QUICK START GUIDE

# VAB-820

## Linux EVK v4.1.2

1.00-11072017-102000

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# Revision History

| Version | Date | Remarks |
|---|---|---|
| 1.00 | 11/07/2017 | Initial release |

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# 1. Introduction

This Quick Start Guide provides an overview on how to boot the Linux EVK system image on the VAB-820 board and configure the supported hardware functions in the build.

The VAB-820 Linux EVK v4.1.2 is developed based on the NXP fsl-yocto-L4.1.15_1.1.0-ga (Yocto 2.0 Jethro) and enables the hardware features of the VAB-820 board.

## 1.1 EVK Package Content

There are two folders in the package listed as below.

| Firmware folder | Description |
|---|---|
| VAB-820_Yocto2.0_BIN_v4.1.2.tar.gz | Yocto EVK system image and installation script files |
| **Document folder** | **Description** |
| VAB-820_Linux_EVK_v4.1.2_Quick_Start_Guide _v1.00_20171107.pdf | Quick Start Guide |

VAB-820 Linux EVK contents

### 1.1.1 Firmware Folder Contents

**VAB-820_Yocto2.0_BIN_v4.1.2.tar.gz:** contains installation script files and the precompiled U-boot and image for evaluating the VAB-820 board.

### 1.1.2 Document Folder Contents

**VAB-820_Linux_EVK_v4.1.2_Quick_Start_Guide _v1.00_20171107.pdf:** This Quick Start Guide provides an overview on how to boot the Linux EVK system image on the VAB-820 board and configure the supported hardware functions in the build.

## 1.2 Version Information and Supported Features

- U-Boot version: 2015.04
- Kernel version: 4.1.15
- Evaluation image: OpenEmbedded-core built with Yocto 2.0 Jethro
- Development based on NXP fsl-yocto-L4.1.15_1.1.0-ga (Yocto 2.0 Jethro)
- Supports SPI with eMMC or Micro SD boot (default)
- Supports HDMI and LVDS display
- Supports HDMI audio output
- Supports AUO LVDS capacitive touch panels (through USB interface)
    - AUO 10.4” G104XVN01.0 (1024×768)
    - AUO 7” G070VW01 V0 (800×480)
- Supports S-Video and CVBS
- Supports COM1 DTE mode, COM 2 as debug port
- Supports 2 FlexCAN TX/RX
- Supports Gigabit Ethernet
- Supports Line-in, Line-out, Mic-in
- Supports VNT9271 USB Wi-Fi dongle
- Supports EMIO-1533 USB Wi-Fi module
- Supports EMIO-5531 USB Wi-Fi & Bluetooth module
    - Supports Bluetooth A2DP and SPP profile
- Supports EMIO-1541 miniPCIe Wi-Fi module
- Supports EMIO-2531 miniPCIe Wi-Fi & Bluetooth module
    - Supports Bluetooth A2DP and SPP profile
- Supports EMIO-2550 miniPCIe Mobile Broadband module
- Supports Watchdog Timer, GPIO and RTC

# 2. Image Installation

This section explains the setup requirements for booting from a Micro SD card or the SPI ROM and eMMC.

The installation script files, precompiled U-boot and image are provided in the “Firmware” folder.

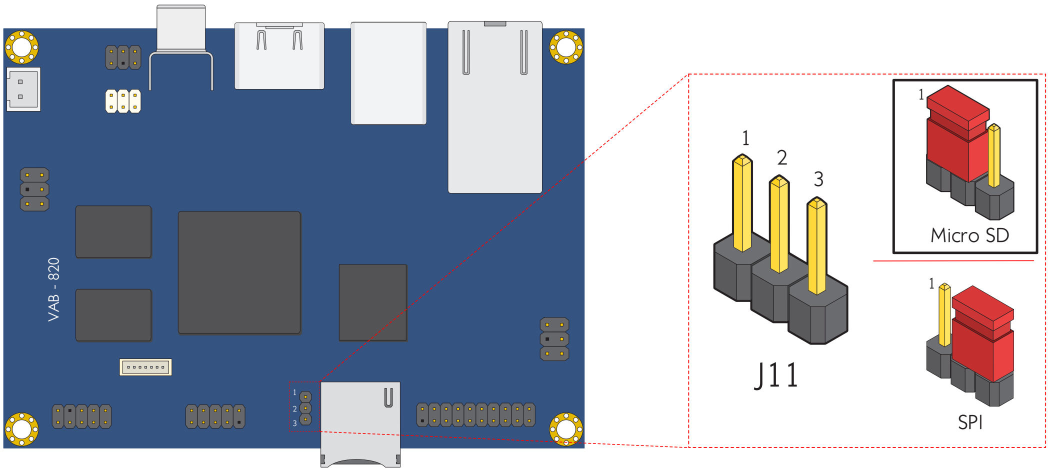
## 2.1 Booting from a Micro SD Card

The first step is to install this image onto a Micro SD card. Insert a Micro SD card into your Linux host machine and make sure it is not mounted. Install the SD Card image onto the Micro SD card with the commands below, replacing <device name> with the correct value for the card.

***Important:** Make sure you are writing to the correct device or the host system environment could be damaged.

```
$ tar xvf VAB820_Yocto2.0_BIN_v4.1.2.tar.gz
$ cd sd_installer/
$ sudo ./mk_sd_installer.sh /dev/<device name> --yocto
```

Next, on the VAB-820, set the boot jumper (J11) to the Micro SD position as shown below.



**Micro SD / SPI boot jumper diagram**

Insert the prepared Micro SD card into the VAB-820, connect an HDMI display, and power on the VAB-820 to initiate the boot process.

When the boot process is completed, you will see the OpenEmbedded desktop.

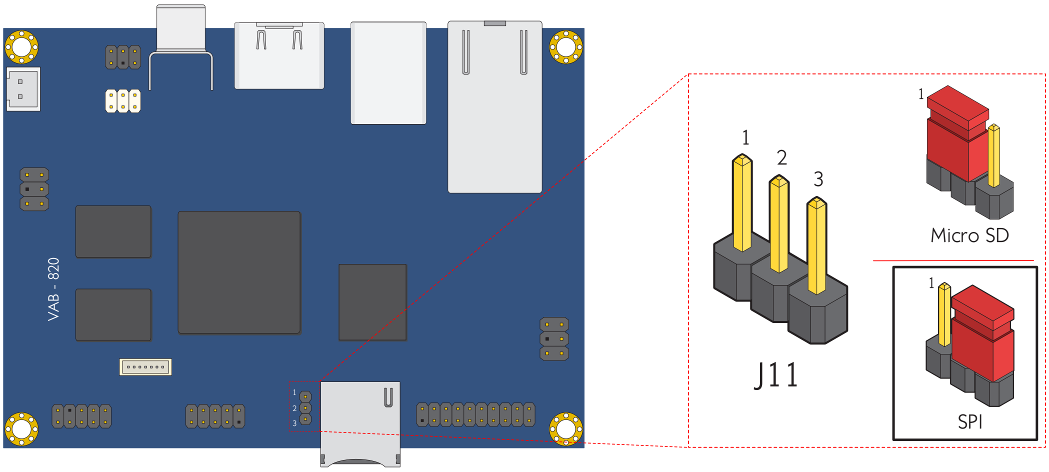
## 2.2 Booting from the SPI ROM with eMMC

The VAB-820 supports booting from the SPI ROM while loading the kernel and root filesystem from eMMC.

The first step is to prepare a Micro SD card as the system installer. Insert a Micro SD card into your Linux host machine and make sure it is not mounted. Install the system installer onto the Micro SD card with the command below, replacing <device name> with the correct value for the card.

```
$ tar xvf VAB820_Yocto2.0_BIN_v4.1.2.tar.gz
$ cd sd_installer/
$ sudo ./mk_sd_installer.sh /dev/<device name>
```

Next, on the VAB-820, set the boot jumper to the Micro SD position as shown below.

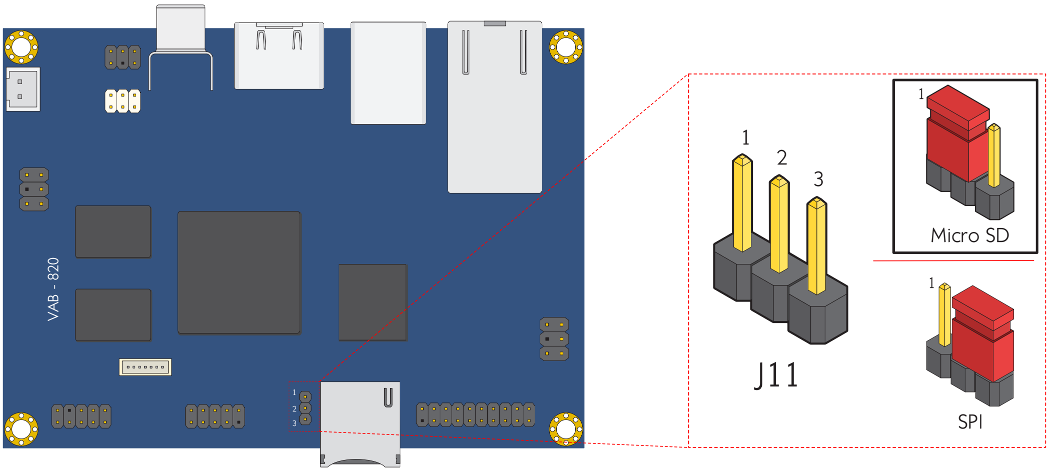


**Micro SD / SPI boot jumper diagram**

Insert the prepared Micro SD card into the VAB-820, and power on the VAB-820. The system will automatically start to install U-boot and image into SPI ROM and eMMC.

When the install process is completed, unplug the power cable and remove the Micro SD card.

And then, in order to boot from the SPI ROM make sure the boot jumper (J11) is set to SPI ROM boot.



**Micro SD / SPI boot jumper diagram**

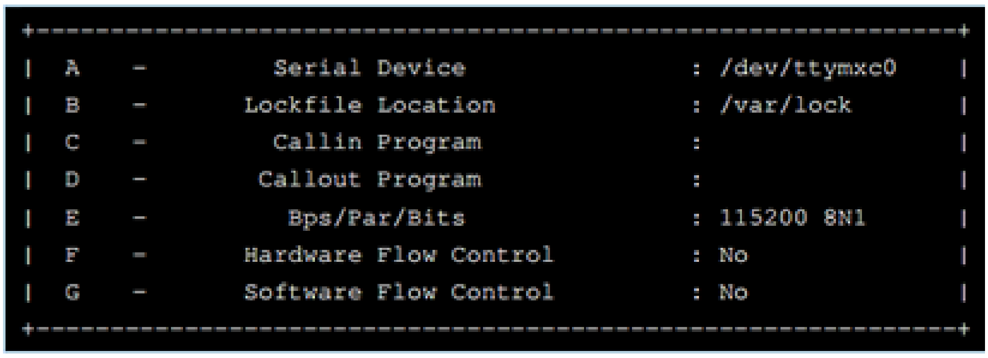
Next, connect an HDMI display, and power on the device to initiate the boot process. When the boot process is completed, you will see the OpenEmbedded desktop.

# 3. Hardware Function

This section explains how to enable and test the hardware functions precompiled in the VAB-820 Linux EVK including setting up U-Boot parameters, configuring display parameters, setting up the Video-in, setting up the CVBS, configuring FlexCAN , configuring Watchdog timer, setting up GPIO, and configuring RTC.

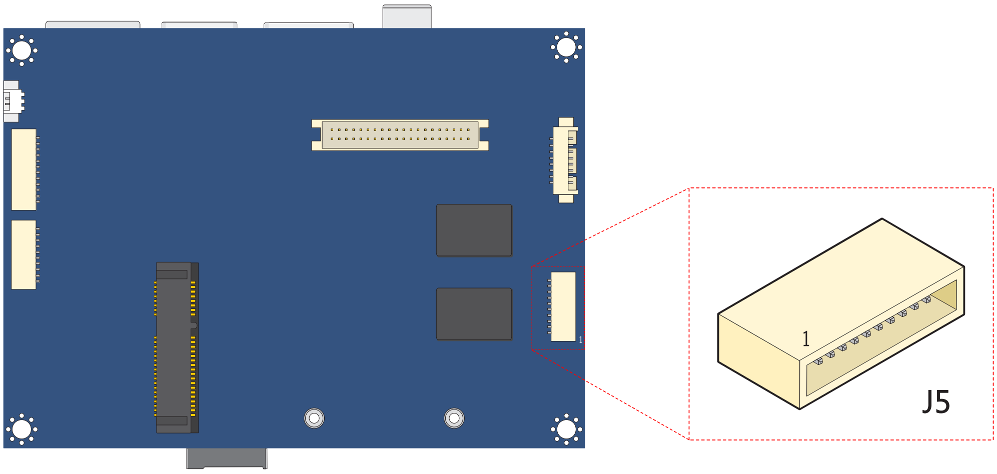
## 3.1 Setting Up U-Boot Parameters

When setting up the U-Boot parameters, the first step is to connect the host machine and the VAB-820 through the COM 2 connector (J5). Use a serial port communication program such as PuTTY, GtkTerm, or Minicom to configure serial port setting and connect to the debug console. There you will be able to see the U-Boot boot log and adjust settings in the U-Boot console.



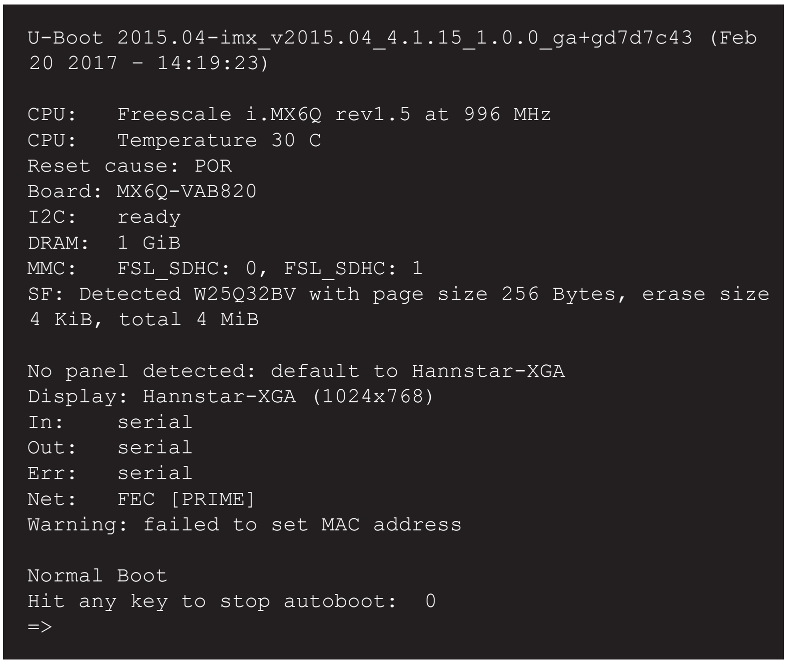
```
+-----------------------------------------------------------------------+
| A  -        Serial Device                 : /dev/ttymxc0      |
| B  -      Lockfile Location               : /var/lock         |
| C  -        Callin Program                :                   |
| D  -       Callout Program                :                   |
| E  -         Bps/Par/Bits                 : 115200 8N1        |
| F  -     Hardware Flow Control            : No                |
| G  -     Software Flow Control            : No                |
+-----------------------------------------------------------------------+
```

**Serial port setting of host machine**



**COM 2 connector (J5) diagram**

Next, power on the VAB-820 to initiate the boot process. When prompted, press any key to stop the boot process and enter the U-Boot console as illustrated by the screenshot below.



```
U-Boot 2015.04-imx_v2015.04_4.1.15_1.0.0_ga+gd7d7c43 (Feb
20 2017 - 14:19:23)

CPU:   Freescale i.MX6Q rev1.5 at 996 MHz
CPU:   Temperature 30 C
Reset cause: POR
Board: MX6Q-VAB820
I2C:   ready
DRAM:  1 GiB
MMC:   FSL_SDHC: 0, FSL_SDHC: 1
SF: Detected W25Q32BV with page size 256 Bytes, erase size
4 KiB, total 4 MiB

No panel detected: default to Hannstar-XGA
Display: Hannstar-XGA (1024x768)
In:    serial
Out:   serial
Err:   serial
Net:   FEC [PRIME]
Warning: failed to set MAC address

Normal Boot
Hit any key to stop autoboot:  0
=>
```

**Debug console view of boot process**

To list the current U-Boot parameters, use the following command:

```
=> printenv
```

To have more information make sure the printout message includes “bootcmd=run bootcmd_auto”.

The default “bootcmd” parameter is set to auto detect the system location by first attempting to load the kernel from the Micro SD card. If it is not detected it continues to boot from the eMMC.

To load the kernel from the specified device, refer to the two examples below.

To load the kernel from the Micro SD card, use the following command:

```
=> setenv bootcmd ‘run bootcmd_sd’
=> saveenv
=> boot
```

To load the kernel from the eMMC, use the following command:

```
=> setenv bootcmd ‘run bootcmd_mmc’
=> saveenv
=> boot
```

## 3.2 Restoring Default U-Boot Parameters

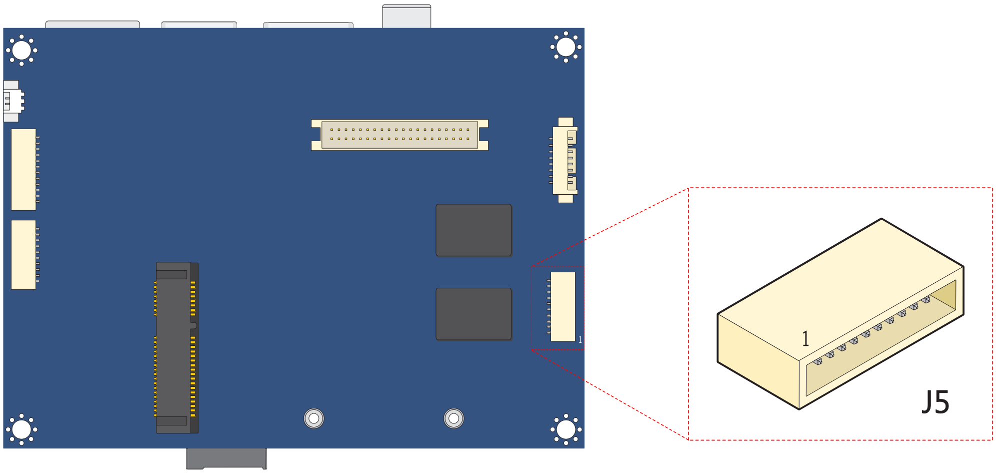
If the U-Boot parameters have been modified, the “destroyenv” command in the U-Boot console can restore the factory defaults settings

To restart the device, use the “reset” command:

```
=> destroyenv
=> reset
```

## 3.3 Using the OpenEmbedded Console

The first step is to connect the host machine and the VAB-820 through the COM 2 connector (J5). Use a serial port communication program such as PuTTY, GtkTerm, or Minicom to connect to the debug console. There you will be able to see the U-Boot boot log and adjust settings in the U-Boot console. Next, power on the VAB-820 to initiate the boot process. When the boot process is completed you will be prompted to login.



**COM 2 connector (J5) diagram**

The default account is “root”, with no password set (just press Enter when prompted for password).

```
...
Freescale i.MX Release Distro 4.1.15_1.1.1 imx6qvab820 /dev/ttymxc1
imx6qvab820 login: root
```

## 3.4 Setting Up Display Device

The VAB-820 Linux EVK v4.1.2 supports the following display devices:

- HDMI monitor
- AUO 10.4" G104XVN01.0 LVDS panel (1024x768)
- AUO 7" G070VW01 V0 LVDS panel (800x480)

### 3.4.1 Setting Up the U-Boot Display Parameters for HDMI

To set the HDMI monitor as the display output, use the following command:

```
=> run o_hdmi
=> saveenv
```

In order to confirm the settings are correct use the following command to list the new U-Boot parameters:

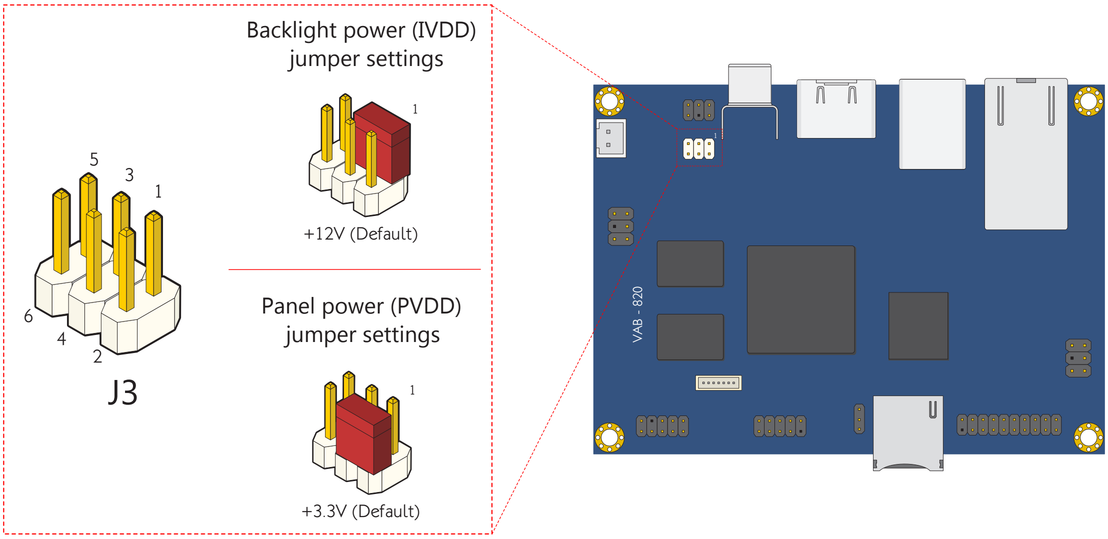
```
=> printenv hdmi

hdmi=video=mxcfb0:dev=hdmi,1920x1080M@60,bpp=32
```

Make sure the display device is HDMI and the resolution matches your monitor's resolution.

### 3.4.2 Setting Up the U-Boot Display Parameters for LVDS

Before setting an LVDS panel as the display output make sure the LVDS backlight power jumper is set to +12V and the LVDS panel power jumper is set to +3.3V as shown below.



**LVDS panel and backlight power jumper diagram**

To set the AUO 10.4” G104XVN01.0 LVDS panel as the display output, use the following command:

```
=> run o_lvdsg104
=> saveenv
```

In order to confirm the settings are correct use the following command to list the new U-Boot parameters:

```
=> printenv lvds_auo_g104
lvds_auo_g104=video=mxcfb0:dev=ldb,LDB-XGA, if=RGB24 ldb=sin0
```

To set the AUO 7” G070VW01 V0 LVDS panel as the display output, use the following command:

```
=> run o_lvdsg070
=> saveenv
```

In order to confirm the settings are correct use the following command to list the new U-Boot parameters:

```
=> printenv lvds_auo_g070
lvds_auo_g070=video=mxcfb0:dev=ldb,480C60,if=RGB24 ldb=sep0
```

## 3.5 Setting Up Dual Displays

An HDMI monitor and an LVDS panel can be used to create a dual display set up for the VAB-820, with support for clone and extension modes.

- HDMI monitor and AUO 10.4” G104XVN01.0 LVDS panel
- HDMI monitor and AUO 7” G070VW01 V0 LVDS panel

### 3.5.1 Setting Up the U-Boot Display Parameters for Dual Displays

Due to system limitations, the maximum resolution suggested for the HDMI monitor in the dual display set up is 1280x720. To change the HDMI resolution to 1280x720 use the following command:

```
# xrandr --output HDMI --mode 1280x720 --rate 60 --output LVDS --mode building
```

The next step is to set the U-Boot display parameters for dual display. (Note: For the dual display set up you must use an HDMI device and one of the LVDS panels supported in the BSP).

To set an HDMI monitor and an AUO 10.4” G104XVN01.0 (1024x768) LVDS panel as the display devices, use the following command:

```
=> setenv hdmilvds_g104 ‘video=mxcfb0:dev=hdmi,1920x1080M@60,bpp=16
video=mxcfb1:dev=ldb,LDB-XGA,if=RGB24 ldb=sin0’
=> setenv mmcargs ‘setenv bootargs console=${console},${baudrate} ${hdmilvds_g104}
root=${mmcroot}’
=> saveenv
=> reset
```

To set an HDMI monitor and an AUO 7” G070VW01 V0 (800x480) LVDS panel as the display devices, use the following command:

```
=> setenv hdmilvds_g070 ‘video=mxcfb0:dev=hdmi,1920x1080M@60,bpp=16
video=mxcfb1:dev=ldb,480C60,if=RGB24 ldb=sep0’
=> setenv mmcargs ‘setenv bootargs console=${console},${baudrate} ${hdmilvds_g070}
root=${mmcroot}’
=> saveenv
=> reset
```

### 3.5.2 Setting Video Playback in Clone Mode

The default setting for the dual display set up is clone mode. In order to enable video playback, use the following command:

```
  # gst-launch playbin2 uri=file:///$filename video-sink=”tee name=tee ! queue max-size-
buffers=1 ! vpudec ! imxv4l2sink device=$VIDEO_DEVICE1 disp-width=$width disp-height=$height
tee. ! queue max-size-buffers=1 ! vpudec !  imxv4l2sink device=$VIDEO_DEVICE2 disp-
width=$width disp-height=$height”
```

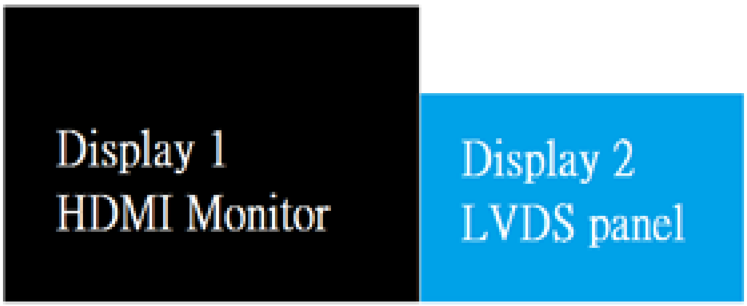
To play MJPEG video files in clone mode, use the following command:

```
  # gst-launch playbin2 uri=file:///$filename video-sink=”tee name=tee ! queue max-size-
buffers=1 ! imxv4l2sink device=$VIDEO_DEVICE1 disp-width=$width disp-height=$height tee.
! queue max-size-buffers=1 ! imxv4l2sink device=$VIDEO_DEVICE2 disp-width=$width disp-
height=$height”
```

### 3.5.3 Setting Video Playback in Extension Mode

There are four panel configurations supported in extension mode. Follow the commands below for your desired set up.

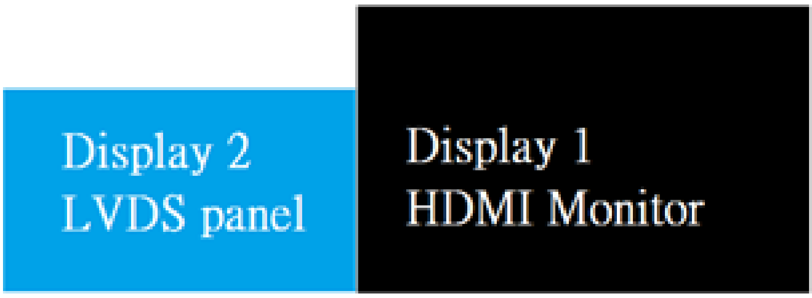
Extension mode configuration 1:



To set this configuration, use the following command:

```
# xrandr -output HDMI --left-of LVDS
```

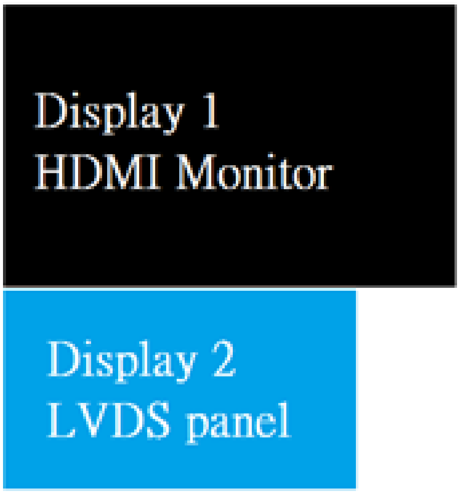
Extension mode configuration 2:



To set this configuration, use the following command:

```
# xrandr -output HDMI --right-of LVDS
```

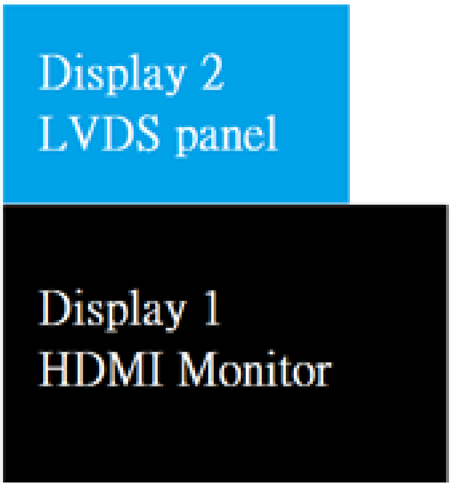
Extension mode configuration 3:



To set this configuration, use the following command:

```
# xrandr -output HDMI --above LVDS
```

Extension mode configuration 4:



To set this configuration, use the following command:

```
  # xrandr -output HDMI --below LVDS
```

To play video on an HDMI monitor and LVDS panel in extension mode, use the following command:

```
  # gst-launch playbin2 uri=file:///$file2 video-sink=”imxv4l2sink device=/dev/video17 disp-
width=1920 disp-height=1080” &
  # gst-launch playbin2 uri=file:///$file1 video-sink=”imxv4l2sink device=/dev/video19”
```

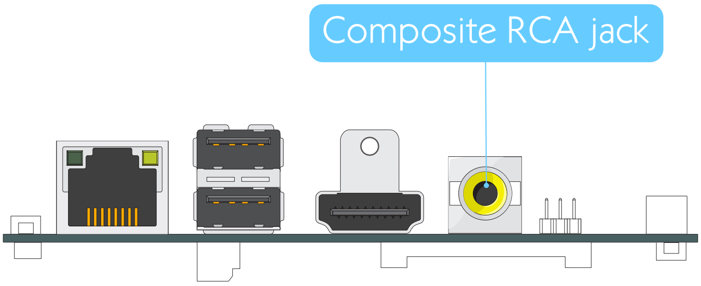
### 3.5.4 Changing Back to Clone Mode

If you would like to switch back to clone mode from extension mode, use the following command:

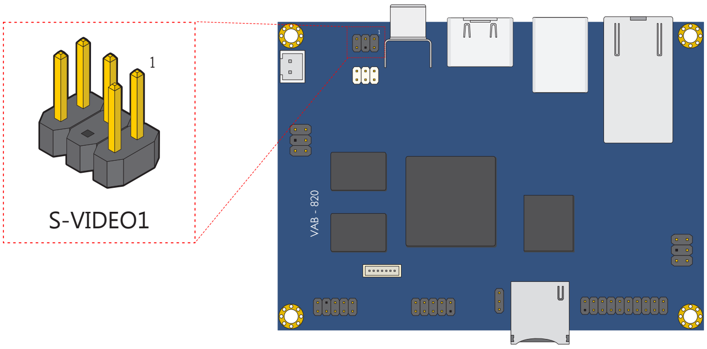
```
  # xrandr --output HDMI --same-as LVDS
```

# 3.6 Setting Up the Video-in

The VAB-820 supports two video inputs. The composite RCA jack is a CVBS signal input and the S-VIDEO1 pin header is an S-Video signal input. The following steps are for video-in function verification.



**Composite RCA jack diagram**



**S-Video pin header diagram**

## 3.6.1 Setting Up the CVBS

To enable the video-in, use the following command:

```
# gst-launch-0.10 imxv4l2src input=1 deinterlace=true! imxv4l2sink
```

If the source of the video

```
# gst-launch-0.10 imxv4l2src input=1 deinterlace=true ! imxv4l2sink crop-top-by-pixel=1
```

To display other video-in sources on the screen, use the following command:

```
# gst-launch-0.10 imxv4l2src input=1 deinterlace=true ! imxv4l2sink
```

### 3.6.1.1 CVBS Video-in Recording

If your application requires the ability to record the video-in feeds onto the device storage, the following commands can be used when writing your software application.

**Record Feed as MP4:**

To save the video-in feed as an MP4 file, use the following command:

```
# gst-launch-0.10 imxv4l2src input=1 num-buffers=<value> ! vpuenc codec=6 ! ffmux_mov !
filesink location=/<path/filename.mp4>
```

For example, to save the video-in video as a 10-second MP4 file into /home folder with a filename demo_1.mp4, use the following command:

```
# gst-launch-0.10 imxv4l2src input=1 num-buffers=300 ! vpuenc codec=6 ! ffmux_mov ! filesink
location=/home/demo_1.mp4
```

To play the saved video file, use the following command:

```
# gst-launch-0.10 playbin2 uri=file:/ <path/filename.mp4>
```

If you need to display the video-in source on the screen and record the feed at the same time, use the following command:

```
# gst-launch-0.10 imxv4l2src input=1 num-buffers=900 queue-size=30 ! tee name=t !
queue ! imxv4l2sink t. ! queue ! vpuenc codec=6 bitrate=3000000 ! matroskamux ! filesink
location=/<path/filename.mp4>
```

### 3.6.2 Setting Up the S-Video

To enable the video-in, use the following command:

```
# gst-launch-0.10 imxv4l2src input=2 ! imxv4l2sink
```

If the source of the video-in is PAL, use the following command to display the video on the screen:

```
# gst-launch-0.10 imxv4l2src input=2 deinterlace=true ! imxv4l2sink crop-top-by-pixel=1
```

To display other video-in sources on the screen, use the following command:

```
# gst-launch-0.10 imxv4l2src input=2 deinterlace=true ! imxv4l2sink
```

#### 3.6.2.1 S-Video Video-in Recording

If your application requires the ability to record the video-in feeds onto the device storage, the following commands can be used when writing your software application.

**Record Feed as MP4:**

To record the video-in feed as an MP4 file, use the following command:

```
# gst-launch-0.10 imxv4l2src input=2 num-buffers=<value> ! vpuenc codec=6 ! ffmux_mov !
filesink location=/path.mp4
```

For example, to save the video-in video as a 10-second MP4 file into /home folder with a filename demo_2.mp4, use the following command:

```
# gst-launch-0.10 imxv4l2src input=2 num-buffers=300 ! vpuenc codec=6 ! ffmux_mov ! filesink
location=/home/demo_2.mp4
```

To play the saved video file, use the following command:

```
# gst-launch-0.10 playbin2 uri=file:/ <path/filename.mp4>
```

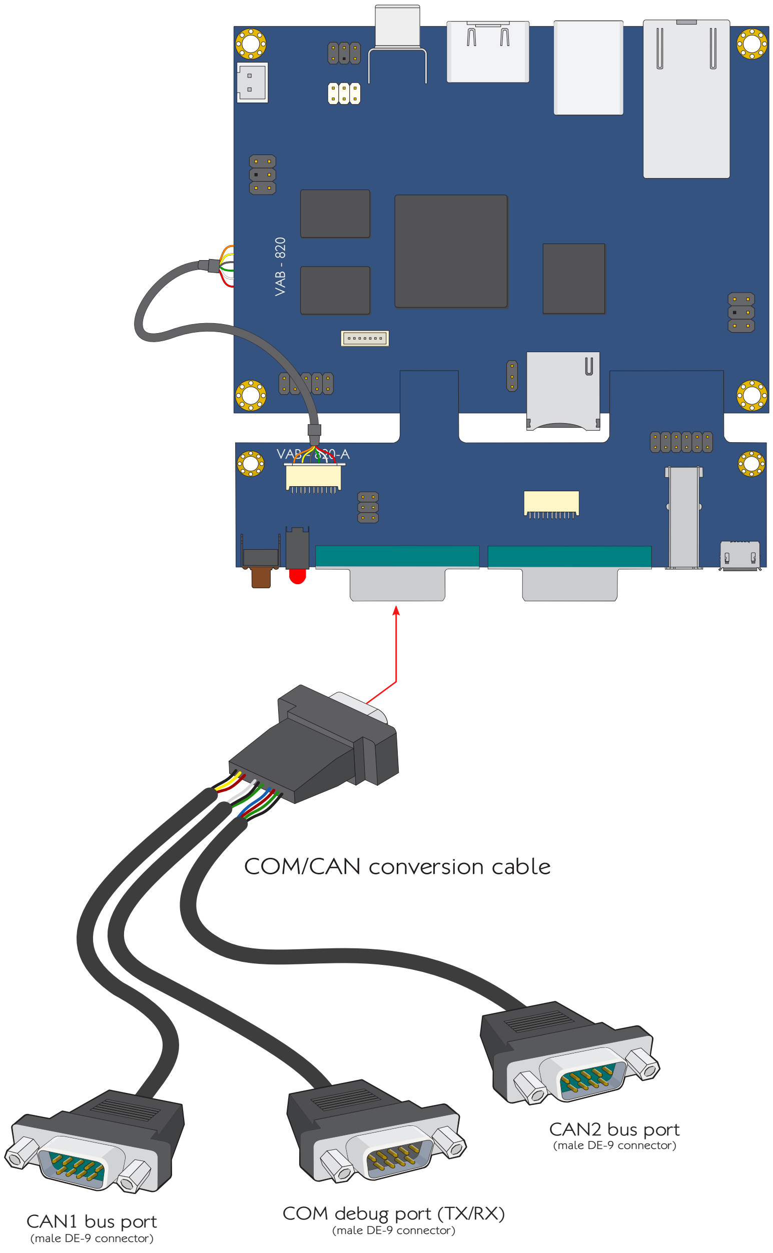
If you need to display the video-in source on the screen and record the feed at the same time, use the following command:

```
# gst-launch-0.10 imxv4l2src input=2 num-buffers=900 queue-size=30 ! tee name=t !
queue ! imxv4l2sink t. ! queue ! vpuenc codec=6 bitrate=3000000 ! matroskamux ! filesink
location=/<path/filename.mp4>
```

## 3.7 Configuring FlexCAN

The CAN/COM 2 port of the VAB-820 supports debug port (COM 2) and two CAN bus ports. The CAN bus supports CAN protocol specification Version 2.0 B while the COM 2 supports TX/RX for debugging purposes only.

The first step is to connect the VAB-820-A daughter-board and COM/CAN converter cable.



**Installing the VAB-820-A daughterboard and COM/CAN conversion cable diagram**

Please note that you need to disable the CAN bus first, set the CAN bus bitrate. The CAN bus bitrate should be 5000 < [BRT_value] < 1000000.

CAN bus 1 is can0 and CAN bus 2 is can1.

To set the CAN bus 1 bitrate [BRT_value], use the following command:

```
# ip link set can0 type can bitrate [BRT_value]
```

To enable the CAN bus 1, use the following command:

```
# ip link set can0 type can bitrate [BRT_value]
```

To disable the CAN bus 1, use the following command:

```
# ifconfig can0 down
```

Use the cansend command to send CAN bus 1 data:

```
# cansend can0 <ID>#<Data>
```

<ID>: Device ID of Can bus

<Data>: Send out data

Use the candump command to receive data from CAN bus 1:

```
# candump can0 &
```

## 3.8 Configuring Watchdog Timer

A Watchdog timer is an electronic timer that is used to detect and recover from system malfunctions.

The **wdt_driver_test.out** provides an application to configure the Watchdog timer.

To enable the Watchdog with the default timeout (60 seconds), use the following command:

```
$ /unit_tests/wdt_driver_test.out enable wdt
```

To change the timeout <value> and the system reboot <value> (seconds), use the following command:

```
$ /unit_tests/wdt_driver_test.out set_timeout <value>
```

To send keep-alive requests to the Watchdog <value> (seconds), use the following command:

```
$ /unit_tests/ wdt_driver_test.out set_keep_alive <value>
```

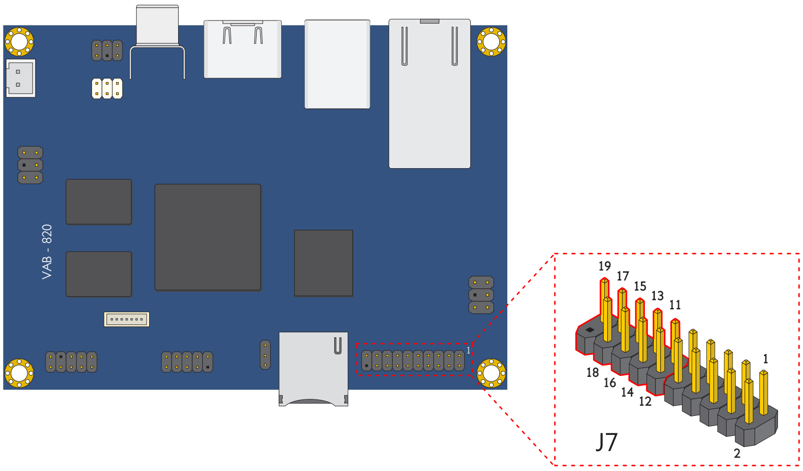
When the value of "set_keep_alive" is smaller than the value of "set_timeout", the system will not reboot.

To disable the Watchdog, use the following command:

```
$ /unit_tests/wdt_driver_test.out disable wdt
```

## 3.9 Setting Up GPIO

The GPIO pins are located on the J7 (Miscellaneous) pin header. The J7 pin header on the VAB-820 is consists of 19-pins where pin11 ~ pin19 are the GPIO pins. The following section explains setting up these pins for input/ output communication.



**J7 pin header diagram**

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | RESET_N | 2 | P_LED+ |
| 3 | GND | 4 | P_LED- |
| 5 | I2C3_SCL | 6 | W_LED+ |
| 7 | I2C3_SDA | 8 | W_LED- |
| 9 | 5VIN | 10 | GND |
| 11 | GPIO_1 | 12 | GPIO_7 |
| 13 | GPIO_2 | 14 | GPIO_8 |
| 15 | GPIO_4 | 16 | GPIO_9 |
| 17 | GPIO_5 | 18 | GPIO_16 |
| 19 | GND | 20 | |

**J7 pin header pinout table**

### 3.9.1 Setting Up DIO Port for GPIO Functionality

The echo value of GPIO pins are listed below:

| Pin | Signal | GPIO echo value |
|---|---|---|
| 12 | GPIO_7 | 7 |
| 11 | GPIO_1 | 1 |
| 14 | GPIO_8 | 8 |
| 13 | GPIO_2 | 2 |
| 16 | GPIO_9 | 9 |
| 15 | GPIO_4 | 4 |
| 18 | GPIO_16 | 203 |
| 17 | GPIO_5 | 5 |
| 19 | GND | |

**GPIO port pinout table**

Set the multifunction pin as a GPIO pin. Here is the example for GPIO pin 1:

```
$ echo 7 > /sys/class/gpio/export
```

### 3.9.2 Setting Up GPI Mode

To set a pin to “input” mode (GPI), use the following command (here is the example for GPIO pin 1):

```
$ echo “in” > /sys/class/gpio/gpio7/direction
```

To read the GPI input value, use the following command:

```
$ cat /sys/class/gpio/gpio203/value
```

### 3.9.3 Setting Up GPO Mode

To set a pin to “output” mode (GPO), use the following command (here is the example for GPIO pin 1):

```
$ echo “out” > /sys/class/gpio/gpio7/direction
```

To output a “Low” value on the GPO pin, use the following command:

```
$ echo 0 > /sys/class/gpio/gpio7/value
```

To output a “High” value on the GPO pin, use the following command:

```
$ echo 1 > /sys/class/gpio/gpio7/value
```

## 3.10 Configuring RTC

The RTC (Real-Time Clock) keeps track of the current time values. The time values include the year, month, date, hours, minutes and seconds. To configure the RTC on the VAB-820, set the system time with the Linux date command as the example shown below:

```
$ date mmddHHMMYYYY
```

| Time | Value |
|---|---|
| mm | 2-digit month |
| dd | 2-digit day |
| HH | 2-digit hours in 24h system |
| MM | 2-digit minutes |
| YYYY | 4-digit year |

**Time value table**

For example, the value 061110072013 means June 11 2013 10:07. The date command also accepts other time formats. For more information, use the following command:

```
$ date --help
```

To write the system time to the RTC, use the following command:

```
$ hwclock -w -f /dev/rtc0
```

To read the RTC time, use the following command:

```
$ hwclock -r
```

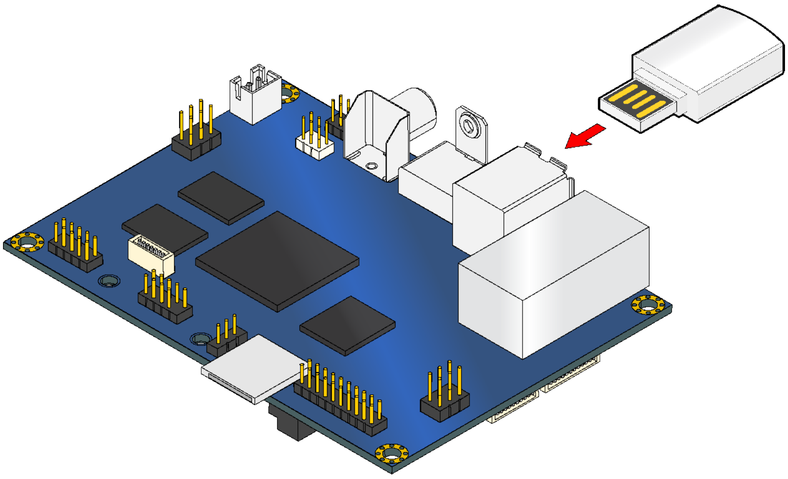
# 4. Accessories

This section explains how to install and configure the various EMIO modules available for the VAB-820 board.

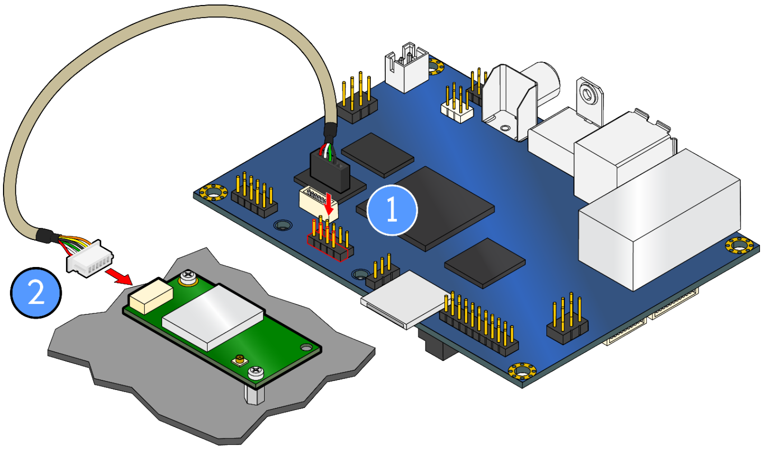
## 4.1 Configuring the VNT9271 USB Wi-Fi Dongle/EMIO-1533 USB Wi-Fi Module

The VNT9271 USB Wi-Fi dongle and EMIO-1533 USB Wi-Fi module support Wi-Fi functionality through USB port or onboard USB pin header connection respectively.

The first step is to insert the VNT9271 USB Wi-Fi dongle into a USB port or connect the EMIO-1533 module to the onboard USB pin (J8) using the USB cable (P/N 99G3-190042). After installing the EMIO-1533 module, the antenna must be installed as well. Next, make sure to unplug any LAN cables or other Wi-Fi/3G modules you have installed. Finally, power on the VAB-820.

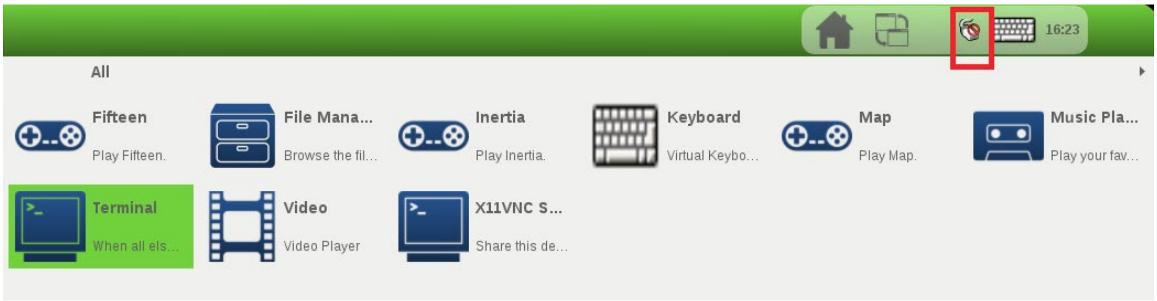


**Inserting the VNT9271 USB Wi-Fi dongle**



**Connecting the EMIO-1533 module**

When the boot process is completed, click on the “Connection Manager” icon to configure WLAN.



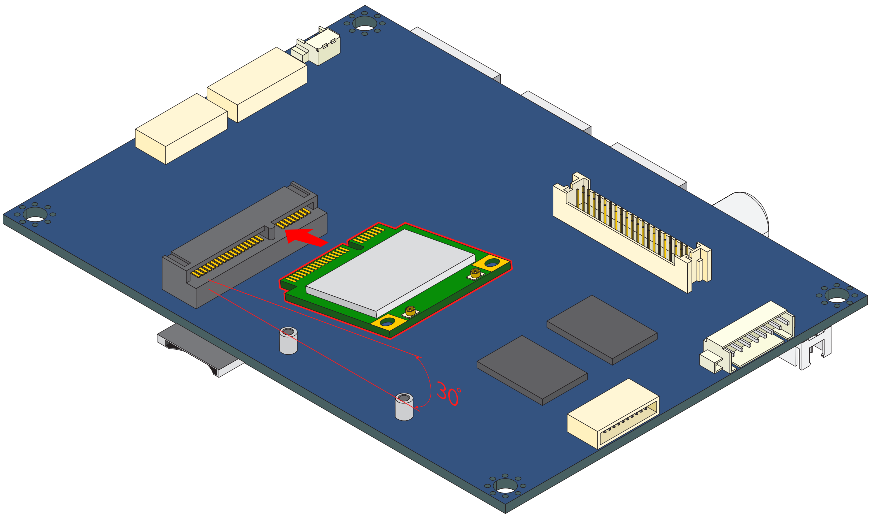
**Connection Manager icon diagram**

When the connection is created, connect to the internet through your web browser.

## 4.2 Configuring the EMIO-1541 miniPCIe Wi-Fi Module

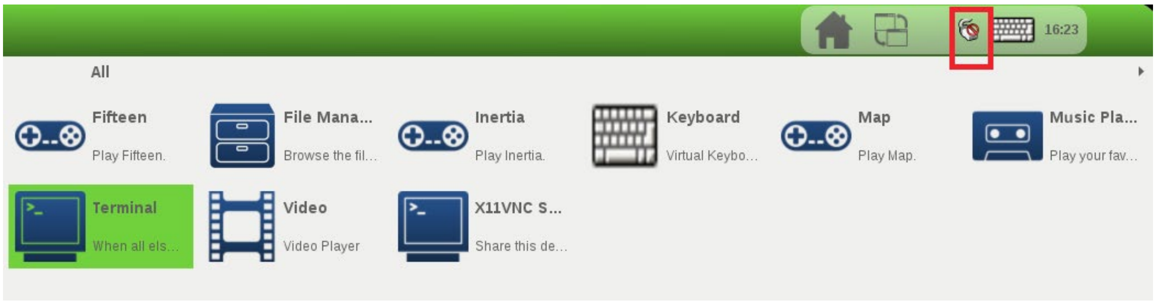
The EMIO-1541 module supports Wi-Fi through the onboard miniPCIe slot.

The first step is to insert the EMIO-1541 module into the miniPCIe slot. After installing the module connect the provided antenna to the module. Next, make sure to unplug any LAN cables or USB Wi-Fi dongles you have installed. Finally, power on the VAB-820.



**Inserting the EMIO-1541 module**

When the boot process is completed, click on the “Connection Manager” icon to configure WLAN.



**Connection Manager icon diagram**

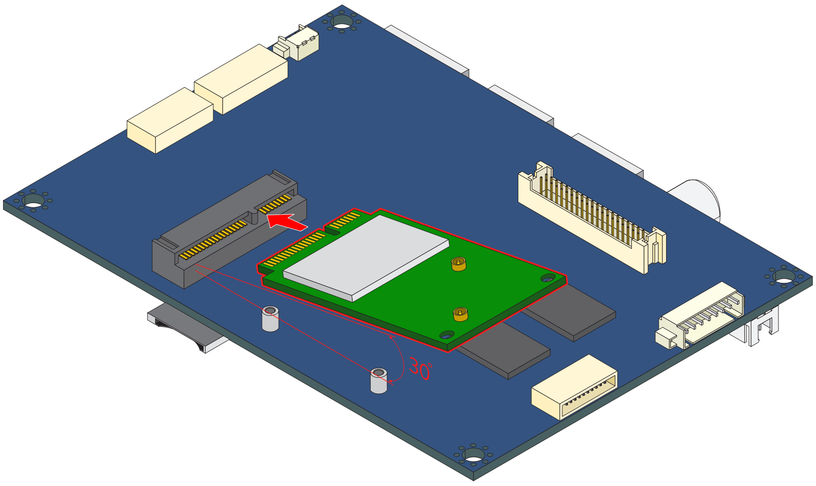
When the connection is created, connect to the internet through your web browser.

# 4.3 Configuring the EMIO-2531 miniPCIe / EMIO-5531 USB Wi-Fi & Bluetooth Module

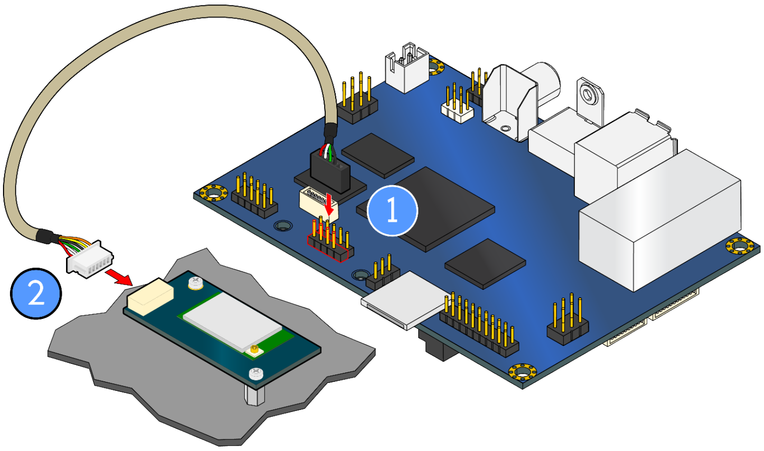
The EMIO-2531 and EMIO-5531 modules support Wi-Fi and Bluetooth functionality through USB or miniPCIe connections respectively.

## 4.3.1 Connecting to the Internet

The first step is to insert the EMIO-2531 module into the miniPCIe slot or connect the EMIO-5531 module to the onboard USB pin header (J8) using the USB cable (P/N 99G3-190042). After installing either module connect the provided antenna to the module. Next, make sure to unplug any LAN cables or other Wi-Fi/3G modules you have installed. Finally, power on the VAB-820.

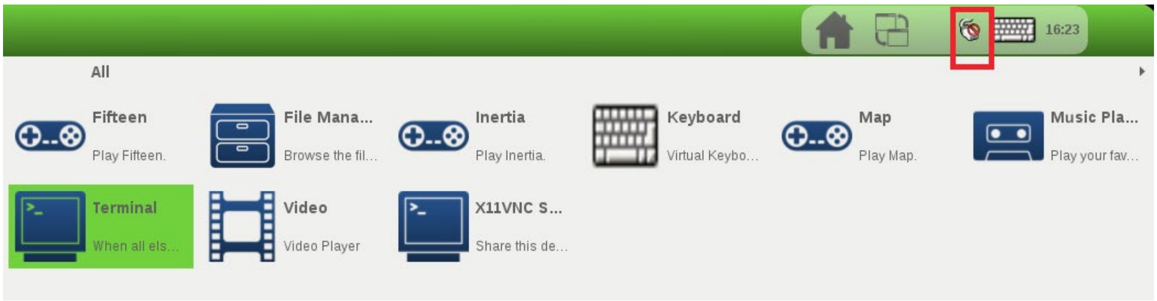


Inserting the EMIO-2531 module



Connecting the EMIO-5531 module

When the boot process is completed, click on the "Connection Manager" icon to configure WLAN.



**Connection Manager icon diagram**

When the connection is created, connect to the internet through your web browser.

## 4.3.2 Enabling Bluetooth

The following section explains setting up the Advanced Audio Distribution Profile (A2DP) and Serial Port Profile (SPP).

### 4.3.2.1 Setting Up Bluetooth A2DP Profile

To add A2DP support to the VAB-820, first copy and replace the pulseaudio-system.conf, bluetooth.conf to the /etc/dbus-1/system.d folder. Next, copy and replace the system.pa files to the /etc/pulse/folder. These files are located in the EVK/BT_Config folder of the BSP.

To enable the Bluetooth service, use the following command:

```
$ rfkill unblock bluetooth
$ hciconfig hci0 up
$ hciconfig hci0 piscan
$ /usr/lib/bluez5/bluetooth/bluetoothd -C -d &
```

Use the following commands to run the “bluetoothctl” to show the EMIO-2531 or EMIO-5531 Bluetooth MAC address and set up pairing mode.

```
$ bluetoothctl
[NEW] Controller 5C:F3:70:24:4B:2E
[bluetooth]#
[bluetooth]# show
Controller 5C:F3:70:24:4B:2E
      Name: BlueZ 5.25
      Alias: BlueZ 5.25
      …..
[bluetooth]# select 5C:F3:70:24:4B:2E
[bluetooth]# power on
Changing power on succeeded
[bluetooth]# agent on
Agent registered
[bluetooth]# default-agent
Default agent request successful
[bluetooth]# discoverable on
Changing discoverable on succeeded
[CHG] Controller 5C:F3:70:24:4B:2E Discoverable: yes
[bluetooth]# pairable on
Changing pairable on succeeded
[bluetooth]# scan on
Discovery started
[CHG] Controller 5C:F3:70:24:4B:2E Discovering: yes
[NEW] Device 00:1D:82:BC:C1:C4 Jabra BT-530
…
[bluetooth]# scan off
[bluetooth]# devices
Device 00:1D:82:BC:C1:C4 Jabra BT-530
Device …
[bluetooth]# pair 00:1D:82:BC:C1:C4
[bluetooth]# trust 00:1D:82:BC:C1:C4
```

To enable Bluetooth device, use the following commands:

```
[bluetooth]# connect 00:1D:82:BC:C1:C4
[bluetooth]# info 00:1D:82:BC:C1:C4
[bluetooth]# quit
```

The default audio output setting for the VAB-820 is HDMI device.

To list all the available audio output devices, use the following command:

```
$ pactl list short sinks
0 alsa_output.platform-sound-hdmi.23.analog-stereo module-alsa-card.c s16le 2ch 48000Hz
SUSPENDED
1 alsa_output.platform-sound.22.analog-stereo  module-alsa-card.c s16le 2ch 48000Hz
SUSPENDED
2 bluez_sink.00_1D_82_BC_C1_C4    module-bluez5-device.c  s16le 2ch 48000Hz       IDLE
```

From the output, we can see the following:

- 0 = HDMI device
- 1 = Line-out
- 2 = Bluetooth device

To set up the audio output to a Bluetooth device, use the following command:

```
$ pacmd set-default-sink 2
```

***Note:** If you would like to change audio output after enabling a Bluetooth device, use the commands below:

To set up the audio output to Line-out, use the following command:

```
$ pacmd set-default-sink 1
```

To set up the audio output to HDMI device, use the following command:

```
$ pacmd set-default-sink 0
```

### 4.3.2.2 Setting Up Bluetooth SPP Profile

The VAB-820 supports SPP server mode and SPP client mode.

To enable the Bluetooth service, use the following command:

```
$ rfkill unblock bluetooth
$ hciconfig hci0 up
$ hciconfig hci0 piscan
$ /usr/lib/bluez5/bluetooth/bluetoothd -C -d &
```

Use the following commands to run the “bluetoothctl” to show the Bluetooth MAC address and set up pairing mode for the EMIO-2531 module.

```
$ bluetoothctl
[NEW] Controller 5C:F3:70:24:4B:2E
[bluetooth]# scan on
Discovery started
[CHG] Controller 5C:F3:70:24:4B:2E Discovering: yes
[NEW] Device 5C:F3:70:25:DD:33 BlueZ 5.25
…
[bluetooth]# scan off
[bluetooth]# devices
Device 5C:F3:70:25:DD:33 BlueZ 5.25
Device …
[bluetooth]# pair 5C:F3:70:25:DD:33
[bluetooth]# trust 5C:F3:70:25:DD:33
[bluetooth]# quit
```

**SPP server mode:**
If you do not change the listen channel number, the service will automatically use the default channel number. Make sure the server or client mode is using the same Bluetooth channel number.

To set up the SPP server mode and allow other devices to connect, use the following commands:

```
# sdptool add SP
Serial Port service registered
# rfcomm listen hci0
Waiting for connection on channel 1
Connection from 5C:F3:70:25:DD:33 to /dev/rfcomm0
Press CTRL-C for hangup
```

**SPP client mode:**
If you do not change the listen channel number, the service will automatically use the default channel number. Make sure the server or client mode is using the same listen channel number.

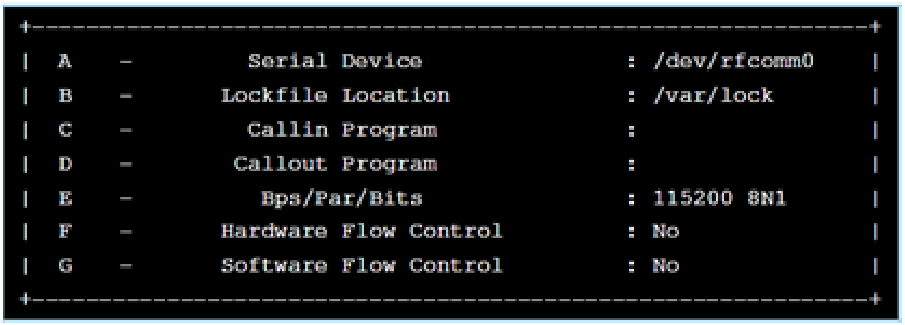
Use the following commands to set up the SPP client mode and request a connection to SPP server.

```
# sdptool add SP
Serial Port service registered
# rfcomm connect hci0 5C:F3:70:24:4B:2E
Connected /dev/rfcomm0 to 5C:F3:70:24:4B:2E on channel 1
Press CTRL-C for hangup
```

To open the minicom serial communication program, use the following command:

```
# minicom -s
```

Connect to the /dev/rfcomm0 serial device with the following settings:



```
+-----------------------------------------------------------------------+
| A    -        Serial Device              : /dev/rfcomm0    |
| B    -      Lockfile Location            : /var/lock       |
| C    -        Callin Program             :                 |
| D    -       Callout Program             :                 |
| E    -         Bps/Par/Bits              : 115200 8N1      |
| F    -      Hardware Flow Control        : No              |
| G    -      Software Flow Control        : No              |
+-----------------------------------------------------------------------+
```

**Serial port setting**

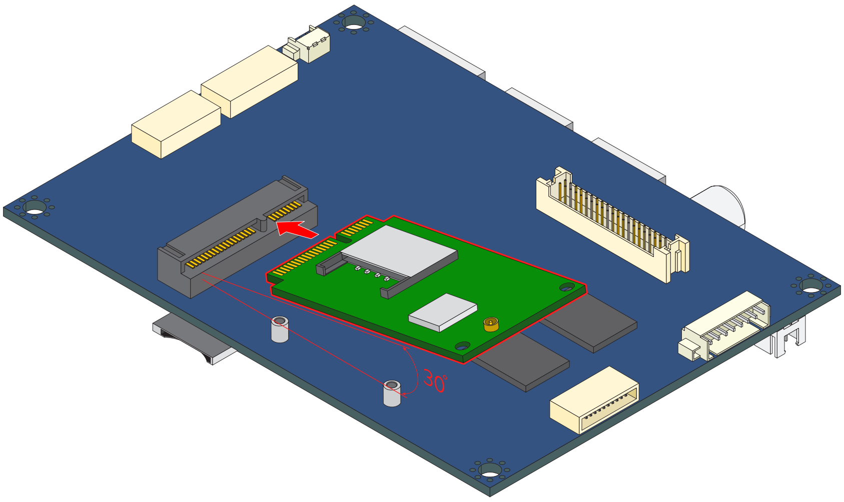
Start a serial communication program on the host machine with the same communication settings using the appropriate Bluetooth SPP device. Afterwards the Bluetooth SPP device and the VAB-820 will be able to communicate through the programs (for example sending a keypress on one machine should be shown on the other machine).

## 4.4 Configuring the EMIO-2550 miniPCIe Mobile Broadband Module

The EMIO-2550 miniPCIe Mobile Broadband module supports 3G and GPS functions.

### 4.4.1 Connecting to the Internet

The first step is to insert an active SIM card into the EMIO-2550 module, and then insert the EMIO-2550 module into the miniPCIe slot. After installing the module connect the provided antenna to the module. Next, make sure to unplug any LAN cables or USB Wi-Fi dongles you have installed. Finally, power on the VAB-820.



**Inserting the EMIO-2550 module**

To check that the system has correctly detected the EMIO-2550 module, use the following command:

```
$ lsusb
```

Make sure the printout message includes “Bus 001 Device 004: ID 1545:1102 U-Blox AG”.

Configure the 3G function by creating a PPP connection with root privilege.

```
$ pppd call Module-ZU200
```

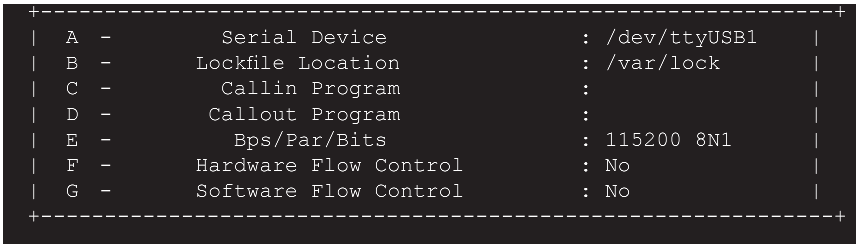
Once the PPP connection has been created, connect to the internet through your web browser.

## 4.4.2 Enabling GPS

To configure the GPS function of the module requires the use of the Minicom serial communication program. Open the Minicom serial communication program with the following command:

```
$ minicom -s
```

Connect to the /dev/ttyUSB1 serial device with the following settings:



```
+-----------------------------------------------------------------+
| A -        Serial Device                 : /dev/ttyUSB1     |
| B -      Lockfile Location               : /var/lock        |
| C -        Callin Program                :                  |
| D -       Callout Program                :                  |
| E -         Bps/Par/Bits                 : 115200 8N1       |
| F -      Hardware Flow Control           : No               |
| G -      Software Flow Control           : No               |
+-----------------------------------------------------------------+
```

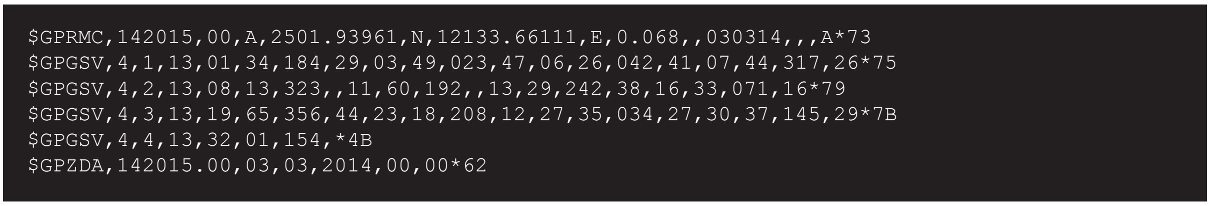
**Serial port setting of VAB-820**

When the setup is complete, type the following GPS AT commands into Minicom: AT+UGPRF=1, AT+UGRMC=1, AT+UGGSV=1, AT+UGZDA=1, and AT+UGPS=1,0

Wait for the “OK” message before sending the next AT command.

```
AT+UGPRF=1
OK
AT+UGRMC=1
OK
AT+UGGSV=1
OK
AT+UGZDA=1
OK
AT+UGPS=1,0
OK
```

Use the Minicom to set the serial device /dev/ttyUSB7 in another terminal and it will output the data received from the GPS module as illustrated in the screenshot below.



```
$GPRMC,142015,00,A,2501.93961,N,12133.66111,E,0.068,,030314,,,A*73
$GPGSV,4,1,13,01,34,184,29,03,49,023,47,06,26,042,41,07,44,317,26*75
$GPGSV,4,2,13,08,13,323,,11,60,192,,13,29,242,38,16,33,071,16*79
$GPGSV,4,3,13,19,65,356,44,23,18,208,12,27,35,034,27,30,37,145,29*7B
$GPGSV,4,4,13,32,01,154,*4B
$GPZDA,142015.00,03,03,2014,00,00*62
```

**GPS NMEA message**

## Taiwan Headquarters

1F, 531 Zhong-zheng Road,
Xindian Dist., New Taipei City 231
Taiwan

Tel: 886-2-2218-5452
Fax: 886-2-2218-9860
Email: embedded@via.com.tw

## USA

940 Mission Court
Fremont, CA  94539,
USA

Tel: 1-510-687-4688
Fax: 1-510-687-4654
Email: embedded@viatech.com

## Japan

3-15-7 Ebisu MT Bldg. 6F,
Higashi, Shibuya-ku
Tokyo 150-0011
Japan

Tel: 81-3-5466-1637
Fax: 81-3-5466-1638
Email: embedded@viatech.co.jp

## China

Tsinghua Science Park Bldg. 7
No. 1 Zongguancun East Road,
Haidian Dist., Beijing, 100084
China

Tel: 86-10-59852288
Fax: 86-10-59852299
Email: embedded@viatech.com.cn

## Europe

Email: embedded@via-tech.eu