CURRENT SENSOR BT22i

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

http://www.cma-science.nl

Short description

The Current sensor BT22i is a general-purpose sensor to measure 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 0.04 Ω 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 ±7.5V, which can be measured by an interface. The sensor is protected by a multifuse (resistance of 0.9 Ω). The time to trip the multifuse to a high-resistant state is 0.1 s 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 can be directly connected to analog BT inputs of the CMA interfaces. The sensor cable BT - IEEE1394 needed to connect the sensor to an interface is not supplied with the sensor and has to be purchased separately (CMA Article BTsc_1).

Sensor recognition

The Current sensor has a memory chip (EEPROM) with information about the sensor: its name, measured quantity, unit and calibration. Through a simple protocol this information is read by the CMA interfaces and the sensor is automatically recognized when it is connected to these interfaces. If your Current sensor is not automatically detected by an interface you have to manually set up your sensor by selecting it from the Coach Sensor Library.

Calibration

The CMA Current sensor BT22i is supplied calibrated. The output of the sensor is linear with respect to the input current. The supplied calibration function is:

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

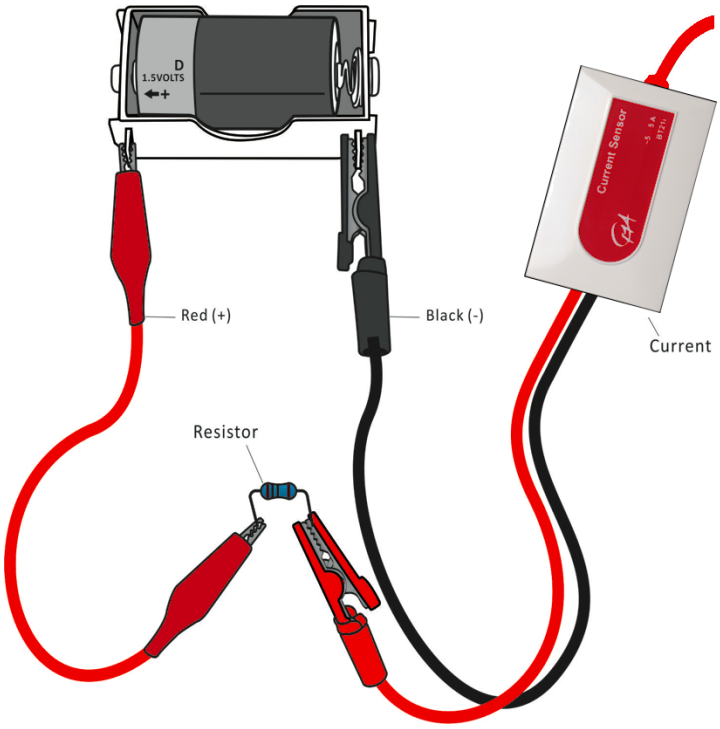
The Coach program allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach Sensor Library. For better accuracy the pre-defined calibration can be shifted.
For even more accurate measurements a new user calibration (a standard, simple 2-point calibration) can be performed in Coach using known currents.

Practical information

CAUTION:

- ***NEVER*** *connect a Current sensor directly across a battery or power supply, without a resistor to limit the current within the range of the sensor. Failure to limit the current will cause permanent damage to the sensor.*
- ***NEVER*** *use high voltages or household AC.*

- The Current sensor should be placed **in series** with the circuit component through which the current is to be measured.
- Make sure you observe the correct polarity, i.e. connect the black lead from the Current sensor to the negative terminal of the cells.
- Currents in either direction can be measured.



Connecting the Current sensor in series with a resistor to measure the current passing through it.

Suggested experiments

The Current sensor can be used in various experiments such as:

- Battery life
- Voltage / Current relationships
- Ohm's law – can be used together with a CMA Differential Voltage sensor
- Electrical component characteristics e.g. a light bulb, a diode, a light dependent resistor
- Series and parallel circuits
- Capacitor discharge, charge and energy stored.

Technical Specifications

Sensor kind	Analog, generates an output voltage between -7.5 .. +7.5 V
Measurement range	- 500 mA .. +500 mA
Resolution	0.38 mA
Sensitivity	12.8 V/A
Calibration function	I (mA) = 78.125 * V_{out} (V) – 0.47
Probe resistance[1]	typical 1.3 Ω
Input impedance to ground	each terminal 400 kΩ
Input offset current error	typical ± 8 mA
Common mode input voltage error	typical 1.5 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*	± 50 V (max. voltage between input terminals) ± 50 V (max. voltage related to ground)
Supply voltage	5 V DC
Supply current	typical 23 mA
Connection	IEEE1394 connector for BT-IEEE1394 sensor cable. Sensor cable not delivered with the sensor.

Warranty:

The Current sensor BT22i is warranted to be free from defects in materials and workmanship for a period of 24 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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[1] 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 s at 5 A.