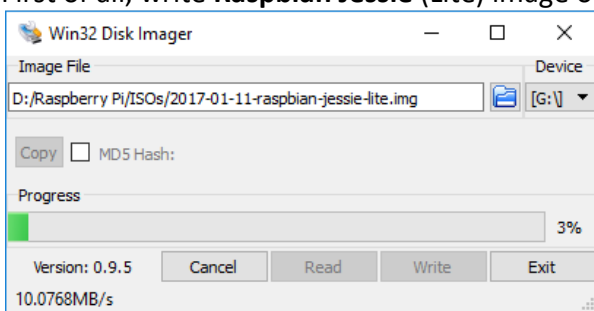


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This guide explains how to set in read mode your **Raspberry Pi 3**, running the latest **Raspbian Jessie** (January 2017). This feature is useful to avoid SD card data corruption in case the power supply goes down when Raspberry is writing on the SD card. During run-time, the root folder is overlaid, therefore the programs will run normally, thinking that they are writing on the Micro SD card, while in reality they are writing in RAM memory.

First of all, write **Raspbian Jessie (Lite)** image on the Micro SD card, using **Win32 Disk Imager**.



Insert the Micro SD card and connect: HDMI monitor, USB keyboard, Ethernet and Micro USB power.



Log-in (user: pi, password: raspberry).

sudo raspi-config

```

[ OK ] Listening on Avahi mDNS/DNS-SD Stack Activation Socket.
[ OK ] Listening on D-Bus System Message Bus Socket.
[ OK ] Reached target Sockets.
[ OK ] Reached target Timers.
[ OK ] Reached target Basic System.
Starting LSB: Apply config from /boot/os_config.json...
Starting LSB: Resize the root filesystem to fill partition...
Starting dhcpd on all interfaces...
Starting Regular background program processing daemon...
[ OK ] Started Regular background program processing daemon.
Starting Regenerate SSH host keys...
Starting Configure Bluetooth Modems connected by UART...
Starting Login Service...
Starting LSB: Autogenerate and use a swap file...
Starting LSB: triggerhappy hotkey daemon...
Starting Avahi mDNS/DNS-SD Stack...
Starting D-Bus System Message Bus...
[ OK ] Started D-Bus System Message Bus.
[ OK ] Started Avahi mDNS/DNS-SD Stack.
Starting System Logging Service...
[ OK ] Started Configure Bluetooth Modems connected by UART.
[ OK ] Started LSB: triggerhappy hotkey daemon.
Starting Load/Save RF Kill Switch Status of rkill1...
Starting Bluetooth service...
[ OK ] Started Load/Save RF Kill Switch Status of rkill1.
[ OK ] Started Login Service.
[ OK ] Started System Logging Service.
[ OK ] Started Bluetooth service.
[ OK ] Reached target Bluetooth.
Starting Hostname Service...
[ OK ] Started dhcpd on all interfaces.
[ OK ] Reached target Network.
Starting /etc/rc.local Compatibility...
[ OK ] Reached target Network is Online.
Starting LSB: Start NTP daemon...
Starting Permit User Sessions...
[ OK ] Started Hostname Service.
My IP address is 2407:c800:2200:3b00:c425:cd9a:1600:7a54
[ OK ] Started /etc/rc.local Compatibility.
[ OK ] Started Permit User Sessions.
Starting Hold until boot process finishes up...
Starting Terminate Plymouth Boot Screen...

Raspbian GNU/Linux 8 raspberrypi tty1
raspberrypi login: pi
Password:
Linux raspberrypi 4.4.34-07+ #930 SMP Wed Nov 23 15:20:41 GMT 2016 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
pi@raspberrypi:~$ sudo raspi-config
```

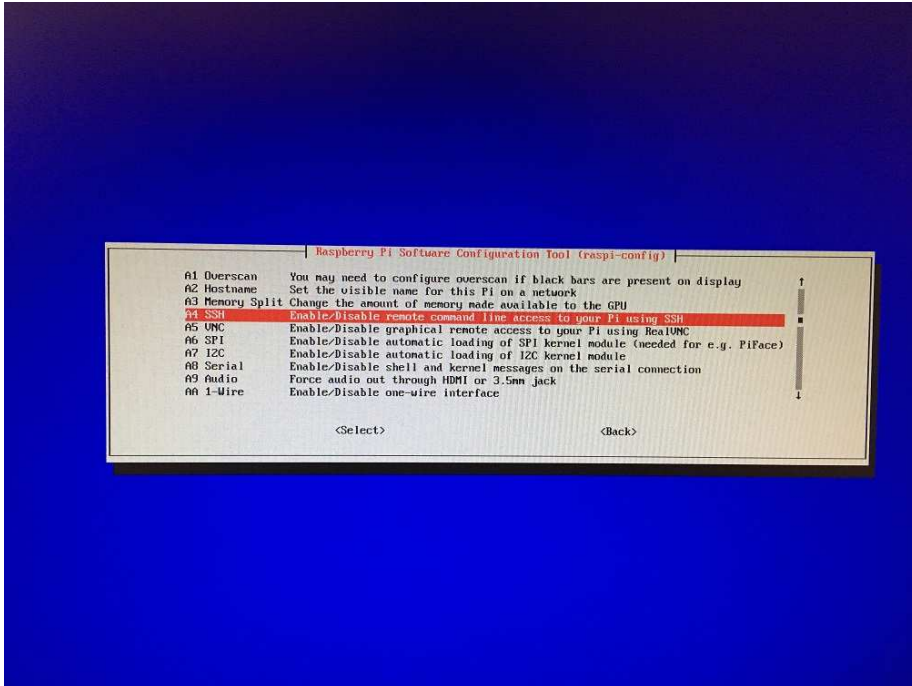
Expand file system

```

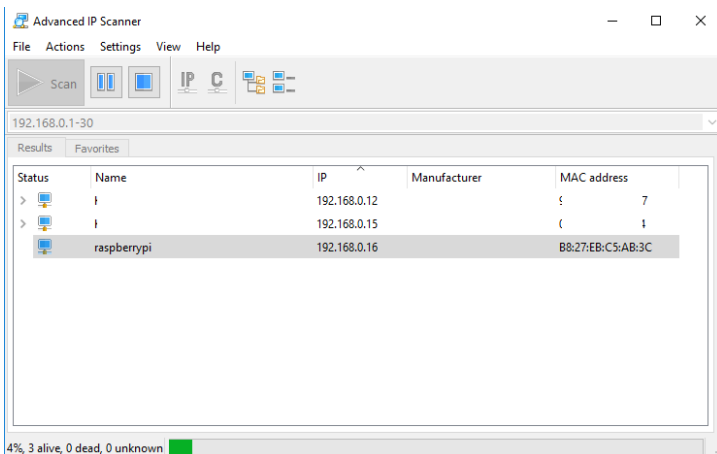
Raspbian Pi Software Configuration Tool (raspi-config)
1 Expand Filesystem          Enables that all of the SD card storage is available to the OS
2 Change User Password      Change password for the default user (pi)
3 Boot Options              Configure options for start-up
4 Internationalisation Options Set up language and regional settings to match user location
5 Enable Camera             Enable this Pi to work with the Raspberry Pi Camera
6 Overclock                Configure overclocking for your Pi
7 Advanced Options         Configure advanced settings
8 About raspi-config       Information about this configuration tool

<Select> <Finish>
```

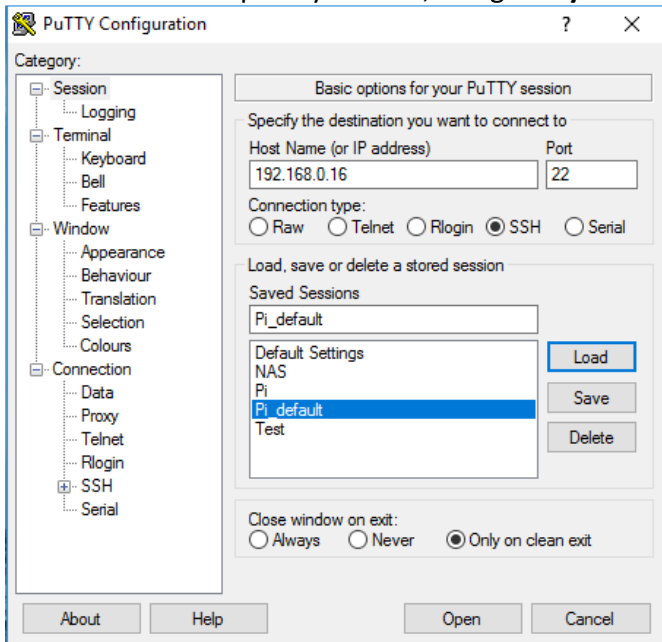
Activate **SSH** and deactivate **Serial**.



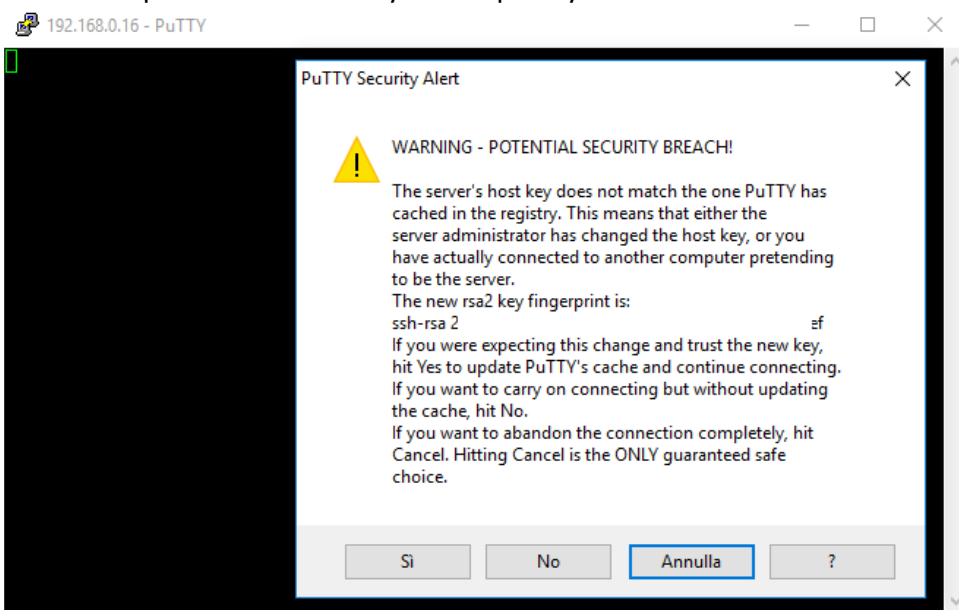
Find Raspberry Pi 3 IP address, using, for example “ifconfig”, and then reboot. Alternatively, you can use also “**Advanced IP Scanner**” from your PC.



Connect to the Raspberry via **SSH**, using **PuTTY**.



Click on “Open” to connect to your Raspberry.



User: *pi*, password: *raspberrypi*.

```
pi@raspberrypi: ~  
login as: pi  
pi@192.168.0.16's password:  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Wed Feb 15 14:15:15 2017  
  
SSH is enabled and the default password for the 'pi' user has not been changed.  
This is a security risk - please login as the 'pi' user and type 'passwd' to set  
a new password.  
  
pi@raspberrypi:~ $
```

Now we are ready for typing commands. First of all, update **apt-get** repositories.

sudo apt-get update

```
pi@raspberrypi:~ $ sudo apt-get update  
Get:1 http://mirrordirector.raspbian.org jessie InRelease [14.9 kB]  
Get:2 http://archive.raspberrypi.org jessie InRelease [22.9 kB]  
100% [1 InRelease gpgv 14.9 kB]  
  
pi@raspberrypi:~ $  
  
pi@raspberrypi:~ $  
Get:1 http://mirrordirector.raspbian.org jessie InRelease [14.9 kB]  
Get:2 http://archive.raspberrypi.org jessie InRelease [22.9 kB]  
Get:3 http://mirrordirector.raspbian.org jessie InRelease [14.9 kB]  
Get:4 http://archive.raspberrypi.org jessie/main armhf Packages [142 kB]  
Get:5 http://archive.raspberrypi.org jessie/ui armhf Packages [53.6 kB]  
Get:6 http://mirrordirector.raspbian.org jessie/contrib armhf Packages [37.5 kB]  
Get:7 http://mirrordirector.raspbian.org jessie/non-free armhf Packages [70.3 kB]  
]   
Get:8 http://mirrordirector.raspbian.org jessie/rpi armhf Packages [1,356 B]  
Ign http://archive.raspberrypi.org jessie/main Translation-en_GB  
Ign http://archive.raspberrypi.org jessie/main Translation-en  
Ign http://archive.raspberrypi.org jessie/ui Translation-en_GB  
Ign http://archive.raspberrypi.org jessie/ui Translation-en  
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-en_GB  
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-en  
Ign http://mirrordirector.raspbian.org jessie/main Translation-en_GB  
Ign http://mirrordirector.raspbian.org jessie/main Translation-en  
Ign http://mirrordirector.raspbian.org jessie/non-free Translation-en_GB  
Ign http://mirrordirector.raspbian.org jessie/non-free Translation-en  
Ign http://mirrordirector.raspbian.org jessie/rpi Translation-en_GB  
Ign http://mirrordirector.raspbian.org jessie/rpi Translation-en  
Fetched 9,323 kB in 27s (341 kB/s)  
Reading package lists... Done  
pi@raspberrypi:~ $
```

The following part of the guide is taken from:

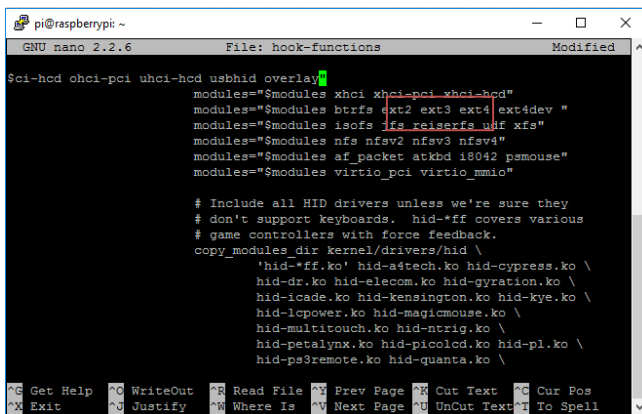
<https://www.raspberrypi.org/forums/viewtopic.php?f=63&t=161416>

```
sudo bash
```

```
cd /usr/share/initramfs-tools
```

```
nano hook-functions
```

Press CTRL+V and CTRL+C until you reach this part (line 528). Add *overlay*. Press CTRL+X and then Y to save.



```
pi@raspberrypi ~
GNU nano 2.2.6 File: hook-functions Modified
$ci-hcd ohci-pci uhci-hcd usbhid overlay
modules="$modules xhci xhci-pci xhci-hcd"
modules="$modules btrfs ext2 ext3 ext4 ext4dev "
modules="$modules isofs jfs reiserfs udf xfs"
modules="$modules nfs nfsv2 nfsv3 nfsv4"
modules="$modules af_packet atkbd i8042 psmouse"
modules="$modules virtio_pci virtio_mmio"

# Include all HID drivers unless we're sure they
# don't support keyboards. hid-ff covers various
# game controllers with force feedback.
copy_modules_dir kernel/drivers/hid \
'hid-ff.ko' hid-a4tech.ko hid-cypress.ko \
hid-dr.ko hid-elecom.ko hid-gyration.ko \
hid-icade.ko hid-kensington.ko hid-kye.ko \
hid-logicpower.ko hid-magicmouse.ko \
hid-multitouch.ko hid-ntrig.ko \
hid-petalynx.ko hid-picolcd.ko hid-pl.ko \
hid-ps3remote.ko hid-quanta.ko \
```

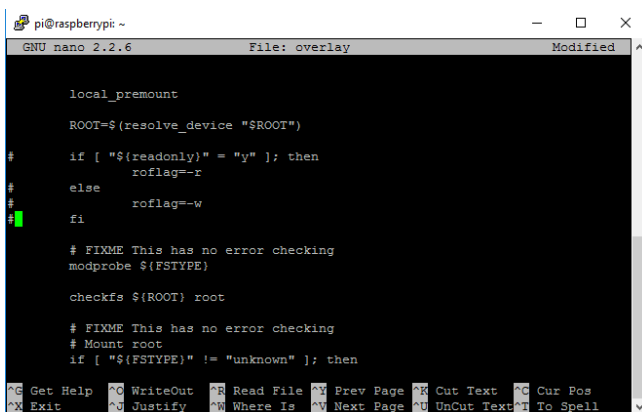
```
cd /usr/share/initramfs-tools/scripts
```

```
cp local overlay
```

```
cp -rp local-premount overlay-premount
```

```
nano overlay
```

Search for “*local_mount_root()*” by typing CTRL+W and “*local_mount_root*”. Comment the following 3 lines, by using “#”, to force read only.



```
pi@raspberrypi ~
GNU nano 2.2.6 File: overlay Modified
local_premount
ROOT=$(resolve_device "$ROOT")
if [ "${readonly}" = "y" ]; then
#   roflag=-r
# else
#   roflag=-w
fi
# FIXME This has no error checking
modprobe ${FSTYPE}
checkfs ${ROOT} root
# FIXME This has no error checking
# Mount root
if [ "${FSTYPE}" != "unknown" ]; then
```

Substitute the following part. The complete code should look as following.

```
# if [ "${readonly}" = "y" ]; then
    roflag=-r
# else
#   roflag=-w
# fi

# FIXME This has no error checking
modprobe ${FSTYPE}

checkfs ${ROOT} root

# FIXME This has no error checking
# Mount root
mkdir /upper /lower
if [ "${FSTYPE}" != "unknown" ]; then
    mount ${roflag} -t ${FSTYPE} ${ROOTFLAGS} ${ROOT} /lower
else
    mount ${roflag} ${ROOTFLAGS} ${ROOT} /lower
fi
modprobe overlay
mount -t tmpfs tmpfs /upper
mkdir /upper/data /upper/work
mount -t overlay \
    -olowerdir=/lower,upperdir=/upper/data,workdir=/upper/work \
    overlay ${rootmnt}
```

Save and exit (CTRL+X and then Y).

```
uname -a
```

The screen will reply with something like:

```
Linux raspberrypi 4.4.34-v7+ #930 SMP Wed Nov 23 15:20:41 GMT 2016 armv7l GNU/Linux
```

Then, run the commands:

```
update-initramfs -c -k 4.4.34-v7+
```

It will require some time, like 1 minute. At the end, you will see a message like:

```
update-initramfs: Generating /boot/initrd.img-4.4.34-v7+
```

```
cd /boot
```

```
mv initrd.img-4.4.21-v7+ initrd7.img
```

The yellow parts in your command should be according to the message info received from Raspbian.

```
pi@raspberrypi: ~
root@raspberrypi:/usr/share/initramfs-tools/scripts# uname -a
Linux raspberrypi 4.4.34-v7+ #930 SMP Wed Nov 23 15:20:41 GMT 2016 armv7l GNU/Linux
root@raspberrypi:/usr/share/initramfs-tools/scripts# update-initramfs -c -k 4.4.34-v7+
update-initramfs: Generating /boot/initrd.img-4.4.34-v7+
root@raspberrypi:/usr/share/initramfs-tools/scripts# cd /boot
root@raspberrypi:/boot# mv initrd.img-4.4.34-v7+ initrd7.img
root@raspberrypi:/boot#
```

It is now time to enable the *initramfs*. If, after making the following changes, your Pi fails to boot, turn the power off, remove the SD card, and mount it in a working computer. Simply revert the changes to `config.txt` and `cmdline.txt` described below and your Pi should work normally as before. The reversion can even be done using a Windows PC as the `/boot` partition is FAT formatted.

`nano /boot/config.txt`

At the end, add the following. Then, save and exit.

`kernel=kernel7.img`

`initramfs initrd7.img`

```
pi@raspberrypi: ~
GNU nano 2.2.6 File: /boot/config.txt Modified
#dtoverlay=lirc-rpi

# Additional overlays and parameters are documented /boot/overlays/README

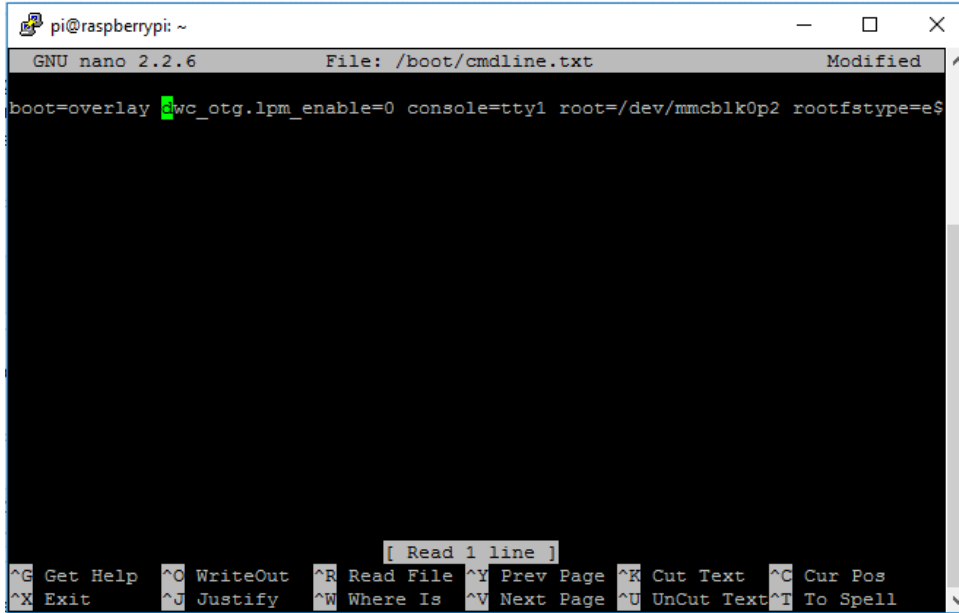
# Enable audio (loads snd_bcm2835)
dtparam=audio=on
enable_uart=0

kernel=kernel7.img
initramfs initrd7.img

^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```


`nano /boot/cmdline.txt`

Add `"boot=overlay"`. Then, save and exit.



```
pi@raspberrypi: ~
GNU nano 2.2.6 File: /boot/cmdline.txt Modified
boot=overlay cwc_otg.lpm_enable=0 console=tty1 root=/dev/mmcblk0p2 rootfstype=e$
[ Read 1 line ]
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```

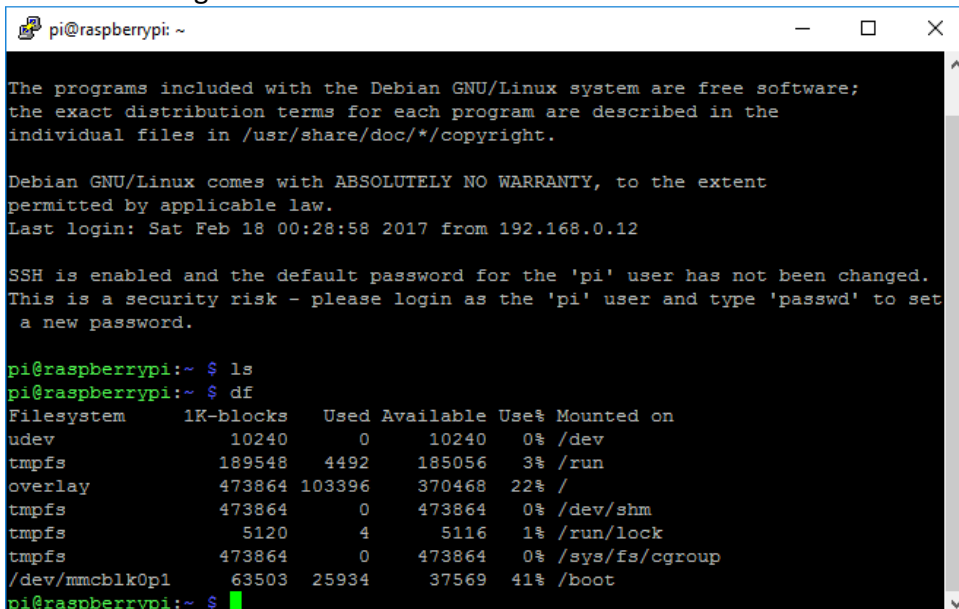
Restart your Raspberry Pi by running:

`sudo reboot now`

Or

`sudo shutdown -r now`

After restart, in order to make sure that the overlay is working, type the `"df"` command. It should show a similar message.



```
pi@raspberrypi: ~
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Feb 18 00:28:58 2017 from 192.168.0.12

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

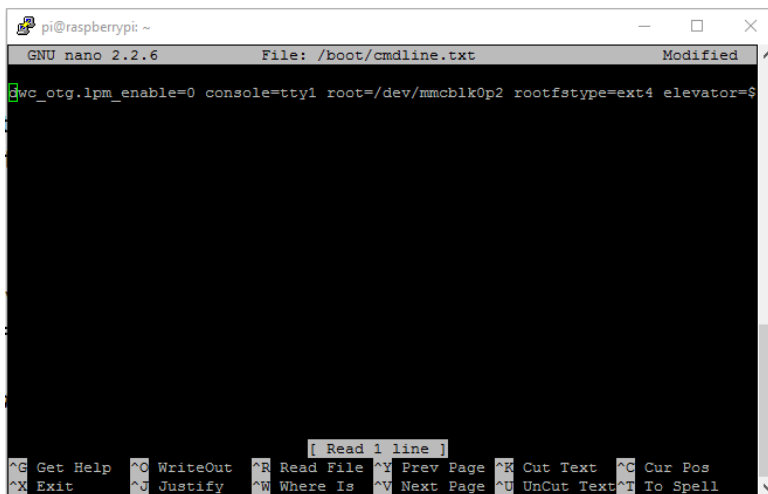
pi@raspberrypi:~ $ ls
pi@raspberrypi:~ $ df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev             10240         0    10240   0% /dev
tmpfs            189548     4492   185056   3% /run
overlay         473864 103396   370468  22% /
tmpfs            473864         0   473864   0% /dev/shm
tmpfs            5120          4     5116   1% /run/lock
tmpfs            473864         0   473864   0% /sys/fs/cgroup
/dev/mmcblk0p1  63503     25934   37569  41% /boot
pi@raspberrypi:~ $
```

If you want to check that the read-only is working properly, you can create a file, for example with “touch” command. After rebooting, the file will not be present.

```
touch test_file
```

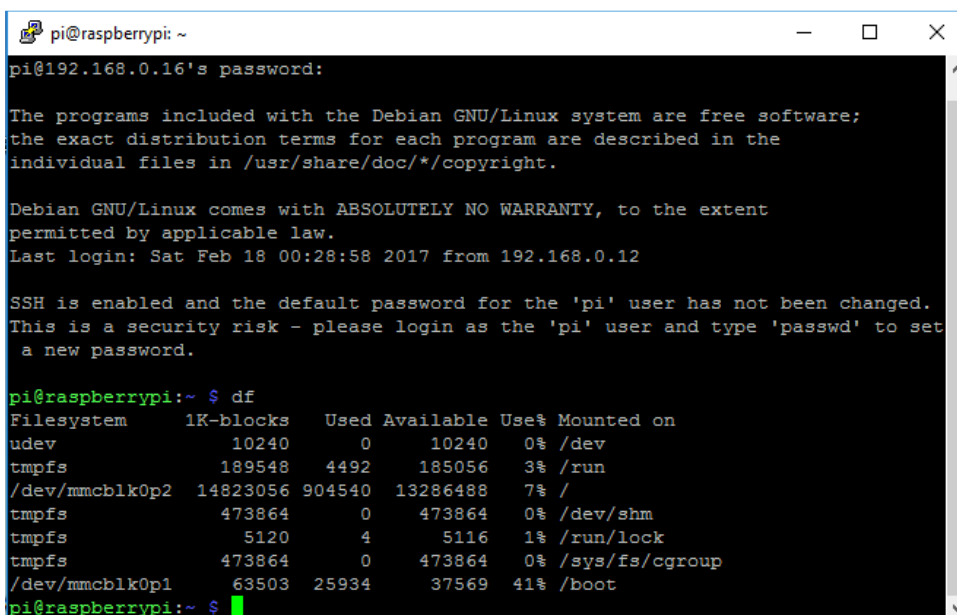
In the future, in case you want to update your system, or make it writeable again, all you have to do is to remove the “boot=overlay” from the `/boot/cmdline.txt`.

```
sudo nano /boot/cmdline.txt
```



```
pi@raspberrypi ~  
GNU nano 2.2.6 File: /boot/cmdline.txt Modified  
dwc_otg.lpm_enable=0 console=tty1 root=/dev/mmcblk0p2 rootfstype=ext4 elevator=.
```

Save, exit, and restart. At next Power On, you Raspberry will be writeable again. You can double check it by typing “df” command. “overlay” should not be shown. Now, for example, you can install new programs and run updates (`sudo apt-get update`).



```
pi@raspberrypi:~  
pi@192.168.0.16's password:  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Sat Feb 18 00:28:58 2017 from 192.168.0.12  
  
SSH is enabled and the default password for the 'pi' user has not been changed.  
This is a security risk - please login as the 'pi' user and type 'passwd' to set  
a new password.  
  
pi@raspberrypi:~ $ df  
Filesystem      1K-blocks    Used Available Use% Mounted on  
udev             10240         0    10240   0% /dev  
tmpfs            189548    4492    185056   3% /run  
/dev/mmcblk0p2  14823056 904540   13286488  7% /  
tmpfs            473864         0    473864   0% /dev/shm  
tmpfs             5120         4     5116   1% /run/lock  
tmpfs            473864         0    473864   0% /sys/fs/cgroup  
/dev/mmcblk0p1   63503    25934   37569   41% /boot  
pi@raspberrypi:~ $
```