

ADcmXL3021 Evaluation User Guide for the EVAL-ADCM Evaluation Kit

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ADcmXL Evaluation Wiki link:

<https://wiki.analog.com/resources/eval/user-guides/inertial-mems/imu/adcmxl-pc-eval>

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Minimum PC System Requirements

- Windows XP, Vista, 7 or 10
- .NET Framework 4.5

Minimum Required Hardware

- Cypress Semiconductor EZ-USB® FX3 Development Kit with included USB3.0 A to B Cable
- FX3 Eval iSensor Breakout board.
- 14 pin to 16 pin adaptor board BR-047904.
- ADcmXL3021 device.

EVAL-ADCM Hardware setup

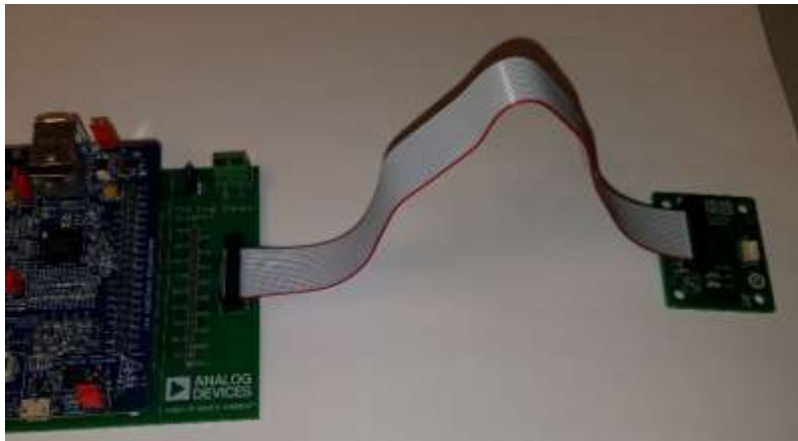


Figure 1. Assembled EVAL-ADCM Hardware

The EVAL-ADCM Evaluation Kit is shown in Figure 1.

Note: Verifying the USB Connection

Before starting the Vibration Evaluation application.

When the Cypress FX3 board is connected it should be listed in Windows Devices and Printers as a WestBridge device. This is confirmation that the Cypress USB drivers have been installed.

When the Vibration Evaluation application is started the device should reconnect as an FX3 device.

EVAL-ADCM Software Quick Start

These step by step instructions will demonstrate a basic Manual Time Capture, before and after Autonulling, and a Manual FFT capture.

1. Setup Hardware per Installation Guide
2. Start Software by running ADCMXL Evaluation Software (this guide was written based on Version 2.1.5)
3. Set Manual Time Capture under the “Mode Selection” Pull Down Menu
4. Press Start; a Manual Time Capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), 3 flat lines should appear in the 3 plots. In some cases, the flat line will be off the plot dimensions. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis.
5. Open Register Access Window
6. Press “Write” next to the Auto-Null under the listed Functions which should be shown on the top right portion of the window. This will initiate a DC offset null calculation and will take less than 1 seconds.
7. Return to the Main ADCMXL Evaluation Software window and press “Start”; a new Manual Time Capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), 3 flat lines should appear in the 3 plots. Unlike the previous capture, the flat lines should be centered on 0. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis.
8. Select “Manual FFT” from the Mode Selection pull down menu.
9. Press Start; a Manual FFT capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), the spectral output will be displayed. Typically, unless user has modified startup settings, the FFT spectrum from 0 to 110 kHz will be displayed. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis. If a sine wave stimulus is applied, the response will be displayed in the graph.
10. Open Register Access Window
11. On the left panel, use the slider to find the Register called AVG_CNT. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter “07” in the New Hex Value entry and push the “Write” button (this will set the time average to 2^7 , reducing effective output sample rate to $220\text{kHz}/2^7$ or 1,719Hz). Note The ADC sample rate remains at 220 kHz, but real time averaging filter is used with its size based on this AVG_CNT setting.
12. Press Start, observe FFT Frequency Graph X-Axis displays frequency from 0 to 859 Hz. The capture with AVG_CNT set to 7 will take approximately 22 seconds.

Application Functional Overview Menu Items

Devices

Select the specific product ADcmXL3021

Register Access

Provides an interface for reading and writing the registers of the device.

The left side panel shows Registers grouped into Categories: Control/Status, Output, Calibration and Filter Bank.

The panel on the right displays the bit fields of a selected control register selected from the pull down menu at the top.

The center of the window provides access to read and write registers and allows the saving of registers to a file and loading register settings from a file.

The screenshot shows the 'Register Access' application window. It features a 'Select a Category' dropdown set to 'Control/Status' and a 'Select Register' dropdown set to 'GLOB_CMD'. The left panel displays a table of registers with columns for Register, Page, Address, and Contents. The central panel, titled 'Single Register Write', shows the 'Selected Register' as 'PAGE_ID', a 'Current Hex Value' of '00', and a 'New Hex Value' field. The right panel shows a detailed view of the selected register with columns for Value, Mask, Function, and a 'Write' button. Below the central panel are buttons for 'Reset Selected Register', 'Update Registers in Category', 'Save Reg Settings to File...', and 'Load Reg Settings from File...'.

| Register | Page | Addr | Contents |
|------------|------|------|----------|
| PAGE_ID | 0 | 00 | 00 |
| FFT_AVG1 | 0 | 06 | 00 |
| FFT_AVG2 | 0 | 08 | 00 |
| REC_PNTR | 0 | 0C | 00 |
| REC_CTRL1 | 0 | 1A | 00 |
| REC_CTRL2 | 0 | 1C | 00 |
| REC_PRO | 0 | 1E | 00 |
| ALM_F_LOW | 0 | 20 | 00 |
| ALM_F_HIGH | 0 | 22 | 00 |
| ALM_X_MAG1 | 0 | 24 | 00 |
| ALM_Y_MAG1 | 0 | 26 | 00 |
| ALM_Z_MAG1 | 0 | 28 | 00 |
| ALM_X_MAG2 | 0 | 2A | 00 |
| ALM_Y_MAG2 | 0 | 2C | 00 |
| ALM_Z_MAG2 | 0 | 2E | 00 |
| ALM_PNTR | 0 | 30 | 00 |

| Value | Mask | Function | Write |
|-------|-------|-----------------------------------|-------|
| 01 | FF... | Auto-Null | Write |
| 02 | FF... | Power-Down (wake with /CS toggle) | Write |
| 04 | FF... | Self-Test | Write |
| 08 | FF... | Factory Reset | Write |
| 10 | FF... | Clear Status | Write |
| 20 | FF... | Fresh Test | Write |
| 40 | FF... | Fresh Update | Write |
| 80 | FF... | Software Reset | Write |
| 100 | FF... | Clear Records | Write |
| 200 | FF... | Clear spectral alarm bands | Write |
| 400 | FF... | Reset buffer pointer | Write |
| 800 | FF... | Record start/stop | Write |
| 10... | FF... | Save spectral alarm band | Write |
| 20... | FF... | Retrieve record | Write |
| 40... | FF... | Retrieve spectral alarm band | Write |
| 80... | FF... | Clear null values | Write |

Alarm

Alarm Settings Form

Allows for the entry of Alarm frequency band values for each of the six bands and four Sample Rate Options. Default values are stored in the application. Alarms must be enabled by setting values in the ALM_CTRL register available in the Register Access Form. Alarm values can be saved in non-volatile memory of the DUT by accessing the Command register available in the Register Access Form.

Alarm Values

| SR | op | Band | F LOW | F HIGH | X MAG | X MAG | Y MAG | Y MAG | Z MAG | Z MAG |
|----|----|------|-------|--------|-------|-------|-------|-------|-------|-------|
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Buttons on the right:

- Read Default Values
- Read from DUT
- Write to DUT
- Read from File
- Write to File

Alarm Status Form

Displays the alarm status for the current capture.

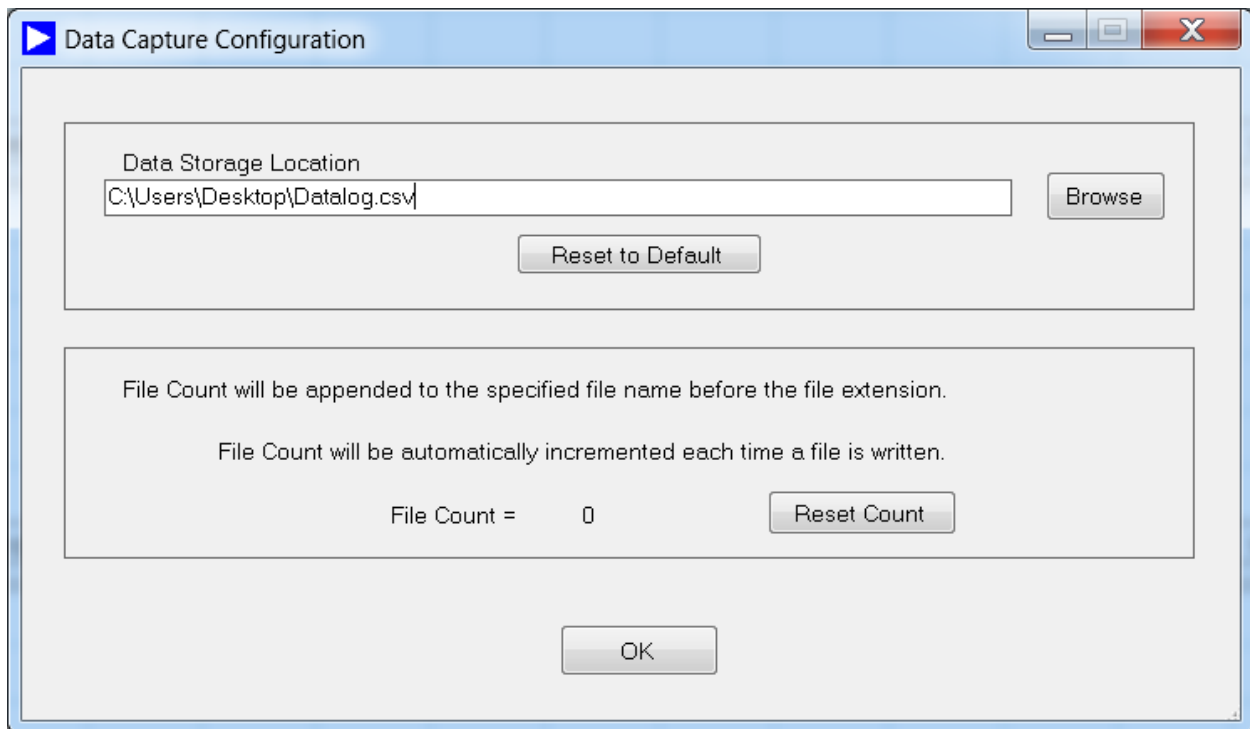
Alarm band line values are shown on FFT plots if the Alarm Status Form is visible.

Alarm Status

| Sens | 1 | 2 | 3 | 4 | 5 | 6 |
|--------|---|---|---|---|---|---|
| X_axis | - | - | - | - | - | - |
| Y_axis | - | - | - | - | - | - |
| Z_axis | - | - | - | - | - | - |

Data Capture

Select the specific product ADcmXL3021



[View](#)

Provides an optional control to display any combination of the available axes.

[Comm](#)

Provides access to view state of the USB interface connection state.

[Help](#)

Provides information regarding the software revision and provide some basic operating information.

[About](#)

Provides a window with software revision.

[Data Graph Windows \(X axis, Y axis and Z axis data Display\)](#)

Select the specific product ADcmXL3021

[Mode Selection \(Pull Down Menu\)](#)

Manual Time Capture Mode:

Right Click any plot to display the scaling controls. Note: scaled coordinates of the cursor are displayed at the bottom of each plot. Real time graphical updates are not possible with this device due to the 12K data points in each capture. Data must be transmitted across the USB and plotted using Windows Graphics Drawing Interface. Demonstrations in this mode may seem unresponsive due to the large data set. The 220 KHz sample time results in a capture duration of only 18.6 msec.

Offset of time domain data can be compensated for by opening the Register Access Form, selecting the Command register and clicking Write button next to the Auto Null function.

Automatic FFT Capture Mode

Will re-trigger a capture according to the value stored in the REC_PRD register.

NOTE: the REC_PRD time must be greater than the acquisition time of the FFT. The FFT acquisition time is determined by the values in the FFT_AVG1, FFT_AVG2 and AVG_CNT register values.

Manual Time Domain Capture Mode

Displays the values of a time domain data capture.

Real Time Capture Mode

When selected and after the Start button is clicked a form is displayed to allow setting the parameters for a real time capture.

NOTE: The ADcmXL data log produces 8 MB of data per second = 220,704 csv file lines.

On some PC's a 1 second capture can require 2 seconds to write files.

File writes queued to the Windows system can only be canceled by closing this application.

Data Log of Manual FTT, Automatic FFT and Time Domain captures

Data logging can be enabled by checking the box on the Main Form. The File Number will increment to show how many files have been written. The Default path for data files is My Documents.

The default data file name is Datalog.csv. The file name is appended with the file count number.

Datalog_001.csv, Datalog_002.csv. The path and name of files can be changed in the Data Capture Configuration Form. File Access is "overwrite."

[Application Use Guide](#)

Main Form

[Setting Registers](#)

1. Open Register Access Window by selecting "Register Access" on the top bar of the Evaluation Software window.
2. The left panel of the window lists registers from the category selected from the pull down menu on the top of the Register Access Window. There are 9 Categories: Output, Control/Status, Calibration and Filter Banks A-F which include a subset of the complete register bank available.
3. On the left panel, the slider is used to find the desired Register. Use the pointer to select the desired register after which the register name will appear in the top center of the Register access window.
 - a. To read the current value from the register, push the "Read Selected Register" button and the current register value will be the value in the "Current Hex Value" indicator.
 - b. To write a new value into the register, enter a hex value in the New Hex Value entry location and push the "Write" button
4. The right panel breaks out the individual control bit of 6 registers: GLOB_CMD, REC_CTRL1, REC_CTRL2, REC_PRD, ALM_CTRL and DIO_CTRL.

Setting Alarms and Reading Alarm Status

Reading Default Values

1. Open Alarm Values Window by selecting “Alarm” on the top bar of the Evaluation Software window and then “Alarm Values”, which will open a window.
2. Readback the current register values by pressing the “Read Default Values”.

Reading from current active values and writing values in table to DUT

1. Open Alarm Values Window by selecting “Alarm” on the top bar of the Evaluation Software window and then “Alarm Values”, which will open a window.
2. Select “Read From DUT” and the table will get updated with current active alarm settings from the DUT.
3. To change a value in the table, select the appropriate box and enter the new desired value. To set the values, select “Write to DUT” and the table values will be loaded into the DUT.

Reading from values from a file to table and saving values in table to DUT

1. Open Alarm Values Window by selecting “Alarm” on the top bar of the Evaluation Software window and then “Alarm Values”, which will open a window.
2. Select “Read From File” and a dialog window will open. Select the desired CSV file and the table will get updated with values stored in the file.
3. To change a value in the table, select the appropriate box and enter the new desired value. To save the values to a file, select “Write to File” and a dialog will open. Select a file name and press save. The displayed table values will be saved to a file.

Checking Alarm Status

1. Open Alarm Values Window by selecting “Alarm” on the top bar of the Evaluation Software window and then “Alarm Status”, which will open a new window.
2. The Alarm Status Window will display the current state of the 6 configurable alarms across the 3 different axes.

Setting Data Capture Options

Open the Data Capture Configuration dialog window by selecting “Data Capture” on the top bar of the Evaluation Software window and then the “Data Capture Configuration” window will open.

A file location and name can be set. Press OK when done with configuration.

Manual Time Capture Example

These step by step instructions will demonstrate a basic Manual Time Capture and then a second capture after Autonulling.

1. Set Manual Time Capture under the “Mode Selection” Pull Down Menu
2. Press Start; a Manual Time Capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), 3 flat lines should appear in the 3 plots. In some cases, the flat line will be off the plot dimensions. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis.
3. Open Register Access Window

4. Press “Write” next to the Auto-Null under the listed Functions which should be shown on the top of the right panel. This will initiate a DC offset null calculation and will take less than 1 seconds.
5. Return to the Main ADCMXL Evaluation Software window and press “Start”; a new Manual Time Capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), 3 flat lines should appear in the 3 plots. Unlike the previous capture, the flat lines should be centered on 0. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis.

Manual FFT Capture Example

1. Select “Manual FFT” from the Mode Selection pull down menu.
2. Press Start; a Manual FFT capture will initiate and complete within a few seconds. If there is no stimulus (vibration or mechanical movement), the spectral output will be displayed. Typically, unless user has modified startup settings, the FFT spectrum from 0 to 110 kHz will be displayed. The Y-Axis magnitude can be changed by right clicking in the window, pressing the “>” will increase the full scale magnitude of the Y-Axis. Pressing the “<” will decrease the full scale magnitude of the Y-Axis. If a sine wave stimulus is applied, the response will be displayed in the graph.
3. Open Register Access Window
4. On the left panel, use the slider to find the Register called AVG_CNT. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter “07” in the New Hex Value entry and push the “Write” button (this will set the time average to 2^7 , reducing effective output sample rate to $220\text{kHz}/2^7$ or 1,719Hz). Note The ADC sample rate remains at 220 kHz, but real time averaging filter is used with its size based on this AVG_CNT setting.
5. Press Start, observe FFT Frequency Graph X-Axis displays frequency from 0 to 859 Hz. The capture with AVG_CNT set to 7 will take approximately 22 seconds.

Automatic FFT Capture Example

In automatic FFT mode the ADCMXL will continuously self-trigger data capture with a period determined by the value set in the REC_PRD register. The re-trigger time (REC_PRD) must be greater than the data capture time which is determined by the values in the FFT_AVG and AVG_CNT registers. The following steps configure the ADCMXL for an automatic FFT mode repetition rate of 2 seconds

1. Select “Automatic FFT” from the Mode Selection pull down menu.
2. Open Register Access Window
3. On the left panel, use the slider to find the Register called AVG_CNT. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter “2” in the New Hex Value entry and push the “Write” button (this will set the time average to 2^2)
4. On the left panel, use the slider to find the Register called FFT_AVG. Use the pointer to select this register after which the register name will appear in the top center of the Register access

window. Enter “2” in the New Hex Value entry and push the “Write” button. This configures the device for a capture duration of 1.6 seconds.

5. On the left panel, use the slider to find the Register called REC_PRD. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter “2” in the New Hex Value entry and push the “Write” button. This configures the device for an automatic repeat time of 2 seconds.
6. Press Start, observe FFT Frequency Graphs displays. The capture with AVG_CNT set to 2 and FTF_AVG set to 2 will take approximately 1.6 seconds and will be repeated every 2 seconds.

Real Time Capture Example

The Real Time capture mode produces data files at a rate of 8MB per second equivalent to 220,704 csv file lines. On some PC's a 1 second capture can require 2 seconds to write files. File writes queued to the Windows system can only be canceled by closing the evaluation application.

1. Select “Real Time” from the Mode Selection pull down menu.
2. Press the Start button on the main form to show the Burst Data configuration window.
3. The default values in this configuration produce a real time capture of **1 second** and a csv file of 220,704 lines, approximately **8MB**.
4. Press the Start button in the Burst Data configuration window to record the data.

Saving and Loading Register Files

1. Select “Register Access” in the menu of the Main form.
2. In the Register Access windows press the Save Registers to file button.
3. In the dialog box select the register category you want to save. Click Save
4. To read register values from a file and load the values to the ADXLCM. Press the Read button in the Register Access Form. Use the file open dialog to select a properly formatted RegDump.csv file. Press Open. The values will be written to the registers of the ADCMXL device.