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DIY Pi Desktop User Manual



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1) Introduction

2.1 Overview

The Pi Desktop is a desktop computer kit based on Raspberry Pi 2 & 3. It includes a case and an expansion board that can turn a Raspberry Pi into a real desktop PC. It provides an intelligent and safe power controller, a real-time clock, and a high capacity Solid State Drive (SSD) expansion card for additional storage.

2.2 Features

- Intelligent On/Off power switch
- mSATA SSD socket for up to 1TB on-board storage
- Integrated RTC (Real Time Clock)
- Includes case and heat sink

2.3 Kit Content

- Add-On board
- Heat sink
- USB Adapter (Micro-Type A)
- Long Spacer (x4)
- Short standoff (x4)
- Screws (x2)
- Enclosure (Base and Lid)
- Button cell, CR2032



2) Assembly & Instructions

2.1 Additional Required Items

- Raspberry Pi 3 or 2
- Pre-programmed Micro SD Card
- Power Supply (5V @ 2.5A)
- HDMI Monitor
- HDMI Cable
- USB Keyboard & Mouse
- Camera Module (Optional)
- mSATA SSD, max. up to 1 TB or USB Flash Drive (Optional)

2.2 Power Supply Selection Guide

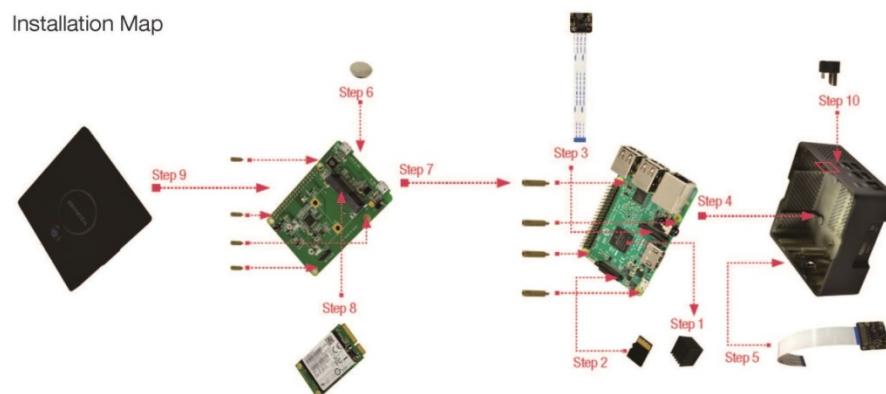
IMPORTANT: To ensure stability, a minimum requirement of 5V @ 2A power supply is required to power the Pi Desktop. Any power supply with current capacity less than 2A may damage the file system and/or hardware.

It is recommended to use an official Raspberry Pi power supply:

5V @ 2.5A with Pi3

5V @ 2A with Pi2

2.3 Assembly Instructions



- 1) Remove the protective film from the bottom of the heat sink and place it on the top of the Processor on the Raspberry Pi.
- 2) Insert the pre-programmed micro-SD card into the Raspberry Pi SD card slot.

Don't have one? Download the latest **Rasbian Jessie with PIXEL** image from the below link and write to the μ SD card using preferred image writer (recommended tool – Win32DiskImager) following the official guide.


<https://www.raspberrypi.org/downloads/>

- 3) (Optional: Complete only if you are installing a Pi camera) – Connect the Pi Camera

into the camera port on the Raspberry Pi.

- 4) Mount the Raspberry Pi into the enclosure using the provided four long spacers.

Note: Ensure the Raspberry Pi orientation is correct as per the connectors on the Raspberry Pi and the slots on the enclosure.

- 5) (Optional: Complete only if you are installing a Pi Camera) – Place the camera into the camera slot in the enclosure. Refer to section 2.6 for further Camera installation instructions.
- 6) Install the button cell on the back of the add-on board.
- 7) Mount the add-on board onto the top of the Raspberry Pi 40 pin GPIO and fasten the board to the Raspberry Pi using the provided four short standoff screws.
- 8) (Optional: Complete only if you are using SSD for booting and storage) – Connect the SSD to the mSATA connector and mount the other end using the provided two small screws. Refer to section 2.7 for further SSD instructions.
- 9) Finally align the enclosure lid with the flap power button so that it is directly above the switch/button on the add-on board and press down gently on the flap – you will hear a click sound when the lid is fit correctly to the enclosure base. (Make sure all items are connected and fastened properly and that there are no loose connectors or screws.)
- 10) Connect the provided USB adapter externally (Type A to micro USB) to the Raspberry Pi USB port and micro USB port with symbol ().
- 11) (Optional: Complete only if you are using USB Flash Drive for booting and storage) – Insert the USB Flash Drive into one of the Raspberry Pi USB ports.
- 12) You are now ready to power your Pi Desktop.

Note: Always ensure your software is up to date by connecting you Pi to the internet, opening a terminal and running the following commands:

```
$ sudo apt-get update
```

```
$ sudo apt-get upgrade
```

2.4 Starting your Pi Desktop



- 1) Connect your Raspberry Pi Desktop to an HDMI monitor using an HDMI cable.
- 2) Connect a USB keyboard and a mouse to the Pi Desktop USB ports.
- 3) Connect a USB power supply (recommended 5V@2.5A) to the micro USB power port marked with PWR. Then turn the supply ON.
- 4) Press the power button on the Pi Desktop and wait for the system to boot.

2.5 Software Installation

To enable the power control, RTC, and the SSD/USB boot feature, a software package will need to be installed. To do so, follow the instructions below:

- 1) Connect your Pi Desktop to the internet using an Ethernet or WiFi network.
- 2) Open your browser and go to www.element14.com/PiDesktop. Located under the download section is a file named “pidesktop-base.deb”. Download this file.
- 3) Open a terminal window and go to the directory with your downloaded file “pidesktop-base.deb”.
- 4) Install the package typing in the following command into the terminal window:

```
$ sudo dpkg -i pidesktop-base.deb
```

Press enter to execute the command.

- 5) (Optional: Complete to clone filesystem from Raspberry Pi µSD card to SSD or USB flash drive) – Type the following command:

\$ sudo ppp-hdclone

In this step, you will be asked to select the SSD or USB drive, select the connected SSD or USB drive and click “Start”. Once completed, reboot your system.



Note: If booting from SSD, ensure there are no other USB Flash Disks plugged into your Pi Desktop as this may result in an error of the Raspberry Pi not finding the correct boot device.

2.6 Camera Installation (Optional)

- 1) Setting up the Camera Hardware:

Note: The RaspiCam camera modules are static-sensitive. Earth yourself prior to handling the PCB.

The camera board attaches to the Raspberry Pi via a 15-way ribbon cable. There are only two connections to make: the ribbon cable must be attached to the camera PCB and the Raspberry Pi itself. The camera will not work if the cable is in the incorrect orientation. On the camera PCB, the blue backing on the cable should be facing away from the PCB, and on the Raspberry Pi should be facing towards the Ethernet connection (or where the Ethernet connector would be if you are using a model A).

Although the connectors on the PCB and the Pi are different, they work in a similar way. On the Raspberry Pi, pull up the tabs on each end of the connector. It should slide up easily and be able to pivot around slightly. Fully insert the ribbon cable into the slot, ensuring it is straight. Gently press down the tabs to secure the cable in place. The camera PCB itself also requires you to pull the tabs away from the board, gently insert the cable, then push the tabs back down to secure the cable. The PCB connector is a little more awkward than the one on the Pi itself. You can watch a video showing you how to attach the connectors at www.raspberrypi.org/archives/3890 (scroll down for the video).

- 2) Setting up the Camera Software:

Execute the following instructions on the command line to download and install the latest kernel, GPU firmware and applications. You will need an internet connection for this to work correctly.

```
$ sudo apt-get update
```

```
$ sudo apt-get upgrade
```

Now you need to enable camera support, using the raspiconfig program you will have used when you first set up your Raspberry Pi.

```
$ sudo raspi-config
```

Use the cursor keys to move to the camera option and select *enable*. On exiting raspiconfig it will ask to reboot. The *enable* option will ensure that on reboot the correct GPU firmware will be running (with the camera driver and tuning), and the GPU memory split is sufficient to allow the camera to acquire enough memory to run correctly. To test that the system is installed and working, try the following command:

```
raspistill -v -o test.jpg
```

The display should show a 5-second preview from the camera and then take a picture, saved to the file test.jpg, while displaying various informational messages.

Note: When installing a Raspberry Pi 3 Camera the image orientation within the software will need to be rotated 180 degrees.

To do so, use the command **--rotation, -rot**

This sets the rotation of the image (0-359) in viewfinder and resulting image. This can take any value from 0 upwards, but due to hardware constraints only 0, 90, 180 and 270-degree rotations are supported.

For troubleshooting and more info on the Raspberry Pi Camera Module visit: <https://www.element14.com/community/docs/DOC-78598/1/raspberry-pi-camera-module>

2.7 Connecting to the mSATA SSD (Optional)

Inside the Pi Desktop we can access the data stored onto the mSATA SSD in one of two ways:

- a) Through the USB connection from the add-on board and then into the attached Raspberry Pi. This option also allows you to boot from the mSATA SSD.

- b) Connect the mSATA SSD to an external computer via a USB connection without having to open up the Pi Desktop case.

If the mSATA SSD that you have connected is pre-formatted with a partition using a FAT32 file system (FAT32 FS), then this FS is typically accessible by all known modern operating systems (OS), and easily accessible. If the mSATA SSD uses a typical Linux FS (such as one with extension 2, 3 or 4) this is trickier to access by all OSs.

Note: If you're connecting the mSATA SSD add-on board to a computer other than the Raspberry Pi inside the Pi Desktop, then you will need the appropriate cable, and you will also have to power the add-on board/Pi Desktop and press the Power-On switch. **This will also power on the Raspberry Pi if it is still connected.**

1) Imaging and Setting Up Partitions

An easy to use utility for managing the partitions on the drive is 'gparted' from the Raspbian (OS) (for example if you booted from the SD Card):

<http://gparted.org/>

This is a graphical user interface (GUI) tool that can be used to manage the partitions on your drives, connected via USB or otherwise. It can be installed via the apt package manager from the command line interface (CLI):

```
$ sudo apt-get update
```

```
$ sudo apt-get install gparted
```

Then you can either run it from the menu of your Raspbian OS, or from the CLI:

```
$ sudo gparted
```

From here you can (re)partition your mSATA SSD if it's running a supported file system. If you are using the CLI, then you will want to issue the following command:

```
$ sudo fdisk /dev/<identifier>
```

Where <identifier> is the mount point for the mSATA SSD.

Alternatively, you can simply write an image to the mSATA SSD, just as you would write an image to an SD Card. The Raspberry Pi Foundation has instructions on how you write images here:

<https://www.raspberrypi.org/documentation/installation/installing-images/>

Note: If you write an image to your mSATA SSD then the data used and accessible from the OS will only be of the size of the image written, unless you resize the partitions.

2) Mounting the mSATA SSD to Access Files

RASPBIAN

The Raspbian OS is based upon Debian Linux, and as such supports the majority of commands and functions that you would use to mount drives within that OS (these typically involve `fstab` - <https://wiki.debian.org/fstab>, and `pmount` - <https://wiki.debian.org/pmount>).

From the Graphical User Interface (GUI)

Depending on your version of Raspbian, and how you have it configured, when you boot your Raspberry Pi to the GUI and then connect the attached mSATA SSD, you will be prompted what to do with your “Removable media” that has been inserted, and the drive will be automatically mounted.

It is possible that the GUI will not behave in this way, and instead you will have a transparent icon representing the drive on your desktop, which you can then double-click with the left mouse button and Raspbian will attempt to mount it.

From the Command Line Interface (CLI)

When mounting the drive from the GUI, you will have made the drive accessible from the CLI. Typically this is located within the folder `/media`.

However, sometimes we can't use the GUI, or merely we don't want to. To mount the drive we must first know how Linux is referring to it. Linux has the majority of its hardware listed under the `/dev` folder structure, with connected devices typically using the format of `/dev/sd<x>` where `<x>` is a letter. These can even extend further with `/dev/sd<x><y>` where `<y>` is the number of the partition(s) on the device.

There are a few commands in which we can determine what the device is of a USB device we connect, first, connect the USB device, and then type the following:

```
$ sudo dmesg
```

This will tell you basically the contents of a system log which gives you information about the device you have just plugged in. You can also issue the following commands:

```
$ sudo lsusb
```

Which will tell you about the device identifiers, and also:

```
$ sudo lsblk
```

This command will tell you the /dev/ mount points.

You will now need somewhere to mount the drive to. To make a directory and set the permissions onto it by issuing the following commands:

```
$ sudo mkdir /media/ssd
```

```
$ sudo chmod 755 /media/ssd
```

Once you know the device mount point, you can then issue the following command:

```
$ sudo mount /dev/sd<x><y> /media/ssd
```

Note: Mounting will only work if the mSATA SSD has a file system and partitions setup (see 'Imaging and Setting Up Partitions' in this document.), you will want to mount the relevant partition (which has a number, such as /dev/sdb1) as opposed to the device itself (/dev/sdb).

The Raspberry Pi Foundation's official magazine, The Mag Pi has a good article on this:

<https://www.raspberrypi.org/magpi/connecting-disks-with-the-command-line/>

MICROSOFT WINDOWS

Thanks to an open source project called Ext2Fsd (Ext2 File System Driver) it is now possible to very easily mount linux FS onto Microsoft Windows OS.

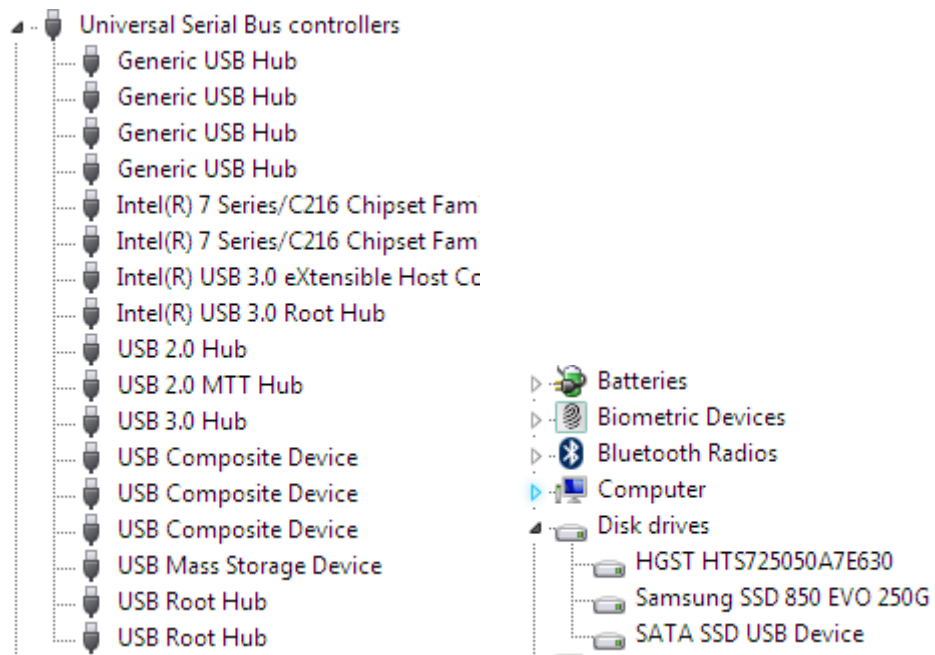
You can download and install the software from these websites:

<http://www.ext2fsd.com/>

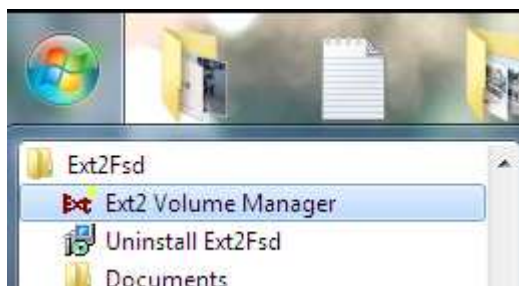
<https://sourceforge.net/projects/ext2fsd/>

To install the software you will need to have administrative rights on the computer you're installing it onto, and the ability to install the required system drivers. Afterwards you will likely have to reboot.

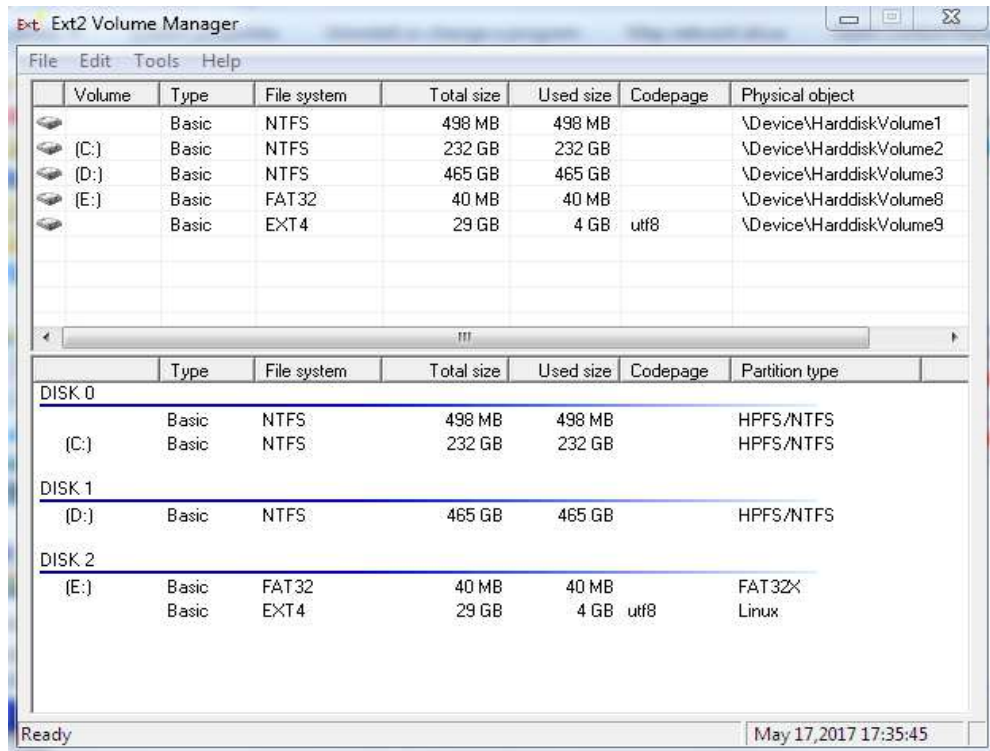
After you have connected the mSATA SSD HAT board to your computer, you will see it in Windows device manager as a USB Mass Storage Device and also as a drive:



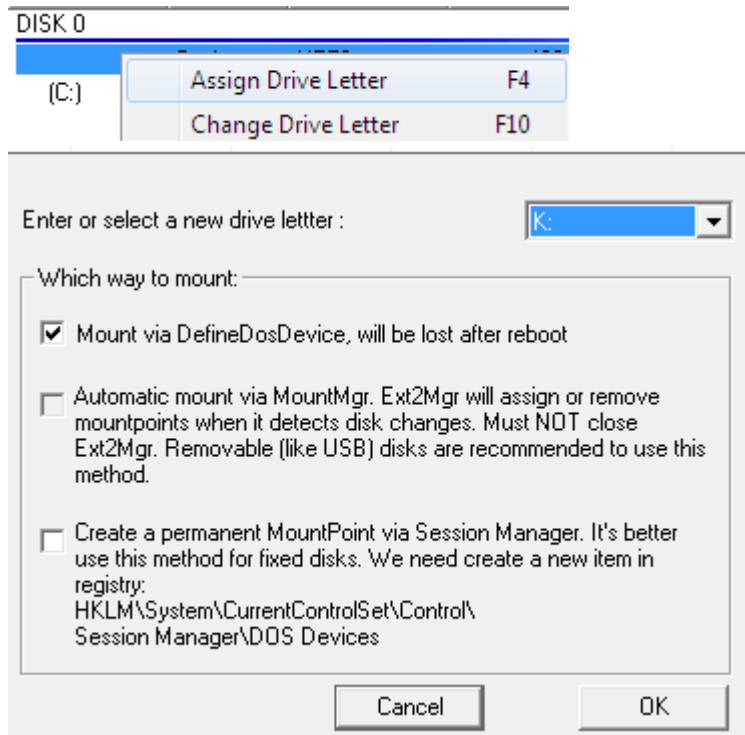
From the start menu, you will want to open the 'Ext2Fsd' folder and then 'Ext2 Volume Manager':



From the software we can then see the partitions of all of the drives listed, including the identified ext. FS:



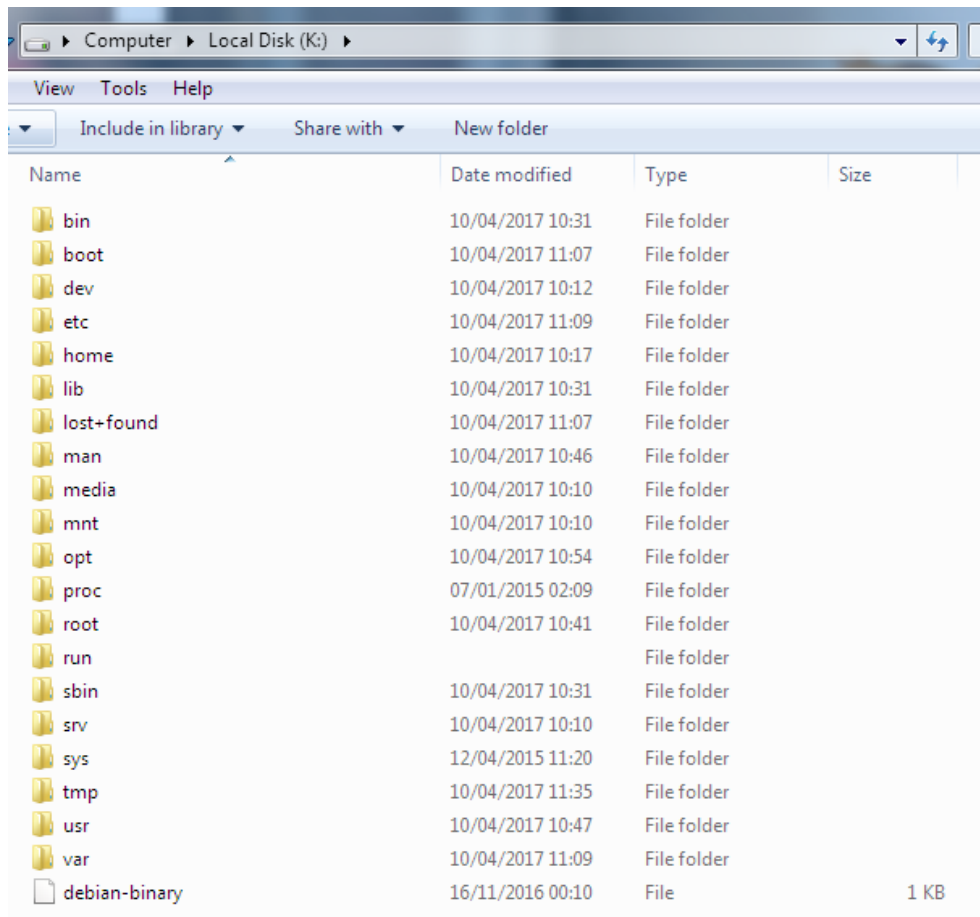
Since in this an example, we have already imaged the mSATA SSD with Raspbian, a FAT32x partition is listed (drive E:). It is the EXT4, Linux FS we want below it:



Make sure we want to give it a drive letter so we can access it; there are various mounting options you can choose from.



Windows Explorer then has the new drive listed, which we can then open and view the Linux EXT FS:



You can now alter the files and unmount them as necessary.

3) Boot from the mSATA SSD

Note: Configuring your Raspberry Pi to boot from a USB device is a one-way setting. You are configuring a 'flag' or a 'bit' on your Raspberry Pi chip that you **cannot revert**.

The Raspberry Pi will always prioritise booting from the SD Card when one is present.

To set this up, you will need an SD Card in your Raspberry Pi that has the Raspbian OS on it. Inside the file located in '/boot/config.txt'.

You need to set this option to the value '1' :

```
$ sudo program_usb_boot_mode=1
```

Then power on your Raspberry Pi with the SD Card inserted. That's all there is to it. Once you're in Raspbian, you can run the following command from the CLI:

```
$ sudo vcgencmd otp_dump | grep 17:
```

This should output the following:

```
17:3020000a
```

Now all you need to do is ensure your mSATA SSD has an OS on it, that it's connected via USB and power up your Pi Desktop. If you're unsure about these steps then you can read the following guide on the Raspberry Pi Foundation site:

<https://www.raspberrypi.org/documentation/hardware/raspberrypi/bootmodes/msd.md>

Note: As mentioned elsewhere in the document, you can write the same Raspbian image to your mSATA SSD as you have done to your SD Card.

Note: You now no longer need the SD Card to boot your Raspberry Pi once this flag is set.

3) Usage

3.7 Power Control

OPERATION	ACTION
Turn on	Press the power button
Shutdown	Hold the button pressed for approx. 2 seconds
Forced Shutdown	Hold the button pressed for about approx. 5 seconds to cutoff power regardless of any other conditions

3.8 Real Time Clock (RTC)

Each time your Pi Desktop starts up it will connect to what is called an Network Time Protocol (NTP) server and request the time.

If there is no internet connection the Pi Desktop utilizes the integrated RTC on the Pi

Desktop add-on board. This contains a clock chip and a battery that tells the Raspberry Pi what time it is. To ensure accuracy the time will need to be set on the system initially.

Note: *Installing the software package then rebooting the system will enable the RTC.*

4) FAQs

4.7 My power control does not work. How do I fix this?

Install the software package first. Then reboot the system.

4.8 Can I use a third party power charger as the power supply?

To ensure stability use a power charger/supply that is rated with a minimum of 5V @ 2A. Any power supply with current capacity under 2A may damage the file system and/or hardware.

4.9 Do I have to have an SSD drive?

No, an SSD drive is not necessary.

5) Software Upgrade and Support

For upgrades and technical support please visit the PiDesktop Product Homepage:
www.element14.com/PiDesktop

6) Appendix

6.7 Electrical Characteristics

CHARACTERISTIC	VALUE
Operating temperature	0~50°C
Storage temperature	-40~80°C
Operating voltage	5V
Power Consumption	Value
Start-up process (Max)	1100mA

6.8 Dimensions

DIMENSION	VALUE
Case	108 x 108 x 43.12 mm
Add-on Board	87 x 56 x 1.4 mm

WARNING: Avoid damage and contact with water.