

ATX Watchdog for Compute Module 4 Revision 1.0 User Manual

ATX Watchdog for Compute Module 4 Installation and User Guide.

February 8 2021

Overview

Congratulations on your purchase of the ATX Watchdog for Compute Module 4 (ATX Watchdog)!

Please read this entire manual before using to ensure you receive maximum benefit from this board while protecting your investment in your Compute Module and I/O board.

While reading this document, please refer to the graphic below on the following pages.

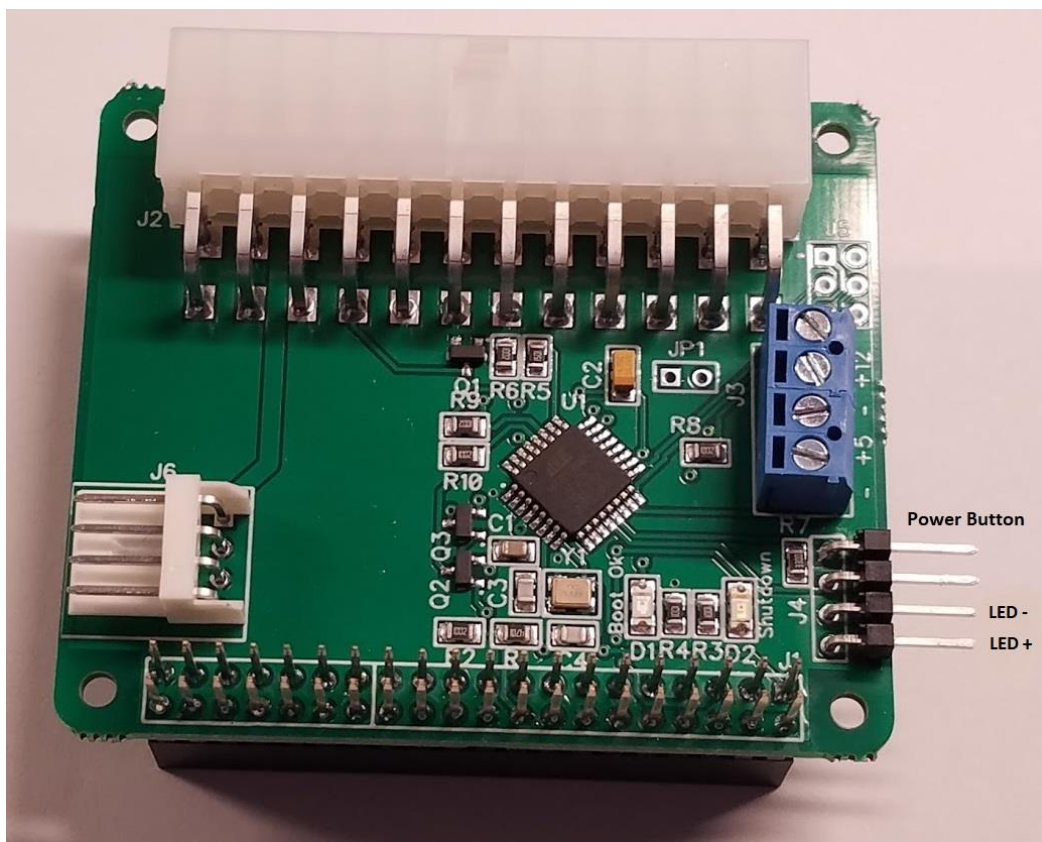


Figure 1 - ATX Watchdog for Compute Module 4

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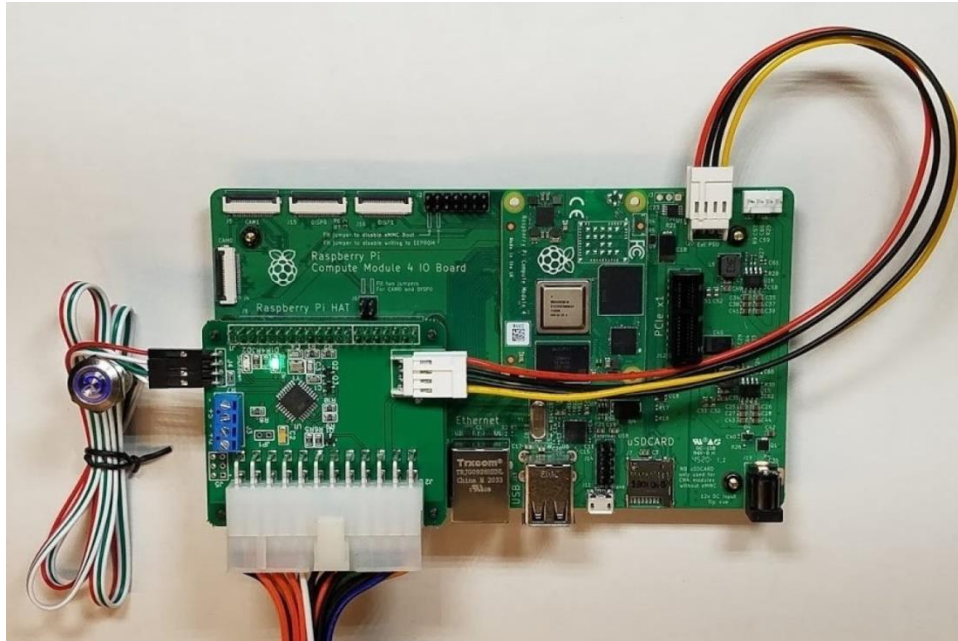


Figure 2 - ATX Watchdog Installed on I/O Board

Features

- Features soft shutdown and reboot of the Compute Module to minimize disk file corruption
- Includes configurable watchdog timer to power cycle the I/O board in case of Compute Module freeze
- Includes configurable power management to automatically restart the Compute Module after a power failure
- Works with most inexpensive off the shelf ATX desktop supplies using 20 or 24 pin ATX connectors
- Screw terminals break out +12 VDC and +5 VDC for user projects. The screw terminals are rated for 3.0 amps
- 12vdc supply to the I/O board is rated for 3 amps
- PCB is 1oz copper with lead free HASL finish
- Conforms to the Raspberry Pi Foundation's HAT footprint

Installing the ATX Watchdog for Compute Module 4

The purpose of the ATX Watchdog is to power your Compute Module I/O board from an ATX style desktop power supply through the I/O board's PSU connector. **Therefore, you must not plug the I/O**

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board into any other power supply while the ATX Watchdog is installed otherwise damage to your Compute Module 4 WILL occur.

You will install the ATX Watchdog in this order:

1. Unbox the Compute Module 4 and I/O board. Assemble those components and install the latest operating system per the given instructions.
2. Use a recommended I/O board power supply to verify that the OS boots up properly.
3. Download and install recommended operating system updates.
4. Enable I2C through the operating system Configuration Panel.
5. Shutdown the operating system from the main menu.
6. Disconnect power supply.
7. Mount the ATX Watchdog to the GPIO header on the I/O board using the supplied mounting kit:
 - a. If you're using the extra tall stacking header, note that there are four extra nuts. These are used as spacers and are screwed onto the male ends of the standoffs to give the standoffs their proper height.
 - b. Plug the four wire cable into the PSU connector on the I/O board.
 - c. Plug the other end of the cable into the PSU connector (J6) on the ATX Watchdog board.
 - d. Connect the ATX Watchdog to the ATX power supply, power LED and power button.
 - e. Turn on the ATX power supply. You should notice that the power and Boot Ok LEDs flash in quick succession. This indicates that the ATX Watchdog is now ready to use.
8. Turn on power to the Compute Module by depressing the power button. Allow the Compute Module to boot up. The ATX Watchdog will now be waiting for the Boot Ok command from the Compute Module.
9. Run "sudo i2cdetect -y 1" in the command window to verify that the ATX Watchdog is found at the default address of 0x5A on the I2C bus.
10. Install the required boot script on to the Compute Module. When you install the boot script, the service that listens for the ATX Watchdog will start up and send a Boot Ok command to the ATX Watchdog.
11. Reboot by typing 'sudo reboot' in the command window. Alternatively, depress the power button for a half a second then release. When the Compute Module reboots, the Boot Ok LED will now illuminate and the ATX Watchdog will be waiting for a power down request.

Installing the ATX Watchdog Boot Script

You will find the necessary boot install script at: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_install.sh. This script assumes that you are running a version of Linux that is compatible to Raspbian. This script installs two services on the Compute Module.

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The first service does the following:

1. Sends a Boot Ok command to the ATX Watchdog.
2. Waits for a shutdown signal from the ATX Watchdog.
3. Initiates either a reboot or a shutdown command on the Compute Module depending on the length of the shutdown pulse received from the ATX Watchdog.

Please note that the first service requires the use of GPIO 5 (pin 18, 'Shutdown'). This pin was selected because it does not conflict with special use pins such as I2C, SPI or UART pins.

The second service executes when the Compute Module starts to reboot or shutdown. When this happens, this service sends a command to the ATX Watchdog to turn off the Boot Ok LED. It then waits until the Compute Module either reboots or shuts down. If the Compute Module shuts down, the ATX Watchdog will shut power off to the Compute Module after a configurable delay to give the Compute Module enough time to properly unmount file systems and resources.

To install the script, follow these instructions: (recommended to have ATX Watchdog mounted on the GPIO header. Otherwise the Compute Module may automatically shut down after reboot)

1. Open a command window and enter the following commands:
2. `sudo wget https://raw.githubusercontent.com/tomtibbetts/ATX-Watchdog-for-Pi/main/scripts/ATX-Watchdog_install.sh`. Alternatively, navigate to: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_install.sh. Click on the "Raw" button. It is found above the script text, on the header to the right. Copy and paste the URL into the command window after "`sudo wget` " then hit enter.
3. `sudo bash ATX-Watchdog_install.sh` – This will start both services. The Boot Ok LED should now light indicating a successful install.
4. `sudo rm ATX-Watchdog_install.sh` to remove the install script.
5. `sudo reboot`.

Operating Modes

Turning on the ATX Power Supply:

Turning on/plugging in the ATX power supply will supply a trickle voltage to the microcontroller on the ATX Watchdog. The ATX Watchdog will flash the power and Boot Ok LEDs in rapid succession to indicate the board is powered up and functioning.

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Power up the Compute Module:

Depressing the power switch when the Compute Module is turned off will initiate the power up sequence. The power indicator LED pulsates slowly until the Boot Ok command is received from the Compute Module. When the Boot Ok command is received, the Boot Ok LED lights and the power LED goes steady on.

Reboot:

Depressing the power switch for greater than a half a second and less than three seconds while the Compute Module is on will initiate a reboot of the Compute Module. The power LED dims and the shutdown LED pulses once to signal the Compute Module to reboot. When the Compute Module starts to reboot, it sends a command to the ATX Watchdog to turn off the Boot Ok LED. The power LED will then pulsate until the Compute Module has rebooted and the ATX Watchdog receives the Boot OK command. The power and Boot Ok LEDs will then go steady on.

Shutdown:

Depressing the power switch for over three seconds while the Compute Module is on will initiate a shutdown of the Compute Module. The power LED dims and the shutdown LED goes steady on to signal the Compute Module to shut down. When the Compute Module shuts down, it sends a command to the ATX Watchdog to turn off the Boot Ok LED. The ATX Watchdog will then wait a long enough period of time for the Compute Module to perform a clean shutdown before turning off power to the Compute Module.

Hard Shutdown:

In the event that the Compute Module has frozen and is not responsive to commands from the ATX Watchdog or user interaction, you may force the ATX Watchdog to power off the Compute Module. Depressing the power switch for greater than ten seconds will power off the Compute Module.

Command line or Application Forced Shutdown:

The ATX Watchdog has the ability to detect when a shutdown or reboot is initiated from the Compute Module. When the user selects “Shutdown” or “Reboot” from the “Logout” menu, for example, the Compute Module sends a command to the ATX Watchdog to turn off the Boot Ok LED and to wait a configurable amount of time. While it’s waiting, the power LED will pulsate. If the Compute Module successfully reboots, it will command the ATX Watchdog to turn on the Boot Ok LED. If the Compute Module does not reboot, for example the user initiated a shutdown, then the ATX Watchdog powers off the Compute Module.

Power Management (Optional)

The power management option directs how the ATX Watchdog responds to power failure. In the event the power fails, the default mode of the ATX Watchdog is keep the Compute Module powered off.

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Optionally, you can configure the ATX Watchdog to power on the Compute Module after a power failure. Please refer to the section, “Programming the ATX Watchdog” for more detailed instructions.

Watchdog Timer (Optional)

The ATX Watchdog has the option of power cycling the Compute Module in the event the Compute Module freezes for some reason and can no longer communicate with the ATX Watchdog. Please refer to the section, “Enabling the Watchdog Timer” for more detailed instructions on how to configure the watchdog timer.

Reset Default Values

You may, at any time, reset all edited parameters to their original values. There are two ways to do this:

1. Execute the Reset Default Values command (0x80) on the ATX Watchdog. See the section, “Programming the ATX Watchdog”.
2. Perform a hard reset upon powering up the ATX power supply.

To perform a hard reset, you first need to power off the ATX power supply and allow its capacitors to fully drain. This may take a few minutes.

Before powering up the ATX power supply, depress and hold down the power button. Turn on the power supply. The Boot Ok LED should give one long pulse. This indicates that you can now reset the ATX Watchdog to its original values.

Release the power button.

If you do nothing, the Boot Ok LED will flash quickly after ten seconds. You can now use the ATX Watchdog as before without having changed any values.

If you depress the power button, the Boot Ok LED will flash quickly in two sequences. The default values will have been restored and you can now proceed to use the ATX Watchdog.

Assembling the ATX Watchdog for Compute Module 4

If you opted to purchase the kit, then you will need to do some assembly. Fortunately, there are only a handful of components to assemble. Additionally, we assume that you already have some experience assembling kits and soldering parts. If not, we strongly encourage you to practice soldering skills on high quality perf boards first. There are several Youtube videos on how to solder.

Regardless of your soldering skills, here are some things to consider:

1. Please use a soldering iron of sufficient wattage. A 40 watt pencil tip soldering iron will work. A hot iron will minimize cold solder joints and solder bridging between pins.

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2. It helps to clean the pads where you will be soldering with rubbing alcohol. This will help produce better solder joints.
3. Double and triple check your solder joints so that you are not creating solder bridges between pins, especially on the power connectors. Also, ensure that solder joints have a 'fillet'. See below:



4. When you have completed soldering, it is worth the effort to clean the board again to removed solder and flux residual. This will ensure a long life for your board. If don't already have some sort of flux remover, then try using rubbing alcohol and an old tooth brush.

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The following order of assembly is recommended:

1. Test fit the header, J1 on the 40 pin GPIO header before soldering to ensure proper fit. Don't solder just yet.
2. Solder J4 – the header for the power button and LED.
3. Solder J1. Make sure that it is “upside down” i.e. with the female portion of the socket under the board so that it can mate with the GPIO header. For best results, make sure the socket is snug against the board and perpendicular to the board.
4. Solder the remaining parts in the following order: J6, J3, and J2.

Do it Yourself Kit:

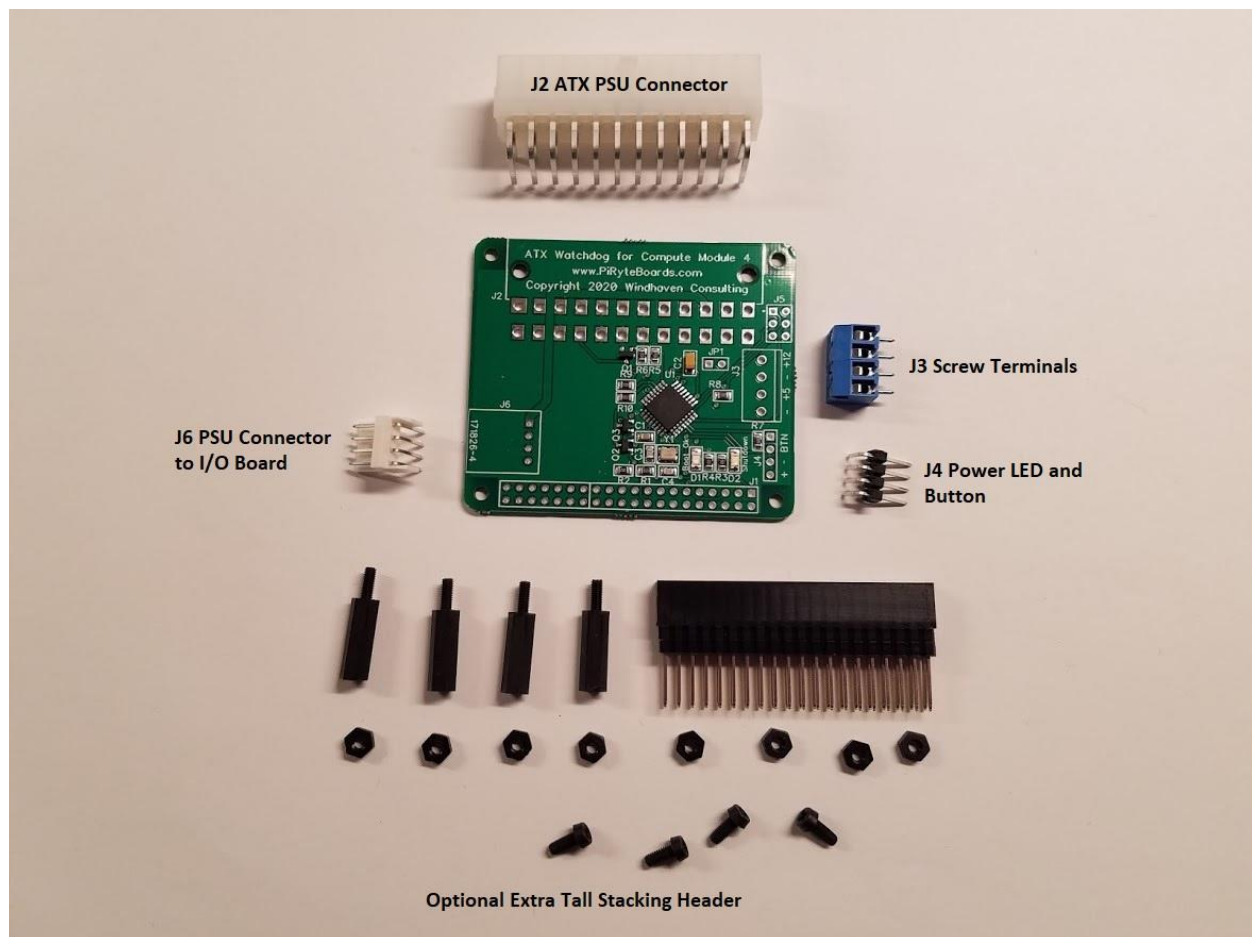


Figure 3: Parts Included in Kit

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Registers and Commands:

The ATX Watchdog comes out of the box with the watchdog and power management disabled. The various shut down and reboot delays are preset to handle most situations.

However, in the event you wish to change or read any of the preset values, you can do so by accessing the registers on the ATX Watchdog over I2C. Additionally, you can send commands to the ATX Watchdog to perform some operations. This is how the shutdown and watchdog services communicate with the ATX Watchdog. Example code is located at: <https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples>.

Descriptions of the registers and commands are below:

Immutable Machine Values (read only)

Register	Address	Value	Notes
Revision Number High	0x21	0x01	Firmware Revision 1.0
Revision Number Low	0x22	0x00	Firmware Revision 1.0

Programmable Default Values (read/write)

Register	Address	Default Value	Notes
Shutdown Delay	0x31	10	0 – 255 Seconds
Remote Shutdown Delay	0x32	30	0 – 255 Seconds
Remote Shutdown Detect Delay	0x33	0	0 – 255 Seconds
Power Management	0x34	0x00	See description Below
Watchdog Timer	0x35	0x00	See description Below
Watchdog Timer Delay	0x36	120	0 – 255 Seconds. Watchdog is disabled if set to 0
Watchdog Timer Reboot Delay	0x37	120	0 – 255 Seconds
Watchdog Timer Power Cycle Delay	0x38	10	0 – 255 Seconds, 0 is not recommended
I2C Address	0x39	0x5A	

Registers 0x21 and 0x22 – Firmware Revision:

These registers are read only and report the current firmware revision of the ATX Watchdog.

Register 0x31 – Shutdown Delay:

When the power button is depressed for over three seconds, the ATX Watchdog sends a shutdown signal to the Compute Module 4. This starts causes the Compute Module to start its shutdown process and send a command to the ATX Watchdog to extinguish the Boot Ok LED. When the Boot Ok LED is

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extinguished, the ATX Watchdog will wait the 'Shutdown Delay' in seconds before powering off the Compute Module 4.

Register 0x32 – Remote Shutdown Delay:

When the user initiates either a shutdown or reboot from the operating system, the Boot Ok LED extinguishes. The ATX Watchdog then waits up to the remote shutdown delay in seconds before removing power from the Compute I/O board. If the Compute Module reboots and the Boot Ok LED illuminates before this delay has expired then power to the I/O board is maintained.

Register 0x33 – Remote Shutdown Detect Delay:

When power management is enabled and the ATX Watchdog senses a remote shutdown, this delays when the Boot Ok LED extinguishes and the ATX Watchdog begins to wait for a Boot Ok command from the Compute Module. If it does then power is maintained to the I/O board. If not, then the power is removed after the remote shutdown delay period has expired.

Register Address 0x34 - Power Management

Bit	7	6	5	4	3	2	1	0
	-	-	-	-	-	-	PWR_MGT_M1	PWR_MGT_M0
Default	0	0	0	0	0	0	0	0

Power Management Mode

PWR_MGT_M1	PWR_MGT_M0	
x	0	Disable power up after power failure
0	1	Enable power up after power failure. Restore power to the I/O board after power failure whether the I/O board was powered before power failure.
1	1	Enable power up after power failure. Always restore power to the I/O board after failure.

By default, power management is disabled on the ATX Watchdog. To enable this feature, write a value with bit 0 (PWR_MGT_M0) to this register. See above table for behavior of the ATX Watchdog after restoration of power.

Register Address 0x35 - Watchdog Timer

Bit	7	6	5	4	3	2	1	0
	WD_TMR	Maximum Reboot Attempts						
Default	0	0						

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WD_TMR	
0	Watchdog Timer Disabled
1	Watchdog Timer Enabled

By default, the watchdog timer is disabled. To enable the watchdog timer, write the value 0x80 to this register. If you wish for the Compute Module to make multiple attempts to reboot, then set the number of desired attempts in bits 0 – 6. The range is 0 – 127 attempts. So, for example if you wish to make a maximum of two reboot attempts, the value you would write would be 0x82.

Register Address 0x36 - Watchdog Timer Delay

When the watchdog timer is enabled, the ATX Watchdog waits up to the value of this register in seconds before power cycling the Compute Module if no keep-alive command (0x82) is received.

Register Address 0x37 - Watchdog Timer Reboot Delay

In the event that the watchdog timer expired and the ATX Watchdog is attempting to reboot the Compute Module, the ATX Watchdog will wait the value of this register in seconds after rebooting for a keep-alive command. If no keep-alive command is received, then the ATX Watchdog will power cycle the I/O board.

Register Address 0x38 - Watchdog Timer Power Cycle Delay

In the event that the watchdog timer expired and the ATX Watchdog power cycles the I/O board, the watchdog timer power cycle delay is the period of time, in seconds, that the ATX Watchdog waits between removing power from the I/O board and restoring power. This delay allows any devices that are attached to the I/O board or the ATX power supply to fully reset before power is restored.

Register Address 0x39 - I2C Address Register

I2C must be enabled on the Compute module. Enter “sudo i2cdetect -y 1” in a command window to verify that the ATX Watchdog is present at the correct address. Changes to this address will require updating the address values in the installed services.

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Commands

Process	Address	Read	Write
Reset Default Values	0x80	Read block of current default values	Any value: reset factory defaults
Ping Watchdog Timer Keep Alive	0x82	Returns 0xff	Any Value: reset watchdog timer
Set Boot Ok State	0x83	Returns 0xff	0xx0: Boot Ok on 0xx1: Boot Ok off

Although the mechanism is the same, executing commands is different than reading/writing values to the registers.

When you execute commands on the ATX Watchdog, you are performing the functions defined in the table above.

Programming the ATX Watchdog

There are several example Python scripts available at: <https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples>. The Raspbian desktop comes with a Python editor called Thonny in which you can copy and paste the code needed to read/write register values and commands.

In most cases you should be able to use the ATX Watchdog out of the box without changing any of its operating parameters. If you do need to change something, then it's easy to edit one of the example scripts to your needs and execute it in Thonny.

Enabling the Watchdog Timer

To enable the watchdog timer, you will need to do the following:

1. Install the Keep Alive service. This service will send a Keep Alive command to the ATX Watchdog at a regular period ensure power to the Compute Module. If the Compute Module freezes and the ATX Watchdog does not receive the Keep Alive command, then the ATX Watchdog will power cycle the I/O board.
2. Enable the watchdog timer.

Installing the Keep Alive service is done much the same way as downloading and executing the original install script.

1. Open a command window and enter the following commands:

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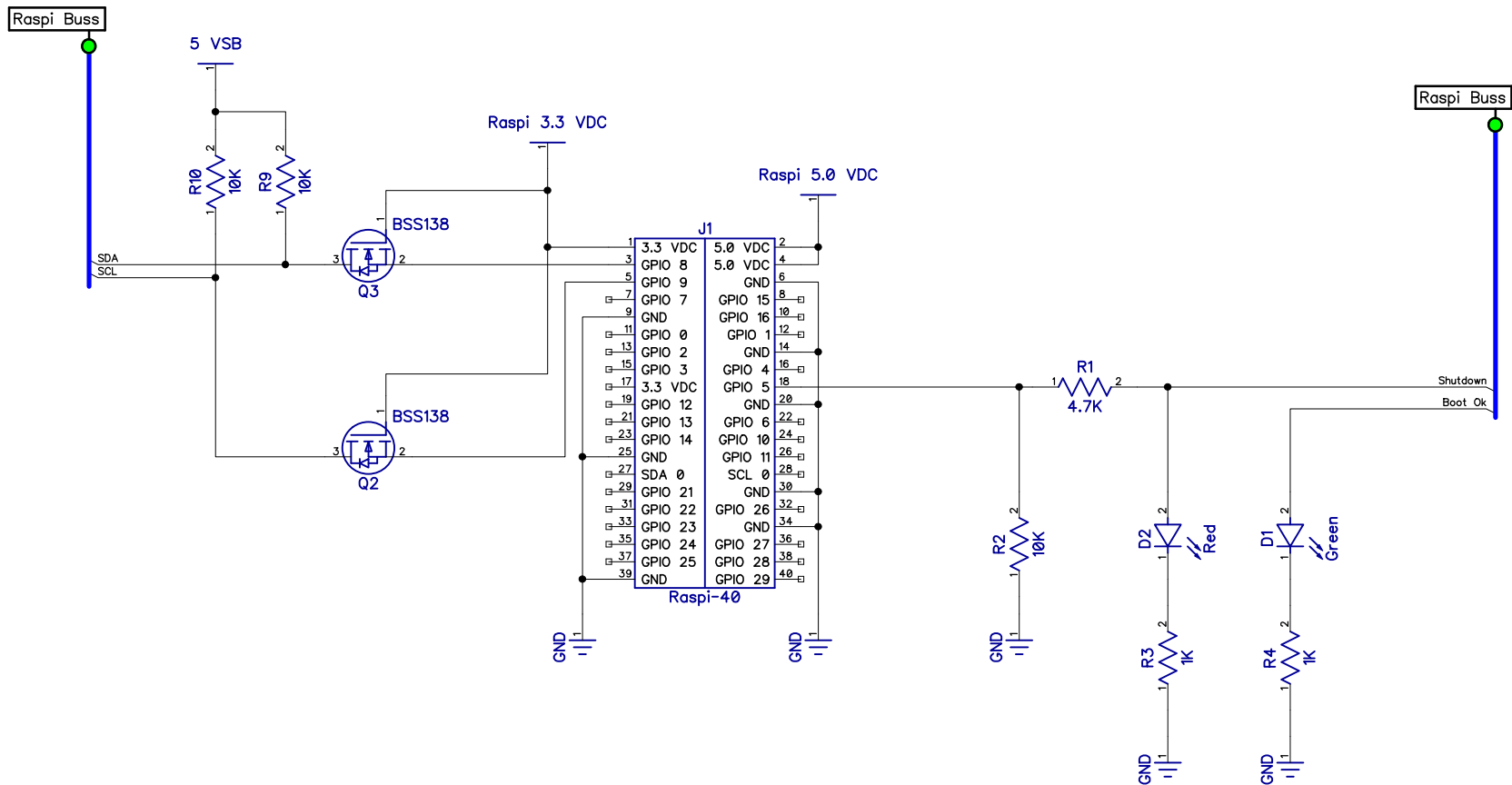
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2. sudo wget https://raw.githubusercontent.com/tomtibbetts/ATX-Watchdog-for-Pi/main/scripts/ATX-Watchdog_Keep_Alive_install.sh. Alternatively, navigate to: https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/blob/main/scripts/ATX-Watchdog_Keep_Alive_install.sh. Click on the “Raw” button. It is found above the script text, on the header to the right. Copy and paste the URL into the command window after “sudo wget “ then hit enter.
3. sudo bash ATX-Watchdog_Keep_Alive_install.sh – This will install and start the Keep Alive service.
4. Enable the watchdog timer by setting bit 7 (WD_TMR) of register 0x35. Please see the enableWatchdog.py script in <https://github.com/tomtibbetts/ATX-Watchdog-for-Pi/tree/main/scripts/examples>
5. sudo rm ATX-Watchdog_Keep_Alive_install.sh to remove the install script.
6. sudo reboot.

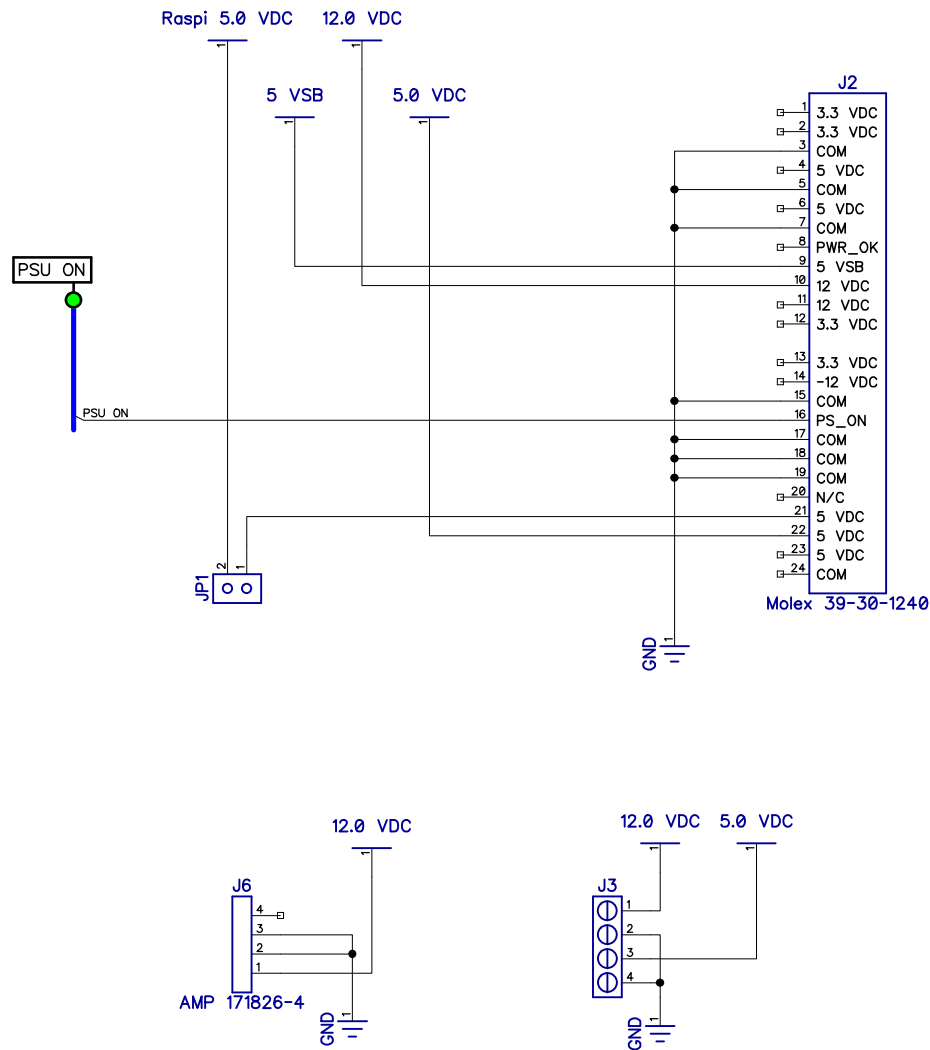
Warranty

Unassembled kits are warranted for the parts only as home assembly cannot be controlled. However, if you do find yourself with a non-working board and have exhausted all attempts to fix the issue, then the board may be exchanged for a new kit at a discounted price.

Product that has failed for non-warranted reasons may be exchanged for new or equivalent functionality at a discounted price. Please email us using the “Contact Us” page at <http://www.pirYTEboards.com/> for more details.



ATX Watchdog 4 Compute Module 4 Rev A		
Size	Number Copyright 2020 Windhaven Consulting, Inc.	Rev A
Date: 12/27/2020	Thomas Tibbetts	
Filename	Raspi Bus	



ATX Watchdog 4 Compute Module 4 Rev A		
Size	Number Copyright 2020 Windhaven Consulting, Inc.	Rev A
Date: 12/27/2020	Thomas Tibbetts	
Filename	ATX PSU	

Size	Number Copyright 2020 Windhaven Consulting, Inc.	Rev A
Date: 12/27/2020	Thomas Tibbetts	
Filename	Atmega	

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