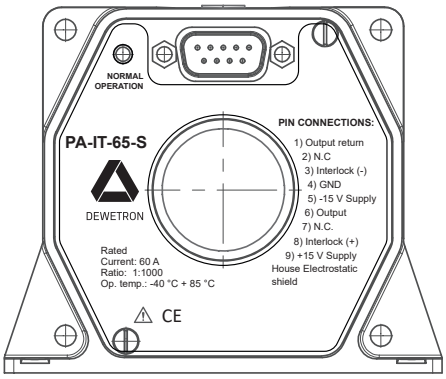
PA-IT-65-S

CURRENT TRANSDUCER

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

I_{PN} = 60 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

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	2000	Basic insulation according to IEC 61010-1 – Over voltage CAT III – Pollution degree 2
			600	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	5.4	Between primary and secondary + shield
Insulated voltage between secondary and shield	-	VDC	200	Between secondary and shield
Insulated voltage between secondary status output	-	VDC	300	Between secondary and status output
Impulse withstand voltage 1.2/50 µs	$\hat{U}_W$	kV	9.9	-
Clearance (pri.–sec.)	d_{Cl}	mm	11	Shortest distance through air
Creepage distance (pri.–sec.)	d_{Cp}	mm	11	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	2150 V CAT III
HAR05	2250 V CAT III
HAR07	2350 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	-	0.33	-	-

ELECTRIC DATA

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

Parameter		Symbol	Unit	Min.	Typ	Max.		Comment
Primary continuous direct current		$I_{PN\ DC}$	A	-60	-	60	*	-
Primary nominal RMS current		I_{PN}	A	-	-	60	*	-
Primary current, measuring range		I_{PM}	A	-85	-	85	*	Peak limit
Measuring resistance over supply voltage range		R_M	Ω	0	-	50		See graph on page 5
Secondary current		I_S	mA	-142	-	142	*	Peak limit
Secondary nominal rms current		I_{SN}	mA	-	-	100	*	-
Conversion ratio		K_N	-	-	1:600	-	*	-
Resistance of secondary winding		R_S	Ω	-	28	-		-
Overload capability[1]		$\hat{I}_P$	A	-300	-	300		@ Pulse of 100 ms
Supply voltage DC		U_C	V	±14.25	±15	±15.75	*	
Current consumption		I_C	mA	-	65	71		Add I_S for total current consumption
					70	78	*	
Output RMS noise current	0…10 Hz[2]	I_{no}	ppm	-	-	0.5	-	-
	0…100 Hz[2]			-	-	0.75	-	
	0…1 kHz[2]			-	-	2	-	
	0…10 kHz[2]			-	-	6	-	
	0…50 kHz[2]			-	-	15	-	
Re-injected rms noise on primary bus bar		-	µV	-	-	30		0...50 kHz
Electrical offset current + self magnetization + effect of earth magnetic field[2]		I_{OE}	ppm	-	±225	±300		-
				-	±330	±400	*	
Offset stability[2]		-	ppm/ month	-	-	2.5	-	-
Linearity error[2]		ε_L	ppm	-	±1	±3	-	@± $I_{PN\ DC}$ range
				-	±3	±9	*	
Error (of full scale)		-	%	-	<0.033	-	-	-
Frequency influence (of measured value)[3]		-	%/kHz	-	<0.025	-	-	-
Angular accuracy[3]		-	°	-	<0.1 + 0.02 °/kHz	-	-	-
Step response time to 90 % of $I_{PN\ DC}$		t_r	µs	-	-	1	-	d*i*/d*t* of 100 A/µs
d*i*/d*t* accurately followed		d*i*/d*t*	A/µs	-	100	-	-	-
Frequency bandwidth (±1 dB)		*BW*	kHz	-	600	-	-	Small-signal bandwidth, 0.5 % of $I_{PN\ DC}$
Frequency bandwidth (±3 dB)		*BW*	kHz	-	800	-	-	

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 100 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.

The overload conditions are:

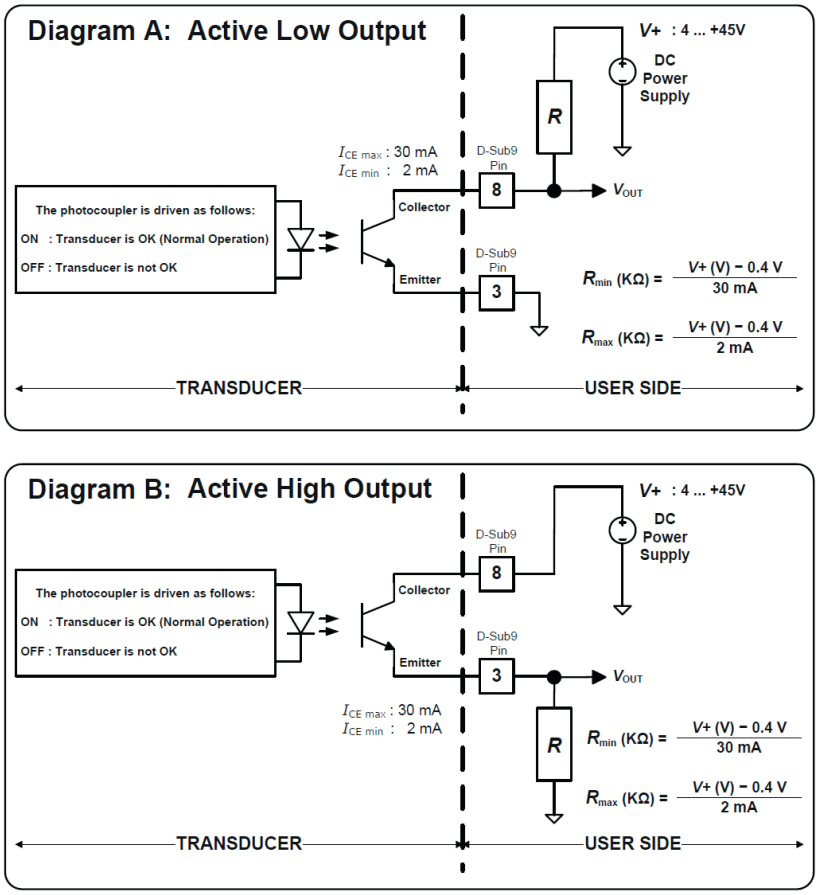
- The secondary current I_S generated is a low frequency signal between -142 mA and 142 mA.
- The signal V_{OUT} (operation status between pin 3 and 8 of the D-SUB connector) switches to V+ or GND depending on how it is wired. Hence, the output transistor is switched off (i.e. no current form collector to emitter). See the status port wiring below.
- The green LED indicator (normal operation status) turns off.

The measuring can resume when the primary current returns in the measuring range between $-I_{PM}$ and $+I_{PM}$. Then the signal V_{OUT} switches to V+ or GND and the green LED indicator (normal operation status) is again lit.

NOTICE

To ensure a safe recovery from saturation, the maximum burden resistor allowed is 43 Ω.

STATUS/INTERLOCK PORT WIRING



The following table shows how the output signal V_{OUT} acts depending on how it is wired.

Case	V_{OUT}	Description
Diagram A	<0.2 V	The transducer is OK (normal operation).
	V+	The transducer is not OK (overload mode or supply fault).
Diagram B	<0.2 V	The transducer is OK (normal operation).
	V+	The transducer is not OK (overload mode or supply fault).

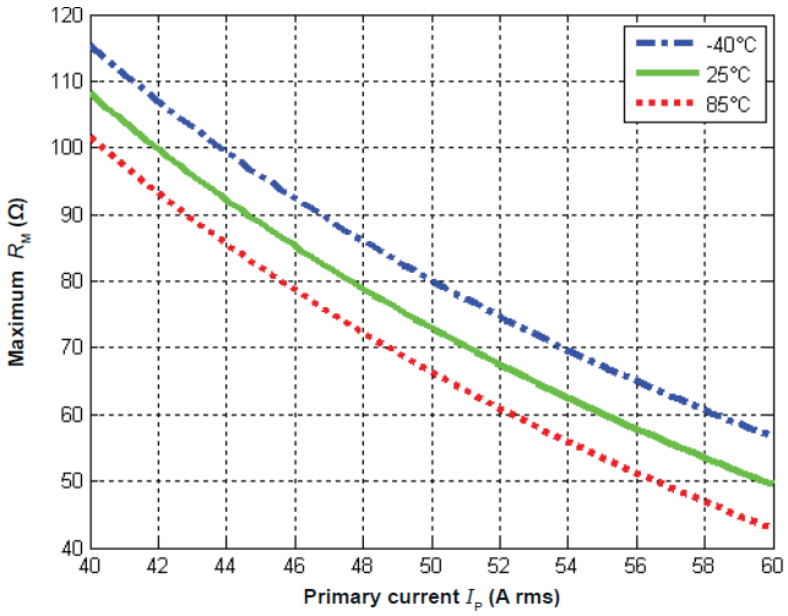
Some recommended standard values of *R*:

Power supply voltage V+	R_{min} (kΩ)	R_{max} (kΩ)	*R* standard values ±5 %
5 V	0.153	2.3	180 Ω, 1 kΩ or 2.2 kΩ
12 V	0.386	5.8	470 Ω, 2.2 kΩ or 4.7 kΩ
24 V	0.786	11.8	1 kΩ, 2.2 kΩ or 10 kΩ

ELECTRICAL DATA - STATUS PORT

Parameter	Symbol	Unit	Min.	Typ.	Max.	Comment
Collector-emitter voltage, off-state	$V_{CE\ off}$	V	4	-	45	-
Collector-emitter current, on-state	I_{CE}	mA	2	-	30	-
Reverse collector-emitter voltage, off-state	$V_{CER\ off}$	V	-	-	5	-
Collector-emitter voltage, on-state	$V_{CE\ on}$	V	-	-	0.2	-

MAXIMUM MEASURING RESISTOR VS. PRIMARY CURRENT AND TEMPERATURE



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

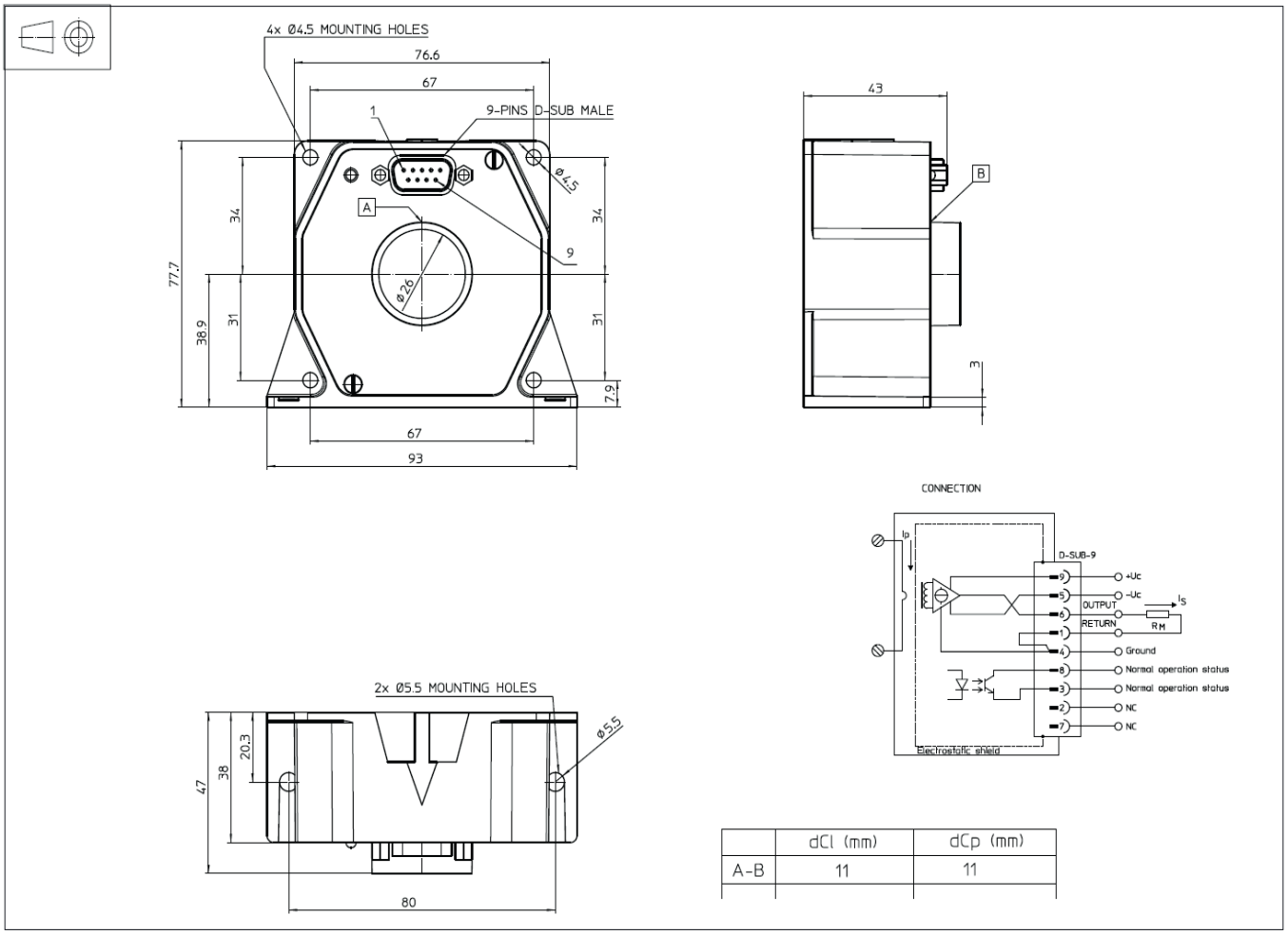
Risk of injury due to electrical shock

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



	dCl (mm)	dCp (mm)
A-B	11	11

CONNECTION

- Normal operation status (pins 3 and 8)
- Normal operation means:
  - ±15 V (±U_C) present
  - zero detector is working
  - primary current ≤110 % of I_{PM}
  - green LED indicator is lit

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 °C.

MECHANICAL CHARACTERISTICS

- General tolerance ±0.3 mm
- Transducer fastening
  - Straight mounting: 2 holes Ø 5.5 mm, 2x M5 steel screws
    - Recommended fastening torque: 3.7 Nm
  - Flat mounting: 4 holes Ø 4.5 mm, 4x M4 steel screws
    - Recommended fastening torque: 2.8 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 Ø ≤26 mm
- Installation of the transducer must be done unless otherwise specified on the datasheet, according to the manufacturer's Transducer Generic Mounting Rules.