

# EVAL-ADCM / EVAL-ADCM-1 User Guide

Date: Jan 18, 2020

ADcmXL Evaluation Wiki link:

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

## Contents

EVAL-ADCM / EVAL-ADCM-1 User Guide .....	1
Orderable Part Numbers .....	1
Minimum PC System Requirements .....	2
Minimum Required Hardware.....	2
EVAL-ADCM Hardware Setup .....	3
Software Installation.....	5
Troubleshooting.....	6
Verifying the USB Connection.....	6
Application Functional Overview and User Guide.....	6
Devices .....	6
Register Access.....	7
Alarms .....	8
Data Capture.....	10
View.....	11
Comm.....	11
Help .....	11
About.....	11
Mode Selection (AFFT, MFFT, MTC and RT) .....	11

## Orderable Part Numbers

- The EVAL-ADCM is an orderable kit that includes ADcmXL3021 module and all necessary boards to interface with a PC.
- The EVAL-ADCM-1 is an orderable kit that includes ADcmXL1021-1 module and all necessary boards to interface with a PC.

Note: EVAL-ADCM and EVAL-ADCM-1 are identical kits except for included ADcmXL modules. As such, one can evaluate both ADcmXL3021 and ADcmXL1021-1 using EVAL-ADCM (or EVAL-ADCM-1) provided that an ADcmXL1021-1 (or ADcmXL3021) module is ordered separately.

### 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), shown in Figure 1.
- ADCMXL\_BRKOUT/PCBZ, shown in Figure 2.
- ADcmXL FX3 Interface board, shown in Figure 3
- ADcmXL device, shown in Figure 4.

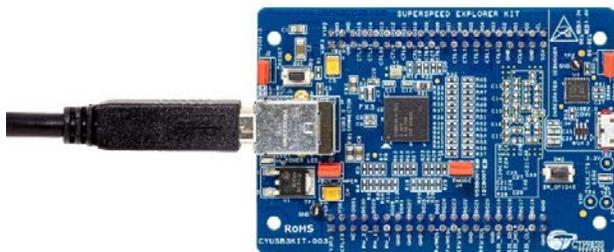


Figure 1 CypresFX3USBKit-003



Figure 2 ADCMXL\_BRKOUT/PCBZ

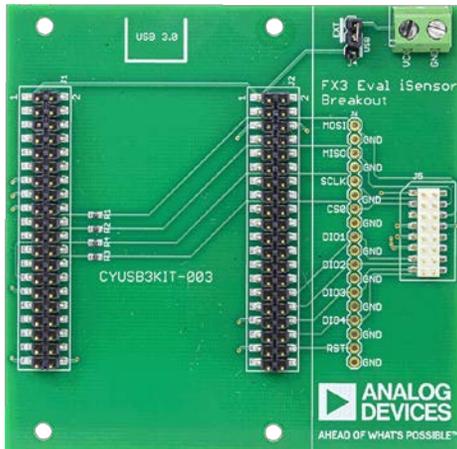


Figure 3 ADcmXL FX3 Interface Board



Figure 4 ADcmXL3021 module

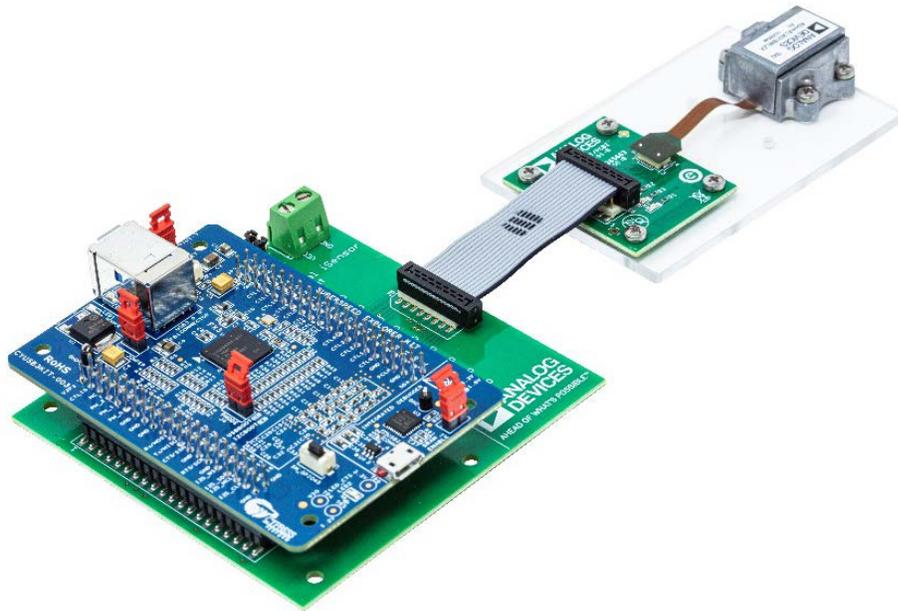


Figure 5 Assembled Hardware EVAL-ADCM (or EVAL-ADCM-1)

## EVAL-ADCM Hardware Setup

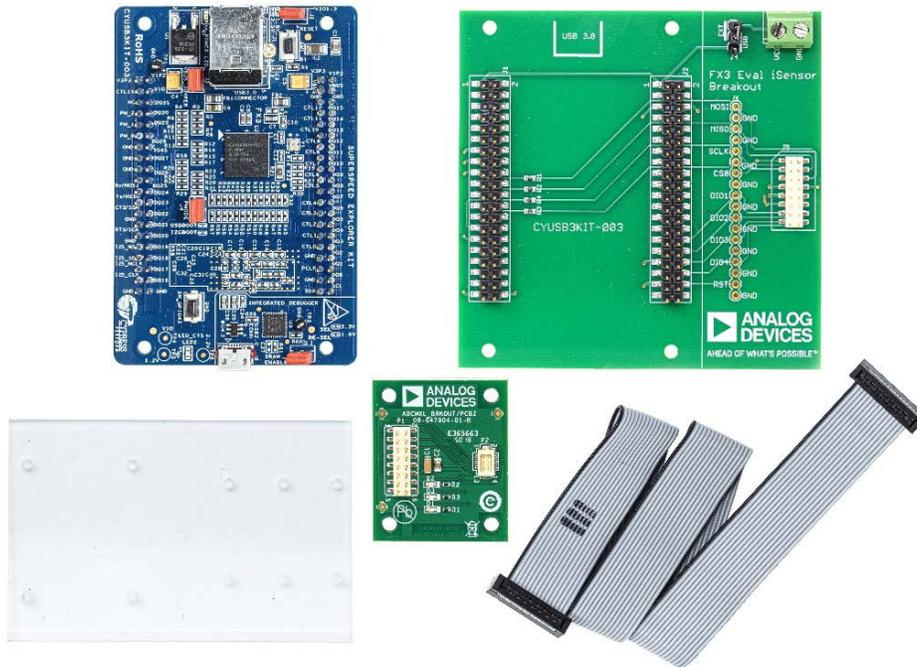
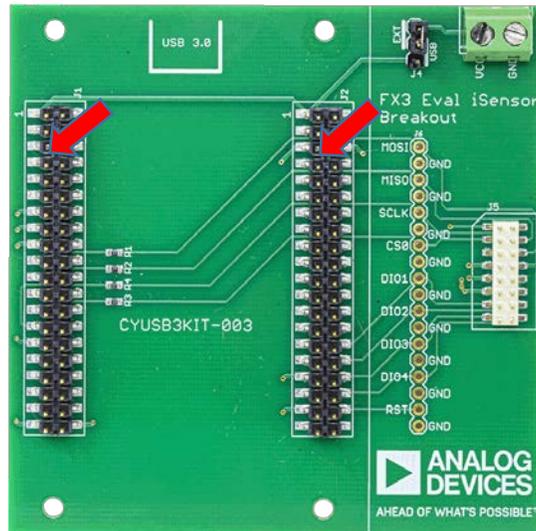


Figure 6 Hardware included with EVAL-ADCM (or EVAL-ADCM-1) kit. Not shown are 8 mounting screws, short ribbon cable option and an ADcmXL3021 (or ADcmXL1021-1) device.

## **Step 1**

Plug in the ADcmXL FX3 Interface Board to the Cypress FX3 Evaluation Board.

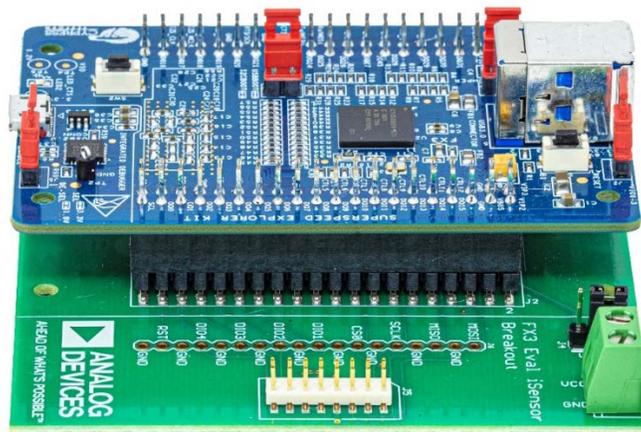


*Figure 7 Pin 3 on both J1 and J2 should be cut.*

Note: On the ADcmXL FX3 Interface Board, the 2 connectors that interface to FX3 board must have Pin 3 on both headers cut. If not already snipped, these pins must be cut or bent out of the way otherwise the FX3 board will not plug in together as these pins are keyed on the FX3 Board.

## **Step 2**

Connect the FX3 and ADcmXL FX3 Interface Board together and connect additional 2 jumpers for the Cypress FX3 Evaluation Kit. (There are 4 jumpers in total and all should be placed on the FX3 board as shown in the figure below).

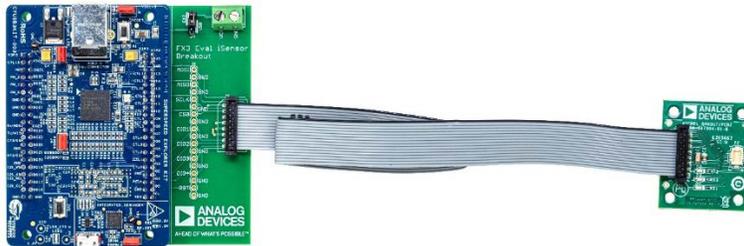


*Figure 8 All four jumpers should be connected.*

### **Step 3**

Connect either available ribbon cables (short or long) from J5 of the ADcmXL FX3 Interface Board to the pre-assembled ADcmXL3021 (or ADcmXL1021-1) and the ADCMXL\_BRKOUT/PCBZ.

Note 1: The shorter ribbon cable (2") is required for RTS Mode but may be used in any of the operation mode. The longer ribbon cable is provided for easier handling and in situ measurements but could result in packet errors when operating in RTS mode. The longer ribbon cable is best of MTC, AFFT and MFFT modes of operation.



*Figure 9 Fx3 Interface connected to ADCMXL\_BRKOUT/PCBZ using the 12" cable*



*Figure 10 ADcmXL module connected to the ADCMXL\_BRKOUT/PCBZ, note the direction of the ADcmXL module with respect to the board.*

Note 2: ADcmXL module and the ADCMXL\_BRKOUT/PCBZ are pre-assembled (both secured to the acrylic plate) to reduce possible stresses on the Flex tail. Depending on the application, the ADcmXL module and the ADCMXL\_BRKOUT/PCBZ can be unmounted from the plate and be secured to the platform of choice.

### **Step 4**

Connect the FX3 Evaluation Board to the PC with the ADCMXL Evaluation Software using the provided USB3.0 cable that is shipped with the Cypress FX3 Evaluation kit box.

### **Software Installation**

In order to use the ADCMXL Evaluation Software, FX3 Driver needs to be downloaded and installed before ADCMXL Evaluation Software. Follow the steps below:

1. Un-compress the file FX3Driver.zip from the [Wiki page](#).

(Note: The FX3 board will have driver software available on Cypress website or other platforms, that may be different than the one provided on ADI's wiki page. The driver provided is the one tested with the ADcmXL Evaluation Software and in some cases other drivers may not be supported.)

2. Run the executable DriverSetup.exe
3. Connect the ADCMXL3021 (or ADcmXL1021-1) device, breakout boards, and the FX3 through the interface board.
4. Connect the FX3 board to a PC USB port. LED indicates power. One LED on the FX3 board and one on the BR-047904 adapter board should be lit by default when the USB cable is plugged into the PC
5. Run the application ADCMXL\_Evaluation\_n\_n\_n.exe. Note: This application and the required DLLs must be in the same folder.

## Troubleshooting

No light on the ADCMXL\_BRKOUT/PCBZ board are lit:

- Check to make sure the ADcmXL module is plugged into P2.
- Check that ribbon cable is firmly and correctly plugged into both boards.
- Check that USB is plugged into the FX3 board, the FX3 board is plugged into the ADcmXL FX3 Interface board.

More or less than 1 LED is lit on the FX3 board

- Check that the USB 3.0 A to B cable is plugged into the PC and the FX3 board.
- Use a different USB port on the PC.
- Be sure 4 jumpers are placed on the FX3 board.

When running software, get a message similar to "Unable to connect to an FX3 Board"

- Be sure ADcmXL Evaluation software is in a folder with all provided .dll files
- FX3 driver not installed properly or at all, Install provided FX3 driver
- Unplug and re-plug USB cable to power cycle the FX3 board

## Verifying the USB Connection

Before starting the ADcmXL Evaluation Software, when the Cypress FX3 board is connected it should be listed in Universal Serial Bus controllers as "Cypress FX3 USB BootLaoder Device". This is confirmation that the Cypress USB drivers have been installed. When the ADcmXL Evaluation Software application is started the device should reconnect as an "Analog Devices iSensor FX3 Demonstration Platform".

## Application Functional Overview and User Guide

### Devices

Select the product, either ADcmXL1021-1 or ADcmXL3021. Note that once ADcmXL1021-1 is selected, some of the features relating to 3-axis is disabled.

## 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.

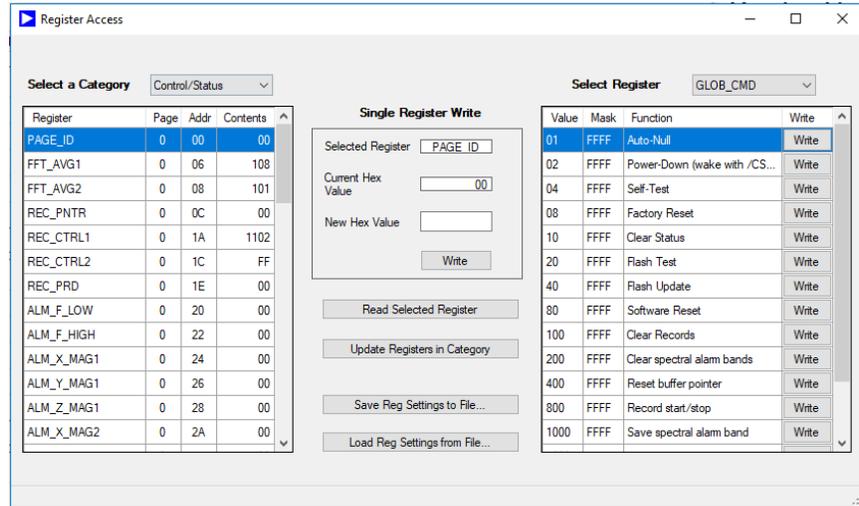


Figure 11 Register Access Window

## 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.

## 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.

- To read register values from a file and load the values to the ADCMXL. 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.

## Alarms

### Alarm Values 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.

The screenshot shows a window titled "Alarm Values" with a table of parameters and control buttons on the right. The table has columns: SR\_opt, Band, F\_LOW, F\_HIGH, X\_MAG1, X\_MAG2, Y\_MAG1, Y\_MAG2, Z\_MAG1, Z\_MAG2. The right side contains buttons: "Read Default Values", "Read Form DUT", "Write to DUT", "Read from File", and "Write to File". A text box at the bottom right contains instructions: "Values displayed in this Form must be written to the DUT by clicking the Write to DUT button. Alarms must be enabled by writing to the ALM\_CTRL register. ALM\_CTRL is accessible in the Register Access Form. Alarm values are only plotted when the Alarm Status Form is visible."

SR_opt	Band	F_LOW	F_HIGH	X_MAG1	X_MAG2	Y_MAG1	Y_MAG2	Z_MAG1	Z_MAG2
0	1	40	230	7000	10000	7000	10000	7000	10000
0	2	230	330	6100	8100	6100	8100	6100	8100
0	3	330	450	5000	7000	5000	7000	5000	7000
0	4	450	580	9000	11000	11000	14000	11000	14000
0	5	580	1000	8000	10000	8000	10000	8000	10000
0	6	1000	2032	6000	9000	6000	9000	6000	9000
1	1	41	231	7001	10001	7001	10001	7001	10001
1	2	231	331	6101	8101	6101	8101	6101	8101
1	3	331	451	5001	7001	5001	7001	5001	7001
1	4	451	581	9001	11001	11001	14001	11001	14001
1	5	581	1001	8001	10001	8001	10001	8001	10001
1	6	1001	2033	6001	9001	6001	9001	6001	9001
2	1	42	232	7002	10002	7002	10002	7002	10002
2	2	232	332	6102	8102	6102	8102	6102	8102
2	3	332	452	5002	7002	5002	7002	5002	7002
2	4	452	582	9002	11002	11002	14002	11002	14002
2	5	582	1002	8002	10002	8002	10002	8002	10002
2	6	1002	2034	6002	9002	6002	9002	6002	9002
3	1	43	233	7003	10003	7003	10003	7003	10003
3	2	233	333	6103	8103	6103	8103	6103	8103
3	3	333	453	5003	7003	5003	7003	5003	7003
3	4	453	583	9003	11003	11003	14003	11003	14003
3	5	583	1003	8003	10003	8003	10003	8003	10003
3	6	1003	2035	6003	9003	6003	9003	6003	9003

Figure 12 Alarm Values Form, the default values are loaded from the nonvolatile memory of the DUT.

### 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.

The screenshot shows a window titled "Alarm Stat..." with a table of status values. The table has columns: Sens 1, 1, 2, 3, 4, 5, 6. The rows are X\_axis, Y\_axis, and Z\_axis.

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

Figure 13 Alarm Status form.

## 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.

Example: In the example below, the Y and Z axis alarms are enabled, however, X -axis is not enabled. Note that the Alarm Status form shows normal (0) for X-axis, while the in five out of six bands the alarm should have been raised.

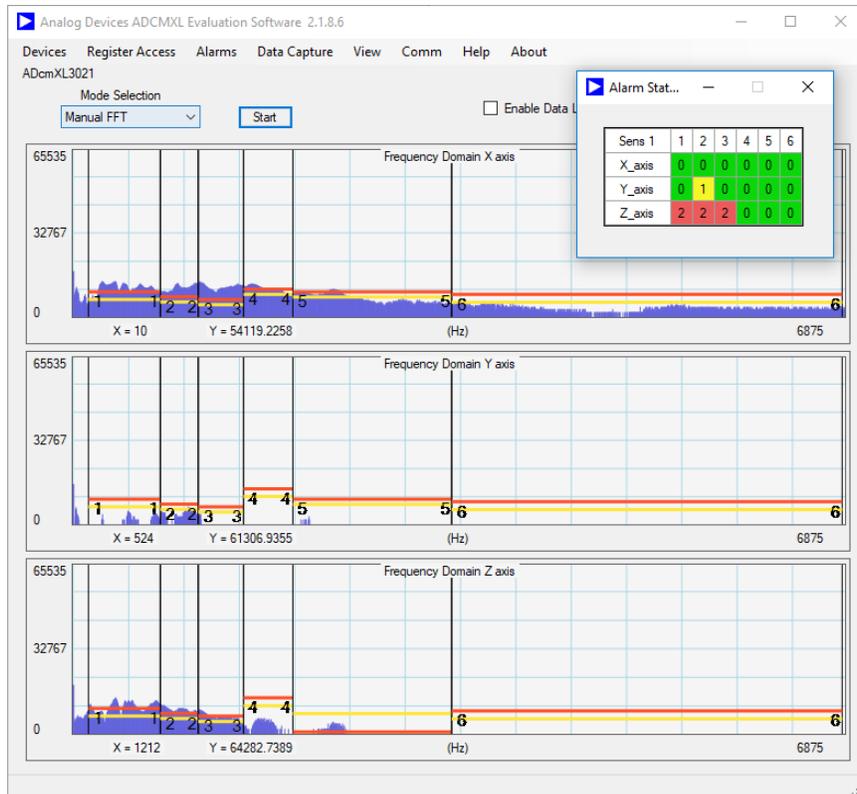


Figure 14 Alarm band lines and Alarm Status form (overlay) shown in an example vibration measurement. X-axis alarm is disabled.

## Data Capture

The user can configure where the files to be stored and reset the file count. To set the 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. Note: Data logging can be enabled by checking the “Enable Data Log” 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.”

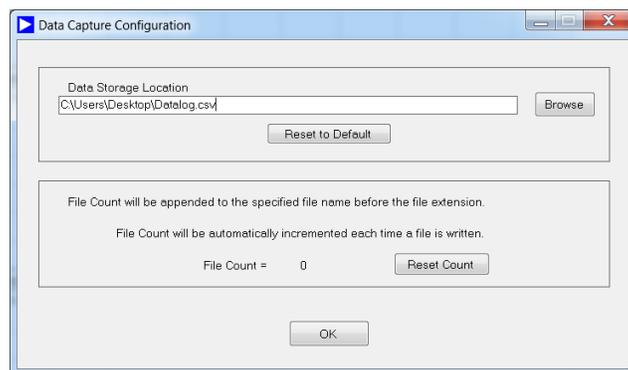


Figure 15 Data Capture Configuration Window

## View

Provides an optional control to display any combination of the available axes (only in case of ADcmXL3021).

### *Note about plot setting*

- Right Click any plot to display the scaling controls.
- Scaled coordinates of the cursor are displayed at the bottom of each plot.
- Demonstrations in this mode may seem unresponsive due to the large data set.

## Comm

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

## Help

Provides general information regarding the software revision and provide some basic operating information. For more information about the operation of the ADcmXL module please refer to the datasheet.

## About

Provides a window with software revision.

## Mode Selection (AFFT, MFFT, MTC and RT)

### *Automatic FFT (AFFT) Capture Mode*

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.

Note: if the REC\_PRD time is smaller than the acquisition time of the FFT the ADCMXL Evaluation Software will generate an error, will give the estimated capture time and terminate sample capture.

### *Automatic FFT Capture Example*

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 "02" in the New Hex Value entry and push the "Write" button (this will set the time average to 2<sup>2</sup>). Note: this will set the AVG\_CNT for SR0, which is the default Sample Rate configuration.
4. On the left panel, use the slider to find the Register called FFT\_AVG1. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter "102" in the New Hex Value entry and push the "Write" button. (This configures SR0 FFT averaging to 2, and leaves SR1 rate at the default value. For further information regarding the sample rate configuration please refer to the datasheet of the product.) This selection along with the above AVG\_CNT setting, sets the device for a capture duration of 1.8 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\_AVG1 SR0 set to 2 will take approximately 1.8 seconds and will be repeated every 2 seconds.

#### *Manual FFT (MFFT) Capture Mode*

MFFT mode can be used to manually trigger a capture to create a single FFT record with 2048 bins and allows various configuration options.

#### *Manual FFT Capture Example*

The following steps configure the ADCMXL for a manual FFT mode repetition rate of 8 seconds

1. Select “Manual 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 “05” in the New Hex Value entry and push the “Write” button (this will set the time average to 2<sup>5</sup>). Note: this will set the AVG\_CNT for SR0, which is the default Sample Rate configuration.
4. On the left panel, use the slider to find the Register called FFT\_AVG1. Use the pointer to select this register after which the register name will appear in the top center of the Register access window. Enter “108” in the New Hex Value entry and push the “Write” button.
5. Press Start, observe FFT Frequency Graphs displays. The capture with AVG\_CNT set to 5 and FTF\_AVG set to 8, will take approximately 8.4 seconds. There will be only a single capture.

#### *Manual Time Capture (MTC) Mode:*

When operating in MTC mode, the ADcmXL captures 4096 consecutive time domain samples. These samples are displayed only after all configured averaging and filtering on the data set are completed.

#### *Manual Time Capture Example*

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

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.

#### *Real Time (RT) 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. Real time graphical updates are not possible with this device due to the 12K data points in each 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.