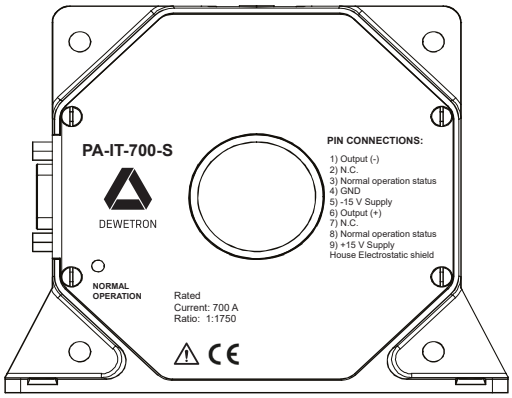
PA-IT-700-S

CURRENT TRANSDUCER

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

I_{PM} = 700 A



FEATURES

- 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
- Status signal to indicate the transducer state
- LED indicator confirms normal operation

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

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

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
		V_{DC}	200	Between secondary and shield
		V_{DC}	500	Between secondary and status output
Impulse withstand voltage 1.2/50 µs	$\hat{U}_W$	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*	V	600	-

If an 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	-10	-	+50	-
Ambient storage temperature	T_S	°C	-20	-	+85	-
Relative humidity	*RH*	%	20	-	80	Non condensing
Dimensions	See drawing on page 6					
Mass	*m*	kg	-	0.8	-	-

DEWETRON

ELECTRICAL DATA

At T_A = 25 °C, ±U_C = ±15 V, unless otherwise noted.

Parameter		Symbol	Unit	Min.	Typ.	Max.	Comment
Primary continuous direct current		$I_{PN\ DC}$	A	-700	-	700	-
Primary nominal rms current		I_{PN}	A	-	-	495	-
Primary current, measuring range		I_{PM}	A	-700	-	700	-
Measuring resistance, over operating current, temperature and supply voltage range		R_M	Ω	0	-	2.5	See graph on page 5
Secondary current		I_S	A	-0.4	-	0.4	-
Conversion ratio		K_N	-	-	1:1750	-	-
Resistance of secondary winding		R_S	Ω	-	20	-	-
Overload capability[1]		$\hat{I}_P$	kA	-3.5	-	3.5	@ Pulse of 100 ms
Supply voltage		U_C	V	±14.25	±15	±15.75	-
Current consumption		I_C	mA	-	-	80	Add I_S for total current consumption
Output rms noise current	0…10 Hz[2]	V_{no}	ppm	-	-	0.05	-
	0…100 Hz[2]			-	-	0.5	
	0…1 kHz[2]			-	-	1	
	0…10 kHz[2]			-	-	3	
	0…50 kHz[2]			-	-	6	
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	-50	-	50	-
Temperature coefficient of I_{OE}[2]		TCI_{OE}	ppm/K	-0.5	-	0.5	10...50 °C
Offset stability[2]		-	ppm/ month	-0.5	-	0.5	-
Linearity error[2]		ε_L	ppm	-3	-	3	-
Step response time to 90 % of $I_{PN\ DC}$		t_r	µs	-	-	1	di/dt of 100 A/µs
di/dt accurately followed		di/dt	A/µs	100	-	-	-
Frequency bandwidth	(±1 dB)	BW	kHz	-	50	-	Small-signal bandwidth, 0.5 % of I_{PM}
	(±3 dB)				100		

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_S) of 0.4 A.

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 $I_{PN\ DC}$ 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 $-I_{PN\ DC}$ and $+I_{PN\ DC}$.

In overload mode the secondary current generated is a low frequency triangle waveform between -0.4 A and +0.4 A.

Under these conditions:

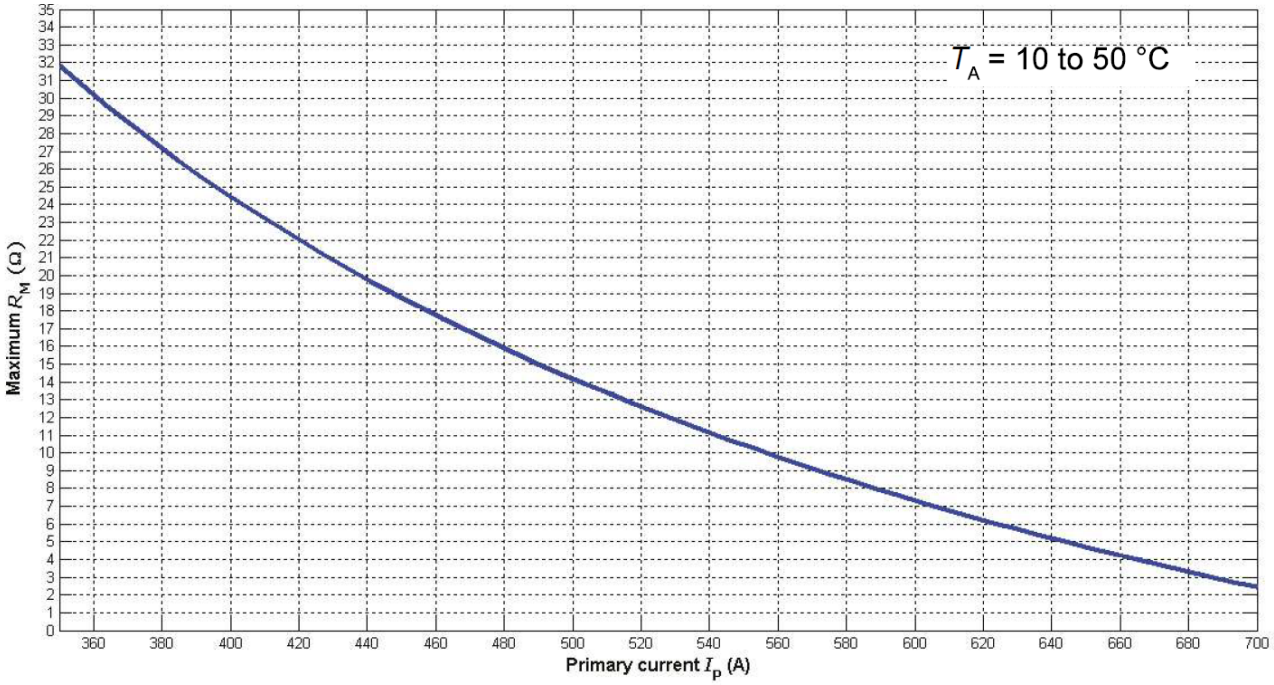
- The potential-free contact (normal operation status) between pin 3 and 8 of the D-SUB connector switches off, this contact becomes open.
- The green LED indicator (normal operation status) turns off.

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	50 mΩ (typ.)

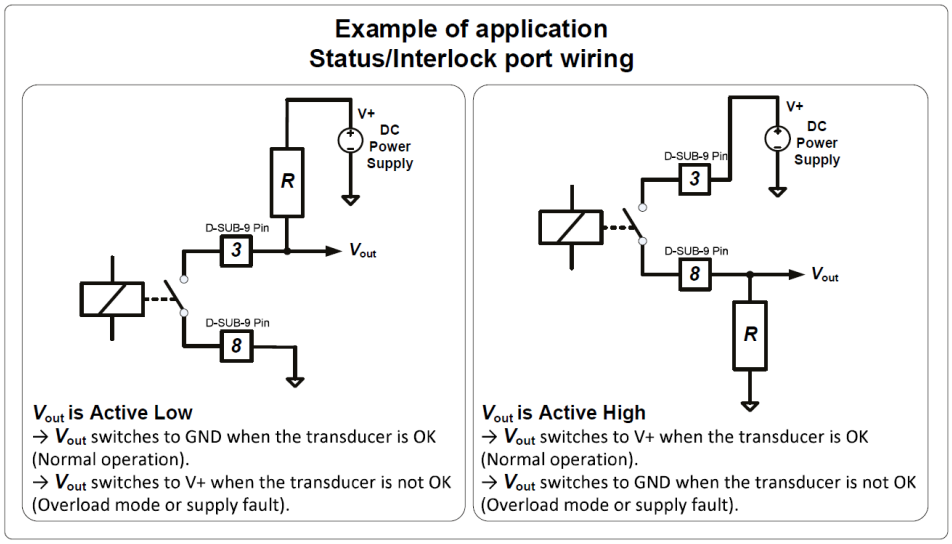
NOTICE

To ensure a safe recovery from saturation, the maximum burden resistor allowed is 2.5 Ω.

MAXIMUM MEASURING RESISTOR VS. PRIMARY CURRENT

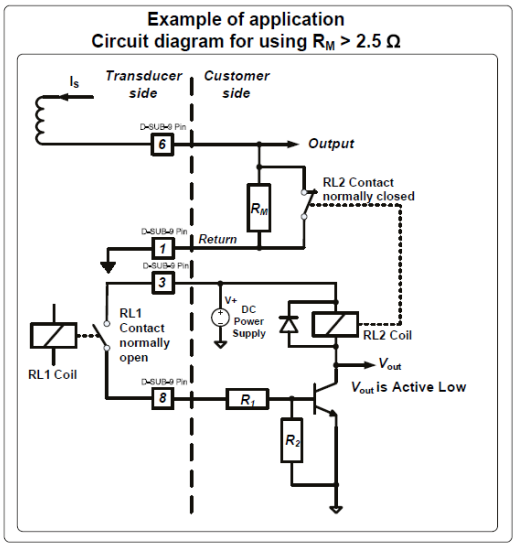


STATUS/INTERLOCK PORT WIRING



CIRCUIT DIAGRAM FOR USING R_M >2.5 Ω

The circuit ensures a safe recovery from saturation when using R_M >2.5 Ω. It allows the transducer to recover normal operation in case R_M is greater than 2.5 Ω and an overload is detected by the transducer.



Contact RL 1 (pins 3 and 8)	Contact RL2	V_{OUT}	Description
Closed	Open	Low (switches to GND)	The transducer is OK (normal operation).
Open	Closed	High (switches to V+)	The transducer is not OK (overload mode or supply fault).

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

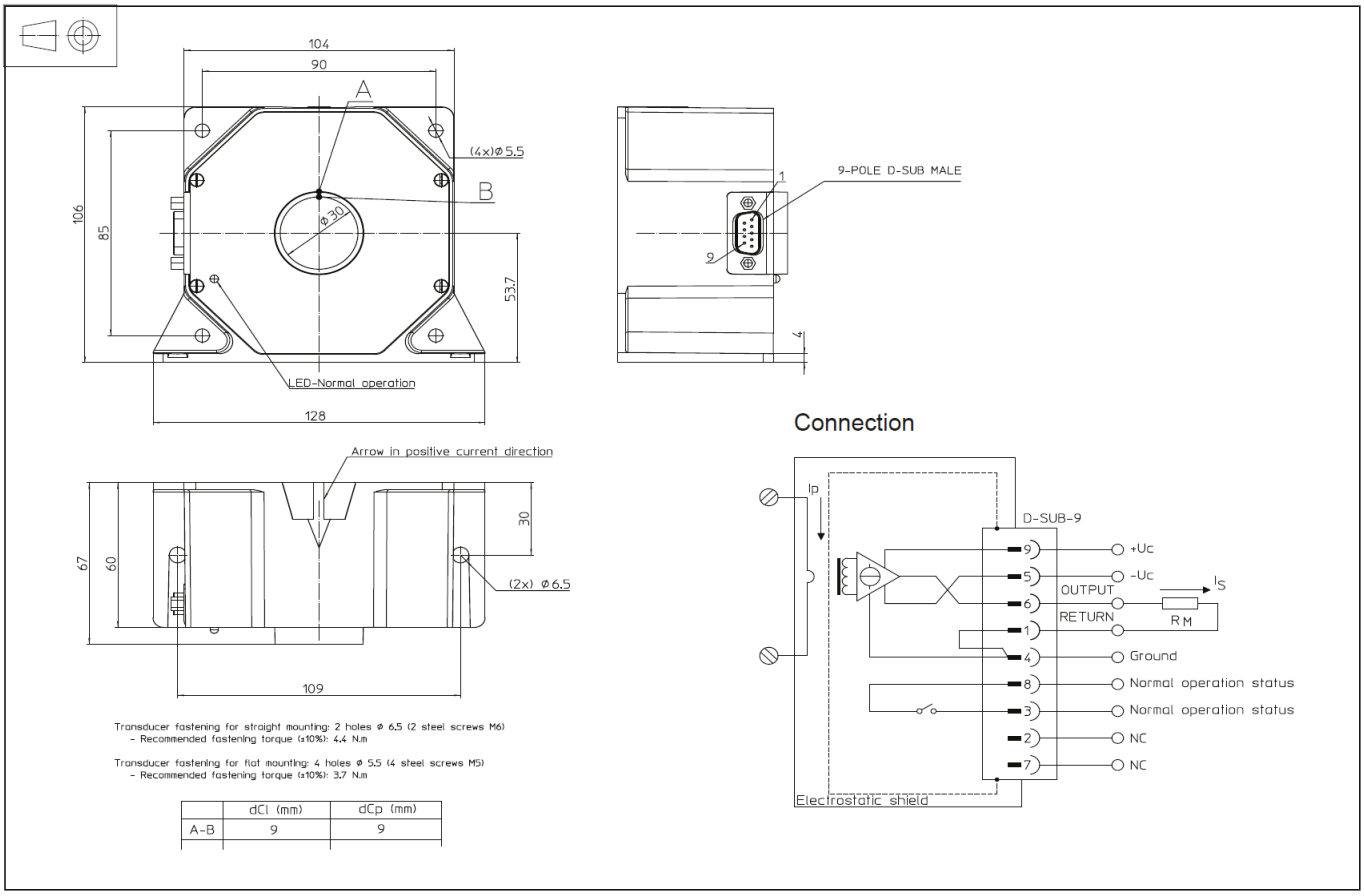
Risk of injury due to electrical shock

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.

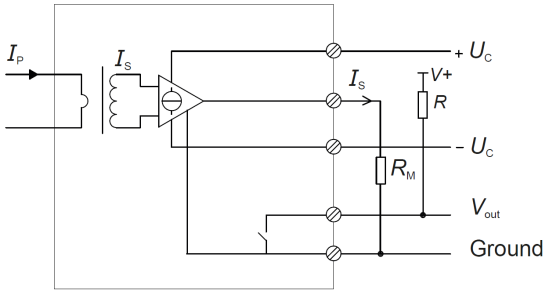
DIMENSIONS



DEWETRON

PERFORMANCE PARAMETERS DEFINITION

The schematic used to measure all electrical parameters is shown below:



TRANSDUCER SIMPLIFIED MODEL

The static model of the transducer at temperature T_A is:

$$I_S = K_N \cdot I_P + \text{error}$$

In which

$$\text{error} = I_{OE} \text{ at } 25\ °C + I_{OT}(T_A) + \varepsilon_L \cdot I_{PM} \cdot K_N$$

Where

$$I_{OT}(T_A) = TCI_{OE} \cdot |T_A - 25\ °C| \cdot I_{PM} \cdot K_N$$

I_S : secondary current (A)

K_N : conversion ratio

I_P : primary current (A)

I_{PM} : primary current, measuring range (A)

T_A : ambient operating temperature (°C)

I_{OE} : electrical offset current (A)

I_{OT} : temperature variation of I_{OE} at T_A (A)

ε_L : linearity error

This is the absolute maximum error. As all errors are independent, a more realistic way to calculate the error would be to use the following formula:

$$\text{error} = \sqrt{\sum (error\_component)^2}$$

LINEARITY

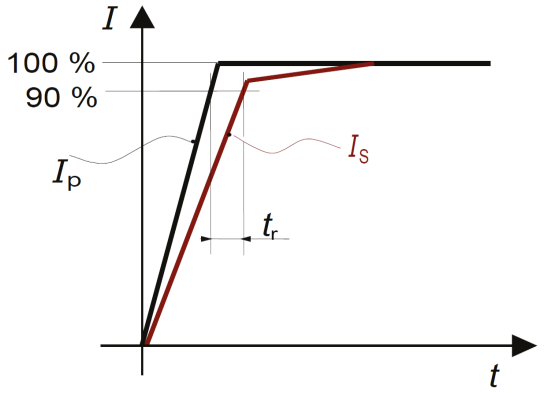
To measure linearity, the primary current (DC) is cycled from 0 to I_{PM}, then to $-I_{PM}$ and back to 0 (equally spaced $I_{PM}/10$ steps). The linearity error ε_L is the maximum positive or negative difference between the measured points and the linear regression line, expressed in parts per million (ppm) of full-scale which corresponds to the maximum measured value.

ELECTRICAL OFFSET

The electrical offset current I_{OE} is the residual output current when the input current is zero. The temperature variation I_{OT} of the electrical offset current I_{OE} is the variation of the electrical offset from 25 °C to the considered temperature.

RESPONSE TIME

The response time t is shown in the next figure. It depends on the primary current di/dt and it is measured at nominal current.



DEWETRON

CONNECTION

- Normal operation status (pins 3 and 8)
- Normal operation means:
  - ±15 V (±U_C) present
  - zero detector is working
  - compensation current ≤110 % of $I_{PN\ DC}$
  - 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 50 °C.

MECHANICAL CHARACTERISTICS

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