

# Yocto 2.1 Pre-Built Image User's Guide

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***TechNexion***

INNOVATORS OF TECHNOLOGY

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## **1. Supported information**

### **1.1 Supported hardware**

These are the systems covered in this guide:

#### **System-on-Modules**

- EDM1-CF-IMX6
- EDM1-IMX6P
- EDM1-IMX6PLUS
- EDM1-CF-IMX6SX
- PICO-IMX6
- PICO-IMX6POP
- PICO-IMX6UL-EMMC
- PICO-IMX6UL-NAND
- PICO-IMX7D

#### **Carrier Boards**

- EDM1-FAIRY
- EDM1-GOBLIN
- EDM2-ELF
- PICO-DWARF
- PICO-HOBBIT
- PICO-NYMPH
- PICO-PI

#### **Fanless Computing**

- TEK3-IMX6
- TEK3-IMX6UL

#### **Panel Computing**

- TEP-0500/TEP-0700 -IMX6UL
- TEP-0500/TEP-0700 -IMX7
- TEP-1010/TEP1560 -IMX6
- TC-07x0/TC-10x0

## 1.2 Software version

name	version
u-boot	tn-imx_v2016.03_4.1.15_2.0.0_ga
linux kernel	tn-imx_4.1.15_2.0.0_ga
Yocto	2.1 (krogoth)
QT	5.6.2

## 2. Memory layout of the yocto image

For the boards use eMMC/SD as boot storage:

Section	Description
MBR	Partition information
SPL	First stage u-boot image
Partition 1 (FAT32) Under / directory <ul style="list-style-type: none"><li>◆ uEnv.txt</li><li>◆ u-boot.img</li><li>◆ zImage</li><li>◆ dtb</li></ul>	<ul style="list-style-type: none"><li>◆ u-boot.img: Second stage u-boot image</li><li>◆ uEnv.txt: U-boot environment, you can set display type and baseboard type in this plain text.</li><li>◆ dtb: linux device tree file, it's platform-specific.</li></ul>
Partition 2 (EXT4) rootfs	Yocto rootfs

For the boards use NAND flash as boot storage:

Section	Description
MBR	Partition information
u-boot.imx	u-boot image
Partition 1 (FAT32) Under / directory <ul style="list-style-type: none"><li>◆ zImage</li><li>◆ dtb</li></ul>	<ul style="list-style-type: none"><li>◆ dtb: linux device tree file, it's platform-specific.</li></ul>
Partition 2 (EXT4) rootfs	Yocto rootfs

### 3. Login to Yocto on target board

Please enter “root” in Yocto login prompt.

```
Freescall i.MX Release Distro 4.1.15-1.1.1 edml-cf-imx6 /dev/ttymx60
```

```
edml-cf-imx6 login: root
```

### 4. Change display settings

For imx6 series(i.mx6 Solo/Dual Lite/Dual/Quad), display settings can be changed by modifying uEnv.txt.

The eMMC corresponds to /dev/mmcblk2. uEnv.txt is in /dev/mmcblk2p1.

```
root@edml-cf-imx6:~# mkdir -p /mnt/temp
root@edml-cf-imx6:~# mount /dev/mmcblk2p1 /mnt/temp/
root@edml-cf-imx6:~# vi /mnt/temp/uEnv.txt
root@edml-cf-imx6:~# umount /mnt/temp/
```

The content of uEnv.txt:

```
displayinfo=video=mxcfb0:dev=hdmi,1280x720M@60,if=RGB24 fbmem=28M
mmccargs=setenv bootargs console=${console},${baudrate} root=${mmccroot} ${display
bootcmd_mmc=run loadimage;run mmccboot;
uenvcmd=run bootcmd_mmc
```

Replace the red string with:

**For HDMI 720P output:**

```
video=mxcfb0:dev=hdmi,1280x720M@60,if=RGB24 fbmem=28M
```

**For HDMI 1080P output:**

```
video=mxcfb0:dev=hdmi,1920x1080M@60,if=RGB24 fbmem=28M
```

**For VGA output:**

```
video=mxcfb0:dev=lcd,1280x720M@60,if=RGB24
```

**For 7 inch LVDS panel:**

```
video=mxcfb0:dev=ldb,1024x600@60,if=RGB24
```

**For 7 inch TTL panel:**

```
video=mxcfb0:dev=lcd,800x480@60,if=RGB24
```

**For 10 inch TTL panel: (TEP series)**

```
video=mxcfb0:dev=ldb,1280x800@60,if=RGB666
```

**For dual display for HDMI and LVDS:**

```
video=mxcfb0:dev=hdmi,1280x720M@60,if=RGB24
```

```
video=mxcfb1:dev=ldb,1024x600@60,if=RGB24
```

**Note:**

1. imx6sx, imx6ul and imx7d don't support uEnv.txt to change display settings

2. For HDMI or VGA output, the display resolution depends on the display monitor. In order to adapt to different monitors, the [display timings](#) should follow [CVT timings standard](#).

If 'M' is present after the resolution you give, it will force to output CVT timings:

example:

```
video=mxcfb0:dev=lcd,1280x720M@60,if=RGB24
```

## 5. Change baseboard type

For EDM1-CF-IMX6 and PICO-IMX6 CPU module, they are compatible with PICO/EDM standard baseboards. For each combination of CPU module and baseboard, it means a unique hardware configurations, so it should correspond to a device tree file in kernel. You can specify baseboard type in uEnv.txt to instruct u-boot to load correct device tree file.

```
root@edml-cf-imx6:~# mkdir -p /mnt/temp  
root@edml-cf-imx6:~# mount /dev/mmcblk2p1 /mnt/temp/  
root@edml-cf-imx6:~# vi /mnt/temp/uEnv.txt  
root@edml-cf-imx6:~# umount /mnt/temp/
```

There are three baseboards support for EDM1-CF-IMX6:  
fairy, mimas, tc0700.

Example:

Set baseboard as "fairy" in uEnv.txt:

```
baseboard=fairy
```

There are three baseboards support for PICO-IMX6:  
dwarf, hobbit, nymph

Example:

Set baseboard as "dwarf" in uEnv.txt:

```
baseboard=dwarf
```

Compatible list of CPU module and baseboard:

<b>Series</b>	<b>CPU module</b>	<b>Baseboard</b>
EDM	EDM1-CF-IMX6 (i.mx6 Solo/Dual Lite/Dual/Quad)	EDM1-FAIRY TC-07x0 TC-1000
	EDM1-CF-IMX6P (i.mx6 Solo/Dual Lite/Dual/Quad with PMIC)	
	EDM1-CF-IMX6QP	
	EDM1-CF-IMX6SX (two LANs)	EDM1-GOBLIN (two LANs)
PICO	PICO-IMX6	PICO-DWARF (GL)
	PICO-IMX6POP	PICO-HOBBIT (GL)
	PICO-IMX7D	PICO-NYMPH (GL)
	PICO-IMX6UL-EMMC	PICO-PI (GL)
	PICO-IMX6UL-NAND	PICO-DWARF (FL) PICO-HOBBIT (FL) PICO-NYMPH (FL) PICO-PI (FL)

## 6. Calibrate Resistive Touch Panel

For 4-wire resistive touch panel, the touch panel is connected to touch screen controller “ADS7846”. The calibration data is generated from `ts_calibrate` (the calibration utility of [tslib](#)). The calibration data is fed to ADS7846 driver while booting to apply the calibration, so `xinput` calibration wouldn't be needed.

`more /etc/init.d/touch_cal.sh`

```
#!/bin/sh
CALFILE="/pointercal"

if [ -e $CALFILE ] ; then
    TOUCH_INPUT=`cat /proc/bus/input/devices | grep -A9 'ADS7846 Touchscreen' | grep 'Sysfs' | grep -o 'input[0-9]'`
    if [ "$?" == "0" ];then
        cat ${CALFILE} > /sys/class/input/${TOUCH_INPUT}/calibration
        echo -e "\nFeed calibration data to ADS7846 driver\n"
    fi
fi

exit 0
```

### Generate calibration data:

Check the input device number for ADS7846

```
root@edml-cf-imx6:~# cat /proc/bus/input/devices | grep -A9 'ADS7846 Touchscreen' | \
grep 'Sysfs' | grep -o 'input[0-9]'
input0
```

The calibration data would be expected to be placed on the path “ / ”.

```
root@edml-cf-imx6:~# export TSLIB_CALIBFILE=/pointercal
root@edml-cf-imx6:~# export TSLIB_TSDEVICE="/dev/input/event0"
```

Here we get the input device number “input1” for ADS7846. For different platform, the input device number may be different.

Clean the old calibration data.

```
root@edml-cf-imx6:~# echo '0 0 0 0 0 0 0 0' > /sys/class/input/input0/calibration
root@edml-cf-imx6:~# ts_calibrate
```

Apply the new calibration data immediately.

```
root@edml-cf-imx6:~# cat /pointercal > /sys/class/input/input0/calibration
```

## 7. Test WIFI and Bluetooth

The yocto qt5 image utilizes “[connman](#)” as network manager.

The default settings for connman in the image is to turn WIFI and bluetooth on.

Please check:

```
more /var/lib/connman/settings
```

```
[global]
OfflineMode=false
```

```
[WiFi]
Enable=true
Tethering=false
```

```
[Bluetooth]
Enable=true
Tethering=false
```

### Test wifi:

Load wifi driver module first, then driver would load wifi firmware correspondingly by wifi chip ID.

```
root@edml-cf-imx6:~# modprobe bcmhdhd
```

Run “connmanctl” in interactive mode.

```
root@edml-cf-imx6:~# connmanctl
```

Scan and list the wifi hotspots, then register the agent to handle user requests.

```
connmanctl> scan wifi
Scan completed for wifi

connmanctl> services
  hotspot      wifi_4439c4970d84_544543484e4558494f4e_managed_psk

connmanctl> agent on
Agent registered
```

Connect to the hotspot and enter the passphrase.

```
connmanctl> connect wifi_4439c4970d84_544543484e4558494f4e_managed_psk

Agent RequestInput wifi_4439c4970d84_544543484e4558494f4e_managed_psk
Passphrase = [ Type=psk, Requirement=mandatory, Alternates=[ WPS ] ]
WPS = [ Type=wpspin, Requirement=alternate ]
Passphrase?
```

```
Connected wifi_4439c4970d84_544543484e4558494f4e_managed_psk
```

Quit the interactive mode of “connmanctl”.

```
connmanctl> quit
```

Test if wifi actually works.

```
root@edml-cf-imx6:~# ping www.google.com
PING www.google.com (203.66.124.251): 56 data bytes
64 bytes from 203.66.124.251: seq=0 ttl=59 time=4.905 ms
64 bytes from 203.66.124.251: seq=1 ttl=59 time=12.278 ms
64 bytes from 203.66.124.251: seq=2 ttl=59 time=4.307 ms
```

For the next boot, connman will automatically connect to the hotspot you used before.

Clean the stored settings of hotspot.

```
root@edml-cf-imx6:~# rm /var/lib/connman/*/settings
```

Switch on/off wifi.

```
root@edml-cf-imx6:~# connmanctl disable wifi
Disabled wifi
```

```
root@edml-cf-imx6:~# connmanctl enable wifi
Enabled wifi
```

## Test bluetooth:

Make sure bluetooth device for testing is able to be scanned.

Load bluetooth firmware into BT chip via UART and need to wait 5~10 sec to complete.

### For EDM1-CF-IMX6:

```
root@edml-cf-imx6:~# brcm_patchram_plus --timeout=6.0 \  
--patchram /lib/firmware/brcm/bcm4330.hcd --baudrate 3000000 --no2bytes --tosleep=2000 \  
--enable_hci /dev/ttymx2 &
```

### For EDM1-CF-IMX6P/EDM1-CF-IMX6QP with AP6335/AP6212 WIFI/BT module::

```
root@edml-cf-imx6:~# brcm_patchram_plus --timeout=6.0 \  
--patchram auto --baudrate 3000000 --no2bytes \  
--tosleep=2000 --enable_hci /dev/ttymx2 &
```

### For EDM1-CF-IMX6SX:

```
root@edm-goblin-imx6sx:~# brcm_patchram_plus --timeout=6.0 \  
--patchram /lib/firmware/brcm/bcm4330.hcd --baudrate 3000000 --no2bytes --tosleep=2000 \  
--enable_hci /dev/ttymx5 &
```

### For PICO-IMX6 with AP6335/AP6212 WIFI/BT module:

```
root@pico-imx6:~# brcm_patchram_plus --timeout=6.0 \  
--patchram auto --baudrate 3000000 --no2bytes \  
--tosleep=2000 --enable_hci /dev/ttymx1 &
```

### For PICO-IMX6UL-EMMC/PICO-IMX6UL-NAND with AP6335/AP6212 WIFI/BT module:

```
root@pico-imx6ul-emmc:~# brcm_patchram_plus --timeout=6.0 \  
--patchram auto --baudrate 3000000 --no2bytes \  
--tosleep=2000 --enable_hci /dev/ttymx4 &
```

### For PICO-IMX7D with AP6335/AP6212 WIFI/BT module:

```
root@pico-imx6ul-emmc:~# brcm_patchram_plus --timeout=6.0 \  
--patchram auto --baudrate 3000000 --no2bytes \  
--tosleep=2000 --enable_hci /dev/ttymx6 &
```

Check if interface “hci” device node exist.

```
root@edml-cf-imx6:~# hciconfig -a  
hci0: Type: BR/EDR Bus: UART  
BD Address: 43:30:A0:00:00:00 ACL MTU: 1021:8 SCO MTU: 64:1  
DOWN
```

```
RX bytes:574 acl:0 sco:0 events:27 errors:0
TX bytes:411 acl:0 sco:0 commands:27 errors:0
Features: 0xbf 0xfe 0xcf 0xfe 0xdb 0xff 0x7b 0x87
Packet type: DM1 DM3 DM5 DH1 DH3 DH5 HV1 HV2 HV3
Link policy: RSWITCH SNIFF
Link mode: SLAVE ACCEPT
```

Bring hci interface up.

```
root@edm-fairy-imx6:~# hciconfig hci0 up
```

Scan the bluetooth device.

```
root@edm-fairy-imx6:~# hcitool -i hci0 scan
Scanning ...
    00:1F:20:7E:21:6C    Logitech Bluetooth Mouse M555b
```

## 8. Switch audio output

The default audio output for HDMI pre-built image is HDMI audio and for LVDS pre-built image is SGTL5000.

List the available audio output sink in the system.

```
root@edm-fairy-imx6:~# LANG=C pactl list sinks | grep 'Name: ' | cut -d" " -f2
alsa_output.platform-sound-hdmi.analog-stereo
alsa_output.platform-sound-spdif.analog-stereo
alsa_output.platform-sound.analog-stereo
```

### For EDM1-CF-IMX6/EDM1-CF-IMX6P/EDM1-CF-IMX6QP:

Set audio output to HDMI.

```
pacmd set-default-sink alsa_output.platform-sound-hdmi.analog-stereo
```

Set audio output to SGTL5000 audio codec.

```
pacmd set-default-sink alsa_output.platform-sound.analog-stereo
```

Set audio output to SPDIF.

```
pacmd set-default-sink alsa_output.platform-sound-spdif.analog-stereo
```

Play sound.

```
gst-launch-1.0 filesrc location=/unit_tests/audio8k16S.wav ! decodebin ! pulsesink
```

**For PICO-IMX6:**

Set audio output to HDMI.

```
pacmd set-default-sink alsa_output.platform-sound-hdmi.analog-stereo
```

Set audio output to SGTL5000 audio codec.

```
pacmd set-default-sink alsa_output.platform-sound.analog-stereo
```

Play sound.

```
gst-launch-1.0 filesrc location=/unit_tests/audio8k16S.wav ! decodebin ! pulsesink
```

**For TEK3-IMX6/TEP-IMX6:**

Set audio output to HDMI.

```
pacmd set-default-sink alsa_output.platform-sound-hdmi.analog-stereo
```

Set audio output to SGTL5000 audio codec.

```
pacmd set-default-sink alsa_output.platform-sound.analog-stereo
```

Play sound.

```
gst-launch-1.0 filesrc location=/unit_tests/audio8k16S.wav ! decodebin ! pulsesink
```

**For EDM1-CF-IMX6SX:**

Set audio output to SGTL5000 audio codec.

```
pacmd set-default-sink alsa_output.platform-sound.analog-stereo
```

Set audio output to SPDIF.

```
pacmd set-default-sink alsa_output.platform-sound-spdif.analog-stereo
```

Play sound.

```
gst-launch-1.0 filesrc location=/unit_tests/audio8k16S.wav ! decodebin ! pulsesink
```

**For PICO-IMX6UL-EMMC/PICO-IMX6UL-NAND/PICO-IMX7D :**

PICO-IMX6UL-HOBBIT only can only output to SGTL5000 audio codec:

Play sound.

```
gst-launch-1.0 filesrc location=/unit_tests/audio8k16S.wav ! decodebin ! pulsesink
```

Save change of the audio output settings permanently:

The audio settings for output are in the bottom of /etc/pulse/default.pa.

Please edit audio output settings manually.

**For EDM1-CF-IMX6/EDM1-CF-IMX6P/EDM1-CF-IMX6QP:**

vi /etc/pulse/default.pa

```
set-default-sink alsa_output.platform-sound.analog-stereo
```

**For PICO-IMX6:**

vi /etc/pulse/default.pa

```
set-default-sink alsa_output.platform-sound.analog-stereo
```

**For TEK3-IMX6/TEP-IMX6:**

vi /etc/pulse/default.pa

```
set-default-sink alsa_output.platform-sound.analog-stereo
```

**For EDM1-CF-IMX6SX:**

vi /etc/pulse/default.pa

```
set-default-sink alsa_output.platform-sound.analog-stereo
```

## 9. Adjust backlight for LVDS panel

**For EDM1-CF-IMX6/EDM1-CF-IMX6P/EDM1-CF-IMX6QP:**

Brightness is from 0 to 7.

```
echo 0 > /sys/class/backlight/backlight_lvds/brightness
```

**For EDM1-CF-IMX6SX:**

Brightness is from 0 to 7.

```
echo 0 > /sys/class/backlight/backlight2.16/brightness
```

**For PICO-IMX6:**

Brightness is from 0 to 7.

```
echo 0 > /sys/class/backlight/backlight_lvds/brightness
```

**For PICO-IMX6UL-EMMC/PICO-IMX6UL-NAND:**

Brightness is from 0 to 7.

```
echo 0 > /sys/class/backlight/backlight/brightness
```

**For PICO-IMX7D:**

Brightness is from 0 to 7.

```
echo 0 > /sys/class/backlight/backlight/brightness
```

## 10. Test MIPI camera

This BSP supports TechNexion “[CAM-OV5645](#)” by default.

### For EDM1-CF-IMX6/EDM1-CF-IMX6P/EDM1-CF-IMX6QP/PICO-IMX6:

```
gst-launch-1.0 imxv4l2src device=/dev/video0 ! 'video/x-raw, \
format=(string)UYVY,width=640,height=480,framerate=(fraction)30/1' ! imxv4l2sink
```

### For PICO-IMX7D:

```
gst-launch-1.0 imxv4l2src device=/dev/video1 ! imxv4l2sink
```

### Note:

EDM1-CF-IMX6SX and PICO-IMX6UL-EMMC/ PICO-IMX6UL-NAND don't support MIPI camera.

## 11. Set up WIFI in AP mode

Load wifi driver and set it up in AP mode.

```
modprobe bcmdhd op_mode=2
```

### Expeced message:

```
dhd_module_init in
Power-up adapter 'DHD generic adapter'
wifi_platform_bus_enumerate device present 1
mmc1: queuing unknown CIS tuple 0x80 (2 bytes)
mmc1: queuing unknown CIS tuple 0x80 (3 bytes)
mmc1: queuing unknown CIS tuple 0x80 (3 bytes)
mmc1: queuing unknown CIS tuple 0x80 (7 bytes)
mmc1: queuing unknown CIS tuple 0x80 (11 bytes)
mmc1: new high speed SDIO card at address 0001
F1 signature OK, socitype:0x1 chip:0x4330 rev:0x4 pkg:0x0
DHD: dongle ram size is set to 294912(orig 294912) at 0x0
wifi_platform_get_mac_addr
fw path is /lib/firmware/brcm/fw_bcm4330_apsta_bg.bin
nvram_path is /lib/firmware/brcm/brcmfmac4330-sdio.txt
CFG80211-ERROR) wl_setup_wiphy : Registering Vendor80211)
wl_create_event_handler(): thread:wl_event_handler:41b started
CFG80211-ERROR) wl_event_handler : tsk Enter, tsk = 0xa97c143c
dhd_attach(): thread:dhd_watchdog_thread:41c started
dhd_attach(): thread:dhd_dpc:41d started
dhd_deferred_work_init: work queue initialized
fw path is /lib/firmware/brcm/fw_bcm4330_apsta_bg.bin
nvram_path is /lib/firmware/brcm/brcmfmac4330-sdio.txt
```

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```
dhd_sdio_write_vars: Download, Upload and compare of NVRAM succeeded.
dhd_bus_init: enable 0x06, ready 0x06 (waited 0us)
wifi_platform_get_mac_addr
Firmware up: op_mode=0x0002, MAC=44:39:c4:9e:5b:5e
dhd_preinit_ioctls buf_key_b4_m4 set failed -23
Firmware version = wl0: Jan 23 2013 17:47:42 version 5.90.195.114 FWID 01-73201c1f
dhd_preinit_ioctls wl_ampdu_hostreorder failed -23
dhd_wlfc_init(): successfully enabled bdev2 tlv signaling, 79
dhd_wlfc_init(): wlfc_mode=0x0, ret=-23

Dongle Host Driver, version 1.141.88 (r)
Compiled from
Register interface [wlan0] MAC: 44:39:c4:9e:5b:5e
```

Disable network manager - connman.

```
pkill connman
```

Connect ethernet cable and get IP from DHCP server.

```
udhcpc -i eth0
```

### Expeced message:

```
udhcpc (v1.22.1) started
Sending discover...
Sending select for 10.20.30.168...
Lease of 10.20.30.168 obtained, lease time 86400
/etc/udhcpc.d/50default: Adding DNS 10.20.80.127
/etc/udhcpc.d/50default: Adding DNS 8.8.8.8
/etc/udhcpc.d/50default: Adding DNS 168.95.192.1
```

Create hotspot with WPA + WPA2 passphrase.

```
create_ap --no-virt wlan0 eth0 MyAccessPoint MyPassPhrase &
```

For example:

```
create_ap --no-virt wlan0 eth0 SAP 12345678 &
```

### Expeced message:

```
Config dir: /tmp/create_ap.wlan0.conf.6kHrAjKg
PID: 1116
dhd_ndo_remove_ip: ndo ip addr remove failed, retcode = -23
dhd_inet6_work_handler: Removing host ip for NDO failed -23
dhd_ndo_add_ip: ndo ip addr add failed, retcode = -23
```

```
dhd_inet6_work_handler: Adding host ip for NDO failed -23
Sharing Internet using method: nat
hostapd command-line interface: hostapd_cli -p
/tmp/create_ap.wlan0.conf.6kHrAjKg/hostapd_ctrl
Configuration file: /tmp/create_ap.wlan0.conf.6kHrAjKg/hostapd.conf
CFG80211-ERROR) wl_cfg80211_del_station : Disconnect STA : ff:ff:ff:ff:ff:ff scb_val.val 3
Using interface wlan0 with hwaddr 94:a1:a2:4a:90:28 and ssid "SAP"
Low entropy detected, starting haveged
CFG80211-ERROR) wl_cfg80211_set_channel : netdev_ifidx(4), chan_type(1) target channel(1)
CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
wlan0: interface state UNINITIALIZED->ENABLED
wlan0: AP-ENABLED
```

## 12. Run QT5 on imx6ul/imx7

Because i.mx6ul/i.mx7 is lack of GPU. QT is supported with framebuffer backend instead of X-window. The pre-built image with “gui-x11” doesn’t support QT. Please choose the pre-built image with “qt5-fb” to have the QT environment.

Run QT application on “i.mx6ul/i.mx7 qt5-fb pre-built image”:

```
cd /usr/share/qt5/examples/
widgets/widgets/analogclock/analogclock --platform linuxfb
touch/dials/dials --platform linuxfb
touch/fingerpaint/fingerpaint --platform linuxfb
```