

Current Transducer IT 205-S ULTRASTAB

$I_{PN} = 200\text{ A}$

For ultra-high precision measurement of current: DC, AC, pulsed..., with galvanic separation between primary and secondary.



RoHS



Features

- Wide operating temperature range of $-40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$
- 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

- Feed back 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, basic insulation | U_b | V | 2000 | IEC 61010-1 conditions - over voltage cat III - pollution degree 2 |
| Rated insulation rms voltage, reinforced insulation | U_b | V | 600 | IEC 61010-1 conditions - over voltage cat III - pollution degree 2 |
| Rated insulation rms voltage, basic insulation | U_b | V | 1000 | EN 50178 conditions - over voltage cat III - pollution degree 2 |
| Rated insulation rms voltage, reinforced insulation | U_b | V | 600 | EN 50178 conditions - 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 |
| Insulation voltage between secondary and shield | | V DC | 200 | Between secondary and shield |
| Insulation voltage between secondary status output | | V DC | 300 | Between secondary and status output |
| Impulse withstand voltage 1.2/50 μ s | \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 page 7 |
| Mass | m | kg | | 0.35 | | |

Electrical data

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

Lines with a * in the comment column apply over the $-40 \dots 85\text{ °C}$ ambient temperature range.

| Parameter | Symbol | Unit | Min | Typ | Max | Comment | | |
|---|--------------|------------------|-------------|-----------|-------------|---|---|--|
| Primary continuous direct current | I_{PNDC} | A | -200 | | 200 | * | | |
| Primary nominal rms current | I_{PN} | A | | | 200 | * | | |
| Primary current, measuring range | I_{PM} | A | -283 | | 283 | * Peak limit | | |
| Measuring resistance over supply voltage range | R_M | Ω | 0 | | 20 | See graph page 5 | | |
| Secondary current | I_S | mA | -283 | | 283 | * Peak limit | | |
| Secondary nominal rms current | I_{SN} | mA | | | 200 | * | | |
| Conversion ratio | K_N | | | 1:1000 | | * | | |
| Resistance of secondary winding | R_S | Ω | | 20 | | | | |
| Overload capability ¹⁾ | \hat{I}_P | A | -1000 | | 1000 | @ 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 | | | 0.1 | | | |
| Output rms noise current 0 ... 100 Hz ²⁾ | | | | | 0.5 | | | |
| Output rms noise current 0 ... 1 kHz ²⁾ | | | | | | 1.5 | | |
| Output rms noise current 0 ... 10 kHz ²⁾ | | | | | | 6 | | |
| Output rms noise current 0 ... 50 kHz ²⁾ | | | | | | 15 | | |
| 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 | | ± 45 | ± 100 | | | |
| | | | | ± 100 | ± 190 | * | | |
| Offset stability ²⁾ | | ppm/month | | | 1 | | | |
| Linearity error ²⁾ | ϵ_L | ppm | | ± 1 | ± 3 | | @ $\pm I_{PNDC}$ range | |
| | | | | ± 4 | ± 11 | * | | |
| 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 | | 400 | | Small-signal bandwidth, 0.5 % of I_{PNDC} | | |
| Frequency bandwidth ($\pm 3\text{ dB}$) | BW | kHz | | 1000 | | Small-signal bandwidth, 0.5 % of I_{PNDC} | | |

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 200 mA.

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.

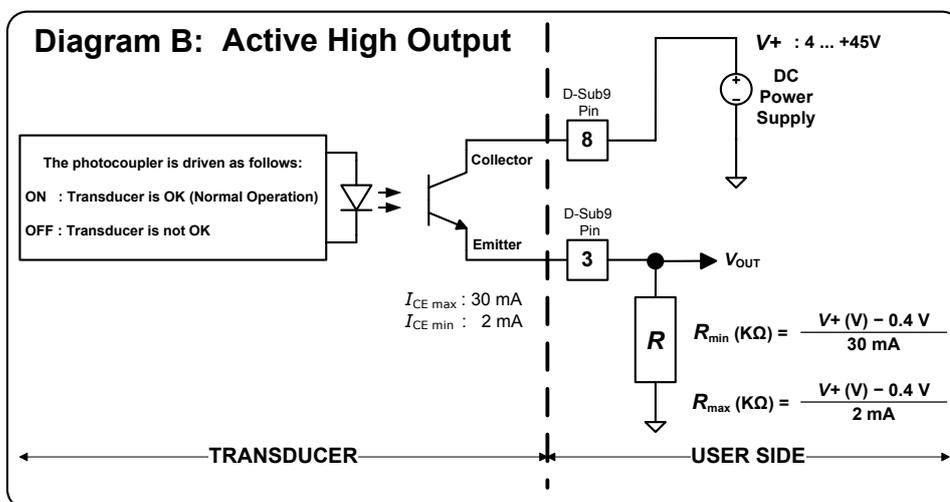
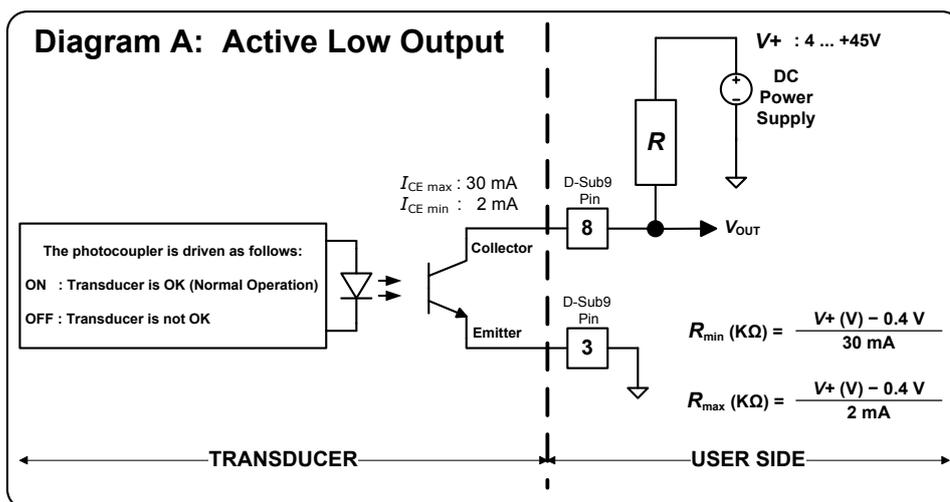
The overload conditions will be:

- The secondary current I_s generated is a low frequency signal between -283 mA and 283 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. In other words, the output transistor is switched off (i.e., no current from 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.

TO ENSURE A SAFE RECOVERY FROM SATURATION, THE MAXIMUM BURDEN RESISTOR ALLOWED IS 15 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 not OK (Overload mode or supply fault) |
| | V+ | The transducer is OK (Normal operation) |

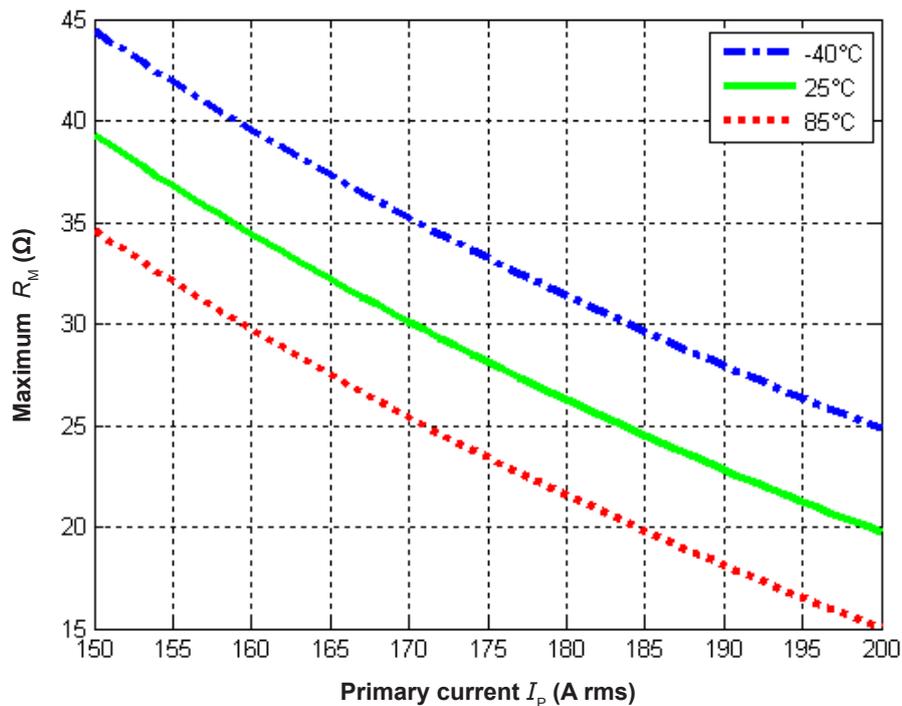
Some recommended standard values of R :

| Power supply voltage V+ | R_{min} (k Ω) | R_{max} (k Ω) | R standard values $\pm 5\%$ |
|-------------------------|-------------------------|-------------------------|---|
| 5 V | 0.153 | 2.3 | 180 Ω , 1 k Ω or 2.2 k Ω |
| 12 V | 0.386 | 5.8 | 470 Ω , 2.2 k Ω or 4.7 k Ω |
| 24 V | 0.786 | 11.8 | 1 k Ω , 2.2 k Ω or 10 k Ω |

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 versus primary current and temperature



Safety

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



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.



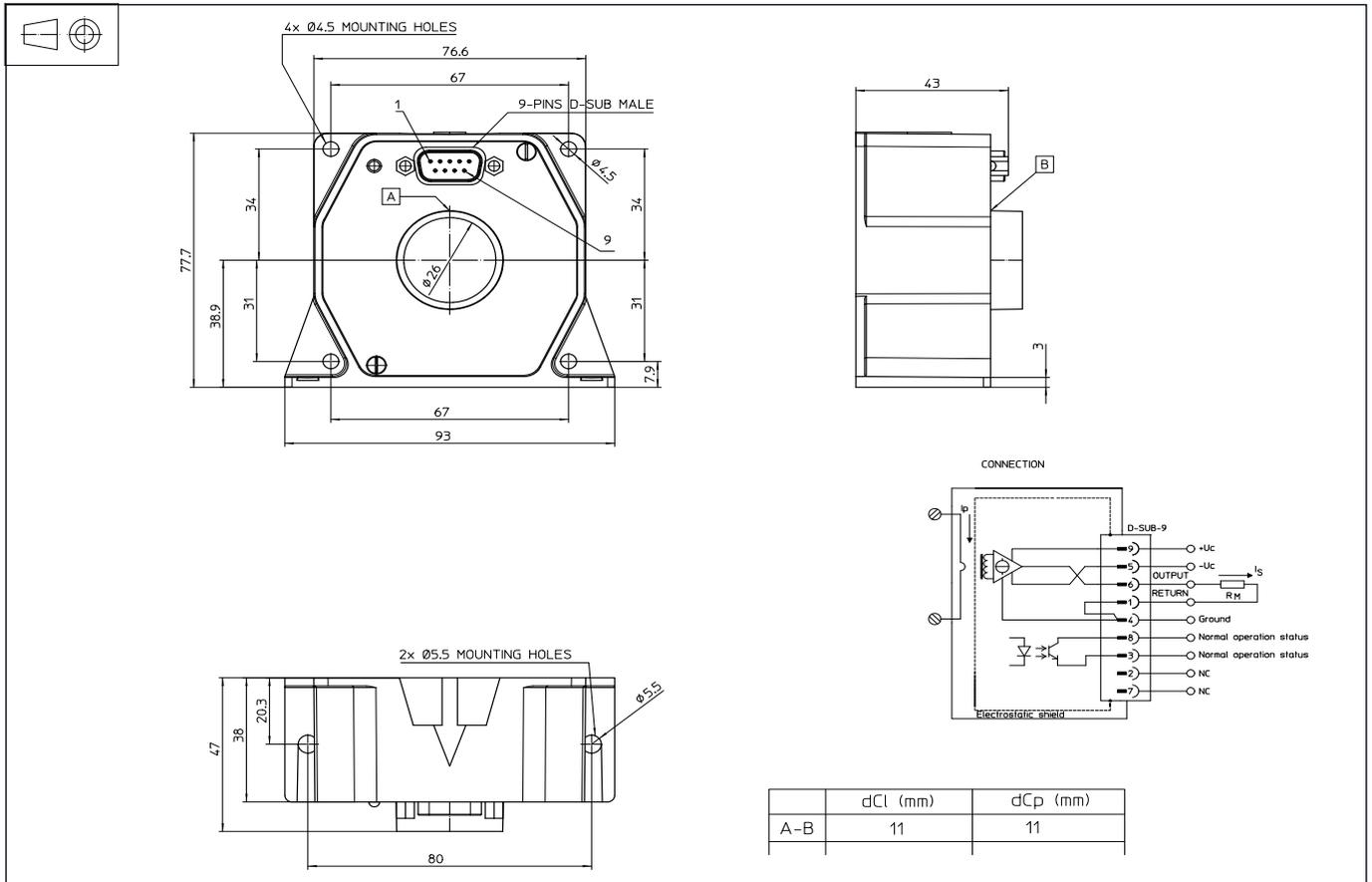
Caution, risk of electrical shock

When operating the transducer, certain parts of the module can carry hazardous voltage (eg. 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 (in mm)

Connection

- Normal operation status (Pins 3 and 8)
Normal operation means:
 - $\pm 15\text{ V}$ ($\pm U_C$) present
 - zero detector is working
 - primary current $\leq 110\%$ 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 $\pm 0.3\text{ mm}$
- Transducer fastening
 - Straight mounting 2 holes $\phi 5.5\text{ mm}$
2 x M5 steel screws
Recommended fastening torque 3.7 N·m
 - Flat mounting 4 holes $\phi 4.5\text{ mm}$
4 x M4 steel screws
Recommended fastening torque 2.8 N·m
- 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 $\phi \leq 26\text{ mm}$
- Installation of the transducer must be done unless otherwise specified on the datasheet, according to LEM Transducer Generic Mounting Rules. Please refer to LEM document N°ANE120504 available on our Web site: [Products/Product Documentation](#).