Micro Control Systems

APPLICATION NOTE
APP-066

4-20mA Sensor Connection to MCS-Magnum

Revision History

Date	Author	Description
02/17/11	Weston Klebs	Created application note

General Concept

In order to properly read a sensor input that varies its amperage, a special setup is required. In this document we will consider how to convert amps to volts, how to wire the sensor, and also an example to follow when setting up this type of sensor yourself.

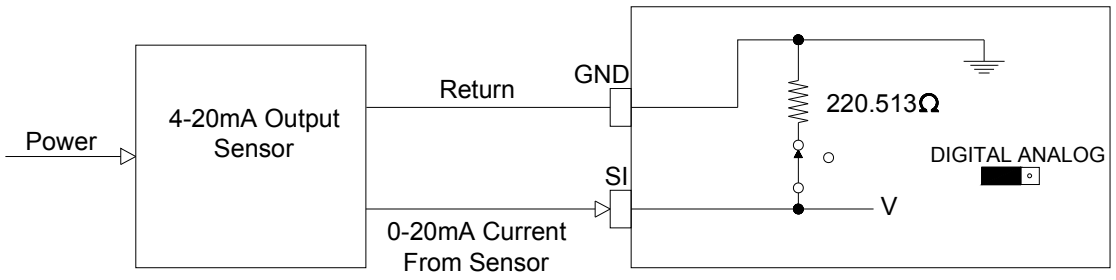
Amperage to Voltage Calculation

Current (amperage), Resistance (ohms), and Voltage are all related through the formula:
Voltage = Amperage × Ohms
Therefore, if any two of the values are known, the third can be easily calculated. The Magnum board reads sensor inputs using a 0-5 volt range. To calculate the voltage we take the amp reading given by the sensor and multiply it by the resistance, which is approximately 220.513 ohms (Ω) when the input type jumper on the Magnum board is set to 'DIGITAL'. With that knowledge we can make the following chart:

Amperage (milliAmps)	Ohms (Ω)	Voltage
0 mA	220.513 Ω	0.000 vdc
1 mA	220.513 Ω	0.221 vdc
2 mA	220.513 Ω	0.441 vdc
3 mA	220.513 Ω	0.662 vdc
4 mA	220.513 Ω	0.882 vdc
5 mA	220.513 Ω	1.103 vdc
6 mA	220.513 Ω	1.323 vdc
7 mA	220.513 Ω	1.544 vdc
8 mA	220.513 Ω	1.764 vdc
9 mA	220.513 Ω	1.985 vdc
10 mA	220.513 Ω	2.205 vdc
11 mA	220.513 Ω	2.426 vdc
12 mA	220.513 Ω	2.646 vdc
13 mA	220.513 Ω	2.867 vdc
14 mA	220.513 Ω	3.087 vdc
15 mA	220.513 Ω	3.308 vdc
16 mA	220.513 Ω	3.528 vdc
17 mA	220.513 Ω	3.749 vdc
18 mA	220.513 Ω	3.969 vdc
19 mA	220.513 Ω	4.190 vdc
20 mA	220.513 Ω	4.410 vdc

Sensor Wiring Detail

The correct wiring for this type of sensor is shown in the diagram below. Make sure the jumper position is on 'DIGITAL'.

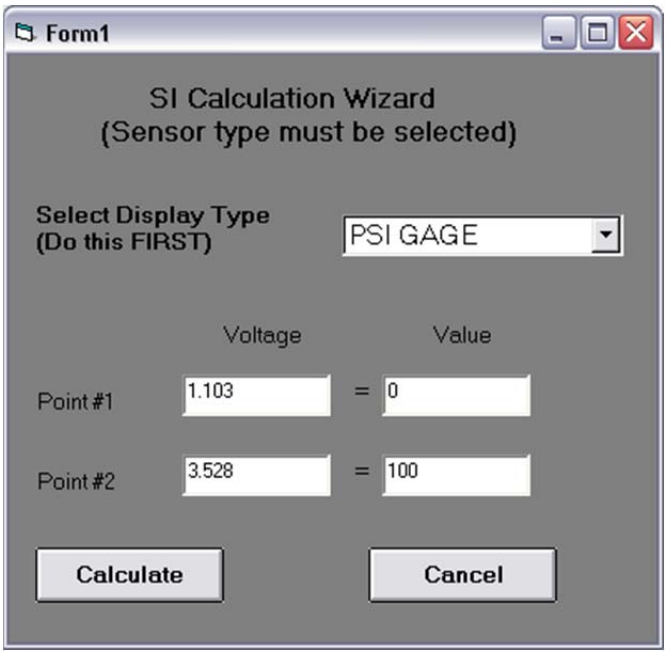


Example Setup

The following is an example of a typical 4-20 mA sensor setup. Let us assume that the manufacturer's specifications of the sensor say that at a reading of 0 psi the sensor output will be 5 mA and at 100 psi the output will be 16 mA. Using these values we will be able to calculate the voltages needed to configure the Magnum based on the chart and equation above. At 5 mA the voltage will be 1.103 vdc, and at 16 mA the voltage will be 3.528 vdc.
In MCS-Config, select 'User Defined' as the Display Type for this sensor.

	#	Name (1 to 10 char)	Display Type
▶	1-15	PSI SENSOR	User Defined

When User Defined is selected, a window will pop up in which you can input these values to tell the Magnum how to correctly interpret the signals coming from the sensor.



When finished inserting the values in the SI Calculation Wizard, click the Calculate button and the correct calculation will be developed automatically in the Multiplier, Divisor, and Off Set fields.

Multiplier	Divisor	Off Set
100	497.125	-45.48

Now the Magnum has been properly configured and will be able to accurately read the input from the 4-20 mA sensor.