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MSP430-JTAG-ISO-MK2
professional MSP430 programmer/debugger

USER'S MANUAL

Revision J, April 2014
Designed by OLIMEX Ltd, 2012



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Table of Contents

<u>DISCLAIMER.....</u>	<u>2</u>
<u>CHAPTER 1: OVERVIEW.....</u>	<u>4</u>
<u>1. Introduction to the chapter.....</u>	<u>4</u>
<u>1.1 Features.....</u>	<u>4</u>
<u>1.2 Target market and purpose of the device.....</u>	<u>5</u>
<u>1.3 Organization of this document.....</u>	<u>5</u>
<u>CHAPTER 2: REQUIREMENTS AND FIRST START-UP.....</u>	<u>6</u>
<u>2. Introduction to the chapter.....</u>	<u>6</u>
<u>2.1 Electrostatic warning.....</u>	<u>6</u>
<u>2.3 Hardware requirements.....</u>	<u>6</u>
<u>2.4 Software requirements.....</u>	<u>6</u>
<u>2.5 First time start-up.....</u>	<u>7</u>
<u>2.6 Rowley Crossworks installation.....</u>	<u>8</u>
<u>CHAPTER 3: MSP430-JTAG-ISO-MK2 BOARD DESCRIPTION.....</u>	<u>10</u>
<u>3. Introduction to the chapter.....</u>	<u>10</u>
<u>3.1 Basic device description.....</u>	<u>10</u>
<u>CHAPTER 4: MODES OF OPERATION.....</u>	<u>12</u>
<u>4. Introduction of the chapter.....</u>	<u>12</u>
<u>4.2 Debugger mode.....</u>	<u>13</u>
<u>4.3 Mass storage mode.....</u>	<u>14</u>
<u>4.4 Stand alone mode.....</u>	<u>15</u>
<u>4.4.1 Opening an existing project.....</u>	<u>16</u>
<u>4.4.1.1 Editing the open project.....</u>	<u>16</u>
<u>4.4.1.2 Writing in an existing project.....</u>	<u>17</u>
<u>4.4.4 Reading from a microcontroller “READ”.....</u>	<u>18</u>
<u>CHAPTER 5: OPJ file format.....</u>	<u>19</u>
<u>CHAPTER 6: DIMENSIONS.....</u>	<u>21</u>
<u>6. Introduction to the chapter.....</u>	<u>21</u>
<u>CHAPTER 7: REVISION HISTORY, WEB LINKS AND SUPPORT.....</u>	<u>22</u>
<u>7. Introduction to the chapter.....</u>	<u>22</u>
<u>7.1 Document revision.....</u>	<u>22</u>
<u>7.2 Device revision.....</u>	<u>23</u>
<u>7.3 Firmware revision.....</u>	<u>23</u>
<u>7.4 Useful web links and purchase codes.....</u>	<u>24</u>
<u>7.5 Product support.....</u>	<u>25</u>

CHAPTER 1: OVERVIEW

1. Introduction to the chapter

Thank you for choosing the MSP430-JTAG-ISO-MK2 debugger/programmer! This document provides a user's guide for the Olimex MSP430-JTAG-ISO-MK2. As an overview, this chapter gives the scope of this document and lists the board's features. The document's organization is then detailed.

The MSP430-JTAG-ISO-MK2 programmer/debugger development board enables code uploading of applications running on MSP430 microcontrollers, manufactured by Texas Instruments.

The product is our most sophisticated MSP430 programmer/debugger and has many improvements over the our previous MSP430 tools.

1.1 Features

- Supports both JTAG and SBW interfaces
- Ultra fast programming 14KB/s faster several times than TI-USB-FET (1.4KB when spy-bi-wire)
- Opto-isolation 1000VDC, target circuit can be high voltage powered (electricity meters safe debugging)
- Can burn the MSP430 JTAG security fuse in debugger and standalone mode
- LCD display for convenient navigation between different modes of operation
- 1,76 GB internal memory available for custom code (standalone mode) or mass storage
- 3-different modes of operation – Debugger, Mass storage, Stand alone
- Can be powered either by external power or the USB interface
- Extended firmware features – target voltage display, target current consumption display
- Sleek and solid black case
- Easy navigation via 4 analog buttons
- Sophisticated custom-made front panel
- MSP430.dll makes it compatible with all existing software which works with TI-USB-FET (emulates TI-USB-FET) compatible with all MSP430 programming and debugging software
- 14-pin JTAG ribbon cable included
- Dimensions: 75mm x 111mm (2.95" x 4.37")

1.2 Target market and purpose of the device

MSP430-JTAG-ISO-MK2 is suitable for programming and debugging all Texas Instruments MSP430 microcontrollers which support JTAG or SBW (Spy-Bi-Wire) interfaces. The device is recommended for all MSP430 fans. It is especially convenient for mass production due to the ease of stand-alone programming and the ability to power targets.

The ISO means that you can't burn your target device by a bad USB port (or electric failure event – over voltage) nor you can burn the USB port from a bad target board since the USB and JTAG interfaces are optically isolated. Note that it is still possible to burn the ISO-MK2 from a target device or a bad PC port.

1.3 Organization of this document

Each section in this document covers a separate topic, organized as follow:

- Chapter 1 is an overview of the debugger's usage and features
- Chapter 2 lists the additional software and hardware means you might need for proper use of the device
- Chapter 3 contains detailed description of the board peripherals and the basic controls
- Chapter 4 describes the modes of operation
- Chapter 5 is an explanation of the file format used for stand-alone programming
- Chapter 6 shows the dimensions of MSP430-JTAG-ISO-MK2
- Chapter 7 contains the revision history, the useful web links and support information

CHAPTER 2: REQUIREMENTS AND FIRST START-UP

2. Introduction to the chapter

This section helps you set up the MSP430-JTAG-ISO-MK2 debugger for the first time. Please consider first the electrostatic warning to avoid damaging the device, then discover the hardware and software required to operate the board.

The procedure to power up the debugger is given, and a description of the default board behavior is detailed.

2.1 Electrostatic warning

MSP430-JTAG-ISO-MK2 is shipped in a carton package and features a plastic case. The board must not be exposed to high very high electrostatic potentials. Avoid touching the component pins or any other metallic element without wearing a ground strap.

2.3 Hardware requirements

The board can be powered either by the USB or by +12V external source. If you use the USB note that the connector is type B – to connect to a personal computer you will probably need USB-A to USB-B cable which is not included in the package. You can purchase such a cable from us, the code is:

USB-CABLE – USB standard type A to USB standard type B cable

Powering the board from external source is very convenient for stand alone mode since you don't need to be connected to a personal computer once you have uploaded the needed files on the SD card.

Note! When powered by +12V external source the ISO-MK2 debugger can provide maximum of 350mA of current to the target board. The 12V external is not meant to provide much additional current – it is meant to be used when no USB is available.

You might also use the +12V power supplies Olimex sells:

SY0612E – reliable power supply adapter 50Hz (for EU) 12V/0.5A

SY0612E-CHINA – cheaper power supply adapter 50Hz (for EU) 12V/0.5A

2.4 Software requirements

You will need a software set of tools to be able to debug with MSP430-JTAG-ISO-MK2 in debugger mode.

We distribute a free programmer software that can be used with MSP430-JTAG-ISO-MK2.

We have tested the device with the latest “Code Composer Studio” and “IAR embedded work bench for MSP430”.

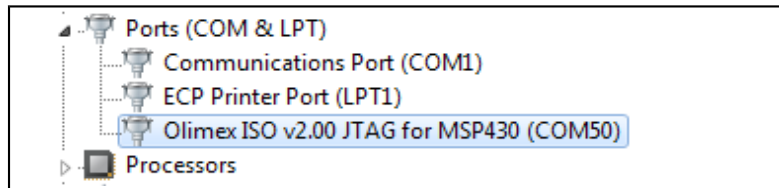
2.5 First time start-up

Setting up the MSP430-JTAG-ISO-MK2 for development purposes might vary between different users. However, at least a personal computer with a working USB port and a cable USB type A to USB type B are required.

Connect the device to the computer via the cable. At first the device won't show as a new or recognized device. Depending on the mode of operation you choose (debugger, mass storage or stand alone) a driver might be required for proper operation. If the driver is installed properly and you are in stand-alone mode new device should be recognized properly by the device manager.

You need to install the latest drivers that can be downloaded from our web site. Navigate to MSP430 section and then to the web page of MSP430-JTAG-ISO-MK2 they are located in the software section. After downloading and extracting the archive plug the debugger to the computer and enter “debugger mode” with the right arrow. You will then discover new unrecognized device in device manager. Right click over it and point the installer to “Drivers” folder from the archive. Ignore the warning and the drivers should install successfully.

After successful installation of the drivers and when in debugger mode the device should be shown in device manager as show below:



It might be a good idea at this point to change the COM port number to a free one in the 1-4 range since some software tools does not enumerate all COM ports.

You will also need to replace the MSP430.dll and/or olimex.dll in your software tools (e.g. IAR EW for MSP, Code Composer Studio, Rowley Crossworks, or similar TI FET dll compatible IDE) driver's folder with the one downloaded from our web-site. This is a required step to ensure that your software will work with our product.

The default location of the .dll for IAR EW for MSP is \IAR Systems\Embedded Workbench x.x\430\bin.

The default location of the .dll for CCS4 for MSP is \Texas Instruments\ccsv4\DebugServer\drivers.

The default location of the .dll for CCS5 for MSP is C:\ti\ccsv5\ccs_base\DebugServer\drivers.

After replacing the dlls restart your IDE. If prompted for firmware update the next time you debug (and device in debugger mode) choose to update the firmware.

If you use Rowley Crossworks please refer to the next chapter in the manual

Then in the software tools select as tool TI USB or OLIMEX USB depending which dll you replaced.

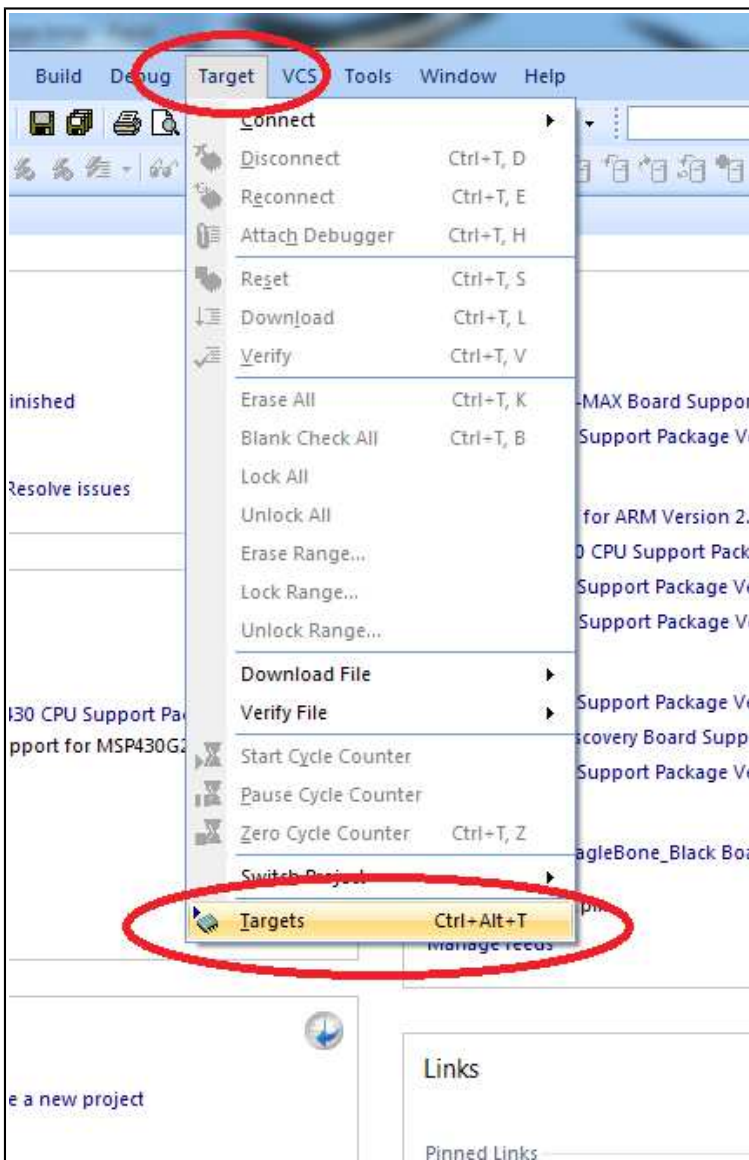
It is recommended to check the device's web page for firmware updates. In time newer devices

would receive support and bugs will be fixed. The procedure for firmware update requires replacing the older .dll files with the newer ones. If something extra has to be done it would be mentioned in the supporting the drivers README.txt.

2.6 Rowley Crossworks installation

To install the ISO-MK2 debugger with Rowley Crossworks is fairly simple. The algorithm is listed below:

1. Download the latest drivers/firmware archive from ISO-MK2's product page
2. Extract it at a chosen location
3. Open Rowley Crossworks for MSP430
4. Navigate to “Target” → “Targets” (as shown in the picture below)

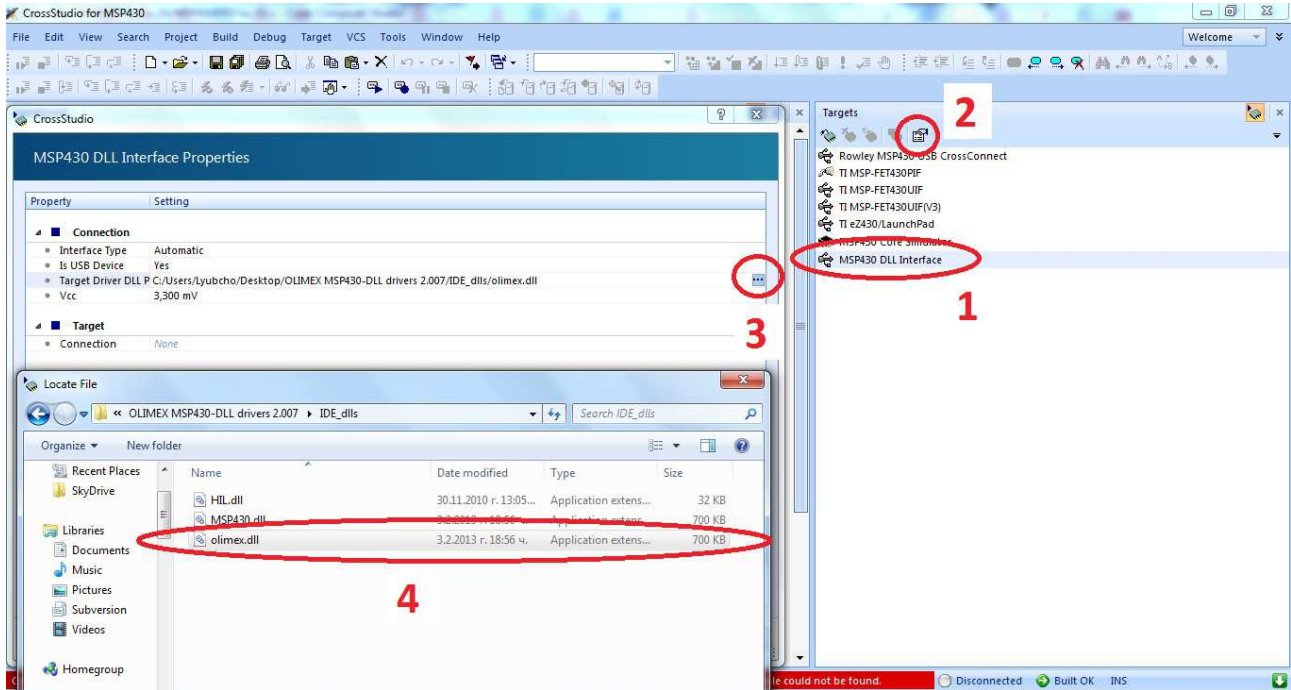


5. In the “Targets” pane that is now open highlight “MSP430 DLL Interface” and click “Properties” over it
6. Point the DLL path in the properties windows that showed up to the Olimex.dll in the extracted

archive, and more specifically, the Olimex.dll located in folder “IDE_dlls”.

7. Connect to the debugger.

The actions described in points 5, 6 and 7 are shown in the picture below:



CHAPTER 3: MSP430-JTAG-ISO-MK2 BOARD DESCRIPTION

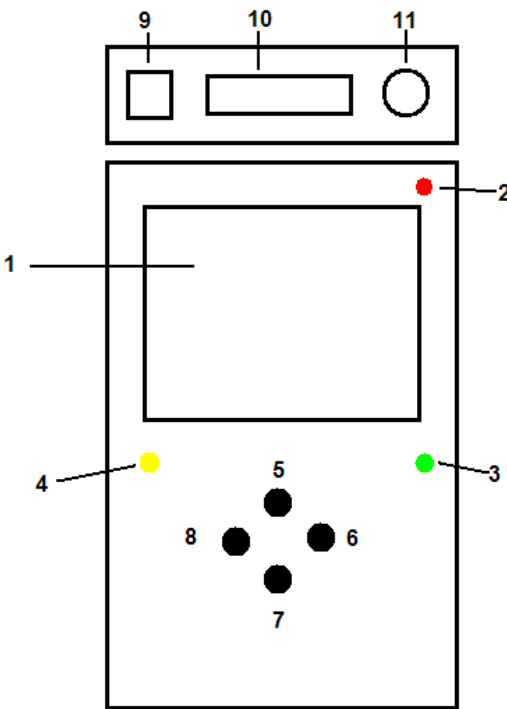
3. Introduction to the chapter

Here you get acquainted with the main parts of the board and their location on the case. Some of the elements are named near their position on the case of MSP430-JTAG-ISO-MK2.

3.1 Basic device description

In the table below are show the main parts of the board and their positioning on the case.

MSP430-JTAG-ISO-MK2 description	
#	Function
1	Display
2	Power LED
3	Status LED
4	Communication LED
5	Up/Increment button
6	Select button
7	Down/Decrement button
8	Mode/Back button
9	USB connector
10	JTAG/SBW connector
11	External power connector



The diagram shows a rectangular case with a display area (1) in the upper center. To the right of the display is a red LED (2). Below the display are four buttons: a yellow LED (4) to the left, and three black buttons (5, 6, 7) in a cluster. A green LED (3) is to the right of the buttons. At the top edge, there are three connectors: a square USB connector (9) on the left, a rectangular JTAG/SBW connector (10) in the middle, and a circular external power connector (11) on the right.

The functions supported are further explained in the next chapters of this document.

The LEDs functions are detailed in the table below:

LED COLOR	MODE OF OPERATION	MEANING
RED	ON	INPUT POWER PRESENT
GREEN	ON	INDICATES THE DEVICE IS PROPERLY WORKING
	BLINKING	ERROR or UNDEFINED PROGRAMMER/DEBUGGER STATE
YELLOW	BLINKING	USB OR JTAG/SBW COMMUNICATION

It is not recommended to power down the board when the YELLOW LED is blinking.

Note the debugger cannot be used to power the target board while no programming/debugging action takes place! You need to run debug from your IDE of choice for the board to power the target without external power supply, else the ISO-MK2 will hold the main microcontroller in reset (when not programming/debugging/reading the device).

CHAPTER 4: MODES OF OPERATION

4. Introduction of the chapter

In this chapter we will explain the mode options of MSP430-JTAG-ISO-MK2. Furthermore, a step-by-step guide to each option will be provided. Each option will be explained.

MSP430-JTAG-ISO-MK2 has three modes of operation. Upon powering the device from external source of power (12V) or via the USB(5V) the screen should look like the image below.

Main menu	
#	Function
1	Current mode - current mode highlights the mode lastly used
2	Mode select (up arrow key/increment button, down arrow key/decrement button) - mode select maker is used to navigate to desired new mode - the available modes are: Debugger, Mass Storage, Stand Alone
3	Confirm selection (right arrow key/select button) - confirms our selected by mode-select choice

The image shows a screen with three menu items: '> Debugger', 'Mass Storage', and 'Stand alone'. The 'Stand alone' item is highlighted with a black background. Below the menu items is a 'SELECT' button. Three numbered callouts are present: '1' points to the right arrow '>', '2' points to the menu items, and '3' points to the 'SELECT' button.

Each of the modes selected are explained in the next sub-chapters.

Generally, the up and down yellow arrows are used for selection (navigation), the right arrow (->) is used to confirm selection or execute a selection, the left arrow is used to return one level up in the menus.

4.2 Debugger mode

Debugger mode gives your IDE or software tools control over MSP430-JTAG-ISO-MK2 via the USB. Still the debugger gives you extra info about the microcontroller, the power and the consumption.

Menu "Debugger"	
#	Function
1	Current mode of operation - debugger
2	Microcontroller type
3	Source of power: - EXT - shows the target is powered from external source (different than MSP430-JTAG-ISO-MK2) - INT - means the target is powered by the debugger/programmer
4	Shows microcontroller power in Volts
5	Shows current consumption - only if powering the target from the MSP430-JTAG-ISO-MK2
6	Change the mode (button Mode/Back button)

The screenshot shows a rectangular menu box with the following text:

1 Debugger

MCU F11x1_P 2

Power EXT 3

Vt 3.3 It 100uA 5

MODE

6

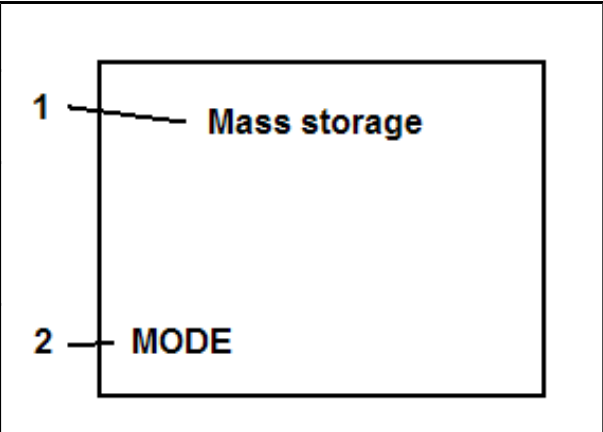
4 points to the left side of the menu box.

4.3 Mass storage mode

When connected in this mode to a computer, the computer would recognize the built-in SD card. You can then transfer OPJ files you have edited on the computer to the debugger or vice versa save to the computer files you have previously read with MSP430-JTAG-ISO-MK2.

Additionally you are able to use the SD card as general purpose card if you suddenly need to save files and lack another storage at hand.

Menu "Mass storage"	
#	Function
1	Current mode of operation - mass storage
2	Change mode (Mode/Back button/Left button)



4.4 Stand alone mode

Stand alone mode is used when you need to program a number of devices with the same program or when you lack a computer near the device you need to program. However, you need to provide +12V DC to the jack in order to be able to use stand alone mode. Note that you never should apply more than 12.5V since that would damage the board or its components.

Menu "Stand alone"	
#	Function
1	Current mode of operation - stand alone mode
2	Open an existing (previously saved) project
3	Highlighted operation (Up/Increment button, Down/Decrement button)
4	Create new project
5	Change mode (Mode/Back button)
6	Select the highlighted operation (Select button)

The options in this menu let you either open the program file located on the SD card or read the memory of the currently connected MCU.

4.4.1 Opening an existing project

If you have selected the “Open” choice in the previous menu you will be presented with a list of available projects. Choosing the one you want to write to your device will lead you to a new menu.

Sub-menu “Open”	
#	Function
1	Sub-menu “OPEN”
2	Available projects
3	Highlight (Up/Increment button, Down/Decrement button)
4	Back to the upper menu (Mode/Back button)
5	Select the highlighted project (Select button)

4.4.1.1 Editing the open project

Edit of the opened project gives provides a way to change some basic faster.

Sub-menu “Edit”	
#	Function
1	Sub-menu “EDIT”
2	Highlighted operation (Up/Increment button, Down/Decrement button)
3	Choosing the default programmer interface - JTAG - SBW - AUTO - automatically chooses JTAG or SBW interface is available
4	Shows the current voltage of the microcontroller
5	Blows the READ fuse of the target (ON/OFF)

6	Back to the "Open" sub-menu (Mode/Back button)	
7	Store the changes in the project (Select button)	

4.4.1.2 Writing in an existing project

Writing to the target board. If you program the same type of board with the same program you would probably stay just in this menu just pressing the right arrow button, switching the board and then again pressing the right arrow.

After selecting the "Write" option (7) you will be given again the most important options before finally writing the device.

You would also receive a message for a successful (or eventually unsuccessful) write that needs to be discharged before writing again.

Sub-menu "Write"	
#	Function
1	Sub-menu "WRITE"
2	Microcontroller type
3	Interface used
4	READ protection fuse
5	Voltage of the microcontroller
6	Back to "EDIT" sub-menu (Mode/Back button)
7	Store (Select button)

The screenshot shows a menu titled 'WRITE' with the following items: 'MCU F11x1_P', 'IF AUTO', 'Vt 3.3', 'Blow OFF', 'BACK', and 'WRITE'. Numbered callouts are: 1 points to the title 'WRITE'; 2 points to 'MCU F11x1_P'; 3 points to 'IF AUTO'; 4 points to 'Blow OFF'; 5 points to 'Vt 3.3'; 6 points to the 'BACK' option at the bottom left; 7 points to the 'WRITE' option at the bottom right.

Note that if the writing fails for some reason you will be given a screen notifying you for the failed write attempt. You will have to press the left arrow key to discard the message (opposed to the key required to the write – right arrow).

4.4.4 Reading from a microcontroller “READ”

The “READ” option in “Stand alone” mode gives a chance to get the program of a standard MSP430 MCU which hasn't its read fuse blown.

You will not be able to read MSP430 chips with burnt code protection fuses.

Sub-menu “Read”	
#	Function
1	Sub-menu “READ”
2	Highlighted operation (Up/Increment button, Down/Decrement button)
3	Programming interface
4	Voltage of the microcontroller
5	Reading the program from the microcontroller and creating a project file named the type of the microcontroller and consecutive number
6	Back to the main menu (Mode/Back button)
7	Select the highlighted operation (Select button)

CHAPTER 5: OPJ FILE FORMAT

The default form of the OPJ file. It can be opened with a text editor for faster edit. It is useful to edit the OPJ file when you need to change only options in the programming mechanism, not the logic of the program. Some of the options can be modified only in the OPJ file.

Note that the OPJ file name is limited to 8 characters which are also case sensitive.

For the OPJ file below I have read the contents of a board with MSP430F2274. It is preferable that binary file (in .txt or .hex format) that contains the source code is located in the same directory as the OPJ file.

<?xml version="1.0" encoding="UTF-8"?>	- xml header
<ISO_V2>	- ISO V2 section
<!--Device ID-->	- ID of the controller
<!--Device interface – JTAG,SBW,AUTO-->	- Interface type
<!--Device voltage 2700-3600 mV-->	- Controller voltage
<!--Device main base address-->	
<!--Device info base address-->	
<Target Id="57" IF="AUTO" Vt="3000" MainBase="0x8000" InfoBase="0x1000"/>	- ON/OFF operation
<!--Presave calibration data - 0/1 disbale/enable-->	
<!--Erase device - 0/1/2 disbale/sectors/mass-->	- Erasing
<!--Blank check device - 0/1 disbale/enable-->	- Blank check
<!--Programming device - 0/1 disbale/enable-->	- Programming
<!--Verify device - 0/1 disbale/enable-->	- Verification
<!--Blow device - 0/1 disbale/enable-->	- Read protection
<!--File name-->	- Program file name in TXT or HEX format
<Programming PresaveCal="1" Erase="2" Blank="1" Write="1" Verify="1" Blow="0" File="F2274_00.TXT"/>	
<!--Serializing enable - 0/1 disbale/enable-->	- Serialization ON/OFF
<!--Serial number format – HEX,BDC-->	- Serial number format
<!--Serial number endian – LE,BE32,BE8-->	- Serial number endian
<!--Serial number size - 1:4 bytes-->	- Serial number size
<!--Serial number start address-->	- Serial number start address
<!--Serial number-->	- Current serial number
<!--Last serial number-->	- Last serial number
<SN Enable="0" Format="HEX" Endian="LE" Size="0" Addr="0x0" Count="0" Last="0"/>	
<!--Sections preserve-->	- Description of sections that would NOT be modified
<Section>	
<!--Section start address-->	- Section start address

```
<!--Section size-->                                     - Section size
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
<Entry Start="0x0" Size="0x0"/>
</Section>
</ISO_V2>
```

Note the part “sections preserve”. It is very helpful when there are parts of the memory you don't want to modify.

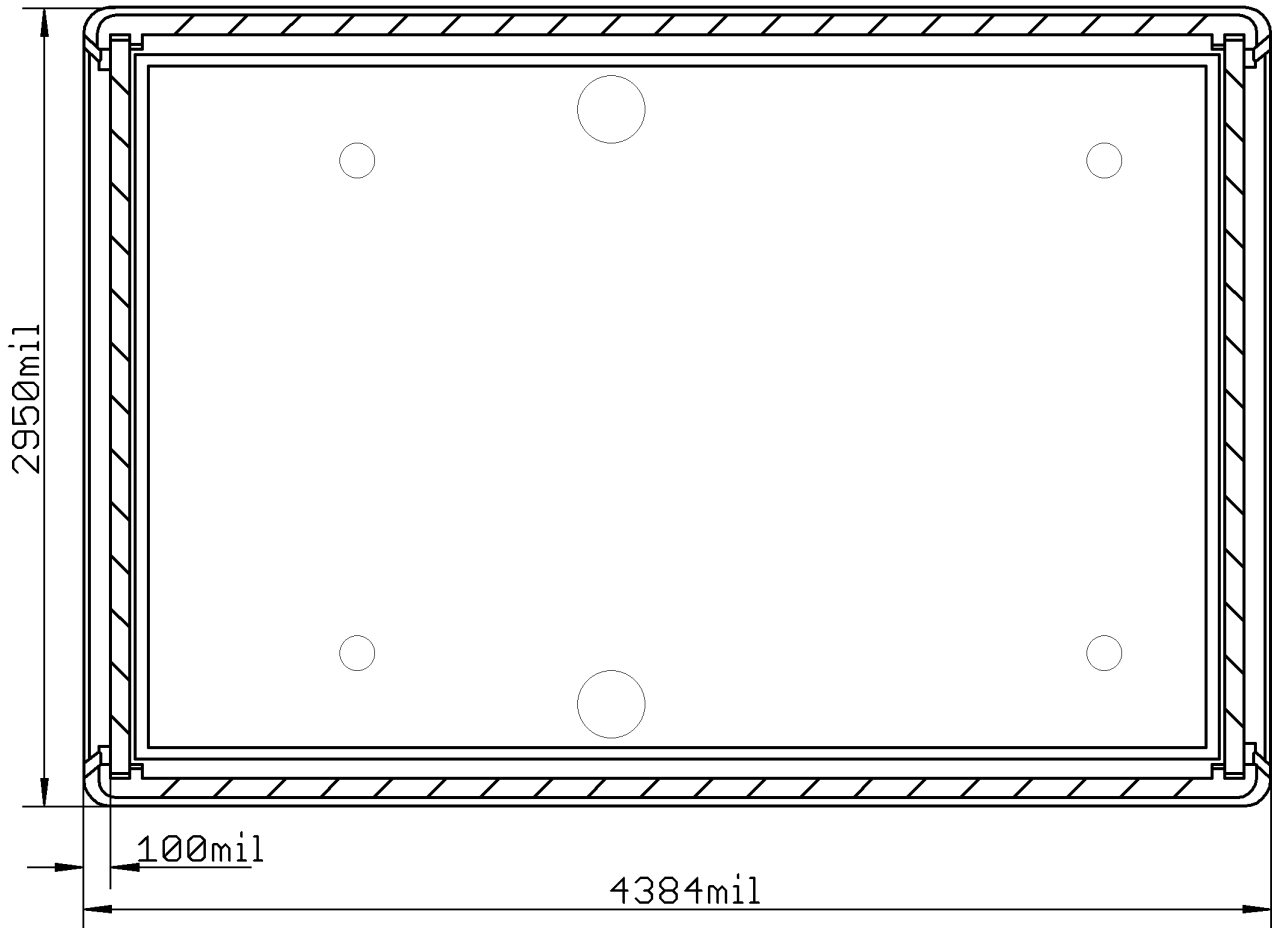
The best practice to understand the .OPJ file better is:

- 1) Connect a target chip/board to the debugger in debugger mode and program it with any code.
- 2) Enter stand alone mode and read the device.
- 3) Enter mass storage mode and via a computer examine the two files (.txt and .opj with same names) that were created in the ISO-MK2's memory.

CHAPTER 6: DIMENSIONS

6. Introduction to the chapter

The MSP430-JTAG-ISO-MK2 comes in a plastic box. The dimensions of the box can be seen below:



Note that all dimensions are in mils.

CHAPTER 7: REVISION HISTORY, WEB LINKS AND SUPPORT

7. Introduction to the chapter

In this chapter you will find the current and the previous version of the document you are reading. Also the web-page for your device is listed. Be sure to check it after a purchase for the latest available updates and examples.

7.1 Document revision

Revision	Changes	Modified page
A, 01.08.12	Preliminary revision	All
B, 22.08.12	Initial release	All
C, 04.10.12	7 - Added info on selecting the proper option depending on proper driver dll-file replaced 21 - Updated links	7, 21
D, 10.10.12	7 - Added info on selecting the proper option depending on proper driver dll-file replaced 17 - Updated the OPJ file description 21 - Updated links	7, 17, 21
E, 30.01.13	5 - Added more information about the isolation 17 - Added information about OPJ naming restrictions	5, 17
F, 11.02.13	6 - Fixed spelling and added more details 17 - Added best practice routine 21 - Firmware revision added	6, 17, 21
G, 05.04.13	Small spelling fixes	All
H, 19.09.13	Added instructions about Crossworks	8, 9

I, 30.09.13	4 - Added info about the compatible power adapters 7 - Added correct default dll path for CCS5 11 - Added information about the lack of power for stand-alone run operation	4, 7, 11
J, 04.15.14	7 - spelling and grammar	7

7.2 Device revision

Revision	Notable changes
K	Initial release of the device

7.3 Firmware revision

Revision	Notable changes
2.003	Initial release of the firmware for ISO-MK2
2.005	Fixed bug in standalone operation restraining the board from entering stand alone mode
2.006	Fixed bug in auto-detection of JTAG/SBW interface; Fixed erroneous external voltage detection and measurement
2.007	Fixed SBW device recognition; Fixed fuse blowing of MSP430F44x; Improvements in the user interface: 1) choice selector swapped with reverse color, last chosen menu is shown with angle brackets now for better visibility 2) increased screen contrast for a wider visibility angle 3) improved interface in case of failed write

7.4 Useful web links and purchase codes

The web page you can visit for more info on your device is

<https://www.olimex.com/Products/MSP430/JTAG/MSP430-JTAG-ISO-MK2/>.

ORDER CODES:

MSP430-JTAG-ISO-MK2 – professional programmer featuring LCD, SD card, stand-alone mode, 12V supply

USB-CABLE – USB type A to USB type B cable

SY0612E – reliable power supply adapter 50Hz (for EU) 12V/0.5A

SY0612E-CHINA – cheaper power supply adapter 50Hz (for EU) 12V/0.5A

The latest price list can be found at <https://www.olimex.com/prices>.

How to order?

You can purchase directly from our web shop or from any of our distributors. List of Olimex distributors around the world: <https://www.olimex.com/Distributors/>

Check <https://www.olimex.com/> for more info.

7.5 Product support

For product support, hardware information and error reports mail to: support@olimex.com. All document or hardware feedback is welcome. Note that we are primarily a hardware company and our software support is limited. Please consider reading the paragraph below about the warranty of Olimex products.

All goods are checked before they are sent out. In the unlikely event that goods are faulty, they must be returned, to OLIMEX at the address listed on your order invoice.

OLIMEX will not accept goods that have clearly been used more than the amount needed to evaluate their functionality.

If the goods are found to be in working condition, and the lack of functionality is a result of lack of knowledge on the customers part, no refund will be made, but the goods will be returned to the user at their expense.

All returns must be authorized by an RMA Number. Email support@olimex.com for authorization number before shipping back any merchandise. Please include your name, phone number and order number in your email request.

Returns for any unaffected development board, programmer, tools, and cables permitted within 7 days from the date of receipt of merchandise. After such time, all sales are considered final.

Returns of incorrect ordered items are allowed subject to a 10% restocking fee. What is unaffected? If you hooked it to power, you affected it. To be clear, this includes items that have been soldered to, or have had their firmware changed. Because of the nature of the products we deal with (prototyping electronic tools) we cannot allow returns of items that have been programmed, powered up, or otherwise changed post shipment from our warehouse.

All returned merchandise must be in its original mint and clean condition. Returns on damaged, scratched, programmed, burnt, or otherwise 'played with' merchandise will not be accepted.

All returns must include all the factory accessories which come with the item. This includes any In-Circuit-Serial-Programming cables, anti-static packing, boxes, etc.

With your return, enclose your PO#. Also include a brief letter of explanation of why the merchandise is being returned and state your request for either a refund or an exchange. Include the authorization number on this letter, and on the outside of the shipping box.

Please note: It is your responsibility to ensure that returned goods reach us. Please use a reliable form of shipping. If we do not receive your package we will not be held liable.

Shipping and handling charges are not refundable. We are not responsible for any shipping charges of merchandise being returned to us or returning working items to you.

The full text might be found at <https://www.olimex.com/wiki/GTC#Warranty> for future reference.