



This is your manual for supercharging your V4 system with the Ultimate Expansion board!

DISCLAIMER: By installing and using the Ultimate Expansion board you do so on the understanding that the manufacturer of the Ultimate Expansion board, whilst taking care during design and manufacture, accepts no responsibility for any damage to your V4/V4+ or any other item caused by the Ultimate Expansion board, and you use the board at your own risk. The Ultimate Expansion board is designed exclusively for use with the Apollo Computer V4 Standalone computer. Features and functions of the Ultimate Expansion Board will change over time as the product and firmware are developed. Only use the supplied 3V3 FTDI cable. Used of any other cable will potentially damage the Expansion Board and other attached equipment.

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1. Installation

To install and use the expansion board you will need:

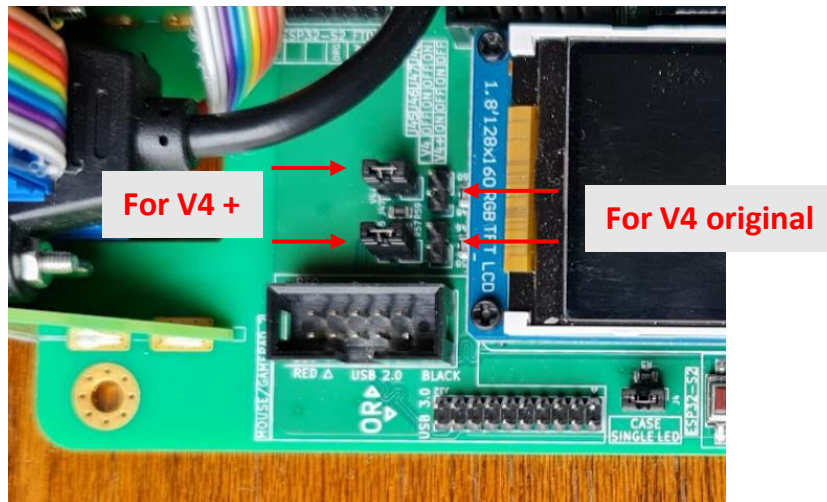
- A V4 and its peripherals (e.g., keyboard, mouse, monitor)
- Suitable Phillips screwdrivers (#1 and #2)
- A suitable ITX or mini-ITX case (with either single power/reset button, or separate buttons)
- A mains-power to IDC cable (“computer” or “jug cable”) suitable for your country.

WARNING: TAKE ANTI-STATIC PRECAUTIONS. Before starting, please ensure that you are not wearing nylon or other clothing or footwear that may generate static electricity. Ideally use an anti-static mat and grounding wires. Ground yourself using a tap or other grounded metal before starting, to dissipate any static electricity on your body.

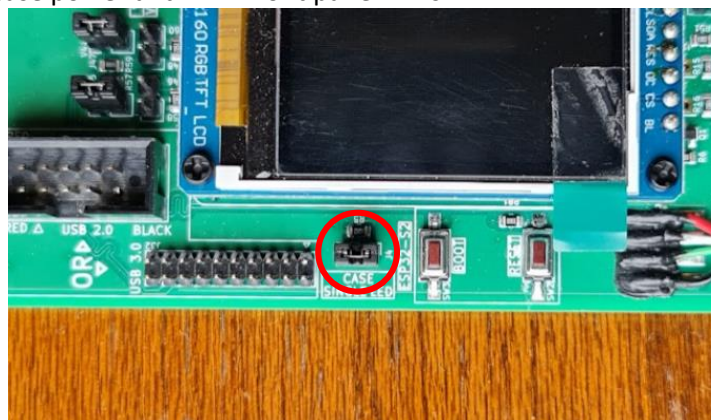
STEP 1: INSTALL THE V4/V4+ INTO THE ULTIMATE EXPANSION BOARD

It is highly recommended you watch the video demonstrating how to install the V4 into the Ultimate Expansion Board: www.jakeandpeppy.com/v4-ultimate-videos

- Configure the two jumpers on the Expansion Board for your V4 type: V4 original or V4+. These jumpers set the required electronics for the 2nd USB gamepad to function properly.

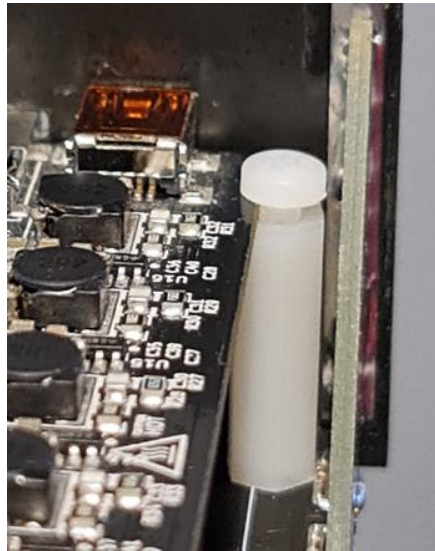


- Select case LED type – Place a jumper ON for single case for power and HDD access, or leave jumper OFF (default) for separate case power and HDD front panel LEDs.

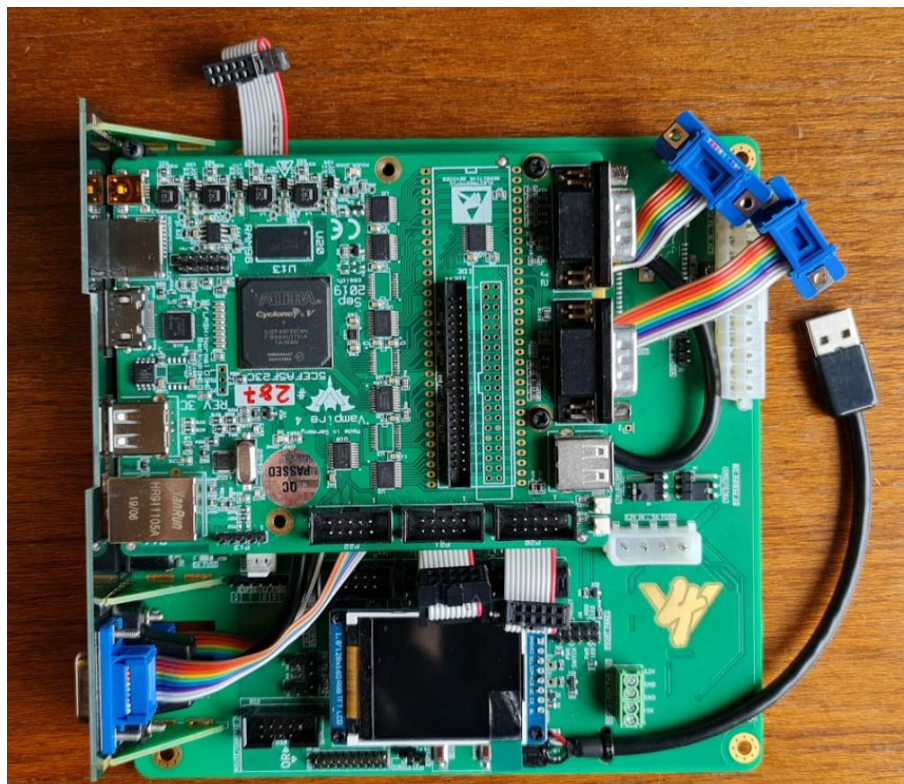


- The DB9 extension cables should follow the USB Blaster extension cable, for optimal routing of the DB9 cables underneath the V4. Please see the online video to demonstrate the recommended way to do this.
- The USB blaster IDC cable needs to fold over itself so that it comes underneath the V4 when installed, with the wire of the cable on the right hand side. Please see the online video to demonstrate the recommended way to do this.

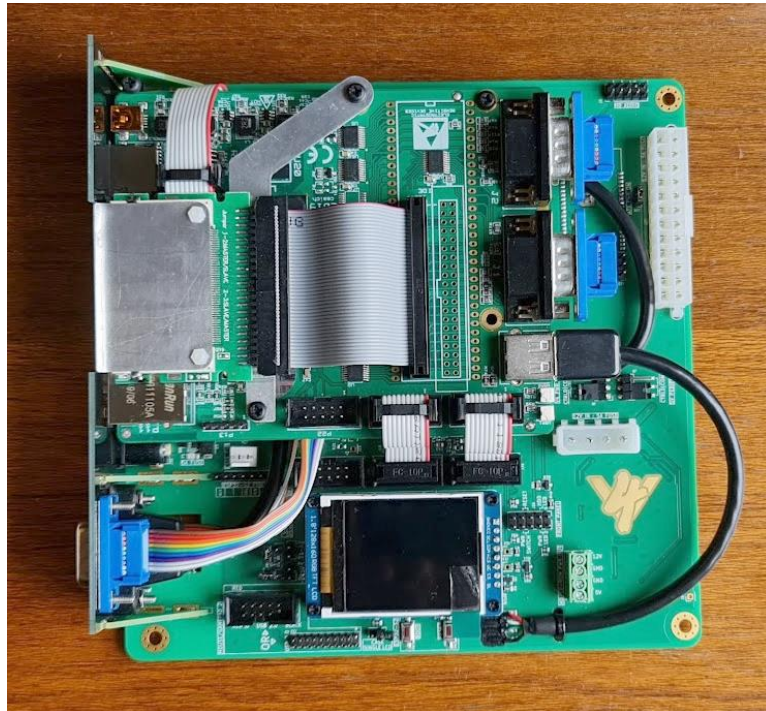
- Remove the compact flash extender, along with the white nylon standoffs (leave the black standoffs in place)
- Carefully remove your V4/V4+ from the official case. This will involve remove the screws on the panels at the end. NOTE THAT THIS MAY VOID YOUR V4/V4+ WARRANTY, AND YOU DO SO AT YOUR OWN RISK. ENSURE ANTI-STATIC PROTOCOLS ARE FOLLOWED.
- Use the microSD socket on the PCB as a guide for aligning the board into the Expansion board backplane, install the V4 so that it is resting on the 4x standoffs. Lift up the two grey IDC cables so that they rest on top of the V4 PCB. The edge of the V4 PCB near the original USB power socket is designed to slot into the space between the nylon standoff the screw, as can be seen below. This screw should not be tightened – it is designed to provide support for the V4 board, not to hold it in place. Again, please see the online video to demonstrate the recommended way to do this.



- Use 2 of the nylon screws on the right-hand screw holes to affix the PCB to the expansion board. Check the screws on the bottom of the board to make sure they are not loose. DO NOT OVERTIGHTEN THE NYLON SCREWS. They only need to be finger tight, to hold the V4 PCB in place. Your board should look like this:

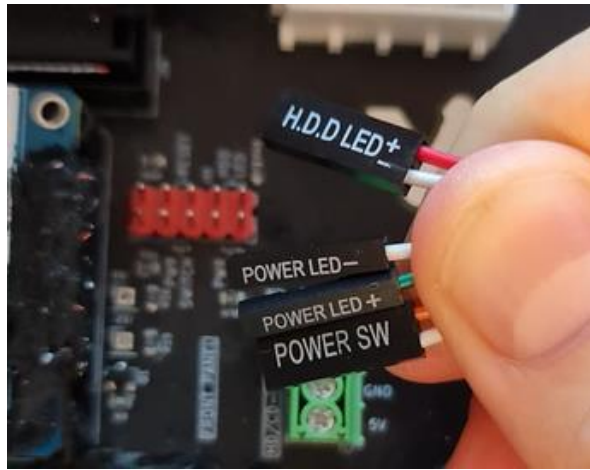


- Next, plug in the USB blaster IDC cable into the V4 board, with the red stripe on the right. Screw in the two white nylon standoffs, with the smaller standoff on the bottom (near the Ethernet port). Place the compact flash extender onto the white nylon standoffs, and screw in the nylon screws. The compact flash board will rest on top of the ethernet port on the V4. Again, do not overtighten the screws.
- Carefully plug in the DB9 cables, USB cable (lower port on the V4+), and two grey IDC cables from the Expansion board, into the V4. Your board should now look like this:

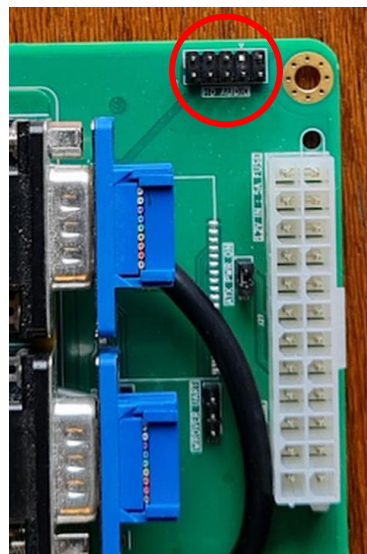


STEP 2: INSTALL EXPANSION BOARD INTO YOUR CASE

- Carefully install the Ultimate Expansion board into your ITX compatible case, and secure using the 4 screws (you may have to gently work around the USB blaster cable to get to one of the screw holes).
- Attach the front panel header wires/connector from your case. It may be a single block, or multiple headers like those shown below. Connect these to the appropriate pins on the front-panel header. The minimum requirement is that POWER SW is connected (to start/stop/reset the system). The LEDs and RESET are optional. Note that if you only have one LED then set the jumper 'CASE LED SINGLE' on the expansion board, as the board will then use LED intensity to indicate when IDE access is occurring on the V4.



- If you are using the case audio jack rather than the rear of the V4, attached the HD audio connector to the expansion board.



- Connect up your case USB header. Note that the Ultimate Expansion board has both USB2 and USB3 headers available. Only connect ONE of these at any time, as their data lines are connected.



- Connect your desired power supply. Each board ships with a high quality DC power supply. If you prefer to use another power supply you can provide power by the 4 pin 'power peripheral' connector, or by a 24-pin ATX power connector.

Note that the Expansion board runs from 12V, and the 5V line from the ATX power supply is insufficient for driving the board. Hence the 'ATX PWR ON' jumper (beside the ATX connector) is provided to keep the ATX power supply on, and providing 12V. Most modern power supplies have thermally regulated fans, but this may mean your ATX supply fan continually spins, even when the V4 expansion is 'off'.

When power is connected, the Expansion Board is in 'sleep' mode, and the case power LED and 'V4' logo on the board with gently pulse. Connect your peripherals (keyboard, mouse, monitor, etc), and press your case power button. The V4 will then be powered up!

CONGRATULATIONS. YOUR V4 IS NOW SUPER POWERED WITH THE ULTIMATE EXPANSION BOARD!

You can remove the protective screen on the LCD.

2. How to startup, shutdown, and reset the V4 in your Ultimate Expansion Board

The Ultimate Expansion Board is always 'powered up' when 12V is connected. There are two jumpers on the right-hand side of the board, between the 'V4' logo and the ATX power connector, that configure how the board powers up the V4:

- V4_PWR_ON determines whether the on-board microprocessor intelligently controls the power to the V4 (set to CTRLD by default). This means that the power button on the case will turn on/off the V4. Setting this jumper to CONST will enable constant power to the V4, bypassing the intelligent controls completely.
- 5V_PERIPH_ON determines whether the on-board microprocessor intelligently controls the secondary 5V power rail which feeds the internal Expansion Board USB headers (e.g., for the case USB ports) and also the 5V line on the HD/CD-ROM_PWR_OUT screw terminals (set to CTRLD by default). Setting this jumper to CONST will enable constant power to the headers and screw terminals, bypassing the intelligent controls completely.

When the jumpers are configured to 'CTRLD' (default)

- When the system is asleep, tapping the 'power' button on your case will wake up and power the V4.
- Tapping the 'power' button on your case will perform a hard reset of the V4, with a 6 second time delay (user settable in the future)
- Holding down the 'power' button will shut the V4 down, and the Ultimate expansion board will enter 'sleep' mode.

When the jumpers are in the 'CTRLD' mode the board will be in sleep mode by default. This is indicated by the slowly pulsing colours on the glowing V4 logo.

Notes: The analogue audio, MIDI, RS232, and FTDI ports operated independently of the microprocessor. The LCD, LEDs, and case power/reset buttons are dependent on the processor, and will not work without it functioning. Setting both jumpers to CONST will bypass the microprocessor and enable your V4 to run without it.

3. Upgrading firmware on the Ultimate Expansion Board

The Ultimate Expansion Board has an ESP32 processor, which can be updated using the provided FTDI serial cable (only use the supplied 3V3 FTDI cable – there are many variants available which can damage your ESP32 processor). You will require a Windows 10 PC.

The programming software and latest firmware files can be downloaded from:

<https://www.jakeandpeppy.com/files>.

You can check the firmware version by double-tapping the power button on the case, which will display the firmware version on the LCD screen. *[NOTE: from FW 1.01 this will also toggle the display of temperature units between Celsius and Fahrenheit. Double tap again to set your desired units].*

Instructions for upgrading the firmware:

1. Run the 'FirmwareUpdateForm.exe' on your windows 10 PC. *[Note: the software is currently in ALPHA development].*
2. Look at the COM ports in the drop down list (if any). Note these down.
3. Plug the FTDI cable into a USB port on your PC. After a few seconds, a new COM port should appear in the drop down list. Select this new COM port.

4. Ensure your Ultimate Expansion Board is completely powered down (the V4 logo is NOT glowing). Plug the FTDI connector of the supplied cable onto the 'ESP32-S2 FTDI' pin header on the Expansion Board (beside the FAN header). Line up the black wire on the connector with the 'BLK' mark on the pin header.
5. Plug in the 12V power supply to your Ultimate Expansion Board. The V4 logo should be glowing.
6. Hold the BOOT button down (below the LCD), and tap the RESET button on the Ultimate Expansion board to tell the processor to enter 'firmware update' mode. *[NOTE: These small buttons can sometimes become 'sticky' when not used for a while, and may require several pushes to 'loosen them up']*.
7. When the ESP32 is in 'firmware update' mode, the V4 logo will no longer glow as the processor is awaiting new firmware. If the logo does not glow, please retry this above step again.
8. In 'FirmwareUpdateForm.exe' on your Windows 10 computer, select the firmware zip files (e.g., "FWx.xx.zip"). The software will then attempt to send the firmware to the board. With the ALPHA version of 'FirmwareUpdateForm.exe', you will see text scrolling in the output window. You should see something like the below. If you do not see the various "%" numbers and "Hash of data verified" then the update has failed. Please repeat the above steps.

```
[2022.12.26 06:57:47:113][Event] [2022.12.26 06:57:47:113] [ProcessOutputDataReceived]: "Writing at 0x000246a2... (27 %) Proc:
[2022.12.26 06:57:47:464][Debug] Proc [EspTool] RK: Writing at 0x00029ba0... (36 %)
[2022.12.26 06:57:47:464][Event] [2022.12.26 06:57:47:464] [ProcessOutputDataReceived]: "Writing at 0x00029ba0... (36 %) Proc:
[2022.12.26 06:57:47:784][Debug] Proc [EspTool] RK: Writing at 0x0002f1d9... (45 %)
[2022.12.26 06:57:47:785][Event] [2022.12.26 06:57:47:785] [ProcessOutputDataReceived]: "Writing at 0x0002f1d9... (45 %) Proc:
[2022.12.26 06:57:47:991][Debug] Proc [EspTool] RK: Writing at 0x000348b2... (54 %)
[2022.12.26 06:57:47:992][Event] [2022.12.26 06:57:47:992] [ProcessOutputDataReceived]: "Writing at 0x000348b2... (54 %) Proc:
[2022.12.26 06:57:48:262][Debug] Proc [EspTool] RK: Writing at 0x00039df6... (63 %)
[2022.12.26 06:57:48:262][Event] [2022.12.26 06:57:48:262] [ProcessOutputDataReceived]: "Writing at 0x00039df6... (63 %) Proc:
[2022.12.26 06:57:48:583][Debug] Proc [EspTool] RK: Writing at 0x0004350f... (72 %)
[2022.12.26 06:57:48:583][Event] [2022.12.26 06:57:48:583] [ProcessOutputDataReceived]: "Writing at 0x0004350f... (72 %) Proc:
[2022.12.26 06:57:48:902][Debug] Proc [EspTool] RK: Writing at 0x0005588a... (81 %)
[2022.12.26 06:57:48:902][Event] [2022.12.26 06:57:48:902] [ProcessOutputDataReceived]: "Writing at 0x0005588a... (81 %) Proc:
[2022.12.26 06:57:49:318][Debug] Proc [EspTool] RK: Writing at 0x0005ecc5... (90 %)
[2022.12.26 06:57:49:318][Event] [2022.12.26 06:57:49:318] [ProcessOutputDataReceived]: "Writing at 0x0005ecc5... (90 %) Proc:
[2022.12.26 06:57:49:620][Debug] Proc [EspTool] RK: Writing at 0x00064492... (100 %)
[2022.12.26 06:57:49:621][Event] [2022.12.26 06:57:49:621] [ProcessOutputDataReceived]: "Writing at 0x00064492... (100 %) Proc:
[2022.12.26 06:57:50:675][Debug] Proc [EspTool] RK: Wrote 360272 bytes (173912 compressed) at 0x00010000 in 3.5 seconds (effectiv
[2022.12.26 06:57:50:675][Event] [2022.12.26 06:57:50:675] [ProcessOutputDataReceived]: "Wrote 360272 bytes (173912 compressed)
[2022.12.26 06:57:50:675][Debug] Proc [EspTool] RK: Hash of data verified.
[2022.12.26 06:57:50:675][Event] [2022.12.26 06:57:50:675] [ProcessOutputDataReceived]: "Hash of data verified." Proc: EspTool E
[2022.12.26 06:57:50:675][Debug] Proc [EspTool] RK: Compressed 3072 bytes to 128...
[2022.12.26 06:57:50:675][Event] [2022.12.26 06:57:50:675] [ProcessOutputDataReceived]: "Compressed 3072 bytes to 128..." Proc:
[2022.12.26 06:57:50:675][Debug] Proc [EspTool] RK: Writing at 0x00008000... (100 %)
[2022.12.26 06:57:50:675][Event] [2022.12.26 06:57:50:675] [ProcessOutputDataReceived]: "Writing at 0x00008000... (100 %) Proc:
[2022.12.26 06:57:50:933][Debug] Proc [EspTool] RK: Wrote 3072 bytes (128 compressed) at 0x00008000 in 0.1 seconds (effective 30
[2022.12.26 06:57:50:934][Event] [2022.12.26 06:57:50:934] [ProcessOutputDataReceived]: "Wrote 3072 bytes (128 compressed) at 0
[2022.12.26 06:57:50:934][Debug] Proc [EspTool] RK: Hash of data verified.
[2022.12.26 06:57:50:934][Event] [2022.12.26 06:57:50:934] [ProcessOutputDataReceived]: "Hash of data verified." Proc: EspTool E
[2022.12.26 06:57:50:935][Debug] Proc [EspTool] RK: Leaving...
[2022.12.26 06:57:50:935][Event] [2022.12.26 06:57:50:935] [ProcessOutputDataReceived]: "Leaving..." Proc: EspTool ExecPath: ./1
[2022.12.26 06:57:50:957][Debug] Proc [EspTool] ProcClosed
[2022.12.26 06:57:50:957][Event] [2022.12.26 06:57:50:957] [ProcessClosedEvent]: Proc: EspTool ExecPath: ./Tools/esptool.exe ar
[2022.12.26 06:57:50:957][Debug] Proc [EspTool] Close: STARTED
[2022.12.26 06:57:50:957][Debug] Proc [EspTool] Close: FINISHED
```

0 Exceptions | 0 Errors | 2 Warnings | 0 RedirectedFromConso

9. The board firmware has been updated. You can power down/up the expansion board by removing the power supply and reconnecting, or by sampling tapping the RESET button.

You can use the Amiga command line executable 'V4Send' to send text data to your Expansion Board LCD screen or set the colours of the 'V4' logo when the system is booted. This can be download from:

<http://www.jakeandpeppy.com/files>. Note that this tool currently uses the Amiga serial.device for communication, and so it will not work when other applications are using the serial.device port (such as a terminal program, or MIDI software).

The LCD screen shows the current temperature of the Expansion Board (a small sensor on the board). The current draw displayed is the total current used by the system. About 1.2W is used by the board, before the V4 is powered up (this includes the LCD screen, on-board LEDS etc)

4. Changing the units of temperature on the LCD screen

Double-tap the power button on your case to change the units of temperature displayed on the on-board LCD screen between Celsius and Fahrenheit. The setting is stored on the processor EEPROM

5. Using the built-in MIDI port

The Ultimate Expansion board uses the BeatBuddy MIDI style connector to provide a compact MIDI port on the backplane of the board. You can purchase an adapter cable to provide two standard-sized MIDI IN/OUT ports

from the likes of Amazon, or direct from Singular Sound, enabling you to connect regular MIDI 5-PIN DIN cables to your MIDI devices.

There are a number of MIDI-compatible programs for the Amiga, which is beyond the scope of this manual. However, a brief guide is provided below to get you started on your v4 MIDI journey!

MIDI IN

MIDI In allows devices to send MIDI data to the V4, such as a MIDI keyboard. A simple way to test a MIDI keyboard is to use OctaMED Sound Studio by Teijo Kinnunen (available on Aminet). Configure it as follows:

- From the menu, go to MIDI and select 'MIDI Active', and 'Input Active'.
- In the 'Main Control' window, press 'Props...'. Change 'MIDICh' to 1 (Note that MIDI has multiple channels, and your keyboard may output on a different channel)
- In the 'Main Control' window, tick the 'Edit' box.

If you have plugged and powered your MIDI keyboard, pressing the keys will start entering data into the 'Block' window.

MIDI OUT

There are many MIDI synthesizers which will play General MIDI '.mid' files. One such tool is Horny from Inutilis (demo available from Aminet). Once your device is connected to the Ultimate Expansion board MIDI out, you can simply load up your .mid file and play it. For regular MIDI you go to 'Project->Load'. For importing extended format XG files (for the likes of YAMAHA XG tone generators) you go to 'Project->Import SMF'. Pressing the play button on the bottom of the window

Notes:

- Many MIDI devices will have multiple MIDI ports: IN, OUT, and THRU.
- Connecting a cable from the Expansion board MIDI OUT will enable the V4 to send MIDI commands out to the device. In this case, the same cable should be connected to MIDI IN on your device.
- Connecting a cable to the Expansion board MIDI IN will enable the V4 to receive MIDI commands from the device. In this case, the same cable should be connected to the MIDI OUT of your device (e.g., keyboard).

6. Other notes

- LCD: This is on a header and can be extended by using an 8-pin 'Dupont' style 2.54 mm jumper cable. This has been tested to around 40 cm, though your performance may vary. Remove the LCD by unscrewing the 4 small nylon screws.
- Power can be permanently applied to the V4 by changing the 'V4 PWR ON' and 'V4 PERIPH ON' jumpers. By default, they are on 'CTRLD' (controlled) which means that the power to the V4 is managed by the microprocessor on the Expansion board. Move these jumpers to 'CONST' to have constant power applied to the V4, independent of the microprocessor (e.g., in case of microprocessor failure or corrupted firmware).
- The USB port headers are non-standard, with the power being provided unmanaged. This means you can drive more current through them than the USB standard. Note that there is a 5A fuse on the 12V line of the Ultimate Expansion board, so please ensure current draw through the USB ports is limited. For example, you can power a USB-powered midi keyboard through the second USB port (gamepad), when using it for MIDI input on the Ultimate Expansion board.
- The 'HD/CD-ROM PWR OUT' connector terminal provides power to possible future expansion products for the V4. The power delivered it is limited by the 12V line fuse (5A total) which is used to derive all power to the Expansion board (12V, 2x 5V lines, and internal 3V3 lines). There is no guarantee that this port can provide the necessary power to power all devices, as these have not yet been developed for the V4.
- The high-quality analogue audio output can be run in parallel with the HDMI audio output. They are separately produced.

- The FTDI, RS232, and MIDI ports are run in parallel from serial.device. You can safely plug in devices into all 3 at once, but you will only be able to use one of these at a time as the data will clash.
 - You can plug in the provided FTDI programming cable into the back 'FTDI' port of the Expansion board, plug the USB end into a computer to provide serial communications. This is very useful for Amiga software development.
-

Key functions of the V4 Ultimate Expansion Board

Audio related:

- 16-bit high-quality analogue audio output, with separate ultralow-noise LDO power regulator. 112 dB SNR, and -93 dB THD. Playback both PAULA AND ARNE audio at high quality!
- Pass-through of analogue audio out to case 3.5 mm audio jack using the standard case HD AUDIO/AC97 connector.
- MIDI in/out (serial.device; using beat-buddy format connector due to space constraints).

Serial related:

- Buffered serial UART in/out for FTDI cable (serial.device), 3V3 only.
- RS232 in/out (RX/TX lines) (serial.device).

Power control:

- Integration with standard ITX front-panel case buttons and LEDs.
- Full hardware cold reset from a single press of the case power/reset button.
- Full startup/shutdown from the ITX case power button (power removed from V4). Soft glowing LED when the V4 is powered down.
- LED output selectable for single-led system (combined POWER and IDE access) or dual-led system (separate POWER and IDE access).
- 12V input from a wide range of inputs: a barrel jack connector (external), ATX PSU connector (internal), or PC peripheral connector ('Molex') (internal).
- Separate 5V lines for powering the Apollo V4, and peripherals (e.g., USB).
- Provision of SAFE +5V and +12V passthrough for powering external components like drives/CD-ROMs for the V4.
- Smart power meter for voltage and current measurement of the 12V supply, and two 5V lines.

Keyboard/Mouse/Joystick:

- Passthrough for legacy DB9 mice and joysticks. USB keyboard port from the V4 is accessible directly from the rear panel of the Ultimate Expansion Board.
- USB mouse accessible via USB header on the board, for connection to case or expander USB ports. Both USB2 and USB3 headers are provided to ensure maximum case compatibility.
- Second USB gamepad port provided on the internal USB header, for both V4 and V4+ systems (i.e., it provides the second gamepad port for original V4 board owners).

Other:

- Mini-ITX form factor, for install into any Mini-ITX compatible case.
- A 3-pin fan header for powering 12V fans.
- Internal mounting of USB blaster with mini-USB socket on the rear ITX panel, for easy FPGA programming. No more opening of the case to plug in the USB blaster!
- Internal programming header for on-board microprocessor (3V3 FTDI)
- Multi-colour LED back-lit V4 logo.
- 1.8" 160x128 pixel colour LCD, with communication directly from the Apollo V4!
- On-board temperature sensor for system monitoring.
- Firmware upgradable via supplied FTDI cable (3V3 only) at software running on a Windows 10 PC.
- A compact-flash extender to enable you to remove and change compact-flash cards without opening the case

These functions are subject to change as development progresses with the Expansion Board firmware.

Please contact us at y4expansion@gmail.com for any questions or direct support.

Please enjoy your super-charged V4 Standalone!