	$f_{3dB}$	KHz	500		
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			280	Refer to fig. 1 & 2 for derating
Nominal primary DC current	$I_{PN DC}$	A	-400		400	Refer to fig. 1 for derating
Measuring range	$I_{PM}$	A	-440		440	Refer to fig. 1 & 2 for derating
Overload capacity	$\hat{I}_{OL}$	A			1500	Non-measured, 100ms
Nominal voltage output	$V_O$	V	-10		10	At nominal primary DC current
Primary / secondary ratio		V/kA	25,0000		25,0000	
Linearity error	$\epsilon_L$	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	$tr@90\%$	$\mu s$		1		$di/dt = 100A/\mu s$
Amplitude error	$\epsilon_G$	%			0,04	% refers to nominal current
10Hz-1kHz					0,20	
1kHz-10kHz					7,00	
Phase shift	$\theta$	°			0,01	
10Hz-1kHz					0,07	
1kHz-10kHz					2,00	
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 $V_O/25$ (A)
Negative current consumption	$I_{ns}$	mA			96	Add $V_O/25$ (A)
Operating temperature range	$T_a$	°C	-40		65	
<b>Offset error</b>						
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	-0,3		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	-5		5	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

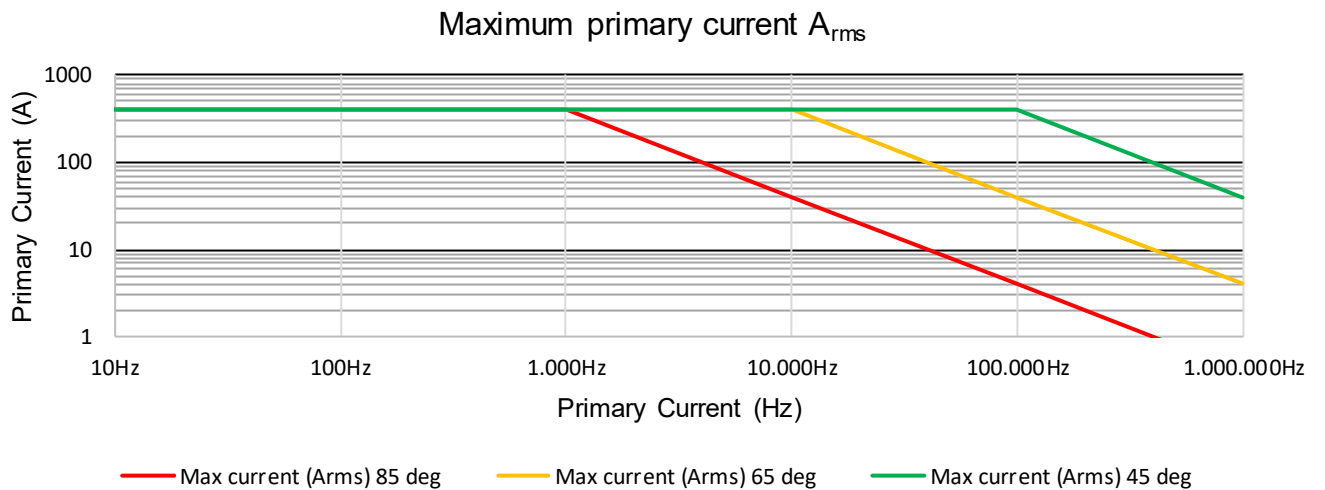


Indicate that caution is necessary when operating the device

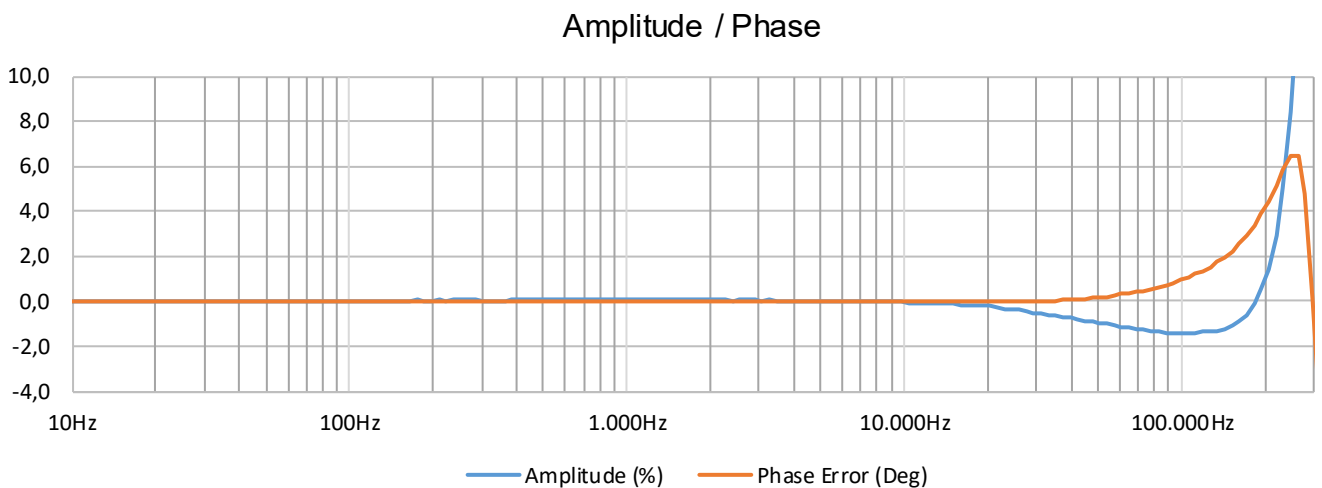


**Caution:** Intended use is to measure current, and the product should only be used for intended use.

**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"> <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 600 300  2000 1000 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 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 <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

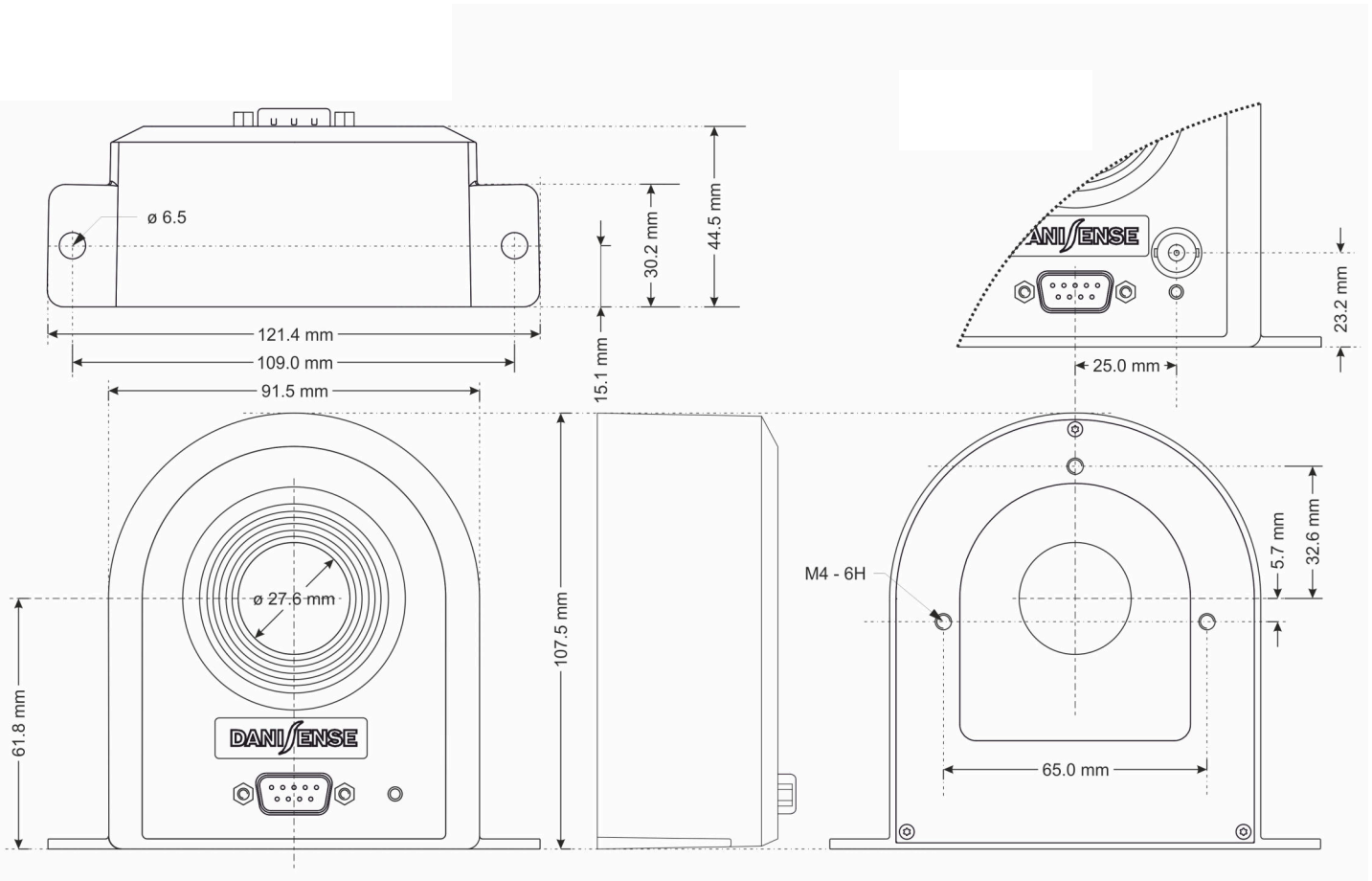
When transducer is operating in normal condition, the status pins (3 and 8) are shorted.

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 –15m - 20m): DSUB2 - DSUB5 - DSUB10 - DSUB15 - DSUB20

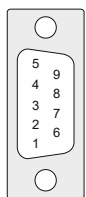
Please visit the Danisense homepage for relevant datasheets.



(general tolerance 0.3mm unless otherwise stat-

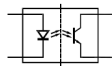
**DSUB pin layout**

DSUB-9 pinout & BNC connection

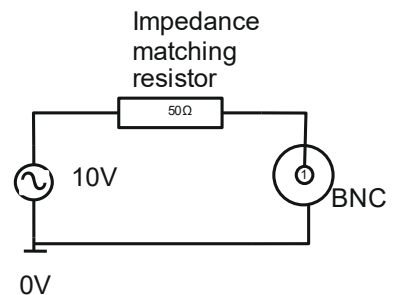


When sensor is operating in normal condition the status pins are shorted.

- 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-10V 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