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# ANGLE (POSITION) SENSOR 013i

## USER GUIDE



CENTRE FOR MICROCOMPUTER APPLICATIONS

<https://cma-science.nl>

## Short description

The CMA Angle (position) sensor 013i contains a potentiometer with a pulley to attach a string to. The sensor is suitable for detecting angles, and (small) displacements. By a displacement of a string, the potentiometer is rotated and the output voltage is adapted. The range of the sensor is 270° of turn or a displacement of about 140mm.

To avoid excessive wear of the sensor, don't burden the disc with masses of more than 100 g.

The sensor is equipped with a BT plug and can be directly connected to the analog BT inputs of the CMA interfaces.

## Sensor recognition

The Angle (position) sensor 013i 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 Angle (position) 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 Angle (position) sensor is supplied calibrated. The output of the sensor is linear with respect to the measured angle. The calibration provided in the sensor's own EEPROM memory:

$$\text{Range } 0^\circ..270^\circ: \quad \text{Angle } (\circ) = 54 * V_{\text{out}} \text{ (V)}$$

The Coach software allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach Sensor Library. The additional sensor ranges can be accessed through the **Set Input Range** option in the Coach software, which is available by right-clicking the sensor icon after it has been detected.

$$\begin{array}{ll} \text{Range } -135^\circ..135^\circ & \text{Angle } (\circ) = 54 * V_{\text{out}} \text{ (V)} - 135 \\ \text{Range } 0..140 \text{ mm} & \text{Position } (\text{mm}) = 28 * V_{\text{out}} \text{ (V)} \end{array}$$

For most experiments it will suffice to use one of the standard calibrations. For very precise angle measurements, it is advised to calibrate the sensor. For precise position experiments it is also advised to calibrate the sensor, since the position will depend on the thickness of the string that is used.

## Suggested experiments

- Studying the swing of a pendulum.
- Measurements of small displacement.
- Measurement of positions of the light sensor in interference and diffraction patterns.

## Technical Specifications

**Warning:** To avoid excessive wear of the sensor, don't burden the disc with masses of more than 100 g.

<i>Sensor kind</i>	Analog, generates an output voltage between 0 – 5 V
<i>Angle range</i> <i>mechanic</i> <i>electric</i>	$300^\circ \pm 5^\circ$ $270^\circ \pm 10^\circ$
<i>Position range</i>	140 mm $\pm$ 5 mm
<i>Resolution using</i> <i>12 bit AD converter</i>	0.07° 0.03 mm
<i>Calibration functions</i> <i>range 0°..270°</i> <i>range -135°..135°</i> <i>range 0..140 mm</i>	$\text{Angle } (^\circ) = 54 * V_{\text{out}} \text{ (V)}$ $\text{Angle } (^\circ) = 54 * V_{\text{out}} \text{ (V)} - 135$ $\text{Position (mm)} = 28 * V_{\text{out}} \text{ (V)}$
<i>Connection</i>	IEEE1394 connector for BT-IEEE1394 sensor cable. Sensor cable is attached to the sensor.

## Warranty:

The Angle (position) sensor 013i 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.

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