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E SERIES

Version 2.0

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Introduction—Document Scope

The following procedure contains information on the calibration of National Instruments E Series data acquisition (DAQ) products.

- *Calibration Overview*—This introductory section tells you what calibration is, why you should calibrate, and how often you should do it.
- *Equipment and Other Test Requirements*—This section describes what you need to do before you can calibrate your device, including an overview of the test equipment, software, calibration functions, and environment needed for calibration.
- *Calibration Process Overview*—This section provides detailed step-by-step instructions for verifying and calibrating your device.

This document will not discuss programming techniques or compiler configuration because of the number of programming languages and programming styles that can be used to perform calibration. The National Instruments DAQ driver, NI-DAQ, contains a number of online help files that contain compiler-specific instructions and detailed function explanations. You can add these help files when you install NI-DAQ on the calibration computer.

Calibration Overview

This section defines calibration, describes why it is necessary, explains when you should do it, and what to expect.

What Is Calibration?

Calibration refers to a procedure of reading offset and gain errors from a DAQ board and updating special analog calibration circuitry that will correct these errors. Every E Series product is calibrated at the factory. During the factory-calibration procedure, the calibration constants (values used to update the analog calibration circuitry) are stored in nonvolatile memory on the board—EEPROM. From memory, these values are loaded used as needed.

Why Calibrate?

Offset and gain errors may drift with time and temperature. As a result, the calibration constants may become invalid, requiring calibration to achieve the specified accuracy of the board.

How Often Should You Calibrate?

E Series products should be calibrated at a regular interval as defined by the measurement accuracy requirements of your application. National Instruments recommends that you perform a complete calibration at least once every year. You can shorten this interval to 90 days or 6 months if desired.

What Can You Expect from External Calibration?

Automated calibration procedures can reduce the total time required to perform calibration and verification to approximately 10 minutes. However, manual calibration and verification can take as long as 1 hour. You can automate the adjustment and verification procedure if you have access to programmable standards such as the Fluke 5700A or HP 3458A. You can control these devices via a GPIB connection. You can then program the entire procedure to save time and effort.

Equipment and Other Test Requirements

This section describes the equipment, software, documentation, and environmental conditions needed for calibration.

Test Equipment

When performing calibration, National Instruments recommends that you use the following instruments for calibration of an E Series board:

- Calibrator—Fluke 5700A
- DMM—Hewlett-Packard 3458A
- Counter—Hewlett-Packard 53131A

If the exact instrument is not available, use the following accuracy requirements to select a substitute calibration standard:

- A high-precision voltage source that is at least 50 ppm accurate for 12-bit boards and 10 ppm for 16-bit boards
- A multiranging 5 1/2-digit DMM with an accuracy of 15 ppm
- A counter accurate to 0.01%



Note If you do not have custom connection hardware available, you may need a connector block such as the National Instruments TBX-68 and a shielded 68-pin connector cable. These components give easy access to the individual pins on the 68-pin board I/O connector.

Software and Documentation

The following software and documentation are required to calibrate the E Series. You can obtain these from the National Instruments web site at `www.ni.com/`

- The latest version of the National Instruments NI-DAQ driver. This driver comes with the NI-DAQ Function Reference Online Help file, while you will also need.
- `niECal.dll`, `niECal.lib`, and `niECal.h` files. You should have downloaded these files when you downloaded this document.
- *NI-DAQ User Manual for PC Compatibles*

Software

The E Series calibration procedure requires that the latest version of the National Instruments NI-DAQ driver be installed on the calibration system. The driver supports a number of programming languages, including LabVIEW, LabWindows/CVI, Microsoft Visual C++, Microsoft Visual

Basic, and Borland C++. When you install the driver, you only need to install support for the programming language that you intend to use.

You also need a copy of the `niECal.dll`, `niECal.lib`, and `niECal.h` files. This `.dll` provides calibration functionality that does not reside in the standard NI-DAQ driver. This functionality includes protecting the calibration constants and updating the calibration date. You can access the functions in this `.dll` through any 32-bit compiler.

Documentation

The NI-DAQ function reference online help and user manuals contain detailed information on using the NI-DAQ driver. The function reference help includes detailed information on the functions in the driver. The user manual provides instructions on installing and configuring National Instruments DAQ devices. This manual also includes detailed information on creating applications that use the NI-DAQ driver. These documents are your primary references for writing your calibration utility. For further information on the products you are calibrating, you may also want to install the device user manuals.

Test Considerations

To calibrate an E Series board, there are a number of issues to consider. First, you must install the NI-DAQ driver on the calibration computer and properly configure the board to be calibrated. Next, you must write calibration software to communicate with the board via NI-DAQ function calls. For more information on using the NI-DAQ driver, refer to the *Software and Documentation* section earlier in this document.

You need to be aware of several connection and environmental concerns during calibration:

- Keep connections to the board as short as possible. Long cables and wires can act as antennae, which could pick up extra noise that would affect measurements.
- Use shielded copper wire for all cable connections to the device. It is often advisable to use twisted-pair wire to eliminate noise and thermal offsets.
- Maintain the temperature between 18–28 °C.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 15 minutes for PXI/PCI/AT bus devices and 30 minutes for PCMCIA cards to ensure that the measurement circuitry is at a stable operating temperature.

Calibration Process Overview

Writing Your Calibration Procedure

The calibration process is described in the *Calibration Process Overview* section later in this document, including step-by-step instructions on calling the appropriate calibration functions. Unless otherwise specified, the calibration functions are C function calls in the NI-DAQ driver. These function calls are also valid for Visual Basic programs. While LabVIEW virtual instruments (VIs) are not discussed in this procedure, the translation from NI-DAQ function calls to LabVIEW VIs is straightforward, as many of the VIs have the same names as the listed function calls. Refer to *Flowcharts for Creating Verification and Calibration Code* for flowcharts detailing the code used at each step of the calibration procedure.

There are a number of compiler-specific steps that you must follow to create an application using the NI-DAQ driver. The *NI-DAQ User Manual for PC Compatibles* details the required steps for each of the supported compilers.

Be aware that many of the functions listed in the calibration procedure in the *Calibration Process Overview* section of this document use variables that are defined in the `nidaqcns.h` file. To use these variables, you must include the `nidaqcns.h` file in your code. If you do not wish to use these variable definitions, you can examine the function call listings in the NI-DAQ documentation and the `nidaqcns.h` file to determine what input values are required.

Calibration Process

The calibration process is broken down into three steps:

1. E Series Verification Procedure—Verify the existing operation of the board. This step allows you to confirm that the board was operating within its specified range prior to calibration.
2. E Series Adjustment Procedure—Perform an external calibration that adjusts the board calibration constants with respect to a known voltage source.
3. Perform another verification to ensure that the board is operating within its specifications after adjustment.

These steps are described in detail in the following sections. As a complete verification of all of the board's gains and ranges can take some time, you may wish to verify only the gains and ranges of interest to you.

Initial Setup

NI-DAQ automatically detects all E Series devices except DAQPad devices. However, for the driver to communicate with the device, it must be configured in NI-DAQ. The following sections provide a brief description of the configuration procedure. For more information, refer to the installation documentation in your board's user manual. Manuals can be downloaded from the National Instruments Web site, `ni.com/manuals`. The following procedure describes how to configure a board in NI-DAQ:

1. Install the NI-DAQ driver software.
2. Turn off the power to the computer that will hold the board and install the board in an available slot.
3. When the computer powers up, launch Measurement & Automation Explorer.
4. Configure the board device number and click **Test Resources** to ensure that the board is working properly.



Note Once a board is configured with Measurement & Automation Explorer, the board is assigned a device number. Each function call uses this number to identify which DAQ board to calibrate.

E Series Verification Procedure

Verification determines how well the DAQ board is meeting its specifications. By performing this procedure, you can see how your board has operated over time. You can use this information to help determine the appropriate calibration interval for your application.

The verification procedure is divided into the major functions of the board. Throughout the verification process, use the tables in the *E Series Board Specifications* section later in this document to determine if your device needs to be adjusted.

Analog Input Verification

Since the E Series board has a number of different ranges and polarities, you need to check measurements for each available range/polarity combination. Because there is only one ADC on E Series boards, you only need to perform verification on a single analog input channel. Use the following procedure to check the performance of the analog input:

1. Make sure that you have read the *Software and Documentation* section earlier in this document.

2. Connect the positive output of the calibrator to analog input channel 0 (pin 68), and the negative output of the calibrator to analog input channel 8 (pin 34).

Note Pin numbers are given for 68-pin connectors only. If you are using a 50-pin connector, refer to the board user manual for signal connection location.

3. Choose the data sheet from the *E Series Board Specifications* section later in this document that corresponds to the board you are verifying. This sheet shows all acceptable settings for the board type. Although it is recommended that all ranges and gains be verified, you may wish to save time by checking only those ranges that are used in your application.
4. Set the calibrator voltage to the test value indicated on the board data sheet.
5. Run the `AI_Configure` function to configure the board for the appropriate device number, input range, and polarity. Read these settings from the table for the board.
6. Run the `DAQ_Op` function to acquire 10,000 points of voltage data. Set the **gain** to the value specified by the board table.
7. Run the `DAQ_VScale` function to convert the buffer of acquired binary values into voltage values.
8. Average the 10,000 voltage values. Compare the resulting average to the upper and lower limits listed in the table. If the result falls between these values, the test is considered to have passed.
9. Repeat steps 5 through 8 until all values have been verified.
10. Disconnect the calibrator from the board.

You have finished verifying the analog input levels on your board.

Analog Output Verification

This procedure checks the performance of the analog output. Skip this step if the board you are calibrating does not have analog output circuitry. Check measurements using the following procedure:

1. Make sure that you have read the *Software and Documentation* section earlier in this document.
2. Most E Series boards have two analog outputs, DAC0OUT and DAC1OUT. This test will check both analog output channels. Connect your DMM to DAC0OUT as shown in Table 1.

Table 1. Connections to Analog Outputs

Analog Output	DMM Positive Input	DMM Negative Input
DAC0OUT	DAC0OUT (pin 22)	AOGND (pin 55)
DAC1OUT	DAC1OUT (pin 21)	AOGND (pin 55)

Note Pin numbers are given for 68-pin connectors only. If you are using a 50-pin connector, refer to the board user manual for signal connection location.

3. Choose the table from the *E Series Board Specifications* section later in this document that corresponds to the board you are verifying. This table shows all acceptable settings for the board. Although it is recommended that all ranges be verified, you may wish to save time by checking only those ranges that are used in your application.
4. Run the `AO_Configure` function to configure the board for the appropriate device number, channel, and output polarity. Use channel 0 as the channel to verify. Read the remaining settings from the table for the board.
5. Run the `AO_VWrite` function to update the analog output channel with the appropriate **voltage**. Use the voltage value to be tested shown on the data sheet for the board.
6. Compare the resulting value shown by the DMM to the upper and lower limits in the table. If the value falls between these limits, the test is considered to have passed.
7. Repeat steps 4 through 6 until all values have been tested.
8. Disconnect the DMM from DAC0OUT, and reconnect it to DAC1OUT, making the connections as shown in Table 1.
9. Run the `AO_Configure` function to configure the board for the appropriate device number, channel, and output polarity. Use channel 1 as the channel to verify. Read the remaining settings from the data sheet for the board.
10. Run the `AO_VWrite` function to update the analog output channel with the appropriate voltage. Use the voltage value to be tested shown on the data sheet for the board.
11. Compare the resulting value shown by the DMM to the upper and lower limits on the data sheet. If the value falls between these limits, the test is considered to have passed.
12. Repeat steps 9 through 11 until all values have been tested.
13. Disconnect your DMM from the board.

You have finished verifying the analog output levels on your board.

Counter Verification

This procedure verifies the performance of the counter. The E Series boards have only one timebase to verify, so only counter 0 needs to be checked. It is not possible to adjust this timebase, so only verification can be performed. Perform checks using the following procedure:

1. Make sure that you have read the *Software and Documentation* section earlier in this document.
2. Connect your counter positive input to GPCTR0_OUT (pin 2) and your counter negative input to DGND (pin 35).

Note Pin numbers are given for 68-pin connectors only. If you are using a 50-pin connector, refer to the board user manual for signal connection location.

3. Run the `GPCTR_Control` function with the **action** set to `ND_RESET`. This places the counter in a default state.
4. Run the `GPCTR_Set_Application` function with **application** set to `ND_PULSE_TRAIN_GNR` to configure the counter for pulse-train generation.
5. Run the `GPCTR_Change_Parameter` function with **paramID** set to `ND_COUNT_1` and **paramValue** set to `2`. This configures the counter to output a pulse with an off time of 100 ns.
6. Run the `GPCTR_Change_Parameter` function with **paramID** set to `ND_COUNT_2` and **paramValue** set to `2`. This configures the counter to output a pulse with an on time of 100 ns.
7. Run the `Select_Signal` function with **signal** and **source** set to `ND_GPCTR0_OUTPUT`. This will route the counter signal to the GPCTR0_OUT pin on the board connector.
8. Run the `GPCTR_Control` function with the **action** variable set to `ND_PROGRAM` to start the generation of a square wave.
9. The board will begin to generate a 5 MHz square wave when the `GPCTR_Control` function completes execution. Compare the value read by your counter to the test limits shown on the board table. If the value falls between these limits, the test is considered to have passed.
10. Disconnect the counter from your board.

You have verified the counter on your board.

E Series Adjustment Procedure

Use the E Series adjustment procedure to adjust the analog input and output calibration constants. At the end of each calibration procedure, these new constants are stored in the factory area of the board EEPROM. Users cannot modify these values, which prevents them from accidentally accessing or modify any calibration constants adjusted by the metrology laboratory.

This step in the calibration process calls functions from the NI-DAQ driver as well as functions from the `niECal.dll`. For further information on the functions in the `niECal.dll`, refer to the comments in the `niECal.h` file.

Perform adjustment of the analog inputs with a calibrator using the following procedure:

1. Read the *Equipment and Other Test Requirements* section earlier in this document.
2. The calibrator connections depend on the resolution of the board you are calibrating. Refer to Table 2 to determine connections between the board and the calibrator.

Table 2. Calibrator Connections

12-Bit E Series Device	16-Bit E Series Device
Connect the positive output of the calibrator to analog input channel 8 (pin 34).	Connect the positive output of the calibrator to analog input channel 0 (pin 68).
Connect the negative output of the calibrator to AISENSE (pin 62).	Connect the negative output of the calibrator to analog input channel 8 (pin 34).
Connect DAC0OUT (pin 22) line to analog input channel 0 (pin 68).	—
If your calibrator and computer are floating with respect to each other, connect the negative output of the calibrator to AISENSE (pin 62) and AIGND (pin 29).	If your calibrator and computer are floating with respect to each other, connect the negative output of the calibrator to the AIGND line (pin 29) and the analog input channel 8 (pin 34).

Note Pin numbers are given for 68-pin connectors only. If you are using a 50-pin connector, refer to the board user manual for signal connection location.

Note If you are calibrating a DAQCard-AI-16XE-50, you will need to make the connections as if the board were a 16-bit device. If you are calibrating a 6052E or a low-cost E Series 16-bit product, you will need to make the connections as if the board were a 12-bit device.

3. To obtain the date of the last calibration, run the `Get_Cal_Date` function included in the `niECal.dll`. Once run, **CalDate** will contain the date when the board was last calibrated.
4. Run the `Calibrate_E_Series` function with **calOP** set to `ND_SELF_CALIBRATE` and **setOfCalConst** set to `ND_USER_EEPROM_AREA`. This step will perform an internal calibration of the board. It may take as long as 30 seconds to complete this function call.
5. Set your calibrator to output a voltage of 7.50 V.
6. Run the `Calibrate_E_Series` function with **calOP** set to `ND_EXTERNAL_CALIBRATE` and **`setOfCalConst`** set to `ND_USER_EEPROM_AREA`. Set **`calRefVolts`** to 7.50. If the voltage supplied by your source does not maintain a steady 7.50 V, you will receive an error. If your voltage source is floating with respect to the computer and you have not connected AISENSE to AIGND, you will receive an error.
7. Run the `Copy_Cal` function included in the `niECal.dll`. This function enables and copies the new calibration constants to the protected factory portion of the EEPROM. This function will also update the calibration date.
8. Run the `Calibrate_E_Series` function with **calOP** set to `ND_SET_DEFAULT_LOAD_AREA` and **setOfCalConst** set to `ND_FACTORY_EEPROM_AREA`. This step sets the factory-calibration constants as the default constants.
9. Disconnect the calibrator from the board.

The board is now calibrated with respect to your external source.

After the board is calibrated, you may want to verify the analog input and output operation. To do this, repeat the *E Series Verification Procedure* section of this document.

Flowcharts for Creating Verification and Calibration Code

This section shows the basic flowcharts for creating the verification and adjustment code the E Series calibration procedure requires. These flowcharts only refer to the appropriate NI-DAQ function calls. You may want to refer to the *Calibration Process Overview* section of this document, to the *NI-DAQ Function ReferenceOnline Help*, and to the *NI-DAQ User Manual for PC Compatibles* for additional information on the software structure and for function explanations.

Analog Input Verification

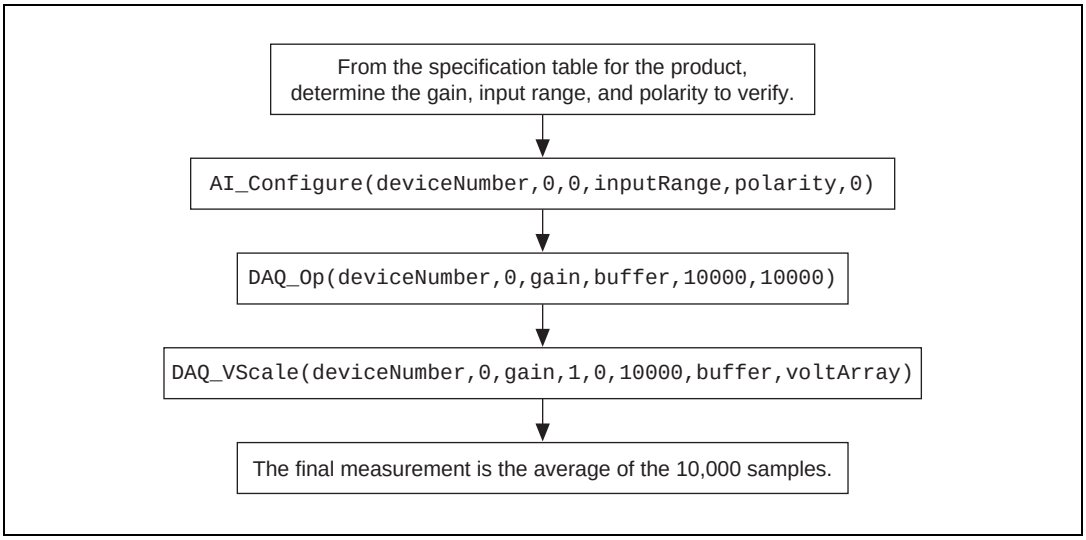


Figure 1. Analog Input Verification

Analog Output Verification

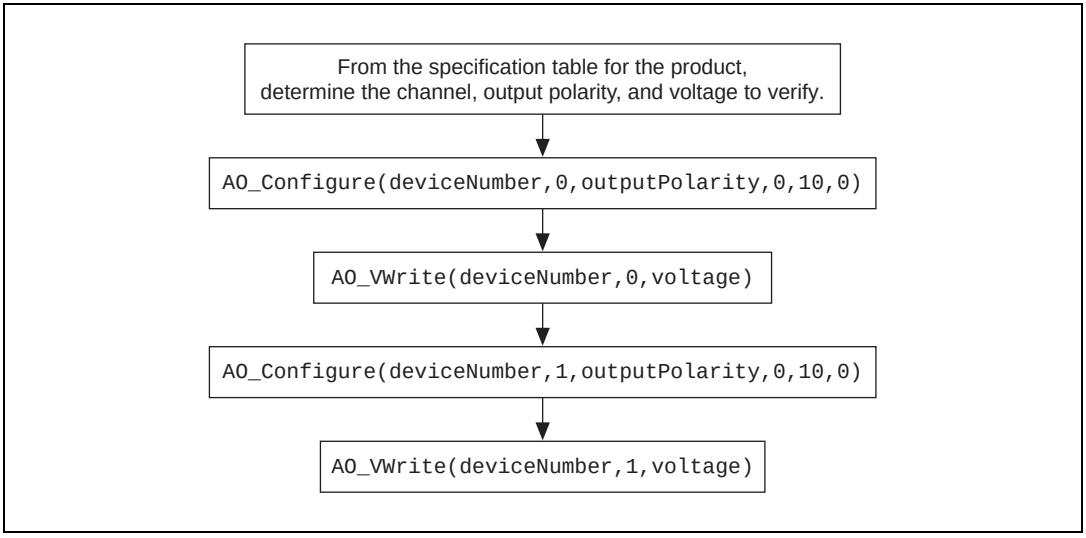


Figure 2. Analog Output Verification

Counter Verification

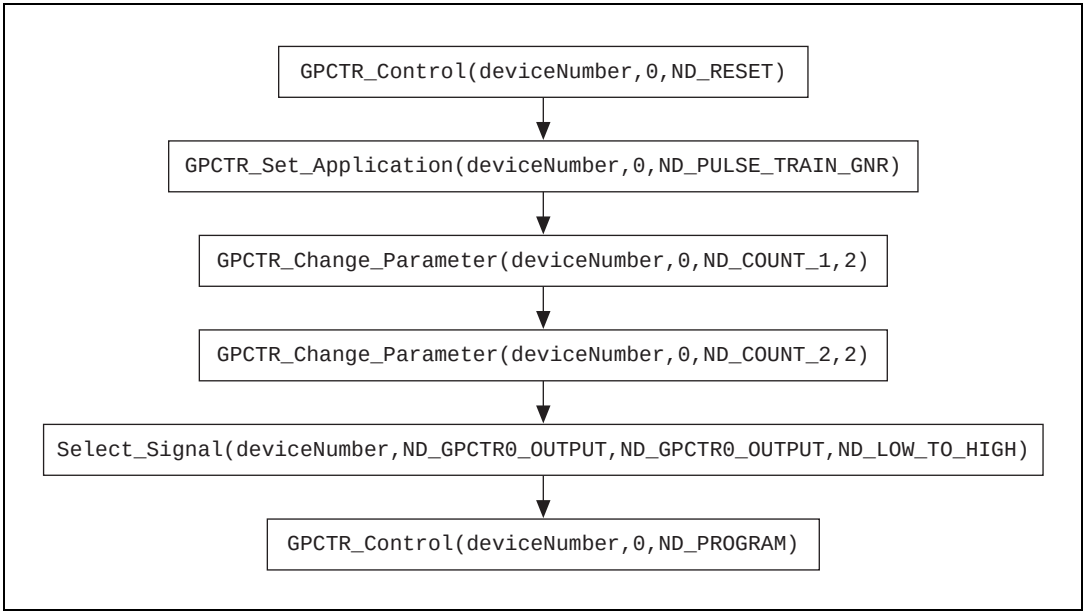


Figure 3. Counter Verification

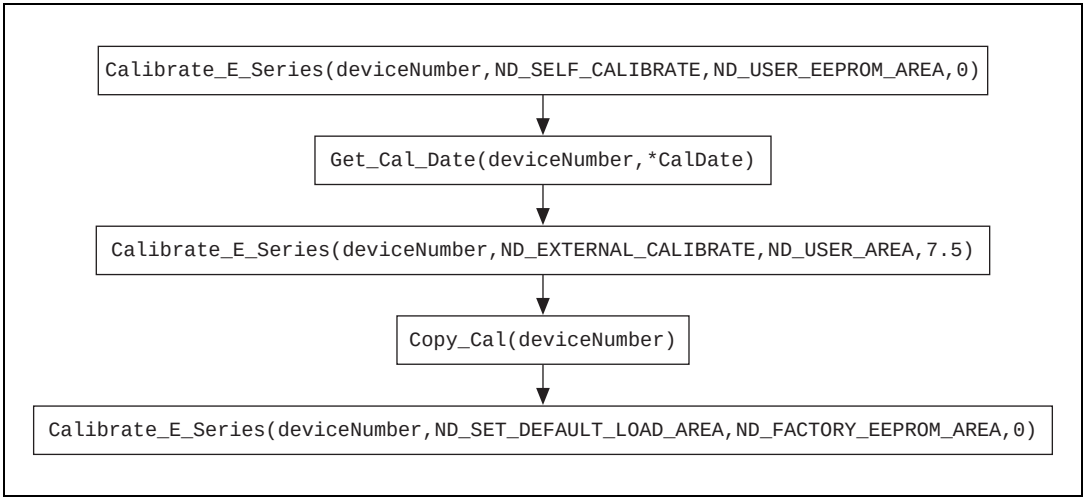


Figure 4. E Series Calibration

Installation and Calibration Issues

Although the operating system automatically detects most E Series products, there are some special cases where manual configuration is required. Refer to the product user manual for specific installation issues.

DAQPad Issues

Once you have completed calibrating a DAQPad, you need to manually remove the DAQPad driver from the system. If you do not remove the driver, NI-DAQ tries to install the DAQPad each time you launch Measurement & Automation Explorer.

E Series Board Specifications

The tables in this section are the specifications for the various E Series products. The specifications are divided into analog input, analog output, and counter/timer tables of values.

The tables display the specifications for both 1-year and 24-hour calibration intervals. That is, the 1-year ranges display the specifications that the boards should meet if it has been 1 year between calibrations. When a board has been calibrated with an external source, the values shown in the 24-hour tables are the valid specifications.

Using the Tables

The following definitions describe how to use the information from the tables in this section.

Range

Range refers to the maximum allowable voltage range of an input or output signal. For example, if a board is configured in bipolar mode with a range of 20 V, the board can sense signals between +10 V and –10 V.

Polarity

Polarity refers to the polarity of the input signal that can be read. In bipolar configuration, the board can read both positive and negative voltages. In unipolar mode, the board can read only positive voltages.

Gain

The *Gain* value is applied to an input voltage prior to sending the voltage to the ADC. The input voltage level, multiplied by the gain, should not exceed the voltage range of the board. For instance, for a gain of 2 with the board configured in bipolar mode, the maximum input voltage can be 4.995 V, because 4.995 × 2.0 = 9.990 V.



Note There are no gain settings for analog output, as the analog output gain is fixed at 1.

Test Point

The *Test Point* is the voltage value that is input or output for verification purposes. This value is broken down into two columns: *Location* and *Value*. *Location* refers to where the test value fits within the test range. *Pos FS* stands for positive full-scale and *Neg FS* stands for negative full-scale. *Value* refers to the voltage value to be verified and is in volts.

24-Hour Ranges

The *24-Hour Range* column contains the *Upper Limits* and *Lower Limits* for the test point value. That is, when the board is within its 24-hour calibration interval, the test point value should fall between the upper and lower limit values. Upper and lower limits are expressed in volts.

1-Year Ranges

The *1-Year Range* column contains the *Upper Limits* and *Lower Limits* for the test point value. That is, when the board is within its 1-year calibration interval, the test point value should fall between the upper and lower limit values. Upper and lower limits are expressed in volts.

Counters

It is not possible to adjust the resolution of the counter/timers. Therefore, these values do not have a 1-year or 24-hour calibration period. However, the test point and upper and lower limits are provided for verification purposes.

6032E Family Boards—16-Bit Resolution

The following tables include values for the AT-MIO-16XE-10, PXI-6030E, PXI-6031E, PCI-MIO-16XE-10, PCI-6031E, PCI-6032E, PCI-6033E, VXI-MIO-64XE-10, and AT-AI-16XE-10 (analog input only).

Table 3. Analog Input Values for 6032E Family Boards

Range	Polarity	Gain	Test Point		24–Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	1	Pos FS	9.9900000	9.9890457	9.9909543	9.9888759	9.9911241
20	bipolar	1	Neg FS	–9.9900000	–9.9909543	–9.9890457	–9.9911241	–9.9888759
20	bipolar	2	Pos FS	4.9950000	4.9932701	4.9967299	4.9931852	4.9968148
20	bipolar	2	Neg FS	–4.9950000	–4.9967299	–4.9932701	–4.9968148	–4.9931852
20	bipolar	5	Pos FS	1.9980000	1.9972877	1.9987123	1.9972537	1.9987463
20	bipolar	5	Neg FS	–1.9980000	–1.9987123	–1.9972877	–1.9987463	–1.9972537
20	bipolar	10	Pos FS	0.9990000	0.9986475	0.9993525	0.9986306	0.9993694
20	bipolar	10	Neg FS	–0.9990000	–0.9993525	–0.9986475	–0.9993694	–0.9986306
20	bipolar	20	Pos FS	0.4995000	0.4993197	0.4996803	0.4993112	0.4996888
20	bipolar	20	Neg FS	–0.4995000	–0.4996803	–0.4993197	–0.4996888	–0.4993112
20	bipolar	50	Pos FS	0.1998000	0.1997214	0.1998786	0.1997180	0.1998820
20	bipolar	50	Neg FS	–0.1998000	–0.1998786	–0.1997214	–0.1998820	–0.1997180
20	bipolar	100	Pos FS	0.0999000	0.0998573	0.0999427	0.0998556	0.0999444
20	bipolar	100	Neg FS	–0.0999000	–0.0999427	–0.0998573	–0.0999444	–0.0998556
10	unipolar	1	Pos FS	9.9900000	9.9892002	9.9907998	9.9890303	9.9909697

Table 3. Analog Input Values for 6032E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24–Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	1	Neg FS	0.0100000	0.0096393	0.0103607	0.0096391	0.0103609
10	unipolar	2	Pos FS	4.9950000	4.9933473	4.9966527	4.9932624	4.9967376
10	unipolar	2	Neg FS	0.0050000	0.0048144	0.0051856	0.0048143	0.0051857
10	unipolar	5	Pos FS	1.9980000	1.9973340	1.9986660	1.9973001	1.9986999
10	unipolar	5	Neg FS	0.0020000	0.0019209	0.0020791	0.0019208	0.0020792
10	unipolar	10	Pos FS	0.9990000	0.9986630	0.9993370	0.9986460	0.9993540
10	unipolar	10	Neg FS	0.0010000	0.0009564	0.0010436	0.0009564	0.0010436
10	unipolar	20	Pos FS	0.4995000	0.4993274	0.4996726	0.4993189	0.4996811
10	unipolar	20	Neg FS	0.0005000	0.0004741	0.0005259	0.0004741	0.0005259
10	unipolar	50	Pos FS	0.1998000	0.1997261	0.1998739	0.1997227	0.1998773
10	unipolar	50	Neg FS	0.0002000	0.0001848	0.0002152	0.0001847	0.0002153
10	unipolar	100	Pos FS	0.0999000	0.0998589	0.0999411	0.0998573	0.0999427
10	unipolar	100	Neg FS	0.0001000	0.0000883	0.0001117	0.0000883	0.0001117

Table 4. Analog Output Values for 6032E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9887375	9.9912626	9.9885676	9.9914324
20	bipolar	Neg FS	–9.9900000	–9.9912626	–9.9887375	–9.9914324	–9.9885676
10	unipolar	Pos FS	9.9900000	9.9889665	9.9910336	9.9887966	9.9912034
10	unipolar	Neg FS	0.0100000	0.0094156	0.0105845	0.0094154	0.0105846

Table 5. Counter Values for 6032E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6020E/6021E Family Boards—12-Bit Resolution

The following tables include values for the AT-MIO-16E-10 and DAQPad-6020E.

Table 6. Analog Input Values for 6020E/6021E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9763226	10.0036774	9.9759030	10.0040970
10	bipolar	0.5	Neg FS	–9.9900000	–10.0036774	–9.9763226	–10.0040970	–9.9759030
10	bipolar	1	Pos FS	4.9950000	4.9909006	4.9990994	4.9906908	4.9993092
10	bipolar	1	Neg FS	–4.9950000	–4.9990994	–4.9909006	–4.9993092	–4.9906908
10	bipolar	2	Pos FS	2.4975000	2.4940677	2.5009323	2.4939628	2.5010372
10	bipolar	2	Neg FS	–2.4975000	–2.5009323	–2.4940677	–2.5010372	–2.4939628
10	bipolar	5	Pos FS	0.9990000	0.9976172	1.0003828	0.9975753	1.0004247
10	bipolar	5	Neg FS	–0.9990000	–1.0003828	–0.9976172	–1.0004247	–0.9975753
10	bipolar	10	Pos FS	0.4995000	0.4988002	0.5001998	0.4987792	0.5002208
10	bipolar	10	Neg FS	–0.4995000	–0.5001998	–0.4988002	–0.5002208	–0.4987792
10	bipolar	20	Pos FS	0.2497500	0.2493916	0.2501084	0.2493811	0.2501189
10	bipolar	20	Neg FS	–0.2497500	–0.2501084	–0.2493916	–0.2501189	–0.2493811
10	bipolar	50	Pos FS	0.0999000	0.0997461	0.1000539	0.0997419	0.1000581
10	bipolar	50	Neg FS	–0.0999000	–0.1000539	–0.0997461	–0.1000581	–0.0997419
10	bipolar	100	Pos FS	0.0499500	0.0498645	0.0500355	0.0498624	0.0500376
10	bipolar	100	Neg FS	–0.0499500	–0.0500355	–0.0498645	–0.0500376	–0.0498624

Table 6. Analog Input Values for 6020E/6021E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	1	Pos FS	9.9900000	9.9850414	9.9949586	9.9846218	9.9953782
10	unipolar	1	Neg FS	0.0100000	0.0067580	0.0132420	0.0067576	0.0132424
10	unipolar	2	Pos FS	4.9950000	4.9897645	5.0002355	4.9895547	5.0004453
10	unipolar	2	Neg FS	0.0050000	0.0033673	0.0066327	0.0033671	0.0066329
10	unipolar	5	Pos FS	1.9980000	1.9958959	2.0001041	1.9958120	2.0001880
10	unipolar	5	Neg FS	0.0020000	0.0013371	0.0026629	0.0013370	0.0026630
10	unipolar	10	Pos FS	0.9990000	0.9979395	1.0000605	0.9978976	1.0001024
10	unipolar	10	Neg FS	0.0010000	0.0006601	0.0013399	0.0006600	0.0013400
10	unipolar	20	Pos FS	0.4995000	0.4989613	0.5000387	0.4989403	0.5000597
10	unipolar	20	Neg FS	0.0005000	0.0003215	0.0006785	0.0003215	0.0006785
10	unipolar	50	Pos FS	0.1998000	0.1995739	0.2000261	0.1995656	0.2000344
10	unipolar	50	Neg FS	0.0002000	0.0001181	0.0002819	0.0001180	0.0002820
10	unipolar	100	Pos FS	0.0999000	0.0997785	0.1000215	0.0997743	0.1000257
10	unipolar	100	Neg FS	0.0001000	0.0000505	0.0001495	0.0000505	0.0001495

Table 7. Analog Output Values for 6020E/6021E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9822988	9.9977012	9.9818792	9.9981208
20	bipolar	Neg FS	–9.9900000	–9.9977012	–9.9822988	–9.9981208	–9.9818792
10	unipolar	Pos FS	9.9900000	9.9847408	9.9952592	9.9843212	9.9956788
10	unipolar	Neg FS	0.0100000	0.0065072	0.0134928	0.0065068	0.0134932

Table 8. Counter Values for 6020E/6021E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6070E Family Boards—12-Bit Resolution

The following tables include values for the PCI-MIO-16E-1, PCI-6070E, PXI-6070E, PXI-6071E, AT-MIO-16E-1, and DAQPad-6070E (for IEEE 1394).

Table 9. Analog Input Values for 6070E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9783206	10.0016794	9.9779010	10.0020990
10	bipolar	0.5	Neg FS	–9.9900000	–10.0016794	–9.9783206	–10.0020990	–9.9779010
10	bipolar	1	Pos FS	4.9950000	4.9904011	4.9995989	4.9901913	4.9998087
10	bipolar	1	Neg FS	–4.9950000	–4.9995989	–4.9904011	–4.9998087	–4.9901913
10	bipolar	2	Pos FS	2.4975000	2.4945672	2.5004328	2.4944623	2.5005377
10	bipolar	2	Neg FS	–2.4975000	–2.5004328	–2.4945672	–2.5005377	–2.4944623
10	bipolar	5	Pos FS	0.9990000	0.9978170	1.0001830	0.9977751	1.0002249
10	bipolar	5	Neg FS	–0.9990000	–1.0001830	–0.9978170	–1.0002249	–0.9977751
10	bipolar	10	Pos FS	0.4995000	0.4989001	0.5000999	0.4988791	0.5001209
10	bipolar	10	Neg FS	–0.4995000	–0.5000999	–0.4989001	–0.5001209	–0.4988791
10	bipolar	20	Pos FS	0.2497500	0.2494412	0.2500588	0.2494307	0.2500693
10	bipolar	20	Neg FS	–0.2497500	–0.2500588	–0.2494412	–0.2500693	–0.2494307
10	bipolar	50	Pos FS	0.0999000	0.0997658	0.1000342	0.0997616	0.1000384
10	bipolar	50	Neg FS	–0.0999000	–0.1000342	–0.0997658	–0.1000384	–0.0997616
10	bipolar	100	Pos FS	0.0499500	0.0498742	0.0500258	0.0498721	0.0500279

Table 9. Analog Input Values for 6070E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	100	Neg FS	–0.0499500	–0.0500258	–0.0498742	–0.0500279	–0.0498721
10	unipolar	1	Pos FS	9.9900000	9.9840424	9.9959576	9.9836228	9.9963772
10	unipolar	1	Neg FS	0.0100000	0.0067570	0.0132430	0.0067566	0.0132434
10	unipolar	2	Pos FS	4.9950000	4.9907635	4.9992365	4.9905537	4.9994463
10	unipolar	2	Neg FS	0.0050000	0.0033683	0.0066317	0.0033681	0.0066319
10	unipolar	5	Pos FS	1.9980000	1.9962955	1.9997045	1.9962116	1.9997884
10	unipolar	5	Neg FS	0.0020000	0.0013375	0.0026625	0.0013374	0.0026626
10	unipolar	10	Pos FS	0.9990000	0.9981393	0.9998607	0.9980974	0.9999026
10	unipolar	10	Neg FS	0.0010000	0.0006603	0.0013397	0.0006602	0.0013398
10	unipolar	20	Pos FS	0.4995000	0.4990609	0.4999391	0.4990399	0.4999601
10	unipolar	20	Neg FS	0.0005000	0.0003213	0.0006787	0.0003213	0.0006787
10	unipolar	50	Pos FS	0.1998000	0.1996136	0.1999864	0.1996052	0.1999948
10	unipolar	50	Neg FS	0.0002000	0.0001178	0.0002822	0.0001178	0.0002822
10	unipolar	100	Pos FS	0.0999000	0.0997982	0.1000018	0.0997940	0.1000060
10	unipolar	100	Neg FS	0.0001000	0.0000502	0.0001498	0.0000502	0.0001498

Table 10. Analog Output Values for 6070E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9822988	9.9977012	9.9818792	9.9981208
20	bipolar	Neg FS	–9.9900000	–9.9977012	–9.9822988	–9.9981208	–9.9818792
10	unipolar	Pos FS	9.9900000	9.9847408	9.9952592	9.9843212	9.9956788
10	unipolar	Neg FS	0.0100000	0.0065072	0.0134928	0.0065068	0.0134932

Table 11. Counter Values for 6070E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6060E Family Boards—12-Bit Resolution

The following tables include values for the AT-MIO-16E-2 and AT-MIO-64E-3.

Table 12. Analog Input Values for 6060E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9783206	10.0016794	9.9779010	10.0020990
10	bipolar	0.5	Neg FS	–9.9900000	–10.0016794	–9.9783206	–10.0020990	–9.9779010
10	bipolar	1	Pos FS	4.9950000	4.9904011	4.9995989	4.9901913	4.9998087
10	bipolar	1	Neg FS	–4.9950000	–4.9995989	–4.9904011	–4.9998087	–4.9901913
10	bipolar	2	Pos FS	2.4975000	2.4945672	2.5004328	2.4944623	2.5005377
10	bipolar	2	Neg FS	–2.4975000	–2.5004328	–2.4945672	–2.5005377	–2.4944623
10	bipolar	5	Pos FS	0.9990000	0.9978170	1.0001830	0.9977751	1.0002249
10	bipolar	5	Neg FS	–0.9990000	–1.0001830	–0.9978170	–1.0002249	–0.9977751
10	bipolar	10	Pos FS	0.4995000	0.4989001	0.5000999	0.4988791	0.5001209
10	bipolar	10	Neg FS	–0.4995000	–0.5000999	–0.4989001	–0.5001209	–0.4988791
10	bipolar	20	Pos FS	0.2497500	0.2494415	0.2500585	0.2494310	0.2500690
10	bipolar	20	Neg FS	–0.2497500	–0.2500585	–0.2494415	–0.2500690	–0.2494310
10	bipolar	50	Pos FS	0.0999000	0.0997659	0.1000341	0.0997617	0.1000383
10	bipolar	50	Neg FS	–0.0999000	–0.1000341	–0.0997659	–0.1000383	–0.0997617
10	bipolar	100	Pos FS	0.0499500	0.0498743	0.0500257	0.0498722	0.0500278
10	bipolar	100	Neg FS	–0.0499500	–0.0500257	–0.0498743	–0.0500278	–0.0498722

Table 12. Analog Input Values for 6060E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	1	Pos FS	9.9900000	9.9840424	9.9959576	9.9836228	9.9963772
10	unipolar	1	Neg FS	0.0100000	0.0067570	0.0132430	0.0067566	0.0132434
10	unipolar	2	Pos FS	4.9950000	4.9907635	4.9992365	4.9905537	4.9994463
10	unipolar	2	Neg FS	0.0050000	0.0033683	0.0066317	0.0033681	0.0066319
10	unipolar	5	Pos FS	1.9980000	1.9962955	1.9997045	1.9962116	1.9997884
10	unipolar	5	Neg FS	0.0020000	0.0013375	0.0026625	0.0013374	0.0026626
10	unipolar	10	Pos FS	0.9990000	0.9981393	0.9998607	0.9980974	0.9999026
10	unipolar	10	Neg FS	0.0010000	0.0006603	0.0013397	0.0006602	0.0013398
10	unipolar	20	Pos FS	0.4995000	0.4990612	0.4999388	0.4990402	0.4999598
10	unipolar	20	Neg FS	0.0005000	0.0003216	0.0006784	0.0003216	0.0006784
10	unipolar	50	Pos FS	0.1998000	0.1996137	0.1999863	0.1996053	0.1999947
10	unipolar	50	Neg FS	0.0002000	0.0001179	0.0002821	0.0001179	0.0002821
10	unipolar	100	Pos FS	0.0999000	0.0997983	0.1000017	0.0997941	0.1000059
10	unipolar	100	Neg FS	0.0001000	0.0000503	0.0001497	0.0000503	0.0001497

Table 13. Analog Output Values for 6060E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9822988	9.9977012	9.9818792	9.9981208
20	bipolar	Neg FS	–9.9900000	–9.9977012	–9.9822988	–9.9981208	–9.9818792
10	unipolar	Pos FS	9.9900000	9.9847408	9.9952592	9.9843212	9.9956788
10	unipolar	Neg FS	0.0100000	0.0065072	0.0134928	0.0065068	0.0134932

Table 14. Counter Values for 6060E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6010E Family Boards—16-Bit Resolution

The following tables include values for the PCI-MIO-16XE-50, DAQPad-MIO-16XE-50, and DAQCard-AI-16XE-50 (analog input only).

Table 15. Analog Input Values for 6010E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	1	Pos FS	9.9900000	9.9890188	9.9909812	9.9885992	9.9914008
20	bipolar	1	Neg FS	–9.9900000	–9.9909812	–9.9890188	–9.9914008	–9.9885992
20	bipolar	2	Pos FS	4.9950000	4.9937582	4.9962419	4.9935484	4.9964516
20	bipolar	2	Neg FS	–4.9950000	–4.9962419	–4.9937582	–4.9964516	–4.9935484
20	bipolar	10	Pos FS	0.9990000	0.9987483	0.9992517	0.9987064	0.9992936
20	bipolar	10	Neg FS	–0.9990000	–0.9992517	–0.9987483	–0.9992936	–0.9987064
20	bipolar	100	Pos FS	0.0999000	0.0998512	0.0999488	0.0998470	0.0999530
20	bipolar	100	Neg FS	–0.0999000	–0.0999488	–0.0998512	–0.0999530	–0.0998470
10	unipolar	1	Pos FS	9.9900000	9.9891737	9.9908263	9.9887541	9.9912459
10	unipolar	1	Neg FS	0.0100000	0.0097525	0.0102475	0.0097521	0.0102479
10	unipolar	2	Pos FS	4.9950000	4.9933361	4.9966639	4.9931263	4.9968737
10	unipolar	2	Neg FS	0.0050000	0.0048730	0.0051270	0.0048728	0.0051272
10	unipolar	10	Pos FS	0.9990000	0.9986640	0.9993360	0.9986220	0.9993780
10	unipolar	10	Neg FS	0.0010000	0.0009714	0.0010286	0.0009713	0.0010287

Table 15. Analog Input Values for 6010E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	100	Pos FS	0.0999000	0.0998527	0.0999473	0.0998485	0.0999515
10	unipolar	100	Neg FS	0.0001000	0.0000934	0.0001066	0.0000934	0.0001066

Table 16. Analog Output Values for 6010E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9832234	9.9967766	9.9828038	9.9971962
20	bipolar	Neg FS	–9.9900000	–9.9967766	–9.9832234	–9.9971962	–9.9828038

Table 17. Counter Values for 6010E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6040E Family Boards—12-Bit Resolution

The following tables include values for the DAQCard-AI-16E-4 (analog input only), PCI-MIO-16E-4, and PXI-6040E.

Table 18. Analog Input Values for 6040E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9772120	10.0027880	9.9767925	10.0032075
10	bipolar	0.5	Neg FS	–9.9900000	–10.0027880	–9.9772120	–10.0032075	–9.9767925
10	bipolar	1	Pos FS	4.9950000	4.9898448	5.0001552	4.9896350	5.0003650
10	bipolar	1	Neg FS	–4.9950000	–5.0001552	–4.9898448	–5.0003650	–4.9896350
10	bipolar	2	Pos FS	2.4975000	2.4942871	2.5007129	2.4941822	2.5008178
10	bipolar	2	Neg FS	–2.4975000	–2.5007129	–2.4942871	–2.5008178	–2.4941822
10	bipolar	5	Pos FS	0.9990000	0.9977025	1.0002975	0.9976606	1.0003394
10	bipolar	5	Neg FS	–0.9990000	–1.0071105	–0.9908895	–1.0071524	–0.9908476
10	bipolar	10	Pos FS	0.4995000	0.4988409	0.5001591	0.4988199	0.5001801
10	bipolar	10	Neg FS	–0.4995000	–0.5001591	–0.4988409	–0.5001801	–0.4988199
10	bipolar	20	Pos FS	0.2497500	0.2494099	0.2500901	0.2493994	0.2501006
10	bipolar	20	Neg FS	–0.2497500	–0.2500901	–0.2494099	–0.2501006	–0.2493994
10	bipolar	50	Pos FS	0.0999000	0.0997504	0.1000496	0.0997462	0.1000538
10	bipolar	50	Neg FS	–0.0999000	–0.1000496	–0.0997504	–0.1000538	–0.0997462
10	bipolar	100	Pos FS	0.0499500	0.0498641	0.0500359	0.0498620	0.0500380

Table 18. Analog Input Values for 6040E Family Boards (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	100	Neg FS	–0.0499500	–0.0500359	–0.0498641	–0.0500380	–0.0498620
10	unipolar	1	Pos FS	9.9900000	9.9834861	9.9965139	9.9830666	9.9969334
10	unipolar	1	Neg FS	0.0100000	0.0062007	0.0137993	0.0062003	0.0137997
10	unipolar	2	Pos FS	4.9950000	4.9904834	4.9995166	4.9902736	4.9997264
10	unipolar	2	Neg FS	0.0050000	0.0030882	0.0069118	0.0030880	0.0069120
10	unipolar	5	Pos FS	1.9980000	1.9961810	1.9998190	1.9960971	1.9999029
10	unipolar	5	Neg FS	0.0020000	–0.0055901	0.0095901	–0.0055901	0.0095901
10	unipolar	10	Pos FS	0.9990000	0.9980801	0.9999199	0.9980382	0.9999618
10	unipolar	10	Neg FS	0.0010000	0.0006011	0.0013989	0.0006010	0.0013990
10	unipolar	20	Pos FS	0.4995000	0.4990296	0.4999704	0.4990086	0.4999914
10	unipolar	20	Neg FS	0.0005000	0.0002900	0.0007100	0.0002900	0.0007100
10	unipolar	50	Pos FS	0.1998000	0.1995982	0.2000018	0.1995899	0.2000101
10	unipolar	50	Neg FS	0.0002000	0.0001024	0.0002976	0.0001024	0.0002976
10	unipolar	100	Pos FS	0.0999000	0.0997881	0.1000119	0.0997839	0.1000161
10	unipolar	100	Neg FS	0.0001000	0.0000402	0.0001598	0.0000402	0.0001598

Table 19. Analog Output Values for 6040 Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9822988	9.9977012	9.9818792	9.9981208
20	bipolar	Neg FS	–9.9900000	–9.9977012	–9.9822988	–9.9981208	–9.9818792
10	unipolar	Pos FS	9.9900000	9.9847408	9.9952592	9.9843212	9.9956788
10	unipolar	Neg FS	0.0100000	0.0065072	0.0134928	0.0065068	0.0134932

Table 20. Counter Values for 6040E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6023E/6024E/6025E Family Boards—12-Bit Resolution

The following tables include values for the PCI-6023E (analog input only), PCI-6024E, PCI-6025E, and PXI-6025E.

Table 21. Analog Input Values for 602*x*E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9763047	10.0036953	9.9758851	10.0041149
10	bipolar	0.5	Zero	0.0000000	-0.0064825	0.0064825	-0.0064825	0.0064825
10	bipolar	0.5	Neg FS	-9.9900000	-10.0036953	-9.9763047	-10.0041149	-9.9758851
10	bipolar	1	Pos FS	4.9950000	4.9903896	4.9996104	4.9901798	4.9998202
10	bipolar	1	Zero	0.0000000	-0.0032518	0.0032518	-0.0032518	0.0032518
10	bipolar	1	Neg FS	-4.9950000	-4.9996104	-4.9903896	-4.9998202	-4.9901798
10	bipolar	10	Pos FS	0.4995000	0.4987945	0.5002055	0.4987735	0.5002265
10	bipolar	10	Zero	0.0000000	-0.0003449	0.0003449	-0.0003449	0.0003449
10	bipolar	10	Neg FS	-0.4995000	-0.5002055	-0.4987945	-0.5002265	-0.4987735
10	bipolar	100	Pos FS	0.0499500	0.0493733	0.0505267	0.0493712	0.0505288
10	bipolar	100	Zero	0.0000000	-0.0005406	0.0005406	-0.0005406	0.0005406
10	bipolar	100	Neg FS	-0.0499500	-0.0505267	-0.0493733	-0.0505288	-0.0493712

Table 22. Analog Input Values for 602*x*E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9822988	9.9977012	9.9818792	9.9981208
20	bipolar	Zero	0.0000000	-0.0059330	0.0059330	-0.0059330	0.0059330
20	bipolar	Neg FS	-9.9900000	-9.9977012	-9.9822988	-9.9981208	-9.9818792

Table 23. Counter Values for 602*x*E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

6034E/6035E Family Boards—16-Bit Resolution

The following tables include values for the PCI-6034E (analog input only) and PCI-6035E.

Table 24. Analog Input Values for 6034E/6035E Family Boards

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9800000	9.97336142	9.98663858	9.97294226	9.98705774
10	bipolar	0.5	Zero	0.0000000	-0.0016885	0.0016885	-0.0016885	0.0016885
10	bipolar	0.5	Neg FS	-9.9800000	-9.98663858	-9.97336142	-9.98705774	-9.97294226
10	bipolar	1	Pos FS	4.9900000	4.98841666	4.99158334	4.98820708	4.99179292
10	bipolar	1	Zero	0.0000000	-0.0008548	0.0008548	-0.0008548	0.0008548
10	bipolar	1	Neg FS	-4.9900000	-4.99158334	-4.98841666	-4.99179292	-4.98820708
10	bipolar	10	Pos FS	0.4990000	0.498648096	0.499351904	0.498627138	0.499372862
10	bipolar	10	Zero	0.0000000	-0.0001044	0.0001044	-0.0001044	0.0001044
10	bipolar	10	Neg FS	-0.4990000	-0.499351904	-0.498648096	-0.499372862	-0.498627138
10	bipolar	100	Pos FS	0.0499000	0.04984575	0.04995425	0.049843654	0.049956346
10	bipolar	100	Zero	0.0000000	-0.0000295	0.0000295	-0.0000295	0.0000295
10	bipolar	100	Neg FS	-0.0499000	-0.04995425	-0.04984575	-0.049956346	-0.049843654

Table 25. Analog Input Values for 6034E/6035E Family Boards

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9800000	9.97230054	9.98769946	9.97188138	9.98811862
20	bipolar	Zero	0.0000000	-0.005933	0.005933	-0.005933	0.005933
20	bipolar	Neg FS	-9.9800000	-9.98769946	-9.97230054	-9.98811862	-9.97188138

Table 26. Counter Values for 6034E/6035E Family Boards

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

VXI-MIO-64E-1—12-Bit Resolution

The following tables include values for the VXI-MIO-64E-1 Board.

Table 27. Analog Input Values for the VXI-MIO-64E-1

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	bipolar	0.5	Pos FS	9.9900000	9.9787702	10.0012298	9.9786003	10.0013997
10	bipolar	0.5	Neg FS	–9.9900000	–10.0012298	–9.9787702	–10.0013997	–9.9786003
10	bipolar	1	Pos FS	4.9950000	4.9906258	4.9993742	4.9905409	4.9994591
10	bipolar	1	Neg FS	–4.9950000	–4.9993742	–4.9906258	–4.9994591	–4.9905409
10	bipolar	2	Pos FS	2.4975000	2.4946796	2.5003204	2.4946371	2.5003629
10	bipolar	2	Neg FS	–2.4975000	–2.5003204	–2.4946796	–2.5003629	–2.4946371
10	bipolar	5	Pos FS	0.9990000	0.9978620	1.0001380	0.9978450	1.0001550
10	bipolar	5	Neg FS	–0.9990000	–1.0001380	–0.9978620	–1.0001550	–0.9978450
10	bipolar	10	Pos FS	0.4995000	0.4989225	0.5000775	0.4989140	0.5000860
10	bipolar	10	Neg FS	–0.4995000	–0.5000775	–0.4989225	–0.5000860	–0.4989140
10	bipolar	20	Pos FS	0.2497500	0.2494528	0.2500472	0.2494485	0.2500515
10	bipolar	20	Neg FS	–0.2497500	–0.2500472	–0.2494528	–0.2500515	–0.2494485
10	bipolar	50	Pos FS	0.0999000	0.0997703	0.1000297	0.0997686	0.1000314
10	bipolar	50	Neg FS	–0.0999000	–0.1000297	–0.0997703	–0.1000314	–0.0997686
10	bipolar	100	Pos FS	0.0499500	0.0498766	0.0500234	0.0498757	0.0500243
10	bipolar	100	Neg FS	–0.0499500	–0.0500234	–0.0498766	–0.0500243	–0.0498757

Table 27. Analog Input Values for the VXI-MIO-64E-1 (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	1	Pos FS	9.9900000	9.9844920	9.9955080	9.9843221	9.9956779
10	unipolar	1	Neg FS	0.0100000	0.0067574	0.0132426	0.0067573	0.0132427
10	unipolar	2	Pos FS	4.9950000	4.9909883	4.9990117	4.9909034	4.9990966
10	unipolar	2	Neg FS	0.0050000	0.0033685	0.0066315	0.0033684	0.0066316
10	unipolar	5	Pos FS	1.9980000	1.9963855	1.9996145	1.9963515	1.9996485
10	unipolar	5	Neg FS	0.0020000	0.0013375	0.0026625	0.0013375	0.0026625
10	unipolar	10	Pos FS	0.9990000	0.9981843	0.9998157	0.9981673	0.9998327
10	unipolar	10	Neg FS	0.0010000	0.0006603	0.0013397	0.0006603	0.0013397
10	unipolar	20	Pos FS	0.4995000	0.4990836	0.4999164	0.4990751	0.4999249
10	unipolar	20	Neg FS	0.0005000	0.0003217	0.0006783	0.0003217	0.0006783
10	unipolar	50	Pos FS	0.1998000	0.1996227	0.1999773	0.1996193	0.1999807
10	unipolar	50	Neg FS	0.0002000	0.0001179	0.0002821	0.0001179	0.0002821
10	unipolar	100	Pos FS	0.0999000	0.0998027	0.0999973	0.0998010	0.0999990
10	unipolar	100	Neg FS	0.0001000	0.0000504	0.0001496	0.0000504	0.0001496

Table 28. Analog Output Values for the VXI-MIO-64E-1

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9827483	9.9972517	9.9825785	9.9974215
20	bipolar	Neg FS	–9.9900000	–9.9972517	–9.9827483	–9.9974215	–9.9825785
10	unipolar	Pos FS	9.9900000	9.9851903	9.9948097	9.9850205	9.9949795
10	unipolar	Neg FS	0.0100000	0.0065077	0.0134923	0.0065075	0.0134925

Table 29. Counter Values for the VXI-MIO-64E-1

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

VXI-MIO-64XE-10—16-Bit Resolution

The following tables include values for the VXI-MIO-64XE-10 Board.

Table 30. Analog Input Values for the VXI-MIO-64XE-10

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	1	Pos FS	9.9900000	9.9890457	9.9909543	9.9888759	9.9911241
20	bipolar	1	Neg FS	–9.9900000	–9.9909543	–9.9890457	–9.9911241	–9.9888759
20	bipolar	2	Pos FS	4.9950000	4.9932701	4.9967299	4.9931852	4.9968148
20	bipolar	2	Neg FS	–4.9950000	–4.9967299	–4.9932701	–4.9968148	–4.9931852
20	bipolar	5	Pos FS	1.9980000	1.9972877	1.9987123	1.9972537	1.9987463
20	bipolar	5	Neg FS	–1.9980000	–1.9987123	–1.9972877	–1.9987463	–1.9972537
20	bipolar	10	Pos FS	0.9990000	0.9986475	0.9993525	0.9986306	0.9993694
20	bipolar	10	Neg FS	–0.9990000	–0.9993525	–0.9986475	–0.9993694	–0.9986306
20	bipolar	20	Pos FS	0.4995000	0.4993197	0.4996803	0.4993112	0.4996888
20	bipolar	20	Neg FS	–0.4995000	–0.4996803	–0.4993197	–0.4996888	–0.4993112
20	bipolar	50	Pos FS	0.1998000	0.1997214	0.1998786	0.1997180	0.1998820
20	bipolar	50	Neg FS	–0.1998000	–0.1998786	–0.1997214	–0.1998820	–0.1997180
20	bipolar	100	Pos FS	0.0999000	0.0998573	0.0999427	0.0998556	0.0999444
20	bipolar	100	Neg FS	–0.0999000	–0.0999427	–0.0998573	–0.0999444	–0.0998556
10	unipolar	1	Pos FS	9.9900000	9.9892002	9.9907998	9.9890303	9.9909697
10	unipolar	1	Neg FS	0.0100000	0.0096393	0.0103607	0.0096391	0.0103609

Table 30. Analog Input Values for the VXI-MIO-64XE-10 (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	2	Pos FS	4.9950000	4.9933473	4.9966527	4.9932624	4.9967376
10	unipolar	2	Neg FS	0.0050000	0.0048144	0.0051856	0.0048143	0.0051857
10	unipolar	5	Pos FS	1.9980000	1.9973340	1.9986660	1.9973001	1.9986999
10	unipolar	5	Neg FS	0.0020000	0.0019209	0.0020791	0.0019208	0.0020792
10	unipolar	10	Pos FS	0.9990000	0.9986630	0.9993370	0.9986460	0.9993540
10	unipolar	10	Neg FS	0.0010000	0.0009564	0.0010436	0.0009564	0.0010436
10	unipolar	20	Pos FS	0.4995000	0.4993274	0.4996726	0.4993189	0.4996811
10	unipolar	20	Neg FS	0.0005000	0.0004741	0.0005259	0.0004741	0.0005259
10	unipolar	50	Pos FS	0.1998000	0.1997261	0.1998739	0.1997227	0.1998773
10	unipolar	50	Neg FS	0.0002000	0.0001848	0.0002152	0.0001847	0.0002153
10	unipolar	100	Pos FS	0.0999000	0.0998589	0.0999411	0.0998573	0.0999427
10	unipolar	100	Neg FS	0.0001000	0.0000883	0.0001117	0.0000883	0.0001117

Table 31. Analog Output Values for the VXI-MIO-64XE-10

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9887375	9.9912626	9.9885676	9.9914324
20	bipolar	Neg FS	–9.9900000	–9.9912626	–9.9887375	–9.9914324	–9.9885676
10	unipolar	Pos FS	9.9900000	9.9889665	9.9910336	9.9887966	9.9912034
10	unipolar	Neg FS	0.0100000	0.0094156	0.0105845	0.0094154	0.0105846

Table 32. Counter Values for the VXI-MIO-64XE-10

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

VXI-MIO-64XE-10—16-Bit Resolution

Table 33. Analog Input Values for the VXI-MIO-64XE-10

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	1	Pos FS	9.9900000	9.9890457	9.9909543	9.9888759	9.9911241
20	bipolar	1	Neg FS	–9.9900000	–9.9909543	–9.9890457	–9.9911241	–9.9888759
20	bipolar	2	Pos FS	4.9950000	4.9932701	4.9967299	4.9931852	4.9968148
20	bipolar	2	Neg FS	–4.9950000	–4.9967299	–4.9932701	–4.9968148	–4.9931852
20	bipolar	5	Pos FS	1.9980000	1.9972877	1.9987123	1.9972537	1.9987463
20	bipolar	5	Neg FS	–1.9980000	–1.9987123	–1.9972877	–1.9987463	–1.9972537
20	bipolar	10	Pos FS	0.9990000	0.9986475	0.9993525	0.9986306	0.9993694
20	bipolar	10	Neg FS	–0.9990000	–0.9993525	–0.9986475	–0.9993694	–0.9986306
20	bipolar	20	Pos FS	0.4995000	0.4993197	0.4996803	0.4993112	0.4996888
20	bipolar	20	Neg FS	–0.4995000	–0.4996803	–0.4993197	–0.4996888	–0.4993112
20	bipolar	50	Pos FS	0.1998000	0.1997214	0.1998786	0.1997180	0.1998820
20	bipolar	50	Neg FS	–0.1998000	–0.1998786	–0.1997214	–0.1998820	–0.1997180
20	bipolar	100	Pos FS	0.0999000	0.0998573	0.0999427	0.0998556	0.0999444
20	bipolar	100	Neg FS	–0.0999000	–0.0999427	–0.0998573	–0.0999444	–0.0998556
10	unipolar	1	Pos FS	9.9900000	9.9892002	9.9907998	9.9890303	9.9909697
10	unipolar	1	Neg FS	0.0100000	0.0096393	0.0103607	0.0096391	0.0103609
10	unipolar	2	Pos FS	4.9950000	4.9933473	4.9966527	4.9932624	4.9967376

Table 33. Analog Input Values for the VXI-MIO-64XE-10 (Continued)

Range	Polarity	Gain	Test Point		24-Hour Ranges		1-Year Ranges	
			Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
10	unipolar	2	Neg FS	0.0050000	0.0048144	0.0051856	0.0048143	0.0051857
10	unipolar	5	Pos FS	1.9980000	1.9973340	1.9986660	1.9973001	1.9986999
10	unipolar	5	Neg FS	0.0020000	0.0019209	0.0020791	0.0019208	0.0020792
10	unipolar	10	Pos FS	0.9990000	0.9986630	0.9993370	0.9986460	0.9993540
10	unipolar	10	Neg FS	0.0010000	0.0009564	0.0010436	0.0009564	0.0010436
10	unipolar	20	Pos FS	0.4995000	0.4993274	0.4996726	0.4993189	0.4996811
10	unipolar	20	Neg FS	0.0005000	0.0004741	0.0005259	0.0004741	0.0005259
10	unipolar	50	Pos FS	0.1998000	0.1997261	0.1998739	0.1997227	0.1998773
10	unipolar	50	Neg FS	0.0002000	0.0001848	0.0002152	0.0001847	0.0002153
10	unipolar	100	Pos FS	0.0999000	0.0998589	0.0999411	0.0998573	0.0999427
10	unipolar	100	Neg FS	0.0001000	0.0000883	0.0001117	0.0000883	0.0001117

Table 34. Analog Output Values for the VXI-MIO-64XE-10

Range	Polarity	Test Point		24-Hour Ranges		1-Year Ranges	
		Location	Value (V)	Lower Limit (V)	Upper Limit (V)	Lower Limit (V)	Upper Limit (V)
20	bipolar	Pos FS	9.9900000	9.9887375	9.9912626	9.9885676	9.9914324
20	bipolar	Neg FS	–9.9900000	–9.9912626	–9.9887375	–9.9914324	–9.9885676
10	unipolar	Pos FS	9.9900000	9.9889665	9.9910336	9.9887966	9.9912034
10	unipolar	Neg FS	0.0100000	0.0094156	0.0105845	0.0094154	0.0105846

Table 35. Counter Values for the VXI-MIO-64XE-10

Set Point (MHz)	Upper Limit (MHz)	Lower Limit (MHz)
5	4.9995	5.0005

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