UM0692
User manual

STEVAL-MKI024V1 demonstration kit for LIS331DL

Introduction

The STEVAL-MKI024V1 is a demonstration kit designed to provide the user with a complete, ready-to-use platform for demonstration of the LIS331DL. The LIS331DL is a low-power 3-axis linear accelerometer with digital output. The device includes a sensing element and an IC interface capable of translating information from the sensing element into a measured signal that can be used for external applications.

In addition to the MEMS sensor, the demonstration board utilizes an ST7-USB microcontroller which functions as a bridge between the sensor and the PC, on which it is possible to use the graphical user interface downloadable to the website or dedicated software routines for customized applications.

This user manual describes the hardware included with the demonstration kit and provides the information required to install and run the demonstration kit user interface.

For details regarding the features of the LIS331DL sensor, please refer to the datasheet for this device and application note AN2960.

Contents

1 **Demonstration kit description 5**

2 **STEVAL-MKI024V1 GUI installation 7**

2.1 PC system requirements 7

2.2 Software installation 7

2.3 Hardware installation 8

3 **Graphical user interface 11**

3.1 Connecting to the virtual COM port 12

3.2 “Easy Start” button 12

3.3 “Options” tab 13

3.4 “Register Setup” tab 13

3.5 “Bars” tab 14

3.6 “Plot” tab 16

3.7 “Data” tab 18

3.8 “Inclinometer” tab 19

3.9 “Map Browsing” tab 19

3.10 “FFT” tab 21

3.11 “Interrupt” tab 21

3.12 “Click Click” tab 22

4 **Data acquisition quick start 24**

5 **EK lite 25**

6 **MEMS pointer 26**

6.1 GUI description 26

6.1.1 Left side: main control 26

6.1.2 Right side: pointer application controls 27

7 **Supported commands 28**

7.1 Getting started 28

7.2 Supported commands 28

7.2.1 Start command 29
7.2.2 Debug command 29
7.2.3 Stop command 29
7.2.4 Register read 29
7.2.5 Register write 30
7.2.6 Single bit write 30
7.2.7 Zon and Zoff 30
7.2.8 Device name 30
7.2.9 Firmware version 30
7.3 Quick start 31

8 DFU 32
8.1 PC requirements 32
8.2 DFU procedure 32

9 Schematic diagram 35

10 Bill of materials 36

11 Revision history 38

List of figures

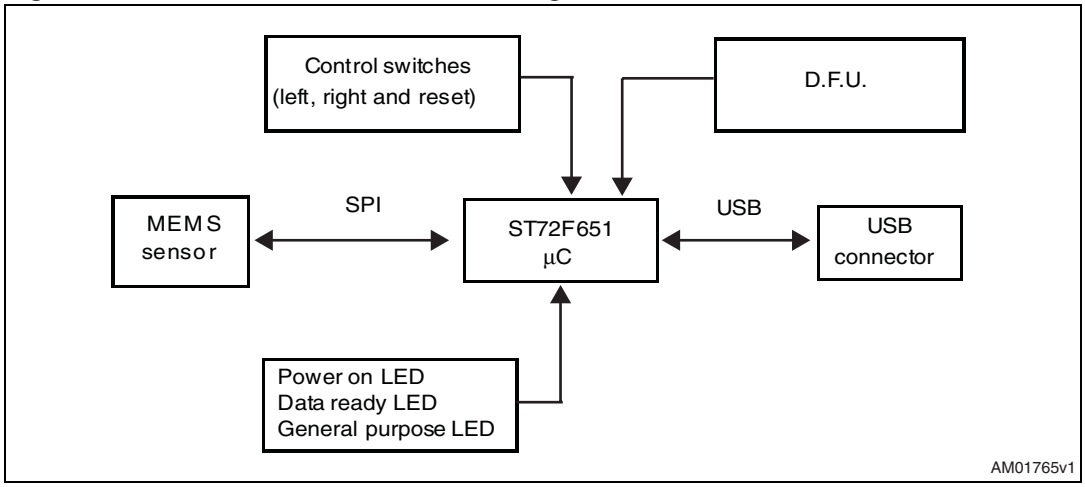
Figure 1. Demonstration board block diagram . . . 5
Figure 2. Top silk screen of the STEVAL-MKI024V1 kit . . . 6
Figure 3. Board photograph . . . 6
Figure 4. Software installation . . . 7
Figure 5. Notify icon . . . 8
Figure 6. Driver installation using the device manager . . . 8
Figure 7. USB driver installation using the hardware update wizard . . . 9
Figure 8. Virtual COM driver port assignment . . . 10
Figure 9. Graphical user interface: main window . . . 11
Figure 10. Options tab . . . 13
Figure 11. Register setup tab . . . 14
Figure 12. Bars tab - acceleration data . . . 15
Figure 13. Bars tab - selected acceleration as a numerical value . . . 15
Figure 14. Plot tab . . . 16
Figure 15. Plot tab - zoom . . . 17
Figure 16. Data tab . . . 18
Figure 17. Inclinometer tab . . . 19
Figure 18. Axis inclination . . . 19
Figure 19. Map browsing tab . . . 20
Figure 20. FFT tab . . . 21
Figure 21. Interrupt tab . . . 22
Figure 22. Click Click tab . . . 23
Figure 23. STEVAL-MKI024V1 lite GUI . . . 25
Figure 24. MEMS pointer demonstration . . . 26
Figure 25. Demonstration kit correctly recognized . . . 32
Figure 26. Select new firmware . . . 33
Figure 27. Flash erasing . . . 33
Figure 28. Flash upgrading . . . 34
Figure 29. Schematic diagram of the STEVAL-MKI024V1 board . . . 35

1 Demonstration kit description

The STEVAL-MKI024V1 is a complete demonstration kit that allows demonstration of the performance of the LIS331DL low-power 3-axis linear accelerometer with digital output.

The block diagram of the demonstration kit is shown in *Figure 1*.

Figure 1. Demonstration board block diagram



The ST7-USB microcontroller included on the board allows communication between the sensor device and the PC. The user can interact with the hardware either through the GUI provided with the kit or through dedicated software routines to run customized applications.

The device firmware upgrade (DFU) is a feature that allows the customer to upgrade the firmware inside the ST7 microcontroller in case a new firmware release is available on www.st.com/mems.

Switches and LED indicators are used to control and monitor the functionality of the board.

The top silk screen view and photo of the full board, respectively, are shown in *Figure 2* and *Figure 3*.

Figure 2. Top silk screen of the STEVAL-MKI024V1 kit

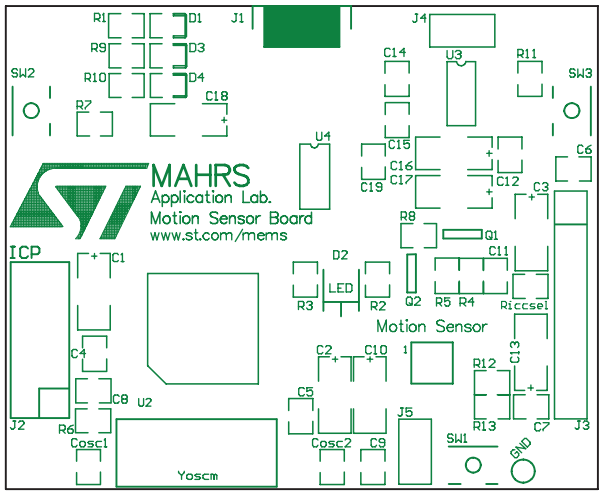
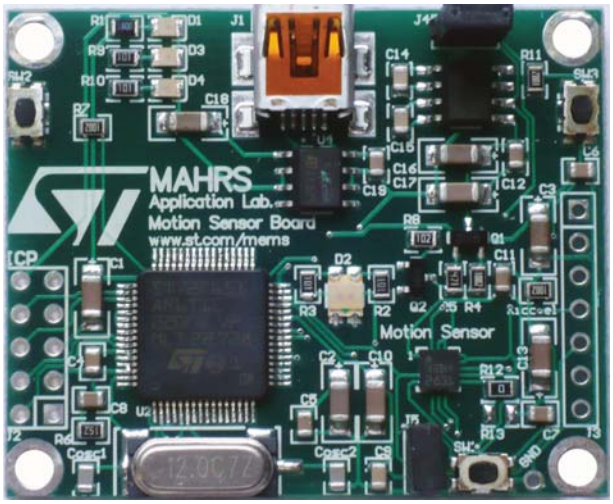


Figure 3. Board photograph



Operation of the STEVAL-MKI024V1 demonstration kit requires the installation of a dedicated driver which is included in the installation pack, together with a GUI interface which allows simple interaction with the sensor. The steps required for driver and software installation are described in the following section.

2 STEVAL-MKI024V1 GUI installation

The installation of the graphical user interface (GUI) for the STEVAL-MKI024V1 requires two steps:

1. installation of the software downloaded from www.st.com
2. installation of the virtual COM driver needed to use the demonstration kit

2.1 PC system requirements

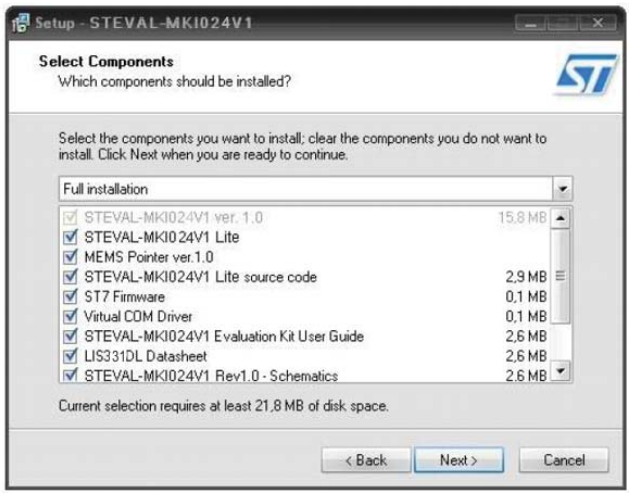
Both the hardware and software that compose the STEVAL-MKI024V1 demonstration kit have been designed to operate with Microsoft® Windows® XP.

2.2 Software installation

To install the software downloaded from demonstration kit web page:

1. double-click on “Setup.exe”
2. follow the on-screen instructions (*Figure 4*)

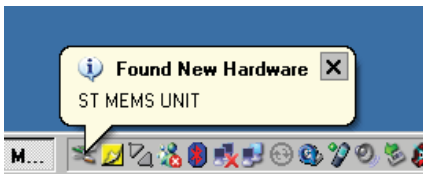
Figure 4. Software installation



2.3 Hardware installation

To install the virtual COM driver, insert the demonstration kit board into a free USB port. The “Notify” icon should appear as in *Figure 5*.

Figure 5. Notify icon

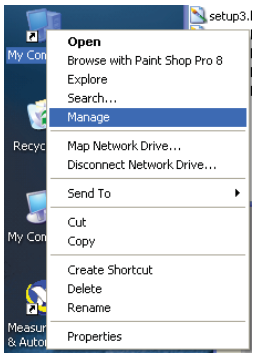


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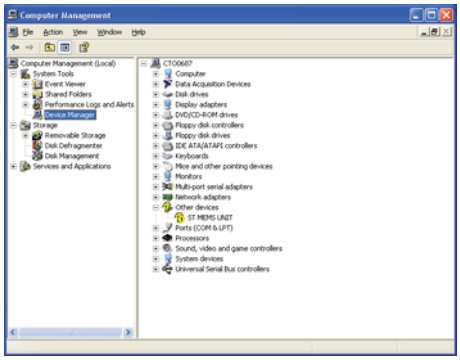
If the “Hardware Update Wizard” window appears (*Figure 7*), follow the instructions on the screen, otherwise, the installation can be performed by following the instructions indicated in *Figure 6* and then *Figure 7*.

Figure 6. Driver installation using the device manager

Right click on My Computer

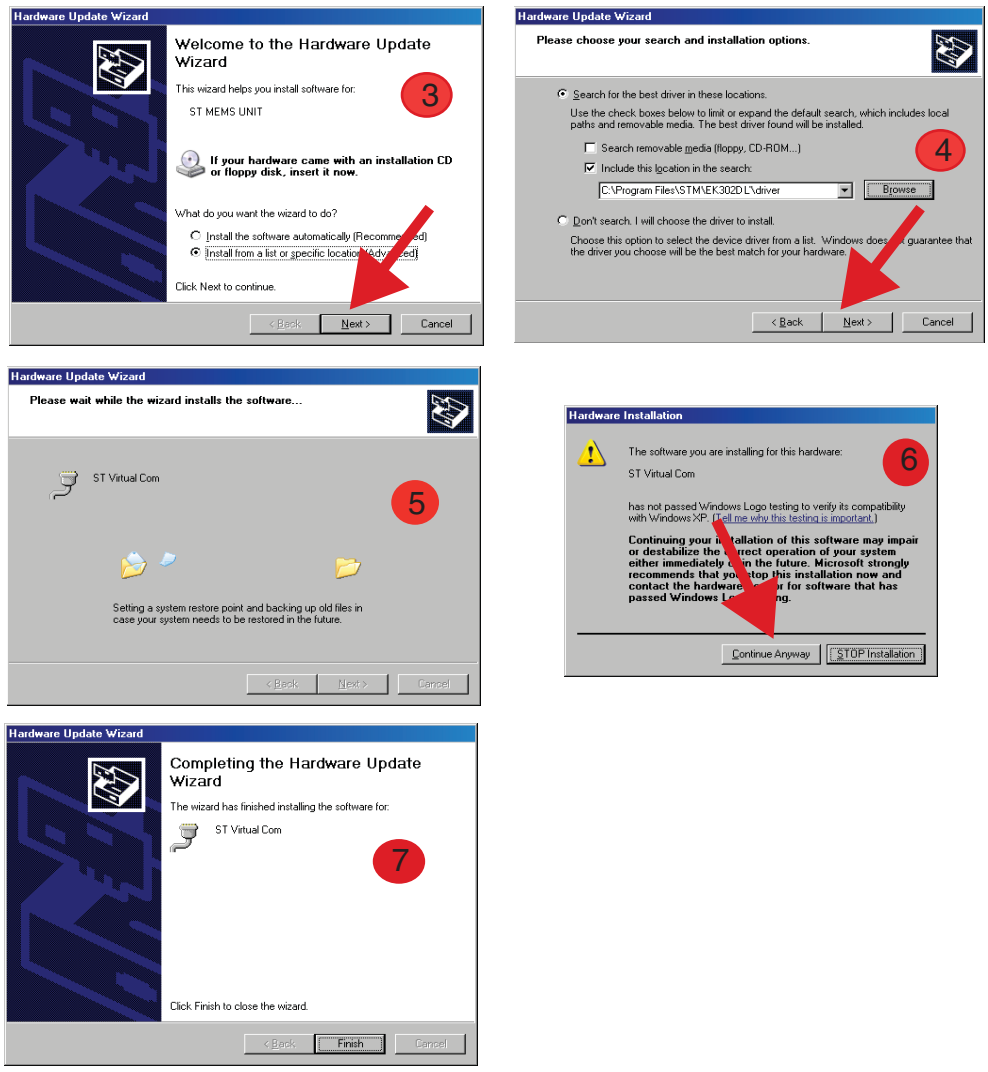


Right click on “ST MEMS UNIT” and choose update driver



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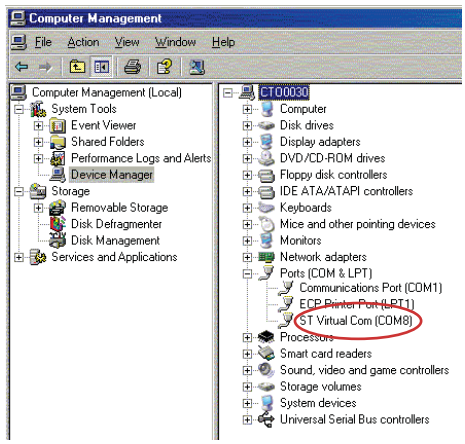
Figure 7. USB driver installation using the hardware update wizard



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Once the installation is complete, a COM port number is assigned to the ST virtual COM driver (*Figure 8*). This number should be retained as it is required to run the STEVAL-MKI024V1 demonstration software GUI. For additional details, see *Section 3.1*.

Figure 8. Virtual COM driver port assignment



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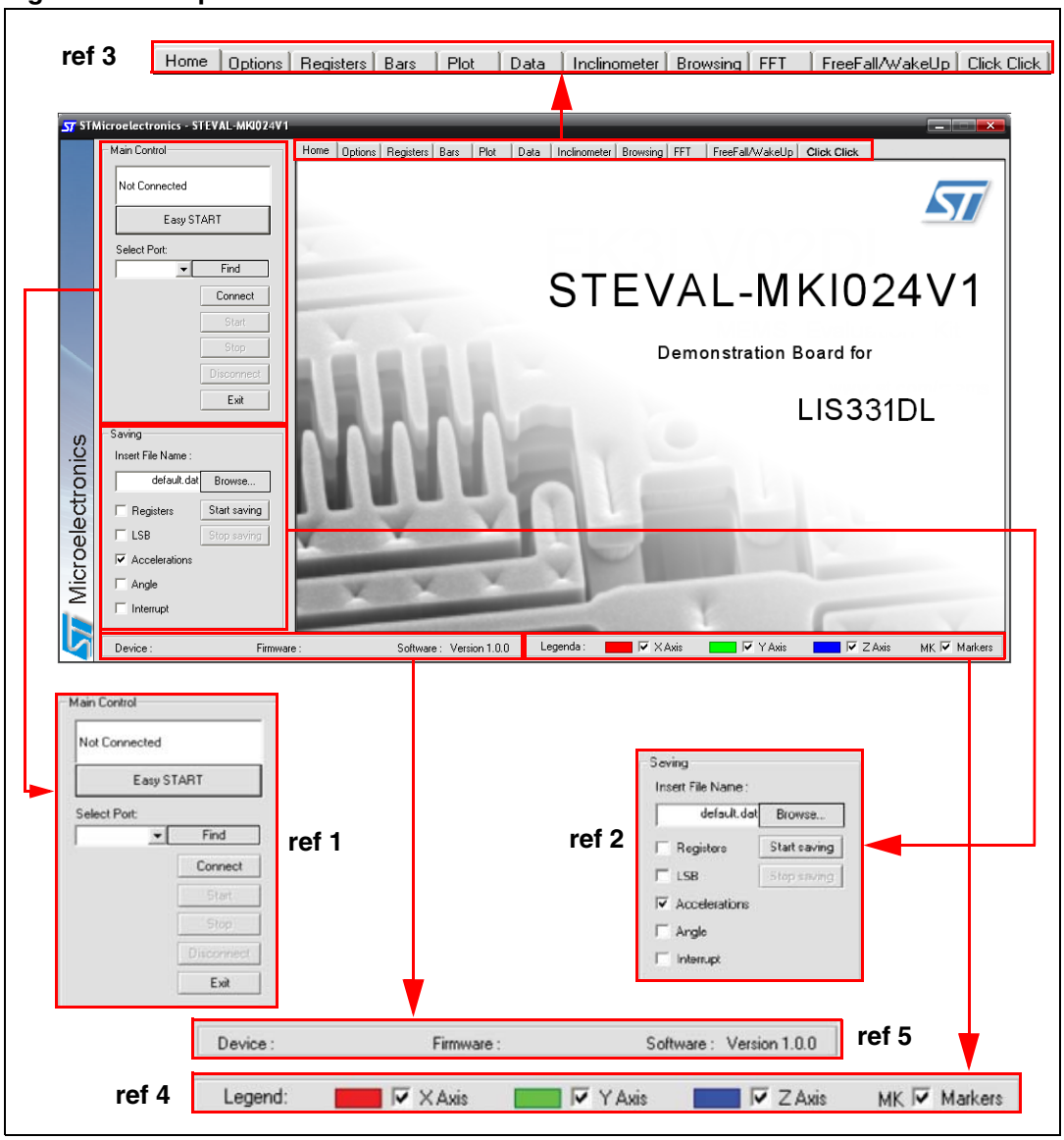
3 Graphical user interface

To execute the STEVAL-MKI024V1 demonstration software GUI:

1. click on Start > All Programs
2. select STEVAL-MKI024V1 > Executables
3. launch the program “STEVAL-MKI024V1 Ver.1.0”

The GUI main window appears as shown in *Figure 9*.

Figure 9. Graphical user interface: main window



The functions of the four main sections of the window are described below:

1. “Main Control” (*Figure 9* , ref 1) - connects/disconnects the board and starts acquisition via the Start/Stop buttons
2. “Saving” box (*Figure 9*, ref 2) - allows the user to save the data to a specified text file, choosing the data type to write. Data types availabe are:
   a) RAW: for each axis the software writes the data read directly from the sensor output registers (OUTX, OUTY and OUTZ)
   b) LSB: the data read directly from the sensor are converted from 2’s complement to sign and magnitude
   c) Acceleration: LSB data are multiplied by the sensitivity to obtain the acceleration expressed in mg
   d) Angle: LSB data converted to the tilting angle of the board expressed in degrees
   e) Interrupt: status of the interrupt
3. “Tab Selector” (*Figure 9*, ref 3) - used to toggle between the different functions of the demonstration kit
4. “Legend” (*Figure 9*, ref 4) - allows the user to enable/disable viewing the axes
5. “Details” (*Figure 9*, ref 5) - shows the details of the demonstration kit, the name of the sensor, the version of the firmware loaded on the microcontroller and the version of the PC software

3.1 Connecting to the virtual COM port

Before using the functions of the demonstration kit software the connection with the STEVAL-MKI024V1 board must be opened using the following steps:

1. connect the STEVAL-MKI024V1 to the desired USB port
2. in the “Select COM” drop-down menu (*Figure 9* ref 1), choose the virtual COM number to which the board has been mapped. For additional information on how to obtain this number, see *Section 2.3*
3. open the connection by clicking on “Connect” (*Figure 9* ref 1)

At this point the user can acquire, plot and save the acceleration data measured by the sensor and access the content of the registers embedded in the device.

When the "Find" button is clicked (*Figure 9* ref 1), the GUI attempts to automatically find the COM number assigned to the demonstration kit and shows it in the list box as a selected item.

The following sections provide details regarding the functions of the tabs in *Figure 9*, ref 1.

3.2 “Easy Start” button

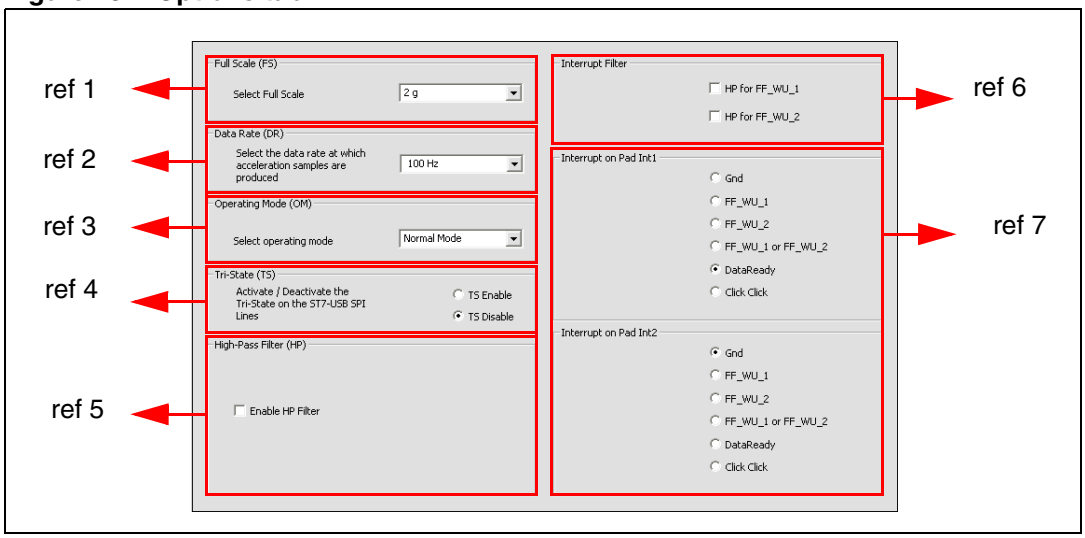
When the "Easy Start" button is clicked (*Figure 9*, ref 1), the GUI attempts to automatically find the COM number assigned to the demonstration kit and starts the acquisition.

3.3 “Options” tab

The options tab allows the user to control the following parameters:

1. Full scale (FS) - Sets the maximum acceleration value measurable by the device. It is possible to select either 2g or 8g (*Figure 10*, ref 1)
2. Data rate (DR) - In this box the rate at which each acceleration sample is produced can be selected. The possible values are 100 and 400 Hz (*Figure 10*, ref 2)
3. Operating mode (OM) - This control allows the customer to select the operating mode: normal mode and power-down mode (*Figure 10*, ref 3)
4. Tri-state (TS) - Permits switching the SPI lines of the ST7-USB microcontroller mounted on the demonstration kit between 3-state (i.e. high-impedance) and normal mode (*Figure 10*, ref 4). This function makes it possible to isolate the sensor mounted on the board from the microprocessor, in case any external control (from a different microcontroller mounted on a separate user board) is needed. This function is inhibited during the acquisition
5. High-pass filter (HP) - This control activates the high-pass filter on the device and selects the cut-off frequency (*Figure 10*, ref 5)
6. Interrupt Filter - Enable or Disable the HP filter on INT1 or INT2(*Figure 10*, ref 6)
7. Interrupt on Pad IntX - Allows the selection of the type of signal to be sent out on Int1 or Int2 Pad(*Figure 10*, ref 7.

Figure 10. Options tab



3.4 “Register Setup” tab

The register setup tab shown in *Figure 11* allows read/write access to the content of the registers embedded in the LIS331DL MEMS sensor mounted on the demonstration kit. The tab is divided into five sections:

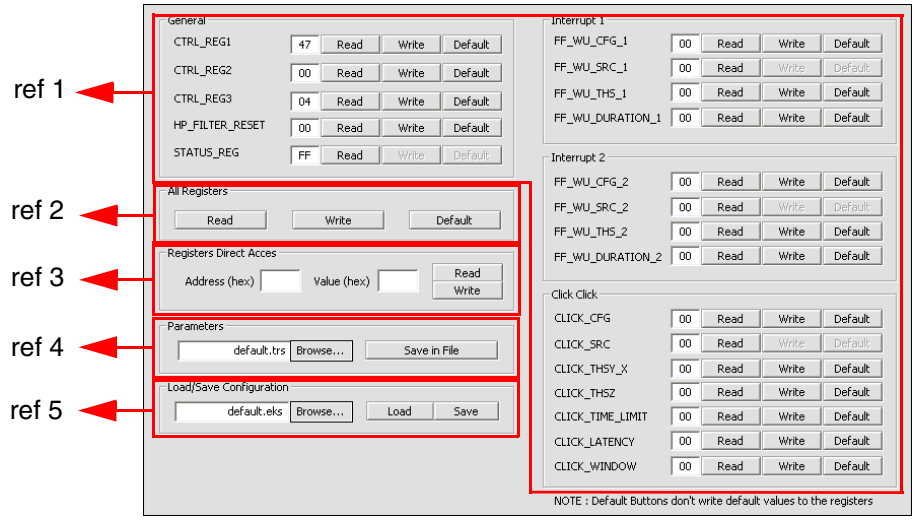
1. “General” (*Figure 11*, ref 1) - provides access to the registers which control the main settings of the device. This section contains the control registers (CTRL_REG1, CTRL_REG2 and CTRL_REG3) and the registers that control the generation of inertial

interrupt signals. It is possible to read and write the contents of each register. To restore the default value for a given register, press the “Default” button

2. “All Registers” (*Figure 11*, ref 2) - permits the user to read, write and recall the default content for all the registers shown in ref 1 with a single click on the read/write/default button
3. “Registers Direct Access” (*Figure 11*, ref 3) - provides access to any register in the device. To read a generic register, insert the address in the “Register Address” textbox, then click on the “Read” button. The retrieved content of the register is displayed in the “Register Value” field. As with writing to a register, the user must specify the address and the data to be written inside the fields marked “Register Address” and “Register Value”, respectively, and then press the “Write” button
4. “Parameters” (*Figure 11*, ref 4) - allows the user to save the register configuration to a text file, which includes a detailed description of the resulting configuration for each register
5. “Load/save configuration” (*Figure 11*, ref 5) - lets the user save/load a specific configuration to/from a file

Note: By pressing the "Default" button, the default values for the registers are recalled in the registers field. To write the values to the registers of the device, the user must press the "Write" button after the "Default" button.

Figure 11. Register setup tab



3.5 “Bars” tab

The bars tab (*Figure 12*) displays the acceleration data measured by the LIS331DL sensor in bar chart format. The accelerations along the X, Y and Z axes correspond respectively to the red, green and blue bars.

The height of each bar is determined by the amplitude of the acceleration signal measured along the related axis. The full scale of the graph depends on the FS1/FS0 bits of CTRL_REG4 that may be changed through both the Option (*Figure 10*, ref 1) and the Register Setup tabs (*Figure 11*, ref 1).

Click on the desired bar to zoom. The selected bar is shown at the center of the screen together with the acceleration as a numerical value. To return to the default view, click on the center of the bar (*Figure 13*).

Figure 12. Bars tab - acceleration data

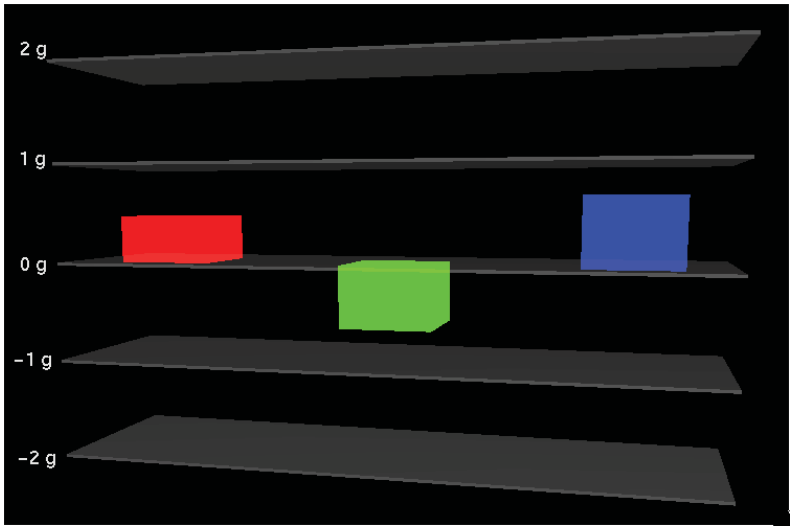
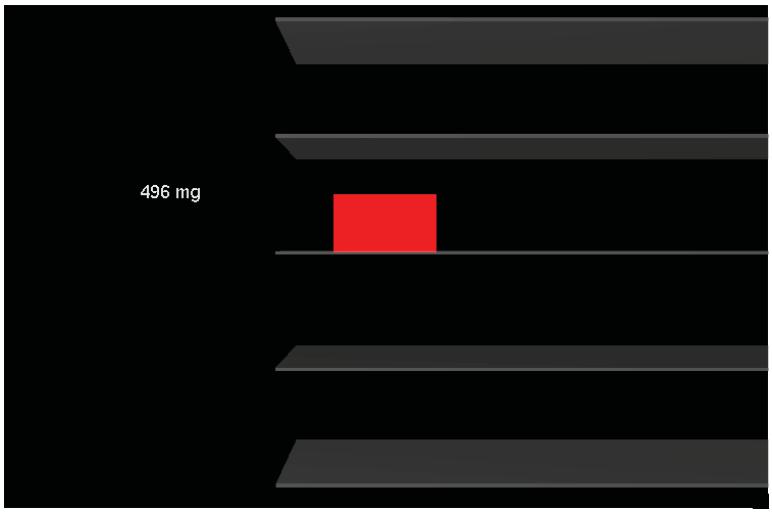


Figure 13. Bars tab - selected acceleration as a numerical value



3.6 “Plot” tab

The plot tab (*Figure 14*) shows the sequence of acceleration samples that have been measured by the LIS331DL MEMS sensor mounted on the demonstration kit. This tab shows:

1. “Acceleration value” (*Figure 14*, ref 1) - shows the numeric values of acceleration samples that have been measured by the sensor
2. “Information” (*Figure 14*, ref 2) - legend of the current status which gives the operating mode, the data rate and the full scale

To zoom in on the waveform, select the desired zone with the left button of the mouse (*Figure 15*). Click again with the right button to return to the default view.

Figure 14. Plot tab

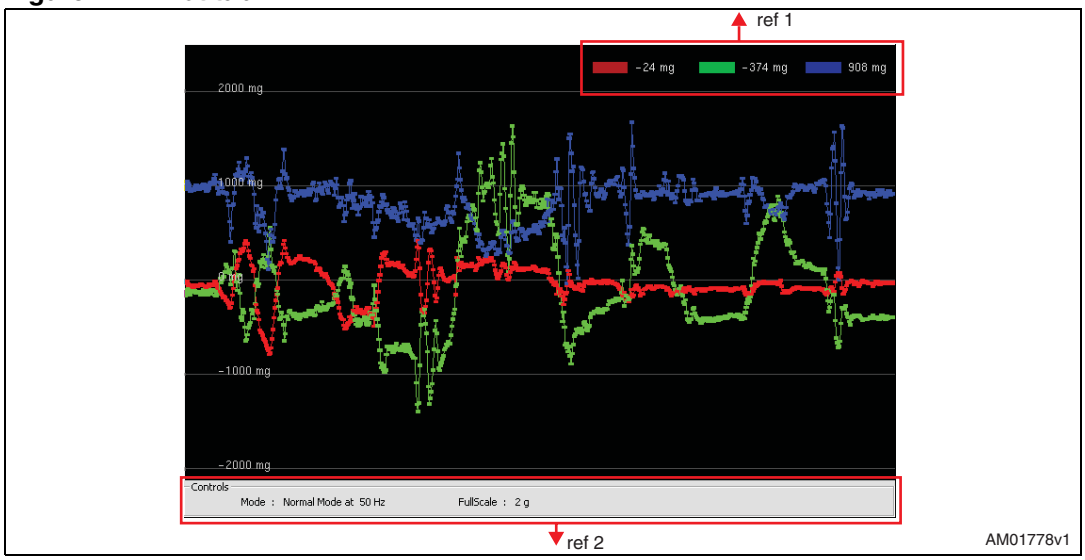
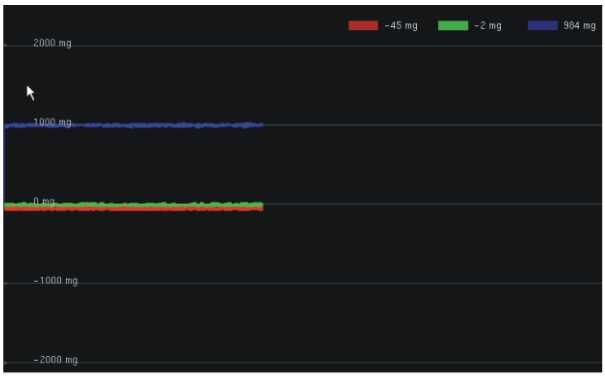


Figure 15. Plot tab - zoom

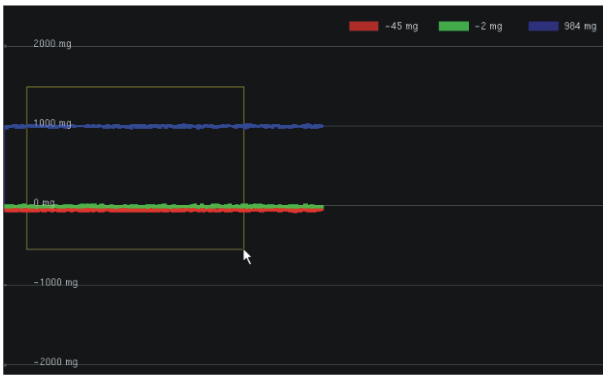
1) Select one point on the screen and click the LEFT mouse button





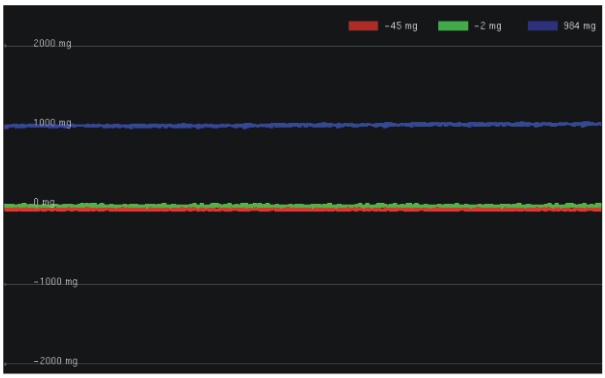
2) Holding the LEFT mouse button clicked, move the cursor to obtain an area on the screen





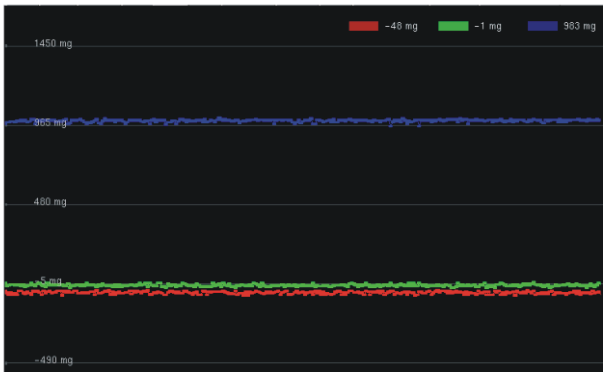
3) Releasing the button to terminate the Zoom in process, a new area is visualized on the screen





4) To return to the previous view the user has to click the RIGHT mouse button





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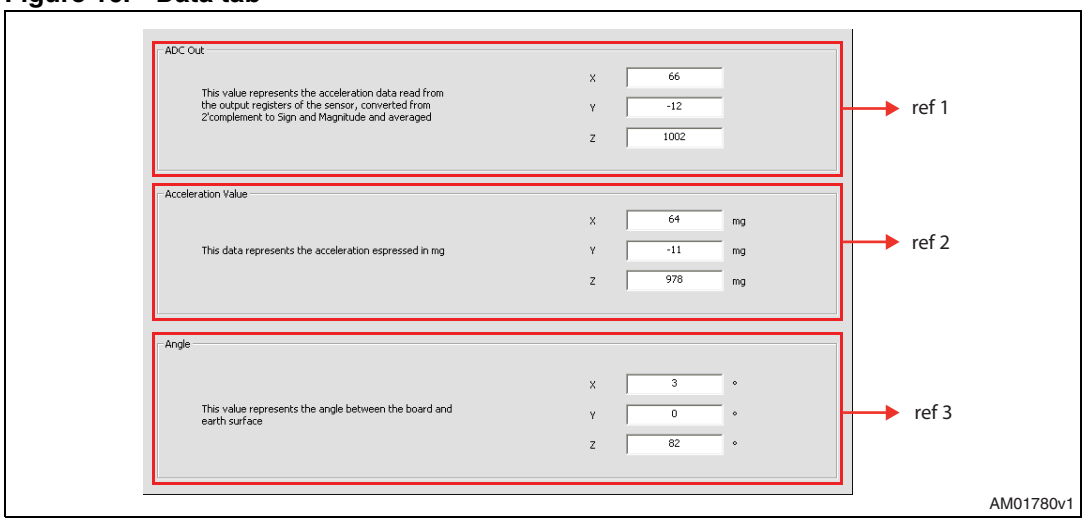
3.7 “Data” tab

The data tab (*Figure 16*) shows the acceleration values measured by the LIS331DL sensor. It is divided into three sections:

1. “ADC Out” (*Figure 16*, ref 1) - displays the acceleration data provided by the sensor after its conversion from 2’s complement to magnitude and sign
2. “Acceleration Value” (*Figure 16*, ref 2) - represents the acceleration data measured by the sensor, expressed in mg
3. “Angle” (*Figure 16*, ref 3) - returns the tilt angle, expressed in degrees, that is inferred from the “ADC Out” data

Note: To increase data readability, the values shown in the boxes described above are based on an average of 50 samples.

Figure 16. Data tab



3.8 “Inclinometer” tab

The inclinometer tab (*Figure 17*) represents the acceleration data measured by the sensor in the form of an artificial horizon.

Figure 17. Inclinometer tab

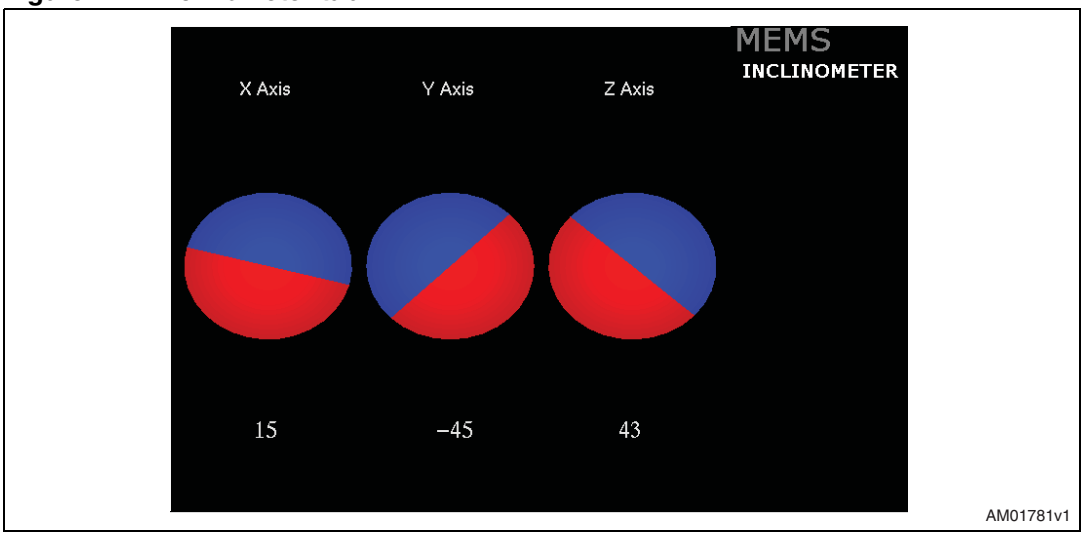
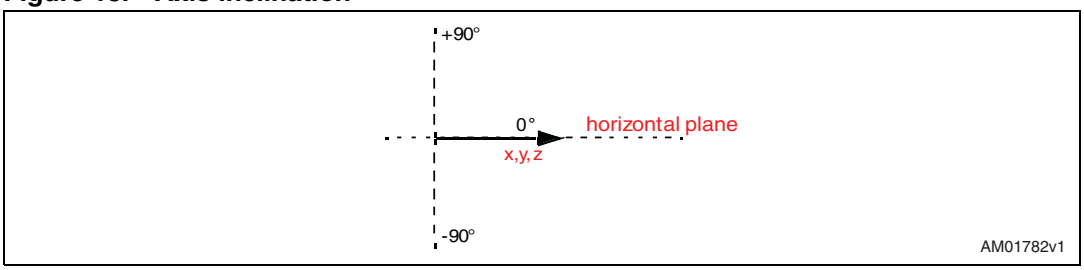


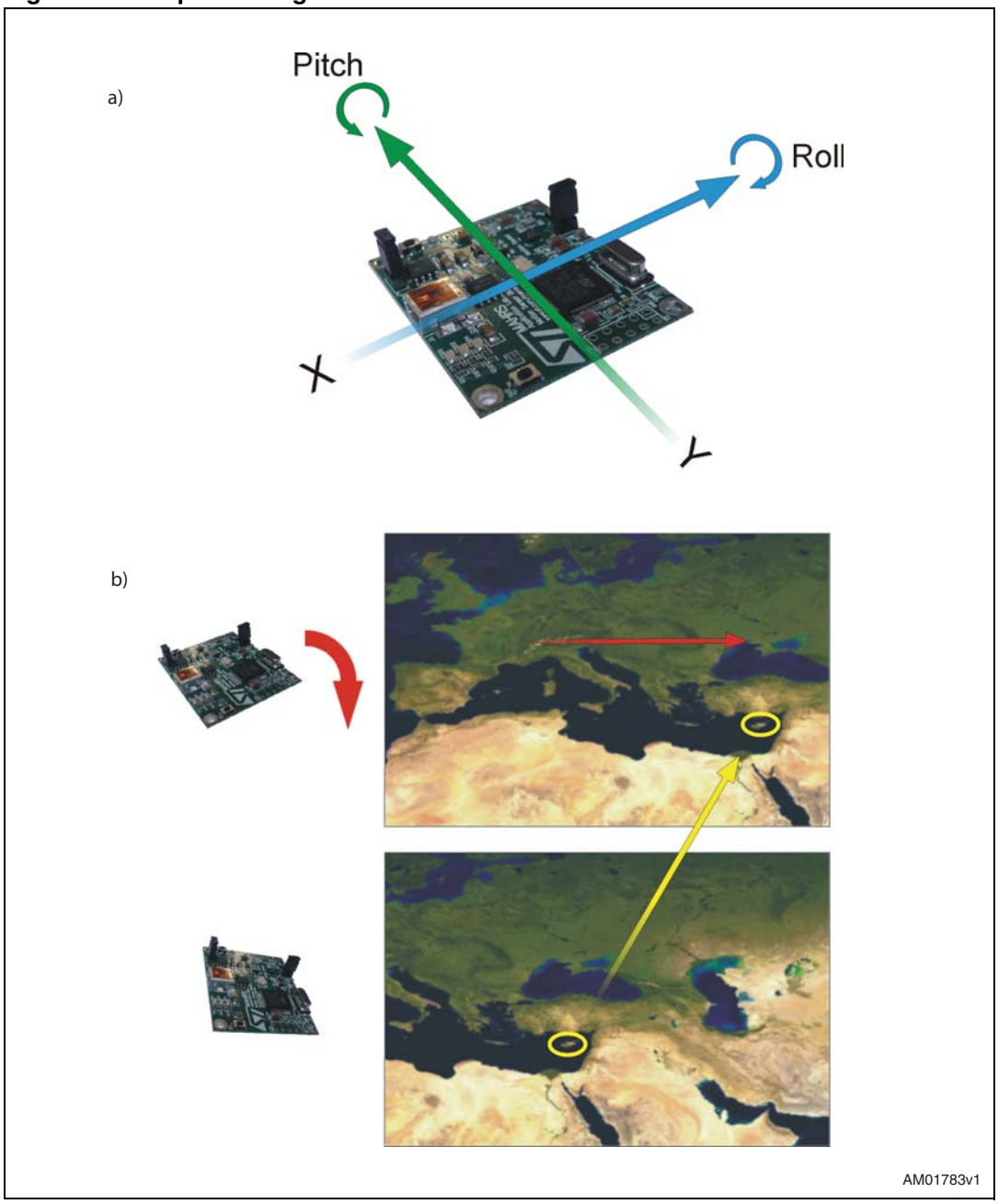
Figure 18. Axis inclination



3.9 “Map Browsing” tab

The map browsing tab demonstrates the possibility of using the acceleration data obtained from the sensor to scroll a map (or another type of document) on the screen.

Figure 19. Map browsing tab



To move the map on the screen, the user must tilt the demonstration kit.

Figure 19, (a) illustrates:

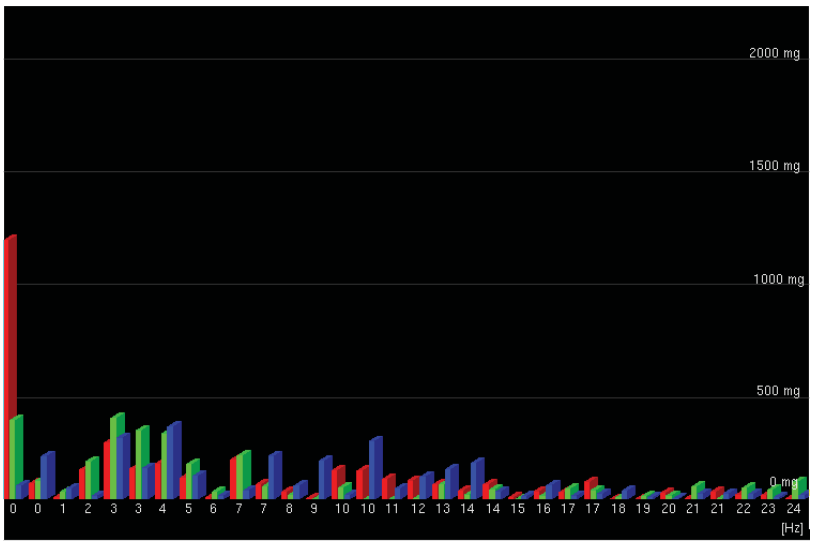
1. a tilt along the X-axis (roll) causes the map to move in a left/right direction on the screen
2. a tilt along the Y-axis (pitch) causes the map to move in a top/bottom direction on the screen

Figure 19 (b) shows an example. The board is tilted along the X-axis (positive roll) and the map on the screen is moved to the right.

3.10 “FFT” tab

The FFT tab (*Figure 20*) shows the FFT of the acceleration signals acquired by the sensor. The spectral data are updated every sample and are calculated on a 64-sample moving window.

Figure 20. FFT tab



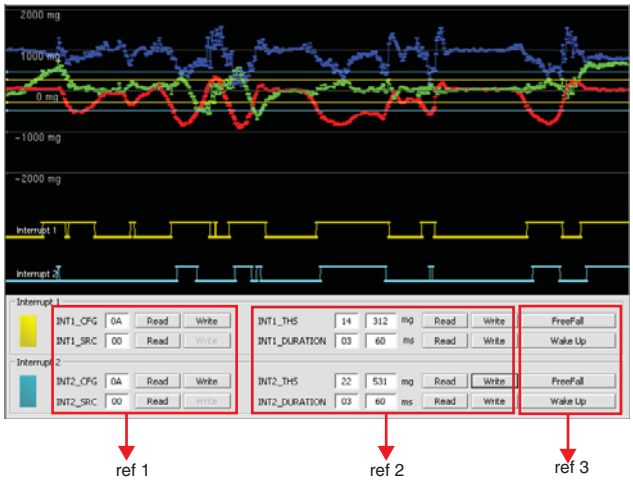
3.11 “Interrupt” tab

The interrupt tab (*Figure 21*) provides a tool for evaluating the interrupt generation features of the LIS331DL MEMS sensor. In this section of the GUI it is possible to configure the characteristics of the inertial events that must be recognized by the device and to visualize, in real-time, the level of the two interrupt lines together with the acceleration signals that are measured by the device.

The GUI provides direct access to the registers (INT_CFG, INT_SRC, THS and duration) that allow the configuration (*Figure 21*, ref 1) of the two independent interrupt sources of the device. Conversion boxes are located on the right-most side of the THS and DURATION registers (*Figure 21*, ref 2). These boxes are intended to show, respectively, the threshold value expressed in mg and the duration value converted in msec for better readability and understanding.

Finally, two buttons are provided for each interrupt line to set the suggested default values for free-fall and wakeup detection. Those buttons are marked “Set FreeFall Default” and “Set Wake Up Default”, respectively (*Figure 21*, ref 3).

Figure 21. Interrupt tab



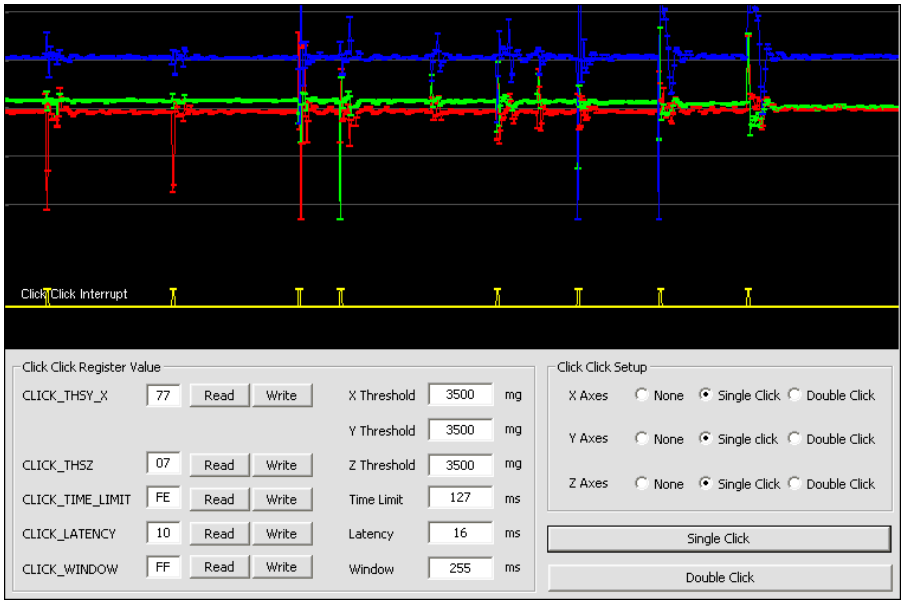
3.12 “Click Click” tab

The Click Click tab (*Figure 22*) is a tool to evaluate the “Click Recognition” funtion of the LIS331DL MEMS sensor. This function allows the recognition of a “Single Click” and a “Double Click” event and provides an interrupt when the event occurs.

Acceleration data (top section) and recognized Click events (bottom section) are plotted in real time for each axis. This tab provides direct access to the registers (CLICK_THSY_X, CLICK_THSZ, CLICK_TIME_LIMIT, CLICK_LATENCY, CLICK_WINDOW), allowing the user to fully configure the “Click Recognition” function and the external interrupt lines.

Two buttons allow the user to set standard values for single and double click.

Figure 22. Click Click tab



4 Data acquisition quick start

This section describes the basic steps that must be performed to acquire the acceleration data from the STEVAL-MKI024V1:

1. connect the STEVAL-MKI024V1 to the USB port
2. start the STEVAL-MKI024V1 GUI
3. select the Virtual COM port and click on the “Connect” button (*Figure 9*, ref 1)
4. select the destination file to which the acceleration data must be saved by clicking “Save” (*Figure 9*, ref 2) in the main control section (optional)
5. use the tab menu to display the desired function
6. click on the “START” (or ”STOP”) button to activate (or stop) the sensor data collection, saving to file, and screen plotting functions
7. to close the application, click on “Disconnect” and then click on “Exit”

5 EK lite

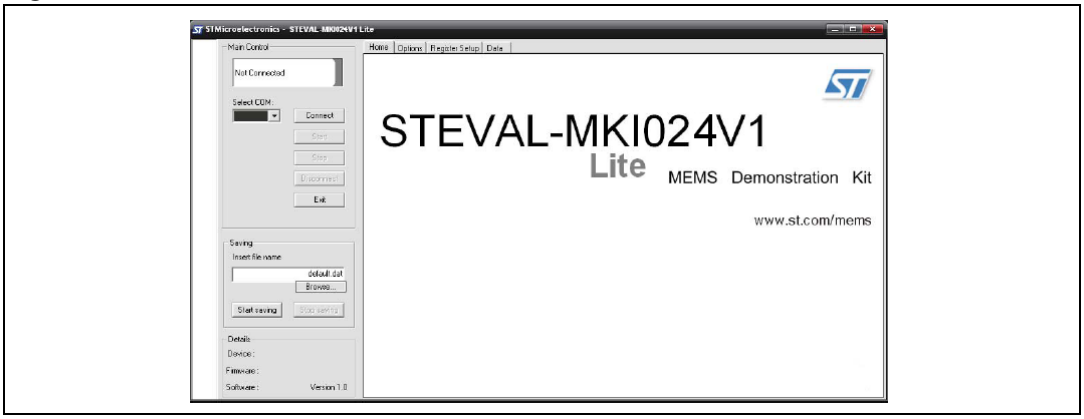
A lite version of the previous GUI together with its source code is also included in the installation pack. The source code can be found in the directory: ($Home)\STM\STEVAL-MKI024V1\STEVAL-MKI024V1_lite, where ($Home) is the directory in which the software that came with the demonstration kit was installed (C:\Program Files by default).

The purpose of the lite version is to provide the user with a base for the development of a customized application.

The lite version of the demonstration kit is started by launching the STEVAL-MKI024V1 lite executable file located in the STEVAL-MKI024V1 > Executables folder.

An example of the GUI of the EK lite application is shown in *Figure 23*.

Figure 23. STEVAL-MKI024V1 lite GUI



Follow these instructions to use the software:

1. connect the STEVAL-MKI024V1 to the USB port
2. launch the GUI for STEVAL-MKI024V1 lite
3. select the virtual COM port and click on the “Connect” button
4. select the destination file to which the acceleration data must be saved (optional)
5. click on the “START” (or ”STOP”) button to activate (or stop) the sensor data collection, saving to file, and screen plotting functions
6. to close the application, click on “Disconnect” and then click on “Exit”

The GUI also gives read/write access to the registers embedded in the LIS331DL device and allows a single read of the acceleration data measured by the sensor.

6 MEMS pointer

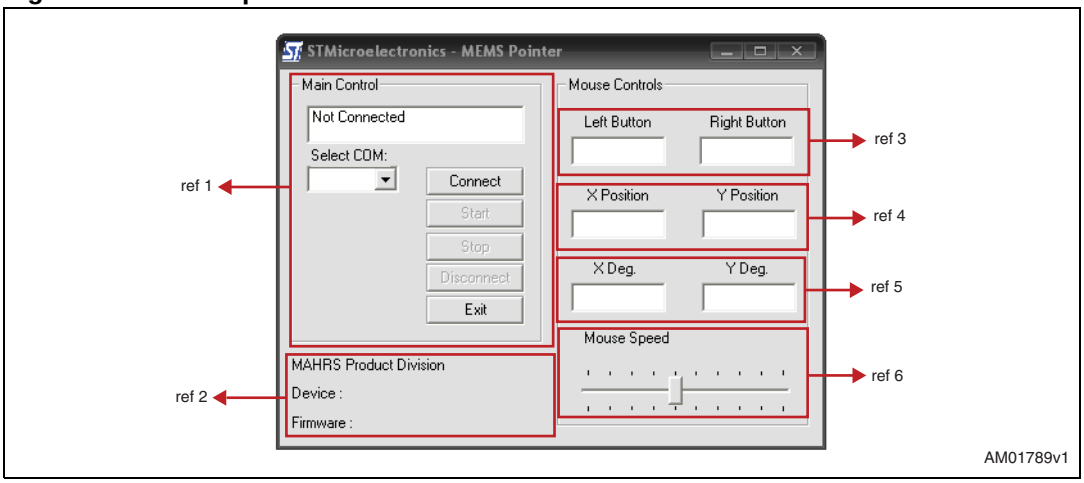
This section describes how to use a simple pointer application which utilizes acceleration data provided by the LIS331DL MEMS 3-axis linear accelerometer to control the position of a pointer on the screen of the PC. The software provided with the kit allows the STEVAL-MKI024V1 demonstration kit to be used as an inertial mouse, where the tilt of the board is translated into movement of the pointer. The board also emulates the left and right buttons of the mouse.

6.1 GUI description

The GUI window (see *Figure 24*) is divided into two sections. The left section contains the main controls to open the connection to the demonstration kit and to start/stop the data acquisition (ref 1). The bottom section contains the demonstration kit details (device and firmware, ref 2).

The right section shows the same data and the mouse speed control.

Figure 24. MEMS pointer demonstration



6.1.1 Left side: main control

The buttons on the left side of the GUI and their related functions are described below:

1. Connect/disconnect control - selects the COM port to which the EK board is connected
2. Acquisition control - starts and stops acquisition
3. Exit - exits the MEMS pointer demonstration application

6.1.2 Right side: pointer application controls

The controls on the right side of the GUI and their related functions are as follows:

1. Left button/right button - indicates when the left/right button on the demonstration kit is pressed (ref 3)
2. X/Y-position - shows the current x/y coordinates of the mouse pointer on the PC screen (ref 4)
3. X/Y-deg - shows the tilt of the demonstration kit along the X and Y axes (ref 5)
4. Pointer speed - sets the sensitivity of the pointer to the inclination of the board (ref 6)

7 Supported commands

The microcontroller mounted on the STEVAL-MKI024V1 board is equipped with dedicated firmware which supports a set of commands that allow the control of the 3-axis digital output MEMS sensor and permit the acquisition of the measured acceleration data. The firmware also handles the communication between the EK board and the PC through the USB bus. These features allow users to easily write their own applications to exploit the capabilities of the accelerometer.

This section describes the commands that are supported by the firmware for the microcontroller of the STEVAL-MKI024V1 demonstration kit.

7.1 Getting started

Before using the commands supported by the firmware, the following procedure must be performed:

1. connect the STEVAL-MKI024V1 to the USB port
2. launch an application which allows the sending of commands through the Virtual serial port. The remainder of this document assumes the use of the Microsoft© Hyper Terminal program integrated in the Windows® XP operating system
3. create a new connection, enter a name (ex. “STEVAL-MKI024V1”), and click “OK”
4. in the “Connect Using” field, select the Virtual COM port to which the USB port has been mapped, and click “OK”
5. in port settings, set bits per second to 115200, data bits to 8, parity to none, stop bits to 1, and flow control to none. Click “OK”
6. in the hyper terminal select files > properties > settings and then click on the “ASCII Setup” button
7. select “Send line ends with line feeds” and “Echo typed characters locally”
8. click the “OK” button to close the “ASCII Setup” window
9. click the “OK” button to close the “Properties” window

Once this procedure has been completed the user can utilize the commands described in the following sections by typing them into the “hyper terminal” window.

7.2 Supported commands

The table below lists the commands supported by the STEVAL-MKI024V1 firmware:

Table 1. Supported commands

Command	Description	Returned value
*start	Starts continuous data acquisition	s t x y z I1 I2 s
*debug	Returns the acceleration data in readable text format	x=XX y=YY z=ZZ
*stop	Stops data acquisition	
*rAA	Register read	RAAhDDh

Table 1. Supported commands (continued)

Command	Description	Returned value
*wAADD	Register write	
*bwAA<0:7><0l1>	Single bit write	
*Zon	Force 3-state	
*Zoff	Exit from 3-state	
*dev	Device name	LIS331DL
*ver	Firmware version	331DL 1.0

Note: *AA: register address*

DD: data

S: service field

X, Y, Z: Acceleration data returned for the X, Y and Z axes

I1, I2 : interrupt value on each axis.

7.2.1 Start command

The *start command initiates the continuous data acquisition. When this command is sent to the board, it returns the acceleration data measured by the LIS331DL device. The acceleration data are packed in a string composed of eight bytes: “s t x y z I1 I2 s”. The first two bytes are always *“s”* and *“t”* which correspond to the hexadecimal values {73 74}, while “*X” “Y” “Z”* represent, respectively, the acceleration data for the X, Y, Z axes.

“I1” and *“I2”* contain the values of FF_WU_SRC1 and FF_WU_SRC2, where each bit is a specific interrupt.

The last byte *“s”* returns information about the switches mounted on the board. Specifically, bit#1 and bit#0 of the "service data" correspond to the status of SW3 and SW2 on the demonstration kit board, and they are set to 1 when the corresponding switch is pressed.

7.2.2 Debug command

The debug command starts the continuous data acquisition in debug mode. When this command is sent to the board, it returns the acceleration data measured by the LIS331DL device in readable text format. The values shown on the screen correspond to the content of the output data registers and are shown as a decimal number. A tab is employed as a separator between the different fields.

7.2.3 Stop command

The *stop command interrupts any acquisition session that has been started with either the *start or *debug commands.

7.2.4 Register read

The *rAA command allows the contents of the LIS331DL device registers in the demonstration kit board to be read. AA, expressed as hexadecimal value and written upper-case, represents the address of the register to be read.

Once the read command is issued, the board returns RAAhDDh, where AA is the address sent by the user and DD is the data present in the register.

For example, to read the CTRL_REG1 the user would issue the command *r20, which returns R20hC7h.

7.2.5 Register write

The *wAADD command permits writing to the contents of the LIS331DL device registers in the demonstration kit board. AA and DD, expressed as hexadecimal values and written upper-case, represent respectively the address of the register and the data to be written. To write 0x47 to the CTRL_REG1, for example, the user would issue the command *w2047.

7.2.6 Single bit write

Using this command it is possible to set/reset a single bit in a given register. The command *bwAA<0:7><0|1> requires the user to specify the address AA of the register in which to change the bit, with AA expressed as a hexadecimal value and written in lower-case, followed by the position of the bit to be changed, an integer between 0 and 7, and the value, either 0 or 1, to be associated to the specified bit.

For example, to set the FS bit to 1 within the CTRL_REG2, the user would issue the command *bw2171.

7.2.7 Zon and Zoff

The *Zon and *Zoff commands are employed respectively to put into 3-state (i.e. high-impedance) and to exit (i.e. normal mode) the SPI lines of the ST7-USB microcontroller mounted on the demonstration kit. These commands allow the isolation of the sensor from the microprocessor in the event that an external control (from a different microcontroller mounted on a separate board) is needed.

By default, when the kit is first turned on, the SPI lines are in 3-state mode and the user is required to send the command *Zoff to allow communication between the sensor and the microcontroller.

7.2.8 Device name

The *dev command retrieves the name of the device mounted on the demonstration kit connected to the PC. For the STEVAL-MKI024V1, the returned value is *“LIS331DL”*.

7.2.9 Firmware version

The *ver command queries the demonstration kit and returns the version of the firmware loaded in the microprocessor.

7.3 Quick start

This section shows the basic sequence of commands to start a data communication session and to retrieve the acceleration data from the demonstration kit:

1. connect the STEVAL-MKI024V1 to the USB port
2. start “Microsoft© Hyper Terminal” and configure it as described in *Section 7.1*
3. inside the “Hyper Terminal” window, enter the command *Zoff to enable the control of the SPI line from the ST7-USB microcontroller
4. send the *debug command to get the acceleration data measured by the sensor
5. send *stop to end the continuous acquisition and visualization

8 DFU

The MEMS device firmware update GUI is a graphical interface that allows the user to download and replace the firmware of an STMicroelectronics MEMS product demonstration board directly from a PC through the USB port.

The MEMS demonstration boards that mount an ST7-USB microcontroller have the capability of reprogramming an application through the USB, in accordance with the DFU class specification defined by the USB Implementers Forum. This capability is useful because it allows reprogramming the microcontroller directly in the field and is particularly well-suited in USB applications where the same USB connector can be used both for the standard operating mode and for the reprogramming process.

Connector J4 must be shorted to allow the DFU procedure. If the demonstration kit is going to be reprogrammed through the ICP connector and the ST7 dedicated tools, J4 must be open.

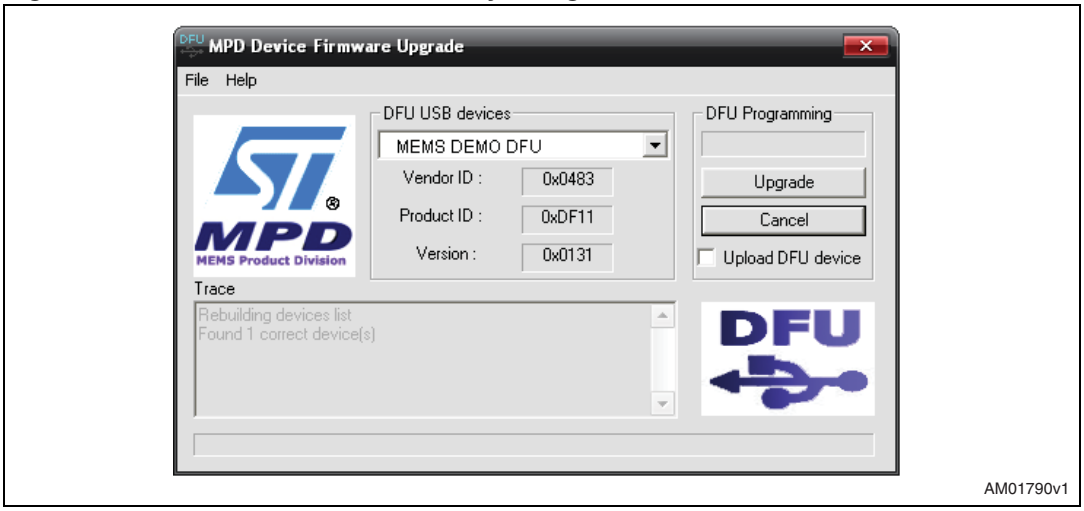
8.1 PC requirements

In order to use the device firmware upgrade (DFU) software with the Windows operating system, a recent version of Windows, such as Windows 98, Windows 98SE, Windows Millennium, Windows 2000 or Windows XP must be installed on the PC.

8.2 DFU procedure

Run the DFU.exe file. To enter the firmware update mode the user must plug in the USB cable to the demonstration kit while pressing Button 2 (*Figure 25*).

Figure 25. Demonstration kit correctly recognized



The DFU driver must be installed before using this feature. The driver can be found in “firmwareupdate.zip” in the driver installation folder of the demonstration kit.

After installation, “MEMS demonstration DFU” appears in the DFU USB devices list (*Figure 25*).

To execute the firmware upgrade:

6. click on File > Open, then locate the directory where the ".dfu" file has been downloaded and select it (*Figure 26*)
7. click on "Upgrade"
8. the internal flash memory is erased (*Figure 27*) and reflashed with the new firmware (*Figure 28*).

Once the procedure is finished, a windows message appears, stating that a USB device is not recognized. The USB cable can be unplugged from the EK demonstration board and used with the new firmware.

In order to back up the current firmware before flashing the demonstration kit with a new one, flag "Upload DFU device" (*Figure 25*) before clicking on "Upgrade". A prompt to save the current firmware in your preferred directory will appear before the erasing of the internal flash.

Figure 26. Select new firmware

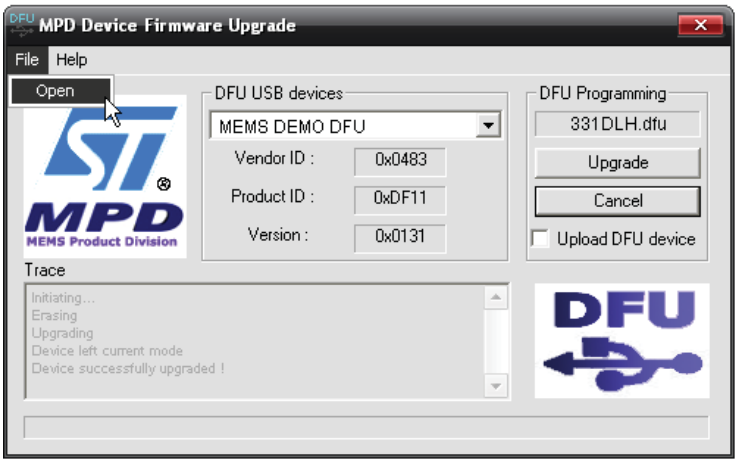


Figure 27. Flash erasing

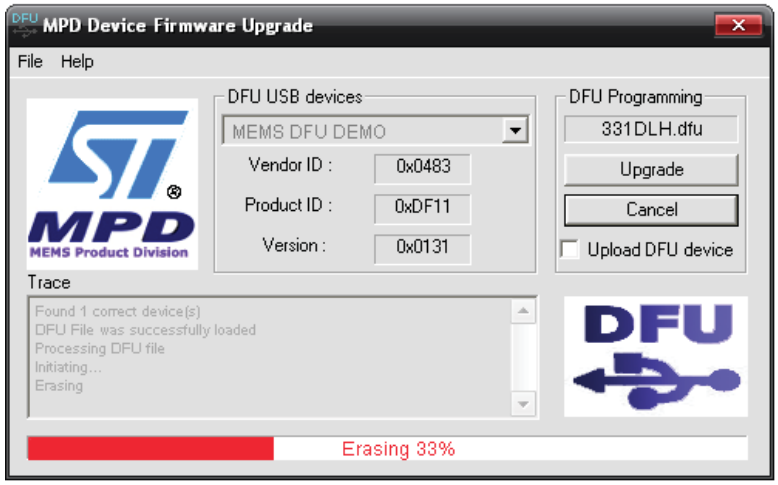
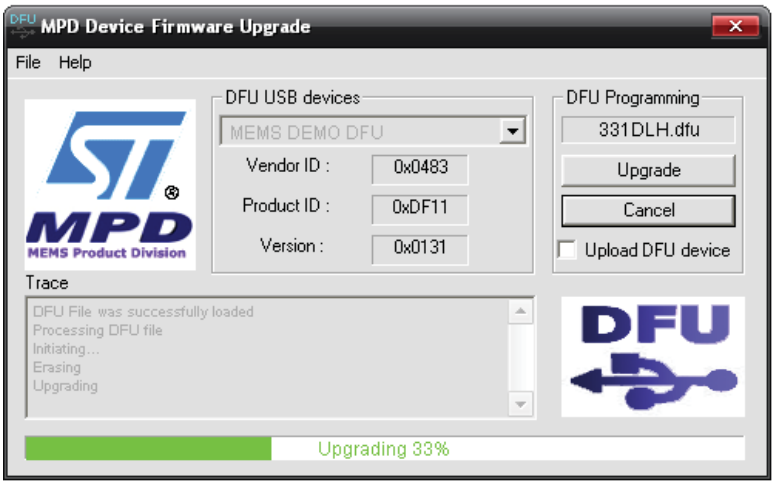
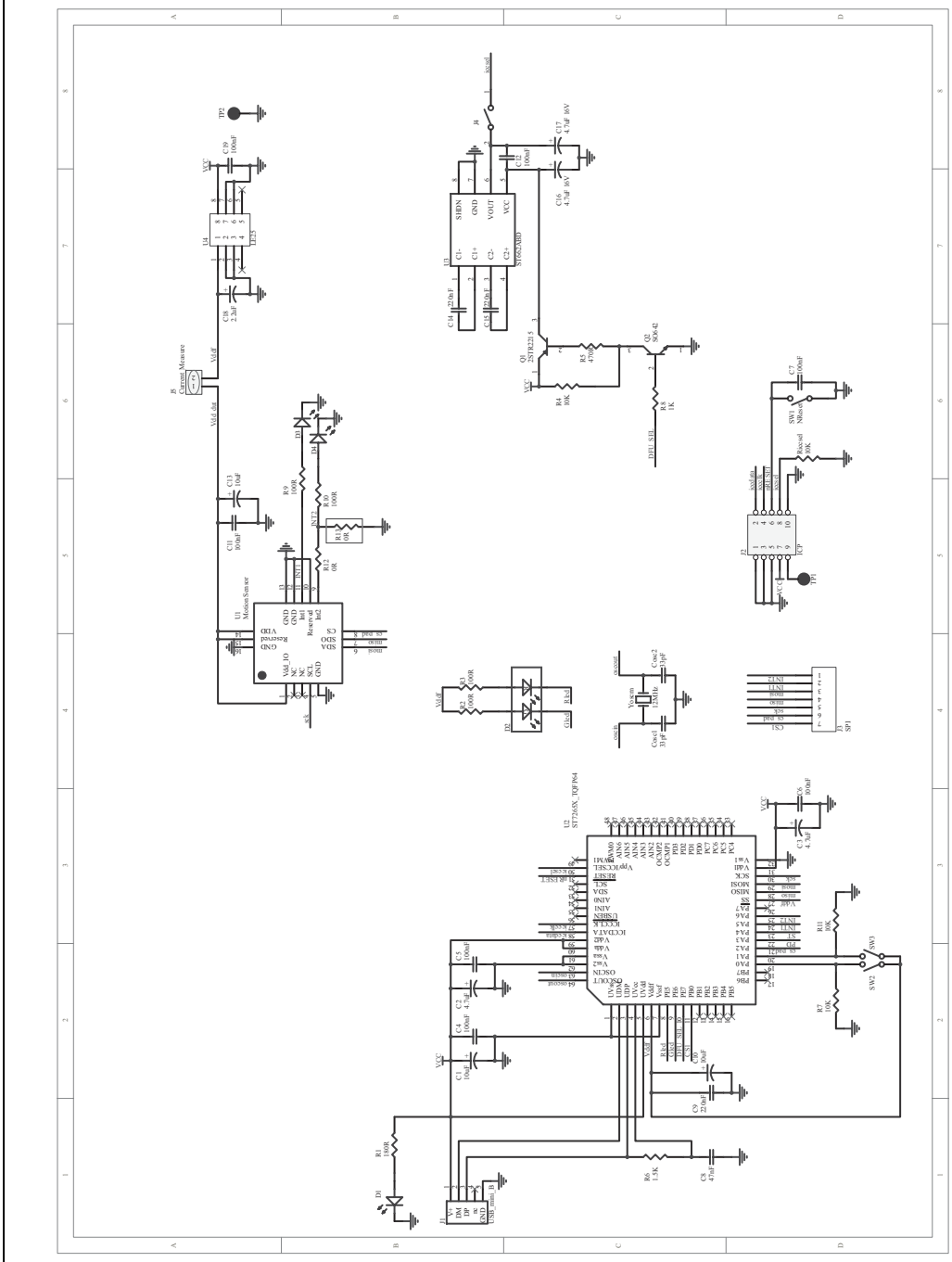


Figure 28. Flash upgrading



9 Schematic diagram

Figure 29. Schematic diagram of the STEVAL-MKI024V1 board



10 Bill of materials

The bill of materials for the STEVAL-MKI024V1 demonstration kit is provided in *Table 2*.

Table 2. Bill of materials

Designator	Description	Comment	Footprint
C1	Capacitor	10 µF	C1206_POL
C2	Capacitor	4.7 µF	C1206_POL
C3	Capacitor	4.7 µF	C1206_POL
C4	Capacitor	100 nF	0805
C5	Capacitor	100 nF	0805
C6	Capacitor	100 nF	0805
C7	Capacitor	100 nF	0805
C8	Capacitor	47 nF	0805
C9	Capacitor	220 nF	0805
C10	Capacitor	10 µF	C1206_POL
C11	Capacitor	100 nF	0805
C12	Capacitor	100 nF	0805
C13	Capacitor	10 µF	C1206_POL
C14	Capacitor	220 nF	0805
C15	Capacitor	220 nF	0805
C16	Capacitor	4.7 µ 16 V	C1206_POL
C17	Capacitor	4.7 µ 16 V	C1206_POL
C18	Capacitor	2.2 µF	C1206_POL
C19	Capacitor	100 nF	0805
Cosc1	Capacitor	33 pF	0805
Cosc2	Capacitor	33 pF	0805
D1	LED	SMD_LED green	SMD_LED
D2	LED	SMD_LED 3C	SMD_LED_3C
D3	LED	SMD_LED green	SMD_LED
D4	LED	SMD_LED red	SMD_LED
J1	USB connector	USB_B_mini	USB_B_mini
J2	Header, 5X2	ICP	HEADER_5X2_A
J3	Header, 7-pin	SPI	HDR1X7
J4	Header, 2-pin	DFU jumper	HDR1X2
Q1	Transistor		2STR2215
Q2	Transistor		SO624
R1	Resistor	180 Ω	0805
R2	Resistor	100 Ω	0805
R3	Resistor	100 Ω	0805
R4	Resistor	10 kΩ	0805

Table 2. Bill of materials (continued)

Designator	Description	Comment	Footprint
R5	Resistor	470 Ω	0805
R6	Resistor	1.5 kΩ	0805
R7	Resistor	10 kΩ	0805
R8	Resistor	1 kΩ	0805
R9	Resistor	100 Ω	0805
R10	Resistor	100 Ω	0805
R11	Resistor	10 kΩ	0805
R12	Resistor	0 Ω	0805
R13	Resistor	0 Ω	0805
Riccsel	Resistor	10 kΩ	0805
SW1	Button	NReset	SMT_Button
SW2	Button	SMT_Button	SMT_Button
SW3	Button	SMT_Button	SMT_Button
TP1	Test point	TP	TP
TP2	Test point	GND	TP
U1		LIS331DL	TLGA_3x3x1
U2		ST72F651AR6T1E	TQFP64_10x10
U3		ST662ABD	SO-G8
U4		LE25	SO8
Yoscm1	Crystal	12 MHz	OSC_SMD

11 Revision history

Table 3. Document revision history

Date	Revision	Changes
07-Apr-2009	1	Initial release

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