

Calibration

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Analog input/output modules are calibrated when you receive them. However, calibration is sometimes required. No screwdriver is necessary because calibration is done in software, with calibration parameters stored in the ADAM module's onboard EEPROM.

The ADAM modules come with utility software that supports the calibration of analog input and analog output. Besides the calibration that is carried out through software, the modules incorporate automatic Zero Calibration and automatic Span Calibration at bootup or reset.

5.1 Analog Input Module Calibration

Models: ADAM 4011, 4011D, 4012, 4014D, 4016, 4017, 4018, 4018M

1. Apply power to the module and let it warm up for about 30 minutes
2. Assure that the module is correctly installed and is properly configured for the input range you want to calibrate. You can do this by using the ADAM utility software. (Refer to Appendix D, Utility Software.)
3. Use a precession voltage source to apply a calibration voltage to the module's +IN and -IN terminals of the ADAM-4011, 4011D and 4012. Use a precession voltage source to apply a calibration voltage to the module's Vin+ and Vin- terminals (or Iin+ and Iin-) for the ADAM-4014D and 4016. Use a precession voltage source to apply a calibration voltage to the module's Vin0+ and Vin0- terminals for ADAM-4017, 4018 and 4018M.

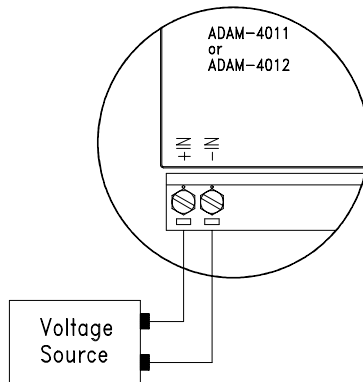


Figure 5-1 *Applying Calibration Voltage*

- Execute the Offset Calibration command. This is also done with the ADAM utility software. (See “Offset Calibration” option in the Calibration sub-menu of the ADAM utility software).



Figure 5-2 Zero Calibration

- Execute the Span Calibration command. This can be done with the ADAM utility software. (See “Span Calibration” option in the Calibration sub-menu of the ADAM utility software).



Figure 5-3 Span Calibration

- 6. Only for ADAM 4011, 4011D, 4018, 4018M
Execute the CJC (cold junction sensor) calibration command. This is also done with the ADAM utility software. (See “CJC Calibration” option in the Calibration sub-menu of the ADAM utility software).



Figure 5-4 Cold Junction Calibration

Table 5-1 Calibration Voltages

Module	Input Range Code (hex)	Input Range	Span Calibration Voltage
4011 4011D 4018 4018M	00	±15 mV	+15 mV
	01	±50 mV	+50 mV
	02	±100 mV	+100 mV
	03	±500 mV	+500 mV
	04	±1 V	+1 V
	05	±2.5 V	+2.5 V
	06	±20 mA	+20 mA ¹
	0E	J thermocouple 0 to 760° C	+50 mV
	0F	K thermocouple 0 to 1000° C	+50 mV
	10	T thermocouple -100 to 400° C	+22 mV
	11	E thermocouple 0 to 1000° C	+80 mV
	12	R thermocouple 500 to 1750° C	+22 mV
	13	S thermocouple 500 to 1750° C	+22 mV
	14	B thermocouple 500 to 1800° C	+15 mV
4012 4017	07	not used	
	08	±10 V	+10 V
	09	±5 V	+5 V
	0A	±1 V	+1 V
	0B	±500 mV	+500 mV
	0C	±150 mV	+150 mV
	0D	±20 mA	+20 mA ¹

NOTE:¹ You can substitute 2.5 V for 20 mA if you remove the current conversion resistor for that channel. However, the calibration accuracy will be limited to 0.1% due to the resistor's tolerance.

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Module	Input Range Code (Hex)	Input Range	Span Calibration Voltage
4016	00	±15 mV	+15 mV
	01	±50 mV	+50 mV
	02	±100 mV	+100 mV
	03	±500 mV	+500 mV
	06	±20 mA	+20 mA
4014D	07	not used	
	08	±10 V	+10 V
	09	±5 V	+5 V
	0A	±1 V	+1 V
	0B	±500 mV	+500 mV
	0C	±150 mV	+150 mV
	0D	±20 mA	+20 mA

5.2 Analog Input Resistance Calibration

Model: ADAM-4013

1. Apply power to the module and let it warm up for about 30 minutes.
2. Assure that the module is correctly installed and is properly configured for the input range you want to calibrate. You can do this by using the ADAM utility software. (Refer to Appendix D, Utility Software.)
3. Apply the reference Span resistance to the terminals of the screw terminals using a 4-wire connection. Refer to Figure 5-5 for the correct wiring diagram and to Table 5-2 to choose the right Span calibration resistance).

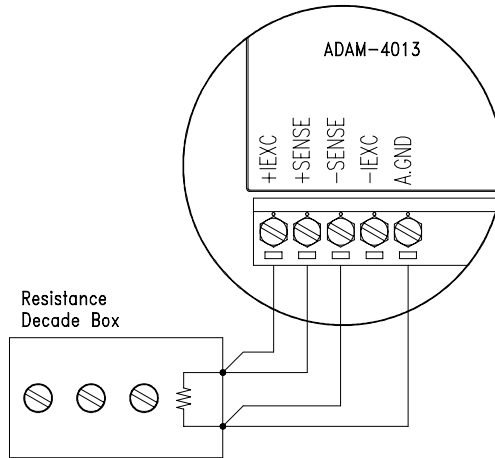


Figure 5-5 *Applying calibration resistance*

Use a precision resistance decade box or discrete resistors with values: 10 W, 15 W, 60 W, 140 W, 200 W and 440 W.

4. Apply the reference Offset resistance to the terminals of the module. (Refer to Figure 5-5 for the correct wiring diagram and to Table 5-2 to choose the right Offset calibration resistance.)

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- 5. Issue an Offset Calibration command to the module. This can be done by either using the Calibrate option in the ADAM utility software (See Appendix D, Utility Software)
- 6. Issue a Span Calibration command to the module. This can be done with the Calibrate option in the ADAM utility software (See Appendix D, Utility Software)

Table 5-2 *Calibration Resistance*

Module	Input Range Code (Hex)	Input Range	Span Calibration Resistance	Offset Calibration Resistance
4013	20	Pt, -100° C to 100° C $\alpha = 0.00385$	140 Ω	60 Ω
	21	Pt, 0° C to 100° C $\alpha = 0.00385$	140 Ω	60 Ω
	22	Pt, 0° C to 200° C $\alpha = 0.00385$	200 Ω	60 Ω
	23	Pt, 0° C to 600° C $\alpha = 0.00385$	440 Ω	60 Ω
	24	Pt, -100° C to 100° C $\alpha = 0.003916$	140 Ω	60 Ω
	25	Pt, 0° C to 100° C $\alpha = 0.003916$	140 Ω	60 Ω
	26	Pt, 0° C to 200° C $\alpha = 0.003916$	200 Ω	60 Ω
	27	Pt, 0° C to 600° C $\alpha = 0.003916$	440 Ω	60 Ω
	28	Ni, -80 °C to 100 °C	200 Ω	60 Ω
	29	Ni, 0 °C to 100 °C	200 Ω	60 Ω

5.3 Analog Output Calibration

Model: ADAM-4021

The output current of analog output modules can be calibrated by using a low calibration value and a high calibration value. The analog output modules can be configured for one of two ranges: 0-20 mA and 4-20 mA. Since the low limit of the 0 - 20 mA range, 0 mA, is internally an absolute reference (no power, or immeasurably small power) just two levels are needed for calibration: 4 mA and 20 mA.

1. Apply power to the analog output module and let it warm up for about 30 minutes.
2. Assure that the module is correctly installed and that its configuration is according your specifications and matches the output range you want to calibrate. You can do this by using the ADAM utility software. (Refer to Appendix D, Utility Software.)
3. Connect either a 5-digit millimeter or voltmeter with a shunt resistor (250 Ω , 0.01% , and 10ppm) to the screw terminals of the module

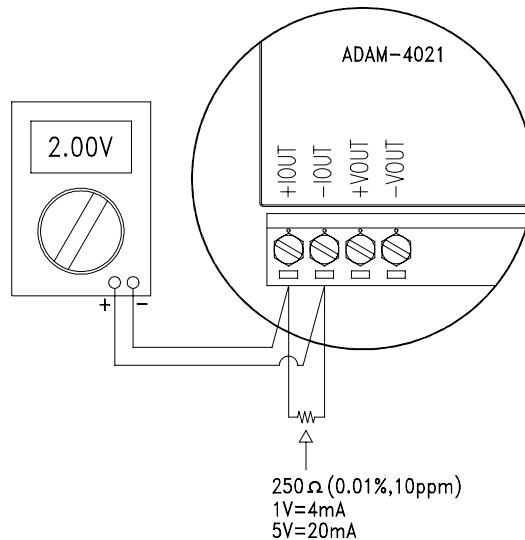


Figure 5-6 Setup for Analog Output Calibration

4. Issue the Analog Data Out command to the module with an output value of 4 mA.
5. Check the actual output value at the modules terminals . If this does not equals 4 mA, use the “Trim” option in the “CaLibrate” sub menu to change the actual output. Trim the module until the milliammeter indicates exactly 4 mA or in case of an voltage meter with shunt resistor, the voltage meter indicates exactly 1 V. (When calibrating for 20 mA using voltage meter and shunt resistor, the correct voltage would be 5 V.)
6. Issue the 4 mA Calibration command to indicate that the output is calibrated and calibration parameters should be stored in the modules EEPROM.
7. Execute an Analog Data Out command with an output value of 20 mA. The module’s output will be approximately 20 mA.
8. Execute the Trim Calibration command as often as necessary until the output current is equal to exactly 20 mA.
9. Execute the 20 mA Calibration command to indicate that the present output is exactly 20 mA. The analog output module will store its calibration parameters in EEPROM.

Module: ADAM-4016

1. Apply power to the strain gauge input module and let it warm up for about 30 minutes.
2. Assure that the module is correctly installed. Connect a voltmeter to the screw terminals of the module.

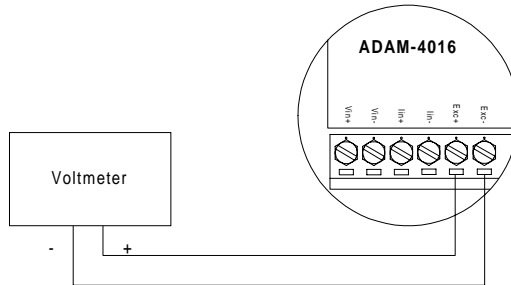


Figure 5-7 Setup for Voltage Output Calibration

3. Execute the Zero Calibration command. This is also done with the ADAM utility software. (See "A/O 0V Calibration" option in the Calibration sub-menu of the ADAM utility software.)



Figure 5-8 Zero Calibration

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4. Execute the Span Calibration command. This can be done with the ADAM utility software. (See "A/O 10 V Calibration" option in the Calibration sub-menu of the ADAM utility software.)



Figure 5-9 *Span Calibration*

5. Check the actual output value at the module's terminals. If this does not equal 0 V or 10 V, use the Trim Calibration command to change the output value. This is also done with the ADAM utility software. (Use the arrow key to adjust the output value after executing the "A/O 0V Calibration" or "A/O 10 V Calibration", use the arrow key to adjust the output value. Right and Up keys mean increasing, Left and Down keys mean decreasing).