Ultra-stable, high precision (ppm class) fluxgate technology DS Series current transducer for non-intrusive, isolated DC and AC current measurement up to 1000A

CE RoHS 2011/65/EU

Features

- Linearity error maximum 1 ppm
- 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
- Large aperture ϕ27.6mm 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

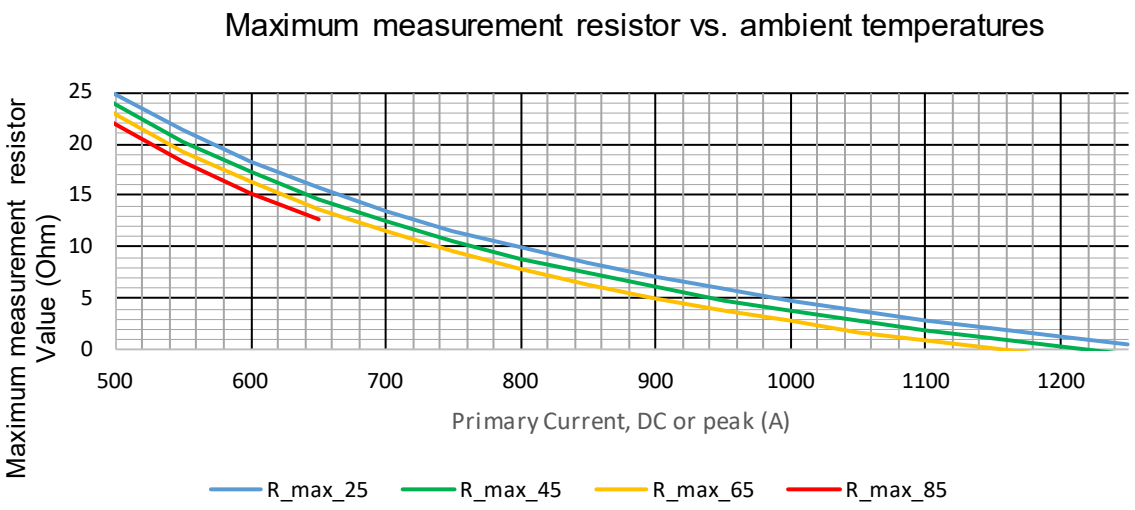
Specification highlights	Symbol	Unit	Min	Typ	Max
Nominal primary AC current	I_{PN} AC	Arms			600
Nominal primary DC current	I_{PN} DC	A	-900		900
Measuring range	$\hat{I}_{PM}$	A	-1000		1000
Primary / secondary ratio	n1:n2		1:1500		1:1500
Linearity error	ε_L	ppm	-1		1
Offset current (including earth field)	I_{OE}	ppm	-12		12
DC-10Hz Overall accuracy @25°C (= $\varepsilon_L + I_{OE}$)	accε	ppm	-13		13
AC Maximum gain error 10Hz to 2kHz	εG	%			±0.01
Operating temperature range	Ta	℃	-40		85
Power supply voltages	Uc	V	±14.25		±15.75

All ppm (or %) values refer to nominal current

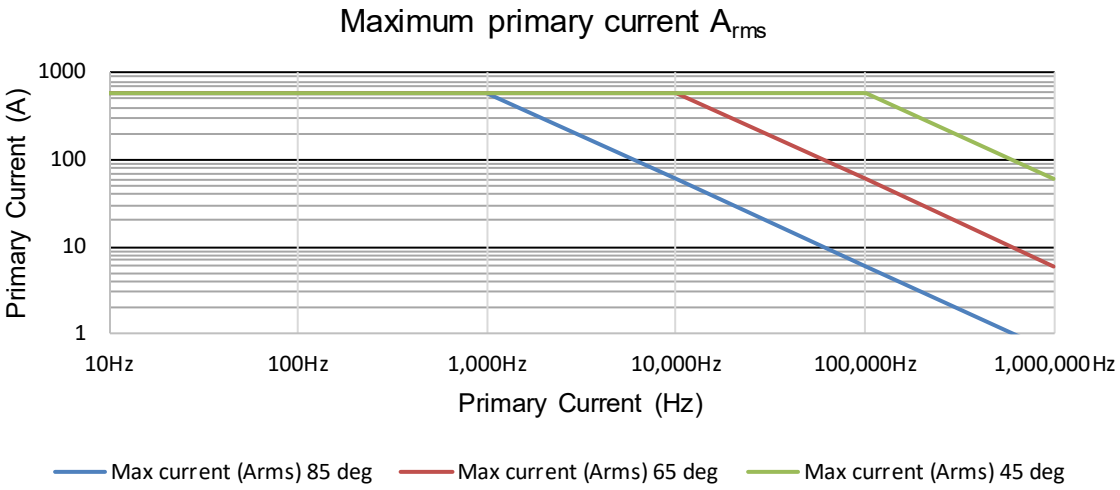
Electrical specifications at Ta=23°C, supply voltage = ± 15V unless otherwise stated

Parameter	Symbol	Unit	Min	Typ.	Max	Comment
Nominal primary AC current	I_{PN} AC	Arms			600	Refer to fig. 1 & 2 for derating
Nominal primary DC current	I_{PN} DC	A	-900		900	Refer to fig. 1 for derating
Measuring range	I_{PM}	A	-1000		1000	Refer to fig. 1 & 2 for derating
Overload capacity	$\hat{I}_{OL}$	A			4500	Non-measured, 100ms
Nominal secondary current	I_{SN}	mA	-600		600	At nominal primary DC current
Primary / secondary ratio			1:1500		1:1500	
Measuring resistance	R_M	Ω	0		3	Refer to fig. 1 for details
Linearity error	ε_L	ppm µA	-1 -0.6		1 0.6	ppm refers to nominal current µA refers to secondary current
Offset current (including earth field)	I_{OE}	ppm µA	-12 -5		12 5	ppm refers to nominal current µA refers to secondary current
DC-10Hz Overall accuracy @25°C (= εL + IOE)	accε	ppm	-13		13	ppm refers to nominal DC current
Offset temperature coefficient	TC_{IOE}	ppm/K µA/K	-0.1 -0.06		0.1 0.06	ppm refers to nominal current µA refers to secondary current
Bandwidth	f(-3dB)	kHz	500			Small signal, graphs figure 3
Amplitude error 10Hz – 2kHz 2kHz - 10kHz 10kHz - 100kHz	εG	%			0.01% 0.20% 2.50%	% refers to nominal current
Phase shift 10Hz – 2kHz 2kHz - 10kHz 10kHz - 100kHz	θ	°			0.03° 0.04° 1.0°	
Response time to a step current IPN	tr @ 90%	µs		1		di/dt = 100A/µs
Noise 0 - 100Hz 0 - 1kHz 0 - 10kHz 0 - 100kHz	noise	ppm rms			0.01 0.02 0.20 0.70	Measured on secondary current
Fluxgate excitation frequency	f_{Exc}	kHz		31.25		
Induced rms voltage on primary conductor		µV rms			5	
Power supply voltages	Uc	V	±14.25		±15.75	
Positive current consumption	Ips	mA	94	100	105	Add Is (if Is is positive)
Negative current consumption	Ins	mA	87	92	98	Add Is (if Is is negative)
Operating temperature range	Ta	℃	-40		85	
Stability						
Offset stability over time		ppm/month µA/month	-0.1 -0.06		0.1 0.06	ppm refers to nominal current µA refers to secondary current
Offset change with vertical external magnetic field		µA /mT		0.2	0.8	(perpendicular to bus bar) µA refers to secondary current
Offset change with horizontal external magnetic field		µA /mT		0.8	2	(parallel to bus bar) µA refers to secondary current
Offset change with power supply voltage changes		µA /V		0.004	0.04	µA refers to secondary current
Offset change with absolute power supply voltages tracking		µA /V		0.012	0.04	µA refers to secondary current

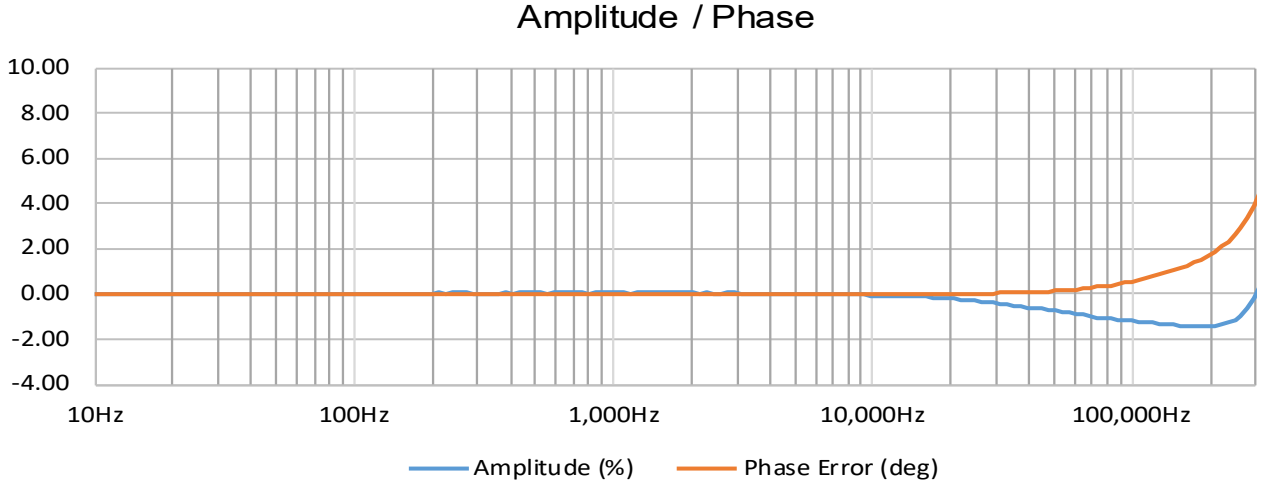
Measurement resistor RM and ambient temperature derating (Fig. 1)



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 • 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 600 300 2000 1000 1000
Transient voltage with Uninsulated wire • Non mains • CAT II • CAT III Insulated wire • 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 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		85	
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 ratisngs 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)

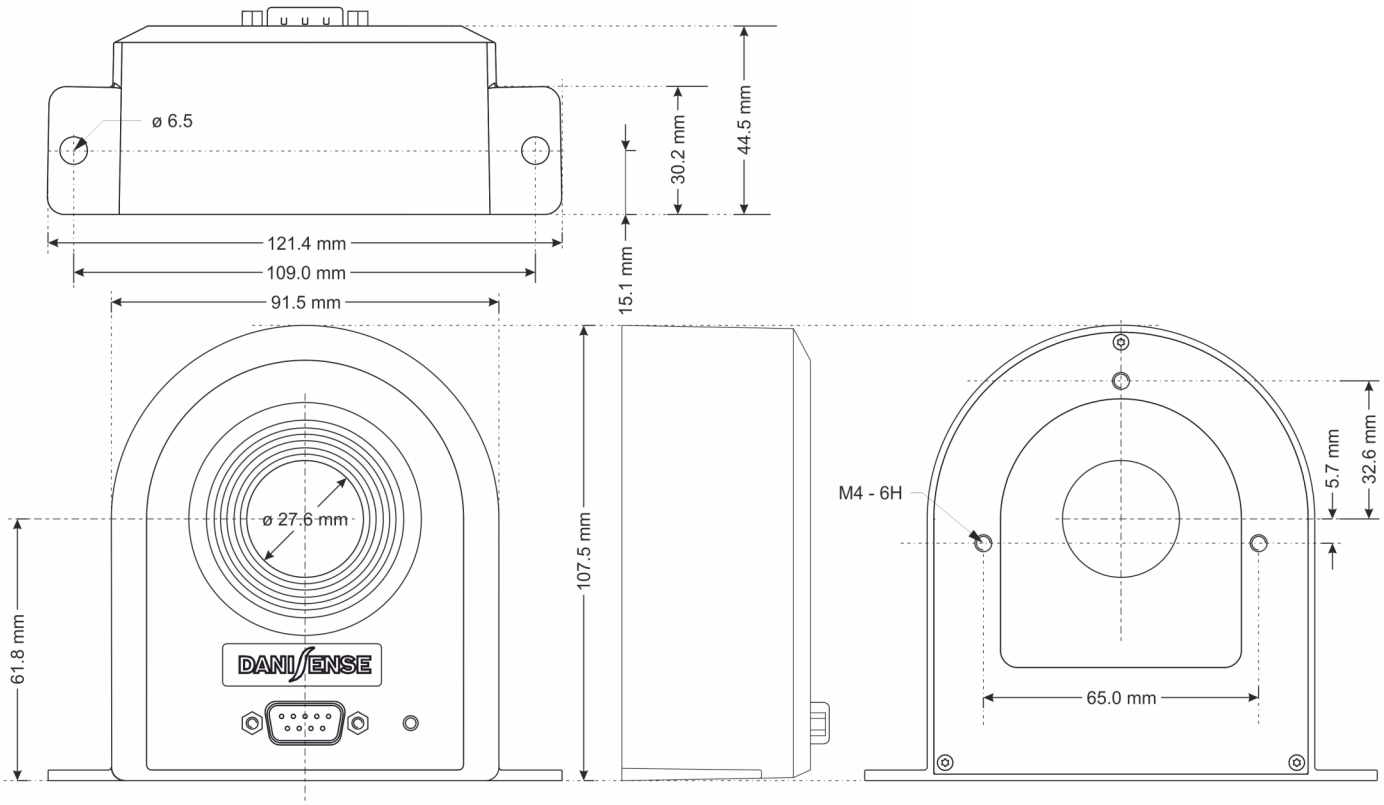
Status pins

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

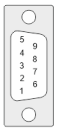
Please visit the Danisense homepage for relevant datasheets.



(general tolerance 0.3mm unless otherwise stat-

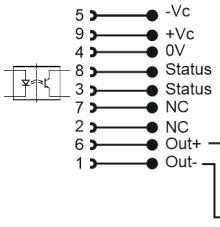
DSUB pin layout

Standard DSUB-9 current output



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



Positive current direction

Is identified by an arrow on the transducer body

Mounting instructions

- Base plate mounting — 2 holes ϕ6.5, 2 x M5 steel screws / 6N.m
- Back side panel mounting — 3 holes ϕ4.0 x 6H, 3 x M4 steel screw / 4N.m

Intended use:

The DS600ID is designed to measure current up to 1000A DC, 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. Place the primary conductor through the apperture of the transducer
3. If the DSSIU-4(6)-1U is intended for desk use, mount the rubber feet which are part of the package.
4. If the DSSIU-4(6)-1U is intended for Rack mounting, use the screw kit for mounting and do not mount the rubber feet.
5. Connect a DSUB cable between DSSIU-4(6)-1U and each sensor
6. Connect a low impedance amperemeter, measuring resistor or power analyzer on the secondary output (4mm red and black connectors)
7. Ensure that no calibration connectors are attached when measuring primary current. Always avoid to create a calibration short circuit, between + and — calibration connection.
8. 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.
9. When all connection are secured - connect mains power
10. 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.