# **iEFIS G4 Internal SDCard creation from scratch**



# General

This document describes how to create a bootable G4 EFIS SD card from scratch. The newly created SD card will boot to a version of the EFIS application.

Please also consult the document iEFIS G4 Internals for information on how the system is made up.

#### **Requirements:**

Terminal program running at 8n1 with baudrate of 115200. Connected to either RS232 port one on Classic G4 systems or RS232 port 2 on native G4 systems. Classic G4 systems have an internal adapter PCB that sandwiches between the G2/G2/G3 main board connectors and the G4 CPU Card.

Note that using a terminal is optional for this process and can be used if you are familiar with Linux.

Download the file SDCardsmall.img from MGL Avionics. This file is 300Mb in size. WWW.MGLAVIONICS.CO.ZA/Data/SDCardSmall.img

Download a SDCard imaging application. This is an application that can write the above file to an SDCard on a sector by sector bases. The above file contains a working Linux and EFIS disk image including partition tables.

Suitable free applications can be found using a Google search. You can use Win32DiskImager or BalenaEtcher. In Linux you can also use "dd" if you know what you are doing. BalenaEtcher is also available for Linux desktop.

A blank SD Micro card. Please use a quality product. You need an SD Card with a minimum size of 16GBytes. You may also use any SD card that has already been used, make sure there is nothing on that card you still need as it will be overwritten by the disk imaging software.

Note: Do NOT just copy the SDCardSmall.img file to the SD card – that will not work. You need to image this to the SDCard – the image is a sector by sector virtual disk that must be copied at a low level sector by sector to the SD card.

# The SDCardSmall.img file

This file contains a complete Linux system including primary and secondary boot loader as well as the EFIS application.

This file differs from the image used when your EFIS is made at the factory in the following ways:

a) It contains the exp4 file so can boot after completing configuration tasks

b) It does not contain Terrain data or Maps as this requires nearly 3GBytes of space making the download difficult. These files are available on the MGL Avionics website and must be installed yourself once the system is up and running.

# Process steps to create a bootable SD card

Image the SDCardSmall.img to a blank SD card using a disk imager such as WinImage32 under windows or dd in Linux. Balena-Etcher is another nice application that can do this.

Once complete insert the SD card – if you are using a terminal connect this at 8n1 and 115200 baud to the Linux console port (RS232 port 1 for classic systems or port 2 for native G4 systems). Note this is optional and available for "power" users.

Apply power to the EFIS.

On first run of this image a few things happen:

The image resizes partition 4 (which contains the root file system) to a size of 15GByte (even if the SD card is larger). At least a 16GByte card is needed.

This takes a few minutes – you should see the text "resizefs" on the LCD display during this time. Please do not interrupt this process – it may take as much as 5 minutes depending on the write speed of your SD card. After completion the exp4 file is executed and you should see the normal EFIS on the screen. Navigate to the system setup and then Linux Console. Enter the command "df" (without the quotes) to ensure the disk resizing process has completed. You should have over 13GBytes available space for your root file system.

Filesystem	1K-blocks	Used Available Use% Mounted on
/dev/root	14211972	281153 13336758 2% /
devtmpfs	156236	0 156236 0% /dev
tmpfs	222284	0 222284 0% /dev/shm
tmpfs	222284	0 222284 0% /tmp
tmpfs	222284	4 222280 0% /run
#		

This initial configuration is done using a "run once" script that deletes itself after completion.

First the current version of u-boot contained in the new image is copied to the NOR flash memory (the actual source of the boot code on the CPU card in normal mode of operation).

Then partition 4 which holds the root file system is resized to about 14GBytes leaving a bit of space at the end of the card. This is done so disk cloning can be done to other cards as not all cards have the same exact space available and it is not easy to make an existing file system smaller.

After the partition is resized the file system needs to be resized to fit the new partition. This displays the "resizefs" message on the display. This process can take a few minutes. It must not be interrupted. If it cannot complete, start again with a newly imaged SD card.

After this the "efis" folder and subfolders are created and some files copied into these folders. This has to be done on the actual EFIS rather than on the source image creation as folder properties need to be set and in this case it is only possible on empty folders. The efis folders are created as "not case sensitive" which is not a normal Linux default.

Once your basic system is working you need to manually install the terrain files (download from MGL Avionics website) as well as the Vector map (also from the same website – we install the World wide vector map file). Finally you also need to install the World.BMP file which also lives in the Terrain folder. Complete the installation with any navidata, raster maps, screen files etc you may need for your application.

At this point it is advised that you download the latest version of the exp4 EFIS application file from the MGL Avionics website and install it using the function available in the u-boot bootloader.

See document G4Boot.pdf for further information on functions available in the bootloader such as cloning (backup and restore) and installation of a current exp4 file.

Another document you can use as reference is the iEFIS G4 Internals.pdf file.

# Using the Linux terminal (console)

The EFIS application contains a limited function Linux console that can be used for most basic tasks however for power users you would connect a real terminal to the Console port (either RS232 port 1 for classic systems or RS232 port 2 for G4 native systems).

On startup you can observe the u-boot messages but Linux startup messages are mostly suppressed. You can change this buy editing the file /boot/extlinux/extlinux.confN (where N is either 0 or 1 - ) for boot from external SD card and 1 for boot from internal SD card). In other words depending on boot from internal or external SD card the appropriate extlinux.conf file is chosen by u-boot (this is a non-standard custom modification of u-boot).

Change the statement "loglevel=1" to your desired log level for example 4 (see Linux documentation for log levels).

Once the EFIS application "exp4" is running the console is not available. To end the application type "x" at the terminal while the EFIS is showing a normal screen or is in a menu. This will end the EFIS application and start the console.

To restart the EFIS application from the console type "/efis/exp4 or if you are inside the efis folder just type ./exp4

Note that nearly all common Linux utilities are available so you have a very complete Linux system at your fingertips.

Note that you have a Ethernet connection available via RNDIS. To activate run the script "ether". This works via the USB micro connector on the main board. Ping your host to ensure the link is up. "ether" configures the link with 192.168.10.1. Configure your host as 192.168.10.2 or use whatever addresses you prefer. The "ether" script lives in /bin.

To mount a remote folder use the script "emnt" also in the /bin directory. This attempts to connect to a NFS file server. View and/or edit the emnt script to suit your needs.

For a Windows system there are some free NFS servers but we have not found any that work well. We use a paid for NFS server called HaneWin that works very well.