

CURRENT SENSOR

- 500 .. + 500 mA

Description D0222i



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

Short 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:

- CoachLab II
- ULAB

Furthermore the sensor can be used in combination with other interfaces, like Texas Instruments CBL™, CBL2™ and Vernier LabPro without the need of an adapter.

Intelligent sensor¹

The Current Sensor is an intelligent sensor. The sensor has a memory chip with information about the sensor. Through a simple protocol (I²C) the sensor communicates with ULAB and transfers its data (name, quantity, unit and calibration) to the datalogger. ULAB automatically displays the calibrated values in the right unit on its screen. Also ULAB communicates the information to the Coach software.

The sensor is delivered with a standard calibration.

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.

¹ At this moment only for CMA ULAB datalogger, in the future also for LabPro and the CBL2.

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.

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 in the standard sensor library of the Coach program.
2. Use the calibration supplied by the sensor EEPROM memory (only for the ULAB datalogger).

or

3. Calibrate the sensor using known currents (a standard, simple 2-points calibration can be done). User calibration can be performed in the Coach software (for details see 'Guide to Coach 5').

Changing of the default calibration in EEPROM of the sensor

In the near future a special simple program will be available to enable a user to replace the default calibration in EEPROM by a calibration done by the user. This will be done while the sensor is connected to ULAB. In this way the sensor can have its own, precise calibration.

The name of the Current Sensor in the sensor library of the Coach program is **Current sensor (0222i) (CMA) (-500 .. 500 mA)**.

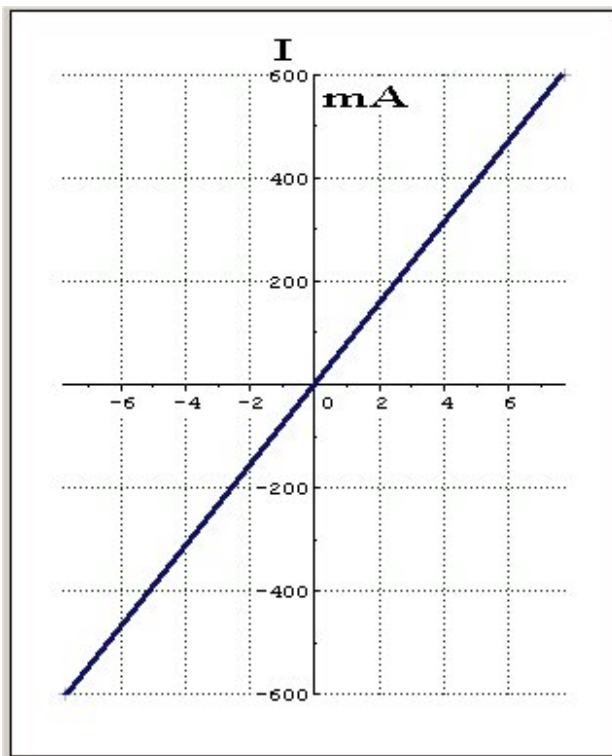


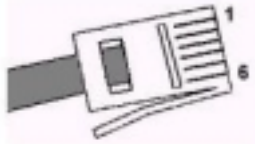
Figure 2.

Default calibration graph of the Current sensor (used in the standard Coach library and 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	± 500 mA
Output voltage range	± 7 V
Sensitivity	12.8 V/A
Resolution using 12 bits A/D converter	0.38 mA
Calibration function	$I_{in} \text{ (mA)} = 78.125 * V_{out} \text{ (V)} - 0.47$
Probe resistance ²	typical 1.3 Ω
Input impedance to ground	each terminal 400 k Ω
Input offset current error	typical ± 0.8 mA
Common mode input voltage error	typical 0.15 mA/V (0 – 500 Hz)
Non-linearity	< 0.001 %
Slew rate	3 V/ μ s (maximum output voltage variation)
Bandwidth (small signal)	120 kHz (-3dB)
Maximum differential input voltage Maximum common-mode input voltage	± 50 V (max. voltage between input terminals) ± 50 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 via I ² C -bus
Connection: BT (British Telecom) plug 	pin 1: V _{out} pin 2: ground pin 3: I ² C data pin 4: I ² C clock pin 5: supply voltage (+5 V) pin 6: n.c.

This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications. Rev. 5/13/2003

CENTRE FOR MICROCOMPUTER APPLICATIONS

Kruislaan 404, 1098 SM Amsterdam, The Netherlands

Fax: +31 20 5255866, e-mail: cma@science.uva.nl, <http://www.cma.science.uva.nl>

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.