CALIBRATION PROCEDURE

NI WSN-3212

This document contains information for calibrating the National Instruments WSN-3212. For more information on calibration, visit `ni.com/calibration`.

Contents

NATIONAL INSTRUMENTS

Conventions

The following conventions are used in this document:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a note, which alerts you to important information.
bold	Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

Software Requirements

Calibrating the NI WSN-3212 requires installing LabVIEW 8.6.1 or later and NI-WSN on the calibration system. You can download the NI-WSN instrument driver from `ni.com/downloads`.

NI recommends installing NI-WSN before connecting the hardware.

Documentation Requirements

For information about NI-WSN and the NI WSN-3212, you can consult the following documents:

- *NI Wireless Sensor Network Devices Getting Started Guide*—provides instructions for installing and configuring NI Wireless Sensor Network (WSN) devices and software. Available online at `ni.com/manuals`.
- *NI WSN-3212 User Guide and Specifications*—includes detailed information about NI WSN-3212 and provides the published specification values for the NI WSN-3212. Available online at `ni.com/manuals`.

- *LabVIEW Help*—includes information about creating applications that use NI-WSN. The LabVIEW Help is available by selecting **Help» Search the LabVIEW Help** in LabVIEW.
- *MAX Help for WSN Devices*—includes information about configuring your device in MAX. Available in MAX from **Start»All Programs» National Instruments»NI-WSN»Configuring WSN in MAX**.

Calibration Interval

National Instruments recommends a calibration interval of one year for the NI WSN-3212. Adjust the recommended calibration interval based on the measurement accuracy demands of your application.

Test Equipment

National Instruments recommends that you use the equipment in Table 1 for calibrating the NI WSN-3212.

Table 1. Recommended Equipment

Equipment	Recommended Model	Parameter Measured	Minimum Requirements
Calibrator	Fluke 5700A	Analog input gain	If this instrument is unavailable, use a high-precision voltage source with an accuracy of at least 10 ppm and an output impedance of less than or equal to 50 Ω
WSN Ethernet gateway and power supply	NI WSN-9791 with 9–30 V power supply or NI 9792 with 9-35 V power supply	All parameters	—
Copper wiring	—	All parameters	14 to 24 AWG wire

Test Conditions

Follow these guidelines to optimize the equipment and the environment during calibration:

- Keep connections to the device as short as possible. Long cables and wires act as antennae, picking up extra noise that can affect measurements. To further reduce settling and noise, use shielded twisted-pair PTFE-insulated cables.
- Verify that all connections to the device are secure.
- Maintain an ambient temperature of 23 ±10 °C. The device temperature will be greater than the ambient temperature.
- Keep relative humidity below 80%.
- Allow a warm up time of at least 10 minutes to ensure that the measurement circuitry is at a stable operating temperature.

Calibration Procedures

The calibration process includes the following steps:

1. *Initial Setup*—Install the device and configure it in Measurement & Automation Explorer (MAX).
2. *Verification*—Verify the existing operation of the device. This step confirms whether the device is operating within the published specifications prior to adjustment.
3. *Adjustment*—If the device does not fall within the desired specifications, return the device to NI for a factory calibration to adjust the calibration constants. Go to `ni.com/calibration` for information about returning a device to NI for a factory calibration.
4. *Reverification*—Repeat the verification procedure to ensure that the device is operating within the published specifications after adjustment.

The first two procedures are described in more detail in the following sections.

Initial Setup

Refer to the *NI Wireless Sensor Network Devices Getting Started Guide* for information about how to install the software and hardware and how to configure the device in MAX.

Verification

This section provides instructions for verifying the NI WSN-3212 specifications.

Verifying Analog Input Gain

Complete the following steps to verify analog input gain.

1. Connect the calibrator to the NI WSN-3212 as shown in Figure 1.

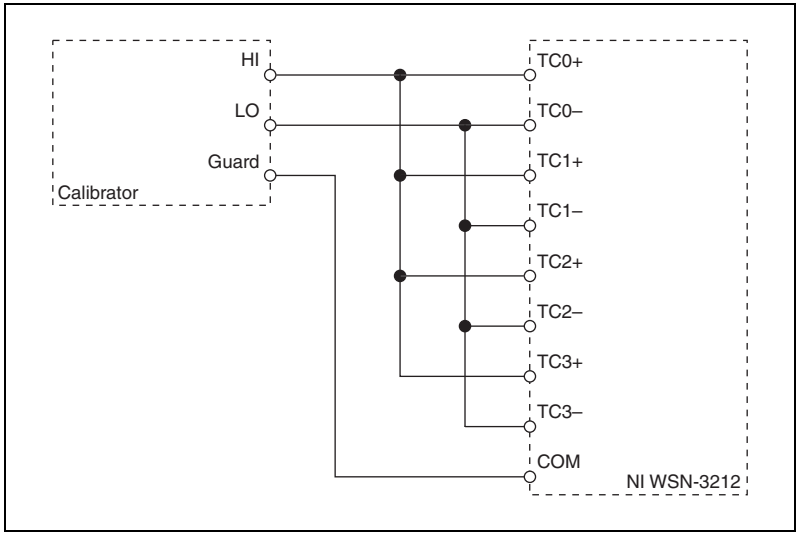

Figure 1. NI WSN-3212 Analog Input Gain Connections

Note If the calibrator you are using does not have a Guard terminal, connect COM on the NI WSN-3212 to the LO terminal on the calibrator.

2. Configure the NI WSN system in LabVIEW.
3. Set the sample interval rate on the NI WSN-3212 to 2 seconds.
4. Set the range to **–0.073 to 0.073 Volts** for each thermocouple input on the NI WSN-3212.
5. Set the calibrator output voltage to a Test Point indicated in Table 2.
6. Create a VI in LabVIEW to acquire a reading from the TC 0 variable on the NI WSN-3212.
7. Compare the NI WSN-3212 reading with the 1-Year Limits in Table 2.
8. Repeat steps 5 through 7 for all test points in Table 2 and all channels on the NI WSN-3212.

Table 2. NI WSN-3212 Analog Input Gain Test Limits

Range (V)		Test Point		1-Year Limits (V)	
Minimum	**Maximum**	**Location**	**Value (V)**	**Lower Limit**	**Upper Limit**
–0.073	0.073	Max	0.065	0.064976725	0.065023275
–0.073	0.073	Min	–0.065	–0.065023275	–0.064976725

Verifying Analog Input Offset

Complete the following steps to verify analog input offset.

1. Use copper wire to create a 0 Ω short circuit to the NI WSN-3212 as shown in Figure 2.

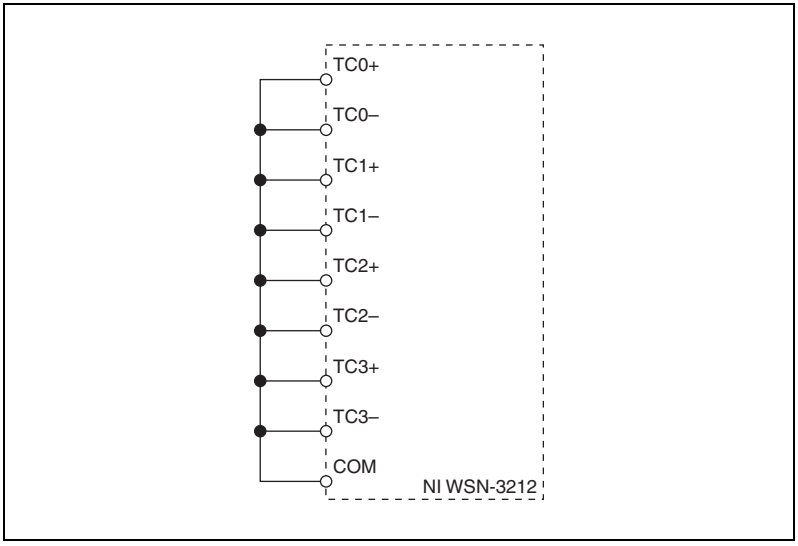

Figure 2. NI WSN-3212 Analog Offset Connections

2. Configure the NI WSN system in LabVIEW.
3. Set the sample interval rate on the NI WSN-3212 to 2 seconds.
4. Set the range to **–0.073 to 0.073 Volts** for each thermocouple input on the NI WSN-3212.
5. Create a VI in LabVIEW to acquire a reading from the TC 0 variable on the NI WSN-3212.
6. Compare the NI WSN-3212 reading with the 1-Year Limits in Table 3.
7. Repeat steps 5 and 6 for all channels on the NI WSN-3212.

Table 3. NI WSN-3212 Analog Input Offset Test Limits

Range (V)		Test Point		1-Year Limits (V)	
Minimum	**Maximum**	**Location**	**Value (V)**	**Lower Limit**	**Upper Limit**
−0.073	0.073	Mid	0.000000	−0.00001000	0.00001000

Calibration Specifications

Test Limits used in Tables 2 and 3 are derived using the following calibration specifications. Calibration specifications are based on calibrated scaling coefficients that are stored in the onboard flash. Calibration specifications are the maximum limits for 25 ±10 °C within one year of the last calibration.

Table 4. Calibration Specifications

Gain Error	Offset Error
182 ppm	10 µV

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 358 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737,
Italy 39 02 41309277, Japan 0120-527196, Korea 82 02 3451 3400,
Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710,
Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466,

New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60,
Poland 48 22 328 90 10, Portugal 351 210 311 210,
Russia 7 495 783 6851, Singapore 1800 226 5886,
Slovenia 386 3 425 42 00, South Africa 27 0 11 805 8197,
Spain 34 91 640 0085, Sweden 46 (0) 8 587 895 00,
Switzerland 41 56 2005151, Taiwan 886 02 2377 2222,
Thailand 662 278 6777, Turkey 90 212 279 3031,
United Kingdom 44 (0) 1635 523545

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