

SX-2 User Manual



Because the nature of FPGA's reconfigurability some of the specifications and features might change depending on the running firmware.

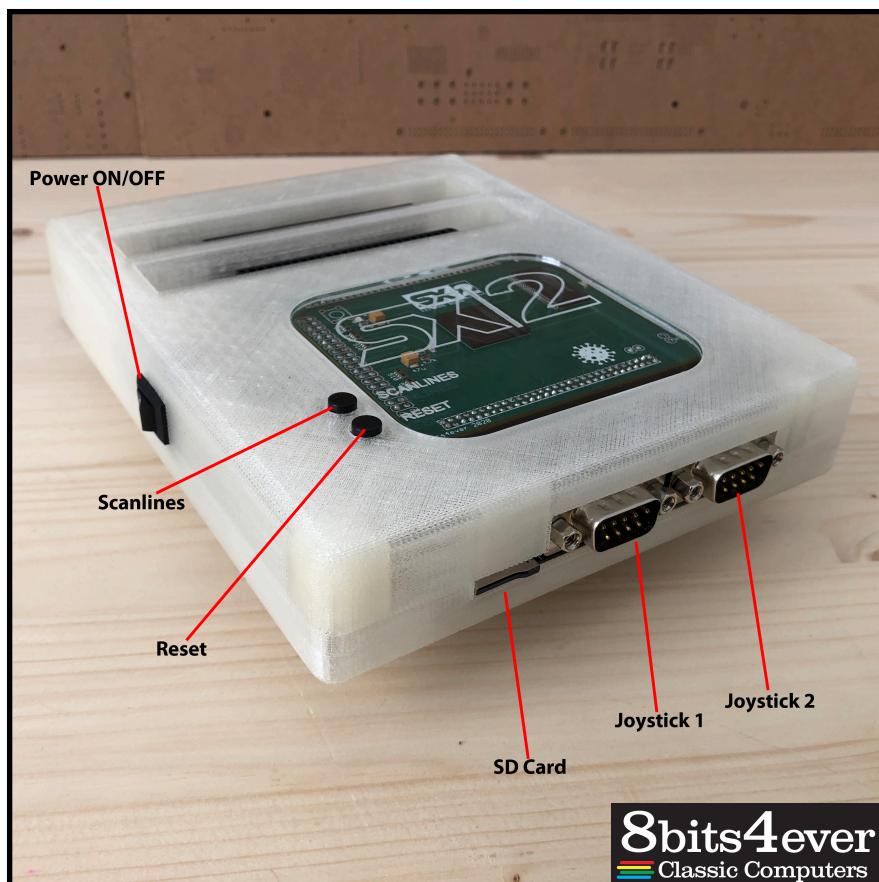
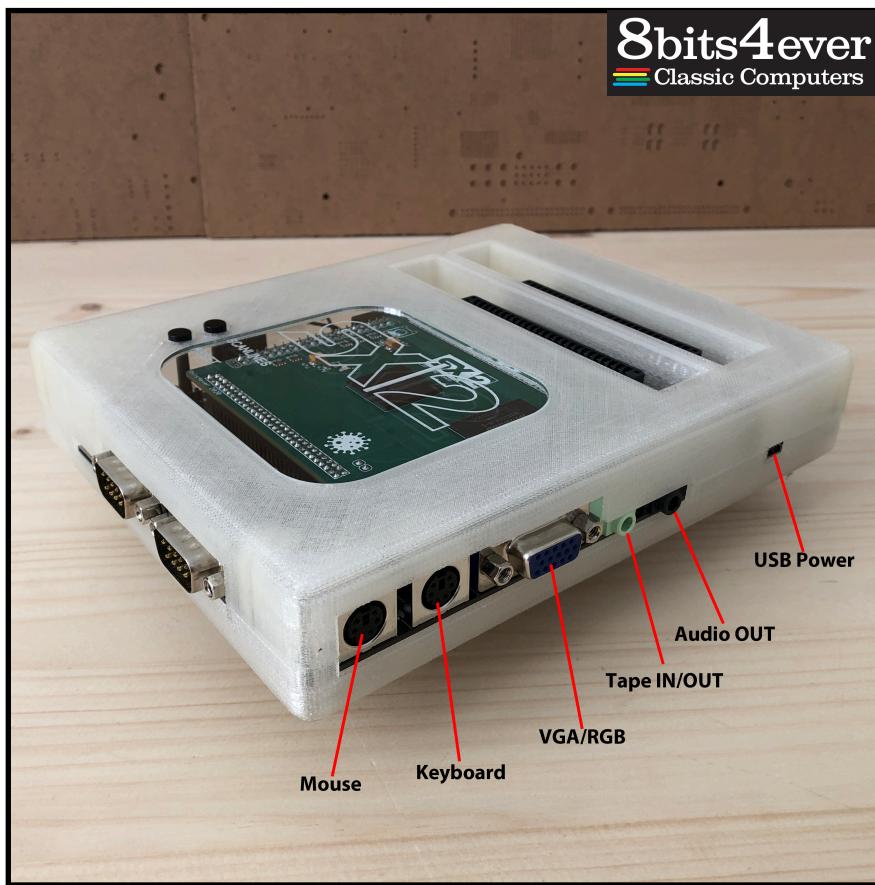
All units from September 2021 batch are shipped with OCM 3.9.0 firmware.

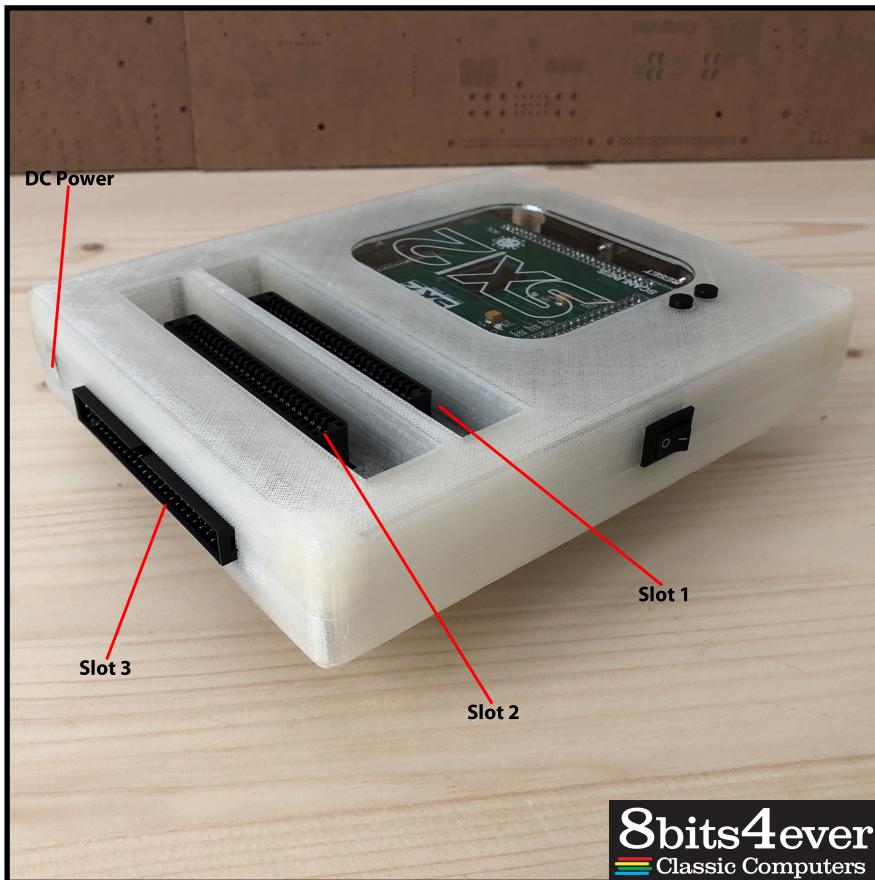
All support files can be found in our G-drive, under the SX2 folder.

Tech Specs

- Altera Cyclone IV EP4CE22F17
- 32 MB SDRAM
- 2 Standard MSX cartridge Slots
- 1 Extra expansion IDC-50 connector (works as slot 1 mirror)
- CPU Turbo 5.37 or 8.06 MHz Modes
- 1x microSD card slot (FAT-16 support only)
- Internal PSG, SCC+, OPLL (YM2413), OPL (YM3526), OPL2 (YM3812) and OPL3 (YMF262).
- 1 Mb ESE-MegaRAM/ESE-RAM SCC+ internal (soft cart slots)
- 2/4 Mb RAM Mapper
- D-Sub-15 VGA/RGB video output w/ scanline generator
- Composite and S-Video output through VGA connector
- PS/2 Keyboard Connector
- PS2 mouse port (emulates MSX mouse on joystick port 1)
- 2 DB9 Joystick Ports (MSX compatible)
- 3.5mm Jack Stereo Audio Output
- 3.5mm jack tape in/out
- Optional internal WiFi module (Might require SDBIOS pack)
- MIDI out (through joystick 2 port)

Unit overview





To start running your SX-2 you will need:

- USB power supply or **DC barrel style (5.5/2.1 mm) power supply 5 volts, center positive**. Unit requires at least 2 Amp (2000 mA) output.
- High quality shielded Mini-USB cable (in case you use USB power supply).
- Monitor and video cable. Either VGA or RGB-Scart standards are supported. (See **DIP Switch Settings** section to select video output settings)
- PS/2 Keyboard. Optional PS/2 Mouse
- FAT16 formatted SD card with MSXDOS2/Nextor boot files (See **DIP Switch Settings** section to enable the SD slot).
- Optionally, DB9 joysticks (MSX compatible), tape player (or Maxduino), MSX compatible cartridges, etc

You can plug any MSX compatible cartridge (game cartridges, Floppy/IDE controllers, FlashROM carts, etc are supported).

WARNING!!! Do not plug/unplug any cartridge when the unit is powered. It will very likely damage the unit permanently.

DIP Switch Settings

The DIP switch block is accessible from beneath the unit and can be used to select/configure the various features the **SX-2** offers.

Switch	Function	Setting	
SW1	CPU Clock	OFF	CPU 3.58Mhz
		ON	Custom Speed mode 4.10MHz to 8.06MHz <ul style="list-style-type: none"> • [F12] change clock (3.58MHz >> 5.37MHz >> Custom Speed) • The external clock is set on [Sync to CPU] by default • [Turbo Pana] is 5.37MHz like the original specification • A special hybrid clock [Turbo MegaSD] is enabled by default
SW2/ SW3	Video Output	OFF/OFF	Composite / S-Video w/ mono audio signal(through the VGA connector, NTSC 60hz).
		OFF/ON	RGBs 15khz
		ON/OFF	VGA Mode for LED TV or LED Display <ul style="list-style-type: none"> • Progressive video signal 31kHz / 50Hz+60Hz with the ability to set the pixel ratio 1:1 at 60Hz
		ON/ON	VGA+ Mode for CRT Monitor <ul style="list-style-type: none"> • Progressive video signal 31kHz / 50Hz+60Hz / SETSMART -D0 must be executed to force 60Hz
SW4	SLOT 1 Config	OFF	External Slot-1 / Optional Slot-3 (shared) <ul style="list-style-type: none"> • Advised like default
		ON	Internal ESE-MegaSCC+ 1024kB (shared w/ the 2nd half of ESE-MegaSCC+ Slot-2) <ul style="list-style-type: none"> • External Slot-1 / Optional Slot-3 are disabled • Memo: the internal OPL3 toggle is [Scroll Lock] key (disabled by default). OPL3 is always active when both ESE-MegaSCC are enabled
SW5/ SW6	SLOT 2 Config	OFF/OFF	External Slot-2 <ul style="list-style-type: none"> • Advised like default
		OFF/ON	Internal ESE-MegaRAM ASCII-8K 1024kB <ul style="list-style-type: none"> • External Slot-2 is disabled
		ON/OFF	Internal ESE-MegaSCC+ 2048kB <ul style="list-style-type: none"> • External Slot-2 is disabled
		ON/ON	Internal ESE-MegaRAM ASCII-16K 2048kB <ul style="list-style-type: none"> • External Slot-2 is disabled
SW7	RAM Mapper	OFF	Internal 2048kB RAM / 1st EPBIOS
		ON	Internal 4096kB RAM / Optional 2nd EPBIOS
SW8	SD Card Slot	OFF	Disabled
		ON	Enabled

Keyboard

The **SX-2** supports standard PC PS/2 keyboards. Most **SX-2** functions and settings are accessible through key strokes and shortcuts. MSX specific keys (STOP, GRAPH, etc) are mapped to PC keyboard as well.

PC Key/ Combo	Function
END	MSX STOP Key
ALT	MSX GRAPH Key
WIN	MSX SPACE Key
F6	MSX GRAPH Key
F7	MSX KANA Key
F8	MSX SELECT Key
F9	Increase PSG volume
SHIFT + F9	Decrease PSG volume
F10	Increase SCC volume
SHIFT + F10	Decrease SCC volume
F11	Increase FM volume
SHIFT + F11	Decrease FM volume
PAGE UP	Increase overall volume
PAGE DOWN	Decrease overall volume
F12	Changes CPU speed between 3.58MHz, 5.37MHz and 8.06MHz
PRINTSCREEN/ SHIFT + PRINTSCREEN	Changes video output CVBS/S-Video, SCART, VGA 31KHz, VGA+ 31KHz
SCROLL LOCK	Enable/disable OPL3
SHIFT + F12	Toggles SLOT 1 configuration external/SCC+
SHIFT + SCROLL LOCK	Toggles SLOT 2 configuration external/ASCII8/SCC+/ASCII16

Cartridges

External slots on the **SX-2** can be used to plug MSX compatible cartridges. These can be ROM based software cartridges or any hardware add-on cart like FDD/IDE interfaces, FlashROM cartridges, etc. Any cart that works on an original MSX machine should work fine on the **SX-2**. *Notice the /BUSDIR signal is only present on SLOT 1.*

To enable the external slots make sure the DIP switches are set properly: Switch 4 OFF to activate SLOT 1 and 3, Switches 5 and 6 OFF to activate SLOT 2.

ATTENTION!! DO NOT INSERT/EXTRACT CARTRIDGES WHILE THE UNIT IS POWERED ON.

External Mass Storage

When using external storage devices such as floppy disk controllers or IDE controller cartridges you might need to disable the **SX-2** on-board SD slot to avoid hardware conflicts. To turn off the SD slot set the DIP switch 8 to OFF.

Tape Player

It is possible to use a tape player and MSX cassette tapes to load and save software into the **SX-2** through the TAPE jack. Remember the tip of the connector is the one which carries the tape signal coming into the **SX-2**.

SD Card Slot

Bare in mind the **SX-2** works exactly as a real MSX machine, therefore there is no fast loading menus, no OSD, etc. The access to the SD card is done entirely through the command line (MSXDOS/Basic).

To enable the **SX-2** internal SD card slot set DIP switch 8 to ON. You can use SD cards **formatted as FAT16, max partition size 4GB**.

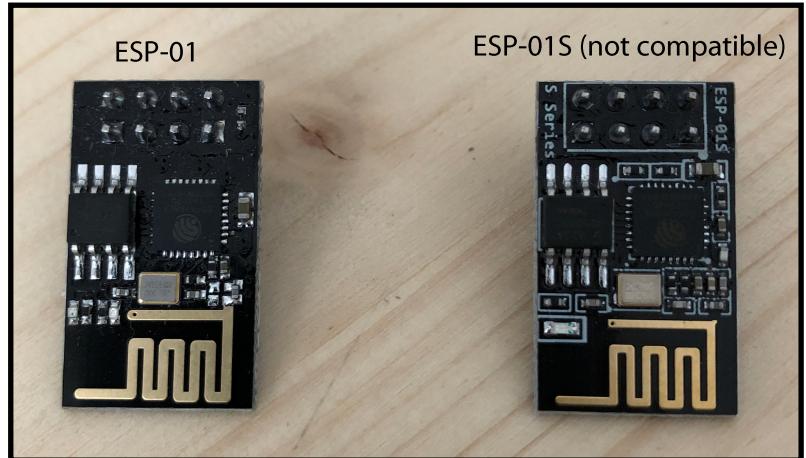
You will be able to access the SD card directly with the regular MSX BASIC commands (FILES, SAVE, LOAD, etc). The card will be recognised as drive “A”. If there is an external storage interface plugged onto one of the cartridge slots the internal SD should be recognised as drive “C”.

Its recommended to run MSXDOS. In this case you need to copy MSXDOS2.SYS and COMMAND2.COM on the root of the SD card.

Running MSXDOS will allow the use of various tools and utilities such as ROMLOAD.COM/MGLOCM.COM to load ROM files, SofaRUN to browse and launch files and programs, C compilers, etc. Notice you need to individually download and copy these utilities into the card. We strongly recommend to read the MSXDOS2 user manual to get familiar with all its functions and features.

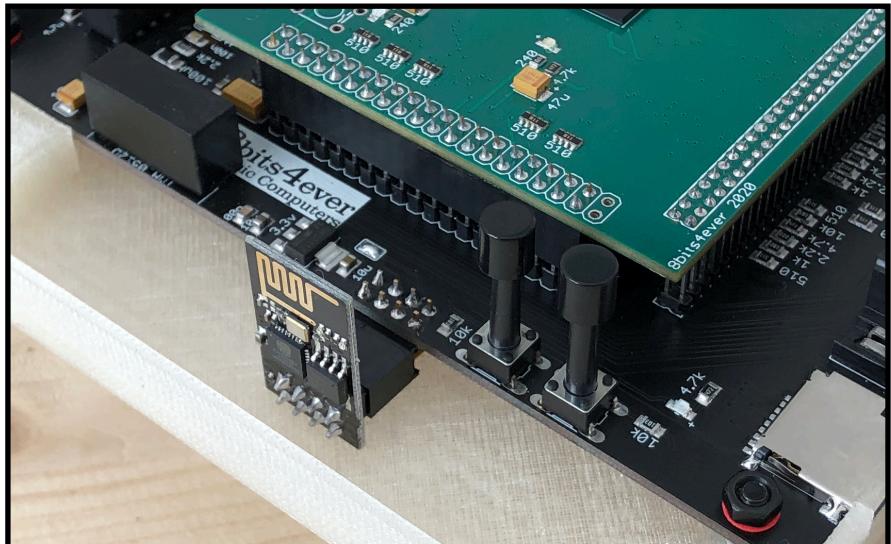
WiFi Module

If you ordered the WiFi ESP-01 module from us, it will be installed inside your **SX-2**. If that is not the case you can still install the module yourself however, **you will void the warranty if you open the case**. The best would be to send the unit back for installing the module. **ESP-01S module is not compatible.**



If you choose to install it yourself you need to remove only the four screws located at each corner of the case, beneath the rubber feet. The top of the case will become loose, remove it with care as the power switch is still connected to the board.

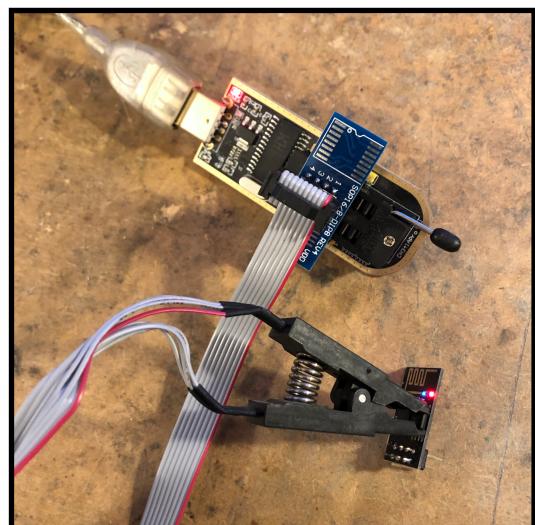
Install the WiFi module as shown in the following picture. Once installed close the case and it's done.



You will now need to run the configuration tools included in the WiFi package. This includes flashing the WiFi module with the provided firmware and configure the WiFi BIOS to connect to your home network. Remember you need to use the SDBIOS package to generate a SD card with the WiFi BIOS. Please follow the instructions inside the SDBIOS pack from KdL.

Another option is programming the WiFi module off-board with a CH341A based programmer and some programming clips.

Attention: The WiFi module can introduce electric noise into the audio/video signals.



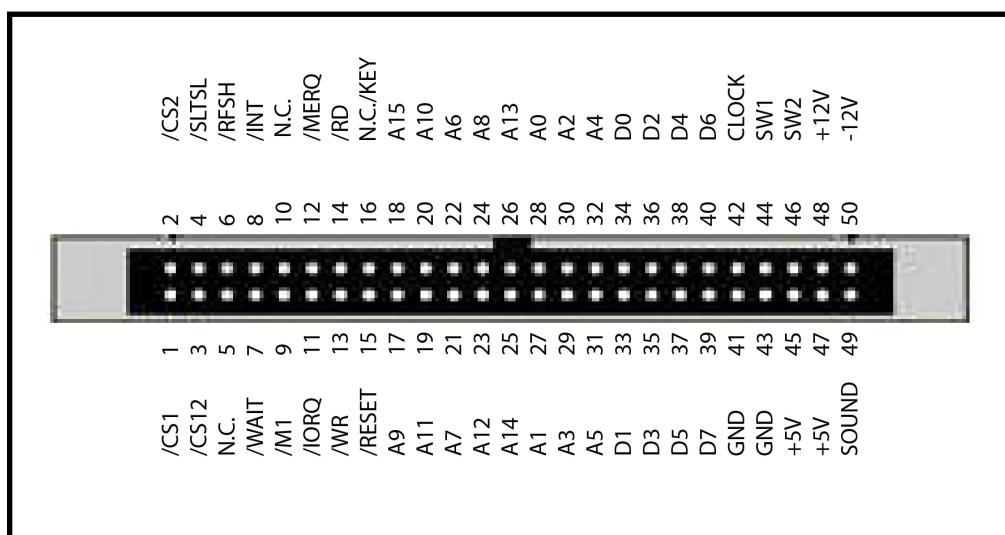
Third Expansion Slot

Besides the two standard MSX cartridge/expansion slots, the **SX-2** features a third slot on the back of the unit **which mirrors the SLOT 1**. To plug a standard MSX cartridge an adapter (available at our store) is needed. When used simultaneously, and since SLOT 1 and SLOT 3 are mirrored, **one of the two will function as an I/O slot only**. For instance, you cannot have an IDE interface and a game cart plugged at the same time. On the other hand is perfectly fine to have a game cartridge and a I/O only cart (such as Moonsound or GFX9000) working at the same time. This is a firmware limitation and might change in the future.

A way of overcome this limitation is to use a slot expander. In fact, If you already own one of our slot expanders you can connect the expander module directly on the back of the **SX-2** (you might need additional power supply).



Photo by HRA!



SLOT 3 pinout

Reflashing/Recovery via JTAG

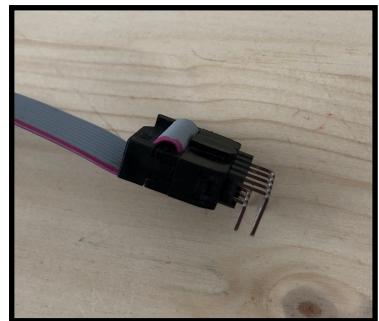
This procedure should be used only in case the unit becomes unusable due a bad firmware upgrade. It's always best in these cases you send the unit back to us for refreshing.

Remember you will void the warranty if you open the case.

You will need an Altera USB Blaster programmer (or compatible chinese clone) and a Windows machine with the Altera Quartus software installed. You will also need a 2x5 pin header



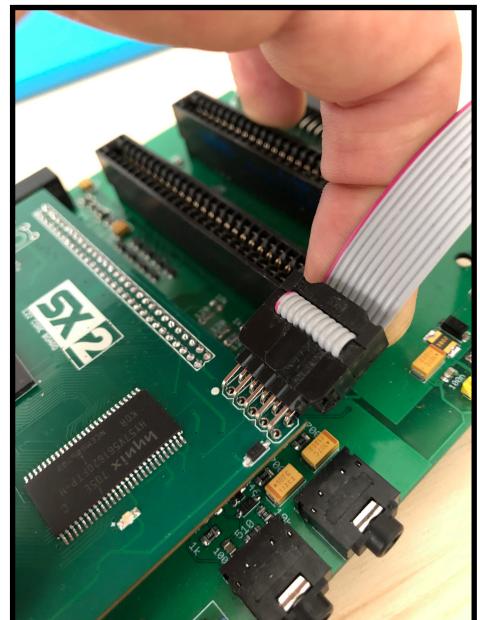
Remove the four screws located at each corner of the case, beneath the rubber feet. The top of the case will become loose, remove it with care as the power switch is still connected to the board but don't disconnect the power button. You will need to power the board for reflashing the firmware.



Plug the 2x5 header into the ribbon cable coming from the USB blaster and then insert it into the core board's JTAG 10 pin slot. Mind the red wire on the ribbon cable. It must align with the dot by the slot.

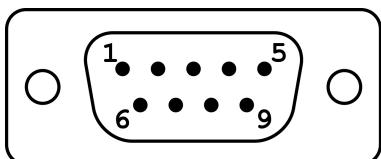
Inside the KdL firmware package you will find detailed guide on what do do on the PC side, how to deal with Altera Quartus, etc. Just follow the guide to the letter.

For the FPGA detection and firmware programming processes you will need to push the JTAG connector upwards from the back, in a way that is on a slight angle in relation to the FPGA core board. Hold it firmly but do not apply excessive force, just enough to ensure all pins make contact with the board. You need to keep this position until the programming process is done (about 2-3 minutes).



MIDI-OUT (Turbo-R standard)

MIDI-OUT data is coming out from the joystick port 2. You will need a custom-made cable to connect it to a standard MIDI port. The MIDI-OUT pinout (looking into the unit connector):



1:MIDI Tx (Use 220ohm resistor between SX-2 and MIDI receiver)
5:VCC (Use 220ohm resistor between SX-2 and MIDI receiver)
9:GND

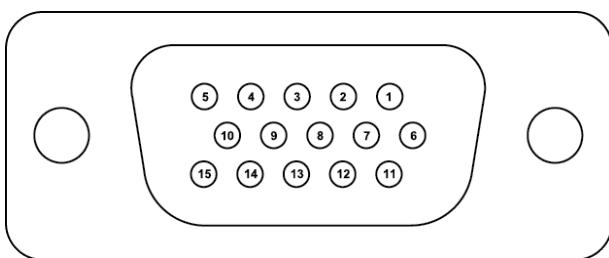
PS/2 Mouse

The SX-2 allows the use of PS/2 mice. This is particularly useful for running SYMBOS. The mouse will be seen as a MSX-Mouse standard.

Currently there is a bug on the mouse implementation. Once the mouse is unplugged you will need to restart the SX-2 in order to use it again. Hopefully this bug will be fixed in upcoming firmware updates.

Composite/S-Video Output

The **SX-2** can also output composite or S/Video (see DIP switches table for video settings) however, since the signals come through the VGA connector a custom cable will be needed to connect this signals to a compatible screen. The pinout is as follow (front view of the **SX-2** DB15 connector):



1-Chrominance (S-Video)
2-Luminance (S-Video)
3-Composite Video Out
14-Mono Audio Out
6.7.8-GND



