

CURRENT SENSOR 0222i

- 500 .. + 500 mA

User's Guide



Figure 1. The Current Sensor - 500 .. +500 mA



CENTRE FOR MICROCOMPUTER APPLICATIONS

<http://www.cma-science.nl>

Description

The Current sensor 0222i is designed for measuring small currents in AC and DC circuits in the range between -500 and +500 mA. It has two banana (4-mm) plugs for easy connection.

The sensor contains a sensing element and a signal-conditioning amplifier. The sensing element is a $0.4\ \Omega$ resistor (0.3 W) connected between the red and black terminals. As the current passes through the resistor, a small potential difference can be measured across this resistor. This potential difference goes through a signal amplifier and the output of the sensor is adjusted to the range of $\pm 7.5\text{V}$, which can be measured by an interface. The sensor is protected by a multifuse (resistance of $0.9\ \Omega$). The time to trip the multifuse to a high-resistant state is 0.1 sec. at 5 A.

The sensor should be connected in series to a circuit element. Currents in either direction can be measured. The current is indicated as positive when it flows from the red terminal to the black terminal.

The Current sensor is equipped with a BT plug and can be connected to the following CMA interfaces: €Lab, CoachLab II/II⁺ and ULAB. Furthermore the sensor can be used with Texas Instruments CBL™, CBL2™ and Vernier LabPro.

Sensor specifications

The Current sensor has a memory chip (EEPROM) with information about the sensor. Through a simple protocol (I²C) the sensor transfers its data: name, quantity, unit and calibration to the interface¹.

Examples of experiments

The Current sensor is specially designed for measurements of very low and accurate currents. It can be used in various experiments such as:

- characteristics of a light bulb and a diode,
- measurements of internal resonance and EMF,
- measurements in series and parallel electrical circuits.

Together with a Differential Voltage Sensor it can be used to explore the relationship between the current and the voltage in electrical circuits - the Ohm's Law.

¹ This is valid for the following interfaces: CMA €Lab, BT inputs of CoachLab II/II⁺ and ULAB, TI CBL™ and CBL2™, and Vernier LabPro.

Calibration

The output of the Current sensor is linear with respect to the input current. To collect data you can:

1. Use the calibration supplied by the sensor EEPROM memory.
2. Use the calibration supplied in the standard sensor library of the Coach program.
The name of the Current sensor in the sensor library of Coach is
Current sensor (0222i) (CMA) (-500 .. 500 mA).
3. Calibrate the sensor using known currents (a standard, simple 2-point calibration can be done). User calibration can be performed in the Coach software.

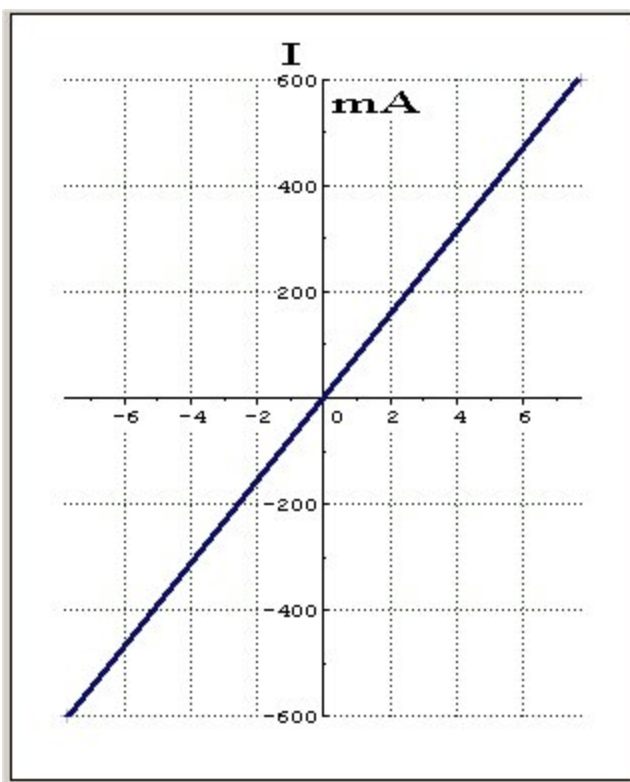


Figure 2.

Default calibration graph of the Current sensor (used in the standard Coach sensor library and in the sensor memory).

$$I \text{ (mA)} = 78.125 * V_{\text{out}} \text{ (V)} - 0.47$$

Default linear calibration coefficients:
 $a=78.125$; $b=-0.47$

Technical data

Input current range	$\pm 500 \text{ mA}$
Output voltage range	$\pm 7 \text{ V}$
Sensitivity	12.8 V/A
Resolution using 12 bits A/D converter	0.38 mA
Calibration function	$I_{\text{in}} (\text{mA}) = 78.125 * V_{\text{out}} (\text{V}) - 0.47$
Probe resistance ²	typical 1.3 Ω
Input impedance to ground	each terminal 400 k Ω
Input offset current error	typical $\pm 0.8 \text{ mA}$
Common mode input voltage error	typical 0.15 mA/V (0 – 500 Hz)
Non-linearity	< 0.001 %
Slew rate	3 V/ μs (maximum output voltage variation)
Bandwidth (small signal)	120 kHz (-3dB)
Maximum differential input voltage Maximum common-mode input voltage	$\pm 50 \text{ V}$ (max. voltage between input terminals) $\pm 50 \text{ V}$ (max. voltage related to ground)
Supply voltage / Supply current	5 V DC / typical 23 mA
Sensor information for Auto-ID and calibration	256 byte serial EEPROM
Connection	Right-hand BT (British Telecom) connector

Warranty:

The 0222i Current sensor is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

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² The probe resistance is a compound of a 0.4 Ω shunt and a 0.9 Ω multifuse. The multifuse protects the shunt against overload. The time to trip the multifuse to a high-resistant state is 0.1 sec. at 5 A.