

User Manual for

USBJTAG NT

January 2019

(1.00)

## Preface

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**Use u-Link NT, USBJTAG NT and USB BDM NT at your own risk. Nothing is implied outside this document.**

**The manufacture is not responsive for any damage using the u-Link NT USBJTAG NT USBBDM NT software and hardware.**

There are more information on <http://www.usbjtag.com>. Newer videos are also added to youtube channel <http://www.youtube.com/usbbdm>.

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## Terms

In this document, **target** or **target board** refers to any device that has MIPS, ST20, ST40 ARM9 (ARM11 in the future) core CPU. Eg. Broadcom, LSI, etc. USB JTAG and USB EJTAG are both used for USB JTAG device. EJTAG is the JTAG name for MIPS core. DCU is the JTAG name for ST20 core.

For USBBDM NT hardware, **target** or **target board** refers to any device that has Motorola CPU like MC6833x

Only power on the u-Link/JTAG (or BDM) and the target **AFTER** the u-Link/JTAG (or BDM) and the target are connected. Connecting the JTAG (or BDM) and the target with either of their power on could burn either the JTAG (or BDM) or the target.

## Warranty

For normal usage the devices can last very long. But since this is testing device and you are making contact to another powered device, there is a risk that hardware might get burnt out. The devices offer **three months** free repair. After three months, a fee needs to repair the u-Link NT USB JTAG NT or USB BDM NT. Warranty voided if covered is removed.

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# Chapter 1 Basic concept

## 1.1 What is JTAG

Here is the quote from <<MIPS EJTAG Specification>>

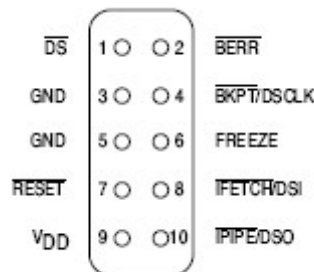
*EJTAG is a hardware/software subsystem that provides comprehensive debugging and performance tuning capabilities to MIPS® microprocessors and to system-on-a-chip components having MIPS processor cores. It exploits the infrastructure provided by the IEEE 1149.1 JTAG Test Access Port (TAP) standard to provide an external interface, and extends the MIPS instruction set and privileged resource architectures to provide a standard software architecture for integrated system debugging.*

**USB JTAG NT supports MIPS 32, MIPS 64, ST20 and ST40 core from STMicroelectronics. Arm 9. USB JTAG NT can also be used as SPI programming programmer. For more information, please visit <http://www.usbjtag.com>.**

USB JTAG NT software runs on mainstream OS like Microsoft Windows, Linux and MacOS.

## 1.2 What is BDM

BDM stands for Background Debugging Mode. Here is the pin layout of 10 pin BDM.

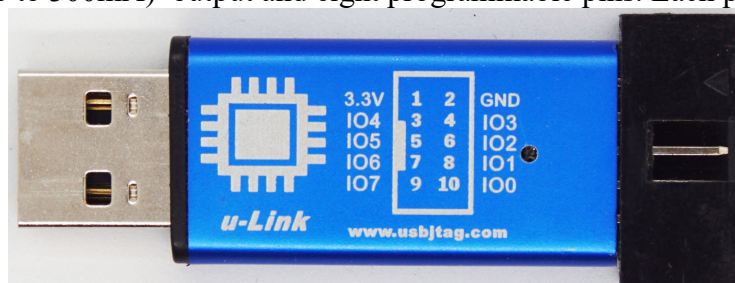


For detailed BDM information, please refer to chapter 5 of MC68331Ref.pdf. Recently users are using USB BDM NT for programming MC6833X based Engine Control Unit (ECU) or Transmission Control Unit (TCU)

**USB JTAG NT software support both USB JTAG NT and USB BDM NT hardware.**

## 1.3 What is u-LINK NT

u-Link is a new design for PC to interface another device. It has 10 pins with one ground and one 3.3v(up to 300mA) output and eight programmable pins. Each pin can be



programmed as input or output pin. Each pins is 5V tolerant.

### **1.4 What can be done with USBJTAG NT**

USB JTAG provides an affordable yet powerful enough tool to have most functions that a professional JTAG tool can provide. It allows you to

1. Read memory from target board. This is to capture the state of the CPU.
2. Modify memory to target board.
3. Program flash using target CPU and memory. (Gain fast speed)
4. Do simple debugging. Break and single step the target in its execution. (MIPS32 only for now)

### **1.5 What can be done with USBBDM NT**

USB BDM provides an affordable yet powerful enough tool to have most functions that a professional BDM tool can provide. It allow you to

1. View the registers of the target CPU.
2. Single step the target CPU.
3. Read memory from target board.
4. Write memory to target board.
5. Program flash using target CPU and memory.

### **1.6 What can be done with u-Link NT.**

At this stage, u-Link NT supports all the features that USB JTAG NT supports and several more already. More will be added in the future.

Several additional features supported by u-Link are,

- Atmega programming, this is non standard SPI and USB JTAG NT cannot have enough pins to support it.
- JTAG pin finder, simply because each pins can be programmed, then we can use this to search possible JTAG pins.
- 93CXX EEPROM programming.

Working project, MPC850 BDM.

## **Chapter 2 Install USBJTAG NT (USBBDM NT)**

### **2.1 Setup software**

**First time installation (Windows):**

Download proper USB driver from

<http://www.usbjtag.com/filedownload/index.php>, extract it.

Download the setup.rar file from <http://www.usbjtag.com/filedownload/usbjtag-nt-setup.php>, extract the setup.exe file and run it.

*Plug in the USB, when it ask for driver, select the folder of the driver you have extracted. Select the appropriate OS version. (Windows 7/8/10).*

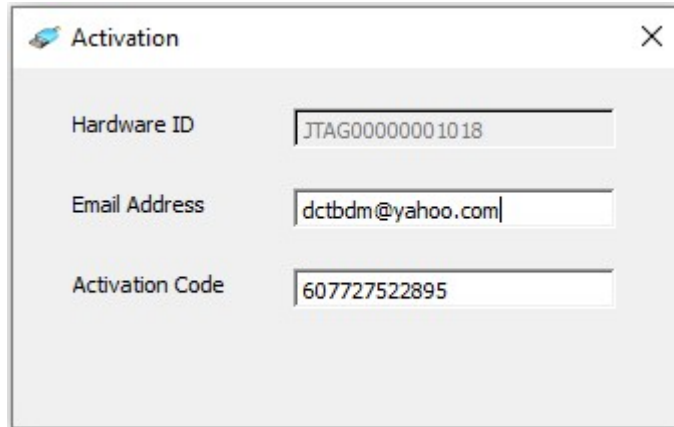
**Update:**

If you have installed older version of software, you need to uninstall the older software and reinstall the new one. Your previous configuration or activation info will not get lost during uninstallation.

USB JTAG NT configuration data are stored at %appdata%\usbjtag\. In case you need to manually add to any of xml, here you can find the files.

## 2.2 Activation

Your activation code is a unique number working with your **email address** (case sensitive and your **hardware ID**).



1. When you do not have the code, enter email address and click “**Email Activation**” and it will popup your email software and send out the email request. If you do not have integrated email app, send email to [activation@usbjtag.com](mailto:activation@usbjtag.com) with **hardware ID and email address** to get the code.
2. If you get the code then enter the code manually (*Email is case sensitive*). Click **OK when done**.
3. If you have activated before and you lost your activation code, you can enter email address and click “**Online Activation**”. It will try to get the code from the online database.
4. The software does not limit the number of computer you run on. You can install as many computers as you like.

When manually send email to [activation@usbjtag.com](mailto:activation@usbjtag.com) to request activation, please specify the hardware ID in the email.

## 2.3 Install hardware

### USB JTAG NT

The EJTAG connector on the board matches the standard Broadcom 14 pin EJTAG connector.



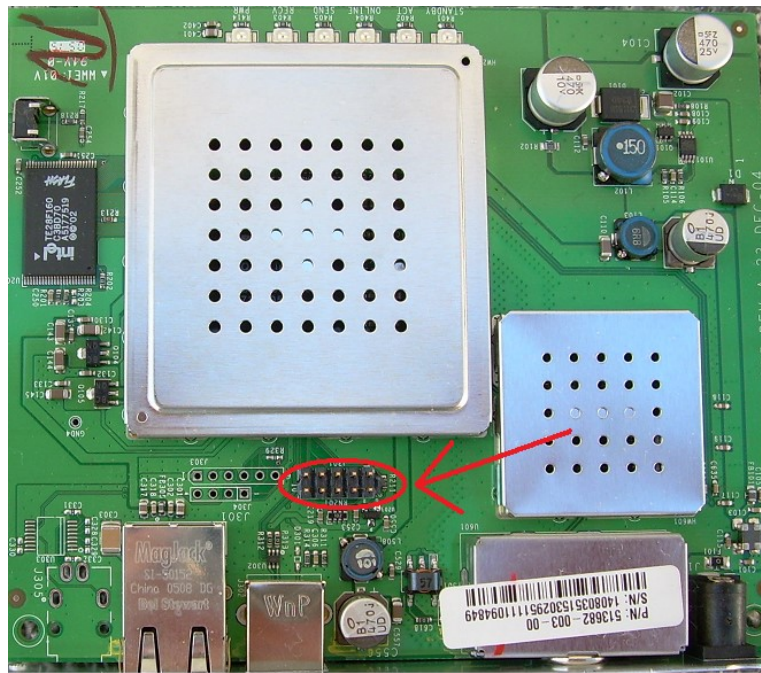
Here are the definitions of EJTAG.

Pin1 – TRST  
Pin3 – TDI  
Pin5 – TDO  
Pin7 – TMS  
Pin9 – TCK  
Pin11 – RESET  
Pin13 – DEBUG (Not used)  
Pin 2, 4,6,8,10 Ground. Pin 14 NC.

**On back of the USB JTAG NT module, printed labels are used to indicate pin 1. The preconnected ribbon cable has a red pin indicate pin 1, too.**

**If your target does not have the same pinout, you need to make a connector to match your target.**

Some board might not have JTAG connector and you need to solder a connector for it. Here is an example for sb5101 cable modem with a JTAG connector soldered on.



1. Power off the target board.
2. Plug the JTAG connector to the JTAG connector on target board  
**Improper connecting to the target will not work and might kill your target or USB JTAG NT.**
3. Connect the USB JTAG NT into one of the PC's USB slot.
4. Power on the target board.

#### USB BDM NT

1. Power off the target board.

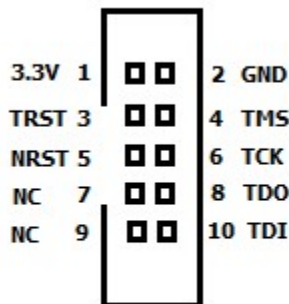


2. Plug the BDM connector to the BDM connector on target board. Make sure pin 1 matches the pin 1 on the target BDM connector. Reversing the BDM will cause the BDM to not function properly. If this happened, power off the target and plug back in.
3. Connect the USB BDM NT to one of the PC's USB port.
4. Power on the target board.

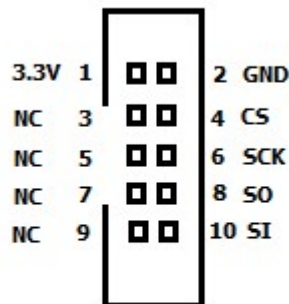
#### u-Link NT

1. Power off the target board.
2. Plug the u-Link NT connector to the connector on target board  
**Improper connecting to the target will not work and might kill your target or u-Link NT.**
3. Connect the u-Link NT into one of the PC's USB slot.
4. Power on the target board.

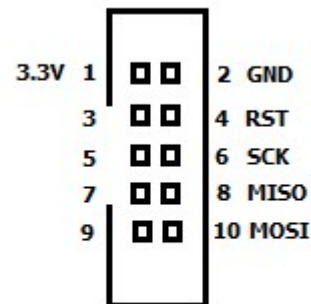
#### JTAG



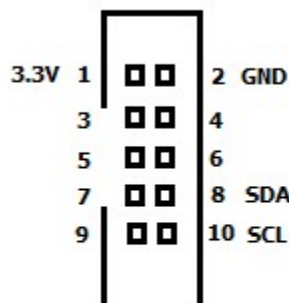
#### SPI



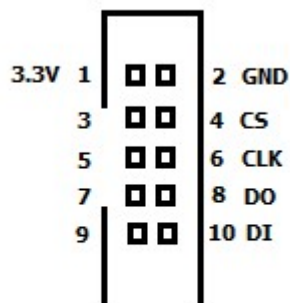
#### Atmega



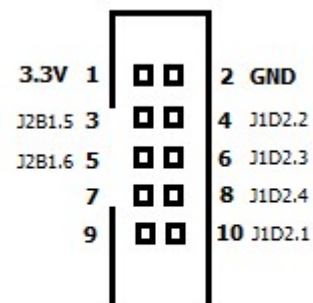
#### EEPROM



#### EEPROM 93CXX



#### XBOX



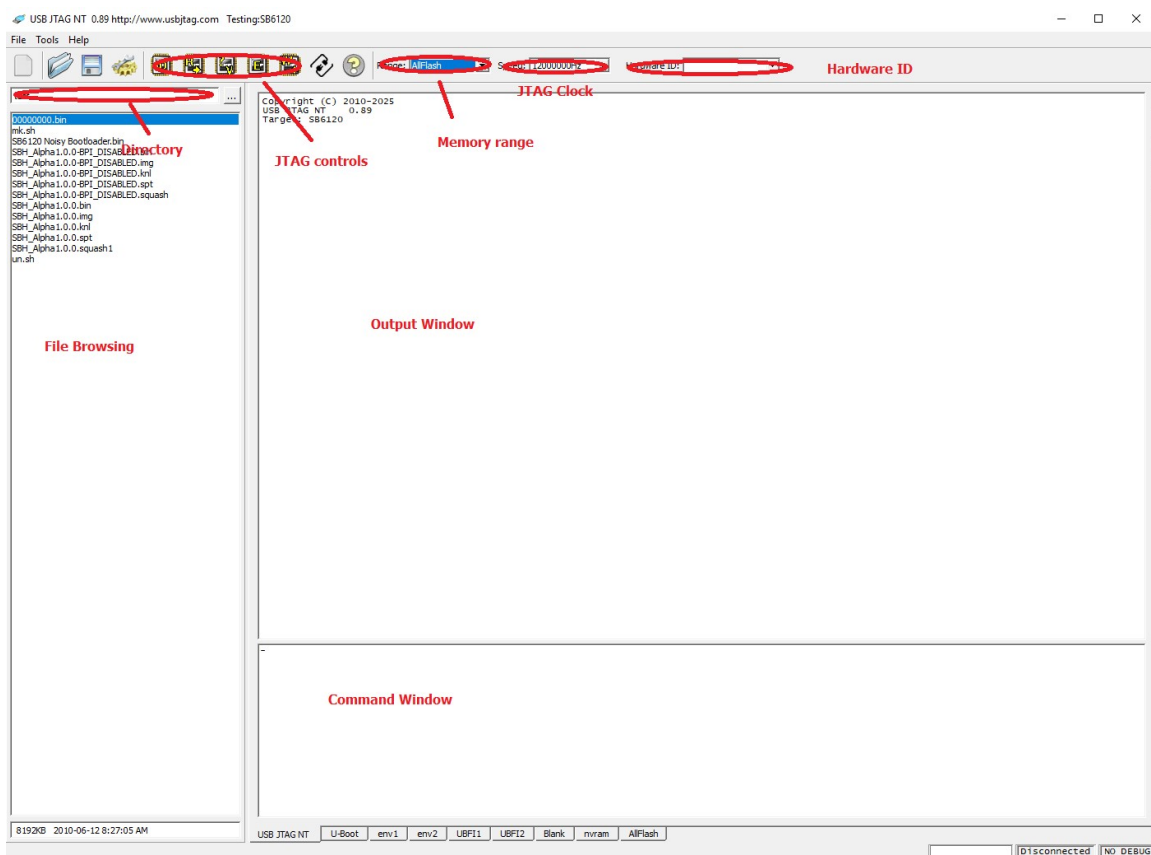
For other configuration just click  to get detail connection.

## Chapter 3. Using USBJTAG NT software

### 3.1 Software layout.

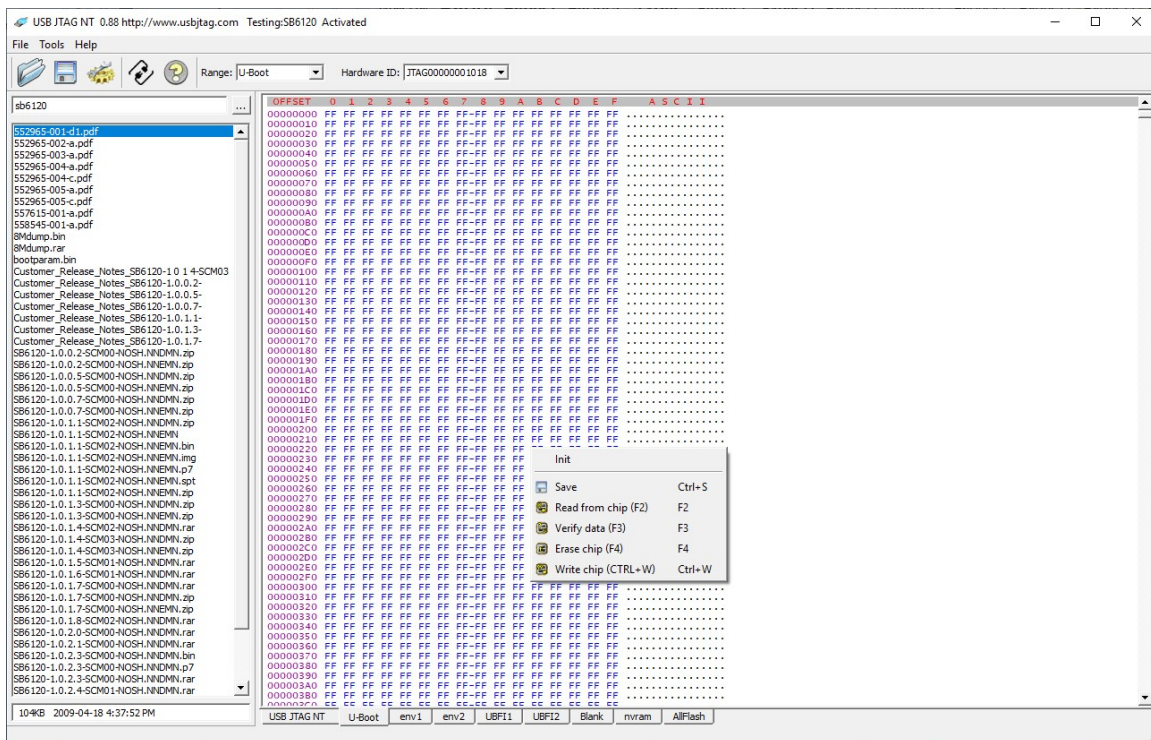
Start from 0.88. USB JTAG NT has two major working mode. Single JTAG mode and multi-JTAG mode. Most people will use single JTAG mode. Multi JTAG mode is for production line that program multiple device at the same time with one PC.

This is single JTAG view.



This is 9 JTAG view. You need to **plug in all your JTAG** when you start the software. If not single JTAG mode will be used. The number of JTAG displayed will depends on the number of JTAG plugged in when software is started.

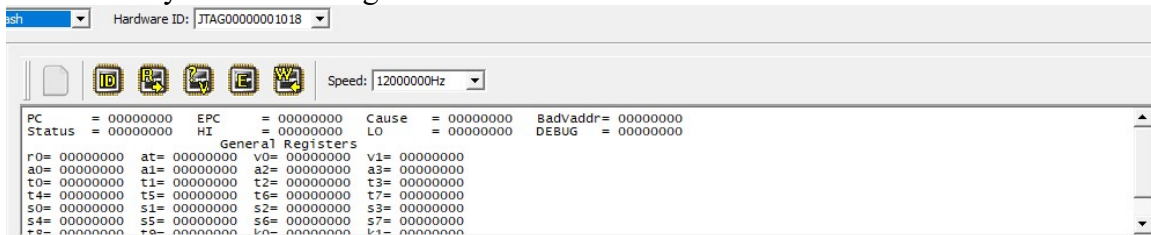




Memory view.

You can view the memory and also execute commands with the right click the memory tab to trigger pull down menu.

To read file you can use drag from the left file browser or external file browser.



Register view, display MIPS (Or MC6833X) register values when in debug mode.

**Note:** For some board when power on and you see **DEBUG ON**, type “r” command. If PC is 0xBFC00000 then type “g” or press F5 to run the target.

## Check the version of software

Help->about, version of the software printed out. Example



USBJTAG NT is the main application. Test module is the plug in DLL. If present, a new pull down menu exists after the “Tools” menu. **The plug in DLL must exist in the same folder as the main USB JTAG application.**

## Configure the software

Before the software can be used, configuration must be done based on your target.

Xml configuration files exists under the config directory.

When select the target you can.

1. Type any word in “Search Target For” (eg.”510”), you can then select the target in the “Target select” (like, 510,SB5100, SB5101,SB5101Mod,SB5102, SB5102Mod)
2. Select target based on Category or Protocol. You can select Modem, then all supported modem will be on the “Target select”. You can also select EJTAG, then all EJTAG targets will be on the right.

The current supported protocols are:

EJTAG (MIPS)

DCU(ST20)

EJTAG64(MIPS64) – limited targeted tested.

BDM

SPIFlash

ARM7 –limited

ARM9

EJTAGPIC (PIC32MX)

ST20C1

EEPROM – Direct program the EEPROM.

XBOX360 – NAND programming

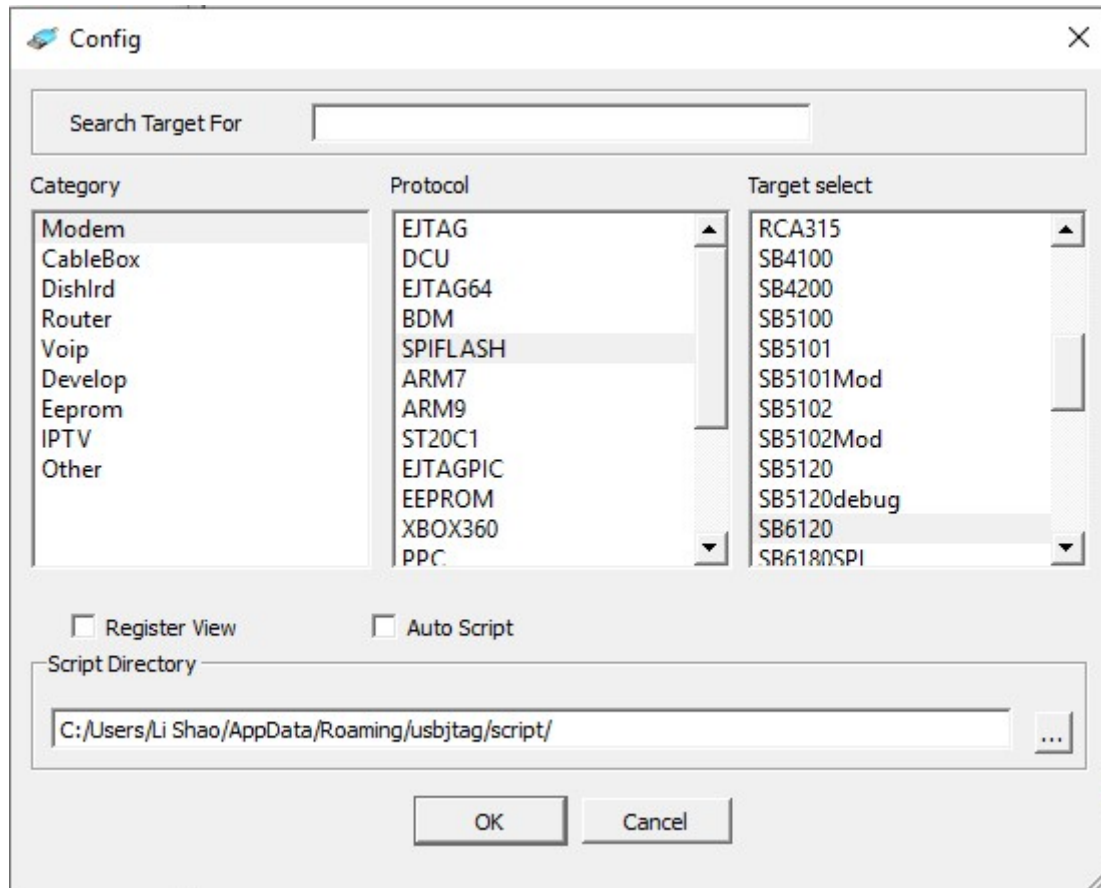
PPC- (DM500)

CPLD (JAM file playing)

ST40

ATMEGAICSP (under development)

SPI LCD (Experimental for Nokia 5110 LCD)  
BDM PPC (under development).



### 3.2 GUI Usage

Even though the command line interface provides more power, many of its functions can be simplified by the included GUI interface.

#### Range selection

Memory access needs the start address and the length of the target memory. In the tool bar there is a drop down box that contains predefined start addresses and length with sudo-names. One can also click the tabs under the middle window of the picture shown above to determine what range selection is used.

#### Speed selection

This is to select the JTAG (BDM) clock speed. Even though we normally need high speed to program the target, it is needed sometime (especially when target is bricked) to use slower speed. The current hardware allows you to select three JTAG (BDM) speed.

## Toolbar

Going from left to right

- Open file (command line equivalent: ldram)
- Save file (command line equivalent: save)
- Tools → configuration (command line equivalent: config)
- Target id detection (command line equivalent: detect)
- Read (command line equivalent: getram)
- Verify (command line equivalent: cmprom)
- Erase flash/EEPROM (command line equivalent: erase)
- Program flash (command line equivalent: program/sprogram)
- Connection. Show how to connect the target.
- About/Copyright info

## 3.3 Commands

USB EJTAG NT software is command driven. In command window typing “help” will give you all the command available. Type “help” and then a command will give you details of that command. Up, Down arrow keys can be used to go through the command history in the command window. Some commands are only available for certain target. “help” will always give you the exact command sets that can be used. Auto completion is incorporated, you can type partial command and hit tab to complete or toggle between commands that start with the same letters. Eg. Type “fl” + tab will give you flshdct.

### Most used commands

1. **d:** Display the address.  
Syntax: d address (in hexadecimal)  
Example: d 9fc80000
2. **exit:** Exit the whole application.  
Syntax: exit
3. **help:** prints command help.  
Syntax: help — This will print all the command names.  
Syntax: help (cmd) — This will print the usage of the cmd.  
Example: help flshdct
4. **reset:** Reset the target.  
Syntax: reset  
*Note: Not all the target board has the reset pin connected to JTAG port and even if the JTAG pin is connected to the JTAG port, the reset command might not reset the target for some other reasons. If this happened a power off/on will do the same work as reset.*
5. **detect:** Detect the target CPU and possible flash types. If there are memory tabs defined as flash then a flash detect command is also issued.  
Syntax: detect  
Shortcut: F1  
Example: (sb5101)

```
-detect
  IDCODE 334917F
  Broadcom BCM3349
  IMPCODE 800904
  DMA supported
  Found Address= 9fc00000 Intel 28F160C3B
```

6. **search:** Search the memory block. This is ONLY used for an unknown target and you want to find the memory map. Most important to find where the firmware starts. For most users this **command** should not be used.

Syntax: search start end step.

Example:

```
-SEARCH 90000000 a0000000 200000
Address 90000000 data=FFFFFFFF
Address 90200000 data=FFFFFFFF
. . . . .
Address 9E000000 data=0BF00004
Address 9E200000 data=0BF00004
Address 9E400000 data=0BF00004
Address 9E600000 data=0BF00004
Address 9E800000 data=0BF00004
Address 9EA00000 data=0BF00004
Address 9EC00000 data=0BF00004
Address 9EE00000 data=0BF00004
Address 9F000000 data=0BF00004
Address 9F200000 data=0BF00004
Address 9F400000 data=0BF00004
Address 9F600000 data=0BF00004
Address 9F800000 data=0BF00004
Address 9FA00000 data=0BF00004
Address 9FC00000 data=0BF00004
Address 9FE00000 data=0BF00004
```

By further analyzing the firmware we can then figure out that the firmware starts at 9fc00000. For MIPS CPU they also maps as 1fc00000 or Bfc00000.

7. **flshdct:** Detect the flash type.

Syntax: flshdct tabname

flshdct address

Example:

```
-flshdct boot
Found Address= 9fc00000 Intel 28F160C3B
-flshdct 9fc00000
Found Address= 9fc00000 Intel 28F160C3B
```

8. **flshset:** Set a flash type to the tab. This is used when the target is complete dead and normal rescue method cannot be used.

Syntax: flshdct tabname value1 value2. (Value1 and value2 will be the same value otherwise flshdct is used. Manufacture ID and chip ID).

Example:

```
-FLSHSET boot 89 8891
```



```

Found Address= 9fc00000 Intel 28F160C3B
-configshow
Test name:      SB5100
Test DLL:  SB5100.dll
IRLength:  5
Endian:      Big
Boot        Flash=Intel 28F160C3B
cfg         Flash=Intel 28F160C3B
Image0      Flash=Intel 28F160C3B
Image1      Flash=Intel 28F160C3B
log         Flash=Intel 28F160C3B

```

9. **init.** This is to initialize the target (in dll or in xml).
10. **initusb:** Initialize the USB PORT. This will trigger USB PORT to reinitialize the USB JTAG. It might take several seconds to get back “JTAG connected” state.  
Syntax: initusb
11. **getram:** Read memory from target to PC. This is lengthy operation and the progress bar will show roughly where you are. After completion of the memory read, the memory in the tabs will be updated. You can view and edit the memory in the memory tabs. Be careful when editing the memory map, since most flash firmware have complicated checksum to avoid data corruption, simply editing the firmware and programming it back might not work.  
Syntax: getram tab  
          getram start length  
Example: getram boot  
          getram 9fc00000 200000
12. **save:** Save the PC memory to a file. The default file extension is “.bin”  
Syntax: save tabname  
          save start length  
Example: save boot  
          save 9fc00000 200000
13. **ldram:** Load binary file to PC memory. This is opposite to “save” command.  
Syntax: ldram tabname (filename)  
          ldram address  
Example: ldram boot  
          ldram 9fc00000
14. **cmprom:** Compare the PC memory with target memory. This is very useful especially for programming flash. If you use EJTAG you cannot do cmprom right after the programming if non-DMA is used. The OK means the memory are identical between PC and the target. Otherwise the failed address will be displayed.  
Syntax: cmprom tabname  
          cmprom address length  
Example: cmprom boot  
          cmprom 9fc00000 200000
15. **setram:** Opposite to getram, this set the target memory from PC. *This can only be used for ram not for flash. For flash you can only use “program” or “sprogram” to alter the target memory.*

- Syntax: setram tabname  
           setram address length  
 Example: setram 80000000 200
16. **peek:** Get one word from target.  
 Syntax: peek address  
 Example: peek 80000000
  17. **pokeh:** Poke two bytes.  
 Syntax: pokeh address value
  18. **pokeb:** Poke one byte.  
 Syntax: pokeb address value
  19. **peekh:** Peek two bytes.  
 Syntax: peekh address
  20. **peekb:** Peek one byte  
 Syntax: peekb address
  21. **poke:** Set one word to target.  
 Syntax: poke address value
  22. **flshlist:** List all the flash types that are defined in flash.def  
 Syntax: flshlist
  23. **config:** Start configuration dialog to configure the target and view.
  24. **about:** Display the about dialog box.  
 Syntax: about
  25. **cls:** Clear the screen  
 Syntax: cls
  26. **e:** Edit data in PC memory. To update to the target ram or flash you need to use  
 "setram" or "program" commands.  
 Syntax: e address data1 data2 ....  
 Example: -e 9fc08000 11 22 33 44
  27. **f:** Fill data in PC memory. To update the target ram or flash you need to use  
 "setram" or "program" commands.  
 Syntax: f tabname value  
           f start length value  
 Example: f bootff  
           f 9fc00000 200000 ff
  28. **s:** Search patterns in PC memory.  
 Syntax: s tabname string  
           s tabname data1 data2 ...  
           s start length string  
           s start length data1 data2 ...  
 Example:  
 -s image1 "SB5100"  
 -s image1 40 08 80  
 -s 9fd00000 100000 "SB5100"  
 -s 9fd00000 100000 40 08 80
  29. **configshow:** Show all the configuration.  
 Syntax: configshow  
 Example:

```

-CONFIGSHOW
Test name:      SB5100
Test DLL:  SB5100.dll
IRLength:  5
Endian:      Big
Boot        Flash=Intel 28F160C3B
cfg         Flash=Intel 28F160C3B
Image0      Flash=Intel 28F160C3B
Image1      Flash=Intel 28F160C3B
log         Flash=Intel 28F160C3B

```

30. **erase:** Erase the flash. The erase command is used with sprogram. Normal program command auto erase the flash. This command is only used when normal program command does not work. ST20 target must use erase/sprogram to program the flash. Please note that the erase command does not have feedback while erasing. And normally erase take quite a long time. A 2M flash's erase normally will take up to 20-40 seconds. If after a long time the program does not return something has gone wrong and you need to stop the program and start again.

Syntax: erase tabname  
erase address length

Example:

```

-ERASE image0
Erase starts
Erase time 00:00:08 .021

```

31. **sprogram:** Slow program. This is slow program compared to normal program. In EJTAG this method is not used to target ram. In EJTAG when the boot is not in setup and the initialization sequence to access ram is unknown, sprogram is normally used for program a boot block. Make sure the target flash is erased.

Syntax: sprogram tabname  
sprogram start length

Example:

```

-ERASE boot
Erase starts
Erase time 00:00:00 .031
-SPROGRAM boot
Program Starts...
Program time 00:00:08 .084
-CMPRAM boot
Compair data OK

```

32. **program:** Programs the flash or eeprom. If you program the flash make sure you have executed "flshdct" or "detect" command. The right flash type must be set to the memory.

Syntax: program tabname  
program address length

Example: program boot  
program 9fc00000 200000  
program eeprom

- ```

-PROGRAM image0
Erase starts...
Erase time 00:00:08 .071
Program speed 138.26 KB/s
Program time 00:00:07 .081
Program pass, if no further programming needed, power
off/on the target

```
33. **bk:** Breakpoint in the target. Normally use this with register view enabled.  
 Syntax: bk  
 Shortcut: F6
  34. **r:** Read registers or set register value to the target  
 Syntax: r  
         r register value  
 Example: r r1 8000200
  35. **t:** Single step. (Not for EJTAG64)  
 Syntax: t  
 Shortcut: F10
  36. **g:** Execute in full speed.  
 Syntax: g  
 Shortcut: F5
  37. **tap:** Send tap command to the device (Used for de-bricking MIPS device).  
 Syntax: tap x (y)  
 Example: tap c  
           tap a ffffffff
  38. **blkchk:** Check if the flash is blanked. If the result is not blanked do not try to use  
 sprogram.  
 Syntax: blkchk tabname  
         blkchk start length  
 Example:  
 -blkchk flash  
 Flash blanked
  39. **flshdcth:** This happens on IRD6000 dish receiver, while there were two flash chip  
 and one hold the high word of data and another flash hold lower word of data.  
 flshdcth uses different routine to detect the flash. In the usbjtag.def the  
 "Protocol=DCU" and "HiLo=1". If not the flshdcth will not get the right result.  
 Syntax: flshdcth tabname
  40. **ldramh:** This is the same reason as for flshdcth. When file saved in high word or  
 lower word. You can use ldramh command to only load to high word or lower  
 word of the memory in pc.  
 Syntax: ldram address  
 Example:  
 -ldramh 7fc00000 (lower word file)  
 -ldramh 7fc00002 (high word file.)
  41. **speed:** Select JTAG speed.  
 -speed 2 (select 3MHz JTAG or 1.5MHz BDM)

### 3.4 JTAG Usage

1. Read memory  
Use “getram” command. Eg. “getram u22”
2. Write memory  
Use “setram” command. Eg. “setram nvram”

### Program flash

The flash contains all the essential programs for your target to work properly. Therefore it is very important to understand the process of programming flash. In most case, you can burn flash in fast mode. But if the flash is accidentally erased and no initialization is known, then a slow mode might be used

First you need to make sure that watchdog is disabled. For known board with proper initialization a “detect” command will both detect the CPU and initialize the target. IT IS VERY IMPORTANT EACH TIME TARGET IS PLUGGED IN, A “DETECT” needs to be executed. F1 is the short cut key.

#### EJTAG only.

If it is the first time you program the flash, type the command “bk”, this command puts the CPU in “DEBUG ON” mode. Please do nothing for at least 30 seconds. If “debug on” stays, then the watch dog is disabled and you can program the flash safely.

You only need to do this once for each type of target. If DEBUG goes off, then the watchdog is not disabled and program the flash is unsafe. Before you do some real programming, make sure the data is valid. (“bk” is break command and “g” is run to normal command).

You can then program the flash by typing the command “program tabname or program start length”. It is highly recommend the first time find a non-used sector to program and compare to make sure you have can program properly.

### 3.4 Bug report.

Please report bug to [usbbdm@usbjtag.com](mailto:usbbdm@usbjtag.com) . Since there are so many targets out there and people use them in different way, there will be bugs in the software. (Especially when using scripts). So if you find a bug or want to make an enhancement request, do not hesitate to write to me. The support forum can also be used.

<http://www.usbjtag.com/phpbb3/index.php>

## Chapter 4 Script

USB JTAG NT supports very complicated script so it can automate a lot of the jobs. If you are programming a large number of devices, using script can save you a lot of time.

### 4.1 Basic script.

Basic script does not use controls and only have commands. Here is an example of basic script. (5101a.usp)

```
// *****  
// sb5100 restore script  
// *****  
detect  
ldram 9fc00000 %1  
echo Press enter to program, any other character with return exit the script.  
pause  
program 9fc00000 200000
```

In the command window you type in

```
sb5101a backup1.bin
```

Which the script will take one parameter as backup1.bin. Here is the explanation of how the script works.

```
// *****  
// sb5100 restore script  
// *****
```

These lines only displays the output to screen. (Echo does the same thing but will not display “Echo”)

```
detect
```

Execute command “detect”

```
ldram 9fc00000 %1
```

Equivalent to ldram 9fc00000 backup.bin

```
echo Press enter to program, any other character with return exit the script.
```

Display a prompt.

```
pause
```

Pause for you to hit “Enter”. You can enter any character and Enter to exit the script.

```
program 9fc00000 200000
```

Do the programming.

For further support on script, please contact [usbbdm@usbjtag.com](mailto:usbbdm@usbjtag.com) or go to <http://www.usbjtag.com> and join the forum.