# Keysight N2125A/6A/7A and N2136A Calibration Modules

KEYSIGHT TECHNOLOGIES

User's Guide

# Notices

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## Safety Notices

**CAUTION**

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**WARNING**

**A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

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# 1 Calibration Module Overview

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This chapter introduces the four calibration modules used to calibrate the Keysight Infiniium UXR real-time oscilloscopes and the M8131A digitizer module.

# Calibration Module Models

The N2125A, N2126A, and N2127A calibration modules are used to calibrate Infiniium UXR oscilloscopes.

| N2125A 1.0 mm | N2126A 1.85 mm | N2127A 3.5 mm |
|---|---|---|
| UXR1104A, UXR1102A | UXR0704A, UXR0702A | UXR0334A |
| UXR1004A, UXR1002A | UXR0594A, UXR0592A | UXR0254A |
| UXR0804A, UXR0802A | UXR0504A, UXR0502A | UXR0204A |
| UXR0704AP, UXR0702AP | UXR0404A, UXR0402A | UXR0164A |
| UXR0594AP, UXR0592AP | | UXR0134A |
| UXR0404AP, UXR0402AP | | |
| UXR0254AP, UXR0252AP | | |

The N2136A calibration module is used to calibrate M8131A digitizers. The M8131A digitizers can be ordered in following configurations:

| Description | Product Number |
|---|---|
| 1 channel, 4 GSa/s, 1.6 GHz bandwidth, single ended | M8131A-011* |
| 2 channel, 4 GSa/s, 1.6 GHz bandwidth, single ended | M8131A-012* |
| 4 channel, 4 GSa/s, 1.6 GHz bandwidth, single ended | M8131A-014* |
| | |
| 1 channel, 16 GSa/s, 6.5 GHz bandwidth, single ended | M8131A-061* |
| 2 channel, 16 GSa/s, 6.5 GHz bandwidth, single ended | M8131A-062* |
| 4 channel, 16 GSa/s, 6.5 GHz bandwidth, single ended | M8131A-064* |
| | |
| 1 channel, 32 GSa/s, 12.5 GHz bandwidth, single ended | M8131A-131* |
| 2 channel, 32 GSa/s, 12.5 GHz bandwidth, single ended | M8131A-132* |
| | |
| 1 channel, 16 GSa/s, differential input | M8131A-FD1** |
| 2 channel, 16 GSa/s or 1 channel, 32 GSa/s, diff. input | M8131A-FD2** |
| 4 channel, 16 GSa/s or 2 channel, 32 GSa/s, diff. input | M8131A-FD4** |
| * Options -011,-012,-014, -061,-062,-064,-131,-132 require the N2136A for calibration. | |
| ** Options -FD1, FD2, FD4 do NOT require the N2136A for calibration. | |

**Figure 1** N2125A 1.0 mm Calibration Module

**Figure 2** N2126A 1.85 mm Calibration Module

**Figure 3** N2127A 3.5 mm Calibration Module

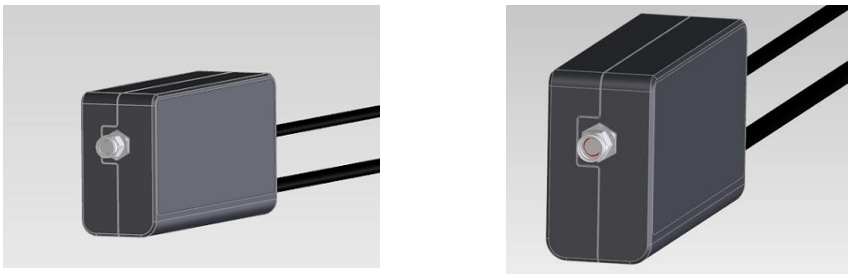

**Figure 4** N2136A 2.92 mm Calibration Module

# What Is a Calibration?

Calibration of an oscilloscope or digitizer is simply a self-adjustment. The purpose of running a calibration is to reach performance optimization. Running a calibration performs a complete calibration of the entire oscilloscope or digitizer, including all channels installed in it, so it can be referenced back to NIST-characterized standards.

### Calibration of UXR oscilloscopes

The calibration of a UXR oscilloscope is referred to as a frame calibration. It is a rigorous, complete set of cals. It includes interleave correction, time scale, and 50 Ω input resistance calibrations, among others. To perform a frame calibration, the N2125A, N2126A, or N2127A calibration module is required.

All of the oscilloscope's calibration factors are stored into flash memory (NAND) on the backplane board.

### Calibration of M8131A digitizers

Calibration of M8131A digitizer modules is required to compensate certain hardware distortions as well as calibrate the DC levels.

# When to Perform a Calibration

For UXR oscilloscopes, you need to perform a calibration:

- When it has been more than 1 year since the last calibration.
- When the oscilloscope's operating temperature (after a 30-minute warm-up period) is more than ±5 °C different from that of the last calibration.

For M8131A digitizers, you need to perform a calibration:

- When it has been more than 1 year since the last calibration.
- When the digitizer's operating temperature (after a 15-minute warm-up period) is more than ±10 °C different from that of the last calibration.
- When the digitizer's number of available channels gets increased by a new license/option.

# Inspecting the Package Contents

Verify that you received the items listed below for your calibration module.

| Description | N2125A | N2126A | N2127A | N2136A | Part /Model No. |
|---|---|---|---|---|---|
| Calibration module assembly, 1.0 mm | X | | | | N2125A |
| Calibration module assembly, 1.85 mm | | X | | | N2126A |
| Calibration module assembly, 3.5 mm | | | X | | N2127A |
| Calibration module assembly, M8131A | | | | X | N2136A |
| Adapter, 3.5 mm (f) to (f) | X | X | X | X | 5061-5311 |
| Calibration cable, coaxial 50-ohm | X | X | X | | 8121-3052 |
| Torque wrench, 8 in-lbs, 5/16 inch | | | | X | 8710-1765 |
| Functional Test Certificate | X | X | X | X | 9320-6636 |
| Finding Product Manual sheet | X | X | X | X | 9320-6794 |
| Keysight safety leaflet | X | X | X | X | 9320-6797 |
| China RoHS addendum | X | X | X | X | 9320-6679 |
| South Korean Class A EMC declaration | X | X | X | X | 5061-7383 |

# Safety and Regulatory Information

Familiarize yourself with safety markings and instructions before you use the calibration module. This product has been designed and tested in accordance with international standards.

These symbols may be used on your calibration module or its packaging.

| Symbol | Description |
|---|---|
| | The RCM mark is a registered trademark of the Australian Communications and Media Authority. |
| | The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.<br>ICES/NMB-001 indicates that this ISM device complies with the Industry Canadian Interference-Causing Equipment Standard (ICES-001). Cet appareil ISM est conforme a la norme NMB-001 du Canada.<br>ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product. |
| | The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.<br>Please refer to keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions. |
| | This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product. |
| | The symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.<br>To return unwanted products, contact your local Keysight office. |
| | South Korean Certification (KC) mark; includes the marking's identifier code. |
| | This mark denotes compliance with the essential requirements of the following applicable UK regulations:<br>▪ Electromagnetic Compatibility Regulations 2016 No. 1091 (as amended)<br>▪ Electrical Equipment (Safety) Regulations 2016 No. 1101 (as amended)<br>▪ The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 No. 3032 (as amended) |

# Cleaning and Handling the Calibration Module

**WARNING**

**Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.**

**Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.**

**In case of spill, soak up with sand or earth. Flush spill area with water.**

**Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.**

Inspect the calibration module regularly to prevent any surface contamination. If the module requires cleaning:

1. Disconnect the calibration module from the oscilloscope.
2. Gently clean the external parts of the module with a soft cloth dampened with isopropyl alcohol, preferably 99.5%. Do not try to clean internal parts.

To keep the calibration module in top condition:

- Store the module in its protective case when not in use.
- Be careful not to stretch any cables when using the module.
- Use the wrench that came with the oscilloscope or calibration module to torque connections as instructed.
- Do not bend or twist the cables.

# 2 Using the Calibration Modules

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# Calibrating an Infiniium UXR Oscilloscope

The UXR calibration modules are hot-swappable. That is, they can be connected and disconnected while the UXR oscilloscope is powered.

## Additional Equipment Required

In addition to the calibration module and the accessories that came with it, you need the following equipment to calibrate a UXR oscilloscope. The adapters were included with the UXR oscilloscope.

| Description | Critical specifications | Recommended part number or product |
|---|---|---|
| Adapter: 3.5 mm (f) to (f) | No substitute | 5061-5311 |
| Adapter: 1.0 mm ruggedized (f) to 2.92 mm (f) **for models with 1.0 mm connector types** | No substitute | 5067-1393 |
| Adapter: 2.92 mm to 2.40 mm 50 Ω **for models with 1.85 mm connector types** | No substitute | 1250-3782 |
| GPS 10 MHz frequency reference | Output Frequency: 10 MHz, < ±0.1 ppb with no aging | Fluke Electronics 910R GPS Rubidium Frequency Reference |

## Calibration Module Components

The N2125A and N2126A calibration modules consist of an AutoProbe pod, a remote head, a main cable, and an RF cable.

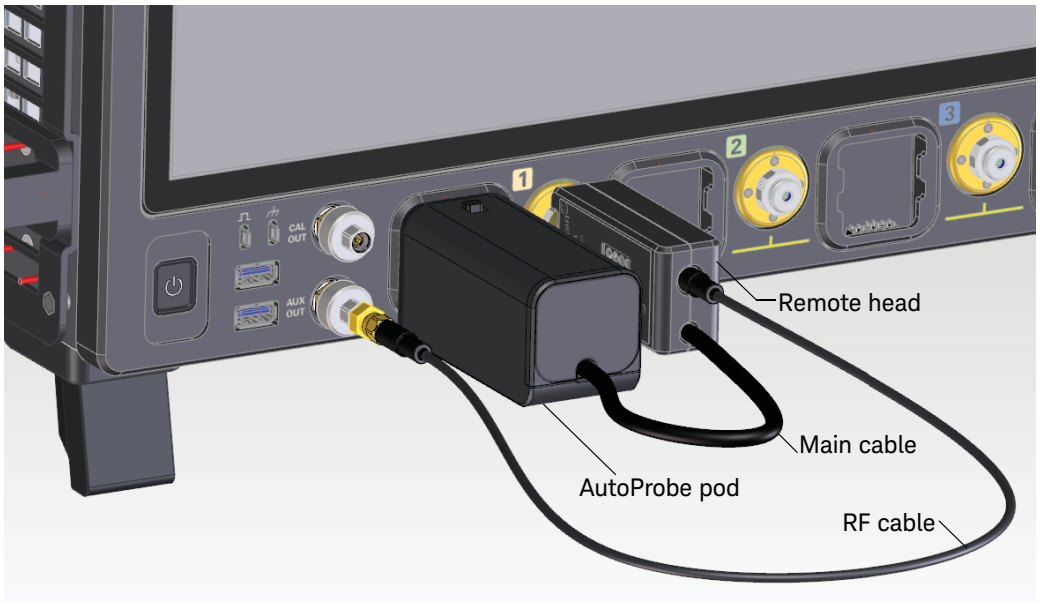



**Figure 5** N2125A calibration module connected to UXR oscilloscope with 1.0 mm connector types

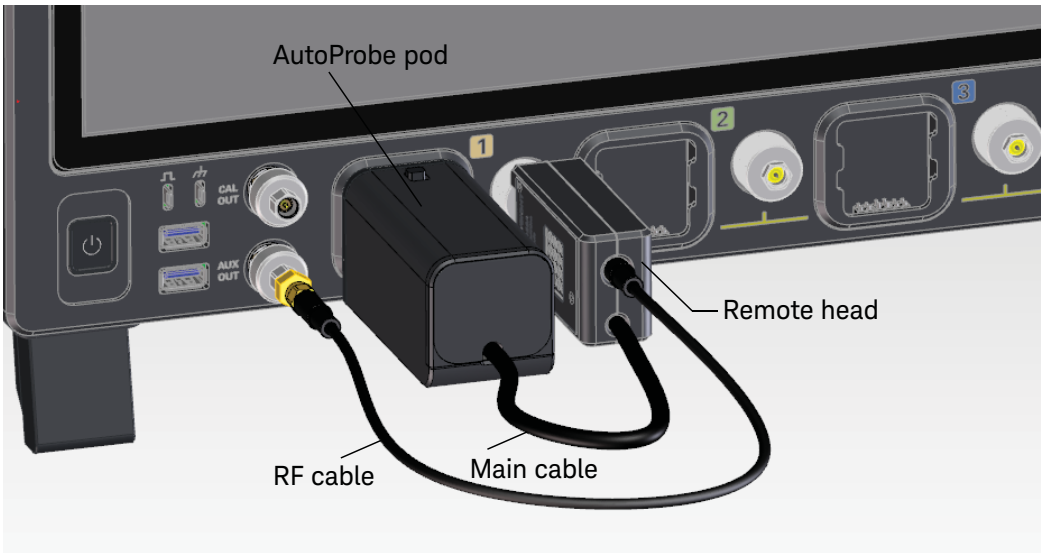



**Figure 6** N2126A calibration module connected to UXR oscilloscope with 1.85 mm connector types

The N2127A calibration module is a single unit.

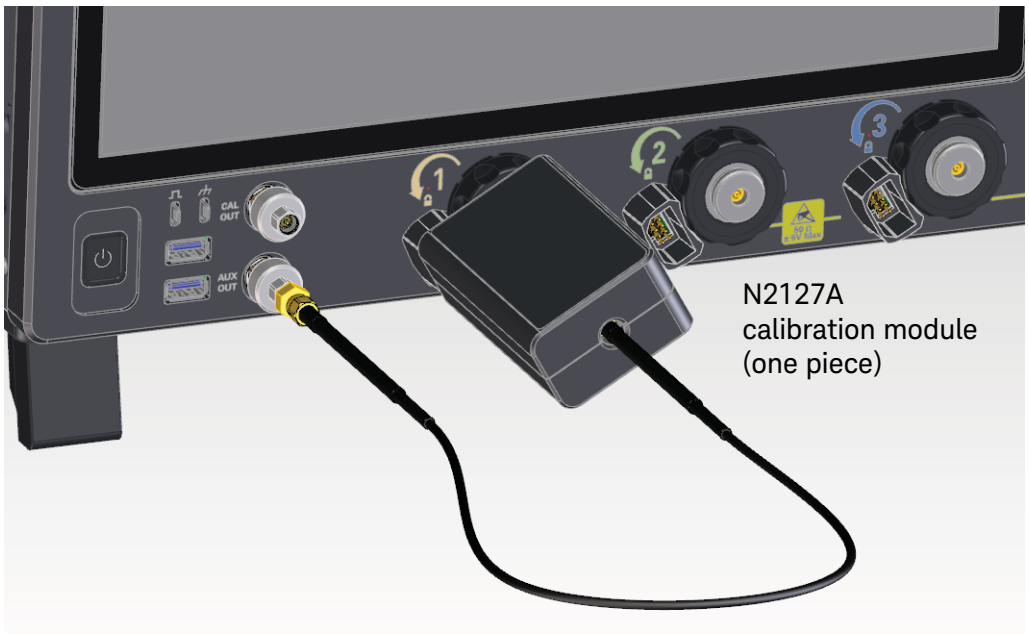



**Figure 7** N2127A calibration module connected to UXR oscilloscope with 3.5 mm connector types

## Applying Torque

**CAUTION** **Over-tightening cables can damage the input connectors on the UXR oscilloscope.**

For UXR models with 1.85 mm connector types, use the 5/16-inch torque wrench to tighten the connections to 8-in-lbs. Use the dual-ended 6 mm and 7 mm wrench to hold the mating connections in place while turning the connector.

For UXR oscilloscope models with 1.0 mm connector types, use the dual-ended torque wrench. One end is calibrated to 4 in-lbs for use when mating to standard 1.0 mm connectors; the other end is calibrated to 10 in-lbs for use only when mating to Keysight ruggedized 1.0 mm connectors. The N2125A has a ruggedized connector, so be sure to use the ruggedized end of the wrench. Follow the usage instructions in the *Keysight Infiniium UXR Real-Time Oscilloscopes User's Guide*.

## Calibration Time

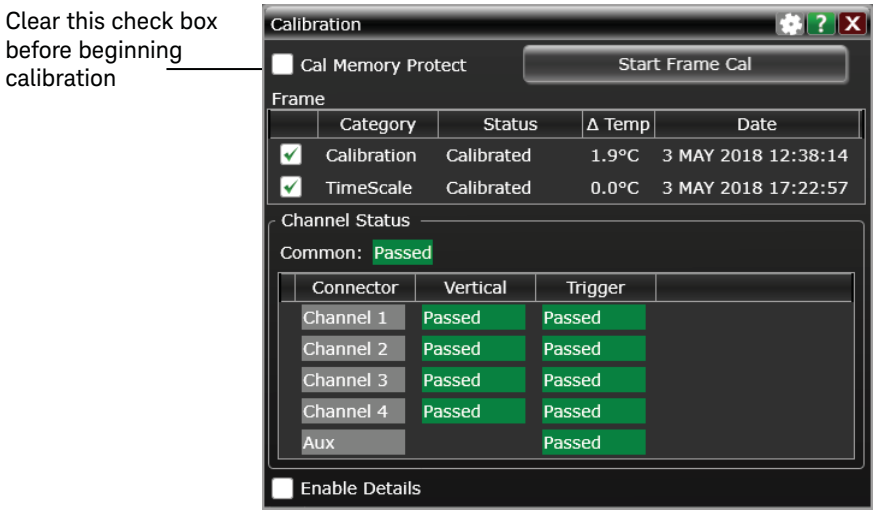
It takes about 1-1/2 hours to calibrate the first channel, and about an hour per each additional channel, including the time required to change cables from channel to channel.

## Calibration Procedure

1. Remove the connector savers from all channels.
2. Connect the calibration module to the oscilloscope. For N2125A and N2126A modules, connect the components in this order:
   a. Attach the AutoProbe pod to the AutoProbe 3 interface for channel 1.
   b. Connect the RF cable to Aux Out.
   c. Attach the remote head to channel 1, using the wrench to apply proper torque.
3. Let the oscilloscope and calibration module warm up before running the cal.

**NOTE** **Both the calibration module and the oscilloscope must be warmed up (with the Infiniium application running) for at least 30 minutes at ambient temperature before starting the calibration procedure. Failure to allow warm up may result in inaccurate calibration.**

4. Click **Utilities** > **Calibration...**.
5. Clear the **Cal Memory Protect** check box. You cannot run a calibration if this box is selected.




6. To run a calibration without a time scale cal, select only the **Calibration** check box. If you also want to run a time scale calibration, you will need additional equipment.

7 A dialog box appears, showing an estimated time to complete the calibration. Click **OK**.

8 Click **Start Frame Cal**, then follow the instructions on the screen.

- You must use the appropriate calibration module for your oscilloscope, and use the appropriate calibration cable with adapters when prompted by the software. Failure to use the appropriate parts will result in an inaccurate calibration.
- As you move the calibration module from one channel to the next, first disconnect the remote head and the AutoProbe pod from the channel just calibrated. When connecting the calibration module to the next channel, connect the AutoProbe pod first, then connect the remote head.
- A Passed/Failed indication appears for each calibration section.
- If any section has failed, wait until the calibration is complete and then select the **Enable Details** check box for information on the failures. Also check the calibration cables.

9 When the calibration procedure is complete, click **Close**.

# Calibrating an M8131A Digitizer

The N2136A calibration module is hot-swappable. That is, it can be connected and disconnected while the M8131A digitizer is powered.

## Calibration Time

The time it takes to calibrate the M8131A digitizer module depends on the model:

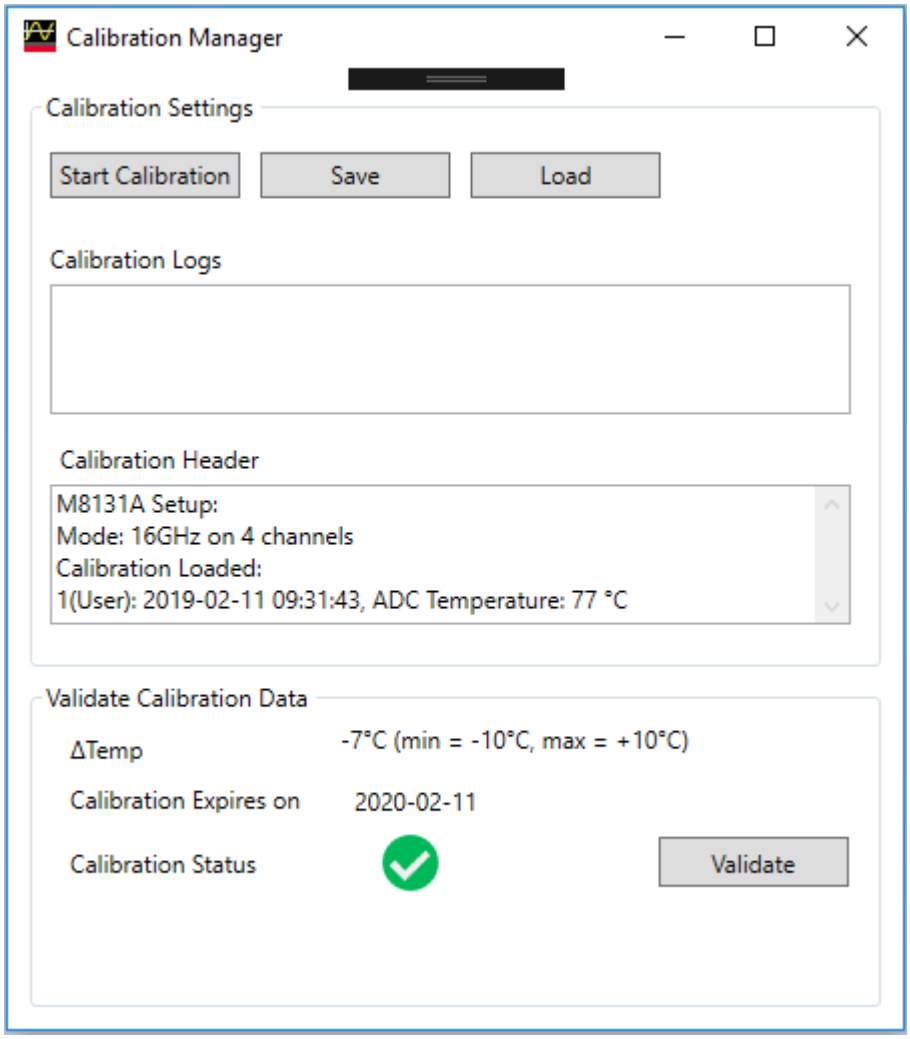
- 4 GSa/s digitizer with single-ended input (options -011, -012, -014) takes about 20 minutes per channel.
- 16 GSa/s digitizer with single-ended input (options -061, -062, -064) takes about 20 minutes per channel.
- 32 GSa/s digitizer with single-ended input (options -131, -132) takes about 40 minutes per channel.

**NOTE** The M8131A 16/32 GSa/s digitizer with differential input (options -FD1, -FD2, -FD4) does not require a calibration module. Refer to the *M8131A User's Guide* for calibration information.

## Calibration Procedure

1. Disconnect all cables from the M8131A digitizer.
2. Let the digitizer warmed up for 15 minutes before running the calibration.

3 Open the Calibration dialog box (**Utilities > Calibration**).

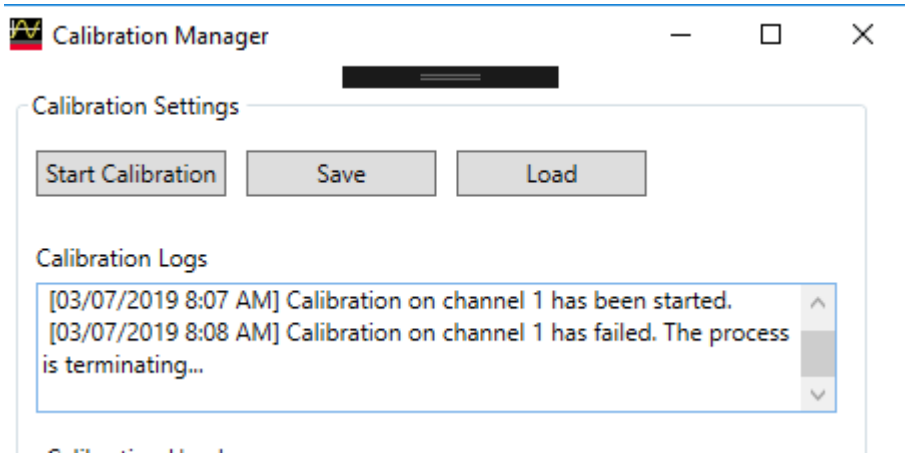



4 Click **Start Calibration**, the follow the instructions on the screen.

The Process Result field will indicate that the calibration has been started. You can click **Abort** at any time. If the calibration module is not properly connected, a dialog box will appear, requesting you to verify the connection.

5 When calibration is complete for the first channel, follow the on-screen instructions for calibrating the remaining channels.

If any calibration fails, the calibration terminates with the following message (in Calibration Logs):




6 When all channels have completed calibration, click **Save** to save the calibration data to a text file.

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