Evaluation Board User Guide
UG-287

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EVAL-ADIS: *i*Sensor Evaluation System

FEATURES

PC USB evaluation system for inertial measurement units
Product-specific evaluation software
Windows XP, Windows Vista, and Windows 7 compatible
32-bit and 64-bit USB driver support
USB 2.0 or subsequent version required
Synchronous data acquisition
Maximum sample rate for most ADIS16xxx products
No external power supply required for most products

KIT CONTENTS

EVAL-ADIS circuit board
16-pin ribbon connector, 2 mm
USB mini cable, 6 ft
M2 × 0.4 mm machine screw kit



Figure 1. Photograph of Inertial Sensor Evaluation System

GENERAL DESCRIPTION

The *i*Sensor® family of products provides a serial peripheral interface (SPI) for data communications. The SPI interface and a well-calibrated cluster of sensors enable quick integration into systems that employ embedded processor systems. For users who are familiar with embedded processors, integrating the *i*Sensor device with a familiar processor system enables development with familiar software tools, provides more flexibility, and enables more design reuse after the initial sensor evaluation is complete. For users who are unfamiliar with embedded processors and their development tools, the EVAL-ADIS system provides a simple PC-based tool for getting started with *i*Sensor products.

The EVAL-ADIS circuit board provides tapped holes (M2 × 0.4 mm), and the kit includes an assortment of M2 × 0.4 mm machine screws for a simple device under test (DUT) attachment. The location of the mounting holes facilitates easy electrical connection with the mating connectors (J1 or J4 on the EVAL-ADIS).

The power management system provides jumper selection for three device under test (DUT) power options: 5 V (USB), 3.3 V, and an external power option. The 5 V option provides access to the USB's 5 V supply voltage for the DUT, and the 3.3 V option uses a linear regulator, 400 µF of bulk capacitance, and a soft start circuit to manage transient currents on the USB port.

The evaluation software packages, which support operation with the EVAL-ADIS, typically offer three modes of operation: demonstration, register access, and data capture. In most cases, the demonstration mode will be a simple waveform recorder function, which provides a simple visual response to sensor motion. The waveform recorder is useful in concept demonstrations or functional verification of units. Individual register read and write cycles are available in the **Register Access** window. PC data acquisition is available using the **Data Capture** window, which provides various control inputs, including data register selection, data file format, and data storage location. In data capture mode, the EVAL-ADIS reads and stores data from each selected register every time that the sensor's data-ready signal pulses. This synchronous capture mode supports the ADIS16488 (10 registers, 16-bits wide, 2.46 kSPS)

The EVAL-ADIS kit includes a USB mini cable for quick connection to a PC. The IMU evaluation software package supports operation on Windows® XP, Windows Vista, and Windows 7 (32-bit and 64-bit) PC systems.

PLEASE SEE THE LAST PAGE FOR AN IMPORTANT
WARNING AND LEGAL TERMS AND CONDITIONS.

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REVISION HISTORY

2/13—Rev. A to Rev. B

Changes to Features Section and General Description Section 1
Changes to IMU Installation Section 3
Changes to Table 1, combined with Table 2, and deleted Table 2 4
Changes to Data Register Selection Section and to Data Record Options Section 9

5/12—Rev. 0 to Rev. A

Changes to Features Section and General Description Section 1
Replaced Overview Section and ADIS16375 and ADIS16488 Installation Section with IMU Installation Section, Changes to Table 1, Table 2, and Figure 4 3
Added Figure 2 and Figure 3; Renumbered Sequentially 3
Replaced Software Installation Section with IMU Evaluation Software Guide, Changes to Microsoft .NET Framework 3.5 Section, Deleted IMU Evaluation Software Installation Section and Figure 6 to Figure 9, Added Software Operation Section, Replaced Initial Setup Section with Start-Up Sequence Section 4
Deleted Table 3; Renumbered Sequentially 4
Replaced IMU Evaluation Software Operation Section with Main Window Section, Moved and Changed Waveform Recorder Section, Added Main Window Menu Bar Options Section, Changes to Devices Section and Figure 10 5
Added Figure 11 and Figure 12, Deleted Figure 13 and Figure 14 6
Changes to Register Access Menu Section and Figure 13 7
Deleted Data Capture Timing Section, Data Record Time Section, Figure 16, and Figure 17; Added Sample Rate Section and Figure 14 8

11/11—Revision 0: Initial Version

MECHANICAL SETUP/INSTALLATION

IMU INSTALLATION

Figure 4 provides a top level view of the EVAL-ADIS printed circuit board (PCB), which provides two electrical connectors (J1, J4) and a series of mounting holes. Table 1 provides the mating connector and mounting hole identifiers for each compatible product as well as the mounting hardware, the power supply settings (JP1), and the most appropriate reference picture for each compatible product (and future product support plans). Note that inclusion in Table 1 does not necessarily reflect full support of a particular product; that requires application software. Refer to the www.analog.com/EVAL-ADIS for the most recent list of supported products.

When installing an *i*Sensor product on the EVAL-ADIS, do not plug it into the PC-USB port or any other potential source of power, before the installation is complete. Before pressing the mating connector into J4, ensure that the pins align correctly. For the ADIS16375, ADIS16485, and ADIS16488, installing JP2 across both leads provides 3.3 V of power to the real-time clock power pin.



Figure 2. ADIS16488 Installation Example

When installing the ADIS16334 or ADIS16448, use the flexible cable to connect the device to J4 on the EVAL-ADIS. Note that these products and the associated flexible cable have only 20 pins. J4, on the other hand, has 24-pins; therefore, ensure that the flexible cable connects to Pin 1 to Pin 20 on J4 and aligns correctly prior to plugging the USB cable into the USB connection on the EVAL-ADIS. Ignore the Pin 1 markings on the flexible connector because these markings do not reflect the correct Pin 1 connections with respect to the ADIS16334/ADIS16448 or J4 on the EVAL-ADIS.



Figure 3. ADIS16448/PCBZ Installation Example

Table 1 provides additional details for installing other products onto the EVAL-ADIS. For additional installation instructions, see the product-specific Wiki User Guide links, under **Documentation** at www.analog.com/EVAL-ADIS.

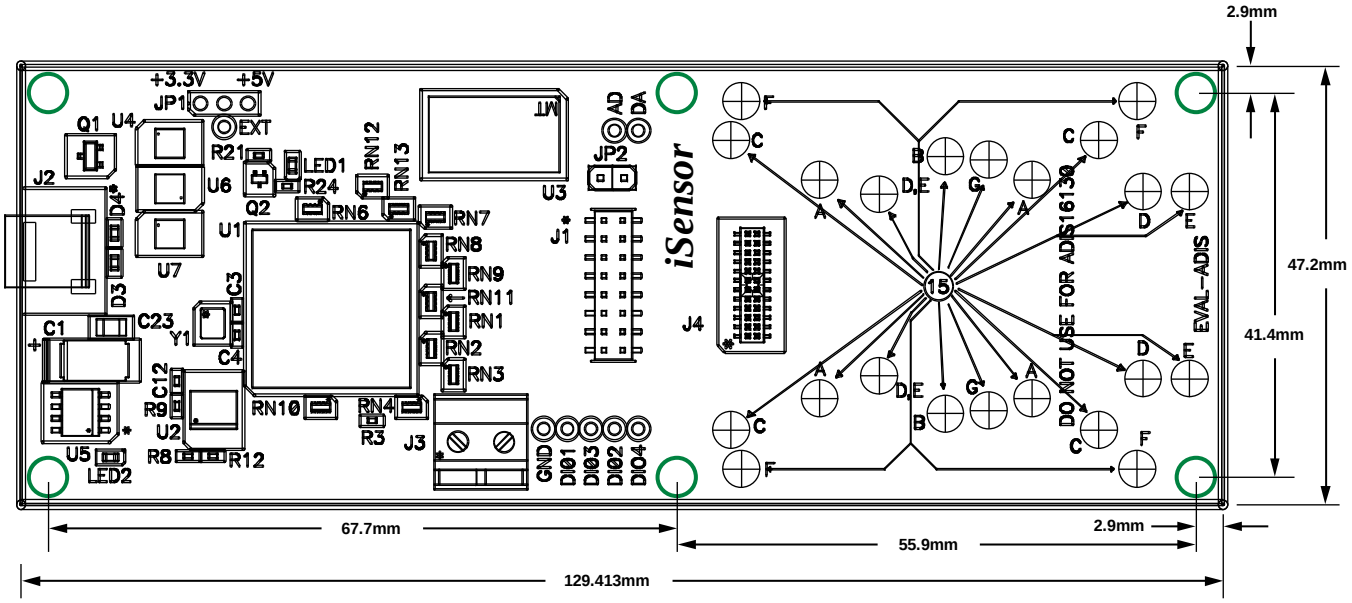


Figure 4. Top Level View of PCB

Table 1. Mating Connector and Mounting Hole Identifiers

Product	Mating Connector	Mounting Holes	JP1	Machine Screws
ADIS16003/PCBZ	J1	A	+5 V	M2 × 0.4 mm × 6 mm
ADIS16006/PCBZ	J1	A	+5 V	M2 × 0.4 mm × 6 mm
ADIS16133BMLZ	J4	C	+5V	M2 × 0.4 mm × 20 mm[1]
ADIS16135BMLZ	J4	C	+5V	M2 × 0.4 mm × 20 mm[1]
ADIS16136AMLZ	J4	C	+5V	M2 × 0.4 mm × 20 mm[1]
ADIS16201/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16203/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16204/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16209/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16210/PCBZ	J1	A, B	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16220/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16223/PCBZ	J1	A, B	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16227/PCBZ	J1	A, B	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16228/PCBZ	J1	A, B	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16240/PCBZ	J1	A	+3.3 V	M2 × 0.4 mm × 6 mm
ADIS16260/PCBZ	J1	A	+5 V	M2 × 0.4 mm × 6 mm
ADIS16265/PCBZ	J1	A	+5 V	M2 × 0.4 mm × 6 mm
ADIS16266/PCBZ	J1	A	+5 V	M2 × 0.4 mm × 6 mm
ADIS16300/PCBZ	J4	B	+5 V	M2 × 0.4 mm × 12 mm
ADIS16305/PCBZ	J4	B	+5 V	M2 × 0.4 mm × 12 mm
ADIS16334/PCBZ	J4	D	+5 V	M2 × 0.4 mm × 12 mm
ADIS16360BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16362BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16364BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16365BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16367BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16375BMLZ	J4	F	+3.3 V	M2 × 0.4 mm × 20 mm[1]
ADIS16400BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16405BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16407BMLZ	J4	G	+5 V	M2 × 0.4 mm × 6 mm
ADIS16445/PCBZ	J4	E	+3.3 V	M2 × 0.4 mm × 12 mm
ADIS16448/PCBZ	J4	E	+3.3 V	M2 × 0.4 mm × 12 mm
ADIS16480AMLZ	J4	F	+3.3 V	M2 × 0.4 mm × 20 mm[1]
ADIS16485AMLZ	J4	F	+3.3 V	M2 × 0.4 mm × 20 mm[1]
ADIS16488AMLZ	J4	F	+3.3 V	M2 × 0.4 mm × 20 mm[1]

[1] May need to trim length or use M2 × 0.4 mm × 16 mm machine screws to maintain a flush bottom-side surface.

IMU EVALUATION SOFTWARE GUIDE

The IMU evaluation software is available for download at the EVAL-ADIS website, www.analog.com/EVAL-ADIS, under Software and Tools. The download file contains the USB driver and IMU evaluation software (see Figure 5). Extract these files to a directory on the PC and start the USB driver installation process.

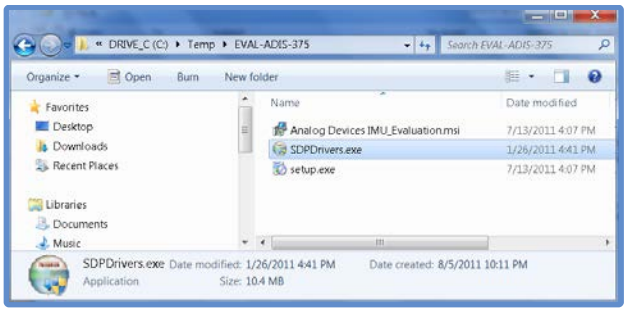


Figure 5. Typical Contents in Evaluation Download

USB DRIVER FILE INSTALLATION

The **SDPDrivers.exe** file contains USB drivers that are compatible with both 32-bit and 64-bit Windows-based systems. Double-click the **SDPDrivers.exe** file and follow the prompts to install the USB driver files onto the PC. Figure 6 and Figure 7 show the windows associated with this process.

Microsoft .NET Framework 3.5

The IMU evaluation software requires the Microsoft .NET Framework 3.5. If a PC has a more recent version, version 3.5 is available for download from the Microsoft Download Center on the Microsoft website.

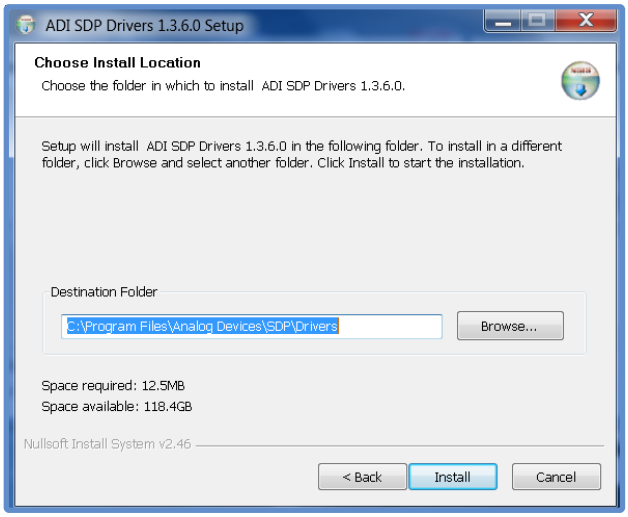


Figure 6. USB (SDP) Driver Setup Window

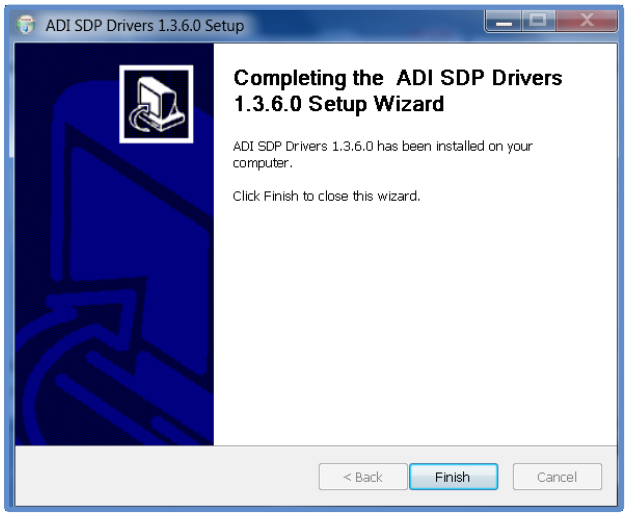


Figure 7. USB Driver Installation Confirmation Window

SOFTWARE OPERATION

Start-Up Sequence

1. Plug the EVAL-ADIS into a PC USB port using the cable that comes with the EVAL-ADIS kit. LED2 illuminates immediately. The EVAL-ADIS goes through an initialization process that takes approximately 10 sec, and then LED1 illuminates.
2. If the **Hardware Select** window indicates that no device was found (see Figure 8), unplug the EVAL-ADIS from the PC, wait 2 sec to 3 sec, and then plug the EVAL-ADIS back into the PC-SUB port.
3. After LED1 illuminates, click **Rescan** in the **Hardware Select** window. LED1 starts blinking, and the **Hardware Select** window updates with an option to select the device (see Figure 9).
4. Click **Select**. The program completes the connection and opens the main window (see Figure 10).

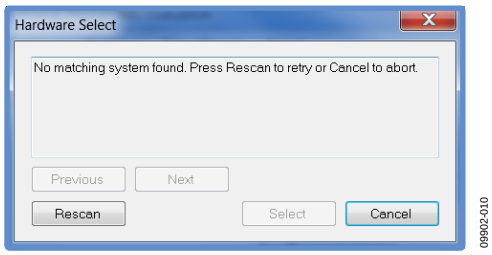


Figure 8. Hardware Select Window, No Device Found

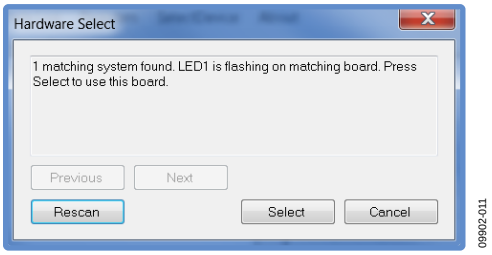


Figure 9. Hardware Select Window, Select Option Enabled

MAIN WINDOW

After the software completes the initialization process, the main window (see Figure 10) appears. The main window (see Figure 10) provides waveform recorders for basic demonstration, along with the following menu bar options: **Devices** (device selection), **Register Access**, **Data Capture**, **USB Tools**, and **About** (basic information).

Waveform Recorder

After selecting the device for evaluation (see the Devices section), click **Read** to start the waveform recorder function, and then move the IMU to observe the signal response within the waveform output boxes (see Figure 11 for an example). The **Read** button changes to a **Stop** button when the waveform recorder is in operation. Click **Stop** to turn the waveform recording off. Right-click on one of the waveform output boxes to access a pop-up control box, which provides options to add cursor tracking, statistics, and scale and waveform division controls (see Figure 12 for an example). The color coding corresponding with the register names matches the color of each signal in the waveform output.

MAIN WINDOW MENU BAR OPTIONS

Devices

Click **Devices** in the menu bar of the main window to select the appropriate product for evaluation. Use the following steps to change a unit while continuing to run the IMU evaluation software:

1. Unplug the EVAL-ADIS from the PC USB and any other power source.
2. Remove the existing DUT from the EVAL-ADIS.
3. Install the new DUT onto the EVAL-ADIS (see the IMU Installation section).
4. Plug the EVAL-ADIS back into the PC USB.
5. Wait for LED1 to illuminate, indicating that the EVAL-ADIS is ready for communication with the PC.
6. If the software does not recognize the EVAL-ADIS automatically, click **USB Tools** and then click **Connect** to establish communication (see Figure 15).
7. Select **Devices** and then the part number for the new DUT.

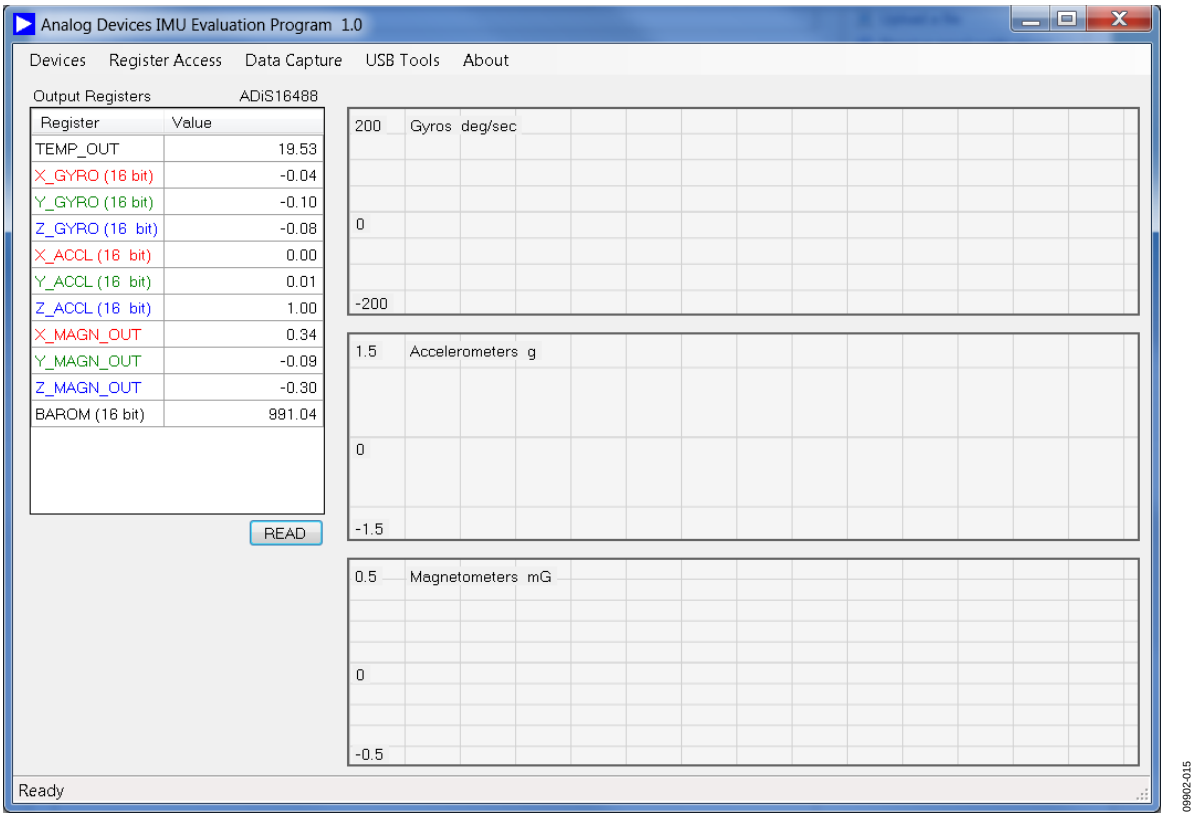


Figure 10. IMU Evaluation Software Main Window

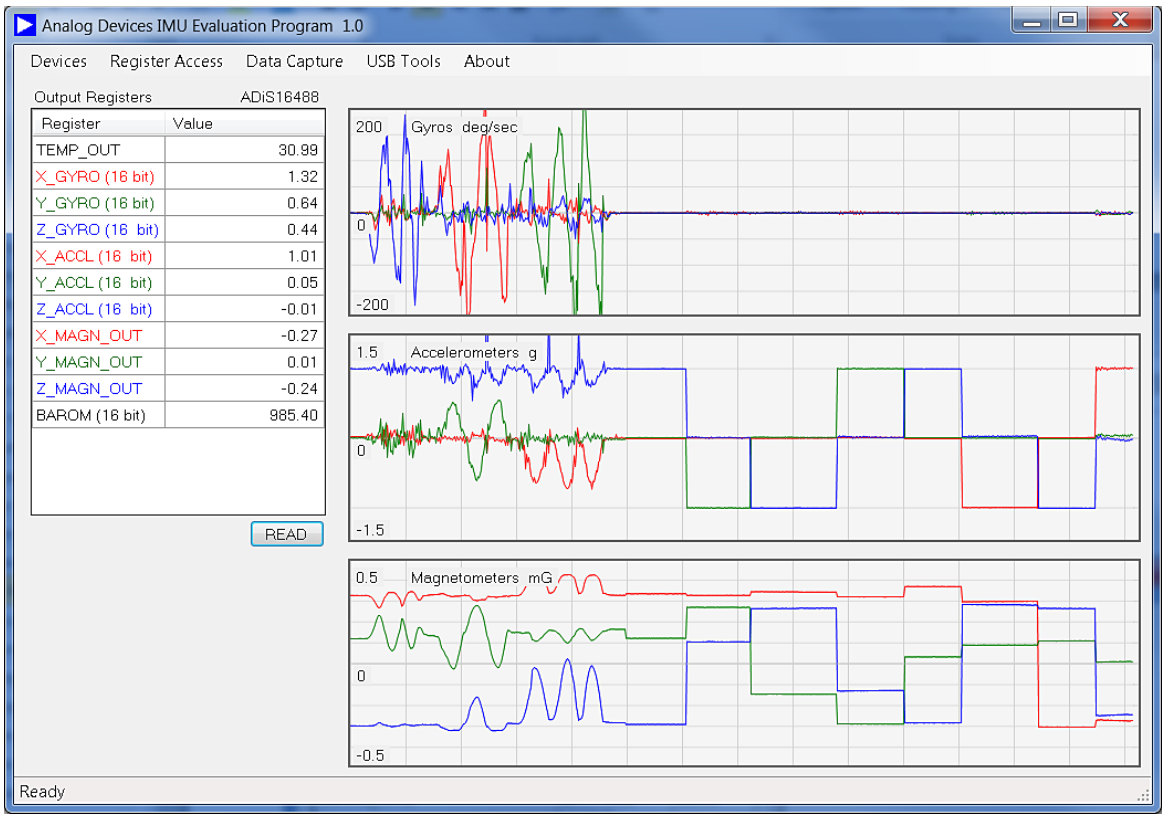


Figure 11. IMU Evaluation Software Main Window with Sensor Responses

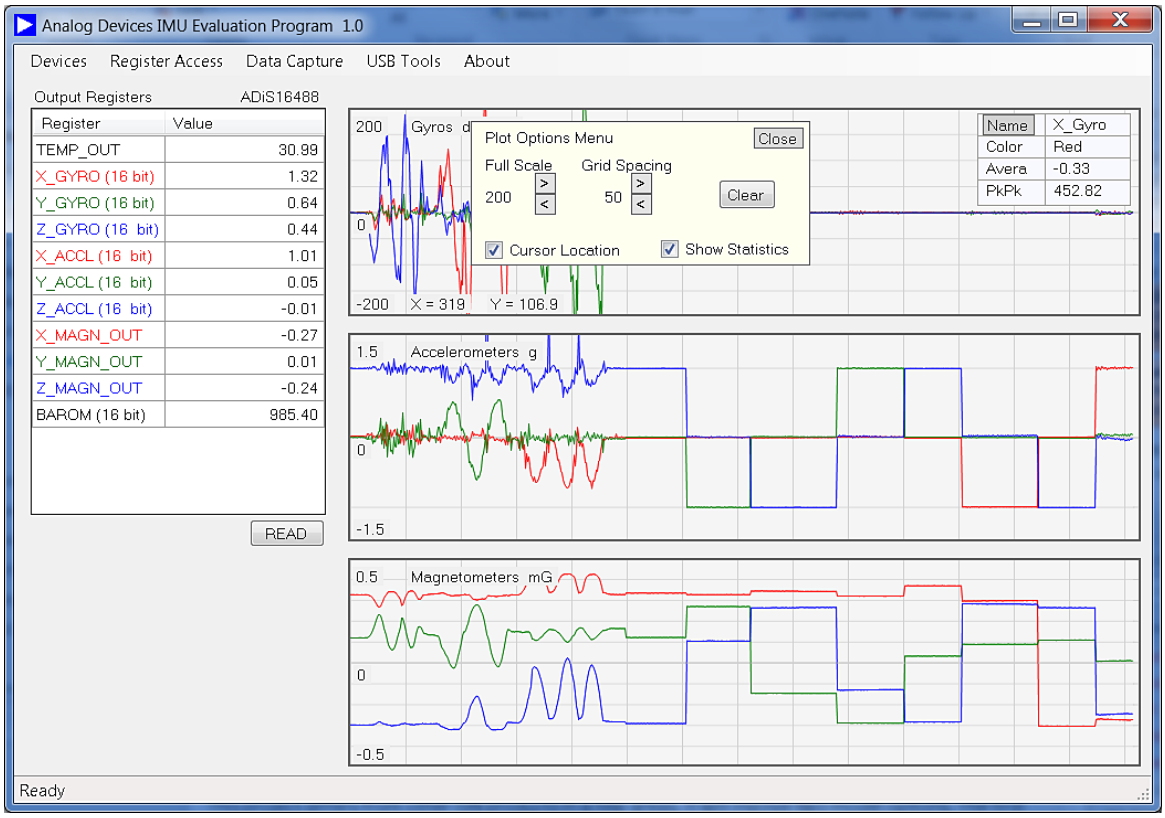


Figure 12. IMU Evaluation Software Main Window with Scale Options

Register Access

Clicking **Register Access** in the menu bar of the main window provides read/write access to all user-accessible registers in the IMU. For example, Figure 13 demonstrates using this menu to write 0x0009 to the DEC_RATE register in the ADIS16488 or ADIS16375, which lowers the output data rate from 2.46 kSPS to 246 SPS.

In this case,

1. Select **Control** from the **Select a Category** drop-down box to access the control register group.
2. Click **DEC_RATE** in the register listing.
3. Type **9** in the **New Hex Value** box.
4. Click **Write Register** to write this value to the register inside the IMU.
5. Click **Update Flash** to make this setting nonvolatile.

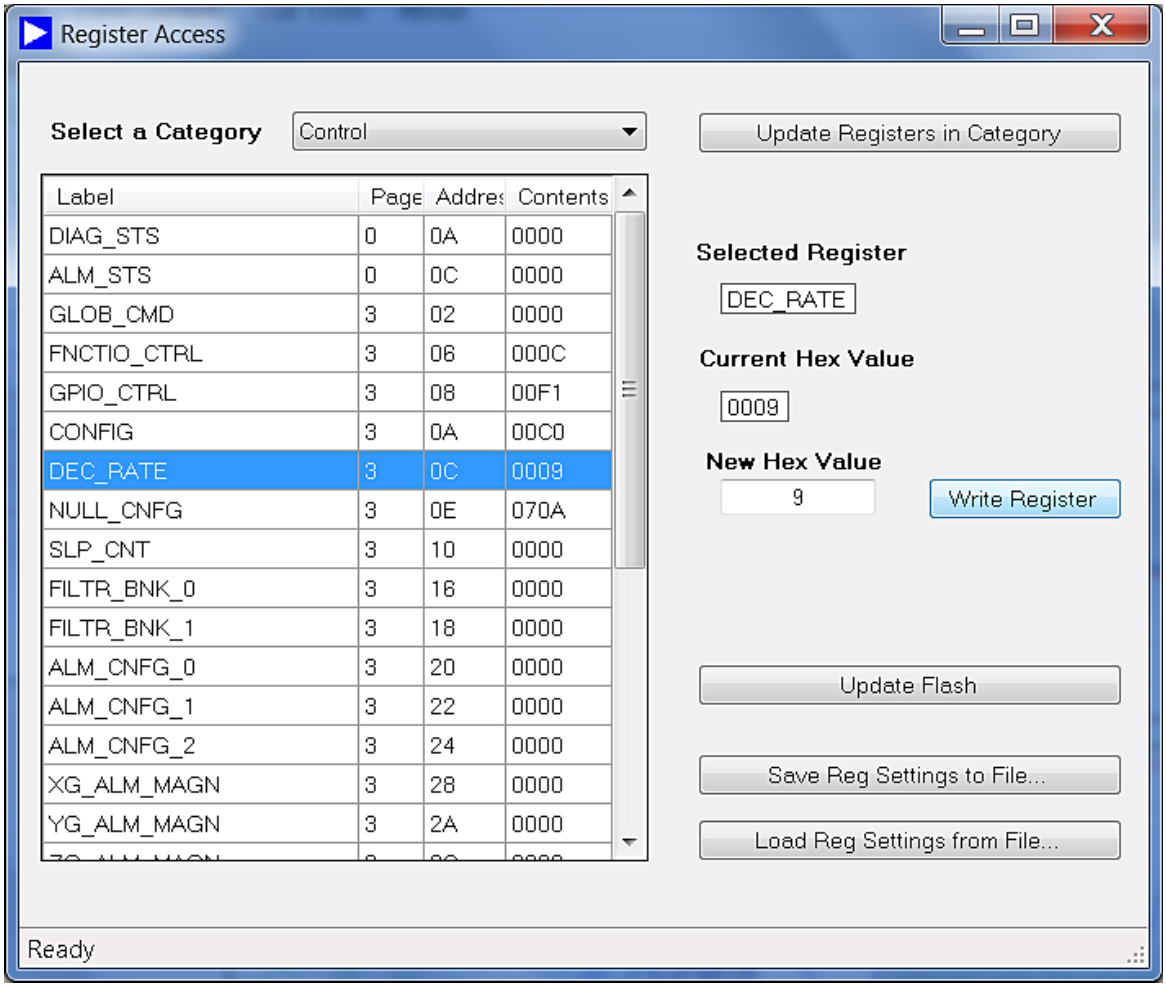


Figure 13. Register Access, Write DEC_RATE = 0x0009 Example

Data Capture

Click **Data Capture** in the menu bar of the main window to read and store a sequence of output data from the DUT. The **Data Capture** window (see Figure 14) provides controls for the data storage location, data file name, register selection, data format, and data file header. Each data collection cycle starts when the DUT's data-ready signal pulses.

Data Register Selection

The **Data Capture** window contains a list of sensor data, which are associated with the output registers, along with a corresponding selection check box. Use the check box to include an output register in each data collection cycle of the data record. The ADIS1613x, ADIS1637x, and ADIS1648x products currently provide lower word registers, that capture the bit growth associated with integrated filtering operations. For example, X_GRYO_LOW is a 16-bit register that captures this bit growth for the x-axis gyroscope in these products. While this register provides 16 more bits (for a total of 32-bits), the ADIS1648x products rarely need more than 24 bits to preserve the precision available in the ADIS1648x products, so many of the least significant bits in these registers are not significant.

Selecting the 16-bit option in the Data Capture menu includes only the upper 16 bits of output data (for example, only X_GRYO_OUT). Selecting the 32-bit option includes all 32 bits in the data record (for example, X_GYRO_OUT and X_GYRO_LOW). Selecting both 16-bit and 32-options result in separate entries: one for the X_GYRO_OUT and another that combines X_GYRO_OUT and X_GYRO_LOW data. For maximum speed, select one or the other, but not both.

Data Record Options

Selecting the **Add File Header** check box controls the first line of the data record file. Clearing this check box removes the header line from the data record. Selecting the **Use Scaled Data** check box causes the software to convert the digital output codes into a decimal equivalent prior to storing them in the data record file. When using scaled data, the result is rounded to the 4th decimal place. For finer resolution, uncheck the **Use Scale Data** option and convert the twos complement result using post-event signal processing routines.

Sample Rate

The sample rate is dependent on the data-ready signal coming from the IMU and is typically associated with a register setting, such as DEC_RATE in the ADIS16488.

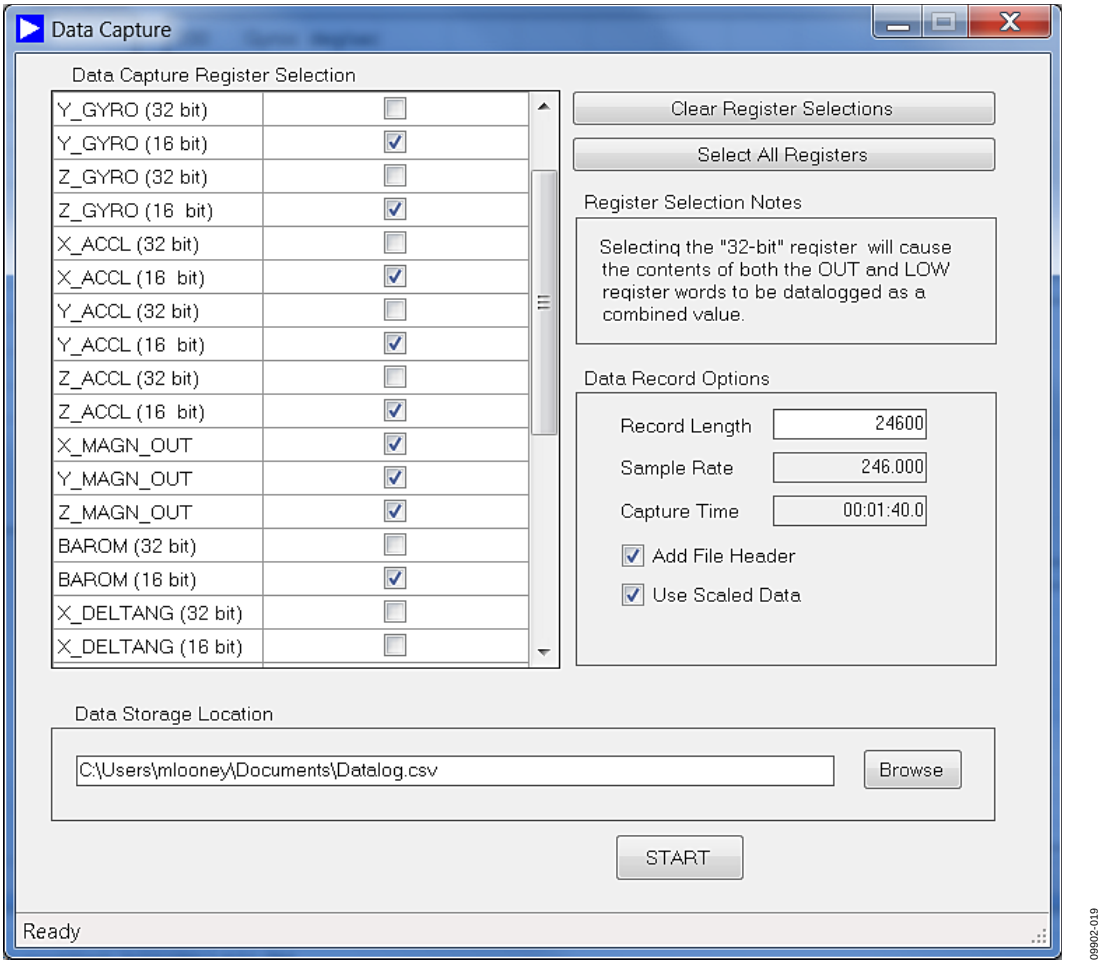


Figure 14. Data Capture

USB Tools

Clicking **USB Tools** in the menu bar of the main window provides a diagnostic tool for managing the USB connection to the EVAL-ADIS. Click this option to request a connection attempt. This window also provides several revision numbers. These numbers represent internal source control codes and are for Analog Devices, Inc., internal use only (see Figure 15 and Figure 16).

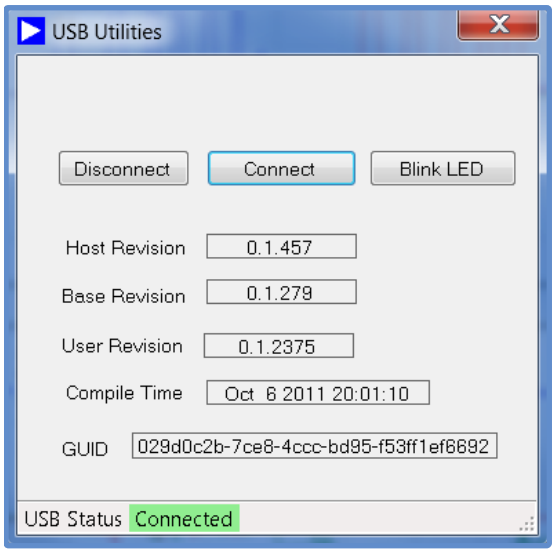


Figure 15. USB Tools, Connected



Figure 16. USB Tools, Not Connected

About

Click **About** in the menu bar of the main window to review the software revision information.

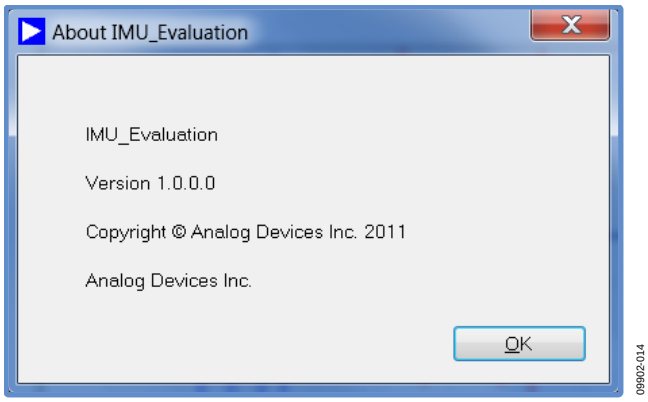


Figure 17. About Window

Wiki User Guides

For additional software instructions and product-specific functions, see the appropriate Wiki User Guide, under **Documentation** at www.analog.com/EVAL-ADIS.

NOTES



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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