
BitCtrl Systems GmbH

**QNX6.5.0SP1/6.6.0/7.0 BSP for PHYTEC i.MX6
boards (RDK/MIRA)
Installation and User's Guide**

Version 1.4.4

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January 28, 2015	1.0	Checked against real target, ok	A. Uhlmann
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1 PHYTEC i.MX6 QNX Board Support Package (phyFLEX, phyCORE)

1.1 Date and Version of this edition

This document refers to baseline version 1.4, release v1.4.4, date December 7, 2018, of the BSP. This is a maintenance release of the v1.4 baseline but it adds some new features, including a pushbutton driver with de-bouncing capabilities, configurable edges as well as short/long press distinction.

1.2 Target Hardware

The product is targeted at the phyFLEX i.MX6, hardware revision C (1362.2) on the Rapid Development Carrier (1364.4) and phyCORE i.MX6 (1429.3-5) on the MIRA board (1434.2, 1434.3 and 1434.5).

Depending on your order, you may or may not have the graphics shipped. If not, you do not need to connect DVI monitor/LCD display, mouse and keyboard, and the demo applications will not be available.

1.3 Host OS

Same as documented in [RelNotes].

1.4 References

[phyFLEX] Information about the phyFLEX hardware can be found here:

<http://www.phytec.eu/product/system-on-modules/phyflex-imx-6/>.

[phyCORE] Information about the newer phyCORE hardware can be found here:

<http://www.phytec.eu/product/single-board-computer/phyboard-mira/>.

[REFBSP] Information about the reference BSP that is used as a foundation for the product can be found here:

<http://community.qnx.com/sf/wiki/do/viewPage/projects.bsp/wiki/FreescaleImx6QSubreLite>

[QNXDOC] The documentation of the QNX Neutrino RTOS v6.5.0SP1 is available here: http://www.qnx.com/developers/docs/6.5.0_sp1/index.jsp. For QNX6.6.0 use this link: <http://www.qnx.com/developers/docs/660/index.jsp>. For QNX 7 use this link: <http://www.qnx.com/developers/docs/7.0.0/#com.qnx.doc.qnxsdp.nav/topic/bookset.html>.

[RelNotes] Release Notes for the BSP

1.5 Contact and Support

BitCtrl Systems GmbH
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 Germany

Use our online form to request the BSP:

http://www.bitctrl.de/kontakt/kontakt_en.shtml

For support, use our helpdesk:

<http://www.bitctrl.de/helpdesk/>

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2 Background information

Once you have registered via our web site you will be emailed a ZIP archive that contains several projects that you will need to import into your QNX Momentics IDE. You will need to help yourself to an SD card that will be used to transfer the installation built in Momentics to the board. Please use 4 GB SD cards of class 4 or less for phyFLEX-i.MX6 Rapid Development Kit. Some older versions of barebox tend to have problems with faster and/or bigger cards. Smaller cards (2 GB) have different file format which is currently not supported.

For using the phyBOARD MIRA, please use Transcend 4 GB class 10 MicroSDHC cards. Intenso cards 4 GB class 10 are also reported to work, as have Sony 8 GB Class 10 and SanDisk EDGE 16 GB class 10.

3 Installing hardware

For using phyFLEX Rapid Development Kit:

1. Power off the board.
2. Setup the board with serial connection as described in the documentation of the Rapid Development Kit.
3. Connect the board via Ethernet cable to your QNX Momentics development machine (directly via cross-over cable or via switch). Use RJ45 port on top of the Rapid Development Kit (labeled ETH0 / POE).
4. Connect a DVI monitor to the DVI port or connect LCD display to display port.
5. Connect USB mouse and keyboard to USB ports next to DVI port.
6. Connect ETM0700G0DH6 LVDS display to board, if you have one

For using the phyBOARD MIRA Imaging Kit:

1. Power off the board.
2. Setup the board with serial connection as described in the documentation of the Kit.
3. Connect the board via Ethernet cable to your QNX Momentics development machine (directly via cross-over cable or via switch).
4. Connect a HDMI display to the HDMI port, or use a HDMI-2-DVI converter to connect a standard DVI monitor.
5. Connect USB mouse and keyboard to USB ports next to HDMI port.
6. Connect ETM0700G0DH6 LCD display or Mitsubishi AA084SC01 LVDS display to board, if you have one

If you have been delivered a source code archive, please proceed to chapter 4 “

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Set up source tree (QNX Momentics IDE”).

If you have been delivered a binary-only archive, please extract the archive to an empty SD-card such that the root of the card contains the folder “setup”, the various IFS and .install/.info files. Then proceed directly to chapter 5 “Install Barebox and QNX on the PHYTEC hardware”.

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4 Set up source tree (QNX Momentics IDE and command line)

4.1 Setup source tree using the QNX Momentics IDE (MS Windows)

Important: If you are using QNX 6.5 and want to use Screen graphics, be sure to install the QNX Screen package for QNX 6.5, which can be downloaded here: <http://www.qnx.com/download/feature.html?programid=27697>.

1. Import the BSP source package(s) by using "Import" → "Existing projects into workspace".
2. Import the reference BSP for the Sabrelite platform for the corresponding QNX version:
 - a. For QNX **6.5**, use "BSP_freescale-imx6q-sabrelite_br-650_be-650sp1_SVN767708_JBN93.zip" (released January 2015).
 - i. **Important:** If you intend to build and use the ETFS NAND flash driver yourself be sure to import the updated ETFS libraries/headers into the "prebuilt" directory. You will get these patches directly from QSS.
 - ii. The System Builder project "bsp-freescale-mx6q-sabrelite" which gets created automatically can be deleted.
 - iii. Delete the folder "bsp-freescale-mx6q-sabrelite-src/src/hardware/devi"
 - b. For QNX **6.6**, use "BSP_freescale-imx6q-sabrelite_br-660_be-660_SVN815608_JBN808.zip" (released October 25, 2016).
 - i. Import the BSP using the QNX BSP import wizard. The IDE tries to set the project name to "bsp-freescale-mx6q-sabrelite-SDP6.6". Before you click finish, change this to "bsp-freescale-mx6q-sabrelite-src", otherwise the build will fail!
 - ii. Additionally, extract the patches "BSP_freescale-imx6q-sabrelite_br-660_be-660_PATCHES_JBN808.zip":
 1. Extract patches/armle-v7 to prebuilt/
 2. Extract patches/usr to prebuilt/
 - c. For QNX **7.0**, use the SabreSMART BSP "QNX® SDP 7.0 NXP i.MX6x SABRE Platform for Smart Devices".
 - i. The BSP must first be installed via the QNX Software Center. The result is a ZIP archive in ~/qnx700/bsp named "BSP_nxp-imx6q-sabresmart_br-mainline_be-700_SVN848889_JBN11.zip". The SVN and JBN numbers might be higher, but that's the version the BSP has been validated against.
 - ii. This ZIP archive must then be imported into the IDE using "Import -> QNX -> Board Support Package".

Hint: We can provide you with ready-to-use versions of the Sabrelite/SabreSMART BSP for your platform.

3. Open the toplevel makefile of the reference BSP (bsp-freescale-mx6q-sabrelite-src/Makefile) and modify it like this: In the make target "install", behind the line \$(MAKE) -Csrc put the keyword "install" (if not already there).
4. Optional: Edit various files under "bsp-PHYTEC-phyFLEX-i.MX6-src/prebuilt/etc"

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to suit your needs.

- Right-click on the project "bsp-PHYTEC-phyFLEX-i.MX6-releng" and choose "Make Targets → Build". A dialog appears that allows you to select the carrier you want to build the installation image for, e.g. "RDK-SD" or "MIRA-SD". This will build all sources and can take quite a while. After that, the subfolder "RDK-SD" (or whatever you chose) will contain a lot of files, e.g. the folder "target" and beneath folder "setup".
- Insert the SD card into your Windows machine (using any USB Card Reader). Copy the contents (!) of the "target" subdirectory to the root directory of the SD card. Safely remove it. To be more clear, the root directory of the SD card must contain the folder "setup", various *.ifs files and the .install script.

4.2 Setup source tree for command line builds (Linux)

In order to build the BSP from the command line (e.g. also on a build server), you need to install QNX Momentics on that host first. Aside the base installation, QNX Screen support, i.MX6 graphics support as well as the SabreSMART BSP must be installed via QNX Software Center, identical to the procedure outlined above under Windows. Next, follow these steps:

- Create an empty directory that will host all sources, e.g. "PHYTEC-BSP_v1.4.4" or similar.
- Change into this directory.
- Extract the BSP source package(s) by using "unzip" into this directory.
- Create a new directory named "bsp-freescale-mx6q-sabrelite-src" (QNX 6.x) or "bsp-nxp-mx6q-sabresmart" (QNX 7).
- Change into this directory.
- Extract the reference BSP "BSP_nxp-imx6q-sabresmart_br-mainline_be-700_SVN848889_JBN11.zip" into this folder.
- Change to the release engineering project folder "bsp-PHYTEC-phyFLEX-i.MX6-releng"
- Issue the make command for your particular target, as follows:

Target	Build command line
Rapid Development Kit (RDK)	
SD	make
ETFS	make CARRIER_TARGET=RDK-ETFS CARRIER_IFS=bsp-PHYTEC-phyFLEX-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyFLEX-i.MX6-ETFS_prod.ifs RDK-ETFS
MIRA Single-board computer (SBC)	
SD	make CARRIER_TARGET=MIRA-SD CARRIER_IFS=bsp-PHYTEC-phyCORE-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyCORE-i.MX6_prod.ifs SYSTEM_BUILDER_PROJECT=bsp-PHYTEC-phyCORE-i.MX6 MIRA-SD
EMMC	make CARRIER_TARGET=MIRA-EMMC CARRIER_IFS=bsp-PHYTEC-phyCORE-i.MX6.ifs CARRIER_PROD_IFS=bsp-PHYTEC-phyCORE-i.MX6-EMMC_prod.ifs SYSTEM_BUILDER_PROJECT=bsp-PHYTEC-phyCORE-i.MX6 MIRA-EMMC

Table 1: Build command lines

- After building, go to the target folder "RDK-SD/target" (or "MIRA-EMMC/target", or whatever you built).
- Copy all files to the root directory of the SD card installation media, including .info and .install. These are not shown by default. Alternatively, you can create a ZIP archive like this: `zip -r ~/some_meaningful_name.zip .info .install *.ifs setup/`. This archive can then be transferred to some other machine for

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extracting to the SD card installation media.

5 Install Barebox and QNX on the PHYTEC hardware

1. If you have a different carrier for runtime: Make sure boot switch of RDK matches your carrier's settings.
2. Insert the card
 - a. On phyFLEX: into slot 2 (the right one when the kit is viewed from top).
 - b. On MIRA: into the MicroSDHC slot
3. Boot the development kit, but stop autoboot by pressing a key.
4. Make sure you have the latest Barebox installed. It should be 15.3.0 or later.
5. SD-Card is auto-mounted, check: `ls -l /mnt/mmc`, this should show the root directory of the MicroSD card.
6. Install boot file and launch QNX: `/mnt/mmc/.install`
7. On the QNX prompt, check and set the date and save it to battery-backed clock using `rtc -s hw` (on MIRA: `rtc -s m41t6x /dev/i2c2`).
8. On the QNX prompt, issue: `/dos/setup/qnx/install-qnx`
9. The script asks you to confirm the SD card erase. Under QNX6.6 and QNX 7, you will get a warning "volume at '/dos/' will be unmounted". It is safe to ignore it.
10. Wait while root file system is extracted (can take several minutes depending on speed of SD card).
11. Reboot board when prompted by entering `shutdown` on the prompt. Now QNX should boot automatically from SD card.
12. After boot, you can create or remove additional cookie files in the directory `/etc/system/config` in order to control which drivers will be launched. Cookies supported are: `useaps`, `usecamera`, `usexti2c`, `usepci`, `use100Mbit`, `useip6`, `usesata`, `useuart3`, `useqconn`, `useham`.
13. You can now also install additional tools packages if you have received them. They usually reside in `/usr/local/bin`, although this is not a strict requirement, as long as it is in the PATH environment variable: `tar -C /usr/local/bin -xzf /tmp/bsptools_<date>.tgz`.

6 Using QNX Screen

6.1 Installing pyhFLEX-specific files (QNX6.5 and QNX6.6)

The graphics configuration and a default calibration file for the touch screen are already present on the system, along with the display drivers

```
/etc/system/config/scaling.conf
/usr/lib/graphics/graphics-LVDS.conf
/usr/lib/graphics/graphics-DUAL.conf
/usr/lib/graphics/graphics-HDMI.conf
/usr/lib/graphics/libwfdcfg-imx6x-etm0700g0dh6.so
/usr/lib/graphics/libwfdcfg-imx6x-rdk_dual.so
/lib/libmtouch-etmDDDDGx.so
```

Next, you need to check whether the carrier info file (see `rc.devices`) is present. It should be already there, if not, issue:

```
echo -n <carrier name> > /etc/system/config/carrier
```

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<carrier name> is either RDK or MIRA.

After that, tell rc.devices to launch QNX Screen next time you boot:

```
rm /etc/system/config/noscreen
```

Choose the display configuration by selecting exactly one of the options below:

- If the file `usehdmionly` exists, only HDMI output is active.
- If the file `uselvdsonly` exists, only the LVDS (RDK) or LCD (MIRA) outputs are active.
- If neither file exists, this means “Dual-Display” configuration, the primary display is the LVDS/LCD display, the secondary display is HDMI.

REBOOT. After the next boot, the selected display(s) should be usable:

On successful launch of screen, screen will be blacked out. Try to run some OpenGL applications: `gles2-gears`, `gles2-maze` or `gles2-gears -display=2` (Our default `rc.apps` script does exactly that).

If that works, you can try to install a Qt5 runtime environment, if it has not automatically been installed by the installer.

6.2 Installing Qt5 runtime

There are newer versions of Qt5 for QNX out there, but we have tested only 5.1.0 for QNX6.5.

```
# mkdir /opt (in most cases it will already exist)
# tar -C / -xzf /tmp/qt510+icu49_QNX650SP1_bin_<date>.tgz (takes 3 Minutes or so)
# tar -C /usr/local/bin -xzf /tmp/qt5.1-startupdemos.tgz
# animatedtiles
```

(It will issue a warning about physical screen size)

For QNX6.6, you should install the Qt5.3 Creator on your Windows host and get the Qt5.3 runtime from there (essentially the contents of `C:\Qt\Qt5.3.0\5.3\qnx6-armle-v7`). You need to set the x-Bit on all `*.so*` files after transferring them to the target.

We have compiled a downstripped version of the Qt 5.3 runtime environment that you only need to copy to your target and unpack under `/opt` directory. Please contact us if you want to obtain this archive, which is meant for testing only.

Any newer version of Qt5 will need to be gotten directly off the QT website; QNX support is fully integrated.

6.3 Calibrating the touchscreen

Try to calibrate the touch screen:

```
# calib-touch -recalibrate
```

This should create a file called `/etc/system/config/calib.RDK` (or `calib.MIRA`, respectively). However, under QNX6.5 currently the values are not propagated back to `scaling.conf`, which is what is being read by QNX Screen on startup. So the calibration holds only until the next launch of Screen. That's why we provide a default `scaling.conf` that is approximately right for the 7" displays of the PHYTEC.

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Under QNX6.6 and 7, it is sufficient to call `calib-touch` once on bootup to load the values back into QNX Screen.

7 Building and installing the camera drivers

If you have source for the camera drivers:

- Right-click on project "clko" and choose "Make Targets → Build". A dialog appears that allows you to select the target, choose "install".
- Right-click on project "camera-PHYTEC-phyFLEX-i.MX6" and choose "Make Targets → Build". A dialog appears that allows you to select the target, choose "install". It takes a while to build the drivers, after that you will get the various binaries under the "install" folder.
- Copy them to the target preserving the directory structure (you can TAR the directory before transferring)

If you have been delivered a pre-compiled archive:

- Copy the file "camera-<Board>-<Version>-QNX<Version>-<Processor>.tgz" to the target, e.g. /tmp
- On a target console, issue "tar -xzf camera*.tgz"
- If you have built under Windows, make sure the driver and start scripts are executable (e.g. set the x-Bit).
- Modify the `/usr/sbin/devcam-restart` script to match camera drivers and command line options.
- Connect your camera and issue "devcam-restart"
- Issue "camtest -r21" → live image should be seen on primary display

On target, issue `touch /etc/system/config/usecamera` to have camera drivers automatically start on boot.

8 Using PCIe (Experimental, QNX 6.6 only, RDK only)

QSS provides an experimental version of its new PCI server on the Foundry 27 web site. We have prepared the environment in the boot sequence that is necessary for the server to run. To enable PCIe on the RDK, follow these steps:

- Obtain archive 'pci-mx6-JBN35-bin.tgz' via helpdesk
- Copy it to the target, e.g. to /tmp
- On target, issue: `tar -C / -xvzf /tmp/pci-mx6-JBN35-bin.tgz`
- On target, issue `pci-server -c &`. Use `pci-tool -v` to verify that server is running.
- On target, issue `touch /etc/system/config/usepci` to have PCI server automatically start on boot.

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9 Using CAN driver

Important: Make sure the bus termination is set up correctly! On the MIRA board, use jumper J2 just next to the CAN connector to enable the termination. The CAN connector, X3, is located next to the HDMI port.

You have obtained an archive file named “dev-can-mx6x-<carrier>-A.B.C-QNX<version>-armle-v7.spk”.

1. Copy that file to the running target, e.g. to /tmp.
2. On the target, issue “sh /tmp/dev-can-mx6x-<carrier>-A.B.C-QNX<version>-armle-v7.spk”
3. After installation, edit /usr/sbin/can-restart to select correct baud rate and CAN ports to use.
4. Issue “can-restart”, or reboot your system to launch CAN driver automatically.
5. Use the demo program to generate and receive some CAN traffic:

```
# qCANv2demo -r0xFF -s0x1F -v
CANv2 driver demo, built Mar  8 2018 18:18:08 $LastChangedRevision: 64738 $
RX cnt   10 TX cnt  143
#
```

10 Conditional launch of drivers

10.1 Cookie Files

In order to avoid having the system initialization scripts be edited to change the boot behavior, or to maintain a multitude of variants of these scripts, the system makes use of a set of small cookie files in the folder /etc/system/config which are queried at script execution time. These cookie files have, for the most part, no contents, the scripts just check for their existence and then decide to take a certain action or not. For example, normally the system launches the driver for port UART3 automatically. In order to achieve that, the (empty) cookie file “useuart3” must be present in the directory /etc/system/config. In order to skip the launch of the driver for UART3 at boot time, simply delete this file.

The following table gives an overview of which cookie files are available, and what they allow to control:

Cookie	Default	What does it control?
useaps	Present	Creation and use of CPU partitions for the system
useaudio	Absent	Automatic start of audio subsystem
usecamera	Absent	Automatic start of camera drivers, if installed.
useexti2c	Absent	Automatic start of the I2C driver for the external bus On this release, it is temporary present after installation (#5696).
useham	Absent	Automatic start of the QNX High-Availability Manager as well as the HAM attach daemon, if installed
useip6	Present	Launch the IPv6 stack, otherwise the IPv4 stack. Please note that the SSH daemon requires the IPv6 stack.
usepci	Absent	Automatic start of the PCI subsystem
useqconn	Depends	Automatic start of qconn. The installation routine will ask for this setting.

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usesata	Absent	Automatic start of the S-ATA driver and mount of filesystem
useuartN	Absent	Automatic start of driver for UARTN (external serial communication). Possible values for N are 1-6, but be aware that on the phyCORE UART2 and on the phyFLEX UART4 are already in use for the serial debug console so setting this will have no effect. The only value currently supported is N=3.
use100MBit	Present	Determines whether network is set to 100 Mbit or auto-negotiated speed.
uselvdonly	Absent	Use the LVDS/LCD display as primary and only output
usehdmionly	Absent	Use the HDMI display as primary and only output. Note: If neither "uselvdonly" nor "usehdmionly" are present, the system enters dual-display mode.
usepushbtn	Absent	Automatic start of the pushbutton driver(s)

Table 2: System configuration cookie files

10.2 Carrier Information Files

The system initialization scripts are setup such that they support multiple carrier boards. They can find out on which carrier they are sitting and then take conditional actions, e.g. launch drivers with different parameters depending on the carrier they are sitting on.

The current implementation simply reads the file `carrier` (in the directory `/etc/system/config`) and stores that name in a local variable, which can then be used in any conditional statement.

The carrier file is created by the installation routine, but can be changed later if the CPU module is installed on one carrier and then moved to a different one. Important: The carrier file must contain only the name, no other characters, and no newline. You can create/overwrite it like this:

```
echo -n MYCARRIER > /etc/system/config/carrier.
```