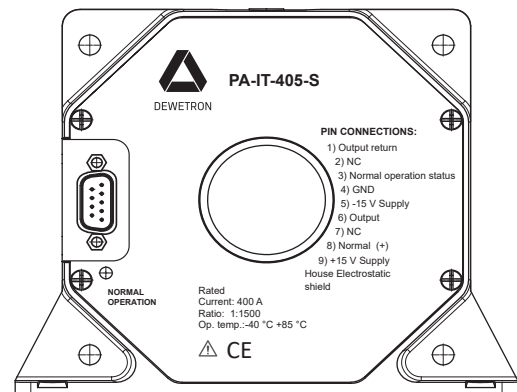


PA-IT-405-S

CURRENT TRANSDUCER

FOR ULTRA-HIGH PRECISION MEASUREMENT OF CURRENT: DC, AC, PULSED..., WITH GALVANIC SEPARATION BETWEEN PRIMARY AND SECONDARY

$$I_{PN} = 400 \text{ A}$$



FEATURES

- ▶ Wide operating temperature range of -40 to +85 °C
- ▶ Closed loop (compensated) current transducer using an extremely accurate zero flux detector
- ▶ Electrostatic shield between primary and secondary circuit
- ▶ 9-pin D-SUB male secondary connector
- ▶ Optically insulated output (photocoupler type) indicates transducer state
- ▶ LED indicator confirms normal operation

APPLICATIONS

- ▶ Feedback element in high performance gradient amplifiers for MRI
- ▶ Feedback element in high-precision, high-stability power supplies
- ▶ Calibration unit
- ▶ Energy measurement
- ▶ Medical equipment

ADVANTAGES

- ▶ Very high accuracy
- ▶ Excellent linearity
- ▶ Extremely low temperature drift
- ▶ Wide frequency bandwidth
- ▶ High immunity to external fields
- ▶ No insertion losses
- ▶ Low noise on output signal
- ▶ Low noise feedback to primary conductor

STANDARDS

- ▶ EN 61000-6-2:2005
- ▶ EN 61000-6-3:2007
- ▶ EN 61010-1:2010

APPLICATION DOMAINS

- ▶ Industrial
- ▶ Laboratory
- ▶ Medical

INSULATION COORDINATION

Parameter	Symbol	Unit	Value	Comment
Rated insulation RMS voltage	U_b	V	1600	Basic insulation according to IEC 61010-1 – Over voltage CAT III – Pollution degree 2
			300	Reinforced insulation according to IEC 61010-1 – Over voltage CAT III – Pollution degree 2
			1000	Basic insulation according to EN 50178 – Over voltage CAT III – Pollution degree 2
			600	Reinforced insulation according to EN 50178 – Over voltage CAT III – Pollution degree 2
RMS voltage for AC insulation test 50/60 Hz, 1 min	U_d	kV	4.6	Between primary and secondary + shield
Insulated voltage between secondary and shield	-	VDC	200	Between secondary and shield
Insulated voltage between secondary status output	-	VDC	500	Between secondary and status output
Impulse withstand voltage 1.2/50 μ s	\hat{U}_w	kV	8.5	-
Clearance (pri.–sec.)	d_{cl}	mm	9	Shortest distance through air
Creepage distance (pri.–sec.)	d_{cp}	mm	9	Shortest path along device body
Comparative tracking index	CTI	-	600	-

If insulated cable is used for the primary circuit, the voltage category could be improved with the following table (for single insulation) (IEC 61010-1 standard):

Cable insulated (primary)	Category
▶ HAR03	▶ 1750 V CAT III
▶ HAR05	▶ 1850 V CAT III
▶ HAR07	▶ 1950 V CAT III

ENVIRONMENTAL AND MECHANICAL CHARACTERISTICS

Parameter	Symbol	Unit	Min.	Typ	Max.	Comment
Ambient operating temperature	T_A	°C	-40	-	+85	-
Ambient storage temperature	T_S	°C	-40	-	+85	-
Relative humidity	RH	%	20	-	80	Non condensing
Dimensions	See drawing on page 6					
Mass	m	kg	-	1.08	-	-

ELECTRICAL DATA

At $T_A = 25\text{ °C}$, $\pm U_C = \pm 15\text{ V}$, unless otherwise noted.

Parameter	Symbol	Unit	Min.	Typ	Max.		Comment
Primary continuous direct current	I_{PNDC}	A	-400	-	400	*	-
Primary nominal rms current	I_{PN}	A	-	-	400	*	-
Primary current, measuring range	I_{PM}	A	-566	-	566	*	Peak limit
Measuring resistance over supply voltage range	R_M	Ω	0	-	15		See graph on page 5
Secondary current	I_S	mA	-377	-	377	*	Peak limit
Secondary nominal rms current	I_{SN}	mA	-	-	266	*	-
Conversion ratio	K_N	-	-	1:1500	-	*	-
Resistance of secondary winding	R_S	Ω	-	11	-		-
Overload capability ¹⁾	\hat{I}_P	A	-2000	-	2000		@ Pulse of 100 ms
Supply voltage DC	U_C	V	± 14.25	± 15	± 15.75	*	-
Current consumption	I_C	mA	-	122	128		Add I_S for total current consumption
				131	139	*	
Output rms noise current	I_{no}	ppm	-	-	0.1	-	-
				-	1	-	
				-	1.5	-	
				-	4.5	-	
				-	9	-	
Re-injected rms noise on primary bus bar	-	μV	-	-	5		0...50 kHz
Electrical offset current + self magnetization + effect of earth magnetic field ²⁾	I_{OE}	ppm	-	± 38	± 48		-
				± 42	± 55	*	
Offset stability ²⁾	-	ppm/month	-	-	1	-	-
Linearity error ²⁾	ϵ_L	ppm	-	± 4	± 11	-	@ $\pm I_{PNDC}$ range
				± 5	± 12	*	
Error (of full scale)	-	%	-	<0.0059	-	-	-
Frequency influence (of measured value) ³⁾	-	%/kHz	-	<0.175	-	-	-
Angular accuracy ³⁾	-	°	-	<0.1 + 0.08°/kHz	-	-	-
Step response time to 90 % of I_{PNDC}	t_r	μs	-	-	1	-	di/dt of 100 A/ μs
di/dt accurately followed	di/dt	A/ μs	-	100	-	-	-
Frequency bandwidth ($\pm 1\text{ dB}$)	BW	kHz	-	200	-	-	Small-signal bandwidth, 0.5 % of I_{PNDC}
Frequency bandwidth ($\pm 3\text{ dB}$)	BW	kHz	-	300	-	-	

Notes

1) Single pulse only, not AC. The transducer may require a few seconds to return to normal operation when autoreset system is running.

2) All ppm figures refer to full-scale which corresponds to a secondary nominal RMS current (I_{SN}) of 266 mA.

3) Verified with 50 Arms, DC...10 kHz

*) Lines with an * in the comment column apply over the -40...85 °C ambient temperature range.

OVERLOAD PROTECTION – ELECTRICAL SPECIFICATION – STATUS

The overload occurs when the primary current I_p exceeds a trip level such that the fluxgate detector becomes completely saturated and, consequently, the transducer will switch from normal operation to overload mode.

This trip level is guaranteed to be greater than 110 % of I_{PM} and its actual value depends on operating conditions such as temperature and measuring resistance.

When this happens, the transducer will automatically begin to sweep in order to lock on the primary current again and the measuring can resume when the primary current returns in the measuring range between $-I_{PM}$ and $+I_{PM}$.

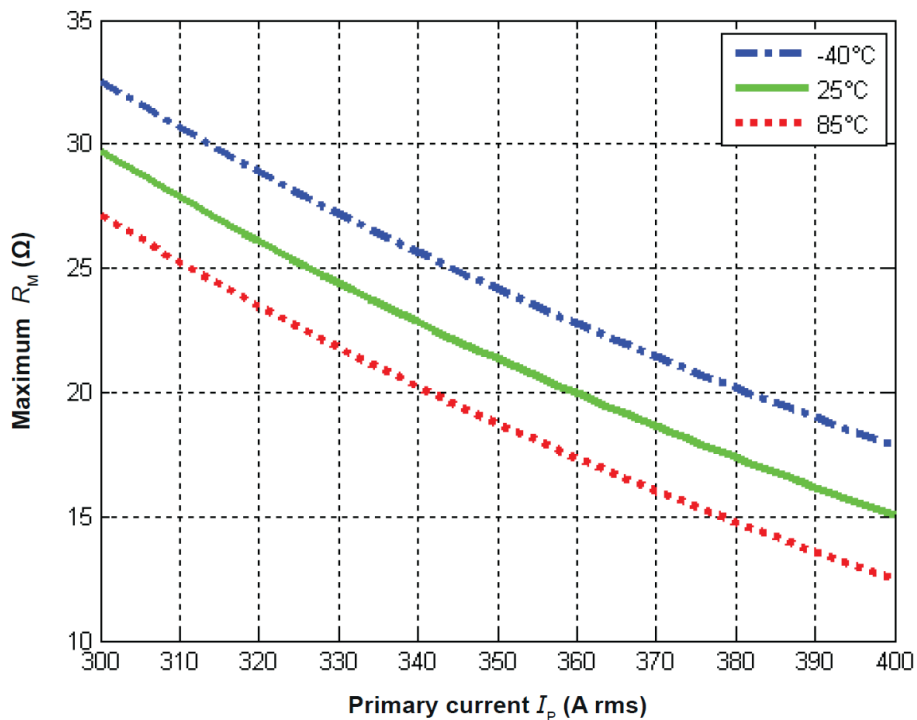
In overload mode the secondary current I_s generated is a low frequency signaling between -0.377 A and 0.377 A.

The overload conditions are:

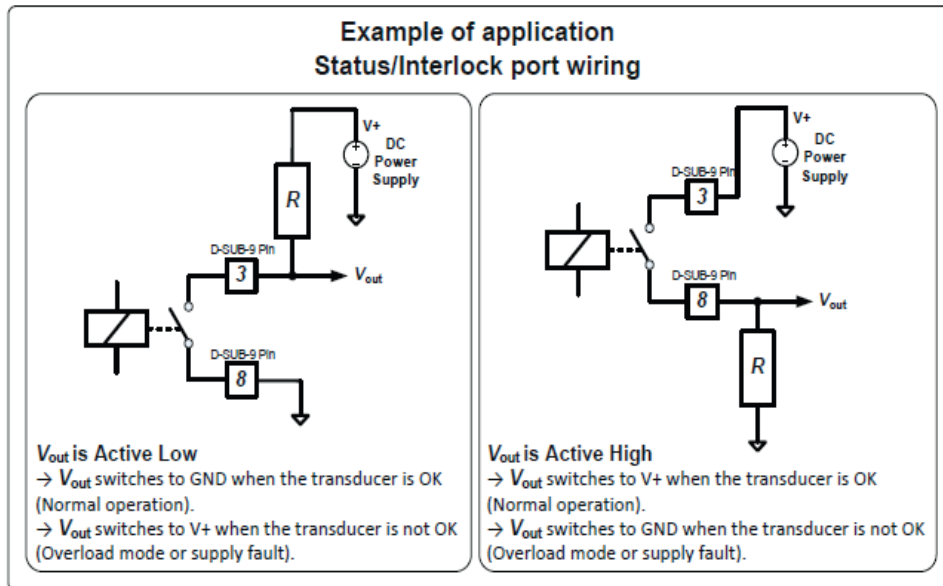
- ▶ The potential-free contact (normal operation status) between pin 3 and 8 of the D-SUB connector switches off, this contact becomes open.
- ▶ The green LED indicator (normal operation status) turns off.

Max. voltage pin 3 and pin 8; off-state	100 V
Max. voltage pin 3 and pin 8; on-state	1000 mA
On-state resistance pin 3 and 8	30 mΩ

MAXIMUM MEASURING RESISTOR VS. PRIMARY CURRENT AND TEMPERATURE



STATUS/INTERLOCK PORT WIRING



SAFETY

This transducer must be used in limited-energy secondary circuits according to IEC 61010-1.

WARNING



Risk of injury

This transducer must be used in electric/electronic equipment with respect to applicable standards and safety requirements in accordance with the manufacturer's operating instructions.

CAUTION



Risk of injury due to electrical shock

When operating the transducer, certain parts of the module can carry hazardous voltage (e.g. primary connection, power supply). Ignoring this warning can lead to injury and/or cause serious damage.

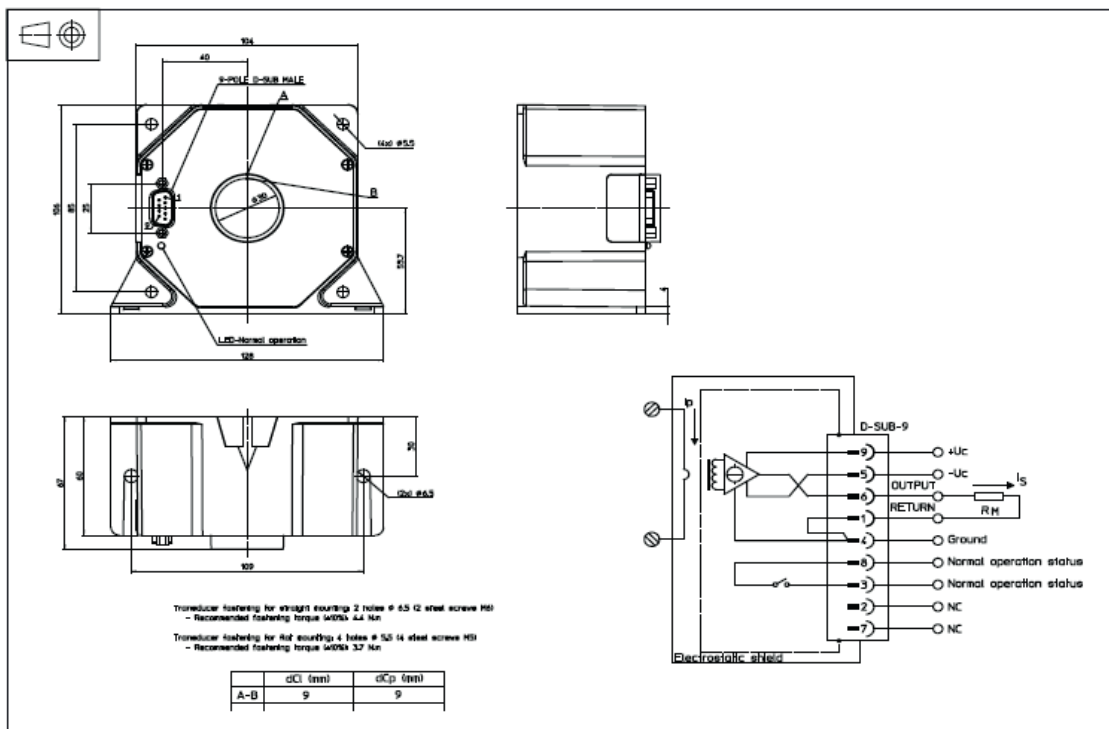


This transducer is a build-in device, whose conducting parts must be inaccessible after installation.

A protective housing or additional shield could be used. Main supply must be able to be disconnected.

PA-IT-405-S

DIMENSIONS



CONNECTION

- ▶ Normal operation status (pins 3 and 8)
- ▶ Normal operation means:
 - $\pm 15\text{ V}$ ($\pm U_L$) present
 - zero detector is working
 - primary current $\leq 110\%$ of I_{PM}
 - green LED indicator is lit

Contact (pins 3 and 8)	Description
Closed	The transducer is OK (normal operation)
Open	The transducer is not OK (overload mode or supply fault)

REMARKS

- ▶ I_s is positive when I_p flows in the direction of the arrow.
- ▶ We recommend that a shielded output cable and plug are used to ensure the maximum immunity against electrostatic fields.
- ▶ Pin 4 should be connected to cable and connector shield to maintain lowest output noise.
- ▶ Temperature of the primary conductor should not exceed $100\text{ }^\circ\text{C}$.

MECHANICAL CHARACTERISTICS

- ▶ General tolerance $\pm 0.3\text{ mm}$
- ▶ Transducer fastening
 - Straight mounting: 2 holes \varnothing 6.5 mm, 2x M6 steel screws, Recommended fastening torque: 4.4 Nm
 - Flat mounting: 4 holes \varnothing 5.5 mm, 4x M5 steel screws, Recommended fastening torque: 3.7 Nm
- ▶ Connection of secondary: on D-SUB-9, connector UNC 4-40
- ▶ All mounting recommendations are given for a standard mounting. Screws with flat and spring washers.
- ▶ Primary through hole $\varnothing \leq 30\text{ mm}$
- ▶ Installation of the transducer must be done, unless otherwise specified on the datasheet, according to the manufacturer's [Transducer Generic Mounting Rules](#).