

**Get started with the 7-inch HDMI Kit**

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# **Get started with the 7-inch HDMI Display Kit**

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# 1 Document Revision History

<i>Revision</i>	<i>Date</i>	<i>Description</i>
A	2020-10-01	First version

## 2 Introduction

This document provides you with step-by-step instructions for how get started with the 7-inch HDMI Display Kit together with Embedded Artists iMX6, iMX7 and iMX8 based COM boards.

The philosophy behind the Display Kit is to have one common display for all iMX Developer's Kit. The display is be useful for initial prototyping and proof-of-concept tests. Instead of spending time on connecting (maybe creating an adapter board) a specific display with the resolution that is planned to be used in the final design, the 7-inch HDMI Display Kit can be used right out-of-the-box.

Select a display resolution that is supported (see this document under respective (u)COM board) and that is closest to the planned resolution. Little is gained to have the exact resolution, at least not during initial testing. It is however important to have a relatively close resolution so that the system load for creating the display data is approximately correct.

The display performs scaling on the incoming display data to the native 1024x600 pixel resolution. Some fine (pixel) details may be lost in this scaling but that is rarely critical during initial testing.

There is no need to interface the final display until the design of the carrier board.

**This way of working will save you time and resources!**

Additional documentation you might need is.

- *Working with Yocto to build Linux* – found on Embedded Artists website.
- Getting started guide - <https://www.embeddedartists.com/getting-started/>

### 2.1 Conventions

A number of conventions have been used throughout to help the reader better understand the content of the document.

`Constant width text` – is used for file system paths and command, utility and tool names.

```
$ This field illustrates user input in a terminal running on the
development workstation, i.e., on the workstation where you edit,
configure and build Linux
```

```
# This field illustrates user input on the target hardware, i.e.,
input given to the terminal attached to the COM Board
```

```
This field is used to illustrate example code or excerpt from a
document.
```

## 3 Setup hardware

### 3.1 7-inch HDMI display kit

All the instructions in this document are based on using the 7-inch HDMI display kit (**EAD00363** or **EAD00369**) from Embedded Artists.



Figure 1 - 7-inch HDMI display

The 7-inch HDMI display kit comes with the following content:

- 7-inch display mounted in a frame
- 2x micro-B to A USB cables
- 1x HDMI cable
- 1x RGB-to-HDMI adapter board (**Note:** only included with **EAD00369**).

See Figure 2 below for the location of important connectors on the display.

Number	Connector	Description
1	HDMI connector	Connect to the HDMI connector on the carrier board or to RGB-to-HDMI adapter for boards that require this adapter (see section 3.2).
2	Power	For powering, connect micro-B to A USB cable to an external USB hub, your computer or to USB port on carrier board. See section 3.4 for details about powering.
3	Touch	Connect micro-B to A USB cable to USB port on carrier board, see section 3.3 for details.

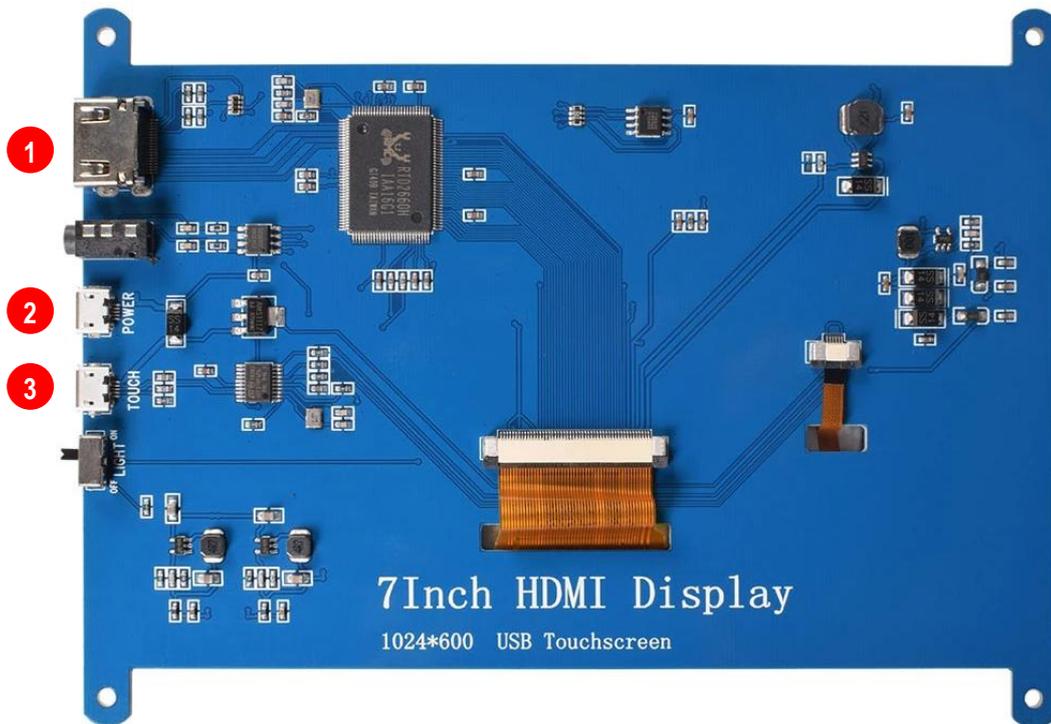


Figure 2 - Connectors on 7-inch HDMI display

### 3.2 Optional RGB-to-HDMI adapter

The following COM boards require you to use the RGB-to-HDMI adapter (included with **EAD00369**) between the Developer's Kit and the display.

- iMX7 Dual COM
- iMX7 Dual uCOM
- iMX6 SoloX COM
- iMX6 UltraLite COM

First connect the flat cable to the **J39 connector** on the COM Carrier Board V2 as shown in Figure 3.

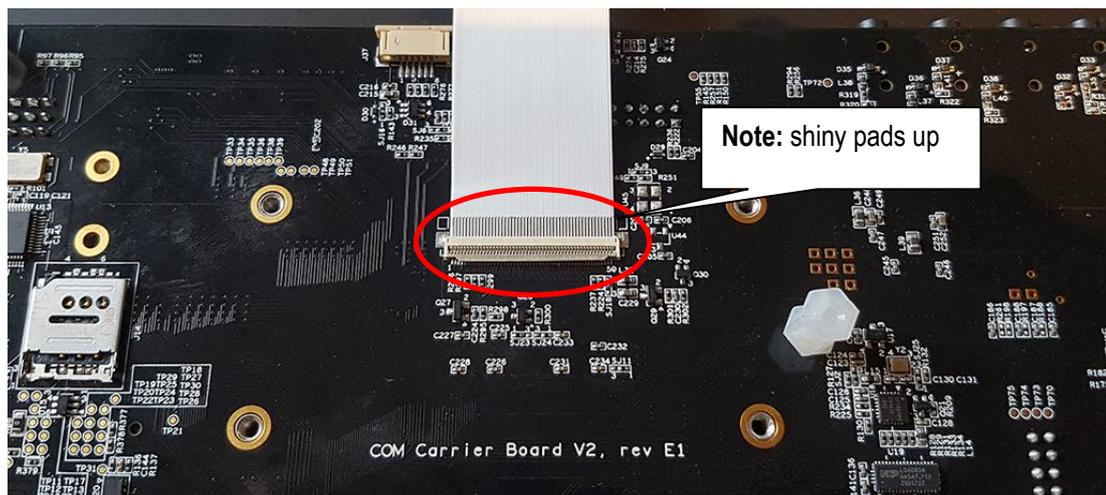


Figure 3 - Flat cable connected to J39 on Carrier Board

Secondly connect the flat cable to the RGB-to-HDMI adapter as shown in Figure 4.

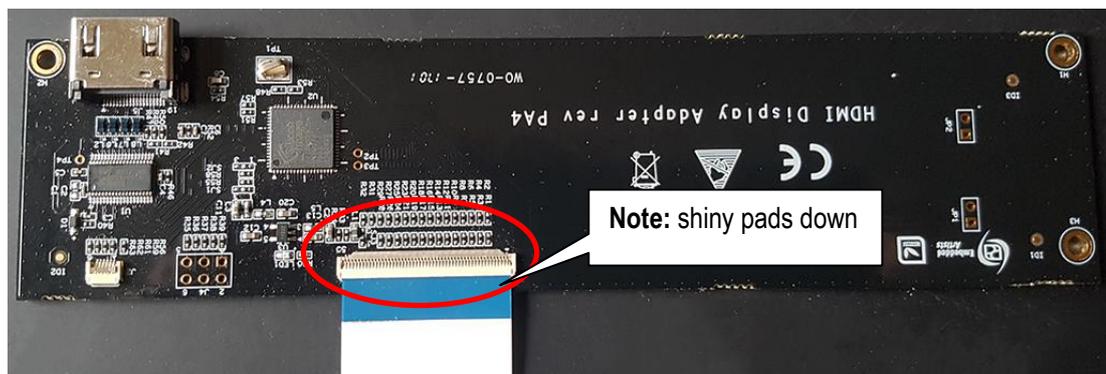


Figure 4 - Flat cable connected to RGB-to-HDMI adapter

You can now connect the HDMI cable between the HDMI connector (J5) on the adapter and the HDMI connector on the display.

### 3.3 Touch interface - USB port on carrier board

The touch interface should for most of the COM boards be connected to the USB Host Type A connector (J12) on the carrier board, see Figure 5.

For iMX7ULP uCOM and for iMX8M Nano uCOM you however have to use connector J11 instead since these boards only have one USB interface. To be able to use J11 you need a micro-B (male) to USB A (female) adapter similar to the one shown in Figure 6.

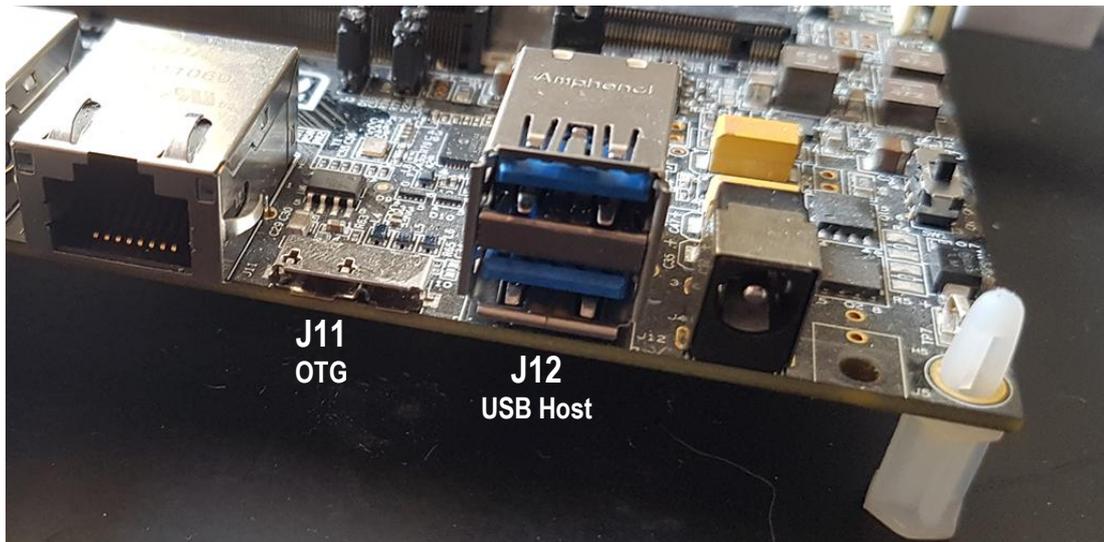


Figure 5 - USB connectors on carrier board



Figure 6 - USB micro-B (male) to USB A (female) adapter

### 3.4 Powering

The 7-inch HDMI Display is powered with +5V DC over the USB connectors. It requires about 500 mA current (but with a powerup current surge of up to 800mA). There are three ways of powering:

- From the COM Carrier Board's USB Host interface (requires a small rework to increase current limit)
- From a USB interface on a PC/laptop or simple USB charger.
- From a USB hub.

#### 3.4.1 Rework of COM Carrier Board rev E1 USB Hub Current Limit

The default design limits the current on each USB Host interface to 500mA. Due to the initial current surge at power-up, a small rework is needed to increase the current limit to 1.15A. See picture below to locate R67 and R69 (in corner where the dual USB Host connector is located). The resistors shall change to 20K ohm. Alternatively, a 33K ohm resistor is mounted on top of the existing resistor. It is recommended to rework both resistors so that both USB Host connectors have the same current limit.

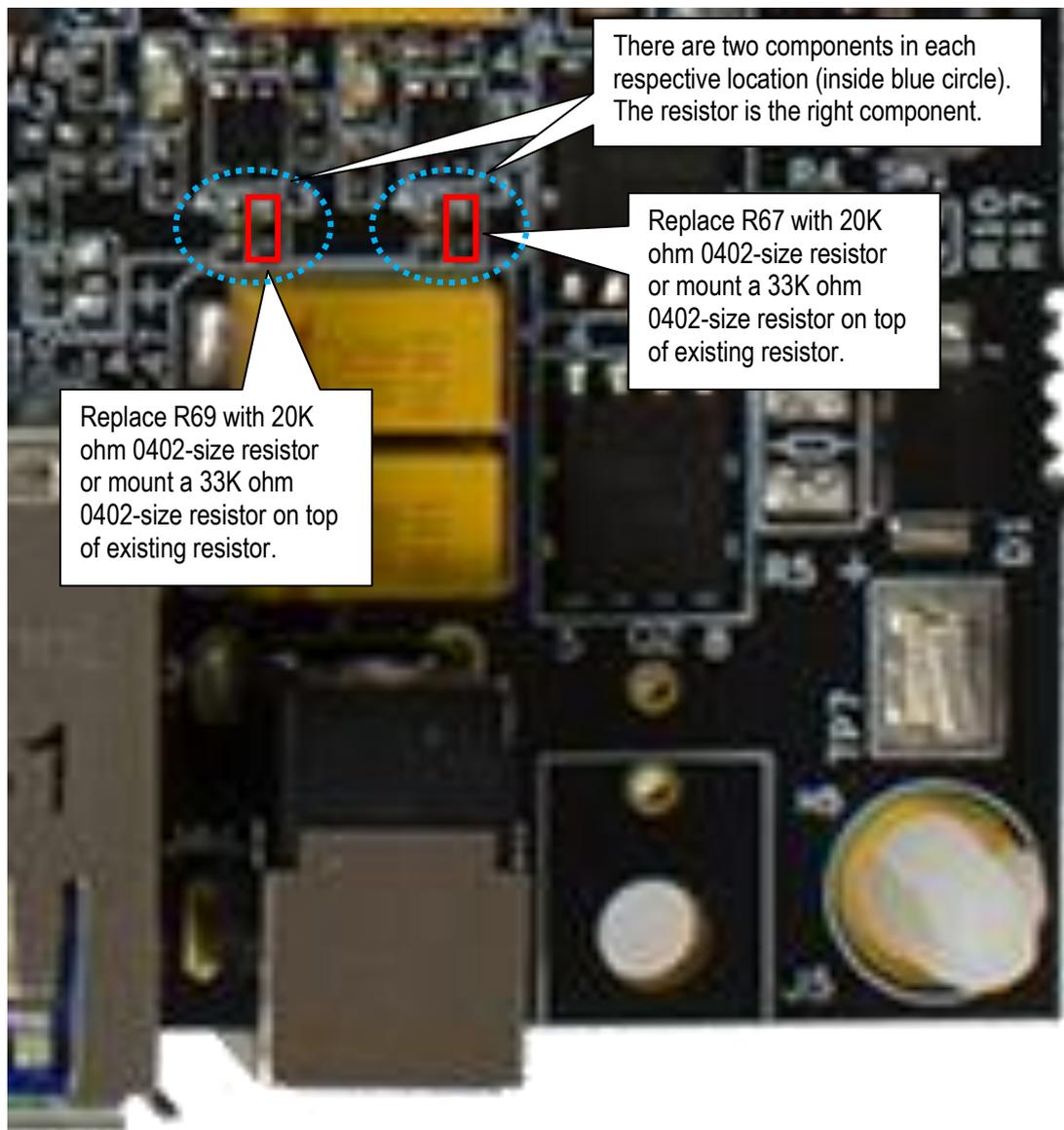


Figure 7 - Rework of COM Carrier Board rev E1

### 3.5 Connecting

The picture below illustrates how to connect the 7-inch HDMI Display. One HDMI cable is always needed. One USB cable is needed for the touch interface and optional powering. A second USB cable is needed if an alternative power source is needed.

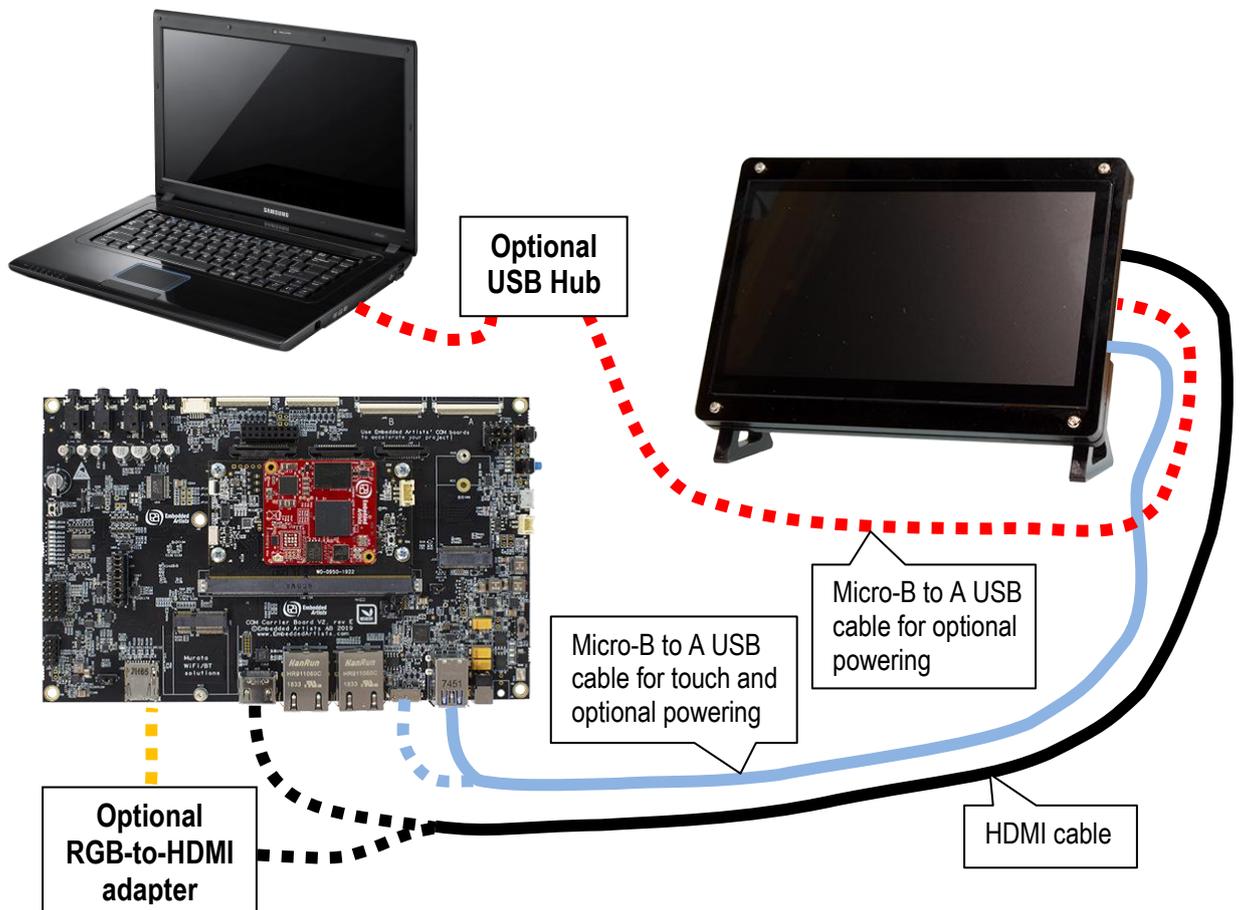


Figure 8 - How to connect 7-inch Display Kit

The HDMI cable shall be connected directly to the HDMI connector on the COM Carrier Board for:

- iMX6 DualLite COM
- iMX6 Quad COM
- iMX8M Mini uCOM
- iMX8M Nano uCOM
- iMX8M COM
- iMX7ULP uCOM

The optional RGB-to-HDMI adapter is needed for:

- iMX7 Dual COM
- iMX7 Dual uCOM
- iMX6 SoloX COM
- iMX6 UltraLite COM

## 4 Get up-and-running

This chapter contains one subsection with instructions for each supported COM board. Go to the subsection for the COM board you are using.

The instructions have been tested with Embedded Artists official `ea-image-base` builds that can be downloaded from <http://imx.embeddedartists.com>. Versions **4.14.98** and **5.4.24** were tested when writing these instructions.

### 4.1 iMX8M Mini uCOM

#### 4.1.1 Instructions

For this board there is a MIPI-to-HDMI bridge on the uCOM adapter so you can connect the HDMI cable between the HDMI connector (J13) on the carrier board and the HDMI connector on the display.

1. Let the board boot into Linux.
2. Login using user: `root` and password: `pass`.
3. You will see the Weston desktop on the display, see Figure 9.

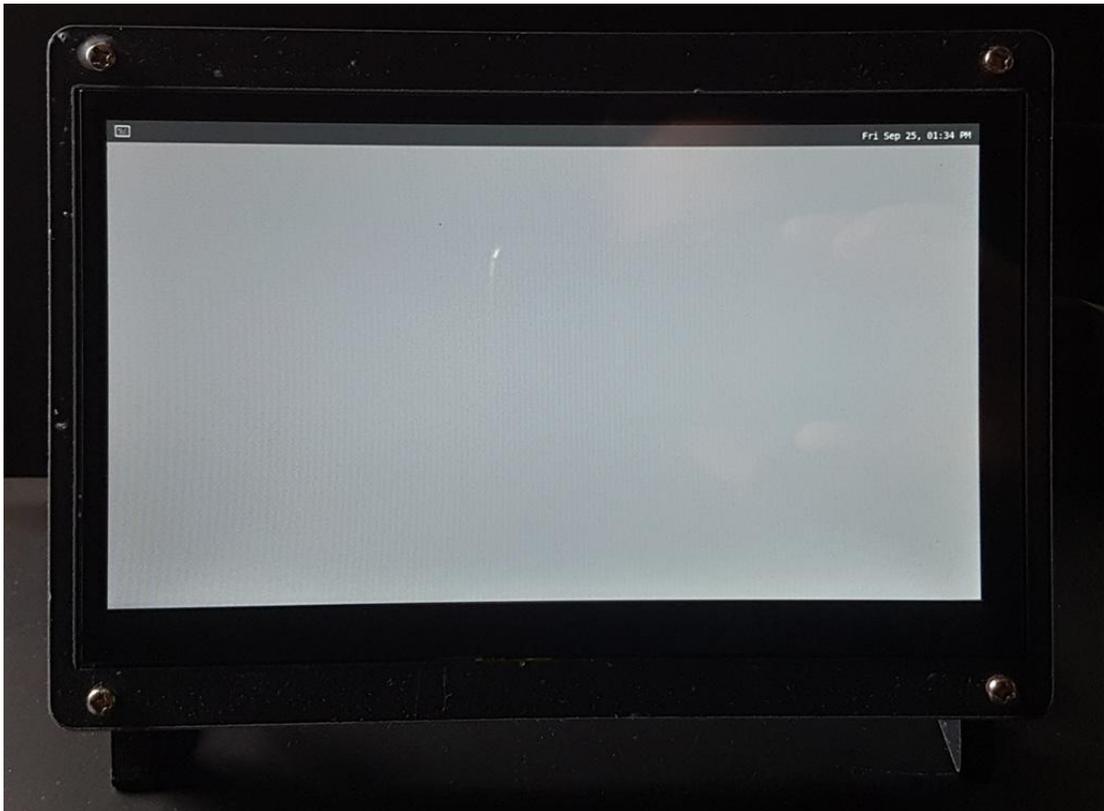


Figure 9 - Weston desktop

#### 4.1.2 Resolutions

The following resolutions have been tested and known to work. See section 6.1.2 for instructions of how to change the resolution.

- 1920x1080@60
- 1280x720@60
- 800x600

- This resolution doesn't work by modifying `Weston.ini`, only by setting the kernel parameter `video=800x600`, see section 5.1.2 below.

## 4.2 iMX8M Nano uCOM

### 4.2.1 Instructions

For this board there is a MIPI-to-HDMI bridge on the uCOM adapter so you can connect the HDMI cable between the HDMI connector (J13) on the carrier board and the HDMI connector on the display.

1. Let the board boot into Linux.
2. Login using user: `root` and password: `pass`.
3. You will see the Weston desktop on the display, see Figure 9.

### 4.2.2 Resolutions

The following resolutions have been tested and known to work. See section 6.1.2 for instructions of how to change the resolution.

- 1920x1080@60
- 1280x720@60
- 800x600@75
- 720x576@50 (only available when using 4.14.98)
- 720x480@60 (only available when using 4.14.98)

## 4.3 iMX8M COM

### 4.3.1 Instructions

This board has direct support for HDMI display interfaces. Connect the HDMI cable between the HDMI connector (J13) on the carrier board and the HDMI connector on the display.

1. Let the board boot into Linux.
2. Login using user: `root` and password: `pass`.
3. You will see the Weston desktop on the display, see Figure 9.

### 4.3.2 Resolutions

The following resolutions have been tested and known to work. See section 6.1.2 for instructions of how to change the resolution.

- 1920x1080@60
- 1280x720@60
- 720x576@50
- 720x480@60

## 4.4 iMX6 Quad COM / iMX6 DualLite COM

### 4.4.1 Instructions

This board has direct support for HDMI display interfaces. Connect the HDMI cable between the HDMI connector (J13) on the carrier board and the HDMI connector on the display.

1. Boot into u-boot and enter the commands below.
  - a. Enable the HDMI interface

```
=> eadisp enable hdmi
```

- b. Save changes and boot into Linux

```
=> saveenv  
=> boot
```

2. Let the board boot into Linux.
3. Login using user: `root` and password: `pass`.
4. You will see the console on the display, see Figure 10.

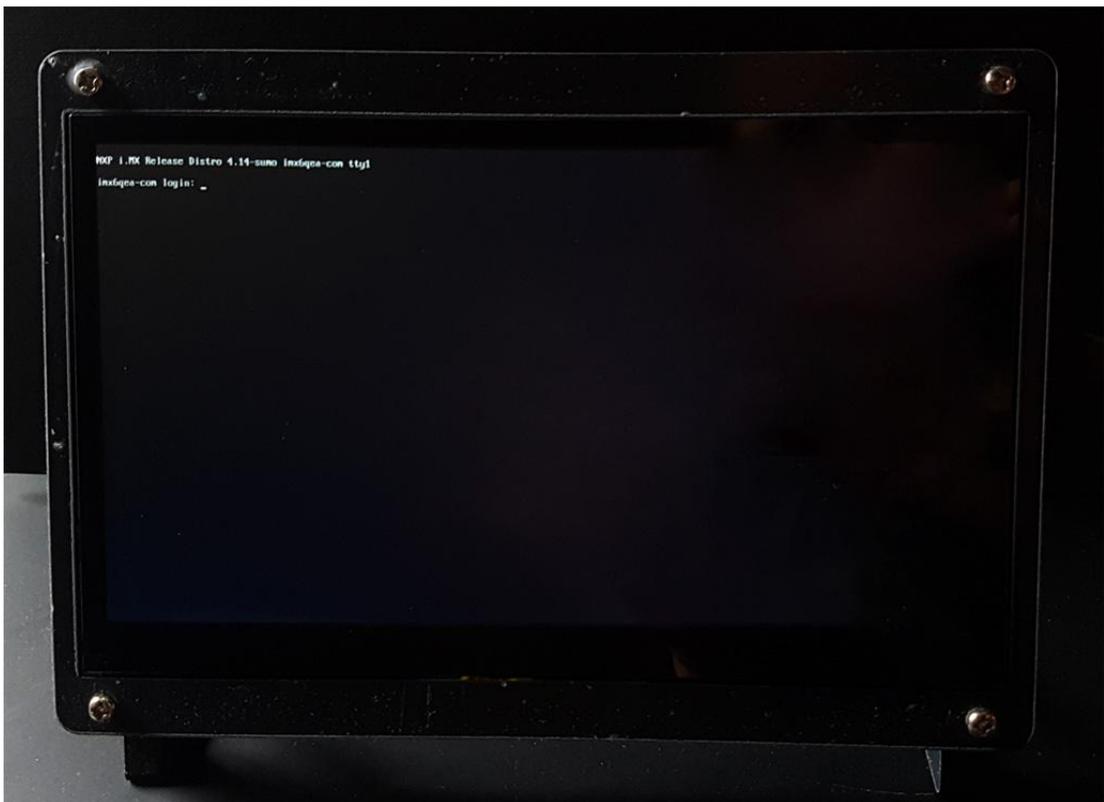


Figure 10 - Console on framebuffer

### 4.4.2 Resolutions

The following resolutions have been tested and known to work. See section 5.1.2 for instructions of how to change the resolution.

- 1920x1080
- 1280x720

- 720x576
- 720x480
- 640x480

## 4.5 iMX6 SoloX COM

### 4.5.1 Instructions

This board supports RGB display interface which means that you must use the RGB-to-HDMI adapter as described in section 3.2

1. Boot into u-boot and enter the commands below.
  - a. Enable the sii902x device (RGB-to-HDMI bridge).

```
=> setenv cmd_custom fdt set i2c0/sii902x status okay\;fdt set /sii902x-reset status okay
```

- b. Enable the RGB display interface.

```
=> eadisp enable rgb
```

- c. Add a new display configuration.

```
=> eadisp add rgb
"DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0"
```

- d. Check which number the new configuration got (in this case it was 12).

```
=> eadisp

Available display configurations:
 0) lvds0 hannstar:18:64998375,1024,768,220,40,21,7,60,10,0,0,0,0
 1) lvds0 lp101wh4_X11:24:72051300,1360,768,80,48,14,3,32,5,0,0,1,0
 2) lvds0 lp101wh4:24:72332730,1366,768,80,48,14,3,32,5,0,0,1,0
 3) lvds0 nhd-10.1-1024600af:24:51208521,1024,600,160,160,23,12,0,0,0,0,1,0
 4) rgb Innolux-AT070TN:24:33336667,800,480,89,164,75,75,10,10,0,0,1,0
 5) rgb nhd-4.3-480272ef:24:9009009,480,272,2,2,2,2,41,10,0,0,1,0
 6) rgb nhd-5.0-800480tf:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0
 7) rgb nhd-7.0-800480ef:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0
 8) rgb umsh-8864:24:9061007,480,272,20,20,20,20,3,3,0,0,1,0
 9) rgb umsh-8596-30t:24:33264586,800,480,128,120,20,20,8,5,0,0,1,1
10) rgb umsh-8596-33t:24:32917475,800,480,200,200,45,45,1,1,0,0,1,1
11) rgb rogin-rx050a:24:32917475,800,480,200,200,45,45,1,1,0,0,1,0
12) rgb DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0
```

- e. Change to the new display configuration. Change the number 12 to whatever number you got when adding the new display configuration.

```
=> eadisp conf rgb 12
```

- f. Save the changes.

```
=> saveenv
```

- g. Boot into Linux.

```
=> boot
```

2. Let the board boot into Linux.
3. Login using user: `root` and password: `pass`.
4. You will see the console on the display, see Figure 10 for an example.

#### 4.5.2 Resolutions

The following resolutions have been tested and known to work. See section 5.1.2 for instructions of how to change the resolution.

- 1920x1080
- 1366x768
- 1280x720
- 1024x768
- 800x600
- 720x576
- 720x480
- 640x480

## 4.6 iMX6 UltraLite COM

### 4.6.1 Instructions

This board supports RGB display interface which means that you must use the RGB-to-HDMI adapter as described in section 3.2

1. Boot into u-boot and enter the commands below.
  - a. Enable the sii902x device (RGB-to-HDMI bridge).

```
=> setenv cmd_custom fdt set i2c0/sii902x status okay\;fdt set /sii902x-reset status okay
```

- b. Enable the RGB display interface.

```
=> eadisp enable rgb
```

- c. Add a new display configuration.

```
=> eadisp add rgb  
"DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0"
```

- d. Check which number the new configuration got (in this case it was 8).

```
=> eadisp  
  
Available display configurations:  
0)  rgb  Innolux-AT070TN:24:33336667,800,480,89,164,75,75,10,10,0,0,1,0  
1)  rgb  nhd-4.3-480272ef:24:9009009,480,272,2,2,2,2,41,10,0,0,1,0  
2)  rgb  nhd-5.0-800480tf:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0  
3)  rgb  nhd-7.0-800480ef:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0
```

```

4)  rgb  umsh-8864:24:9061007,480,272,20,20,20,20,3,3,0,0,1,0
5)  rgb  umsh-8596-30t:24:33264586,800,480,128,120,20,20,8,5,0,0,1,1
6)  rgb  umsh-8596-33t:24:32917475,800,480,200,200,45,45,1,1,0,0,1,1
7)  rgb  rogin-rx050a:24:32917475,800,480,200,200,45,45,1,1,0,0,1,0
8)  rgb  DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0

```

- e. Change to the new display configuration. Change the number 8 to whatever number you got when adding the new display configuration.

```
=> eadisp conf rgb 8
```

- f. Save the changes.

```
=> saveenv
```

- g. Boot into Linux.

```
=> boot
```

2. Let the board boot into Linux.
3. Login using user: `root` and password: `pass`.
4. You will see the console on the display, see Figure 10 for an example.

#### 4.6.2 Resolutions

The following resolutions have been tested and known to work. See section 5.1.2 for instructions of how to change the resolution.

- 1920x1080
- 1366x768
- 1280x720
- 1024x768
- 800x600
- 640x480

## 4.7 iMX7 Dual COM / iMX7 Dual uCOM

### 4.7.1 Instructions

This board supports RGB display interface which means that you must use the RGB-to-HDMI adapter as described in section 3.2

1. Boot into u-boot and enter the commands below.
  - a. Enable the sii902x device (RGB-to-HDMI bridge).

```
=> setenv cmd_custom fdt set i2c0/sii902x status okay\;fdt set /sii902x-reset status okay
```

- b. Enable the RGB display interface.

```
=> eadisp enable rgb
```

- c. Add a new display configuration.

```
=> eadisp add rgb
"DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0"
```

- d. Check which number the new configuration got (in this case it was 8).

```
=> eadisp

Available display configurations:
0)  rgb  Innolux-AT070TN:24:33336667,800,480,89,164,75,75,10,10,0,0,1,0
1)  rgb  nhd-4.3-480272ef:24:9009009,480,272,2,2,2,2,41,10,0,0,1,0
2)  rgb  nhd-5.0-800480tf:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0
3)  rgb  nhd-7.0-800480ef:24:29232073,800,480,40,40,29,13,48,3,0,0,1,0
4)  rgb  umsh-8864:24:9061007,480,272,20,20,20,20,3,3,0,0,1,0
5)  rgb  umsh-8596-30t:24:33264586,800,480,128,120,20,20,8,5,0,0,1,1
6)  rgb  umsh-8596-33t:24:32917475,800,480,200,200,45,45,1,1,0,0,1,1
7)  rgb  rogin-rx050a:24:32917475,800,480,200,200,45,45,1,1,0,0,1,0
8)  rgb  DMTFT70:24:33336667,1280,720,89,164,75,75,10,10,0,0,1,0
```

- e. Change to the new display configuration. Change the number 8 to whatever number you got when adding the new display configuration.

```
=> eadisp conf rgb 8
```

- f. Save the changes.

```
=> saveenv
```

- g. Boot into Linux.

```
=> boot
```

2. Let the board boot into Linux.
3. Login using user: `root` and password: `pass`.
4. You will see the console on the display, see Figure 10 for an example.

#### 4.7.2 Resolutions

The following resolutions have been tested and known to work. See section 5.1.2 for instructions of how to change the resolution.

- 1920x1080
- 1366x768
- 1280x720
- 1024x768
- 800x600
- 640x480

## 4.8 iMX7ULP uCOM

### 4.8.1 Instructions

For this board there is a MIPI-to-HDMI bridge on the uCOM adapter so you can connect the HDMI cable between the HDMI connector (J13) on the carrier board and the HDMI connector on the display.

1. Let the board boot into Linux.
2. Login using user: `root` and password: `pass`.
3. You will see the console on the display, see Figure 10 for an example.

### 4.8.2 Resolutions

The following resolutions have been tested and known to work.

- 640x480

## 5 Linux kernel – graphics subsystems

### 5.1 Framebuffer device (fbdev)

The framebuffer device subsystem is the first in-kernel display subsystem. It provides an abstraction for the graphics hardware and represents the framebuffer or video memory used by some graphics hardware.

In Linux a framebuffer will be represented as a file in the `/dev` directory, such as `/dev/fb0`. This file is a memory device which can be read and written to in order to access or modify the content in the buffer and thereby on the display.

More information in the kernel documentation:

<https://www.kernel.org/doc/html/latest/fb/framebuffer.html>

#### 5.1.1 Available resolutions

It is possible to check which resolutions that are supported by the attached HDMI display.

**Note:** Although a resolution is available in the output from modes it is not sure that it will actually work with the 7-inch HDMI display and the COM board you are using. Please see the section for the COM board you are using in chapter 4 for a list of resolutions that are known to work.

```
# cat /sys/class/graphics/fb0/modes
S:1920x1080p-60
S:1920x1080p-50
S:1280x720p-60
S:1280x720p-50
S:720x576p-50
S:720x576p-50
S:720x480p-60
S:720x480p-60
V:640x480p-60
V:640x480p-60
```

In the list above you can see a letter preceding the resolution. This letter is a representation of the flag set for a resolution. The most important is 'U'. If you see this letter it means that the resolution has not been fetched directly from the display.

- U: Unknown
- D: Detailed
- S: Standard
- V: Vesa

Besides listing all available resolutions, you can use the command `fbset` to see the current resolution.

```
# fbset

mode "1280x720-60"
  # D: 74.250 MHz, H: 45.000 kHz, V: 60.000 Hz
  geometry 1280 720 1280 720 24
  timings 13468 220 110 20 5 40 5
  accel false
```

```
    rgba 8/16,8/8,8/0,0/0
endmode
```

### 5.1.2 Change resolution

#### Write to mode file

In sysfs there is a mode file that you can write to. The command below will change the resolution to 720x480.

```
# echo S:720x480p-60 > /sys/class/graphics/fb0/mode
```

#### Kernel parameter

From U-boot you can set the kernel parameter video to the resolution you want. Do the following from the U-boot console.

```
=> setenv extra_bootargs video=720x480
=> saveenv
=> boot
```

### 5.1.3 COM boards using fbdev

The following COM boards are using the fbdev subsystem.

- iMX6 Quad COM
- iMX6 DualLite COM
- iMX6 SoloX COM
- iMX6 UltraLite COM
- iMX7 Dual COM
- iMX7 Dual uCOM
- iMX7ULP uCOM

## 5.2 Direct Rendering Manager (DRM)

The DRM subsystem was introduced to handle more complex graphic cards which normally contains a Graphics Processing Unit (GPU).

More information about DRM.

<https://www.kernel.org/doc/html/latest/gpu/introduction.html>

[https://en.wikipedia.org/wiki/Direct\\_Rendering\\_Manager](https://en.wikipedia.org/wiki/Direct_Rendering_Manager)

### 5.2.1 Available resolutions

It is possible to check which resolutions that are supported by the attached HDMI display. The reason why the same resolution is listed more than once is because it can be supported with different refresh rates. The refresh rate is unfortunately not specified in the output from the `modes` file.

**Note:** Although a resolution is available in the output from `modes` it is not sure that it will actually work with the 7-inch HDMI display and the COM board. Please see the section for the COM board you are using in chapter 4 for a list of resolutions that are known to work.

```
# cat /sys/class/drm/card0-HDMI-A-1/modes
1920x1080
1920x1080
1920x1080
1280x720
1280x720
1280x720
1280x720
720x576
720x576
720x576
720x480
720x480
```

### 5.2.2 COM boards using DRM

The following COM boards are using the DRM subsystem. The `ea-image-base` image built for these boards are using Wayland / Weston, see chapter 6 below.

- iMX8M Mini uCOM
- iMX8M Nano uCOM
- iMX8M COM

## 6 Wayland

Wayland is a protocol that lets a client communicate with a display server. It is the display server's responsibility to coordinate the input from clients, for example input devices, and the output on the display.

More information about Wayland.

<https://wayland.freedesktop.org/>

### 6.1 Weston compositor

Weston is the reference implementation of the Wayland protocol and more specifically the display server, also known as the compositor.

#### 6.1.1 Available resolutions

You can use the utility program `weston-info` to list available resolutions. There will be more information than resolutions in the output from the utility program.

```
...
interface: 'wl_output', version: 3, name: 20
  x: 0, y: 0, scale: 1,
  physical_width: 340 mm, physical_height: 190 mm,
  make: 'DWE', model: 'HDMI',
  subpixel_orientation: unknown, output_transform: normal,
  mode:
    width: 1920 px, height: 1080 px, refresh: 60.000 Hz,
    flags:
  mode:
    width: 1920 px, height: 1080 px, refresh: 50.000 Hz,
    flags:
  mode:
    width: 1920 px, height: 1080 px, refresh: 50.000 Hz,
    flags:
...
```

#### 6.1.2 Change resolution

Weston is using a configuration file named `weston.ini` where the resolution can be specified.

##### Open the file

```
# nano /etc/xdg/weston/weston.ini
```

##### Modify the file

Go to the section that begins with `[output]`. In the example below the resolution is set to 1280x720.

```
[output]
name=HDMI-A-1
mode=1280x720@60
#transform=90
```

##### Restart Weston

Use `systemctl` to restart the Weston service.

**Note:** For Linux 4.14.98 you shouldn't specify the '@root' part.

```
# systemctl restart weston@root
```

### 6.1.3 COM boards using Wayland / Weston

The `ea-image-base` image for the following COM boards have Wayland and Weston enabled.

- iMX8M Mini uCOM
- iMX8M Nano uCOM
- iMX8M COM

## 7 Show something on the display

### 7.1 Show a photo / image

#### 7.1.1 Framebuffer device

For boards using fbdev (see section 5.1.3 above) you can use the `fbi` utility program to show an image on the display.

```
# fbi -T 2 -d /dev/fb0 myimage.png
```

#### 7.1.2 Weston

For boards using Weston (see section 6.1 and 5.2.2 above) you can use `weston-info` to show an image on the display.

```
# weston-image myimage.png
```

### 7.2 Video playback

The gstreamer multimedia framework with utility programs is included in the `ea-image-base` build. You can use for example `gst-play` or `gplay` to play a video. Video files can be downloaded from <https://www.sample-videos.com/>.

```
# gst-play-1.0 big_buck_bunny_720p_30mb.mp4
```

#### 7.2.1 Missing codec

If you cannot see anything on the display when playing a video this can be because a suitable codec is missing. For example, for the iMX8M Nano uCOM and iMX7ULP uCOM boards there isn't any suitable codecs available since the processors doesn't have a hardware decoder. Instead a software decoder / codec must be used which isn't included in a default `ea-image-base` build. You can however add this to your own build by adding the following to your `conf/local.conf` file (see the document *Working with Yocto* for more details about building your own images).

```
IMAGE_INSTALL_append = "\
    packagegroup-fsl-gstreamer1.0-commercial \
"

LICENSE_FLAGS_WHITELIST = "commercial"
```

### 7.3 Crank Storyboard – User Interface

Crank Storyboard is a tool that lets you develop User Interfaces for your product. There are pre-built demos as well as instructions on Embedded Artists website for Crank Storyboard. Go to the website and search for Crank Software Demos or use direct link below.

<https://www.embeddedartists.com/crank-software-demos/>